Republican River Basin in Nebraska

Rapid Watershed Assessment

July 2008

NRCS Natural Resources Conservation Service

Federal Building, Room 152
100 Centennial Mall North
Lincoln NE 68508-3866

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CHAPTER 1
INTRODUCTION

The Republican River Basin is located in Southwest Nebraska and extends from the Colorado-Nebraska border and travels across the lower portion of the state where it exits into Kansas. The Republican River Watershed covers approximately 25,000 square miles of which approximately 9600 square miles, or 6,110,472 acres are located in Nebraska. Major sub-basins in Nebraska are listed in Figure 1.

REGION	BASIN	SUBBASIN	HUC_8	ACRES	SQ_MILES
Missouri Region	Republican	Lower Sappa	10250011	142,352	222.4
Missouri Region	Republican	Prairie Dog	10250015	42,191.7	65.9
Missouri Region	Republican	Beaver	10250014	268,272.9	419.1
Missouri Region	Republican	North Fork Republican	10250002	294,711.5	460.5
Missouri Region	Republican	Middle Republican	10250016	958,980.5	1498.4
Missouri Region	Republican	Frenchman	10250005	509,787.9	796.5
Missouri Region	Republican	Harlan County Reservoir	10250009	861,199.2	1345.6
Missouri Region	Republican	Upper Republican	10250004	1,233,072.7	1926.7
Missouri Region	Republican	Medicine	10250008	593,360.7	927.1
Missouri Region	Republican	Stinking Water	10250006	687,137.5	1073.6
Missouri Region	Republican	Red Willow	10250007	507,828.8	793.5
Missouri Region	Republican	Arikaree	10250001	8,646.5	13.5
Missouri Region	Republican	South Fork Republican	10250003	2,930.6	4.6
			Totals	6,110,4072.9	9547.6

Figure 1 Major Sub-Basins in Nebraska

We will concentrate on the portion of the Republican River Basin in Nebraska in this assessment.

All or parts of 18 counties are located within the Nebraska portion of the Republican River Basin as shown in Figure 2.

Nebraska is unique in that it has multi county Natural Resource Districts (NRDs) instead of Soil and Water Conservation Districts (SWCDs) found in most other states. In addition

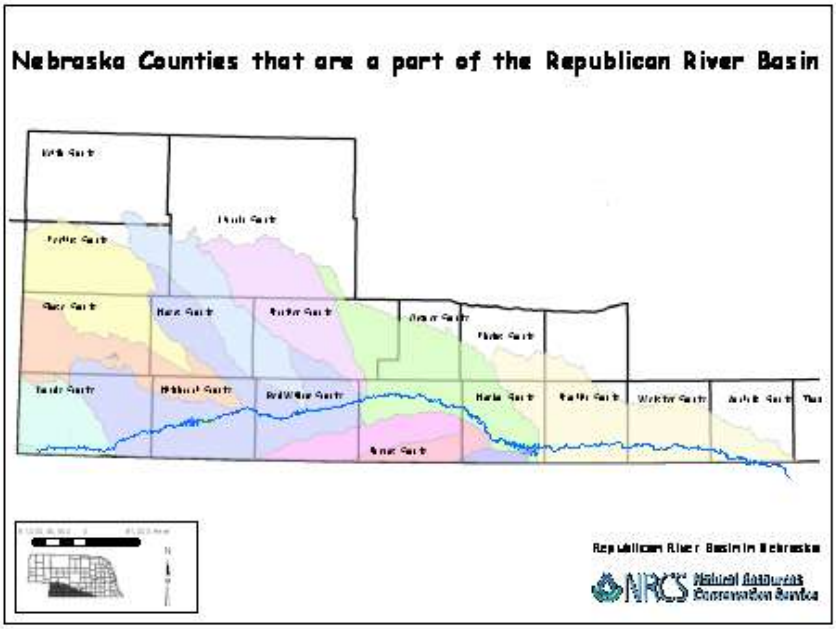


Figure 2 Counties

to the typical soil and water conservation activities associated with SWCDs, the Natural Resource Districts (NRDs) in Nebraska are responsible for regulating groundwater use. The Republican River Basin is represented primarily by four NRDs, the Upper Republican NRD, the Middle Republican NRD, the Lower Republican NRD and the Tri-Basin NRD (Figure 3). Small portions of the Republican River Basin are located in the Twin Platte NRD and the Little Blue NRD. Each NRD has its own elected Board of Directors and has local taxing authority.

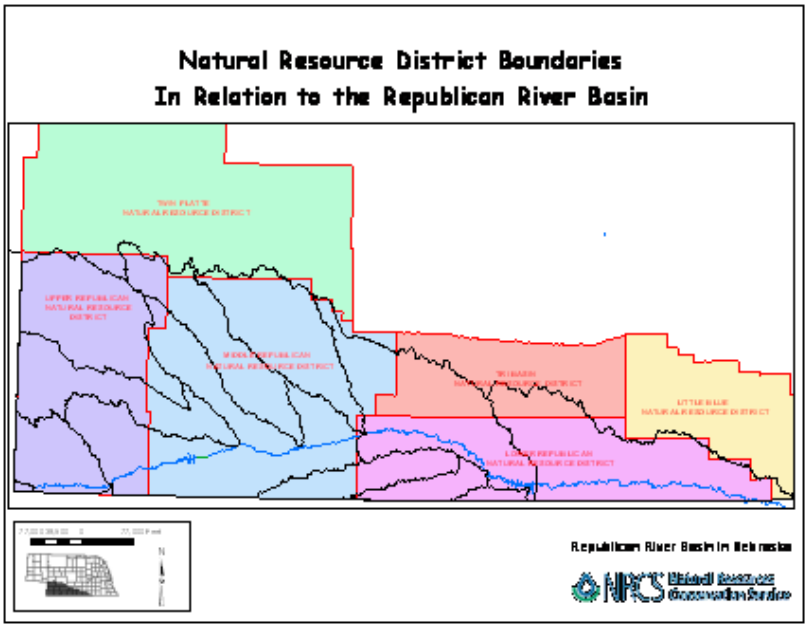


Figure 3 Natural Resource District Boundaries

Four Resource,Conservation and Development areas (RC&D's), Southwest, South Central, Trailblazer and Sandhills RC&D, represent the Nebraska portion of the Republican River Basin as shown in Figure 4.

The Twin Valley Weed Management District and the Southwest Weed Management District are actively working on management of invasive species within the bed and bank of the Republican River. The Republican River Riparian Restoration Partnership is a

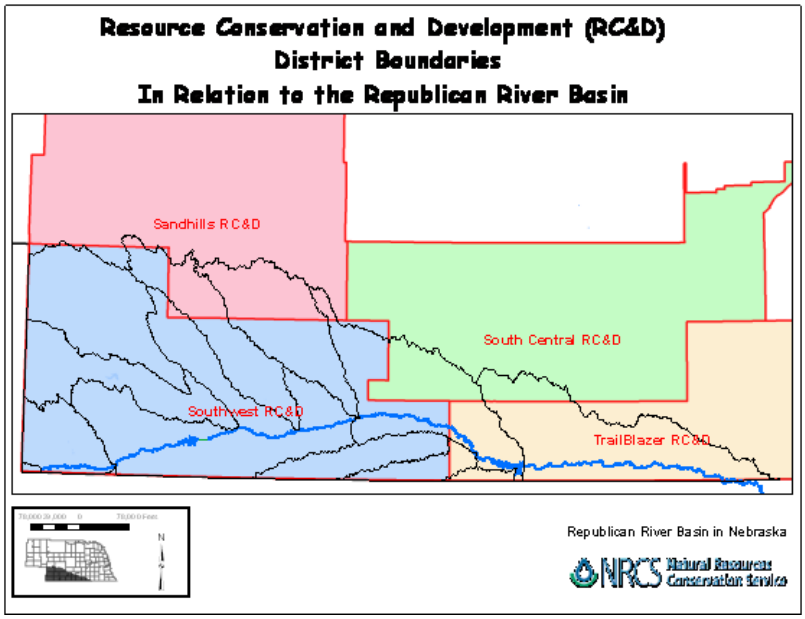


Figure 4 RC & D Boundaries

group representing Colorado, Nebraska and Kansas working on the development of a long range plan to address riparian management in the entire Republican River Basin.

The entire Nebraska portion of the Republican River Basin is located in the 3rd Congressional District.

CHAPTER 2
PHYSICAL DESCRIPTION

2.1 – Land Use

The Republican River Valley watershed is located in the south west portion of Nebraska. The watershed encompasses approximately 6,110,472 surface acres within Nebraska and covers the counties of Keith, Perkins, Chase, Dundy, Hitchcock, Hayes, Frontier, Red Willow, Lincoln, Furnas, Gosper, Harlan, Phelps, Kearney, Franklin, Webster, Nuckolls and Thayer.

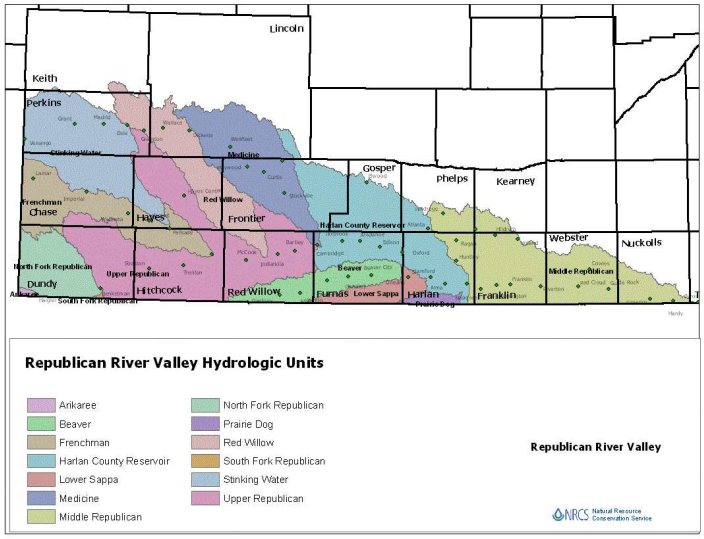


Figure 5 Location Map

As the watershed goes from east to west, three major Common Resource Areas are covered. The Central Loess Plains, the Rolling Plains and Breaks and the Central High Tableland.

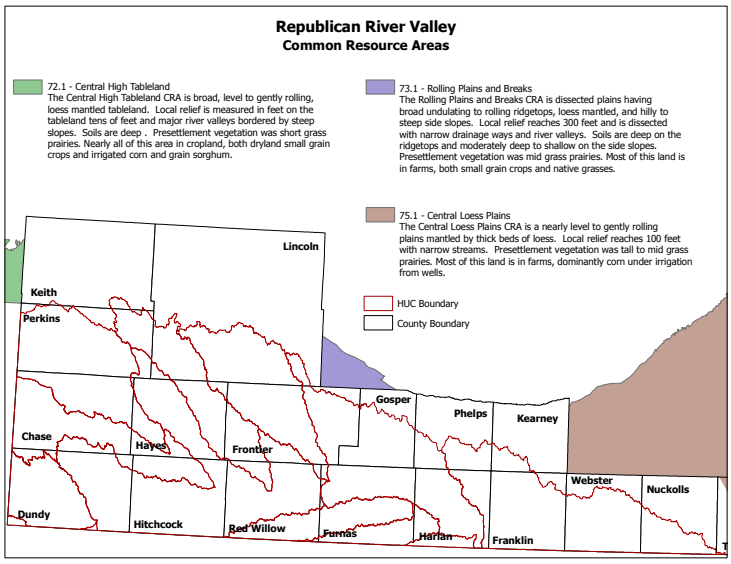


Figure 6 Common Resource Areas

As the watershed goes from east to west, three major Common Resource Areas are covered. The Central Loess Plains, the Rolling Plains and Breaks and the Central High Tableland.

As stated in the descriptions, the terrain goes from a nearly level to gently rolling plains to a gently rolling loess tableland. The entire area is mostly in farms and ranges from irrigated cropland to rangeland.

Soils within this watershed area consists vary as you travel from the east to the west. Soils in the eastern portion of this watershed consist mainly of soils that have formed in silty loess on uplands as well as river valley soils that have formed in alluvial and colluvial material. Slopes within the eastern portion of the watershed are very gently sloping to steep and slope to the south towards the Republican River Valley. Some deep entrenchments have developed steep canyons that divide high gently sloping divides that are a result of erosion of the loess deposits along the uplands. Upland soils are well drained to moderately well drained soils and runoff is rapid. As you move west within the watershed, soils become silty or loamy soils that are

moderately coarse to coarse textured, with the rest being sandy. Most of the soils in the valleys are finer textured than those on the surrounding sandhills. A majority of the area is well drained and runoff is rapid. Surface water drains thru tributaries of the Republican River.

The topography of the area is dominantly of plains that wind, stream erosion, and some deposition have modified into divides or into tablelands and valleys. Slopes are nearly level to gently sloping, except for a few well defined, intermittent drainage ways that have strong slopes. Elevations range from 1,358 ft in the east to 3,854 ft in the west.

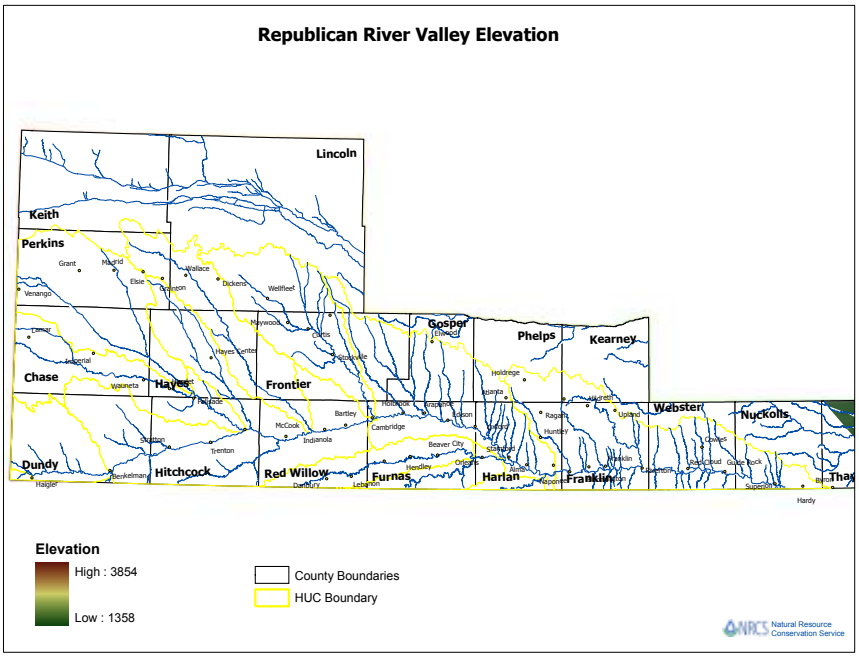


Figure 7 Elevation Map

Several streams and rivers drain the Republican River watershed. The main river running thru the entire watershed is the Republican River. Many tributaries drain into the Republican and total approximately 2,543 miles of main rivers and streams which includes the Republican. There are several more miles of small intermittent streams that flow during peak rainfall months.

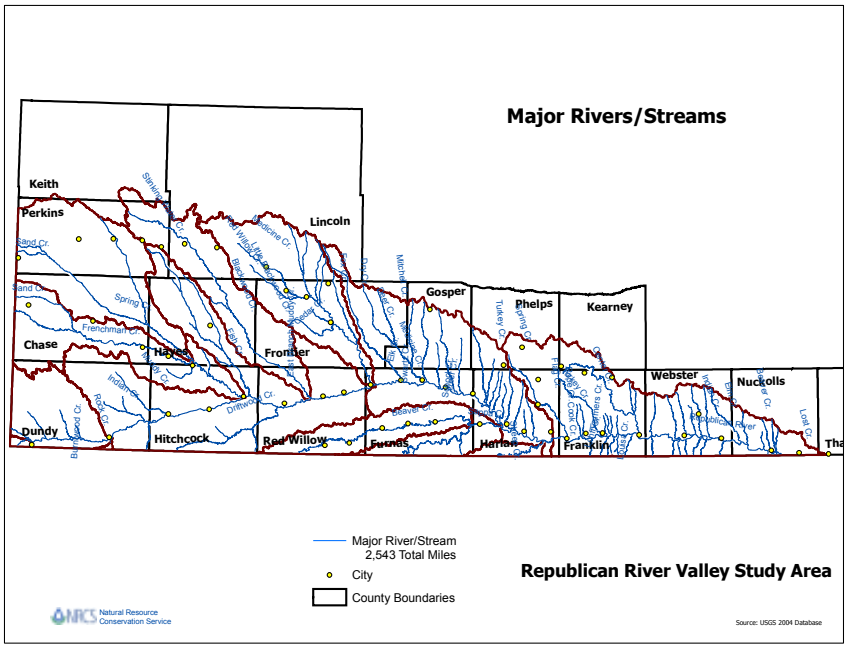


Figure 8 Major Streams/Rivers

Climatic conditions across the Republican River Valley vary from east to west. The most significant variation is in the amount or rainfall. The eastern one-half of the watershed averages 23" – 30" of rainfall per year, which is based on a 30 year norm. However, rainfall amounts decrease significantly as you move into the western half of the watershed where on average, rainfall amounts are 13" – 22" per year.

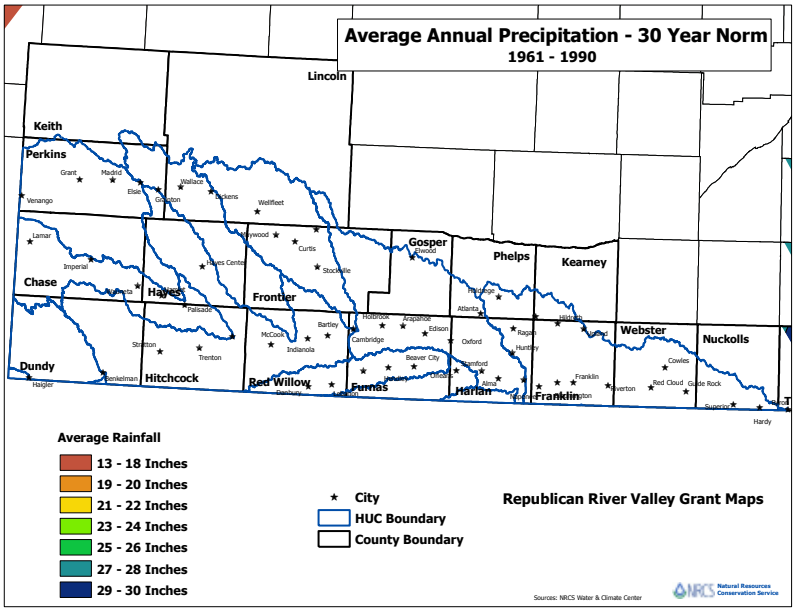


Figure 9 Average Rainfall

Land use within the Republican River Valley HUCs is predominately pasture, grassland and range. Based on the 2007 NASS Cropland Data Layer, over 58% of the basin is pasture/idle cropland, with only 37% of the basin in crops.

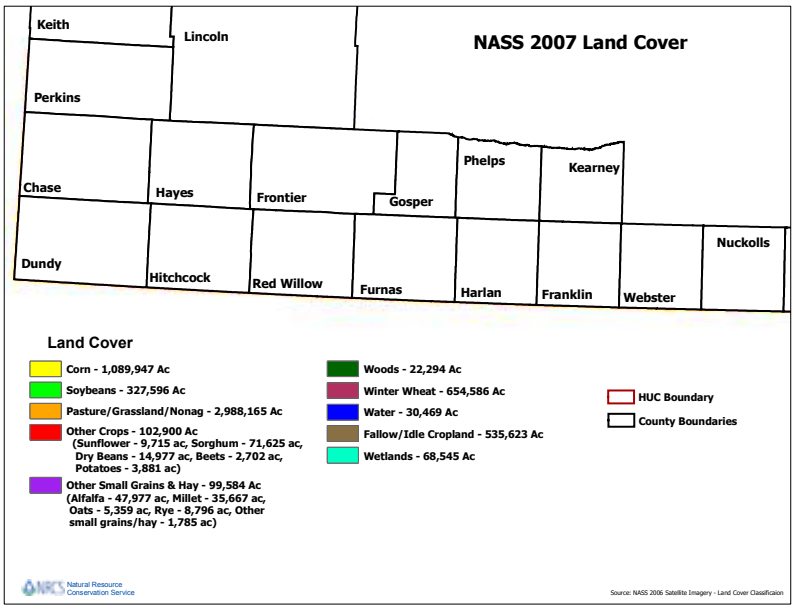


Figure 10 2007 Cropland Data Layer

The main agricultural crop grown within this area is corn with a little over 1,000,000 acres planted in 2007. Other crops include soybeans, wheat and other small grains and hay. Irrigation occurs on approximately 1,300,000 acres of cropland within the Republican River Valley HUCs and includes not only agricultural crops, but also hay and alfalfa fields.

Much of the vegetative cover within the pastures and range land consists of a mixture of Loess Mixed-grass Prairie with some Lowland Tallgrass Prairies along the river bottoms.

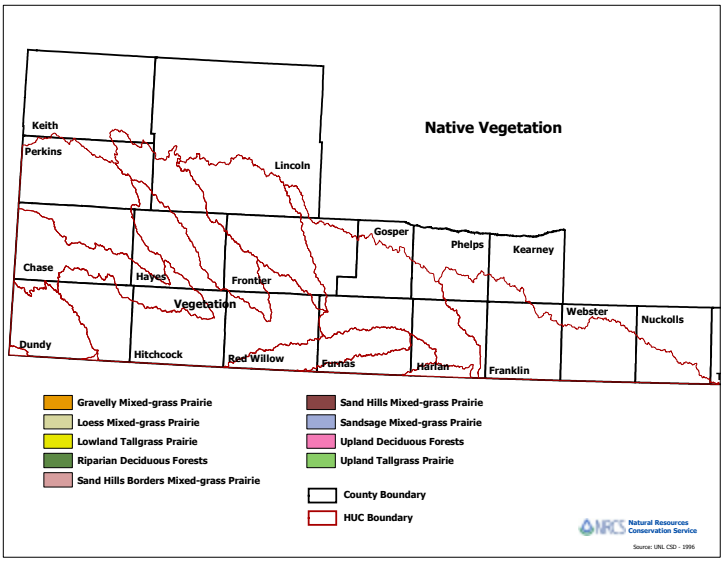


Figure 11 Native Vegetation Map

Other agricultural activities within the Republican River Valley HUCs are Confined Animal Feeding Operations or CAFOs. Currently there are 209 CAFO operations within the HUCs that consist of Dairy Cattle, Turkeys, Feeder Cattle, Swine, and Weaned Pig operations, (Figure 15 pg 10). The total number of permitted animals allowed for all 209 operations is approximately 895,000, (Figure 16 pg 10)

Water is a major natural resource within the HUCs. The High Plains Aquifer, or Ogallala as many know it, lies below the entire Republican River Valley HUC area. This aquifer provides the water for irrigation, domestic and municipal water supplies and varies in thickness throughout the HUC from 1 to 500 ft as shown on the Aquifer Thickness Map (Figure 12). The depth to the ground water ranges from 0 to over 200 ft is some areas and does fluctuate based on use and precipitation, which recharges the ground water reserves. The many rivers and streams that transcend this HUC area also provide water for recreation, plants and animals as well as agricultural uses.

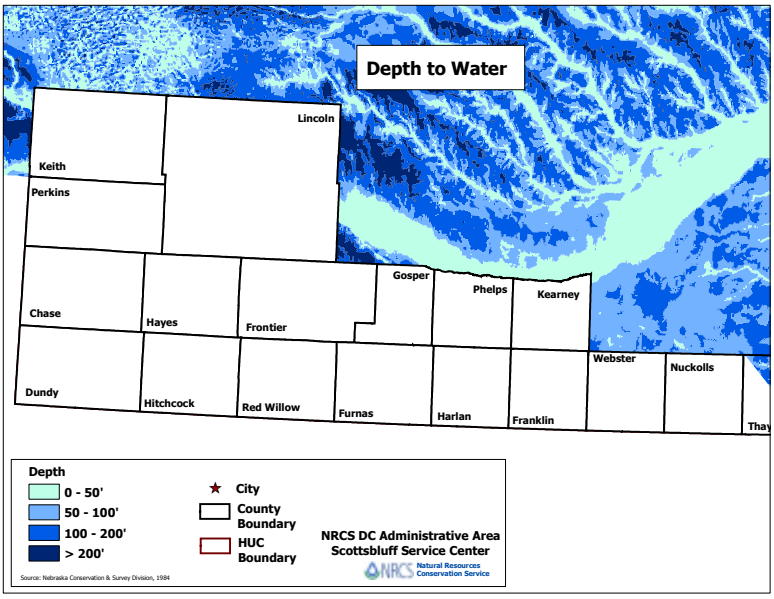


Figure 12 Depth to Water Table

2.2 – Climate

Precipitation ranges from an annual average of 20 inches in the western end of the basin to 26 inches at the eastern end. Typically, a majority of the precipitation occurs during the spring and early summer. Rainfall distribution is highly variable from year to year, with very few years being "average". Periods of drought are common but local flooding can occur when a major portion of the annual rainfall is received in one rainfall event.

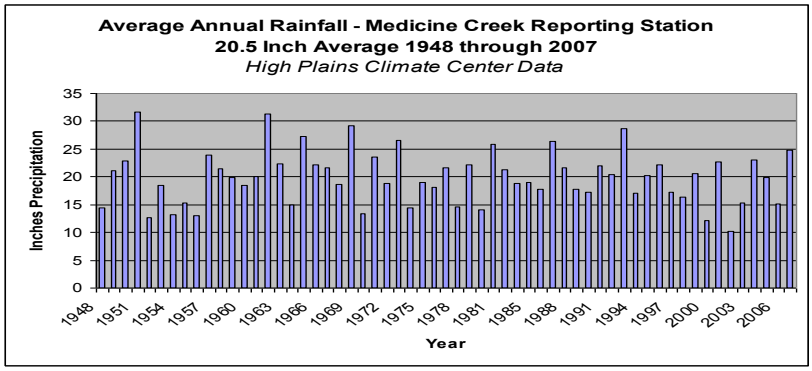


Figure 13 Average Annual Rainfall

Temperatures in the basin range from an average high of 88 degrees during June, July and August to an average low of 15 degrees during the winter *(High Plains Regional Climate Center – Imperial and Red Cloud Reporting Stations – 1948 to 2007 data)*. Temperature is highly variable from year to year, similar to rainfall. Instances of higher temperature typically occur in years when below average rainfall occurs, intensifying the impacts of drought.

2.3 – Common Resource Areas

Common Resource Areas are areas that share common resource concerns, soil groups, hydrologic units, resource use, topography, other landscape features, and human use and treatment needs. CRAs are subdivisions of the current MLRA areas (see Figure 5 pg 3).

2.3.1 - Central High Tableland 72.1: The Central High Tableland CRA is broad, level to gently rolling loess mantled tableland. The average annual precipitation in this area is 14 to 25 inches. Slopes are generally nearly level to gently rolling on the smooth table land, but steep slopes border the major valley. Local relief is measured in feet on the tableland, but valleys are tens of feet below the general level of the uplands. Soils are deep. Pre-settlement vegetation was short grass prairies. Nearly all of this area is in cropland, both dryland small grain crops and irrigated corn and grain sorghum.

2.3.2 - Rolling Plains and Breaks 73.1: The Rolling Plains and Breaks CRA is dissected plains having broad undulating to rolling ridgetops. The average annual precipitation in this area is 19 to 30 inches. Soils are deep on the ridgetops and moderately deep to shallow on the side slopes. Presettlement vegetation was mid grass

prairies. Most of this land is in farms, with about 60% in crop production, both dry and irrigated cropland and 40% native grasses.

2.3.3 - Central Loess Plains 75.1: The Central Loess Plains CRA is nearly level to gently rolling plains mantled by a thick bed of loess. The average annual precipitation in this area is 23 to 36 inches. Soils are generally moderately deep to very deep. Presettlement vegetation was tall to mid grass prairies. Most of this land is in farms, both dry land and irrigated cropland and grassland.

2.4 – Soils

Soils in the Republican River basin are varied across the basin. The western one third is primarily sandy soils while the remainder of the basin is composed of fine textured soils formed from loess. Infiltration rates are generally moderate in the areas of fine textured soils and higher as expected in areas with sandy soils. Topography in the majority of the basin is deeply dissected with definite drainage patterns. Figure 14 shows the general categories of soils in the basin. Specific soils information can be accessed for more detailed analysis at: http://websoilsurvey.nrcs.usda.gov/app/

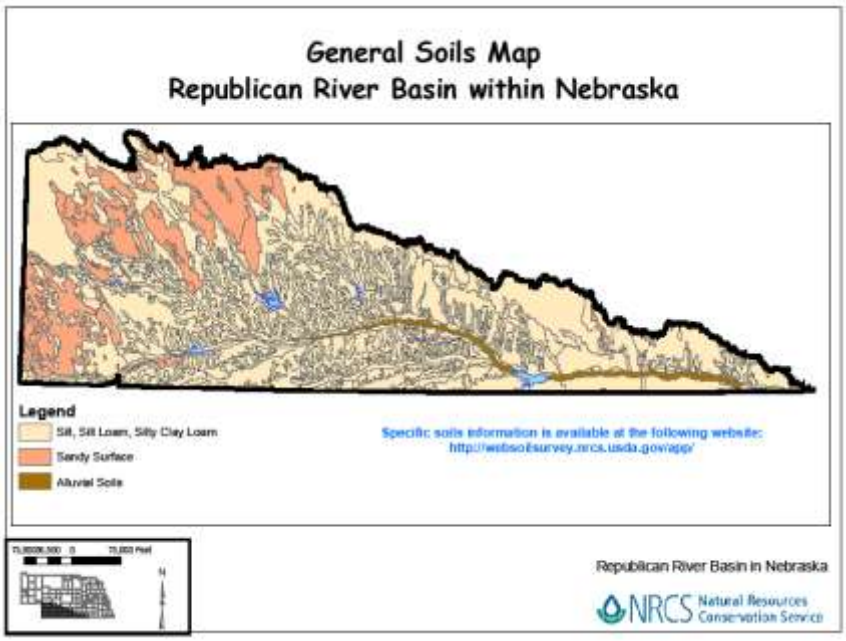


Figure 14 General Soils Map

2.5 – Geology

The Republican River watershed physiographically consists of dissected plains, outlier sand hills (northwest part of the uplands region) and the prominent Republican River valley itself (located in the south tier of southwest Nebraska counties). The geology of this area is made up of primarily glacial wind and water deposited sediments, primarily in the form of loess, overlying bedrock composed of fluvial and marine deposits.

The surface sediments are mainly Quaternary Age (primarily Middle to Late Pleistocene) windblown sands, silts and clays, alluvium (recent deposits in the valleys and footslopes), and colluvium, (accumulations at footslopes due to the result of gravity and water moving of soil downslope). Stratigraphically, from youngest to oldest, these are the Bignell, Peoria, Loveland, Beaver Creek, Grafton, Sappa, Walnut Creek and Red Cloud Formations. The loess, as a general trend, is thin to non existent along the Colorado border (replaced by sand deposits) thickens to its maximum thickness near an area north of Parks in Dundy County then decreases in thickness towards the east. The loess can be many hundred feet thick. Thick soils have developed on the sand silts and clays of the Pleistocene deposits and on the Ogallala Formation itself.

The Ogallala Formation (Pliocene and Miocene Age) is found as surface outcrops near canyon rims and valley sides and underlies the vast majority of the loess (and sand) of the watershed. It can be from 0 to 630 feet thick in this region. It is predominately weakly consolidated calcareous sand, silt and clay with gravels and beds of caliche and limestone. It lies on an erosional surface above much older Pierre Shale of Upper Cretaceous Age.

Where the Republican River, its larger tributaries (including the Arikaree, Frenchman, Driftwood, Red Willow, Beaver, Medicine, Deer, Sappa, Turkey and Prairie Dog Creeks) and the many smaller tributaries have down cut through the Ogallala Group, the Pierre Shale, Niobrara Formation, Carlile Shale (both of Upper Cretaceous age, yet sequentially older than the Pierre Shale) found below the alluvial fills of the major drainage valleys. A small exposure of White River Group (Oligocene Age) also is found underlying the modern alluvium east of Lebanon, NE.

The extent and sandy nature of the Ogallala Formation has lead to its long history of water absorption. The groundwater of the High Plains Aquifer, of which the Ogallala Formation comprises a major component, is highly utilized as a drinking and irrigation water source. However, in the main valley of the Republican River, the chemical characteristics of the Pierre Shale (high gypsum, iron and manganese content) and its contact with the overlying groundwater aquifer have resulted in drinking water quality issues for those communities and producers in the valley.

2.6 – Confined Animal Feeding Operations (CAFO) Status

The status of Confined Animal Feeding Operations (CAFO) is shown in Figures 14 and 15.

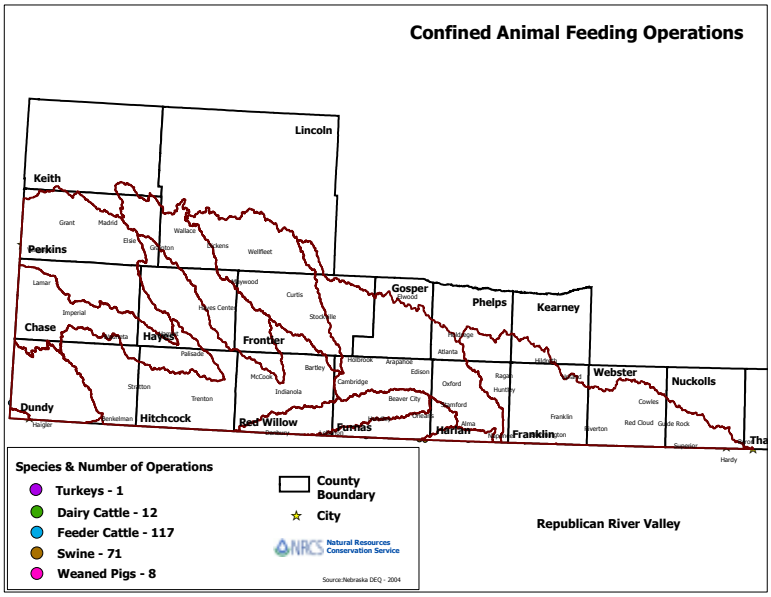


Figure 15 CAFO Locations

Livestock feeding is important within the basin. The combination of corn production and ethanol production fit well with the livestock feeding industry. Several large feeding operations (>greater than 50,000 head) and located within the Republican River Basin.

In Nebraska the Nebraska Department of Environmental Quality (NDEQ) Livestock Waste Control Program administers two types of permitting programs for livestock waste control facilities: The federal National Pollutant Discharge Elimination System (NPDES) permitting program and the state Construction and Operating Permit program. NDEQ Livestock program issues individual NPDES permits, as well as coverage under a General NPDES permit. NPDES permit holders are required to submit an annual report by March 1 of each year.

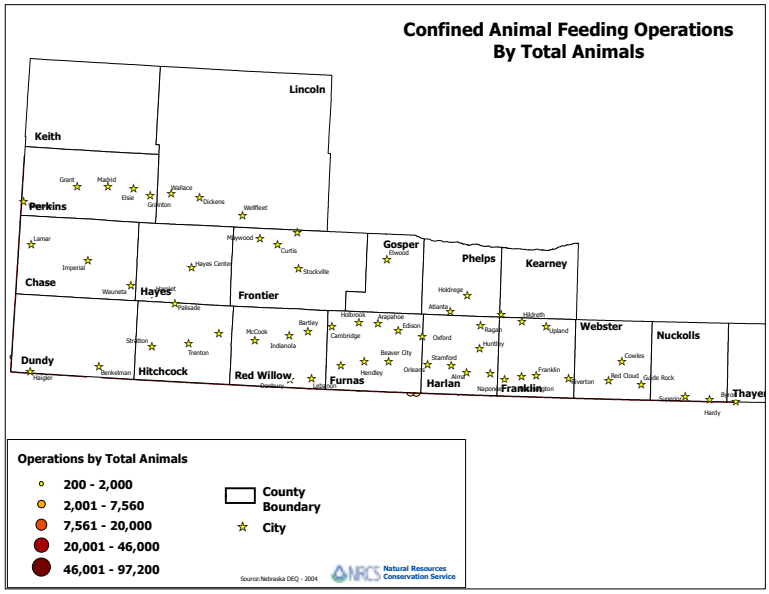


Figure 16 CAFOs by Size

NDEQ conducts initial investigations on both proposed and existing animal feeding operations to determine which operations require livestock waste control facilities. Operations determined to require a treatment facility must submit an application for a Construction and Operating Permit. NDEQ will notify the operation whether or not a National

Pollutant Discharge Elimination System permit must be obtained. Large and Medium concentrated animal feeding operations (CAFO) must apply for an NPDES permit if the operation discharges, or intends to discharge, livestock waste into waters of the State. A small AFO must apply for an NPDES permit only if designated as a CAFO by NDEQ. Individual and General NPDES permits are issued for a maximum of five years. Applications for NPDES permit coverage must be submitted at least 180 days before the planned use of the livestock waste control facilities, or before the current permit expires. Additional information can be found at the Nebraska Department of Environmental Control website. http://www.deq.state.ne.us/

NRCS has an important role in the CAFO Rule implementation by helping clients develop and implement Comprehensive Nutrient Management Plans (CNMP) that are required as part of the Construction and Operating Permit issued by NDEQ. USDA also has financial assistance programs, such as EQIP that provide financial incentives in the completion and operation of animal waste management systems. These programs provide many benefits in the area, especially in terms of water quality.

