Planning and Assistance Division

GENERAL BASIN MAP

ELKHORN RIVER BASIN

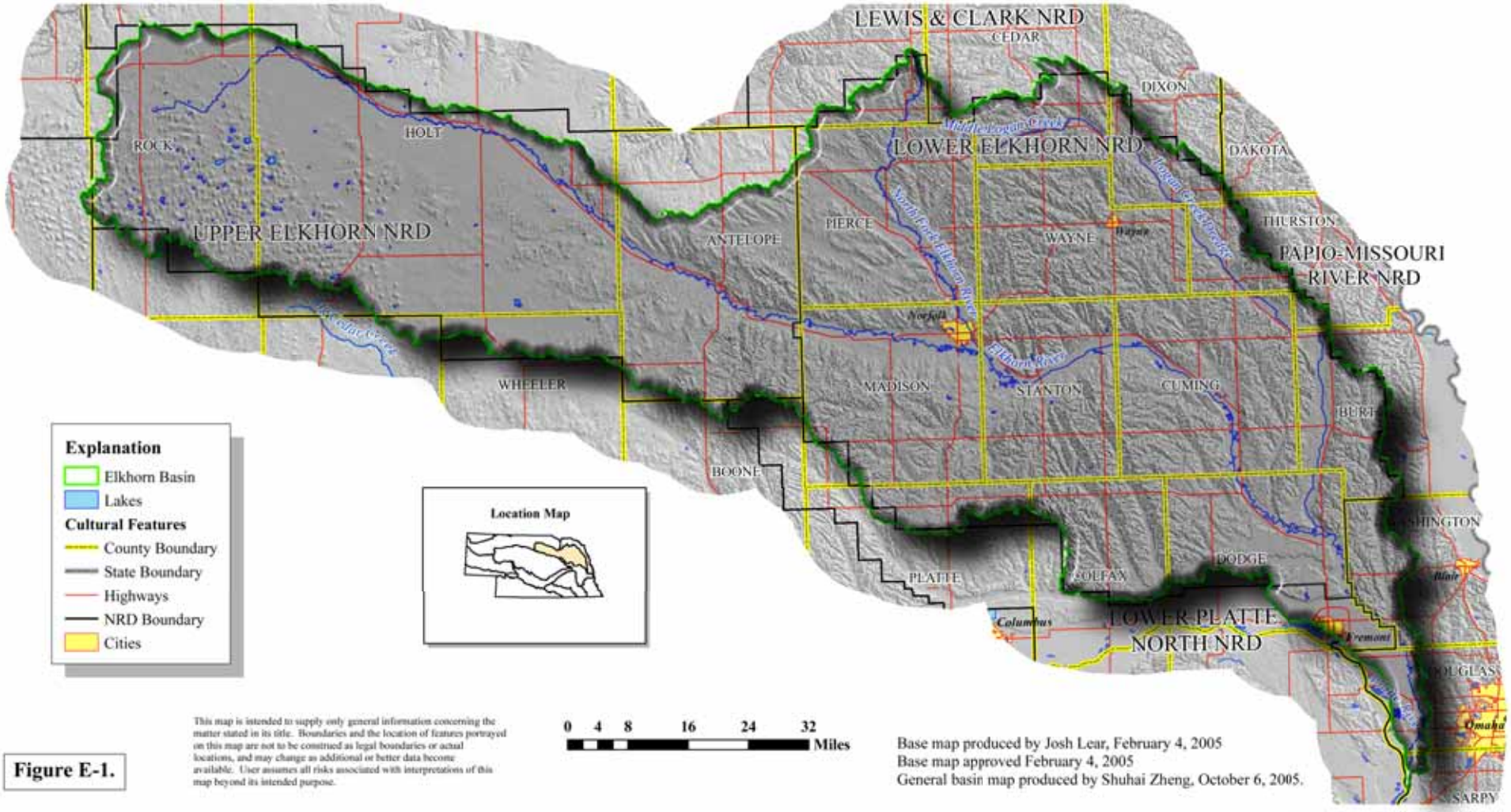

Figure E-1.

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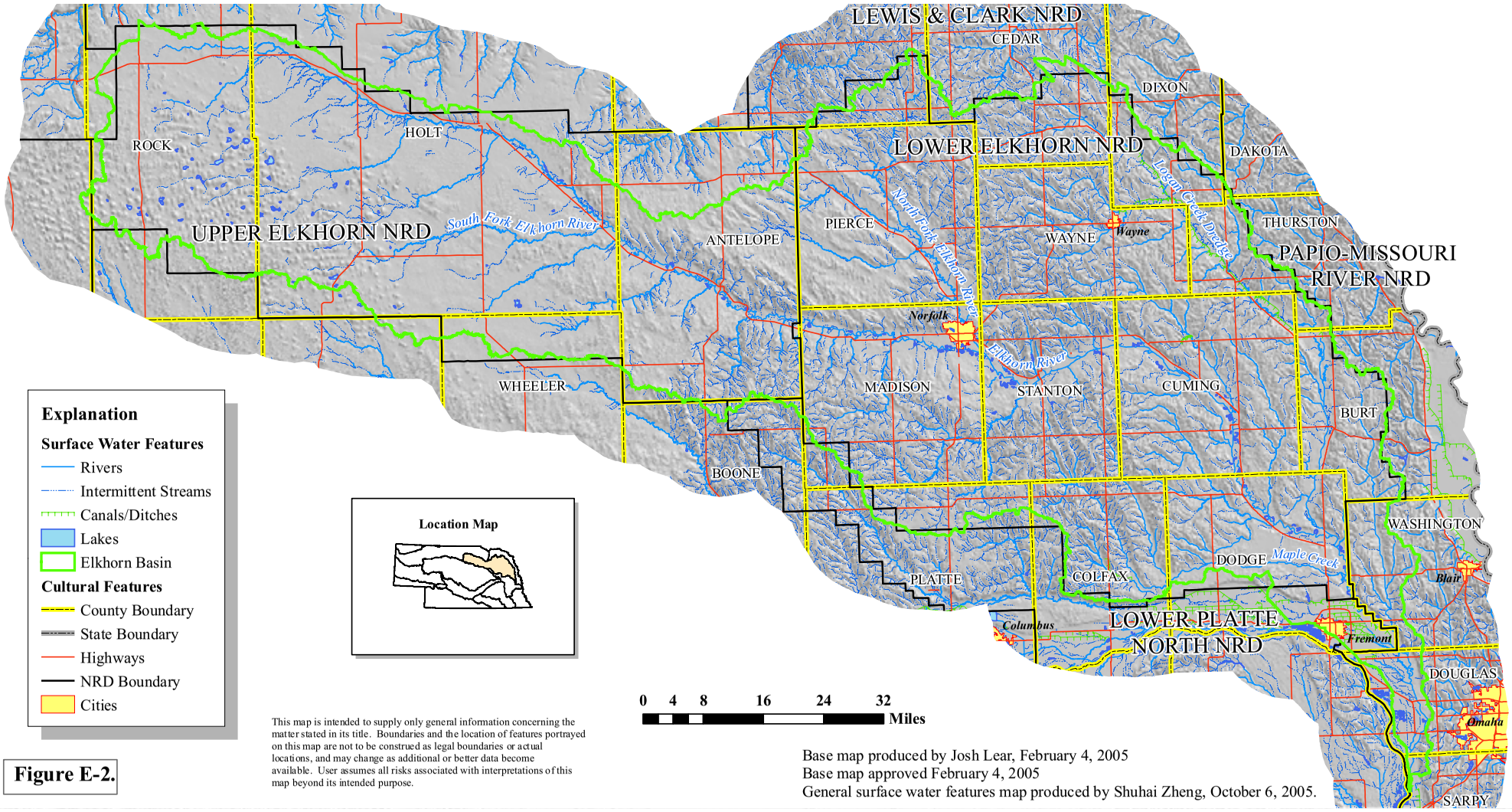
Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
General basin map produced by Shuhai Zheng, October 6, 2005.

General Surface Water Features

ELKHORN RIVER BASIN

Planning and Assistance Division



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Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
General surface water features map produced by Shuhai Zheng, October 6, 2005.

Figure E-2.

Figure E-3. Annual Precipitation at Newport, Nebraska.

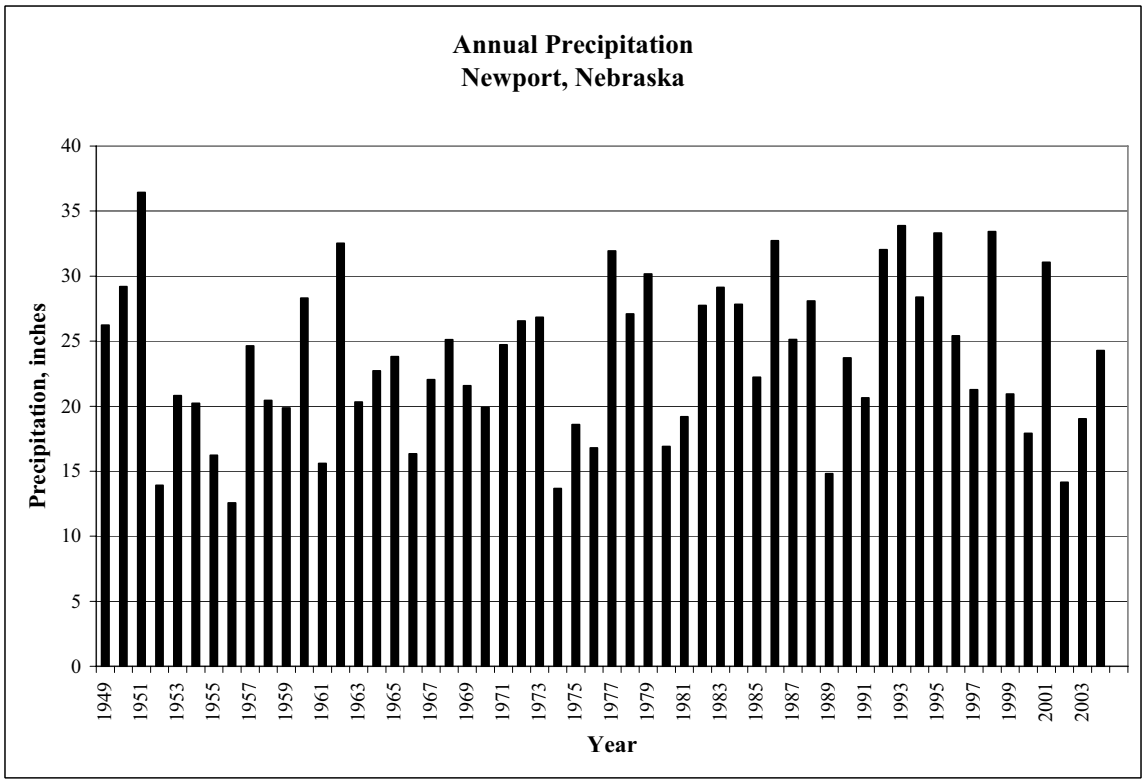
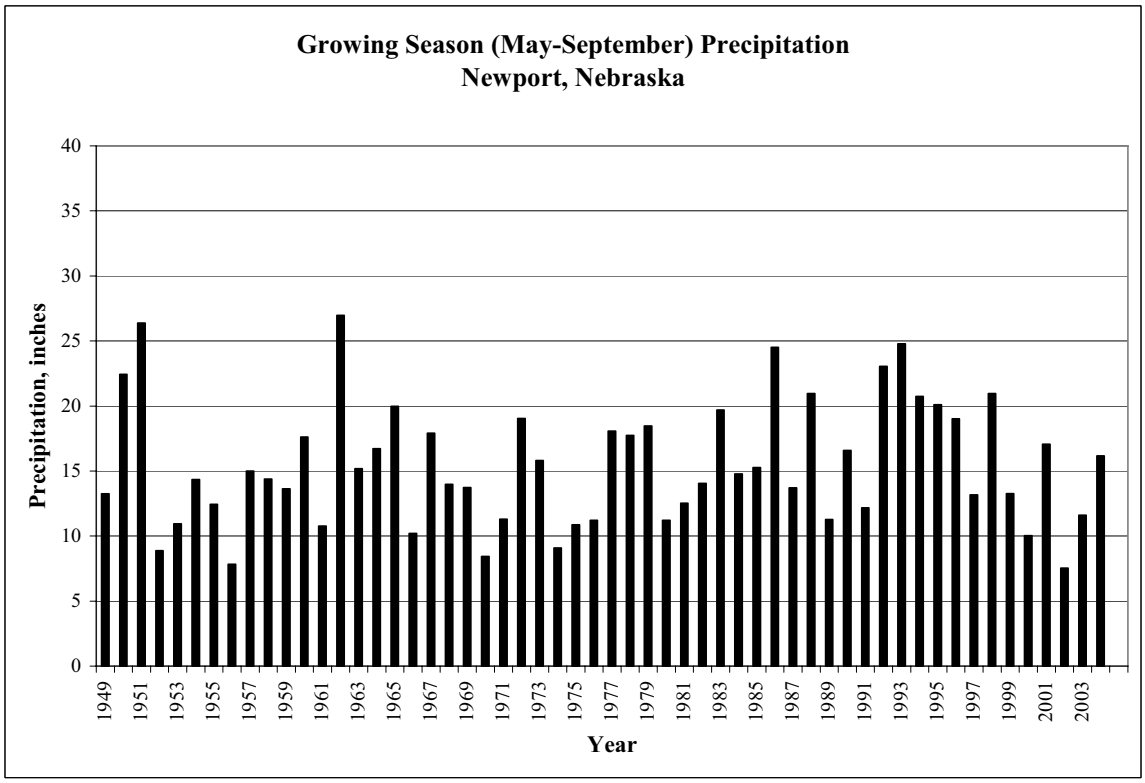


Figure E-4. Growing Season (May-September) Precipitation at Newport, Nebraska.



Source: High Plains Climate Center

Figure E-5. Annual Precipitation at Norfolk, Nebraska.

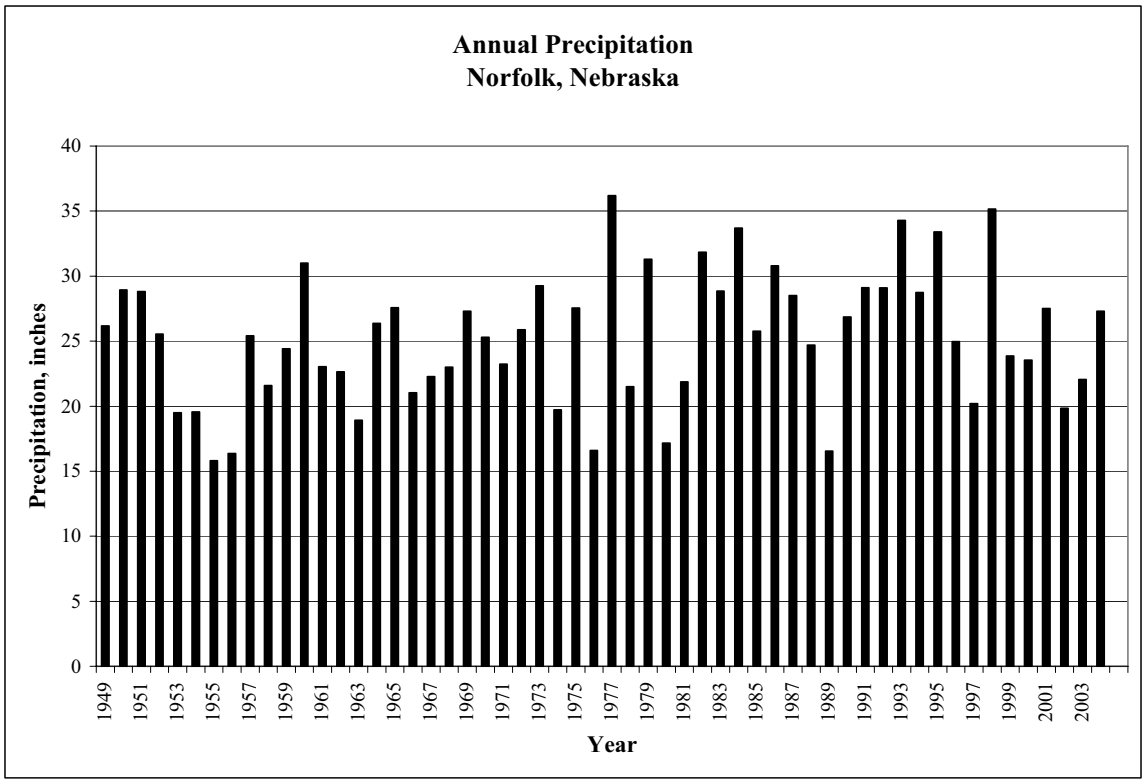
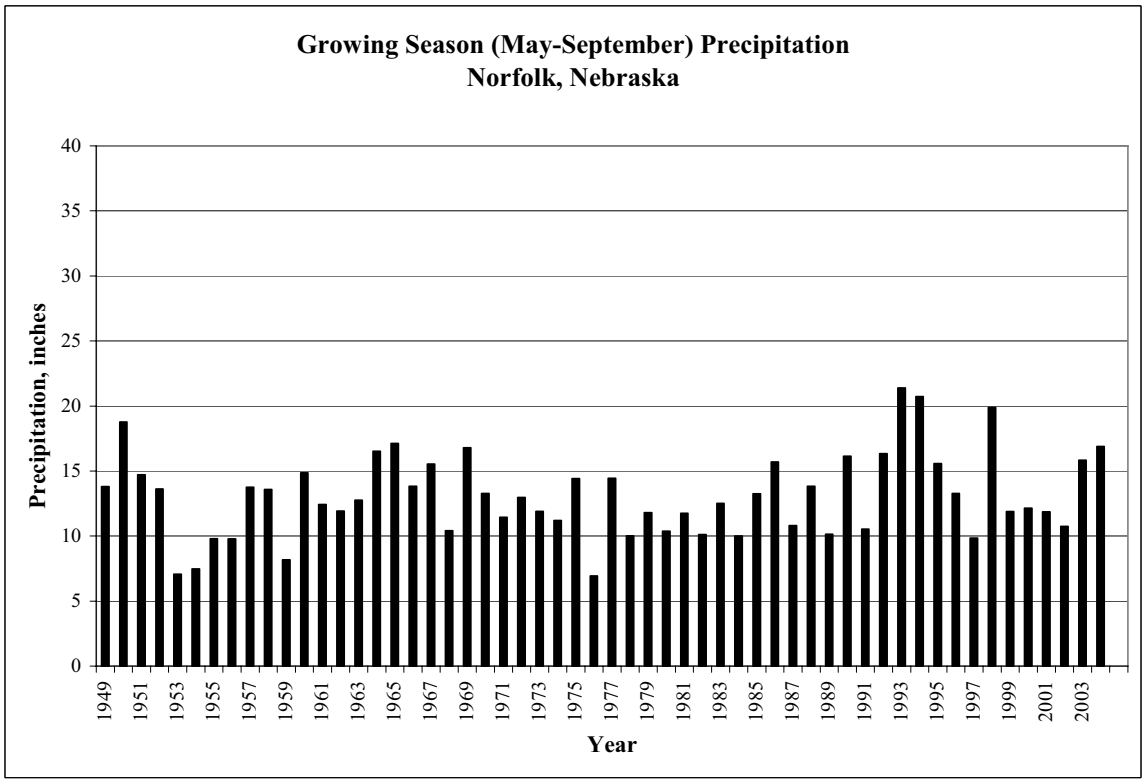


Figure E-6. Growing Season (May-September) Precipitation at Norfolk, Nebraska.



Source: High Plains Climate Center

Figure E-7. Annual Precipitation at O'Neill, Nebraska.

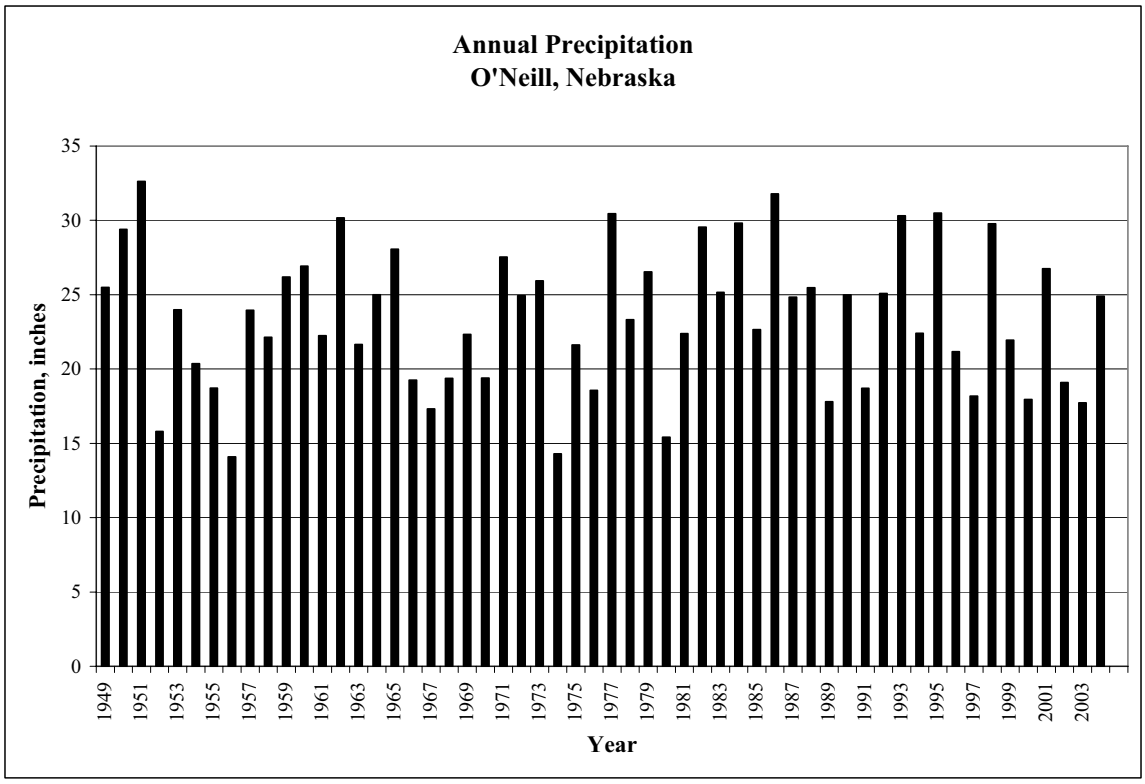
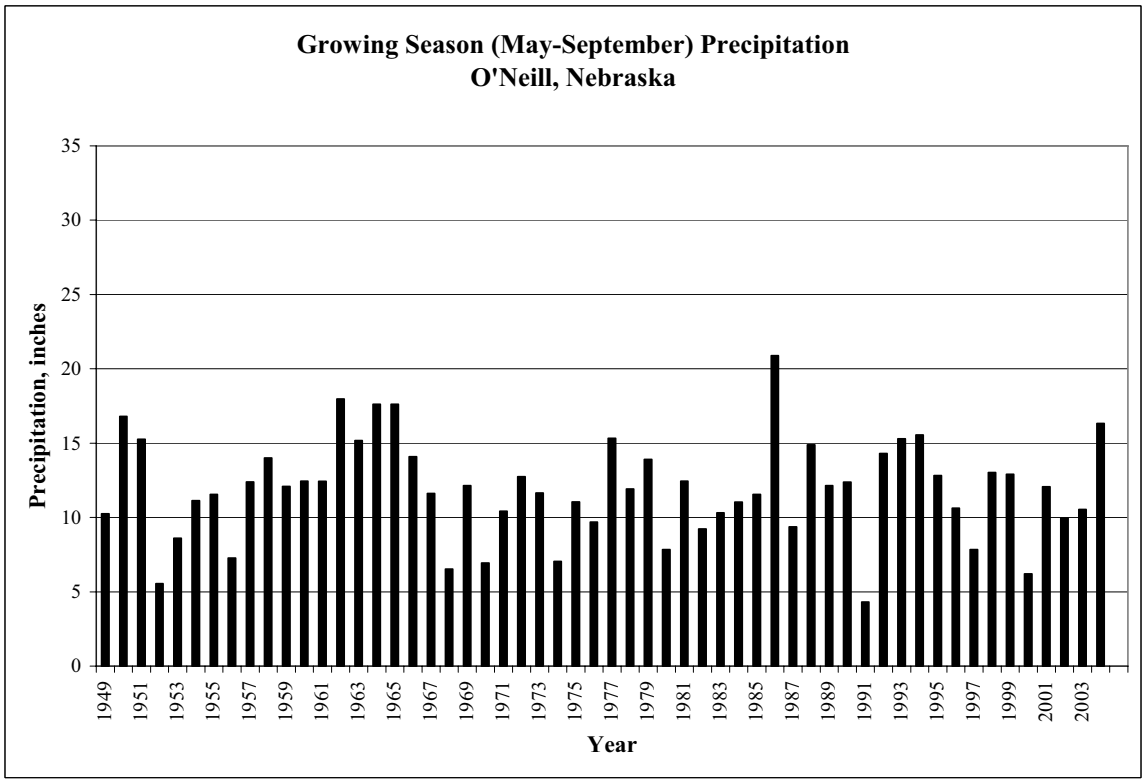


Figure E-8. Growing Season (May-September) Precipitation at O'Neill, Nebraska.



