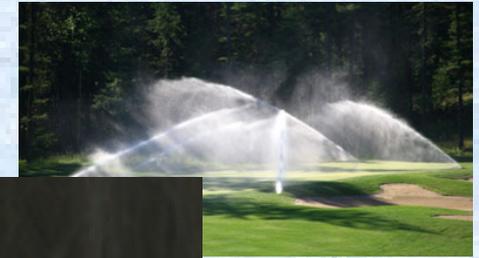


Little Blue Natural Resources District

Highlighting Our Water Resources,
Related Water Issues and
Opportunities

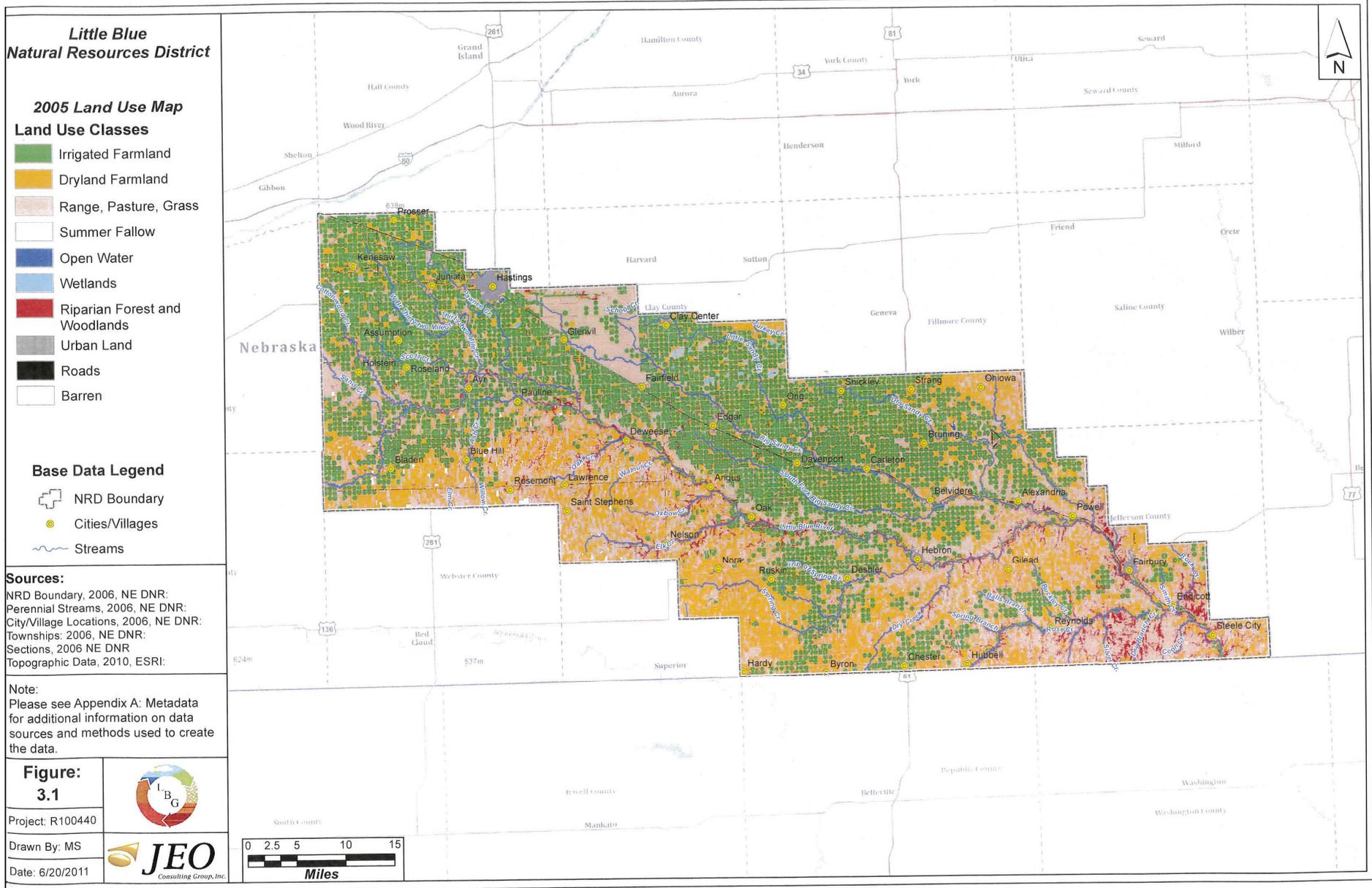
Our Demands for Water



Little Blue NRD - District of Diversity

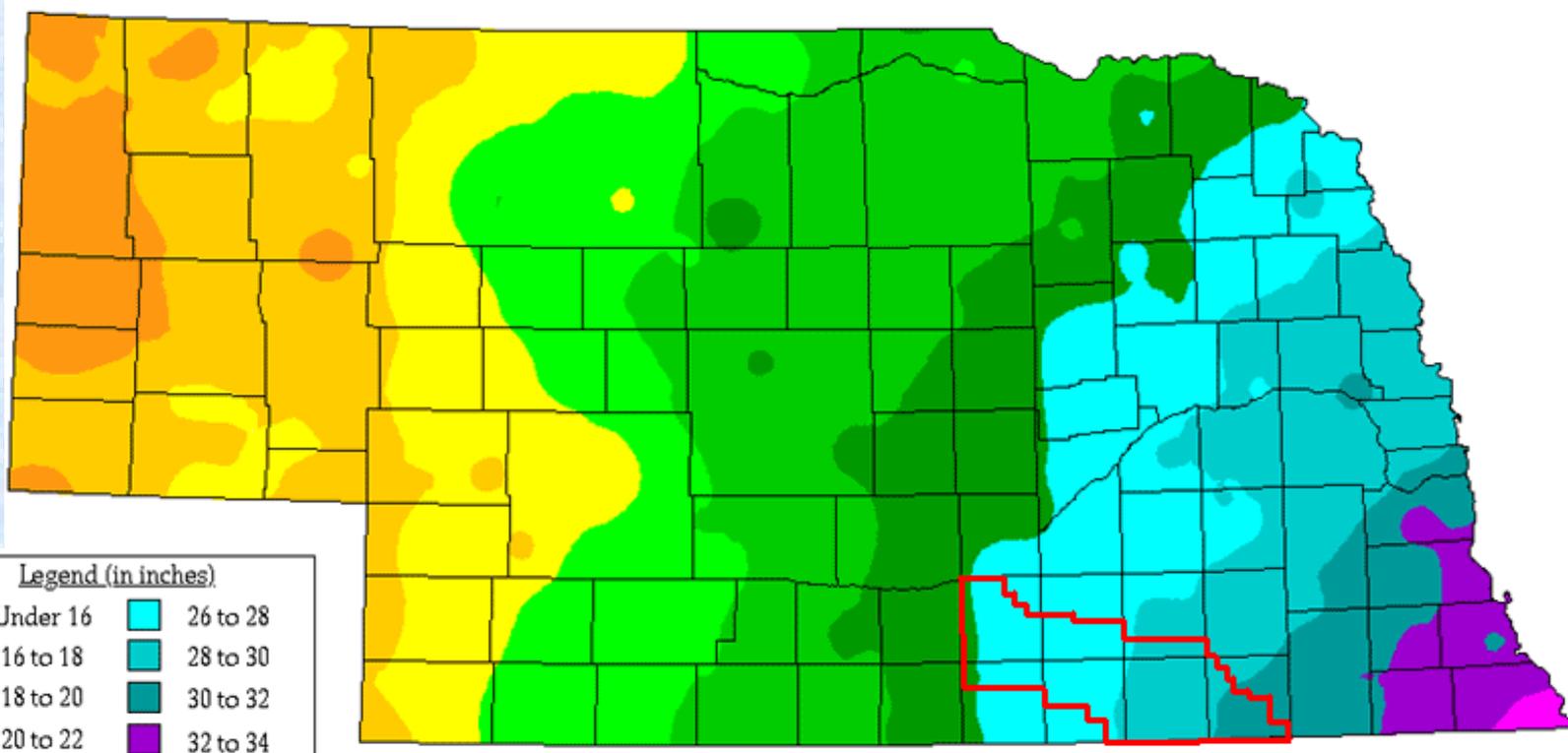
- Valentine Sands in NW Adams County to Ozark-like terrain of southern Jefferson County
- Flat upland irrigated lands of Adams, Clay and Fillmore County to glacial-till dryland area of Thayer and Jefferson County
- Deep aquifer of western district to areas void of an aquifer to support modest domestic uses
- Rainwater Basins of Nebraska to steep breaks along Little Blue River

Land Use Map



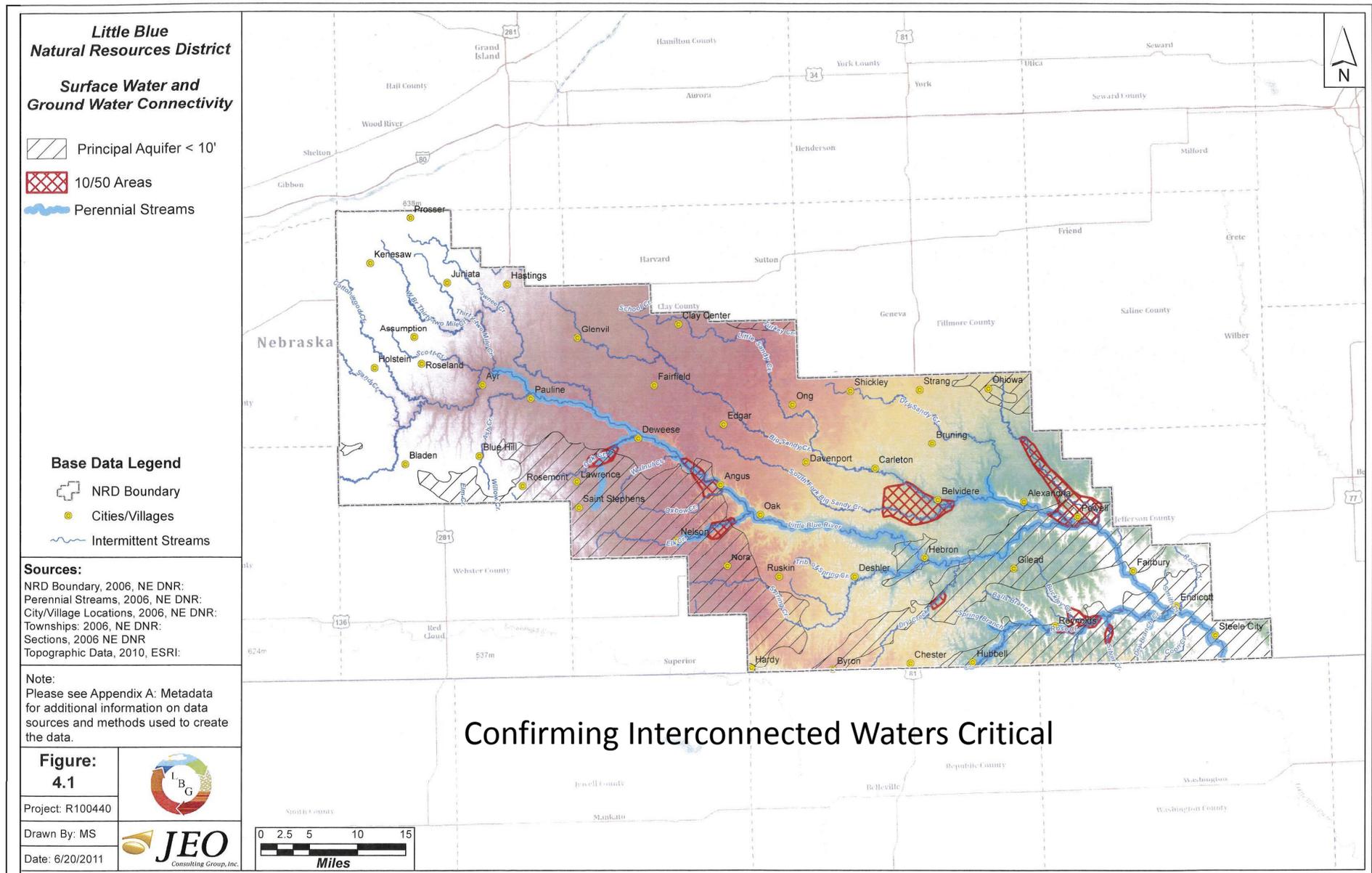
Nebraska Average Rainfall

1961 - 1990

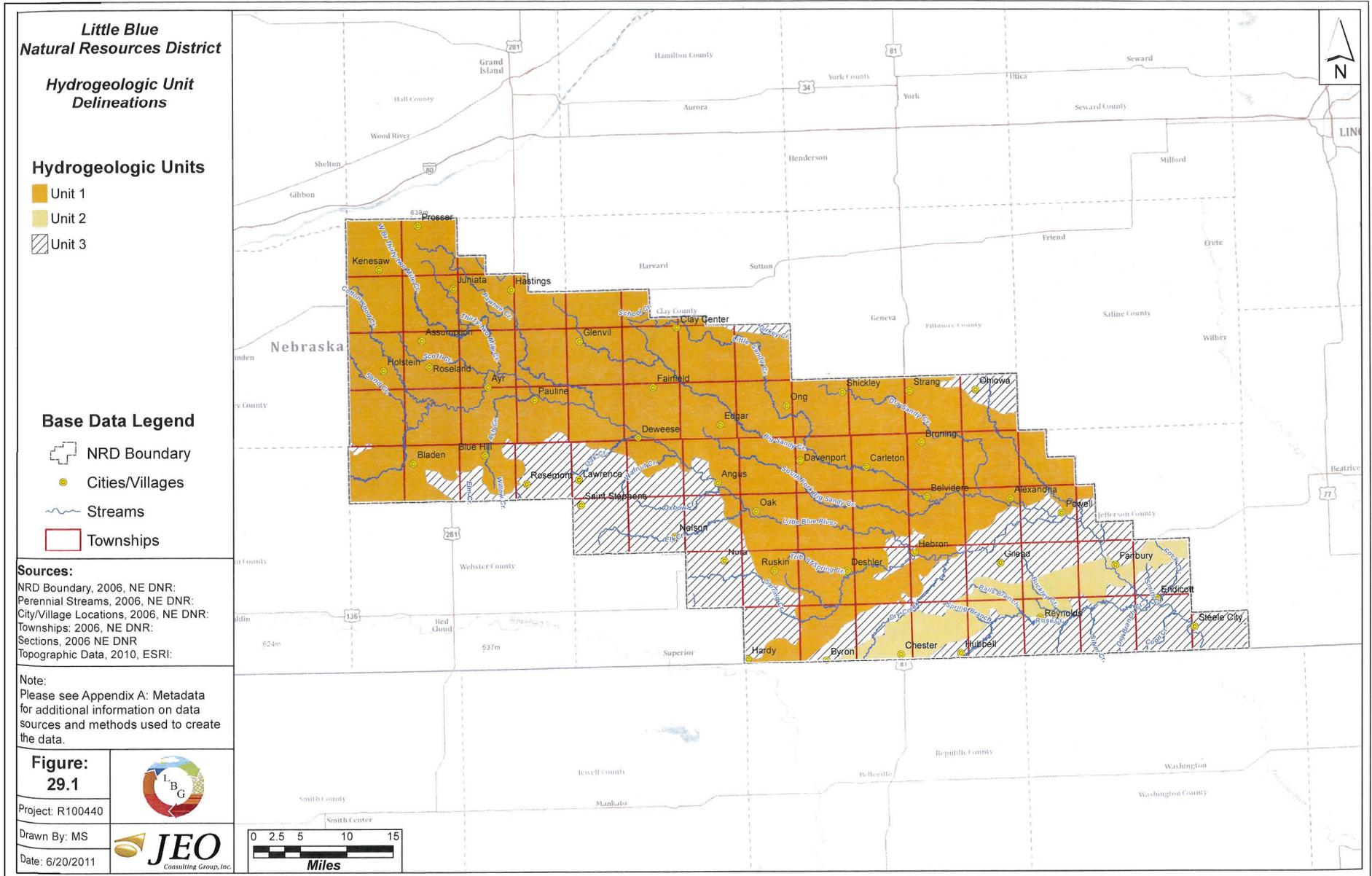


Average Rainfall between 26" and 31"