2.7 – Ethanol Production

Ethanol production is an important consideration in resource management issues within the Republican River Basin. It is an important factor in the local economy and combined with corn production and livestock feeding, is a major factor impacting resource considerations and economics in the basin. The production of ethanol will need to be balanced with the current water quantity issues in the basin to avoid additional conflicts over water.

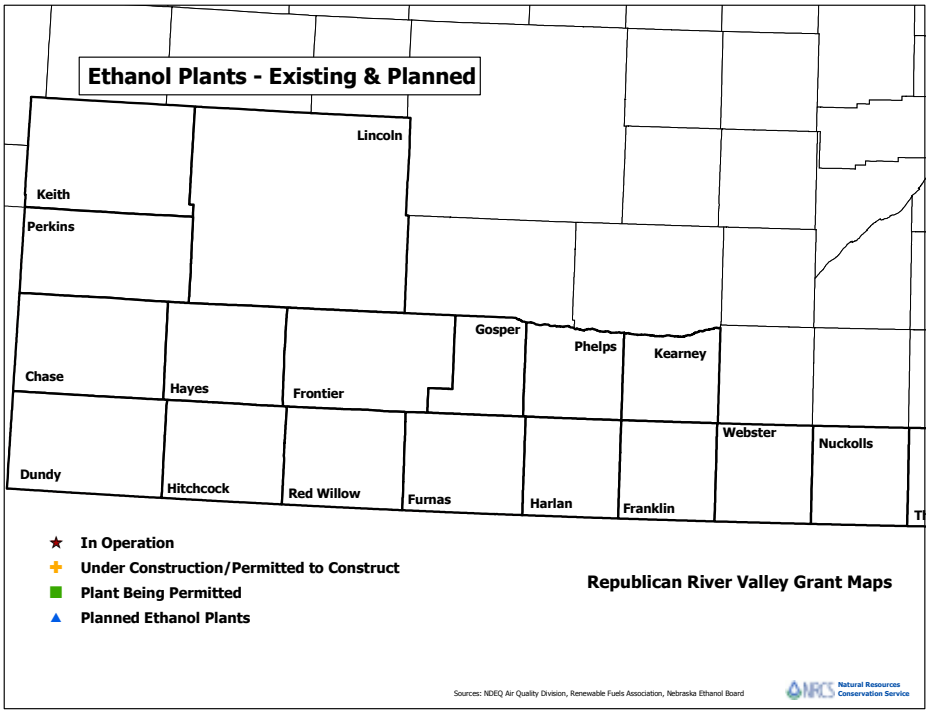


Figure 17 Ethanol Plants

CHAPTER 3
RESOURCE CONCERNS

3.1 Water Quantity

The Republican River originates in eastern Colorado and travels through southern Nebraska, enters Kansas and flows to its confluence with the Kansas River. Water quantity is a major concern in the Republican River Basin. In 1943 the States of Colorado, Kansas and Nebraska, with the approval of Congress, entered into the Republican River Compact as a pre-requisite to the construction of a system of multi purpose (ie. Flood control, irrigation, recreation) dams on the Republican River and it tributaries. The Compact provides for the division of the "virgin water supply" of the Republican River Basin between the three states. Following several years of dispute about Nebraska's consumptive use of water within the basin, Kansas filed an original action in the United States Supreme Court against the states of Nebraska and Colorado in 1998. After several rulings by the Court and its Special Master and several months of negotiation, all three states entered into a comprehensive Settlement Agreement. That Agreement was approved by the Court on May 19, 2003 and the Special Master's final report approving the Joint Groundwater Model developed by all three states for use in computing stream flow depletions resulting from groundwater use was submitted to the Court on September 17, 2003. Water quantity and the amount of water "consumed" by each state is the measure of compliance with the Compact Settlement Agreement.

Water quantity is very important when discussing the economics of the area. This area has a history of highly variable rainfall patterns. Being able to use additional water supplies, either surface water or ground water, for irrigation of crops enables a crop to be grown in times of drought. This has stabilized production enabling development of value added industry such as ethanol production and livestock feeding.

The management and regulation of water use and especially ground water use, is of increasing importance. The balance of using water in to ensure compliance with the Compact Settlement Agreement and still having an adequate supply for domestic, industrial and agricultural is both a current and future challenge.

The Republican River Basin in Nebraska has significant available groundwater, with areas in the northern and parts of the western portion of the basin having up to 500 feet of available water (Fig. 18).

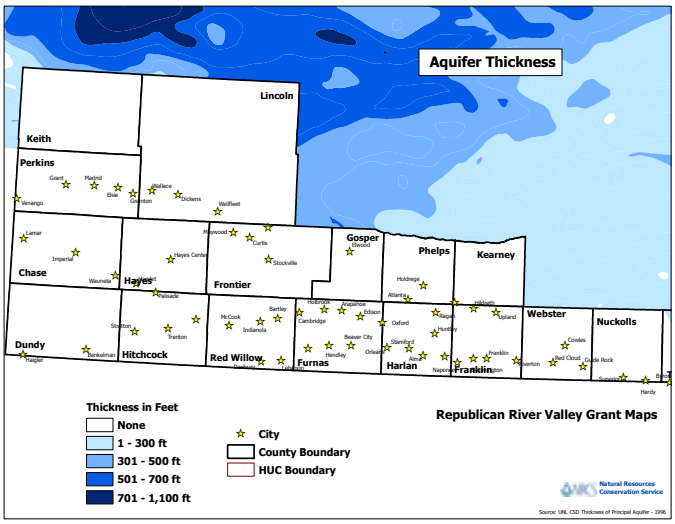


Figure 18 Aquifer Thickness

There are significant areas of groundwater decline in portions of the basin and significant areas of groundwater rises in other portions of the basin (Fig 19). Base flows in some of the tributaries originating in the Gosper and Phelps Counties in the area of the "water mound" have increased through time, due to a rise in the groundwater table. This rise resulted primarily from delivery and irrigation with surface water from the Platte River by Central Nebraska Public Power and Irrigation District (CNPPID) in Gosper, Phelps and Kearney Counties.

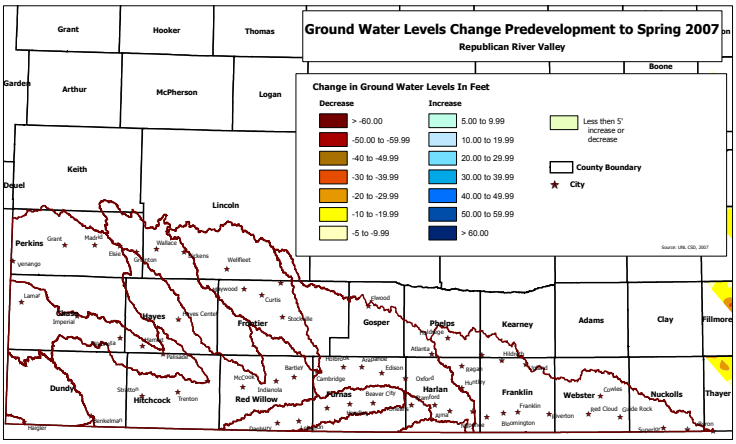


Figure 19 Groundwater Change Map

Figure 20 Groundwater Change Map 1972

Prior to 1970, there were small areas of ground water decline within the Republican River Basin in Nebraska, but significant groundwater decline began to appear after accelerated development of irrigation in the decade of the 70's (Fig. 19, 20 & 21).

Declines in surface water supplies have significantly reduced the number of acres originally irrigated using surface water. Some of the irrigation districts in the upper end of the basin have not had the water supply to deliver irrigation water to irrigators for several years. Groundwater wells were drilled to replace or supplement surface water on some of the land originally developed to utilize surface water.

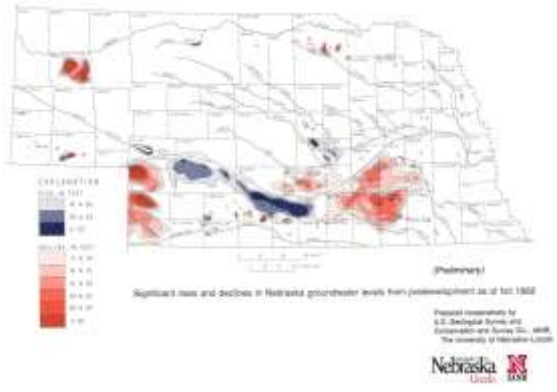


Figure 21 Groundwater Levels Map

In some sub watersheds in the Basin stream flows and reservoir levels have generally been declining over time. In other sub basins the stream gauging data has remained relatively steady over time. Direct comparisons are difficult because of the availability of stream gauge data varies from sub basin to sub basin. Data for the Frenchman gauge is

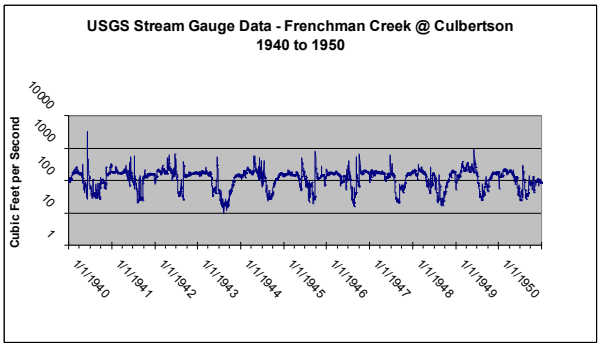


Figure 22 Frenchman Creek 1940 - 1950

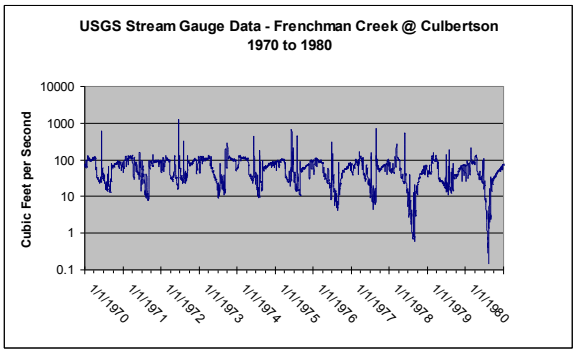


Figure 23 Frenchman Creek 1970 - 1980

available from 1930 until 1998 while data for Medicine creek is available from 1960 until 1994.

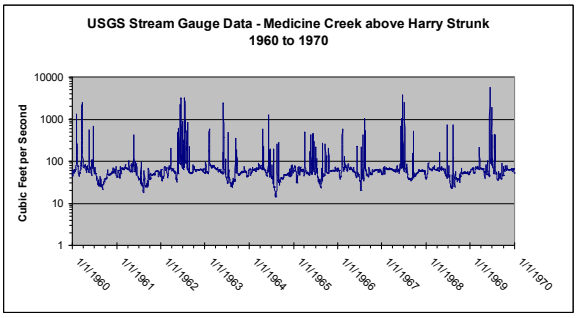


Figure 24 Medicine Creek 1960 - 1970

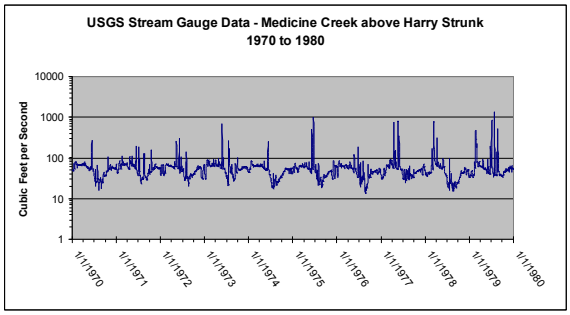


Figure 25 Medicine Creek 1970 - 1980

The decline in flow in the Republican River and its tributaries have been attributed to prolonged drought, increased pumping of ground water for irrigation, increased water use by vegetation and invasive species and the reduction of runoff due to the installation of conservation practices. Reviewing stream flow data on a monthly basis rather than an annual basis indicates that the low point in flow in both of these sub watersheds is typically reached in June or July. The progressive decrease in the mid year low flow point in the Frenchman Creek data suggests that impacts over time at this time of the year have increased. This suggests that uses that peak in mid summer, ie. Irrigation and consumption by vegetation, are the main causes of reductions in total annual flows in this sub-watershed. Flows in the Medicine Creek Watershed, by comparison, are relatively unchanged over the 20 years of available data.

The sub-watersheds that make up the Republican River Basin are highly variable in geology. Studies quantifying the impact of activities impacting water quantity are

ongoing. It is important to note that each sub-watershed is unique. Treatment may need to be tailored to each sub-watershed for maximum effectiveness.

Interstate and intrastate lawsuits, funding issues, surface and ground water issues and an extended drought have focused attention on the management of water within the Republican River Basin in Nebraska.

Moratoriums on drilling new irrigation wells and expansion of acres under irrigation have been implemented across the basin. All irrigation, industrial and municipal wells within the basin have had meters installed and allocations are in place to limit the amount of water pumped.

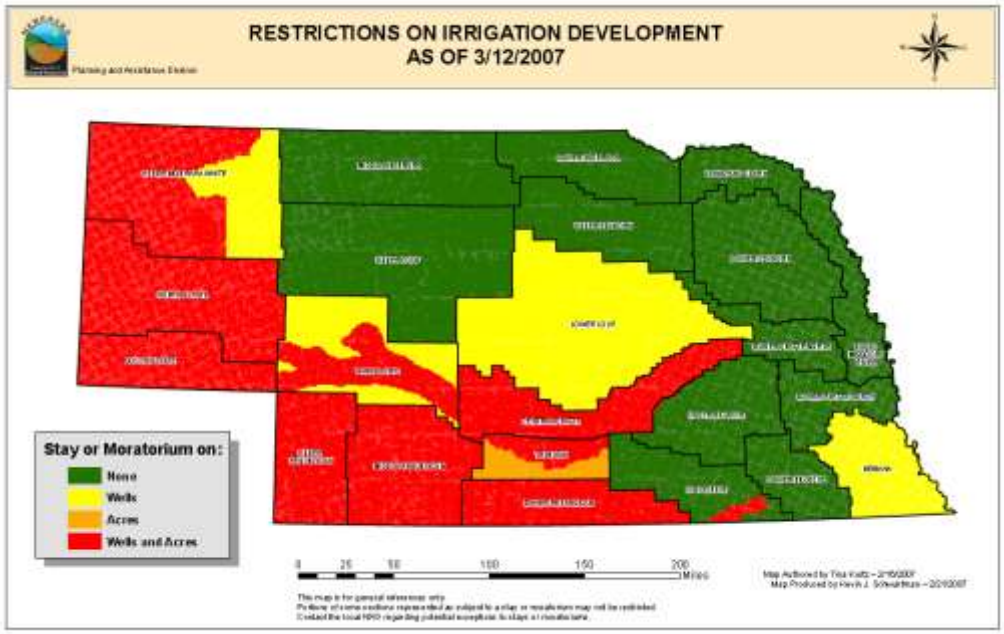


Figure 26 Irrigation Moratorium Map

Most irrigators in the Nebraska portion of the Republican River Basin have adopted irrigation water management strategies to meet the allocation requirements. A large portion of formerly gravity irrigated fields have been converted to sprinkler irrigation. Some gravity irrigated fields where it is not feasible to install a center pivot have used other methods to apply irrigation water including surge valves, subsurface drip irrigation or linear move pivots. Some irrigators are using crops that require less irrigation water in a cropping rotation and using no till to further conserve water. The basin wide average ground water pumping was 14.79 acre inches in 2003. The basin wide average groundwater pumping fell to 9.79 acre inches, 10.8 acre inches and 8.86 acre inches in 2005, 2006 and 2007 respectively.

Further reductions in the amount of ground water pumped are going to be difficult to achieve through gains in efficiency. Any future reductions of ground water pumping are likely going to come from converting from irrigation to a non irrigated land use

(rangeland, dry cropland). Allocations could become more restrictive, but considering the cost of fertilizer, fuel, and seed it is doubtful that producers could plant all of their irrigated acres to a high water use crop like corn. It is more likely that producers would adopt a strategy that would idle some of their irrigated acres to have adequate irrigation water available on fewer corn acres. Irrigators would also have the option of planting crops requiring less water in their rotation.

Programs are currently available on a voluntary basis for producers to temporarily convert to non-irrigation land uses. Programs in the past have been available to purchase a conservation easement to permanently convert irrigated lands to non irrigated land uses. Considering the high commodity prices at the time this is being written, it is unlikely that demand for participation in these programs is going to be high. There might be an opportunity in the future for some type of program offering compensation to switch to a non irrigated land use, depending on future water supplies, economics and additional regulation.

The State of Nebraska and the Upper, Middle and Lower Republican Natural Resource Districts have also purchased available surface water from the Bostwick and Frenchman Cambridge Irrigation Districts for release to Kansas during drought to ensure compliance. The future of this strategy depends on dependable funding, willingness of the Irrigation Districts to sell the water and the availability of surface water. Compact compliance is not determined until the following year (i.e. 2007 compliance isn't determined until 2008), which makes determining how much water to purchase and release a difficult target considering the variability of the annual rainfall.

There is some thought that removal of invasive species within the riparian areas of the river would increase stream flows. While some models predict such results, studies have not been able to actually measure a long term increase in stream flow attributed directly to vegetation removal.

3.2 Water Quality

3.2.1 Surface Water Quality

The status of surface water in the Republican River Basin is summarized using the categories established by Section 303(d) of the federal Clean Water Act.

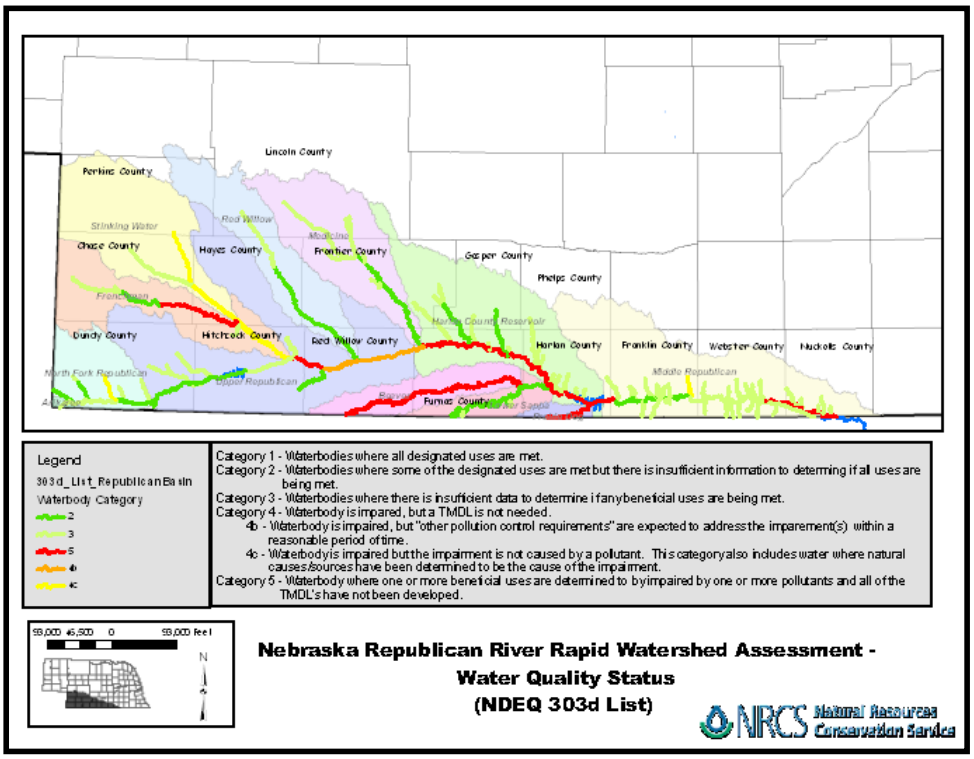


Figure 27 303d Listed Waters

Category 1 - Waterbodies where all designated uses are met.

Category 2 – Waterbodies where some of the designated uses are met, but there is insufficient information to determine if all uses are met.

Category 3 – Waterbodies where there is insufficient data to determine if any beneficial uses are being met.

Category 4 – Waterbody is impaired, but a TMDL is not needed. Sub-categories 4A-C outlines the rationale for the waters not needing a TMDL:

Category 4A – Waterbody assessment indicates the Waterbody is impaired, but all of the required TMDLs have been completed.

Category 4B – Waterbody is impaired, but "other pollution control requirements" are expected to address the water quality impairment(s) within a reasonable period of time. Other pollution control requirements include, but are not limited to, National pollutant Discharge Elimination System (NPDES) permits and best management practices.

Category 4C – Waterbody is impaired but the impairment is not caused by a pollutant. This category also includes water where natural causes/sources have been determined to be the cause of the impairment. In general, natural causes/sources shall refer to those pollutants that originate from landscape geology and climactic conditions. It should be noted, this definition is not inclusive.

Category 5 – Waterbodies where one or more beneficial uses are determined to be impaired by one or more pollutants and all of the TMDLs have not been developed. Category 5 waters constitute the Section 303(d) list subject to EPA approval/disapproval.

Based on these categories, a Waterbody beneficial use assessment can have 1 of 3 outcomes:

S = Beneficial use is supported
I = Beneficial use is impaired
Blank = insufficient data to determine if the beneficial use is supported or impaired.

Water quality information for the Republican River Basin Hydrologic Units 10250001, 10250002, 10250003, 10250004, 10250006, 10250007, 10250008, 10250009, 10250011, 10250014, 10250015 and 10250016 is summarized in Exhibit 7.2.1 and 7.2.2 or available on the Nebraska Department of Environmental Quality website.

3.2.2 Ground Water Quality

Shallow alluvial aquifers, such as the Republican River Valley, are susceptible to contamination because of their relative lower total volume. In Nebraska, Groundwater Management Area Program (GWMA) focuses on assessing areas where groundwater problems from non point source contaminants (such as agricultural chemicals or fertilizer) exist.

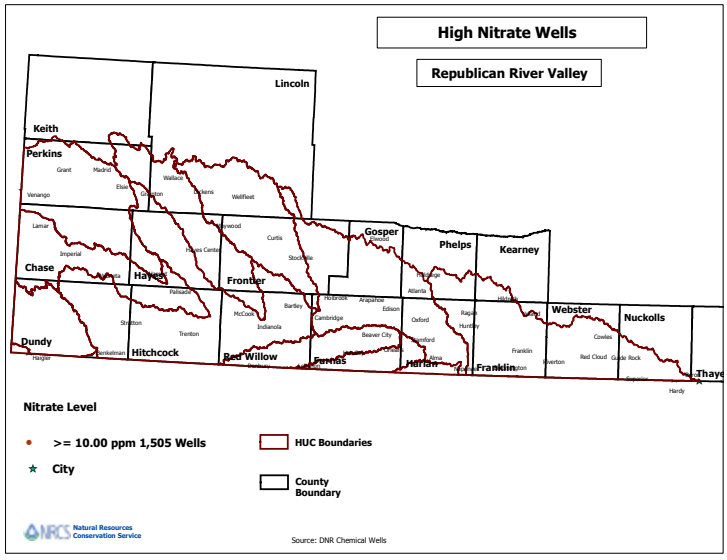


Figure 28 High Nitrate Wells

Nitrates from application of commercial fertilizers or animal wastes to cropland fields can, if not properly managed, leach from the application areas into the underlying groundwater. Also, due to the Pierre Shale parent material, trace element like selenium and arsenic occur in public drinking water supplies.

Most of the communities that have their well fields in the Republican River Valley have had nitrate levels greater then 10 parts per million and have been placed on notice by the Nebraska Department of Health at least once. Some communities have had to relocate well fields to upland sites to meet current drinking water standards for nitrates, selenium and arsenic. Other communities are using a combination of methods ranging from blending various wells, water treatment and relocating some wells to meet the new standards.

The Ground water management areas rely on cooperation between the Nebraska Department of Environmental Quality and the Natural Resource Districts(s). A ground water management area can be designated by either the Director of the Department of Environmental Quality or the local Natural Resource District. Figure 27 shows NEDQ study areas (numbers) and existing management areas (shaded areas).

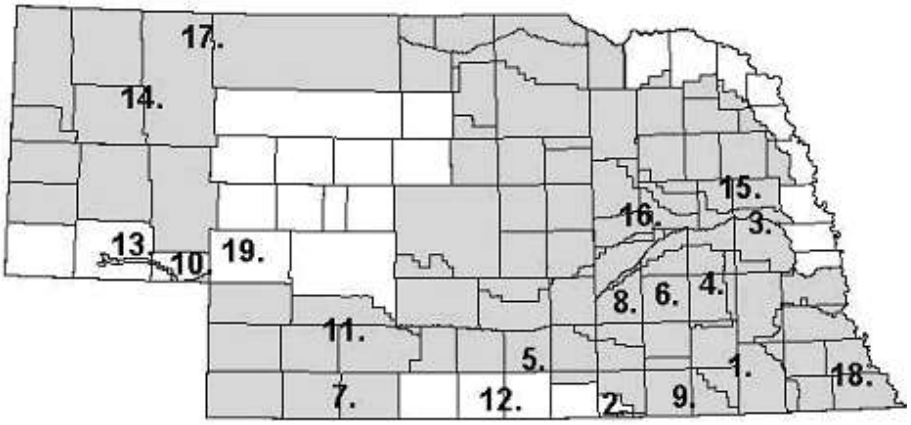


Figure 29 NEDQ Study Areas

Areas testing high in nitrates are typically treated by working with local landowners and operators to apply commercial fertilizer and animal wastes in a manner that allows the nutrients to be used by crops or other plants rather that leaching into the groundwater. The program and level of regulation depend on the level and trend of nitrates currently in the groundwater supply. Actions can range from educational efforts to regulation prohibiting application of nutrients at certain times of year and limiting amounts and types of fertilizers.

3.3 Soil Erosion

Erosion by both wind and water are issues in the Republican River Basin in Nebraska. Soil types and textures vary widely across the Basin.

In general, the western one third of the basin is dominated by sandy loam and fine sandy loam soils that are highly susceptible to wind erosion.

In general, the eastern two thirds of the basin are dominated by soils formed from loess deposits, or wind blown deposits, that form silt loam soils. The topography of this portion of the basin has been highly dissected forming deep canyons with relatively flat areas, or tablelands, left in between canyons. Theses tablelands get wider in the upper portions, or north central portion of the basin. Wind erosion can be an issue in these loess formed soils, but the major soil erosion issue in this portion of the basin is water erosion. Water running off of the tablelands leads to sheet and rill erosion.

Gully and ephemeral erosion are a significant issue in the uplands of the basin. Gullies are formed when water leaving the tablelands fall 80 to 100 feet before entering a stable area in canyons. Sediment carried from sheet, rill and gully erosion is a pollutant in area streams and reservoirs. Much of the cropland in the basin is located in the tablelands in this portion of the landscape. Gully erosion can cause portions of some of these upland fields to become unusable for crop production. Conservation practices that reduce the amount of runoff from the uplands are the most cost effective in preventing this type of erosion.

Conservation practices have been adopted by producers to control much of the erosion in the Republican River Basin in Nebraska. Terraces and ecofallow (a rotation of wheat followed by one or more years of no-till row crop followed by a year of fallow) is commonly used on dryland acres in the basin.

Irrigated cropping systems are typically a no till or minimum till cropping system of crop rotation using various row crops (typically corn, milo, soybeans). Lower water use crops like wheat are starting to be used in this rotation because of the allocation of irrigation water.

Opportunities to increase the level of erosion control in dryland conservation systems are to increase the use of continuous no till through the use of chemical fallow. This would reduce wind erosion on summerfallowed wheat fields in years where inadequate moisture is available in the fall and spring to ensure sufficient spring growth to control wind erosion.

The level of conservation on irrigated fields could be increased by converting from minimum tillage to continuous no till systems. Vegetative practices including waterways, field borders or buffer strips could incorporated into existing conservation systems to reduce gully erosion and keep sediment from leaving the field.

3.4 Animals – Fish and Wildlife

Wildlife species to be considered for habitat development and management include primary game species such as ring-necked pheasant, Northern bobwhite quail, greater prairie chicken, wild turkey, white-tailed deer, and mule deer. Channel catfish is the primary game fish within the rivers and streams of the watershed. Game fish which exist within small ponds within the watershed include primarily bluegill, largemouth bass, and channel catfish. Other species which have declining populations that may occur within the watershed are listed below along with a general description of the required habitat. These are listed as Tier I species in the Nebraska Natural Legacy Project and additional information on population distribution and habitat enhancements to benefit each species can be obtained from wildlife biologists with local knowledge and/or the Natural Heritage database at the Nebraska Game and Parks Commission.

Birds	Insects	Mammals	Plants
Bald eagle – riparian corridors and associated wetlands	Regal fritillary – mixed-grass prairies with violet component	River otter – major riverine corridors	Large-spike prairie clover – short-grass prairie
Bell's Vireo – mixed-grass prairies with interspersed shrub component		Swift fox – mixed-grass prairies	
Brewer's sparrow – mixed-grass prairies			
Burrowing owl – prairie dog towns within mixed-grass prairies			
Ferruginous hawk – remote rock outcrops and lone trees in mixed-grass prairies			
Greater prairie chicken – mixed-grass prairies			
Long-billed curlew – mixed-grass prairies			
Short-eared owl – mixed-grass prairies with standing cover			

This watershed contains areas dominated by cropland consisting primarily of corn, soybeans, and wheat. As a result, lack of permanent vegetative cover as habitat is the most limiting factor for most wildlife populations in these areas. This is highlighted by the fact that many of the rare and declining wildlife species are dependent upon prairie habitats. The installation of conservation buffers on small portions of these crop fields would provide a significant increase in available habitat, especially for game species which highly utilize the cropland and permanent habitat interface. These same buffer practices along with the conversion of marginal irrigated cropland to wildlife habitat will also address the primary resource concern in the watershed of water quantity. Enrollment of eligible lands into the continuous sign-up provisions of the Conservation Reserve Program and the Platte-Republican Conservation Reserve Enhancement Program (CREP) administered by the Farm Services Agency is the most lucrative option since annual land-use payments are made as well as cost-share assistance for the necessary practice components. Other conservation programs such as the Environmental Quality Incentives Program, Wildlife Habitat Incentives Program, and the Wetlands Reserve Program can also be used on a case by case basis to convert cropland to grassland for use by livestock and wildlife, manage existing rangeland using prescribed grazing and prescribed burning, restore wetlands and riparian corridors by removing invasive species such as saltcedar, Russian olive, and phragmites, and various other conservation actions.

3.5 Plants – Invasive Species

The spread of invasive plant and woody species into the Great Plains is a topic that is continuing to receive a great amount of attention. Eastern red cedar and leafy spurge have stretched out into Nebraska grasslands, while salt cedar, Russian olive, and phragmites continue to invade our riparian waterways. In some areas of the Republican River basin Eastern Red Cedar and Russian Olive have invaded the riparian area. Quantifying the extent of these invasive populations is a growing concern for conservationists, landowners, and resource managers.

Invasive species impact issues including water quantity, management of riparian habitat and flooding. Invasive vegetation encroaching on rivers and streams in the Republican River basin reduce the volume of flow that the river channel historically carried. Water consumed by invasive species also impacts the amount of water available in times of drought and low flow in the river system. Understanding the impacts and the management of invasive plant species is an important part future management of resources in the basin.

Initial mapping inventories in the Republican River basin have been conducted using satellite imagery and helicopter surveys. These surveys are useful on a regional management scale, but are too limited to be used for actual quantitative measurements of population. Satellite imagery is inadequate for small scale measurements due to low resolution, acquisition date limitations, and cloud cover. Helicopter surveys rely largely on eyeball estimates and note taking to quantify invasive species. Invasive estimates can vary greatly depending on species being mapped, the note taker, and time of flight.

Recently, there have been efforts to provide a more detailed quantity estimate for invasive plant varieties using remote sensing technologies. Using color infra-red aerial photos and an object-oriented image processing software package, different plant and tree species can often be distinguished from one another. This approach has been used by the NRCS and NE Forest Service to discern different tree species and obtain forest acre estimates in the Niobrara River Corridor in northern Nebraska. This same approach has been used to establish EQIP brush management payment rates for land in Custer and Valley counties in central Nebraska. The same process can be extended to other areas of resource concern, including the Republican River watershed.

The example below shows a stretch of waterway in the Republican watershed. Objects are created and lumped together based on color, texture, and shape. These objects can be fed into an image processing algorithm or manually classified using ground control data. The result is a detailed map of the river/vegetation that can be used to calculate acres of different vegetation types and better manage the river resource. Exhibit 7.1.3 provides additional details and methods used to complete this inventory.