Source: High Plains Climate Center

Figure E-9. Annual Precipitation at Wayne, Nebraska.

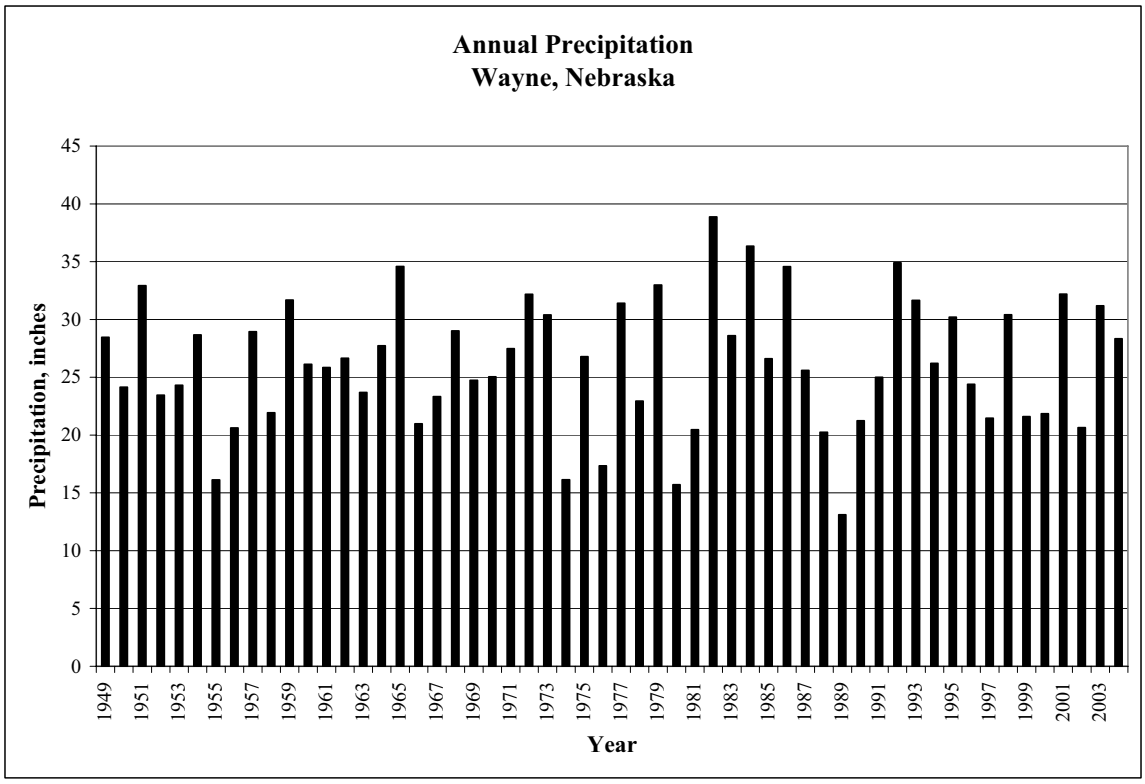
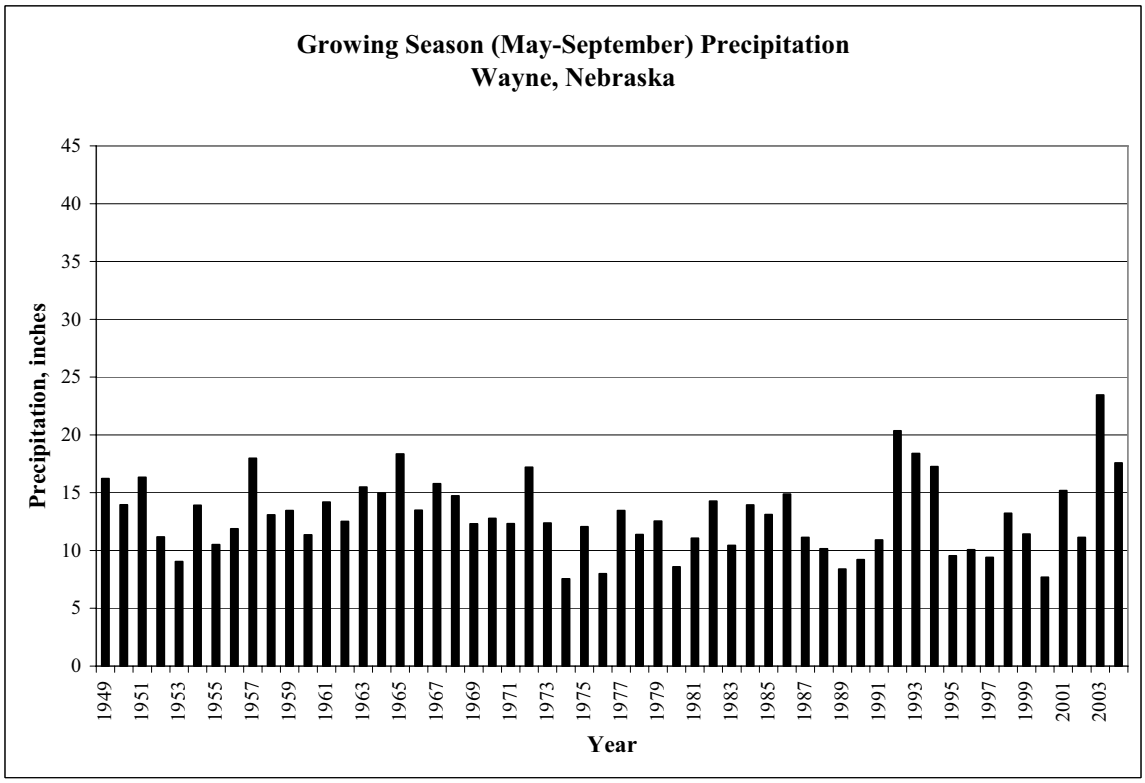


Figure E-10. Growing Season (May-September) Precipitation at Wayne, Nebraska.



Source: High Plains Climate Center

Figure E-11. Annual Precipitation at West Point, Nebraska.

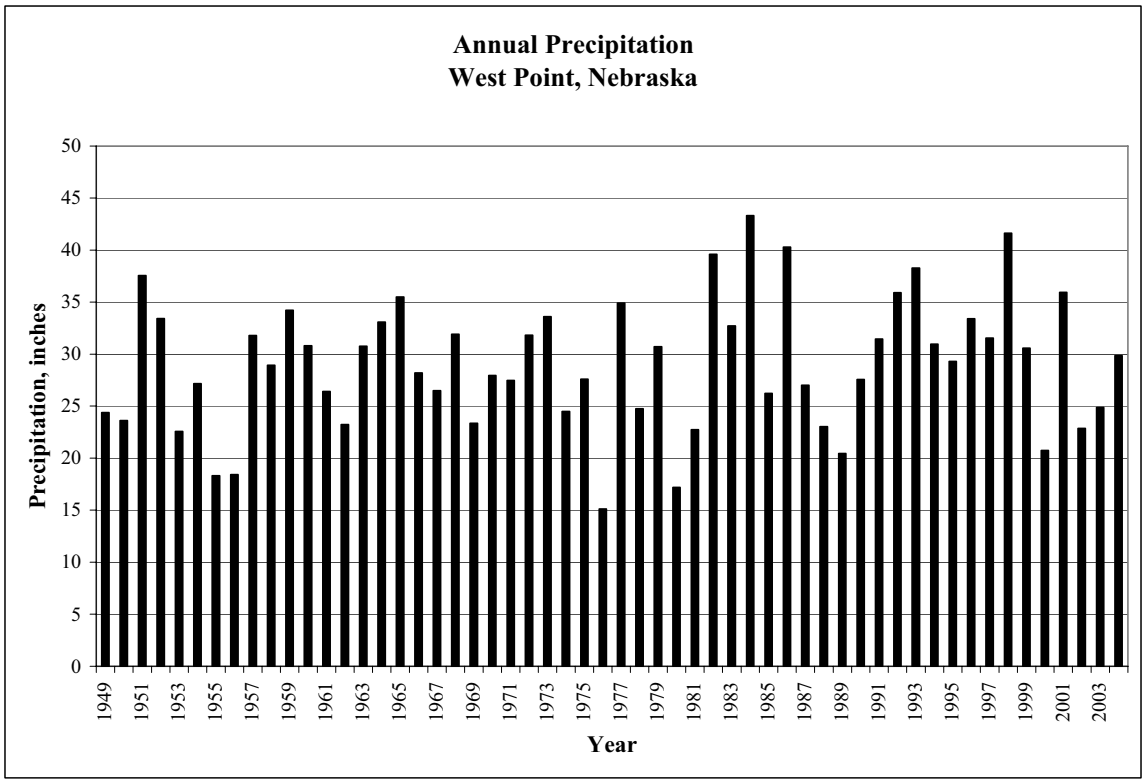
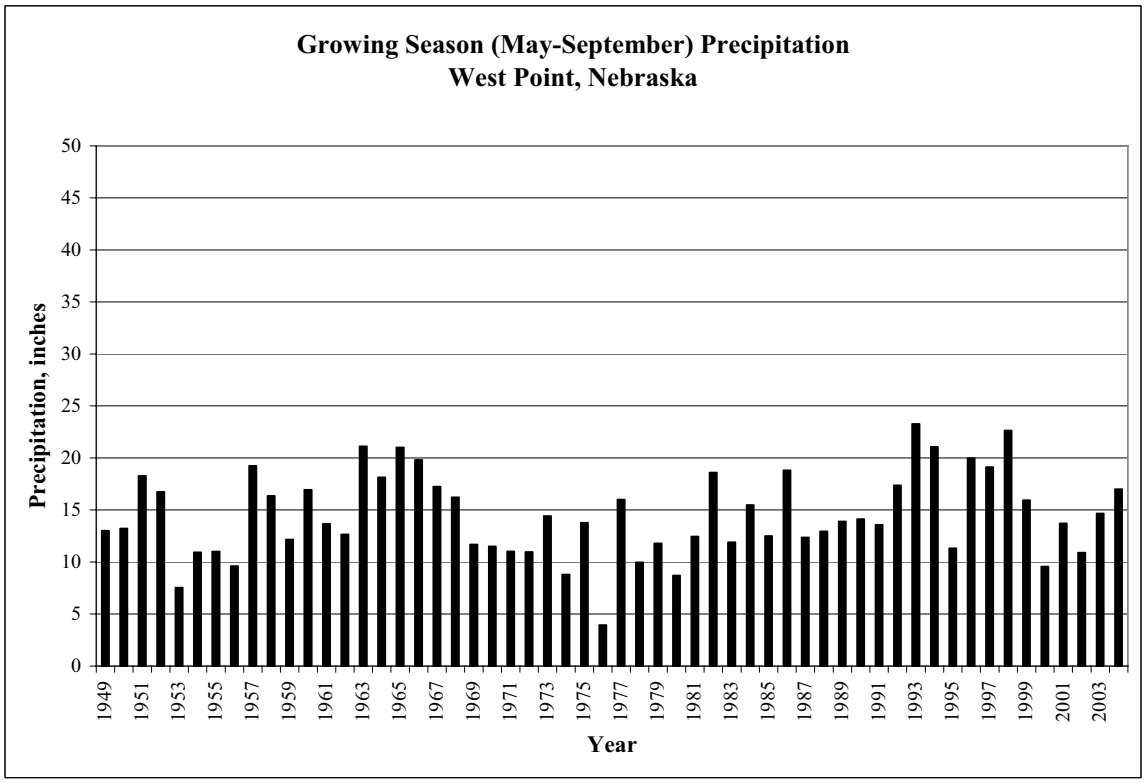


Figure E-12. Growing Season (May-September) Precipitation at West Point, Nebraska.

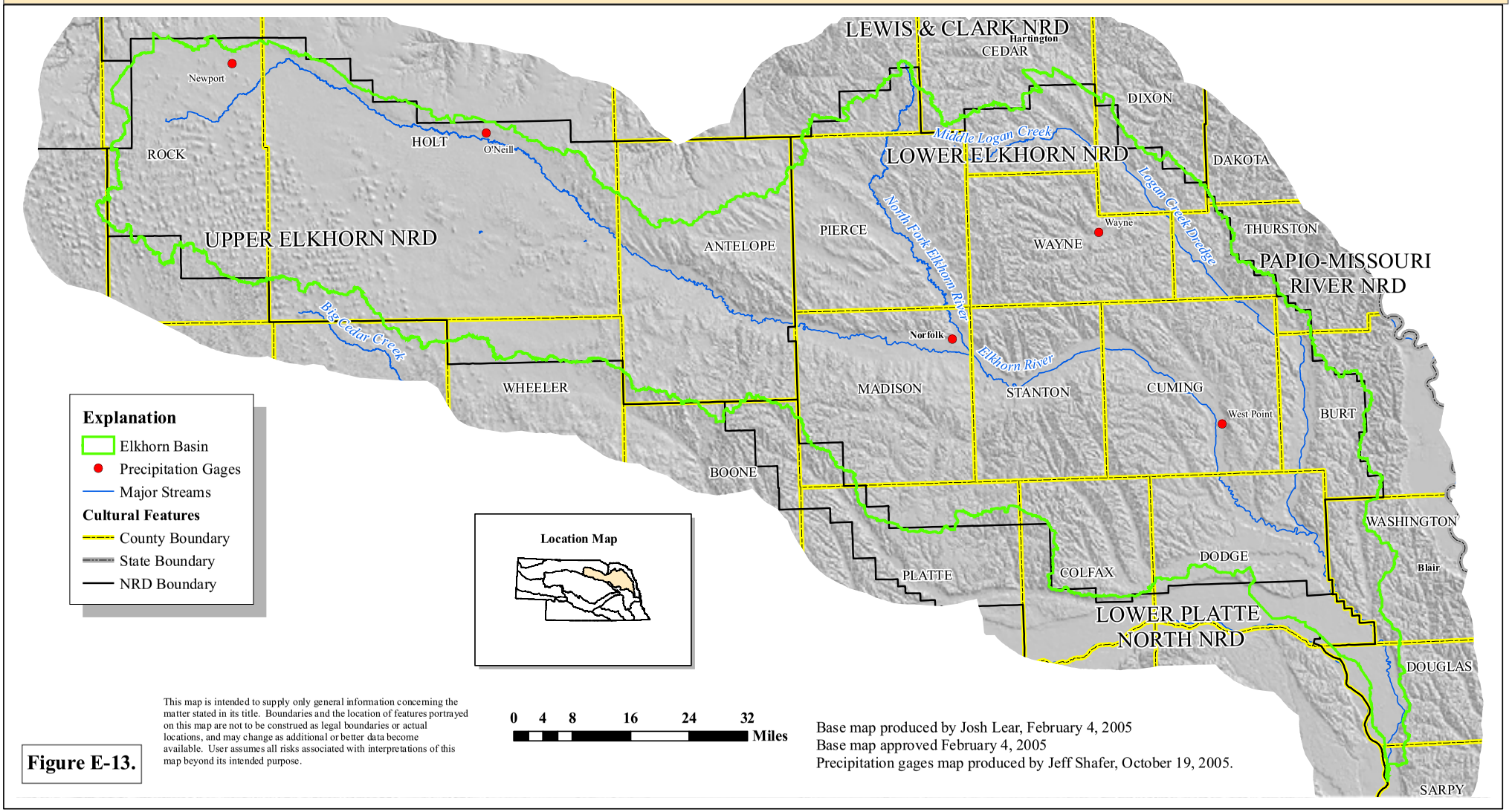


Source: High Plains Climate Center

Planning and Assistance Division

Precipitation Gages

ELKHORN RIVER BASIN



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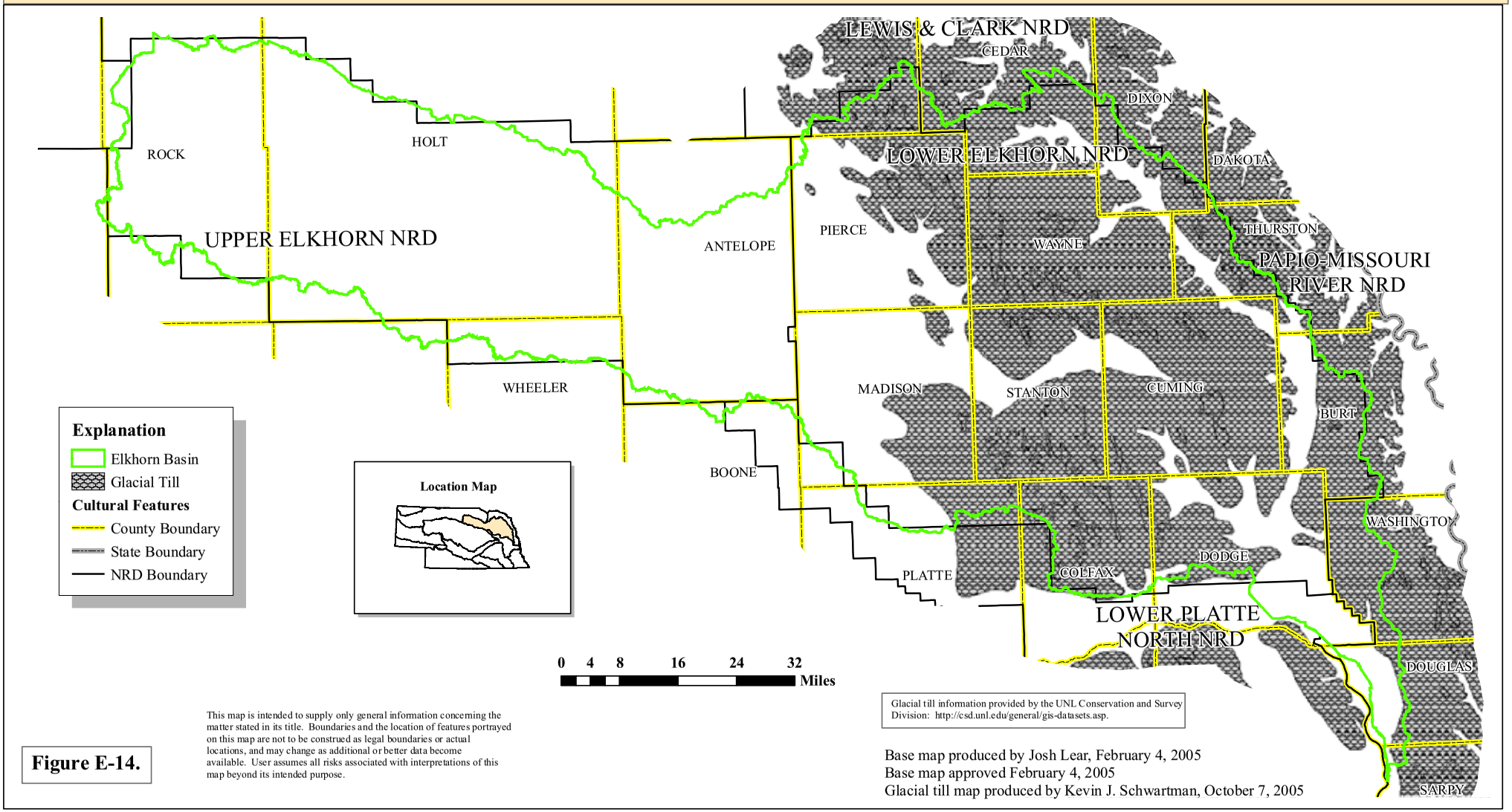
Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Precipitation gages map produced by Jeff Shafer, October 19, 2005.

Figure E-13.

Planning and Assistance Division

Glacial Till

ELKHORN RIVER BASIN



This map is intended to supply only general information concerning the matter stated in its title. Boundaries and the location of features portrayed on this map are not to be construed as legal boundaries or actual locations, and may change as additional or better data become available. User assumes all risks associated with interpretations of this map beyond its intended purpose.

Glacial till information provided by the UNL Conservation and Survey Division: http://csd.unl.edu/general/gis-datasets.asp.

Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Glacial till map produced by Kevin J. Schwartman, October 7, 2005

Figure E-14.

Table E-1. – Aquifers in unconsolidated surficial deposits (modified from Brogden, Shaffer and Engberg, 1976; Newport, 1957; LENRD, 1994; UENRD, 1995)

System	Hydrogeologic unit	Character and description	Maximum thickness, in feet	Hydrogeologic characteristics
Recent	Alluvium, loess, dune sand and soil	Clay, silt, sand and gravel alluvium in reworked stream-valley lands and sand and gravel in stream channels. Loess deposited on valley terraces and upland surfaces.	30	Not an important source of water except in areas where the water table is close to the land surface.
Quaternary	Peorian Loess	Wind deposits of massive clay on uplands and on terraces; some dune sand.	45	Yields water slowly to wells in areas where it occurs below the water table.
	Todd Valley Formation	Eolian or alluvial sand and gravel. Dune-like topography on upper surfaces.	50	May yield water to wells where it occurs below the water table.
	Loveland Formation	Stratified silt and clay with fine sand laminae in valleys. Massive silt and clay (loess) in uplands. Capped with paleosol.	50	Yields water slowly to wells in areas where it occurs below the water table.
	Crete Formation	Sand and gravel deposited as channel fill. Modified by local materials. Generally occurs as buried channels. Upland equivalent is a very thin deposit of boulders and gravel.	30	May yield water to wells in areas where it occurs below the water table.
	Kansan (Glacial) Drift	Boulder till with a high percentage of Sioux Quartzite fragments and thick oxidized and leached material.	100	Not an important source of water but may yield small amounts of water in some areas.
	Grand Island Formation	Sand and gravel deposited by streams. Fine sand near top with some glacial outwash.	75	Yields abundant good quality water to wells in areas where it occurs below the water table.
	Holdrege Formation	Fluvial sand and gravel generally deposited in pre-Pleistocene valleys.	15	Yields abundant supplies of good quality water to wells.