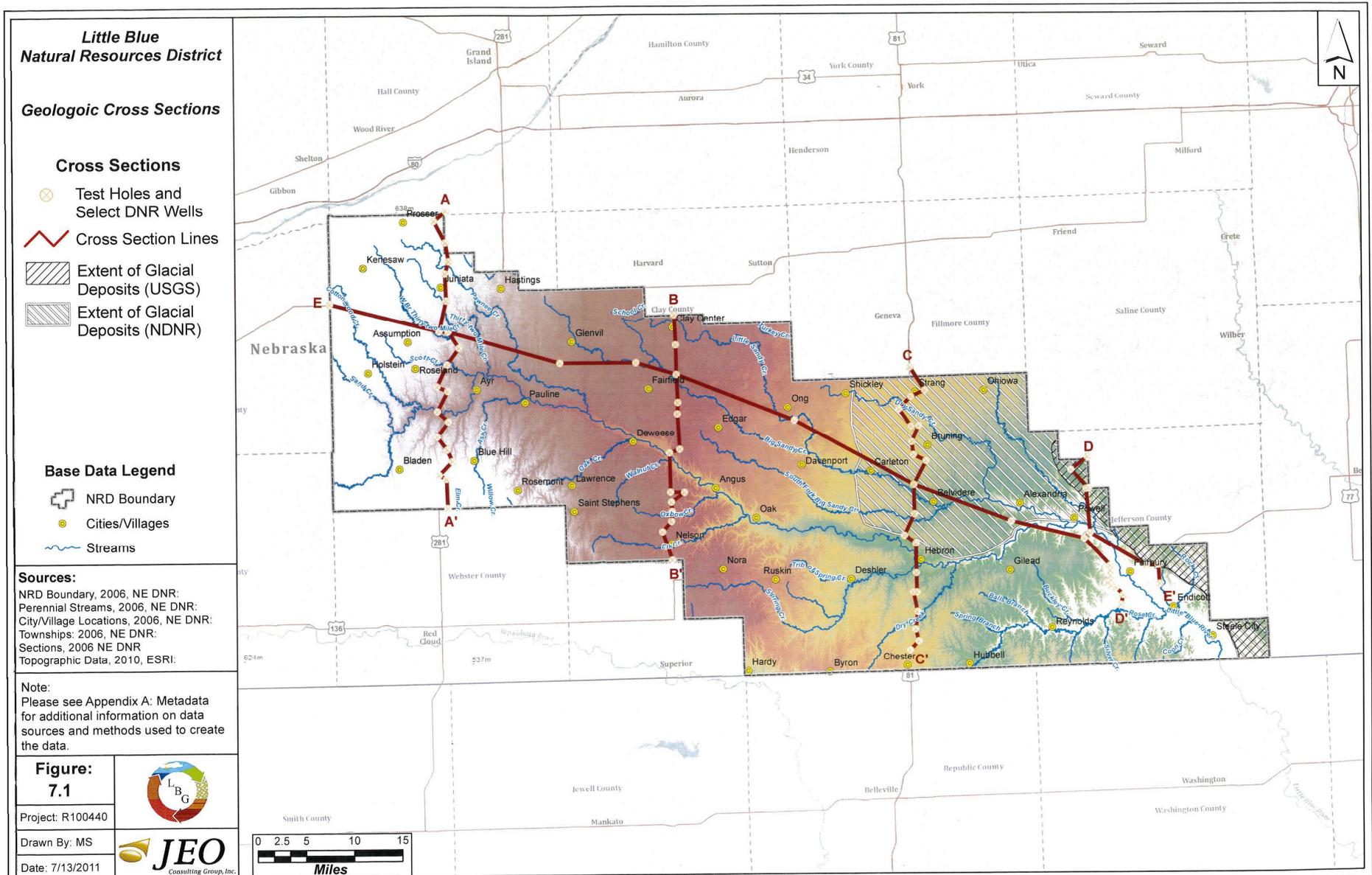
Interconnected Surface and Groundwater



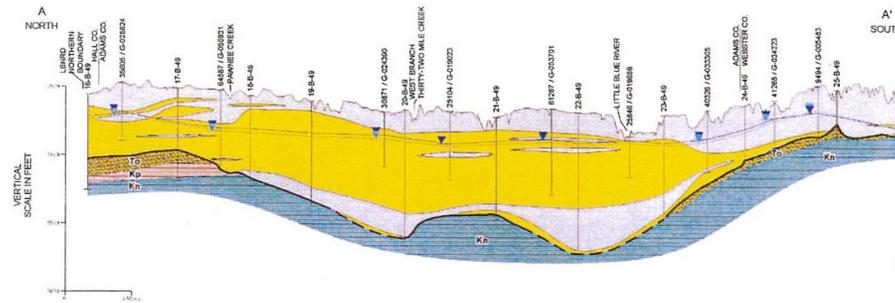
Aquifers of Little Blue NRD



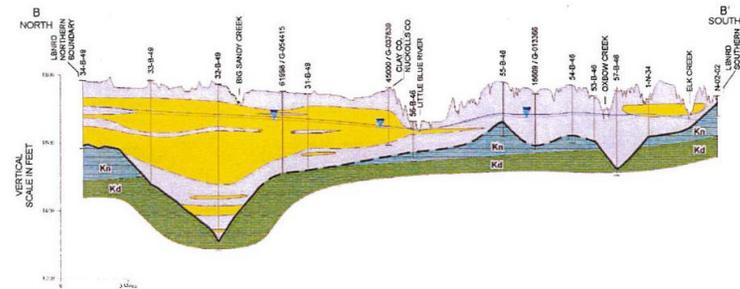
Geologic Cross-Sections



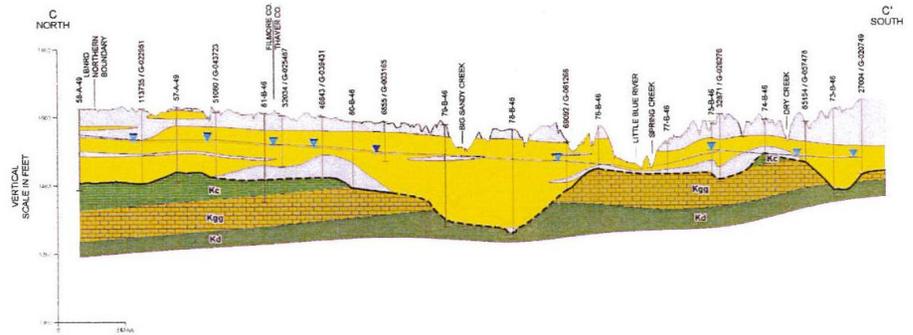
Center of Adams County



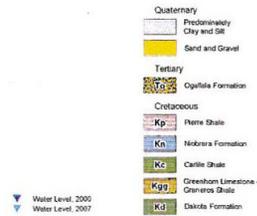
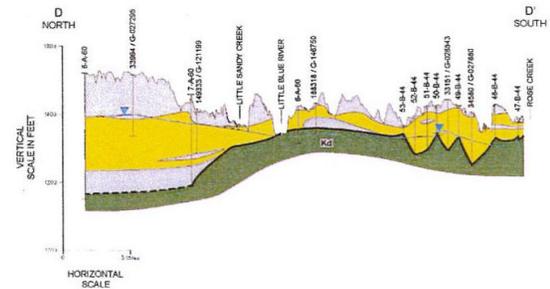
Center of Clay/Nuckolls County



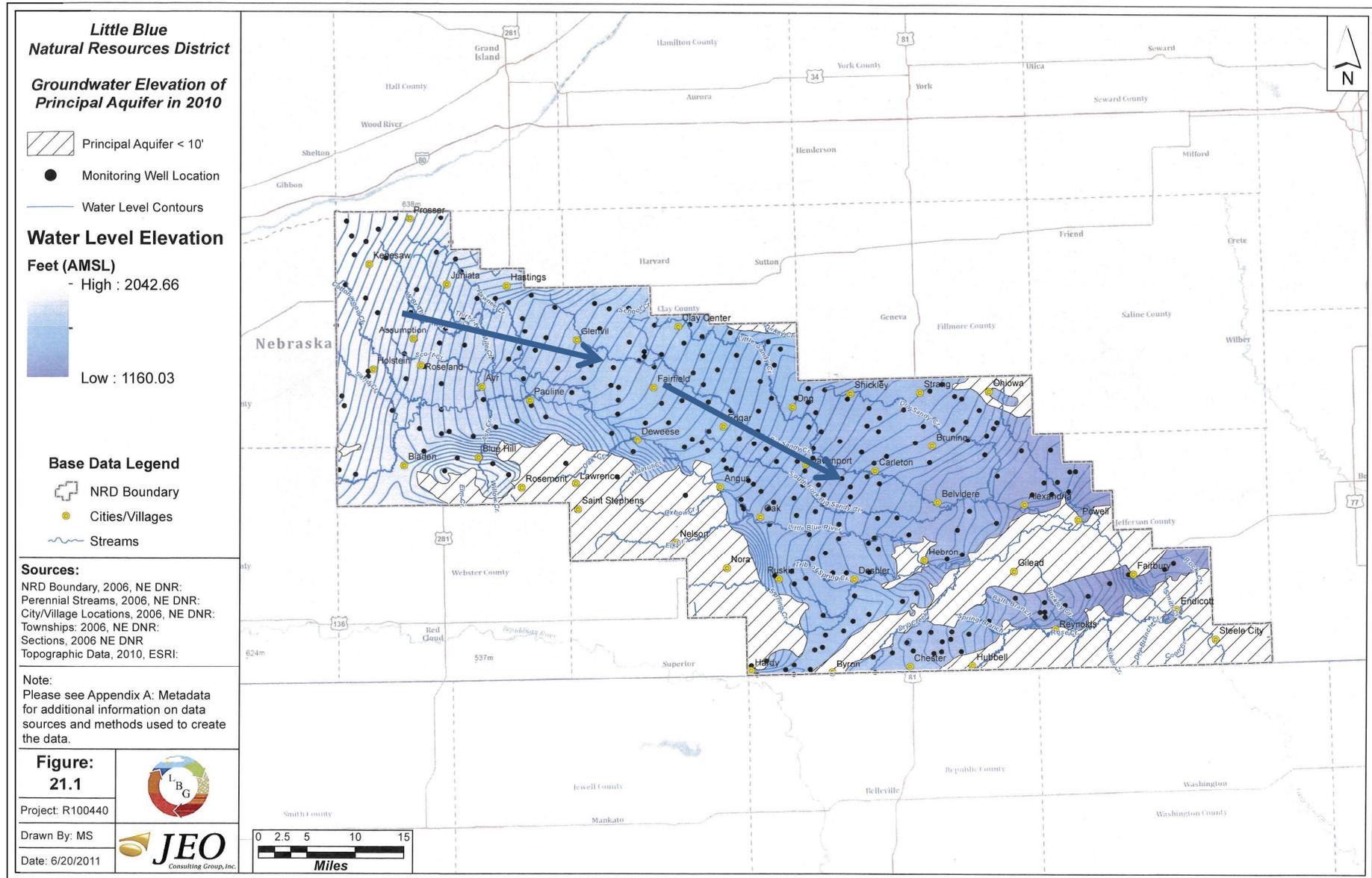
Center of Fillmore/Thayer County



Center of Jefferson County



Groundwater Elevations and Flow



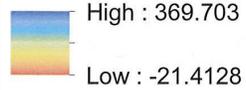
**Little Blue
Natural Resources District**

**Saturated Thickness of
Unconsolidated Sediments**

 Principal Aquifer < 10'

 Sediment Contours

**Saturated Thickness
Value**



Base Data Legend

-  NRD Boundary
-  Cities/Villages
-  Streams

Sources:

NRD Boundary, 2006, NE DNR;
Perennial Streams, 2006, NE DNR;
City/Village Locations, 2006, NE DNR;
Townships: 2006, NE DNR;
Sections, 2006 NE DNR
Topographic Data, 2010, ESRI;

Note:
Please see Appendix A: Metadata
for additional information on data
sources and methods used to create
the data.