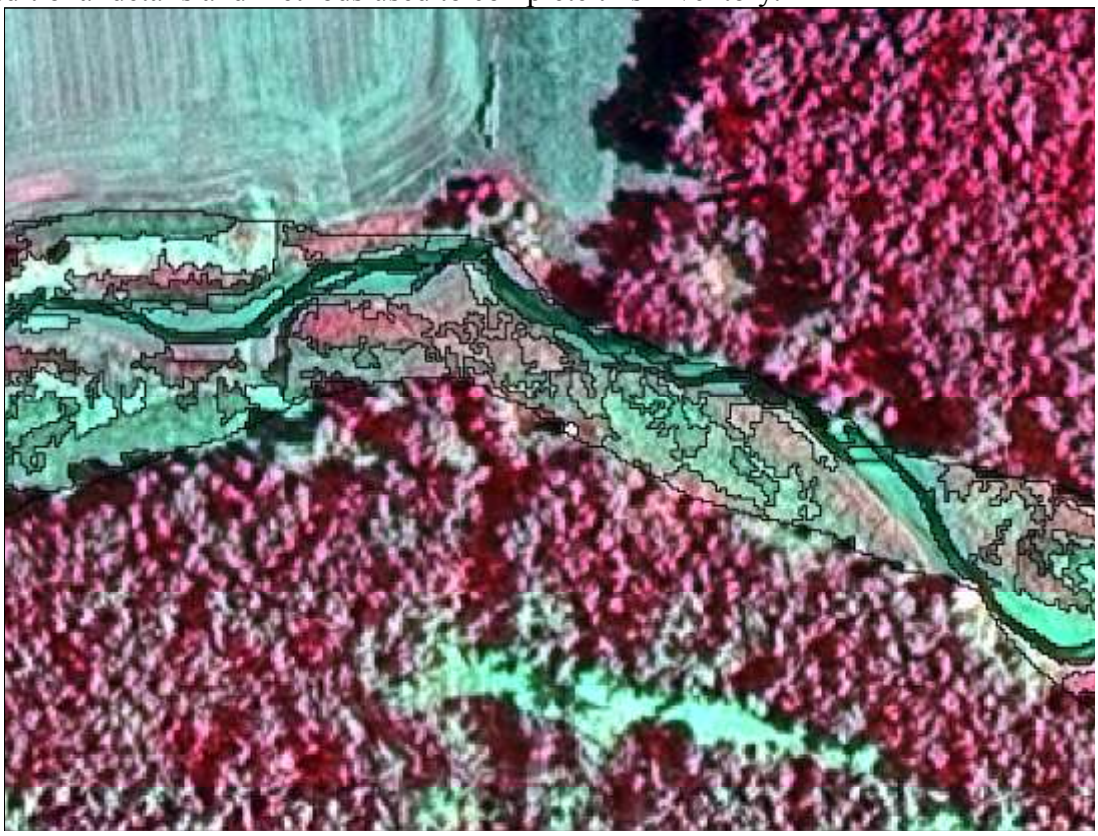


Figure 30 Objects of similar color, size, and texture

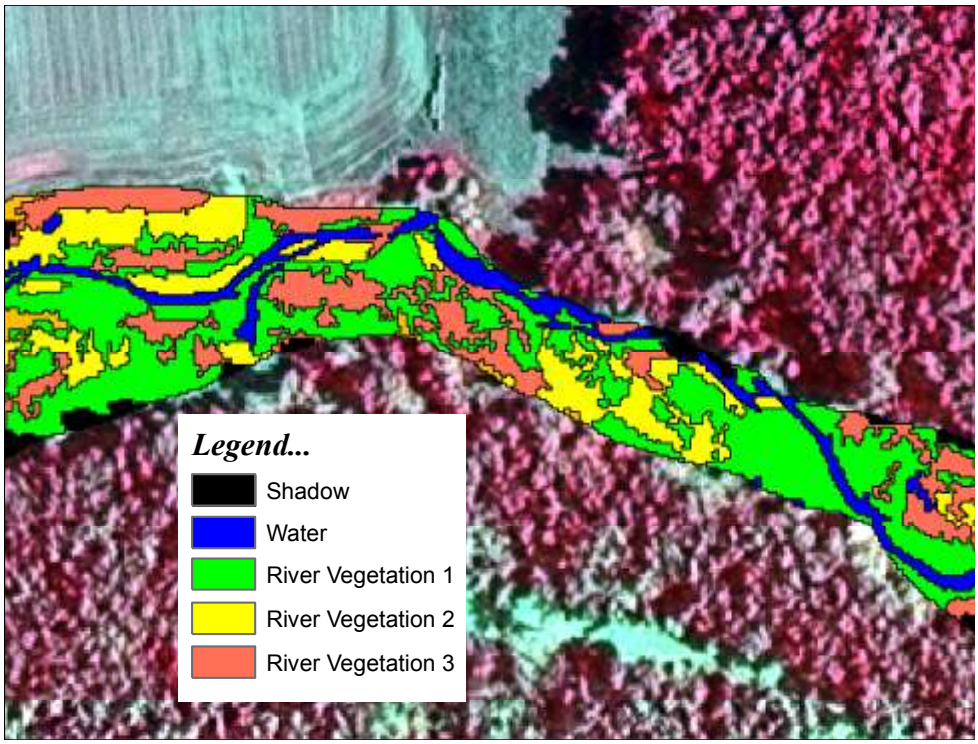


Figure 31 Classified objects displaying vegetation of Republican River

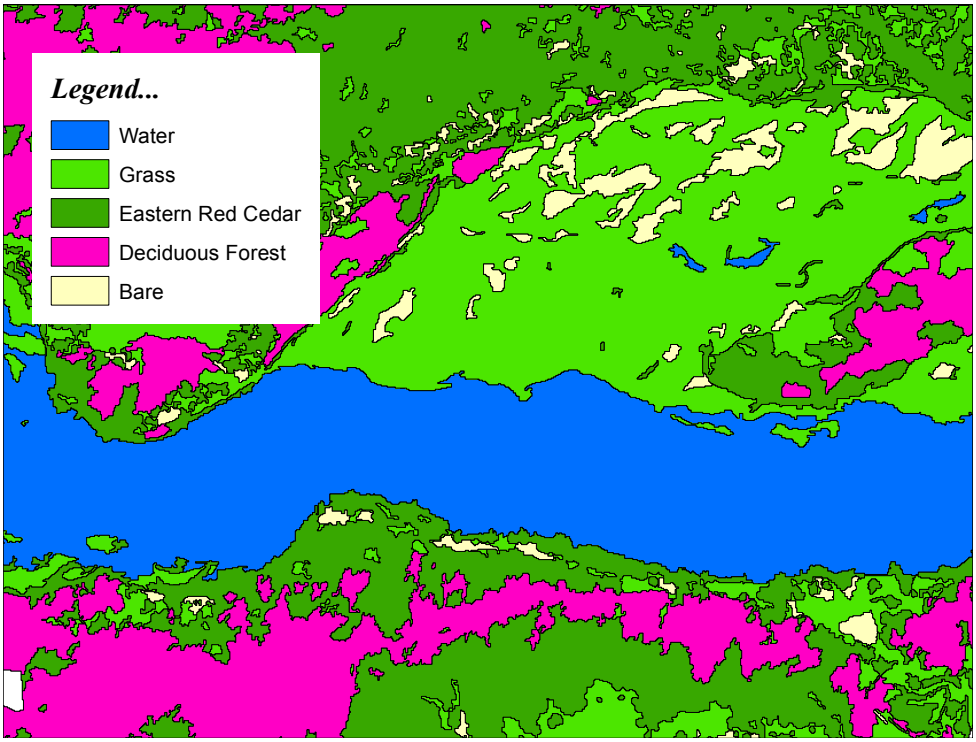


Figure 32 Classified objects displaying vegetation surrounding the Niobrara River along Brown/Keya Paha County Border

3.6 Plants – Range Condition

Rangeland is an important part of the Nebraska portion of the Republican River Basin. According to 2007 NASS data, approximately 58% of the basin is in rangeland. Most of the rangeland in the basin is native vegetation. Some of the rangeland in the basin is land previously used as cropland and seeded back to grass. Most native grass stands are predominantly warm season grasses and the primary use is grazing of livestock.

The vegetation varies from west to east with the average amount of rainfall. The western portion of the Republican River Basin in Nebraska is typically short grass prairie and the eastern portion of the Basin is mid to tall grass prairie.

Management of these areas varies from operation to operation, but significant numbers of producers are using some type of rotation to improve and maintain plant vigor.

The recent drought has stressed the rangeland resources in portions of the basin. Livestock numbers have been adjusted to some extent to accommodate the lower growth rates and some producers have adopted more management and grazing rotation strategies to stretch their number of grazing days without hurting future grass production.

Rangelands in portions of the basin are experiencing encroachment of invasive species, primarily Red Cedar in the uplands and Red Cedar and Russian Olive in riparian grazing areas. Control of invasive species in these areas is important in maintaining productivity and function. Prescribed burning is used in some areas of the basin to reclaim areas and restore them to grazing. Other methods of control include managed grazing, grazing with alternate species (goats) and chemical or mechanical control. Potentially some of the woody invasive species could be used for commercial uses. Eastern Red Cedar could be used as a resource providing wood products or fuel products in the future.

3.7 Cultural Resources

Within the area of the Republican River Basin Rapid Watershed Assessment a rich history of human occupation can be traced back approximately 15,000-18,000 years ago to the present. Resources of historical, cultural, and scientific value occur and include artifacts, buildings, other structures, objects and places. These are commonly referred to as cultural resources. Other less tangible cultural resources that may be present include dance forms, aspects of folklife, landscapes, vistas, as well as cultural or religious practices.

There are areas within the Republican River Basin Watershed Assessment area that contain higher densities of previously identified cultural resources. This may be due to several factors: preservation potential of the resource, accessibility, past investigation of areas, and/or attractiveness of the space for various human activities. And while there are over a thousand cultural resources identified in the watershed it is appropriate to assume that there are others that have not yet been identified.

Cultural resources are important to our state and nation's heritage and many of them have been destroyed or irreversibly altered by recent human activities. As a result, state and federal legislation has been enacted to require agencies take into consideration the effects of their actions on resources determined to be eligible for listing on the National Register of Historic Places. Activities carried out in the watershed may be subject to the Nebraska Archaeological Resources Preservation Act, the National Historic Preservation Act, American Indian Religious Freedom Act, as well as other state and federal legislation.

Additional information on topics discussed above can be found at the following web sites:

1) The National Register of Historic Places see http://www.nebraskahistory.org/histpres/nrhp/index.htm.

2) The National Historic Preservation Act see http://www.achp.gov/nhpp.html.

3) Additional information on historic preservation in Nebraska see http://www.nebraskahistory.org/histpres/index.htm.

3.8 Endangered and Threatened Species

The federally listed and proposed species documented by the U.S. Fish and Wildlife Service as a concern for the project and their applicable counties are listed in the below table. Also to be considered in the planning process are the state species of concern that are indicated by the maps in the NRCS field office technical guide (FOTG): bald eagle, sturgeon chub, and swift fox. Those species that are already federally listed are not included.

The actual review of affects upon these species will depend on the alternatives that are developed and then reviewed in site specific detail. However, following is a project area cursory review of the above listed species for the area in general based on information from the FOTG.

Federally Listed Species

American Burying Beetle:

Specific habitat requirements are not readily identifiable (treeless grasslands, cropland, riparian, and savannah areas). Prior to conducting ground-disturbing activities the U.S. Fish and Wildlife Service must be consulted.

Black-footed Ferret evaluation factor:

Would proposed project be implemented on, or negatively impact a prairie dog town or complex which is 10,000 acres or more in size?

Federal Species	Scientific Name	Federal Status
American Burying Beetle	*Nicrophorus americanus*	Endangered
Black-footed Ferret	*Mustela nigripes*	Endangered
Interior Least Tern	*Sternula antillarum*	Endangered
Piping Plover	*Charadrius melodus*	Threatened
Whooping Crane	*Grus americana*	Endangered

County	Species
CHASE, DUNDY, FRANKLIN, FURNAS, HARLAN, HAYES, HITCHCOCK, NUCKOLLS, PERKINS, WEBSTER	Black-footed Ferret
	Whooping Crane
FRONTIER	American Burying Beetle
	Black-footed Ferret
	Whooping Crane
GOSPER, LINCOLN	American Burying Beetle
	Black-footed Ferret
	Interior Least Tern
	Piping Plover
	Whooping Crane
KEARNEY, KEITH, PHELPS	Black-footed Ferret
	Interior Least Tern
	Piping Plover
	Whooping Crane
RED WILLOW	Black-footed Ferret
	Piping Plover
	Whooping Crane
THAYER	Whooping Crane

Interior Least Tern and Piping Plover evaluation factors:

Is the area of potential effects (include noise and sight) within 1/4 mile with no visual or sight barrier of a beach area, peninsula, sand, shale, or gravel bar within the area indicated on the present distribution map in the FOTG and would the project be implemented from April 15 to September 1?

Would the practice be implemented on a beach area, peninsula, sand, shale or gravel bar within the area indicated on the present distribution map in the FOTG?

Whooping Crane evaluation factors:
Has landowner or another person historically observed Whooping cranes using the site or area of potential effect?
Are subirrigated grasslands, meadows, streams, river channels, or shallow wetlands present on in the area of potential effect?

State Species of Concern
Bald Eagle: Currently there are known nest and/or specifically recognized winter roost sites along the Republican River and Enders Reservoir.
Sturgeon Chub: Historically found and documented occurrences in the Republican River and the lower reach of the Frenchman River.
Swift Fox: Concentration areas in northwestern Perkins County with potential habitat in western half of project area.

CHAPTER 4
CENSUS and SOCIAL DATA

4.1 Population

The Republican River Valley has seen population decline over the last several years. Of the sixteen counties located either partially or entirely in the study area, fifteen have seen population declines over the period from 2000-2006. The average percent change in population for the study area is negative 5.9%, while the state average percent change in population over the same period is 3.3%. The population of each county in 2000 and 2006 along with the percent change in population is shown in Table 4-1. This study area is also more sparsely populated than the rest of the state with an average population density of 7.6 persons per square mile compared with 22.3 persons per square mile on average in the state of Nebraska. The population densities of each county are also shown in Table 4-1.

Table 4-1
Population Data for Republican River Valley

County	2006 Population	2000 Population	Population, Percent Change	Population Density (person/mi^2)
Perkins	2,992	3,200	(6.2)	3.6
Chase	3,811	4,068	(6.3)	4.5
Dundy	2,109	2,292	(8.0)	2.5
Lincoln	35,865	34,632	3.6	13.5
Hayes	1,029	1,068	(3.7)	1.5
Hitchcock	2,926	3,111	(5.9)	4.4
Frontier	2,729	3,099	(11.9)	3.2
Red Willow	10,865	11,448	(5.1)	16.0
Gosper	1,978	2,143	(7.7)	4.7
Furnas	5,003	5,324	(6.0)	7.4
Phelps	9,442	9,747	(3.1)	18.1
Harlan	3,446	3,786	(9.0)	6.8
Franklin	3,348	3,574	(6.3)	6.2
Webster	3,701	4,061	(8.9)	7.1
Nuckolls	4,650	5,057	(8.0)	8.8
Kearney	6,701	6,882	(2.6)	13.3

4.2 Demographics

According to the US Census Bureau, the racial make-up of the Republican River Valley study area is 98.5% white, 2.4% Hispanic, 0.4% American Indian/Alaska Native, 0.3% Asian, 0.2% Black; with 0.6% of the population reporting two or more races. Persons 65 years old and over comprise 21.1% of the population in the Republican River Valley compared with 13.3% for the state of Nebraska; persons under 18 years old comprise 21.9% of the study area's population compared with 25.2% of the state's population.

Amongst the counties included in the study area, 16.2% of the study area's population have a Bachelor's degree or higher, compared with 23.7% of the state.

According to the US Department of Commerce's Bureau of Economic Analysis, the average per capita personal income (PCPI) for the study area in 2006 was $29,158 compared with $34,440 for the state. The percent of persons living below poverty on average for the study area is 10.2%, this compares with 10.0% for the state. A breakdown of the county values is shown in Table 4-2.

Table 4-2
Demographic Information for Republican River Valley

County	PCPI[1]	Rank in State[2]	Persons below poverty, percent
Perkins	$27,485	50	10.4
Chase	$28,660	34	9.5
Dundy	$30,133	20	12.0
Lincoln	$29,104	31	10.5
Hayes	$20,491	86	9.3
Hitchcock	$21,361	83	12.5
Frontier	$28,034	43	10.5
Red Willow	$28,151	42	10.4
Gosper	$28,647	35	6.9
Furnas	$24,492	74	11.5
Phelps	$30,926	11	9.7
Harlan	$26,528	60	10.5
Franklin	$25,764	66	11.2
Webster	$30,456	18	9.9
Nuckolls	$25,391	69	10.3
Kearney	$30,644	15	8.2

1/ PCPI stands for Per Capita Personal Income
2/ The rank is based on 93 counties in Nebraska.

4.3 Farm Data

According to the 2002 Census of Agriculture, there are a total of 6,427 farms in the counties located either partially or entirely in the study area. This number is down from 7,449 farms identified in the 1997 Census of Agriculture. The average farm size in 2002 for the study area was 1,206 acres which was up from the 1997 average of 1,052 acres. The number of operators in the study area in 2002 was 9,343 of which 324 were female. For a breakdown of this information by county, see Table 4-3.

Table 4-3
Farm Data Information for Republican River Valley

County	Number of Farms (2002)	Average Size of Farm (2002)	Number of Operators (2002)	Number of Female Operators (2002)
Perkins	438	1252	636	24
Chase	326	1655	477	24
Dundy	262	2164	381	14
Lincoln	959	1594	1529	84
Hayes	260	1570	387	22
Hitchcock	299	1450	445	12
Frontier	318	1530	460	8
Red Willow	380	1129	538	10
Gosper	242	1084	346	9
Furnas	412	1070	574	15
Phelps	470	779	688	9
Harlan	346	893	488	19
Franklin	378	876	543	19
Webster	449	709	613	31
Nuckolls	476	736	649	10
Kearney	412	804	589	14

CHAPTER 5
STATUS OF RESOURCES

5.1 Status and History of Resource Conservation in the Watershed

Agriculture in the Republican River Basin has gone through many changes since the first sod was "busted" in the late 1800s. Lands near flowing rivers and streams in the basin were the first to be used for crop production. As settlers moved west, these prime sites were soon occupied and settlement moved to the uplands. Favorable economic and climatic conditions and world events brought more farmers to the valley. European immigrants displaced by World War I moved to the area in the early 1900s seeking farmland. Rainfall was timely and crop prices were high. Wheat prices reached $3.00 per bushel range in 1917 due to shortages brought about by World War I. The combination of high prices, favorable rainfall and a large number of individuals with farming experience led to accelerated conversion from native rangeland to cropland in the basin. This conversion activity peaked in the late 1920s coinciding with the stock market crash of 1929.

Frontier County, 620,000 acres, located near the center of the Republican River Basin, is a prime example of the huge swings in land use from the 1929 peak. The Nebraska 1929 Census of Agriculture shows 425,000 cropped acres compared to 2006 National Agricultural Statistics Service (NASS) data showing approximately 240,000 cropped acres. This large scale development of basically clean tillage with no conservation practices led to what is commonly called the "dirty thirties".

The drought of the 1930's along with the "great depression" and 47 cent per bushel wheat in 1933 drove many families off the farm. Severe erosion by both wind and water was common in the area. With few crops and no conservation practices water was free to run at will. Flooding of lowland areas became common.

In 1935, in the middle of the drought, a "perfect storm" dropping up to 20 inches of rain in some areas, followed the Republican River from Colorado to Kansas. Hundreds of lives were lost and millions of dollars of both public and private property were damaged. Many bridges spanning the Republican were washed away or severely damaged during the flood. The river jumped out of its channel and cut many new channels. Much of the vegetation along the river banks was washed away.

Private Citizens formed groups and requested assistance from the Federal Government to prevent such events from happening again. The Federal Government responded through the efforts of agencies like the Bureau of Reclamation (BOR), the Soil Conservation Service (SCS) and the Agricultural Stabilization and Conservation Service (ASCS).

The BOR proposed several dams on the Republican River in and its major tributaries to control flooding. Surface water stored in the reservoirs during times of water surplus in the river could be stored for use to grow crops in dry times. An agreement as to how Colorado, Nebraska and Kansas would divide the water generated in the Republican River Basin was required before the federal funds would be obligated to the project. The

Republican River Compact Agreement was signed into law on December 31, 1942 allocating the average annual water supply of the Republican River, 11% to Colorado, 49% to Nebraska and 40% to Kansas. Dams were constructed in Nebraska by the BOR near Imperial (Enders Reservoir), Trenton (Swanson Reservoir), McCook (Red Willow Reservoir), Cambridge (Medicine Creek Dam) and the Corps of Engineers (COE) built and dam near Alma (Harlan County Reservoir).

The SCS, now known as the Natural Resources Conservation Service (NRCS), concentrated on conservation practices intended to reduce erosion on cropland and improve grassland. Local offices were established in each county to provide technical assistance to private landowners in managing their soil, water and rangeland related resources. The Great Plains Program provided funds to seed steep eroding cropland back to native grass species, construct conservation practices to control soil erosion and install fence and livestock pipeline to distribute grazing. Crop residue management practices were promoted and Soil and Water Conservation Districts were formed to be the local leaders in promoting conservation practices to restore the land. The duties of the Soil and Water Conservation Districts were assumed by the Natural Resource Districts in 1972. These multi county units of local government were given taxing authority to continue the function of the Soil and Water Conservation Districts and other resource related boards in the area. The SCS, in conjunction with the Middle Republican Natural Resource District, installed flood control projects on Medicine Creek, Blackwood Creek, Perry Drainage District and the Dry Creek Pilots utilizing PL-566 funding to reduce upland flood damages (Figure 32 pg 33).

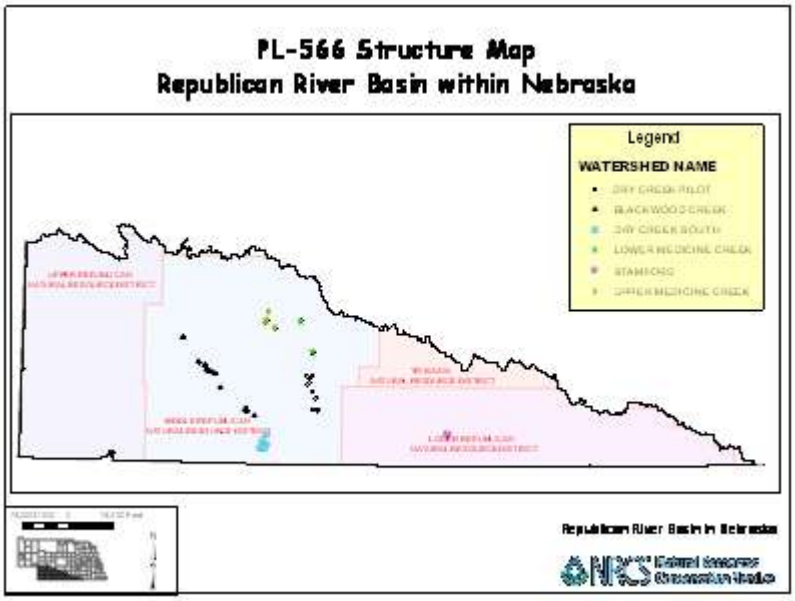


Figure 33 PL-566 Watershed Map

The ASCS, now known as the Farm Service Agency (FSA) administered programs to provide funding to private landowners to install conservation practices with technical assistance provided by SCS.

Conservation practices typically were readily accepted in the Nebraska portion of the Republican River Basin. This may be largely contributed to history of the basin and memories of the damages caused by not caring for the land.

Irrigation was introduced into the basin initially as surface water irrigation through direct diversion from the river or its main tributaries.

In a 1907 report by USGS there were about 35,000 acres under irrigation with a total of about 130 miles of ditch. This was enhanced and acreages increased by the installation of the BOR dams installed for flood control and irrigation. Water was stored throughout the year for use in the growing season. A system of canals was expanded to deliver water from the BOR reservoirs to fields receiving water. These canals are concentrated in and around the alluvial areas of the Republican River and it tributaries.

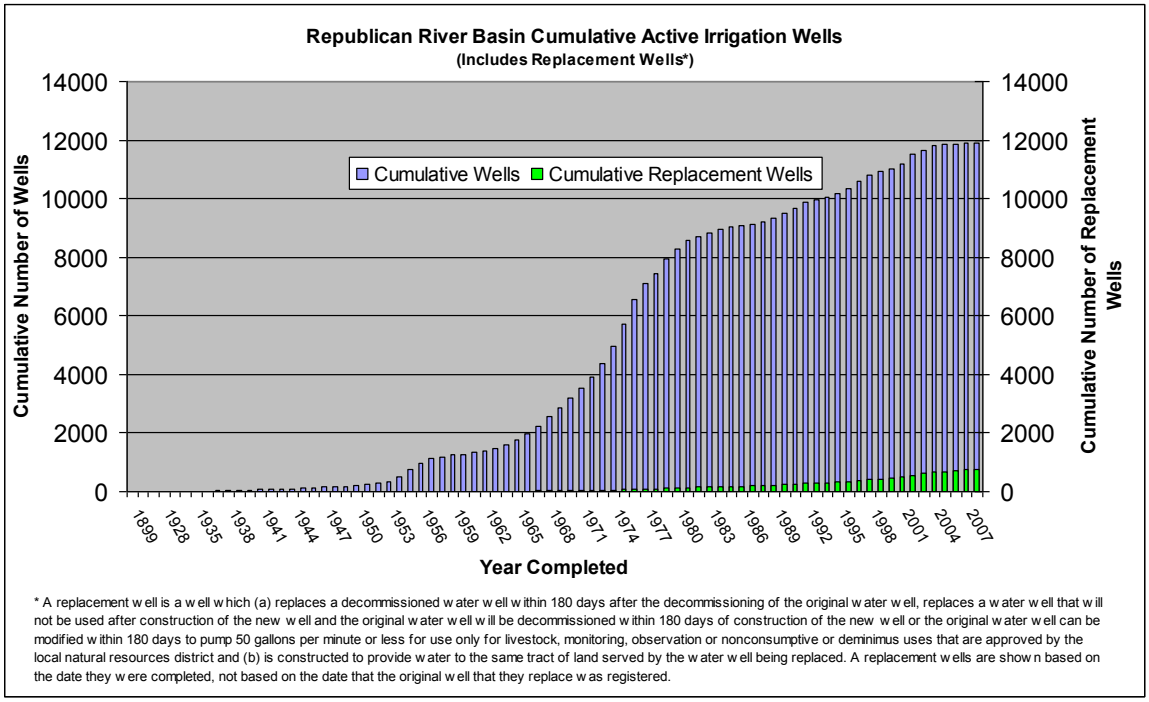


Figure 34 Active Irrigation Wells

The first irrigation well was drilled in the Republican River Basin in 1899, but large capacity ground water wells began to appear across the Basin in the 1930's. The rate of increase in irrigation "ratchets" up during times of drought and levels off in times of above average rainfall. The drought of the 1950s brought an increase of irrigation in the area. This irrigation was typically gravity

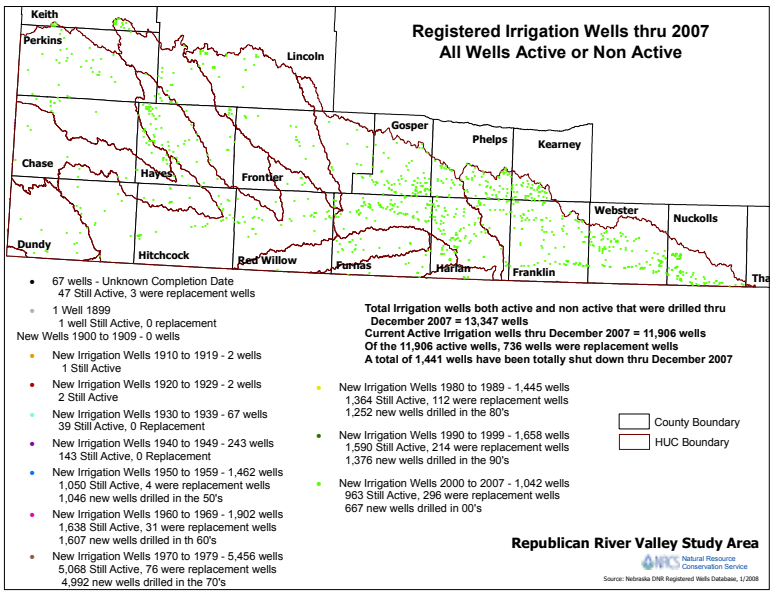
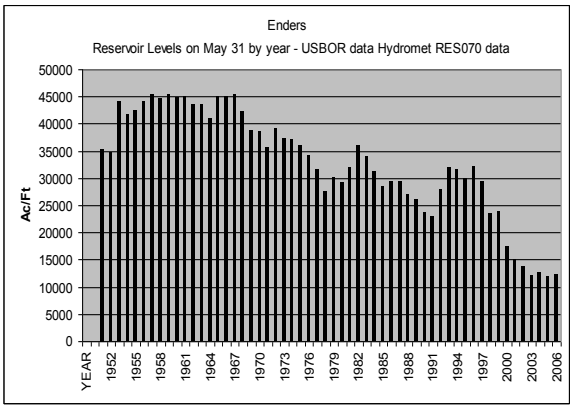


Figure 35 Active Irrigation Wells by Year

type irrigation using a ditch and later, gated irrigation pipe.

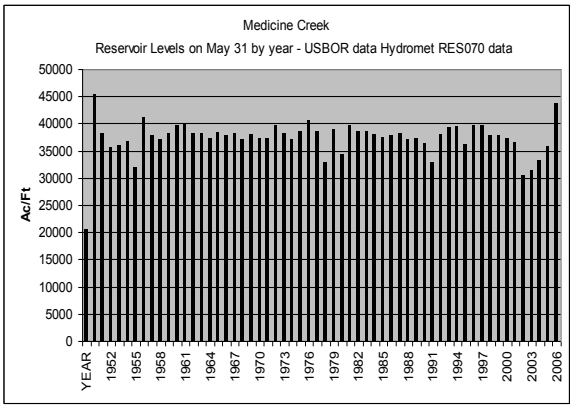
The rate of irrigation development was fairly flat in the 1960s due to a period of above average rainfall.

Irrigation technology in the form of the "center pivot" brought a great new change to irrigation in the basin. Acres that were too steep or not uniform enough to irrigate using gravity irrigation could now be irrigated using a center pivot. The center pivot and favorable farm prices in the early to mid 1970s led to a rapid increase in the rate of irrigation development, 43% of the current irrigation systems in the Republican River Basin were installed in the 10 year period from 1971 through 1980.



The rate of irrigation development again flattened during the farm credit crisis and poor commodity prices in the 1980s and early 1990s.

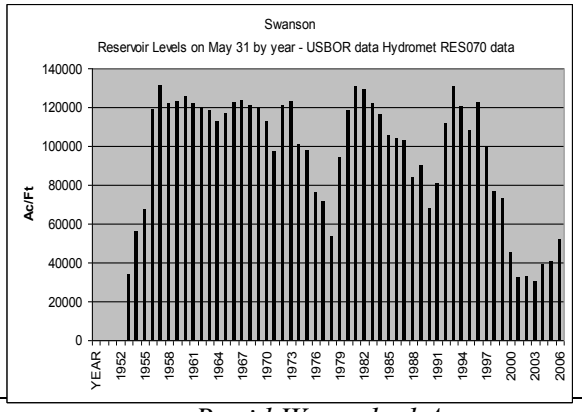
In May, 1998 the State of Kansas filed a complaint with the U.S. Supreme Court alleging that Nebraska and Colorado violated the 1942 Republican River Compact "by allowing the proliferation and use of thousands of wells hydraulically connected to the Republican River and its tributaries, by the failure to protect surface flows from unauthorized appropriations by Nebraska users, and by other acts and omissions".



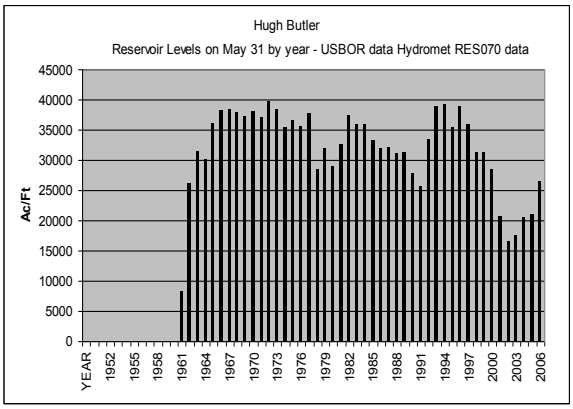
The three states settled the lawsuit in December 2002 by signing a Settlement Agreement.

In February 2008 Kansas officially submitted the dispute that Nebraska was in violation of the Settlement signed in 2002 and had consumed more than the agreed to share of water in the Republican River Basin. Kansas and Nebraska are currently in negotiations moving through the steps established in the Settlement Agreement.

Data from the US Bureau of Reclamation show a steady decline in some reservoir levels over time while other reservoir levels stay relatively stable. This would appear to be due to steady base flows from some sub-basins. The long term drought has been a major contributor to recent reductions in stream flow and reservoir levels, but other factors are undoubtedly accountable. Other factors include, but are



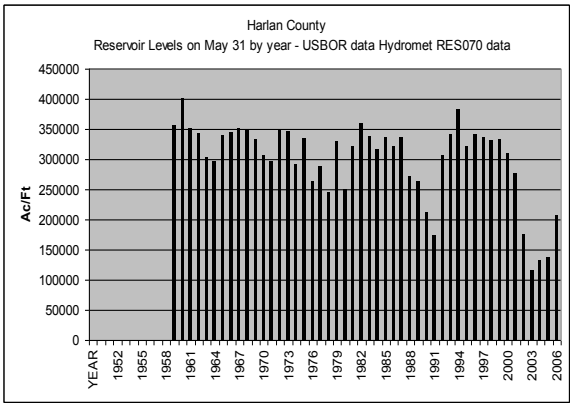
not limited to, reduction of base flow because of groundwater level decline, increased irrigation efficiency that limits runoff and deep percolation, increased water use by invasive species in riparian areas and the installation of conservation practices that limit runoff. The level of impact of each of these factors is difficult to quantify. Studies are currently ongoing to study the impact of conservation practices and non federal reservoirs and the impact of consumptive use by invasive species on water supplies in the basin. Management decisions impacting surface water flows may be made more clear as information from these studies become available.



Programs have been put in place to implement ground water pumping allocations, to retire irrigation through voluntary means either temporarily or permanently through the use of various local, state and federal programs and to purchase surface water from surface water irrigation districts and leave it in the river system to be delivered downstream into Kansas. Organizations have formed to work on the management of riparian areas along the Republican River and its tributaries primarily through the control of invasive species.

Water quantity issues are the primary resource concern in the Republican River Basin at this time.

There is potential for soil erosion through both wind and water on the cropland in the basin. Most of the irrigated lands are farmed using either a complete no-till system or with minimal tillage leaving most residues on the surface. Most dry cropland is farmed under a system that uses a combination of no-till and minimum tillage and many fields are terraced.



5.1 Conservation Programs for Resource Considerations

The Environmental Evaluation (EE) is a NRCS planning process as described in the NRCS National Planning Procedures Handbook. The EE identifies and analyzes the economic, environmental, and social concerns. This process is documented/summarized on the NE-CPA-52 Environmental Evaluation for Conservation Planning form.

For the purposes the Republican River Rapid Watershed Assessment, the NE-CPA-52 has been used as a part of the Inventory and Evaluation and scoping process. The results of the EE are used to identify the resource concerns and special environmental concerns.

The Resource Consideration Field Inventory Guide Sheet portion of the NE-CPS-52 can be found in Appendix B Supporting Information.

5.1.1 – Water Quantity

RESOURCE CONCERN	ALTERNATIVE	FUNDING SOURCE
Aquifer Overdraft Insufficient Water due to Interstate Compact Issues Invasive Species	• Convert to landuse requiring less water. • Irrigation Water Management • Pest Management	• EQIP • Platte Republican CREP • WHIP • Local • CRP

5.1.2 – Animals – Fish and Wildlife

RESOURCE CONCERN	ALTERNATIVE	FUNDING SOURCES
Inadequate Cover/Shelter Plant Community Fragmentation	<u>Primary Corridor Habitat</u> • Field Borders • Contour Buffer Strips • Filter Strips • Riparian Forest Buffers • Grassed Waterways	• Continuous CRP • WHIP • WRP • EQIP

5.1.3 – Plants – Range Condition

RESOURCE CONCERN	ALTERNATIVE	FUNDING SOURCE
Plants – Invasive Species	Chemical	LB 701
	Mechanical	EQIP
	Biological	

5.1.4 - Special Environmental Concerns

CULTURAL RESOURCES	PLANNING CONCERN
Culturally Significant and Indigenous Plant Species	Field investigation for identification and evaluation of condition and documentation of identified Cultural Resources.
Cultural Resource Sites	Field investigation for identification and evaluation of condition and documentation of identified Cultural Resources.