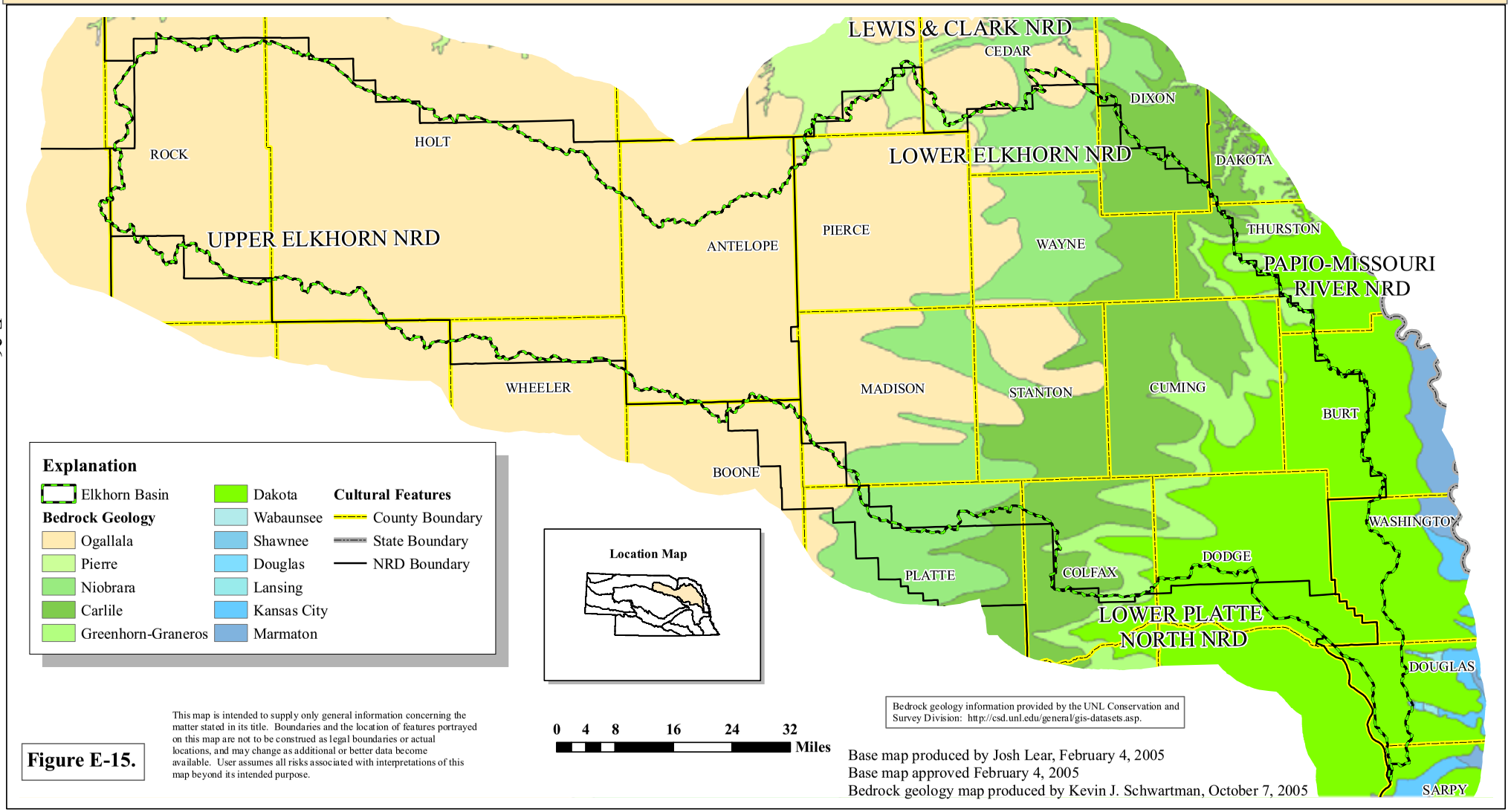
Table E-2. – Characteristics of bedrock aquifers (modified from Keech and Dreeszen, 1959, 1968; LENRD, 1994)

System	Hydrogeologic unit	Character and description	Maximum thickness, in feet	Hydrogeologic characteristics
Tertiary	Ogallala Group	Fluvial gravel, sand, silt and clay. Generally occurs in thin lenses that interfinger within a short distance. Moderately to well cemented in places by calcium carbonate forming resistant ledges.	200	Yields abundant supplies of good quality water to wells. More important in western part of the Basin where it is thicker than in the eastern part of the Basin.
Cretaceous	Pierre Shale	Shale that is generally weathered at the top. Some areas with overlying clay may be made-up of weathered Pierre Shale.	400	Not an important source of water but may yield small amounts of poor quality water to wells were fractured or along bedding planes and thin isolated sand beds.
	Niobrara Formation	Soft shaley limestone or impure chalk with some clay, fine sand and limy shale beds.	250	Not an important source of water but may yield small amounts of water to wells.
	Dakota Sandstone	Fine to medium-grained sandstone interbedded with clay shale, sandy shale, siltstone and claystone. May be massive or cross-bedded, common ironstone zones. Sandstones are slightly to moderately permeable.	600	Will yield small amounts of poor quality water. May be too highly mineralized for most uses.

Planning and Assistance Division

Bedrock Geology

ELKHORN RIVER BASIN



Bedrock geology information provided by the UNL Conservation and Survey Division: http://csd.unl.edu/general/gis-datasets.asp.

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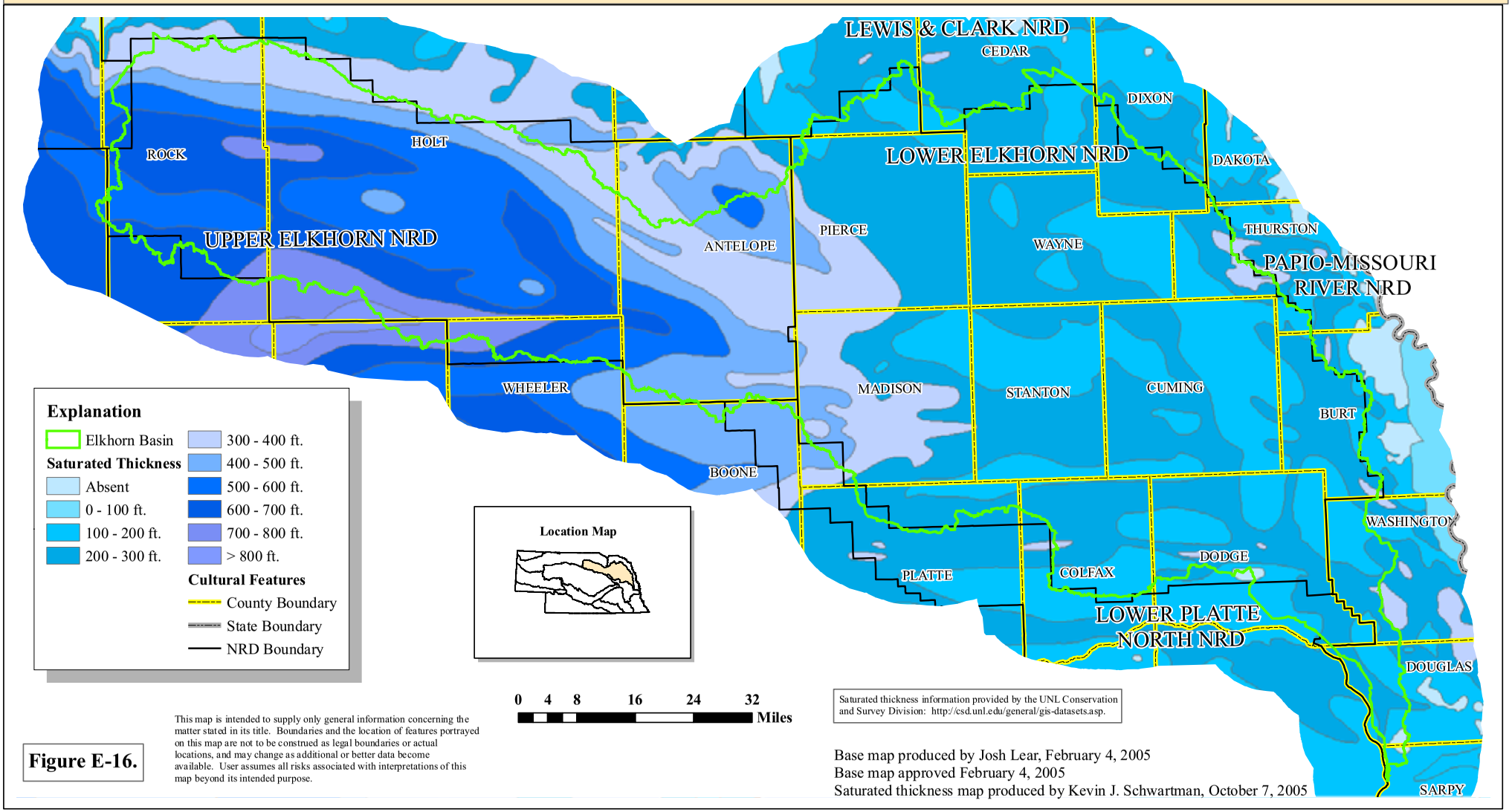
Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Bedrock geology map produced by Kevin J. Schwartman, October 7, 2005

Figure E-15.

Planning and Assistance Division

Saturated Thickness

ELKHORN RIVER BASIN



Saturated thickness information provided by the UNL Conservation and Survey Division: http://csd.unl.edu/general/gis-datasets.asp.

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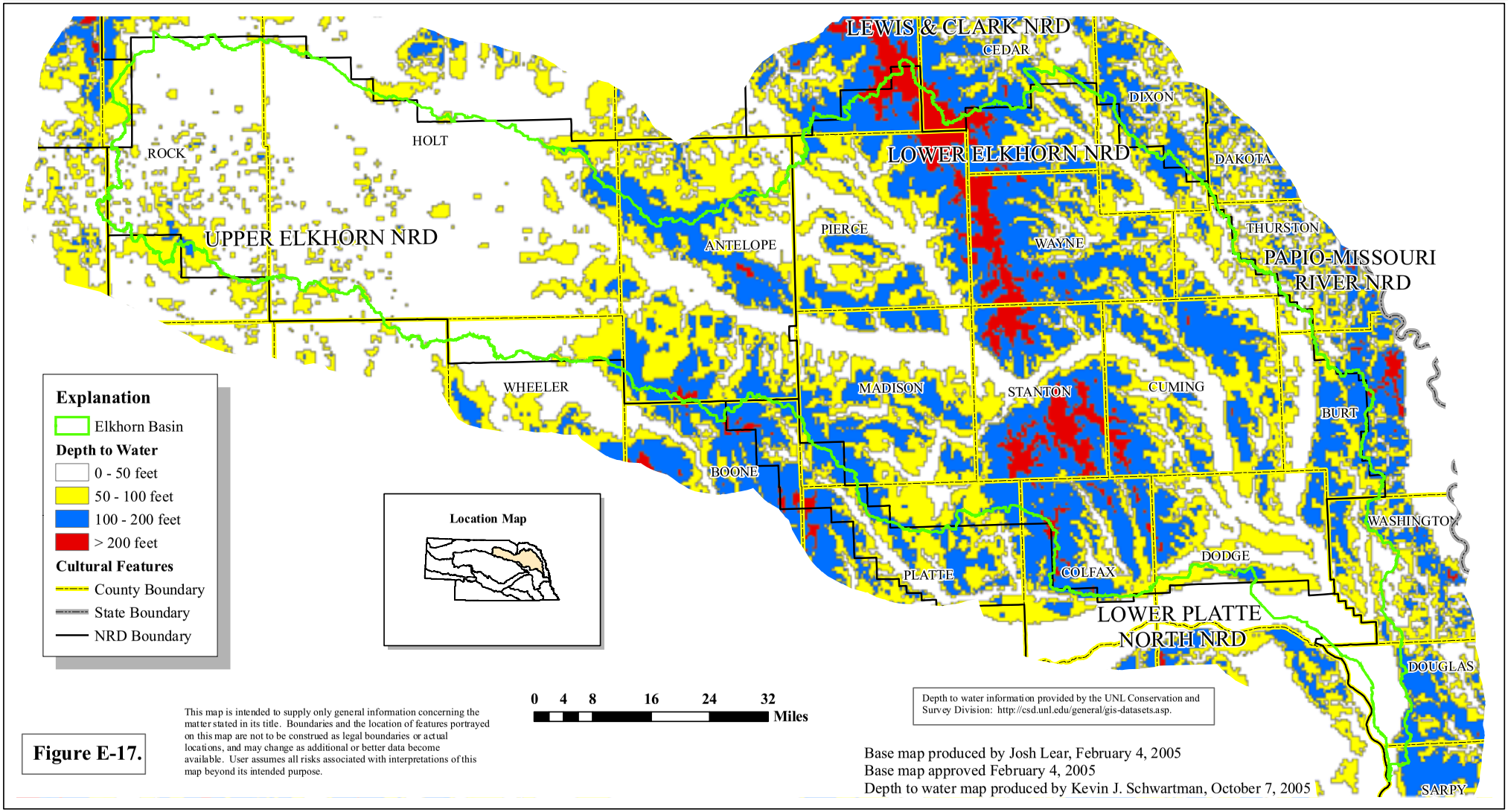
Figure E-16.

Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Saturated thickness map produced by Kevin J. Schwartman, October 7, 2005

Planning and Assistance Division

Depth to Water

ELKHORN RIVER BASIN



Depth to water information provided by the UNL Conservation and Survey Division: http://csd.unl.edu/general/gis-datasets.asp.

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Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Depth to water map produced by Kevin J. Schwartman, October 7, 2005

Figure E-17.

Planning and Assistance Division

Transmissivity

ELKHORN RIVER BASIN

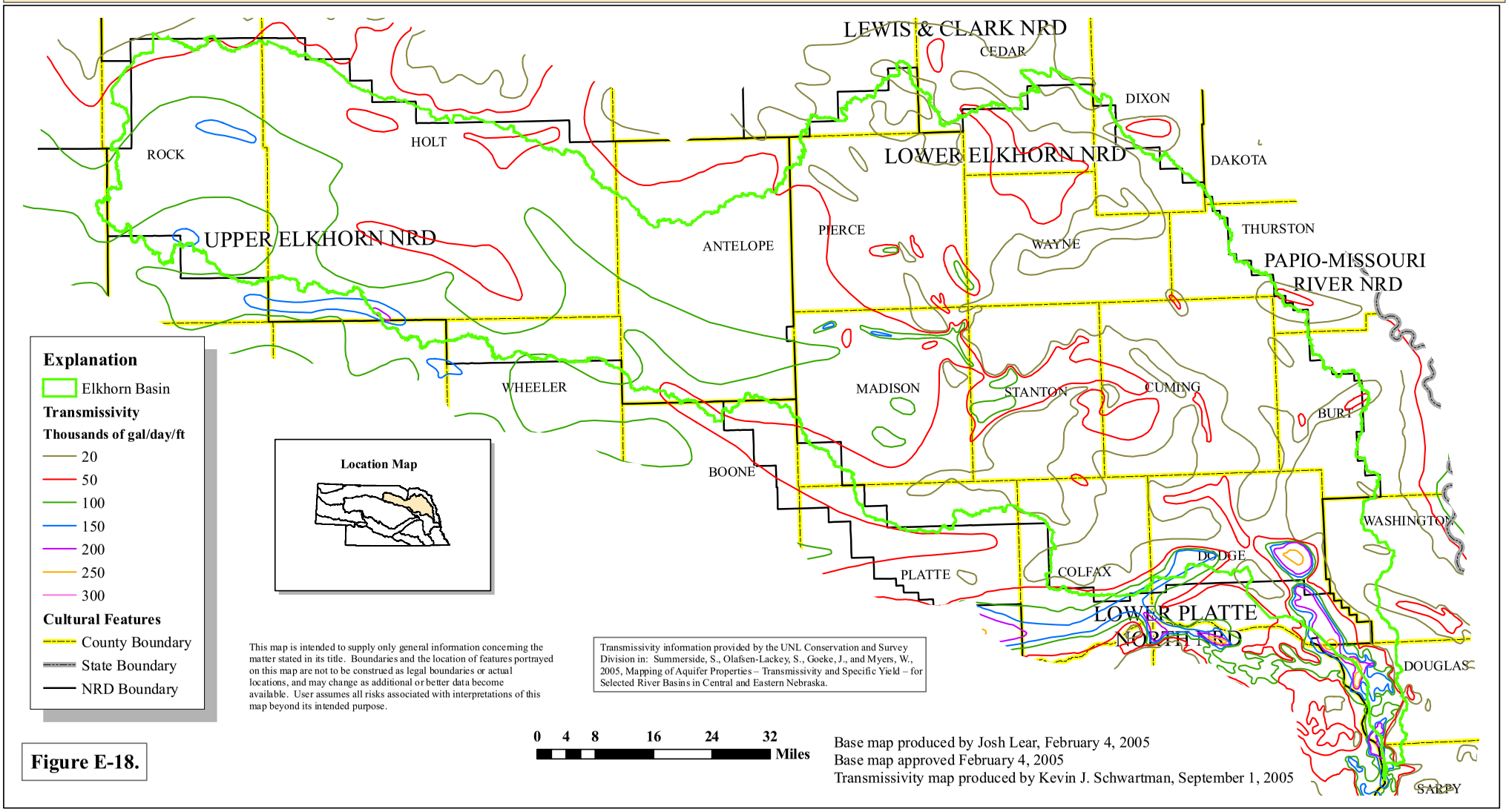
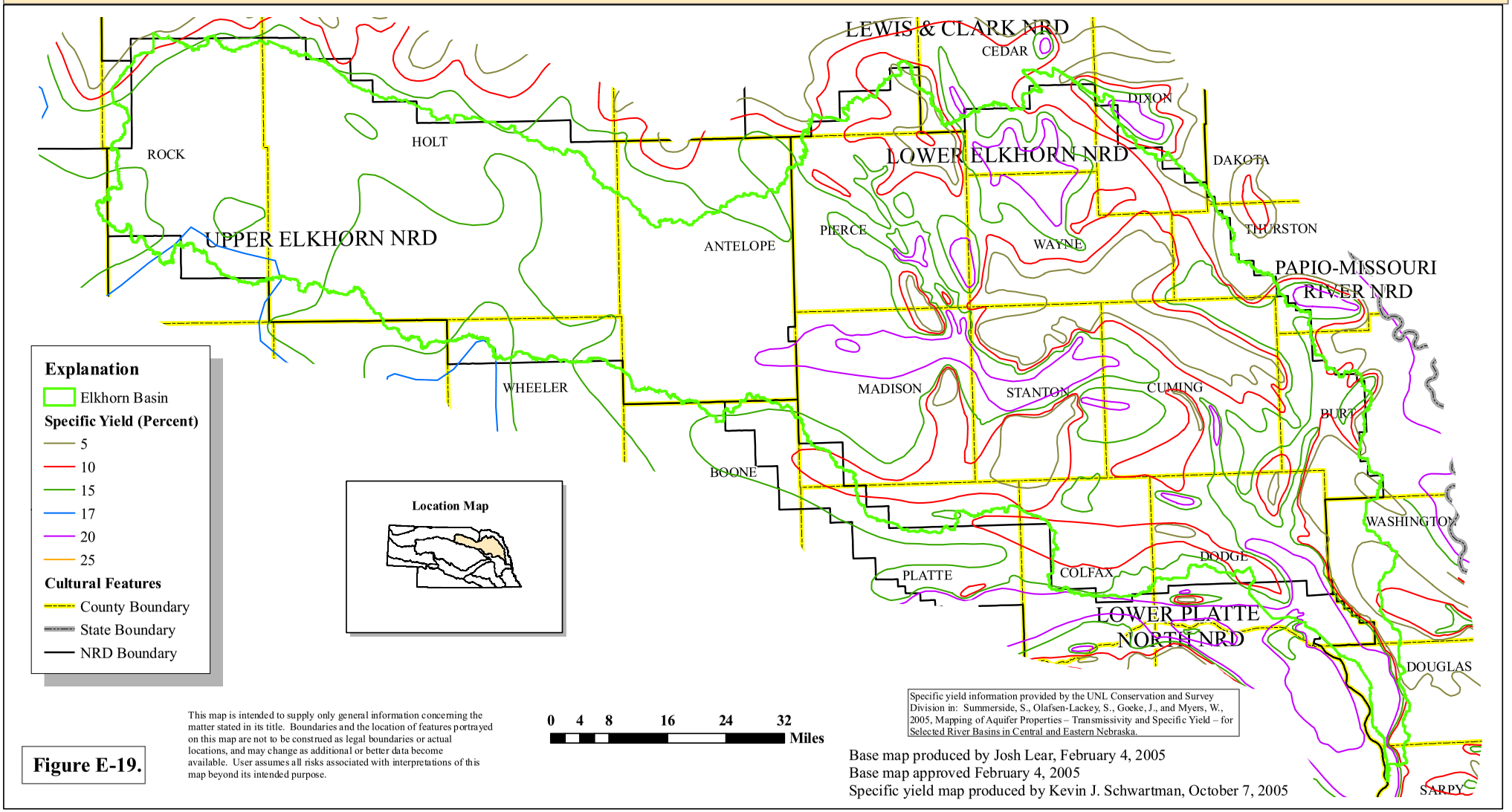


Figure E-18.

Planning and Assistance Division

Specific Yield

ELKHORN RIVER BASIN



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Specific yield information provided by the UNL Conservation and Survey Division in: Summerside, S., Olafsen-Lackey, S., Goeke, J., and Myers, W., 2005, Mapping of Aquifer Properties – Transmissivity and Specific Yield – for Selected River Basins in Central and Eastern Nebraska.

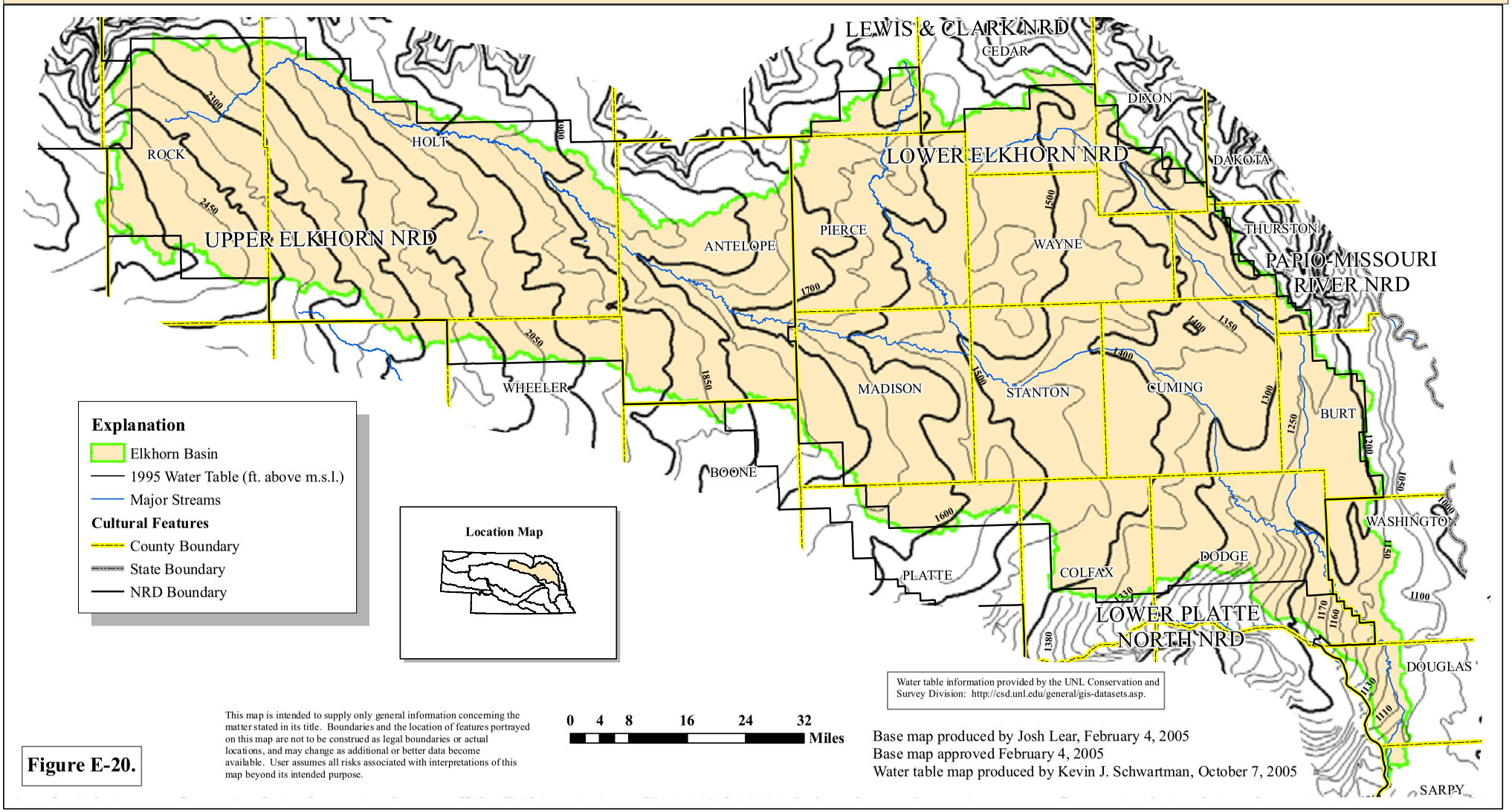
Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Specific yield map produced by Kevin J. Schwartman, October 7, 2005

Figure E-19.