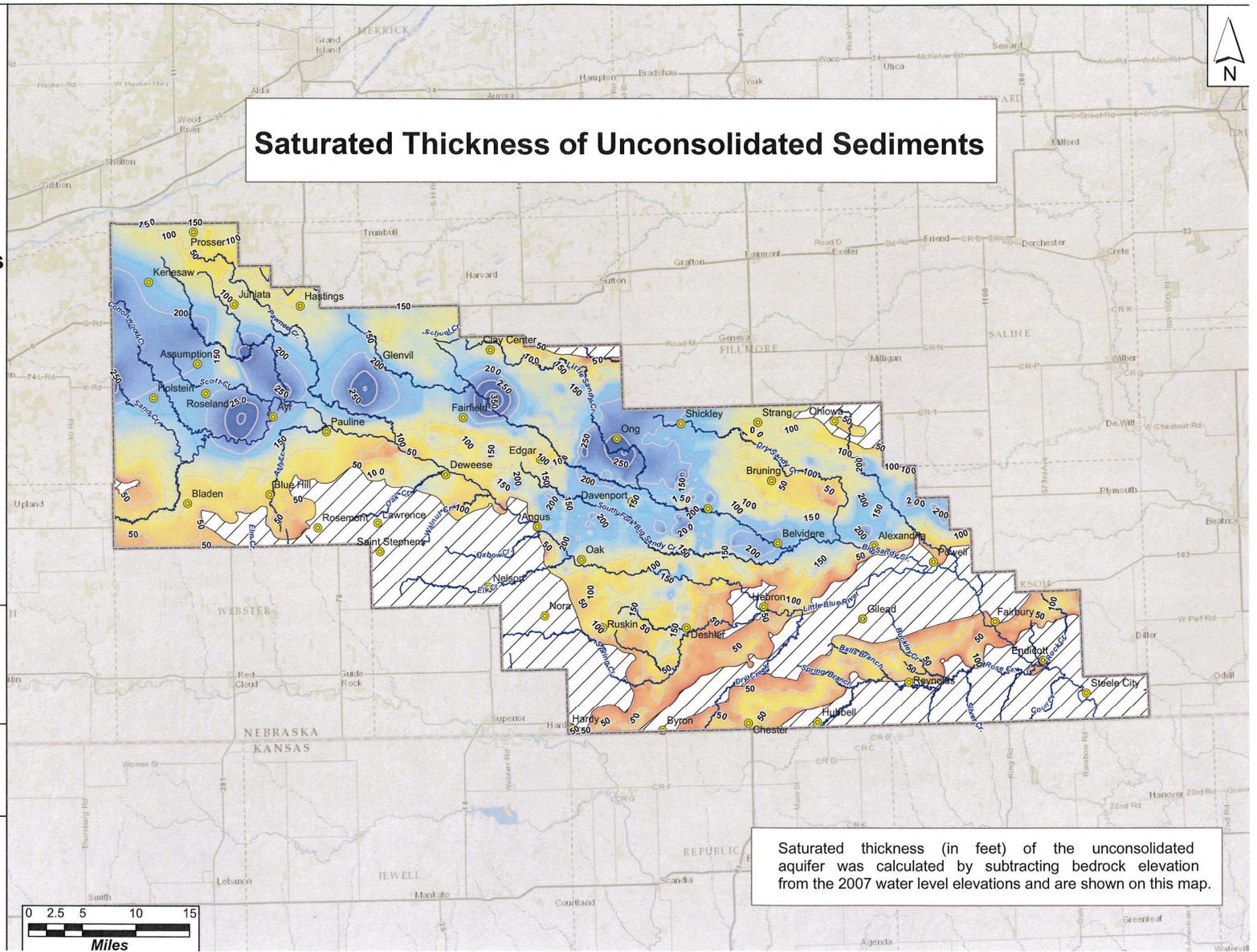
**Figure:
17.1**

Project: R100440

Drawn By: DA

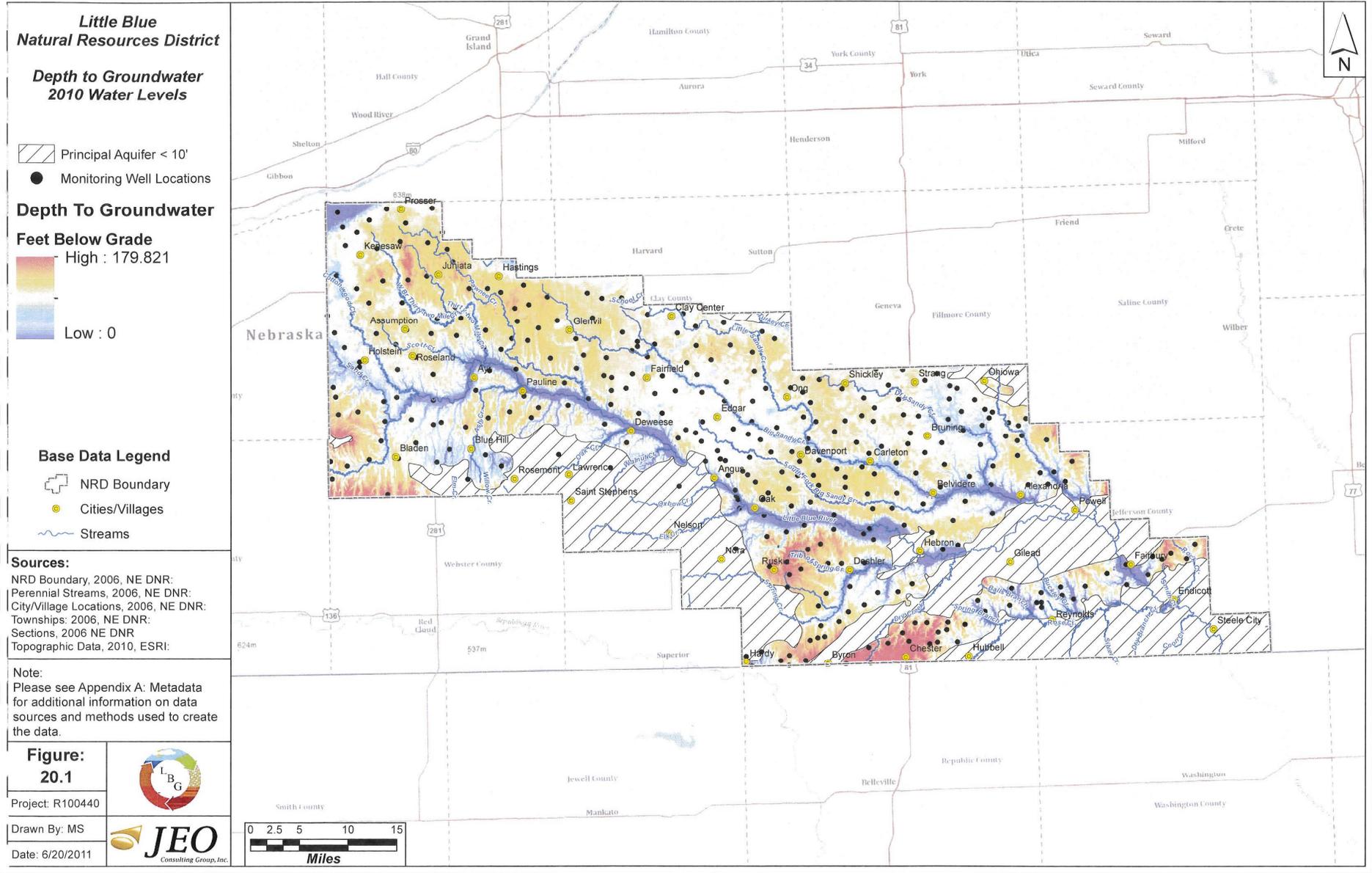
Date: 4/17/2012

Saturated Thickness of Unconsolidated Sediments

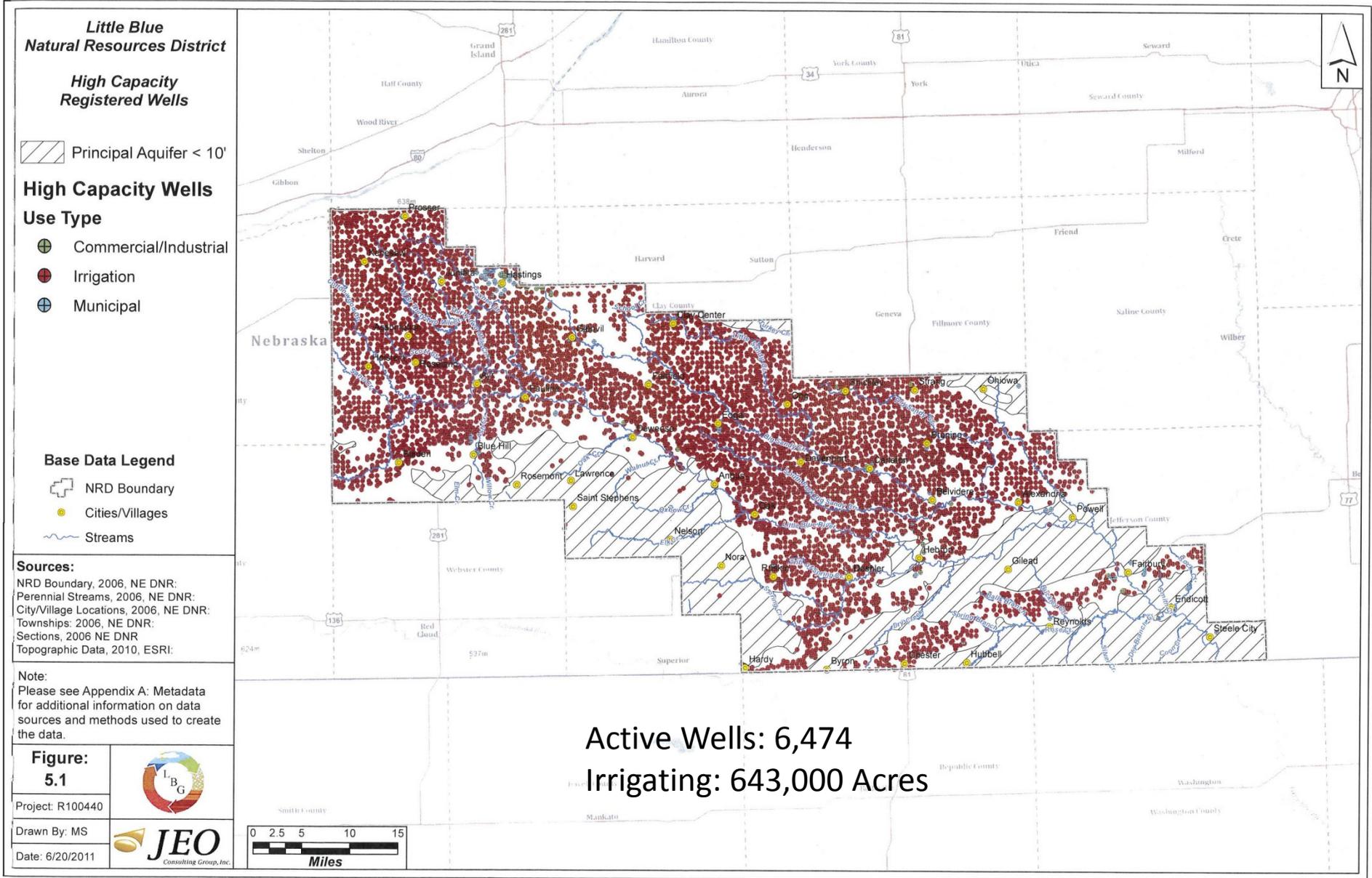


Saturated thickness (in feet) of the unconsolidated aquifer was calculated by subtracting bedrock elevation from the 2007 water level elevations and are shown on this map.

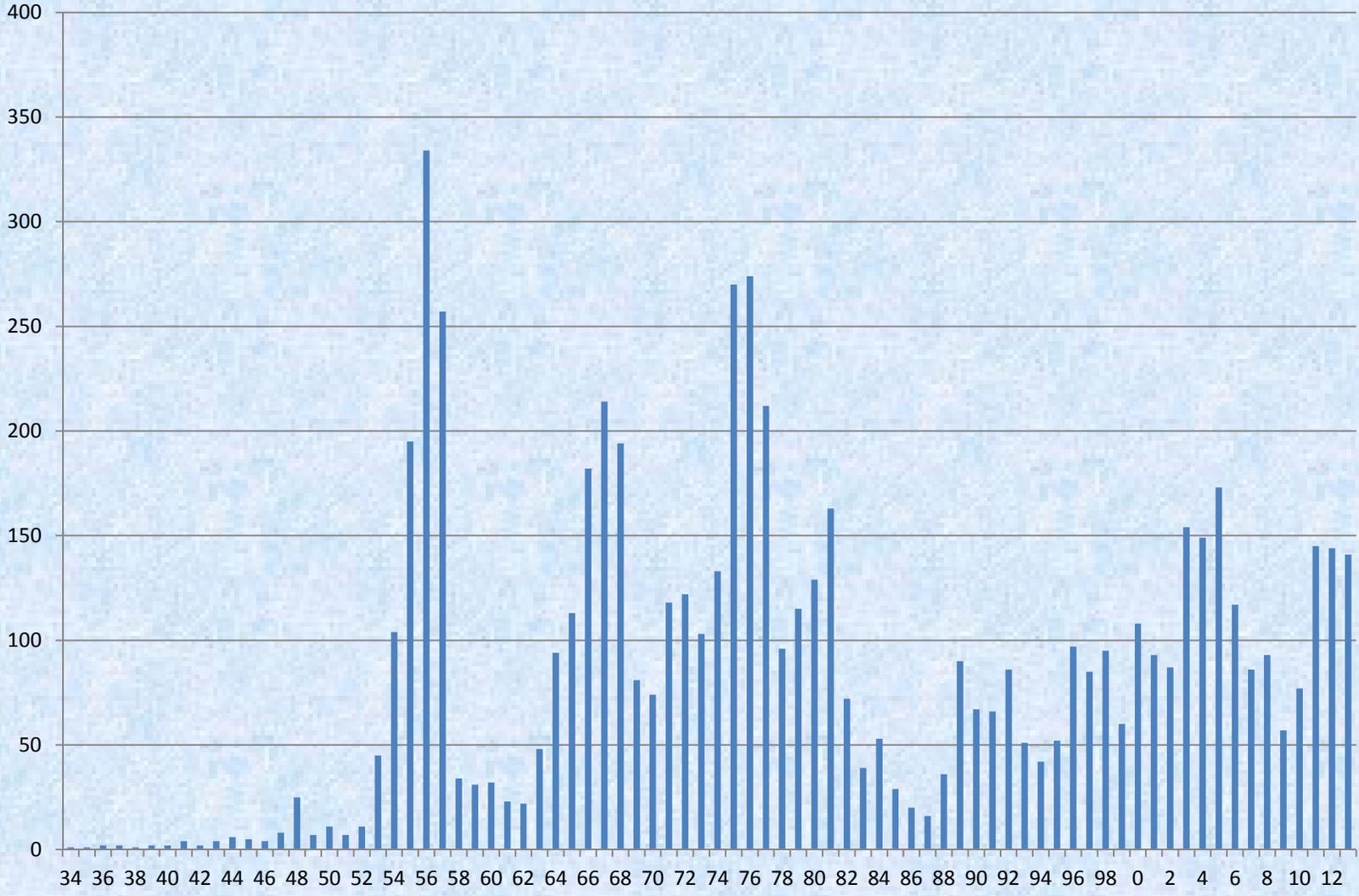
Depth to Groundwater



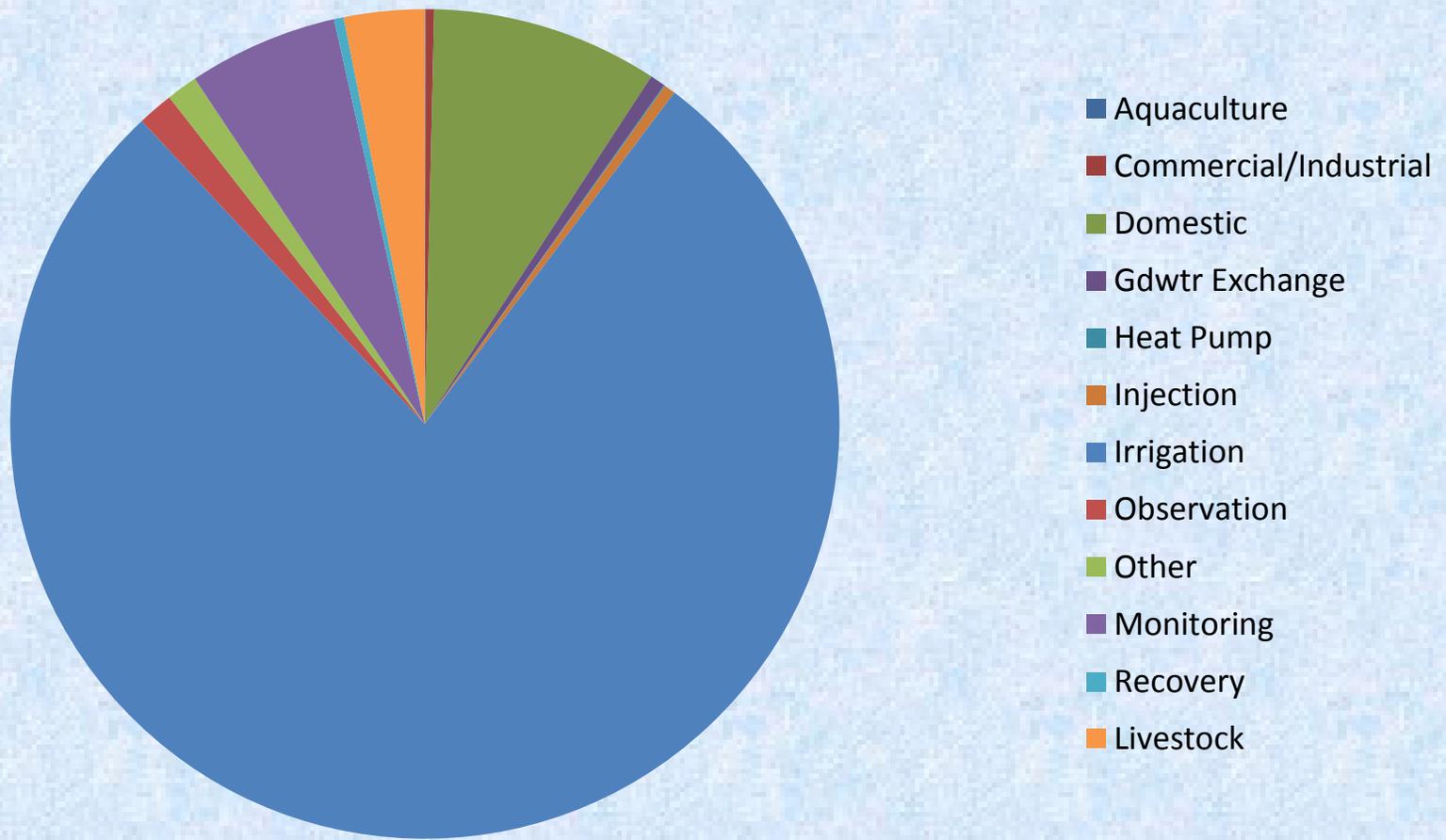
High Capacity Wells



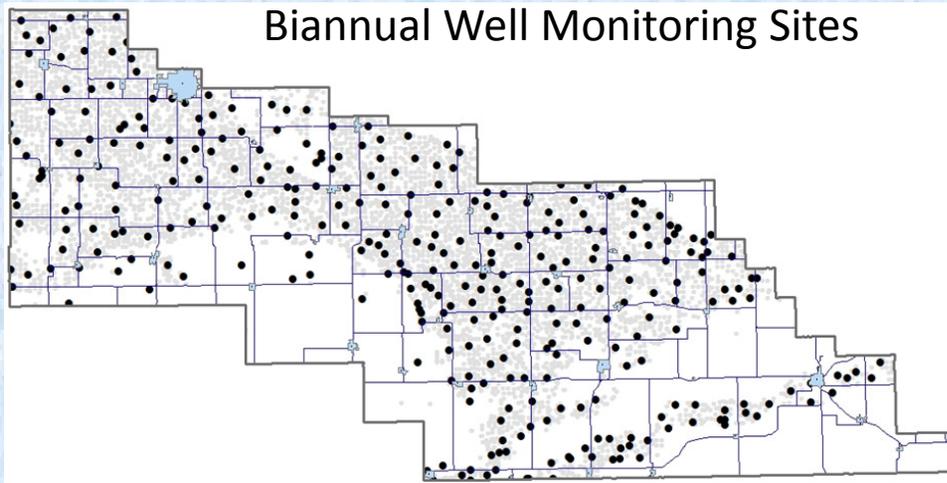
Irrigation Wells Registered Since 1934



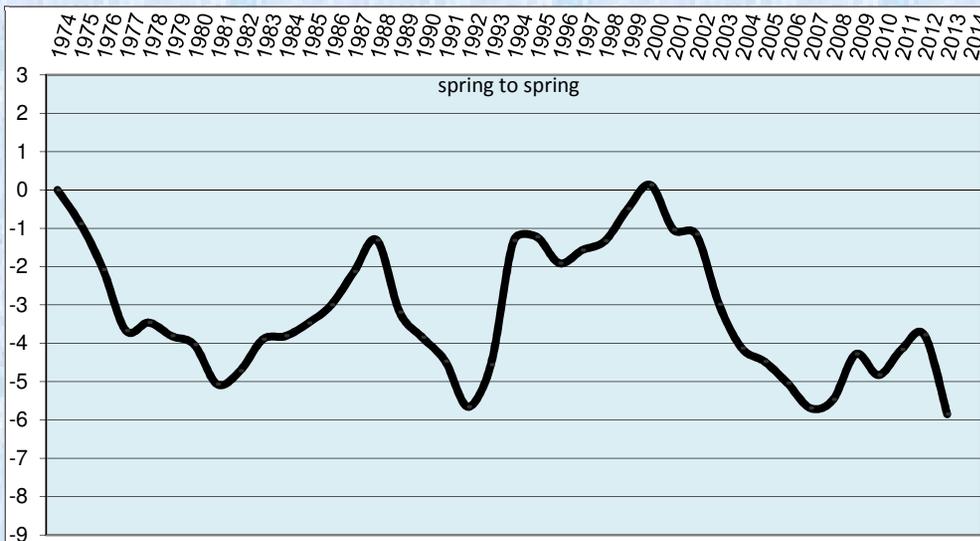
Registered Wells in Little Blue NRD



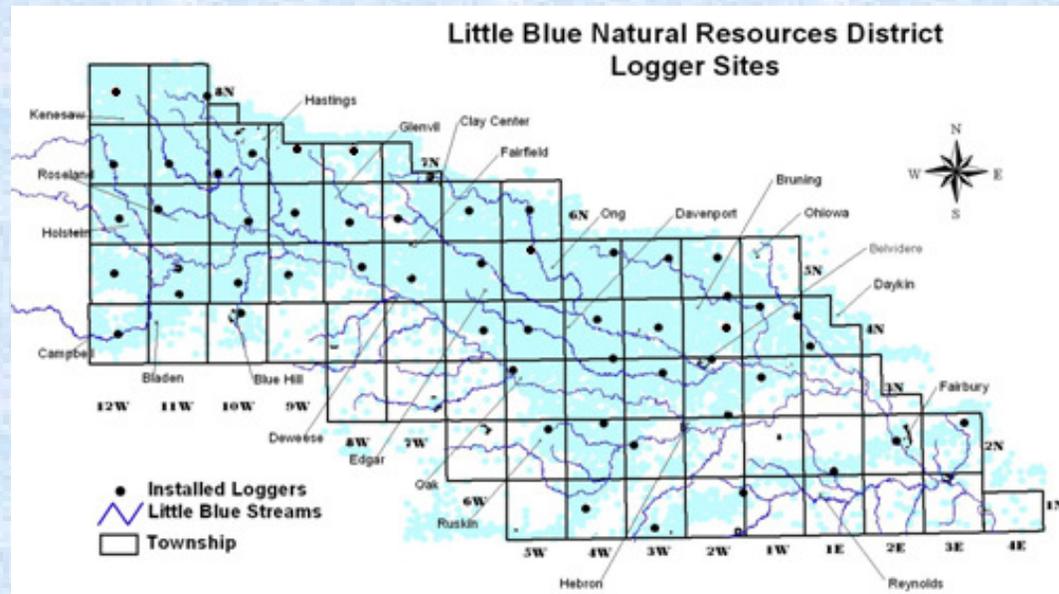
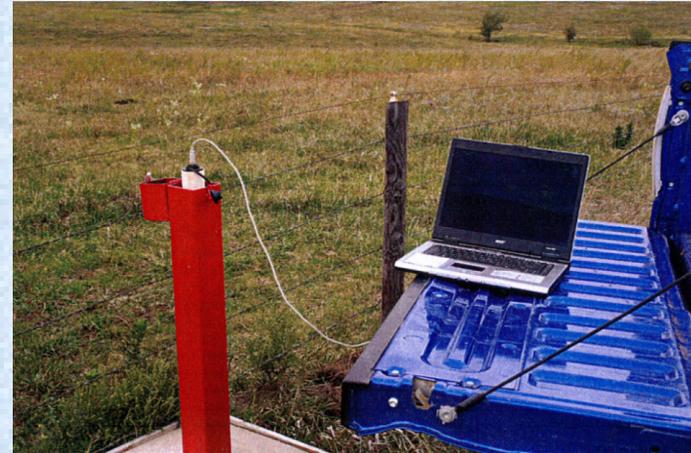
Groundwater Monitoring Critical



