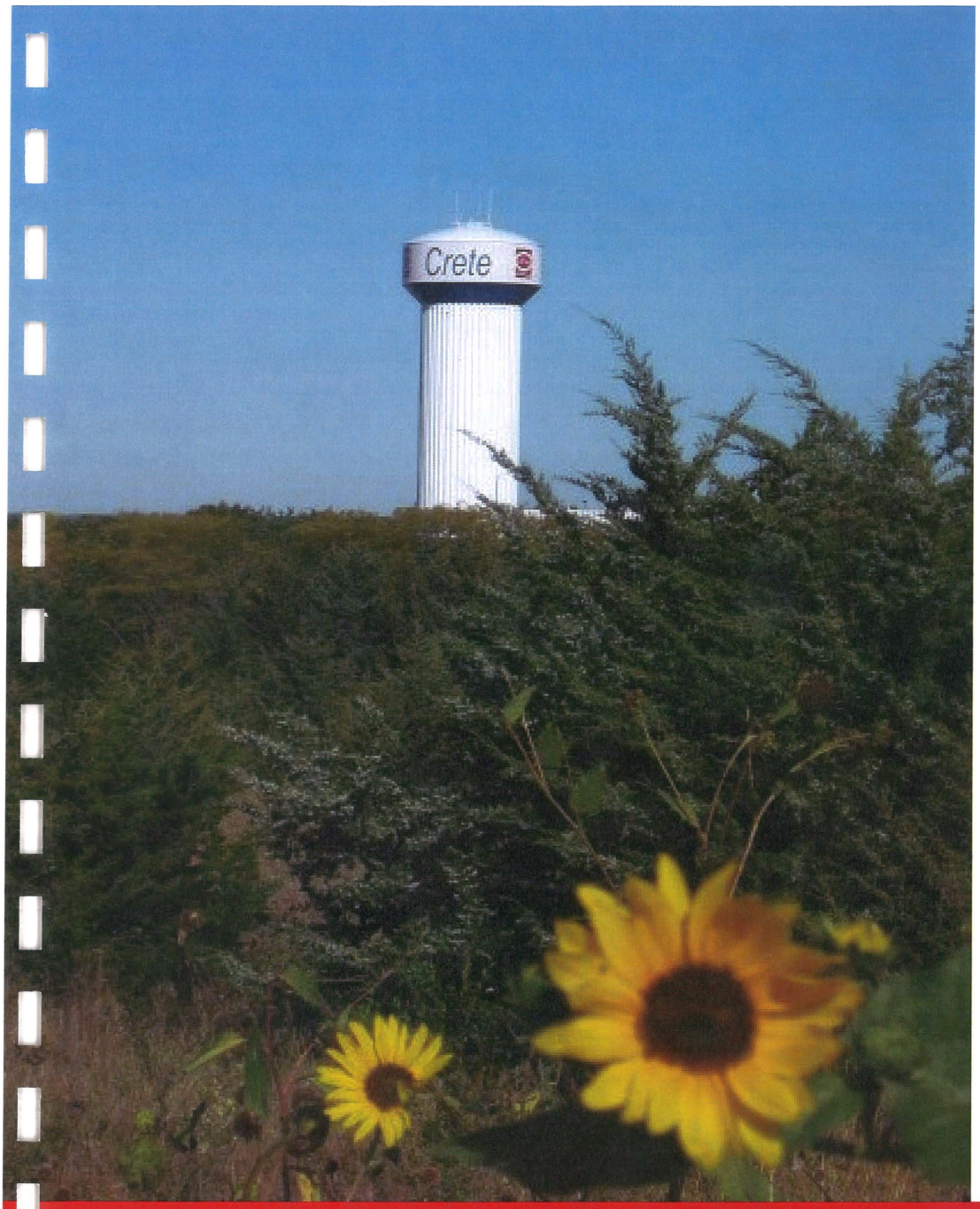

JEO CONSULTING GROUP INC

November 2013

Crete Wellhead Protection Plan

Crete, NE

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City of Crete, Nebraska

Wellhead Protection Plan

Prepared November 2013
Adopted February 2014

Prepared for: *City of Crete, Nebraska*

Prepared by: *JEO Consulting Group, Inc.*

JEO Project Number: *121273*

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This wellhead protection plan has been prepared to assist the City of Crete to proactively protect and manage the aquifer that is the source of community drinking water. It has been written with guidance published by the Nebraska Department of Environmental Quality (NDEQ).

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TABLE OF CONTENTS

List of Tables ..... **iv**
Table of Figures ..... **iv**
List of Appendicies ..... **iv**
Nebraska's Wellhead Protection Program Summary ..... **v**
Section 1. Introduction **1**
1.01 About This Plan 1
1.02 Groundwater Pollution in Nebraska 1
1.03 Future Updates to This Plan 3
1.04 Community Background 3
1.05 Lower Big Blue Natural Resources District 5
1.06 Nebraska Groundwater 6
1.07 Groundwater Vulnerability to Contamination 8
Section 2. Crete Water System **13**
2.01 Nebraska's Public Water System Program 13
2.02 Crete Water System Information 13
2.03 Historical Nitrate Sampling Information 15
Section 3. Crete Wellhead Protection Area **17**
3.01 Wellhead Protection Area Summary 17
3.02 Wellhead Protection Area Land Cover 20
Section 4. Potential Contaminant Source Inventory **25**
Section 5. Management StrategIES **33**
5.01 Potential Management Activities 34
Section 6. Regulatory Authority **37**
6.01 City of Crete 37
6.02 Lower Big Blue Natural Resources District 39
6.03 State of Nebraska 41
Section 7. Emergency, Contingency, and Long Term Planning **45**
7.01 Emergency Planning 45
7.02 Contingency Planning 45
7.03 Long Term Planning 46
7.04 Drought Conservation Planning 46
Section 8. Public Education and Notification **49**
8.01 Opportunity for Public Input 49
8.02 Crete Wellhead Protection Plan Stakeholder Committee 49
8.03 Meeting Summary 50
References **51**
List of Appendices **53**

CD-ROM (in front cover pocket)

Digital copy of the plan, appendices, and maps in PDF format

LIST OF TABLES

Table 1: Historical Population for Crete 4
Table 2: Crete General Water System Information 14
Table 3: Crete Municipal Water Supply Well Information 15
Table 4: Historical Nitrate-Nitrite Sampling Data 16
Table 5: Crete WHPA Land Cover Breakdown 22
Table 6: Crete Potential Contaminant Sources Summary 27
Table 7: Crete Potential Contaminant Source Inventory (three pages) 30
Table 8: Crete Wellhead Protection Stakeholder Committee Members 49

TABLE OF FIGURES

Figure 1: Generalized Nitrate Levels in Wells Sampled, 1974 - 2011 2
Figure 2: Crete Water Tower 3
Figure 3: Crete, Nebraska Location 4
Figure 4: Lower Big Blue Natural Resources District 5
Figure 5: Density of Active Registered Irrigation Wells - January 2011 6
Figure 6: Groundwater-level Changes in Nebraska - Predevelopment to Spring 2010 8
Figure 7: Groundwater Vulnerability to Contamination in Nebraska Using the DRASTIC Method 9
Figure 8: Typical Routes of Groundwater Contamination 10
Figure 9: Crete Municipal Well Location 14
Figure 10: Official 2013 Crete WHPA Map (Provided by NDEQ) 18
Figure 11: Varying Types of Landuse. (A) Row crops; (B) Abandoned gas station in an urban setting; (C) Natural vegetation 20
Figure 12: Crete WHPA Land Cover 23
Figure 13: Common Potential Contaminant Sources. (A) Leaking Fuel Drums; (B) Livestock Waste; (C) Abandoned Wells; (D) Parking Lot Runoff 25
Figure 14: Crete Potential Contaminant Source Inventory Map 29
Figure 15: Samples brought in through a Test-Your-Well Event 33
Figure 16: Installed WHPA Signage 34
Figure 17: Crete ETJ and 2013 WHPA 39
Figure 18: Test Wells are often helpful in identifying future well fields 46
Figure 19: Public Open House 50

LIST OF APPENDICIES

APPENDIX A: ANNUAL WATER QUALITY REPORT AND SANITARY SURVEY
APPENDIX B: LBG WHPA & MODELING REPORT
APPENDIX C: SELECT ORDINANCES AND MUNICIPAL CODE
APPENDIX D: CRETE PWS EMERGENCY RESPONSE INFORMATION
APPENDIX E: DOCUMENTATION OF PUBLIC INVOLVEMENT

NEBRASKA'S WELLHEAD PROTECTION PROGRAM SUMMARY

A WELLHEAD PROTECTION AREA IS THE SURFACE AND SUBSURFACE AREA SURROUNDING A COMMUNITY DRINKING WATER WELL OR WELL FIELD, THROUGH WHICH CONTAMINANTS ARE REASONABLY LIKELY TO MOVE TOWARD AND REACH SUCH WATER WELL OR WELL FIELD.

NEBRASKA'S WELLHEAD PROTECTION PROGRAM

The Nebraska Department of Environmental Quality (NDEQ) administers the Wellhead Protection Program, which began after the Nebraska Legislature passed LB 1161 in 1998 (Neb. Rev. Stat. §46-1501 – 46-1509), authorizing the Wellhead Protection Area Act. **The Act sets up a process for public water supply systems, to use if they choose to implement a local Wellhead Protection Plan**. The intent of this program was to establish guidelines for communities and other public water suppliers to develop local wellhead protection plans. A wellhead protection plan does not provide any new powers to a community; it serves as a guide to local decision makers tasked with protecting the community drinking water supply.

All community public water supplies have a Wellhead Protection Area map as of October 1, 2004.

Nebraska Department of Environmental Quality

WELLHEAD PROTECTION PROGRAM ACTIVITIES

1. **Delineate the Wellhead Protection Area (WHPA)** - The NDEQ, and some Natural Resources Districts (NRDs), can provide a public water system with a WHPA map which shows the area that is critical to recharging a community's groundwater and drinking water supply.
2. **Perform a Contaminant Source Inventory (CSI)** - Conducting a CSI involves locating and documenting activities, structures, and locations which could affect the quality of the source of drinking water.
3. **Manage potential contaminants** - After identifying potential contaminant sources within the WHPA, the community can use management such as county and municipal zoning, local ordinances, working with landowners to implement best management practices (BMPs), or other options, such as education and information, to ensure a safe drinking water supply, which complies with The Safe Drinking Water Act.
4. **Develop emergency and contingency plans** - These plans will enable a community to react to events such as natural disasters, contamination, and drought. These and other issues, such as population growth, can be addressed through emergency/contingency plans, as well as by planning for new wells.
5. **Educate and involve the public** - Community awareness will help to provide citizens with the information they need to protect drinking water and increase their participation in the development of a wellhead protection plan.

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SECTION 1. INTRODUCTION

1.01 ABOUT THIS PLAN

This plan, like many other long-term planning documents, is prepared to give the City of Crete a general guide to accommodate anticipated future growth. It is not intended to be a regulatory document nor does the adoption of it give additional powers to the City of Crete or any other Federal, State, or Local authority. Instead, adoption of this document does indicate to the water system users, the community, and outside agencies that the City of Crete values its water system and wants to protect its source of water.

A strength, and often over looked value of developing a wellhead protection plan is the process through which communities must go through. The planning process brings together community leaders, agency representatives, land owners, technical specialists, and the general public – all which may have competing interests, different viewpoints, varying terminologies, or a general lack of knowledge regarding drinking water protection. The process challenges stakeholders to reevaluate their own ideas and to continue their education of the issues. The planning process helps to form closer bonds between these stakeholders and facilities future community efforts.

In addition to a guiding document for the City of Crete, this Wellhead Protection Plan is meant to be a public document, thus efforts have been made to write in plain language. Plain language is intended to assist the non-technical reader understand the subject material the first time they read or hear it. It allows readers to find what they need, and use what they find. Plain language makes participation easier for the public whom will not waste a lot of time "translating" difficult, wordy documents. Plain language documents are ultimately defined by results – they are easy to read, understand, and use.

1.02 GROUND WATER POLLUTION IN NEBRASKA

Ground water pollution throughout Nebraska varies considerably by the type of pollutant and scale of the pollution. Typically, three major types of pollutants are of concern in Nebraska: nitrates, pesticides, and bacteria (coliforms, *E. coli*, etc). The occurrence of pesticides in water supplies has become an increasing concern, with Atrazine being the most commonly detected pesticide found in drinking water wells in Nebraska, which is consistent with its usage as well as its relatively high mobility and persistence. Coliform group bacteria are microscopic, generally harmless organisms that live in the intestinal tract of many warm blooded animals. Although coliform bacteria do not cause disease, they are often indicators of other, more dangerous bacteria. Sources of fecal coliform are septic systems, barnyards, and animal waste lagoons (Gosselin, 1997).

Of the three pollutants, however, the most pervasive is nitrate-nitrogen (nitrate). Nitrates are known to cause a disease called methemoglobinemia (or "blue baby syndrome") in infants, which inhibits the blood's ability to carry oxygen. It may also be converted to nitrosamines in the water, which have been

found to cause cancer. Because of risk of causing "blue baby syndrome" the US Environmental Protection Agency (EPA) has set a maximum contaminant level (MCL) of 10 milligrams per liter (mg/L) or parts per million (ppm) for nitrate nitrogen in drinking water.

Available records show that beginning in the 1960s and extending through 1998, 37% of Nebraska's small city and village water systems have exceeded the MCL for nitrates. Additionally, another 28% have had readings between 5 and 10 mg/L (USDOI 1999). Figure 1, below, illustrates the generalized nitrate levels in sampled wells across Nebraska. Therefore, groundwater concerns in Nebraska have focused heavily on nitrates, and for this reason WHPPs are typically written in that context.

Additional contaminants or concerns in water quality or quantity may be found at the local level, and can also be addressed through the wellhead protection planning process.

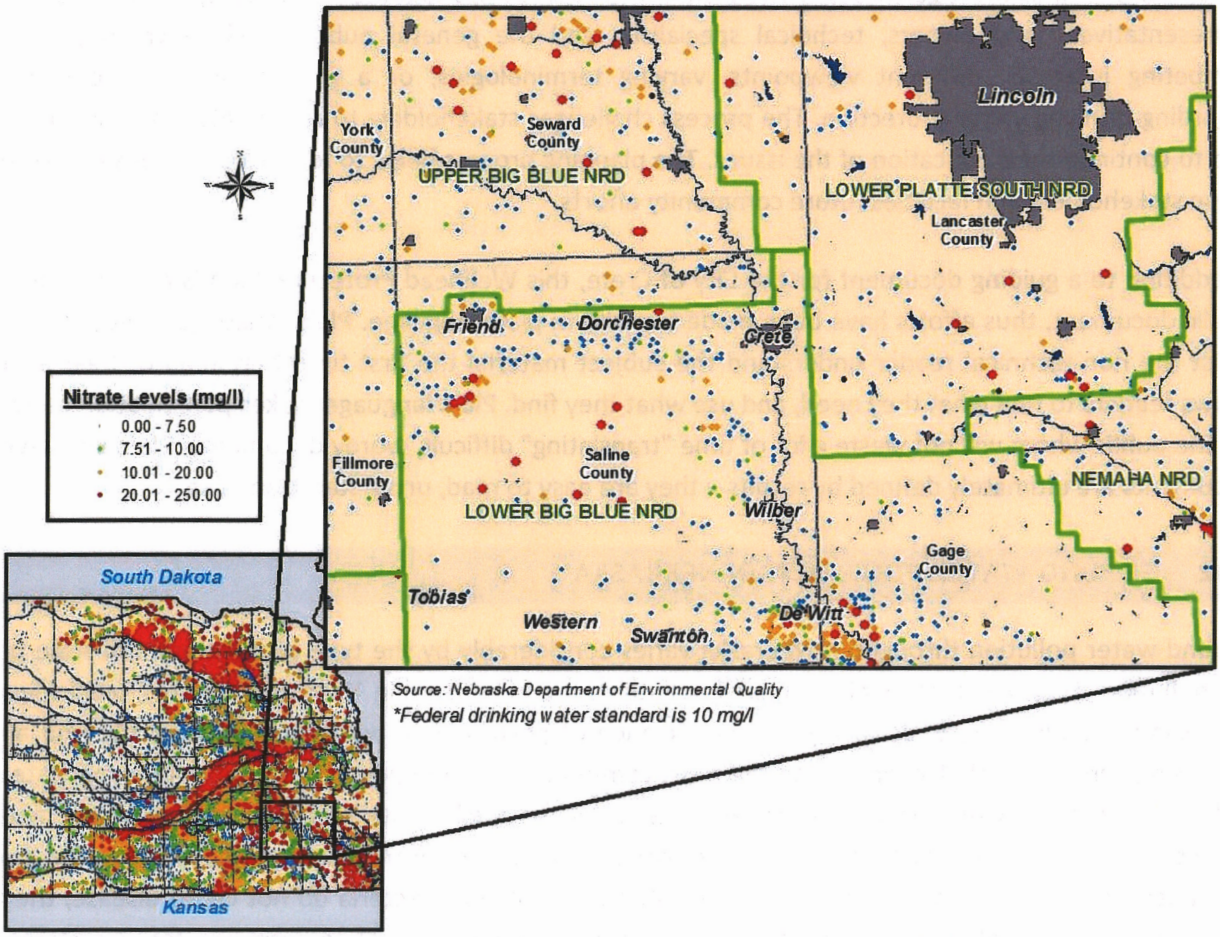


Figure 1: Generalized Nitrate Levels in Wells Sampled, 1974 - 2011

1.03 FUTURE UPDATES TO THIS PLAN

As with any plan or document, periodic reviews and revisions should be completed to ensure the best science and up-to-date information is included. Regular monitoring of the progress of implementing the plan is also recommended. At a minimum, the wellhead protection plan should be updated or reviewed when new information changes the WHPA boundaries. This could be when a new well is added to the system, NDEQ issues an updated map, or there has been a significant change to the landuse within the WHPA.

The timeframe for updates is at the discretion of the community and may be based on the complexity of the area or how fast the community is changing. It is recommended the plan be reviewed annually by the Wellhead Protection Stakeholder Committee. Groundwater and wellhead protection related actions should be documented, reported, evaluated, and revised at this time. A more comprehensive update should be contemplated approximately every five years. At this milestone, updates should include any changes in the potential contaminant source inventory and landuse of the WHPA. Long-term trends should be evaluated and extrapolated into future projections to ensure sustainability of the source water is maintained.

NDEQ should be consulted at each update to determine if additional information has been developed or if any related regulations or plan requirements require a review of the plan.

1.04 COMMUNITY BACKGROUND

Crete is the largest community in Saline County (Figure 3). The City is located approximately 30 miles southwest from Lincoln, NE and on the edge of the ancient glacial extent. Crete boasts a diverse economic base which includes agriculture, industrial and manufacturing, health care, and higher education (Doane College). Doane is a private liberal arts college, which offers four-year degrees in 40 areas of study, and rests on approximately 300 acre campus. The City has steadily grown throughout its history (Table 1). The population of Crete is also diverse with approximately 70% white citizens and 30% Hispanic or Latinos, making up the majority of the population. Utilities are provided by the City of Crete, through the Department of Public Works.

The City of Crete is considered a "First Class City". First Class municipalities include all cities having more than 5,000 inhabitants, but not more than 100,000.



Figure 2: Crete Water Tower

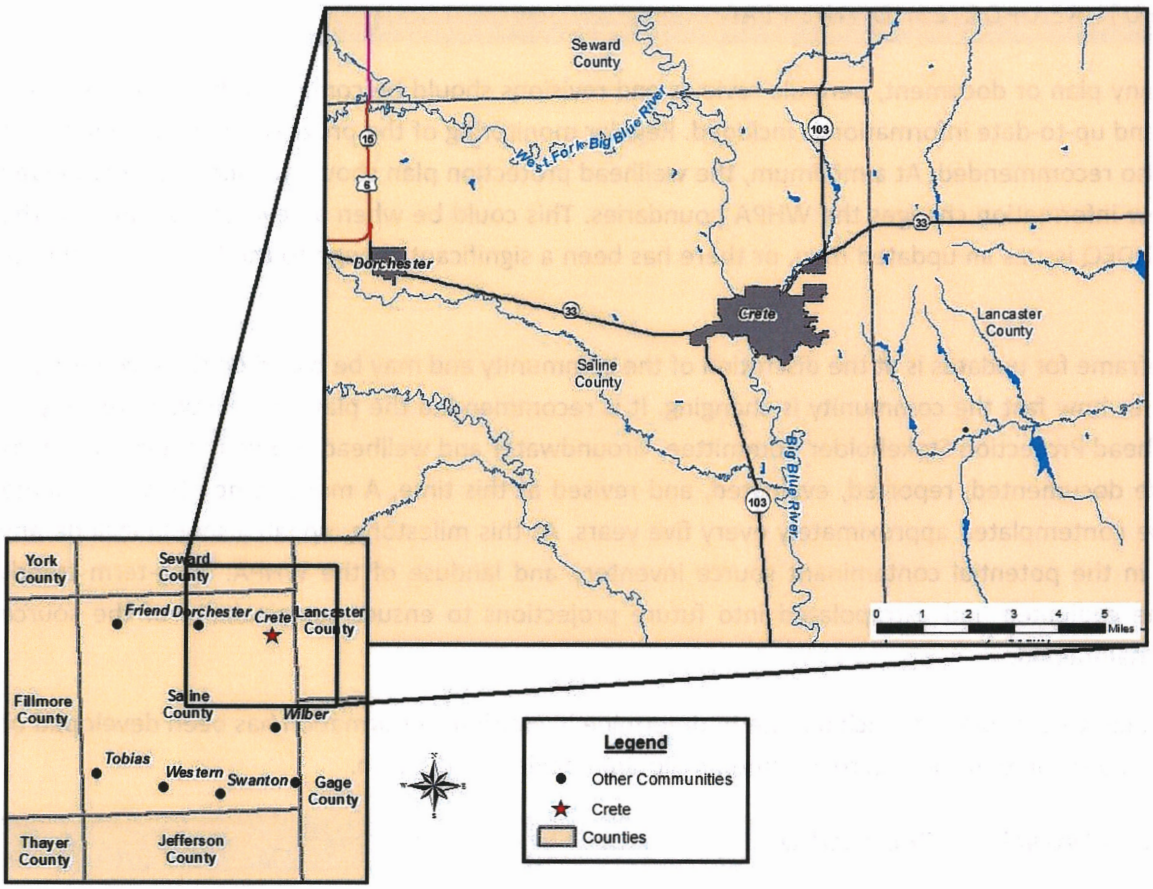
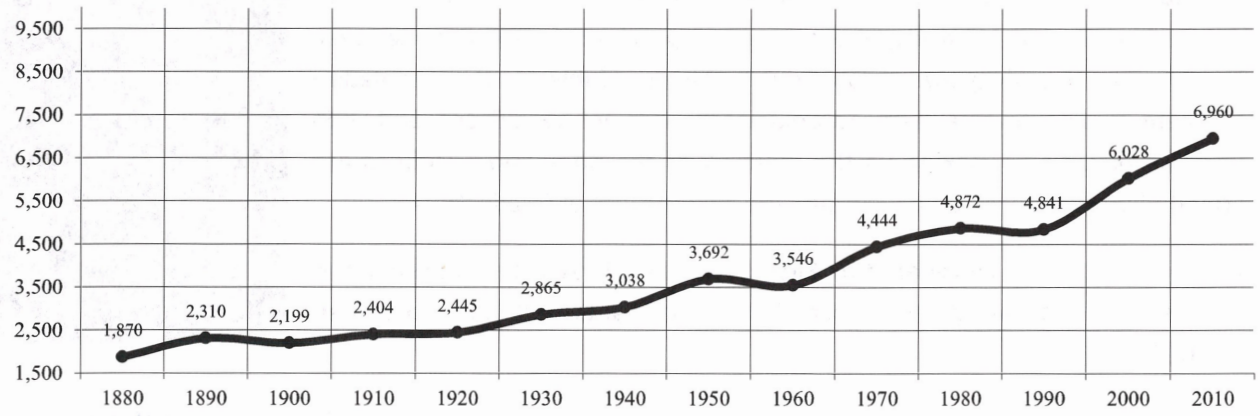


Figure 3: Crete, Nebraska Location

Table 1: Historical Population for Crete



Source: U.S. Bureau of the Census
Compiled by: Nebraska State Data Center, Center for Public Affairs Research, University of Nebraska Omaha

1.05 LOWER BIG BLUE NATURAL RESOURCES DISTRICT

Natural Resources Districts (NRDs) are local government entities with broad responsibilities to protect natural resources. Major Nebraska river basins form the boundaries, enabling districts to respond best to local needs. Elected boards of directors govern district and much of their funding comes from local property taxes.

Natural Resources Districts were created to solve flood control, soil erosion, irrigation run-off, and groundwater quantity and quality issues. Nebraska's NRDs are involved in a wide variety of projects and programs to conserve and protect the state's natural resources. NRDs are charged under state law with 12 areas of responsibility including flood control, soil erosion, groundwater management and many others. Crete is located in the Lower Big Blue NRD, as shown in Figure 4, below.

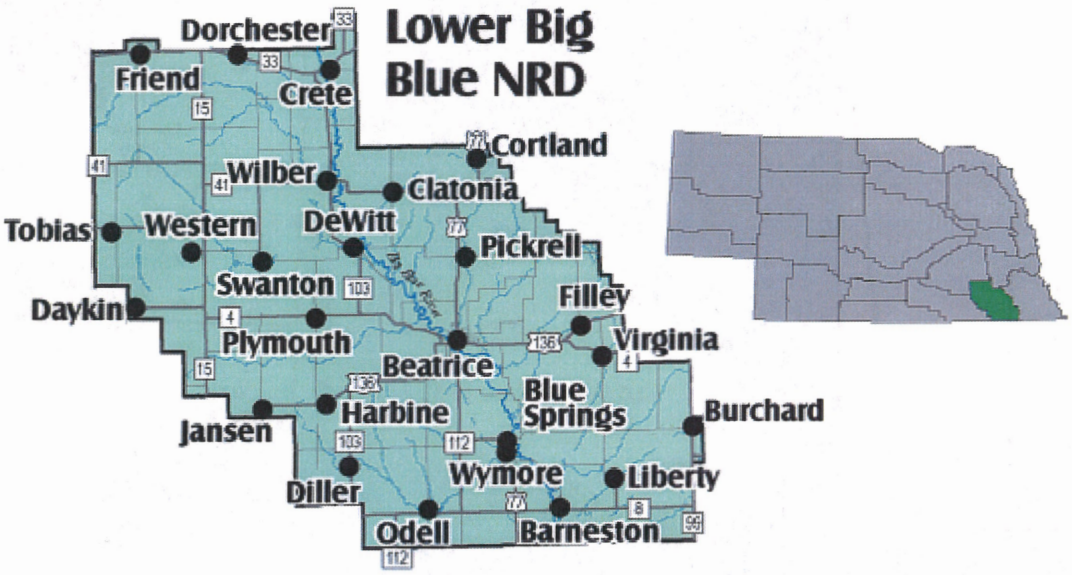


Figure 4: Lower Big Blue Natural Resources District

1.06 NEBRASKA GROUNDWATER

The State of Nebraska is blessed with a great supply of groundwater, which makes it one of Nebraska's most important natural resources. Groundwater is used for irrigation, water supply for humans and animals, and commercial and industrial uses. Nebraska receives nearly 85% percent of its public drinking water and nearly 100% of its private water supply from groundwater sources. Agriculture (the state's largest industry) is dependent on this resource as well. In fact, as of October 2010, the Nebraska Department of Natural Resources (DNR) listed over 92,000 active irrigation wells and nearly 23,900 domestic wells registered in the state. Figure 5, below, displays the density of registered irrigation wells in the vicinity of Crete.

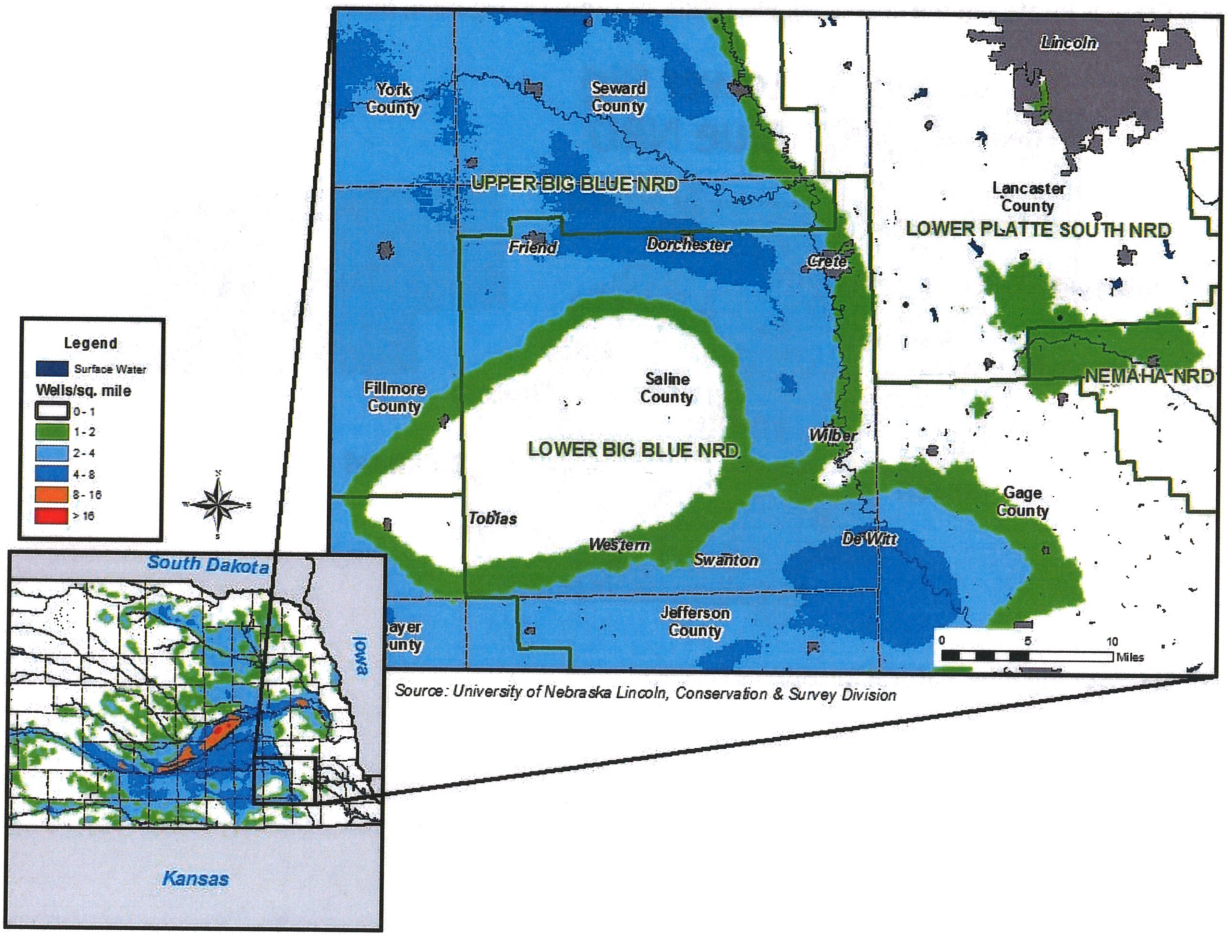


Figure 5: Density of Active Registered Irrigation Wells - January 2011

Due to the importance of groundwater to the state, a massive effort is made in monitoring the quality of the resource. Several entities are involved:

- Natural Resource Districts (23)
- Nebraska Department of Agriculture
- Nebraska Department of Environmental Quality
- Nebraska Department of Health and Human Services
- University of Nebraska-Lincoln
- United State Geologic Survey

The results of these monitoring efforts is combined in the Quality-Assessed Agrichemical Contaminant Database for Nebraska Groundwater (Database) The Database brings together groundwater data from many different sources and provides public access to this data. The dates of this data represent the majority of sample results available and range from mid-1974 to the present. Most monitoring takes place from irrigation or domestic supply wells; however, in recent years, dedicated groundwater monitoring wells have been installed in increasing numbers.

The network of monitored wells provides data from a wide range of geologic conditions and water that is sampled for a wide variety of compounds used in agriculture production. Because of the widespread utilization of groundwater, it's "abundance" or change in availability is also closely watched. Figure 6, below, displays the change in depth to groundwater from pre-development to the spring of 2010.

While groundwater is typically abundant in the state, the southeast, northeast and northwest corners have difficulty providing adequate yields. Good quality groundwater is available for most areas of the state; however, in some areas, non-point sources of contamination, such as nitrates and other agricultural contaminants, have impacted groundwater sources. Point sources of contamination have impacted localized areas. These sources can include underground injection wells, leaking underground tanks, livestock lagoons, landfills, improperly constructed wells, hazardous waste, grain fumigants, munitions sites, or septic systems.

The cost of contamination is a major concern. Communities have been forced to abandon wells and/or construct expensive treatment systems. These costs can have a significant financial impact on communities. Both point and nonpoint source contamination cause increased costs to the public - in the form of treatment, new wells, or long term management programs.

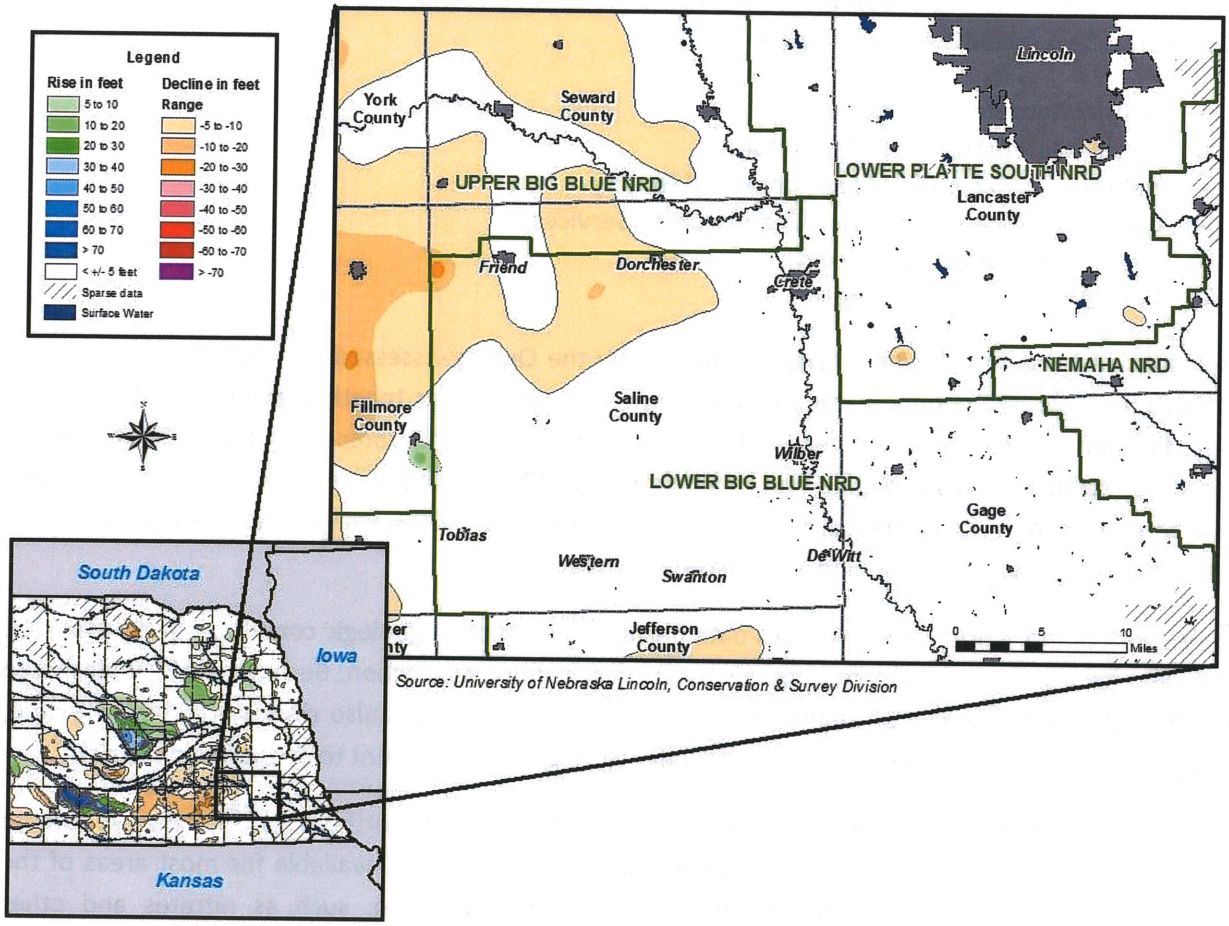


Figure 6: Groundwater-level Changes in Nebraska - Predevelopment to Spring 2010

1.07 GROUNDWATER VULNERABILITY TO CONTAMINATION

In any given area, the groundwater within an aquifer, or the groundwater produced by a well has some vulnerability to contamination from human activities. In order to quantify or illustrate that vulnerability, there are various computer models available, which act as a practical visualization tool for decision making. Alone, they do not fill a direct decision making role, but contribute to the understanding of the issues. According to the National Research Council (1993):

> ***GROUNDWATER VULNERABILITY TO CONTAMINATION IS THE TENDENCY OR LIKELIHOOD FOR CONTAMINANTS TO REACH A SPECIFIED POSITION IN THE GROUNDWATER SYSTEM AFTER INTRODUCTION AT SOME LOCATION ABOVE THE UPPERMOST AQUIFER.***

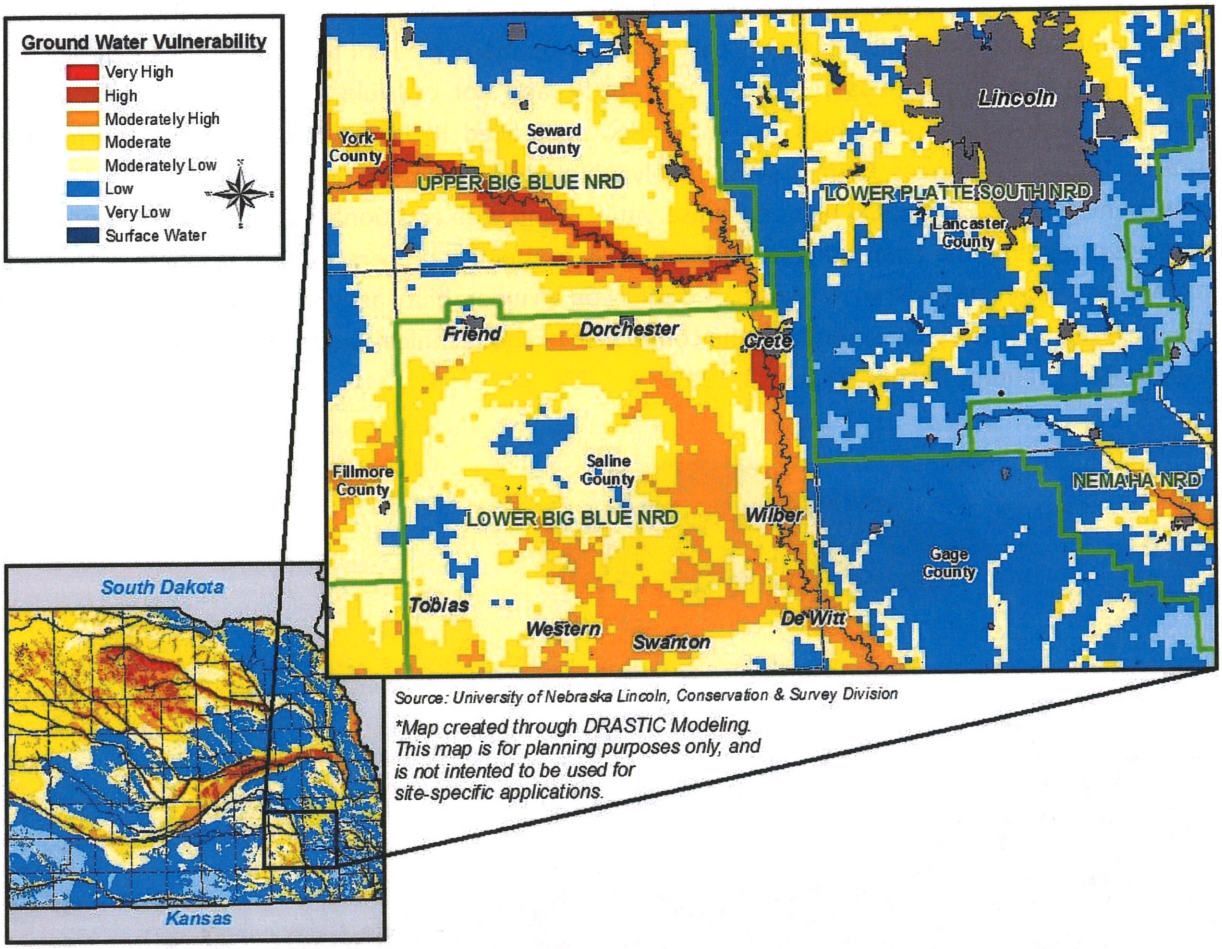
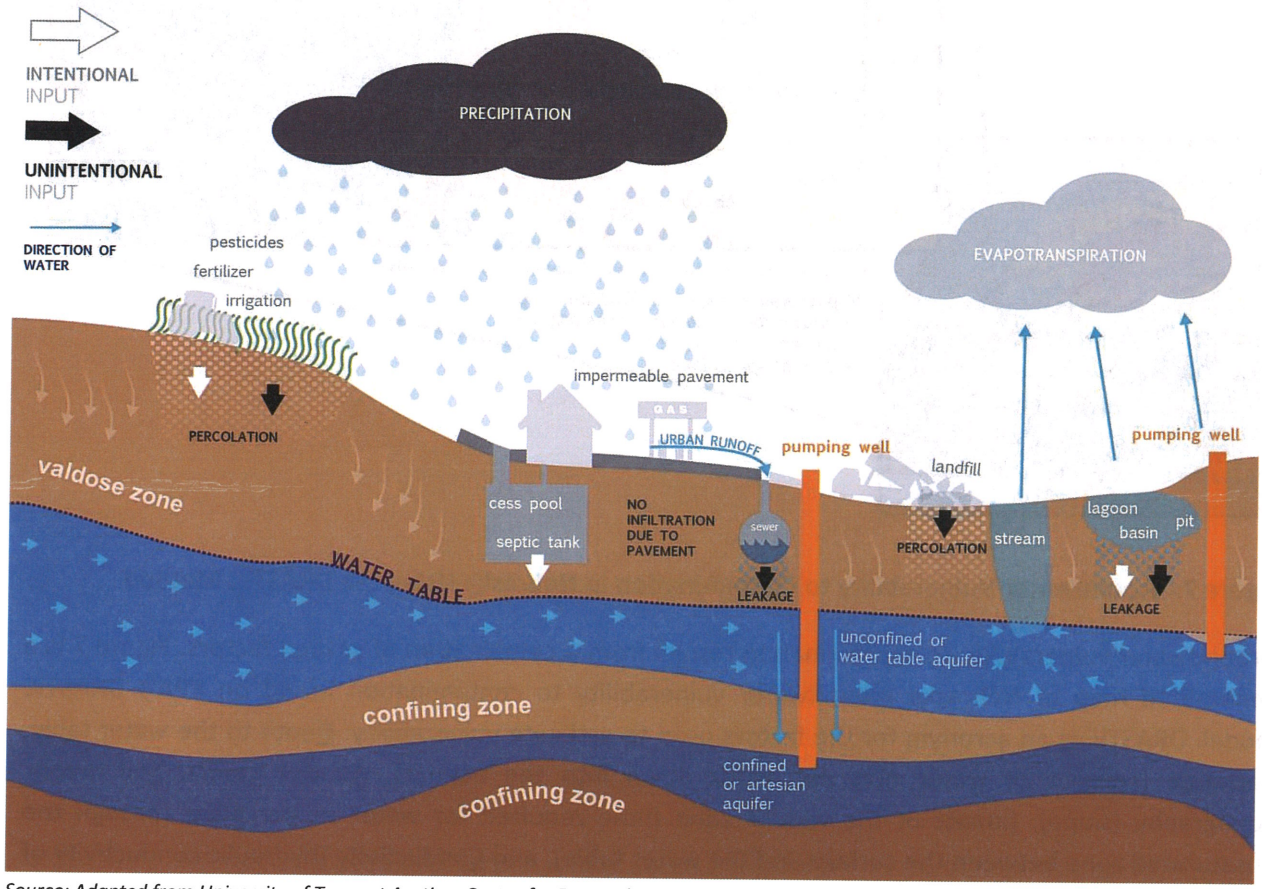


Figure 7: Groundwater Vulnerability to Contamination in Nebraska Using the DRASTIC Method

Groundwater vulnerability to contamination results from a combination of several factors. Figure 7 is a generalized map of Nebraska groundwater vulnerability to contamination based on EPA's DRASTIC model. DRASTIC is an acronym for the factors used to estimate vulnerability: **D**epth to the water table, **R**echarge (amount of water that percolates down into the aquifer), **A**quifer media, **S**oil media, **T**opography (slope), **I**mpact of the vadose zone (time required for water to percolate through the unsaturated zone between the surface and the water table), and **C**onductivity (hydraulic conductivity of the soil). The model results displayed in Figure 7 were developed on a statewide scale, therefor; site (field) specific applications of the contamination potential may be limited.

Each pesticide, herbicide, fertilizer, or other chemical has unique properties which influence how they move downward (leach) through soil to groundwater. The highest potential for groundwater contamination occurs in sandy, permeable soils low in organic matter, particularly in locations with shallow water tables.

The DRASTIC model only provides a relative evaluation of vulnerability and is not designed to provide absolute vulnerability. Generally, it is fairly easy to delineate many areas of high vulnerability, difficult to say for certain that an area has very low vulnerability, and not possible to make fine gradations in between. Areas identified with high risk may need a detailed hydrogeologic evaluation performed (Nebraska Natural Resources Commission). Solely utilizing this vulnerability model (or any) to base management decisions on should be done conservatively and with additional information. Groundwater management requires the cooperative efforts of regulatory policy makers, natural resource managers, educators, and technical experts. Actions based solely on a vulnerability assessment should be tempered by the uncertainty of the assessment and the confidence of the technical experts in the assessment they have produced (National Research Council, 1993).



Source: Adapted from University of Texas at Austin – Center for Research in Water Resources

Figure 8: Typical Routes of Groundwater Contamination

Groundwater vulnerability is a function of the properties of the natural systems that groundwater resides in; however, the risk of contamination may be relativity low or high regardless of the vulnerability. Risk of contamination is derived from the proximity of activities which may increase the introduction of contaminates to vulnerable areas. For example, limiting pesticide applications or industrial development would reduce the risk of groundwater contamination. Additional groundwater

monitoring of vulnerable areas may also reduce the risk of contamination. It is important that decision makers understand the distinction between vulnerability and risk. (Rahman 2008) Figure 8 illustrates the many ways in which contamination may be introduced to a groundwater system (risk factors). The more potential sources of contamination present, the higher the risk of contamination (regardless of vulnerability).

BECAUSE THE WELLHEAD PROTECTION AREA IS THE MOST CRITICAL AREA FOR RECHARGE OF THE CITY OF CRETE'S SOURCE OF DRINKING WATER, IT SHOULD BE CONSIDERED HIGHLY VULNERABLE AND EVERY RISK FACTOR SHOULD BE EVALUATED CAREFULLY.

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SECTION 2. CRETE WATER SYSTEM

2.01 NEBRASKA'S PUBLIC WATER SYSTEM PROGRAM

The EPA established the Public Water System Supervision (PWSS) Program under the authority of the 1974 Safe Drinking Water Act (SDWA). Under the SDWA and the 1986 Amendments, EPA sets national limits on contaminant levels in drinking water to ensure that the water is safe for human consumption. These limits are known as Maximum Contaminant Levels (MCLs). Additionally EPA sets rules for sampling, treatment, and public notification. Within the State of Nebraska, the Division of Public Health of the Department of Health and Human Services (DHHS) administers the PWSS Program, under EPA authority. The mission of the Public Water System Program of DHHS is to protect the health and welfare of Nebraskans by assuring safe, adequate, and reliable drinking water

PEOPLE EXPECT THEIR DRINKING WATER WILL BE SAFE WHEN THEY TURN ON THE FAUCET.

As part of administering the PWSS program, DHHS Department of Regulation and Licensure visits all Public Water Supply Systems (PWSSs) to conduct a sanitary survey. The routine sanitary survey is conducted once every three years for community water systems (CWS). A sanitary survey is an on-site review of the water source, facilities, equipment, operations, and maintenance of a public water system for the purpose of evaluating the system's adequacy and ability to reliably produce and distribute safe drinking water within the confines of the regulatory requirements.

The sanitary survey also includes a vulnerability assessment done within 1,000 feet of community wells. Ranking of vulnerability is based on the locations of potential contaminant sources within established setbacks up to a 1,000 foot radius.

Crete's most recently completed (2011) Sanitary Survey and Annual Water Quality Report (2011) is included in Appendix A. The documents are also available from the Crete Department of Public Works.

2.02 CRETE WATER SYSTEM INFORMATION

The City of Crete's municipal water system consists of six wells, an underground concrete storage reservoir, an elevated steel water tank, two water treatment plants for iron and manganese removal, approximately 43.3 miles of water main, and is laid out in a two zone distribution system. The water system is metered at the individual wells and at the individual connections. Table 3, displays the general system summary for Crete's water system.

The source of water supply for Crete is groundwater, which is stored in aquifers underlying the Crete area. Water is supplied to the city by six city-owned municipal wells, which extract groundwater from the water bearing formation. Figure 9 and Table 3 display additional location and information about each well.