Planning and Assistance Division

1995 Ground Water Table

ELKHORN RIVER BASIN



Water table information provided by the UNL Conservation and Survey Division: http://csd.unl.edu/general/gis-datasets.asp.

This map is intended to supply only general information concerning the matter stated in its title. Boundaries and the location of features portrayed on this map are not to be construed as legal boundaries or actual locations, and may change as additional or better data become available. User assumes all risks associated with interpretations of this map beyond its intended purpose.

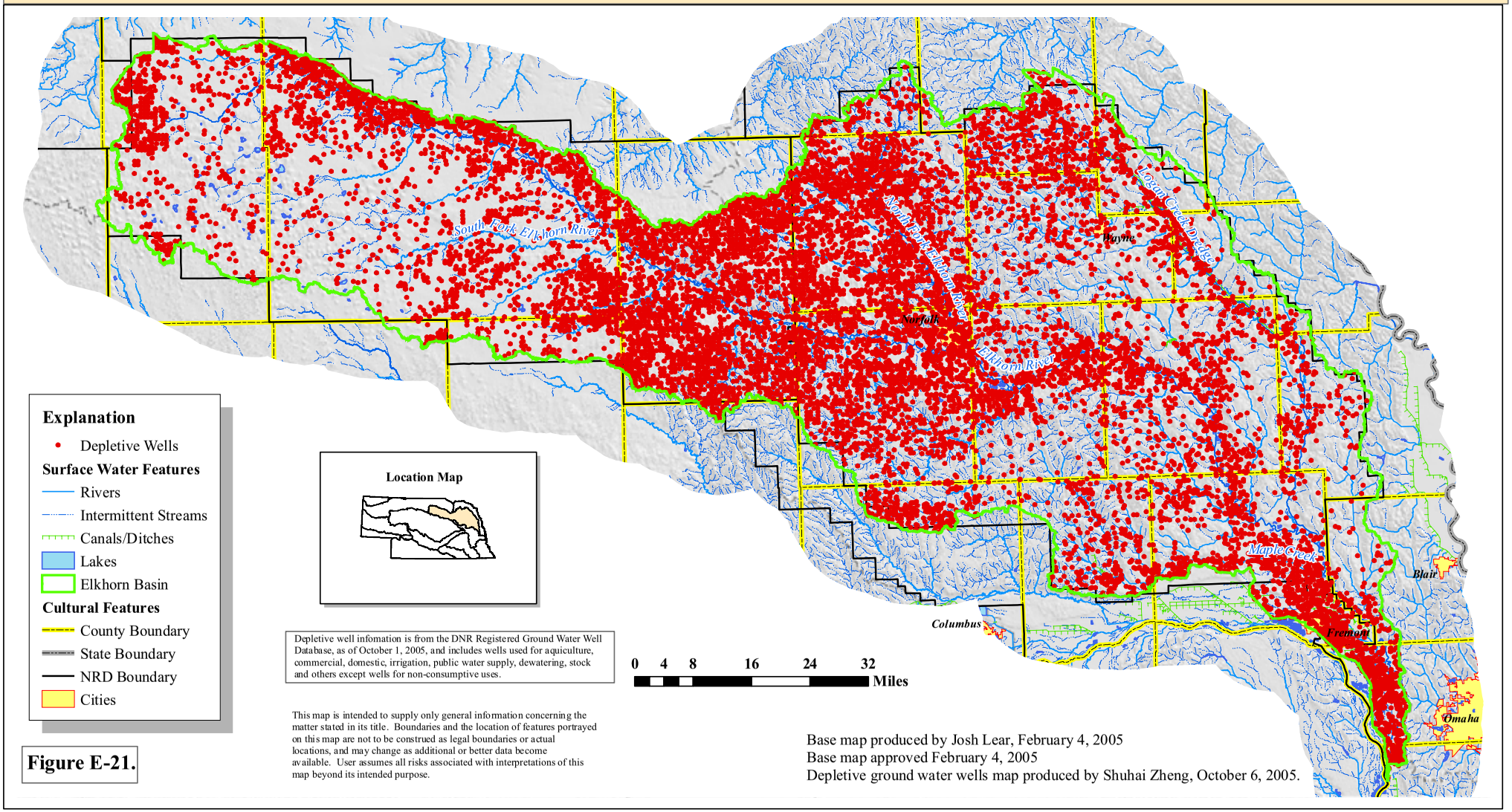
Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Water table map produced by Kevin J. Schwartman, October 7, 2005

Figure E-20.

Planning and Assistance Division

Depletive Ground Water Wells

ELKHORN RIVER BASIN



Depletive well infomation is from the DNR Registered Ground Water Well Database, as of October 1, 2005, and includes wells used for aquiculture, commercial, domestic, irrigation, public water supply, dewatering, stock and others except wells for non-consumptive uses.

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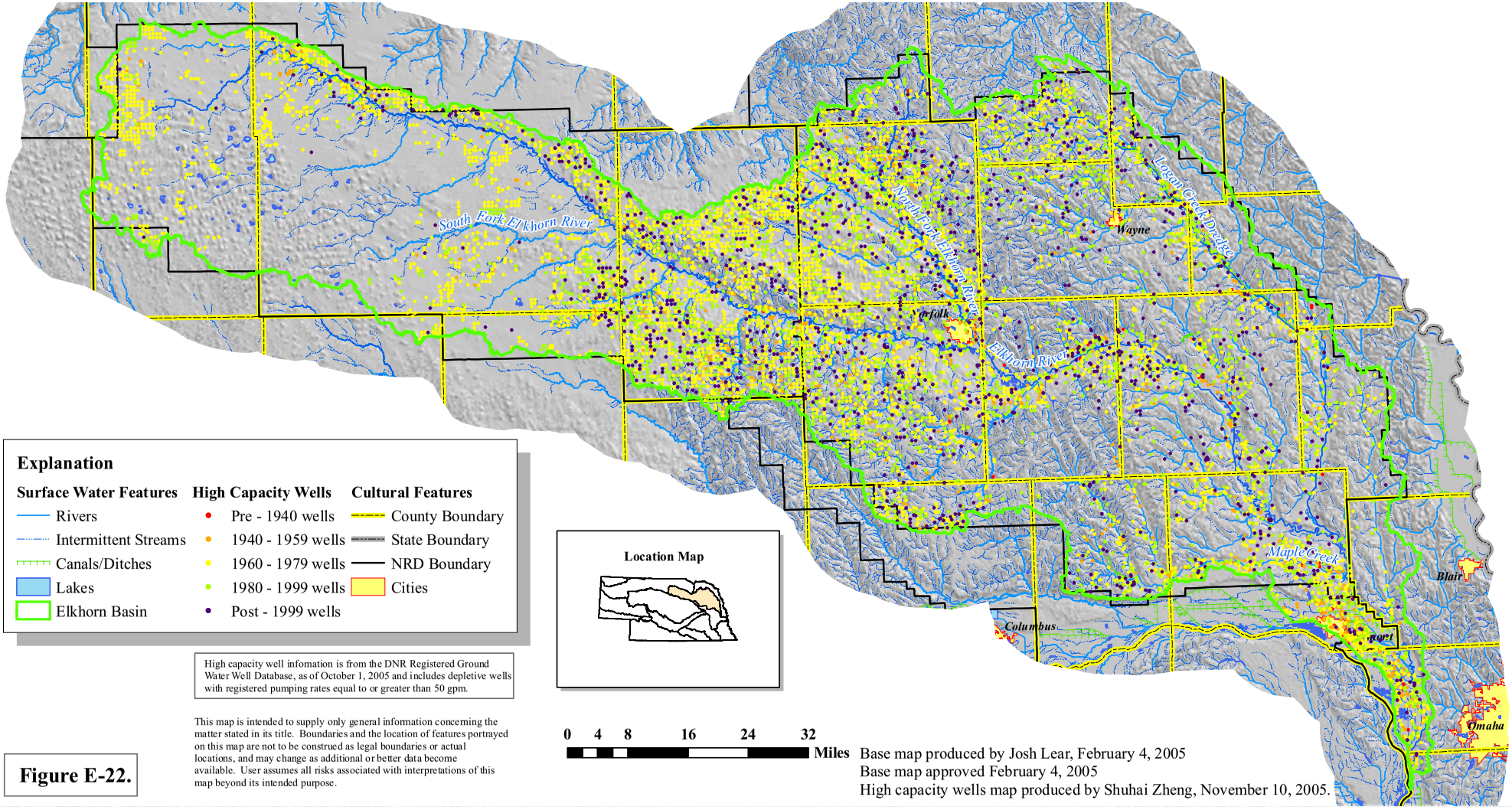
Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Depletive ground water wells map produced by Shuhai Zheng, October 6, 2005.

Figure E-21.

High Capacity Wells by Completion Date

ELKHORN RIVER BASIN

Planning and Assistance Division



High capacity well infomation is from the DNR Registered Ground Water Well Database, as of October 1, 2005 and includes depletive wells with registered pumping rates equal to or greater than 50 gpm.

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Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
High capacity wells map produced by Shuhai Zheng, November 10, 2005.

Figure E-22.

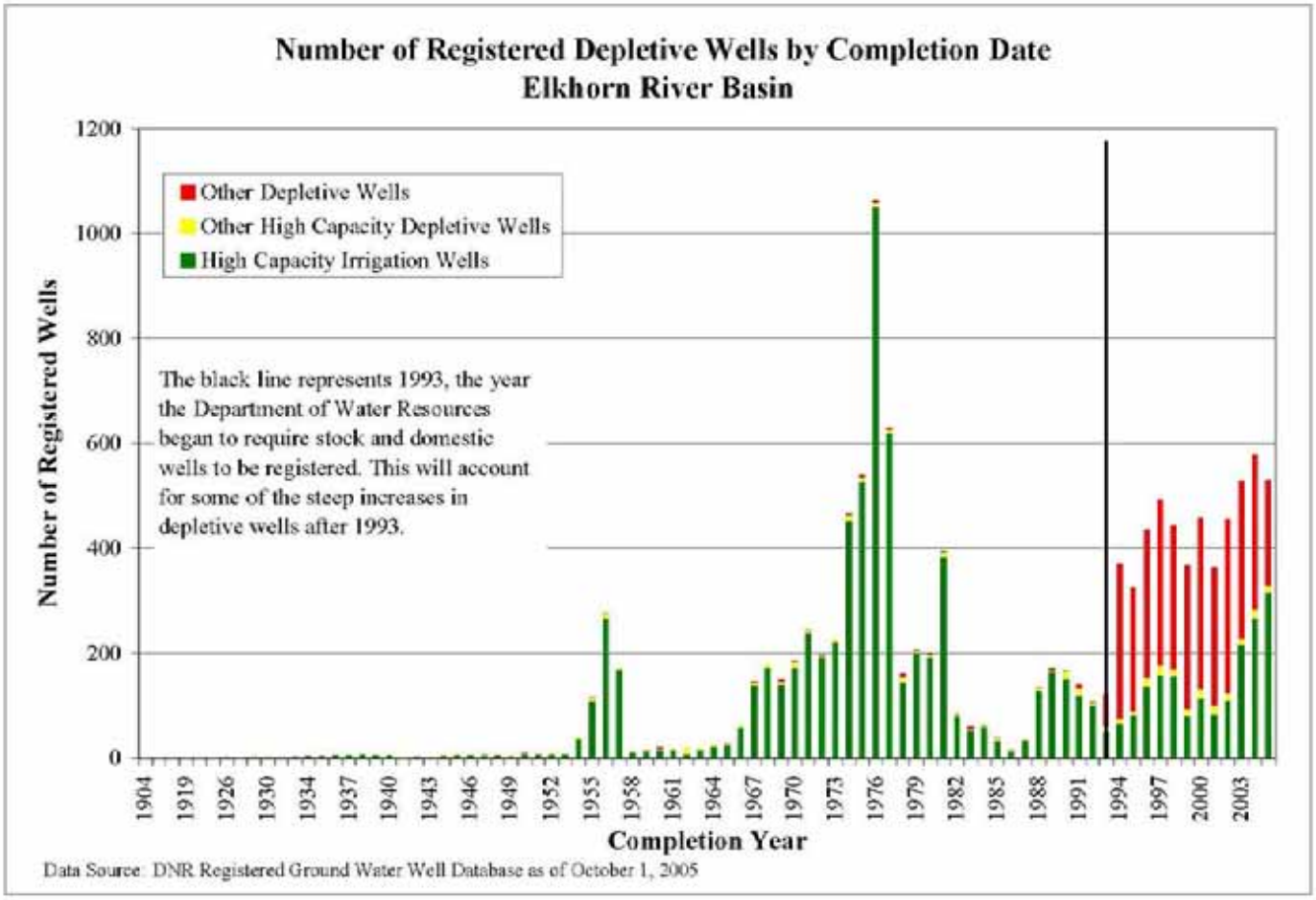


Figure E-23

By Shuhai Zheng, 11/15/2005

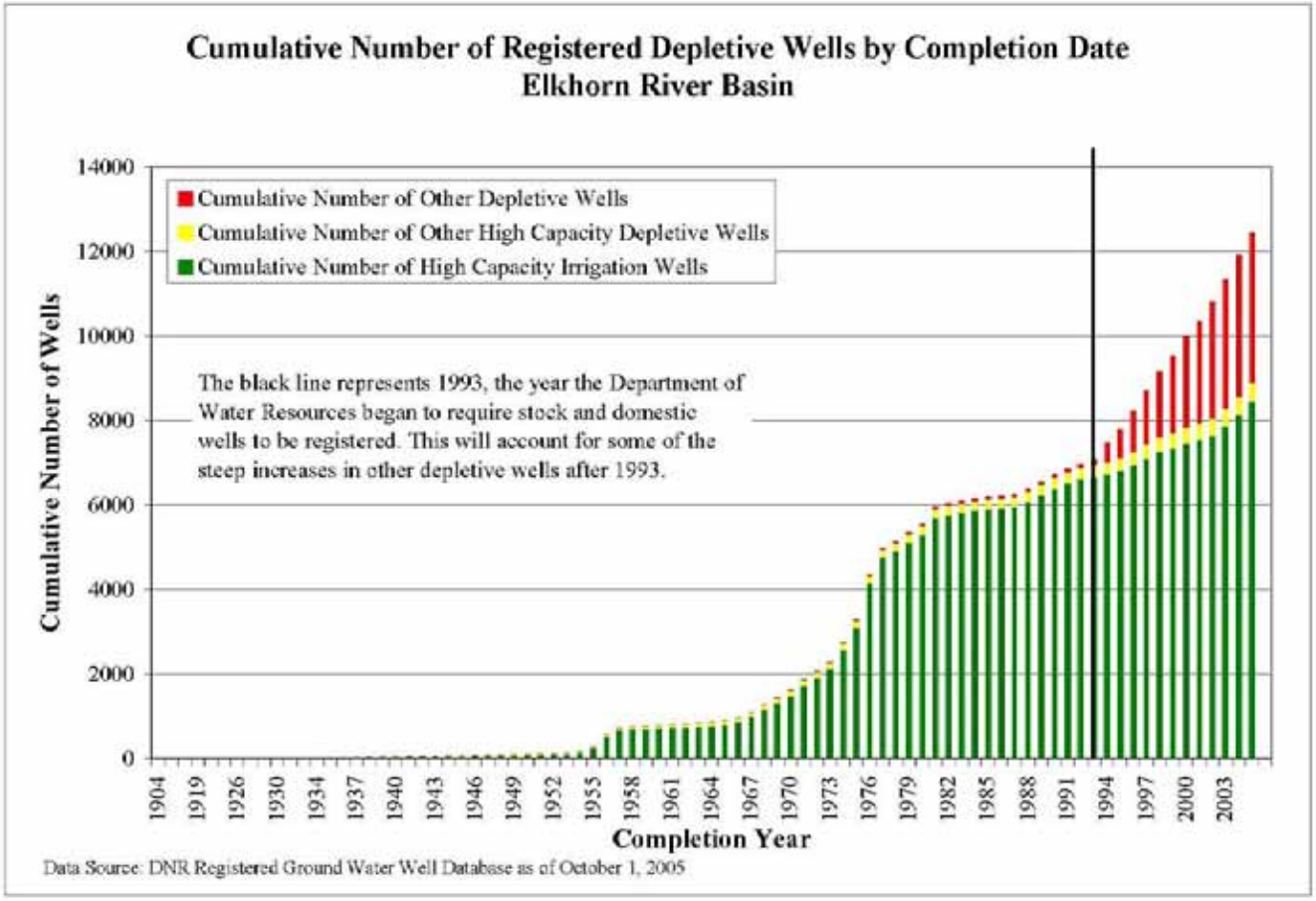


Figure E-24

By Shuhai Zheng, 11/15/2005

Table E-3. Average Irrigated Acreage 1950-2003 for Counties Fully or Partially in the Elkhorn River Basin

	Estimated Average Irrigated Acreage by County						
County Name	*Percent of County in Elkhorn Basin*	*1950-1959*	*1960-1969*	*1970-1979*	*1980-1989*	*1990-1999*	*2000-2003*
Antelope	72	3140	14709	89076	160910	184990	213225
Boone	2	10299	25671	63326	111210	141590	164400
Brown	<1	1995	10633	46396	52650	49940	47775
Burt	43	1381	5037	23483	39080	47950	55925
Cedar	29	963	2710	22303	54880	65180	78350
Colfax	57	6048	16812	31426	59530	59970	63850
Cuming	100	786	2352	11849	27020	36840	42875
Dakota	<1	489	1734	5431	10190	17000	18000
Dixon	28	105	599	5859	15650	17290	19025
Dodge	78	6865	19554	51683	80740	93890	104050
Douglas	21	825	2188	7555	12830	12640	9850
Garfield	4	3173	5654	12800	19450	14610	14650
Holt	54	2746	27950	133669	195120	210960	220725
Knox	7	677	3535	17682	35420	43430	49875
Madison	94	2219	8494	37086	70420	86440	102150
Pierce	99	1673	5891	42958	94670	104610	114725
Platte	16	10651	31718	77881	127710	161700	188775
Rock	58	115	1646	27958	38410	37150	36825
Sarpy	3	816	981	3597	5390	6690	6375
Stanton	100	1152	4391	13785	25280	26120	29000
Thurston	35	592	1277	3823	8470	6450	13275
Washington	30	512	1693	7132	17270	16340	17250
Wayne	100	227	761	5564	16680	24960	36075

Shuhai Zheng, November 29, 2005

	Estimated Average Irrigated Acreage by County						
County Name	*Percent of County in Elkhorn Basin*	*1950-1959*	*1960-1969*	*1970-1979*	*1980-1989*	*1990-1999*	*2000-2003*
Wheeler	20	442	1804	16334	41330	42820	44050
Total		**57890**	**197794**	**758656**	**1320310**	**1509560**	**1691075**
% Change from Previous 10 Years			241.67%	283.56%	74.03%	14.33%	12.02%

* The percentage is the percentage of the county area which is in the Elkhorn Basin. It does not necessarily represent the percentage of irrigated county acreage in the Elkhorn River Basin.

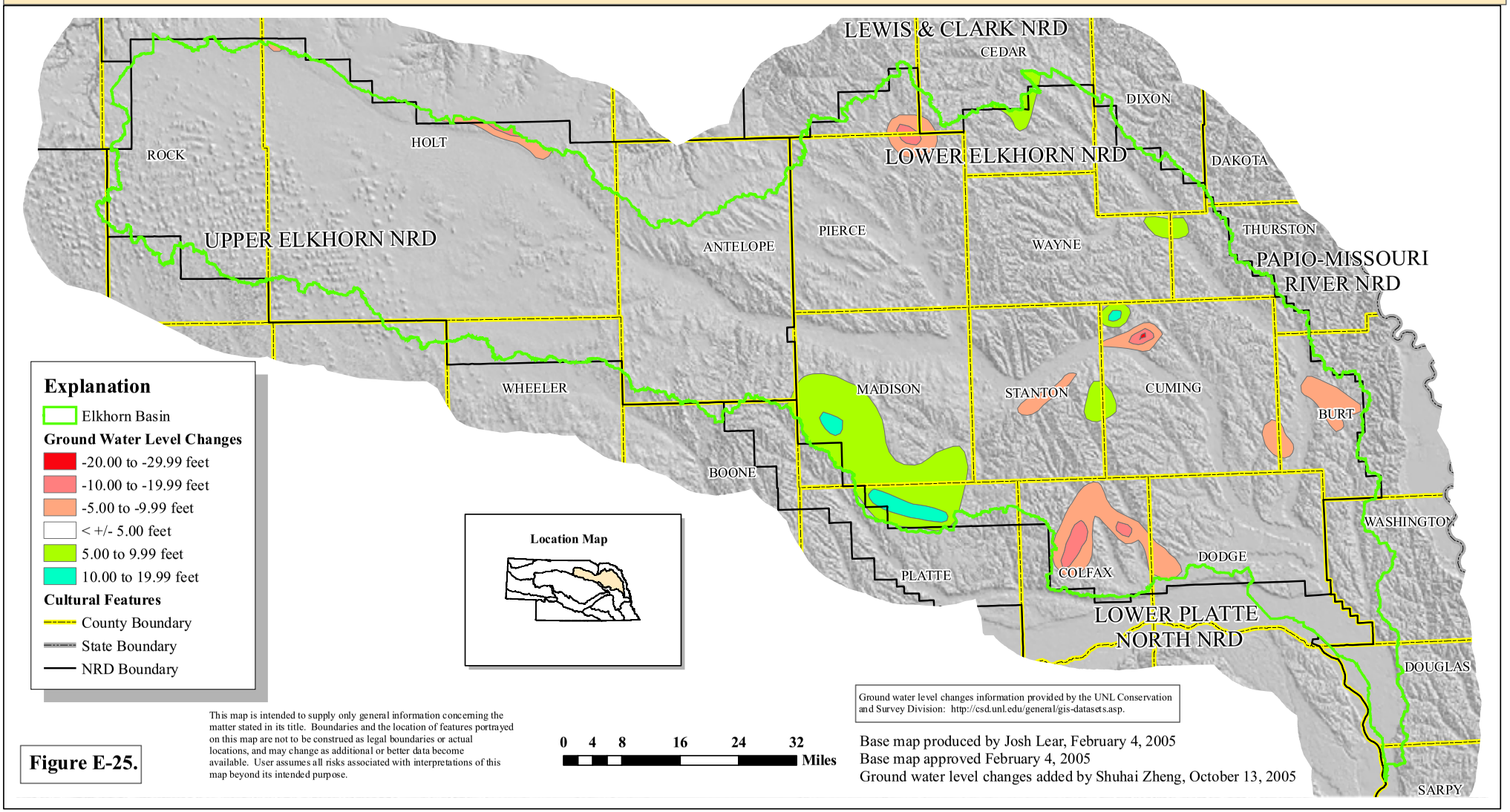
Data Source: http://www.usda.gov/nass/, National Agricultural Statistics Service, **U.S. Department of Agriculture**

Shuhai Zheng, November 29, 2005

Ground Water Level Changes Predevelopment to Spring 2005

ELKHORN RIVER BASIN

Planning and Assistance Division



Ground water level changes information provided by the UNL Conservation and Survey Division: http://csd.unl.edu/general/gis-datasets.asp.

Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Ground water level changes added by Shuhai Zheng, October 13, 2005

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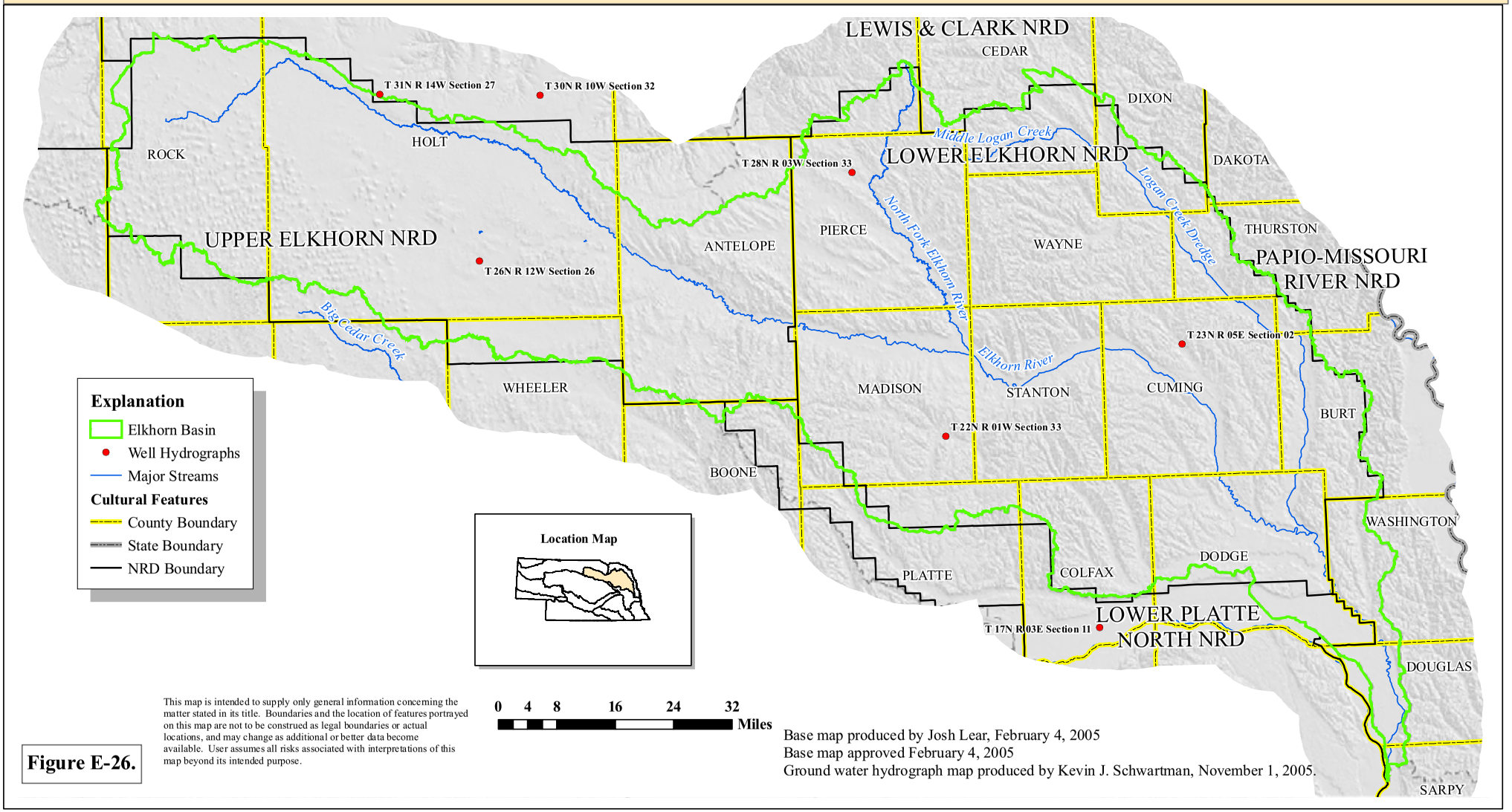
Figure E-25.

Planning and Assistance Division

Ground Water Hydrograph Locations

ELKHORN RIVER BASIN



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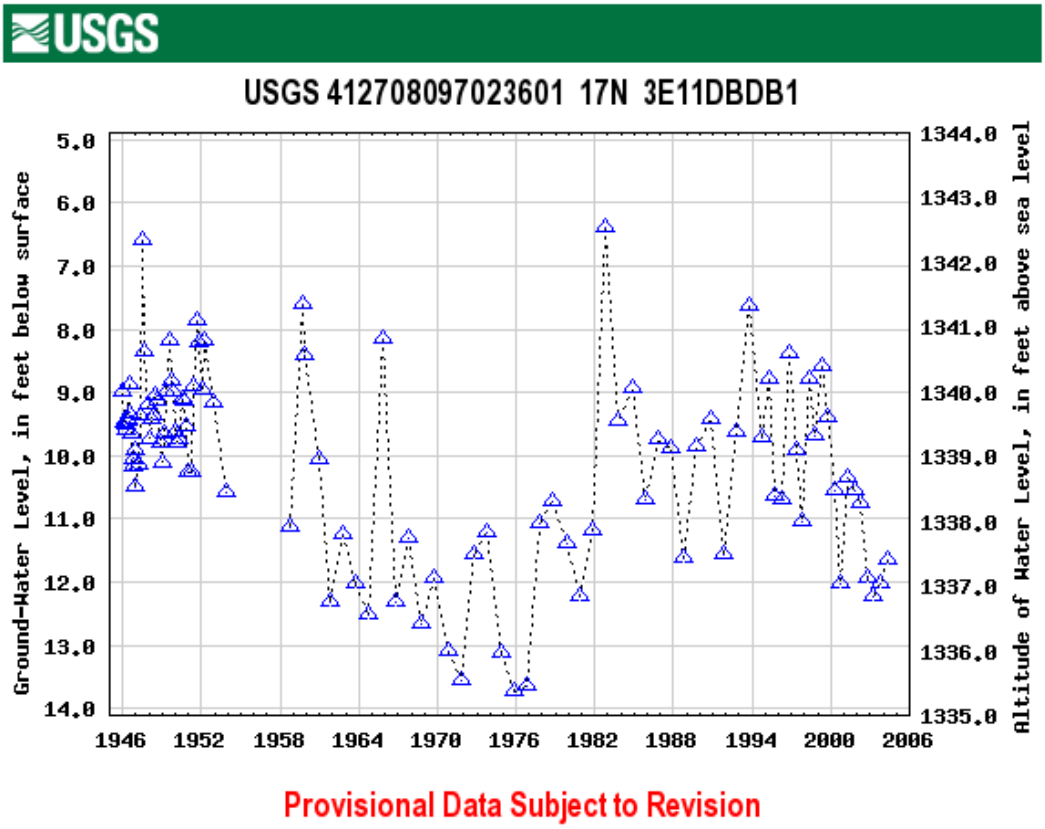
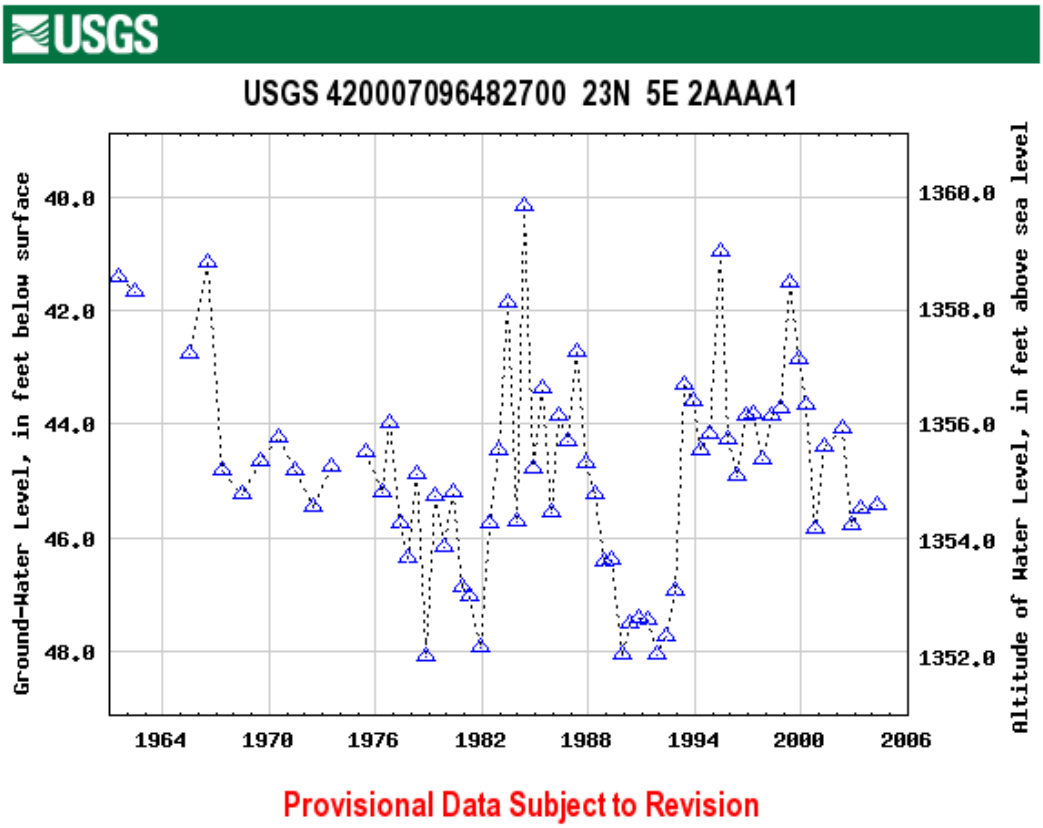
Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Ground water hydrograph map produced by Kevin J. Schwartman, November 1, 2005.

Figure E-26.



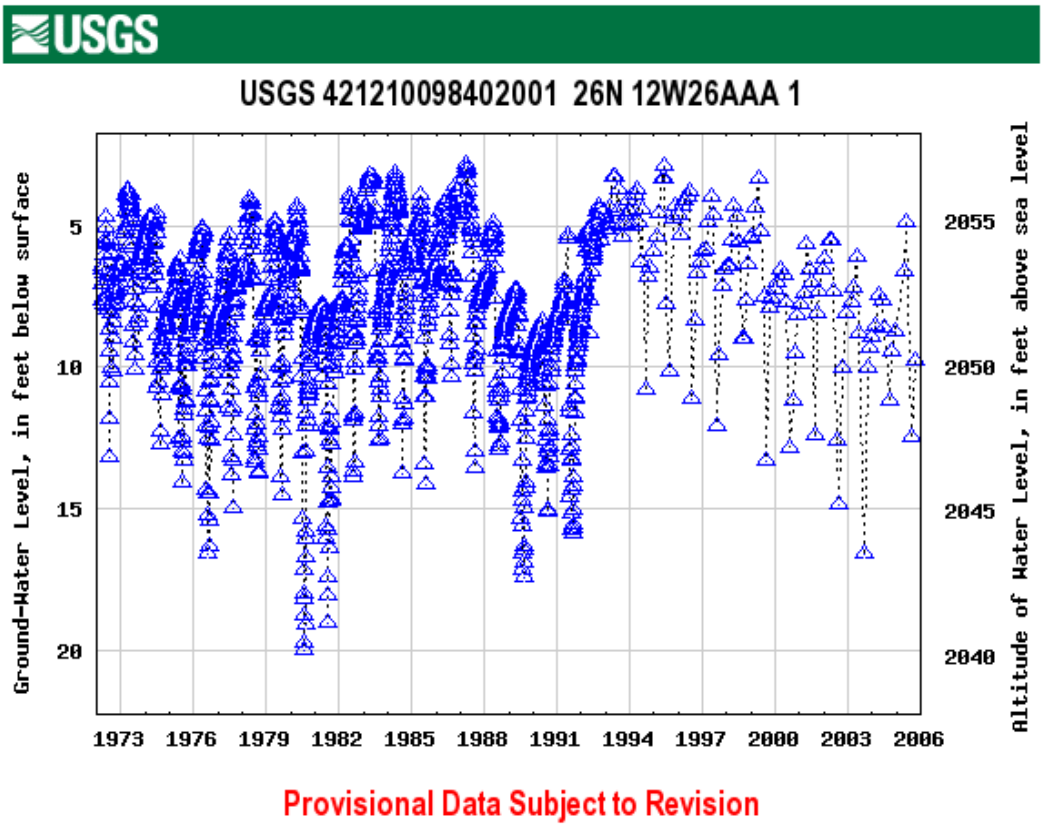
Colfax County, Nebraska
Hydrologic Unit Code 10200103
Latitude 41°27'26.12", Longitude 97°02'48.04" NAD27
Land-surface elevation 1,349.00 feet above sea level NGVD29
The depth of the well is 90.0 feet below land surface.
This well is completed in the QUATERNARY GRAVEL DEPOSITS local aquifer.

Figure E-27 (T 17N R 03E Section 11)



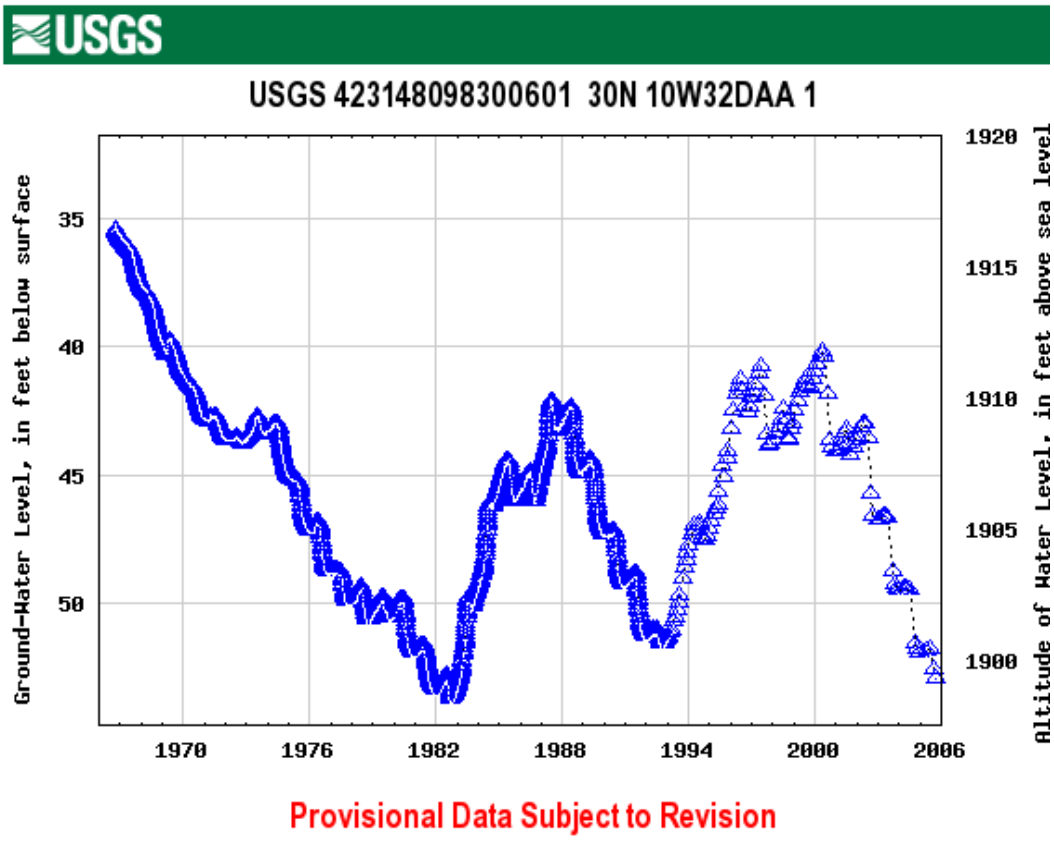
Cuming County, Nebraska
Hydrologic Unit Code 10220003
Latitude 42°00'07", Longitude 96°48'27" NAD27
Land-surface elevation 1,400. feet above sea level NGVD29
The depth of the well is 102 feet below land surface.
This well is completed in the QUATERNARY GRAVEL DEPOSITS local aquifer.

Figure E-28 (T 23N R 05E Section 02)



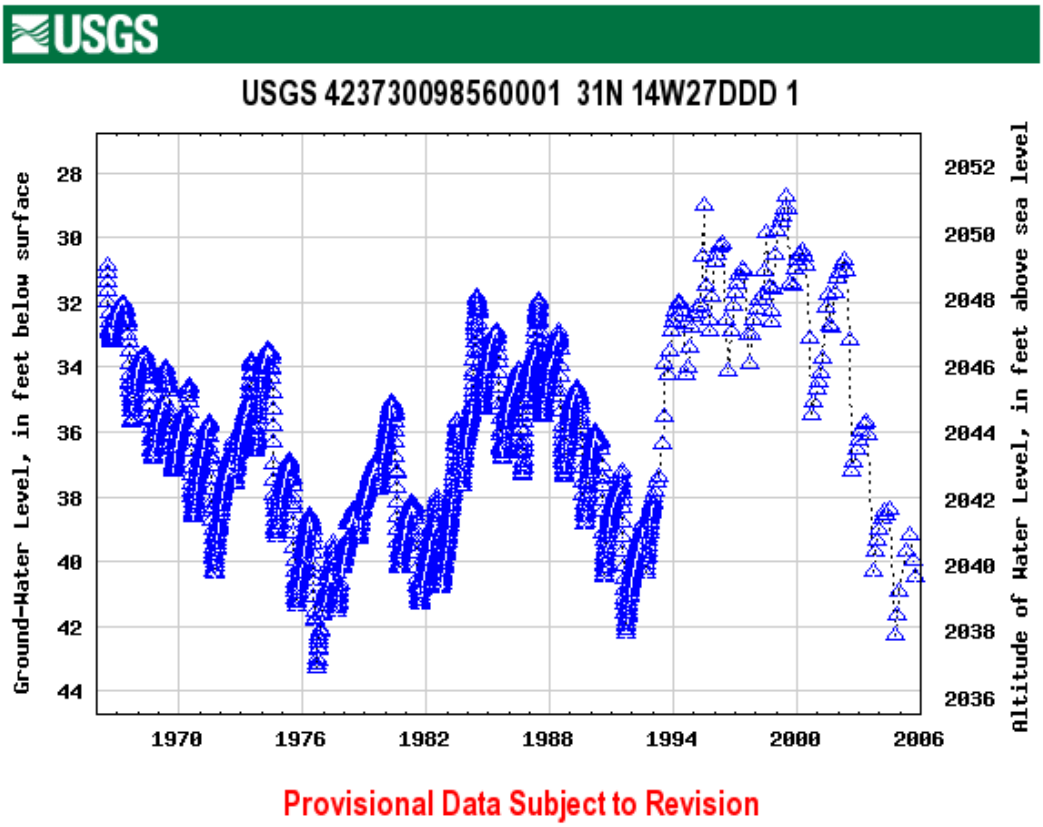
Holt County, Nebraska
Hydrologic Unit Code 10220001
Latitude 42°12'10", Longitude 98°40'20" NAD27
Land-surface elevation 2,060.00 feet above sea level NGVD29
The depth of the well is 140 feet below land surface.
This well is completed in the TERTIARY OGALLALA GROUP DEPOSITS (112SDGV) regional aquifer.

Figure E-29 (T 26N R 12W Section 26)



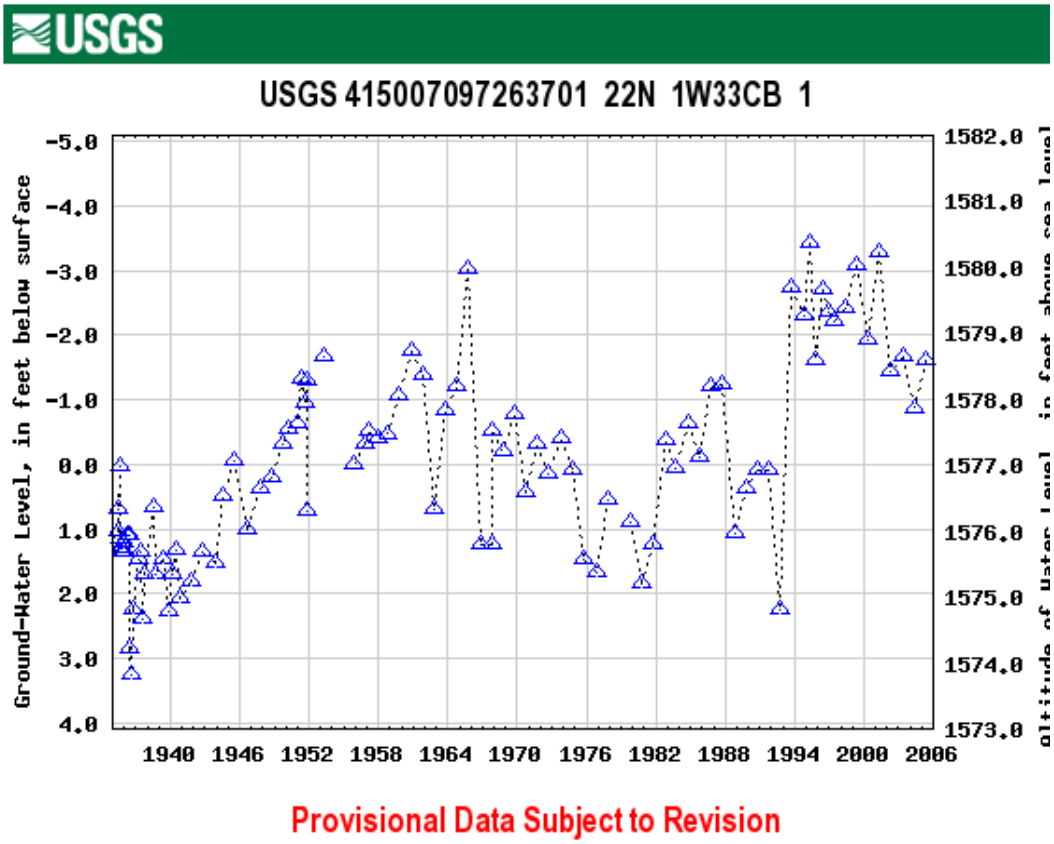
Holt County, Nebraska
Hydrologic Unit Code 10150007
Latitude 42°31'48", Longitude 98°30'06" NAD27
Land-surface elevation 1,952.00 feet above sea level NGVD29
The depth of the well is 85.0 feet below land surface.
This well is completed in the QUATERNARY SAND AND GRAVEL DEPOSITS (112SDGV) local aquifer.