CHAPTER 6
Assessment Matrix

WATERSHED NAME & CODE	REPUBLICAN RIVER BASIN IN NEBRASKA -	LANDUSE ACRES	1,298,512
LANDUSE TYPE	IRRIGATED CROPLAND	TYPICAL UNIT SIZE ACRES	130
CONSERVATION INVESTMENT INFORMATION		ESTIMATED PARTICIPATION	95%

CONSERVATION SYSTEMS BY TREATMENT LEVELS	FUTURE	USDA INVESTMENT				PRIVATE INVESTMENT		
	New Treatment Units	Installation Cost 50%	Management Cost - 3 yrs 100%	Technical Assistance 20%	Total Present Value Cost	Installation Cost 50%	Annual O & M + Mgt Costs 100%	Total Present Value Cost
Progressive System Acres Treated	**38,955**							
Conservation Crop Rotation (ac.) 328	0	$0	$0	$0	$0	$0	$0	$0
Irrigation System, Sprinkler (ac.) 442	0	$0	$0	$0	$0	$0	$0	$0
Irrigation System, Surface and Subsurface (ac.) 443	5,843	$14,608	$0	$2,922	$17,530	$14,608	$876	$18,300
Irrigation Water Management (ac.) 449	0	$0	$0	$0	$0	$0	$0	$0
Nutrient Management (ac.) 590	31,164	$0	$1,402,393	$280,479	$1,530,016	$0	$467,464	$719,592
Pest Management (ac.) 595	31,164	$0	$1,869,857	$373,971	$2,040,022	$0	$623,286	$959,456
Residue Management, No-Till/Strip Till/Direct Seed (ac.) 329	38,955	$0	$3,505,982	$701,196	$3,825,041	$0	$1,168,661	$1,798,980
	Subtotal	**$14,608**	**$6,778,233**	**$1,358,568**	**$7,412,609**	**$14,608**	**$2,260,287**	**$3,496,329**
Resource Management System (RMS) Acres Treated	**480,449**							
Conservation Crop Rotation (ac.) 328	0	$0	$0	$0	$0	$0	$0	$0
Filter Strip (ac.) 393	24,022	$2,282,135	$0	$456,427	$2,738,562	$2,282,135	$91,285	$2,666,662
Irrigation System, Sprinkler (ac.) 442	0	$0	$0	$0	$0	$0	$0	$0
Irrigation Water Management (ac.) 449	0	$0	$0	$0	$0	$0	$0	$0
Nutrient Management (ac.) 590	116,866	$0	$5,258,974	$1,051,795	$5,737,561	$0	$1,752,991	$2,698,470
Pest Management (ac.) 595	116,866	$0	$7,011,965	$1,402,393	$7,650,082	$0	$2,337,322	$3,597,960
Residue Management, No-Till/Strip Till/Direct Seed (ac.) 329	25,970	$0	$2,337,322	$467,464	$2,550,027	$0	$779,107	$1,199,320
	Subtotal	**$2,282,135**	**$14,608,260**	**$3,378,079**	**$18,676,232**	**$2,282,135**	**$4,960,705**	**$10,162,413**
TOTAL ACRES TREATED / ESTIMATED TREATMENT COSTS	**0**	**$2,296,743**	**$21,386,493**	**$4,736,647**	**$26,088,840**	**$2,296,743**	**$7,220,993**	**$13,658,741**

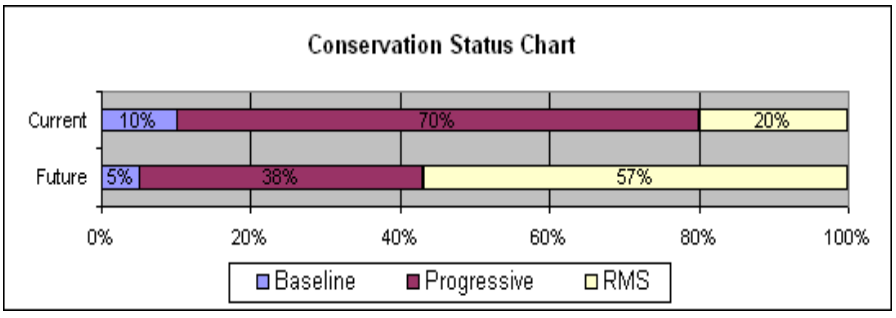


Chart Refers To	
Landuse Type	IRRIGATED CROPLAND
Estimated Participation Rate	95%

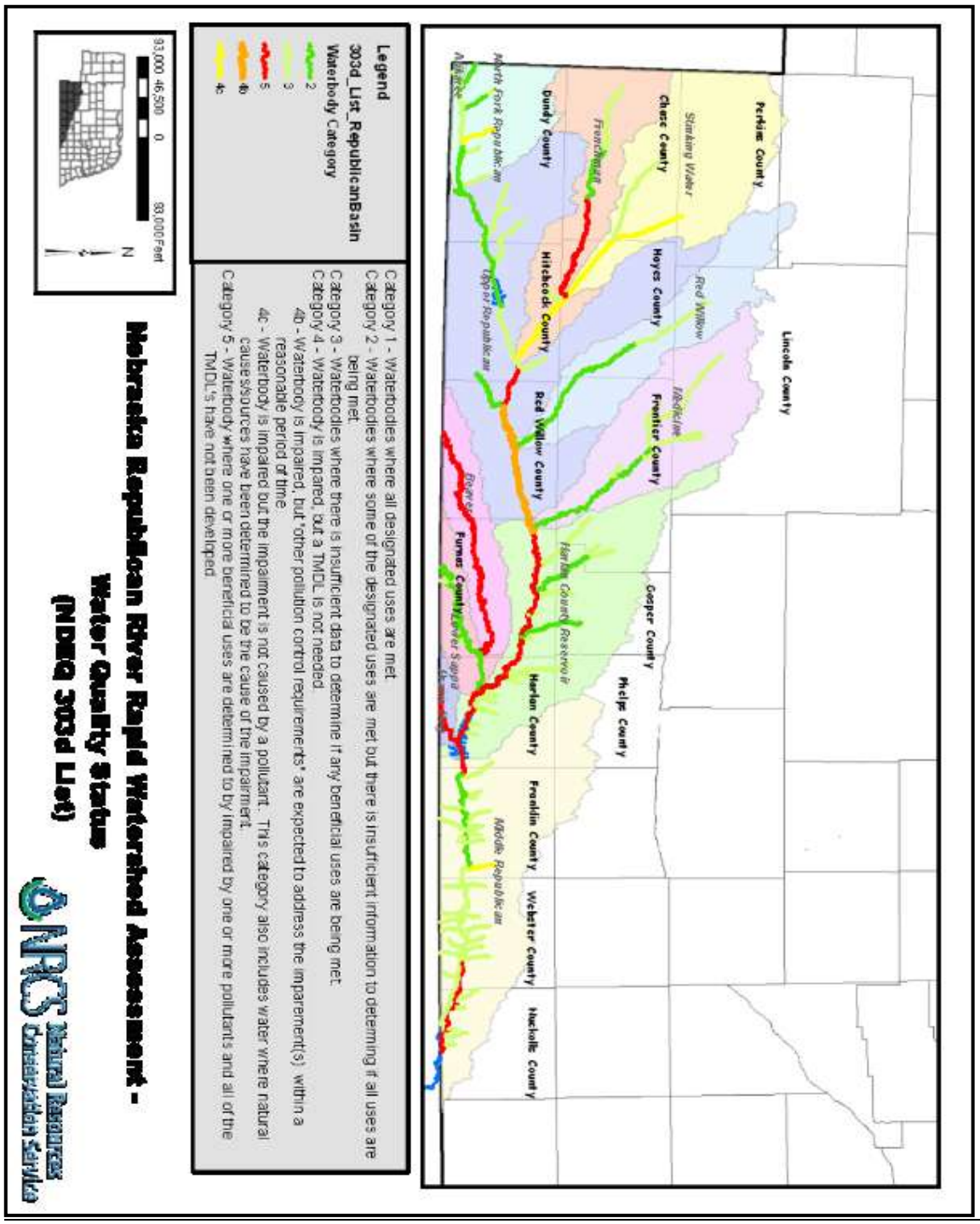
Average PV Costs per Ac		
System	Federal	Private
Prog	$190	$90
RMS	$39	$21

Estimated FTE per Year		9.5

CHAPTER 7
REFERENCES

7.1 List of Exhibits

7.1.1 Water Quality 303(d) information (Map)



7.1.2 Water Quality 303(d) information (Tables)

S = Beneficial use is supported I = Beneficial use is impaired Blank = insufficient data to determine if the beneficial use is supported or impaired

		Beneficial Uses								
Water body ID	Water body Name [1]	Primary Contact Recreation	Aquatic Use	Public Drinking Water Supply	Agriculture Water Supply	Industrial Water Supply	Aesthetics	Water body Assessment Category	Parameter(s)) Impairing Use	Comments
Streams										
RE1-30100	Elm Creek		S		S			2		
RE1-40000	Republican River		S					2		
RE2-10600	Sappa Creek		S		S			2		
RE2-11100	Turkey Creek		S		S			2		
RE2-11400	Muddy Creek		S		S			2		
RE3-10100	Medicine Creek	S	S		S			2		
RE3-10200	Medicine Creek		S		S			2		
RE3-10500	Red Willow Creek		S		S			2		
RE3-10900	Red Willow Creek		S		S			2		
RE3-10800	Driftwood Creek		S		S			2		
RE3-20400	Frenchman Creek		S		S			2		
RE3-40000	Republican River		S		S			2		
RE3-40500	South Fork Republican River		S		S			2		
RE3-50100	Buffalo Creek		S		S			2		
RE3-50300	North Fork Republican River		S		S			2		
RE1-10100	Blakely Creek							3		
RE1-10110	Oak Creek							3		
RE1-10200	Lost Creek							3		
RE1-10300	Unnamed Creek							3		
RE1-10400	Cottonwood Creek							3		
RE1-10500	Beaver Creek							3		
RE1-20100	Rankin Creek							3		
RE1-20200	Willow Creek							3		
RE1-20300	Courtland Canal							3		
RE1-30000	Republican River							3		
RE1-30200	Lost Creek							3		
RE1-30300	Hicks Creek							3		
RE1-30400	Dry Creek							3		
RE1-30500	Crooked Creek							3		
RE1-30600	Cedar Creek							3		
RE1-30700	Indian Creek							3		
RE1-30800	Base Penny Creek							3		
RE1-30900	Louisa Creek							3		
RE1-31000	Walnut Creek							3		
RE1-31100	Farmers Creek							3		

1. Title 117 - Nebraska Water Quality Standards may include a legal location or descriptive text within the same water body name. Please refer to Title 117 for these details

S = Beneficial use is supported I = Beneficial use is impaired Blank = insufficient data to determine if the beneficial use is supported or impaired

Water body ID	Water body Name [1]	Primary Contact Recreation	Aquatic Use	Public Drinking Water Supply	Agriculture Water Supply	Industrial Water Supply	Aesthetics	Water body Assessment Category	Parameter(s)) Impairing Use	Comments
RE1-40100	Wortham Creek							3		
RE1-40200	Lovely Creek							3		
RE1-40300	Reams Creek							3		
RE1-40400	Coates Creek							3		
RE1-40410	Wasp Creek							3		
RE1-40500	Calumet Creek							3		
RE1-40600	Walnut Run							3		
RE1-40700	Center Creek							3		
RE1-40800	Lost Creek							3		
RE1-40900	Little cottonwood Creek							3		
RE1-41000	Cottonwood Creek							3		
RE1-41100	Turkey Creek							3		
RE2-10100	Methodist Creek							3		
RE2-10200	Cook Creek							3		
RE2-10400	Rope Creek							3		
RE2-10500	Flag Creek							3		
RE2-10620	Sheep Creek							3		
RE2-10630	Dutch Creek							3		
RE2-10700	Melrose Creek							3		
RE2-10800	Foster Creek							3		
RE2-10900	Spring Creek							3		
RE2-10910	Deep Creek							3		
RE2-11000	Swartz Creek							3		
RE2-11200	Dry Creek							3		
RE2-11300	Elk Creek							3		
RE2-11410	West Muddy Creek							3		
RE2-11500	Muddy Creek							3		
RE2-11600	Deer Creek							3		
RE3-10210	Cedar Creek							3		
RE3-10220	Spring Creek							3		
RE3-10230	Curtis Creek							3		
RE3-10240	Fox Creek							3		
RE3-10241	Cut Canyon							3		
RE3-10300	Medicine Creek							3		
RE3-10310	Brushy Creek							3		
RE3-10400	Medicine Creek							3		
RE3-10700	Red Willow Creek							3		

1. Title 117 - Nebraska Water Quality Standards may include a legal location or descriptive text within the same water body name. Please refer to Title 117 for these details

7.1.2 Water Quality 303(d) information (Tables)

S = Beneficial use is supported I = Beneficial use is impaired Blank = insufficient data to determine if the beneficial use is supported or impaired

Water body ID	Water body Name [1]	Primary Contact Recreation	Aquatic Use	Public Drinking Water Supply	Agriculture Water Supply	Industrial Water Supply	Aesthetics	Water body Assessment Category	Parameter(s)) Impairing Use	Comments
RE3-20100	Blackwood Creek							3		
RE3-20210	Bobtail Creek							3		
RE3-20221	Spring Creek							3		
RE3-20410	Sand Draw							3		
RE3-20500	Frenchman Creek							3		
RE3-30000	Republican River							3		
RE3-40100	Muddy Creek							3		
RE3-40200	Burntwood Creek							3		
RE3-40300	Indian Creek							3		
RE3-40310	Rock Canyon							3		
RE3-40400	Indian Creek							3		
RE3-40510	Big Timber Creek							3		
RE3-40600	Spring Creek							3		
RE3-40700	Horse Creek							3		
RE3-50000	Republican River							3		
RE3-50200	Buffalo Creek							3		
RE3-50400	Arikaree River							3		
RE3-10000	Republican River							4B	Ammonia	
RE1-31200	Thompson Creek		I		S			4C	Temperature	
RE3-20200	Frenchman Creek		I		S			4C	Temperature	
RE3-20220	Stinking Water Creek		I		S			4C	Temperature	
RE3-40800	Rock Creek		I		S			4C	Temperature	
RE1-10000	Republican River	I	S		S			5	E.Coli & Fecal Coliform	TMDLs targeted for completion in next 2 years
RE1-20000	Republican River	I	S		S			5	E.Coli & Fecal Coliform	TMDLs targeted for completion in next 2 years
RE1-50000	Republican River	I	S		S			5	E.Coli & Fecal Coliform	TMDLs targeted for completion in next 2 years
RE2-10000	Republican River	I	S		S			5	E.Coli	
RE2-10300	Prairie Dog Creek		I		S			5	Dissolved Oxygen	
RE2-10510	Beaver Creek		I		S			5	Dissolved Oxygen	
RE3-20000	Republican River	I	I		S			5	E.Coli & Selenium	TMDLs targeted for completion in next 2 years

1. Title 117 - Nebraska Water Quality Standards may include a legal location or descriptive text within the same water body name. Please refer to Title 117 for these details

S = Beneficial use is supported I = Beneficial use is impaired Blank = insufficient data to determine if the beneficial use is supported or impaired

Water body ID	Water body Name [1]	Primary Contact Recreation	Aquatic Use	Public Drinking Water Supply	Agriculture Water Supply	Industrial Water Supply	Aesthetics	Water body Assessment Category	Parameter(s)) Impairing Use	Comments
RE3-20300	Frenchman Creek	I	I		S			5	E.Coli & Temperature	TMDLs targeted for completion in next 2 years
Lakes/Reservoirs/Impounded Waters										
RE3-L0010	Harry Strunk Lake	S	S		S		S	1		
RE3-L0100	Enders Reservoir	S	S		S		S	1		
RE3-L0080	Hayes Center Lake		S				S	2		
RE1-L0010	Sacramento-Wilcox Lake No. 1							3		
RE1-L0020	Sacramento-Wilcox Lake No. 2							3		
RE1-L0030	Sacramento-Wilcox Lake No. 3							3		
RE1-L0040	Holdrege Park Lake							3		
RE1-L0050	Limestone Bluffs Lake							3		
RE3-L0020	Bartley Diversion Dam Lake							3		
RE3-L0030	Hansen Memorial Reserve Lake							3		
RE3-L0040	Red Willow Diversion Dam Lake							3		
RE3-L0050	Barnett Park Lake							3		
RE3-L0120	Rock Creek Lake							3		
RE2-L0010	Harlan County Reservoir	S	I		S		I	5	Nutrients	
RE3-L0060	Hugh Butler Lake	S	I		S		I	5	Dissolved Oxygen	
RE3-L0070	Wellfleet Lake		I		S		I	5	Nutrients	
RE3-L0090	Swanson Reservoir	S	I		S		I	5	Nutrients	
RE3-L0110	Champion Mill Pond		I		S		I	5	Nutrients	

1. Title 117 - Nebraska Water Quality Standards may include a legal location or descriptive text within the same water body name. Please refer to Title 117 for these details

7.1.3 - Vegetation mapping using Definiens, Imagine, and IR imagery:

Process:
Using 2006 CIR aerial photography and ground reference data, vegetation cover can be identified within a defined using Definiens image analysis software. Definiens is an object-oriented image processing software that incorporates texture, shape, and spectral response to discriminate between land cover types. Segmentation polygons will be created by Definiens for the area of interest and likened to the ground reference (vegetation) information. Likely vegetation categories will include (but not be limited to):

- Evergreen
  - Red Cedar
  - Mixed Forest
- Deciduous
- Grassland
- Agriculture
- Barren (no cover)

Software
Definiens image processing software was used to break down IR imagery into objects of similar color, texture, and shape. These objects were assigned to vegetation (and other land cover) classes using ground truth data. The remaining objects were then run through a classification algorithm and placed into the classes based on similarities to the ground truth objects. This produced a vegetation map from the IR imagery. All agricultural land was removed prior to classification using the Farm Service Agency common land unit layer and a subset operation in *Erdas Imagine*. Noticeable errors and inconsistencies in the final vegetation map were removed using *Erdas Imagine* image cleaning tools.

Software Costs
Erdas Imagine remote sensing software license - $5800 Maintenance - $2075/yr
Definiens Developer license - $11520 Maintenance - $1840/yr

Notes
1. The outlined process was pursued as a joint venture between the Natural Resources Conservation Service and Nebraska Forest Service. Approximately three million acres of vegetation was classified along the Niobrara River in northern Nebraska. The error assessment has not yet been completed.

2. The costs may be higher/lower based on number of licenses and purchasing agent. The new license price is paid once, while maintenance is paid on a yearly basis.

7.2 List of References

US Census Bureau, State and County QuickFacts.
http://quickfacts.census.gov/qfd/states/31000.html

US Department of Commerce, Bureau of Economic Analysis. Regional Economic Accounts.
http://www.bea.gov/bea/regional/bearfacts/countybf.cfm?fips=31000&areatype=31000&yearin=2003&sublist=next

USDA-National Agricultural Statistics Service. 2002 Census of Agriculture.
http://www.agcensus.usda.gov/Publications/2002/index.asp

USDA – NASS Research and Development Division Cropland Data Layer.
http://www.nass.usda.gov/research/Cropland/SARS1a.htm

Nebraska Department of Environmental Quality.
http://www.deq.state.ne.us/

University of Nebraska School of Natural Resources.
http://snr.unl.edu/Data/NebrGIS.asp

Nebraska Department of Natural Resources.
http://www.dnr.ne.gov/databank/spat.html

Nebraska Weather & Climate
http://www.hprcc.unl.edu/nebraska/

Nebraska Ethanol Board
http://www.ne-ethanol.org/industry/ethplants.htm

Renewable Fuels Association
http://www.ethanolrfa.org/industry

Additional Maps & References for The Republican River Valley can be found at the following location:
USDA NRCS Nebraska – Entire Republican River Valley Resource Assessment
http://www.ne.nrcs.usda.gov/technical/HUC_RA_Maps/Republican_4_Digit_HUC.html

7.3 List of Figures

7.4 Appendix A – Support Maps and Figures

Figure 1

REGION	BASIN	SUBBASIN	HUC_8	ACRES	SQ_MILES
Missouri Region	Republican	Lower Sappa	10250011	142,352	222.4
Missouri Region	Republican	Prairie Dog	10250015	42,191.7	65.9
Missouri Region	Republican	Beaver	10250014	268,272.9	419.1
Missouri Region	Republican	North Fork Republican	10250002	294,711.5	460.5
Missouri Region	Republican	Middle Republican	10250016	958,980.5	1498.4
Missouri Region	Republican	Frenchman	10250005	509,787.9	796.5
Missouri Region	Republican	Harlan County Reservoir	10250009	861,199.2	1345.6
Missouri Region	Republican	Upper Republican	10250004	1,233,072.7	1926.7
Missouri Region	Republican	Medicine	10250008	593,360.7	927.1
Missouri Region	Republican	Stinking Water	10250006	687,137.5	1073.6
Missouri Region	Republican	Red Willow	10250007	507,828.8	793.5
Missouri Region	Republican	Arikaree	10250001	8,646.5	13.5
Missouri Region	Republican	South Fork Republican	10250003	2,930.6	4.6
			Totals	6,110,4072.9	9547.6

Figure 2

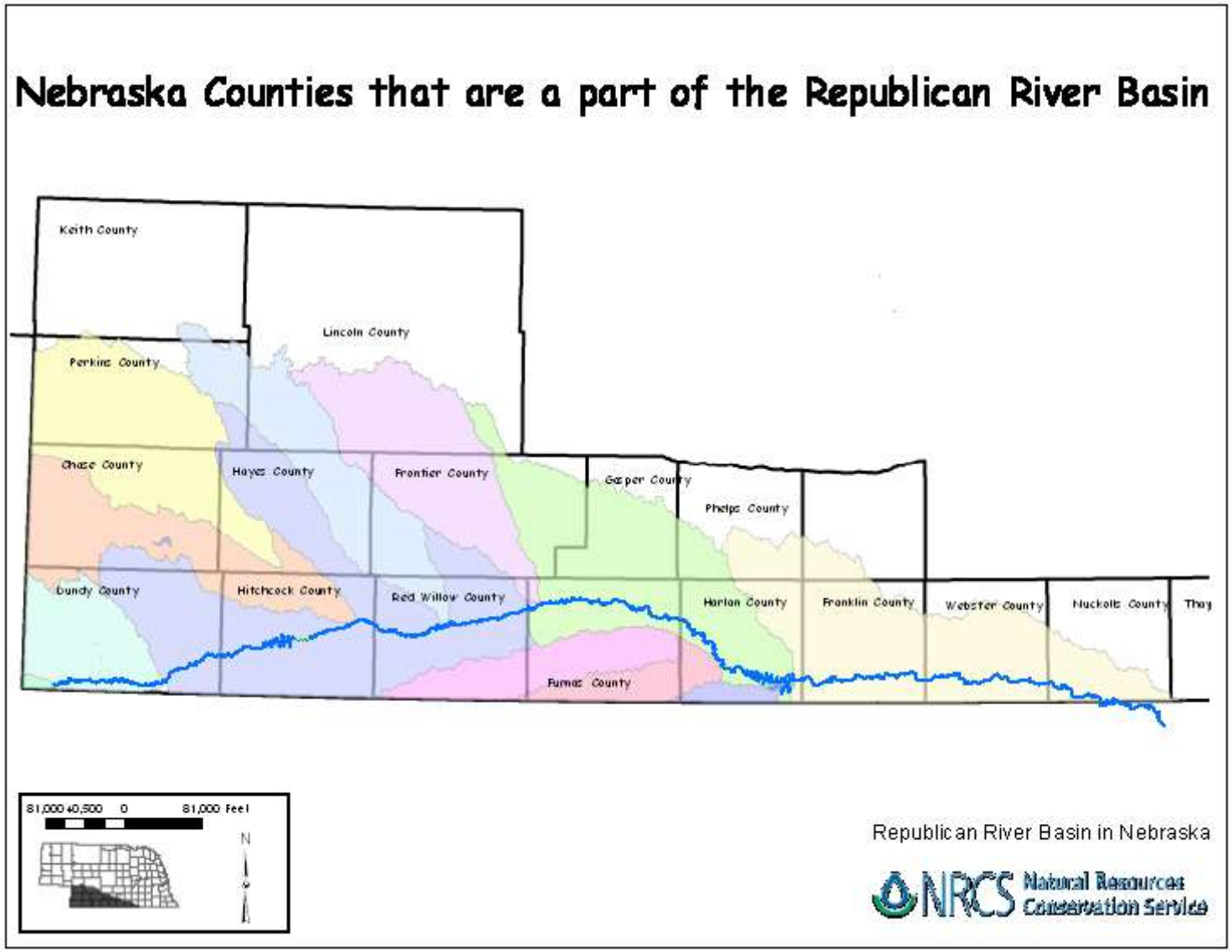

Nebraska Counties that are a part of the Republican River Basin
Keith County
Lincoln County
Perkins County
Chase County
Hayes County
Frontier County
Gosper County
Phelps County
Dundy County
Hitchcock County
Red Willow County
Harlan County
Franklin County
Webster County
Nuckolls County
Furnas County
81,000 40,500 0 81,000 Feet
N
Republican River Basin in Nebraska
NRCS Natural Resources Conservation Service

Figure 3

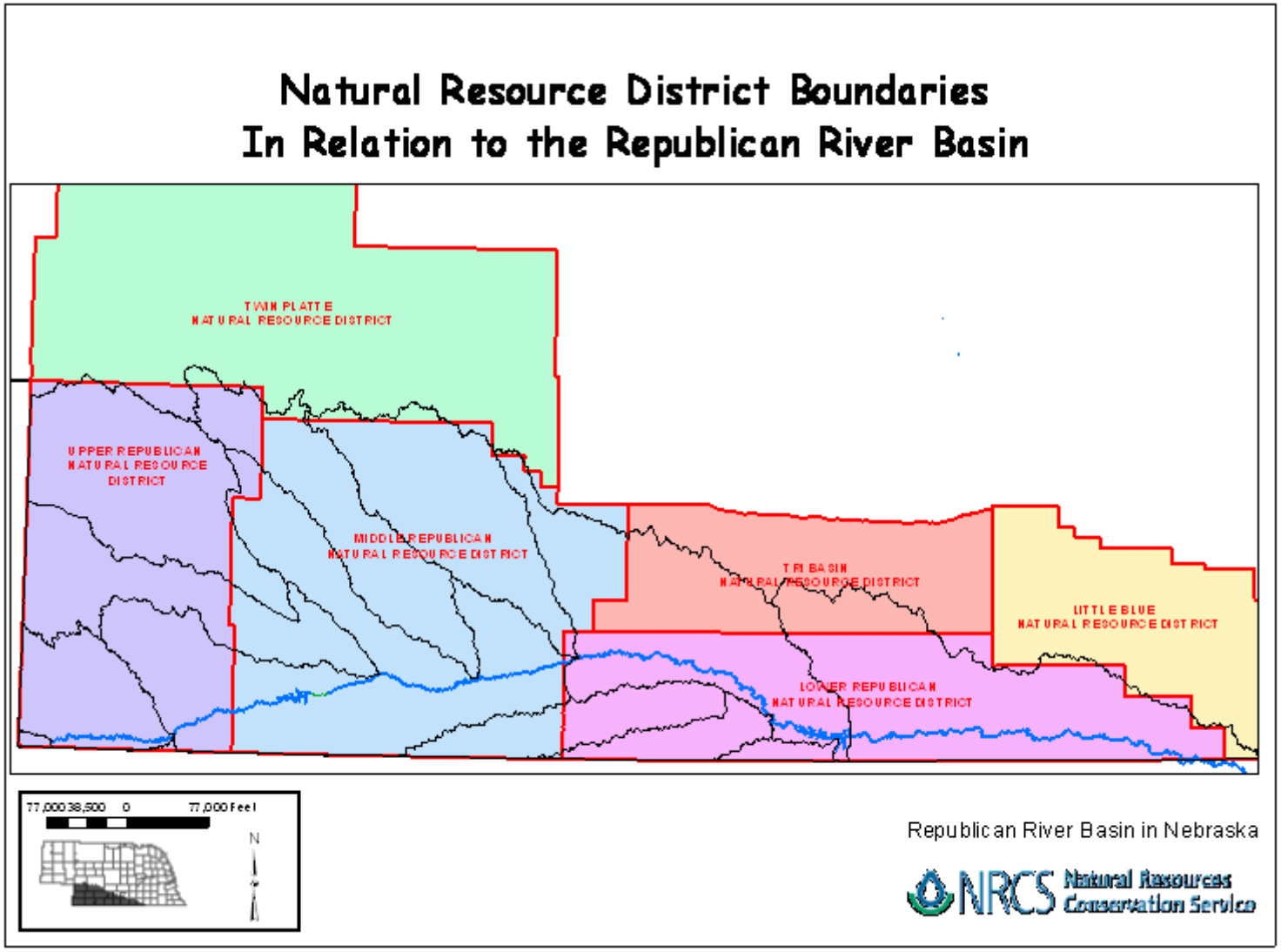

Natural Resource District Boundaries
In Relation to the Republican River Basin
TWIN PLATTE
NATURAL RESOURCE DISTRICT
UPPER REPUBLICAN
NATURAL RESOURCE
DISTRICT
MIDDLE REPUBLICAN
NATURAL RESOURCE DISTRICT
TRI BASIN
NATURAL RESOURCE DISTRICT
LITTLE BLUE
NATURAL RESOURCE DISTRICT
LOWER REPUBLICAN
NATURAL RESOURCE DISTRICT
77,000 38,500 0 77,000 Feet
N
Republican River Basin in Nebraska
NRCS Natural Resources Conservation Service

Figure 4

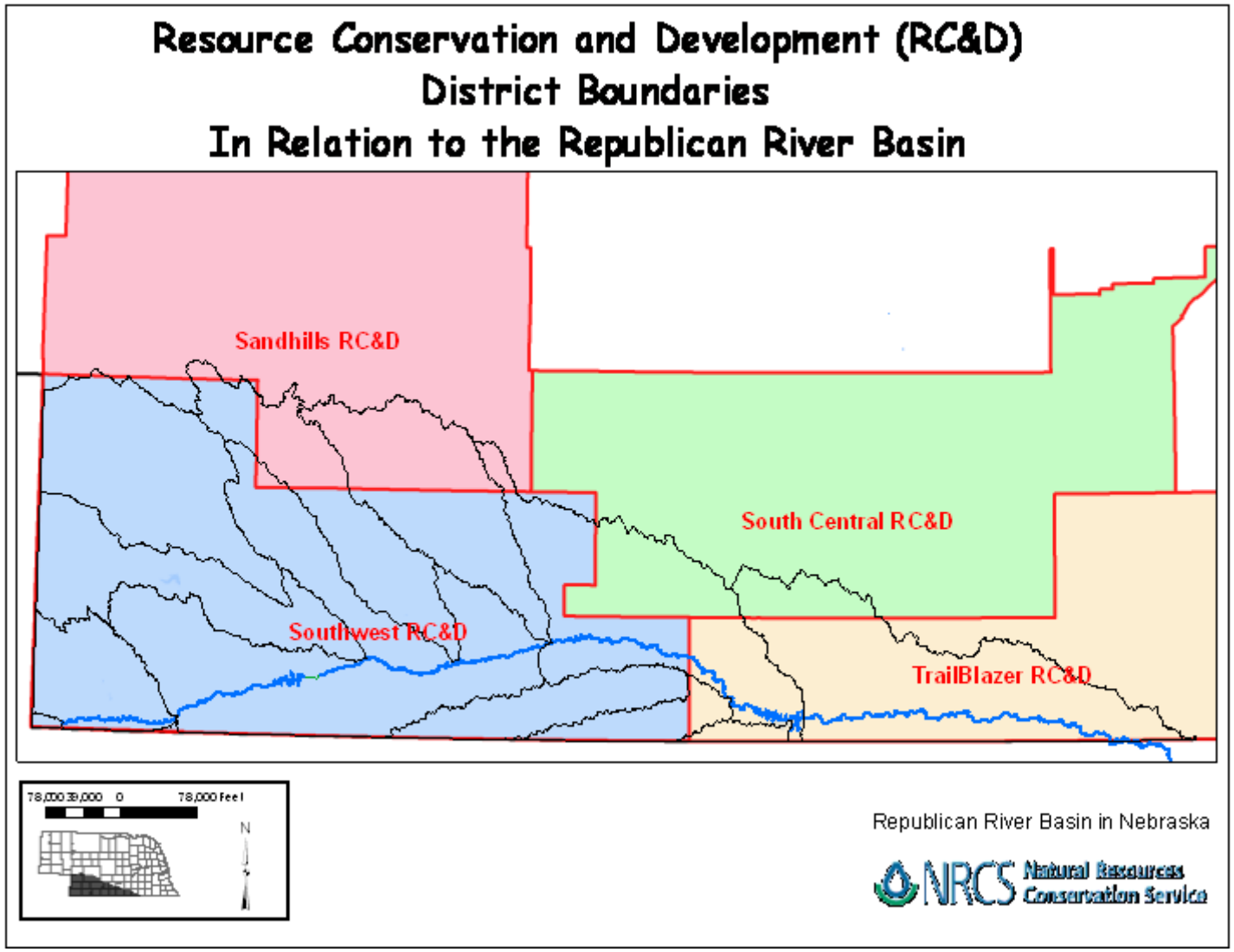

Resource Conservation and Development (RC&D)
District Boundaries
In Relation to the Republican River Basin
Sandhills RC&D
South Central RC&D
Southwest RC&D
TrailBlazer RC&D
78,000 39,000 0 78,000 Feet
N
Republican River Basin in Nebraska
NRCS Natural Resources Conservation Service

Figure 5

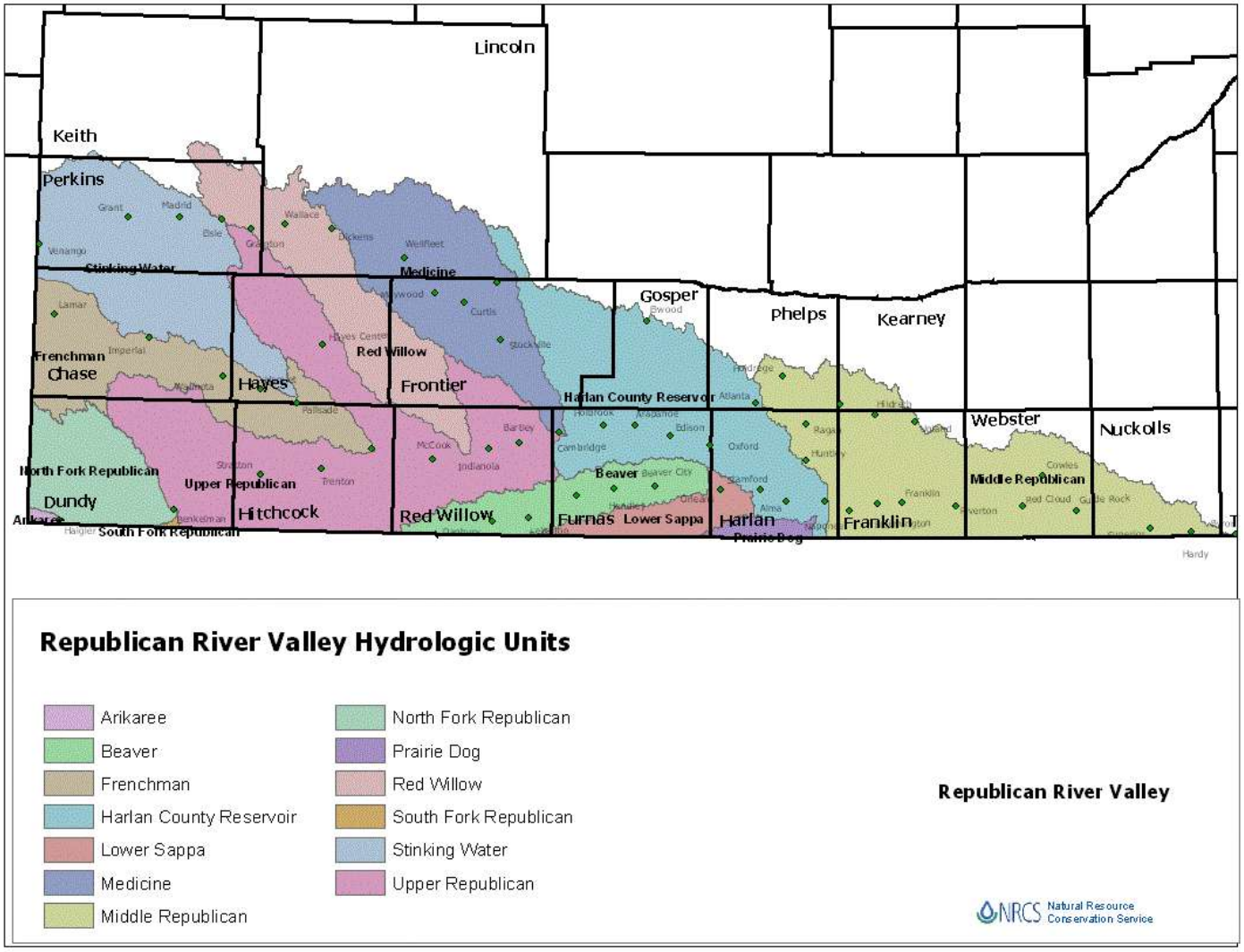

Lincoln
Keith
Perkins
Stinking Water
Medicine
Gosper
Phelps
Kearney
Frenchman
Chase
Hayes
Red Willow
Frontier
Harlan County Reservoir
Webster
Nuckolls
North Fork Republican
Upper Republican
Dundy
Hitchcock
Red Willow
Beaver
Furnas
Lower Sappa
Harlan
Franklin
Middle Republican
South Fork Republican
Republican River Valley Hydrologic Units
Arikaree
Beaver
Frenchman
Harlan County Reservoir
Lower Sappa
Medicine
Middle Republican
North Fork Republican
Prairie Dog
Red Willow
South Fork Republican
Stinking Water
Upper Republican
Republican River Valley
NRCS Natural Resource Conservation Service