Table 2: Crete General Water System Information

General System Information	
Population Served	6,800
Meters Connected	100%
Maximum Daily (24-hour) Production Capability	4.694 million gallons/day
Total Production for past year	337.546 million gallons

Source: Public Water Supply Routine Sanitary Survey (2011)

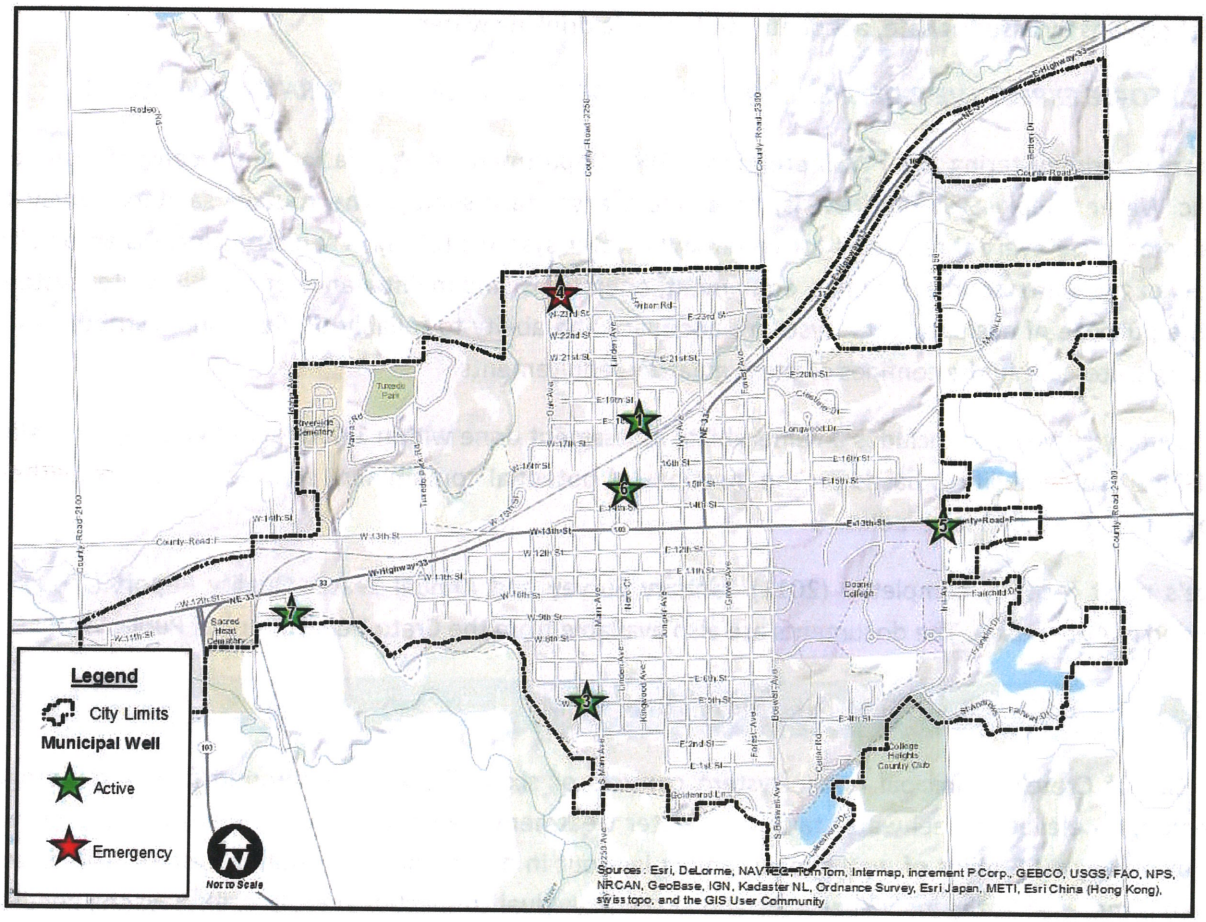


Figure 9: Crete Municipal Well Location

Table 3: Crete Municipal Water Supply Well Information

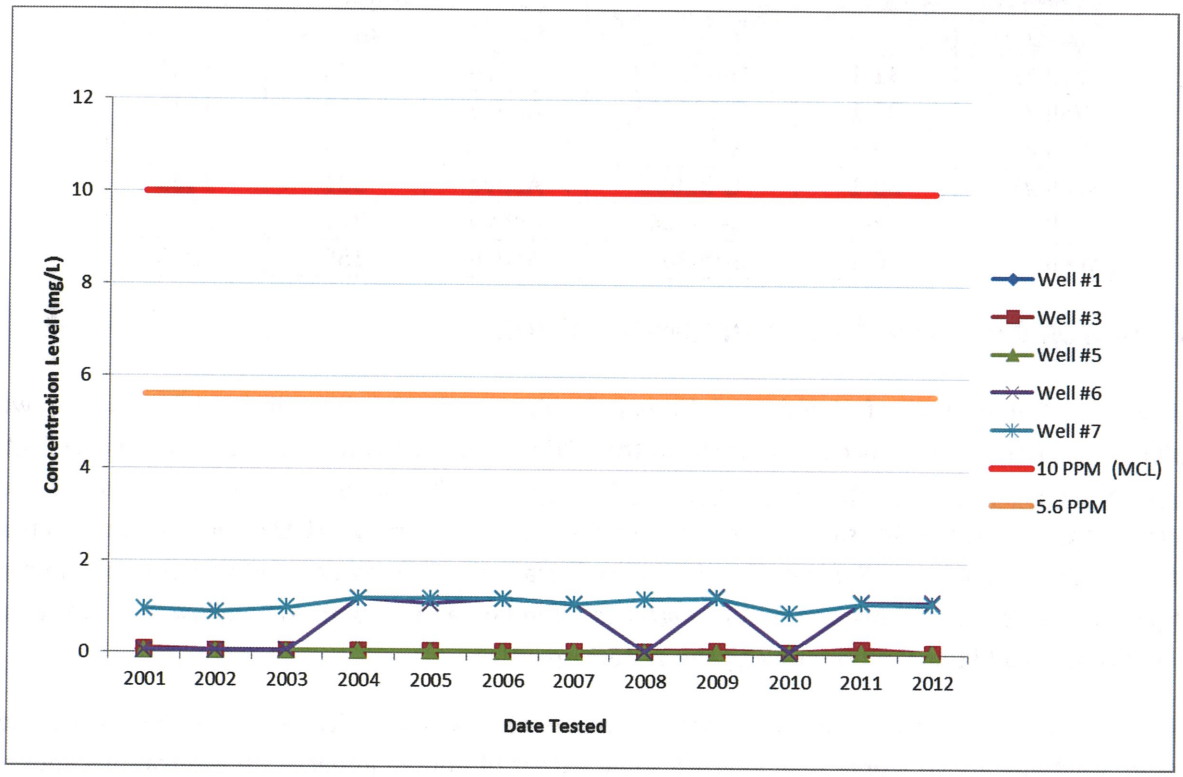
Well Common Name	Well ID #	DNR Registration #	Status	Total Well Depth (feet)	Date Built
Well #1	31-1	G-031679	Active	180	1931
Well #3	39-1	G-031681	Active	182	1939
Well #4	55-1	G-031682	Emergency	214	1955
Well #5	65-1	G-31683	Active	321	1965
Well #6	72-1	G-063645	Active	221	1972
Well #7	66-1	G-063646	Active	155	1966

2.03 HISTORICAL NITRATE SAMPLING INFORMATION

The Nebraska Department of Health and Human Services maintains historical drinking water well sampling information. This is accessible through the "Drinking Water Watch" located on their website: http://dhhs.ne.gov/publichealth/Pages/enh_pwsindex.aspx. The "Drinking Water Watch" was searched for nitrate-nitrite (code 1038) sampling results for the past 10 years (2001 thru 2012). The available results are displayed below in Table 4. The chart also displays the EPA regulated Maximum Contaminant Level (MCL) at 10 parts per million (PPM or mg/L) as a red line and 5.6ppm as a yellow line, which is a level that triggers additional monitoring by the system operator.

Nitrates are known to be a natural occurrence in groundwater, with a typical background concentration of 3 ppm. Anything above 3 ppm may indicate some extent of human impacts. Concentrations above 5 ppm have most likely been affected by human activity (Gosselin, 1997). Currently, all wells are sampled on a yearly basis. No well indicated it was currently, or previously, near the Maximum Contaminant Level (MCL) of 10 parts per million (PPM) for nitrate.

Table 4: Historical Nitrate-Nitrite Sampling Data



SECTION 3. CRETE WELLHEAD PROTECTION AREA

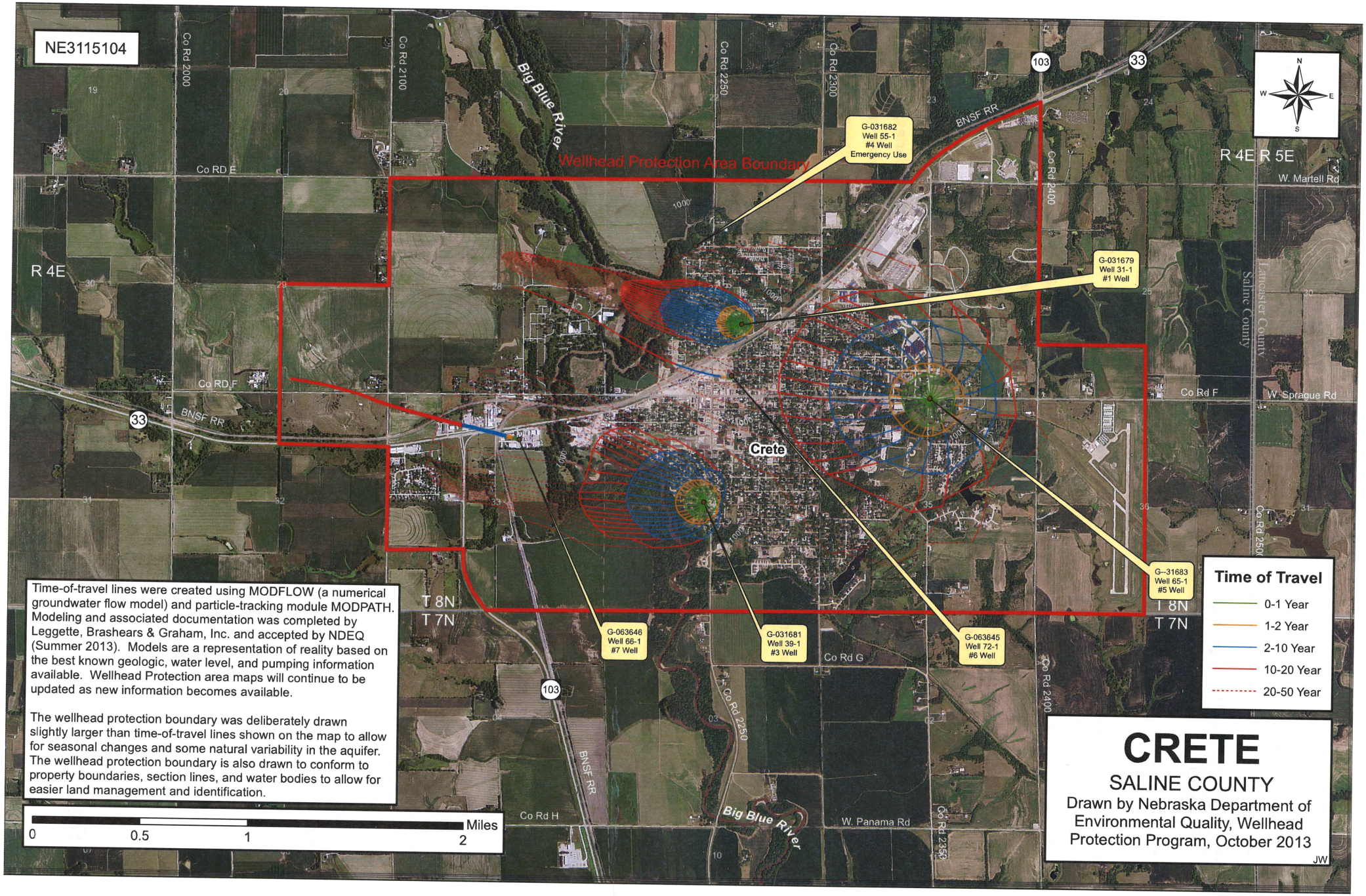
3.01 WELLHEAD PROTECTION AREA SUMMARY

Crete's previous wellhead protection area (WHPA) was provided by the NDEQ in September 2012. In October 2013, the NDEQ updated Crete's WHPA (Figure 10). The WHPA was created by NDEQ based on modeling conducted by Leggette, Brashears, & Graham, Inc. (LBG) and accepted by NDEQ. Time-of-travel lines were created using MODFLOW (a numerical groundwater flow model) and particle-tracking module MODPATH. Additional documentation is provided by a report from LBG in Appendix B, dated July 2, 2013. Crete's current WHPA covers a total of approximately 4,500 acres.

Groundwater modeling utilizes geohydrologic modeling variables for steady pumping wells, including the influence of hydrological boundaries, annual recharge estimation, and no-flow boundaries, such as rivers, recharge areas, historical well pumping data, and no-flow contacts like the local geological formations of bedrock. Additionally groundwater flow direction and velocity, pumping volumes, and well construction data is used in the model. The modeling generates flow lines, which depict the approximate path groundwater, or a contaminant in groundwater, will take to reach a well. These flow lines are associated with an estimated time-of-travel (TOT). One set of TOT path lines are delineated for each active well: one, two, 10, 20, and 50-year. The 20-year time-of-travel is what generally determines the water system's wellhead protection area. However, due to the advanced modeling provided by LBG, the City of Crete and NDEQ delineated the WHPA on the 50-year TOT lines. This will enabled increased long-term protection and planning.

The wellhead protection boundary is deliberately drawn slightly larger than time-of-travel lines shows on the map to allow for seasonal changes and some natural variability in the aquifer. The wellhead protection area is statutorily recognized as a boundary in which a community can manage potential contaminant sources though a wellhead protection program. The WHPA is delineated around the 20-year time-of-travel along visible or easily identifiable boundaries such as roads, rivers, creeks, section, quarter-section, and quarter-quarter sections lines. This allows for easier land management and identification. Maps are periodically updated as modeling advances, the science behind aquifers advances, as wells are added/removed from use, or as well pumping volumes change.

THE WELLHEAD PROTECTION AREA MAP BY ITSELF DOES NOT GIVE A COMMUNITY ANY ADDITIONAL AUTHORITY OR PROTECTION OF THE PUBLIC WATER SUPPLY. IT IS JUST A PIECE OF "SCRAP PAPER" UNLESS A COMMUNITY ENACTS ORDINANCES, ZONING, OR VOLUNTARY ACTIVITIES WITHIN THE WHPA.


NE3115104
Wellhead Protection Area Boundary
G-031682
Well 55-1
#4 Well
Emergency Use
G-031679
Well 31-1
#1 Well
G--31683
Well 65-1
#5 Well
G-063646
Well 66-1
#7 Well
G-031681
Well 39-1
#3 Well
G-063645
Well 72-1
#6 Well
Crete
Big Blue River
BNSF RR
Co RD E
Co RD F
Co Rd G
Co Rd H
Co Rd 2000
Co Rd 2100
Co Rd 2250
Co Rd 2300
Co Rd 2400
Co Rd 2500
W. Martell Rd
W. Sprague Rd
W. Panama Rd
Saline County
Lancaster County
R 4E
R 4E R 5E
T 8N
T 7N
Time of Travel
0-1 Year
1-2 Year
2-10 Year
10-20 Year
20-50 Year
Time-of-travel lines were created using MODFLOW (a numerical groundwater flow model) and particle-tracking module MODPATH. Modeling and associated documentation was completed by Leggette, Brashears & Graham, Inc. and accepted by NDEQ (Summer 2013). Models are a representation of reality based on the best known geologic, water level, and pumping information available. Wellhead Protection area maps will continue to be updated as new information becomes available.
The wellhead protection boundary was deliberately drawn slightly larger than time-of-travel lines shown on the map to allow for seasonal changes and some natural variability in the aquifer. The wellhead protection boundary is also drawn to conform to property boundaries, section lines, and water bodies to allow for easier land management and identification.
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Miles
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SALINE COUNTY
Drawn by Nebraska Department of Environmental Quality, Wellhead Protection Program, October 2013
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3.02 WELLHEAD PROTECTION AREA LAND COVER

Types of land cover can affect nonpoint source (NPS) pollution, which, unlike pollution from industrial and sewage treatment plants, comes from many diffuse (and often hard to find) sources. NPS pollution is caused by rainfall or snowmelt moving over and through the ground. As the runoff travels across the land surface or through the ground, it picks up and carries away natural and human-made pollutants, finally depositing them into lakes, rivers, wetlands, coastal waters and groundwaters. Certain types of ground cover are commonly associated with varying potential for different types of contaminates, as shown in Figure 11, below. An inventory of land cover will allow Crete to adopt specific and appropriate management strategies to reduce potential contamination.

Agriculture areas, particularly row-crops, can contribute to non-point source pollution through agricultural runoff, which can potentially contribute to nitrates flowing into surface water, and nitrates infiltrating through the soil into groundwater aquifers.

Urban land areas, particularly areas of impervious surfaces, can contribute to non-point source pollution through various sources, such as increased run off of parking lots, over application of lawn fertilizers, or other industrial land uses. However, urban areas can also be a particular area of concern due to the high concentration of facilities or land uses which can contribute to water pollution.

A



B



C



Figure 11: Varying Types of Landuse. (A) Row crops; (B) Abandoned gas station in an urban setting; (C) Natural vegetation

Natural vegetation, such as trees, grasses, and shrubbery are generally considered to have the capability of improving or protecting water quality. Natural vegetation can act as a buffer or filter between pollutant sources and water bodies. The vegetation often removes some or all of contaminants and nutrients before they enter the water supply.

Land cover in the Crete WHPA was determined by GIS analysis of the 2011 USDA-NRCS's Cropland Data Layer (CDL), which is available at the GeoSpatial Data Gateway (http://datagateway.nrcs.usda.gov/). The CDL is a complete, geographically referenced classification of all satellite ortho-imagery data within a state by crop or land cover. By using imagery from multiple times of the year, the CDL is able to classify pastures, trees, and other permanent vegetation separately from annual crops. The CDL is spot-checked for accuracy during the potential contaminant source inventory. Table 5, below, displays the land cover in the Crete WHPA. The percentages of land cover are approximate. The Crete WHPA's land cover is evenly distributed between row crops, developed areas, and "natural areas".

Strategies to limit non-point source water pollution may vary greatly throughout the WHPA because of the varying land uses. See Figure 12 for a map of the land cover. Several management strategies are discussed to limit non-point source pollution in Section 6: Management Strategies.

Land cover types included in the summary are as follows:

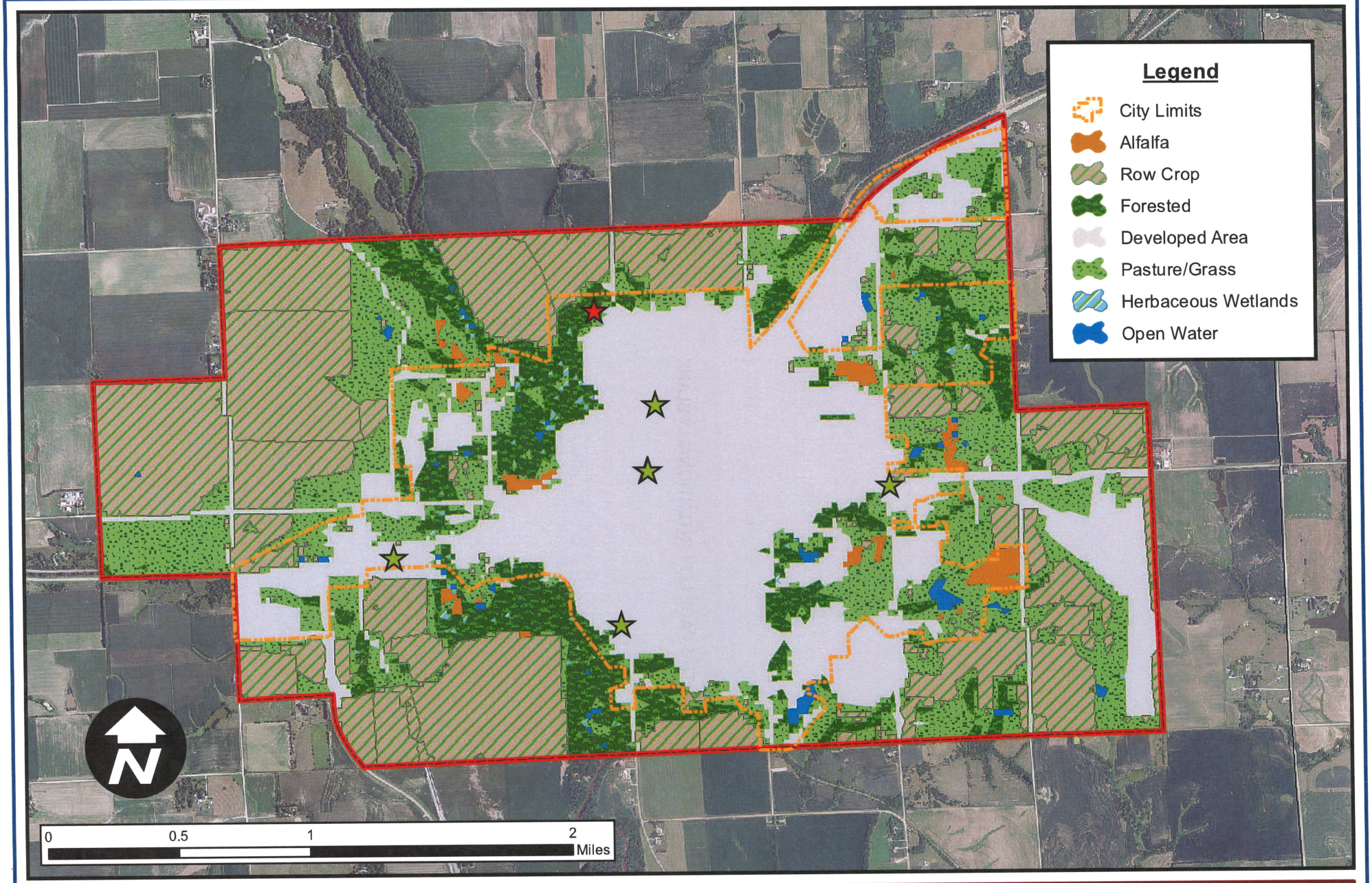
- **Developed, Open Space** - Includes areas with a mixture of some constructed materials, but mostly vegetation in the form of lawn grasses. Impervious surfaces account for less than 20 percent of total cover. These areas most commonly include large-lot single-family housing units, parks, golf courses, gravel roads and ditches, and vegetation planted in developed settings for recreation, erosion control, or aesthetic purposes
- **Developed, Low Intensity** - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 20-49 percent of total cover. These areas most commonly include single-family housing units.
- **Developed, Medium Intensity** - Includes areas with a mixture of constructed materials and vegetation. Impervious surfaces account for 50-79 percent of the total cover. These areas most commonly include single-family housing units.
- **Developed, High Intensity** - Includes highly developed areas where people reside or work in high numbers. Examples include apartment complexes, row houses and commercial/industrial. Impervious surfaces account for 80 to100 percent of the total cover.
- **Deciduous Forest** - Areas dominated by trees generally greater than 5 meters tall, and greater than 20% of total vegetation cover. More than 75 percent of the tree species shed foliage simultaneously in response to seasonal change.
- **Grassland/Herbaceous** - Areas dominated by herbaceous vegetation, generally greater than 80% of total vegetation. These areas are not subject to intensive management such as tilling, but can be utilized for grazing.
- **Pasture/Hay** - Areas of grasses, legumes, or grass-legume mixtures planted for livestock grazing or the production of seed or hay crops, typically on a perennial cycle. Pasture/hay vegetation accounts for greater than 20 percent of total vegetation.
- **Cultivated (Row) Crops** - Areas used for the production of annual crops, such as corn, soybeans, vegetables, tobacco, and cotton, and also perennial woody crops such as orchards and vineyards. Crop vegetation accounts for greater than 20 percent of total vegetation. This class also includes all land being actively tilled.
- **Woody Wetlands** - Areas where forest or shrubland vegetation accounts for greater than 20 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.

- **Alfalfa** – Areas used for the production of alfalfa for livestock, typically on a perennial cycle.
- **Herbaceous Wetlands** - Areas where perennial herbaceous vegetation accounts for greater than 80 percent of vegetative cover and the soil or substrate is periodically saturated with or covered with water.
- **Open Water** – All areas of open water, generally with less than 25 percent of vegetation or soil.

Table 5: Crete WHPA Land Cover Breakdown

Land Cover Type	Wellhead Protection Area	
	Total Acres in WHPA	% of Total in WHPA
Alfalfa	47	1%
Barren	0	0%
Corn	520	12%
Deciduous Forest	517	11%
Developed/High Intensity	100	2%
Developed/Low Intensity	841	19%
Developed/Medium Intensity	202	4%
Developed/Open Space	451	10%
Fallow/Idle Cropland	0	0%
Grassland Herbaceous	957	21%
Herbaceous Wetlands	0	0%
Open Water	24	1%
Pasture Hay	18	0%
Rye	0	0%
Soybeans	814	18%
Winter Wheat	0	0%
Woody Wetlands	16	0%
Total	**4,508**	100%
Summary		
Row Crop (Corn, Soybeans, etc.)	1,335	30%
Developed (Roads, Town, Farmsteads)	1,594	35%
Grassland/Pasture/Alfalfa/Forested	1,579	35%

Source: 2011 Cropland Data Layer, provided by USDA-NRCS GeoSpatialDataGateway



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Crete Wellhead Protection Plan
Figure 12: Crete WHPA Land Cover

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SECTION 4. POTENTIAL CONTAMINANT SOURCE INVENTORY

The purpose of a potential contaminant source inventory (CSI) is to identify potential drinking water contaminants or sources that contaminants may originate from. Strategies to limit non-point source water pollution may vary greatly within the WHPA because of the varying types of potential contaminant sources. See Figure 12 for a map of the land cover. Several management strategies are discussed to limit non-point source pollution in Section 6: Management Strategies. Additionally, identifying potential sources of contamination allows a community to plan for potential accidental releases of pollutants. The inventory is compiled from existing databases and on-the-ground observations. Even if identified in the CSI, a feature may not be contributing to contamination presently.

UNDERSTANDING WHAT POTENTIAL CONTAMINANT SOURCES EXISTS WITHIN THE WHPA, ALLOWS A COMMUNITY TO MAKE INFORMED DECISIONS TO SAFELY MANAGE THEIR DRINKING WATER SUPPLY.

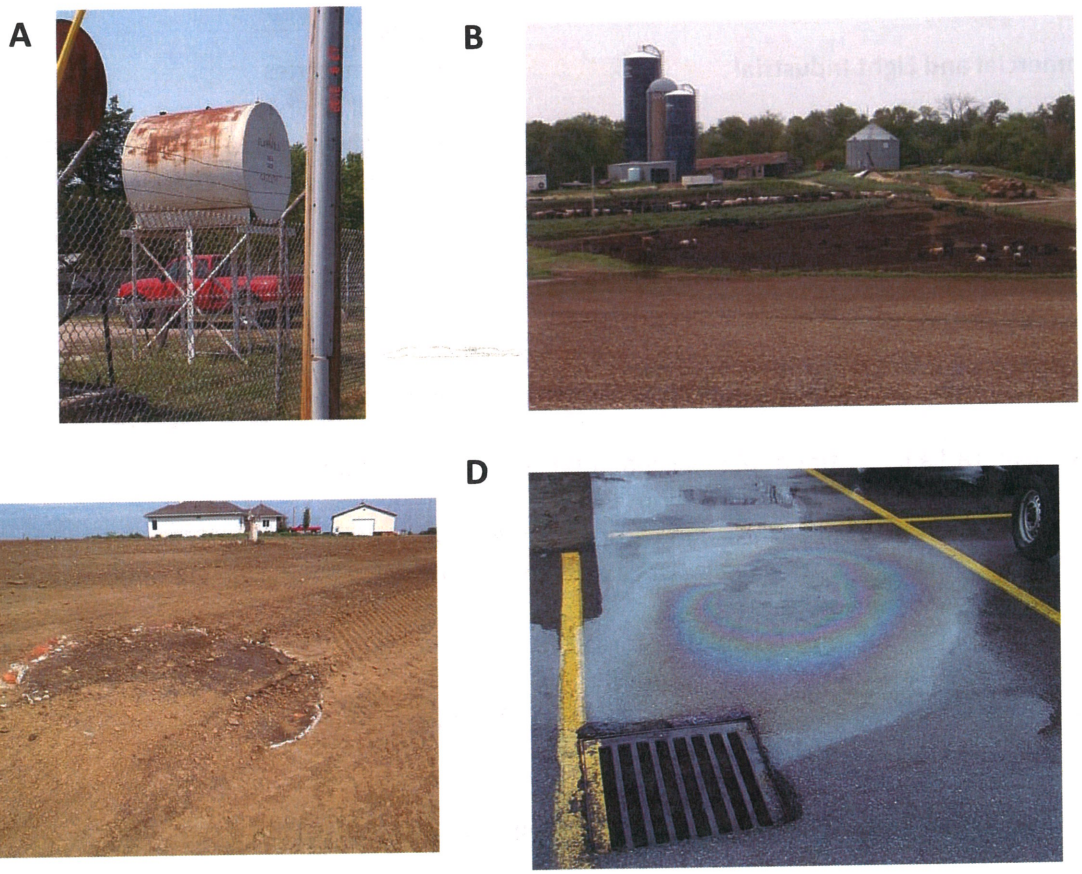


Figure 13: Common Potential Contaminant Sources. (A) Leaking Fuel Drums; (B) Livestock Waste; (C) Abandoned Wells; (D) Parking Lot Runoff

It is important to note that this inventory only represents a snapshot in the history of the area. There may be features which have already contributed to groundwater contamination, but there is no record of their occurrence. Just as likely, is that, features recorded may not be actively operating, but have in the past. Due to the long period of time it can take for an aquifer to respond to changes in the land surface or for contaminants to migrate through the aquifer, historical land use and activities are important to record.

Based on guidance provided by NDEQ, the inventory typically consists of:

Agricultural

- Fuel Storage
- Grain Storage
- Water Wells
- Chemigation
- Livestock
- Abandoned Wells

Commercial and Light Industrial

- Auto Repair
- Dry Cleaners
- Fuel Stations
- Machine Shops
- Rail Yards
- Large Parking Lots

Industry

- Manufacturing Plants
- Gas/Oil Wells
- Junk Yards
- Landfills
- Sewage Treatment Facilities

Other

- Cemeteries
- Golf Coursies
- Highway/Road Maintenance Yards
- Transportation Corridors
- Others

Crete's potential contaminant source inventory (CSI) is a compilation of multiple sources:

- Nebraska Department of Environmental Quality* provided:
  - NDEQ Regulated Facilities Database
  - Above & Below Ground Storage Tank Database (maintained by State Fire Marshall)
  - Gas and Oil Wells Database (maintained by Nebraska Oil and Gas Conservation Commission)
  - Agriculture Chemical Storage & Manufacturer Database (maintained by Nebraska Department of Agriculture)
- Nebraska Department of Natural Resources* (DNR) provided:
  - Registered Wells Database
- JEO Consulting Group, Inc,. conducted:
  - On-the-ground field inventory completed May 16th, 2013

**The data made available through outside agencies was furnished for interpretive reasons. To the extent possible, the data is current, accurate, and reliable. However, there may be discrepancies in the information and not all map location coordinates have been verified. In addition, the NDEQ assumes no legal responsibility, either implied or*

expressed, about the accuracy, completeness, reliability, or appropriateness of this data made available through or retrieved from its web site.

The field inventory was completed on May 16th, 2013 using a tablet PC with Geographic Information System (GIS) software and aerial photography. JEO prepared a CSI geodatabase to collect data on potential contaminant sources as identified in the field through a windshield survey. The CSI is a major step in establishing a wellhead protection plan and includes recording locations and information on potential contaminant sources such as fuel storage, onsite wastewater systems, illegal wells, and many others.

Due to the use of a laptop computer with GIS, field data sheets were not used to collect data on potential contaminant sources. Information collected in the field was entered directly into a database as seen in the CSI database tables below. A CSI allows a community to plan for and manage potential contaminant sources and decide where to focus educational and management efforts to minimize the likelihood of source water contamination. Table 6, below, displays a summary count of potential contaminant sources found in the Crete WHPA. A full map of Crete's CSI is found below in Figure 14, where each potential contaminant is numbered on the map and then included in a database (Table 7), with information on each potential contaminant.

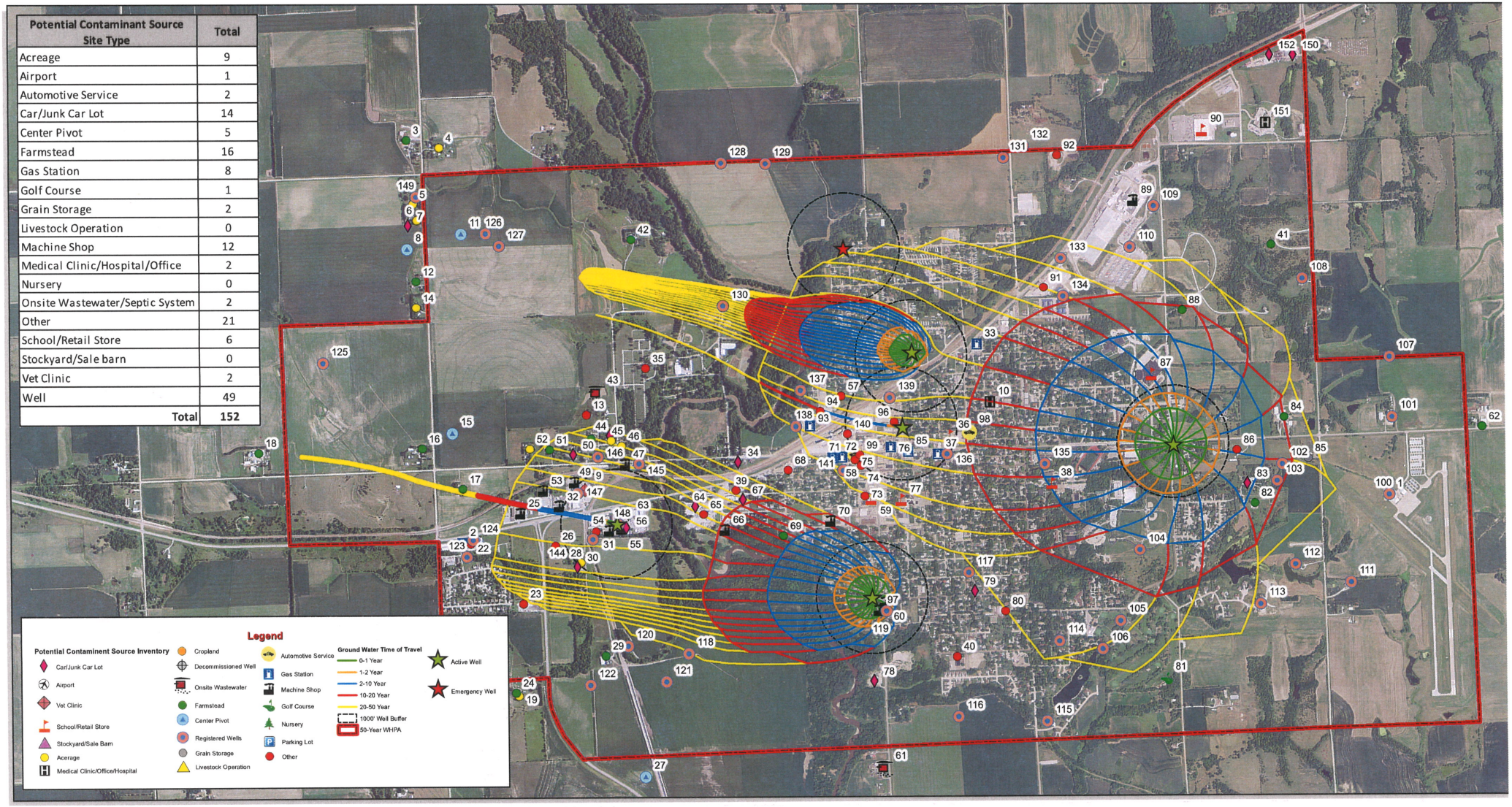
Table 6: Crete Potential Contaminant Sources Summary

Potential Contaminant Source Site Type	Total
Acreage	9
Airport	1
Automotive Service	2
Car/Junk Car Lot	14
Center Pivot	5
Farmstead	16
Gas Station	8
Golf Course	1
Grain Storage	2
Livestock Operation	0
Machine Shop	12
Medical Clinic/Hospital/Office	2
Nursery	0
Onsite Wastewater/Septic System	2
Other	21
School/Retail Store	6
Stockyard/Sale barn	0
Vet Clinic	2
Well	49
Total	**152**

The stakeholder committee reviewed and discussed the potential contaminant source inventory to ensure local accuracy, to add any historical items that may not be recorded in state-maintained databases, and to ensure nothing was missed in the field inventory.

All rural residences (farmsteads and acreages) were assumed to have both a private well and septic system, which puts a potentially large number in the WHPAs (25 total). The CSI identified 40 potentially abandoned well sites, however more are assumed to exist and will need to be located. Old car/junk car lots were found to be fairly numerous (12), as well as machine shops (12) – both of which could potentially contained solvents, chemicals, and petrochemicals.

Potential Contaminant Source Site Type	Total
Acreage	9
Airport	1
Automotive Service	2
Car/Junk Car Lot	14
Center Pivot	5
Farmstead	16
Gas Station	8
Golf Course	1
Grain Storage	2
Livestock Operation	0
Machine Shop	12
Medical Clinic/Hospital/Office	2
Nursery	0
Onsite Wastewater/Septic System	2
Other	21
School/Retail Store	6
Stockyard/Sale barn	0
Vet Clinic	2
Well	49
Total	**152**



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Crete Wellhead Protection Plan
Figure 14: Potential Contaminant Sources Inventory Map

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Table 7: Crete Potential Contaminant Source Inventory

Record Number	SiteType	Above Ground Fuel Storage	Below Ground Fuel Storage	Automotive Chemical	Solvents	Fertilizer Storage	Chemical Storage	Septic System	Private Well	Stock well	Abandoned Well	Chemigation Site	Grain Fumigant	Structure Fumigant	Site Description	Materials Description	Facility Name
1	Airport	Yes	Yes	No	No	No	No	No	No	No	Yes	No	No	No		A few abandoned wells	Crete Municipal Airport
2	Gas Station	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No			C &V Truck Plaza
3	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	5 grain bins		
4	Acreage	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	abandoned farmstead, abandoned wind mill		
5	Acreage	Yes	No	No	No	No	No	Yes	Yes	No	No	No	No	No			
6	Acreage	Yes	No	No	No	No	No	Yes	Yes	No	No	No	No	No			
7	Car/Junk Car Lot	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No			
8	Center Pivot	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
9	Vet Clinic	No	No	No	No	No	No	No	No	No	No	No	No	No			Crete Vet Clinic
10	Medical Clinic/Hospital/Office	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No			Crete Area Medical Clinic
11	Center Pivot	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
12	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	horses, small junk yard, abandoned wind mill.		
13	Other	No	No	No	No	No	No	No	No	No	No	No	No	No			
14	Acreage	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No			
15	Center Pivot	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
16	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	abandoned wind mill, 1 grain bin		Bonnie Hillgren Farm
17	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	2 grain bins		
18	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	grain elevator; cattle		
19	Acreage	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	potentially abandoned farmstead.		
20	Center Pivot	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
21	Grain Storage	No	No	No	No	No	No	No	No	No	No	No	No	No	Grain Bin		
22	Other	No	No	No	No	No	Yes	No	No	No	No	No	No	No	Culligan Water Conditioning - storage facility		Culligan Water Conditioning
23	Other	Yes	No	No	No	No	No	No	No	No	No	No	No	No	Very large tank	Unknown	Schwann's Co
24	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	Possible livestock operation. NOT abandoned.		
25	Machine Shop	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No	small junk yard in back		
26	Other	No	No	No	No	No	No	No	No	No	No	No	No	No	cemetary		
27	Center Pivot	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
28	Acreage	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No	junk cars/Propane tank		
29	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	a few grain bins		
30	Car/Junk Car Lot	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No			
31	Other	No	No	No	No	No	No	No	No	No	No	No	No	No	car wash		
32	Machine Shop	No	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	outside yard +tire/oil changes		Orschlen Farm and Home
33	Gas Station	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No		w/ car wash	Stop N Shop
34	Car/Junk Car Lot	No	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No			
35	Other	No	No	No	No	No	No	No	No	No	No	No	No	No	Cemetery		
36	School/Retail Store	No	No	No	No	No	No	No	No	No	No	No	No	No	Sacred Heart School & Church		Sacred Heart School & Church
37	Gas Station	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No			Casey's
38	School/Retail Store	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No			Doane College
39	Other	No	No	No	No	No	No	No	No	No	No	No	No	No			Crete Livestock Market
40	Other	No	Yes	No	No	No	No	No	Yes	No	Yes	No	No	No		a few abandoned wells on site	NE ARNG Armory
41	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No			
42	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No			
43	Onsite Wastewater	No	No	No	No	No	No	No	No	No	No	No	No	No			
44	Car/Junk Car Lot	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No			
45	Acreage	Yes	No	No	No	No	No	Yes	Yes	No	No	No	No	No		Horse/donkey pen	
46	Acreage	Yes	No	No	No	No	No	Yes	Yes	No	No	No	No	No		horse pen	
47	Machine Shop	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No		Above Ground Fuel Tank	
48	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No			
49	Machine Shop	No	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No			Crete Farm and Lumber
50	Car/Junk Car Lot	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No			
51	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No			
52	Acreage	No	No	No	No	No	No	Yes	Yes	No	No	No	No	No			

Record Number	SiteType	Above Ground Fuel Storage	Below Ground Fuel Storage	Automotive Chemical	Solvents	Fertilizer Storage	Chemical Storage	Septic System	Private Well	Stock well	Abandoned Well	Chemigation Site	Grain Fumigant	Structure Fumigant	Site Description	Materials Description	Facility Name
53	Machine Shop	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No		Large stockpile of 55-gallon drums	
54	Machine Shop	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No		wrecked cars	
55	Machine Shop	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No		many 55-gallon drums, many diesel drums	
56	Car/Junk Car Lot	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No			
57	Other	No	Yes	No	No	No	No	No	No	No	No	No	No	No			Sapp Bros Petroleum Bulk Plant
58	Automotive Service	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No			Crete Auto Supply
59	School/Retail Store	No	No	No	No	No	No	No	No	No	No	No	No	No			Sunmart
60	Machine Shop	No	No	Yes	Yes	No	No	No	Yes	No	No	No	No	No		15 active wells	Farmers Coop
61	Onsite Wastewater	No	No	No	No	No	No	No	No	No	No	No	No	No			Crete Wastewater
62	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No			Ken McMillan Farm
63	Car/Junk Car Lot	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No			
64	Car/Junk Car Lot	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No			M&R Auto
65	Other	No	Yes	No	Yes	No	Yes	No	No	No	No	No	No	No			Crete Ready Mix
66	Machine Shop	Yes	No	Yes	Yes	No	No	No	No	No	No	No	No	No		Junk Cars & Above Ground Tank	
67	Car/Junk Car Lot	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No			
68	Other	No	No	No	No	No	No	No	No	No	No	No	No	No	Car Wash		
69	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No	Abandoned		
70	Machine Shop	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No			
71	Gas Station	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No			Casey's
72	Gas Station	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No	No			Jays Oil & Propane
73	Other	No	No	No	No	No	Yes	No	No	No	No	No	No	No	Pharmacy		Shopko
74	Other	No	No	No	No	No	No	No	No	No	No	No	No	No	laundry mat		
75	Other	No	No	No	No	No	No	No	No	No	No	No	No	No	dry cleaners		
76	Gas Station	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No			Sapp Bros
77	School/Retail Store	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No			Crete Elementary School
78	Car/Junk Car Lot	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No	Recycling Center		
79	Car/Junk Car Lot	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No			Eggert Transfer
80	Other	No	No	No	No	No	Yes	No	No	No	No	No	No	No	Accu-tab chemicals		Swim Park
81	Golf Course	Yes	No	No	No	Yes	No	No	No	No	No	No	No	No			
82	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No		Grain Bins (3)	
83	Car/Junk Car Lot	No	No	Yes	Yes	No	No	No	No	No	No	No	No	No		55-gallon drums	
84	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No			
85	Vet Clinic	No	No	No	No	No	No	No	No	No	No	No	No	No			Lothrop Farms/Animal Clinic
86	Grain Storage	No	No	No	No	No	No	No	No	No	No	No	No	No	grain bin operation		
87	School/Retail Store	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No			Crete High School
88	Farmstead	No	No	No	Yes	No	No	Yes	Yes	No	No	No	No	No			
89	Machine Shop	Yes	Yes	Yes	Yes	No	Yes	No	No	No	No	No	No	No			Nestle Purina PetCare Company
90	School/Retail Store	No	No	No	No	No	No	No	No	No	No	No	No	No			Super Walmart
91	Other	No	No	No	No	No	No	No	No	No	No	No	No	No			NOVEL Chemical Solutions Inc
92	Other	No	No	No	No	No	No	No	No	No	No	No	No	No			Crete Landfill North
93	Gas Station	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No			
94	Other	No	No	No	No	No	No	No	No	No	No	No	No	No			Douglas manufacturing Co
95	Gas Station	No	Yes	Yes	No	No	No	No	No	No	No	No	No	No			F & M Co-op Gas & Oil
96	Other	No	Yes	No	No	No	No	No	No	No	No	No	No	No			Crete Municipal Plant
97	Machine Shop	No	Yes	Yes	Yes	No	No	No	No	No	No	No	No	No			Vyhnalek Trucking
98	Automotive Service	No	No	No	No	No	No	No	No	No	No	No	No	No	Hiers Hillside Service (previously)		Abloom Floral and Gifts
99	Other	No	Yes	No	No	No	No	No	No	No	No	No	No	No		Orphan Tank	
100	Well	No	No	No	No	No	No	No	No	No	No	No	No	No			
101	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
102	Well	No	No	No	No	No	No	No	No	No	Yes	No	No	No			
103	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
104	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			

Record Number	SiteType	Above Ground Fuel Storage	Below Ground Fuel Storage	Automotive Chemical	Solvents	Fertilizer Storage	Chemical Storage	Septic System	Private Well	Stock well	Abandoned Well	Chemigation Site	Grain Fumigant	Structure Fumigant	Site Description	Materials Description	Facility Name
105	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
106	Well	No	No	No	No	No	No	No	No	No	No	No	No	No			
107	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
108	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
109	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
110	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
111	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
112	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
113	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
114	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
115	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
116	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
117	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
118	Well	No	No	No	No	No	No	No	No	No	Yes	No	No	No			
119	Well	No	No	No	No	No	No	No	No	No	No	No	No	No		15 active wells	
120	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
121	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
122	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
123	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
124	Well	No	No	No	No	No	No	No	No	No	Yes	No	No	No		4 abandoned wells	
125	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
126	Well	No	No	No	No	No	No	No	No	No	Yes	No	No	No			
127	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
128	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
129	Well	No	No	No	No	No	No	No	No	No	No	No	No	No			
130	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No	Inactive		
131	Well	No	No	No	No	No	No	No	No	No	Yes	No	No	No			
132	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
133	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
134	Well	No	No	No	No	No	No	No	No	No	Yes	No	No	No		3 abandoned wells	
135	Well	No	No	No	No	No	No	No	No	No	Yes	No	No	No		6 abandoned wells	
136	Well	No	No	No	No	No	No	No	No	No	Yes	No	No	No		4 abandoned wells	
137	Well	No	No	No	No	No	No	No	No	No	Yes	No	No	No		3 abandoned wells	
138	Well	No	No	No	No	No	No	No	No	No	Yes	No	No	No		4 abandoned wells	
139	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No		30 active wells	
140	Other	No	Yes	No	No	No	No	No	Yes	No	No	No	Yes	Yes		11 active wells	Bunge Milling
141	Well	No	No	No	No	No	No	No	No	No	No	No	No	No			
142	Well	No	No	No	No	No	No	No	No	No	Yes	No	No	No		6 abandoned wells	
143	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
144	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
145	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
146	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No		suspense well	
147	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No		11 active wells	
148	Well	No	No	No	No	No	No	No	No	No	Yes	No	No	No	3 abandoned wells		
149	Well	No	No	No	No	No	No	No	Yes	No	No	No	No	No			
150	Car/Junk Car Lot	No	No	Yes	No	No	No	No	No	No	No	No	No	No			Sid Dillon Auto
151	Medical Clinic/Hospital/Office	Yes	Yes	No	No	No	No	No	No	No	No	No	No	No			Crete Area Medical Center
152	Car/Junk Car Lot	No	No	Yes	No	No	No	No	No	No	No	No	No	No			Hillside Auto

SECTION 5. MANAGEMENT STRATEGIES

This wellhead protection plan lays out the ground work for protecting Crete's drinking water source. Crete should develop a comprehensive management strategy to implement actions over the next 10 to 20 years. The follow may serve as a starting point for discussion or ideas, however it will take constant work from city officials, residents, and land owners to actively protect Crete's drinking water.

In areas where nonpoint contamination is likely, application of best management practices will help improve well water quality, however improved management practices must be applied on a regional scale and not just on isolated fields. In instances where well water contamination has been affected by local activities and sources of contamination (bacterial), improved conditions around individual wells is necessary (Gosselin, 1997).

THE FOLLOWING LIST OF STRATEGIES IS NOT INTENDED TO BE A "STEP BY STEP" GUIDE, BUT RATHER A HIGHLIGHT OF THE POTENTIAL ACTIVITIES WHICH COULD BENEFIT GROUNDWATER PROTECTION.

The ultimate goal of the management practice recommendations below is to provide the community with the best possible management strategies, which are both implementable and protective of the water supply for the community. It is important to note that the management strategies outlined below, while endorsed by the NDEQ, were developed based on the potential pollution sources identified through the potential contaminant source inventory, land use evaluation, and comments gathered through the community planning process.



Figure 15: Samples brought in through a Test-Your-Well Event

Educational activities and voluntary approaches should be considered the core of the recommended management strategies for Crete's Wellhead Protection Plan because these can be implemented now. Furthermore, even though the City is owner and operator of the community water system, it does not have jurisdiction over all of the land identified in the wellhead protection areas. Consequently, educational activities and voluntary approaches offer the greatest potential for more immediate and successful plan implementation.

For example, the City could host a "Test-Your-Well Night", where area residents with private well could bring samples of their water (Figure 15) for Nitrate testing and to learn more about source water protection.

Management strategies outlined below are general in nature; however they should not be considered the only options available. Specific strategies should be developed on a case-by-case basis through working with landowners, the Lower Big Blue NRD, wellhead protection stakeholder committee, and the community. Some areas within the WHPA may provide opportunities to work directly with willing landowners. These opportunities often are the low hanging fruit in a wellhead protection program, and should be pursued on a priority basis, whenever feasible.

5.01 POTENTIAL MANAGEMENT ACTIVITIES

Public Education – *Education is often the first step in a successful wellhead protection program*. Crete has provided education opportunities in the past and will continue to provide opportunities to educate all ages of citizens and property owners, in and around the wellhead protection area, about the importance of source water protection. There are many entities which could assist in education efforts such as local schools, the Lower Big Blue NRD, University Extension, and the Nebraska Rural Water Association.

Public education efforts may include, but are not limited to:

- Focus groups
- Community workshops
- Press releases
- "Test Your Well" nights
- Distributing brochures
- School poster contests
- News/information articles
- Utility bill stuffers
- Others

Education could be on a variety of topics, such as:

- Proper animal waste handling
- Aquifer and Groundwater Basics
- Private Well and Lagoon Management
- Urban and Rural BMP practices
- Others

Wellhead Protection Area Signage – Crete can post WHPA signs in the affected areas to alert property owners to the issues. Nebraska Department of Roads (NDOR) can install signs on the State Highway System where it intersects with the WHPA's. These signs could be supplemented with information regarding existing land use regulations and directing property owners to contact the City of Crete.