Figure E-30 (T 30N R 10W Section 32)



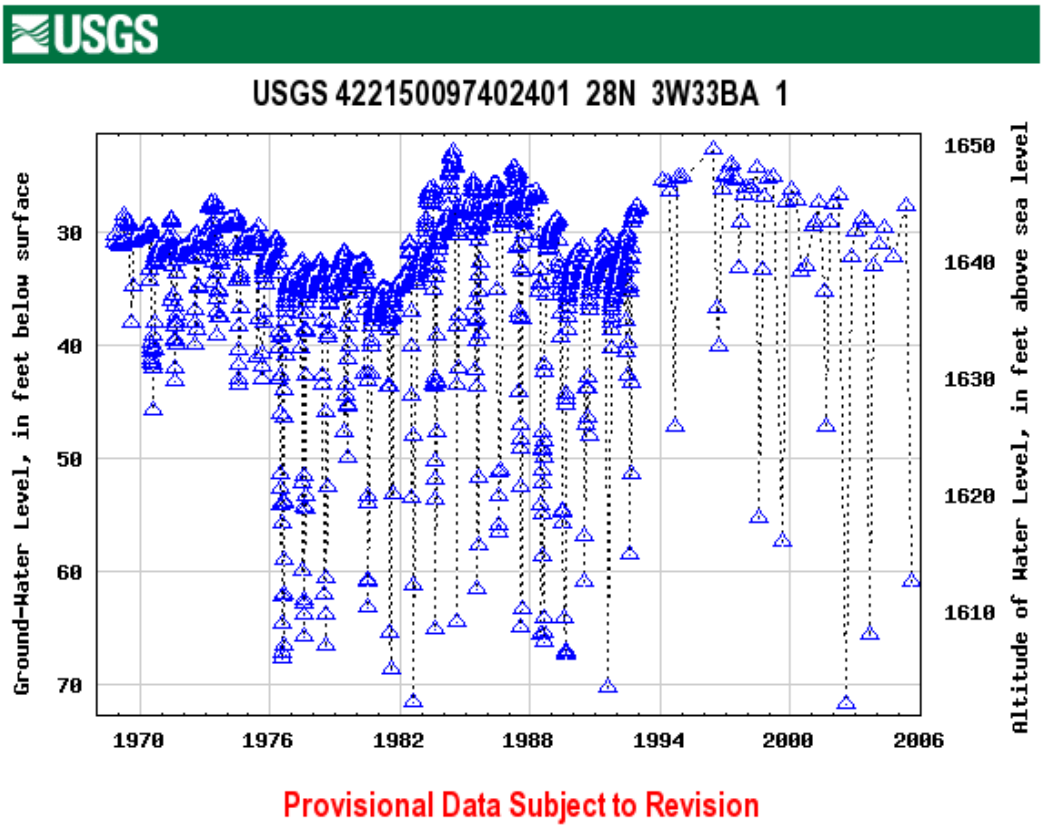
Holt County, Nebraska
Hydrologic Unit Code 10150007
Latitude 42°37'30", Longitude 98°56'00" NAD27
Land-surface elevation 2,080.00 feet above sea level NGVD29
The depth of the well is 72.0 feet below land surface.
This well is completed in the QUATERNARY SAND AND GRAVEL DEPOSITS (112SDGV) local aquifer.

Figure E-31 (T 31N R 14W Section 27)



Madison County, Nebraska
Hydrologic Unit Code 10220003
Latitude 41°50'07", Longitude 97°26'37" NAD27
Land-surface elevation 1,577.00 feet above sea level NGVD29
The depth of the well is 60.0 feet below land surface.
This well is completed in the QUATERNARY SAND DEPOSITS (112SDGV) local aquifer.

Figure E-32 (T 22N R 01W Section 33)



Pierce County, Nebraska
Hydrologic Unit Code 10220002
Latitude 42°21'50", Longitude 97°40'24" NAD27
Land-surface elevation 1,673.00 feet above sea level NGVD29
The depth of the well is 121 feet below land surface.
This well is completed in the QUATERNARY SAND AND GRAVEL DEPOSITS (112SDGV) local aquifer.

Figure E-33 (T 28N R 03W Section 33)

Figure E-34. Annual Flows, South Fork of the Elkhorn River at Ewing.

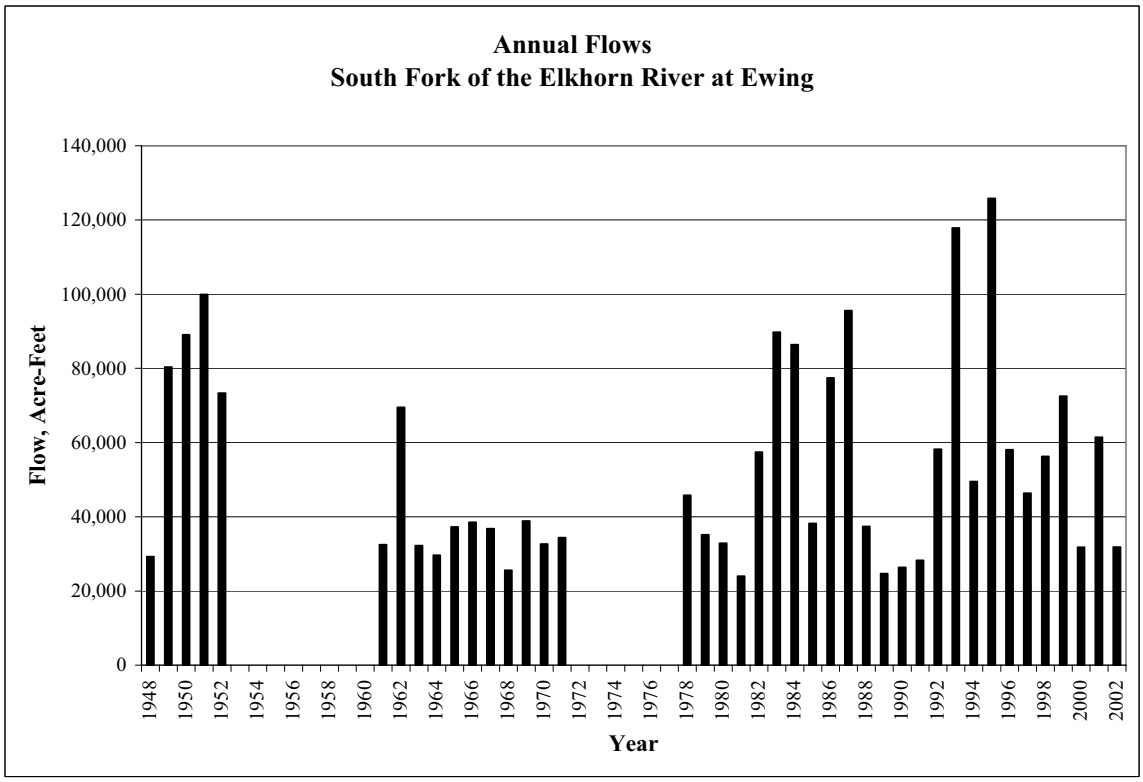
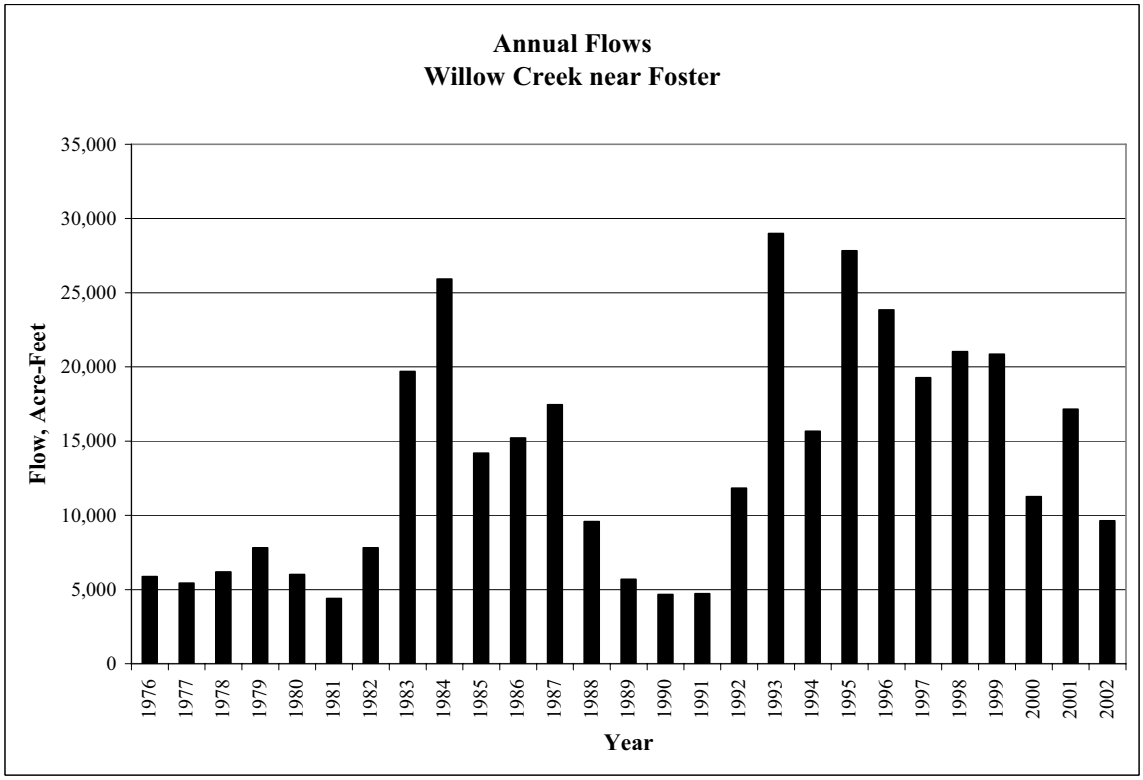


Figure E-35. Annual Flows, Willow Creek near Foster.



Data from: US Geological Survey and NE Department of Natural Resources

Figure E-36. Annual Flows, North Fork of the Elkhorn River near Pierce.

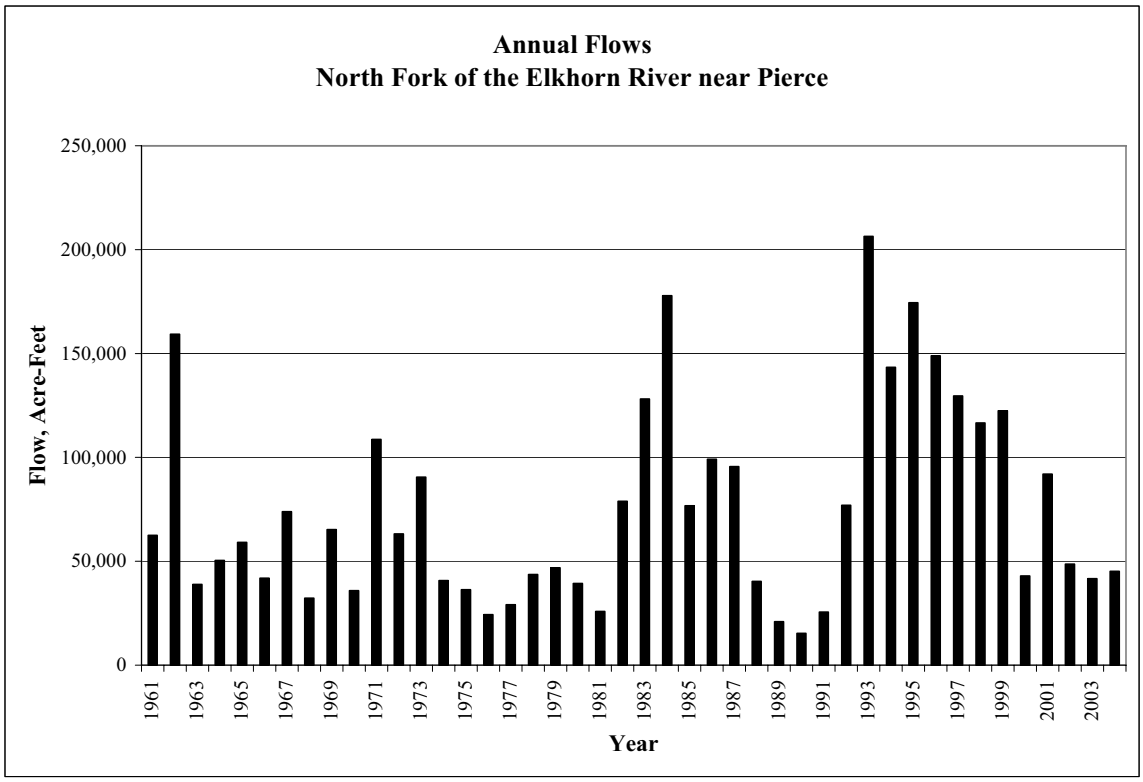
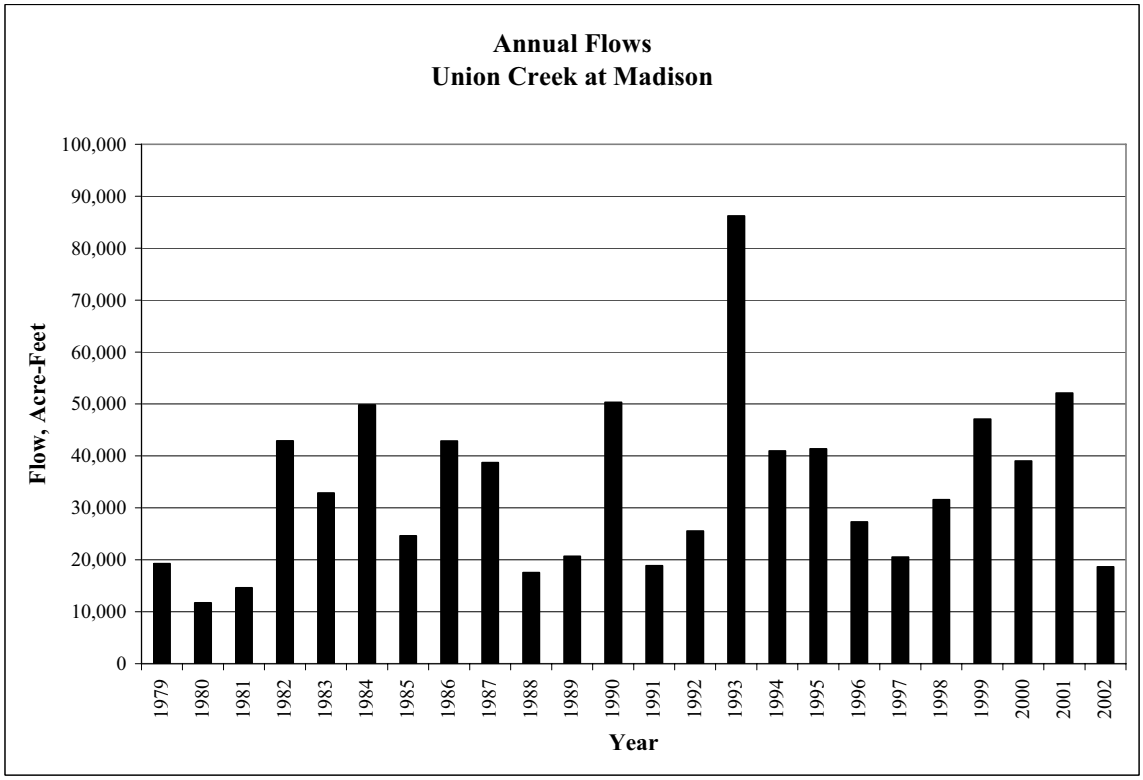


Figure E-37. Annual Flows, Union Creek at Madison.



Data from: US Geological Survey and NE Department of Natural Resources

Figure E-38. Annual Flows, Pebble Creek at Scribner.

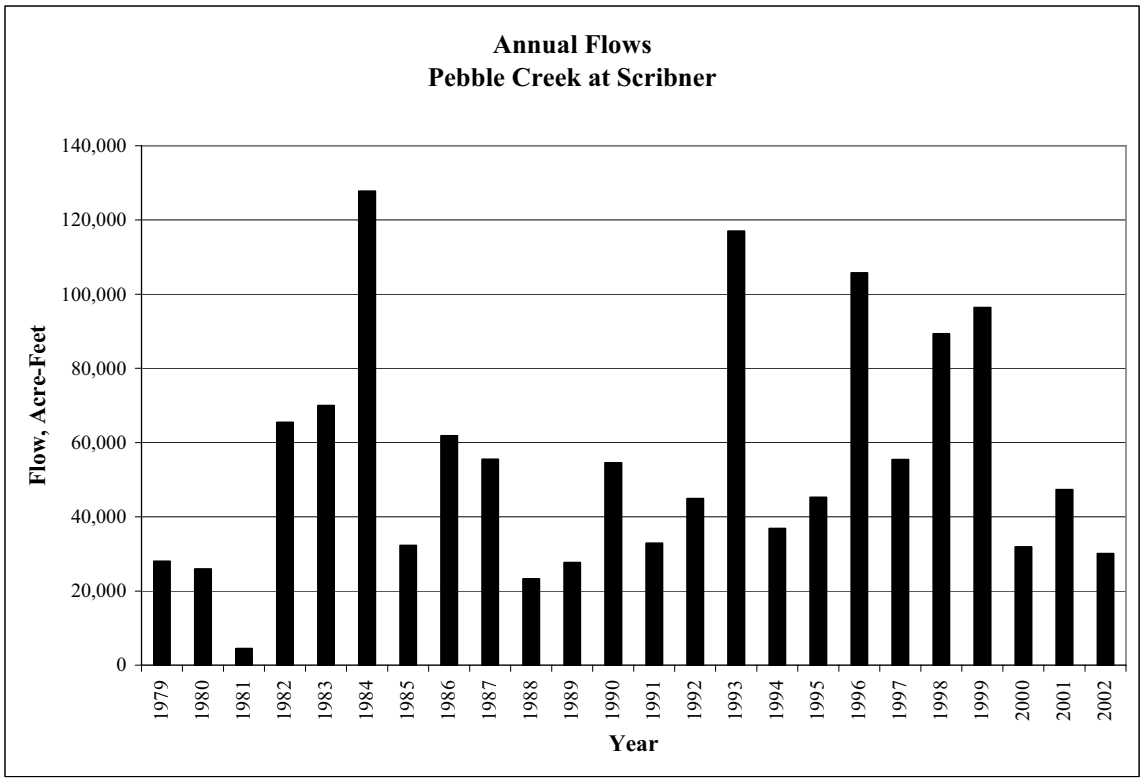
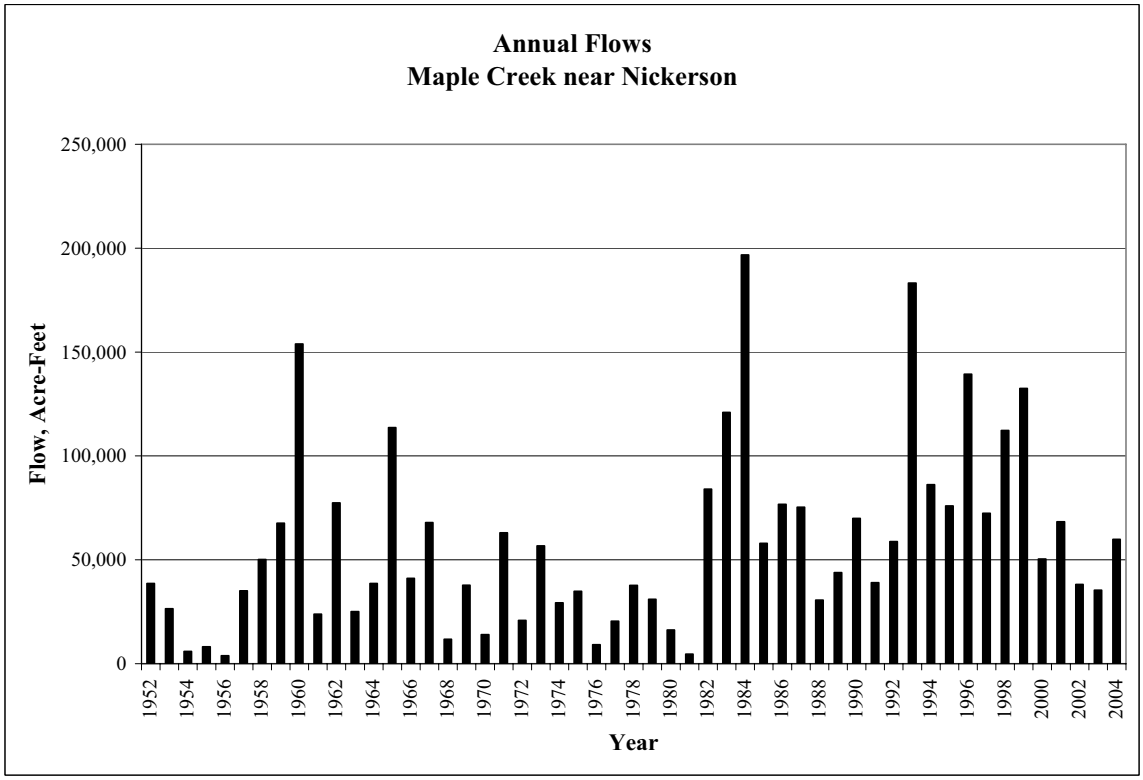


Figure E-39. Annual Flows, Maple Creek near Nickerson.



Data from: US Geological Survey and NE Department of Natural Resources

Figure E-40. Annual Flows, Logan Creek at Pender.