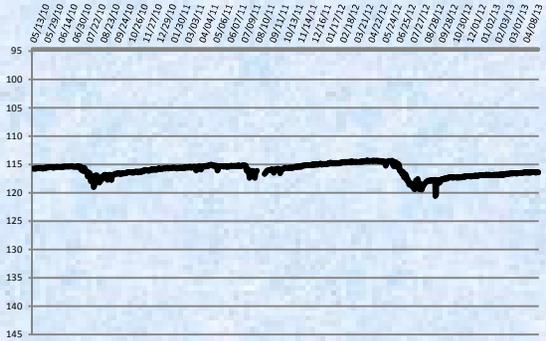
Historical Groundwater Level Trend



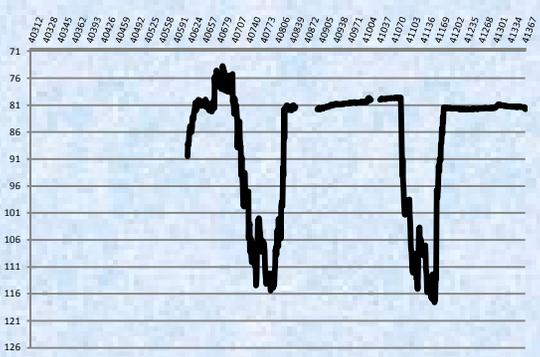
Dedicated Monitoring Wells



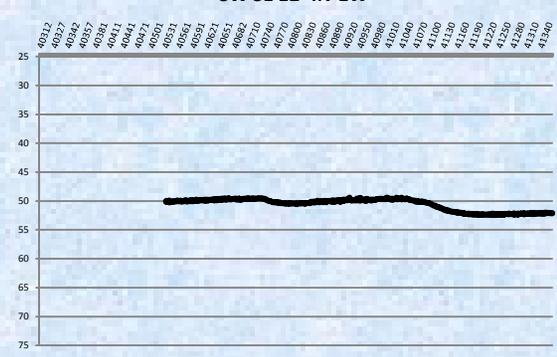
NW NE 23-7N-10W



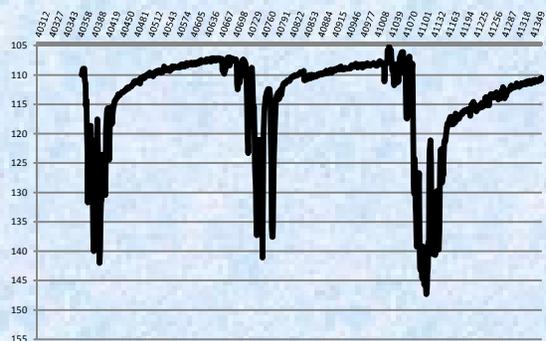
SE NE 35-7N-7W



SW SE 12-4N-1W



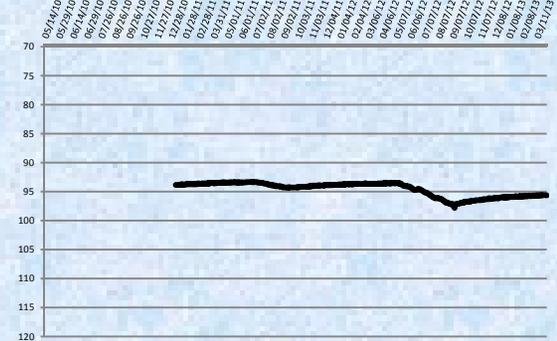
NE NW 21-5N-12W



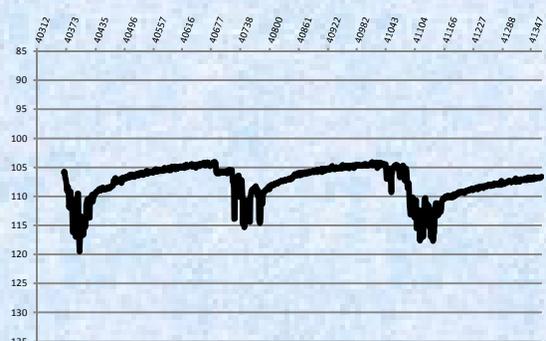
SE SE 16-6N-6W



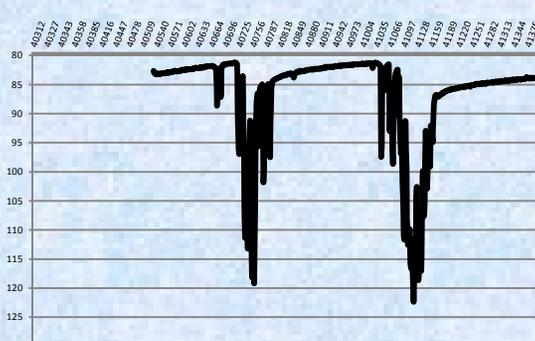
NE SW SE 35-3N-2W



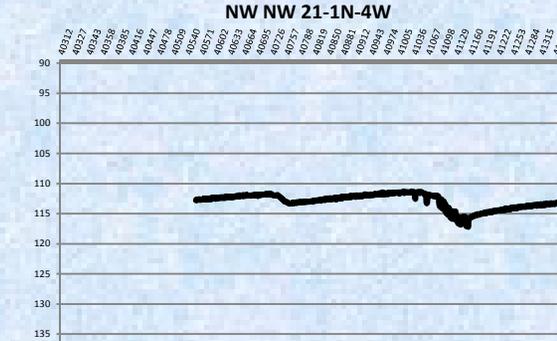
NW NW 2-4N-12W



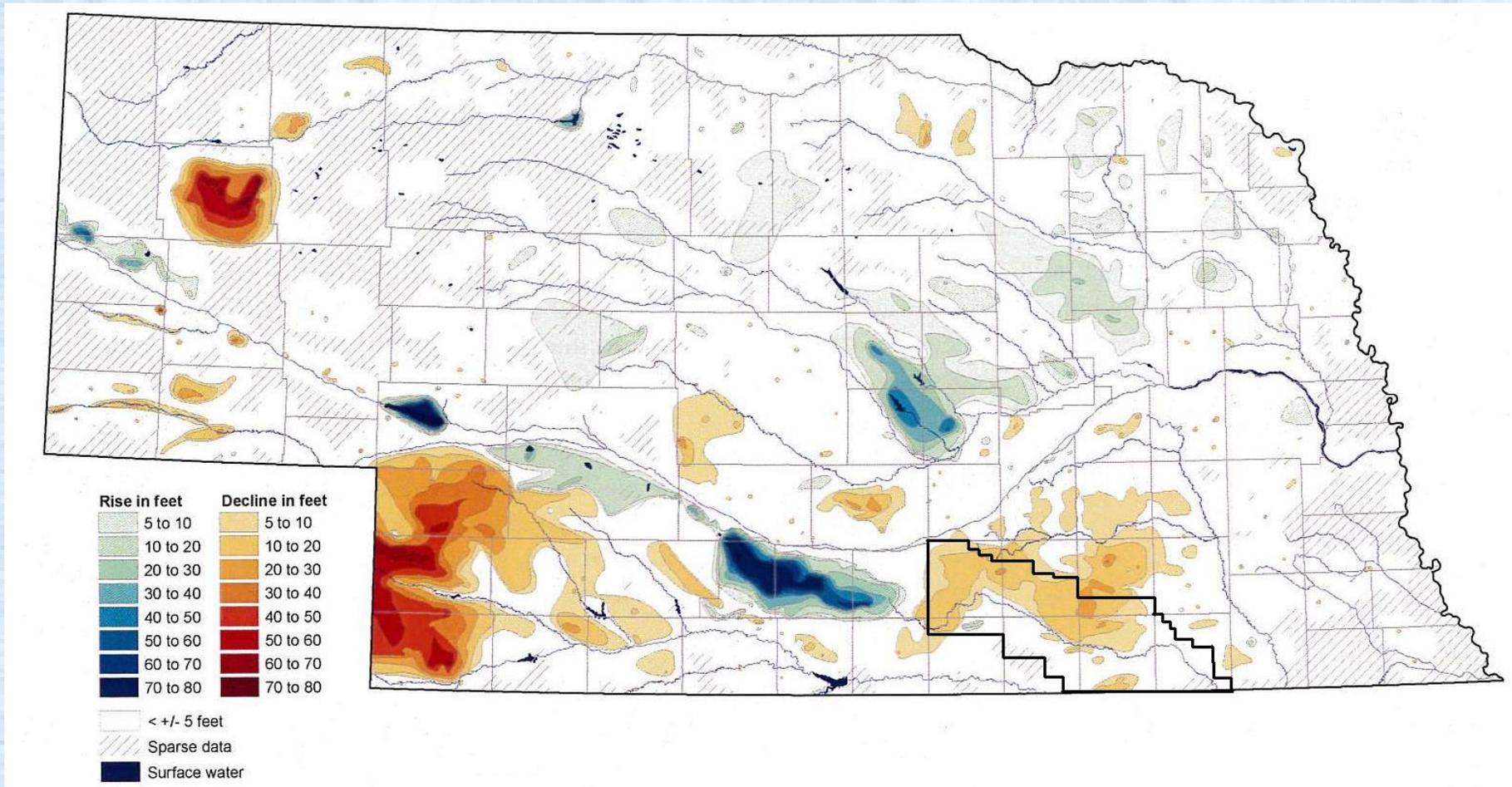
SW SE 16-4N-5W



NW NW 21-1N-4W

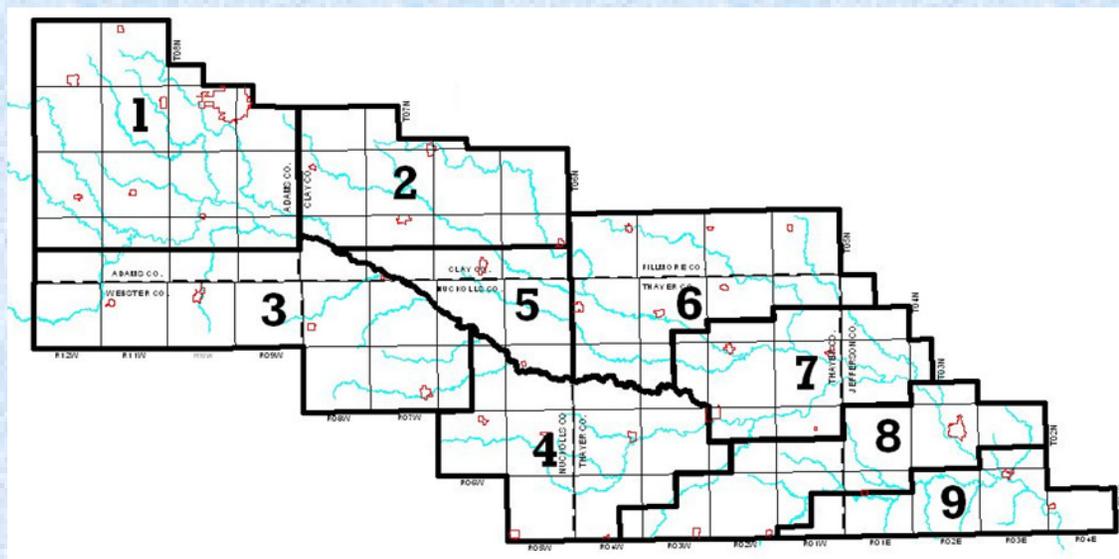


Groundwater Declines – Predevelopment to Spring 2012



Little Blue Groundwater Management Plan

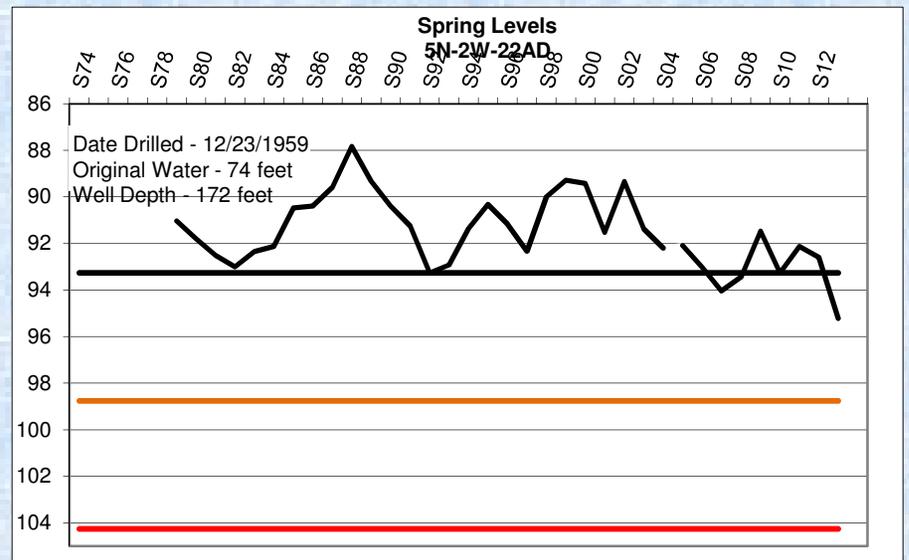
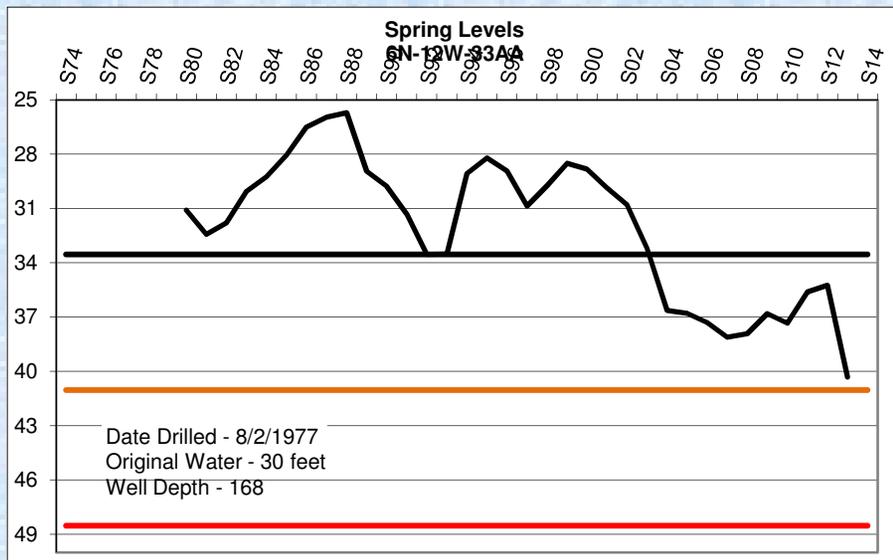
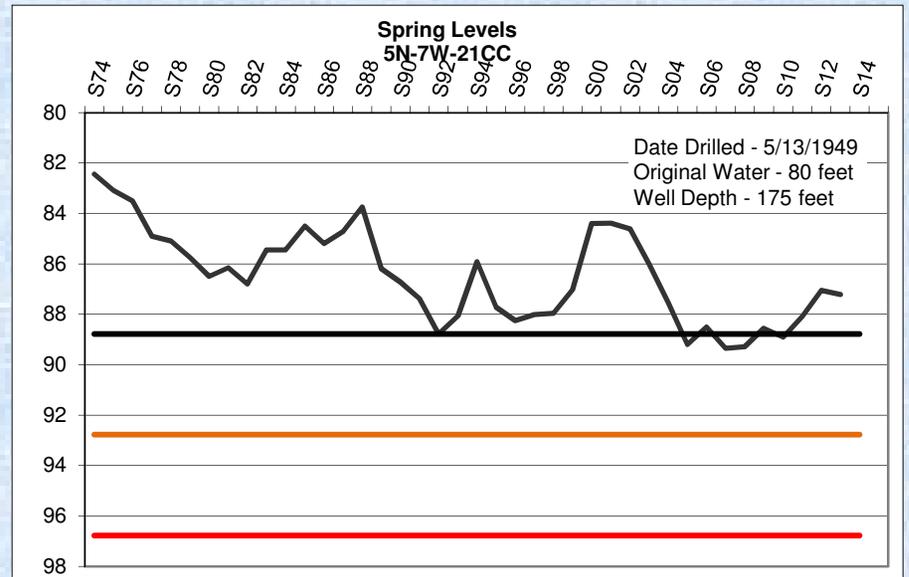
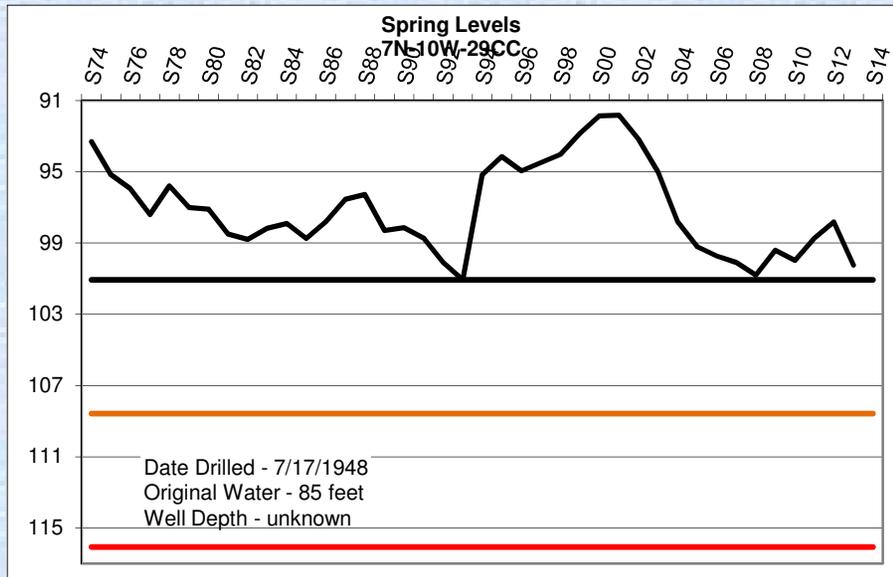
- Established aquifer regions
- NRD Monitors levels to assess relation to triggers
- Established acceptable declines and groundwater level triggers for each region



Associated Reasonable Acceptable Decline Chart

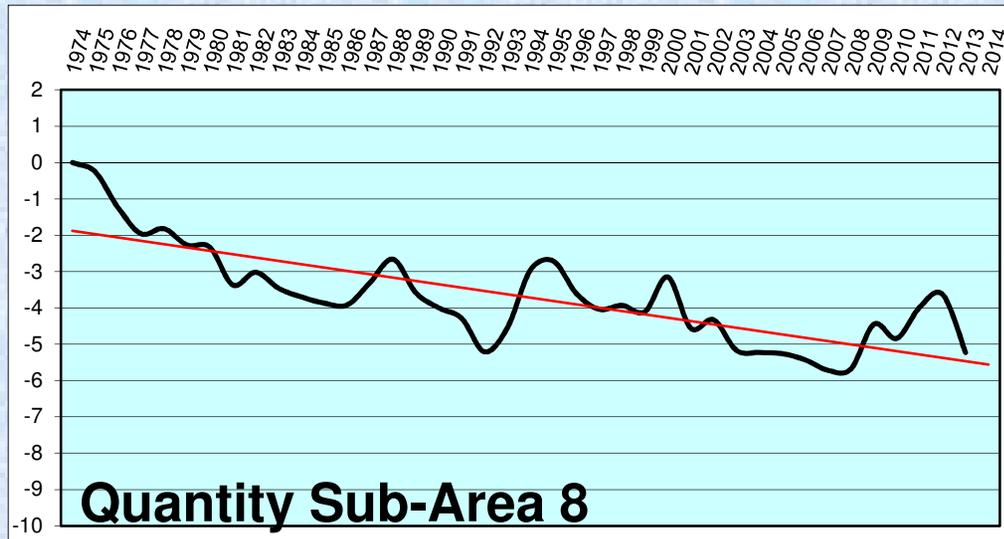
When declines occur in the associated hydro-geologic sub-areas which meet the triggers below, actions to meter and allocate water would be imposed respectively.