Figure 16: Installed WHPA Signage

Decommission Abandoned Wells – Abandoned wells can directly channel contaminated surface water into groundwater, and so pose a considerable risk to water supplies. Abandoned wells must be decommissioned (filled, sealed, and plugged) according to state regulations or they are deemed "illegal". The Lower Big Blue NRD could help implement this program as they currently offer cost-share assistance in decommissioning abandoned wells.

Infrastructure Security – Focusing on infrastructure security can help to reduce the immediate risk to drinking water. Installing locks, adding lighting to well houses, and installing fencing around equipment are all examples of work that is easily implementable and has an immediate effect.

Deep Soil Sampling Cost Share– Deep soil sampling (36 inches in depth) enables producers to better manage fertilizer application by knowing what exists in the full crop root zone. The Lower Big Blue NRD currently has a cost-share program for performing a deep soil sample. The City of Crete can encourage producers to perform deep soil sampling. If the results are used to inform management decisions, this will ultimately reduce nitrate introduction into the source aquifer.

Groundwater Sampling – Groundwater monitoring wells can help with evaluation of whether management practices implemented in the wellhead protection area are effective. Groundwater sampling can help the City determine the current nitrate concentrations in the WHPAs. The NRD has an irrigation well sampling program and monitoring wells throughout the district.

Vadose Zone Soil Sampling - In order to better understand the potential level of nitrate contamination, the City could conduct vadose testing of nitrate levels in the wellhead protection areas. This would help to determine future areas of concern for nitrate contamination of the groundwater and would help establish management strategies as part of the source water plan.

Easements and Contracts – Some areas within the WHPA may provide opportunities to work with willing landowners. Conservation easements, cost share assistance, land purchasing/managed leasing or contracting with land owners for land use restrictions may be viable options to protect areas outside the City's zoning power.

Conservation Reserve Program (CRP) – Agricultural producers with farmed land in a WHPA are eligible for increased payment amounts for enrolling land in the CRP when located in a wellhead protection area. The local NRD and NRCS office would assist in this.

Water Conservation Planning – This encompasses polices, strategies, and activities to manage fresh water in a sustainable manner. It generally includes ways in which communities, business, households, individuals and agriculture produces work to reduce the amount of water used or wasted. See Section 7.04 for additional information.

Installation of Monitoring Wells – Monitoring wells are used to monitor the groundwater level and can also be used to sample the groundwater quality. Installation at different levels can allow for discrete samples to be taken at varying elevations at the same map location. The City could work with the NRD and NDEQ to install these. Data from these well could be used as a trigger as part of a conservation plan or as additional information for future planning.

Advanced Vulnerability Assessment – Understanding the vulnerability to groundwater contamination is important to the implementation of management activities. Currently, no detailed model of Crete's source water's vulnerability exists. The DRASTIC model in Figure 7: Groundwater Vulnerability to

Contamination in Nebraska Using the DRASTIC MethodFigure 7 is not a detailed model and only gives a general sense that there are areas near Crete which are highly vulnerable. A tailored and up-to-date modeling effort would be beneficial to the City.

Best Management Practices (BMPs) – Both urban and agricultural BMPs offer an effective prevention strategy or solution to reduce the threat of contamination of groundwater. Agriculture BMPs focus on management of agricultural inputs and general land management to provide for economic, environmental, and agronomic efficiency in an operation. Selection of the most appropriate BMP or combination of BMPs under a voluntary approach is each land owner's decision. Additionally, The NRD, NRCS, and others could offer incentives to increase the amount of BMPs implemented. Additional information on BMP's can be obtained from the Lower Big Blue NRD or the local NRCS office.

Agricultural BMPs

- Vegetative and tillage practices
- Increase the amount of soil sampling
- Encourage no-till or low-till agriculture
- Irrigation Management
- Pesticide Management
- Livestock Waste Management
- Windbreak Management
- Nitrogen Management
- Use of Nitrogen Inhibitors
- Buffer, Filter Strips, or Strip Cropping
- Establish permanent cover on marginal cropland
- Integrated Pest Management
- Adoption of "smart technology"
- Irrigation Scheduling
- Domestic Well Registration
- Others

Urban BMP Incentives

- Use of native plants in lawns and landscapes
- Recycling
- Soil Sampling of lawns
- Mulching Lawn Clippings
- Rain Barrels/Rain Gardens
- Household hazardous waste collection
- Rain sensor rebate program
- Domestic Well Registration
- Others

SECTION 6. REGULATORY AUTHORITY

JEO makes NO judgment or guarantee as to the legality or effectiveness of any approach and recommends consulting with legal counsel before enacting any ordinances, zoning, regulations, or entering into any legally binding agreement.

6.01 CITY OF CRETE

Due to the different threats and limits of jurisdiction in each well field, it is important that any current or future ordinances and/or zoning districts are flexible, enforceable, and developed with citizen/landowner input.

CRETE MUNICIPAL CODE

Ordinances are part of the police power authority of a community, which is simply the power of the State to regulate, in order to protect the public health, safety, and general welfare of its residents. Currently, several sections of the City's municipal code provide protection of the community's drinking water, within the City and it's jurisdiction. A summary of applicable codes are given below, however the actual text of the Municipal Code can be found online at http://www.crete-ne.com

At the time this plan was being developed, well setback distances are established in the latest version of Nebraska Title 179 – *Public Water Systems*, Chapter 7 (Effective date April 4, 2010). Articles 7 and 10 of Chapter 9 of the Crete Municipal Code codifies some of these setback distances, which are modified automatically in accordance with updates to Title 179 Chapter 7.

Article 7 of the Crete Municipal Code provides regulations on well permits; well location and usage; cross connections; well registration; well drilling denial or discontinuance prohibition of lead pipes, solder, and flux; and other plumbing requirements. Article 10 of the Crete Municipal Code provides regulations for the interconnection of water lines within the city's water system. In all cases, those provisions not covered by City Code, are governed by State Law and statute allows the municipality to be stricter in its regulations.

ZONING CONTROLS

The City of Crete has an adopted comprehensive plan, zoning ordinance and set of subdivision regulations that were updated in 2006. At the time of this plan, the City is in the process of updating the comprehensive plan. Through the exercise of planning and zoning, Crete gained land use control up to two miles beyond the corporate limits, through the adoption of an extraterritorial jurisdiction (ETJ). Additional jurisdiction may be ceded to the City by the county through resolution and ordinance in accordance Nebraska Revised Statute 13-327. Figure 17 illustrates the location of the ETJ in relation to the 2013 WHPA. The protection area clearly falls within the City's ETJ. The Crete Zoning Ordinances may only be applied to areas within the City's ETJ and Crete has the ability to enact a wellhead protection overlay district or adjust the current zoning to allow for regulations to the land use portions of the City's zoning jurisdiction.

The City is not able to utilize the Nebraska Revised Statute 17-536 (the 15-mile Statute). This State Law, which applies to villages and second class cities, allows communities to protect sources of drinking water outside the community's ETJ. Saline County has adopted a comprehensive plan and zoning regulations, however does not currently have a wellhead protection overlay district within their regulations. Should the City need to pursue protection to their WHPA outside of their ETJ in the future, the City should work with the Saline County (or the applicable county) Planning Commission and Board of Commissioners to apply such an overlay district to the area within the county's jurisdiction. The zoning overlay district within the county should be compatible to the City's wellhead protection overlay district to help protect the public drinking water for Crete.

The Crete Zoning Ordinance does not currently provide for a wellhead protection district. With the adoption of Wellhead Protection Plan, the City should amend the zoning ordinance by creating a new overlay district with wellhead protection regulations. Such amendment would involve a public hearing and recommendation by the Crete Planning Commission and a public hearing and ordinance adoption by the City Council. The wellhead protection overlay district would be illustrated on the Official Zoning Map and any adopted wellhead regulations would take priority over the underlying zoning district. Changes to the zoning would most likely be a long-term process and should involve public input and periodic review of any adopted regulations.

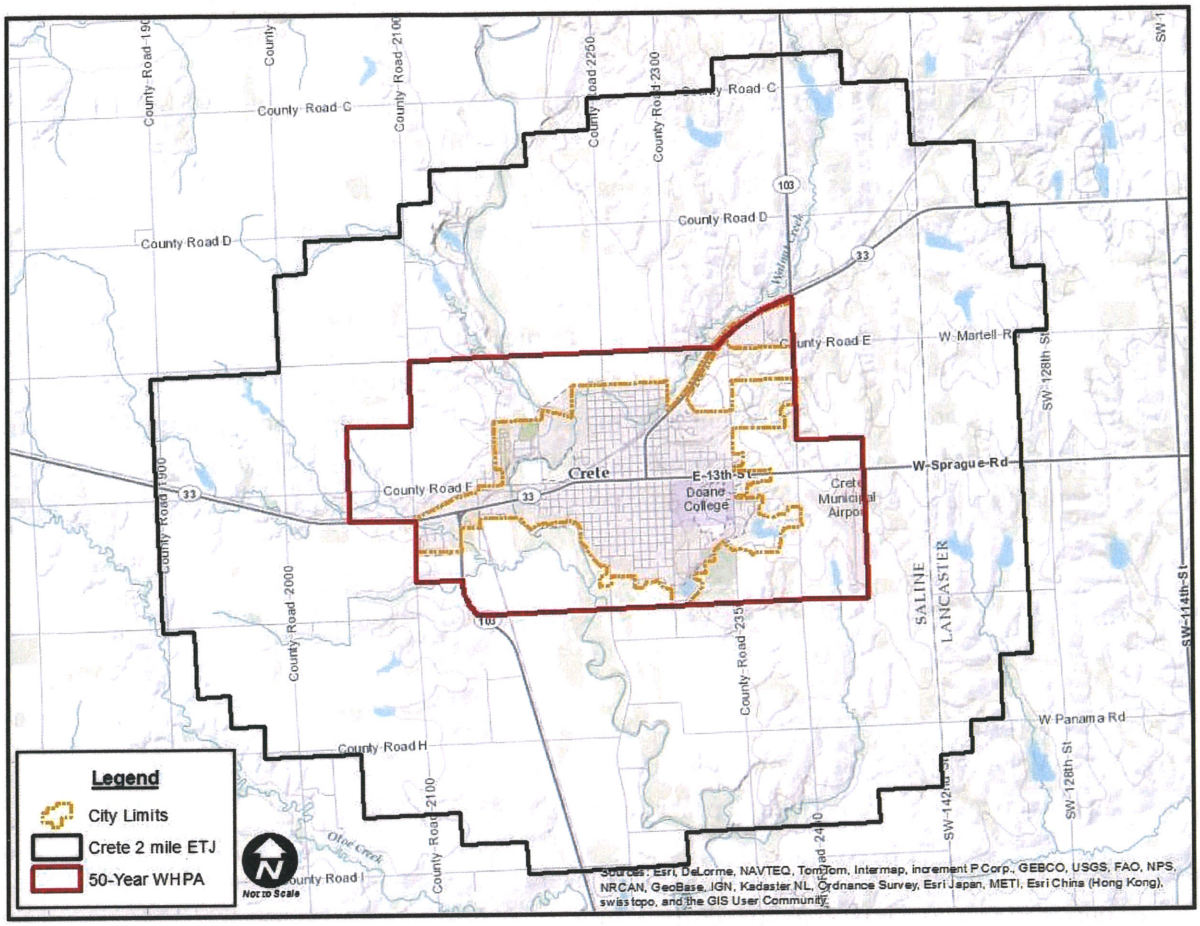

Figure 17: Crete ETJ and 2013 WHPA

6.02 LOWER BIG BLUE NATURAL RESOURCES DISTRICT

GROUNDWATER MANAGEMENT PLAN SUMMARY

The Lower Big Blue NRD established a groundwater management plan in 1985 (last updated in 1995). The plan was authorized by Nebraska Revised Statute Chapter 46, Article 6, Section 73.01. The groundwater management plan is used in conjunction with other Lower Big Blue NRD plans to manage the groundwater resources of the district and serves as a foundation for decision-making.

The Lower Big Blue NRD's non-point source pollution objectives, regarding groundwater quality management, are:

1. The Lower Big Blue will continue its groundwater monitoring network to obtain the most accurate results possible
2. Increase public awareness and understanding of groundwater quality problems in the district
3. The district will continue current programs and projects that result in reduced potential for groundwater contamination and improve overall water quality.

Nebraska NRD's are authorized to form special areas to protect groundwater quantity and/or quality. Within these areas, NRDs can encourage, require, or control actions that have an impact on groundwater. The groundwater management area may address both groundwater quantity and quality issues. The management is divided into subareas called Phases, which also include levels of control for groundwater quality management. As outlined in the Lower Big Blue NRD Groundwater Management Plan, they are:

Phase I Area and Controls: Area defined as having an average groundwater contamination level of less than 60% of the MCL.

- Encompass entire NRD
- Voluntary Best Management Practices
- Information and Education programs for BMPs

Phase II Area and Controls: Area defined as having an average groundwater contamination level of between 60% and less than 90% of the MCL.

- Operator Certification for nutrient/water management
- Deep soil sampling for residual nitrate
- Irrigation Scheduling
- Irrigation Well Sampling
- Fall Application of fertilizer prohibited before November 1st
- Analysis of manure applications
- Annual reporting to NRD of sampling results, water use, with UNL recommendations for yield goals based on sampling results
- Other "best management practices" that have been proven effective

Phase III Area and Controls: Area defined as having an average groundwater contamination level above 90% of the MCL

- Same requires as in Phase II, with the addition of:
  - Fall and winter application of fertilizer prohibited until after March 1st
  - Require split application of fertilizer and use of nitrification inhibitors

The City of Crete is currently falls within a Phase I Area only.

A complete copy of the Lower Big Blue NRD Groundwater Management Plan was not included in this document due to size. For a complete copy of the Plan and related rules or information, contact the NRD at 402.228.3402, or at:

Lower Big Blue Natural Resources District
805 Dorsey Street; P.O. Box 826
Beatrice, NE 68310

Note: At the time Crete's WHPP was being prepared, the NRD was in the process rewriting their groundwater management plan. This section should be reevaluated once the plan update is complete.

ABANDONED WELL PROGRAM

Lower Big Blue NRD can provide cost-share to properly close and seal illegal wells. The District will provide assistance in the amount of 60% of the actual cost to plug a well, up to a maximum of $500.00

The procedure is as follows:

- Abandonment must be completed by a licensed well driller.
- Decommissioning must be in accordance with all applicable laws and regulations
- Cost of decommissioning does not include cost of pump or tower removal
- Original receipts showing work done and materials used must accompany the Well Decommissioning Form

Landowners are required to report the abandonment of a registered well to the Nebraska Department of Water Resources.

DEEP SOIL SAMPLING COST SHARE

Deep soil sampling (36 inches in depth) enables producers to better manage fertilizer application by knowing what exists in the full crop root zone. Lower Big Blue NRD currently has a cost-share program for performing a deep soil sample. If the results are used to inform management decisions, this will ultimately reduce nitrate introduction into the source aquifer.

6.03 STATE OF NEBRASKA

Below is a listing of Nebraska's legislature statutes that allow local jurisdictions to protect public health and safety. NDEQ administers the wellhead protection program and provides technical assistance to any controlling entity designating a wellhead protection area and adopting controls to limit potential threats to the public water supply. The Nebraska Rural Water Association also can assist with wellhead protection in Nebraska. State statues and laws are summarized below.

WELLHEAD PROTECTION STATUTES

Sections 46-1501 to 46-1509 shall be known and may be cited as the Wellhead Protection Area Act.

46-1502 - Terms defined

For purposes of the Wellhead Protection Area Act:

(1) Controlling entity means a city, a village, a natural resources district, a rural water district, any other entity, including, but not limited to, a privately owned public water supply system, or any combination thereof operating under an agreement pursuant to the Interlocal Cooperation Act or the Joint Public Agency Act that operates a public water supply system;

(2) Department means the Department of Environmental Quality;

(3) Director means the Director of Environmental Quality; and

(4) Wellhead protection area means the surface and subsurface area surrounding a water well or well field, supplying a public water system, through which contaminants are reasonably likely to move toward and reach such water well or well field.

46-1503 - Wellhead protection area; designation

Any controlling entity may designate a wellhead protection area and adopt controls pursuant to the Wellhead Protection Area Act for the purpose of protecting the public water supply system. The department shall provide technical assistance to any controlling entity designating a wellhead protection area and adopting controls pursuant to the act.

46-1504 - Wellhead protection area designation; controlling entity; duties

Any controlling entity proposing to designate a wellhead protection area and adopt controls shall:

(1) Designate the boundaries of the wellhead protection area following the procedure in section 46-1505. The wellhead protection area shall be based on all reasonably available hydrogeologic information on groundwater flow, recharge, and discharge and other related information necessary to adequately determine the wellhead protection area for the purposes stated in this section;

(2) Identify within each proposed wellhead protection area all potential sources of contaminants which may have any adverse effect on the health of persons;

(3) Describe a program that contains, as appropriate, technical assistance, financial assistance, implementation of controls, education, training, and demonstration projects to protect the water supply within the wellhead protection area from such contaminants;

(4) Include contingency plans for the location and provision of alternate drinking water supplies for each affected public water supply system in the event of water well or well field contamination by such contaminants; and

(5) Propose the controls necessary to provide protection from contaminants which may have any adverse effect on the health of persons served by the public water supply system of each participating controlling entity.

46-1505 - Proposed wellhead protection area; public notice and comment

The controlling entity shall publicize proposed boundaries for the wellhead protection area and the proposed controls and shall provide time for public comment at one or more regularly scheduled public meetings of the governing board of the controlling entity. Notice of the time for public comment shall be published in conjunction with notice of such regularly scheduled meeting. A description of the proposed boundaries and the text of the proposed controls shall be available at the office of the controlling entity for thirty days before such meeting. Persons shall be given the opportunity to speak on the proposed designation and the proposed controls or to submit written testimony for consideration by the controlling entity.

46-1506 - Boundaries of wellhead protection area; designation; procedure

Within sixty days after the last time for public comment under section 46-1505, the controlling entity shall make a final designation of the boundaries of the wellhead protection area and the controls necessary to protect the water in the wellhead protection area and shall submit them to the director for approval or disapproval. Such approval shall be based on whether the boundaries of the wellhead protection area are reasonably defined, the controls are reasonably related to the purpose of groundwater protection in the area, and such approval is in the public interest. The director shall act on the proposed designation of boundaries and proposed controls within ninety days after the date the proposals are received by him or her.

If the director approves the proposed boundaries and controls, he or she shall so notify the controlling entity, but the boundaries and controls shall not be deemed effective until the controlling entity has adopted such boundaries and controls by ordinance or resolution. If the director disapproves either or both of the proposals, he or she shall return the proposals to the controlling entity with an explanation of the reasons for such disapproval. The controlling entity may revise such proposed designation of boundaries and proposed controls and, after notice and hearing as provided for in the original proposed designation of boundaries and proposed controls, submit the revised proposed designation of boundaries and proposed controls to the director for approval or disapproval.

If the director does not act on either the original or revised proposed designation of boundaries and proposed controls within ninety days after submission by the controlling entity, the proposed designation of boundaries and proposed controls shall be deemed approved by the director.

46-1507 - Existing wellhead protection areas; effect of act

Any wellhead protection area established before July 15, 1998, by resolution or ordinance of the controlling entity need not be reestablished under the Wellhead Protection Area Act unless controls are proposed. If such controls are proposed, the controls and the boundaries of the wellhead protection area are subject to the requirements of sections 46-1504 to 46-1506. Any wellhead protection area purported to have been established before July 15, 1998, other than by official action of a controlling entity shall be null and void beginning nine calendar months after July 15, 1998, unless reestablished by resolution or ordinance of the controlling entity.

46-1508 - Designated wellhead protection area; boundary area changes

A designated wellhead protection area may be amended as to boundaries and controls as provided for in the initial designation of a wellhead protection area in the Wellhead Protection Area Act.

46-1509 - Environmental Quality Council; rules and regulations

The Environmental Quality Council shall adopt and promulgate rules and regulations to carry out the Wellhead Protection Area Act.

SECTION 7. EMERGENCY, CONTINGENCY, AND LONG TERM PLANNING

7.01 EMERGENCY PLANNING

Crete's Public Water System Emergency Response Plan is located in Appendix D.

The City of Crete is not currently a member of the Nebraska Water/Wastewater Agency Response Network (NEWARN). NEWARN is a statewide Water/Wastewater Agency Response Network (WARN) of "utilities helping utilities" to:

- Prepare for the next natural or human-caused emergency.
- Organize response according to established requirements.
- Share personnel and other resources statewide, by agreement.

NEWARN provides water and wastewater utilities with:

- A Mutual Aid Agreement and process for sharing emergency resources among water and wastewater agencies statewide.
- A mutual assistance program consistent with other statewide mutual aid and assistance programs and the National Incident Management System.
- The resources to respond and recover more quickly from a natural or human caused disaster.
- A forum for developing and maintaining emergency contacts and relationships.

Additional information can be found at http://www.newarn.org/

7.02 CONTINGENCY PLANNING

Crete's has multiple documents which contain planning for an emergency regarding the public water system. The Water Department Emergency and Disaster Plan, Emergency Contact List, and relevant portions of the Saline County Local Emergency Operations Plan are located in Appendix D. The following incidents are anticipated emergencies:

- Loss of Pressure
- Power Failure at Wells
- Water main break
- Fire hydrant damage
- Frozen water mains and services
- Flood
- System Contamination

7.03 LONG TERM PLANNING

Currently the City has an adequate supply and acceptable quality of source drinking water. However, given the City's historical growth pattern, identifying future sources of water is very important. Given the extensive amount of time it can take to locate, construct, and bring online a new well it is important to start sooner rather than later. No potential well locations were analyzed as part of this planning effort. Going forward, as part of future planning, the City will begin to explore areas for locating a new well. The City will need to ensure siting criteria (Title 179, NHHS-R&L) are met. Identifying a new well or well field will be a long term process outside the scope of this plan; however, a few considerations have been identified during the development of this plan:



Figure 18: Test Wells are often helpful in identifying future well fields

- Establishing a Conservation Plan, will help extend the lifespan of the existing water system. See Section 7.04, below.
- Crete could utilize the Lower Big Blue NRD's groundwater monitoring and sampling program and Groundwater Management Plan to aid in preliminarily identifying future well locations.
- The City could consider staying in the same areas as the existing well fields to utilize the infrastructure
- Some of the City's wells are aging and therefore, replacing them lead to an improved future water supply
- An evaluation of existing capacity of the infrastructure will need to be explored
- The City should obtain a provisional wellhead protection area from NDEQ in order to identify potential contaminant sources before the future well site is chosen. The provisional WHPA will ensure that groundwater is protected until it is needed. This should include a contaminant source inventory. Assistance from DHHS, including site inspections, will be beneficial.
- The City should obtain an option or purchase a property for the new well once the site is identified.
- Purchasing new land, drilling wells, and building infrastructure are expensive undertakings. The City should establish or maintain a dedicated fund to assist with these efforts.

7.04 DROUGHT CONSERVATION PLANNING

Drought is a period of excessive dryness long or intense enough to affect agriculture, habitats, or people. It is difficult to define because it often develops slowly over months or years and has different impacts depending on the location, time of year, and sector of the community you are focusing on. Although

drought can and does cause severe and far reaching impacts, it is not as tangible as other disasters, such as wildfires or tornadoes (Drought Ready Communities Guide).

Agriculture is the primary sector affected by drought; however, impacts on rural and municipal water supplies can be quite severe: conflicts between water users increase during water-short periods, water systems develop operational problems; large, industrial, independent water users may overdraft available supplies, and wells experience water quality and quantity problems.

The best approach is to anticipate these conflicts and issues well in advance in drought and initiate appropriate actions to avoid problems. A drought plan can be an effective means to improve information flow on drought conditions severity, and impact, and thus the timeliness of mitigation and emergency response actions. Mitigation actions for water supply systems commonly fall under the following categories:

- Assessment programs
- Water supply augmentation/development of new supplies
- Public awareness/education programs
- Water use conflict resolution
- Drought Contingency Plans

WATER CONSERVATION PLAN

A water conservation plan is a written document developed by a public drinking water system that evaluates current and projected water use, assesses infrastructure, operations, and management practices, and describes actions to be taken to reduce water losses, waste, or consumption and increase the efficiency with which water is used, treated, stored, and transmitted.

Developing a water conservation plan also helps to optimize existing facilities and may reduce or eliminate the need to undertake new drinking water and/or wastewater projects. In addition, water conservation leads to increased energy conservation and cost savings for utilities and their customers. A water conservation plan should address conservation on the supply side (i.e., leak detection and repairs, metering, etc); as well as on the demand side (i.e., reductions in consumer usage). Recommended actions/elements of a plan include:

- Conduct Water Use Audits for Consumers
- Offer fixture retrofits and replacements
- Offer rebates and incentives
- Promote water reuse and recycling
- Encourage landscape efficiency
- Reduce excessive distribution system pressure
- Identify Voluntary or Mandatory Water-Use Restrictions

DROUGHT READY COMMUNITIES

The National Drought Mitigation Center, located at the University of Nebraska Lincoln, has developed a program known as "Drought-Ready Communities". The intent of the program and associated "Guide to Community Drought Preparedness" is to help communities understand and reduce their drought risk. A certified drought ready community has taken steps to:

1. Involve a representative cross section of the community;
2. Learn how drought has affected them in the past and how it would likely affect them in the future;
3. Set up a system to **monitor** and communicate about drought conditions in the community;
4. Prepare and document a set of actions to take before and in response to drought;
5. Educate the public about water, drought, and community's **drought plan**.

Currently, Crete is not a certified Drought Ready Community.

Additional Information can be found at:
http://drought.unl.edu/Planning/PlanningProcesses/DroughtReadyCommunities.aspx

WATER CONSERVATION ORDINANCE DEVELOPMENT

Often, the most visible result of a water conservation plan is the development of a water conservation ordinance. Typically, a water conservation ordinance is written to guide water conservation promotion and impose water use restriction, when necessary. An ordinance enables a community to:

1. Keep water use within pumping capacity and delivery capability, based on professional judgment, water conditions, weather forecasts, water system operations, and groundwater conditions
2. Define procedures to be used when the above criteria cannon be met, and
3. Familiarize citizens, businesses, and industry with the procedures which may be implemented when voluntary or mandatory water restrictions are required

Currently, Crete has no comprehensive water conservation plan or ordinance.

SECTION 8. PUBLIC EDUCATION AND NOTIFICATION

8.01 OPPORTUNITY FOR PUBLIC INPUT

In order for a plan to be approved by the NDEQ, there must be proper documentation of public involvement. The Crete Wellhead Protection Plan approval format has followed the guidance of NDEQ to ensure proper opportunity for public input. Due to efforts to satisfy all public comments and concerns, the Crete WHPP project went through multiple public meetings and the documentation materials for each of the opportunities (copy of newspaper notices, affidavit of publication, minutes, etc) is located in Appendix E. The following steps below are the basic minimum requirements that must be documented:

1. Prepare a Wellhead Protection Plan
2. The WHP Plan is made available for public review at least 30 days prior to the meeting where public comment will be taken on the Plan.
3. Public comment is taken at a regularly scheduled meeting of the "controlling entity" (meaning the village board, city council, Rural Water District board, etc)

8.02 CRETE WELLHEAD PROTECTION PLAN STAKEHOLDER COMMITTEE

A 11-member stakeholder committee was established at the initiation of the project. As shown in Table 8, below, members include the City staff, Lower Big Blue NRD, Jindra Irrigation, NDEQ, and JEO. The Stakeholder Committee was responsible for planning public workshops and open houses, plan review, and serving as local contacts to residents to provide information during the planning period.

Table 8: Crete Wellhead Protection Stakeholder Committee Members

NAME	TITLE/ROLE	ASSOCIATION
Tom Ourada	City Administrator	Crete
Tim Coffey	Water Department Superintendent	Crete
Ray Sueper	Municipal Building Inspector	Crete
Marvin Kohout	County Commissioner	Saline County
Brian Flesner	Assistant Director of Facilities Operations	Doane College
Travis Sears	Councilman	Crete
Scott Sobotka	Assistant Manager	Lower Big Blue NRD
Ryan Jindra	President	Jindra Irrigation
Ryan Chapman	Wellhead Protection Coordinator	NDEQ
Marc Rosso	Project Manager	JEO Consulting Group
Adam Rupe	Environmental Planner	JEO Consulting Group

8.03 MEETING SUMMARY

During the establishment of the wellhead protection plan, Crete offered a series of community meetings/workshops, established a wellhead protection committee, and a held public open meeting to offer residents and property owners an opportunity to voice their opinion or ask any questions about wellhead protection and the plan. Below is a summary of the types and dates of meetings. Sign-in sheets and other public notification materials are located in Appendix E.

WHP Stakeholder Meeting #1 – June 18, 2013

The first WHP Stakeholder meeting was held on June 18, 2013. The group discussed their responsibilities, plan progress and schedule, the WHPA map, the contaminant source inventory process, issues and ideas about the development of the plan, and potential timing of the next WHP Committee meeting, and Public Open House.

Notification: Committee members were invited to the meeting by phone calls, letters, and word to mouth.

WHP Stakeholder Meeting #2 – September 18, 2013

The second WHP Stakeholder meeting was held on September 18, 2013. The group discussed the progress of the project and the next steps for the open house and adoption. The new WHPA, provided by NDEQ was reviewed along with the potential contaminants source inventory. The approach/set-up for the upcoming public open house was discussed.

Notification: Committee members were invited to the meeting by phone calls, letters, and word to mouth.

Public Open House – October 16, 2013; 5:30 to 7:30 PM

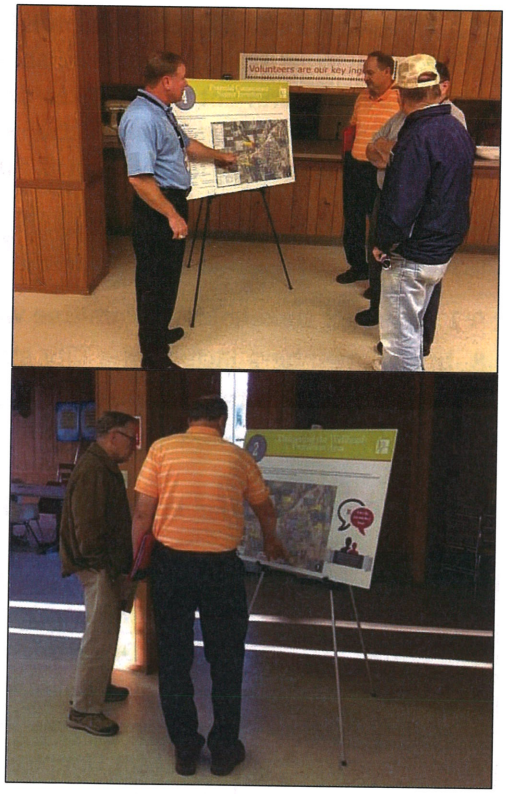

Figure 19: Public Open House

An opportunity was held for the public to learn about the wellhead protection plan and to offer the chance for comments, questions, and input on the draft plan and wellhead protection planning in general. Twelve (12) individuals were present. Members of the planning team staffed five (5) stations at the open house, each with different information about the plan and process. They were able to answer questions and take comments. An n "Input and Comment" form was provided for the public to record comments on; however, no forms were received back.

Notification: The open house was advertised though the local newspaper and a direct post card mailing to each address in the WHPA.

REFERENCES

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US Department of the Interior, Bureau of Reclamation, in cooperation with the Nebraska Natural Resources Commission. December 1999. "Nitrate and Nebraska's Small Community and Rural Domestic Water Supplies: An Assessment of Problems, Needs, and Alternatives."

Rahman, A. A GIS based DRASTIC model for assessing groundwater vulnerability in shallow aquifer in Aligarh, India. Applied Geography 28 (2008) 32-53.

Nebraska Department of Health & Human Services. 2010. Nebraska Public Water Supply Program Summary Report.

Nebraska Natural Resources Commission Data Bank. DRASTIC Methodology. Accessed via web: ftp://ftp.dnr.ne.gov/Pub/nrd/drast_doc.html

Gosselin, D. C., Headrick, J., Tremblay, R., Chen, X.-H. and Summerside, S. (1997), Domestic Well Water Quality in Rural Nebraska: Focus on Nitrate-Nitrogen, Pesticides, and Coliform Bacteria. Groundwater Monitoring & Remediation, 17: 77–87. doi: 10.1111/j.1745-6592.1997.tb01280.x

Drought Ready Communities: A Guide to Community Drought Preparedness. Published online by the National Drougt Mitigation Center at:
http://drought.unl.edu/Planning/PlanningProcesses/DroughtReadyCommunities.aspx

Conservation and Survey Division – IANR – UNL. "The Groundwater Atlas of Nebraska" 1986

Gillmore & Associates, Inc. Water Study – Crete, Nebraska. 2005.

Guidance available from NDEQ:

- "Documenting Public Input – WHP Plan". July 25, 2013
- Thomas O'Connor. "Contaminant Source Management Options for Wellhead Protection". September 2002
- "Wellhead Protection Area Management Planning Manual: A Community-based Approach to the Wellhead Protection Area Management Planning Process in Nebraska" (2008)
- "Wellhead Protection Plan Guidance Checklist"

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LIST OF APPENDICES

APPENDIX A: ANNUAL WATER QUALITY REPORT AND SANITARY SURVEY

APPENDIX B: LBG WHPA & MODELING REPORT

APPENDIX C: SELECT ORDINANCES AND MUNICIPAL CODE

APPENDIX D: CRETE PWS EMERGENCY RESPONSE INFORMATION

APPENDIX E: DOCUMENTATION OF PUBLIC INVOLVEMENT

APPENDIX A: ANNUAL WATER QUALITY REPORT AND SANITARY SURVEY

2011 Annual Water Quality Report

2011 Public Water Supply Routine Sanitary Survey

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Infants and young children are typically more vulnerable to lead in drinking water than the general population. It is possible that lead levels at your home may be higher than at other homes in the community as a result of materials used in your home's plumbing. If you are concerned about elevated lead levels in your home's water, you may wish to have your water tested. Flushing your tap for 30 seconds to 2 minutes before using your tap water will clear the line of any lead that may have leached into the water while the line was idle. Additional information is available from the Safe Drinking Water Hotline (800-426-4791) or the Department of Health and Human Services/division of Public Health/Office of Drinking Water (402-471-2541).

CRETE PUBLIC WORKS

For more information regarding this report, contact:

Tom Ourada, Director
Dept. of Public Works
243 E. 13th Street
Crete, Nebraska 68333
(402) 826-4312
tourada@crete-ne.gov

City of Crete

Annual Water Quality Report

for the period of

January 1 to December 31, 2011

Quality On Tap!

Our Commitment Our Profession

This report is intended to provide you with important information about your drinking water and the efforts made by the City of Crete water system to provide safe drinking water.

If you would like to observe the decision-making processes that affect drinking water quality, please attend the regularly scheduled meeting of the Crete City Council. If you would like to participate in the process, please contact Jerry Wilcox, City Clerk, at (402) 826-4313 to arrange to be placed on the agenda of the next regularly scheduled meeting of the Crete City Council.

This report will not be mailed but copies of this report are available to the public upon request. This report is also available on the City of Crete website at http://www.crete-ne.gov.

Para Clientes Que Hablan Español:

Este informe contiene información muy importante sobre el agua que usted bebe. Tradúzcalo ó hable con alguien que lo entienda bien.

Drinking water, including bottled water, may reasonably be expected to contain at least small amounts of some contaminants. The presence of contaminants does not necessarily indicate that water poses a health risk. More information about contaminants and potential health effects can be obtained by calling the EPA's Safe Drinking Water Hotline (800-426-4791).

In order to ensure that tap water is safe to drink, EPA prescribes regulations which limit the amount of certain contaminants in water provided by public water systems. FDA regulations establish limits for contaminants in bottled water which must provide the same protection for public health.

Source Water Assessment Availability

The Nebraska Department of Environmental Quality (NDEQ) has completed the Source Water Assessment. Included in the assessment is a Wellhead Protection Area map, potential contaminant source inventory, vulnerability rating, and source water protection information. To view the Source Water Assessment or for more information please contact the person named on the back cover of this report or NDEQ at (402) 471-6988.

Sources of Drinking Water

The sources of drinking water (both tap water and bottled water) include rivers, lakes, streams, ponds, reservoirs, springs, and groundwater wells. As water travels over the surface of the land or through the ground, it dissolves naturally-occurring minerals and, in some cases, radioactive material, and can pick up substances resulting from the presence of animals or from human activity.
The source of drinking water used by the City of Crete is groundwater. This water is pumped from wells maintained by the City of Crete.

Contaminants that may be present in source water include:

* Microbial contaminants, such as viruses and bacteria, which may come from sewage treatment plants, septic systems, agricultural livestock operations and wildlife.

The City of Crete is required to test for the following contaminants:

Coliform Bacteria, Antimony, Arsenic, Asbestos, Barium, Beryllium, Cadmium, Chromium, Copper, Cyanide, Fluoride, Lead, Mercury, Nickel, Nitrate, Nitrite, Selenium, Sodium, Thallium, Alachlor, Atrazine, Benzo(a)pyrene, Carbofuran, Chlordane, Dalapon, Di(2-thylhexyl)adipate, Dibromochloropropane, Dinoseb, Di(2-ethylhexyl)phthalate, Diquat, 2,4-D, Endothall, Endrin, Ethylene dibromide, Glyphosate, Heptachlor, Heptachlor epoxide, Hexachlorobenzene, Hexachlorocyclopentadiene, Lindane, Methoxychlor, Oxamyl (Vydate), Pentachlorophenol, Picloram, Polychlorinated biphenyls, Simazine, Toxaphene, Dioxin, Silvex, Benzene, Carbon Tetrachloride, o-Dichlorobenzene, Para-Dichlorobenzene, 1, 2-Dichlorethane, 1,1-Dichloroethylene, Cis-1, 2,-Dichloroethylene, Trans-1,2-Dichloroethylene, Dichloromethane, 1,2-Dichloropropane, Ethylbenzene, Monochlorobenzene, 1,2,4-Trichlorobenzene, 1,1,1-Trichloroethane, 1,1,2-Trichloroethane, Trichloroethylene, Vinyl Chloride, Styrene, Tetrachloroethylene, Toluene, Xylenes (total), Gross Alpha (minus Uranium & Radium 226), Radium 226 plus Radium 228, Sulfate, Chloroform, Bromodichloromethane, Chlorodibromomethane, Bromoform, Chlorobenzene, m-Dichlorobenzene, 1,1-Dichloropropene, 1,1-Dichloroethane, 1,1,2,2-Tetrachlorethane, 1,2-Dichloropropane, Chloromethane, Bromomethane, 1,2,3-Trichloropropane, 1,1,1,2-Tetrachloroethane, Chloroethane, 2,2-Dichloropropane, o-Chlorotoluene, p-Chlorotoluene, Bromobenzene, 1,3-Dichloropropene, Aldrin, Butachlor, Carbaryl, Dicamba, Dieldrin, 3-Hydroxycarbofuran, Methomyl, Metolachlor, Metribuzin, Propachlor

MCL (Maximum Contaminant Level): The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to the MCLGs as feasible using the best available treatment technology.

MCLG (Maximum Contaminant Level Goal): The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety.

ppb: parts per billion

pCi/l: picoCuries per liter (measurement of radioactivity).

ppm: parts per million

Ppt: parts per trillion

ug/l: micrograms per liter

AL (Action Level) The concentration of a contaminant which, if exceeded, triggers treatment or other requirements which a water system must follow.

TEST RESULTS (COLLECTED IN 2011 UNLESS NOTED)

Microbiological	Highest No. of Positive Samples	MCL	MCLG	Likely Source of Cont
No Detected Results were Found in the Calendar Year of 2011				

Contaminant (Lead and Copper)	Range	Action Level (AL)	90th Percentile	# Sites Over AL	Likely Sour
Copper, Free 2008 - 2010	0.00801 - 0.377	1.3 ppm	0.209 ppm	0	Erosion of nat
Lead 2008 - 2010	1.18 - 5.3	15 ppb	1.69 ppb	0	Corrosion of h

Inorganic Contaminants							
Contaminant	**Highest Level Detected**	**Range of Levels Detected**	**Units**	**MCLG**	**MCL**	**Violation**	**Likely Sourc**
*Arsenic (5/10/10)	6.52	6.52	ppb	0	10	No	Erosion of n from electro
Barium (8/17/09)	0.182	0.126 - 0.182	ppm	2	2	No	Discharge of Erosion of n
Chromium (8/17/09)	6.07	5.2 - 6.07	ppb	100	100	No	Discharge fr posits
Fluoride (8/17/09)	0.216	0 - 0.216	ppm	4	4	No	Erosion of n strong teeth
Nitrate-Nitrite (9/6/11)	1.15	1.13 - 1.15	ppm	10	10	No	Runoff from age; Erosion
Radioactive Contaminants							
COMBINED RADIUM (-226 &-228) (7/30/07)	2	1.4 - 2	pCi/l	0	5	No	Erosion of n
GROSS ALPHA, INCL. RADON & U (1/4/10)	11	11	pCi/l	0	15	No	Erosion of n
RADIUM -226 (7/30/07)	2	1.4 - 2	pCi/l	0	5	No	Erosion of n

Unregulated Water Quality Data	Collection Date	Highest Value	Range	Unit
Nickel	07/06/2010	0.00354	0.00354	mg/
Sulfate	07/06/2010	94.2	94.2	mg/

Note: The state requires monitoring of certain contaminants less than once per year because the concentrations of these contaminants do not change frequently. Therefore, some of this data may be more than one year old.

*While your drinking water meet EPA's standard for arsenic, it does contain low levels of arsenic. EPA's standard balances the current understanding of arsenic's possible health effects against the costs of removing arsenic from drinking water. EPA continues to research the health effects of low levels of arsenic which is a mineral known to cause cancer in humans at high concentrations and is linked to other health effects such as skin damage and circulatory problems.

Department of Health & Human Services
DHHS
NEBRASKA

Division of Public Health

State of Nebraska
Dave Heineman, Governor

August 19, 2011

Tom Ourada
City of Crete
PO Box 86
Crete NE 68333

Re: Routine Sanitary Survey, City of Crete, NE3115104, Saline County.

Dear Mr. Ourada:

On July 20, 2011, a survey of the City of Crete (the system) was conducted by Bob Byrkit, accompanied by Tim Coffey representing the system, to determine compliance with Title 179 NAC *Regulations Governing Public Water Supply Systems*. Findings of the inspection were discussed with Mr. Coffey at the completion of the inspection. This letter serves as official notification from the Department to the system that no deficiencies were found during the RSS.

If you wish to discuss the findings of this RSS, please contact me at the address listed below, by E-mail at bob.byrkit@nebraska.gov or by phone at 402-432-4831.

Sincerely,

Bob Byrkit

Bob Byrkit
Water Supply Specialist
DHHS DPH Field Area 4 Representative
PO Box 33
Nelson, Nebraska 68961

CC: Tim Coffey
PWS File in Lincoln

Revised 12/30/2010
DLW

Department of Health & Human Services
DHHS
NEBRASKA

Nebraska Department of Health and Human Services
Division of Public Health – Office of Drinking Water
Public Water Supply Routine Sanitary Survey

PWS Name: City of Crete PWSID #: NE31-15104 Permit Issue Date: 07/01/1977

County: Saline NRD #: 2 - Lower Big Blue System Class: 2 Type of System: C

Accompanied By: Tim Coffey Title: water operator Governing Body: Mayor & City Council

Is there a defined organizational structure for decision making: Y ☒ N ☐

RSS Date: 07/20/2011 Last RSS Date: 06/26/2008 Inspection By: Bob Bykrit

Is the operator in responsible charge properly licensed: Y ☒ N ☐

Do all other operators that make process control / sytem integrity decisions have at least a Grade 4 License: Y ☒ N ☐

FINANCIAL INFORMATION

% Metered Connections: 100%

System Interconnections: ____ Reason: ☐ Purchase ☐ Sell ☐ Emergency

Comments: ____

Is operating budget available for inspection: Y ☒ N ☐ Planned or Actual for Year: ____

(Procure a copy of the systems operating budget and water rate structure and attach to survey)

SYSTEM RECORDS / PROGRAMS

	S	U	NA	Comments
System Maps	☒	☐	☐	
Water Quality / Sample results	☒	☐	☐	
Water Production Records	☒	☐	☐	
Chemical Use Records	☒	☐	☐	
Maintenance Records	☒	☐		
Customer Complaints	☒	☐		
Cross-Connection Control Requirements	☒	☐		
Copy of Sampling Plans	☒	☐	☐	
Wellhead Encroachment Policy	☒	☐	☐	Date Adopted: Description:
Emergency Phone List	☒	☐		
Emergency Plan	☒	☐	☐	Expiration date: 10/06/2013
Planning Records	☒	☐	☐	(Master Plan)
CCR(s)	☒	☐	☐	
O&M Manual	☒	☐		
Provisions For Drought Mitigation/Management	☒	☐	☐	

Other Records and Comments: ____

WATER SOURCE INFORMATION

Source Type: ☐ Surface Water ☐ Infiltration Gallery ☐ Spring ☒ Well

Other: _____

Does the system have a withdrawal (allocation) permit: Y ☐ N ☒

If yes, from whom and quantity: _____

Max. daily (24 hour) production capability: 4.694 MG Total production for past year: 337.546 MG

Comments: 6800 population

Complete a Source Water VA for each source and attach to sensitive / secure information sheet (Bulls eye, State only)

**VOLUNTARY PROGRAMS

**Does the system have a Watershed Management Program: Y ☐ N ☒

**Does the system have a delineated Well Head Protection Area: Y ☒ N ☐

**Has the WHPA officially been adopted by the system: Y ☐ N ☒ N/A ☐ Date: _____

**Has a contaminant source inventory been completed: Y ☒ N ☐ Date: 2003

**Has the contaminant source inventory been updated: Y ☐ N ☒ N/A ☐ Date: _____

**Does the system have a delineated WDA (surface sources only): Y ☐ N ☐ N/A ☒

**Has a contaminant inventory for the WDA been completed: Y ☐ N ☐ N/A ☒ Date:

**Is there an ERP for spills within WHP or WDA Areas: Y ☐ N ☐ N/A ☒

(Items below required for systems over 3,300 population)

**Has an EPA Vulnerability Assessment (VA) been completed: Y ☒ N ☐ N/A ☐ Date: 2003

**Has certification documentation been submitted for the EPA VA: Y ☒ N ☐ N/A ☐

**Has an EPA Emergency Response Plan (ERP) been completed: Y ☒ N ☐ N/A ☐ Date: 2003

**Have certification documents been submitted for the EPA ERP: Y ☒ N ☐ N/A ☐

Comments: _____

DHHS-DPH will assess the following:

Is the source adequate to meet peak demands: Y ☒ N ☐

Is all source water metered: Y ☒ N ☐

Are any source water facilities located within a 100 yr. flood plain: Y ☒ N ☐

If yes, list each facility: well #1

Have any source water facilities ever been flooded: Y ☐ N ☒

If yes, list each facility: _____

Comments on Water Source: _____

CROSS-CONNECTION CONTROL PROGRAM

Name of person responsible for the administration and enforcement of the CCC Program: Tim Coffey

PWS Grade 6 Operators:

Name	License #	Expiration Date
Tim Coffey	7234	12/31/2011
Kevin Sunken	7504	12/31/2011
Gary Henning	7497	12/31/2011
Kenneth Brown	6482	12/321/2011
Ray Sueper	8374	12/31/2011

Does the system have an adopted resolution, ordinance, or other enforceable instrument that assures the CCC requirements are being met: Y ☒ N ☐ N/A ☐ Comments: ____

If yes, provide the following information: Ordinance #: Chapter 9 Article 10 Other: ____

Responsibility of PWS: test own devices & program

Responsibility of Consumer: test own devices and repair

Fines or Penalties for Noncompliance: disconnection of service after 30 days of notice

Date(s) of last cross-connection survey: 2008 N/A ☐

How were (are) surveys distributed: mailed

% of residential surveys returned: 97% % of non-residential surveys returned: 60%

What actions are taken if surveys are not returned: door to door

Have cross-connections been properly addressed: Y ☒ N ☐ Comments: ____

Required testing frequency of assemblies: yearly

Have all backflow preventers been tested by a properly licensed G6 operator: Y ☒ N ☐

Are testing records for the last 5 years available: Y ☒ N ☐ Is testing current: Y ☒ N ☐

Does the PWS enforce the requirements of their cross-connection control program: Y ☒ N ☐ Comments:

Is an on-going public information program being done (beyond the CCR addition): Y ☒ N ☐ Describe: add in paper & school programs

Comments: System is updating cross-connections this year

ANNUAL REVIEW – SHORT AND LONG TERM PLANNING

Are records being kept to facilitate an annual review of the capabilities of the system: Y ☒ N ☐

If yes, is an annual review being done: Y ☐ N ☒

Have the following items been included in the Annual Review of the PWS for the purpose of short (2 years) and long (10 years) term planning:

Item	Y	N	Comments
Source	☐	☐	
Storage	☐	☐	
Distribution System	☐	☐	
Population	☐	☐	
PWS Value	☐	☐	
Water Quality	☐	☐	
Security/Vulnerability	☐	☐	

Intended Capital Improvements for next 5 years:

1.) water main replacement

2.) new well

3.) _____

4.) _____

5.) _____

WATER QUALITY MONITORING

If the system has an AO, are the requirements of the order being followed: Y ☐ N ☐ N/A ☒

If not, describe: _____

If the AO is for nitrate, list locations of all nitrate postings: _____

If the system has a current MCL violation, is the system taking the required actions: Y ☐ N ☐ N/A ☒

If not, describe: _____

Is compliance water testing equipment calibrated or standardized: Y ☒ N ☐ N/A ☐

Are calibration records readily available: Y ☒ N ☐

What non-compliance water testing, if any, is routinely done: Hardness & Maganese ☐ None

List any established water quality goals: good water

Comments on Water Quality Monitoring: _____

DISTRIBUTION SYSTEM

☐ This is a non-community PWS without a distribution system.

Are there maps of the Distribution System(s): Y ☒ N ☐ Date of last update: constant

Are the following features shown on the distribution map(s):

Line and Valve Locations:	Y ☒	N ☐		Comments: ____
Line and Valve Sizes:	Y ☒	N ☐		Comments: ____
Line Materials:	Y ☒	N ☐		Comments:
Fire Hydrant Locations:	Y ☒	N ☐	N/A ☐	Comments: ____
Pressure-zone(s) Boundaries:	Y ☐	N ☐	N/A ☒	Comments: ____
Storage Facilities:	Y ☒	N ☐	N/A ☐	Comments: ____
Booster Pump Stations:	Y ☒	N ☐	N/A ☐	Comments: ____
Sampling sites and zone boundaries:	Y ☒	N ☐		Comments: ____
Does system have dead end mains:	Y ☒	N ☐		
Do dead-ends have flushing capability:	Y ☒	N ☐		

Distribution system map comments: ____

Does the System retain records or documentation on the following:

O&M Distribution System Repairs:	Y ☒	N ☐		
Leak Detection / Water Loss:	Y ☒	N ☐	N/A ☐	Water Loss last year: 10%

R&R / Water Loss Comments: ____

Does the system have a flushing program:	Y ☒	N ☐		Frequency: 2 X yearly
Does the system utilize directional flushing:	Y ☐	N ☒		Frequency: ____
Does the system utilize pigging:	Y ☐	N ☒		Frequency: ____
Are valves inspected and exercised:	Y ☐	N ☒		Frequency:
Are fire hydrants inspected and operated routinely:	Y ☒	N ☐	N/A ☐	Frequency: 2 X yearly
Are sampling stations available:	Y ☐	N ☒		Number: ____
Is there a common POE for more than one source:	Y ☐	N ☒		

If yes, how many sources per POE?