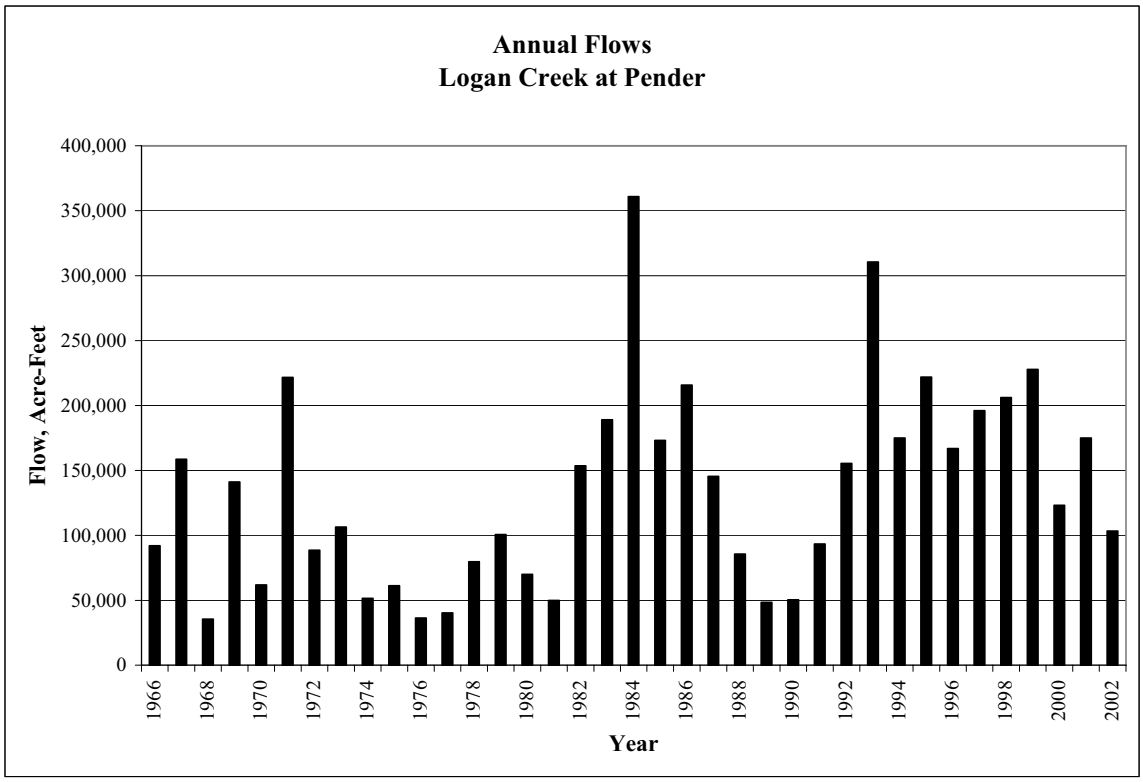
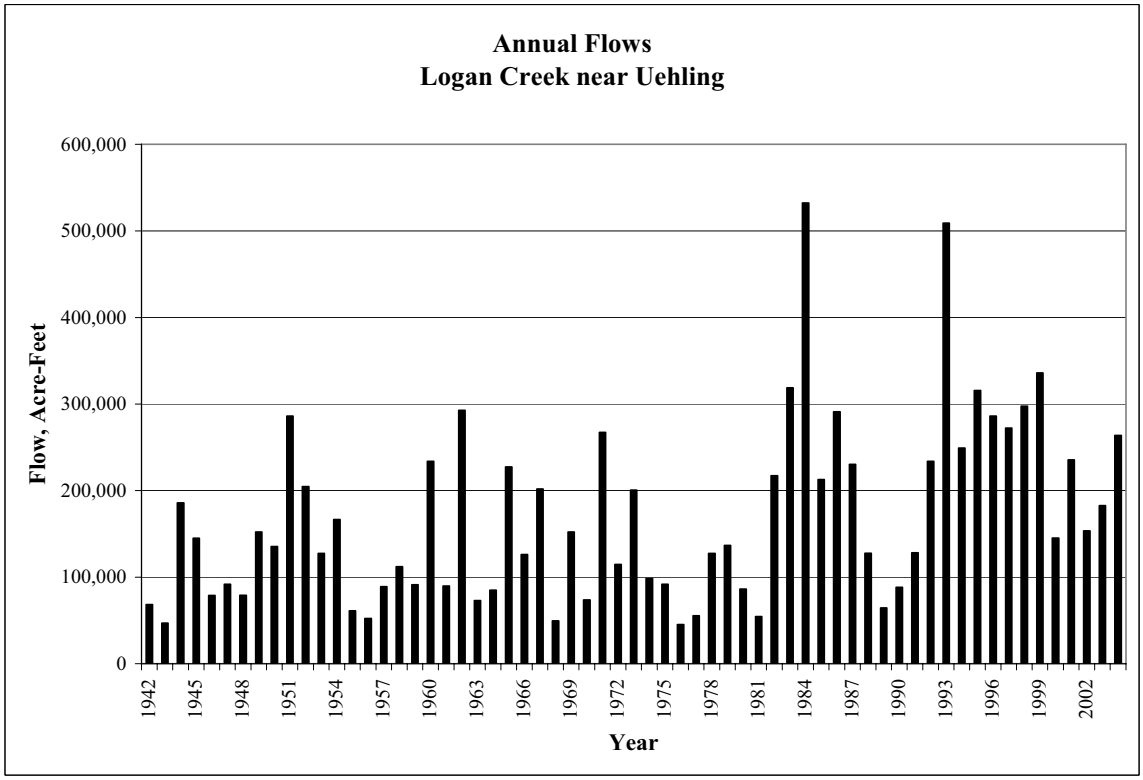


Figure E-41. Annual Flows, Logan Creek near Uehling.



Data from: US Geological Survey and NE Department of Natural Resources

Figure E-42. Annual Flows, Elkhorn River near Atkinson.

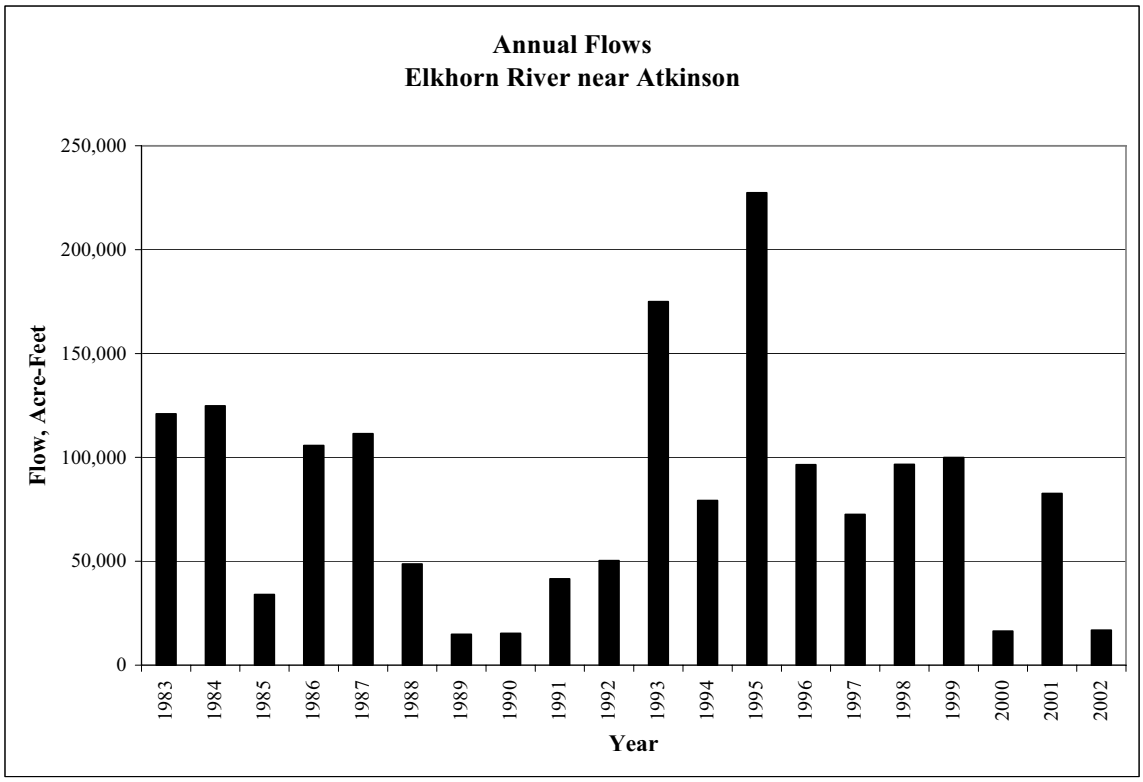
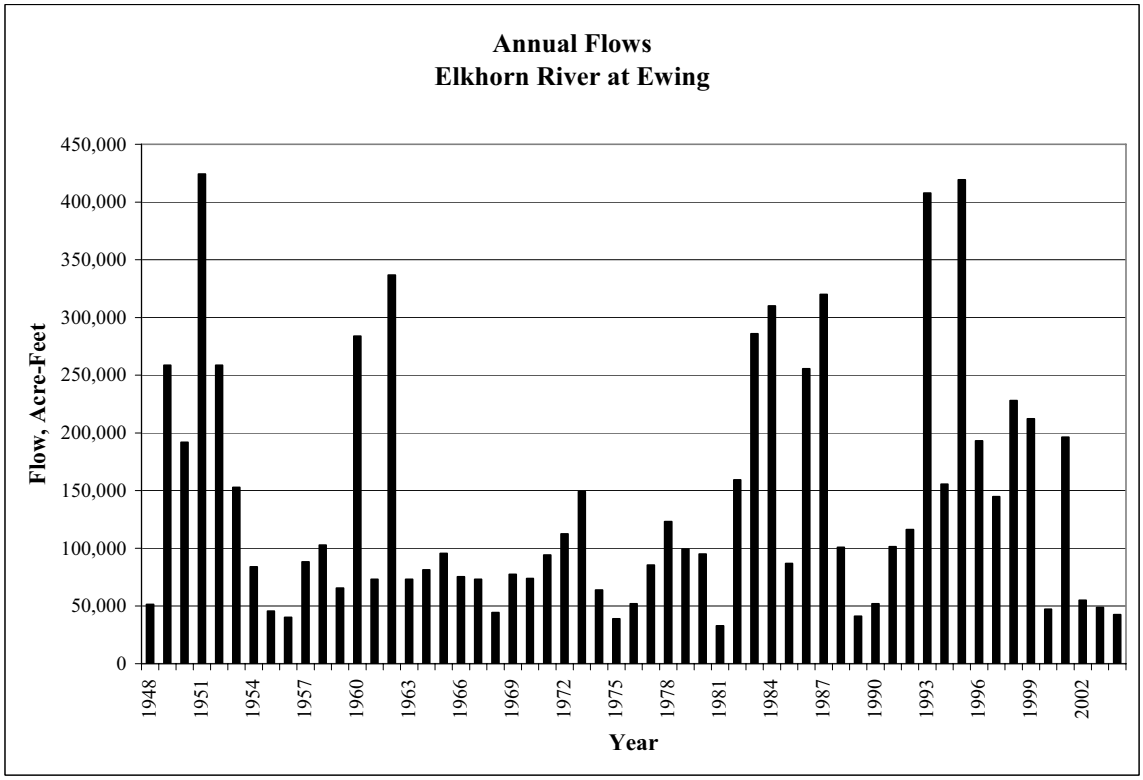


Figure E-43. Annual Flows, Elkhorn River at Ewing.



Data from: US Geological Survey and NE Department of Natural Resources

Figure E-44. Annual Flows, Elkhorn River at Neligh.

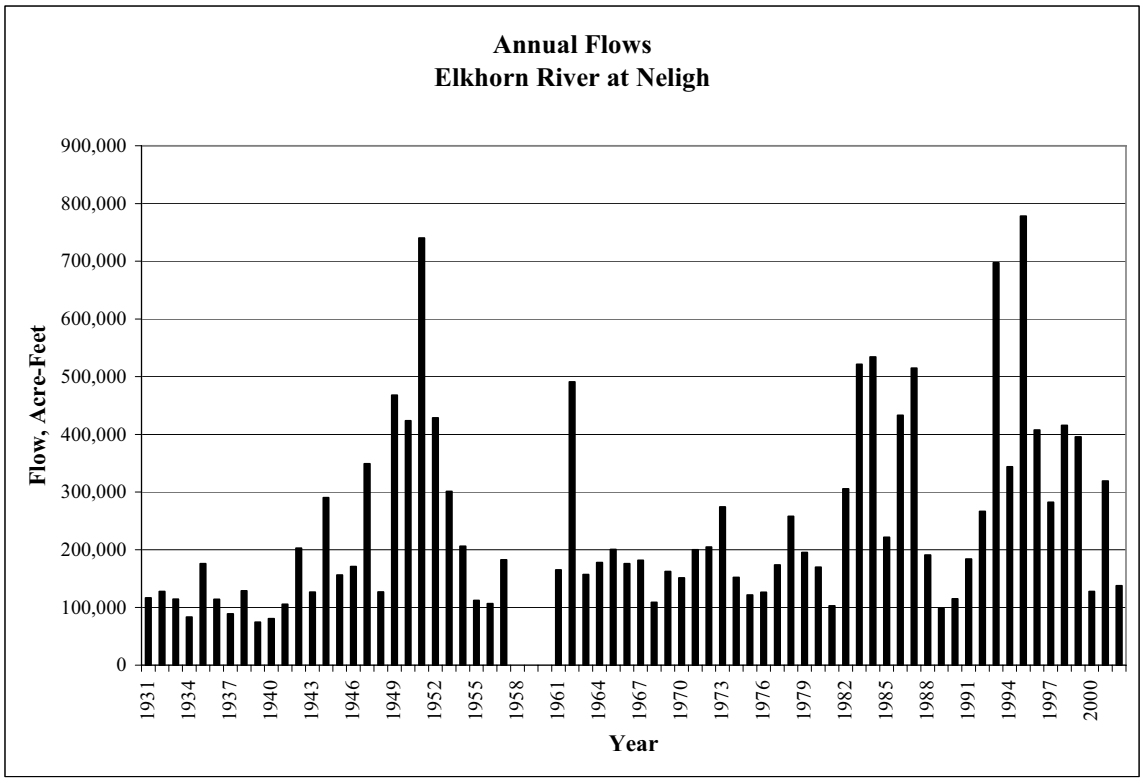
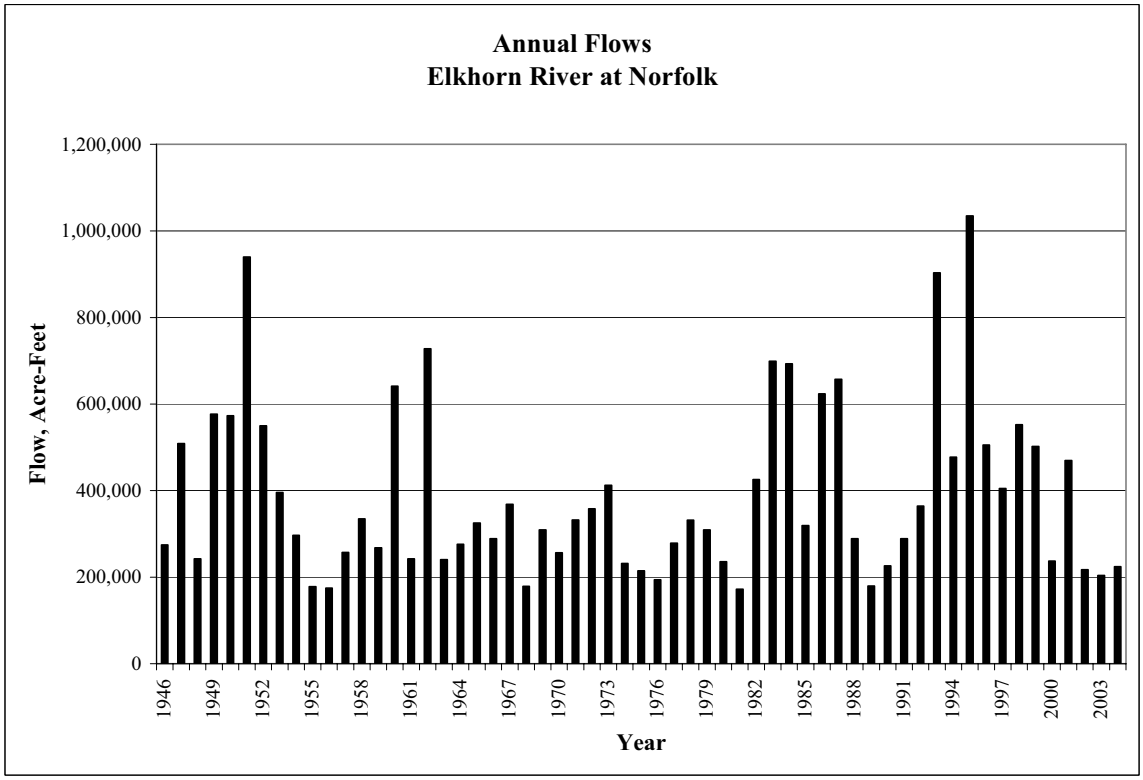


Figure E-45. Annual Flows, Elkhorn River at Norfolk.



Data from: US Geological Survey and NE Department of Natural Resources

Figure E-46. Annual Flows, Elkhorn River at West Point.

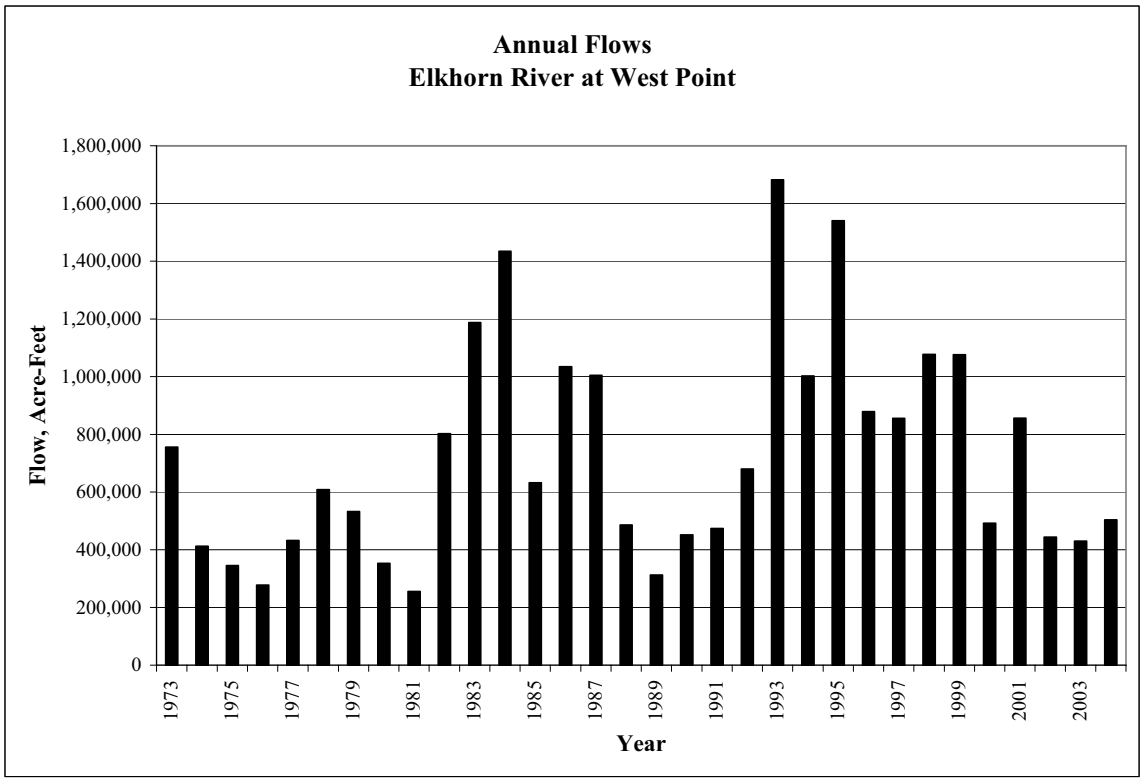
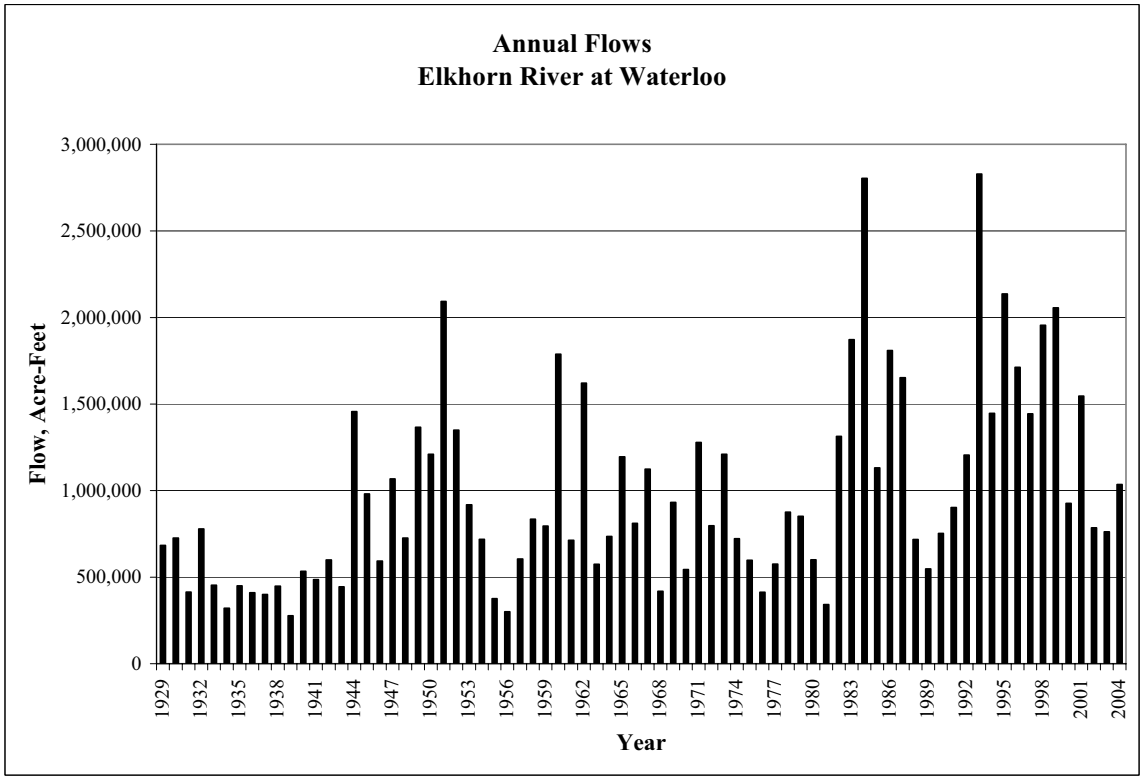


Figure E-47. Annual Flows, Elkhorn River at Waterloo.