Sub-Area	Ave. Pre-Devel. Sat. AQUI.	Ave. 1992 Sat. AQUI.	Ave. Approx. Pump Drawdown	NRD Allowable Usage	Reasonable Acceptable Decline 1	% of Wells Allowed to Decline
1	155	148	14 ft.	10%	15 ft.	80%
2	135	121	21 ft.	10%	12 ft.	80%
3	90	86	30 ft.	10%	9 ft.	80%
4	70	65	20 ft.	10%	7 ft.	80%
5	92	80	27 ft.	10%	8 ft.	80%
6	125	110	21 ft.	10%	11 ft.	80%
7	135	130	17 ft.	10%	13 ft.	80%
8	70	65	15 ft.	5%	3 ft.	40%
9	N.A. 2					



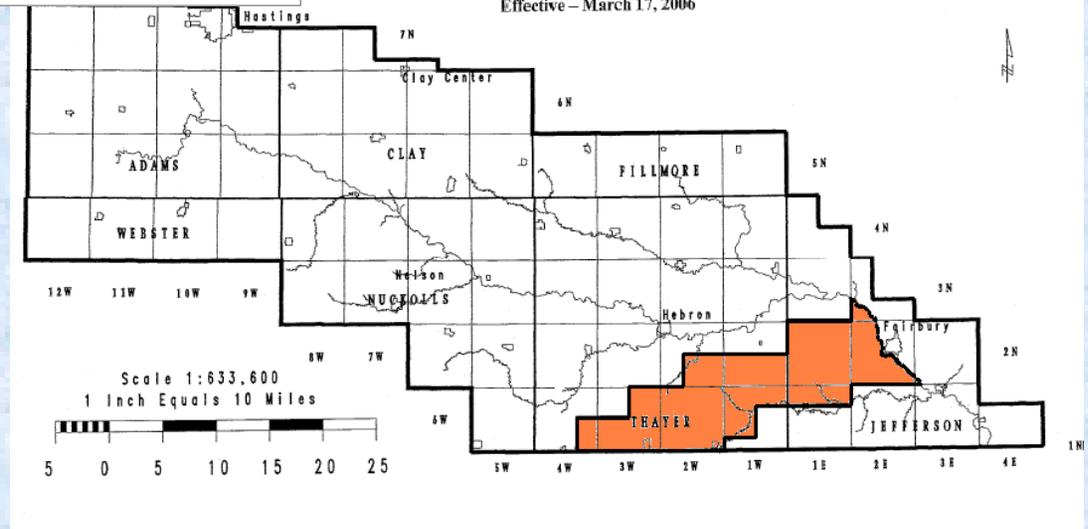
Sub-Unit 8

Moratorium on Wells and New Acres

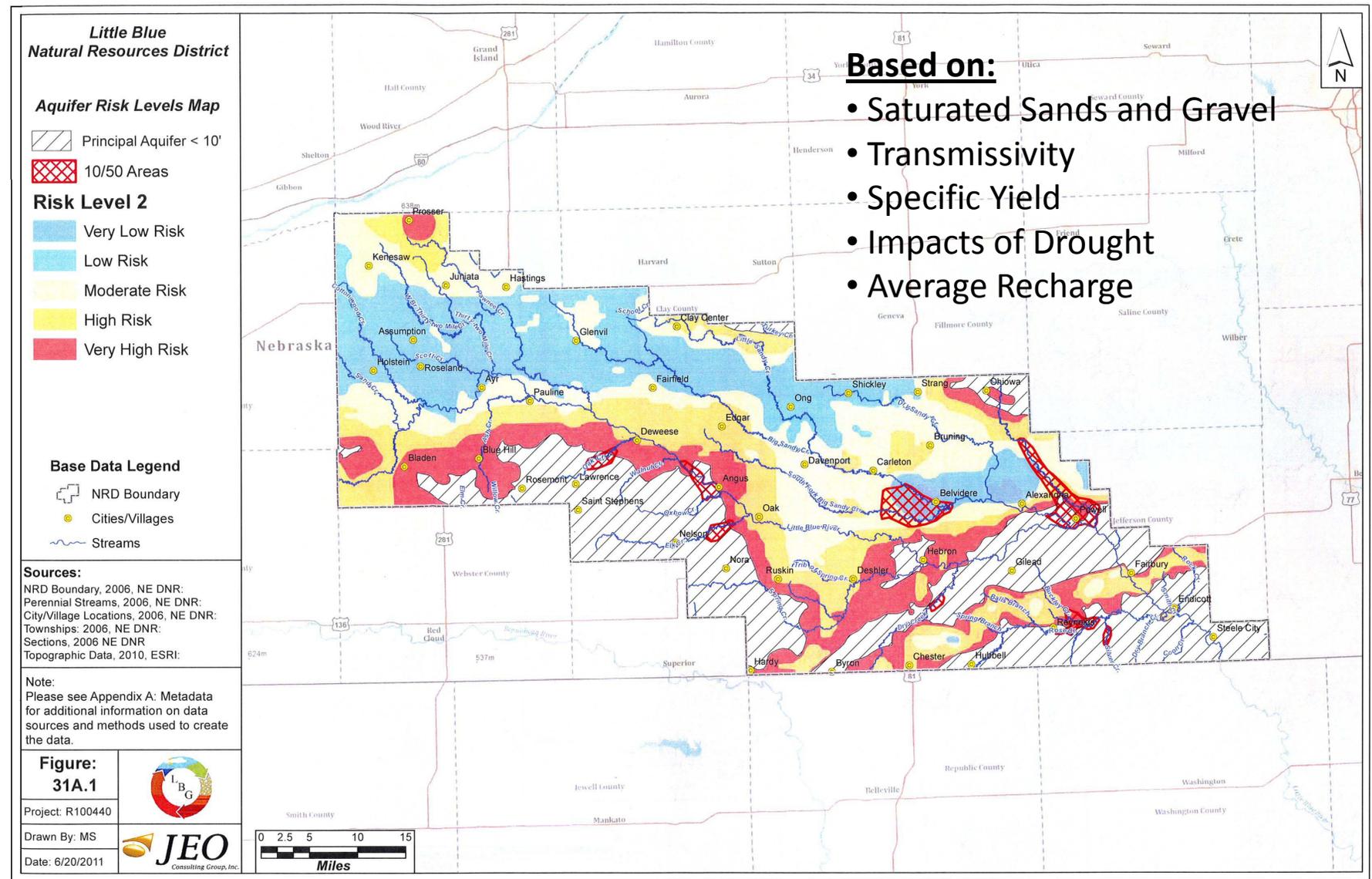


LITTLE BLUE NATURAL RESOURCES DISTRICT
STAY ON WELL PERMITS, HIGH CAPACITY
WELL DEVELOPMENT AND IRRIGATED ACRES
Effective - March 17, 2006

Stay Impacts 127,000 Acres



Hydro-Geologic Aquifer Risk Map



**Little Blue
Natural Resources District**

Aquifer Risk Levels Map

 Principal Aquifer < 10'

 10/50 Areas

Risk Level 2

-  Very Low Risk
-  Low Risk
-  Moderate Risk
-  High Risk
-  Very High Risk

Base Data Legend

-  NRD Boundary
-  Cities/Villages
-  Streams
-  Townships
-  Sections

Sources:

NRD Boundary, 2006, NE DNR;
Perennial Streams, 2006, NE DNR;
City/Village Locations, 2006, NE DNR;
Townships: 2006, NE DNR;
Sections, 2006 NE DNR
Topographic Data, 2010, ESRI;

Note:

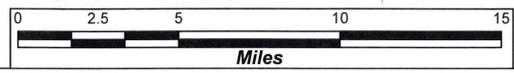
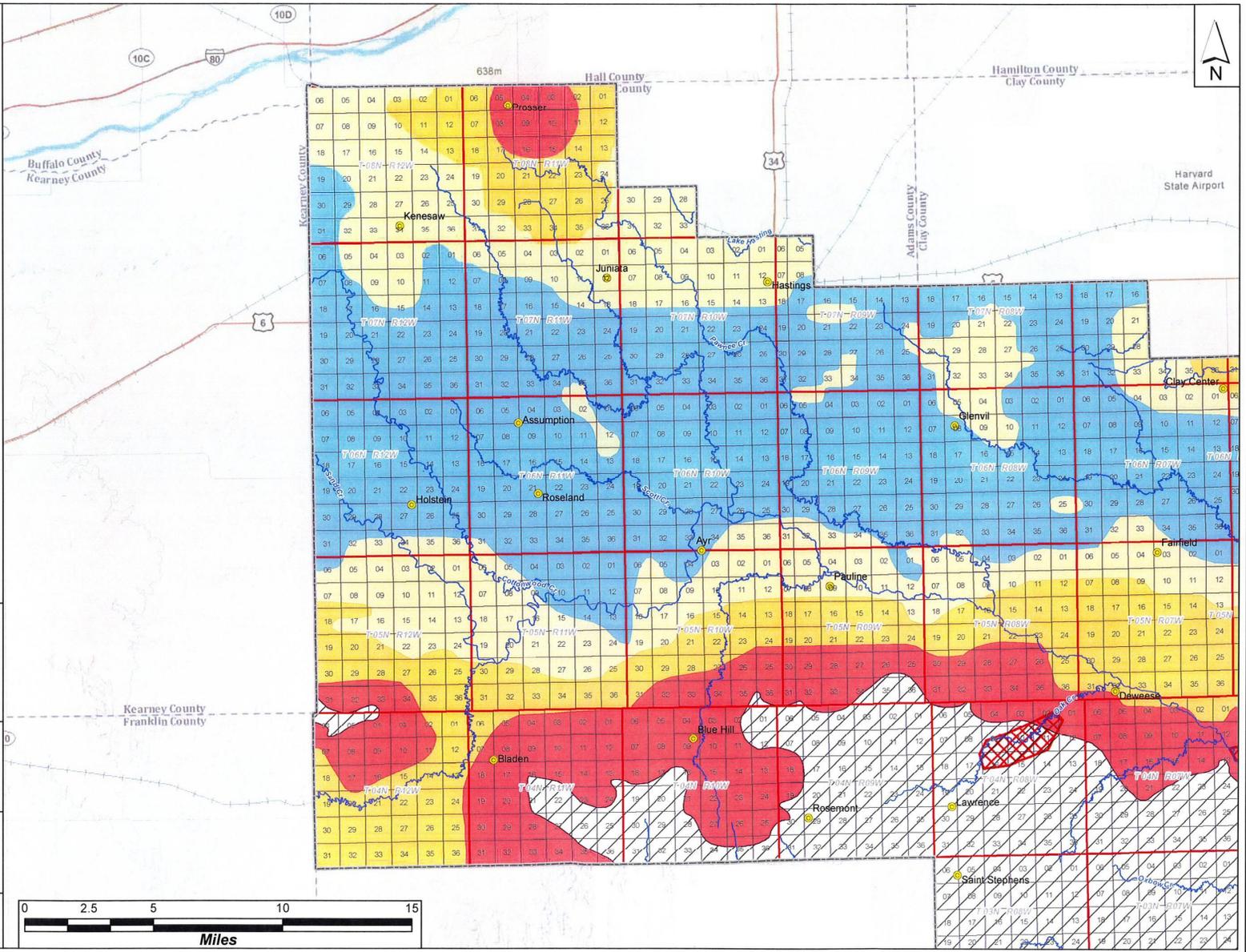
Please see Appendix A: Metadata for additional information on data sources and methods used to create the data.

**Figure:
31A.2**

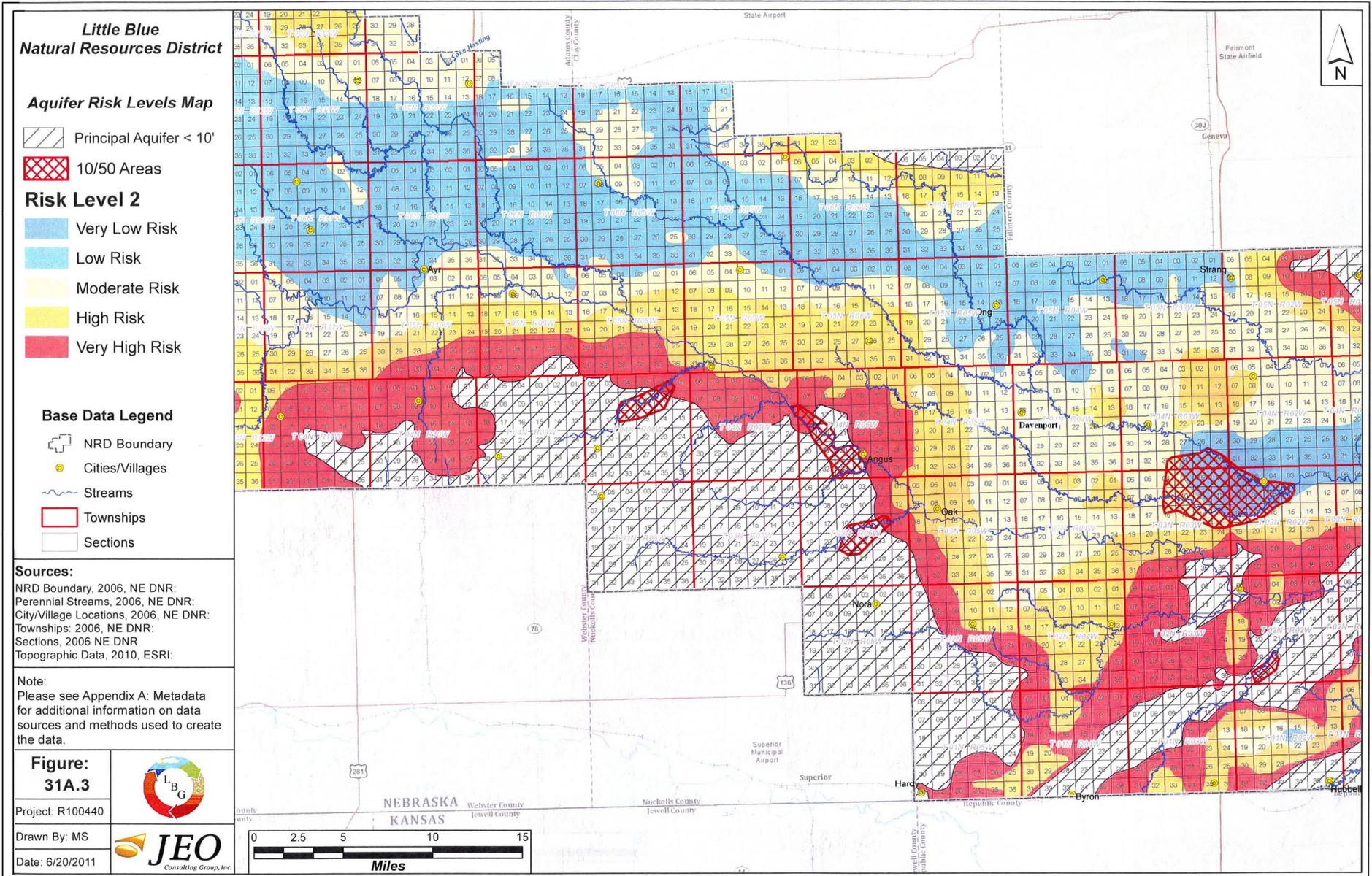
Project: R100440

Drawn By: MS

Date: 6/20/2011



Concerns of Irrigated Impacts on Dryland Areas



Approach to Wells Permits in High Risk Areas

- New Irrigation Wells and Developments
 - Score of aquifer characteristics
 - Score of soils irrigation suitability
 - Projects must meet minimum standards of conditions are applied:
 - Conservation Farm Plan Implementation (NRCS)
 - Water Flow Meter
 - Multiple seasonal recordings of gpm
 - Year end reports
 - Irrigation Scheduling using Soil Moisture Probes

Example:

Tract in Thayer County

E½ 20-2N-3W

Soil Number	Soils Value	Acres	Field Value	
3561	241.81	51.95	12562.01	Hobbs silt loam, occasionally flooded
3839	25.85	13.99	361.68	Geary silty clay loam, 11 to 30 percent slopes
3840	32.52	28.93	940.80	Geary silty clay loam, 7 to 11 percent slopes, eroded
3841	25.24	7.50	189.33	Geary silty clay loam, 11 to 30 percent slopes, severely eroded
3866	91.04	2.20	200.28	Hastings silt loam, 1 to 3 percent slopes
3869	32.18	0.21	6.76	Hastings silt loam, 7 to 11 percent slopes
3870	42.98	15.23	654.62	Hastings silty clay loam, 3 to 7 percent slopes
3955	31.91	17.00	542.49	Geary silty clay loam, 7 to 11 percent slopes
3969	36.14	0.05	1.81	Hastings soils, eroded
Totals		137.06	15459.78	
		Field Score	112.80	

Aquifer Parameter	Value	Points	Permit Ranking	Score
T	285528	100	2680	0.94
Sy	24.499	100	4.56	18.61
Sat San	223.594	100	13.06	5.84
WL~	-15.8	25	-1.57	-2.48
Recharge	15	25	11.01	18.35
			Aquifer Score	41.26



Average Water Use – 112,172 Acres

Crop Year	Total Acres	Water Applied		
		Gravity	Pivot	All Acres
1999	115,115	15.7	10.1	11.4
2000	100,354	17.0	11.1	13.6
2001	102,525	13.9	8.2	10.6
2002	107,143	19.9	13.6	16.5
2003	110,216	16.9	10.3	12.8
2004	112,005	13.1	7.6	10.4
2005	119,498	13.5	8.5	10.7
2006	123,005	13.0	7.8	10.0
2007	112,916	10.6	6.8	7.9
2008	109,313	7.3	4.4	5.2
2009	115,285	13.5	7.5	8.8
2010	113,945	9.1	5.4	6.2
2011	114,542	8.2	4.9	5.9
2012	114,542	16.8	11.9	12.1
Average	112,172	13.5	8.4	10.2

Water Management Programs and Education



Needs

- Evaluation of Groundwater Management Plan
Aquifers and Triggers
- Assessment of Cause and Impacts of Water
Use
- Investigations into Impacts of Water Use on
Dryland Areas

Water Quality Issues

**Little Blue
Natural Resources District**

**2001-2010 Nitrate Levels
in Principal Aquifer**

 Principal Aquifer < 10'

Sampling Results

mg/L

-  0.2 - 4.0
-  4.01 - 8.0
-  8.01 - 12.0
-  12.01 - 16.0
-  16.01 - 34.0

Base Data Legend

-  NRD Boundary
-  Cities/Villages
-  Streams

Sources:

NRD Boundary, 2006, NE DNR:
Perennial Streams, 2006, NE DNR:
City/Village Locations, 2006, NE DNR:
Townships, 2006, NE DNR:
Sections, 2006, NE DNR:
Topographic Data, 2010, ESRI:

Note:

Please see Appendix A: Metadata
for additional information on data
sources and methods used to create
the data.