Are the POE's metered? Y☐ N☐

What is the pressure at each common POE?

Comments on POE's:

DISTRIBUTION SYSTEM

Page 2 of 2

Piping Materials *(indicate all types of piping existing in distribution system, # of feet of each type may be included)*

C-900:	☒	C-909:	☐ ____	PVC:	☐	Copper:	☐
Steel:	☐	Lead:	☐	AC:	☐	Concrete:	☐
Ductile Iron:	☒	CIP:	☒	SandCIP:	☐	Other:	☐

Size of Pipe *(indicate each pipe size present in distribution system, # of feet of each size may be included)*:

1"	☐	2"	☒	3"	☐	4"	☒
6"	☒	8"	☒	10"	☒	12"	☒
14"	☒	16"	☐	18"	☐	24"	☐
36"	☐	Other: ____					

Comments: ____

The following applies to all PWS

Does the system have any lead service lines: Y ☒ N ☐ Unknown ☐

If yes, does the system have a removal or replacement method: Y ☒ N ☐ **Describe:** remove when found

Where does the systems responsibility for the distribution system end (corp stop, curb stop, etc.): curb stop

Where is the point of maximum water residence time in the distribution system: County road 2100 (Physical location description)

Disinfectant Residual Check: **POE:** .80 mg/L **Max. residence time:** .18 mg/L

Other checks: ____

Frequency of checking distribution disinfectant residual: daily

Test kit used: pocked tester & Hach DR2010

Typical distribution system pressure range (pressure fluctuation): 5 psi

Pressure at highest elevation (lowest pressure): 66 psi **Location (address or physical):** Fairchild & Jasmine

Are pressure readings routinely taken from the distribution system: Y ☒ N ☐

Frequency: with complaints

Comments on Distribution System:

CONTROL SYSTEMS

Age of Control System or Installation Date: 2006 Control Type: SCADA

Mode of Communications: Phone: ☒ Leased: ☐ Owned: ☒ _____

Radio: ☐ _____ Hard wired: ☐ _____ Other: _____

Is there a backup communications system: Y ☐ N ☒ N/A ☐ Describe: _____

Is a UPS available: Y ☒ N ☐ If yes, at all sites?: Y ☒ N ☐ Duration of backup: 2 hours

Does control system automatically log system data: Y ☒ N ☐

If yes, what data is automatically logged: storage levels and pump run times

Frequency of data logging: constant

Does control system generate automatic reports: Y ☐ N ☒

If yes, what are the reports: _____

Frequency of automatic reports: _____

Is there manual override capability in the control system: Y ☒ N ☐

If yes, describe: switch at wells

Who has the authority to make set-point changes (provide a name): Tim Coffey

Describe the security measures for the control system: locked doors

Is a spare parts inventory maintained on hand: Y ☒ N ☐ Comments:

Comments on Control Systems: _____

SOURCE FACILITIES – GROUNDWATER SUPPLY FACILITIES

(Complete one sheet per source or well.)

Well ID #: 311 Well Common Name: #1 DNR Registration #: G-031679 Well Status: Active

Comments: pumps to small plant

If INACTIVE, is well disconnected from the system: Y ☐ N ☐ Decommissioned properly: Y ☐ N ☐

Is this well part of a combined POE to the distribution system: Y ☐ N ☒ N/A ☐ If yes, which one: ____

Frequency site is inspected by PWS: Weekly Describe other: ____

Is the well sealed properly at the surface: Y ☒ N ☐ Comments: ____

Casing extends min of 18"(CWS) or 12"(NCWS) above well slab, floor, or ground surface: Y ☒ N ☐

Motor HP: 10 Pump Type: Turb Well Depth: 180' Well Casing Dia: 12"

Screen Const. Type: SS-WW Top of Screen Depth: 140' Casing Type: Steel Pump Setting: UN'

Is the well vent termination and screening acceptable: Y ☒ N ☐ Size: 1.25" Comments: ____

Well blow-off size: 2.5" Is blow-off properly capped or screened: Y ☒ N ☐

Is a sampling tap available: Y ☒ N ☐ Is the sample tap smooth nosed: Y ☒ N ☐

Is a pressure gauge available: Y ☒ N ☐ Working: Y ☒ N ☐ Observed pressure gauge reading: 40 psi Static

Is a chemical injection tap available: Y ☒ N ☐ Chemical tap size: 1"

Is an approved electrical outlet available for chemical tap: Y ☒ N ☐ Is this a GFI outlet: Y ☐ N ☒

Is well metered: Y ☒ N ☐ Type: propeller Size: 8" Make/Model: Rockwell Serial #:

Electric meter reading: ____ Water meter reading: 253709 X 1000 Hr. meter reading: ____

Are drawdown readings taken routinely: Y ☒ N ☐ Frequency: monthly Airline Length: 21'

Static Water Level: 22' Pumping Water Level: 38.5' Drawdown: 16.5' Avail. DD: 118'

Are cross-connection requirements adequately met: Y ☒ N ☐

Are chemicals injected at the well: Y ☐ N ☒ If yes, what chemical(s):

Observed condition of piping and valving: Good, paint Ok and no corrosion

Observed condition of electrical systems: Good, everything appears OK

Is backup power available: Y ☒ N ☐ Type: X Describe Other: City Generator

Size: ____ Kwh ____ Hp ____ RPM for PTO or Belt Drive If exercised, how often monthly? Under load Y ☒ N ☐

Is the facility well maintained and secure: Y ☒ N ☐ If yes, describe security measures: locked door

If necessary, is appropriate signage in place: Y ☐ N ☐ N/A ☒

Does well meet criteria for potential GWUDI: Y ☐ N ☒ Unknown ☐

Has the source been deemed to be GWUDI: Y ☐ N ☐ Date of determination: ____

Are there any encroachments on this well: Y ☐ N ☒ If yes, are they pre-existing or new: ☐ Pre ☐ New

Current well vulnerability rating: ☐ Vulnerable ☒ Non-Vulnerable

Comments on this well: ____

SOURCE FACILITIES – GROUNDWATER SUPPLY FACILITIES

(Complete one sheet per source or well.)

Well ID #: 551 Well Common Name: #4 DNR Registration #: G-031682 Well Status: Emergency

Comments: _____

If INACTIVE, is well disconnected from the system: Y ☐ N ☐ Decommissioned properly: Y ☐ N ☐

Is this well part of a combined POE to the distribution system: Y ☐ N ☒ N/A ☐ If yes, which one:

Frequency site is inspected by PWS: Weekly Describe other: _____

Is the well sealed properly at the surface: Y ☒ N ☐ Comments: _____

Casing extends min of 18"(CWS) or 12"(NCWS) above well slab, floor, or ground surface: Y ☒ N ☐

Motor HP: 75 Pump Type: Turb Well Depth: 214' 8"' Well Casing Dia: 14"

Screen Const. Type: Conc-Slot Top of Screen Depth: 140' Casing Type: Conc Pump Setting: 200'

Is the well vent termination and screening acceptable: Y ☒ N ☐ Size: 1.25" Comments: _____

Well blow-off size: 2.5" Is blow-off properly capped or screened: Y ☒ N ☐

Is a sampling tap available: Y ☒ N ☐ Is the sample tap smooth nosed: Y ☒ N ☐

Is a pressure gauge available: Y ☒ N ☐ Working: Y ☒ N ☐ Observed pressure gauge reading: 68 psi Static

Is a chemical injection tap available: Y ☒ N ☐ Chemical tap size: 1"

Is an approved electrical outlet available for chemical tap: Y ☒ N ☐ Is this a GFI outlet: Y ☐ N ☒

Is well metered: Y ☒ N ☐ Type: propeller Size: 8" Make/Model: Rockwell Serial #: _____

Electric meter reading: _____ Water meter reading: 993100 X 1000 Hr. meter reading: _____

Are drawdown readings taken routinely: Y ☒ N ☐ Frequency: monthly Airline Length: 20'

Static Water Level: 24.5' Pumping Water Level: 32.5' Drawdown: 8' Avail. DD: 115.5'

Are cross-connection requirements adequately met: Y ☒ N ☐

Are chemicals injected at the well: Y ☐ N ☒ If yes, what chemical(s):

Observed condition of piping and valving: Good, paint Ok and no corrosion

Observed condition of electrical systems: Good, everything appears OK

Is backup power available: Y ☒ N ☐ Type: X Describe Other: city generator

Size: _____ Kwh _____ Hp _____ RPM for PTO or Belt Drive If exercised, how often monthly? Under load Y ☒ N ☐

Is the facility well maintained and secure: Y ☒ N ☐ If yes, describe security measures: locked door

If necessary, is appropriate signage in place: Y ☐ N ☐ N/A ☒

Does well meet criteria for potential GWUDI: Y ☐ N ☒ Unknown ☐

Has the source been deemed to be GWUDI: Y ☐ N ☐ Date of determination: _____

Are there any encroachments on this well: Y ☐ N ☒ If yes, are they pre-existing or new: ☐ Pre ☐ New

Current well vulnerability rating: ☐ Vulnerable ☒ Non-Vulnerable

Comments on this well: _____

SOURCE FACILITIES – GROUNDWATER SUPPLY FACILITIES

(Complete one sheet per source or well.)

Well ID #: 391 Well Common Name: #3 DNR Registration #: G-031681 Well Status: Active

Comments: ____

If INACTIVE, is well disconnected from the system: Y ☐ N ☐ Decommissioned properly: Y ☐ N ☐

Is this well part of a combined POE to the distribution system: Y ☐ N ☒ N/A ☐ If yes, which one:

Frequency site is inspected by PWS: Weekly Describe other: ____

Is the well sealed properly at the surface: Y ☒ N ☐ Comments: ____

Casing extends min of 18"(CWS) or 12"(NCWS) above well slab, floor, or ground surface: Y ☒ N ☐

Motor HP: 40 Pump Type: Turb Well Depth: 182' 6"' Well Casing Dia: 10"

Screen Const. Type: X Top of Screen Depth: 162.6' Casing Type: Steel Pump Setting: 110'

Is the well vent termination and screening acceptable: Y ☒ N ☐ Size: 1.25" Comments: ____

Well blow-off size: 2.5" Is blow-off properly capped or screened: Y ☒ N ☐

Is a sampling tap available: Y ☒ N ☐ Is the sample tap smooth nosed: Y ☐ N ☒

s a pressure gauge available: Y ☒ N ☐ Working: Y ☒ N ☐ Observed pressure gauge reading: 72 psi Static

Is a chemical injection tap available: Y ☒ N ☐ Chemical tap size: 3/4"

s an approved electrical outlet available for chemical tap: Y ☒ N ☐ Is this a GFI outlet: Y ☐ N ☒

Is well metered: Y ☒ N ☐ Type: propeller Size: 4" Make/Model: Sensus Serial #: ____

lectric meter reading: ____ Water meter reading: 313237 X 1000 Hr. meter reading: ____

re drawdown readings taken routinely: Y ☒ N ☐ Frequency: monthly Airline Length: 110'

Static Water Level: 22' Pumping Water Level: 47' Drawdown: 23' Avail. DD: 88'

re cross-connection requirements adequately met: Y ☒ N ☐

Are chemicals injected at the well: Y ☐ N ☒ If yes, what chemical(s):

bserved condition of piping and valving: Good, paint Ok and no corrosion

Observed condition of electrical systems: Good, everything appears OK

backup power available: Y ☒ N ☐ Type: X Describe Other: city generator

ize: ____ Kwh ____ Hp ____ RPM for PTO or Belt Drive If exercised, how often monthly? Under load Y ☒ N ☐

Is the facility well maintained and secure: Y ☒ N ☐ If yes, describe security measures: locked door

necessary, is appropriate signage in place: Y ☐ N ☐ N/A ☒

Does well meet criteria for potential GWUDI: Y ☐ N ☒ Unknown ☐

as the source been deemed to be GWUDI: Y ☐ N ☐ Date of determination: ____

Are there any encroachments on this well: Y ☐ N ☒ If yes, are they pre-existing or new: ☐ Pre ☐ New

urrent well vulnerability rating: ☐ Vulnerable ☒ Non-Vulnerable

Comments on this well: ____

SOURCE FACILITIES – GROUNDWATER SUPPLY FACILITIES

(Complete one sheet per source or well.)

Well ID #: 721 Well Common Name: #6 DNR Registration #: G-063645 Well Status: Active

Comments: ____

If INACTIVE, is well disconnected from the system: Y ☐ N ☐ Decommissioned properly: Y ☐ N ☐

Is this well part of a combined POE to the distribution system: Y ☐ N ☒ N/A ☐ If yes, which one:

Frequency site is inspected by PWS: Weekly Describe other: ____

Is the well sealed properly at the surface: Y ☒ N ☐ Comments: ____

Casing extends min of 18"(CWS) or 12"(NCWS) above well slab, floor, or ground surface: Y ☒ N ☐

Motor HP: 60 Pump Type: Turb Well Depth: 221' Well Casing Dia: 16"

Screen Const. Type: SS Top of Screen Depth: 161' Casing Type: Steel Pump Setting: 50'

Is the well vent termination and screening acceptable: Y ☒ N ☐ Size: 1.25" Comments: ____

Well blow-off size: 2.5" Is blow-off properly capped or screened: Y ☒ N ☐

Is a sampling tap available: Y ☒ N ☐ Is the sample tap smooth nosed: Y ☒ N ☐

Is a pressure gauge available: Y ☒ N ☐ Working: Y ☒ N ☐ Observed pressure gauge reading: 68 psi Static

Is a chemical injection tap available: Y ☒ N ☐ Chemical tap size: 1"

Is an approved electrical outlet available for chemical tap: Y ☒ N ☐ Is this a GFI outlet: Y ☐ N ☒

Is well metered: Y ☒ N ☐ Type: propeller Size: 8" Make/Model: Rockwell Serial #: ____

Electric meter reading: ____ Water meter reading: Unable to read Hr. meter reading: ____

Are drawdown readings taken routinely: Y ☒ N ☐ Frequency: monthly Airline Length: 50'

Static Water Level: 38' Pumping Water Level: 48' Drawdown: 10' Avail. DD: 2'

Are cross-connection requirements adequately met: Y ☒ N ☐

Are chemicals injected at the well: Y ☐ N ☒ If yes, what chemical(s):

Observed condition of piping and valving: Good, paint Ok and no corrosion

Observed condition of electrical systems: Good, everything appears OK

Is backup power available: Y ☒ N ☐ Type: X Describe Other: city generator

Size: ____ Kwh ____ Hp ____ RPM for PTO or Belt Drive If exercised, how often monthly? Under load Y ☒ N ☐

Is the facility well maintained and secure: Y ☒ N ☐ If yes, describe security measures: locked door

If necessary, is appropriate signage in place: Y ☐ N ☐ N/A ☒

Does well meet criteria for potential GWUDI: Y ☐ N ☒ Unknown ☐

Has the source been deemed to be GWUDI: Y ☐ N ☐ Date of determination: ____

Are there any encroachments on this well: Y ☒ N ☐ If yes, are they pre-existing or new: ☒ Pre ☐ New

Current well vulnerability rating: ☒ Vulnerable ☐ Non-Vulnerable

Comments on this well: in city generation plant

SOURCE FACILITIES – GROUNDWATER SUPPLY FACILITIES

(Complete one sheet per source or well.)

Well ID #: 651 Well Common Name: #5 DNR Registration #: G-031683 Well Status: Active

Comments: goes to new plant

If INACTIVE, is well disconnected from the system: Y ☐ N ☐ Decommissioned properly: Y ☐ N ☐

Is this well part of a combined POE to the distribution system: Y ☐ N ☒ N/A ☐ If yes, which one: _____

Frequency site is inspected by PWS: Weekly Describe other: _____

Is the well sealed properly at the surface: Y ☒ N ☐ Comments: _____

Casing extends min of 18"(CWS) or 12"(NCWS) above well slab, floor, or ground surface: Y ☒ N ☐

Motor HP: 75 Pump Type: Turb Well Depth: 321' Well Casing Dia: 16"

Screen Const. Type: SS Top of Screen Depth: 261' Casing Type: Steel Pump Setting: 200'

Is the well vent termination and screening acceptable: Y ☒ N ☐ Size: 1.25" Comments: _____

Well blow-off size: 2.5" Is blow-off properly capped or screened: Y ☒ N ☐

Is a sampling tap available: Y ☒ N ☐ Is the sample tap smooth nosed: Y ☐ N ☒

Is a pressure gauge available: Y ☒ N ☐ Working: Y ☒ N ☐ Observed pressure gauge reading: 68 psi Static

Is a chemical injection tap available: Y ☒ N ☐ Chemical tap size: 3/4"

Is an approved electrical outlet available for chemical tap: Y ☐ N ☒ Is this a GFI outlet: Y ☐ N ☐

Is well metered: Y ☒ N ☐ Type: propeller Size: 8" Make/Model: Rockwell Serial #: _____

Electric meter reading: _____ Water meter reading: 15181 X 1000 Hr. meter reading: _____

Are drawdown readings taken routinely: Y ☒ N ☐ Frequency: monthly Airline Length: 200'

Static Water Level: 144.5' Pumping Water Level: 154.5' Drawdown: 10' Avail. DD: 55.5'

Are cross-connection requirements adequately met: Y ☒ N ☐

Are chemicals injected at the well: Y ☐ N ☒ If yes, what chemical(s):

Observed condition of piping and valving: Good, paint Ok and no corrosion

Observed condition of electrical systems: Good, everything appears OK

Is backup power available: Y ☒ N ☐ Type: X Describe Other: city generator

Size: _____ Kwh _____ Hp _____ RPM for PTO or Belt Drive If exercised, how often monthly? Under load Y ☒ N ☐

Is the facility well maintained and secure: Y ☒ N ☐ If yes, describe security measures: locked door

If necessary, is appropriate signage in place: Y ☐ N ☐ N/A ☒

Does well meet criteria for potential GWUDI: Y ☐ N ☒ Unknown ☐

Has the source been deemed to be GWUDI: Y ☐ N ☐ Date of determination: _____

Are there any encroachments on this well: Y ☐ N ☒ If yes, are they pre-existing or new: ☐ Pre ☐ New

Current well vulnerability rating: ☐ Vulnerable ☒ Non-Vulnerable

Comments on this well: _____

TRANSMISSION OF SOURCE WATER

(For purposes of this survey, if the Transmission main exceeds 300' in length this sheet must be completed)

If the system treats, does the transmission main deliver all raw water to a treatment plant: Y ☐ N ☒

If no, explain: only wells G-031683 & G-031679 go to plants Number of Transmission mains: 2

Length	Construction Date	Type of Material	# Air Relief	# Blow Off
3300'	1986	DI	none	none
1650'	1998	C900	none	none

Does the air relief(s) terminate above ground level: Y ☐ N ☐ N/A ☒ Is (are) the air relief(s) screened: Y ☐ N ☐ N/A ☒

Is (are) the blow off(s) capped: Y ☐ N ☐ N/A ☒ Is there a valve exercising program: Y ☒ N ☐ N/A ☐

Frequency: _____ Are repair materials available on-site: Y ☒ N ☐

Comments on Transmission main:

DISTRIBUTION SYSTEM PUMPS AND PUMP FACILITIES

(Booster Pump Stations, etc. Excluding Well and Other Source Water Facilities)

	Facility Name	Pump Type	Application	Motor HP	Var. Speed	PM Prog.	Backup Power	Comments
1	New plant 1	VT	system water	60	No	Yes	Yes	
2	New plant 2	VT	system water	40	No	Yes	Yes	
3	New plant 3 & 4	VT	system water	30	No	Yes	Yes	
4	small plant	C	system water	25	No	Yes	Yes	
5	small plant	C	system water	25	No	Yes	Yes	

Type Codes: PDP = Positive Displacement Pump; E = Ejector Pump; RP = Reciprocating Pump; SR = Helical or Spiral Rotor; RT = Regenerative Turbine; SC = Split Case (horizontal); C = Centrifugal Pump; ES = End Suction (vertical); O = Other; VT = Vertical Turbine; S = Submersible

Are all pumps operational: Y ☒ N ☐ Comments: _____ Are spare-parts on hand for repairs: Y ☐ N ☒ Comments: _____

Are the pump facilities located in a flood plain: Y ☐ N ☒ If yes, what are the provisions for facility access: _____

Are all drains and vents properly screened: Y ☒ N ☐ N/A ☐ Comments: _____

Are the following adequate for operation at all facilities: Lighting: Y ☒ N ☐ Signage: Y ☐ N ☒ Ventilation: Y ☒ N ☐

Type of Heating: Electric Interior Drainage: Y ☒ N ☐ Describe security measures: locked door

Comments on Pumps and Pump Facilities: _____

SOURCE FACILITIES – GROUNDWATER SUPPLY FACILITIES

(Complete one sheet per source or well.)

Well ID #: 661 Well Common Name: #7 DNR Registration #: G-063646 Well Status: Active

Comments: _____

If INACTIVE, is well disconnected from the system: Y ☐ N ☐ Decommissioned properly: Y ☐ N ☐

Is this well part of a combined POE to the distribution system: Y ☐ N ☒ N/A ☐ If yes, which one:

Frequency site is inspected by PWS: Weekly Describe other: _____

Is the well sealed properly at the surface: Y ☒ N ☐ Comments: _____

Casing extends min of 18"(CWS) or 12"(NCWS) above well slab, floor, or ground surface: Y ☒ N ☐

Motor HP: 15 Pump Type: Turb Well Depth: 155' Well Casing Dia: 8"

Screen Const. Type: SS Top of Screen Depth: 130' Casing Type: Steel Pump Setting: 60'

Is the well vent termination and screening acceptable: Y ☒ N ☐ Size: 1.25" Comments: _____

Well blow-off size: 2.5" Is blow-off properly capped or screened: Y ☒ N ☐

Is a sampling tap available: Y ☒ N ☐ Is the sample tap smooth nosed: Y ☒ N ☐

Is a pressure gauge available: Y ☒ N ☐ Working: Y ☒ N ☐ Observed pressure gauge reading: 65 psi Static

Is a chemical injection tap available: Y ☒ N ☐ Chemical tap size: .75"

Is an approved electrical outlet available for chemical tap: Y ☒ N ☐ Is this a GFI outlet: Y ☐ N ☒

Is well metered: Y ☒ N ☐ Type: propeller Size: 8" Make/Model: Rockwell Serial #:

Electric meter reading: _____ Water meter reading: 33845 X 1000 Hr. meter reading: _____

Are drawdown readings taken routinely: Y ☒ N ☐ Frequency: Monthly Airline Length: 60'

Static Water Level: 22' Pumping Water Level: 28.5' Drawdown: 6.5' Avail. DD: 38'

Are cross-connection requirements adequately met: Y ☒ N ☐

Are chemicals injected at the well: Y ☐ N ☒ If yes, what chemical(s):

Observed condition of piping and valving: Good, paint Ok and no corrosion

Observed condition of electrical systems: Good, everything appears OK

Is backup power available: Y ☒ N ☐ Type: X Describe Other: City generator

Size: _____ Kwh _____ Hp _____ RPM for PTO or Belt Drive If exercised, how often monthly? Under load Y ☒ N ☐

Is the facility well maintained and secure: Y ☒ N ☐ If yes, describe security measures: locked door

If necessary, is appropriate signage in place: Y ☐ N ☐ N/A ☒

Does well meet criteria for potential GWUDI: Y ☐ N ☒ Unknown ☐

Has the source been deemed to be GWUDI: Y ☐ N ☐ Date of determination: _____

Are there any encroachments on this well: Y ☐ N ☒ If yes, are they pre-existing or new: ☐ Pre ☐ New

Current well vulnerability rating: ☐ Vulnerable ☒ Non-Vulnerable

Comments on this well: _____

PRESEDIMENTATION BASINS

(If all basins are not same dimension, complete a separate sheet for each size of basin.)

Number of basins: none PWS name or identification for basin(s): _____

Basin Measurements: Length: _____' Depth: _____' Width: _____' Diameter: _____'

Baffling Factor: _____

Average Turbidity Removal: _____ NTU Historical Turbidity Removal Range: _____ NTU

Frequency of Cleaning: _____

Sludge Disposal method: _____

Contamination Potential: Wildlife: Y ☐ N ☐ Runoff: Y ☐ N ☐ Other: _____

Comments: _____

FLOW CONTROL AND METERING

Source Water Influent Metered: Y ☒ N ☐ Finished Water Outlets Metered: Y ☒ N ☐

Meter Type	Size	Make	Model	Location & Use
Turbine	10'	Sensus		Source new plan
Turbine	10'	Sensus		Finished new plant
Turbine	8'	Sensus		Source old plant
Turbine	8'	Sensus		Finished old plant
	'			X
	'			X
	'			X

Comments: _____

RAPID MIX PROCESS

Type: ☐ Mechanical: _____

☐ Static In-line: _____

☐ Diffuser: _____

☐ Hydraulic (Baffled): _____

Chamber Measurements: Length: _____' Depth: _____' Width: _____' Diameter: _____'

Baffling Factor: _____

Chemicals Being Fed: _____

Continuous Feed: Y ☐ N ☐ Are feeds flow paced: Y ☐ N ☐ Manual Adjusted: Y ☐ N ☐

Variable Speed mixers: Y ☐ N ☐ RPM: _____ RPM Range: _____

Multiple Units: Y ☐ N ☐ Number: _____

Maintenance Frequency: _____

Are there visible hydraulic inadequacies: Y ☐ N ☐ If yes, describe: _____

Is cross-connection control protection adequate, where necessary: Y ☐ N ☐ If no, explain: _____

Comments on Pre-sedimentation Basins, Flow Control Metering, and Rapid Mix Process: _____

TREATMENT FACILITIES AND PROCESSES

Is the treatment plant located within 100-year floodplain: Y ☐ N ☒ Comments: _____

Are there any potential contamination sources in the vicinity of the plant: Y ☐ N ☒

If yes, describe: _____

Are the grounds and facility well maintained: Y ☒ N ☐

Is the facility staffed 24/7: Y ☐ N ☒

If not, what are the normal operating shifts: 8-5

Is the facility secure from trespassers and vandalism: Y ☒ N ☐

If yes, describe security measures: locked door & cameras

Is the system currently using or participating in any type of optimization programs: Y ☐ N ☒

ATTACH A FLOW DIAGRAM (LINE DRAWING) OF THE FACILITY SHOWING FLOW DIRECTION AND CHEMICAL INJECTION POINTS FROM THE SOURCE(S) THROUGH ALL TREATMENT PROCESSES INCLUDING CLEARWELL STORAGE, FOR ALL OPERATING SCENARIOS.

Historical Daily Maximum production over last 3 years: .430 MGD small plant 840 GPM new plant X

Are there any limitations to plant flows: Y ☐ N ☒

If yes, describe: _____

Is there an emergency power source: Y ☒ N ☐ Type: City generator wells #1 & #5

Frequency of testing of emergency power source: monthly

Is there a Preventative Maintenance Program for the treatment plant, associated equipment and facilities: Y ☒ N ☐

TREAMENT PROCESS BEING USED

Conventional Filtration: ☐ _____ Direct Filtration: ☒ _____ In-Line Filtration: ☐ _____

Slow-Sand Filtration: ☒ _____ Single-Stage Softening: ☐ _____ Two-Stage Softening: ☐ _____

Conventional Filtration / Softening: ☐ _____ Are there Split and Complex Treatment Trains: Y ☐ N ☒

Membrane Filtration: ☐ _____ Micro-Filtration: ☐ _____ Ultra-Filtration: ☐ _____

Nano-Filtration: ☐ _____ Reverse Osmosis: ☐ _____ Greensand Filtration: ☐ _____

Ion-exchange: ☐ _____ Purpose: _____

Aeration: ☒ _____ Type: ☐ _____

Disinfection: ☒ _____ Pre: ☒ _____ Post: ☒ _____ Other: _____

Oxidation: ☒ _____ Purpose: _____

Sequestering: ☐ _____ Purpose: _____

Fluoridation: ☐ _____ Other Processes: _____

Individual processes or package plant: package plants

If Package plant/treatment unit, brand name and model of unit: U.S. Filters

Comments on Treatment Facilities and Processes: _____

COAGULATION AND FLOCCULATION

(If non-similar multiple units, complete one sheet for each one.)

Type of mixing: Mechanical: _____ Baffled: _____ Number of mixers or baffles: _____

Static: _____ rpm Variable Speed Range: _____ rpm Baffling Factor: _____

Vertical Shaft: _____ Paddle: _____ Up-flow Clarifier: _____

Basin(s) Measurements: Length: _____' Depth: _____' Width: _____' Diameter: _____'

Does process appear to be working correctly: Y ☐ N ☐

Is there a preventative maintenance program for the equipment: Y ☐ N ☐

Comments: _____

Is there Jar Testing Capability at the facility: Y ☐ N ☐ Frequency of Use: _____

Comments on Coagulation and Flocculation: _____

SEDIMENTATION / CLARIFICATION

(If non-similar multiple units, complete one sheet for each one.)

Type: Cross-flow Basin: ☐ _____ Radial-flow Basin: ☐ _____ Up-flow Clarifier: ☒ _____

Number of Basins: 1 Baffling Factor: none

Basin(s) Measurements: Length: 16' Depth: _____' Width: 15' Diameter: _____'

Does flow appear to be evenly distributed: Y ☐ N ☐

Is there evidence of short-circuiting: Y ☐ N ☒

Method of Sludge Removal: Mechanical: none Type: _____

Manual: _____ Frequency: _____

Average Settled Turbidity: _____ NTU Historical Settled Turbidity Range: _____ NTU

Sludge Disposal Location: sanitary sewer

Comments on Sedimentation/Clarification: _____

CHEMICALS AND CHEMICAL FEED SYSTEMS

(This sheet needed for any system required to comply with 179 NAC 22-005 Item 6)

Chemical Name	Day Tank capacity in gal.	Average Daily Feed	Certified By	Measured By	Safety Equip.	MSDS Avail.	Labeling & Signage	Spill Containment	Comments
Chlorine	55	32 #/Day	1	S	Yes	Yes	Yes	Yes	
Polymer	150	25 GPD	1	T	Yes	Yes	Yes	Yes	
Chlorine gas	#150	9 #/Day	1	S	Yes	Yes	Yes	Yes	
Potassium	150	10 GPD	1	T	Yes	Yes	Yes	Yes	

Certification Codes: 1 = NSF 2 = UL 3 = AWWA Standards Measurement Codes: S = Scale L = Labeled T = Tank Marked O = Other

Safety Equip., MSDS Avail., Labeling & Signage, Spill Containment, Storage Secure & Safe = Yes or No

Are MSDS(s) readily accessible to all personnel: Y ☒ N ☐ Comments: _____

Is the appropriate chemical safety equipment available to all personnel: Y ☒ N ☐ Comments: _____

Are there any visible problems with the application points: Y ☐ N ☒ Comments: _____

Describe security measures for chemical storage: locked door

CHEMICAL FEED EQUIPMENT SPECIFICATIONS

Description	Make	Model #	Feed Range	NSF 61 Cert. (Y or N)	Method of setting Feed Rate			
					Well or Motor Paced	Flow Paced	Manual	Other
Volumetric Feeder	capital	200	0-10 #/Day	Yes	no	no	yes	small plant
Diaphragm pump	LMI	B121-92T	2.5 GPH	Yes	no	no	yes	small plant
Diaphragm pump	LMI	C121-71S	4 GPH	Yes	no	no	yes	small plant
Volumetric Feeder	W&T		0-10 #/Day	Yes	no	yes	no	booster station
Diaphragm pump	LMI	B121-91S	2.5 GPH	Yes	no	yes	no	new plant
Diaphragm pump	LMI	C131-25HV	9 GPH	Yes	no	yes	no	2 pumps new plant
Diaphragm pump	LMI	C121-71S	4 GPH	Yes	no	yes	no	new plant

Are backup units available for all feeders: Y ☒ N ☐ Comments: _____

Is appropriate cross-connection control in place for chemical feeders: Y ☒ N ☐ Comments: _____

Are these chemicals fed at a chemical feed facility: Y ☒ N ☐ If not, where are they fed: _____

Comments on Chemicals, Chemical Feed System(s) and Chemical Feed Equipment:

GRAVITY FILTERS

(Complete one sheet per filter type.)

Number of Filters: 4 Filter ID (name or number): _____ Installation Date: 1986

Filter Technology: Rapid Sand: ☐ Slow Sand: ☒

Filter Media (check all that apply): Sand: ☒ Anthracite: ☒ GAC: ☐

Gravel: ☐ Garnet: ☐ DE: ☐ Other: _____

Filter Dimensions: Length: _____' Depth: 3' Width: 3' Diameter: 15' Baffling Factor: _____

Date of last media installation or replacement: none

Are there any visible problems with filter media: Y ☐ N ☒ Comments: _____

Type of under drain system: pipe

Frequency under drain system is inspected: daily

Designed filtration rate: 3.0 gpm /ft^2 Current filtration rate: unknown gpm /ft^2

Design media depth: 2' Current media depth: unknown

Criteria for initiating backwash: daily

Monitoring Equipment: Rate-of-Flow Controller(s): none Are these variable or set: set

Filter Effluent Turbidimeters: none Head Loss gauges: yes

% media expansion during backwash: unknown% Average filter run time: 24 hours

Is there a Surface Wash System for the filter: Y ☐ N ☒ Air Scour: Y ☒ N ☐

Is there filter to waste capability: Y ☒ N ☐ Comments: _____

How are recently washed filters brought back on line: manual Condition of pipe gallery: good

Has a filter profile been developed for the filter: Y ☐ N ☒ Comments: _____

Has a filter self-assessment been completed for the filter: Y ☐ N ☒ Comments: _____

Date of last assessment: none Significant findings: _____

Where is filter effluent turbidity monitored (list all locations): none

Turbidity monitored via: Continuous monitor ☐ or by grab sample ☐

How often are the readings recorded: none

Date of last filter effluent turbidimeter calibration: none Calibration frequency: none

Are calibration records current and accessible: Y ☐ N ☐ Comments: _____

How are required turbidimeter readings recorded: ☐ Chart Recorder ☐ Strip Chart ☐ Data-logging

Frequency of readings: none Is redundancy provided for readings: Y ☐ N ☐

Are filter-aides added prior to filtration: Y ☒ N ☐ If yes, what chemical(s): potassium & Polymers

Dosage rate: .97 potassium & .159 Polymers mg/L Does it meet NSF-60, UL, or AWWA standards: Y ☒ N ☐

Are appropriate cross-connection devices installed, where necessary: Y ☒ N ☐

Comments: _____

Is backwash water retained for recycle: Y ☐ N ☒ If yes, method: ☐ Lagoons ☐ Direct Recycle

Additional Comments on Filtration Practices: _____

Comments on Gravity Filters: _____

GRAVITY FILTERS

(Complete one sheet per filter type.)

Number of Filters: 4 Filter ID (name or number): _____ Installation Date: 1998

Filter Technology: Rapid Sand: ☒ Slow Sand: ☐

Filter Media (check all that apply): Sand: ☐ Anthracite: ☒ GAC: ☐

Gravel: ☐ Garnet: ☐ DE: ☐ Other: _____

Filter Dimensions: Length: _____' Depth: 4' Width: 5.5' Diameter: 26' Baffling Factor: none

Date of last media installation or replacement: 2010

Are there any visible problems with filter media: Y ☐ N ☒ Comments: _____

Type of under drain system: steel with media retainer

Frequency under drain system is inspected: daily

Designed filtration rate: 3.0 gpm /ft^2 Current filtration rate: unknown gpm /ft^2

Design media depth: 2' Current media depth: unknown

Criteria for initiating backwash: hours

Monitoring Equipment: Rate-of-Flow Controller(s): yes Are these variable or set: set

Filter Effluent Turbidimeters: unknown Head Loss gauges: yes

% media expansion during backwash: unknown% Average filter run time: 42 hours

Is there a Surface Wash System for the filter: Y ☐ N ☒ Air Scour: Y ☒ N ☐

Is there filter to waste capability: Y ☒ N ☐ Comments: _____

How are recently washed filters brought back on line: automatic Condition of pipe gallery: good changed in 2010

Has a filter profile been developed for the filter: Y ☐ N ☒ Comments: _____

Has a filter self-assessment been completed for the filter: Y ☐ N ☒ Comments: _____

Date of last assessment: none Significant findings: _____

Where is filter effluent turbidity monitored (list all locations): none

Turbidity monitored via: Continuous monitor ☐ or by grab sample ☐

How often are the readings recorded: none

Date of last filter effluent turbidimeter calibration: none Calibration frequency: _____

Are calibration records current and accessible: Y ☐ N ☐ Comments: _____

How are required turbidimeter readings recorded: ☐ Chart Recorder ☐ Strip Chart ☐ Data-logging

Frequency of readings: _____ Is redundancy provided for readings: Y ☐ N ☐

Are filter-aides added prior to filtration: Y ☒ N ☐ If yes, what chemical(s): potassium & Polymers

Dosage rate: .80 potassium & .05 polymers mg/L Does it meet NSF-60, UL, or AWWA standards: Y ☒ N ☐

Are appropriate cross-connection devices installed, where necessary: Y ☒ N ☐

Comments: _____

Is backwash water retained for recycle: Y ☐ N ☒ If yes, method: ☐ Lagoons ☐ Direct Recycle

Additional Comments on Filtration Practices: _____

Comments on Gravity Filters: _____

DISINFECTION PROCESSES

SW & GWUDI PWS

How are the T10 Times calculated: **Tracer Study:** none **Theoretical:** ____

Date Tracer Study was Conducted: none **By:** ____

Identify the CT Sampling Sequences:

A.) ____ **Baffling Factor:** ____

B.) ____ **Baffling Factor:** ____

C.) ____ **Baffling Factor:** ____

D.) ____ **Baffling Factor:** ____

Where are disinfectant residuals, flow, pH and temperatures being monitored for CT purposes: ____

What is frequency of CT calculations: none

Are at least 3 years of daily CT calculations available: Y ☐ N ☐

Are the CT calculations being performed correctly: Y ☐ N ☐

Testing Equipment for CT Calculations in each zone:

Chlorine Residual: ☐ Grab or ☐ Continuous **Inst. Model:** ____ **Calib. Freq.:** ____

pH: ☐ Grab or ☐ Continuous **Inst. Model:** ____ **Calib. Freq.:** ____

Temperature in C: ☐ Grab or ☐ Continuous **Inst. Model:** ____ **Calib. Freq.:** ____

Comments: ____

All PWS That Disinfect

Monitoring for disinfectant residuals: Continuous ☐ **or grab sampling** ☒ **(frequency** daily**)**

List all locations where disinfectant residuals are monitored: Plants & samples site as per regs

Model of Continuous Monitor: Pocket tester & Hach DR2010

Is there an adequate spare parts inventory: Y ☒ N ☐ **Reagent supply:** Y ☒ N ☐

Residual Information Recording: ☐ Chart-recorder ☐ Strip-charts ☒ Data-logging

Is there a level of redundancy: Y ☐ N ☒ **Comments:** ____

What is the frequency of verifying the continuous read testing results by another method: ____

What is that method: ____

Are backflow preventers installed where necessary: Y ☐ N ☐

Comments: ____

Comments on Disinfection Process: ____

DISINFECTION PROCESSES

Page 1 of 2

Pre-Disinfectant Used: ☒ Chlorine ☐ Ozone ☐ Chlorine Dioxide ☐ Other: _____

In-plant Disinfectant: ☒ Chlorine ☐ Ozone ☐ Chlorine Dioxide ☐ Other: _____

Distribution (plant effluent) Disinfectant Used: ☒ Chlorine ☐ Chloramines ☐ Chlorine Dioxide ☐ Other: _____

Chlorine Type Used: ☒ Gas – 150 lb. Cylinder ☐ Gas – 1T Cylinder ☐ Gas – RR Tank Cars ☒ Liquid – Sodium Hypochlorite: 12.5% ☐ Calcium Hypochlorite: _____%

Primary Purpose: ☐ Oxidation ☐ Disinfection ☒ Both

Chlorine Dioxide:

On-site generated: Y ☐ N ☐ If yes, number of generators: _____

Size of chlorine cylinders: _____ Bulk chlorite storage: _____ gal

Primary Purpose: ☐ Oxidation ☐ Disinfection ☐ Both

Frequency of generator yields: _____ Average yield %: _____%

Method used to detect residuals: _____

Is there a PM Program for the generators: Y ☐ N ☐

Date of last preventative maintenance on generators: _____

Ozone:

Number of Generators: _____ Capacity of Generators: _____ %

Ozone being generated: _____%

Primary Purpose: ☐ Oxidation ☐ Disinfection ☐ Both

Are all applicable residual monitors operational: Y ☐ N ☐

Are excess ozone destructors operational: Y ☐ N ☐

Is there a PM Program for the generators: Y ☐ N ☐

Date of last PM on ozone generators: _____

DISINFECTION APPLICATION POINTS

Disinfectant Type	Application Point
Gas Chlorine	booster station and small plant
Sodium Hypochlorite	after filtration at new plant
X	
X	
X	
X	
X	

HYDROPNUEMATIC AND PRESSURE TANKS

(complete one sheet per tank brand/model)

Brand of Tank(s): Unknow _____ **Model of tank(s):** Unknown

Number of Tank(s): 1 **What wells or water source(s) are tank(s) used for:**

Type: Air **Describe Other:** _____

Installation Date(s): Unknown **Are these tanks used to prevent water hammer:** Y ☐ N ☒

Is tank located completely above ground: Y ☒ N ☐

Date of last internal inspection if applicable: none **Comments:** _____

ASME plate information: none N/A ☐

Is a manway available: Y ☐ N ☒ **Shape:** X **Size: W:** _____" **H:** _____" **D:** _____" x _____"

Is there a functioning pressure relief valve: Y ☐ N ☒

Is there a functioning pressure gauge: Y ☒ N ☐ **If yes, psi:** 65

What are the pump On and Off pressure settings: **On:** 40 **Off:** 62

Is there an automatic control system for water / air ratio: Y ☐ N ☒ N/A ☐

If yes, are air injection lines filtered: Y ☐ N ☐

Is there a sight glass or other water level indicator: Y ☒ N ☐ N/A ☐ **If other, describe:** _____

Overall condition of tank(s): fair

Describe security measures: locked door

Comments on Hyropnuematic and Pressure Tanks: _____

GROUND AND ELEVATED TANK STORAGE FACILITIES

Facility Name	Type	Const. Mat.	Tank ht.	Over-flow ht.	Corrosion Control (Y or N)	Date of Last Inspection	Date of Last Cleaning	Date Interior Painted	Interior Paint Type	Date Exterior Painted	Exterior Paint Type
ground storage	G	C	10.4'	10.4'	No	2010	2006	NA	X	NA	X
water tower	HP	S	114'	114'	No	2010	2005	1994	E	2010	E
	X	X	'	'	X				X		X

Type: G = Ground Storage PB = Partially Buried B = Buried E = Elevated HP = Hydro-pillar UC = Uncovered Facility SP = Stand Pipe

Construction Material: C = Concrete S = Steel O = Other Describe: _____

Paint System Type: E = Epoxy G = Glass Coating W = Wax UK = Unknown O = Other Describe: _____

Current condition of tank exterior(s): good

Any apparent structural problems: Y ☒ N ☐ Comments: Self inspection of storage done every 5 years

Is there a routine inspection and cleaning program: Y ☐ N ☒ Comments: _____

Who performed the last inspection and cleaning? Liquid Engineering

Were any deficiencies noted during the last inspection: Y ☐ N ☒

If yes, have they been corrected: Y ☐ N ☐ If no, what was not corrected: _____

How is the water supply maintained with storage facilities out of service: booster ranning pressure releif valve

Are the facilities well maintained: Y ☒ N ☐ Describe security measures for storage facility: locked door & fence & camera

GROUND AND ELEVATED STORAGE TANK FACILITIES COMPONENTS

(If unable to inspect the following, obtain information from the most recent storage facility inspection report)

Facility Name	Roof Leaks	Access Hatch Locked	Roof Vent Cond	Level Measure Operational	Tank Drain	Overflow 12-24" above ground on splash pad	Overflow Cover	Access Ladders	Valves Operable	Bypass Present / Operable	Level Controls Type	Alarm System
ground storage	S	S	S	S	S	S	Screen	S	S	S	pressure	S
tower	S	S	S	S	S	S	Screen	S	S	S	pressure	S
	X	X	X	X	X	X		X	X	X		X

S = Satisfactory U = Unsatisfactory N = Not Present, but should be UI = Unable to Visually Evaluate NA = Not Applicable

Overall Comments on Ground and Elevated Storage Facilities: _____

THE FOLLOWING MARKED SANITARY SURVEY COMPONENTS ARE NOT APPLICABLE TO THIS PWS.

CROSS-CONNECTION CONTROL PROGRAM	☐
SOURCE FACILITIES—GROUNDWATER SUPPLY FACILITIES	☐
WELL INFORMATION	☐
SURFACE WATER SUPPLIES AND FACILITIES	☒
INFILTRATION GALLERY FACILITIES	☒
SPRING SOURCE FACILITIES	☒
PUMPS AND PUMP FACILITIES	☐
TRANSMISSION OF SOURCE WATER	☐
TREATMENT FACILITIES AND PROCESS	☐
PRESEDIMENTATION BASINS	☐
FLOW CONTROL AND METERING	☐
RAPID MIX PROCESS	☒
CHEMICAL AND CHEMICAL FEED SYSTEMS	☐
CHEMICAL EQUIPMENT SPECIFICATIONS	☐
COAGULATION AND FLOCCULATION	☒
SEDIMENTATION / CLARIFICATION	☒
PRESSURE FILTERS	☐
GRAVITY FILTERS	☐
DISINFECTION PROCESSES	☐
GROUND AND ELEVATED TANK STORAGE FACILITIES	☐
GROUND AND ELEVATED STORAGE FACILITIES COMPONENTS	☐
HYDROPNUEMATIC AND PRESSURE TANKS	☐

Department of Health & Human Services

DHHS

NEBRASKA

Inspector's Signature: Robert C Byrkit

Report Received By: Tmi Coffey

Date Inspection Completed: 7/20/11

Bob Byrkit
Water Supply Specialist
State of Nebraska
Department of Health and Human Services
Division of Public Health
PO Box 33
Nelson, NE 68961

Cell: (402) 432-4831
FAX: (402) 225-2417

Email: bob.byrkit@nebraska.gov

SENSITIVE / SECURE INFORMATION

PWS Name: City of Crete **County: Saline** **PWS ID#: NE31-15104**

Date of Survey: 07/20/2011

WELL INFORMATION

Well ID#	Well Capacity	Chemicals Injected (Y/N)	GPS Location
G-031679 (311 & #1)	420 GPM	N	N 40° 37' 47.15" W 96° 57' 32.30" Elevation 1354'
G-031681 (391 & #3)	800 GPM	N	N 40° 37' 5.0884" W 96° 57' 43.817" Elevation 1346'
G-031682 (551 & #4)	1000 GPM	N	N 40° 38' 6.2958" W 96° 57' 46.511" Elevation 1353'
G-031683 (651 & #5)	860 GPM	N	N 40° 37' 30.194" W 96° 56' 31.933" Elevation 1461'
G-063645 (721 & #6)	1000 GPM	N	N 40° 37' 19.641" W 96° 58' 42.459" Elevation 1356'
G-063646 (661 & #7)	220 GPM	N	N 40° 37' 35.654" W 96° 57' 36.476" Elevation 1357'

STORAGE FACILITIES

Facility Name	Physical Location of Facility	PSI	Capacity	GPS Location
Ground storage	at new plant	0	1 MG	N 40° 37' 28.11" W 96° 56' 16.72" Elevation 1493'
Tower	East Lower LN & CR E	65	1 MG	N 40° 38' 24.38" W 96° 56' 13.58" Elevation 1466'
				N ___ ° ___ ' _____ " W ___ ° ___ ' _____ " Elevation ____ '

DISTRIBUTION SYSTEM GPS DATA

Location of Geographical Center of Distribution System	GPS Location
13th & Juniper	N 40° 37' 30.85" W 96° 57' 28.49" Elevation 1358'

CHEMICALS AND CHEMICAL FEED SYSTEMS

Name of Chemical Stored	Location of Chemicals, Chemical Storage and Chemical Feed Systems	Lbs./Gallons of Chemical Stored
Chlorine	new plant	55 gallons
Polymers	both planats	150#
Chlorine	pump station & small plant	200# each
Potassium	both plants	150#

Name of Chemical Feed Facility and Type of Chemical Fed	GPS Location if different from well locations
small plant	N 40° 37' 40.03" W 96° 57' 34.74" Elevation 1353'
New plant	N 40° 37' 28.11" W 96° 56' 16.72" Elevation 1493'
	N ___ ° ___ ' _____ " W ___ ° ___ ' _____ " Elevation ____ '

DISTRIBUTION SYSTEM PUMPS AND PUMPING FACILITIES

(Booster Stations, etc., excluding wells and other water sources)

Facility Name	Number and Application of Pumps in Facility	PSI	Capacity	GPS Location
New plant	pump #1	75 psi	1300 GPM	N 40° 37' 30.194" W 96° 56' 31.933" Elevation 1493'
New plant	pump #2	75 psi	1000 GPM	N 40° 37' 30.194" W 96° 56' 31.933" Elevation 1493'
New plant	Pump #3 & #4	75 psi	700 GPM	N 40° 37' 31.194" W 96° 56' 31.933" Elevation 1493'
Small plant	2 pumps	115 psi	400 GPM	N 40° 37' 40.03" W 96° 57' 34.74" Elevation 1353'

TRANSMISSION OF SOURCE WATER

Description of Trans. Main Run (stop/end point. Provide GPS for end)	GPS Location
From Wells to new treatment plant	N 40° 37' 30.194" W 96° 56' 31.933" Elevation 1493'
from well to small plant	N 40° 37' 28.11" W 96° 57' 34.74" Elevation 1353'
	N ___ ° ___ ' _____ " W ___ ° ___ ' _____ " Elevation ____ '

TREATMENT FACILITIES AND PROCESSES

1. Physical location and directions to treatment facilities: Licoln & 15th Street 13th & 1433' West fo CR 2400

Treatment Process/Name	Design Cap. of Process	GPS Location if applicable
small plant	400 GPM	N 40° 37' 40.03" W 96° 57' 34.74" Elevation 1353'
New plant	840 GPM	N 40° 37' 28.11" W 96° 56' 16.72" Elevation 1493'
		N __ ° __ ' _____ " W ___ ° __ ' _____ " Elevation ____ '

2. List potential contaminant sources in the vicinity of the treatment facilities: small plant fuel storage

3. Design capacity of treatment plant: 1.641 MGD

FLOW CONTROL AND METERING

Name and Location of Finished Water Outlets:	Meter type and reading	GPS Location
small plant	428013 X 1000	N 40° 37' 40.03" W 96° 57' 34.74" Elevation 1353'
new plant	185355 X 100	N 40° 37' 28.11" W 96° 56' 16.72" Elevation 1493'
		N __ ° __ ' _____ " W ___ ° __ ' _____ " Elevation ____ '

APPENDIX B: LBG WHPA & MODELING REPORT

LBG WHPA & Modeling Report – dated July 2, 2013

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LEGGETTE, BRASHEARS & GRAHAM, INC.