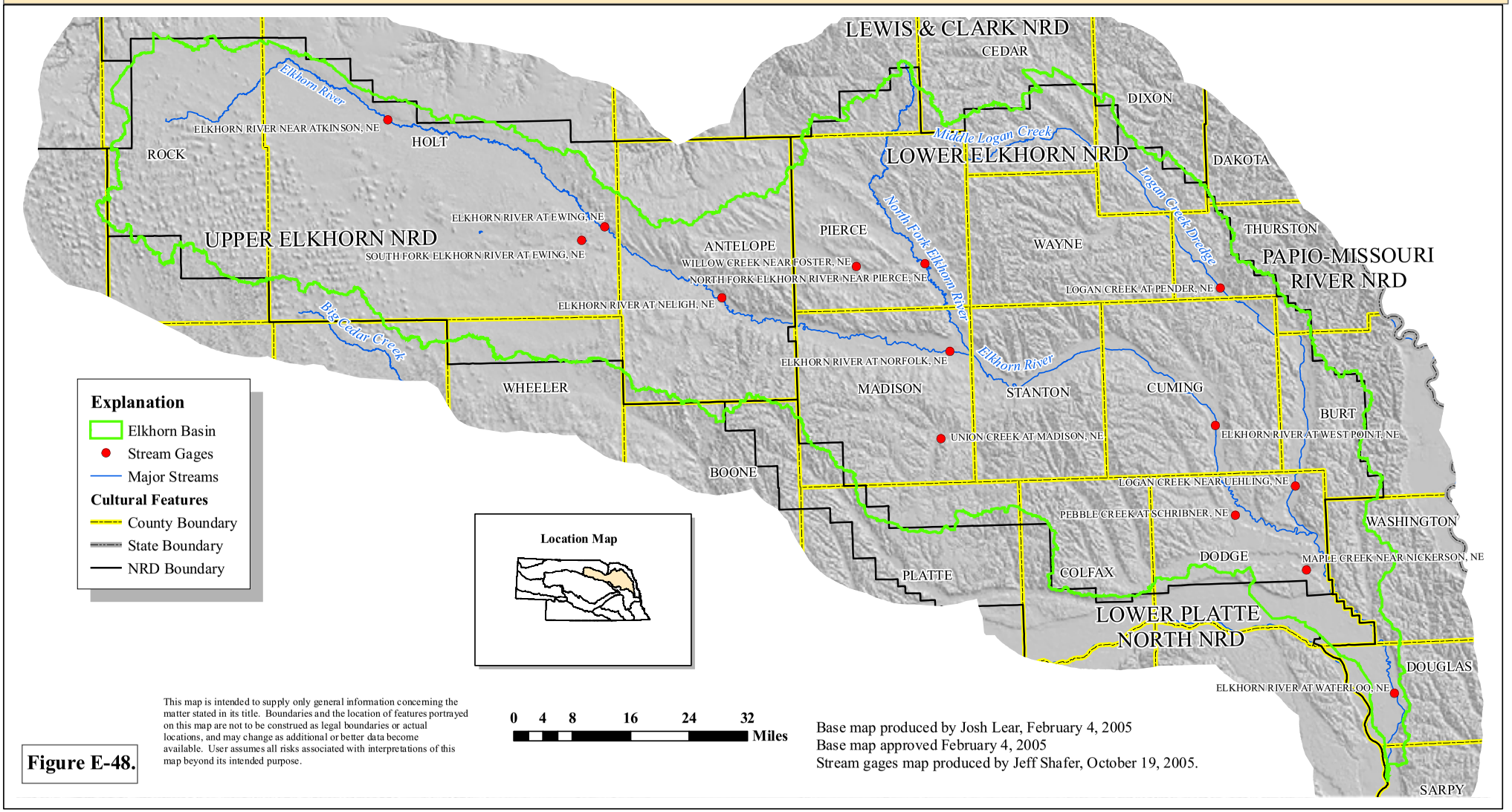


Data from: US Geological Survey and NE Department of Natural Resources

Planning and Assistance Division

Stream Gages

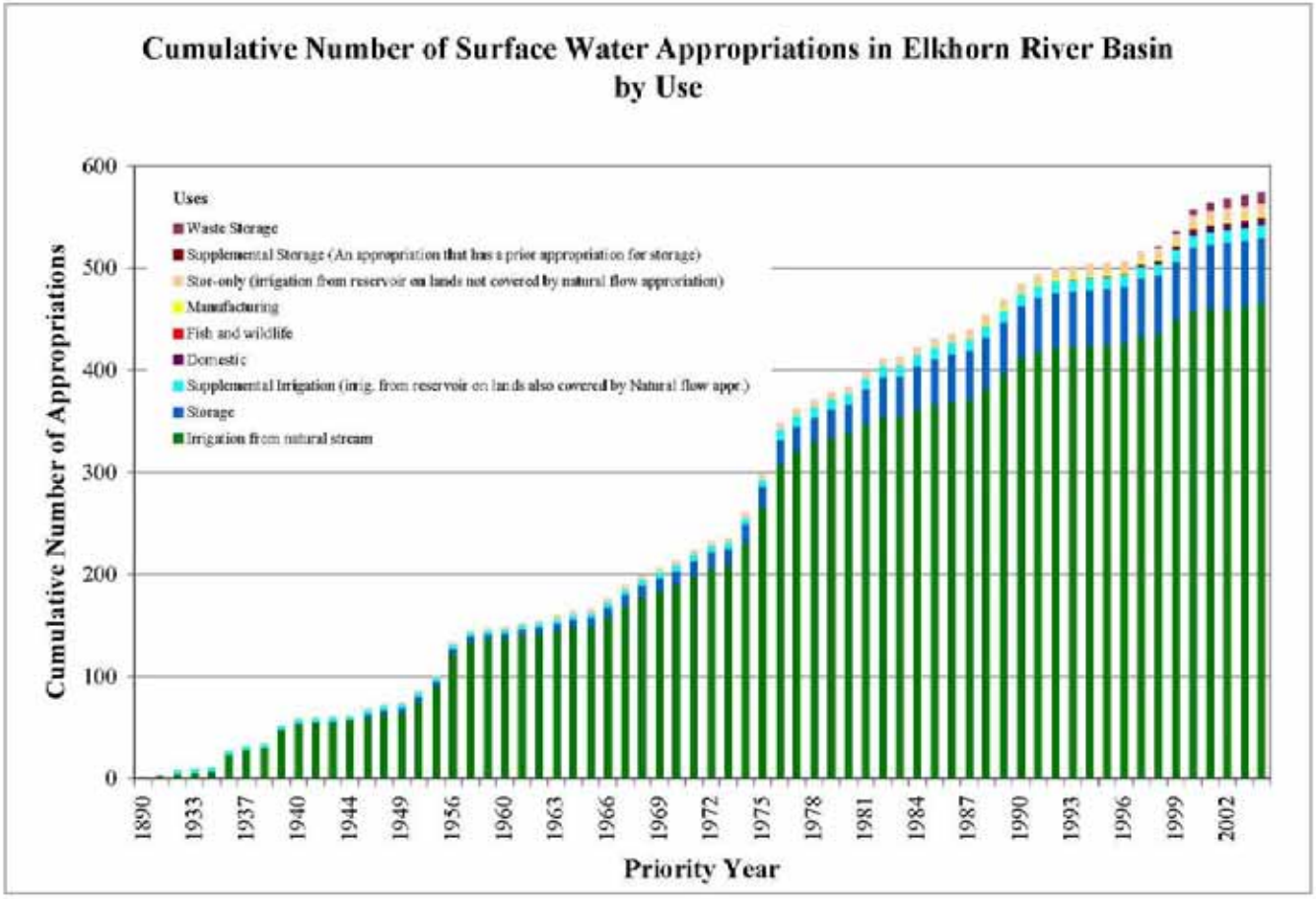
ELKHORN RIVER BASIN



This map is intended to supply only general information concerning the matter stated in its title. Boundaries and the location of features portrayed on this map are not to be construed as legal boundaries or actual locations, and may change as additional or better data become available. User assumes all risks associated with interpretations of this map beyond its intended purpose.

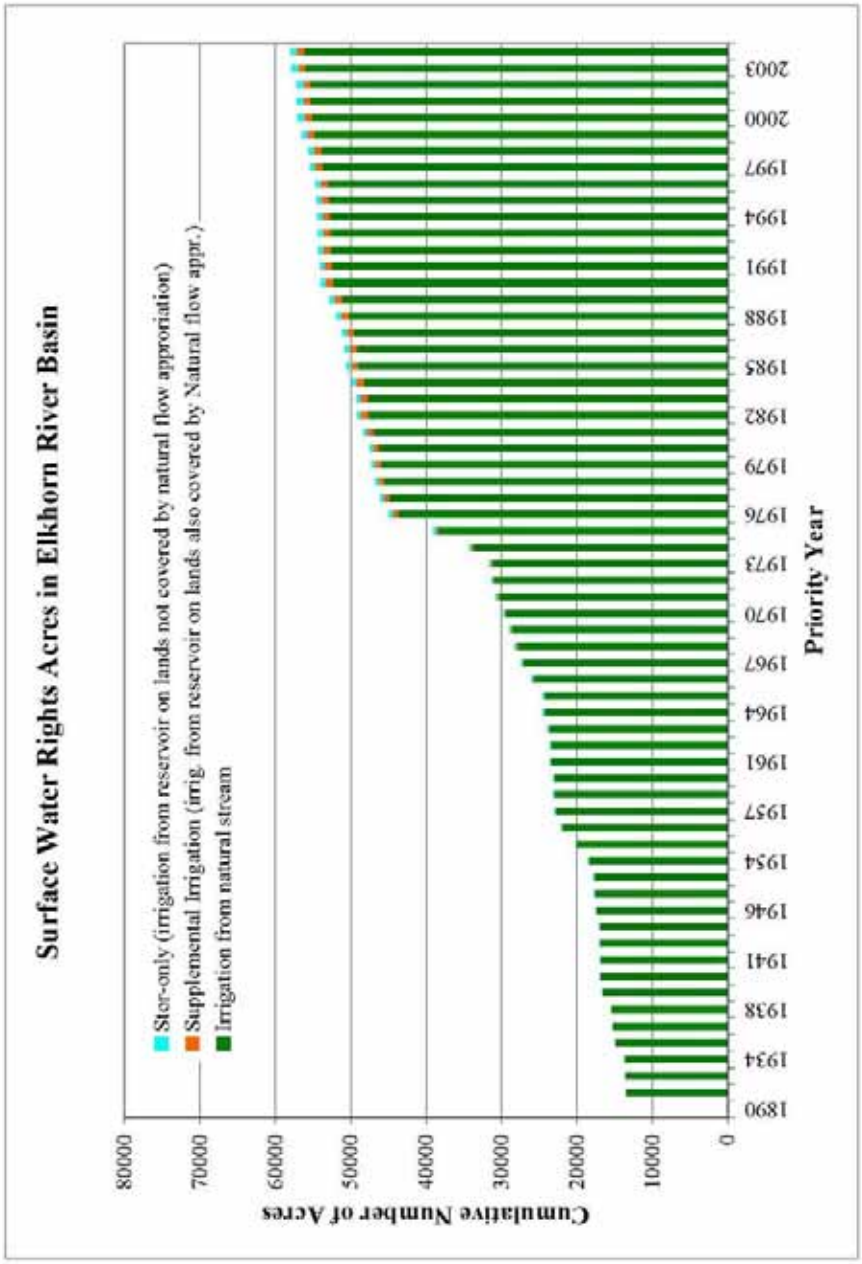
Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Stream gages map produced by Jeff Shafer, October 19, 2005.

Figure E-48.



Source: DNR Surface Water Rights Database
Figure E-49

11/23/2005 by Shuhai Zheng



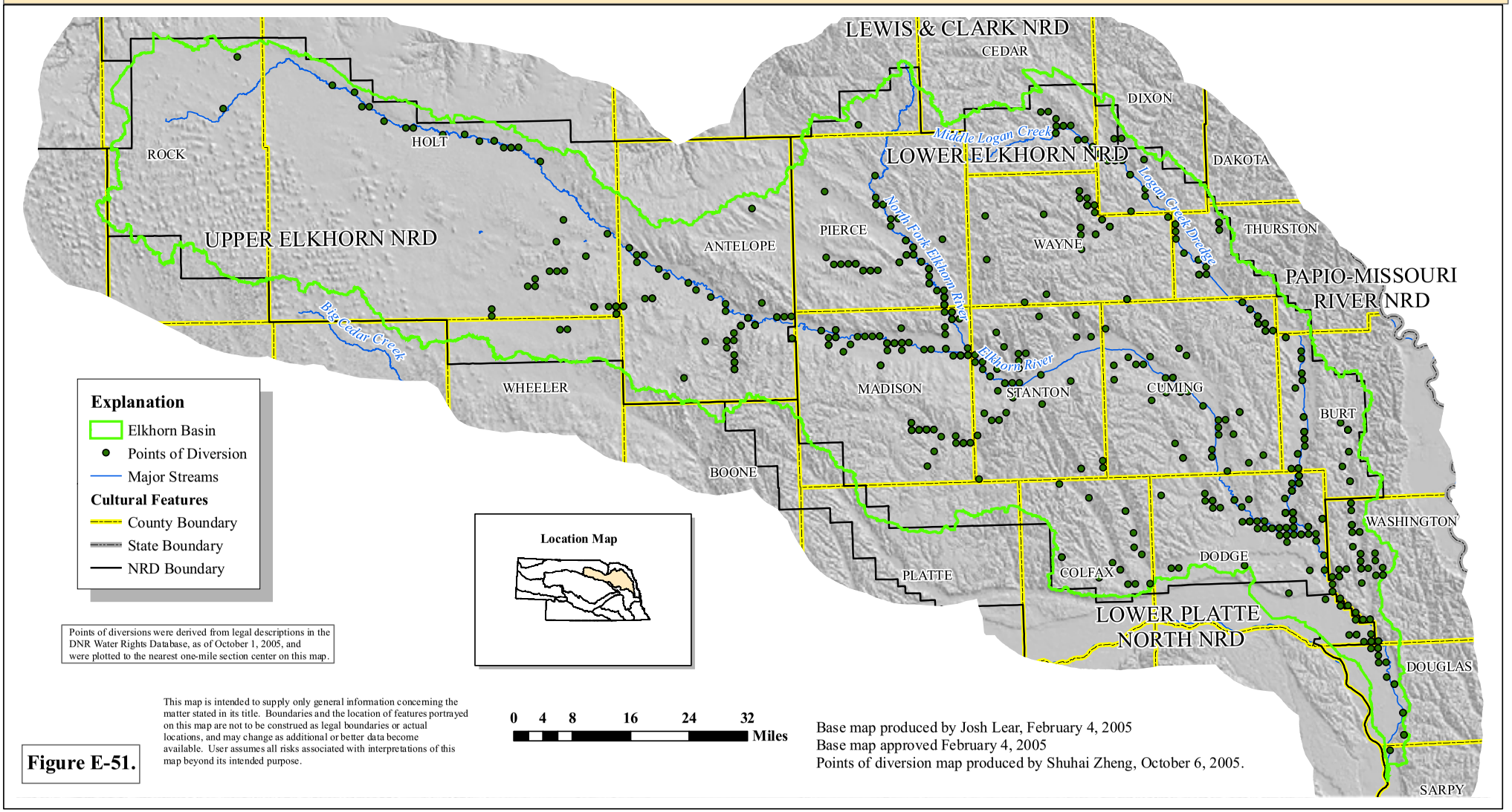
Source: DNR Surface Water Rights Database
Figure E-50

11/23/2005 by Shuhai Zheng

Planning and Assistance Division

Surface Water Points of Diversion

ELKHORN RIVER BASIN



Points of diversions were derived from legal descriptions in the DNR Water Rights Database, as of October 1, 2005, and were plotted to the nearest one-mile section center on this map.

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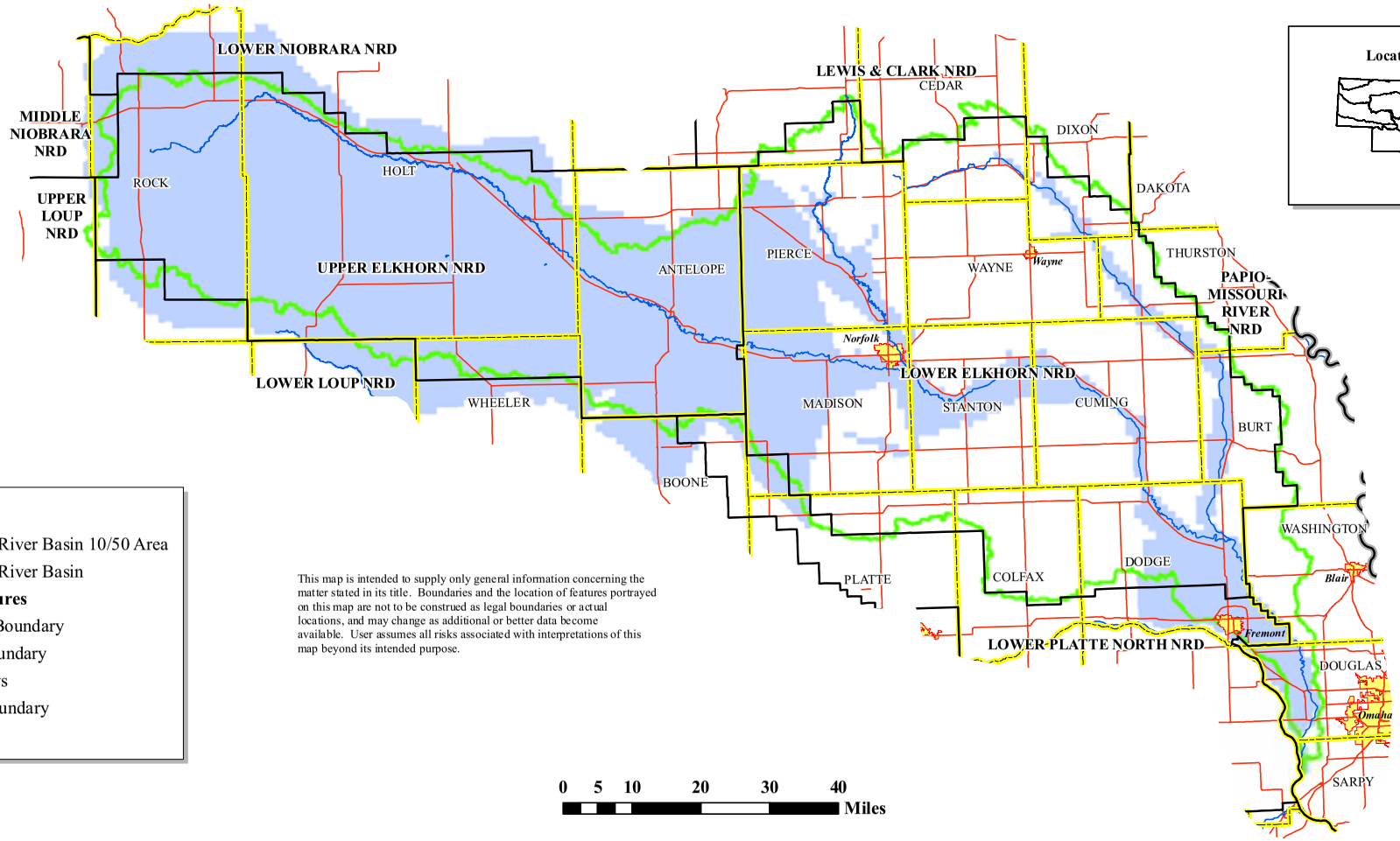
Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Points of diversion map produced by Shuhai Zheng, October 6, 2005.

Figure E-51.

Planning and Assistance Division

Map of Geographic Area within which Surface Water and Ground Water Are Hydrologically Connected For Purposes of the Determination of Fully Appropriated

NEBRASKA DEPARTMENT OF NATURAL RESOURCES
ELKHORN RIVER BASIN



Explanation

- Elkhorn River Basin 10/50 Area
- Elkhorn River Basin

Cultural Features

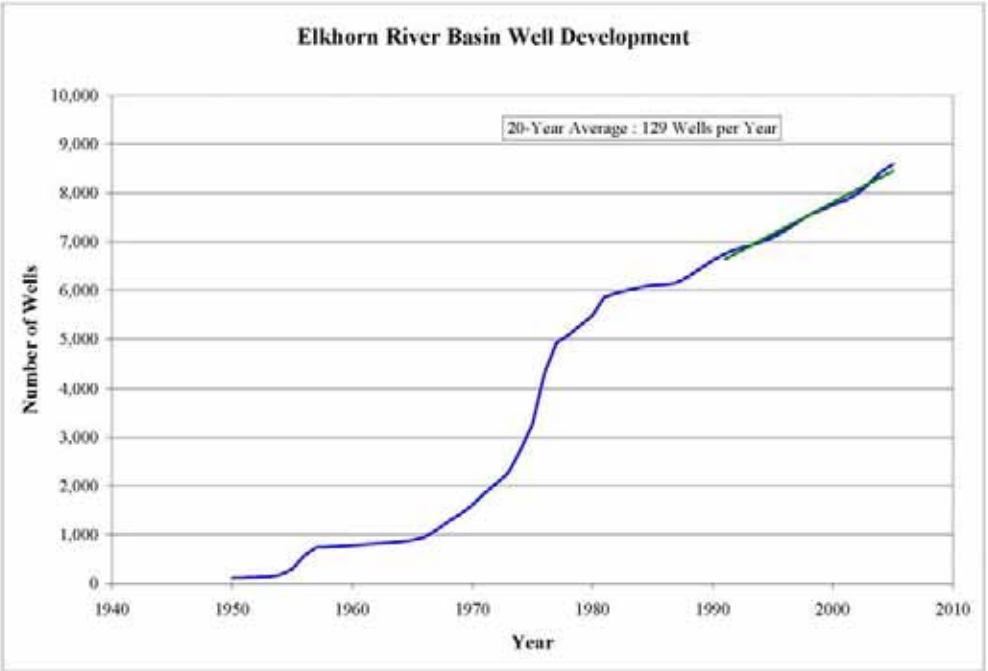
- County Boundary
- State Boundary
- Highways
- NRD Boundary
- Cities

This map is intended to supply only general information concerning the matter stated in its title. Boundaries and the location of features portrayed on this map are not to be construed as legal boundaries or actual locations, and may change as additional or better data become available. User assumes all risks associated with interpretations of this map beyond its intended purpose.

Figure E-52.

Jeff Shafer, Nebraska Department of Natural Resources
September 26, 2005

Figure E-53. Historic High Capacity Well Development in the Elkhorn River Basin.

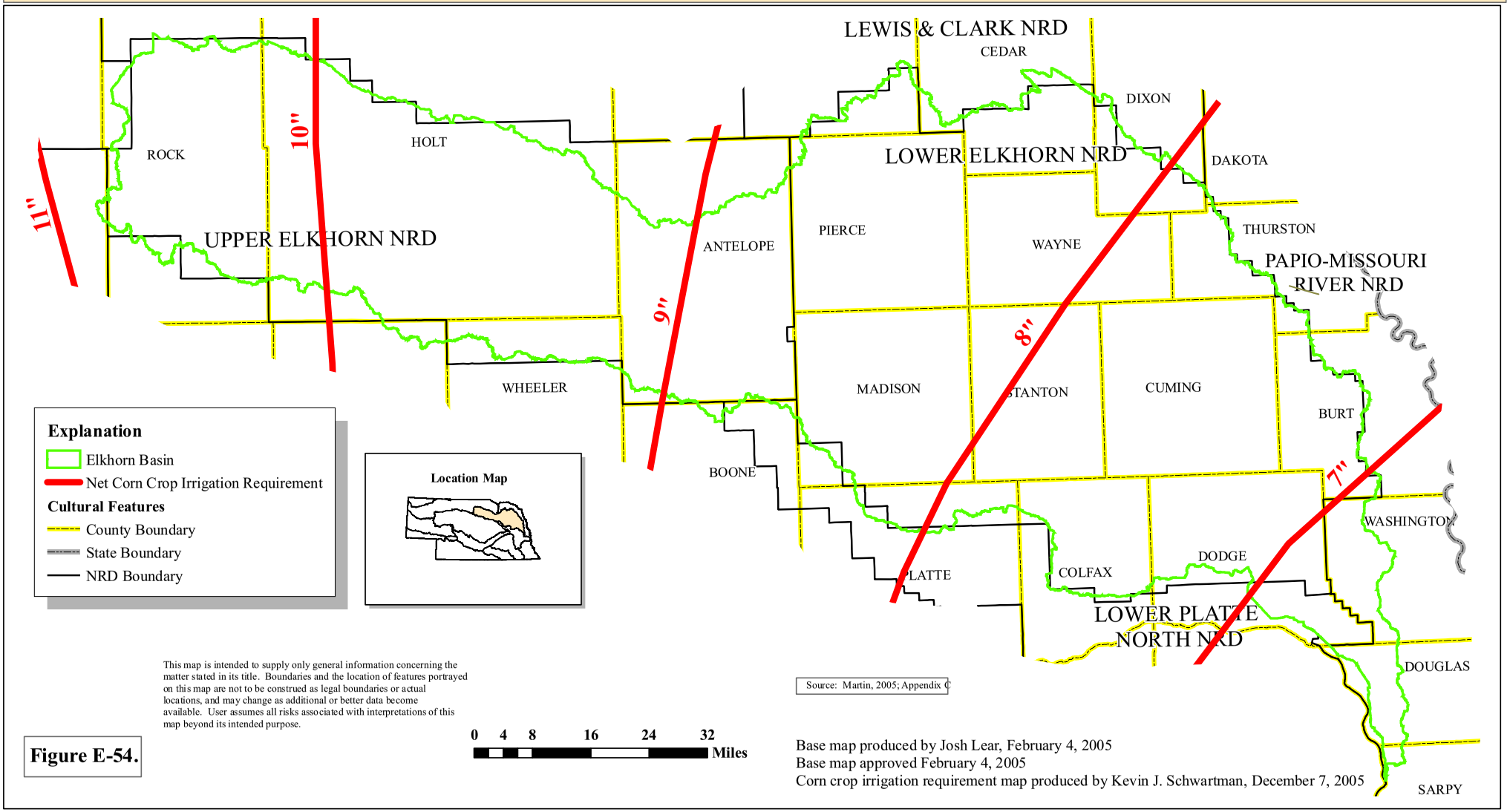


Source: DNR Registered Ground Water Well Database

Planning and Assistance Division

Net Corn Crop Irrigation Requirement

ELKHORN RIVER BASIN



This map is intended to supply only general information concerning the matter stated in its title. Boundaries and the location of features portrayed on this map are not to be construed as legal boundaries or actual locations, and may change as additional or better data become available. User assumes all risks associated with interpretations of this map beyond its intended purpose.

Base map produced by Josh Lear, February 4, 2005
Base map approved February 4, 2005
Corn crop irrigation requirement map produced by Kevin J. Schwartman, December 7, 2005

Figure E-54.

Citation

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Citation

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