Figure 6

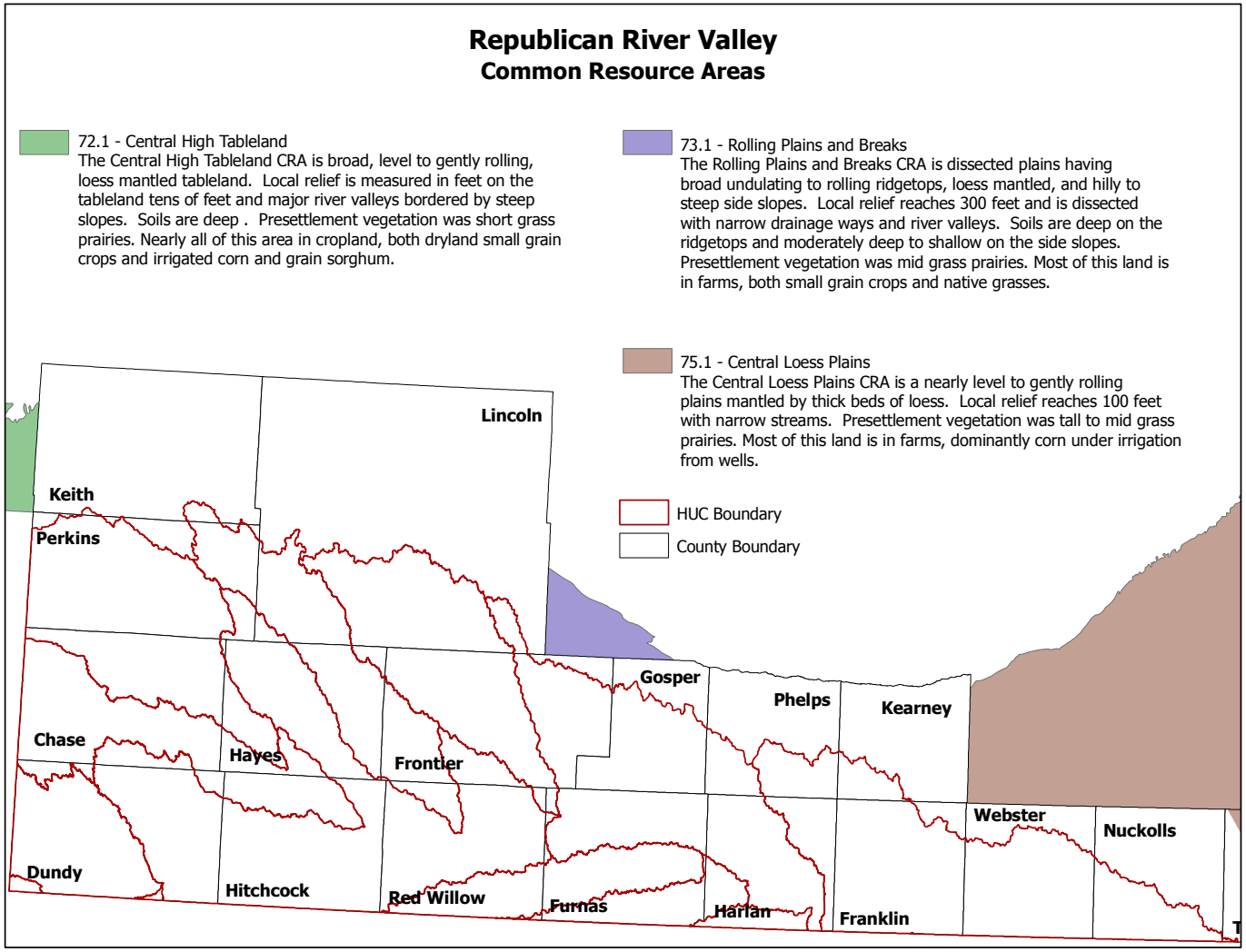

Republican River Valley
Common Resource Areas
72.1 - Central High Tableland
The Central High Tableland CRA is broad, level to gently rolling, loess mantled tableland. Local relief is measured in feet on the tableland tens of feet and major river valleys bordered by steep slopes. Soils are deep . Presettlement vegetation was short grass prairies. Nearly all of this area in cropland, both dryland small grain crops and irrigated corn and grain sorghum.
73.1 - Rolling Plains and Breaks
The Rolling Plains and Breaks CRA is dissected plains having broad undulating to rolling ridgetops, loess mantled, and hilly to steep side slopes. Local relief reaches 300 feet and is dissected with narrow drainage ways and river valleys. Soils are deep on the ridgetops and moderately deep to shallow on the side slopes. Presettlement vegetation was mid grass prairies. Most of this land is in farms, both small grain crops and native grasses.
75.1 - Central Loess Plains
The Central Loess Plains CRA is a nearly level to gently rolling plains mantled by thick beds of loess. Local relief reaches 100 feet with narrow streams. Presettlement vegetation was tall to mid grass prairies. Most of this land is in farms, dominantly corn under irrigation from wells.
HUC Boundary
County Boundary
Lincoln
Keith
Perkins
Gosper
Phelps
Kearney
Chase
Hayes
Frontier
Webster
Nuckolls
Dundy
Hitchcock
Red Willow
Furnas
Harlan
Franklin

Figure 7

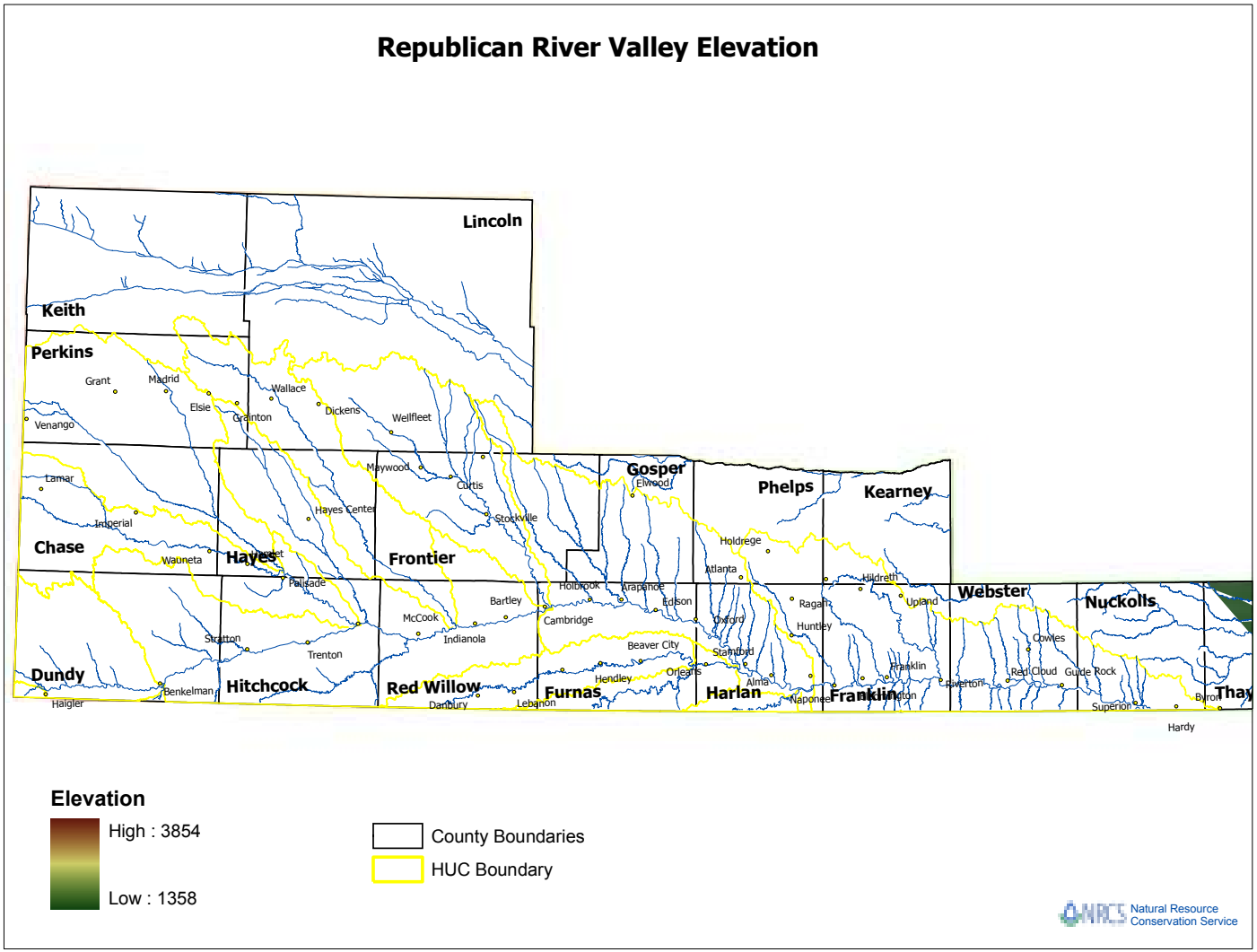

Republican River Valley Elevation
Lincoln
Keith
Perkins
Grant
Madrid
Elsie
Wallace
Grainton
Dickens
Wellfleet
Venango
Lamar
Maywood
Curtis
Gosper
Elwood
Phelps
Kearney
Imperial
Hayes Center
Stockville
Chase
Wauneta
Hayes
Frontier
Holdrege
Atlanta
Palisade
Holbrook
Arapahoe
Edison
Ragan
Upland
Webster
Nuckolls
Bartley
McCook
Cambridge
Oxford
Huntley
Indianola
Beaver City
Stamford
Cowles
Stratton
Trenton
Orleans
Hendley
Alma
Franklin
Red Cloud
Guide Rock
Dundy
Benkelman
Hitchcock
Red Willow
Furnas
Harlan
Naponee
Franklin
Superior
Thay
Hardy
Haigler
Danbury
Lebanon
Elevation
High : 3854
Low : 1358
County Boundaries
HUC Boundary
Natural Resource Conservation Service

Figure 8

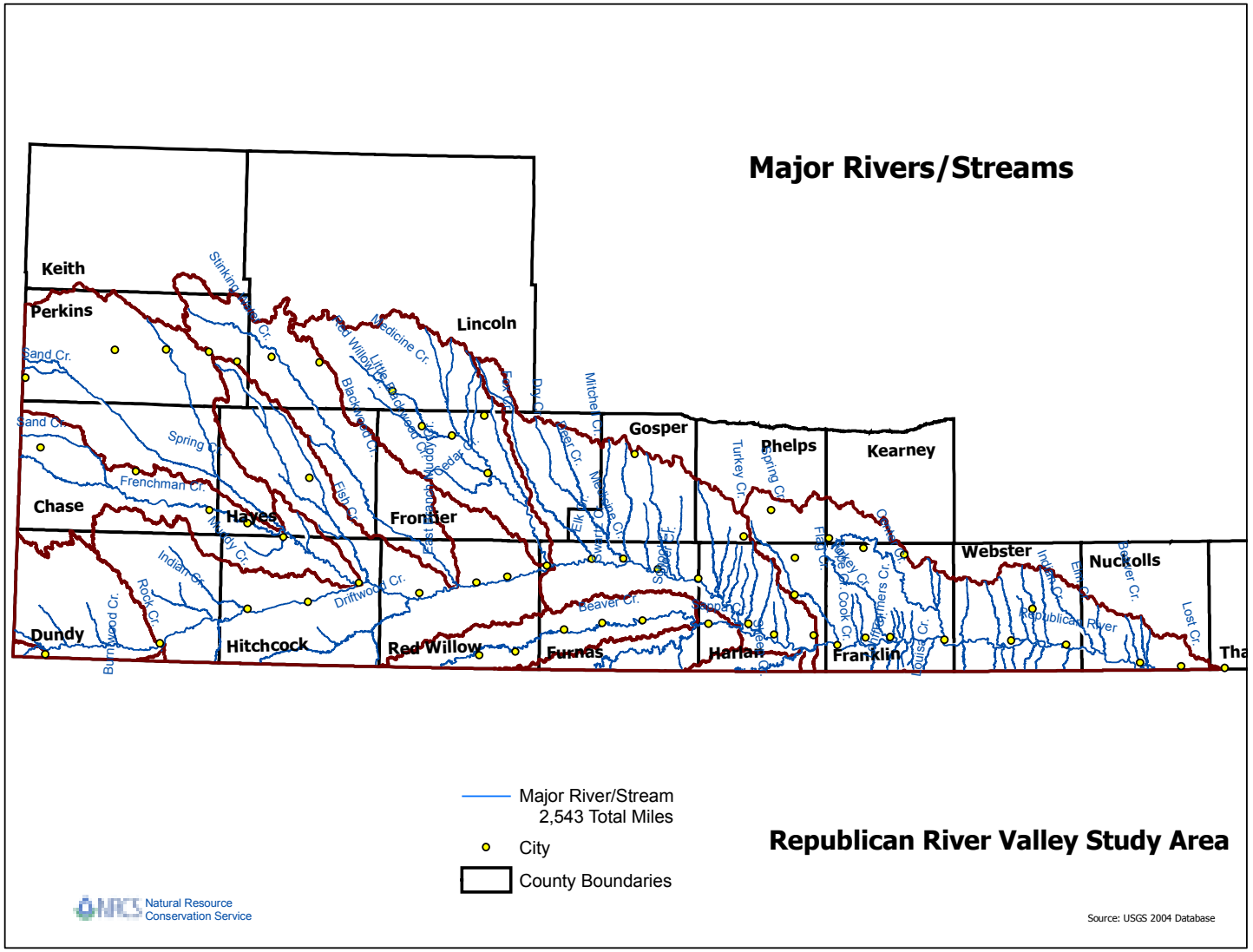

Major Rivers/Streams
Keith
Perkins
Lincoln
Gosper
Phelps
Kearney
Chase
Hayes
Frontier
Webster
Nuckolls
Dundy
Hitchcock
Red Willow
Furnas
Harlan
Franklin
Major River/Stream
2,543 Total Miles
City
County Boundaries
Republican River Valley Study Area
Natural Resource Conservation Service
Source: USGS 2004 Database

Figure9

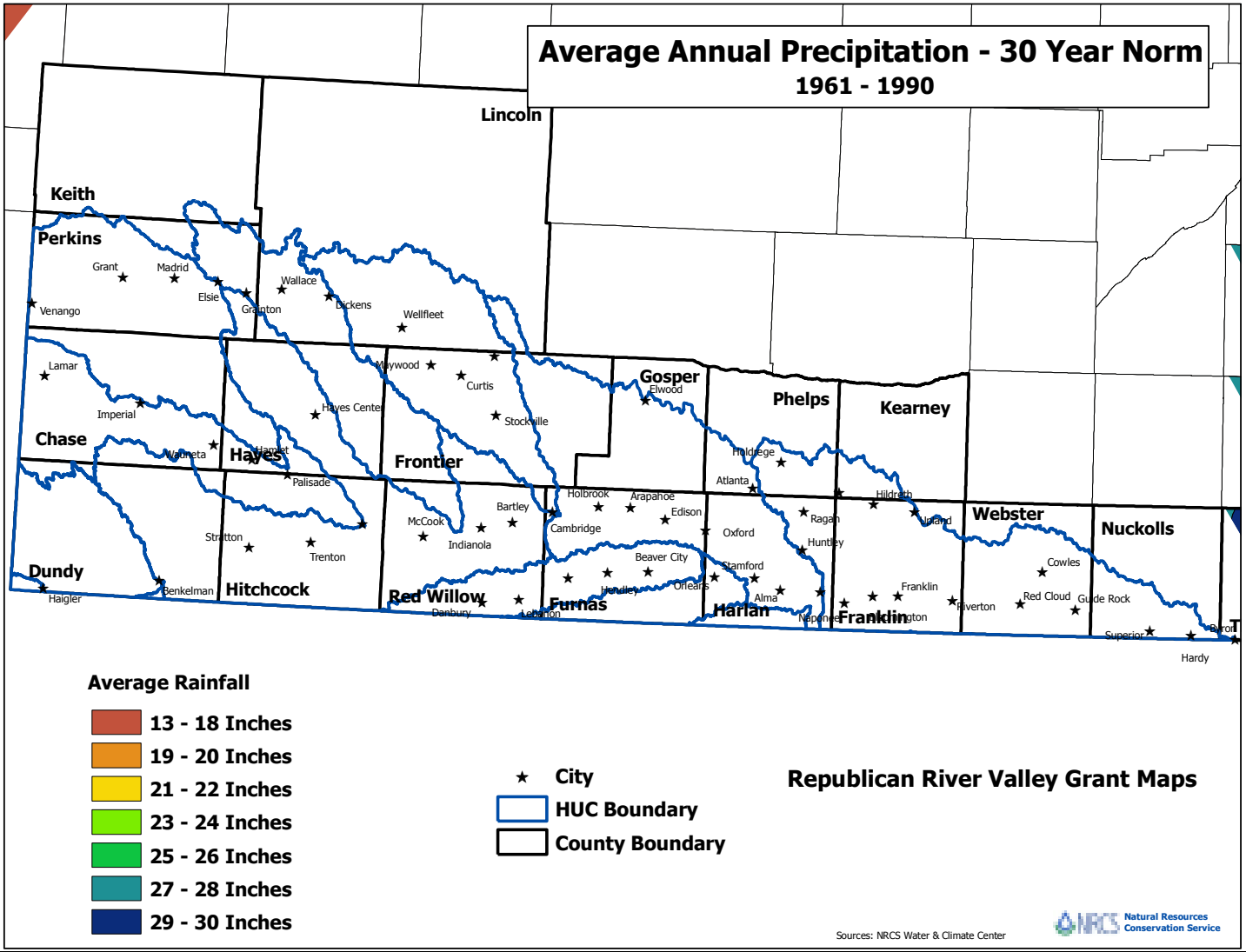

Average Annual Precipitation - 30 Year Norm
1961 - 1990
Lincoln
Keith
Perkins
Grant
Madrid
Elsie
Wallace
Grafton
Dickens
Venango
Wellfleet
Lamar
Imperial
Maywood
Curtis
Stockville
Hayes Center
Gosper
Elwood
Phelps
Kearney
Chase
Wauneta
Hayes
Hayes
Palisade
Frontier
Holbrook
Arapahoe
Edison
Atlanta
Hildreth
Webster
Nuckolls
Bartley
McCook
Indianola
Cambridge
Oxford
Ragan
Huntley
Beaver City
Stamford
Cowles
Stratton
Trenton
Dundy
Haigler
Benkelman
Hitchcock
Red Willow
Danbury
Furnas
Orleans
Harlan
Alma
Franklin
Riverton
Red Cloud
Guide Rock
Superior
Hardy
Average Rainfall
13 - 18 Inches
19 - 20 Inches
21 - 22 Inches
23 - 24 Inches
25 - 26 Inches
27 - 28 Inches
29 - 30 Inches
City
HUC Boundary
County Boundary
Republican River Valley Grant Maps
Sources: NRCS Water & Climate Center
Natural Resources Conservation Service

Figure 10

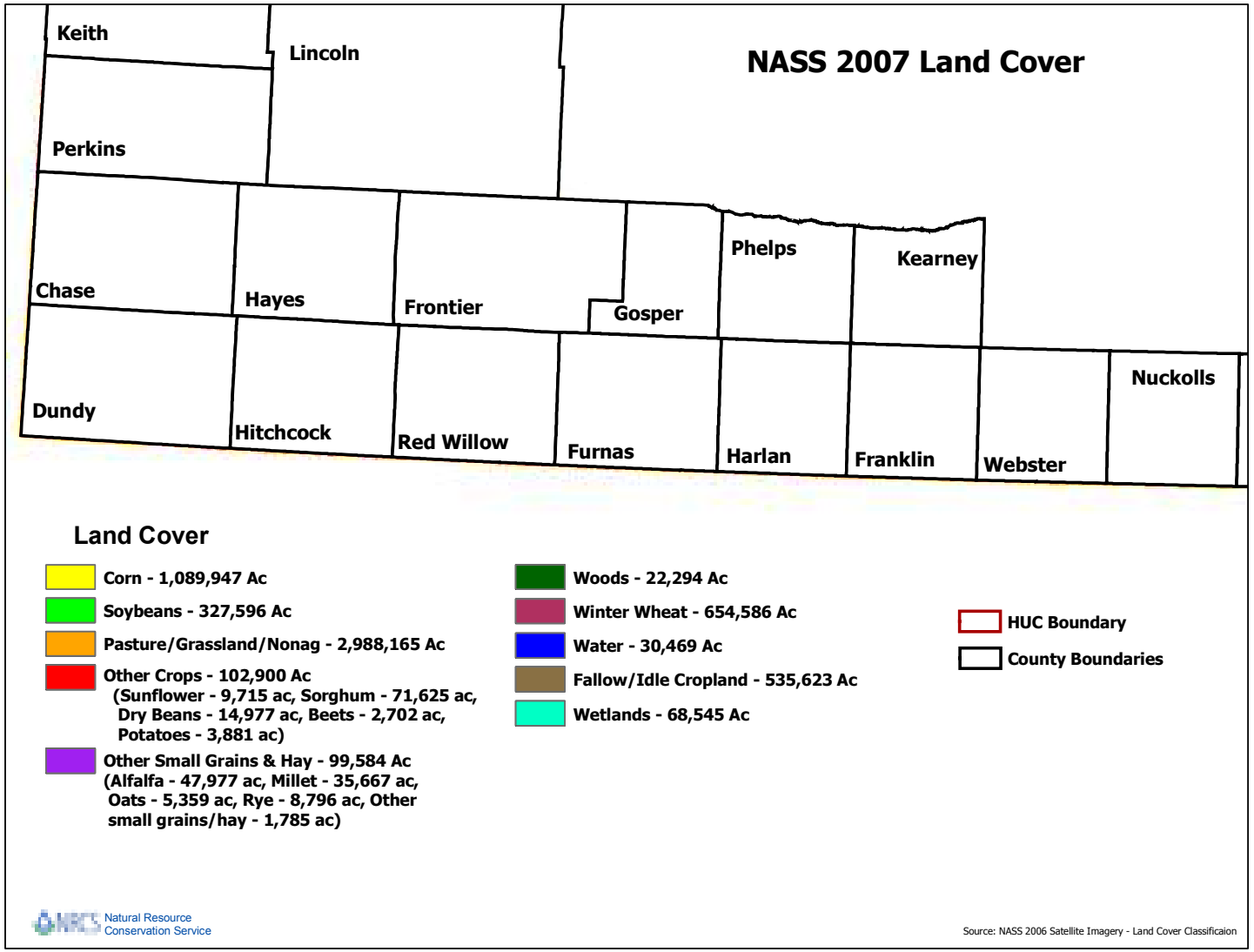

NASS 2007 Land Cover
Keith
Lincoln
Perkins
Chase
Hayes
Frontier
Gosper
Phelps
Kearney
Dundy
Hitchcock
Red Willow
Furnas
Harlan
Franklin
Webster
Nuckolls
Land Cover
Corn - 1,089,947 Ac
Soybeans - 327,596 Ac
Pasture/Grassland/Nonag - 2,988,165 Ac
Other Crops - 102,900 Ac
(Sunflower - 9,715 ac, Sorghum - 71,625 ac, Dry Beans - 14,977 ac, Beets - 2,702 ac, Potatoes - 3,881 ac)
Other Small Grains & Hay - 99,584 Ac
(Alfalfa - 47,977 ac, Millet - 35,667 ac, Oats - 5,359 ac, Rye - 8,796 ac, Other small grains/hay - 1,785 ac)
Woods - 22,294 Ac
Winter Wheat - 654,586 Ac
Water - 30,469 Ac
Fallow/Idle Cropland - 535,623 Ac
Wetlands - 68,545 Ac
HUC Boundary
County Boundaries
Natural Resource Conservation Service
Source: NASS 2006 Satellite Imagery - Land Cover Classificaion

Figure 11

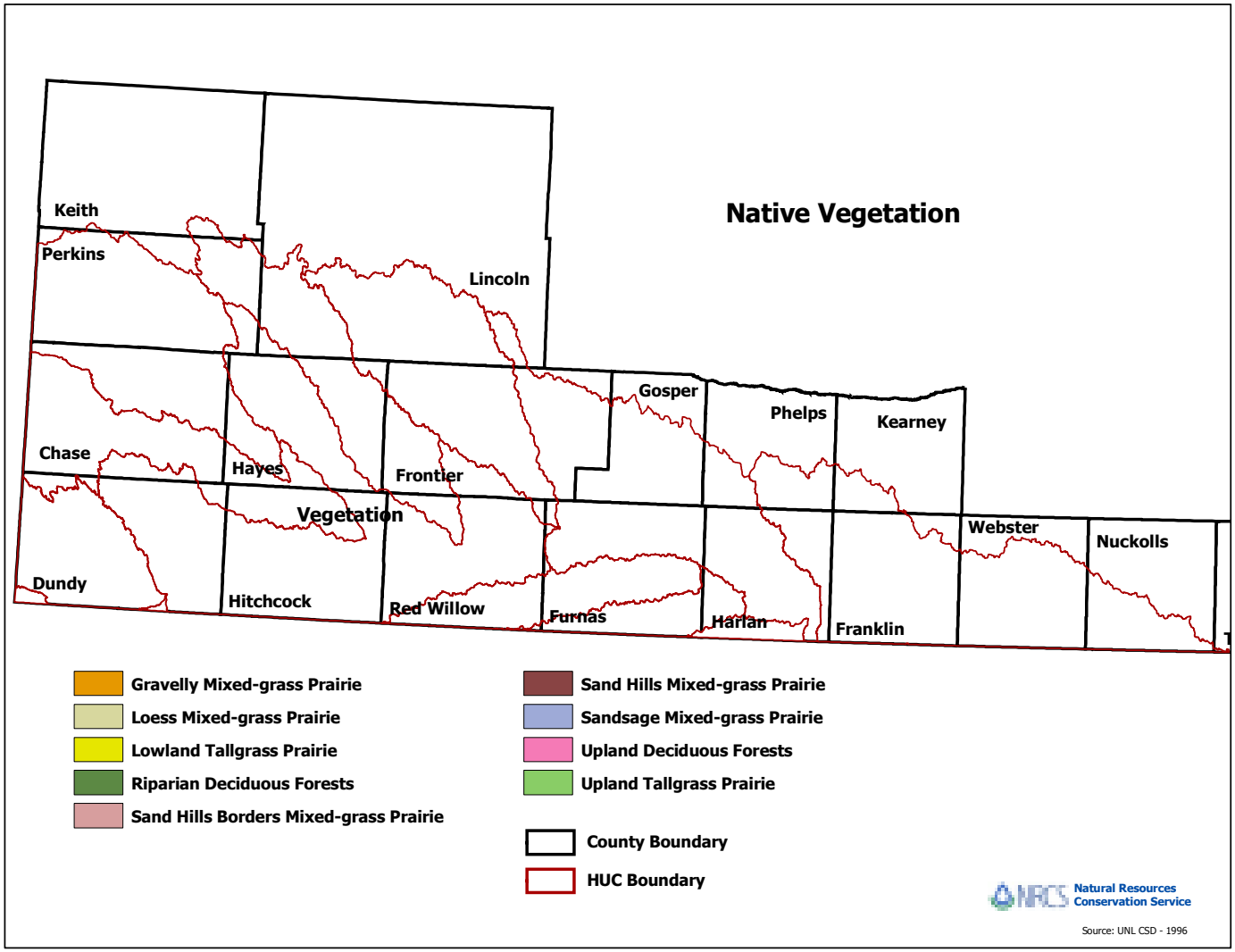

Native Vegetation
Keith
Perkins
Lincoln
Gosper
Phelps
Kearney
Chase
Hayes
Frontier
Vegetation
Webster
Nuckolls
Dundy
Hitchcock
Red Willow
Furnas
Harlan
Franklin
Gravelly Mixed-grass Prairie
Loess Mixed-grass Prairie
Lowland Tallgrass Prairie
Riparian Deciduous Forests
Sand Hills Borders Mixed-grass Prairie
Sand Hills Mixed-grass Prairie
Sandsage Mixed-grass Prairie
Upland Deciduous Forests
Upland Tallgrass Prairie
County Boundary
HUC Boundary
Natural Resources Conservation Service
Source: UNL CSD - 1996

Figure 12

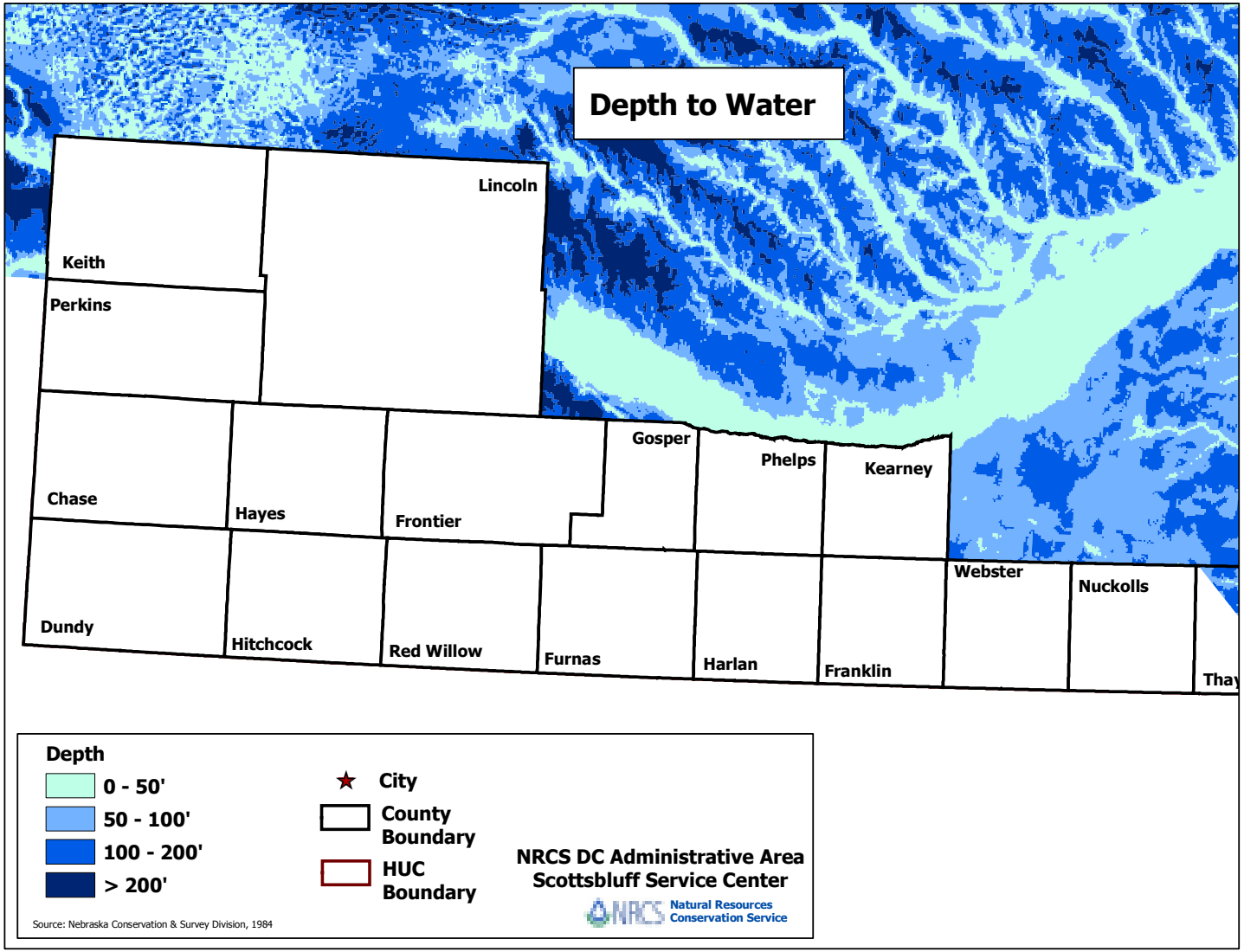

Depth to Water
Lincoln
Keith
Perkins
Chase
Hayes
Frontier
Gosper
Phelps
Kearney
Webster
Nuckolls
Dundy
Hitchcock
Red Willow
Furnas
Harlan
Franklin
Depth
0 - 50'
50 - 100'
100 - 200'
> 200'
City
County Boundary
HUC Boundary
NRCS DC Administrative Area
Scottsbluff Service Center
Natural Resources Conservation Service
Source: Nebraska Conservation & Survey Division, 1984

Figure 13

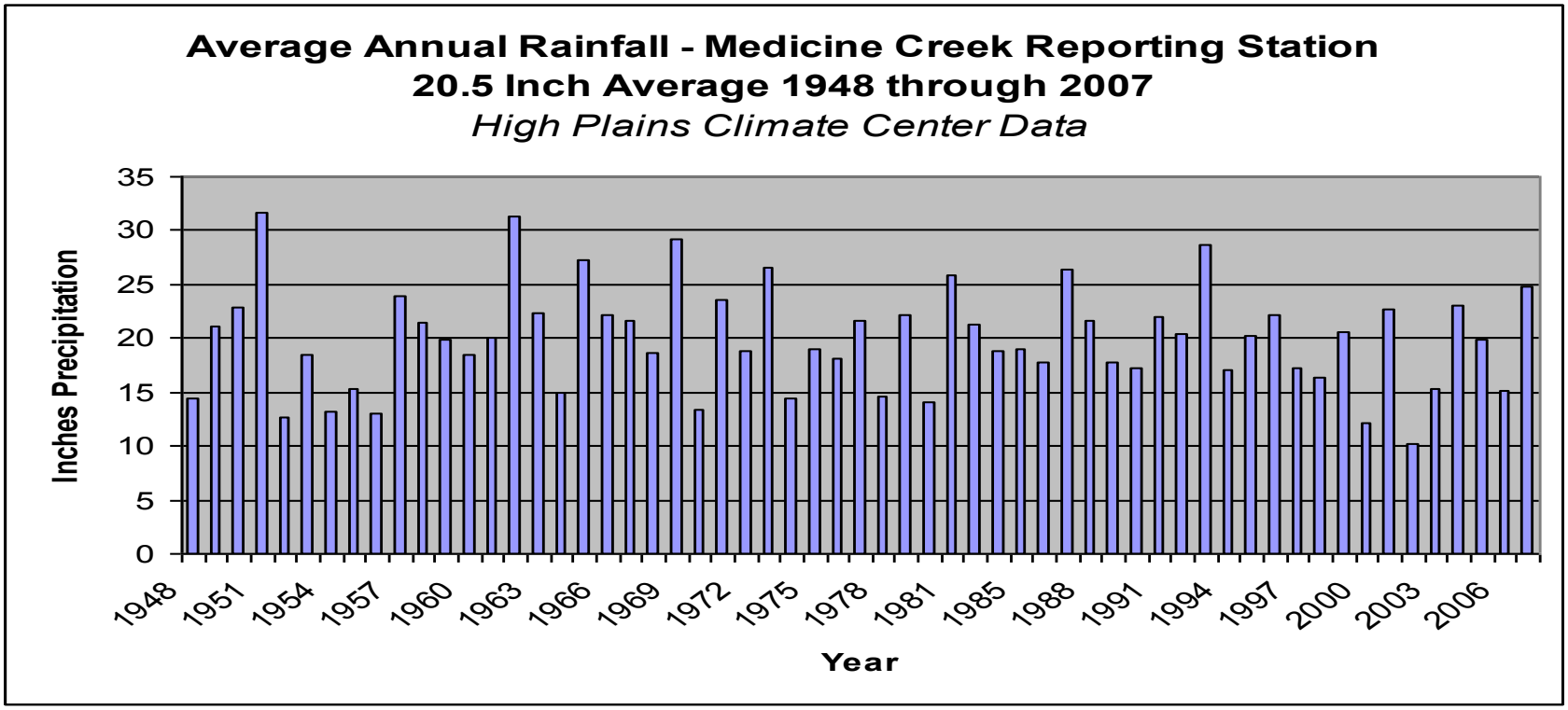

Average Annual Rainfall - Medicine Creek Reporting Station
20.5 Inch Average 1948 through 2007
High Plains Climate Center Data
Inches Precipitation
35
30
25
20
15
10
5
0
1948
1951
1954
1957
1960
1963
1966
1969
1972
1975
1978
1981
1985
1988
1991
1994
1997
2000
2003
2006
Year