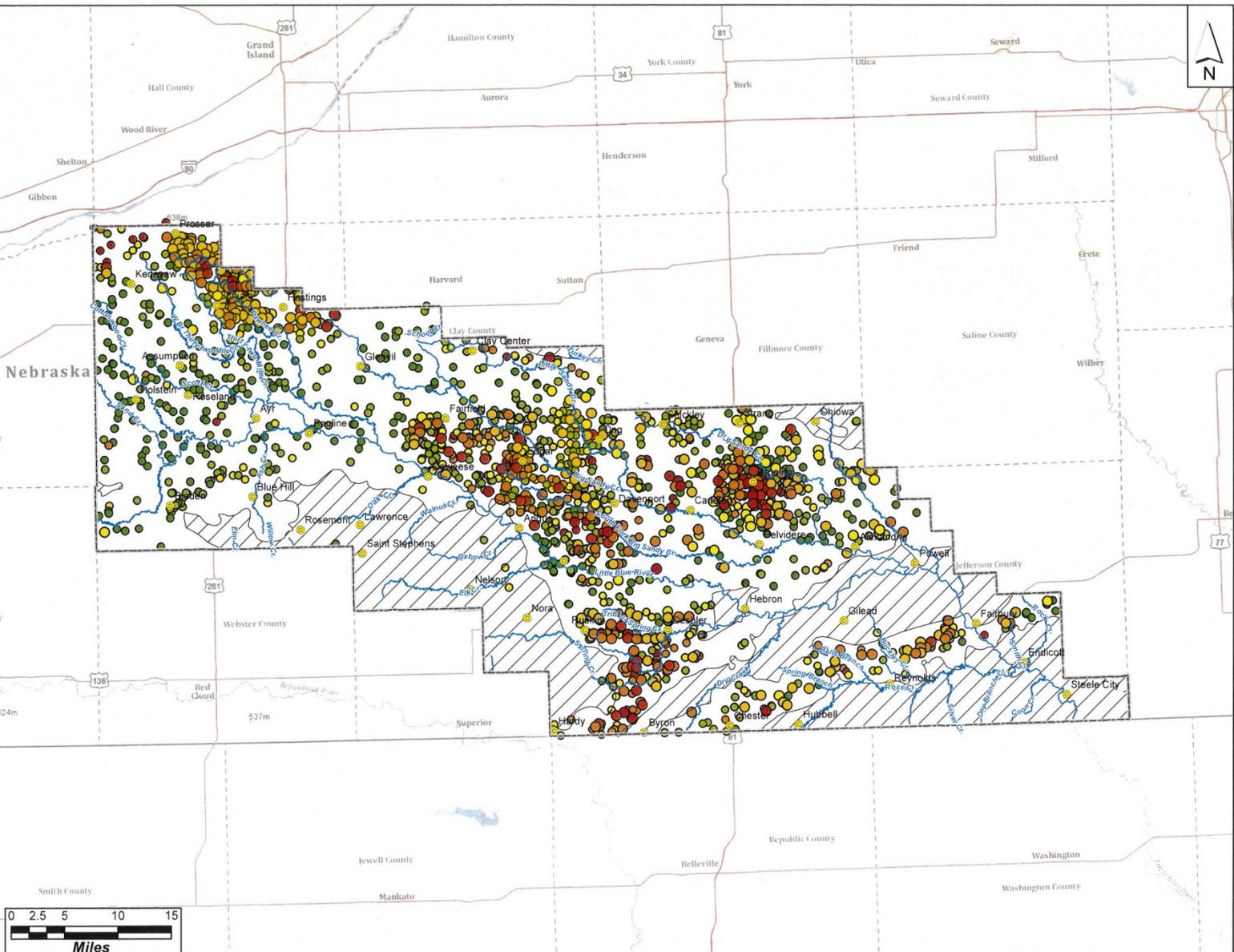
**Figure:
28.1**



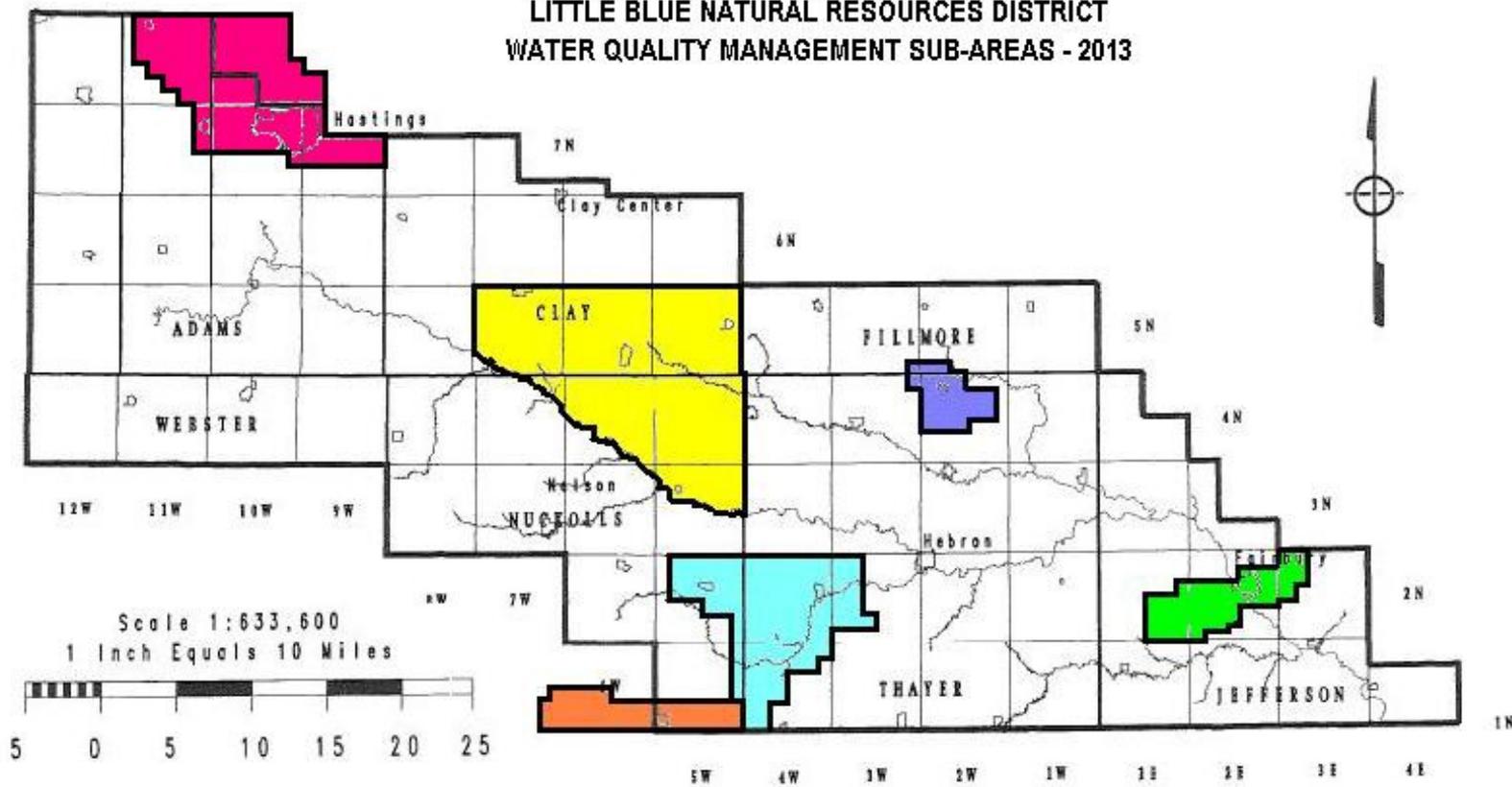
Project: R100440

Drawn By: MS

Date: 7/22/2011



**LITTLE BLUE NATURAL RESOURCES DISTRICT
WATER QUALITY MANAGEMENT SUB-AREAS - 2013**



- | | |
|---|--|
|  Hastings Wellhead Protection Area |  Byron-Deshler-Ruskin Sub-Area |
|  Clay-Nuckolls County Sub-Area |  Superior-Hardy Sub-Area |
|  Bruning Sub-Area |  Fairbury Wellhead Protection Area |

All Areas Encompass Approximately 250,000 Acres

Water Quality Sub-Area - Triggers

- Level I – Entire District
- Level II
 - 70% of the MCL (Nitrate is 10 PPM)
 - 60% of the Monitored Wells
- Level III
 - 85% of the MCL
 - 60% of the Monitored Wells
- Level IV
 - 100% of the MCL
 - 60% of the Monitored Wells

District Wide Rules

Level 1

- The Entire District is in Level 1
- No Fall Fertilizing before November 1
- No Liquid or Dry Nitrogen Fertilizer applied between November 1st and March 1st without nitrogen inhibitor.

Water Quality Level II

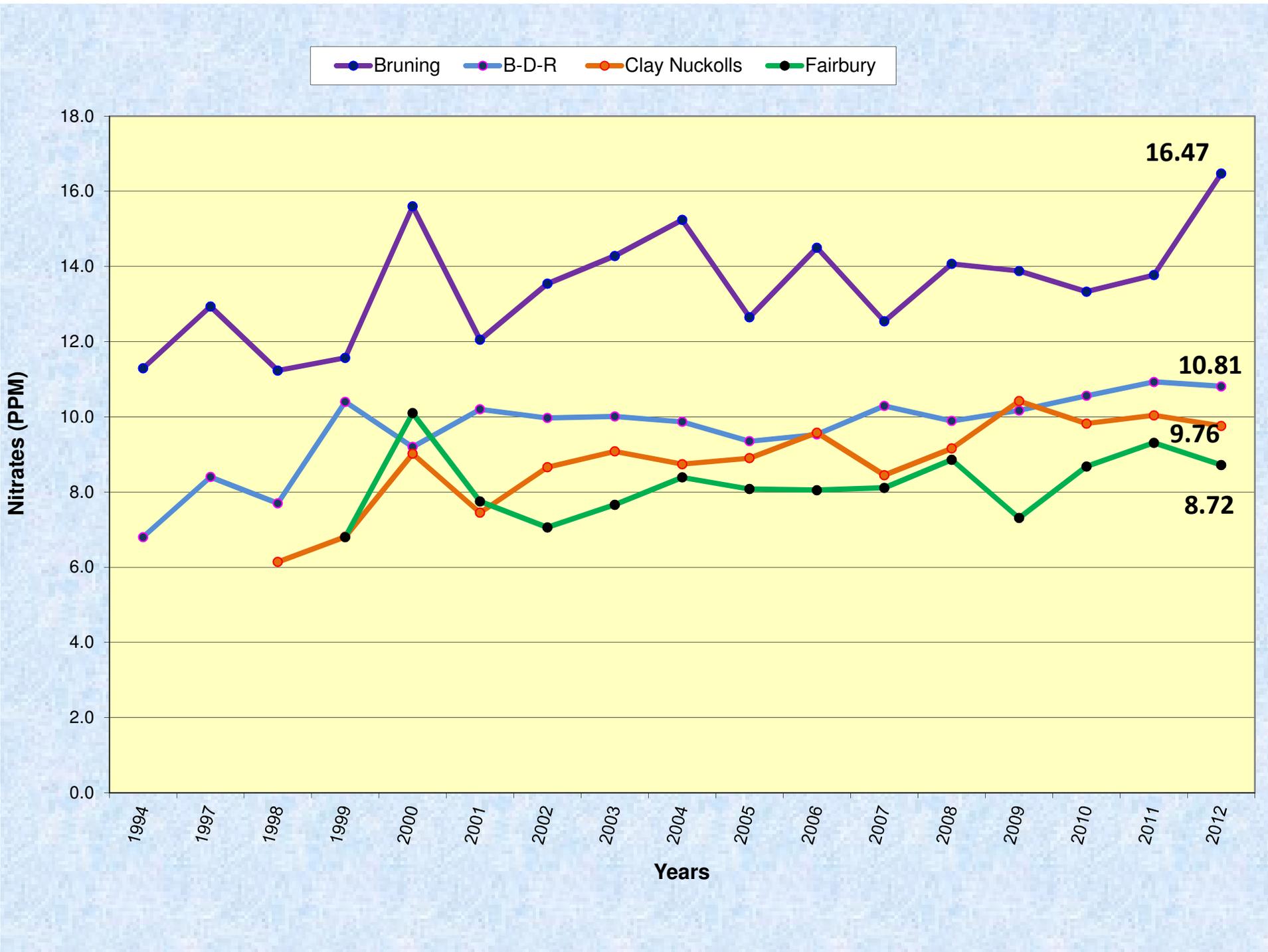
- Operator Training every 4 years
- Establishment of “Demonstration Field”
- Soil Sampling is required on Demo Field if adding nitrogen fertilizer
- Irrigation Scheduling is required on Demo Field
- Annual report required on Demo Field

Level III

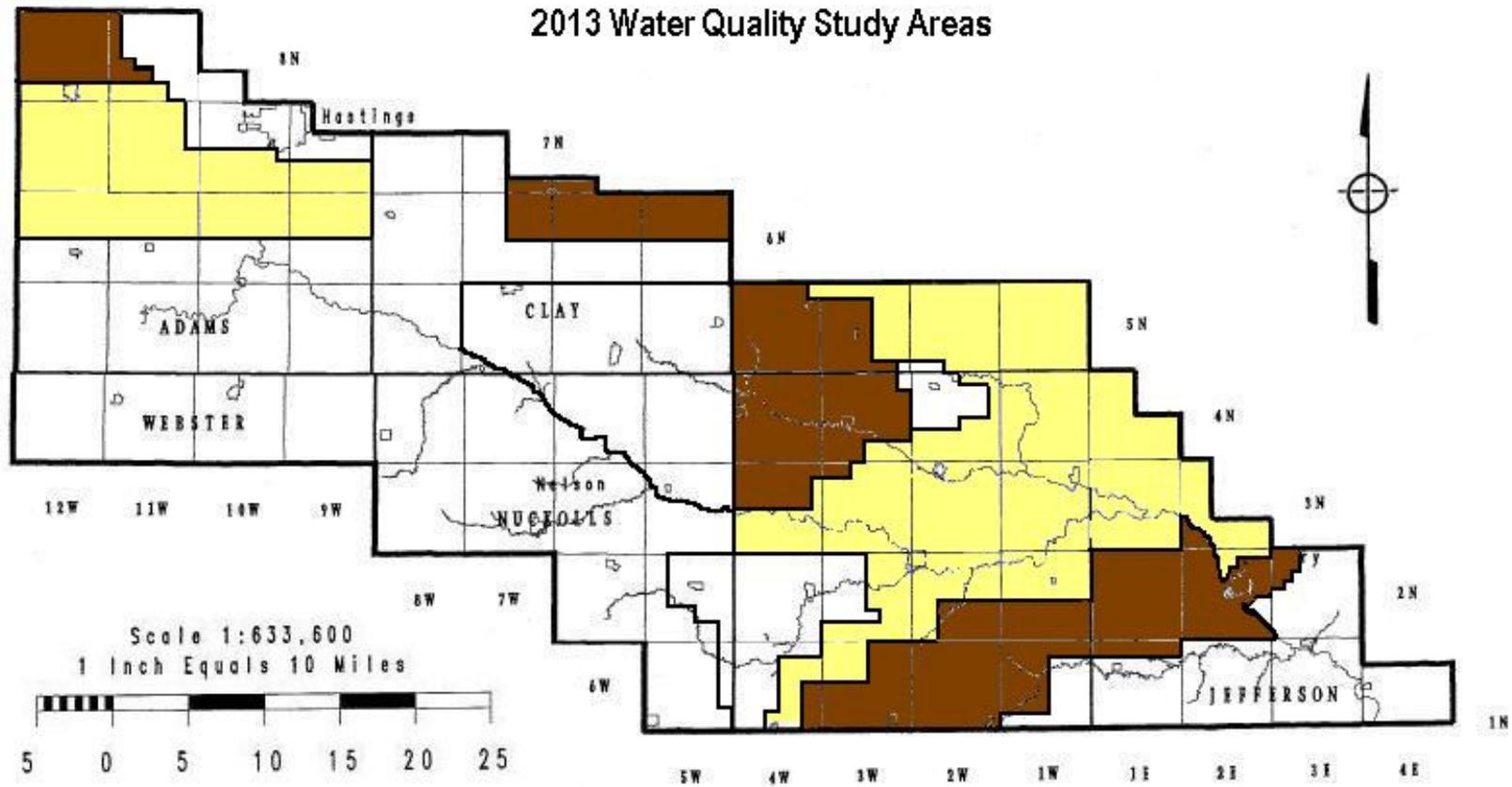
- Annual Soil Sampling on all fields
- Encourage water analysis for nitrogen
- Irrigation Scheduling on all fields
- Annual Report on all fields

Level IV

- No application of Nitrogen fertilizer before January 1st.
- Follow nitrogen fertilizer recommendations, including all credits.