PROFESSIONAL GROUNDWATER AND ENVIRONMENTAL ENGINEERING SERVICES

8 PINE TREE DRIVE
SUITE 250
ST. PAUL, MN 55112
(651) 490-1405
FAX (651) 490-1006
www.lbgweb.com

July 2, 2013

Mr. Ryan Chapman
Nebraska Department of Environmental Quality
Suite 400 The Atrium 1200 N Street
Lincoln, Nebraska 68509

Re: DRAFT: Wellhead Protection Area Model
Crete, Nebraska

Mr. Chapman,

The purpose of this letter report is to document the delineation of Wellhead Protection Areas (WHPA) for the drinking water supply wells operated by the City of Crete, Nebraska (City). Wellhead protection helps to prevent contaminants from entering drinking water supply wells. Leggette, Brashears & Graham, Inc. (LBG) was contracted by JEO, Inc. (JEO) to complete the groundwater flow model and the WHPA delineations. The WHPAs were delineated using MODFLOW (a numerical groundwater flow model) and the particle-tracking module, MODPATH. Findings in this letter are based on information from the City, JEO, LBG, and the Lower Big Blue Natural Resources District (LBBNRD).

The following tasks were completed as part of this study:

- Obtained and evaluated available hydrogeologic information and updated the data elements;
- Refined the conceptual hydrogeologic model using available well logs, water level and well pumping data, previous studies, and other delineation criteria;
- Applied the numerical groundwater flow model, MODFLOW, to update the WHPA of the City wells;
- Used a range of possible values for several model parameters to complete an uncertainty analysis; and,
- Used the results of the uncertainty analysis to create a composite capture zone for defining the WHPAs for the City's wells.

The City is located in the northeastern portion of Saline County as shown on Figure 1. The geologic units of interest in the vicinity of the City and surrounding area consist of Quaternary-Aged glacial deposits that are underlain by Cetaceous-Aged bedrock including

the Dakota Sandstone, Greenhorn Limestone and Carlile and Graneros Shales. All of the City Wells are completed in the Quaternary materials (Figure 2).

In northeastern Saline County, groundwater is encountered in the Quaternary and bedrock aquifers, with the regional flow direction being generally from west to east toward the Missouri River, which serves as a regional hydrologic discharge point for the flow systems. East of Crete the flow appears to diverge with flow north of Crete trending to the north east, some flow continuing directly east, and groundwater south of the City turning to the south along the Big Blue River. A generalized, 4th order, trend surface was created using water level data for area wells completed in the unconsolidated material. This is shown on Figure 3. Some local flow is also directed toward local rivers and streams such as the Big Blue River and Turkey Creek in the area around Crete. A local area model was created by defining a domain that was divided into a three-dimensional, non-uniform grid with 137 rows, 147 columns, and 1 active layer.

The particle-tracking package, MODPATH, was used in conjunction with the calibrated flow model to create the 1-, 2-, 10-, and 20-year time-of-travel pathlines necessary for delineating the WHPAs for the City wells. A number of other model runs were also completed to examine the capture zones for the City Wells under a range of conditions that may be present. The capture zones for all of these possible scenarios were then concatenated to create composite capture zones for each well.

The composite capture zones were then used to delineate the final WHPAs. A combined pumping rate from all wells of approximately 409 MGY (4,250 m3/d) was applied based on the maximum pumping rate from each of the City's wells over the past three years.

Data Elements

Precipitation. Recharge was considered in all areas of the model. The amount of infiltration due to precipitation was determined through estimation and calibration.

Geology. Data was gathered from well logs along with descriptions of the geology including aquifers from regional studies and information (see References).

Soils. Soil characteristics influenced the subsequent delineation of the wellhead protection areas.

Water Resources. Local rivers and streams influence the delineation of the groundwater wellhead protection areas. The Big Blue River and Turkey Creek were included in the model, however, Squaw Creek was not included as it appears to be intermittent in nature.

Water Quantity Data Elements.

Levels in lakes and streams can have an impact on an aquifer that is unconfined if there is a geologic connection between the two. From the review of geologic cross sections and select well logs, and the known occurrence of springs near some sections of the Big Blue River, it does appear that surface waters are in direct connection hydraulically with the aquifer of interest for this WHP Plan.

Surface Water Quantity. Surface water bodies did influence the subsequent delineation of the groundwater wellhead protection areas, and were included in the model.

Groundwater Quantity Table 1 lists the five City wells and their associated pumping rates over the last three years. Figure 2 shows and Table 2 lists 305 irrigation wells that were identified within the model domain from the Nebraska Department of Natural Resources registered groundwater wells database. These were included in the model.

Overland Drainage: Surface runoff is directed toward local surface water features and not considered in the model.

Delineation Criteria

The following discussion presents a summary of the five criteria for delineating the amended WHPA.

Time of Travel: Travel times of 1-, 2-, 10-, 20- and 50-years were used when simulating groundwater movement with pathlines.

Aquifer Transmissivity: In this setting, there are one hydrostratigraphic unit that is of interest, the buried sand and gravel that contains the City Wells. Analysis of well data indicated the hydraulic conductivity of the sand and gravel aquifer could be as high as 100 meters per day (m/d) [330 feet per day (ft/d)] or higher and as low as 10 m/d (33 ft/d). The approximated base of the aquifer is shown on Figure 4 and the top of the modeled aquifer is shown on Figure 5.

The conductivity values for this study are in the general range of values used for other studies in the area. The ranges of conductivities used in the model are described in the Calibration and Uncertainty section of this document. The modeled capture zones for this analysis were plotted together and the resulting outline forms the "composite" capture zone used in the WHPA delineation.

Daily Volume of Water Pumped: The daily volume selected for each well used in the WHPA was chosen as the greatest annual volume of water used over the previous three years. The rates used in the delineation and from the previous three years are summarized in Table 1. Additionally, the total volume illustrated in Table 1 (409.9 million gallons per year [MGY]) is more than 15% greater than the average single-year demand over the period of record (354 MGY), indicating a conservative delineation volume.

Hydrologic Boundaries: Hydrologic boundaries that could affect the delineation are surface water features, geological boundaries, high capacity wells, and overland drainage. These were discussed in detail in the data elements section.

Groundwater Flow Field: In northeastern Saline County, groundwater is encountered in the Quaternary and bedrock aquifers, with the regional flow direction being generally from west to east toward the Missouri River, which serves as a regional hydrologic discharge point for the flow systems. Some local flow is also directed toward local rivers and streams such as the Big Blue River and Turkey Creek in the area around Crete.

Model Setup

The existing WHPA for the City was delineated using WhAEM, an analytic element modeling program developed for the United States Environmental Protection Agency (EPA). The updated WHPA presented in this study was modeled using a MODFLOW model. All of the modeling for this amendment was done using GMS (Aquaveo, 2013), a pre- and post-processor for MODFLOW.

The model domain was divided into a three-dimensional, non-uniform grid as shown on Figures 6. The model has 193 rows, 228 columns, and one layer. Finer grid spacing was applied in the local model with telescopic mesh refinement used in the area of the site where the City wells are located (Figure 7). This grid spacing provides better definition in the area of the flow field where simulating the influence of pumping from the wells was critical. The base of the model is variable at an elevation of approximately 1,170 to 1,300 feet above mean sea level (ft-amsl) as shown on Figure 4 with the top of the aquifer extending from approximately 1,300 to over 1,430 ft-amsl (Figure 5). This layer approximately corresponds to the vertical extent of the sand and gravel defined areas entered on well logs in model domain. The values for various properties of the aquifer are summarized in Table 3.

Model Input Parameters: Discretization of aquifer properties in MODFLOW involves assigning initial values to each cell in the model domain. Hydraulic properties input for this model included horizontal components for hydraulic conductivity (k_x and k_y) and effective porosity (n_e) (required for MODPATH to calculate linear flow velocity). All data are summarized in Table 3.

The boundary conditions for the model were chosen to be far enough from the area of interest within the City as to not impose undue influence on the computed capture zones for the City wells. The West Fork Big Blue River along with a constant head boundary make up the northern edge of the model. The west side is created with another constant head boundary spanning the area between the West Fork Big Blue River and Turkey Creek. Turkey Creek makes up the rest of the western boundary. All of the boundaries are shown on Figure 6. The inter-river boundary of the west side of the model was given a head of 1378 ft-amsl. A constant head boundary creates the southern and eastern limits of the model. All of the Constant head boundaries were defined using the approximate elevation of groundwater as defined by well data in the area. The constant head boundary comprising the southern and eastern limit of the model was defined along a line of approximately equal head at 1310 ft-amsl. It appears that groundwater flow east of Crete radiates to the north toward small local streams, to the east toward the Missouri River and also to the south along the Big Blue River. Turkey Creek, the Big Blue River and the West Fork Big Blue River are defined in the model using the MODFLOW river package. This allows water to enter and exit the model. They were defined using the elevations of the rivers from high resolution digital elevation model (DEM) data from the United States Geologic Survey (USGS).

Within the model domain, precipitation was added at the rate of 4 in/yr (0.00025 m/d) which corresponds to approximately 15% of annual precipitation. The City Wells were added with the pumping rates discussed earlier as well as the irrigation wells. The irrigation well pumping rates were defined by multiplying the number of acres irrigated, as specified in the well database, by 5 in/yr. Discussions with the Lower Big Blue Natural Resources District indicated that the amount of irrigation water used could range anywhere from four to eight

inches per acre per year, with no good estimate on the amount of water applied that returns as recharge. As no return recharge from irrigation is being modeled, a value in the lower end of the range was chosen.

A representative value of 0.3 was chosen for the effective porosity that is consistent with the range of values for this aquifer material. The value was changed to a more conservative value of 0.2 for the uncertainty analysis.

Calibration and Uncertainty

The goal of numerical model calibration is to obtain a reasonable correlation between the simulated model results and observed field data. The calibration process is generally completed by running several steady-state simulations and comparing calculated heads to the measured head data at known calibration points within the model domain.

The groundwater flow field and hydraulic heads in the area of the City for the calibrated model are shown on Figure 8. The calibration plot, showing measured versus simulated hydraulic head values, for the model is shown in Figure 9. It can be seen in the plot that the head values and measured values compare quite favorably and have a normalized root mean squared error of approximately 8 percent. The 1-, 2-, 10-, 20- and 50-year capture zones and groundwater flow paths predicted using the calibrated model are shown on Figure 10.

More extensive observation data collected within the same general time period and more accurate, site-specific conductivity values throughout the model domain would improve calibration and model confidence.

The model agreed quite well with the calibration data, however, all modeling requires simplifying assumptions be made in order to create a groundwater flow model. Obviously there are significant differences in the conductivity, thickness, recharge and other characteristics throughout the model domain. The information and ability to account for all of these differences simply doesn't exist. The modeled aquifer is an attempt to best replicate the average conditions and replicate the general flow field. Due to the amount of uncertainty associated with the physical characteristics of a highly heterogeneous aquifer, an uncertainty analysis was completed as part of the modeling effort. To adequately address the uncertainty associated with the parameters a number of models were completed to simulate the 20- and 50-year capture zones should conditions different from the calibrated model exist.

Eighteen separate simulations were completed to examine the impact on the City Well capture zones of the hydraulic conductivity, recharge from precipitation and river bed conductance. The values used for each of the simulations are found in Table 4. The resulting 20-year capture zones were then all plotted together on Figure 11 and the 50-year capture zones on Figure 12.

WHPA Delineation

After the uncertainty analysis was completed, the capture zones delineated for each of the models were merged and zones encompassing them all were delineated. These concatenations created a final 20-year and 50-year composite WHPA capture zones, shown on Figure 13, which can be used for delineating the Drinking Water Supply Management Area (DWSMA). While it is quite likely that none of the individual capture zones represents

the true configuration, it is likely that the true capture zone for a given length of time is contained within the appropriate composite zone.

Sincerely,

LEGGETTE, BRASHEARS & GRAHAM, INC.

John Oswald, MSc
Environmental Engineer

Martha Silks, PG
Associate

Attachments
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TABLES

Table 1

Municipal Well Pumpage and Pumping Rates used in the WHPA Delineation
City of Crete Wells

Wellhead Protection Plan
Crete, Nebraska

Well	Registration Number	Aquifer	Casing Depth (feet)	Well Depth (feet)	Static Level (ft bg)	Past Use (MGY)			Modeled value used in the WHPA delineation analysis (MGY)*	Modeled value used in the WHPA delineation analysis (m3/d)
						20010	2011	2012		
Well #1	G-031679	Quaternary	140	184	19	37.4	51.1	54.2	54.2	562.1
Well #3	G-031681	Quaternary	167.3	186	21	40	20.5	93.2	93.2	966.5
Well #5	G-031683	Quaternary	264	321	142	252.9	258.3	250.2	258.3	2678.6
Well #6	G-063645	Quaternary	165	221	20	0	0	0.2	0.2	2.1
Well #7	G-063646	Quaternary	131	160	20	0	0.6	4	4.0	41.5
Totals						330.3	330.5	401.8	409.9	4250.7

Notes:

*: Modeled use is the maximum annual pumping volume 2010 through 2012.

Modeled annual and daily pumping volume for the municipal system.

Values representing the maximum value of the previous three years.

Maximum annual pumping volume total for the past three years.

ft bg: feet below grade

Table 2

Irrigation Wells In Model Domain
Wellhead Protection Plan
Crete, Nebraska

Registration Number Unique Well ID	Coordinates		Pumping Rate
	Easting	Northing	MGY
G-007372	674632.3557	4499057.223	0
G-056991	676174.1788	4502672.558	0
G-037917	666061.0734	4490786.75	28.387
G-040528	674092.7102	4492636.639	283.874
G-132946	676382.2017	4492351.567	127.743
G-123236	666254.8268	4490319.146	113.55
G-021614	666406.1083	4490658.828	78.065
G-123741	678078.3761	4502832.022	42.581
G-143442	672678.6575	4493919.619	163.228
G-023533	665990.2598	4490930.893	35.484
G-133875	672886.1065	4489101.255	227.099
G-101083	667004.3207	4491340.041	56.775
G-025175	663791.2477	4494524.645	56.775
G-024326	666230.1787	4491333.853	28.387
G-004811	666437.5019	4490341.545	227.099
G-087053	673629.9308	4494597.607	85.162
G-024897	664514.4982	4492927.022	56.775
G-143567	673894.886	4505654.66	141.937
G-117538	674603.1209	4498965.012	85.162
G-071797	669586.7736	4501097.826	205.809
G-047633	670836.9917	4506217.447	70.968
G-032797	668840.6123	4497467.52	92.259
G-028671	678389.6362	4500496.295	141.937
G-024762	674173.5077	4506007.635	170.324
G-001026	669928.7158	4491018.692	85.162
G-144233	671678.235	4494050.387	83.743
G-155771	661637.3031	4499328.092	113.55
G-108050	664510.9536	4495354.28	117.808
G-092738	667419.6682	4491759.081	170.324
G-077627	667242.7685	4498130.4	93.678
G-073047	667846.4894	4504698.757	85.162
G-071815	677934.3329	4490815.392	198.712
G-047634	671662.835	4504093.453	70.968
G-046629	675035.2094	4496400.79	141.937
G-040157	668627.1359	4489378.445	56.775
G-032354	673489.9815	4493930.688	85.162
G-032162	671949.2466	4490984.472	63.872
G-025176	664529.346	4494498.481	170.324
G-014273	665398.3158	4502802.038	88.001
A-006326	672054.0298	4494104.988	99.356
G-091356	671526.0866	4491476.989	170.324
G-055496	662488.992	4497312.719	113.55
G-040611	666447.1276	4492521.662	42.581
G-037409	669031.627	4493827.893	113.6
G-029260	672338.221	4492864.111	34.1
G-024197	661637.8209	4499105.642	113.6
G-023552	670264.846	4505838.207	113.6
G-010783	661775.5788	4502570.41	113.6
G-005398	661652.5033	4498519.431	184.5
G-003041	668613.3857	4498040.819	85.2
G-155024	679364.5933	4495253.639	150.5
G-153188	663915.1624	4498975.321	42.6
G-149771	664844.4687	4493954.697	66.7
G-149475	662698.6269	4504964.262	106.5
G-143976	661530.7222	4497127.377	133.4
G-141964	670233.3529	4505578.131	212.9
G-139708	666110.7845	4497776.51	227.1
G-132783	670767.3181	4489036.259	177.4
G-128138	667880.2318	4504279.675	212.9
G-110518	667412.347	4492122.884	35.5
G-110315	663175.9462	4501748.818	113.6
G-109377	675229.4858	4499626.639	127.7
G-106595	662077.6208	4496500.646	78.1
G-104458	669466.3774	4505121.63	184.5

Table 2

Irrigation Wells In Model Domain
Wellhead Protection Plan
Crete, Nebraska

Registration Number Unique Well ID	Coordinates		Pumping Rate
	Easting	Northing	MGY
G-091642	662907.15	4496123.914	115.0
G-087925	671486.0675	4493084.15	92.3
G-087322	662837.4017	4499334.385	173.2
G-086438	676031.8193	4500052.898	184.5
G-085968	671169.4397	4489061.464	109.3
G-085493	661546.6523	4503346.771	212.9
G-083369	669524.9539	4491379.696	198.7
G-074533	661557.0353	4502530.781	184.5
G-073852	668396.0338	4503916.822	71.0
G-071815	677933.1951	4490806.257	170.3
G-068978	668134.6176	4489977.536	141.9
G-068394	674298.6489	4496986.309	99.4
G-067853	671221.9217	4505372.609	180.3
G-058846	669691.9648	4496465.591	96.5
G-055736	671938.6756	4502764.734	149.0
G-027146	667114.9693	4501094.504	113.6
G-024848	665211.7544	4495154.989	141.9
G-024056	669485.6771	4503905.284	113.6
G-023551	667163.4916	4504619.265	177.4
G-022077	673859.5347	4493986.618	79.5
G-018425	668779.9879	4499460.845	170.3
G-016838	661578.9017	4500953.694	113.6
G-012319	663884.1173	4500280.552	99.4
G-000232	666455.9043	4502738.082	113.6
G-000168	669956.5017	4489021.305	188.8
A-007230	662937.2962	4503153.786	126.3
A-005890	662774.6318	4501749.237	220.0
G-120439	673728.91	4496369.753	191.6
G-102516	665647.3295	4498588.744	184.5
G-086523	668695.9138	4503496.56	184.5
G-028899	668890.6517	4489409.172	99.4
G-008832	671598.9978	4500740.582	356.3
G-074510	663269.2501	4498145.01	241.3
G-056917	670375.1306	4500307.473	141.9
G-052808	667531.2479	4495597.089	163.2
G-049025	668098.684	4503277.432	191.6
G-049024	668108.2932	4502875.132	191.6
G-026569	671510.2862	4491677.775	113.6
G-024177	665236.2357	4495372	113.6
G-002743	667701.7177	4491975.225	113.6
A-004048	666610.9933	4500814.962	170.3
G-067488	667234.1984	4499825.558	227.1
G-024003	668699.348	4503915.152	88.0
G-081275	670857.3599	4505968.002	113.6
G-068707	671362.3665	4500934.055	356.3
G-066133	668935.3259	4489999.733	99.4
G-066084	671245.4802	4497915.097	42.6
G-066083	671040.0572	4498109.079	28.4
G-065098	666710.7577	4496788.093	85.2
G-060741	671257.4481	4497235.725	52.5
G-057391	665053.038	4498364.51	85.2
G-056446	662267.4171	4497925.292	127.7
G-055910	673775.9162	4495563.459	56.8
G-055431	669874.6527	4493046.585	181.7
G-053497	669115.673	4491414.276	184.5
G-047772	673966.6389	4495768.287	177.4
G-047770	664499.5296	4496152.961	184.5
G-043186	666044.2066	4491734.546	212.9
G-041747	671866.1359	4493508.976	262.6
G-031952	672240.3936	4493663.008	141.9
G-030827	664894.6675	4497357.069	113.6
G-028078	672119.8731	4496334.829	113.6
G-027196	664631.4607	4502298.374	227.1
G-027006	664809.5806	4499635.27	127.7
G-026731	665500.1283	4495753.597	-113.6

Table 2

Irrigation Wells In Model Domain
Wellhead Protection Plan
Crete, Nebraska

Registration Number Unique Well ID	Coordinates		Pumping Rate
	Easting	Northing	MGY
G-026715	662392.3914	4500977.193	141.9
G-026359	668953.2196	4495440.393	113.6
G-026296	672838.2586	4497700.891	141.9
G-025481	668930.0218	4490488.424	163.2
G-025474	666362.116	4503602.428	127.7
G-025265	665822.3268	4499994.202	227.1
G-025265	665484.4473	4500177.379	170.3
G-025122	667218.8719	4494165.626	113.6
G-024983	663303.5607	4496970.694	107.9
G-024848	665053.2877	4495371.276	99.4
G-024550	669558.5103	4489004.478	227.1
G-024363	667785.1309	4498460.377	113.6
G-024087	670351.3441	4490230.187	227.1
G-024037	675974.5909	4497641.981	184.5
G-024002	662328.239	4499885.356	113.6
G-023436	667535.0514	4489759.464	85.2
G-022479	672789.8266	4488947.968	107.9
G-021551	665851.7055	4493072.941	227.1
G-021491	664368.4028	4502982.499	283.9
G-021151	663037.0135	4497530.838	191.6
G-020894	668326.199	4492994.796	113.6
G-016838	661578.9017	4500952.694	203.0
G-015451	667333.8084	4502587.641	212.9
G-014702	664800.3425	4500873.016	227.1
G-014555	664074.2881	4496727.969	113.6
G-013361	669389.7072	4498088.77	254.1
G-012329	667437.2106	4492724.317	163.2
G-011478	663838.3701	4503338.091	170.3
G-010996	664986.8941	4496556.547	212.9
G-009991	668991.0898	4492451.942	227.1
G-008290	662319.9172	4496410.187	127.7
G-007333	662554.2971	4502343.614	227.1
G-005398	661848.9657	4498723.728	207.2
G-004104	669734.8543	4490423.946	241.3
G-003798	665861.342	4491729.81	227.1
G-003707	666734.3283	4495580.317	106.5
G-003440	665792.0346	4492298.149	227.1
G-003040	668228.1344	4497627.809	99.4
G-002421	665422.0536	4501049.869	78.1
G-002421	665601.8625	4500987.787	170.3
G-001807	666162.7391	4503218.334	113.6
G-001350	672570.3722	4500965.105	113.6
A-006903	663460.7104	4498344.467	198.7
A-005890	662779.3167	4501743.898	198.7
G-024056	669170.6843	4503520.907	113.6
G-046554	665011.5976	4493598.851	170.3
G-025441	667390.5501	4493779.855	193.0
G-021572	666883.4299	4498487.637	207.2
G-011142	672178.814	4495927.669	141.9
G-057983	673846.358	4498590.633	283.9
G-029260	672512.0101	4492912.448	82.3
G-028671	678391.5213	4500491.786	170.3
G-024550	669152.4862	4488990.6	0.0
G-012319	663990.4863	4500548.456	168.9
G-002355	663367.2977	4501956.494	113.6
G-026198	669496.7283	4497094.686	227.1
G-153308	668852.8529	4497047.289	227.1
G-133788	665708.1641	4496167.393	113.6
G-120469	665551.138	4503408.935	227.1
G-096432	672165.0421	4489680.702	113.6
G-088008	674347.3718	4503632.927	227.1
G-087863	669620.1678	4498256.404	227.1
G-074906	671427.2814	4496881.762	102.2
G-074738	665545.5394	4501799.77	-174.6

Table 2

Irrigation Wells In Model Domain
Wellhead Protection Plan
Crete, Nebraska

Registration Number Unique Well ID	Coordinates		Pumping Rate
	Easting	Northing	MGY
G-073913	670960.5341	4496293.904	161.8
G-073534	663665.1708	4500210.312	141.9
G-072620	665682.1258	4497770.842	227.1
G-071423	664769.6725	4502981.391	212.9
G-070868	668751.1106	4501068.927	227.1
G-070532	670578.9896	4495084.148	198.7
G-068144	671360.483	4495531.819	92.3
G-066493	665753.7775	4495346.515	106.5
G-065998	670741.2846	4490651.503	293.8
G-065939	665324.1999	4504804.338	63.9
G-064827	669303.4797	4503312.675	170.3
G-063672	670830.5138	4497901.45	198.7
G-061403	669514.154	4496057.802	113.6
G-055496	662107.2742	4496923.224	85.2
G-055494	669874.6527	4493045.585	212.9
G-053049	668063.5996	4505294.895	134.8
G-049803	669361.4387	4500482.58	224.3
G-045715	666342.2688	4494968.789	159.0
G-044121	666358.0032	4494571.298	134.8
G-043653	666716.0271	4498608.502	227.1
G-043185	667594.2335	4492973.305	113.6
G-035417	667536.0778	4501862.362	113.6
G-033645	667834.8986	4490957.955	113.6
G-030956	664139.7086	4495733.93	127.7
G-030320	668164.1332	4493420.861	141.9
G-030133	666534.3347	4494588.677	227.1
G-030133	665721.4367	4494364.411	85.2
G-029952	663167.5685	4500538.573	92.3
G-029060	665386.3561	4493620.819	149.0
G-028794	669136.13	4490803.53	113.6
G-028558	668577.2676	4497064.368	105.0
G-028419	666799.6055	4502472.671	78.1
G-027324	669013.7003	4491858.016	51.1
G-027228	667184.3437	4492548.709	85.2
G-027062	666548.2163	4504038.323	99.4
G-026669	676053.0209	4499464.587	227.1
G-026471	668510.8999	4496237.844	170.3
G-026460	669278.8145	4500064.406	113.6
G-025391	667067.2537	4494612.936	170.3
G-025147	667650.3119	4497209.038	85.2
G-024896	664711.7205	4493690.954	141.9
G-024896	664604.9749	4493689.04	141.9
G-024468	664079.9636	4498156.177	255.5
G-023694	661858.647	4497772.785	227.1
G-014994	670365.0018	4500317.46	227.1
G-010898	671245.4802	4497914.097	227.1
G-010898	671370.2566	4498064.25	170.3
G-004104	669935.8175	4490424.301	177.4
G-003041	668428.2804	4498014.635	113.6
G-002354	664158.2381	4502771.269	212.9
G-068917	668967.9831	4500069.667	227.1
G-061677	671551.9186	4490276.357	141.9
G-058845	667744.686	4501247.632	198.7
G-055152	676143.0246	4496433.467	167.5
G-053426	665768.595	4502805.575	184.5
G-051260	662302.8179	4495913.024	35.5
G-048830	667762.8223	4500440.012	170.3
G-047770	664499.3252	4496162.212	184.5
G-047254	669378.9141	4499678.05	127.7
G-046949	669287.1599	4504121.566	122.1
G-045014	665816.7398	4500969.474	187.4
G-041033	670697.9028	4492675.98	141.9
G-039573	663354.034	4502556.071	105.0
G-035388	664093.5392	4497755.418	-120.6

Table 2

Irrigation Wells In Model Domain
Wellhead Protection Plan
Crete, Nebraska

Registration Number Unique Well ID	Coordinates		Pumping Rate
	Easting	Northing	MGY
G-032797	668678.2344	4497438.848	113.6
G-028079	671774.7662	4497124.91	141.9
G-023772	663131.6395	4504893.967	132.0
G-021054	665763.9919	4497496.33	227.1
G-014994	670302.795	4500377.235	227.1
G-035809	676901.782	4496034.476	71.0
G-126591	663900.8081	4503406.108	227.1
G-055591	663803.8413	4499957.025	92.3
G-030957	665781.9896	4494154.732	113.6
G-027867	663306.4169	4496130.327	78.1
G-001026	669730.0218	4490826.239	227.1
G-005684	667315.5339	4490759.583	106.5
G-032046	668131.0464	4496211.042	170.3
G-030321	667330.8602	4497381.892	113.6
G-024896	664653.4489	4493714.323	141.9
G-024271	666437.8661	4499401.964	212.9
G-002354	664164.0793	4502369.003	227.1
G-045918	670639.4701	4506163.032	156.1
G-041456	662316.9934	4504145.685	188.8
G-034574	673558.2128	4501605.669	141.9
G-038391	668855.3167	4501982.625	212.9
G-037387	670857.8456	4498694.349	44.0
G-036919	664777.8057	4501767.606	113.6
G-035333	673023.9322	4494740.343	227.1
G-026011	671677.9039	4494687.101	283.9
G-024954	663904.0535	4497497.013	227.1
G-038392	670270.2376	4505182.783	227.1
G-031984	665902.1549	4504426.266	113.6
G-034487	669892.1247	4492442.432	113.6
G-029109	671282.5153	4501917.315	184.5
G-039091	669863.3032	4498980.576	85.2
G-030958	663832.8719	4500828.423	220.0
G-023772	663113.4673	4504767.446	184.5
G-000428	662240.2345	4498729.473	227.1
G-049548	670527.2827	4502125.315	85.2
G-023642	665698.9227	4497149.352	227.1

Notes:

- Well pumping rates were calculated by multiplying the acres irrigated vale from the NDNR database by 5 in/yr.
- Coordinates are UTM, Zone 15, NAD83, and are from the Nebraska Registered Well Database

MGY: Million gallons per year

Table 3

Model Input Summary
Wellhead Protection Plan
Crete, Nebraska

Attribute	Description	Comments
Aquifer Material	Unconsolidated Sands and Gravels	Well Logs
Porosity	0.3	Consistent to slightly conservative for aquifer material.
Aquifer Thickness	Variable	Based on information from local muncipal, montioring, and irrigation well logs.
Model Layer (Thickness in area of wellfield)	Layer 1 - Thickness variable (~150 ft)	Sand and Gravel.
Horizontal Hydraulic Conductivity	Single Layer- 65ft/d (20 m/d)	Based on estimates and calibration.
Recharge (from Precipitation)	4in/yr (0.00025 m/day)	Based on estimates and from calibration.

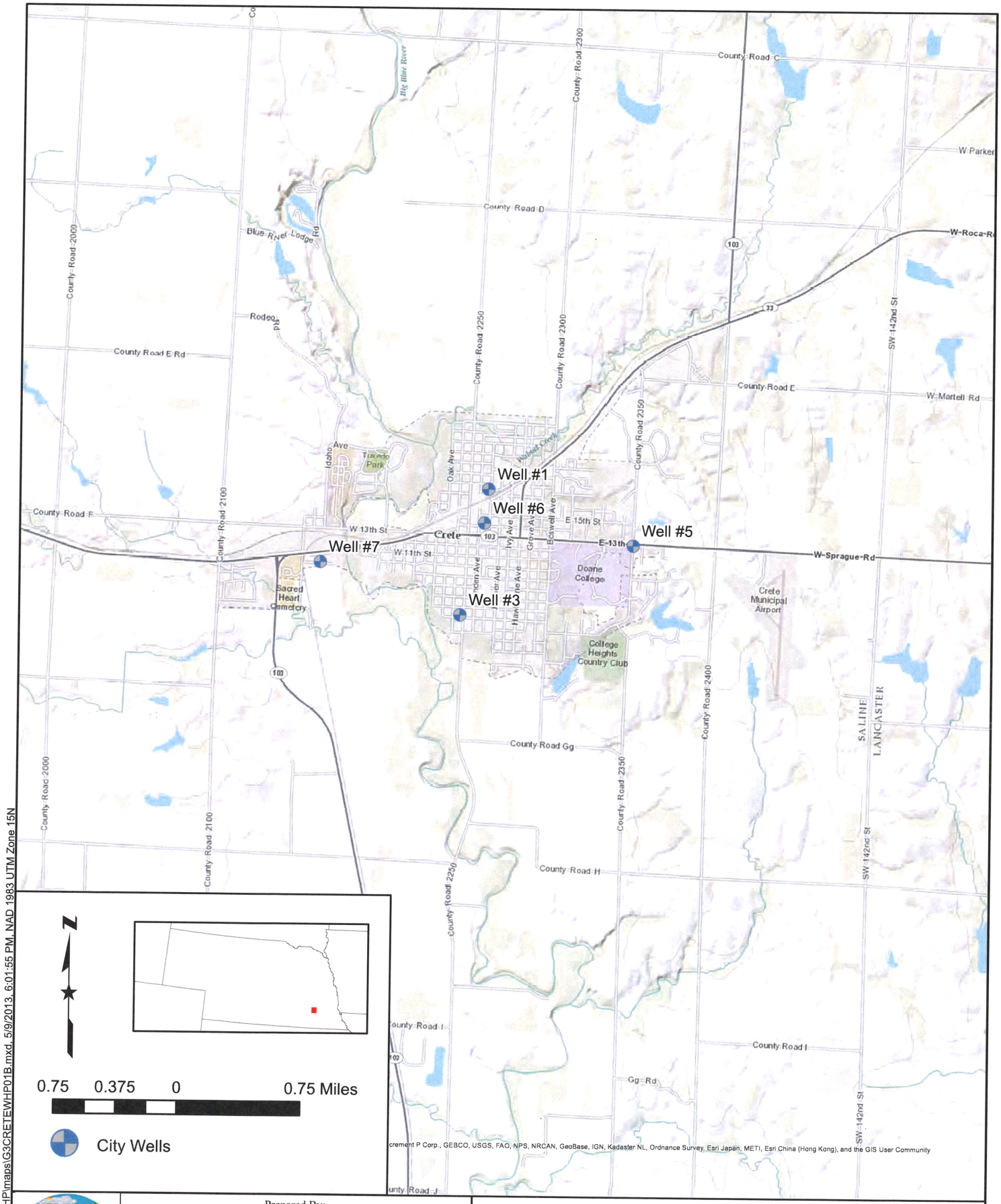
Table 4

Model Parameters Used in Uncertainty Analysis for Creating Composite Capture Zone

Wellhead Protection Plan
Crete, Nebraska

Model Run	Hydraulic Conductivity		Recharge from Precipitation		River Bed Conductance	
Number	(m/d)	(ft/d)	(m/d)	(in/yr)	(m^2/d/m)	(ft^2/d/ft)
1	10	32.8	0.0001	1.44	1.6	5.2
2	20	65.6	0.0001	1.44	1.6	5.2
3	40	131.2	0.0001	1.44	1.6	5.2
4	10	32.8	0.00025	3.6	1.6	5.2
5	20	65.6	0.00025	3.6	1.6	5.2
6	40	131.2	0.00025	3.6	1.6	5.2
7	10	32.8	0.0004	5.76	1.6	5.2
8	20	65.6	0.0004	5.76	1.6	5.2
9	40	131.2	0.0004	5.76	1.6	5.2
10	10	32.8	0.0001	1.44	0.5	1.6
11	20	65.6	0.0001	1.44	0.5	1.6
12	40	131.2	0.0001	1.44	0.5	1.6
13	10	32.8	0.00025	3.6	0.5	1.6
14	20	65.6	0.00025	3.6	0.5	1.6
15	40	131.2	0.00025	3.6	0.5	1.6
16	10	32.8	0.0004	5.76	0.5	1.6
17	20	65.6	0.0004	5.76	0.5	1.6
18	40	131.2	0.0004	5.76	0.5	1.6

FIGURES



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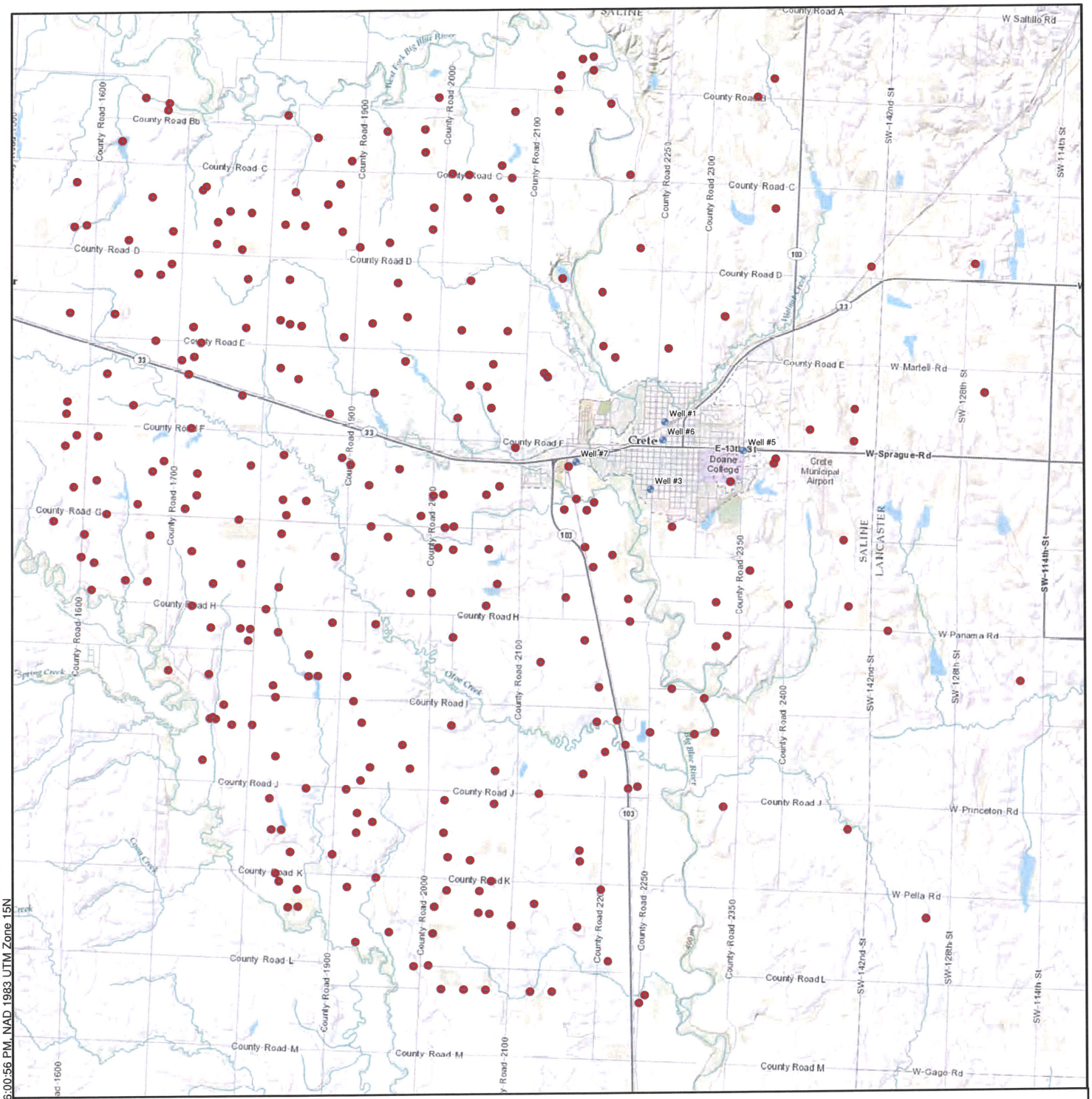
SITE LOCATION

FILE: G3CRETEWHP01B.MXD	DATE: 5/9/2013	FIGURE: 1



City Wells

Irrigation Wells



1.5 0.75 0 1.5 Miles

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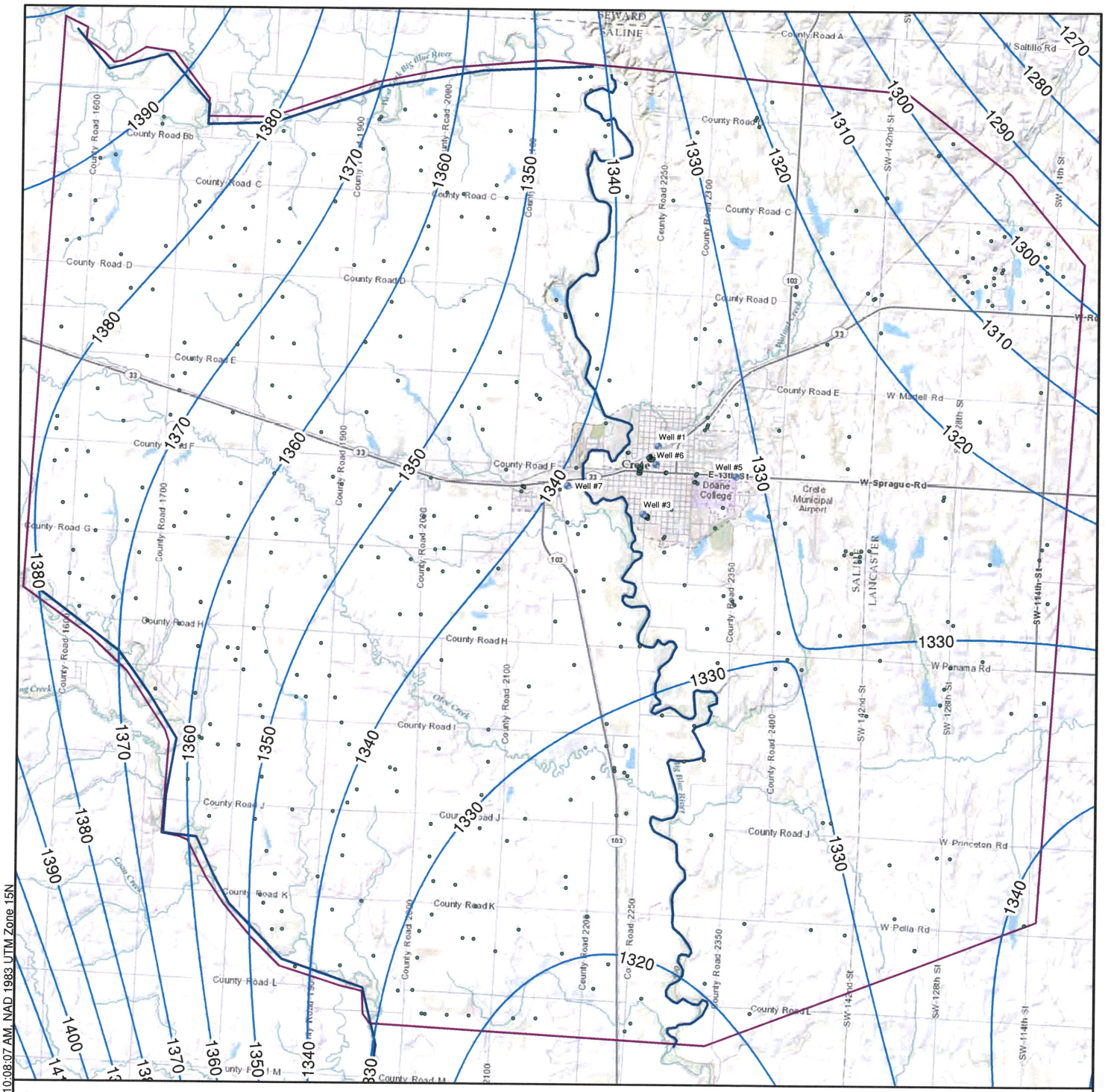
LOCATION OF CITY AND IRRIGATION WELLS USED IN THE GROUNDWATER FLOW MODEL

FILE: G3CRETEWHP01K.MXD	DATE: 5/9/2013	FIGURE: 2



City Wells

Observation Well Locations

4th Order Groundwater Trend Surface

Rivers

Active Model Area

N

1.5 0.75 0 1.5 Miles

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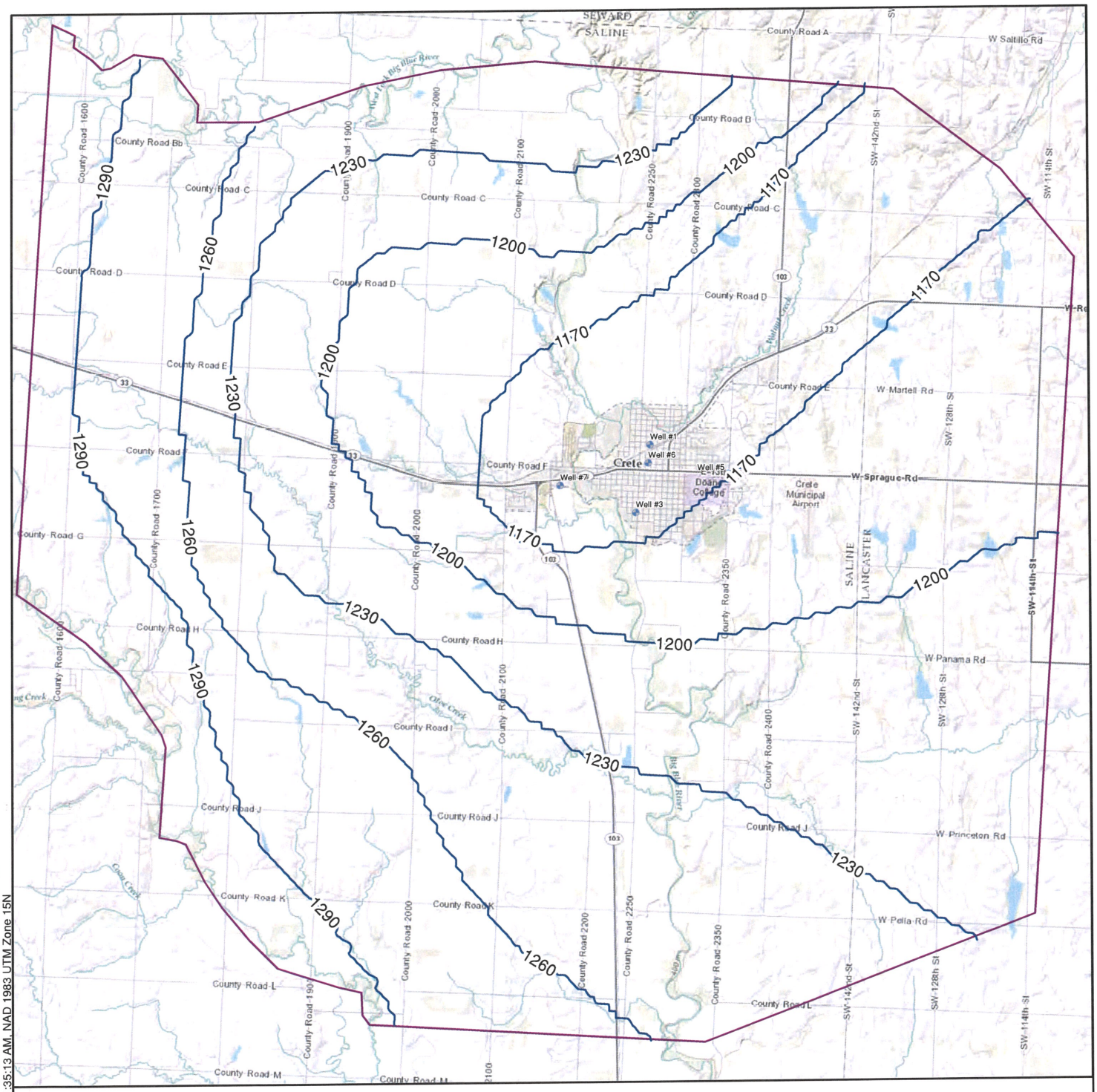
POTENTIOMETRIC SURFACE MAP

FILE: G3CRETEWHP01S.MXD	DATE: 5/10/2013	FIGURE: 3



City Wells

Aquifer Base (ft-amsl)

Active Model Area

N

1.5 0.75 0 1.5 Miles

G:\GIS\Crete NE WHP\maps\G3CRETEWHP01L.mxd, 5/10/2013, 11:35:13 AM, NAD 1983 UTM Zone 15N

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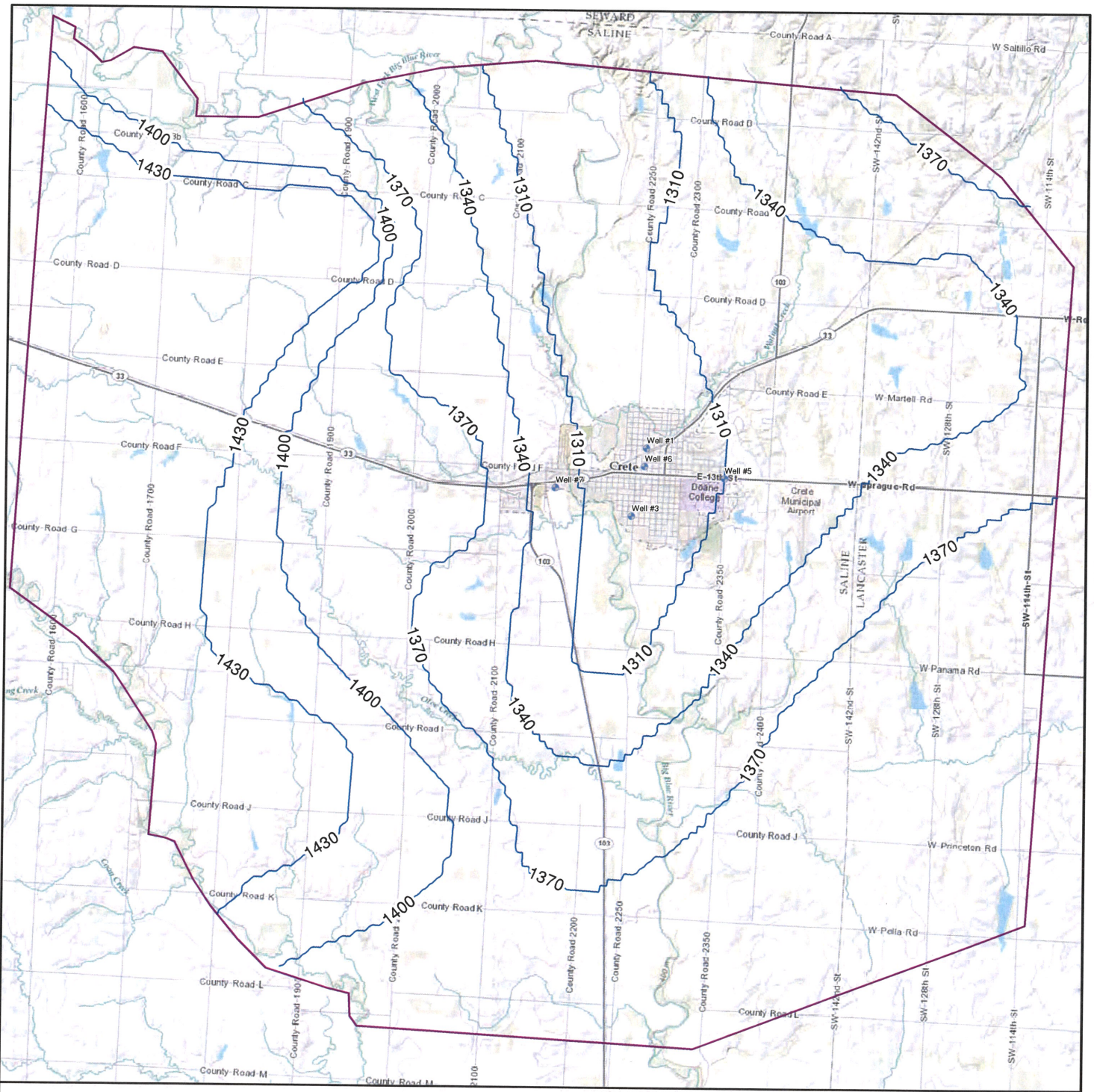
BASE OF AQUIFER CONTOURS IN FEET ABOVE MEAN SEA LEVEL