Figure 14

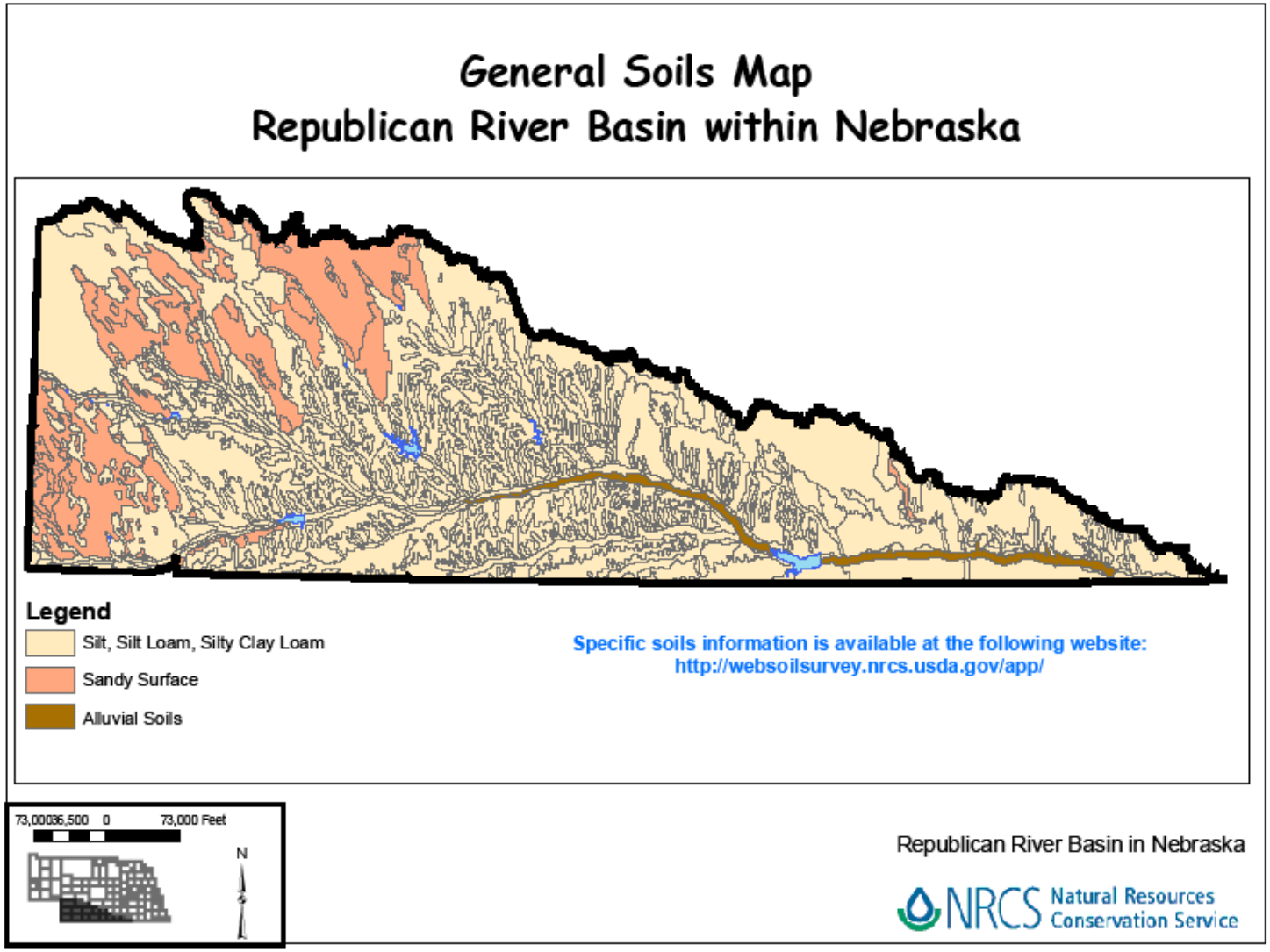

General Soils Map
Republican River Basin within Nebraska
Legend
Silt, Silt Loam, Silty Clay Loam
Sandy Surface
Alluvial Soils
Specific soils information is available at the following website:
http://websoilsurvey.nrcs.usda.gov/app/
73,00036,500 0 73,000 Feet
N
Republican River Basin in Nebraska
NRCS Natural Resources Conservation Service

Figure 15

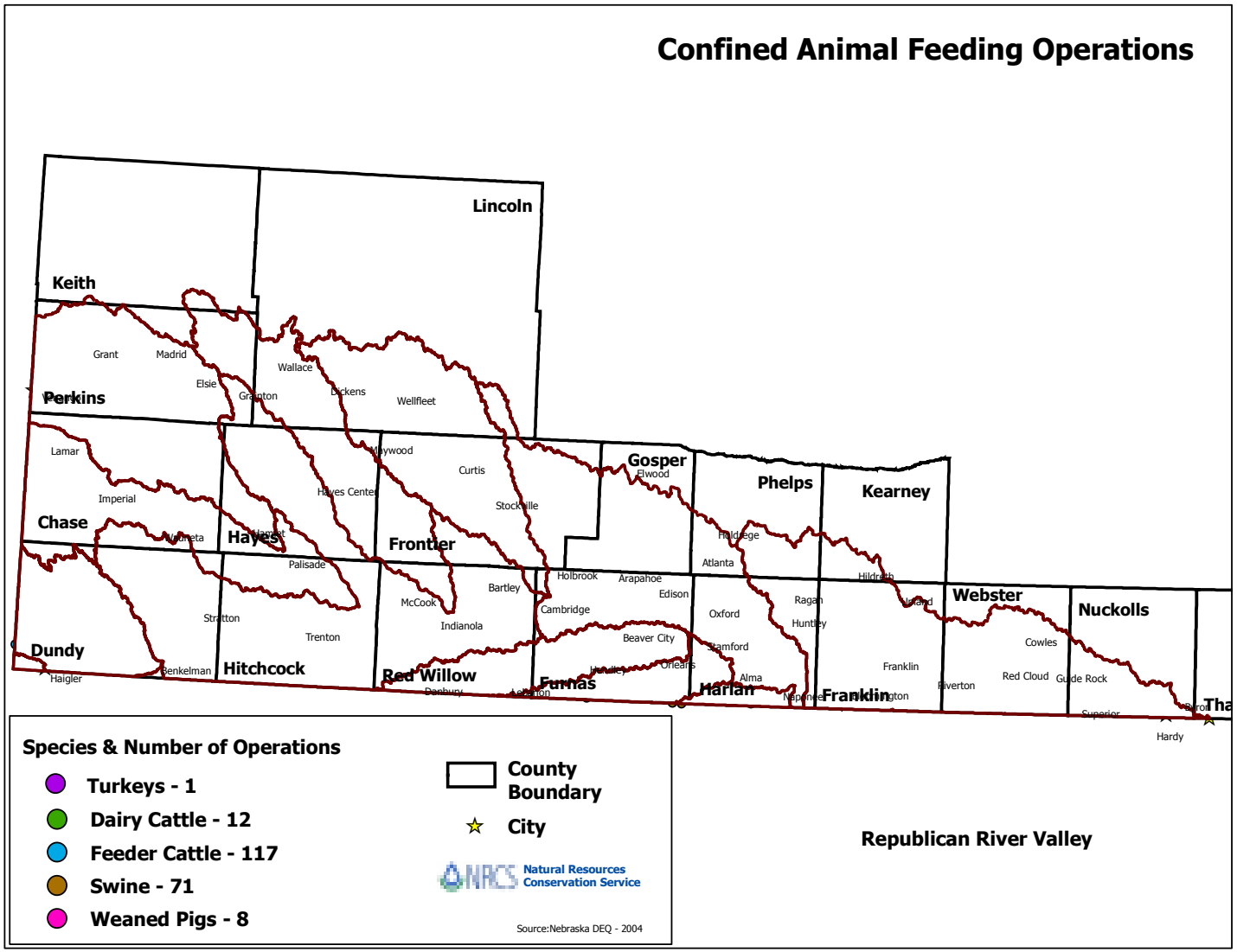

Confined Animal Feeding Operations
Lincoln
Keith
Perkins
Grant
Madrid
Elsie
Wallace
Grainton
Dickens
Wellfleet
Lamar
Imperial
Chase
Haywood
Curtis
Hayes Center
Stockville
Gosper
Elwood
Phelps
Kearney
Hayes
Frontier
Palisade
Holbrook
Arapahoe
Edison
Atlanta
Bartley
McCook
Cambridge
Oxford
Ragan
Webster
Nuckolls
Stratton
Trenton
Indianola
Beaver City
Stamford
Cowles
Dundy
Benkelman
Hitchcock
Red Willow
Orleans
Alma
Franklin
Riverton
Red Cloud
Guide Rock
Harlan
Superior
Hardy
Species & Number of Operations
Turkeys - 1
Dairy Cattle - 12
Feeder Cattle - 117
Swine - 71
Weaned Pigs - 8
County Boundary
City
Natural Resources Conservation Service
Source:Nebraska DEQ - 2004
Republican River Valley

Figure 16

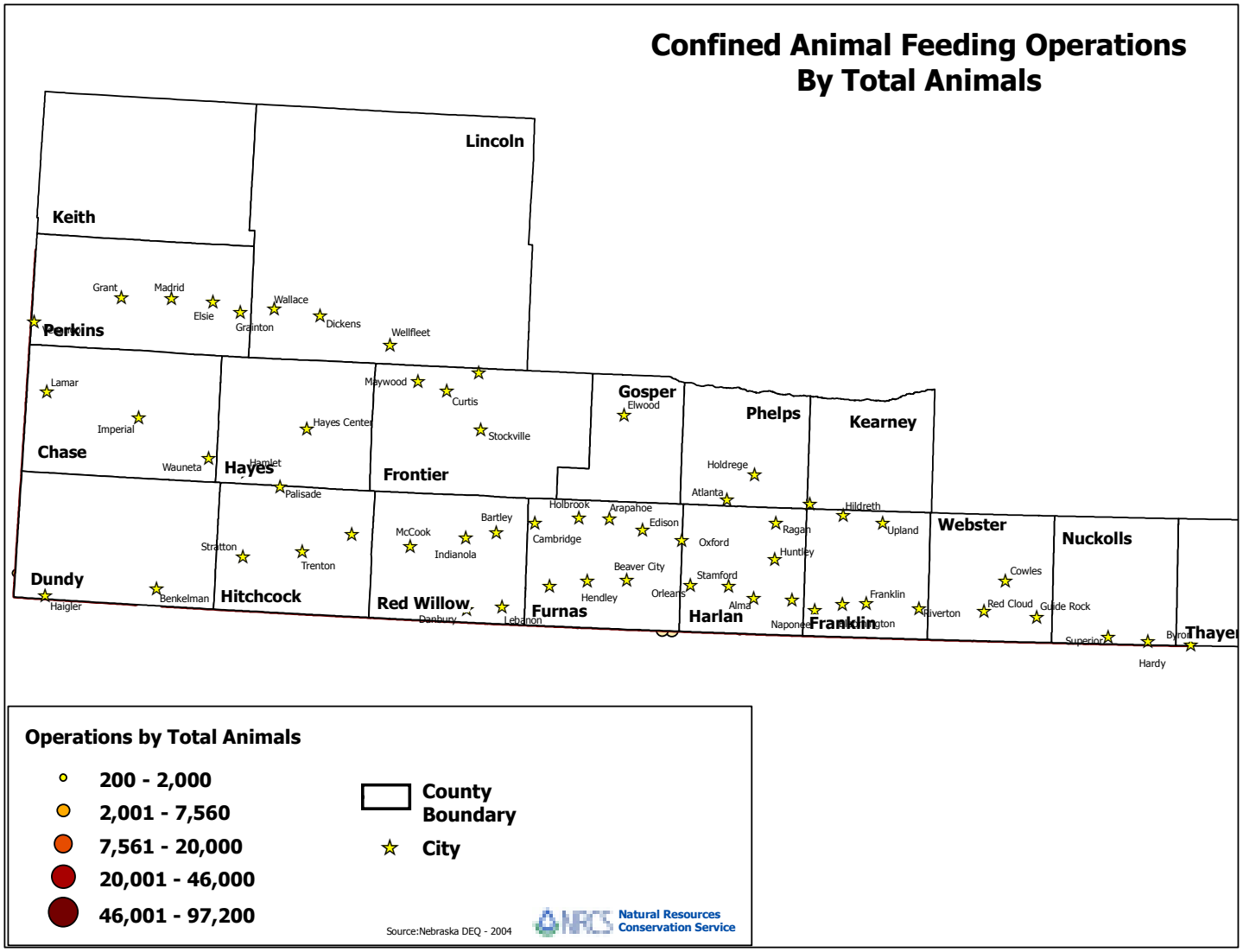

Confined Animal Feeding Operations
By Total Animals
Lincoln
Keith
Perkins
Grant
Madrid
Elsie
Grainton
Wallace
Dickens
Wellfleet
Lamar
Imperial
Chase
Wauneta
Hayes
Hamlet
Hayes Center
Palisade
Maywood
Curtis
Stockville
Frontier
Gosper
Elwood
Phelps
Kearney
Holdrege
Atlanta
Hildreth
Webster
Upland
Nuckolls
Cowles
Red Cloud
Guide Rock
Superior
Hardy
Thayer
Byron
Dundy
Haigler
Benkelman
Stratton
Trenton
Hitchcock
McCook
Indianola
Bartley
Red Willow
Danbury
Lebanon
Holbrook
Arapahoe
Cambridge
Edison
Oxford
Ragan
Huntley
Beaver City
Hendley
Orleans
Stamford
Alma
Harlan
Franklin
Riverton
Naponee
Operations by Total Animals
200 - 2,000
2,001 - 7,560
7,561 - 20,000
20,001 - 46,000
46,001 - 97,200
County Boundary
City
Source:Nebraska DEQ - 2004
Natural Resources Conservation Service

Figure 17

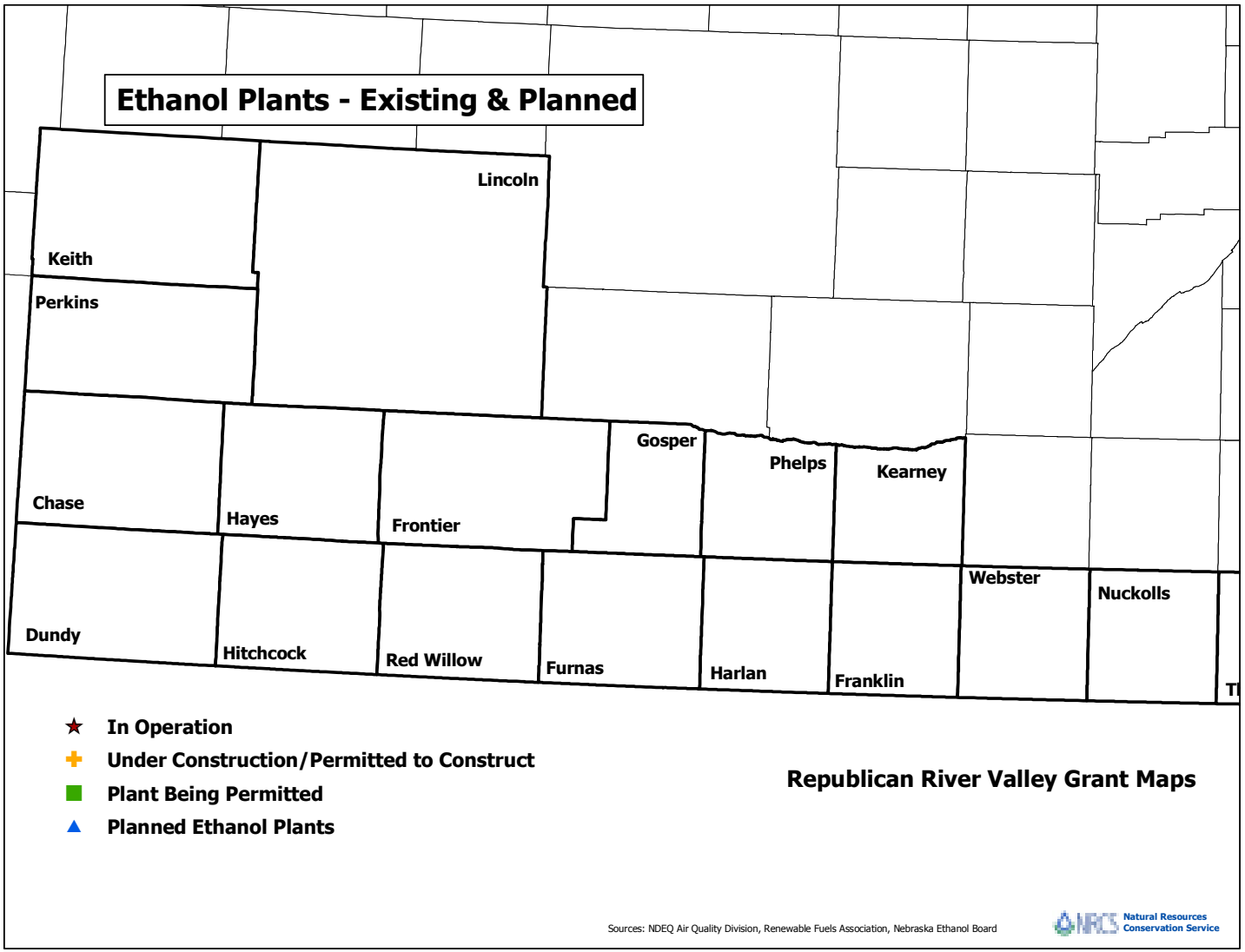

Ethanol Plants - Existing & Planned
Lincoln
Keith
Perkins
Chase
Hayes
Frontier
Gosper
Phelps
Kearney
Dundy
Hitchcock
Red Willow
Furnas
Harlan
Franklin
Webster
Nuckolls
In Operation
Under Construction/Permitted to Construct
Plant Being Permitted
Planned Ethanol Plants
Republican River Valley Grant Maps
Sources: NDEQ Air Quality Division, Renewable Fuels Association, Nebraska Ethanol Board
Natural Resources Conservation Service

Figure 18

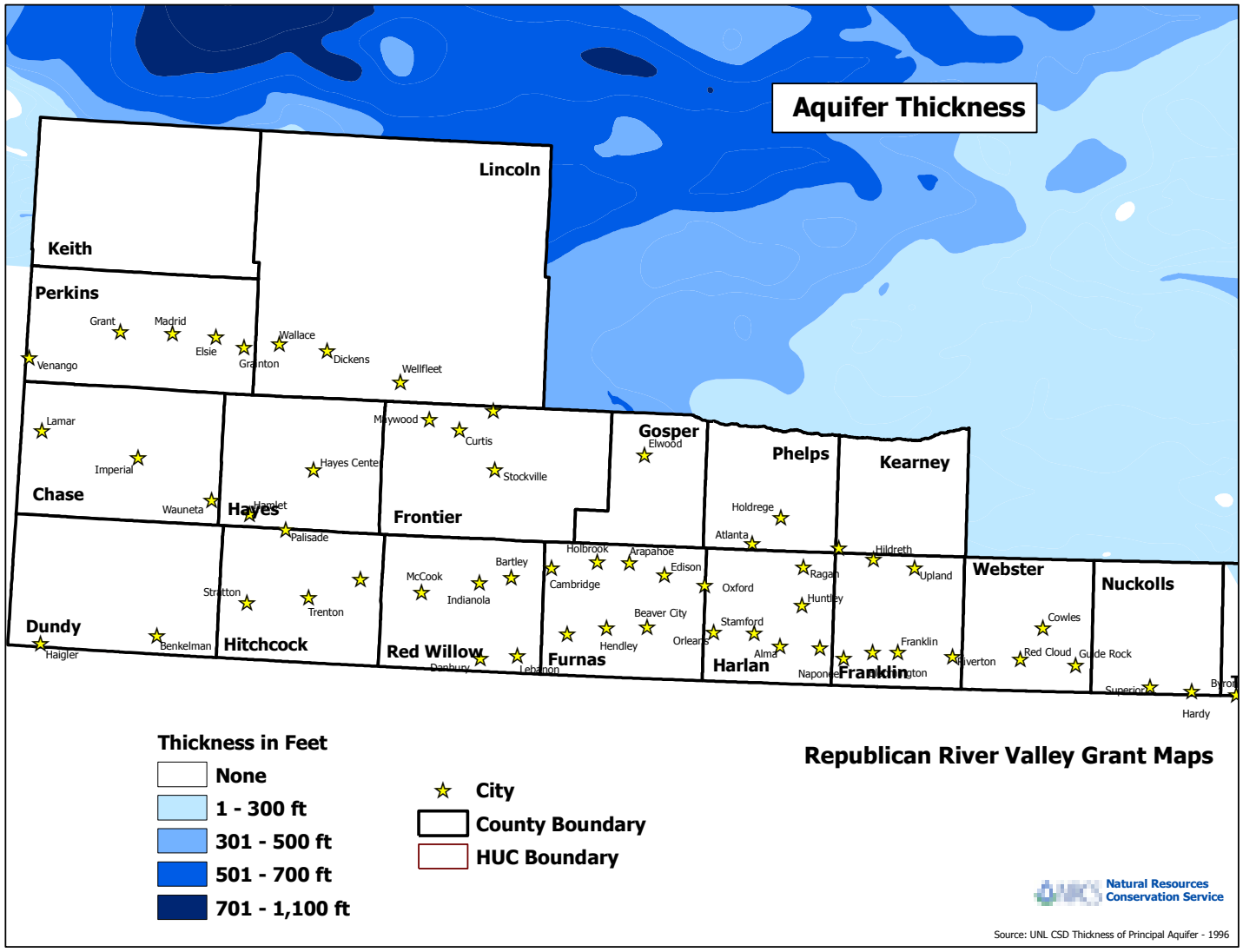

Aquifer Thickness
Lincoln
Keith
Perkins
Grant
Madrid
Elsie
Wallace
Dickens
Venango
Grainton
Wellfleet
Lamar
Imperial
Chase
Wauneta
Haves
Hayes Center
Maywood
Curtis
Stockville
Frontier
Gosper
Elwood
Phelps
Kearney
Holdrege
Atlanta
Hildreth
Webster
Nuckolls
Upland
Ragan
Oxford
Huntley
Cowles
Red Cloud
Guide Rock
Riverton
Franklin
Harlan
Naponee
Stamford
Alma
Orleans
Beaver City
Hendley
Furnas
Holbrook
Arapahoe
Edison
Cambridge
Bartley
McCook
Indianola
Red Willow
Danbury
Lebanon
Palisade
Stratton
Trenton
Hitchcock
Dundy
Benkelman
Haigler
Hardy
Thickness in Feet
None
1 - 300 ft
301 - 500 ft
501 - 700 ft
701 - 1,100 ft
City
County Boundary
HUC Boundary
Republican River Valley Grant Maps
Natural Resources Conservation Service
Source: UNL CSD Thickness of Principal Aquifer - 1996

Figure 19

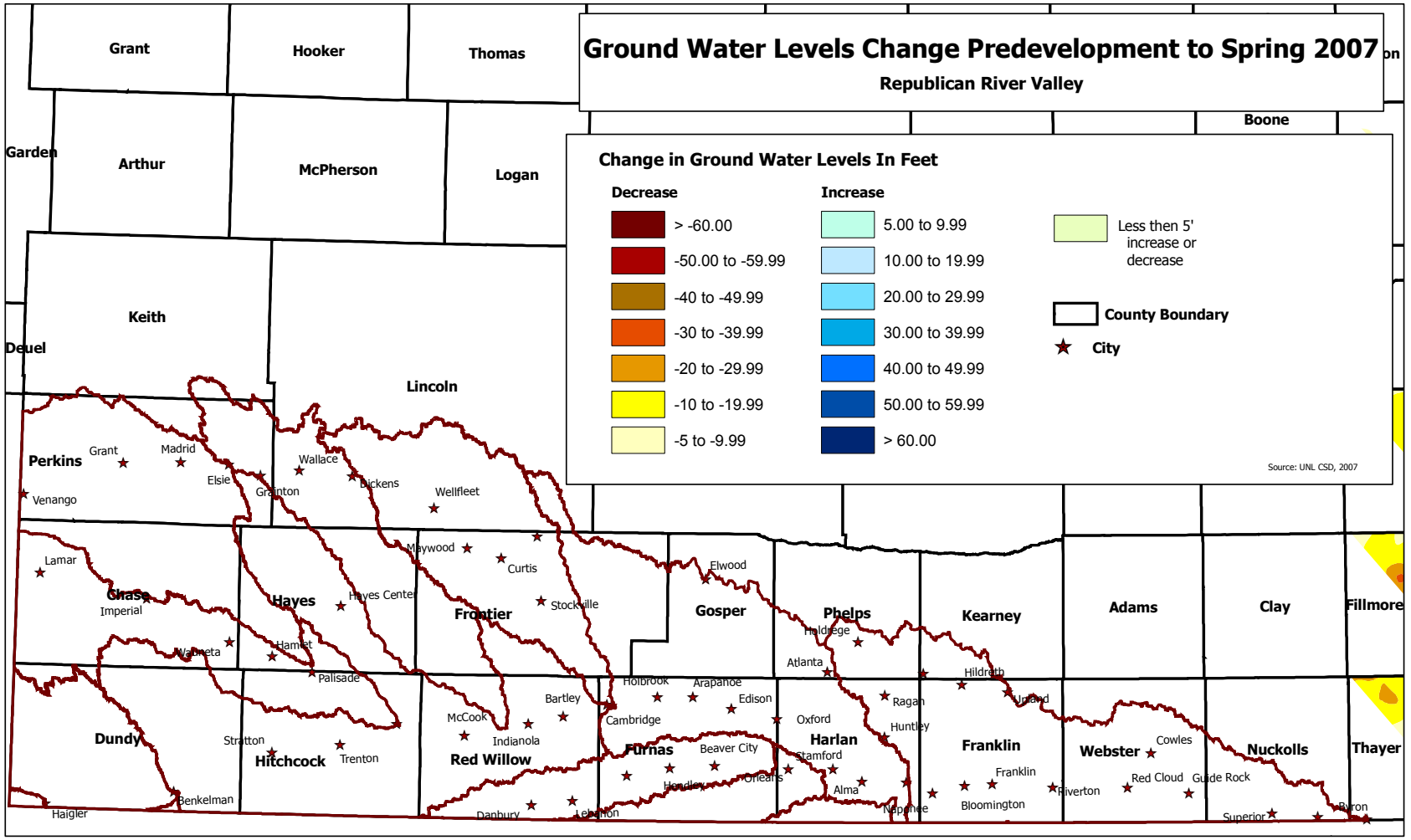

Ground Water Levels Change Predevelopment to Spring 2007
Republican River Valley
Change in Ground Water Levels In Feet
Decrease
> -60.00
-50.00 to -59.99
-40 to -49.99
-30 to -39.99
-20 to -29.99
-10 to -19.99
-5 to -9.99
Increase
5.00 to 9.99
10.00 to 19.99
20.00 to 29.99
30.00 to 39.99
40.00 to 49.99
50.00 to 59.99
> 60.00
Less then 5' increase or decrease
County Boundary
City
Source: UNL CSD, 2007
Grant
Hooker
Thomas
Boone
Garden
Arthur
McPherson
Logan
Keith
Deuel
Lincoln
Perkins
Grant
Madrid
Elsie
Wallace
Dickens
Grainton
Wellfleet
Venango
Lamar
Chase
Imperial
Hayes
Hayes Center
Frontier
Maywood
Curtis
Stockville
Gosper
Elwood
Phelps
Holdrege
Kearney
Adams
Clay
Fillmore
Atlanta
Hildreth
Upland
Ragan
Huntley
Franklin
Webster
Cowles
Nuckolls
Thayer
Red Cloud
Guide Rock
Riverton
Franklin
Bloomington
Superior
Byron
Valmeta
Hamlet
Palisade
Dundy
Stratton
Hitchcock
Trenton
Haigler
Benkelman
Bartley
McCook
Indianola
Red Willow
Danbury
Lebanon
Holbrook
Arapahoe
Edison
Cambridge
Furnas
Beaver City
Oxford
Harlan
Stamford
Orleans
Hendley
Alma
Naponee

Figure 20

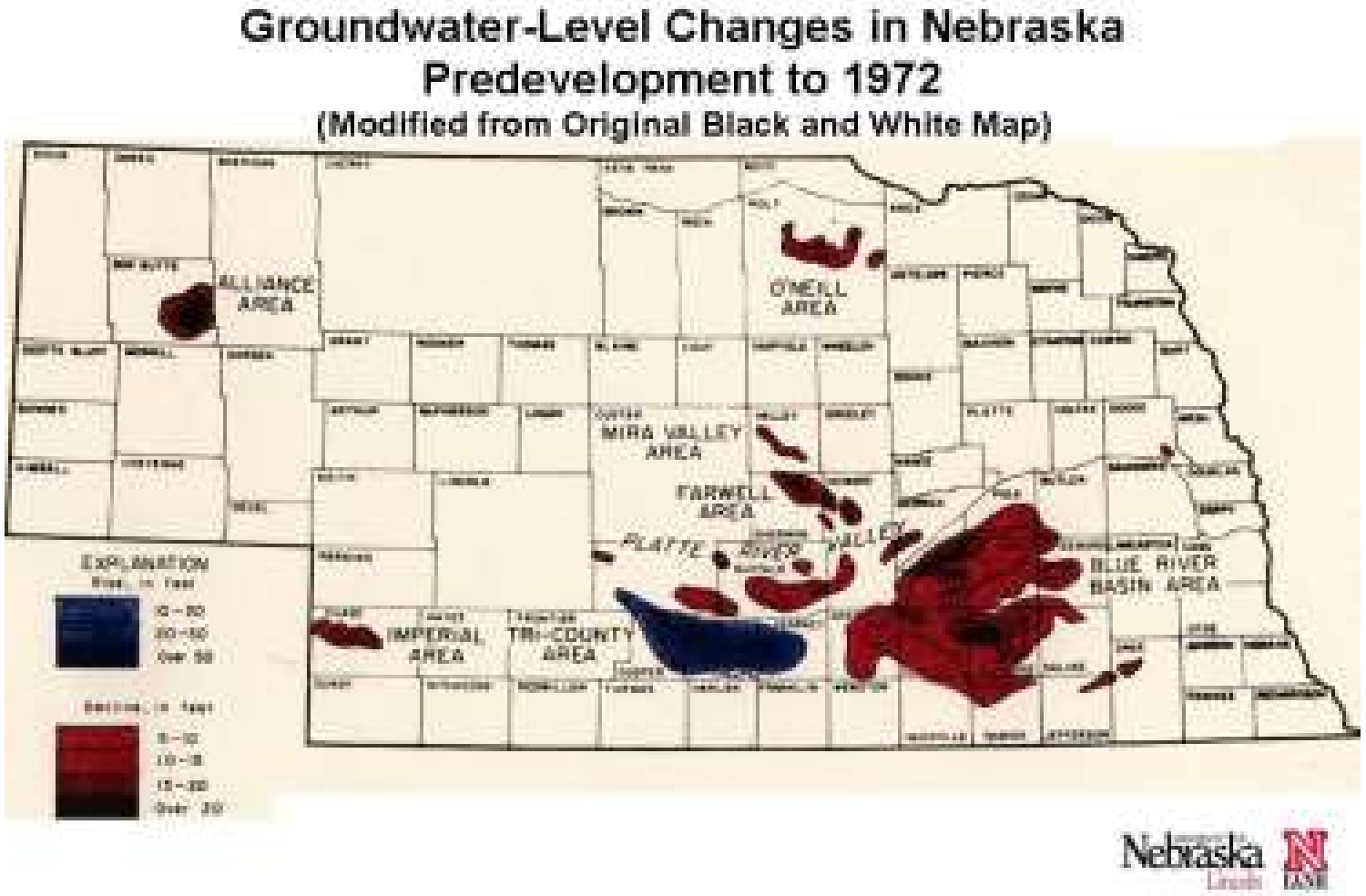

Groundwater-Level Changes in Nebraska
Predevelopment to 1972
(Modified from Original Black and White Map)
ALLIANCE AREA
O'NEILL AREA
MIRA VALLEY AREA
FARWELL AREA
PLATTE RIVER VALLEY
BLUE RIVER BASIN AREA
IMPERIAL AREA
TRI-COUNTY AREA
EXPLANATION
Nebraska

Figure 21

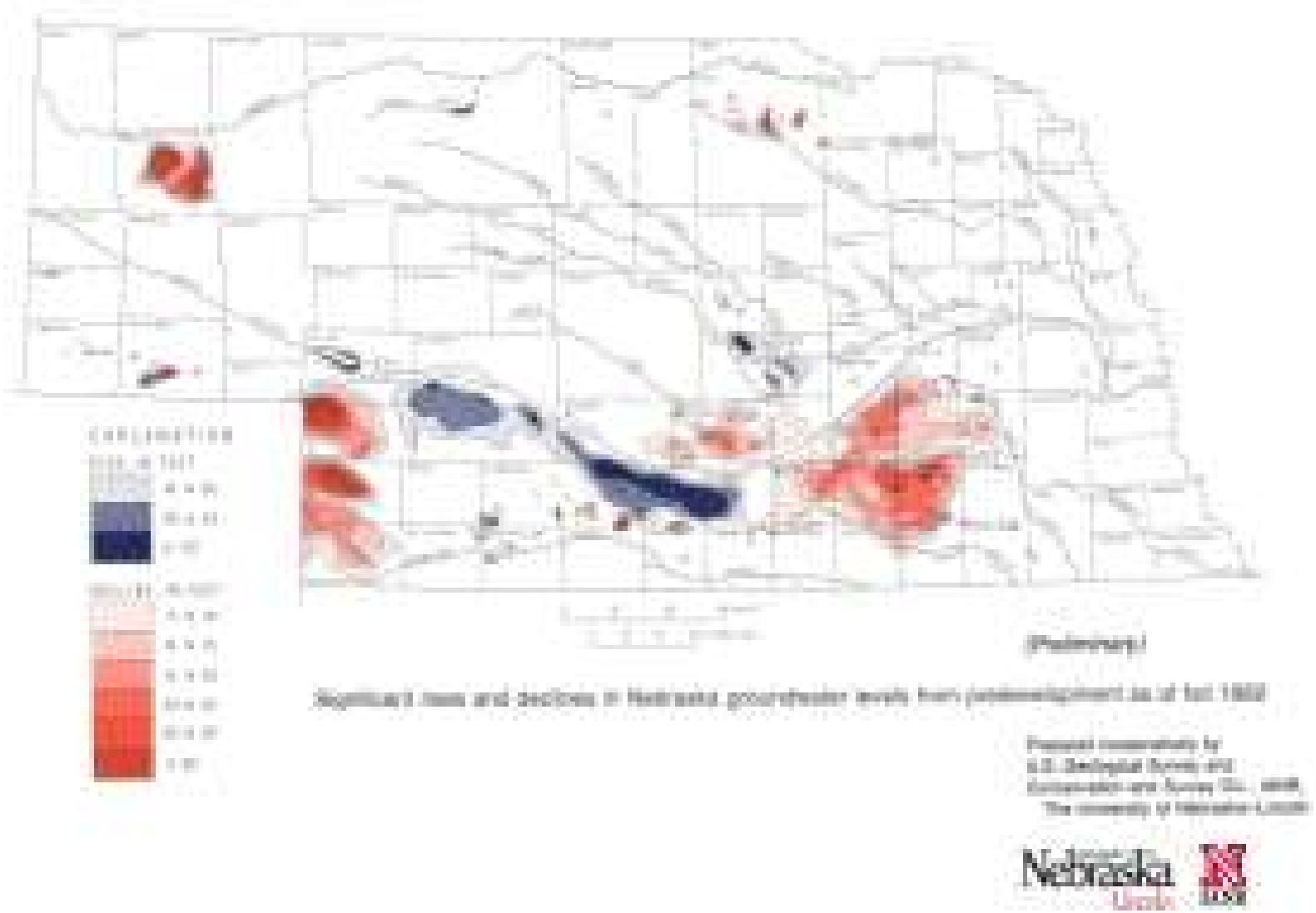


Figure 22

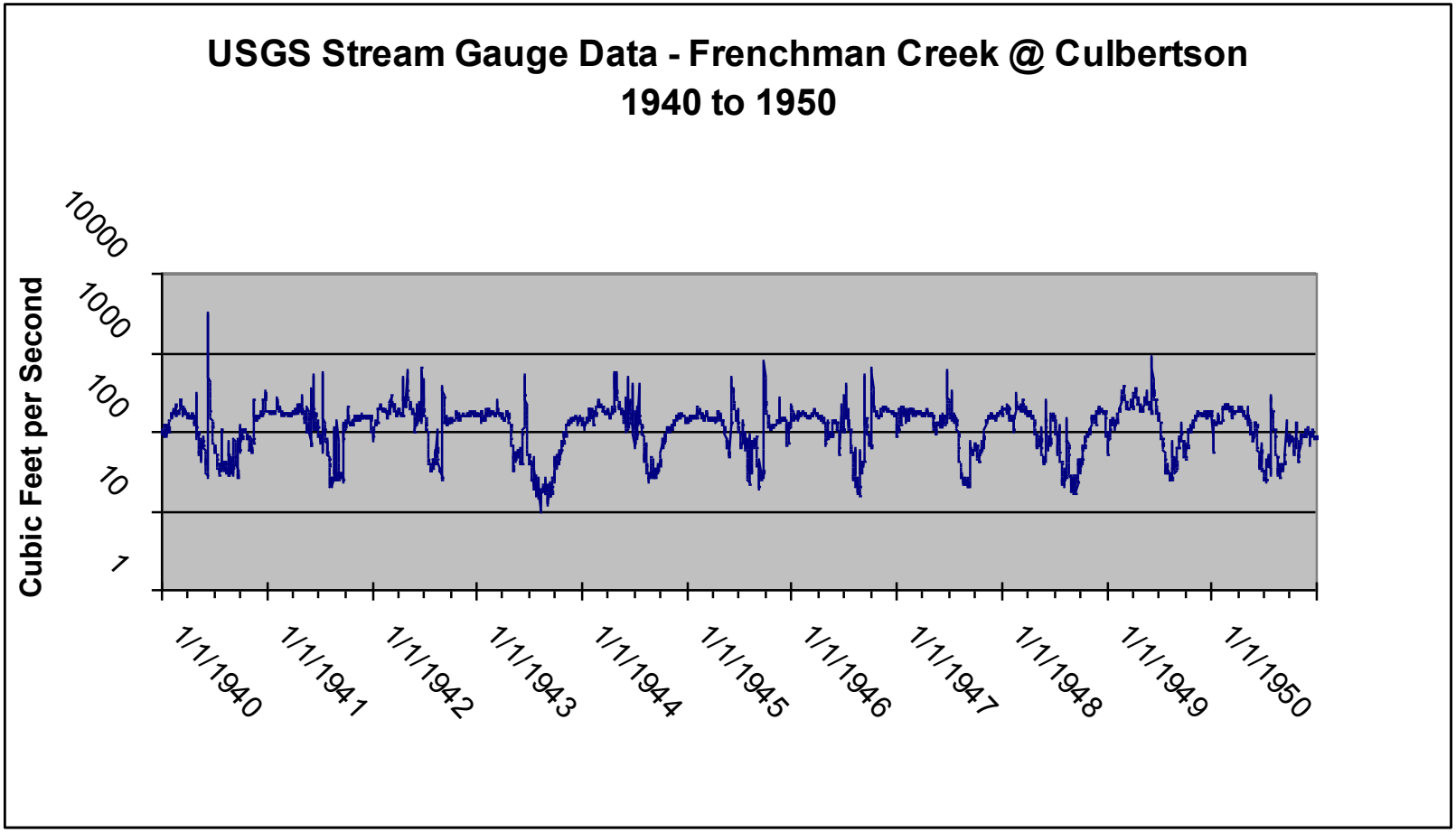

USGS Stream Gauge Data - Frenchman Creek @ Culbertson
1940 to 1950
Cubic Feet per Second
10000
1000
100
10
1
1/1/1940
1/1/1941
1/1/1942
1/1/1943
1/1/1944
1/1/1945
1/1/1946
1/1/1947
1/1/1948
1/1/1949
1/1/1950