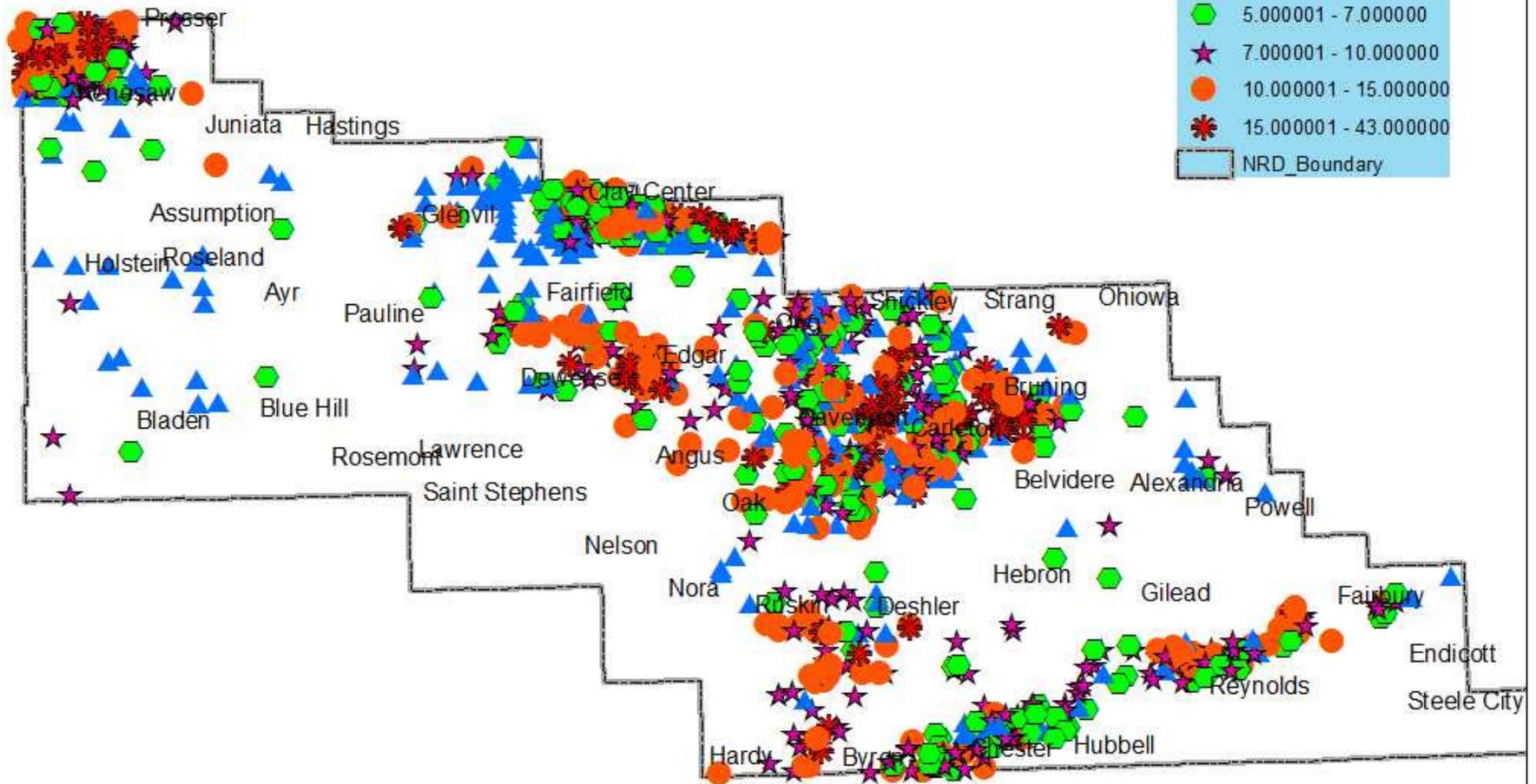
2013 Water Quality Study Areas



Little Blue NRD 2012 Nitrate Results

2012 Nitrate Results

NITRATE_RE



Drinking Water Standard is 10 PPM

EDGAR WELLHEAD PROTECTION AREA

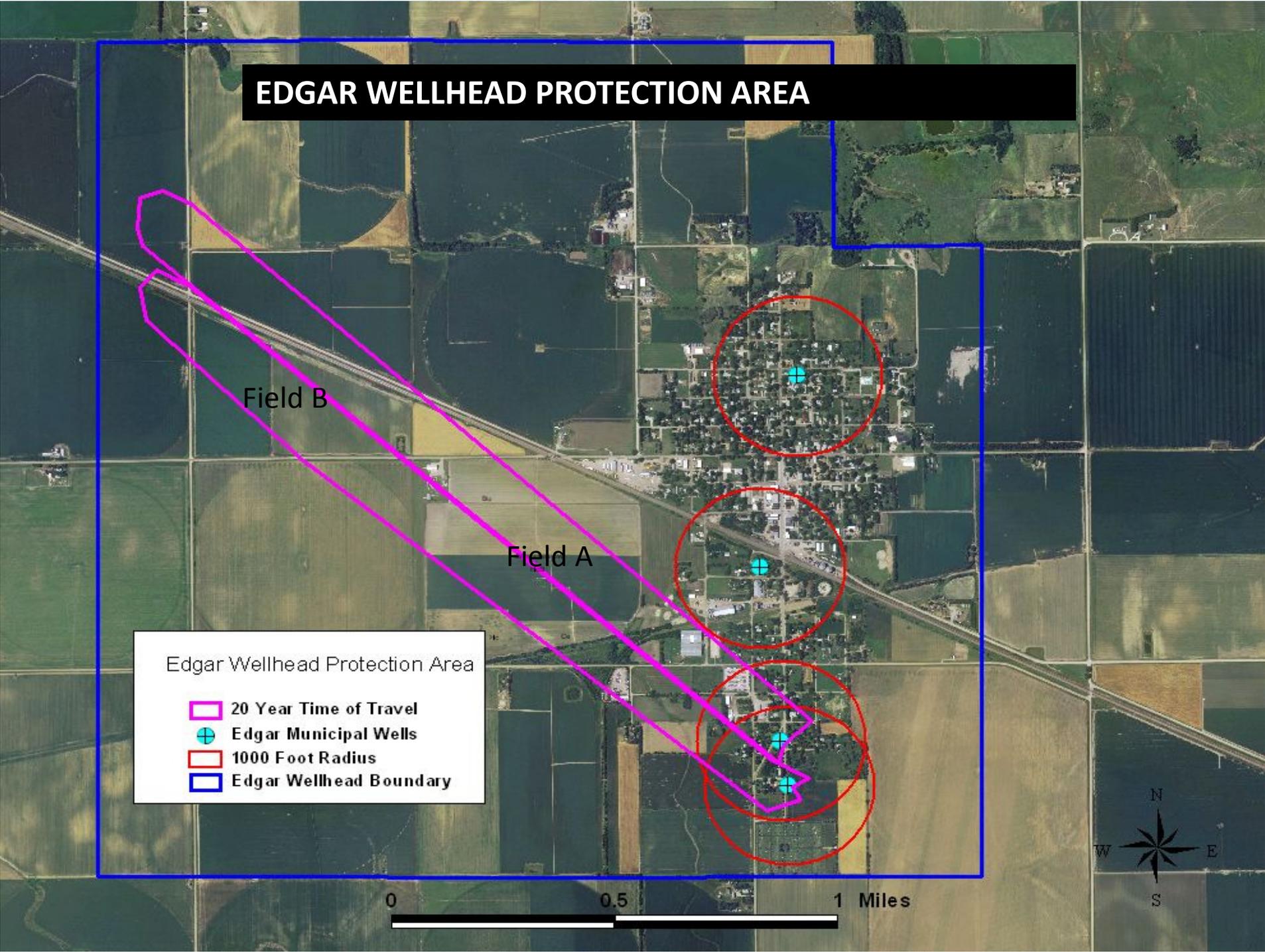
Field B

Field A

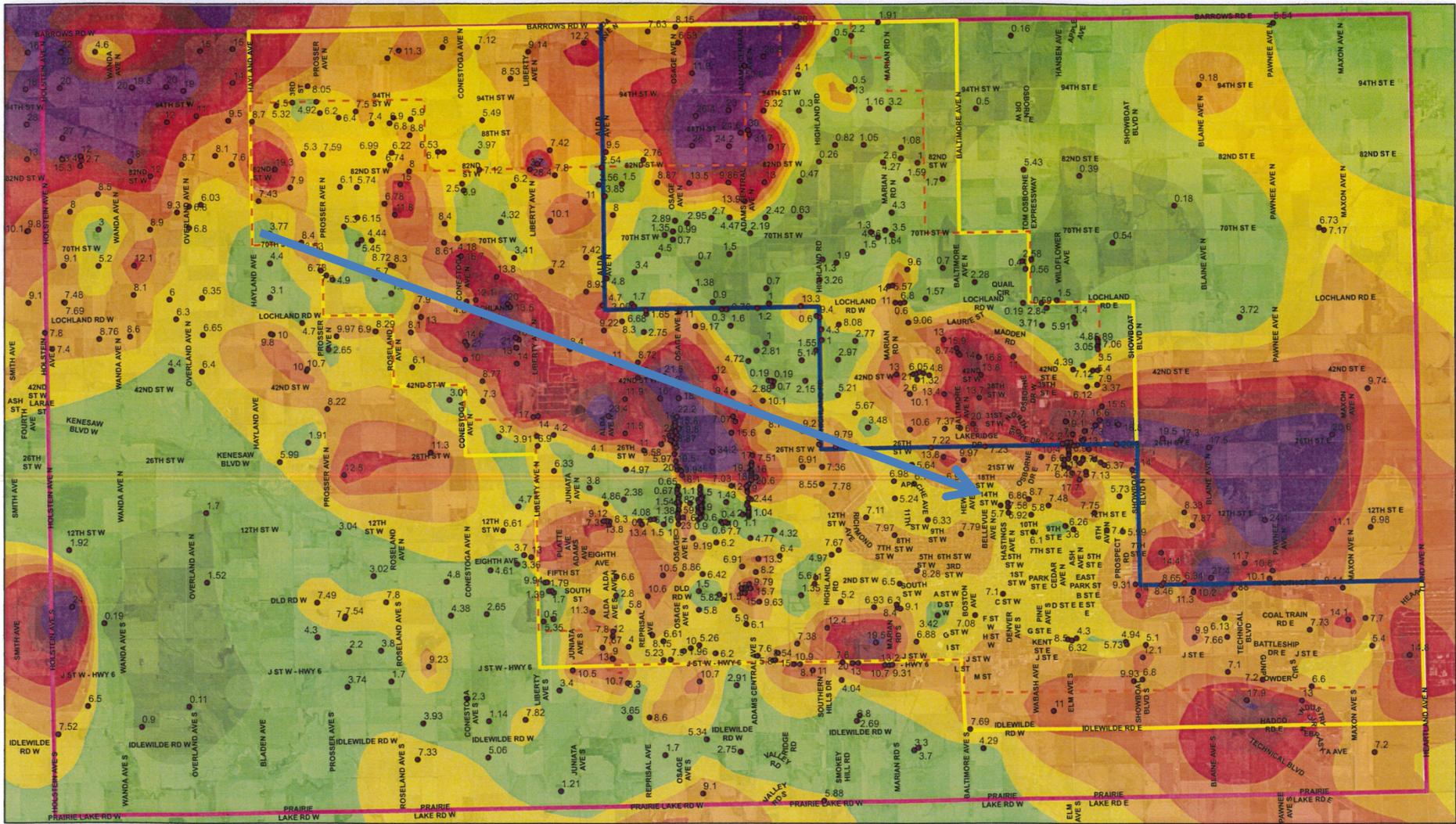
Edgar Wellhead Protection Area

- 20 Year Time of Travel
- Edgar Municipal Wells
- 1000 Foot Radius
- Edgar Wellhead Boundary

0 0.5 1 Miles



Hastings Wellhead Protection Area Nitrate Results - 2012



2012 Nitrate Results

Nitrate mg/L

0 - 5	8 - 10
5 - 8	10 - 20
	20 - 35
	35 +

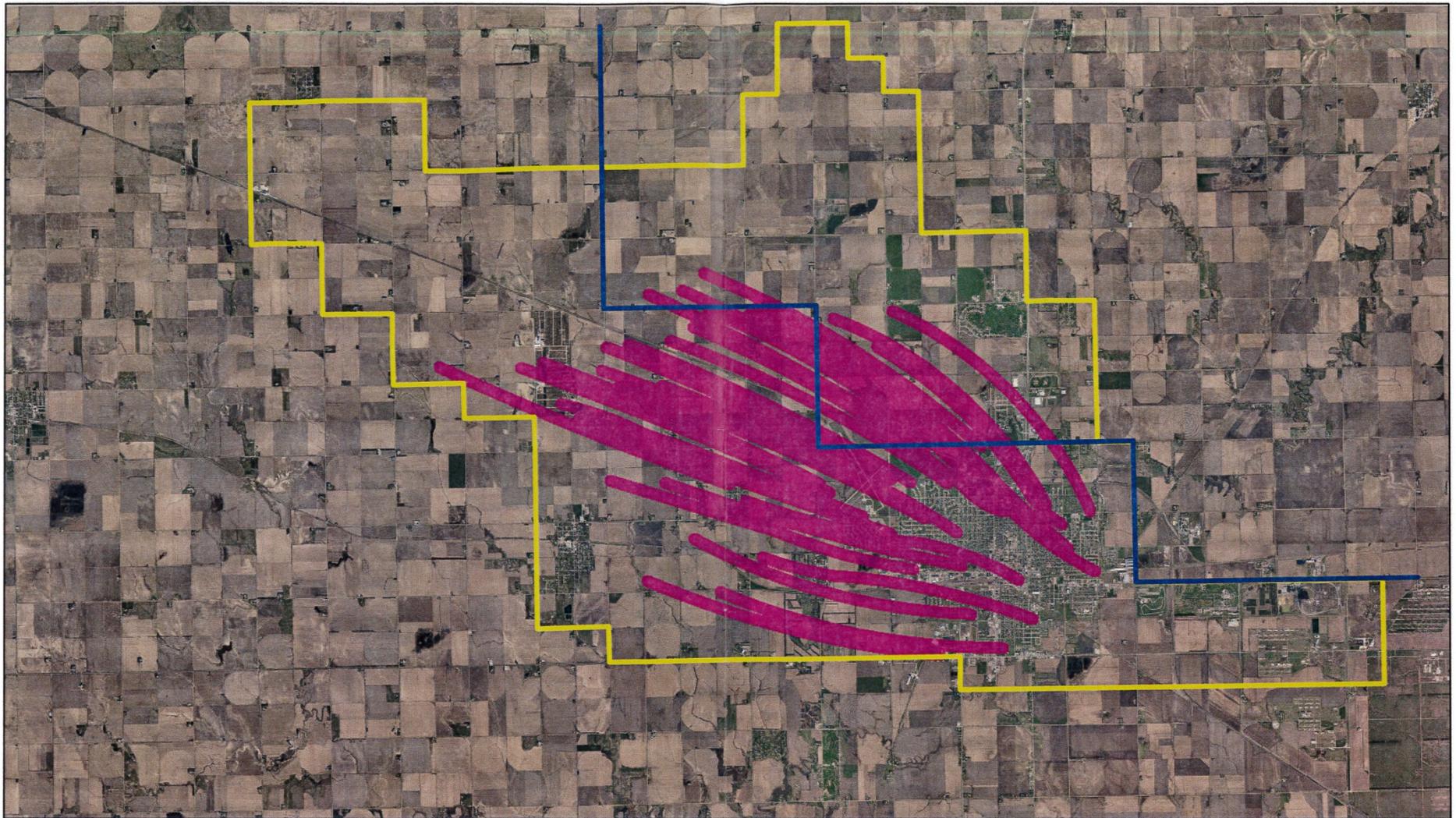
Direction of groundwater flow

2013 Hastings Wellhead Protection Area Map

Path: Z:\Projects\Hastings Wellhead Protection\MXD\2013_HWPA_Small.mxd

Drawn By: Simeon Berns

Date: 1/15/2013



20 Year Time of Travel

HWPB Boundary

NRD Division Line

Direction of groundwater flow



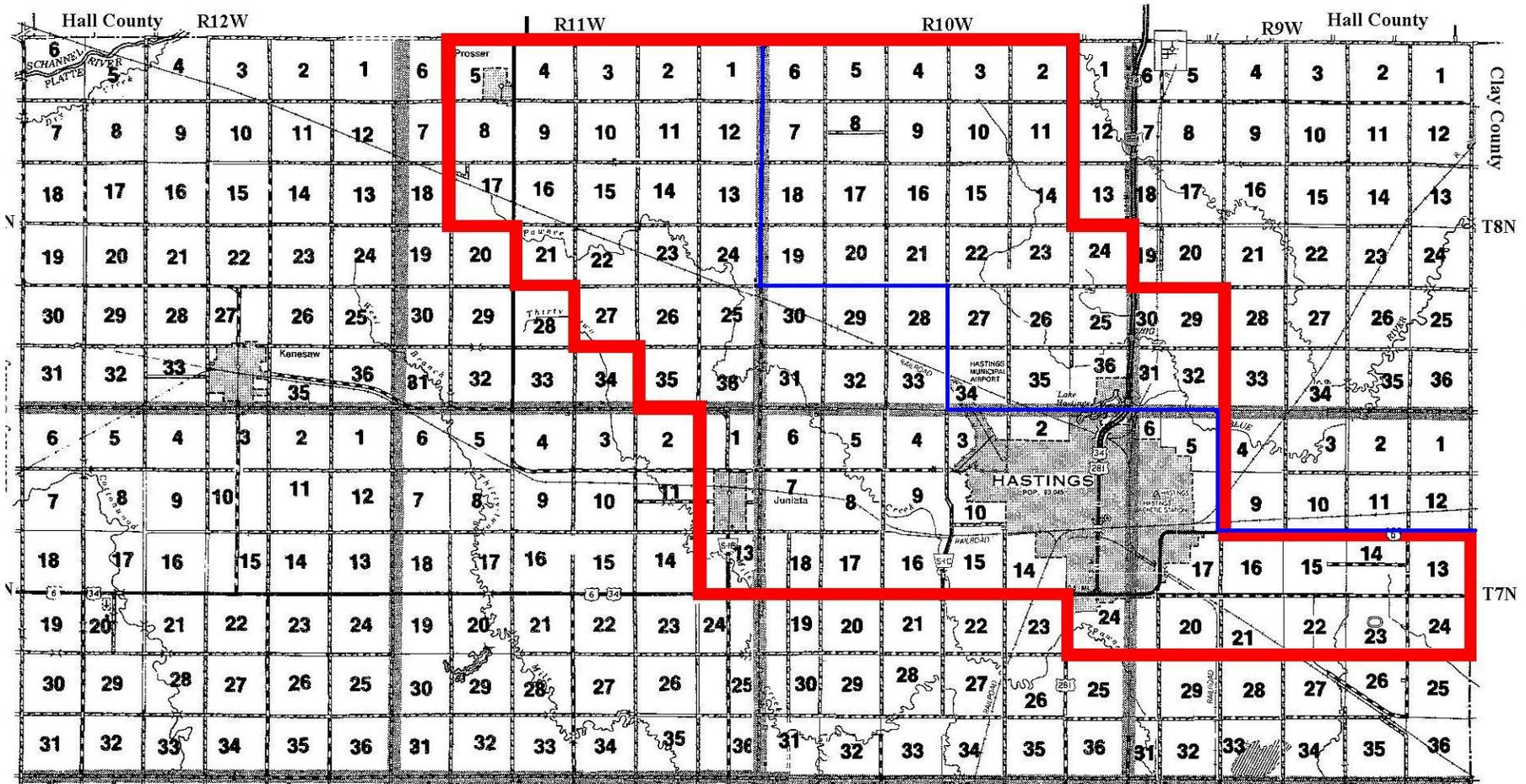
2011 Hastings Wellhead Protection Area Map - Exhibit D