FILE: G3CRETEWHP01L.MXD	DATE: 5/9/2013	FIGURE: 4



City Wells

Aquifer Top (ft-amsl)

Active Model Area

N

1.5 0.75 0 1.5 Miles

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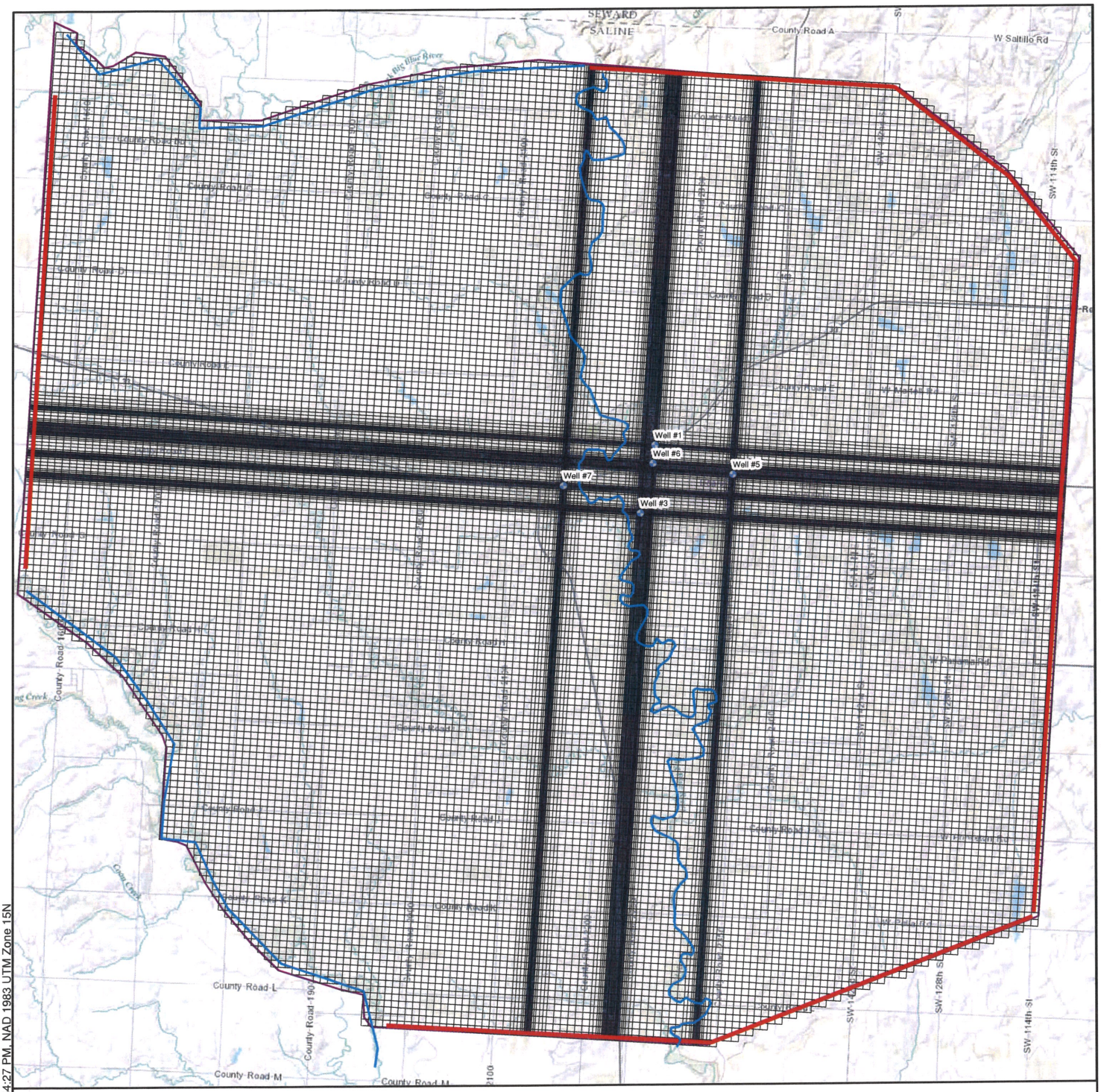
TOP OF AQUIFER CONTOURS IN FEET ABOVE MEAN SEA LEVEL

FILE: G3CRETEWHP01M.MXD | DATE: 5/9/2013 | FIGURE: 5



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MODEL DOMAIN, GRID AND BOUNDARY CONDITIONS

FILE: G3CRETEWHP01O.MXD	DATE: 5/9/2013	FIGURE: 6

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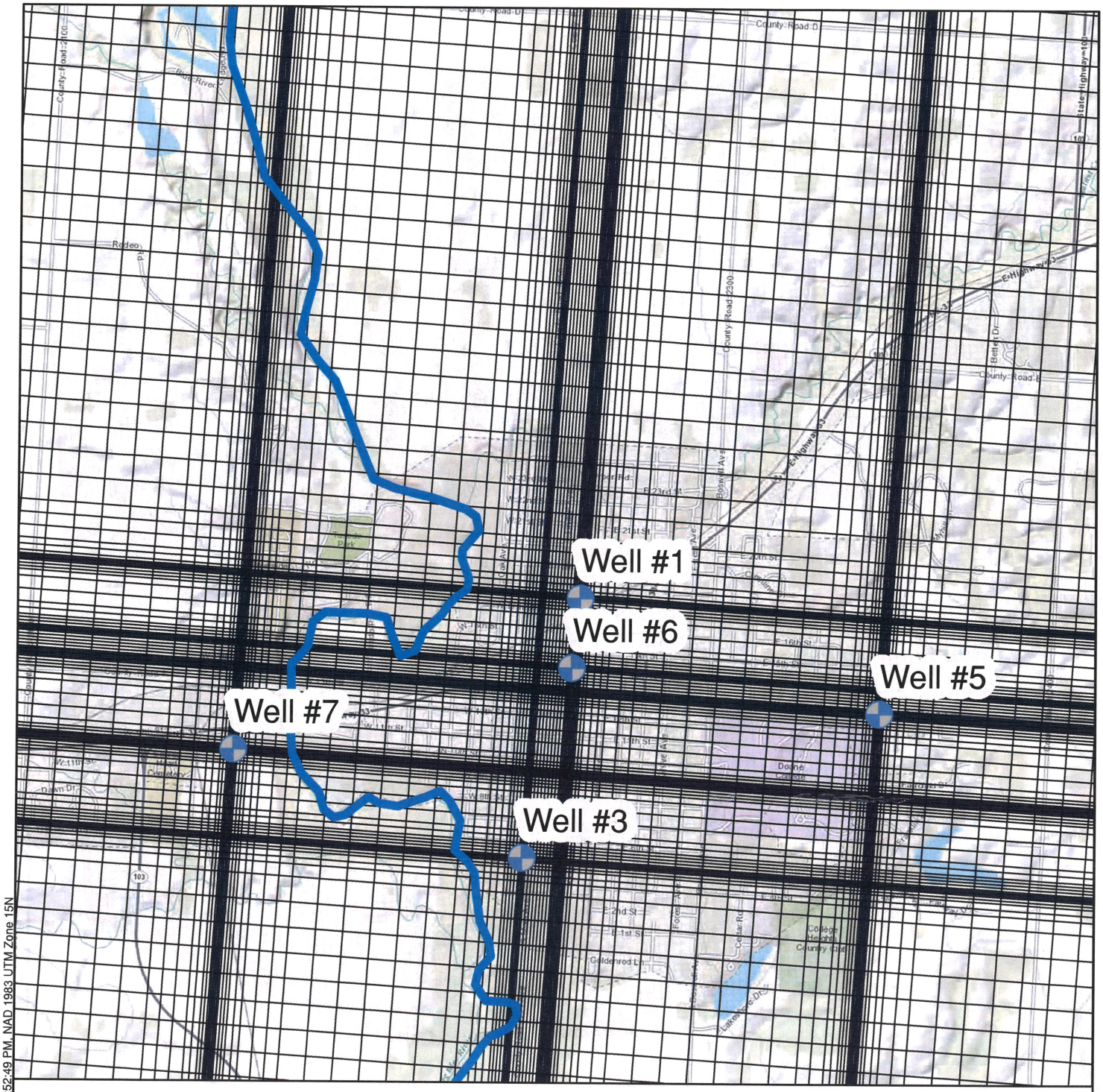

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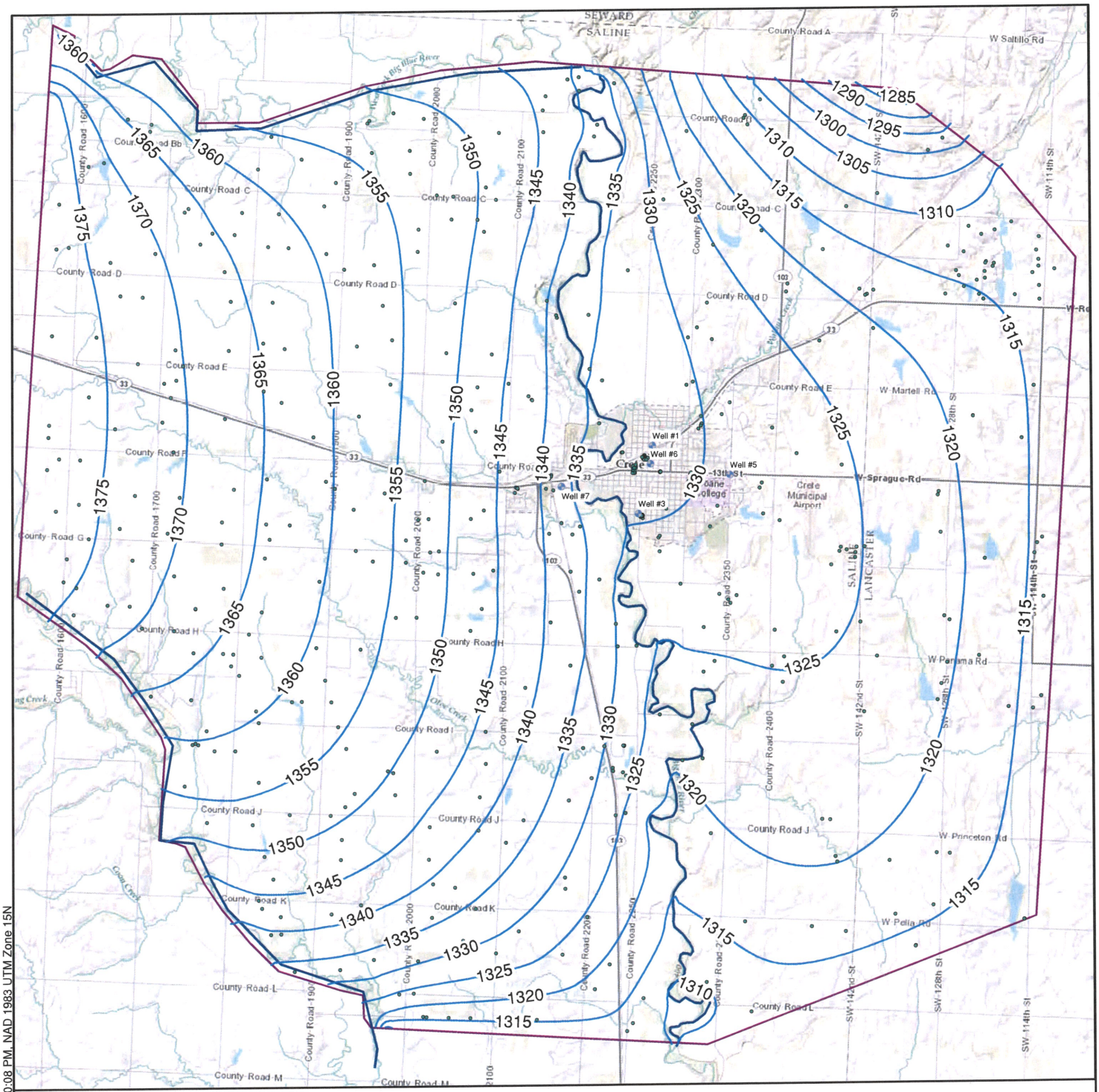
MODEL GRID IN VICINITY OF CITY WELLS

FILE: G3CRETEWHP01P.MXD	DATE: 5/9/2013	FIGURE: 7



City Wells

Observation Well Locations

Simulated Head (ft-amsl)

Rivers

Active Model Area

N

1.5 0.75 0 1.5 Miles

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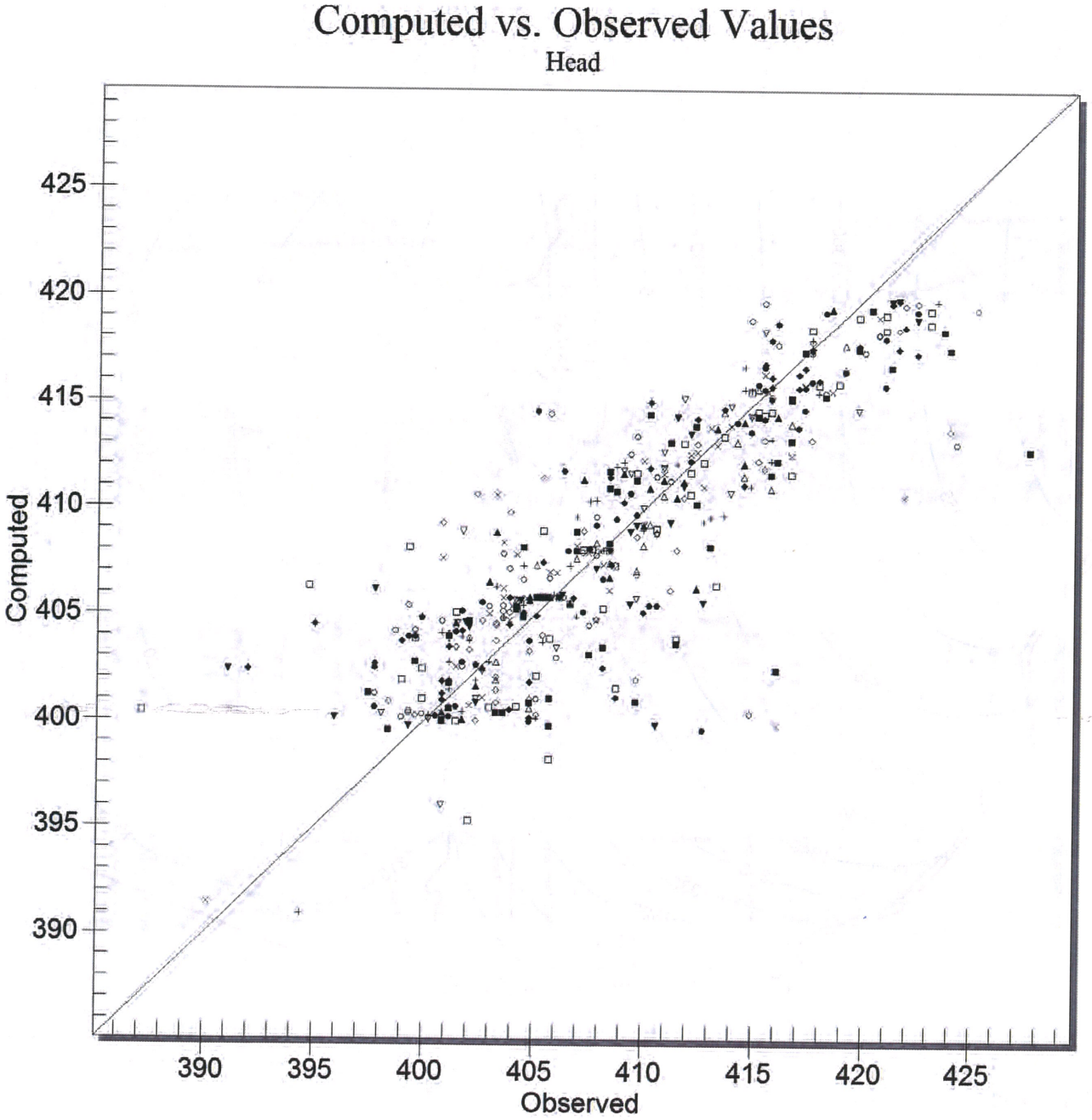
SIMULATED GROUNDWATER EQUIPOTENTIAL CONTOURS AND CALIBRATION WELL LOCATIONS

FILE: G3CRETEWHP01Q.MXD	DATE: 5/9/2013	FIGURE: 8



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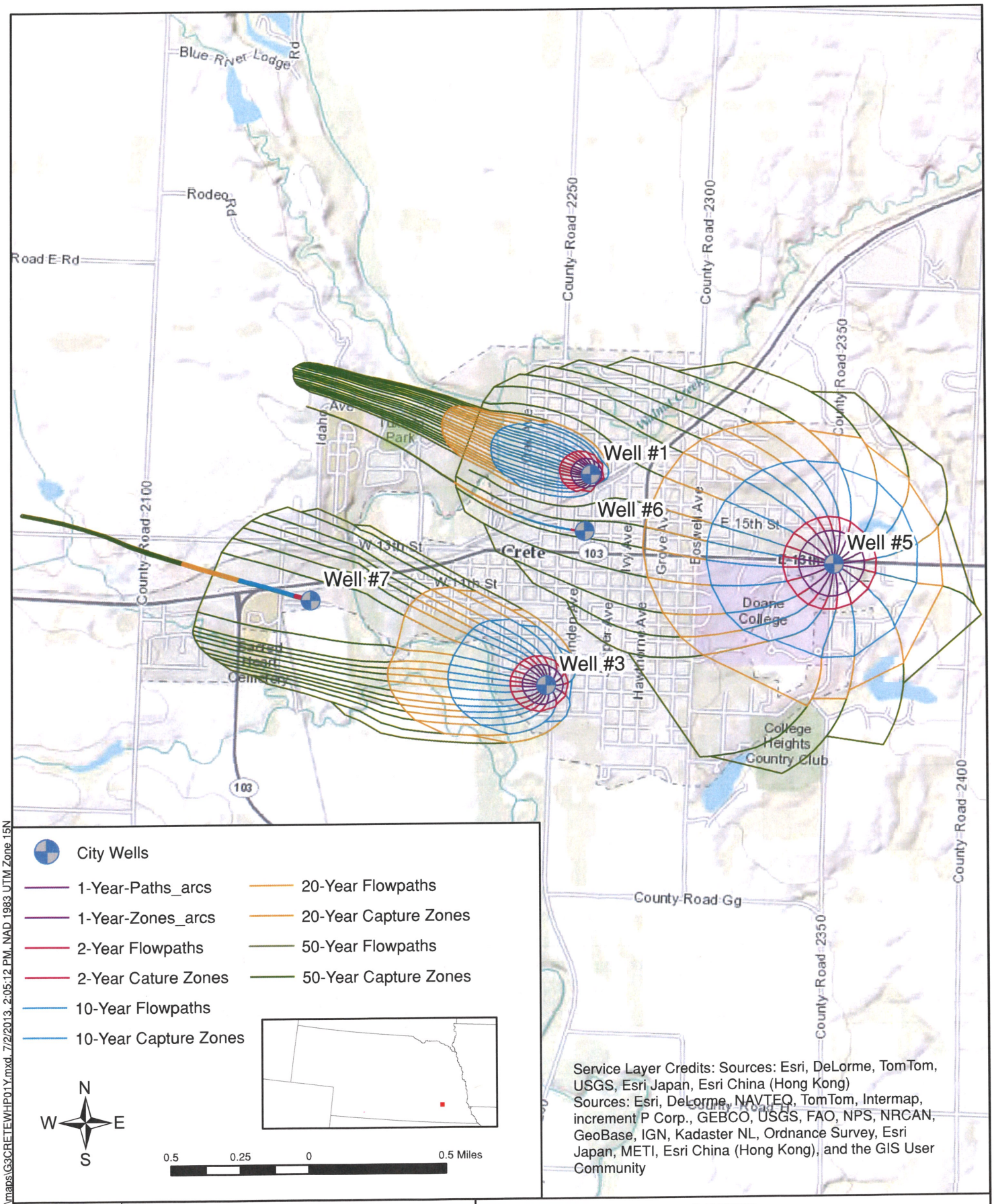
CALIBRATION PLOT
COMPUTED VS. OBSERVED POTENTIOMETRIC HEAD IN METERS

FILE: G3CRETEWHP01G.MXD	DATE: 5/9/2013	FIGURE: 9



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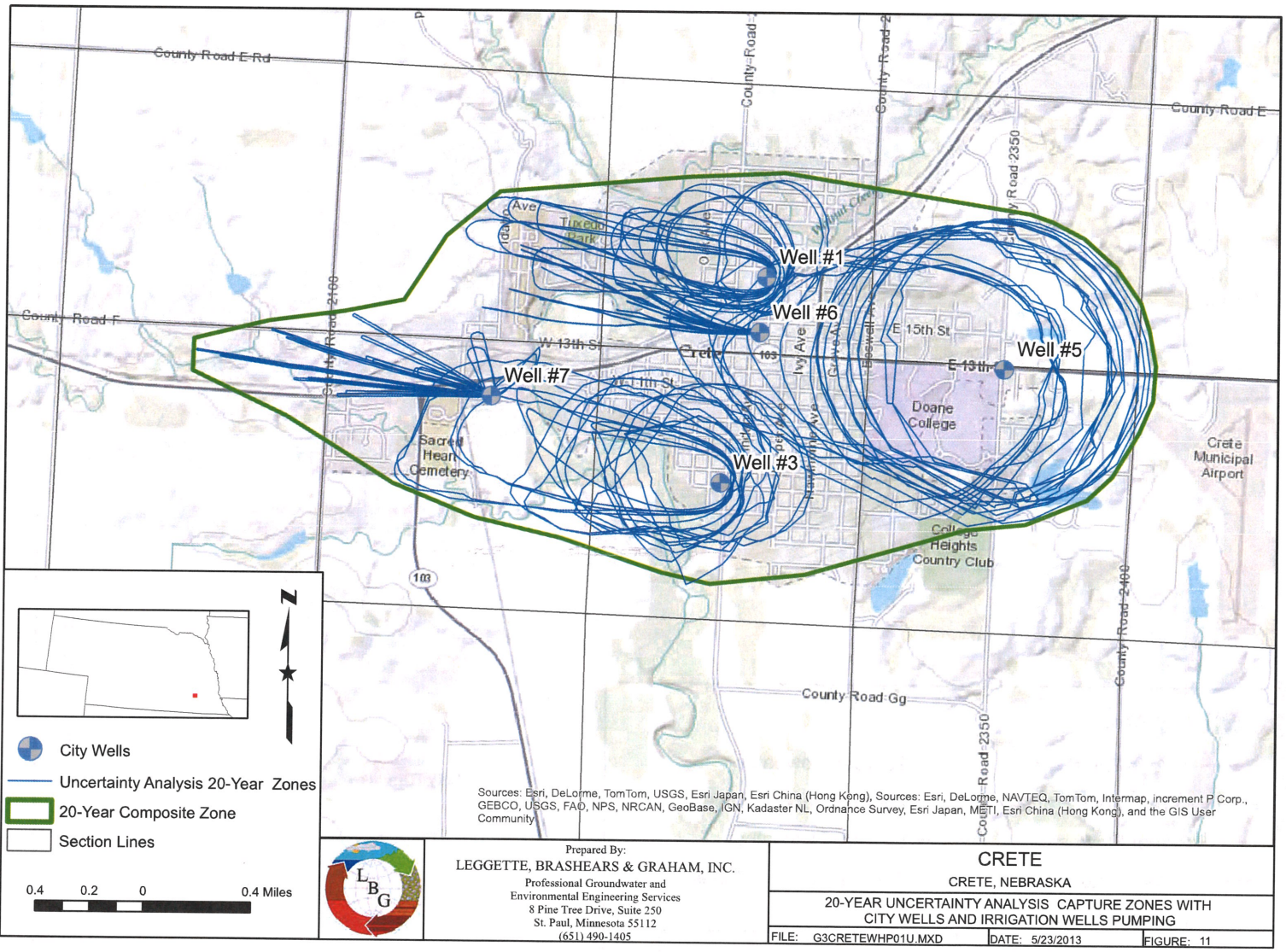
1, 2, 10, 20 AND 50-YEAR CAPTURE ZONES AND PATHLINES
CITY WELLS AND IRRIGATION WELLS PUMPING

FILE: G3CRETEWHP01Y.MXD	DATE: 7/2/2013	FIGURE: 10



Sources: Esri, DeLorme, TomTom, USGS, Esri Japan, Esri China (Hong Kong), Sources: Esri, DeLorme, NAVTEQ, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), and the GIS User Community

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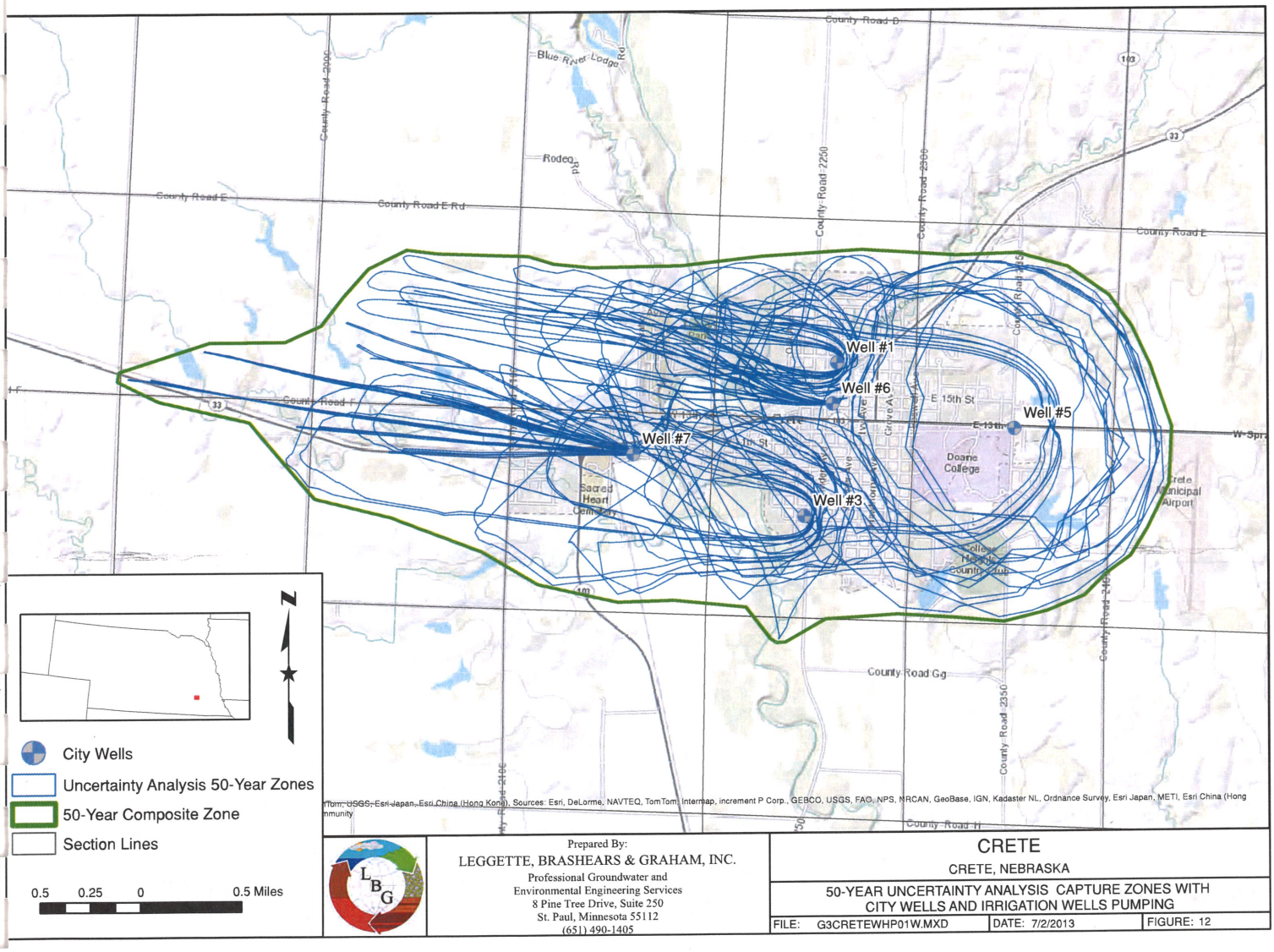
20-YEAR UNCERTAINTY ANALYSIS CAPTURE ZONES WITH CITY WELLS AND IRRIGATION WELLS PUMPING

FILE: G3CRETEWHP01U.MXD | DATE: 5/23/2013 | FIGURE: 11



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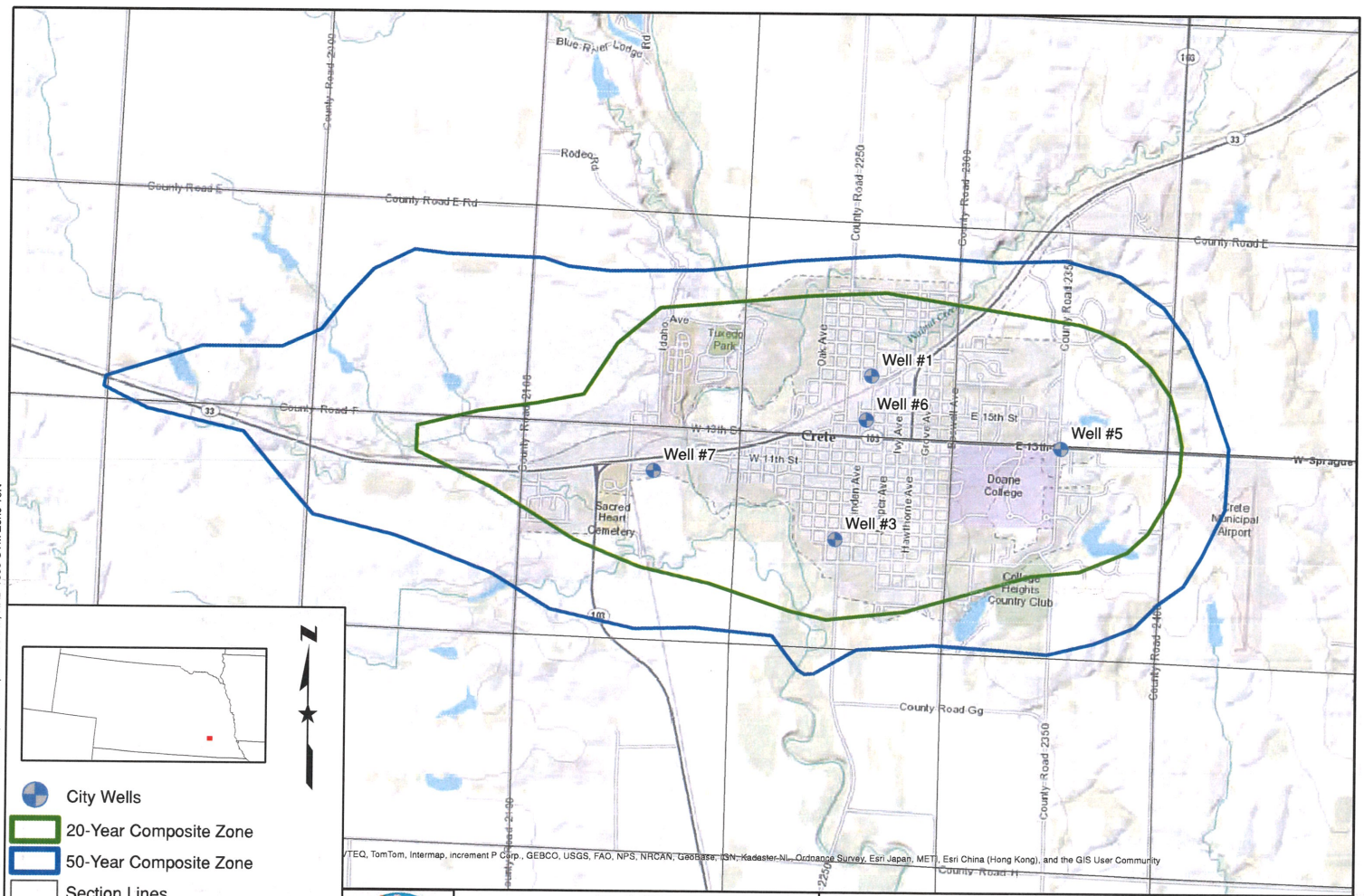
50-YEAR UNCERTAINTY ANALYSIS CAPTURE ZONES WITH CITY WELLS AND IRRIGATION WELLS PUMPING

FILE: G3CRETEWHP01W.MXD	DATE: 7/2/2013	FIGURE: 12



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CRETE, NEBRASKA

20- AND 50-YEAR UNCERTAINTY ANALYSIS CAPTURE ZONES WITH CITY WELLS AND IRRIGATION WELLS PUMPING

FILE: G3CRETEWHP01X.MXD	DATE: 7/2/2013	FIGURE: 13

ATTACHMENT I

Table A-1

Calibration Wells In Model Domain
Wellhead Protection Plan
Crete, Nebraska

Registration Number Unique Well ID	Coordinates		Measured Head (m)	Calculated Head (m)	Residual (m)
	Easting	Northing			
G-155983	679708.6392	4503246.36	405.08	400.120148	4.9598523
G-155631	679900.3545	4491414.961	400.81	400.002716	0.80728394
G-154493	679318.475	4503153.624	399.9	400.29126	-0.39125977
G-152688	677840.5217	4499084.753	401.73	402.717743	-0.98774292
G-155024	679364.5933	4495253.638	399.9	401.035492	-1.13549194
G-151890	677922.5097	4498349.901	399.59	402.753784	-3.16378418
G-149332	679878.6053	4497293.546	405.08	400.282532	4.79746826
G-148880	678447.378	4503126.481	403.86	400.520233	3.33976685
G-148096	678459.5207	4503305.733	400.81	400.384003	0.42599731
G-147670	678212.2931	4492525.305	402.34	401.603088	0.73691162
G-147143	678211.4743	4491574.967	402.34	401.036804	1.3031958
G-146678	678101.5111	4503929.671	399.29	399.759247	-0.46924683
G-145389	678450.794	4503277.753	401.73	400.405884	1.32411621
G-140795	677746.1472	4502674.224	402.64	401.094513	1.54548706
G-138645	679817.1065	4495254.44	399.29	400.363892	-1.0738916
G-138643	677916.5485	4503111.172	397.76	400.618256	-2.85825562
G-137820	676465.8504	4501974.475	399.9	402.438599	-2.53859863
G-137752	676428.4863	4502668.15	401.12	401.755951	-0.63595093
G-137023	678037.7206	4503462.527	399.59	400.240234	-0.65023438
G-137016	679306.2756	4500151.002	400.81	400.966034	-0.15603394
G-134741	679450.798	4502928.489	400.81	400.306641	0.50335938
G-134725	679475.5438	4502682.244	400.81	400.356293	0.45370728
G-134724	679360.1634	4503568.092	398.98	400.138092	-1.15809204
G-133877	679411.1495	4503402.704	401.12	400.178894	0.94110596
G-133739	678876.1378	4504056.277	401.42	399.98291	1.43708984
G-133099	679023.0677	4502736.126	401.12	400.566132	0.55386841
G-131291	676732.6014	4495007.231	402.03	403.305878	-1.27587769
G-131079	678080.7625	4496832.893	397.76	402.665344	-4.90534424
G-131064	679450.798	4502928.489	400.81	400.306641	0.50335938
G-124802	678188.1056	4495995.868	402.64	402.484558	0.1554419
G-123941	677267.0515	4505265.477	400.81	396.037018	4.77298218
G-123741	678078.3761	4502832.022	402.34	400.842529	1.4974707
G-122690	677828.8231	4499023.381	401.12	402.739319	-1.61931885
G-106915	676308.2554	4506231.853	390.14	391.457947	-1.31794678
G-071815	677934.3329	4490815.392	414.83	400.386627	14.4433728
G-115378	676565.6655	4496637.081	404.77	403.768097	1.00190308
G-115320	678313.6976	4502959.629	404.16	400.674927	3.48507324
G-109779	678609.1661	4503283.854	403.56	400.387726	3.17227417
G-107746	679895.0179	4491414.918	402.34	400.00354	2.33645996
G-107183	679948.0208	4495485.868	404.77	400.153503	4.61649658
G-106915	676400.3833	4506304.477	394.41	390.920471	3.48952881
G-106664	677975.2471	4503023.16	402.03	400.694641	1.33535889
G-104448	678104.1904	4495601.945	401.73	402.513855	-0.78385498
G-103374	679467.4113	4501111.278	401.42	400.652069	0.76793091
G-102371	677514.7719	4505498.846	402.03	395.299042	6.73095825
G-101251	678345.836	4503795.043	400.81	399.962463	0.84753662
G-100711	678451.3172	4492526.875	403.25	401.432831	1.81716919
G-100110	677524.0362	4491365.214	400.81	401.246521	-0.436521
G-099926	679701.8491	4498260.881	404.77	400.576233	4.19376709
G-098829	679392.3448	4503814.021	401.73	400.05954	1.67046021
G-098352	676552.6432	4498003.449	401.12	403.841431	-2.72143066
G-098587	677735.6884	4503549.934	395.94	400.154358	-4.21435791
G-097145	678769.3399	4497921.072	401.12	401.909241	-0.78924072
G-097144	678055.2184	4495305.643	401.42	402.511108	-1.0911084
G-096541	679785.805	4498366.545	399.29	400.44043	-1.15042969
G-097498	678584.5054	4503890.973	404.77	399.963745	4.80625488
G-096679	679666.2445	4498073.742	402.95	400.635193	2.31480713
G-093785	678371.1442	4502705.527	404.77	400.843475	3.92652466
G-091080	678457.4254	4502624.734	403.25	400.863739	2.38626099
G-028671	678389.6362	4500496.294	401.12	401.863586	-0.74358643
G-088259	678770.3758	4496150.41	402.34	401.866364	0.47363648
G-085960	678184.3283	4496768.17	402.34	402.557495	-0.21749512

Table A-1

Calibration Wells In Model Domain
Wellhead Protection Plan
Crete, Nebraska

Registration Number Unique Well ID	Coordinates		Measured Head (m)	Calculated Head (m)	Residual (m)
	Easting	Northing			
G-084168	678459.1373	4503004.331	401.12	400.606781	0.51321899
G-083070	679419.7597	4503277.725	400.51	400.216309	0.29369141
G-083069	678588.2877	4503226.925	387.1	400.428406	-13.3284058
G-071815	677933.1951	4490806.257	403.25	400.375336	2.87466431
G-035809	676901.782	4496034.476	401.42	403.474609	-2.05460938
G-028671	678391.5213	4500491.785	400.81	401.863098	-1.05309815
G-155792	676099.5378	4493011.961	403.25	402.771149	0.47885132
G-030320	668263.4774	4493390.782	410.87	411.377686	-0.50768555
G-155668	669859.519	4497178.52	409.96	410.092346	-0.13234619
G-155377C	672032.8432	4499450.181	406.24	405.943329	0.29667114
G-155377B	672046.3061	4499457.589	405.84	405.941162	-0.10116211
G-155771	661637.3031	4499328.092	421.23	419.847778	1.38222168
G-153188	663915.1624	4498975.321	416.05	417.85788	-1.80787964
G-152485	673919.2488	4505708.361	412.7	399.578491	13.1215088
G-153308	668852.8529	4497047.288	409.65	411.746155	-2.09615479
G-024896	664711.7205	4493690.954	410.26	414.403534	-4.14353394
G-149847	673980.5895	4496989.841	403.25	404.572174	-1.32217407
G-149771	664844.4687	4493954.696	413.61	414.707458	-1.0974585
G-147774	663678.0188	4499503.845	417.58	418.107941	-0.52794067
G-147681	670723.3606	4501831.193	404.16	407.864471	-3.70447144
G-147680	670708.3477	4501870.957	403.56	407.899811	-4.33981079
G-146861	676397.7528	4497804.505	399.29	403.936584	-4.64658447
G-146779	673269.0929	4501800.622	401.42	405.091522	-3.67152222
G-146221	675233.3807	4495925.757	401.12	403.973633	-2.85363281
G-145698	670167.3443	4498606.637	400.81	409.359497	-8.54949707
G-144843	672294.6209	4499098.956	406.76	405.799866	0.96013428
G-144272D	672757.2136	4499135.292	404.16	405.660736	-1.50073608
G-144272C	672759.6389	4499151.121	404.77	405.663544	-0.8935437
G-144272B	672751.5481	4499142.38	404.13	405.664246	-1.53424561
G-144272A	672765.5169	4499145.815	404.38	405.6604	-1.28040039
G-144166E	672283.0229	4499092.208	406.12	405.801819	0.31818115
G-144166D	672257.9148	4499140.993	405.84	405.824249	0.01575073
G-144166C	672258.1531	4499090.09	406.3	405.809753	0.49024658
G-144166B	672272.7099	4499141.644	406.12	405.819305	0.30069458
G-144166A	672289.164	4499141.716	406.12	405.813812	0.30618774
G-143567	673894.886	4505654.66	405.69	399.754944	5.93505615
G-142780D	672605.0567	4499427.955	404.47	405.775055	-1.30505493
G-142780C	672595.2295	4499446.239	403.86	405.782043	-1.92204346
G-142780B	672569.4568	4499442.556	403.86	405.790405	-1.93040527
G-142780A	672559.7727	4499454.672	403.56	405.796082	-2.23608154
G-142962I	672258.7754	4499154.588	405.41	405.827545	-0.41754517
G-142962H	672258.0614	4499185.425	405.41	405.835571	-0.42557129
G-142962G	672305.0525	4499186.513	405.54	405.820221	-0.28022095
G-142962F	672280.8428	4499216.806	405.48	405.835602	-0.35560181
G-142962D	672281.5569	4499185.969	405.54	405.827881	-0.28788086
G-142962C	672257.3474	4499216.262	405.41	405.843231	-0.4332312
G-142962B	672304.3382	4499217.35	405.41	405.828033	-0.41803345
G-142962A	672303.624	4499248.187	405.29	405.83548	-0.54547974
G-142696	675044.5286	4489442.022	400.2	400.055115	0.14488525
G-144233	671678.235	4494050.386	397.76	406.186768	-8.42676758
G-141933	676106.3641	4497896.338	400.81	404.099426	-3.28942627
G-141346J	670800.3414	4498968.819	407.46	407.937531	-0.47753052
G-141346I	670800.9352	4498942.953	407.18	407.938507	-0.75850708
G-141346H	670764.5698	4498934.454	406.51	408.035126	-1.52512573
G-141346G	670725.0904	4498928.883	407.61	408.137665	-0.5276648
G-141346F	670766.9133	4498902.408	406.91	408.033081	-1.12308106
G-141346E	670741.3137	4498952.136	408.43	408.092987	0.33701294
G-141346D	670741.4538	4498946.03	408.43	408.093384	0.33661621
G-141346C	670747.5797	4498944.616	408.13	408.077759	0.05224121
G-141346B	670747.7886	4498935.513	407.97	408.078308	-0.10830811
G-141346A	670741.6627	4498936.927	407.67	408.093964	-0.42396362
G-140854D	672447.3071	4498342.485	402.92		

Table A-1

Calibration Wells In Model Domain
Wellhead Protection Plan
Crete, Nebraska

Registration Number Unique Well ID	Coordinates		Measured Head (m)	Calculated Head (m)	Residual (m)
	Easting	Northing			
G-047770	664499.5296	4496152.96	415.44	416.729279	-1.28927856
G-139366	670746.1616	4498940.029	408.4	408.08194	0.3180603
G-139708	666110.7845	4497776.509	418.19	415.414032	2.77596802
G-137853	676395.4885	4497891.312	399.29	403.937988	-4.64798828
G-137852	676411.7112	4497992.553	399.59	403.927307	-4.33730713
G-137628	676234.7382	4497930.823	399.59	404.029572	-4.43957153
G-138774	671594.3124	4499957.192	402.95	406.535889	-3.58588867
G-134470	673052.98	4489564.846	398.07	400.313538	-2.2435376
G-133923	673971.1556	4505538.028	410.57	399.840179	10.7298206
G-133875	672886.1065	4489101.254	400.2	400.239136	-0.03913574
G-132992C	673462.3304	4500065.391	403.98	405.405182	-1.42518189
G-132992B	673448.2997	4500028.41	403.56	405.416565	-1.85656494
G-132992A	673409.0238	4499970.846	410.6	405.443542	5.15645752
A-005890	662774.6318	4501749.237	420.93	418.689514	2.24048584
G-133285	674186.8791	4489927.888	398.37	399.559784	-1.18978394
G-132783	670767.3181	4489036.258	398.37	400.91449	-2.54448975
G-132946	676382.2017	4492351.567	391.97	402.408234	-10.4382336
G-131497	676034.4284	4491053.998	401.12	401.460419	-0.3404187
G-133788	665708.1641	4496167.393	415.59	415.589111	0.00088867
G-131289	674761.7942	4500067.932	400.81	404.671722	-3.86172241
G-131284	674693.3623	4498499.062	399.9	404.81778	-4.91777954
G-131105	673473.0815	4503317.113	405.69	403.888	1.80199951
G-128492	666928.699	4495000.702	412.33	413.910034	-1.58003418
G-126552	673254.5876	4497131.991	402.64	404.709045	-2.06904541
G-012319	663884.1173	4500280.552	417.58	417.759735	-0.17973511
G-124803	676128.0397	4497973.987	401.12	404.088776	-2.96877564
G-123784C	672409.9729	4494126.766	401.42	404.58194	-3.1619397
G-123784B	672410.029	4494138.985	401.48	404.586151	-3.10615112
G-123784A	672395.4245	4494136.981	401.88	404.618866	-2.73886597
G-123578	675238.6658	4495461.22	402.03	403.758575	-1.72857544
G-123076	672524.717	4495962.443	401.42	404.296204	-2.87620361
G-121924C	671017.4922	4498785.208	408.68	407.378723	1.30127686
G-121924B	671016.2171	4498774.404	408.52	407.386047	1.13395264
G-121924A	671026.9084	4498773.206	408.68	407.356232	1.32376831
G-123236	666254.8268	4490319.146	413	408.2034	4.79660034
G-119715	675025.9564	4495745.012	402.03	403.889191	-1.85919067
G-120439	673728.91	4496369.753	401.73	404.216675	-2.48667481
G-016838	661578.9017	4500952.694	423.37	419.835907	3.53409302
G-115402	673955.9577	4500476.676	402.95	405.024933	-2.07493286
G-115401	673444.4451	4500196.917	399.29	405.401917	-6.1119165
G-031731	673822.2469	4500254.178	401.73	405.148621	-3.41862061
G-055496	662488.992	4497312.718	420.93	419.207397	1.72260254
G-114573	674858.9433	4502547.499	407.52	403.122955	4.39704468
G-113632	672398.5151	4490145.482	403.25	402.045471	1.20452881
G-113496	669092.3269	4488993.173	408.74	401.105469	7.63453125
G-113479	670407.0679	4492248.483	408.43	407.441772	0.98822754
G-032797	668840.6123	4497467.52	409.04	411.728271	-2.68827148
G-111816	676418.3654	4492255.232	402.64	402.34613	0.29386963
G-111578	672417.8726	4493649.896	402.03	404.403595	-2.37359497
G-117538	674603.1209	4498965.012	399.9	404.885376	-4.98537598
G-110518	667412.347	4492122.884	412.7	411.021759	1.67824097
G-110185	674196.1634	4496840.181	407.52	404.479614	3.04038574
G-110315	663175.9462	4501748.818	420.93	418.270966	2.65903442
G-108834	675501.6363	4495760.649	399.59	403.878967	-4.28896729
G-108627	674996.2898	4498394.55	402.03	404.676514	-2.64651367
G-109377	675229.4858	4499626.639	403.25	404.497131	-1.24713135
G-108050	664510.9536	4495354.28	415.75	416.242706	-0.4927063
G-107066	676243.4467	4493014.4	402.95	402.74649	0.20350952
G-106983	675843.853	4504158.822	416.05	399.814423	16.2355774
G-000168	669956.5017	4489021.305	405.08	401.016357	4.06364258
G-106595	662077.6208	4496500.645	422.45	419.326385	3.1236145
G-105543	675471.2222	4503352.705	408.74	401.568787	7.17121338

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Calibration Wells In Model Domain
Wellhead Protection Plan
Crete, Nebraska