Figure 23

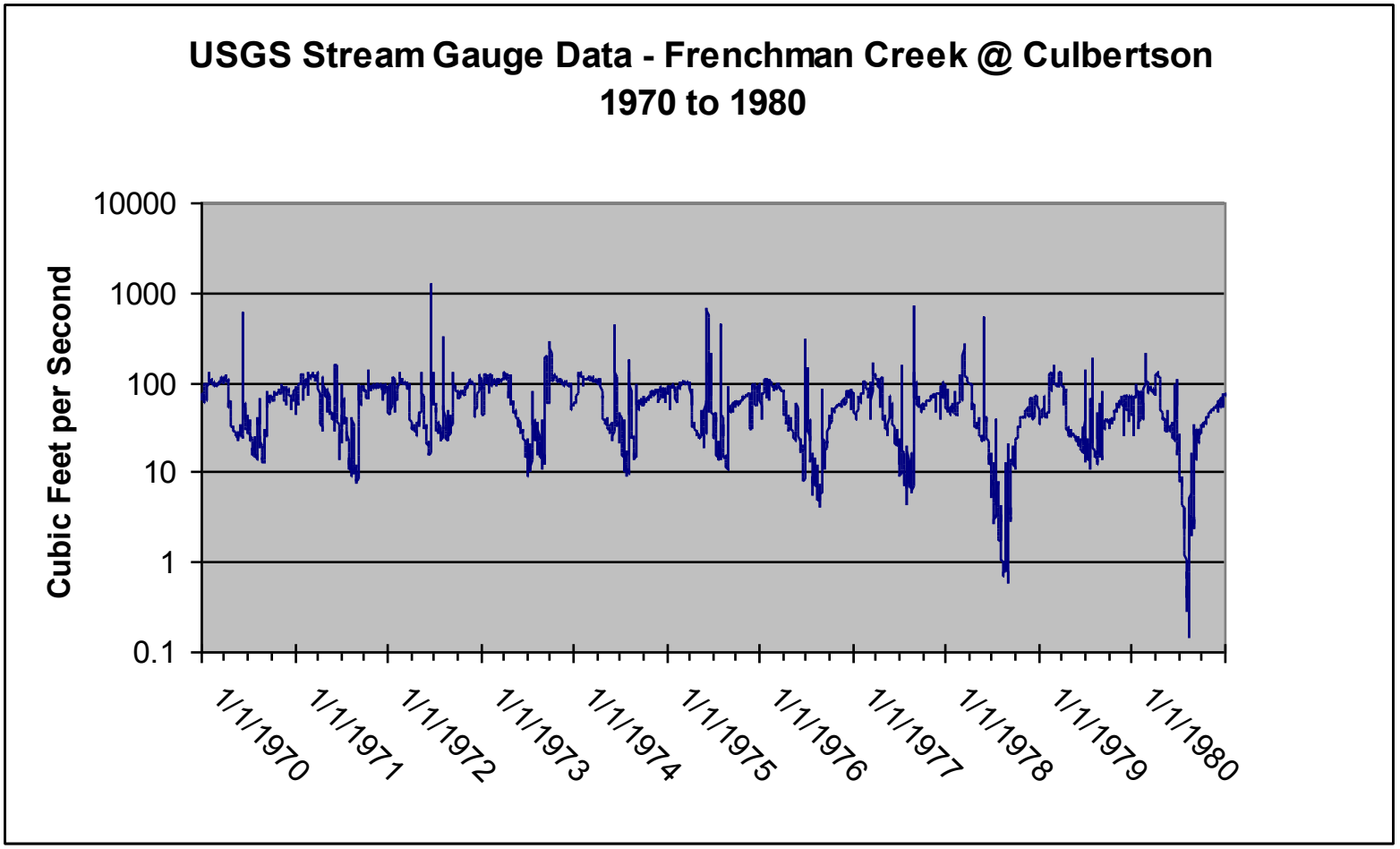

USGS Stream Gauge Data - Frenchman Creek @ Culbertson
1970 to 1980
Cubic Feet per Second
10000
1000
100
10
1
0.1
1/1/1970
1/1/1971
1/1/1972
1/1/1973
1/1/1974
1/1/1975
1/1/1976
1/1/1977
1/1/1978
1/1/1979
1/1/1980

Figure 24

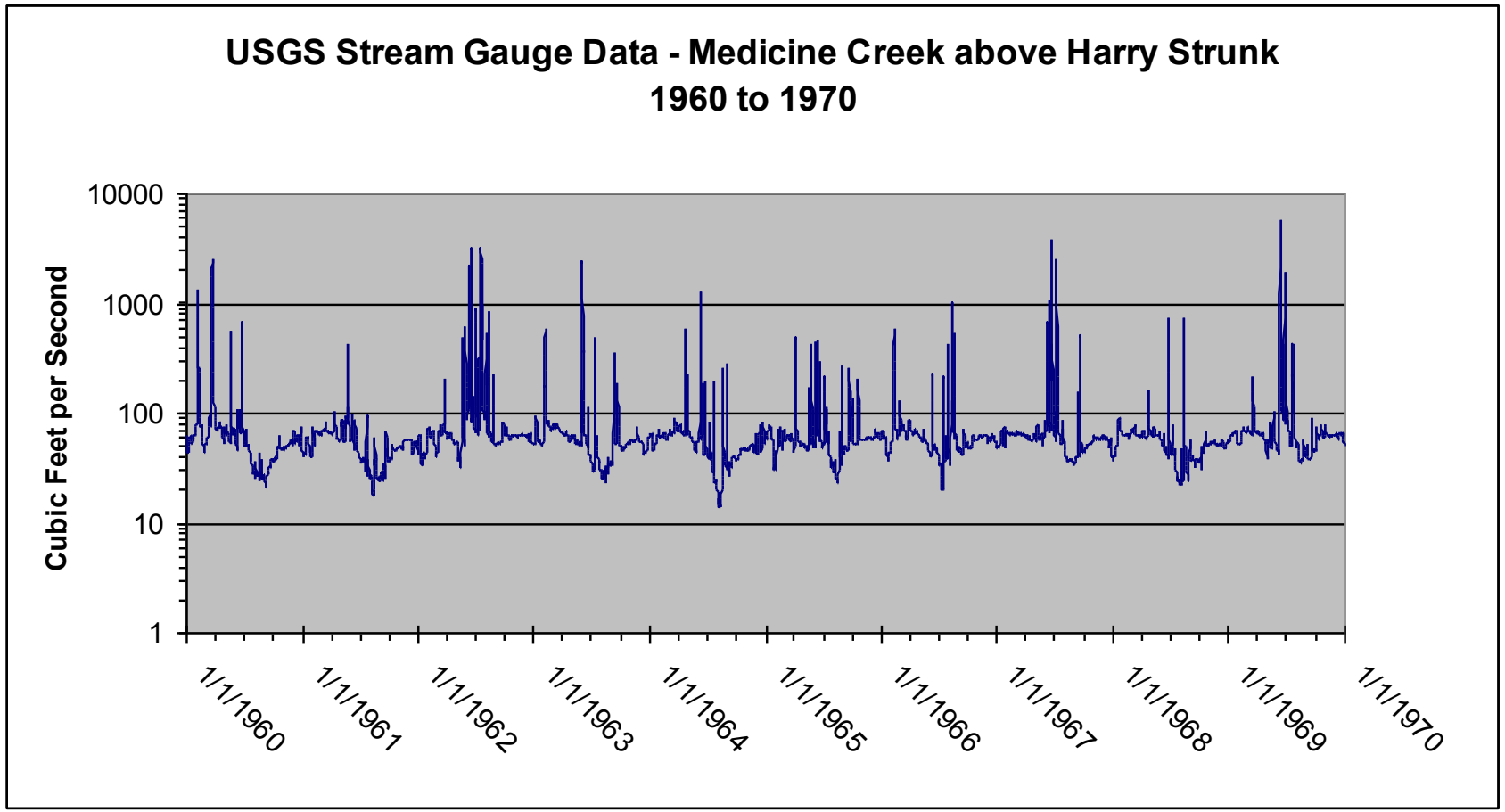

USGS Stream Gauge Data - Medicine Creek above Harry Strunk
1960 to 1970
Cubic Feet per Second
10000
1000
100
10
1
1/1/1960
1/1/1961
1/1/1962
1/1/1963
1/1/1964
1/1/1965
1/1/1966
1/1/1967
1/1/1968
1/1/1969
1/1/1970

Figure 25

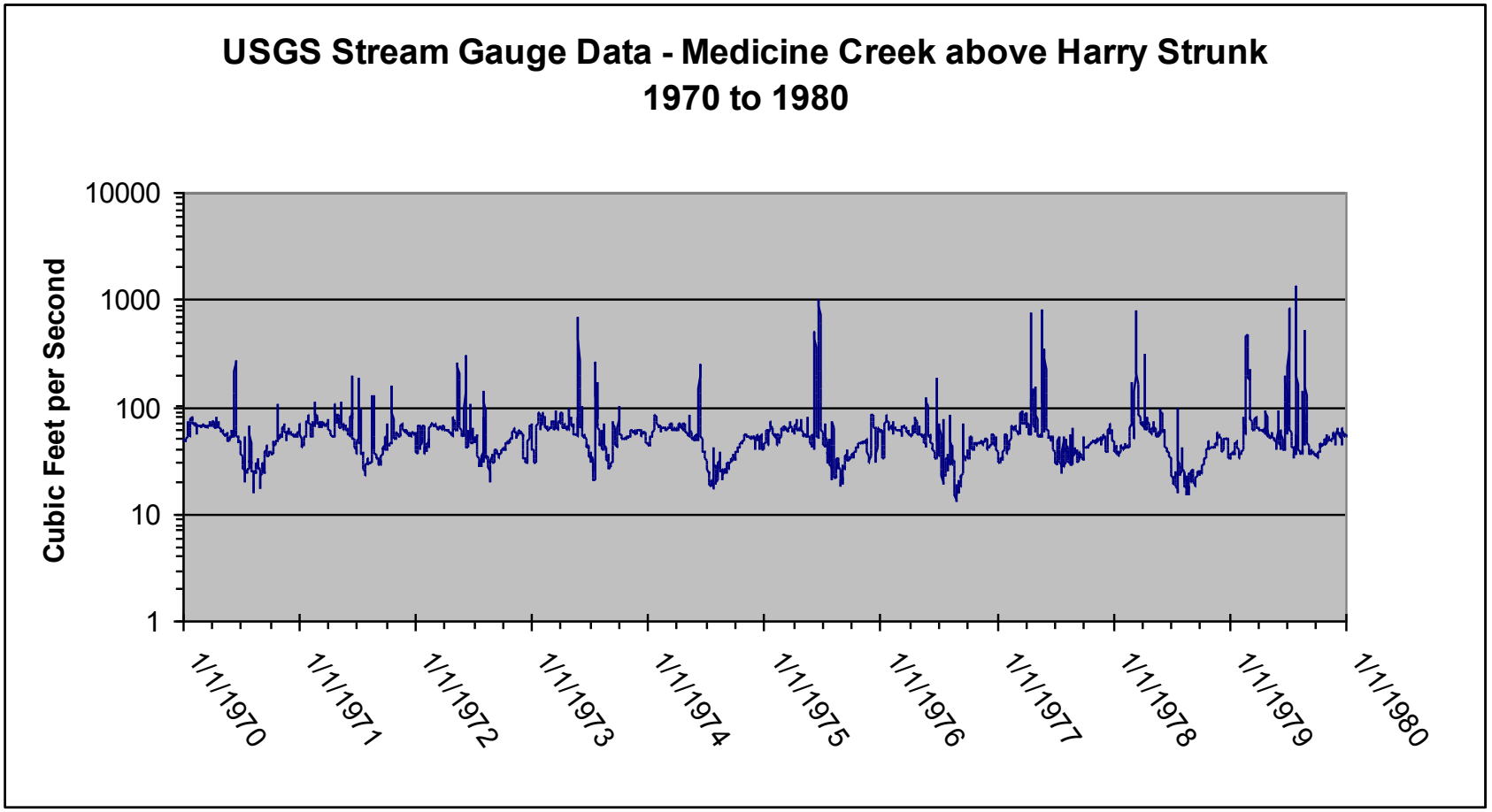

USGS Stream Gauge Data - Medicine Creek above Harry Strunk
1970 to 1980
Cubic Feet per Second
10000
1000
100
10
1
1/1/1970
1/1/1971
1/1/1972
1/1/1973
1/1/1974
1/1/1975
1/1/1976
1/1/1977
1/1/1978
1/1/1979
1/1/1980

Figure 26

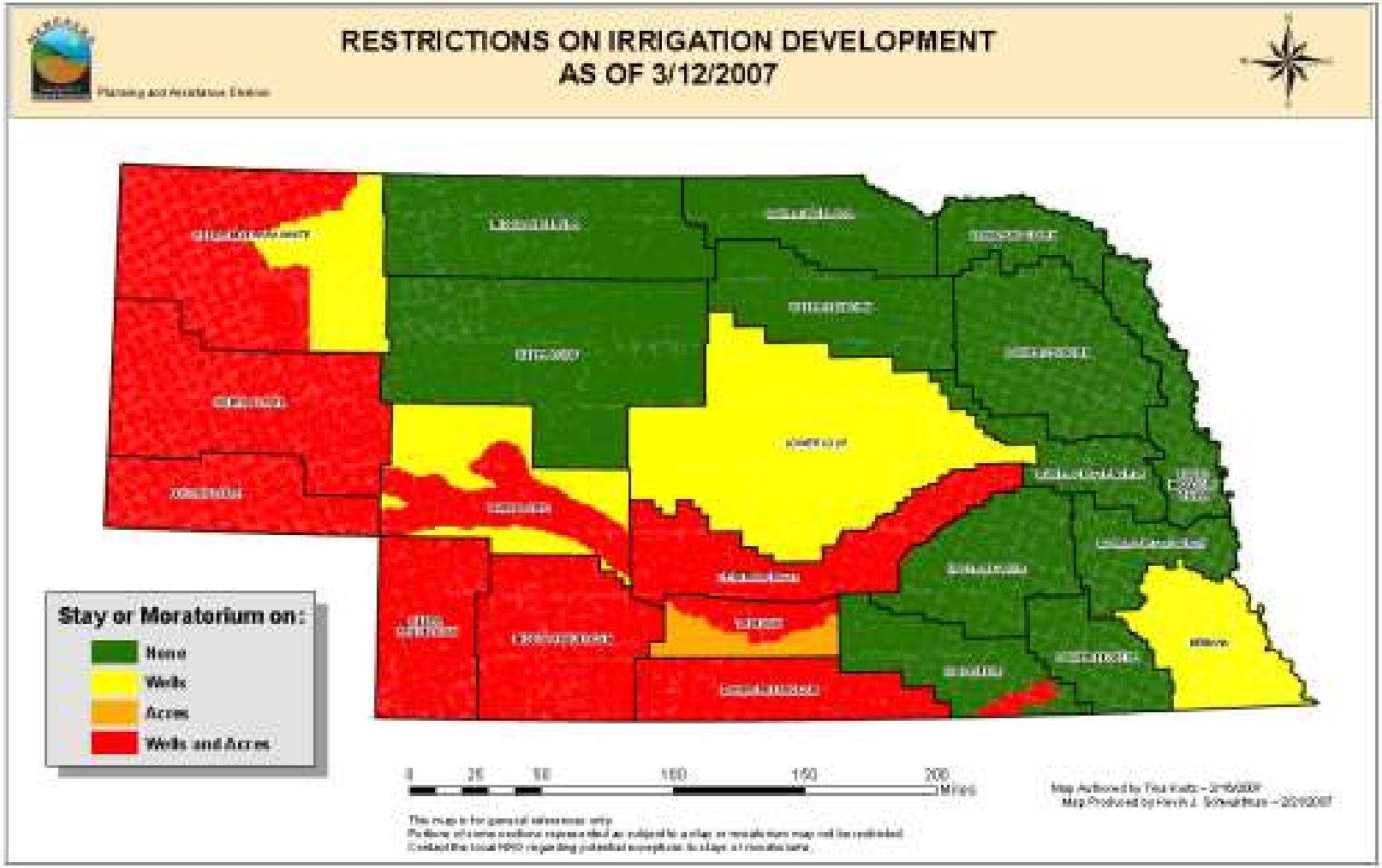

RESTRICTIONS ON IRRIGATION DEVELOPMENT
AS OF 3/12/2007
Stay or Moratorium on:
None
Wells
Acres
Wells and Acres
0
25
50
100
150
200
Miles

Figure 27

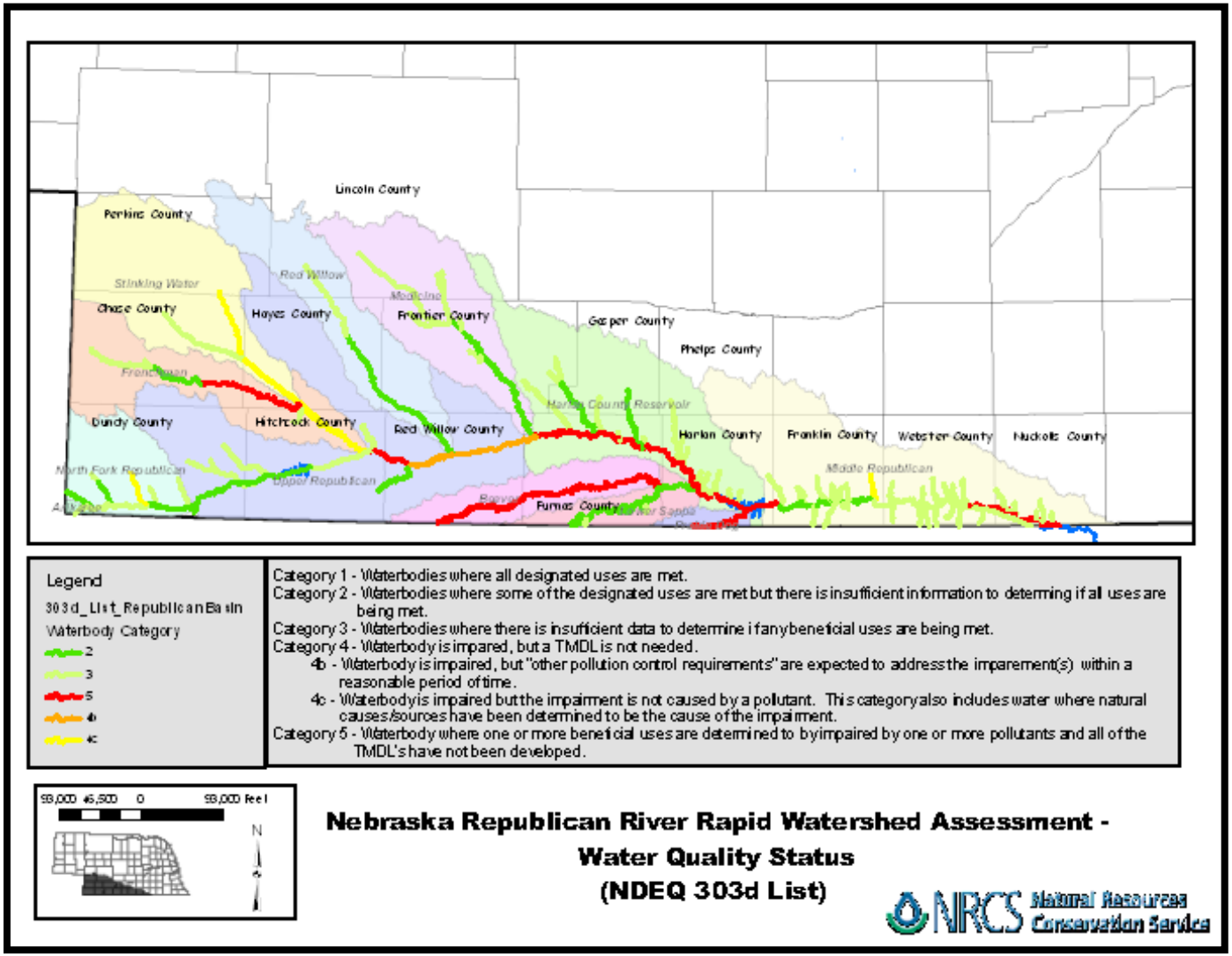

Lincoln County
Perkins County
Chase County
Hayes County
Frontier County
Gosper County
Phelps County
Dundy County
Hitchcock County
Red Willow County
Harlan County
Franklin County
Webster County
Nuckolls County
Furnas County
Harlan County Reservoir
Middle Republican
Upper Republican
North Fork Republican
Legend
303d_List_RepublicanBasin
Waterbody Category
2
3
5
4b
4c
Category 1 - Waterbodies where all designated uses are met.
Category 2 - Waterbodies where some of the designated uses are met but there is insufficient information to determine if all uses are being met.
Category 3 - Waterbodies where there is insufficient data to determine if any beneficial uses are being met.
Category 4 - Waterbody is impared, but a TMDL is not needed.
4b - Waterbody is impaired, but "other pollution control requirements" are expected to address the impairement(s) within a reasonable period of time.
4c - Waterbody is impaired but the impairment is not caused by a pollutant. This category also includes water where natural causes/sources have been determined to be the cause of the impairment.
Category 5 - Waterbody where one or more beneficial uses are determined to by impaired by one or more pollutants and all of the TMDL's have not been developed.
93,000 46,500 0 93,000 Feet
N
Nebraska Republican River Rapid Watershed Assessment -
Water Quality Status
(NDEQ 303d List)
NRCS Natural Resources Conservation Service

Figure 28

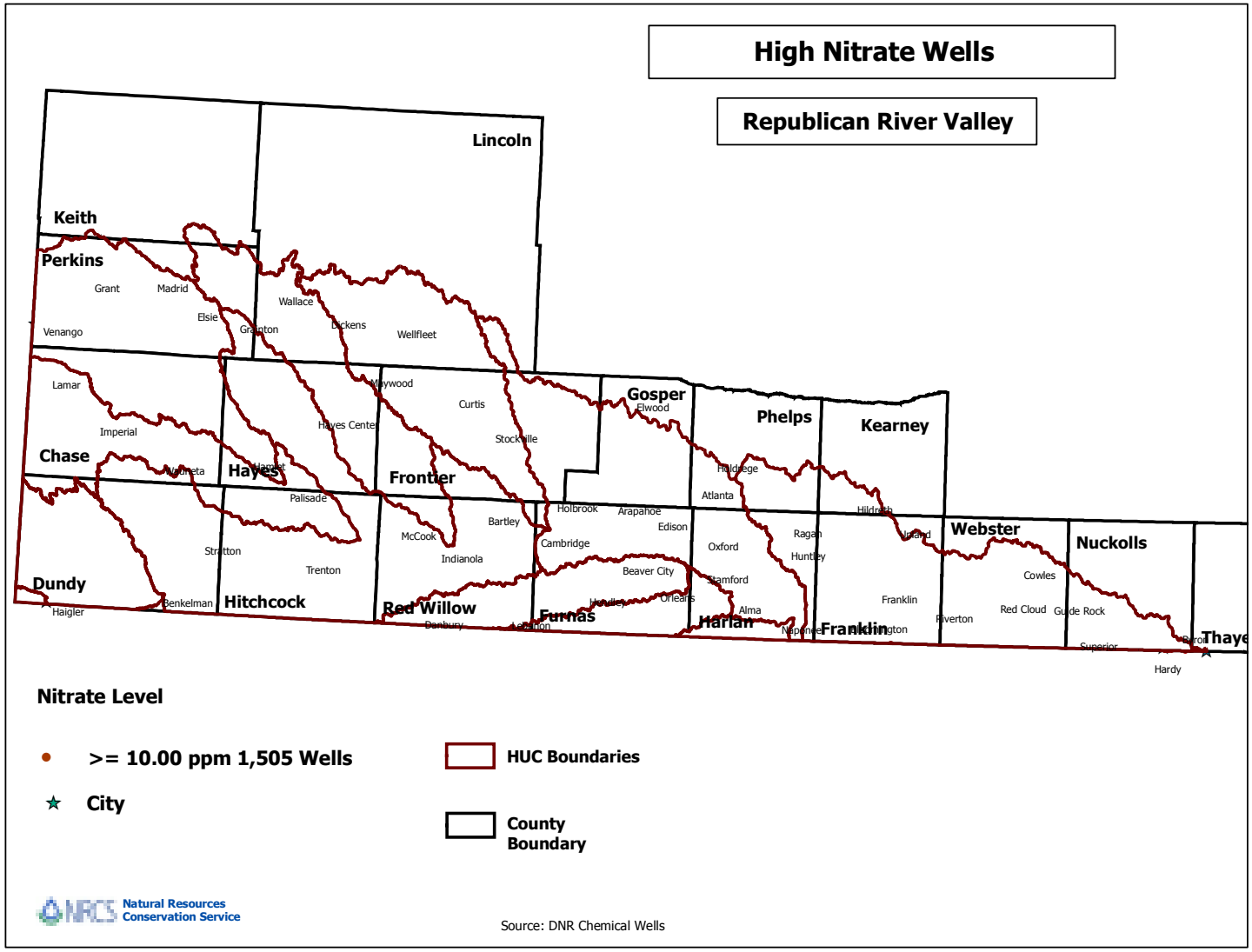

High Nitrate Wells
Republican River Valley
Lincoln
Keith
Perkins
Grant
Madrid
Wallace
Elsie
Dickens
Venango
Grafton
Wellfleet
Lamar
Maywood
Curtis
Gosper
Elwood
Phelps
Kearney
Imperial
Hayes Center
Stockville
Chase
Hayes
Frontier
Hildrege
Atlanta
Palisade
Holbrook
Arapahoe
Bartley
Edison
Webster
Nuckolls
McCook
Ragan
Oxford
Cambridge
Indianola
Huntley
Stratton
Trenton
Beaver City
Cowles
Dundy
Stamford
Franklin
Benkelman
Hitchcock
Red Willow
Furnas
Harlan
Alma
Riverton
Red Cloud
Guide Rock
Haigler
Danbury
Franklin
Superior
Hardy
Nitrate Level
>= 10.00 ppm 1,505 Wells
City
HUC Boundaries
County Boundary
Natural Resources Conservation Service
Source: DNR Chemical Wells