Registration Number Unique Well ID	Coordinates		Measured Head (m)	Calculated Head (m)	Residual (m)
	Easting	Northing			
G-105262	674826.2845	4491071.011	397.46	401.276337	-3.81633667
G-014994	670365.0018	4500317.459	410.57	408.967194	1.6028064
G-104457	674152.0002	4496904.126	403.86	404.514099	-0.65409912
G-102694D	670177.4404	4498703.414	410.26	409.332642	0.9273584
G-102694C	670214.5168	4498684.602	409.96	409.265533	0.69446655
G-102694B	670203.3931	4498701.008	409.96	409.28476	0.67524048
G-102694A	670208.2182	4498693.566	409.65	409.276428	0.37357178
G-102325	670721.3584	4498715.318	408.43	408.184326	0.24567383
G-102516	665647.3295	4498588.743	417.27	415.960815	1.30918457
G-101569	674876.3168	4502692.331	405.99	402.958221	3.03177856
G-099093	672802.772	4497949.647	404.16	405.237061	-1.07706055
G-099092	672822.1253	4497983.752	404.16	405.252441	-1.09244141
G-096955	664959.861	4492289.686	416.05	412.218628	3.83137207
G-096326	665368.7135	4494991.761	415.75	415.334198	0.415802
G-096432	672165.0421	4489680.702	404.77	401.808716	2.96128418
G-095912	672908.8775	4498479.486	404.47	405.432617	-0.96261719
G-097247	671118.7266	4499108.421	405.69	407.026794	-1.33679443
G-098390	676651.7528	4490999.615	397.76	401.26355	-3.50354981
G-095820	669926.2975	4500583.1	409.65	409.804108	-0.15410767
G-024848	665211.7544	4495154.989	414.83	415.561432	-0.73143189
G-101083	667004.3207	4491340.041	412.39	410.188293	2.20170654
G-092738	667419.6682	4491759.081	411.78	410.517548	1.26245239
G-090417	673733.1446	4498205.006	409.96	405.09964	4.86036011
G-089961	676312.0609	4502587.189	403.25	401.924652	1.3253479
G-089741	668500.9854	4498724.793	414.53	412.232697	2.29730347
G-091642	662907.15	4496123.914	415.44	418.342834	-2.90283447
G-091048	663551.2761	4495747.196	417.58	417.446716	0.13328369
G-091356	671526.0866	4491476.989	406.91	404.906952	2.0030481
G-089623	673424.0623	4502264.318	407.82	404.724243	3.09575684
G-001026	669928.7158	4491018.691	404.47	406.637299	-2.16729858
G-088777	669948.7765	4493657.824	407.82	409.233368	-1.41336792
G-088348	673115.1442	4501613.11	408.13	405.295532	2.83446777
G-088008	674347.3718	4503632.926	416.05	402.415009	13.6349915
G-087925	671486.0675	4493084.149	411.18	406.17984	5.00015991
G-087863	669620.1678	4498256.404	409.04	410.359497	-1.31949707
G-087786	669905.3674	4494243.06	406.91	409.612946	-2.70294556
G-087480	668249.1571	4497221.993	412.09	412.649078	-0.55907837
G-087322	662837.4017	4499334.384	414.83	418.976715	-4.14671509
G-087053	673629.9308	4494597.607	402.34	402.619324	-0.27932373
G-086438	676031.8193	4500052.898	411.48	403.876617	7.60338257
G-085968	671169.4397	4489061.464	409.65	400.921143	8.72885742
G-003041	668428.2804	4498014.635	415.14	412.355194	2.78480591
G-005398	661652.5033	4498519.43	421.54	419.857269	1.68273071
G-083369	669524.9539	4491379.696	406.91	407.661316	-0.75131592
G-079038	672452.553	4499427.009	404.77	405.826538	-1.05653809
G-079037	672442.2634	4499414.553	405.08	405.827271	-0.74727051
G-079036	672442.9529	4499414.014	405.08	405.826965	-0.74696533
G-079035	672442.3336	4499404.225	405.08	405.825134	-0.74513428
G-079034	672467.9746	4499404.264	405.08	405.816833	-0.7368335
G-079033	672441.4733	4499393.875	405.08	405.823303	-0.74330322
G-079032	672442.9958	4499393.91	405.08	405.822784	-0.74278442
G-079031	672452.5101	4499392.354	405.08	405.819427	-0.73942749
G-079030	672440.9327	4499391.641	405.08	405.822998	-0.74299805
G-079029	672431.283	4499388.085	405.08	405.825378	-0.74537842
G-079028	672516.1394	4499385.499	405.38	405.797028	-0.41702759
G-079026	672516.2166	4499382.168	405.38	405.796326	-0.41632568
G-079025	672431.0869	4499374.641	405.08	405.822601	-0.74260132
G-079024	672466.4961	4499373.129	405.38	405.810822	-0.43082153
G-079023	672466.6657	4499369.468	405.38	405.810028	-0.43002808
G-079022	672431.3696	4499366.095	405.08	405.820709	-0.74070923
G-079021	672431.5237	4499363.099	405.38	405.820038	-0.44003784
G-079020	672454.2126	4499359.071	405.38	405.811859	-0.43185913

Table A-1

Calibration Wells In Model Domain
Wellhead Protection Plan
Crete, Nebraska

Registration Number Unique Well ID	Coordinates		Measured Head (m)	Calculated Head (m)	Residual (m)
	Easting	Northing			
G-079019	672452.1196	4499347.138	405.38	405.809967	-0.42996704
G-079018	672455.5029	4499347.217	405.69	405.808899	-0.11889893
G-079017	672458.8862	4499347.295	405.69	405.807831	-0.11783081
G-079016	672490.8531	4499348.258	405.69	405.797577	-0.1075769
G-079014	672413.1697	4499388.221	405.08	405.831177	-0.75117676
G-079013	672412.4927	4499391.87	405.08	405.832123	-0.7521228
G-077627	667242.7685	4498130.4	413.92	414.021454	-0.10145386
G-074906	671427.2814	4496881.762	403.86	407.172058	-3.31205811
G-074738	665545.5394	4501799.77	415.75	415.5784	0.17160034
G-074510	663269.2501	4498145.01	417.58	418.545685	-0.96568481
G-073913	670960.5341	4496293.904	404.47	408.175446	-3.70544556
G-073534	663665.1708	4500210.312	417.58	418.046051	-0.46605103
G-072620	665682.1258	4497770.842	415.75	415.870209	-0.12020874
G-071797	669586.7736	4501097.826	407.52	410.485199	-2.96519898
G-070868	668751.1106	4501068.927	410.87	411.855682	-0.98568237
G-070532	670578.9896	4495084.148	410.57	408.833466	1.73653442
G-070054	672031.624	4494510.548	402.64	405.55957	-2.91957031
G-068978	668134.6176	4489977.536	394.72	406.313782	-11.5937817
G-068917	668967.9831	4500069.667	409.65	411.476471	-1.82647095
G-068707	671362.3665	4500934.055	409.65	406.919434	2.73056641
G-068394	674298.6489	4496986.309	395.02	404.533234	-9.51323364
G-068144	671360.483	4495531.819	405.08	407.330475	-2.25047485
G-067488	667234.1984	4499825.557	413.31	413.978851	-0.66885132
G-066493	665753.7775	4495346.514	411.78	415.211334	-3.43133423
G-066133	668935.3259	4489999.732	409.35	405.489136	3.86086426
G-066084	671245.4802	4497914.096	404.47	407.326904	-2.8569043
G-066083	671040.0572	4498109.079	400.81	407.667542	-6.8575415
G-065998	670741.2846	4490651.503	403.86	405.074249	-1.21424927
G-065098	666710.7577	4496788.093	405.08	414.629395	-9.54939453
G-063672	670830.5138	4497901.45	399.29	408.195618	-8.90561768
G-061677	671551.9186	4490276.357	408.13	403.475616	4.65438355
G-061403	669514.154	4496057.801	402.34	410.693787	-8.35378662
G-060741	671257.4481	4497235.725	405.38	407.488739	-2.10873901
G-058846	669691.9648	4496465.59	407.82	410.422394	-2.6023938
G-058845	667744.686	4501247.632	413.31	413.260345	0.04965454
G-057983	673846.358	4498590.632	403.56	405.156952	-1.5969519
G-057391	665053.038	4498364.51	419.1	416.607666	2.49233398
G-056991	676174.1788	4502672.558	398.98	401.918579	-2.9385791
G-056917	670375.1306	4500307.473	406.91	408.947235	-2.03723511
G-056446	662267.4171	4497925.292	425.2	419.445099	5.75490112
G-055910	673775.9162	4495563.458	401.12	403.476379	-2.3563794
G-055591	663803.8413	4499957.025	419.1	417.90744	1.19255981
G-055496	662107.2742	4496923.223	418.49	419.452118	-0.96211792
G-055494	669874.6527	4493045.585	401.73	408.921143	-7.19114258
G-055431	669874.6527	4493045.585	409.35	408.921143	0.42885742
G-055152	676143.0246	4496433.467	401.73	403.923615	-2.1936145
G-053497	669115.673	4491414.276	406.91	408.227448	-1.31744751
G-052808	667531.2479	4495597.089	409.65	413.422729	-3.77272949
G-051260	662302.8179	4495913.024	416.05	418.735779	-2.68577881
G-049803	669361.4387	4500482.579	412.09	410.817902	1.27209839
G-049548	670527.2827	4502125.314	408.43	408.433716	-0.00371582
G-048830	667762.8223	4500440.012	412.39	413.282898	-0.89289795
G-047772	673966.6389	4495768.287	398.98	403.734589	-4.75458862
G-047770	664499.3252	4496162.211	414.53	416.733795	-2.20379517
G-047254	669378.9141	4499678.05	403.25	410.728333	-7.47833252
G-046629	675035.2094	4496400.789	398.68	404.205872	-5.52587158
G-046554	665011.5976	4493598.851	415.44	414.236725	1.20327515
G-045715	666342.2688	4494968.789	415.44	414.49408	0.94592041
G-045014	665816.7398	4500969.473	416.66	415.533661	1.12633911
G-044512	676285.9951	4502566.243	409.65	401.96524	7.68475952
G-044121	666358.0032	4494571.298	412.39	414.255554	-1.8655542
G-043653	666716.0271	4498608.502	413.61	414.704041	-1.09404053

Table A-1

Calibration Wells In Model Domain
Wellhead Protection Plan
Crete, Nebraska

Registration Number Unique Well ID	Coordinates		Measured Head (m)	Calculated Head (m)	Residual (m)
	Easting	Northing			
G-043186	666044.2066	4491734.546	411.78	411.268524	0.51147583
G-043185	667594.2335	4492973.305	409.04	411.807587	-2.76758667
G-041747	671866.1359	4493508.975	412.7	405.589722	7.11027832
G-041226	672231.608	4493720.673	403.56	404.848419	-1.28841919
G-041033	670697.9028	4492675.98	408.13	407.347015	0.78298462
G-040951	672478.4588	4493593.651	399.59	404.237427	-4.64742676
G-040611	666447.1276	4492521.661	412.09	412.243347	-0.15334717
G-040528	674092.7102	4492636.638	405.08	402.10083	2.97916992
G-040157	668627.1359	4489378.444	411.48	403.637268	7.84273193
G-039091	669863.3032	4498980.576	403.86	409.885529	-6.02552856
G-038391	668855.3167	4501982.625	408.43	411.732422	-3.30242188
G-037917	666061.0734	4490786.75	412.7	409.36084	3.33916016
G-037409	669031.627	4493827.893	409.35	410.671173	-1.3211731
G-037387	670857.8456	4498694.349	407.82	407.841278	-0.02127808
G-036919	664777.8057	4501767.606	417.58	416.383118	1.19688232
G-035417	667536.0778	4501862.361	411.78	413.427216	-1.64721558
G-035388	664093.5392	4497755.418	419.71	417.59787	2.11213013
G-035333	673023.9322	4494740.343	404.77	403.290131	1.47986939
G-034574	673558.2128	4501605.669	405.08	404.930145	0.14985474
G-034487	669892.1247	4492442.432	407.82	408.376617	-0.55661743
G-033645	667834.8986	4490957.955	403.25	408.836273	-5.58627319
G-032797	668678.2344	4497438.848	410.87	411.988037	-1.11803711
G-032354	673489.9815	4493930.688	391.06	402.387665	-11.3276648
G-032162	671949.2466	4490984.472	405.38	403.701019	1.67898071
G-032046	668131.0464	4496211.042	412.39	412.75061	-0.36061035
G-031952	672240.3936	4493663.008	403.56	404.812317	-1.2523169
G-031732	673250.7144	4500812.76	410.26	405.430237	4.82976318
G-031731	673140.8405	4500748.605	406.6	405.527863	1.07213745
G-030958	663832.8719	4500828.423	423.98	417.727203	6.25279663
G-030957	665781.9896	4494154.731	411.48	414.400635	-2.92063477
G-030956	664139.7086	4495733.93	415.44	416.856079	-1.4160791
G-030827	664894.6675	4497357.069	419.1	416.704651	2.39534912
G-030321	667330.8602	4497381.891	413	413.917389	-0.91738892
G-030320	668164.1332	4493420.861	410.57	411.530151	-0.96015137
G-030133	666534.3347	4494588.676	414.22	414.10321	0.11678955
G-030133	665721.4367	4494364.411	415.75	414.617676	1.13232422
G-029952	663167.5685	4500538.572	423.67	418.556946	5.1130542
G-029260	672512.0101	4492912.448	403.25	403.750885	-0.50088501
G-029260	672338.221	4492864.111	401.42	404.174591	-2.75459106
G-029109	671282.5153	4501917.315	409.65	407.100769	2.54923096
G-029060	665386.3561	4493620.819	414.53	414.107941	0.42205933
G-028899	668890.6517	4489409.172	405.99	403.439178	2.55082153
G-028794	669136.13	4490803.53	407.82	407.189209	0.63079102
G-028558	668577.2676	4497064.367	411.48	412.169037	-0.68903687
G-028079	671774.7662	4497124.91	403.56	406.259094	-2.69909424
G-028078	672119.8731	4496334.829	402.95	405.370422	-2.42042236
G-027867	663306.4169	4496130.327	415.75	417.958893	-2.20889282
G-027324	669013.7003	4491858.015	405.38	408.936615	-3.55661499
G-027228	667184.3437	4492548.709	408.43	411.740143	-3.31014282
G-027146	667114.9693	4501094.503	423.98	414.010864	9.96913574
G-027006	664809.5806	4499635.269	417.27	416.824219	0.44578125
G-026731	665500.1283	4495753.597	414.83	415.627991	-0.79799072
G-026715	662392.3914	4500977.192	420.62	419.192352	1.42764771
G-026669	676053.0209	4499464.587	405.38	404.01413	1.36587036
G-026569	671510.2862	4491677.774	407.21	405.119995	2.09000488
G-026471	668510.8999	4496237.844	412.7	412.231415	0.46858521
G-026460	669278.8145	4500064.406	408.74	410.932251	-2.19225098
G-026359	668953.2196	4495440.393	405.38	411.443176	-6.06317627
G-026296	672838.2586	4497700.891	404.47	405.092865	-0.62286499
G-026198	669496.7283	4497094.686	410.87	410.678864	0.19113648
G-025481	668930.0218	4490488.423	408.43	406.754364	1.67563599
G-025441	667390.5501	4493779.855	410.87	412.706879	-1.83687866

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Calibration Wells In Model Domain
Wellhead Protection Plan
Crete, Nebraska

Registration Number Unique Well ID	Coordinates		Measured Head (m)	Calculated Head (m)	Residual (m)
	Easting	Northing			
G-025391	667067.2537	4494612.936	412.09	413.575012	-1.48501221
G-025265	665822.3268	4499994.202	417.88	415.68692	2.19307983
G-025265	665484.4473	4500177.379	417.27	416.036163	1.23383667
G-025176	664529.346	4494498.481	418.19	415.470398	2.71960205
G-025175	663791.2477	4494524.645	415.14	415.843994	-0.70399414
G-025147	667650.3119	4497209.037	413.61	413.488861	0.12113892
G-025122	667218.8719	4494165.625	411.18	413.15509	-1.97509033
G-024983	663303.5607	4496970.693	420.62	418.287903	2.33209717
G-024954	663904.0535	4497497.013	419.71	417.784515	1.92548462
G-024897	664514.4982	4492927.022	415.75	413.282806	2.4671936
G-024896	664604.9749	4493689.04	414.83	414.406006	0.42399414
G-024896	664653.4489	4493714.323	405.69	414.44043	-8.75042969
G-024848	665053.2877	4495371.276	420.93	415.823608	5.1063916
G-024762	674173.5077	4506007.635	405.69	398.201508	7.48849243
G-024550	669152.4862	4488990.6	405.69	401.06662	4.62338013
G-024550	669558.5103	4489004.478	404.77	401.022705	3.74729492
G-024468	664079.9636	4498156.177	421.54	417.65271	3.88729004
G-024363	667785.1309	4498460.376	414.22	413.264984	0.95501587
G-024326	666230.1787	4491333.853	411.48	410.510071	0.9699292
G-024271	666437.8661	4499401.964	413.92	415.00293	-1.08292969
G-024197	661637.8209	4499105.641	421.54	419.852997	1.68700317
G-024177	665236.2357	4495372	414.53	415.66922	-1.13921997
G-024087	670351.3441	4490230.187	403.86	404.739044	-0.87904419
G-024037	675974.5909	4497641.981	401.42	404.156097	-2.73609741
G-024002	662328.239	4499885.355	418.19	419.348053	-1.15805298
G-023854	666723.1166	4489677.637	413.31	406.387604	6.92239624
G-023714	664877.5516	4497759.083	421.23	416.776123	4.45387695
G-023694	661858.647	4497772.785	422.45	419.740051	2.70994873
G-023642	665698.9227	4497149.352	416.97	415.792999	1.17700073
G-023533	665990.2598	4490930.893	413.61	409.679291	3.93070923
G-023436	667535.0514	4489759.464	408.43	406.136414	2.29358643
G-022479	672789.8266	4488947.968	400.2	400.158203	0.04179688
G-022077	673859.5347	4493986.618	397.76	402.458008	-4.69800781
G-021614	666406.1083	4490658.828	410.57	409.04599	1.52401001
G-021572	666883.4299	4498487.636	415.14	414.491364	0.64863648
G-021551	665851.7055	4493072.941	415.44	413.256165	2.18383545
G-021151	663037.0135	4497530.838	421.84	418.670258	3.16974243
G-021054	665763.9919	4497496.33	415.14	415.752747	-0.61274658
G-020894	668326.199	4492994.796	410.26	410.978363	-0.71836304
G-018425	668779.9879	4499460.845	409.35	411.778809	-2.42880859
G-016838	661578.9017	4500952.694	421.23	419.835907	1.39409302
G-014994	670302.795	4500377.235	409.96	409.088531	0.87146851
G-014702	664800.3425	4500873.016	415.44	416.616486	-1.1764856
G-014555	664074.2881	4496727.969	417.58	417.401917	0.1780835
G-013361	669389.7072	4498088.77	409.35	410.794861	-1.44486084
G-012329	667437.2106	4492724.317	412.09	411.709686	0.38031372
G-012319	663990.4863	4500548.456	417.27	417.588226	-0.31822632
G-011142	672178.814	4495927.669	404.16	405.29599	-1.13598999
G-010996	664986.8941	4496556.547	416.97	416.416687	0.55331299
G-010898	671245.4802	4497914.096	406.6	407.326904	-0.7269043
G-010898	671370.2566	4498064.249	405.99	406.998444	-1.0084436
G-009991	668991.0898	4492451.942	407.82	409.588684	-1.76868408
G-008832	671598.9978	4500740.582	408.13	406.69632	1.43368042
G-008290	662319.9172	4496410.186	419.71	419.069122	0.64087769
G-007372	674632.3557	4499057.223	404.47	404.872101	-0.40210083
G-005684	667315.5339	4490759.583	407.21	408.922638	-1.71263794
G-005398	661848.9657	4498723.728	421.23	419.736664	1.49333618
G-004811	666437.5019	4490341.545	409.96	408.259979	1.70002075
G-004104	669935.8175	4490424.3	406.6	405.561096	1.03890381
G-004104	669734.8543	4490423.946	409.65	405.766571	3.88342896
G-003707	666734.3283	4495580.316	411.48	414.344696	-2.86469605
G-003440	665792.0346	4492298.149	415.75	412.275452	3.47454834

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Calibration Wells In Model Domain
Wellhead Protection Plan
Crete, Nebraska

Registration Number Unique Well ID	Coordinates		Measured Head (m)	Calculated Head (m)	Residual (m)
	Easting	Northing			
G-003041	668613.3857	4498040.818	410.87	412.073029	-1.20302856
G-003040	668228.1344	4497627.808	409.35	412.654785	-3.30478516
G-002421	665422.0536	4501049.869	415.44	415.937225	-0.49722534
G-000428	662240.2345	4498729.473	423.06	419.434235	3.62576538
A-006326	672054.0298	4494104.988	404.16	405.38562	-1.22562012
G-150663	672509.5899	4504087.116	407.82	404.789001	3.03099854
G-149475	662698.6269	4504964.262	410.26	415.917969	-5.65796875
G-142962K	672281.5569	4499185.969	405.08	405.827881	-0.74788086
G-142962J	672281.5569	4499185.969	405.38	405.827881	-0.44788086
G-142378	667080.4162	4505200.819	411.18	412.136078	-0.95607788
G-141964	670233.3529	4505578.131	408.74	409.674316	-0.93431641
G-138650	664880.7548	4503391.694	415.14	415.280884	-0.14088379
G-130870	665122.713	4504197.521	416.66	414.161224	2.49877564
G-128138	667880.2318	4504279.675	415.44	412.485504	2.95449585
G-126591	663900.8081	4503406.108	417.27	416.382385	0.88761475
G-120469	665551.138	4503408.935	416.66	414.669891	1.99010864
G-112471	667046.9602	4505149.443	407.21	412.203949	-4.99394898
G-024056	669485.6771	4503905.284	413.92	411.033539	2.88646118
G-107791	661986.2685	4502939.182	422.45	419.136627	3.3133728
G-107142	671477.5613	4506142.914	403.25	406.273773	-3.02377319
G-104458	669466.3774	4505121.63	421.84	410.984131	10.8558691
G-103405	662044.3144	4504058.542	420.62	418.52356	2.09644043
G-000232	666455.9043	4502738.082	416.97	414.304321	2.66567871
G-086985	662016.1322	4503284.024	423.06	418.976532	4.08346802
G-086523	668695.9138	4503496.56	415.75	411.97171	3.7782898
G-085493	661546.6523	4503346.771	421.84	419.687134	2.15286621
G-084142	672856.4649	4505355.945	408.13	402.508484	5.62151611
G-082811	667505.028	4505362.132	414.83	411.838745	2.99125488
G-081275	670857.3599	4505968.002	403.56	408.362488	-4.80248779
G-074533	661557.0353	4502530.781	415.44	419.761902	-4.32190186
G-073852	668396.0338	4503916.822	406.3	412.204681	-5.9046814
G-073047	667846.4894	4504698.757	416.66	412.284515	4.37548462
G-071423	664769.6725	4502981.39	416.66	415.733215	0.92678467
G-067853	671221.9217	4505372.609	411.48	408.044128	3.43587158
G-065939	665324.1999	4504804.338	410.26	413.10437	-2.84437012
G-064827	669303.4797	4503312.674	415.75	411.259186	4.49081421
G-055736	671938.6756	4502764.733	412.39	406.289124	6.10087647
G-053426	665768.595	4502805.574	414.83	414.896454	-0.06645386
G-053049	668063.5996	4505294.895	411.78	411.734283	0.04571655
G-049025	668098.684	4503277.432	409.04	412.606628	-3.56662842
G-049024	668108.2932	4502875.132	409.96	412.653076	-2.69307617
G-047634	671662.835	4504093.453	405.69	406.724426	-1.03442627
G-047633	670836.9917	4506217.447	407.52	407.991302	-0.47130249
G-047632	671178.9575	4505157.803	407.21	408.074432	-0.86443237
G-046949	669287.1599	4504121.566	408.43	411.295929	-2.86592896
G-045918	670639.4701	4506163.032	409.65	408.622101	1.02789917
G-039573	663354.034	4502556.07	422.45	417.714752	4.7352478
G-038392	670270.2376	4505182.782	413	409.755341	3.24465942
G-031984	665902.1549	4504426.266	416.66	413.434174	3.22582642
G-041456	662316.9934	4504145.685	420.01	417.862396	2.14760376
G-028419	666799.6055	4502472.67	414.83	414.059845	0.77015503
G-027196	664631.4607	4502298.374	417.88	416.307037	1.57296265
G-027062	666548.2163	4504038.323	427.63	413.477905	14.1520947
G-025474	666362.116	4503602.428	417.58	413.910736	3.66926392
G-024056	669170.6843	4503520.906	414.53	411.453308	3.0766919
G-024003	668699.348	4503915.152	414.53	411.93689	2.59311035
G-023772	663131.6395	4504893.967	416.05	415.360718	0.68928223
G-023772	663113.4673	4504767.445	419.71	415.618073	4.09192749
G-023552	670264.846	4505838.207	411.18	409.481476	1.69852417
G-023551	667163.4916	4504619.265	408.74	412.698517	-3.95851685
G-021491	664368.4028	4502982.499	418.49	416.14447	2.34552979
G-015451	667333.8084	4502587.641	424.28	413.490417	10.7895825

Table A-1

Calibration Wells In Model Domain
Wellhead Protection Plan
Crete, Nebraska

Registration Number Unique Well ID	Coordinates		Measured Head (m)	Calculated Head (m)	Residual (m)
	Easting	Northing			
G-014273	665398.3158	4502802.038	417.27	415.229401	2.04059937
G-011478	663838.3701	4503338.09	418.8	416.529419	2.27058106
G-010783	661775.5788	4502570.409	420.32	419.508728	0.81127197
G-007333	662554.2971	4502343.614	421.54	418.705902	2.8340979
G-002354	664158.2381	4502771.269	417.88	416.560516	1.31948364

APPENDIX C: SELECT ORDINANCES AND MUNICIPAL CODE

Ordinance No. XXX: Adoption of the WHPA Map and WHPP

- Adopted DATE,DATE,DATE

INSERTED AFTER ADOPTION

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APPENDIX D: CRETE PWS EMERGENCY RESPONSE INFORMATION

Contingency/Emergency Response Plan – October 2013

Emergency Contact List

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DHHS NEBRASKA

This form may be completed online (http://www.dhhs.ne.gov/enh/pwsindex.htm). Mail or email completed application to the address listed below.

STATE OF NEBRASKA
DEPARTMENT OF HEALTH AND HUMAN SERVICES
DIVISION OF PUBLIC HEALTH - DWEH
P.O. Box 95026, Lincoln, Nebraska 68509-5026
402/471-1007 or kristin.luebbe@nebraska.gov
24-Hour Emergency Contact # 402/499-6922

CONTINGENCY/EMERGENCY RESPONSE PLAN FOR COMMUNITY WATER SYSTEMS

COPY

Public Water System Name: City of Crete			**County: Saline**
PWS ID #: NE31-15104	**Phone Number: 402-826-4312**		**Population Served: 6028**
Mailing Address:	**Street/PO/Route: 243 E. 13th Street, P.O. Box 86**		
	City: Crete	**State: NE**	**ZIP: 68333**
Prepared by: Tom Ourada		**Title: Director of Public Works**	
Date Completed: 10/06/2010		**Date Update: 10/06/2010**	
Signature: Tom Ourada			
Plan #: 2010			

FOR DHHS DPH USE ONLY

DHHS DPH Approval by:	**Date:**
Signature:	

TABLE OF CONTENTS

Section I – Introduction 1
1. Purpose 1
2. Organization 1
3. Plan Distribution 1
4. Plan Updates 2
Section II - Summary Description of the System 2
1. Location of Pertinent Information 3
2. Existing Source Information 3
A. Well Information 3
B. Surface Water Sources 3
C. Water Quality of the Source(s) 3
D. Description of Surrounding Area and Susceptibility to Contamination 3
E. Source Pump Information 4
F. Interconnections 4
G. Other Emergency Sources (Include equipment needed to use the source) 4
H. Possible Future Sources of Water (How will future water sources be protected?) 4
3. Treatment Information 4
A. Disinfection 4
B. Other Treatment 4
C. Other Applicable Information (booster chlorinators, control systems, etc.) 5
4. Finished Water Storage 5
5. Distribution System and Transmission Main(s) Information 5
6. System Demand 5
7. Power 5
8. Other Pertinent System Information 5
Section III – Emergency Response Actions 5
1. Description of Emergency Response Actions 7
A. Power Outage 7
B. Prolonged Water Outage 7
C. Transmission and/or Distribution System Failure (tanks, controls, piping, etc.) 7
D. Treatment Equipment Failure 7
E. Source Pump Failure 7
F. Loss of SCADA or Other Automated Controls 7
G. Contamination of Supply (including MCL violations) 8
H. Chemical Incident at Facility 8
I. Drought 8
J. Flood 8
K. Severe Weather 8
L. Fire at Water Supply System Facility 9
M. Hazardous Material Release (In Watershed or Recharge Area) 9
N. Terrorism or Vandalism (actual or suspected) 9
O. Earthquake 9
2. Work Order Log 9
3. Emergency Reference Table 10
4. Emergency Reference Table Contacts and Phone Numbers 10
A. Emergency Responders 11
B. State and Local Agencies Notification List 11
C. Local Contact Notification List 12
D. Chemical Supplier Information 12
E. System Equipment Repair and Supplies Contact Information 13
F. Utilities Contact Information 13
G. Bulk Water Suppliers 14
H. Media Notification List 14
Section IV – Consumer Notification 15
Section V - Emergency Water Use Restrictions 16
1. Explanation and Authority 22
2. Restriction Stages 22
Section VI – Communications 22
..... 23

1. Communication Log 24
Section VII – Assessment of Available Equipment 24
1. Emergency Communications Equipment 24
A. CB Radios 24
B. Cellular Phones 24
C. Pagers 24
D. Other Communication Equipment Available 25
2. Emergency Water Supply Equipment 25
A. Bulk Water Supply Truck 25
B. Other Emergency Water Supply Equipment 25
C. Parts Available for Emergency Interconnections 25
3. Power Supply Equipment 25
A. Power Sources 25
B. Generators 25
4. Vehicles and Construction Equipment 25
A. Pickup Trucks, Vans, and other Vehicles 26
B. Dump Trucks 26
C. Construction Equipment 26
5. Spare Parts for Water Source 27
A. Spare Pump(s) 27
B. List of Spare Parts for Pump(s) and Well(s) 27
6. Spare Parts for the Distribution System 27
A. List of Spare Piping 27
B. List of Spare Valves 27
C. Other Parts Available (Distribution System) 28
7. Spare Parts for Treatment 28
A. Spare Chemical Feed Pump(s) 28
B. Reserve Chemicals 28
8. Miscellaneous Parts for the System 29
A. Additional Parts Not Listed Above 29
Section VIII – Recovery 30
1. Assessment and Recovery Period Checklist 30
2. Preliminary Damage Assessment 30
Section IX – Evaluation 31
1. Evaluation Report Form 31

Section I – Introduction

1. Purpose

This emergency plan was developed as a guideline for the operators and administration of the **City of Crete** in order to minimize disruption of normal services to its consumers and to provide public health protection and safety during an emergency. Emergency response planning should be a coordinated and planned process. Proper planning can lessen the impact of an emergency. This plan was designed to address various emergency hazards that may occur in rural and small water systems.

2. Organization

Water Department policies are set by City Council. Large expenditures (over $20,000) must be approved by Council. Smaller purchases can be made by Director.

During any type of emergency, the following persons will be in charge of the water system (contact in order indicated):

Order	Name	Position	Phone Numbers (include area code)				Radio Frequency (MHz)	E-Mail
			Office	Cellular	Pager	Home		
1	Tom Ourada	Director	402-826-4312	402-826-9758		402-826-5896	453-600	tourada@crete-ne.gov
2	Tim Coffey	Superintendent	402-826-4312	402-826-9765		402-826-4509	453-600	tcoffey@crete-ne.gov
3	Ken Brown	Foreman	402-826-4312	402-826-9765		402-826-2698	453-600	kbrown@crete-ne.gov
4	Gary Henning	Operator	402-826-4312	402-826-9765		402-826-4045	453-600	
5	Kevin Sunken	Operator	402-826-4312	402-826-9765		402-826-5443	453-600	
6								

3. Plan Distribution

Copies of the emergency plan have been distributed to the following water supply personnel and other local and HHS-R&L officials as indicated below. In addition, a copy of this plan is kept at so that it can be easily accessed in the event of an emergency. All employees will be trained on implementation of the plan.

Plan Number	Distributed By	Received By	Date

4. Plan Updates

The emergency plan is updated as changes occur such as dictated by personnel, phone numbers, technology, system additions or modifications. A record of plan updates follows:

Change Number	Subject	Date	Entered By

Section II - Summary Description of the System

The following is a summary description of the system that should provide enough information about the system for use during an emergency and to assess and correct system vulnerabilities.

1. Location of Pertinent Information

Item	Location
Distribution System Map	320 W. 9th – Public Works Service Center Service Vehicles
Other Pertinent Maps	320 W. 9th – Public Works Service Center 241 E. 13th – City Hall
Daily Reports	2031 E. 13th – Treatment Plant 220 E. 15th – Treatment Plant
Permits	241 E. 13th – City Hall
Technical Manuals	320 W. 9th – Public Works Service Center 2031 E. 13th – Treatment Plant 220 E. 15th – Treatment Plant
O&M Plan	
Start-Up/Shut-Down Procedures	1440 Linden – City Power Plant 241 E. 13th – City Hall 320 W. 9th – Public Works Service Center

2. Existing Source Information

A. Well Information

☐ Not Applicable

Well ID	Location	Well Depth	Well Yield	Critical Water Level[1]
1. 76104311	1810 Kingwood	182'	400 gpm	
2. 76104391	160 W. 5th	184'	440 gpm	
3. 76104551	240 W. 24th	215'	1000 gpm	
4. 76104651	1711 E. 13th	320'	1000 gpm	
5. 76104721	1440 Linden	221'	1000 gpm	
6. 76104661	1480 W. 10th	155'	220 gpm	

[1] Based upon well and aquifer characteristics.

B. Surface Water Sources

☒ Not Applicable

Location of primary intake and critical water level(s):

Location of alternate intake and critical water level(s):

C. Water Quality of the Source(s)

D. Description of Surrounding Area and Susceptibility to Contamination

Description of significant potential sources of contamination in the area (approximate 1 mile radius) and susceptibility to potential contamination (see Source Water Assessment if available):

Agriculture

E. Source Pump Information

Source ID	Pump Type	Manufacturer	H.P.	Capacity (gpm)	Phase, Voltage
76104311	Turbine	US Electrical	10	400	3 ph, 208/416
76104391	Turbine	US Electrical	40	440	3 ph, 230/460
76104551	Turbine	Westinghouse	75	1000	3 ph, 220/440
76104651	Turbine	US Electrical	75	1000	3 ph, 220/440
76104721	Turbine	US Electrical	60	1000	3 ph, 230/460
76104461	Turbine	US Electrical	15	220	3 ph, 220/440

Note: Source ID includes well identification numbers as well as any other source (i.e., surface water intake pumps etc.)

F. Interconnections

Information on the location of interconnection(s) to other Community or Non-Transient Non-Community public water supplies, type and size of interconnecting pipe, pumps and accessory equipment, meters at interconnection(s), normal pressures at the interconnection, volume of water available through the interconnection(s), type of agreement and approvals needed for use, procedures necessary to use interconnection, etc.

G. Other Emergency Sources (Include equipment needed to use the source)

H. Possible Future Sources of Water (How will future water sources be protected?)

3. Treatment Information

A. Disinfection

Chemical(s) Used: Chlorine

Type of Chemical Feed: Electronic metering pump – vacuum regulator

Location of Disinfection System:

Location of Chemical Storage: Treatment Plant Chemical Room

B. Other Treatment

Other Treatment Methods(s): Sand Filtration
Chemical(s) Used: Potassium Permanganate, Polymer
Type of Chemical Feed: Electronic metering pump
Treatment Chemicals and Storage: Treatment Plant Chemical Room
Laboratory Chemicals and Storage: Treatment Plant
Also attach MSDS sheets on all chemicals used.

C. Other Applicable Information (booster chlorinators, control systems, etc.)

SCADA

4. Finished Water Storage

Name of Storage Unit	Location	Type	Capacity	Overflow Elevation
Reservoir	2015E. 15th		1 mg	
Water Tower	2900 E. 29th	Hydro	1 mg	

5. Distribution System and Transmission Main(s) Information

Crete Water System

6. System Demand

Average daily demand is the system's average daily usage based upon operational records maintained during the past several years. Maximum daily demand is typically the highest daily demand experienced in recent years based upon operational records. System capacity is the maximum daily amount of water that the system is capable of treating or producing and distributing. Peak water demand is the maximum hourly demand that the system can sustain provided by storage or by production capability plus storage.

Average Daily Demand: 940,000 MGD
System Capacity: 4.4 MGD
Maximum Daily Demand: 2.5 MGD
Peak Demand: 104,166 GPH

7. Power

Primary Power: City Distribution System
Backup Power: City Power Plant and City Mobile Generation

8. Other Pertinent System Information

Other information about the system that could be useful during an emergency:

Section III – Emergency Response Actions

The following are the action steps that will be followed for all emergency situations:

1. Take or direct any **immediate** response measures that are obviously needed to reduce risk to the public (see specific emergency response action below).
2. Notify HHS-R&L and (if applicable) the system administration.
3. Determine and implement other appropriate corrective actions to reduce and eliminate the effects of the emergency.
4. Inform consumers of the emergency situation as soon as possible, and again as the status changes.

1. Description of Emergency Response Actions

Refer below to the response action(s) for the specified emergency:

A. Power Outage

Immediate Actions: Call Electric on-call - circuit reroute and trouble shoot cause. Turn on other well(s) to maintain system pressure.
Other Actions: Alert Power Plant/Switching and backup generation if needed.

B. Prolonged Water Outage

Immediate Actions: Due to split systems occurrence would be highly unlikely, but in that event disinfected water would be brought in on tank trucks/retested before distribution. Also have local bottled water contingency.
Other Actions:

C. Transmission and/or Distribution System Failure (tanks, controls, piping, etc.)

Immediate Actions: Water Department will investigate the situation. If repairs require digging – Diggers Hotline will be notified. Repairs would be made to restore normal operation.
Other Actions:

D. Treatment Equipment Failure

Immediate Actions: City employees will investigate and evaluate the situation and take whatever measures are necessary to correct the situation to restore the water system to normal operation.
Other Actions:

E. Source Pump Failure

Immediate Actions: The City of Crete has six (6) wells. If a pump would fail, the remaining wells will provide any demand of water usage. If the City of Crete is unable to repair the pump, Layne Western would be contacted to send a service tech to make the repairs.
Other Actions:

F. Loss of SCADA or Other Automated Controls

Immediate Actions: Recent improvements to control system provide separate independent redundancy of SCADA. Other control systems repair as needed.
Other Actions:

G. Contamination of Supply (including MCL violations)

Immediate Actions: Isolate contamination from rest of system, notify HHS, and test remainder of system to verify safety.
Other Actions: Provide makeup water from rest of system or import water.

H. Chemical Incident at Facility

Immediate Actions: Ensure integrity of water safety and safety of employees. Notify HHS, emergency services, and hazmat if necessary.
Other Actions:

I. Drought

Immediate Actions: Curtail water usage first through voluntary requests. If more is necessary impose water restrictions.
Other Actions:

J. Flood

Immediate Actions: Maintain system pressure. Test water to ensure no infiltration.
Other Actions:

K. Severe Weather

Immediate Actions: Monitor weather and take appropriate action.
Other Actions:

L. Fire at Water Supply System Facility

Immediate Actions: Ensure employee safety. notify fire department, and maintain system integrity.
Other Actions:

M. Hazardous Material Release (In Watershed or Recharge Area)

Immediate Actions: Contact DEQ, notify local emergency services, and contact DEQ.
Other Actions:

N. Terrorism or Vandalism (actual or suspected)

Immediate Actions: Notify law enforcement and HHS. Evaluate system integrity.
Other Actions: Isolate any suspect portion of the system, test, and evaluate.

O. Earthquake

Immediate Actions: Evaluate system for damage and then test for safety.
Other Actions:

2. Work Order Log

As response activities are undertaken, personnel will keep a record of work activities using the work order log form below.

Work Order Number	Crew	Assignment	Estimated Time of Repair	Assignment Made By	Completed By	Date Completed

3. Emergency Reference Table

Refer to the table below for whom to contact during certain emergencies. The next table gives the phone numbers for each contact. Note that the supplier of water must notify HHS-R&L when water delivery is disrupted to 10% or more of the consumers. The supplier of water must not use water from any emergency source or stop disinfection or other treatment without receiving the approval of HHS-R&L.

In addition, the supplier of water must make public notification when a condition exists which according to HHS-R&L constitutes a public health hazard. The water supplier must also notify the chief administrative/elected official where the public water system is located and the local law enforcement department having jurisdiction.

Emergency	Emergency Responders	State/Local Agencies	Local Contacts	Chemical Suppliers	Equipment Repair/Supplies	Utilities	Bulk Water Suppliers	Media
Power Outage	☐	☐	☒	☐	☐	☒	☐	☐
Prolonged Water Outage	☐	☒	☒	☐	☐	☒	☒	☒

Transmission/Distribution System Failure	☐	☐	☒	☐	☒	☒	☐	☐
Treatment Equipment Failure	☐	☐	☒	☒	☒	☒	☐	☐
Source Pump Failure	☐	☐	☒	☐	☒	☒	☐	☐
Loss of SCADA or Other Automated Controls	☐	☐	☒	☐	☒	☒	☐	☐
Contamination of Supply	☒	☒	☒	☒	☒	☒	☒	☒
Chemical Incident at Facility	☒	☒	☒	☒	☐	☒	☐	☐
Terrorism/Vandalism	☒	☒	☒	☒	☒	☒	☒	☒
Drought	☐	☐	☒	☐	☐	☐	☐	☒
Flood	☒	☒	☒	☐	☒	☒	☒	☒
Severe Weather	☐	☐	☒	☐	☐	☒	☐	☐
Earthquake	☐	☒	☒	☐	☒	☒	☐	☒
Fire	☒	☐	☒	☐	☒	☒	☐	☒
Hazardous Material Release in Watershed or Recharge Area	☒	☒	☒	☒	☐	☐	☒	☒

4. **Emergency Reference Table Contacts and Phone Numbers**

   A. **Emergency Responders**

			Phone Numbers (include area code)			
Organization	**Contact Name**	**Title**	**Day**	**Evening**	**Cellular/Pager**	**E-Mail**
Fire Department	Mahlon Kohl	Chief	(402) 826-4311	(402) 826-4311		mkohl@crete-ne.gov
Police Department	Steve Hensel	Chief	(402) 826-4311	(402) 826-4311		shensel@crete-ne.gov
FBI Field Office (for terrorism or sabotage)						

Emergency Medical Service						
HHS-R&L Field Office				**402/499-6922 – 24 Hour**		
HHS-R&L Lincoln Office	Jack Daniel	Section Administrator	402/471-0510	**402/499-6922 – 24 Hour**		jack.daniel@hhss.ne.gov
National Spill Response Office	24 Hour Hotline		**800/424-8802**			
State (NDEQ) Spill Hotline	24 Hour Hotline					
Poison Control			**800/955-9119**			
Water System Operators/Managers						

B. State and Local Agencies Notification List

			Phone Numbers (include area code)			
Organization	**Contact Name**	**Title**	**Day**	**Evening**	**Cellular/Pager**	**E-Mail**
HHS-R&L Lincoln Office	Doug Woodbeck	Program Manager		402/471-0521		doug.woodbeck@hhss.ne.gov
	Randy Fischer	Water Security Coordinator	402/471-1007	402/416-2558	402/416-2558	randy.fischer@hhss.ne.gov
Local County Health Department						
Nebraska Department of Environmental Quality	Regional Office					
	24 Hour Spill Hotline					
State Emergency Management Office				**402/471-7425 – 24 Hour**		
County Emergency Management Office						
Nebraska Rural Water Association						

C. Local Contact Notification List

			Phone Numbers (include area code)			
Organization	**Contact Name**	**Title**	**Day**	**Evening**	**Cellular/Pager**	**E-Mail**
Government Officials						
Hospitals						
Pharmacy						

Priority Water Users (Those that are critically dependent upon water including schools, nursing homes, dialysis centers, institutions, individuals, businesses, interconnected water systems, etc.)						
Others						

D. Chemical Supplier Information

Chemical	Supplier	Contact Name	Phone Numbers (include area code)			E-Mail
			Day	Evening	Cellular/Pager	
Gas Chlorine	Hawkins	Jason – Chip	402-420-0755			
Liquid Chlorine	Hawkins	Jason – Chip	402-420-0755			
Potassium Permanganate	Hawkins	Jason – Chip	402-420-0755			
Polymer	Hawkins	Jason – Chip	402-420-0755			

E. System Equipment Repair and Supplies Contact Information

Organization	Contact Name	Title	Phone Numbers (include area code)			E-Mail
			Day	Evening	Cellular/Pager	
Electrician						
Plumber	Keith Pribyl		402-826-2818			
Pump Specialist	Dan Freese/Layne Western	Technician	308-234-1914	308-237-7569		
Soil Excavator/Backhoe Operator	Keith Pribyl		402-826-2818			
Equipment Rental (Power Generators)						

Equipment Rental (Chlorinators)						
Equipment Repairman						
SCADA Repair Service						
Pump Supplier	Layne Western		308-234-1914			
Well Driller	Sargent Drilling		402-759-3902			
Pipe Supplier	Utility Equipment		800-362-5412			
Local/Regional Analytical Laboratory	NE Department of Health & Human Ser.		402-471-2122			
Elevated Storage						

F. Utilities Contact Information

			Phone Numbers (include area code)			
Organization	**Contact Name**	**Title**	**Day**	**Evening**	**Cellular/Pager**	**E-Mail**
Electric Utility Company	City of Crete Tom Ourada	Director	402-826-4312	402-826-4312	402-826-9758	tourada@crete-ne.gov
Gas Utility Company	Aquila		800-303-0752	800-303-0752		
Sewer Utility Company	City of Crete Tom Ourada	Director	402-826-4312	402-826-4312	402-826-9758	tourada@crete-ne.gov
Telephone Utility Company	Altell		800-501-1754			
Diggers Hotline, UFPO or local equivalent			800-331-5666			

G. Bulk Water Suppliers

			Phone Numbers (include area code)			
Organization	**Contact Name**	**Title**	**Day**	**Evening**	**Cellular/Pager**	**E-Mail**
Bulk Water Hauler						
Bottle Water Source						

H. Media Notification List

Organization	Contact Name	Title	Day	Evening	Cellular/Pager	E-Mail
Designated Water System Spokesperson	Tom Ourada	Director	402-826-4312	402-826-4312	402-826-9758	tourada@crete-ne.gov
Newspaper - Local	The Crete News		402-826-2147			
Newspaper – Regional State	Lincoln Journal Star		402-475-4200			
Radio						
Television						
Other						

Section IV – Consumer Notification

The City of Crete must make public notification when a condition exists which according to HHS-R&L constitutes a public health hazard. The must also notify the chief administrative/elected official ( ) where the public water system is located and the local law enforcement department having jurisdiction ( ).

Consumers will be notified as soon as possible of any emergency that potentially affects them. The public will be notified of emergencies that pose an immediate threat to health or safety through media outlets such as television, radio, and newspapers. In addition, emergency notices will be posted in the following public places: . Critical users will be notified directly, if necessary. These are customers of the system who could be severely impacted immediately by a water system disruption, including schools, institutions, senior citizens complexes, water-dependent businesses, interconnected water systems, medical and dental clinics, restaurants, and individuals with home dialysis machines or other life support devices sensitive to water quality changes.

Examples of some public notifications follow:

DRINKING WATER WARNING:
water has high levels of nitrate

DO NOT GIVE THE WATER TO INFANTS UNDER 6 MONTHS OLD OR USE IT TO MAKE INFANT FORMULA

Water sample results received [date] showed nitrate levels of [level and units]. This is above the nitrate standard, or maximum contaminant level (MCL), of [state/federal MCL]. Nitrate in drinking water is a serious health concern for infants less than six months old; this includes pregnant women and nursing mothers because of the transfer of nitrate to the fetus or baby through the mothers milk or blood.

What should I do?

- **DO NOT GIVE THE WATER TO INFANTS.** ***Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue baby syndrome.*** Blue baby syndrome is indicated by blueness of the skin. Symptoms in infants can develop rapidly, with health deteriorating over a period of days. If symptoms occur, seek medical attention immediately.

- Water, juice, and formula for children under six months of age should not be prepared with tap water. Bottled water or other water low in nitrates should be used for infants until further notice.

- **DO NOT BOIL THE WATER.** Boiling, freezing, filtering, or letting water stand does not reduce the nitrate level. Excessive boiling can make the nitrates more concentrated, because nitrates remain behind when the water evaporates.

- Adults and children older than six months can drink the tap water (nitrate is a concern for infants because they can't process nitrates in the same way adults can). However, if you are pregnant or have specific health concerns, you may wish to consult your doctor.

What happened? What is being done?

Nitrate in drinking water can come from natural, industrial, or agricultural sources (including septic systems and run-off). Levels of nitrate in drinking water can vary throughout the year. We'll let you know when the amount of nitrate is again below the limit.

Describe corrective action, seasonal fluctuations, and when system expects to return to compliance.

For more information, please contact at or .

This notice is being sent to you by , State Water System ID#:
Date distributed:

DRINKING WATER WARNING:

water is contaminated with
fecal coliform or *E. coli* bacteria

BOIL YOUR WATER BEFORE USING

Fecal coliform or E. coli bacteria were found in the water supply on . These bacteria can make you sick, and are a particular concern for people with weakened immune systems.

What should I do?

- **DO NOT DRINK THE WATER WITHOUT BOILING IT FIRST.** Bring all water to a rolling boil and let it boil for at least one minute then let it cool before using; or use bottled water. Boiled or bottled water should be used for drinking, making ice, brushing teeth, washing dishes, and food preparation **until further notice**. Boiling kills bacteria and other organisms in the water.

- *Fecal coliform or E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, some of the elderly, and people with severely compromised immune systems.*

- The symptoms above are not caused only by organisms in drinking water. If you experience any of these symptoms and they persist, you may want to seek medical advice. People at increased risk should seek advice about drinking water from their health care providers.

What happened? What is being done?

Bacterial contamination can occur when increased run-off enters the drinking water source (for example, following heavy rains). It can also happen due to a break in the distribution system (pipes) or a failure in the water treatment process.

Describe corrective action. We will inform you when tests show no bacteria and you no longer need to boil your water. We anticipate resolving the problem within [estimated time frame].

For more information, please contact at or . General guidelines on ways to lessen the risk of infection by microbes are available from the EPA Safe Drinking Water Hotline at 1 (800) 426-4791.

This notice is being sent to you by , State Water System ID#: .
Date distributed: .

DRINKING WATER WARNING:

BOIL YOUR WATER BEFORE USING

Disease-causing organisms have entered water supply.

These organisms are causing illness in people served by . We learned of a waterborne disease outbreak from on .

What should I do?

- **DO NOT DRINK THE WATER WITHOUT BOILING IT FIRST.** Bring all water to a rolling boil and let it boil for at least one minute then let it cool before using; or use bottled water. Boiled or bottled water should be used for drinking, making ice, brushing teeth, washing dishes, and food preparation until further notice. Boiling kills bacteria and other organisms in the water.

- [Describe symptoms of the waterborne disease.] If you experience one or more of these symptoms and they persist, contact your doctor. People with severely compromised immune systems, infants, and some elderly may be at increased risk. These people should seek advice about drinking water from their health care providers.

What happened? What is being done?

Describe the outbreak, corrective action, and when the outbreak might end.

We will inform you when you no longer need to boil your water.

For more information, please contact at or . General guidelines on ways to lessen the risk of infection by microbes are available from the EPA Safe Drinking Water Hotline at 1 (800) 426-4791.

This notice is being sent to you by , State Water System ID# .
Date distributed: .

DRINKING WATER WARNING:

has high turbidity levels

BOIL YOUR WATER BEFORE USING

The (PWS Name) routinely monitors your water for turbidity (cloudiness). This tells us whether we are effectively filtering the water supply. A water sample taken showed turbidity levels of [number] turbidity units. This is above the standard of turbidity units. Because of these high levels of turbidity, there is an increased chance that the water may contain disease-causing organisms.

What should I do?

- **DO NOT DRINK THE WATER WITHOUT BOILING IT FIRST.** Bring all water to a rolling boil and let it boil for at least one minute then let it cool before using; or use bottled water. Boiled or bottled water should be used for drinking, making ice, washing dishes, brushing teeth, and food preparation until further notice.