Figure 29

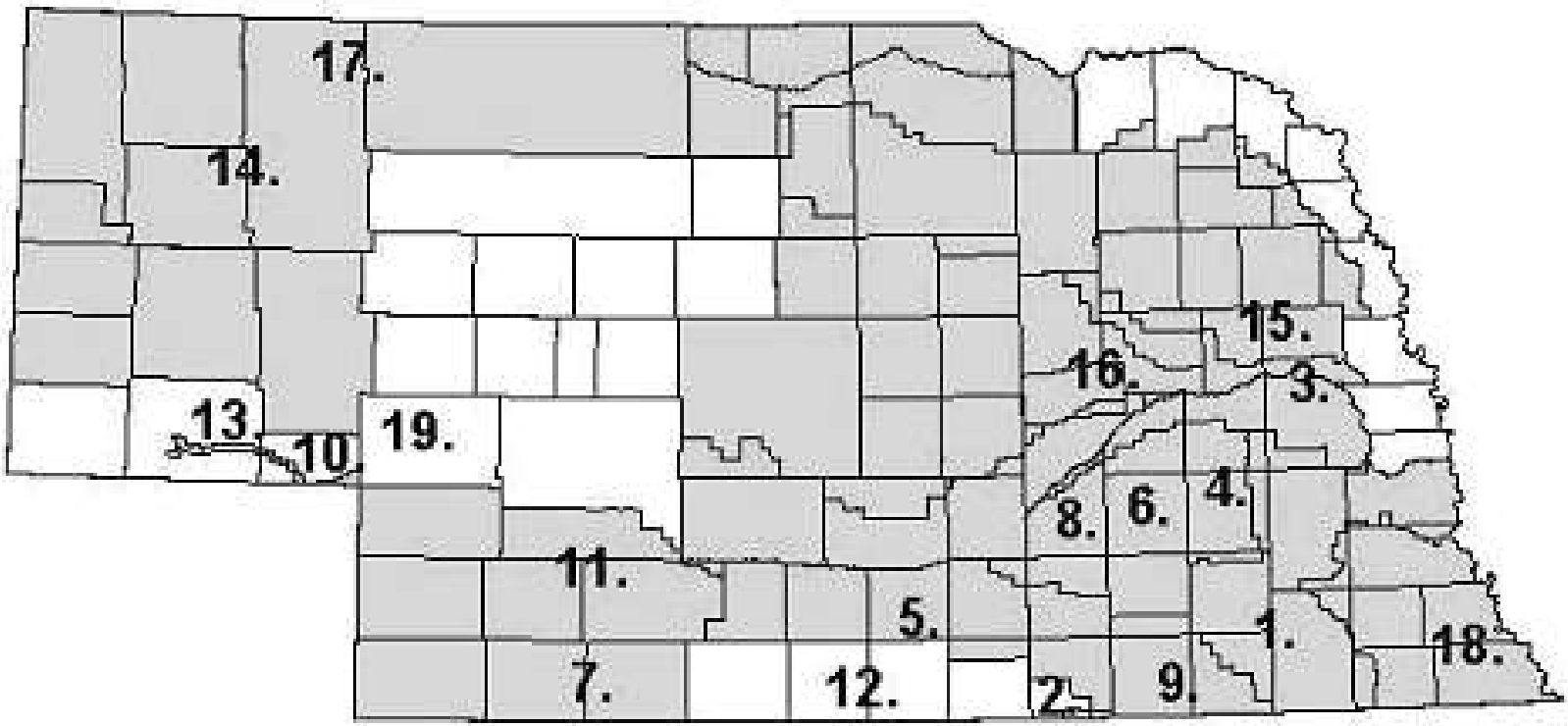


Figure 30

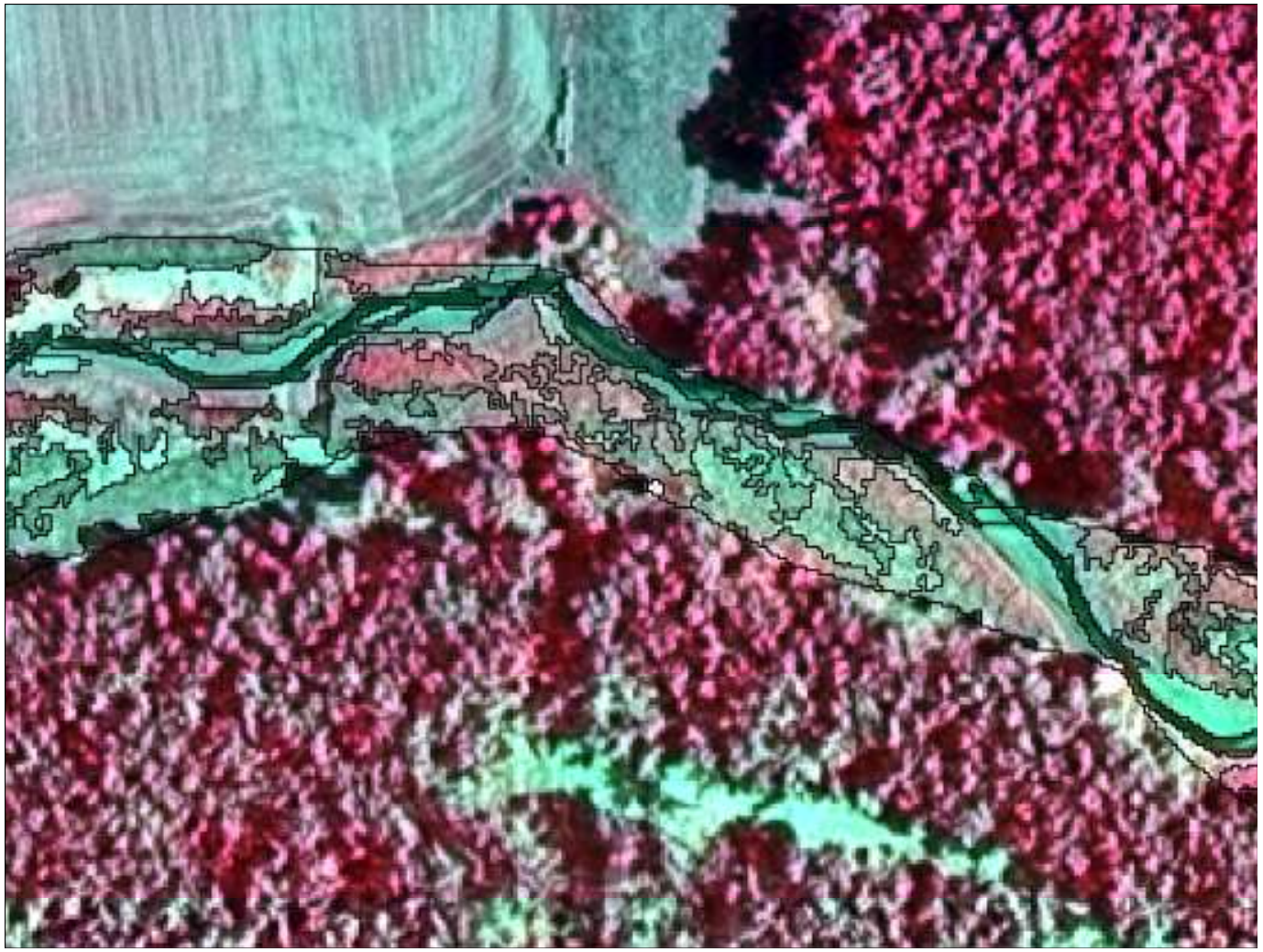


Figure 31

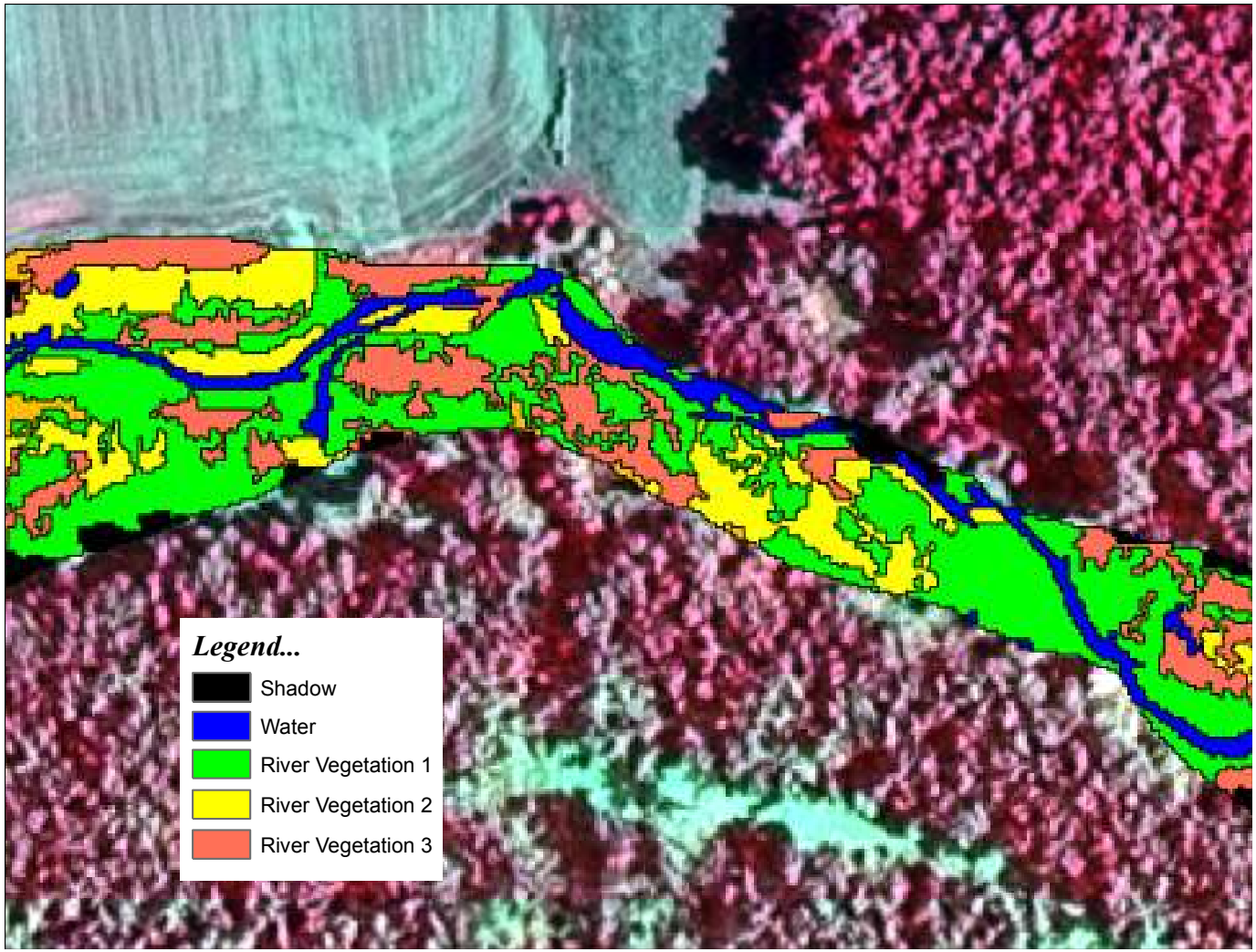

Legend...
Shadow
Water
River Vegetation 1
River Vegetation 2
River Vegetation 3

Figure 32

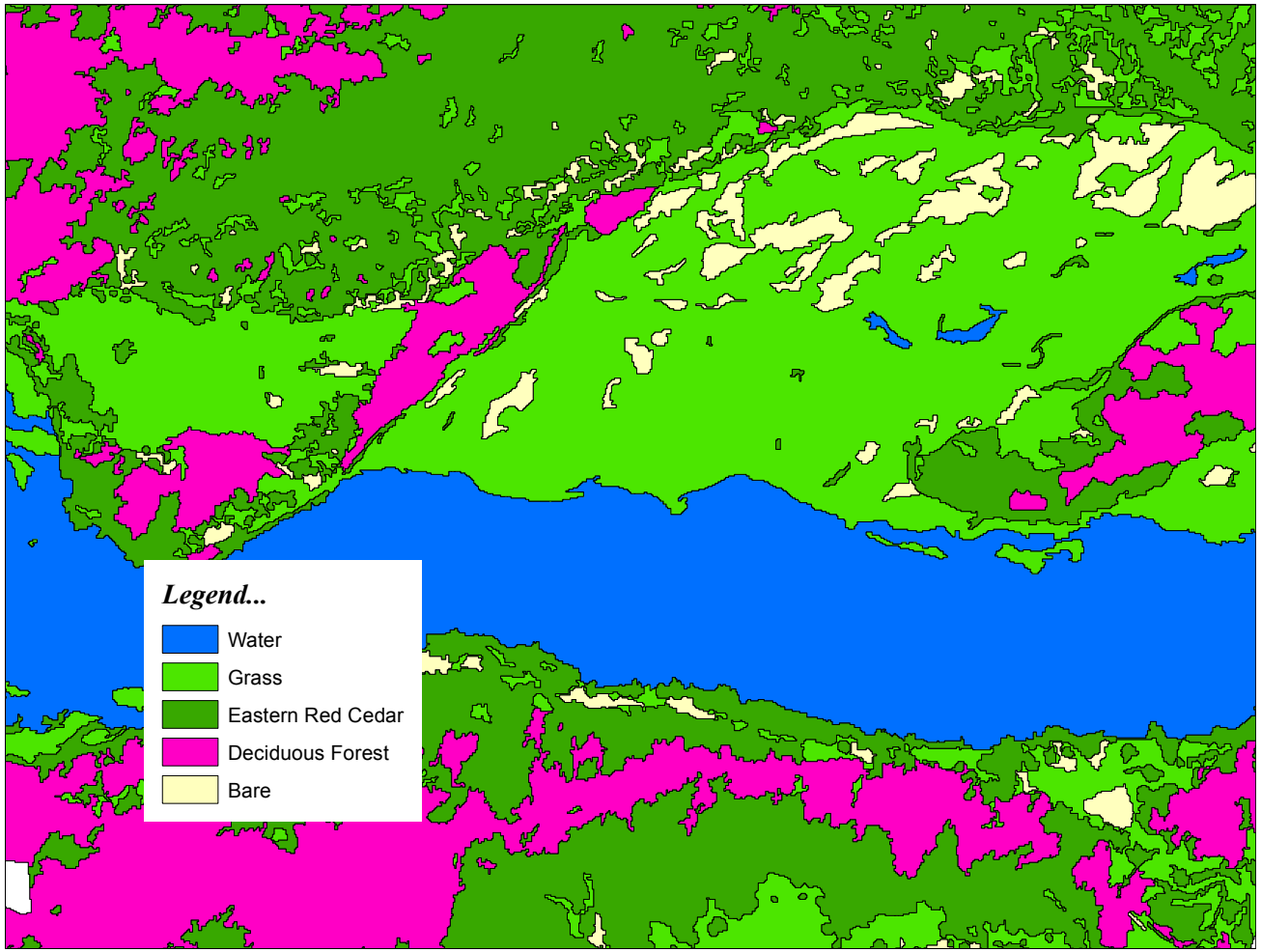

Legend...
Water
Grass
Eastern Red Cedar
Deciduous Forest
Bare

Figure 33

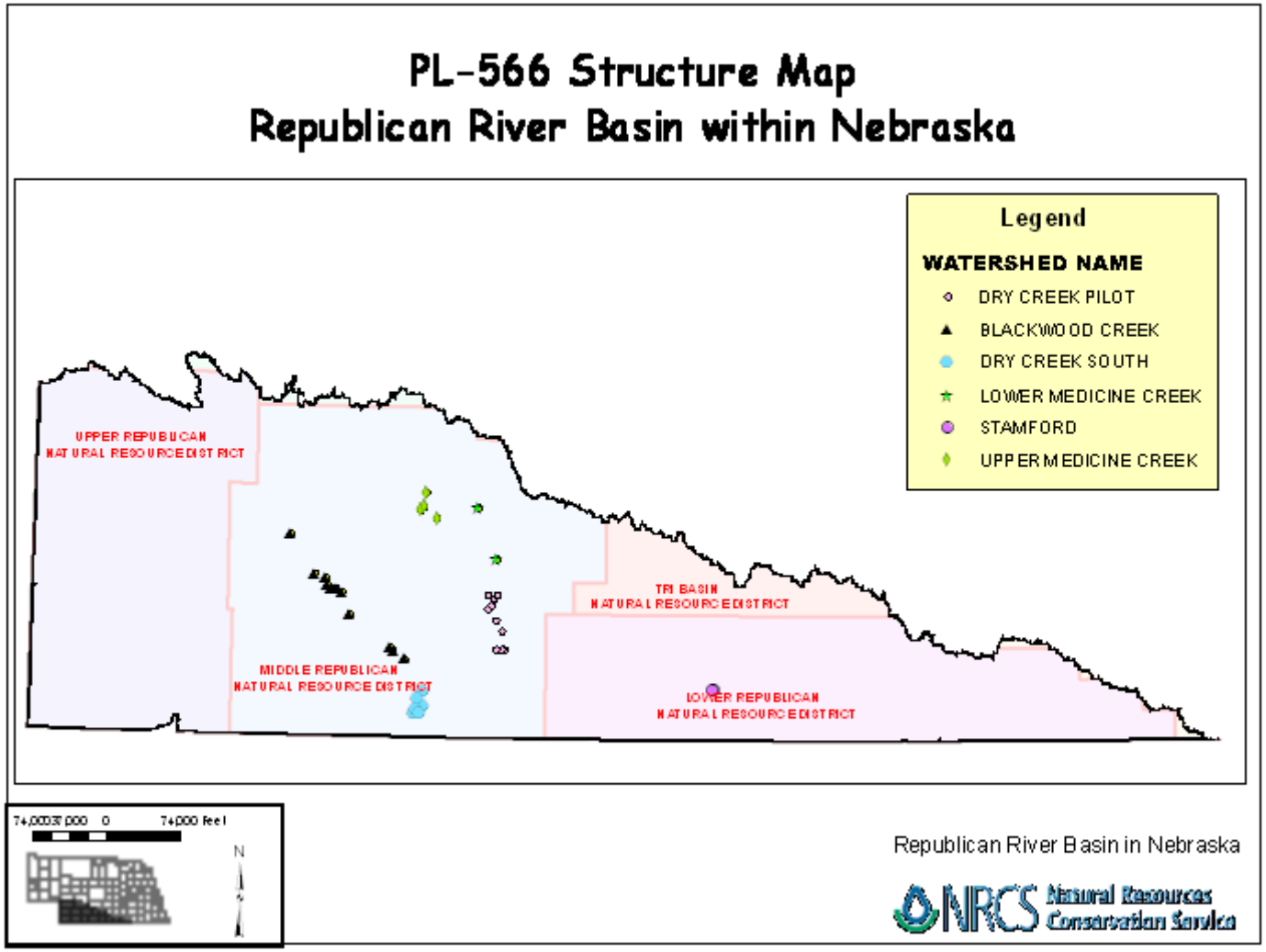
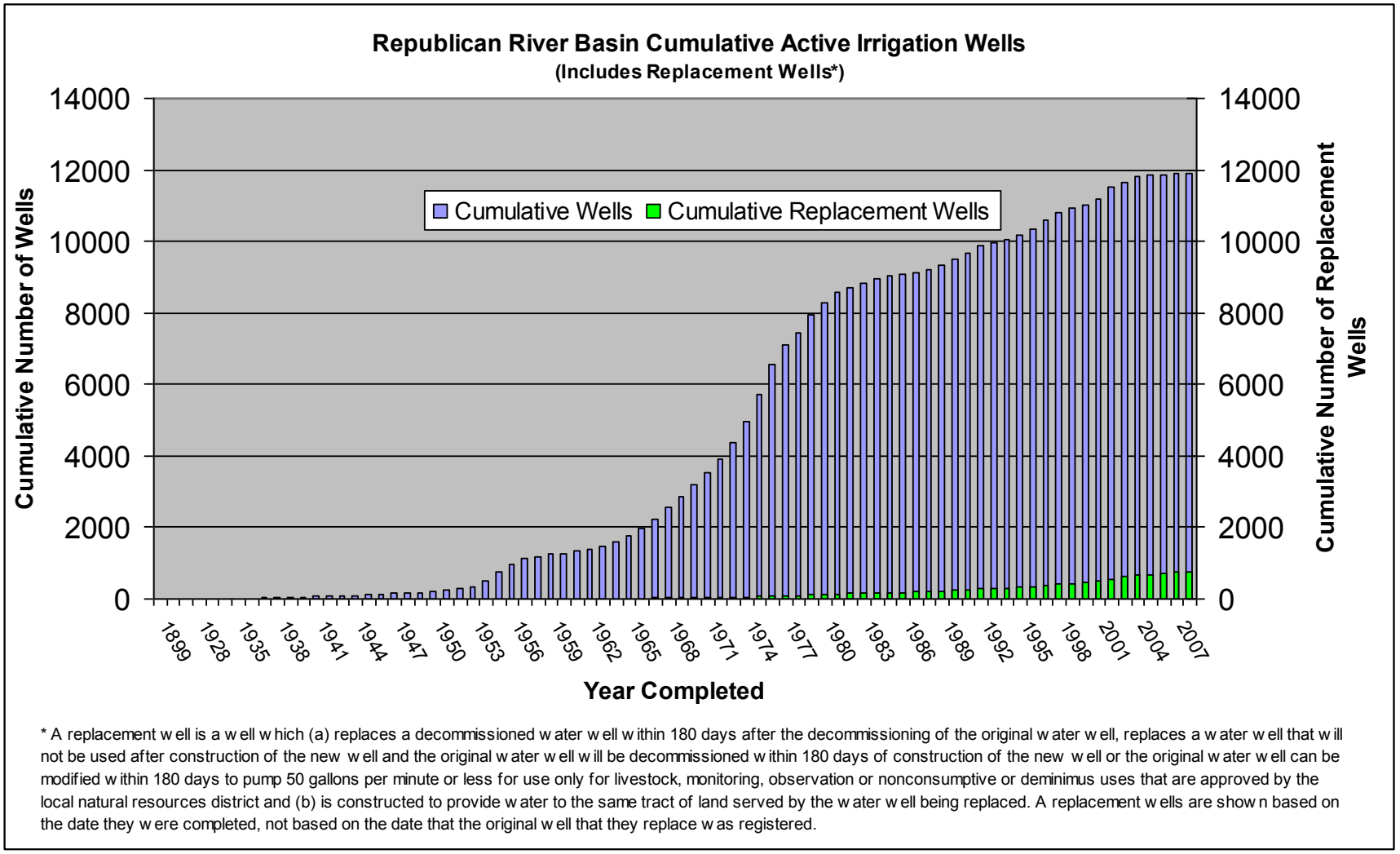
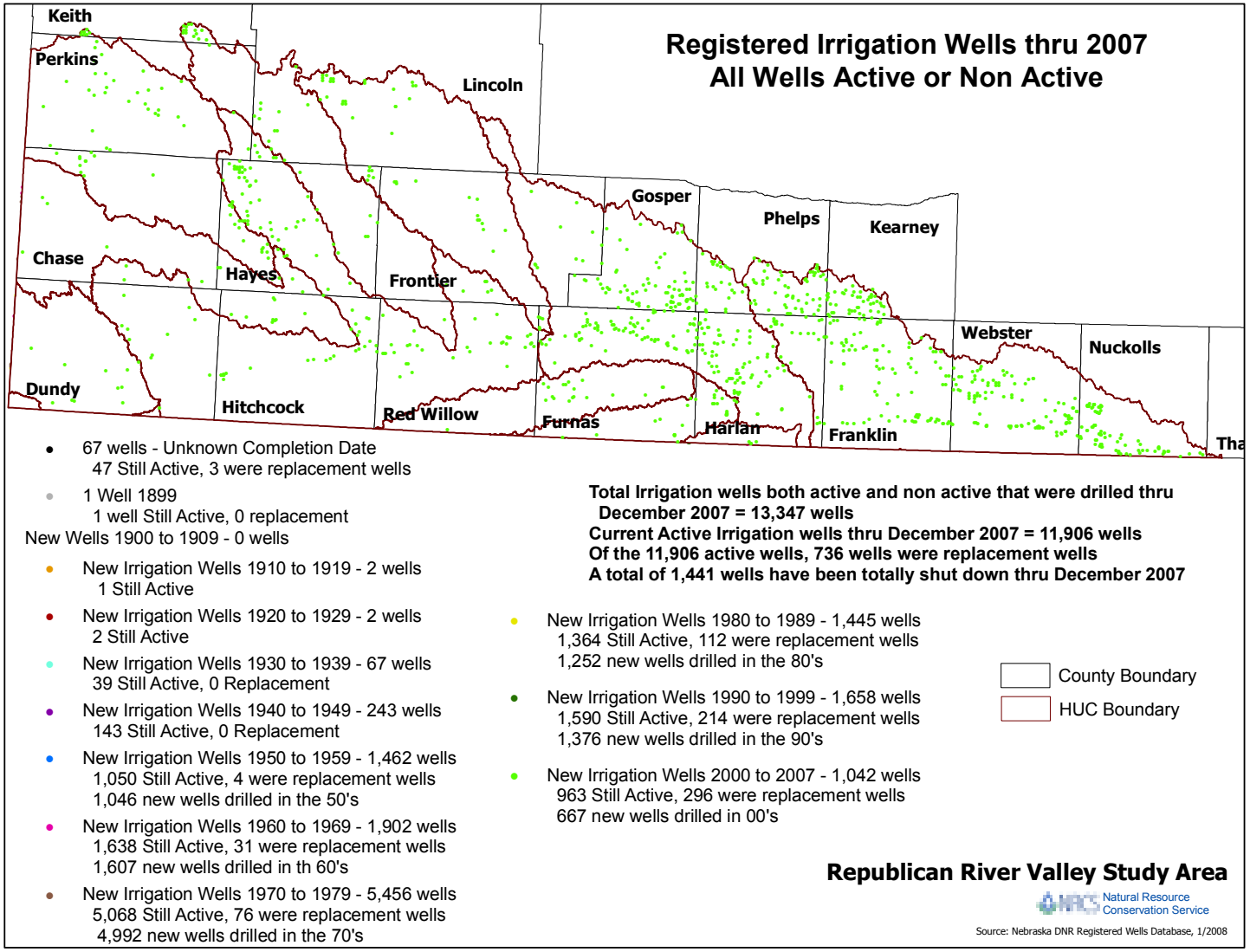

PL-566 Structure Map
Republican River Basin within Nebraska
Legend
WATERSHED NAME
DRY CREEK PILOT
BLACKWOOD CREEK
DRY CREEK SOUTH
LOWER MEDICINE CREEK
STAMFORD
UPPER MEDICINE CREEK
UPPER REPUBLICAN NATURAL RESOURCE DISTRICT
TRI BASIN NATURAL RESOURCE DISTRICT
MIDDLE REPUBLICAN NATURAL RESOURCE DISTRICT
LOWER REPUBLICAN NATURAL RESOURCE DISTRICT
74,000 0 74,000 Feet
N
Republican River Basin in Nebraska
NRCS Natural Resources Conservation Service

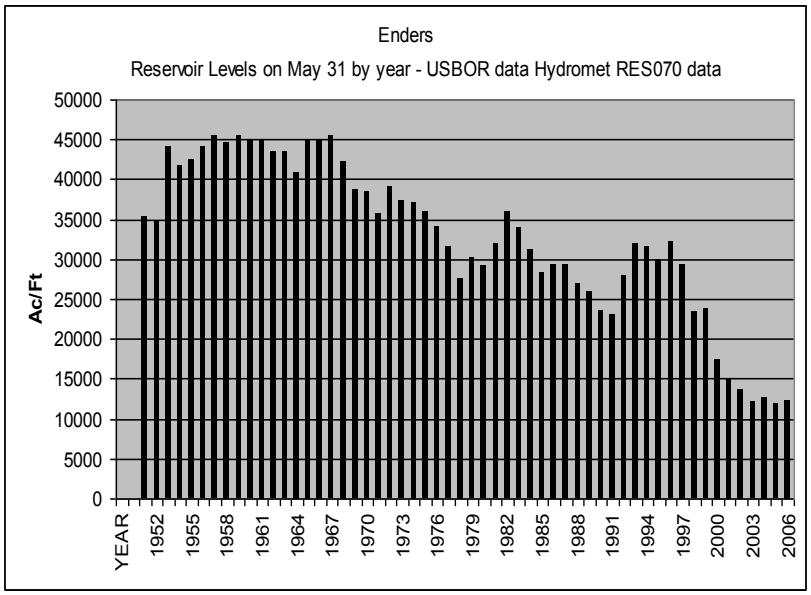
Figure 34

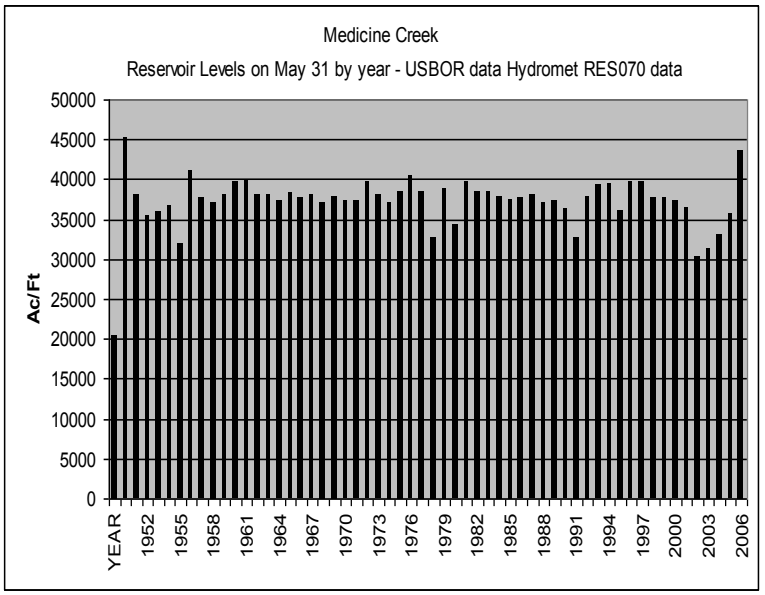


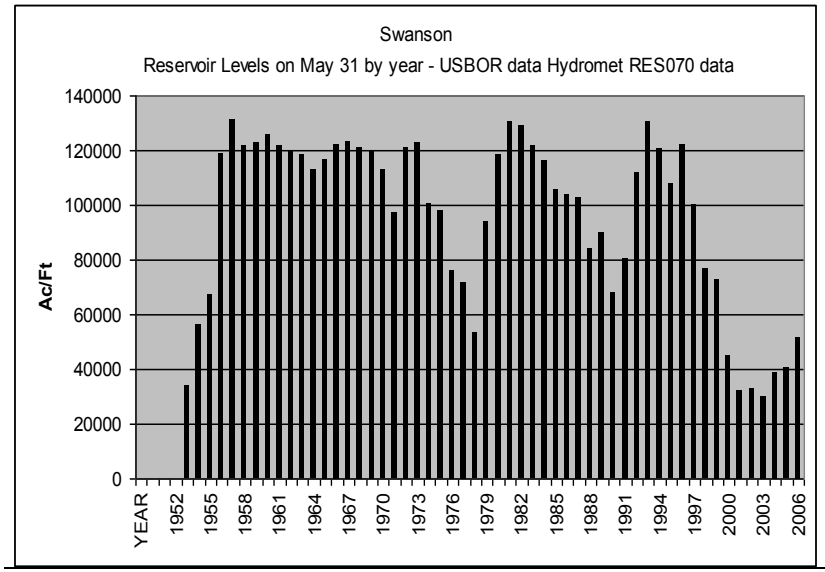
* A replacement well is a well which (a) replaces a decommissioned water well within 180 days after the decommissioning of the original water well, replaces a water well that will not be used after construction of the new well and the original water well will be decommissioned within 180 days of construction of the new well or the original water well can be modified within 180 days to pump 50 gallons per minute or less for use only for livestock, monitoring, observation or nonconsumptive or deminimus uses that are approved by the local natural resources district and (b) is constructed to provide water to the same tract of land served by the water well being replaced. A replacement wells are shown based on the date they were completed, not based on the date that the original well that they replace was registered.

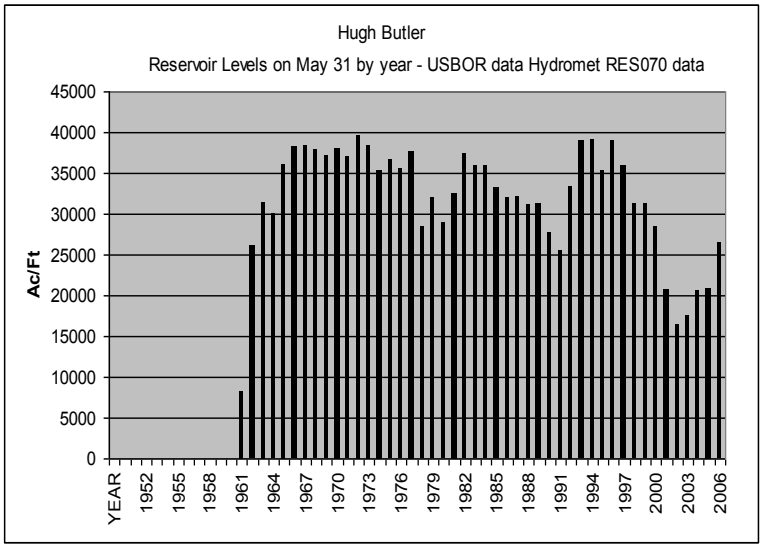
Figure 35

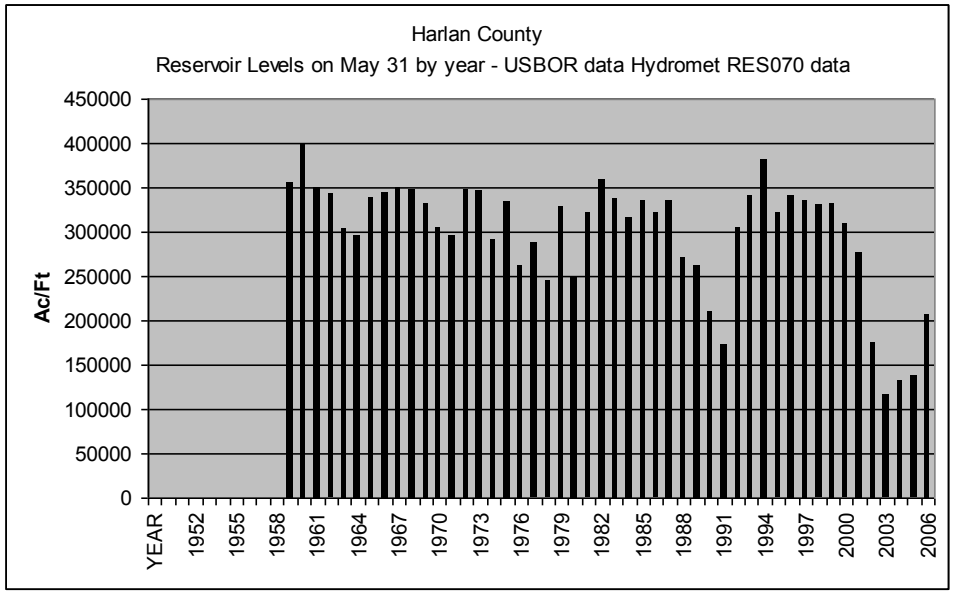

Registered Irrigation Wells thru 2007
All Wells Active or Non Active
Keith
Perkins
Lincoln
Gosper
Phelps
Kearney
Chase
Hayes
Frontier
Webster
Nuckolls
Dundy
Hitchcock
Red Willow
Furnas
Harlan
Franklin
Tha
67 wells - Unknown Completion Date
47 Still Active, 3 were replacement wells
1 Well 1899
1 well Still Active, 0 replacement
New Wells 1900 to 1909 - 0 wells
New Irrigation Wells 1910 to 1919 - 2 wells
1 Still Active
New Irrigation Wells 1920 to 1929 - 2 wells
2 Still Active
New Irrigation Wells 1930 to 1939 - 67 wells
39 Still Active, 0 Replacement
New Irrigation Wells 1940 to 1949 - 243 wells
143 Still Active, 0 Replacement
New Irrigation Wells 1950 to 1959 - 1,462 wells
1,050 Still Active, 4 were replacement wells
1,046 new wells drilled in the 50's
New Irrigation Wells 1960 to 1969 - 1,902 wells
1,638 Still Active, 31 were replacement wells
1,607 new wells drilled in th 60's
New Irrigation Wells 1970 to 1979 - 5,456 wells
5,068 Still Active, 76 were replacement wells
4,992 new wells drilled in the 70's
Total Irrigation wells both active and non active that were drilled thru December 2007 = 13,347 wells
Current Active Irrigation wells thru December 2007 = 11,906 wells
Of the 11,906 active wells, 736 wells were replacement wells
A total of 1,441 wells have been totally shut down thru December 2007
New Irrigation Wells 1980 to 1989 - 1,445 wells
1,364 Still Active, 112 were replacement wells
1,252 new wells drilled in the 80's
New Irrigation Wells 1990 to 1999 - 1,658 wells
1,590 Still Active, 214 were replacement wells
1,376 new wells drilled in the 90's
New Irrigation Wells 2000 to 2007 - 1,042 wells
963 Still Active, 296 were replacement wells
667 new wells drilled in 00's
County Boundary
HUC Boundary
Republican River Valley Study Area
Natural Resource Conservation Service
Source: Nebraska DNR Registered Wells Database, 1/2008


Enders
Reservoir Levels on May 31 by year - USBOR data Hydromet RES070 data
Ac/Ft
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
YEAR
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006


Medicine Creek
Reservoir Levels on May 31 by year - USBOR data Hydromet RES070 data
Ac/Ft
50000
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
YEAR
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006


Swanson
Reservoir Levels on May 31 by year - USBOR data Hydromet RES070 data
Ac/Ft
140000
120000
100000
80000
60000
40000
20000
0
YEAR
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006


Hugh Butler
Reservoir Levels on May 31 by year - USBOR data Hydromet RES070 data
Ac/Ft
45000
40000
35000
30000
25000
20000
15000
10000
5000
0
YEAR
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006


Harlan County
Reservoir Levels on May 31 by year - USBOR data Hydromet RES070 data
Ac/Ft
450000
400000
350000
300000
250000
200000
150000
100000
50000
0
YEAR
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006

7.5 Appendix B – Supporting Information

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE

NE-CPA-52
April 2005

RESOURCE CONSIDERATIONS (Required)
Field Inventory Guide Sheet

Identify the resource concern(s) that need to be addressed and the assessment tool(s) used for the evaluation.

Client/Plan Information:

Republican River Basin in Nebraska
Rapid Watershed Assessment

SOIL

Erosion

- [x] Sheet and Rill
- [x] Wind
- [x] Ephemeral Gully
- [x] Classic Gully
- [ ] Streambank
- [ ] Shoreline
- [ ] Irrigation Induced
- [ ] Mass Movement
- [ ] Road, Road Sides & Construction Sites
- [ ] Other:
- [ ] Other:

Condition

- [ ] Organic Matter Depletion
- [ ] Compaction
- [ ] Subsidence
- [ ] Contaminants-Salts & Other Chemicals
- [ ] Contaminants-Animal Waste & Other Organics
- [ ] Contaminants-Commercial Fertilizer
- [ ] Contaminants-Residual Pesticides
- [ ] Damage from Soil Deposition

Assessment tools, Problems & Notes: Considering current treatment levels - not forwarded as an area wide concern

WATER

Quantity

- [ ] Excessive Seepage
- [x] Excessive Runoff, Flooding, or Ponding
- [ ] Excessive Subsurface Water
- [ ] Drifted Snow
- [ ] Inadequate Outlets
- [ ] Inefficient Water Use on Irrigated Land
- [ ] Inefficient Water Use on Non-irrigated Land
- [ ] Reduced Capacity of Conveyances by Sediment Deposition
- [ ] Reduced Storage of Water Bodies by Sediment Accumulation
- [x] Aquifer Overdraft
- [ ] Insufficient Flows in Water Courses
- [x] Other: Insufficient - Interstate Compact
- [ ] Other:

Quality

- [ ] Harmful Levels of Pesticides in Groundwater
- [ ] Excessive Nutrients and Organics in Groundwater
- [ ] Excessive Salinity in Groundwater
- [ ] Harmful Levels of Heavy Metals in Groundwater
- [ ] Harmful Levels of Pathogens in Groundwater
- [ ] Harmful Levels of Petroleum in Groundwater
- [ ] Harmful Levels of Pesticides in Surface Water
- [ ] Excessive Nutrients and Organics in Surface Water
- [ ] Excessive Suspended Sediment & Turbidity in Surface Water
- [ ] Excessive Salinity in Surface Water
- [ ] Harmful Levels of Heavy Metals in Surface Water
- [ ] Harmful Temperatures of Surface Water
- [ ] Harmful Levels of Pathogens in Surface Water
- [ ] Harmful Levels of Petroleum in Surface Water

Assessment tools, Problems & Notes: Area impacted by the Republican River Settlement Agreement - Irrigated acres capped and irrigation allocations in place, carried forward as concern for Aquifer Overdraft and Insufficient - Interstate Compact

AIR

Quality

- [ ] Particulate matter less than 10 micrometers in diameter
- [ ] Particulate matter less than 2.5 micrometers in diameter
- [ ] Excessive Ozone
- [ ] Excessive Greenhouse Gas - CO2
- [ ] Excessive Greenhouse Gas - N2O
- [ ] Excessive Greenhouse Gas - CH4
- [ ] Ammonia (NH3)
- [ ] Chemical Drift
- [ ] Objectionable Odors
- [ ] Reduced Visibility
- [ ] Undesirable Air Movement
- [ ] Adverse Air Temperature
- [ ] Other:
- [ ] Other:

Assessment tools, Problems & Notes:

PLANTS

- [ ] Plants are adapted or suited

Condition

- [ ] Productivity, Health and Vigor
- [ ] Threatened or Endangered Plant Species
- [x] Noxious and Invasive Plants
- [ ] Wildfire Hazard
- [ ] Other:
- [ ] Other:

Assessment tools, Problems & Notes: Invasive species (salt cedar and phragmities) in water courses reduce water supply for other uses.

ANIMALS

Fish and Wildlife

- [ ] Inadequate Food
- [x] Inadequate Cover/Shelter
- [ ] Inadequate Water
- [ ] Inadequate Space
- [x] Plant Community Fragmentation
- [ ] Imbalance Among and Within Populations
- [ ] Threatened and Endangered Species

Domestic Animals

- [ ] Inadequate Quantities and Quality of Feed & Forage
- [ ] Inadequate Shelter
- [ ] Inadequate Stock Water
- [ ] Stress and Mortality
- [ ] Other:
- [ ] Other:

Assessment tools, Problems & Notes: Adequate cover/shelter not available year round. Shortage of cover during winter months. Grazing of stocks post harvest limits habitat in winter months

Completed by _____ **Date** _____