- *Turbidity has no health effects. However, turbidity can interfere with disinfection and provide a medium for microbial growth. Turbidity may indicate the presence of disease causing organisms. These organisms include bacteria, viruses, and parasites, which can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.* People with severely compromised immune systems, infants, and some elderly may be at increased risk. These people should seek advice about drinking water from their health care providers.

- The symptoms above are not caused only by organisms in drinking water. If you experience any of these symptoms and they persist, you may want to seek medical advice.

What happened? What is being done?

Describe reason for the high turbidity, corrective action, and when the system expects to return to compliance.

We will inform you when turbidity returns to appropriate levels and when you no longer need to boil your water.

For more information, please contact at or . General guidelines on ways to lessen the risk of infection by microbes are available from the EPA Safe Drinking Water Hotline at 1 (800) 426-4791.

This notice is being sent to you by , State Water System ID#: .
Date distributed: .

DRINKING WATER PROBLEM CORRECTED

Customers of were notified on of a problem with our drinking water and were advised to describe recommended action. We are pleased to report that the problem has been corrected and that it is no longer necessary to describe recommended action. We apologize for any inconvenience and thank you for your patience.

Add further details here when appropriate.

As always, you may contact at or with any comments or questions.

This notice is being sent to you by , State Water System ID#:

Date distributed:

Section V - Emergency Water Use Restrictions

1. Explanation and Authority

During periods of a drought, a major leak, a system failure, or excessive consumption beyond the capacity of the system, etc., the has the capability to conserve and restrict water use based upon the local water system regulations found in . During times of drought or other problems that limit the availability of water, public notice of water use restrictions will be issued by: .

2. Restriction Stages

Following are the levels or stages of restrictions that will be applied, the conditions that generally will trigger them, and the types of restrictions that are applied. The conditions that trigger various restriction stages could be based upon critical source water levels and other conditions such as imminent loss of water or pressure.

Restriction Stage	Stage Trigger(s)	Restrictions
I		
II		
III		

Section VI – Communications

1. **In the event of an emergency, the primary line of communication will be (check one):**

   - ☐ Telephone;
   - ☐ Cellular Phone;
   - ☒ Radio System;
   - ☐ Other:

2. **If the primary line of communication is not functional, the back-up line of communication will be (check one):**

   - ☐ Telephone;
   - ☒ Cellular Phone;
   - ☐ Radio System;
   - ☐ Other:

3. **Other lines of communication include:**

4. **Phone Service Emergency Provisions:**

   In the event that the phone lines are not functioning, the phone company will be informed. The operator in charge will also inquire how long the facility will be without phone service.

5. **Specific Communication Instructions:**

Additional Instructions:

1. Communication Log

COMMUNICATION LOG			
Date	Time	Request	Action Taken

Section VII – Assessment of Available Equipment

1. Emergency Communications Equipment
   A. CB Radios

Number of Radios:	
Location(s) of Radios:	

B. Cellular Phones

Number of Cellular Phones:	1
Location(s) of Cellular Phones:	Employee on call

C. Pagers

Number of Pagers:	
Location(s) of Pagers:	

D. Other Communication Equipment Available

Hand radios

2. Emergency Water Supply Equipment

A. Bulk Water Supply Truck
Contact for truck:

Location(s) that truck(s) will be
Set up during an emergency:

B. Other Emergency Water Supply Equipment

Item	Location	Contact

C. Parts Available for Emergency Interconnections

Item	Location	Contact

3. Power Supply Equipment

A. Power Sources

Primary Power Source: _____

Alternate Power Sources: _____

Location of Fuel: _____

B. Generators

Make/Model	Phase/ Voltage/ Amps	Contact Individual	Phone No.	Location of Storage	Location of Use

4. Vehicles and Construction Equipment

A. Pickup Trucks, Vans, and other Vehicles

Make and Model	4x4? Yes	4x4? No	Owner	Phone Number	Location of Vehicle and Keys
1 ton Ford Pickup	☒	☐	City of Crete	402-826-4312	320 W. 9th, Public Works Service Center
¾ Ton Ford Pickup	☐	☒	City of Crete	402-826-4312	320 W. 9th, Public Works Service Center
½ Ton Ford Pickup	☐	☒	City of Crete	402-826-4312	320 W. 9th, Public Works Service Center
Ford Van	☐	☒	City of Crete	402-826-4312	320 W. 9th, Public Works Service Center

Sunkens S10 Pickup X Not

B. Dump Trucks

3/4 ton Ford X Four wh

Make and Model	Capacity (tons)	Owner	Phone Number	Location of Vehicle and Keys
International		City of Crete	402-826-4312	320 W. 9th, Public Works Service Center

C. Construction Equipment

Item (include make/model)	Owner	Phone Number	Location of Item
Case Backhoe	City of Crete	402-826-4312	320 W. 9th, Public Works Service Center
2 – Bobcat Skid Loaders w/pavement breaker	City of Crete	402-826-4312	320 W. 9th, Public Works Service Center
Lerol Air Compressor	City of Crete	402-826-4312	320 W. 9th, Public Works Service Center
Jack hammers/tampers	City of Crete	402-826-4312	320 W. 9th, Public Works Service Center
Trencher			

5. **Spare Parts for Water Source**

   A. **Spare Pump(s)**

Pump Type	Manufacturer	H.P.	Capacity (gpm)	Phase, Voltage

   B. **List of Spare Parts for Pump(s) and Well(s)**

Part	Location

6. **Spare Parts for the Distribution System**

   A. **List of Spare Piping**

Part	Location
2" thru 14" PVC	240 W. 9th, Public Works Storage Facility
4" thru 12" Cast	Recycling storage area

   B. **List of Spare Valves**

Part	Location

2" thru 14"	320 W. 9th, Public Works Service Center
Cut-In Valves	320 W. 9th, Public Works Service Center
4" & 6" Hydrant valves	320 W. 9th, Public Works Service Center

C. **Other Parts Available (Distribution System)**

Part	Location
Hydrants & Parts	320 W. 9th, Public Works Service Center
Repair Clamps/Couplings	320 W. 9th, Public Works Service Center
MJ/Flg fittings	320 W. 9th, Public Works Service Center
Service connection parts	320 W. 9th, Public Works Service Center

7. **Spare Parts for Treatment**

A. **Spare Chemical Feed Pump(s)**

Manufacturer	Model	Location of Spare

List Spare Parts for Feed Pump:	Location:
Diaphragm repair kits	Treatment plant

B. **Reserve Chemicals**

Location of reserve supply of chemicals: _____

8. **Miscellaneous Parts for the System**

   A. **Additional Parts Not Listed Above**

Part:	Location:

Section VIII – Recovery

Returning to normal operations is vital to rapid restoration of clean, safe water to the community and is essential to the assessment and recovery process. The following is a checklist of actions to be taken during the recovery period. A copy of this checklist will be kept for each water supply emergency event. Also included is a preliminary damage assessment to be used in the recovery process.

1. Assessment and Recovery Period Checklist

- ☐ Perform in-depth damage assessment of system to determine long-term effects of damaged areas (use assessment form below). Prepare a preliminary damage report.
- ☐ Notify your local health department and HHS-R&L of system status and situation.
- ☐ Will there be a need to use mutual aid agreements and/or implement standby contracts or other emergency agreements for equipment and operations?
- ☐ Prepare written documentation of emergency work performed for possible compensation by emergency agencies. Make sure that crews make a record of work effort, written logs (see Work Order Log) and take pictures. This will all be helpful in recovery of funds.
- ☐ After completion of emergency repairs, rest the crews and return, if possible, to more normal work schedules.
- ☐ Notify appropriate insurance carriers. Provide written and photo documentation of damage.
- ☐ Assist in the survey of emergency repairs and scheduling of permanent repairs.
- ☐ Assist in the inventory of repair supplies and replacement stock.
- ☐ Servicing of emergency equipment, when able (oil changes, lubrication, etc.).
- ☐ Make sure the public is kept informed throughout the extent of the emergency.

2. Preliminary Damage Assessment

Following the Damage Assessment notify HHS-R&L of the findings.

General Overview:

- ☐ Determine need to repair, replace, or abandon facilities
- ☐ Evacuate buildings in danger of collapse
- ☐ Estimate cost to repair damage

Treatment Plants:

- ☐ Check if power is available and condition of mechanical and electrical equipment
- ☐ Check for chemical spills or releases

Confirm that field crew does the following:

- ☐ Check for structural damage
- ☐ Closes and tags damaged facilities; and equipment

Tanks:

- ☐ Check for evidence of failure of subbase

Reservoirs: Check for:

- ☐ Leaks
- ☐ Seepage
- ☐ Landslides
- ☐ Embankment slump
- ☐ Cracks
- ☐ Broken inlet/outlet pipes, underdrains
- ☐ Check for buckling

Distribution System: Check for:

- ☐ Leaks
- ☐ Pressure loss in lines
- ☐ Check mechanical couplings
- ☐ Breaks
- ☐ Cross-connections
- ☐ Lower water levels to reduce possibility of structural damage

Wells:

- ☐ Check for physical damage to facilities
- ☐ Name, address, phone # for private lab
- ☐ Check power source
- ☐ Test for contamination
- ☐ Check for pump or motor failure

Section IX – Evaluation

At the conclusion of the water supply emergency event, the Public Works Department will assemble and prepare an after-event evaluation report. This report assesses the actions and responses to an emergency. A sample form for this evaluation report follows:

1. Evaluation Report Form

A. Introduction
i. Emergency Declaration
ii. Purpose of Report
iii. Emergency Mitigation Planning
iv. History

B. Description of Emergency
i. Geography
ii. Chronology
iii. Damages and Impact
iv. Statistics

C. Recommendations
i. Issue
ii. Background
iii. Recommendation
iv. Lead
v. Support
vi. Funding
vii. Schedule

D. Appendices
i. Maps
ii. List of Participants

LOCAL EMERGENCY PHONE CONTACT LIST

To be updated annually and a copy submitted to HHSS-R&L. **System retains original for records**

NAME OF SYSTEM: City of Crete **ID#:** NE31-15104

System Phone Number: (402) 826-4312 Fax: (402) 826-4334 E-mail: tourada@crete-ne.com

If System purchases Water from another System: **Name of supplier:** N/A

Supplier Phone Number: _____ **Fax:** _____ **Alternate:** _____

System's Designated Operator in Charge: Tim Coffey Home: (402) 826-4509

Back-up Operator(s): Kevin Sunken (402) 826-5443 Ken Brown (402) 826-2698
Gary Henning Home: (402) 826-4045

HHSS-R&L Field Rep: Robert Byrkit Phone: (402) 471-0517 Cell: (402) 432-4831

HHSS-R&L (Lincoln): Doug Woodbeck, Program Manager, Field Services Phone: (402) 471-0521
Howard Isaacs, Program Manager, Monitoring & Compliance Phone: (402) 471-0930
Jack Daniel, Administrator, Drinking Water Program Phone: (402) 471-0510

Mayor or Board Chairperson: Judy Henning Phone: (402) 826-4314

City Administrator or Manager: _____ Phone: _____

City/Village Clerk: Gary Yank Phone: (402) 826-4313

Public Works Director: Tom Ourada Phone: (402) 826-4312

Engineer: Gilmore & Associates Phone: (402) 564-2807

Police Chief: Steve Hensel Phone: (402) 826-4311

Fire Chief: Mahlon Kohl Phone: (402) 826-2021

Local Health Department or Official: Dr. Robert Quick Phone: (402) 826-2102

Local Civil Defense or Emergency Response Office: Arthur Henning Jr. Phone: (402) 826-2936

Served by American Red Cross Chapter Phone: (402) 826-5575

Electric Utility: City of Crete Phone: (402) 826-4312

Gas Utility: Aquila Phone: 800 303-0752

School Superintendent: John Fero Phone: (402) 826-5855

Schools, Colleges and Universities served by System: Crete Public Elementary School, Crete Public Middle School, Crete High School, St. James School, & Doane College

EMERGENCY CONTACTS

Nebraska Rural Water Association: Main Office: Wahoo Nebraska Phone: (402) 443-5216
Randy Hellbusch Cell Phone #: (402) 443-8535
Russ Top Cell Phone #: (402) 480-4196
Barney Whatley Cell Phone #: (402) 480-2982
NE League of Municipalities, Utilities Section Phone: (402) 476-2829
Midwest Assistance Program: Art May, Walthill Ne. Phone: (402) 846-5123
Tim Rutledge, Humboldt NE. Phone: (402) 862-3227 Cell: (402) 239-8392
Mike Boyd, Gering, Ne. Phone: (308) 436-2700

(CONTINUED ON REVERSE)

Well Driller or Company: Sargent Drilling Phone: (402) 759-3902

County (s) served by PWS: Saline

Sheriff: Alan Moore Phone: (402) 821-2111

County Board Chairperson: Willis Luedke Phone: (402) 826-2544

SYSTEM INFORMATION

Is System Metered: Y X N _____ Other: _____

Total Service Connections: 2,281 Residential: 2,000 Commercial: 254 Industrial: 25

Physical Address of Treatment Plant: 2031 E. 13th & 220 E. 15th

Physical Address or Location of Wells: (Well ID #, 911 or physical address) #1- 1810 Kingwood, #3- 160 W. 5th, #4- 240 W. 24th, #5- 1711 E. 13th, #6- 1440 Linden, #7- 1480 W. 10th

Average Daily Production: 842,000 GPD

Total Design Capacity: 4 GPD

Total Emergency Capacity: 1.612 #4 well GPD

Total Yearly Production: 376 MG

Average Summer Daily Demand 1.115 MGD

Peak Daily Demand: 2.0 MGD

Average Winter Daily Demand .634 MGD

System Total Storage Capacity: 2 MG

Storage Facilities: Local Name	Capacity		Address / Location
Water Reservoir	1	MG	2015 E. 13th
Water Tower	1	MG	2900 E. 29th
		MG	
		MG	
		MG	
		MG	

Total Number of Wells: 6 Range of Production: 220 gpm to 1100 gpm

Number of Wells on Active Status: 5 Inactive: _____ Emergency: 1

Other Information:

Submitted By: Tmi Coffey Title: Water Supt. Date: 3-15-05

APPENDIX E: DOCUMENTATION OF PUBLIC INVOLVEMENT

Meeting Sign-In Sheets

- Stakeholder Meeting #1 – June 18, 2013
- Stakeholder Meeting #2 – September 18, 2013
- Public Open House – October 16, 2013

Public Open House Press Release

Public Open House Invitational Postcard

Public Comment Form

- Blank Public Comment Form from Public Open House

Public Open House Poster Boards

- Displayed as 30x40 inch poster boards

Project Fact Sheet

Public Input/Adoption Process Materials

- Affidavit of Newspaper Publication
- Affidavit of Public Posting
- Minutes from Public Comments and Adoption Meeting

TO BE INSERTED AFTER ADOPTION

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City of Crete, NE – Wellhead Protection Plan
"Stakeholder Meeting #1"
Crete, NE – Tuesday, June 17, 2013; 11:30 AM
PLEASE PRINT CLEARLY- THANK YOU!

NAME	TITLE	JURISDICTION Represented	ADDRESS Street #, Street Name, City, Zip	PHONE	EMAIL
Tom Ourada	City Administrator	City	243 E. 13th	402 826-4312 402 826-9758	tourada@crete-ne.gov
TRAVIS SEARS	CITY COUNCIL	CITY	150 CEDAR RD, CRETE	402 440 1026	travis.sears@ubt.com
Ryan Jindra	President Jindra Irrigation	City	737 Co. Rd. Crete, NE	402-450-9939	jindrairrigation@windstream.net
Adam Rupe	Environmental Planner	JEO	Lincoln, NE	402.322.0377	arupe@jeo.com
Heather Tomasek	Landscape Arch. Intern	City	243 E. 13th		htomasek@crete-ne.gov
AARON KLUTE	PLANNING INTERN	City			aklute@crete-ne.gov.
Tim Coffey	City of Crete-water	City	243 E. 13th	402-418-2802	tcoffey@crete-ne.gov.
Brian Hasner	Asst Director of Facilities	City / Doane	104 Boswell Ave	402-826-8218	brian.hasner@doane.edu
Ray Sueper	Building Inspector	City of Crete	243 E. 13TH	402-826-4312	rsueper@crete-ne.gov
Marvin Kohout	Saline County Commissioner	Saline County	1214 State Hwy 15 Dorchester	402-946-6531	makohout@hotmail.com
SCOTT SOBOTKA (VIA CONFERENCE CALL)	LOWER BIG BLUE NRD	ASST. MANAGER	805 DORSEY ST BEATRICE, NE 68310	402 806 1431	SOBOTKA@LBBNRD.NET

Please Sign In!

City of Crete, NE – Wellhead Protection Plan
"Stakeholder Meeting #2"
Crete, NE – Thursday September 19, 2013; 10:0 AM
PLEASE PRINT CLEARLY- THANK YOU!

NAME	TITLE	JURISDICTION Represented	ADDRESS Street #, Street Name, City, Zip	PHONE	EMAIL
MARC ROSSO	PROJECT MGR	JEO			
TRAVIS SEARS	CITY COUNCIL	CRETE			
Ryan Jindra	Jindra Irrigation Owner	Crete			
Adam Rupe	Natural Resource Specialist	JEO			
Marvin Kohout	~~Saline County~~ Comm.	Saline Co.			
Ray [illegible]	Building Inspector	Crete			
[illegible]	Assistant Manager	LBBNRD.			
Tom Ourada	City Admin	City			

Please Sign In!

City of Crete, NE – Wellhead Protection Plan
"Public Open House"
Crete, NE – Wednesday October 16, 2013; 5:30 PM
PLEASE PRINT CLEARLY- THANK YOU!

	NAME	TITLE	JURISDICTION Represented	ADDRESS Street #, Street Name, City, Zip	PHONE	EMAIL
1	Tom Jurcek	retired	Crete	215 Ivy Crete 68333	402-826-2305	
2	Randy Pryor	UNL Extension		306 w 3rd Wilber	402-821-2151	Randy.Pryor@unl.edu
3	Adam Rupe	Env. Scientist	JEO	Lincoln, NE	402.474.8742	arupe@jeo.com
4	Scott Sobotka		LBBNRD	P.O. Box 826 Beatrice	402-228-3402	sobotka@lbbnrd.net
5	Willis Luedke	Commissioner	Saline County	130 Lakeview Crete	402-826-9341	Wluedke@windstream.net
6	Judy Henning			335 Norman Crete	402 826 2936	jhenning335@gmail.com
7	Ray Sueper	Building Inspector	City of Crete	243 E. 13th "	402-826-4312	RSueper@crete-ne.gov
8	Mike Stehl	Farmer		2265 C.Rd H CRETE	402-826-5292	
9	Tom Ourada	City	City	243 E. 13th Crete	402 826 9758	tourada@crete-ne.gov
10	Chuck Herndon	Retired	Crete	835 Ivy	402-826-3161	
11	Jack Oelschlager	City Council	Crete	1445 E 16th	402 826 4184	
12	Alan Wanek	Resident	Crete	2000 E. 13th	402-826-8026	
13						
14						
15						
16						
17						
18						
19						
20						
21						

Please Sign In!

CRETE WELLHEAD PROTECTION PLANNING OPEN HOUSE PRESS RELEASE

CONTACT:
Tom Ourada
City Administrator
City of Crete
(402) 826-4312
tourada@crete-ne.gov

THE CITY OF CRETE INVITES CITIZENS TO TAKE PART IN PLANNING FOR THE COMMUNITY'S WELLHEAD PROTECTION AREA

October 4, 2013

Crete is pleased to announce an open house to present the DRAFT of the Wellhead Protection Plan (WHPP). The City's selected firm, JEO Consulting Group, Inc. will be discussing the Plan at an informal meeting from 5:30pm to 7:30pm on October 16, 2013 at the Community Center located at 1410 Main Street in Crete.

Crete is taking a proactive approach to protecting our water supply by using detailed groundwater modeling software to show how groundwater travels under Crete, and through its well field. The model is able to predict contaminant travel should any contaminant reach our groundwater supply. Crete is taking a long term view of protecting our groundwater by studying the 50 year "time-of-travel" paths for the City's wells. This 50 year time-of-travel forms the basis for the delineating the Wellhead Protection Area (WHPA).

The goal of this open house is to get the community involved in the planning process and to learn more about what our citizens think of the Plan. This open house gives contributors a chance to share ideas and learn more about the process of planning for the WHPA. At the open house stakeholders will be able to describe the planning process, which includes:

- Delineation of the WHPA
- Potential Contaminant Source Inventory
- Review of Management Alternatives for Potential Contaminant Sources
- Emergency and Contingency Planning
- Public Education

A brief fact sheet can be found at the City's web site.

FOR IMMEDIATE RELEASE

###

Crete Wellhead Protection Plan

Crete is moving forward and we want your help!

Wellhead Protection Plan

The Wellhead Protection planning process includes identifying the land surrounding the public water supply wells to be protected, identifying potential sources of groundwater contamination within this area, and managing the potential contaminant sources. Emergency, contingency, and long term plans are also developed for the community water supply, all while educating and involving the public.

owner

CRETE

contact
Tom Ourada
City of Crete
PO Box 86
Crete, NE 68333
402.826.4312
tourada@crete-ne.gov

technical assistance

Nebraska Department of Environmental Quality

engineer

JEO CONSULTING GROUP INC

Open House

The City of Crete invites you to attend an open house to learn more about the Wellhead Protection Plan. This is an informal meeting and no presentation is planned. There will be informational stations where you can learn about the elements of a Wellhead Protection Plan and discuss your thoughts on how the City could proceed.

When
October 16, 2013
5:30 to 7:30 pm

Where
Crete Community Center
1410 Main Street
Crete, Nebraska 68333

Light refreshments will be served.

CRETE

City of Crete
PO Box 86
Crete, NE 68333

Presort Std.
U.S. Postage
PAID
Cornerstone

CreteWellhead Protection Plan
"Public Open House"
Crete, NE – Wednesday, October 16, 2013 – 5:30 PM

Input and Comment Form

Your thoughts are important to us. Please take a few minutes to complete.

Please return your comments tonight
or
Return comments to the City by Thursday, October 31st, 2013

Feel free to comment on the following

- The DRAFT Wellhead Protection Plan
- The City's efforts to protect drinking water resources
- If you would like to receive a copy of the DRAFT plan for review
- Any ideas, comments, suggestions for the plan or water conservation

If you would like a personal response, be sure to include your name and how you would like to be contacted by providing your mailing address, phone number, or email address. When you're done, please put it in the "comment box". *Please write clearly.* Thank you!

You can also mail or email your comments by October 31st, 2013, to Tom Ourada at:

City of Crete, 243 East 13th St, Crete, NE 68333
tourada@crete-ne.gov
402.826.4312

Please complete the following if you would like a personal reply (**your information will remain confidential**):

Name_____

Address_____

Phone Number _____Email Address_____

Thank you very much!

1 Welcome to Crete's Wellhead Protection Planning Process

Approved WHP Plans

The Nebraska Department of Environmental Quality I(NDEQ) is the lead agency for Wellhead Protection (WHP) Plan approval under the Nebraska Wellhead Protection Area Act (§46-1501 through 46-1509).

Crete is working on completing a detailed Wellhead Protection Plan. This open house is designed to engage the public in conversation about the Plan.

Please review the materials and stop by each station to learn more!

Wellhead Protection Plan

The Wellhead Protection planning process includes identifying the land surrounding the public water supply wells to be protected, identifying potential sources of groundwater contamination within this area, and managing the potential contaminant sources. Emergency, contingency, and long term plans are also developed for the community water supply, all while educating and involving the public.

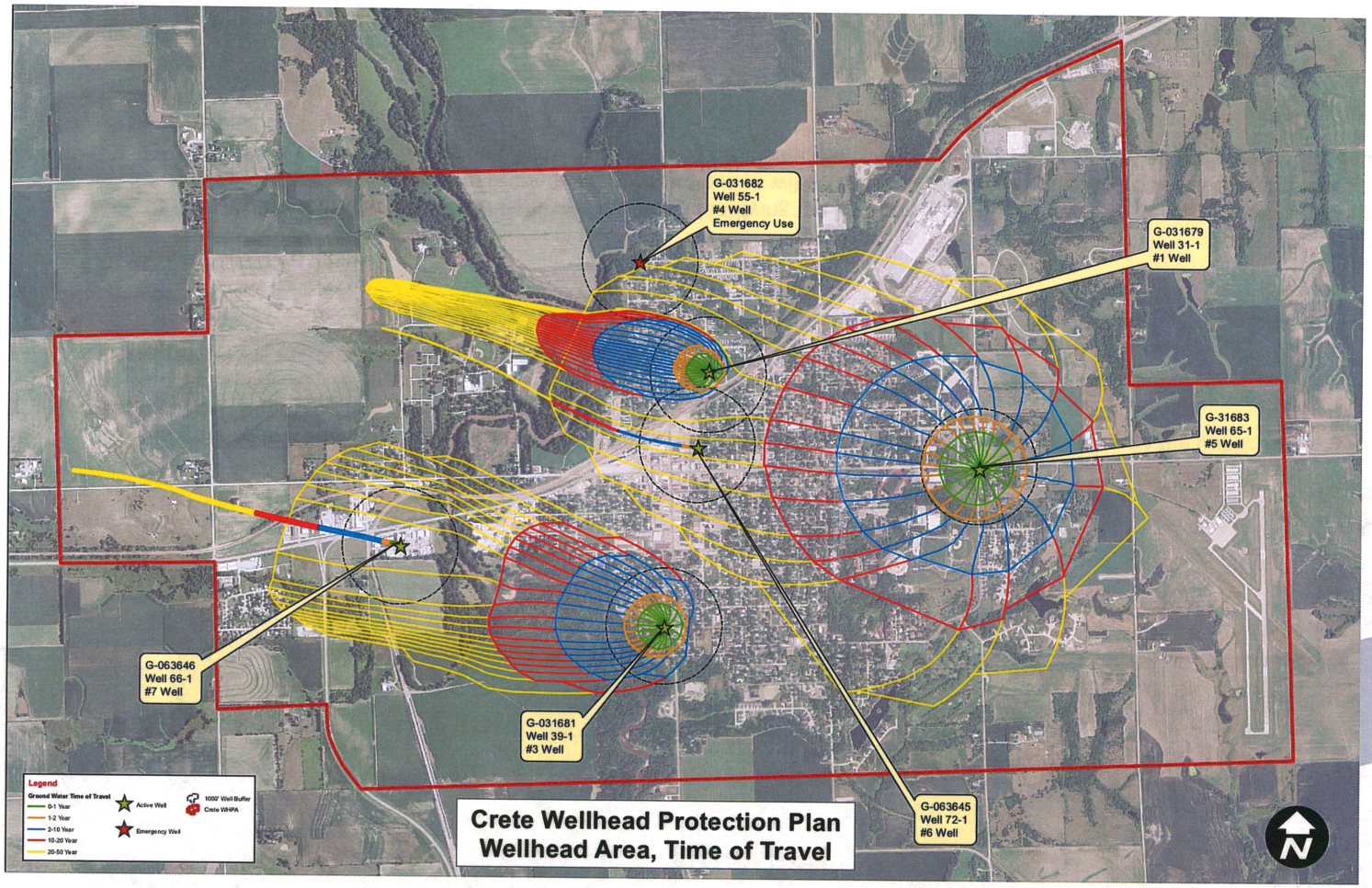


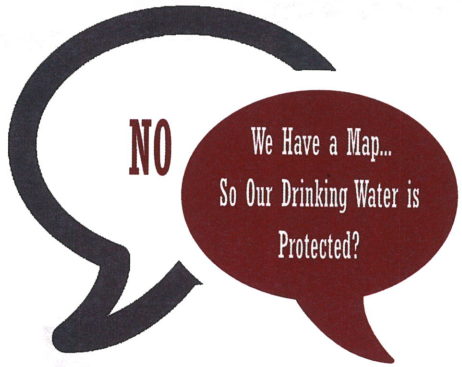
Who's Listening? ... Stakeholder's Are!

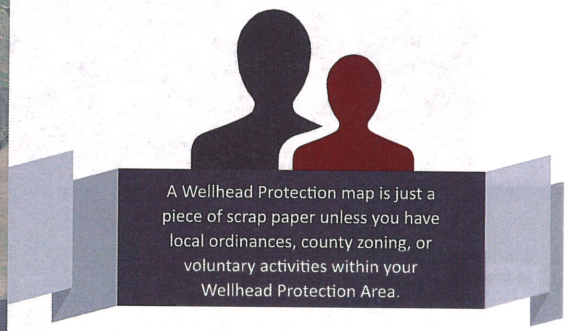
- Tom Ourada | Crete City Administrator
- Tim Coffey | Crete Water
- Ray Sueper | Crete Building and Zoning
- Travis Sears | Crete City Council
- Marvin Kohout | County Commissioner
- Ryan Jindra | Jindra Irrigation
- Brian Flesner | Assistant Director of Facilities, Doane College
- Scott Sobotka | Lower Big Blue NRD
- Marc Rosso, PE | JEO Consulting Group, Inc.

2 Delineating the Wellhead Protection Area

The size of a Wellhead Protection area is calculated from geologic material information and groundwater flow. Computer-generated flow lines depict the approximate path of groundwater, or a contaminant in groundwater, will take to reach a well. Flow lines are then associated with an estimated times-of-travel, and a boundary is drawn enclosing all 20-year-flow lines. Crete is taking a proactive approach by using the 50-year time-of-travel.







3 Contaminant Source Management

Management of a groundwater supply by local communities can involve a number of possible practices. Best Management Practices are encouraged throughout the Wellhead Protection Area.

May Include

- Enactment of sanitary and water ordinances
- Public nuisance laws
- Zoning restrictions on specific land uses
- Purchase of land or conservation easements
- Cooperative efforts with the NRD
- Voluntary landowner actions

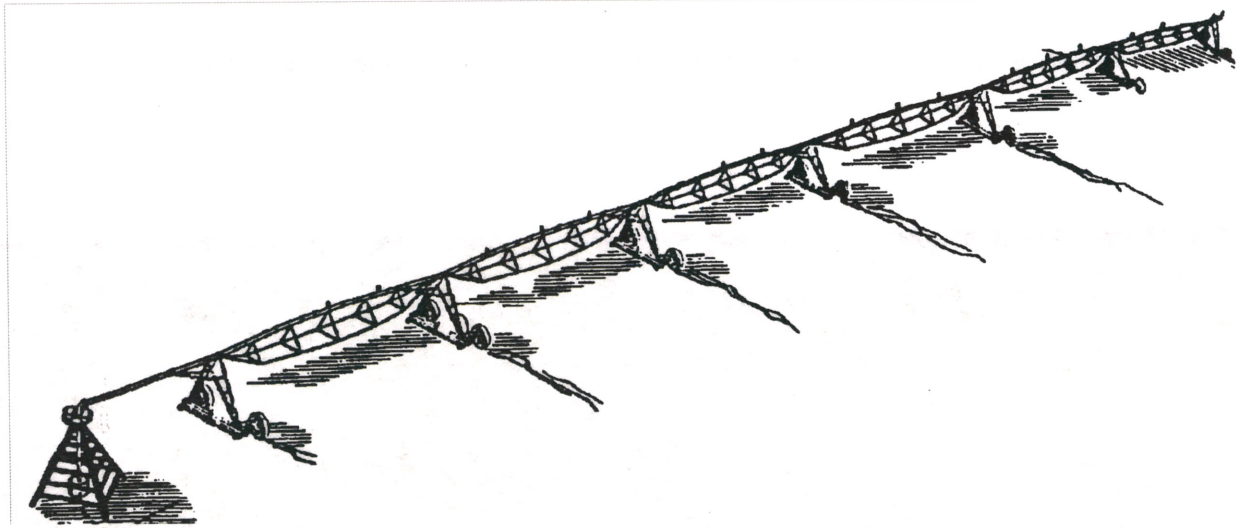
Example Best Management Practices in Urban Settings

- Alternative lawn options
- Improving soil structure
- Installing water meters
- Low flow nozzles
- Mulching lawn clippings
- Permeable pavement
- Rain barrels/rain gardens
- Rain sensors for lawn irrigation

Example Best Management Practices in Ag Settings

- Alternative cropping methods
- Conservation reserve program
- No-till cultivation
- Nutrient management program
- Strip cropping
- Terracing
- Water management program
- Split Application Fertilizer





4 Potential Contaminant Source Inventory

The purpose of a potential contaminant source inventory is to identify sources of potential contaminants that may pollute groundwater. The inventory was compiled from existing databases and on-the-ground observations.

Databases Used

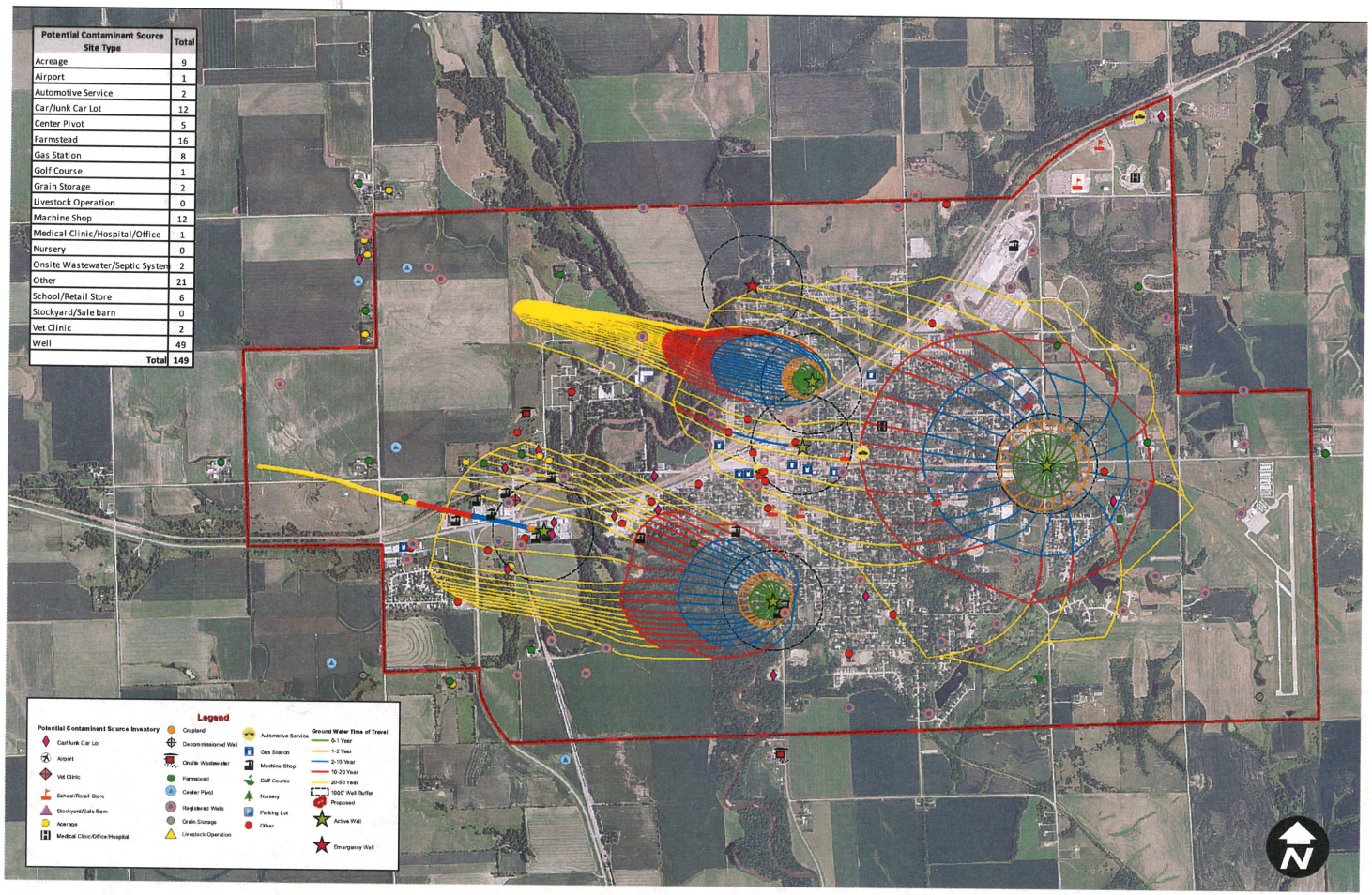
- NDEQ - regulated facilities
- NDNR - water wells
- State Fire Marshal's Office - flammable & hazardous waste storage
- NRDs - abandoned wells
- NE Oil & Gas Conservation Commission - oil & gas wells
- NE Department of Ag - ag chemical storage/manufacturer

Common Potential Contaminants *

- Agriculture
  - Fuel Storage
  - Grain Storage
  - Water Well
  - Chemigation
  - Livestock
- Commercial/Light Industry
  - Auto Repair
  - Dry Cleaners
  - Fuel Stations
  - Machine Shop
  - Rail Yard
- Industry
  - Manufacturing
  - Gas/Oil Well
  - Junk Yard
  - Landfill
  - Sewage Treatment
- Other
  - Cemetery
  - Golf Course
  - HWY Maintenance Yard
  - Transportation Corridors

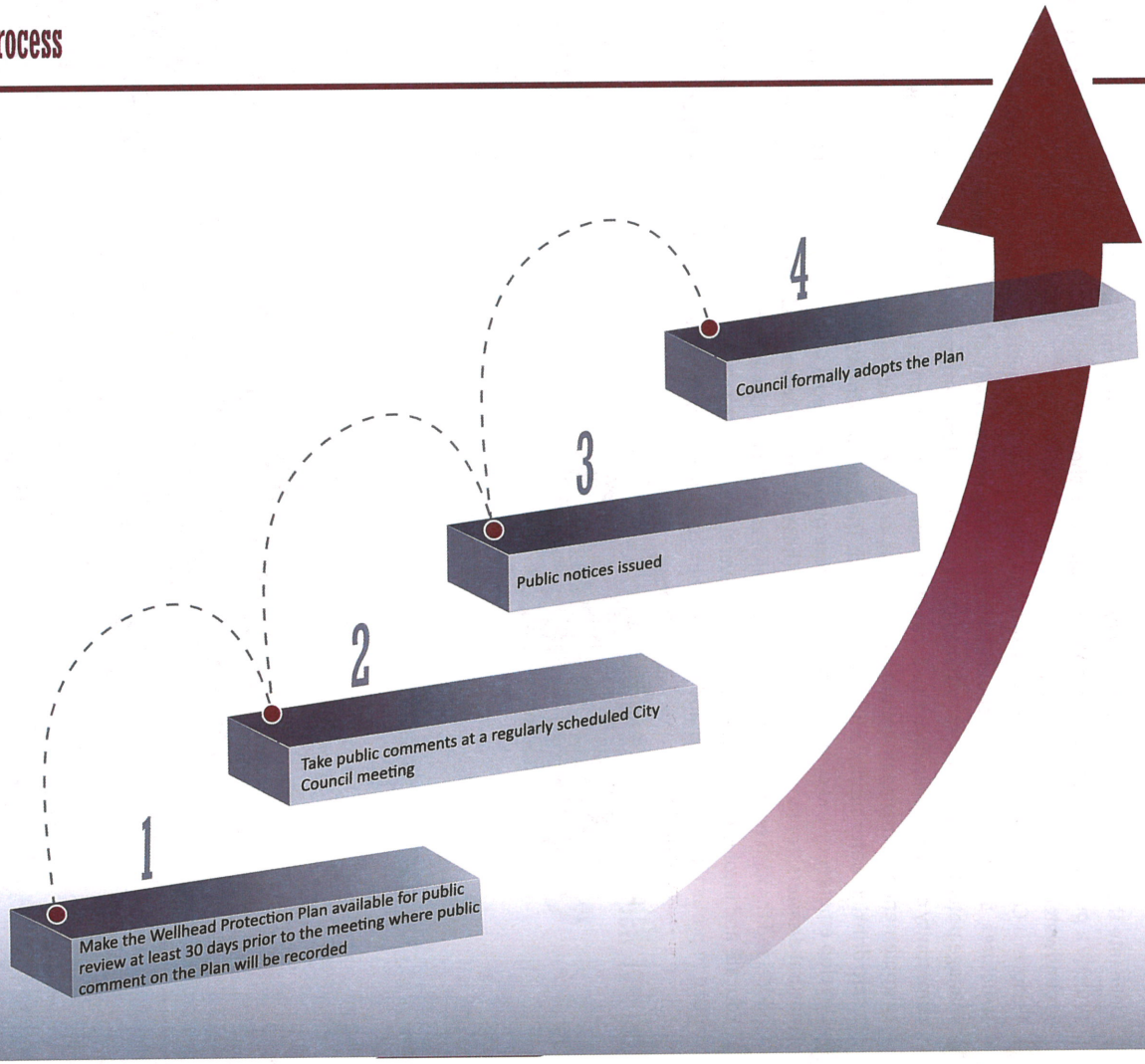
** This list is not all encompassing.*

Potential Contaminant Source Site Type	Total
Acreage	9
Airport	1
Automotive Service	2
Car/Junk Car Lot	12
Center Pivot	5
Farmstead	16
Gas Station	8
Golf Course	1
Grain Storage	2
Livestock Operation	0
Machine Shop	12
Medical Clinic/Hospital/Office	1
Nursery	0
Onsite Wastewater/Septic System	2
Other	21
School/Retail Store	6
Stockyard/Sale barn	0
Vet Clinic	2
Well	49
Total	149



5 Next Steps

Approval Process





Nebraska's Wellhead Protection Program Summary

Wellhead protection area is the surface and subsurface area surrounding a community drinking water well or well field, through which contaminants are reasonably likely to move toward and reach such water well or well field.

Nebraska's Wellhead Protection Program

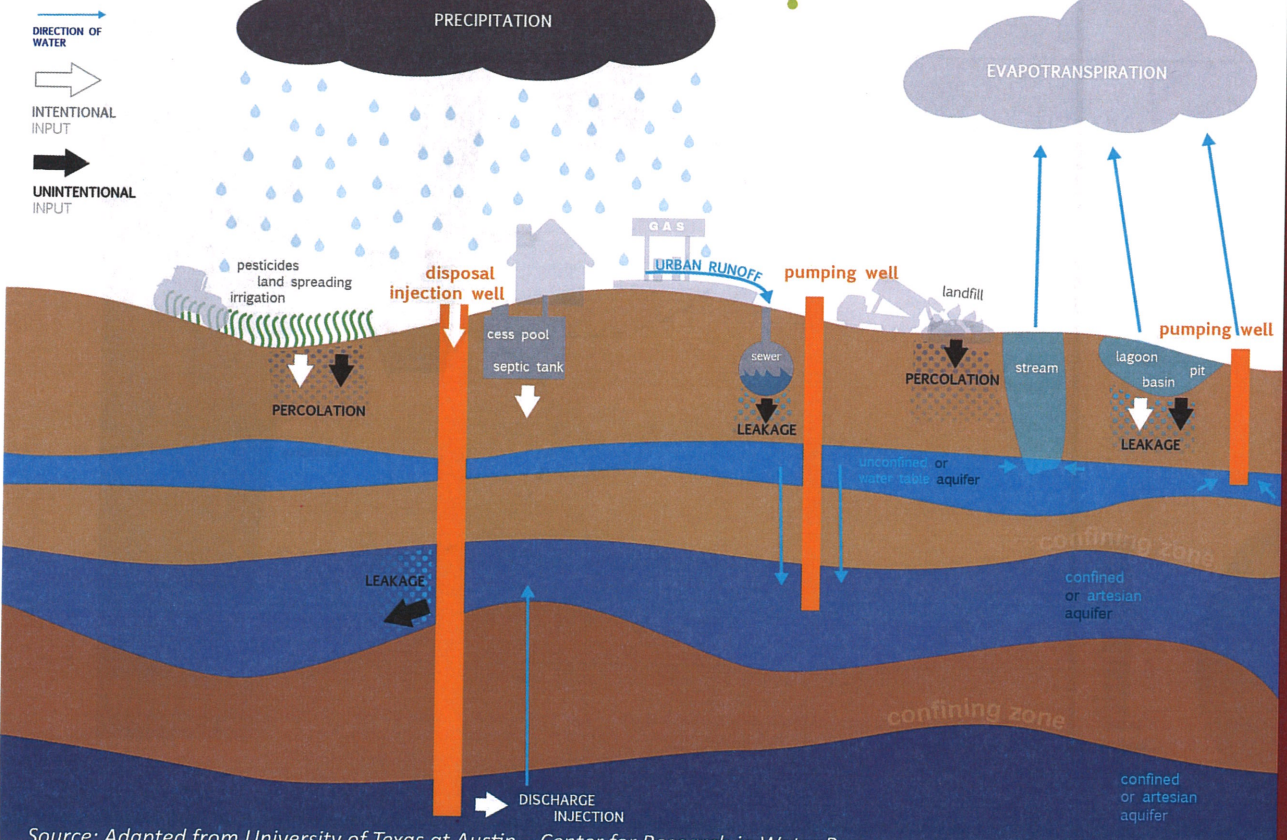
The Nebraska Department of Environmental Quality (NDEQ) administers the Wellhead Protection Program, which began after the Nebraska Legislature passed LB 1161 in 1998 (Neb. Rev. Stat. §46-1501 – 46-1509), authorizing the Wellhead Protection Area Act. **The Act sets up a process for public water supply systems, to use if they choose to implement a local Wellhead Protection Plan.** The intent of this program was to establish guidelines for communities and other public water suppliers to develop local wellhead protection plans. A wellhead protection plan does not provide any new powers to a community; it serves as a guide to local decision makers tasked with protecting the community drinking water supply.

All community public water supplies have a Wellhead Protection Area map as of October 1, 2004.

Wellhead Protection Program Activities

1. Delineate the Wellhead Protection Area (WHPA) - The NDEQ, and some Natural Resources Districts (NRDs), can provide a public water system with a WHPA map which shows the area that is critical to recharging a community's groundwater and drinking water supply.
2. Perform a Contaminant Source Inventory (CSI) - Conducting a CSI involves locating and documenting activities, structures, and locations which could affect the quality of the source of drinking water.
3. Manage potential contaminants - After identifying potential contaminant sources within the WHPA, the community can use management such as county and municipal zoning, local ordinances, working with landowners to implement best management practices (BMPs), or other options, such as education and information, to ensure a safe drinking water supply, which complies with The Safe Drinking Water Act.
4. Develop emergency and contingency plans - These plans will enable a community to react to events such as natural disasters, contamination, and drought. These and other issues, such as population growth, can be addressed through emergency/contingency plans, as well as by planning for new wells.
5. Educate and involve the public - Community awareness will help to provide citizens with the information they need to protect drinking water and increase their participation in the development of a wellhead protection plan.

Protecting Our Water is Paramount to Our Quality of Life



Source: Adapted from University of Texas at Austin – Center for Research in Water Resources

owner

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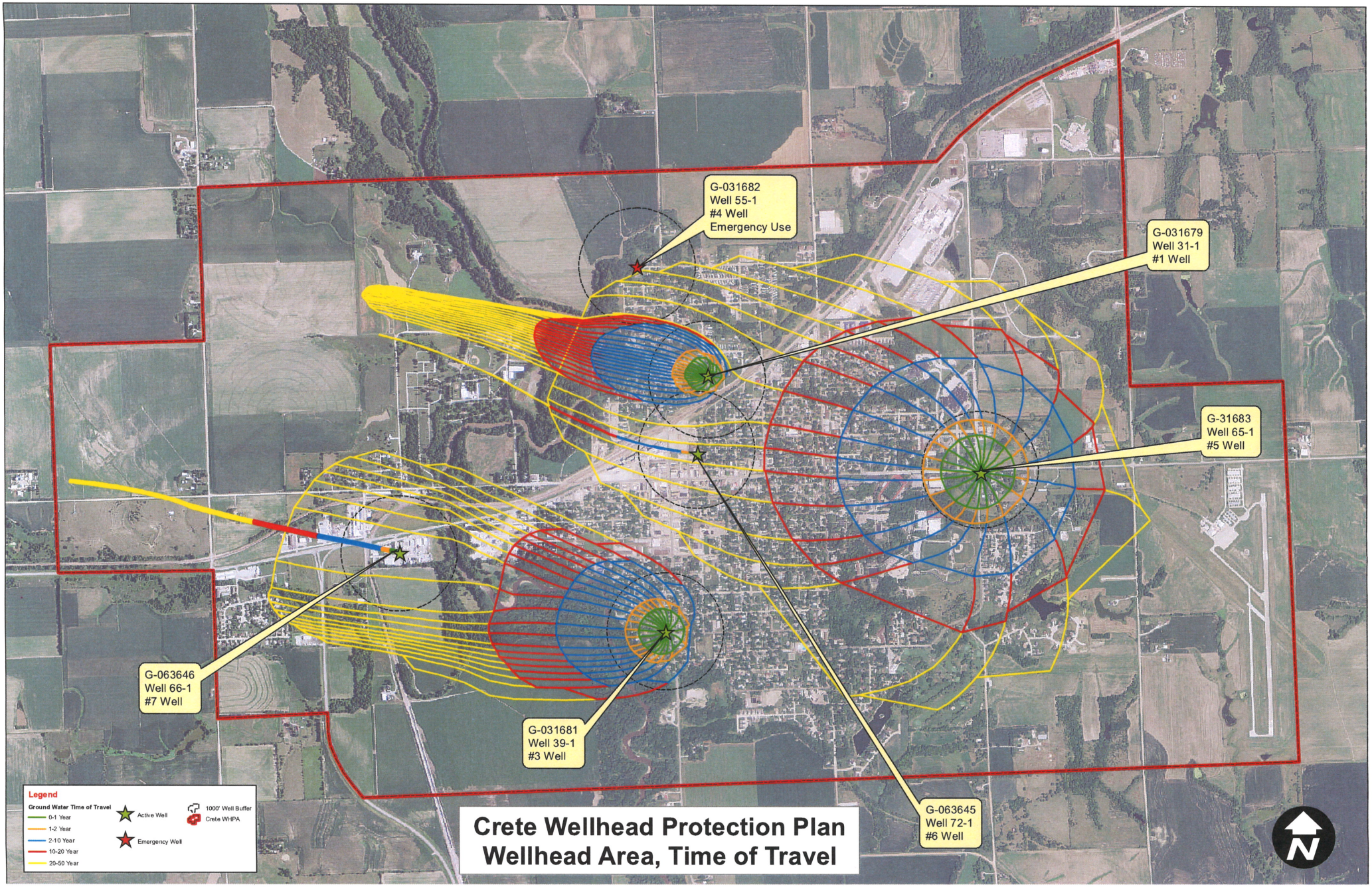
technical assistance

Nebraska Department of Environmental Quality

engineer

JEO CONSULTING GROUP INC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#4 Well
Emergency Use
G-031679
Well 31-1
#1 Well
G-31683
Well 65-1
#5 Well
G-063646
Well 66-1
#7 Well
G-031681
Well 39-1
#3 Well
G-063645
Well 72-1
#6 Well
Legend
Ground Water Time of Travel
0-1 Year
1-2 Year
2-10 Year
10-20 Year
20-50 Year
Active Well
Emergency Well
1000' Well Buffer
Crete WHPA
Crete Wellhead Protection Plan
Wellhead Area, Time of Travel
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