Path: \\Birch\gis\Projects\Hastings Wellhead Protection\MXD\Figures\ExhibitD.mxd

Drawn By: Simeon Berns

Date: 12/23/2011

HASTINGS WELLHEAD PROTECTION GROUNDWATER MANAGEMENT ACTION AREA



Required Actions

- Mandatory training – producers & commercial fertilizer retailers (urban and rural)
- Ag. soil tests for residual nitrogen
- Nitrogen inhibitor with fall applied anhydrous
- No liquid or dry fertilizer until after March 1st
- Required irrigation scheduling
- Annual reports of farm and commercial fertilizer applicator's activities

Other Water Issues

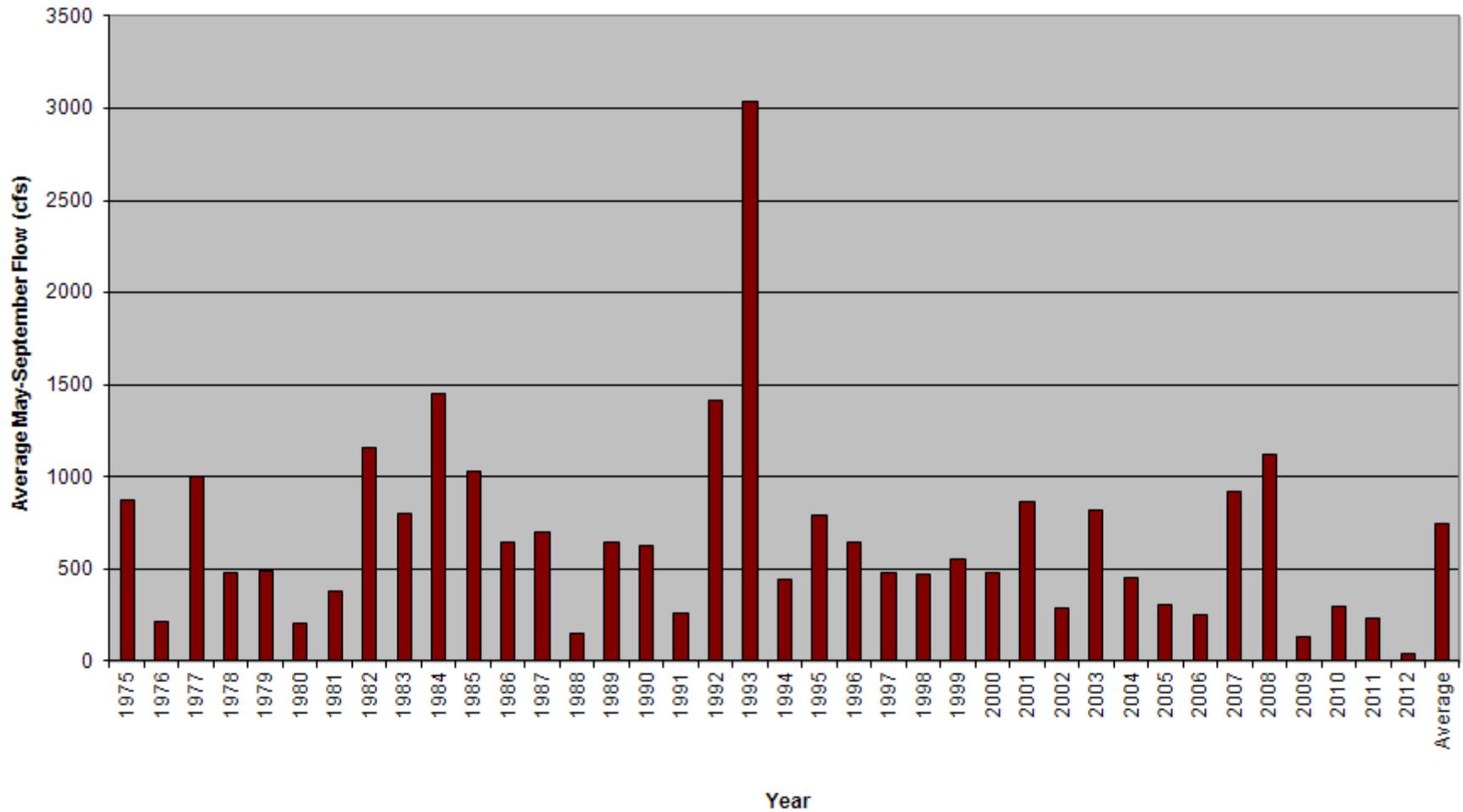
Blue River Compact

Between Kansas & Nebraska

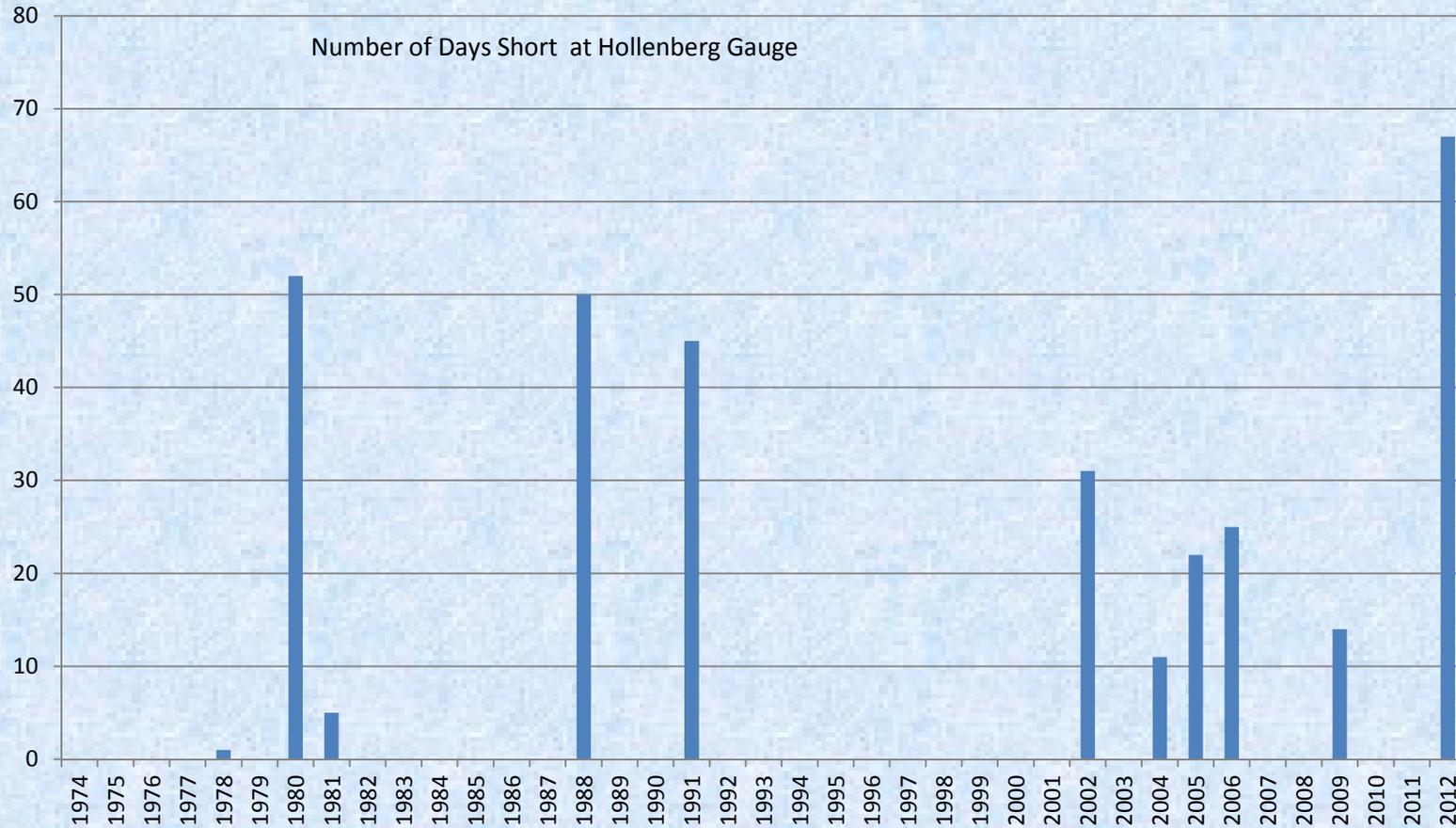
Minimum Blue River Flow Requirements
Measured at Hollenberg, Kansas Gauge
(Effective November 4, 1968)

- May 45cfs
- June 45 cfs
- July 75 cfs
- August 80 cfs
- September 60 cfs

Figure 43. May - September Average Flow Little Blue River at Hollenburg



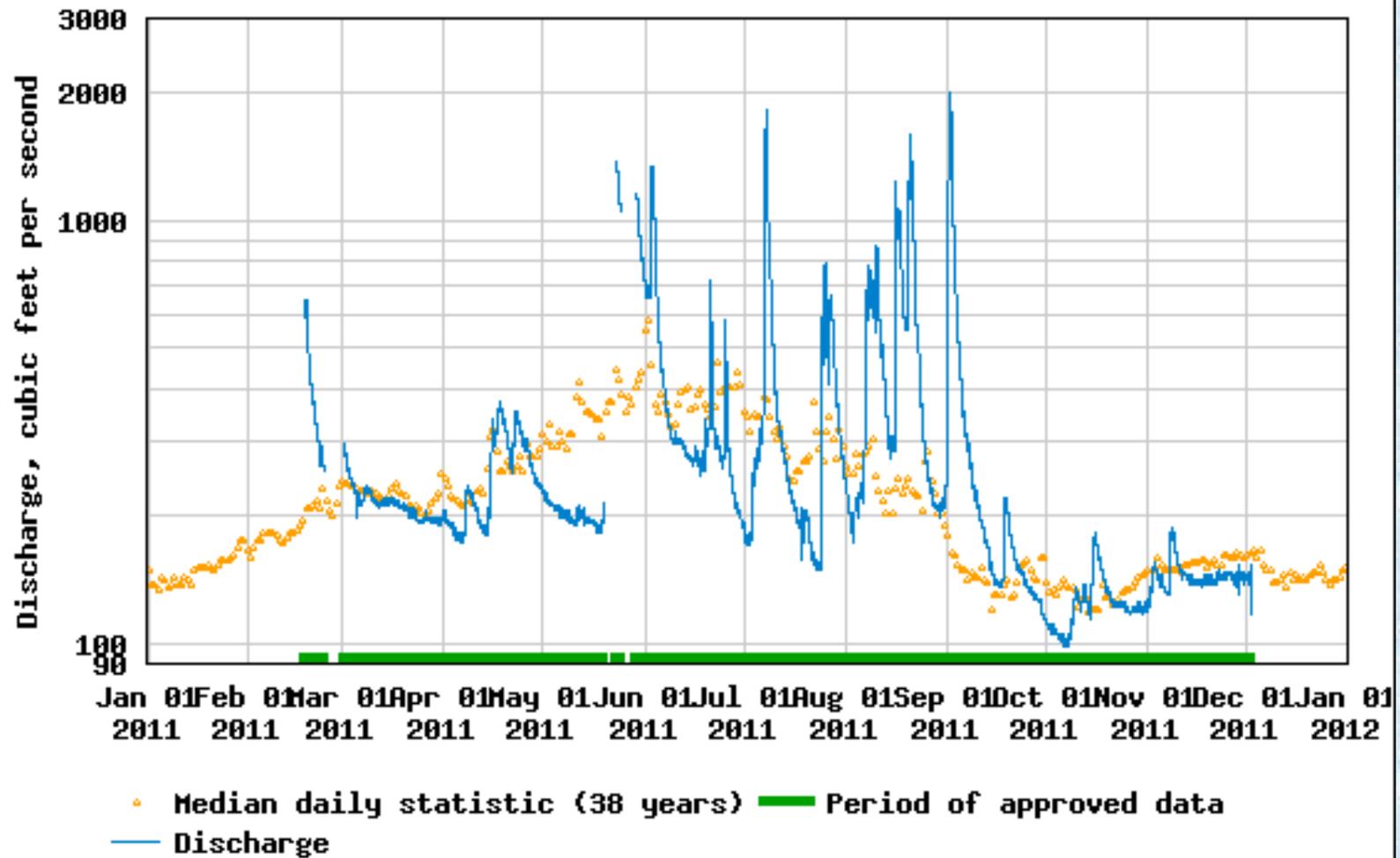
Compact Administration



Administration means: All Appropriations junior to Nov. 1968 are shut down.

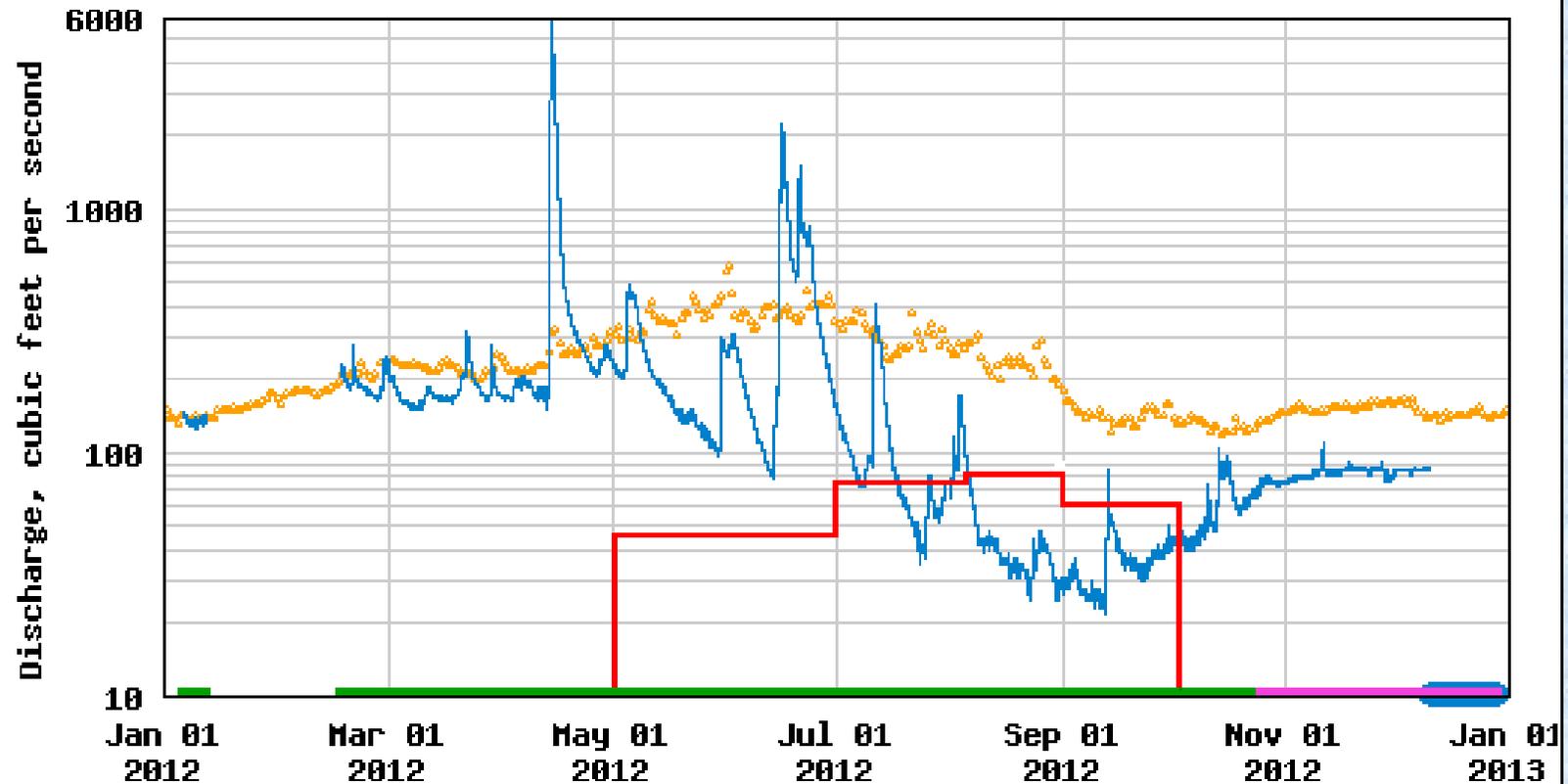


USGS 06884025 Little Blue River at Hollenberg, KS





USGS 06884025 Little Blue River at Hollenberg, KS



- Median daily statistic (38 years)
- Discharge
- Period of approved data
- Flow at station affected by ice
- Period of provisional data

LB 962 Application of Stream Flow Requirements

LB 962 rules provide that surface water rights must be met:

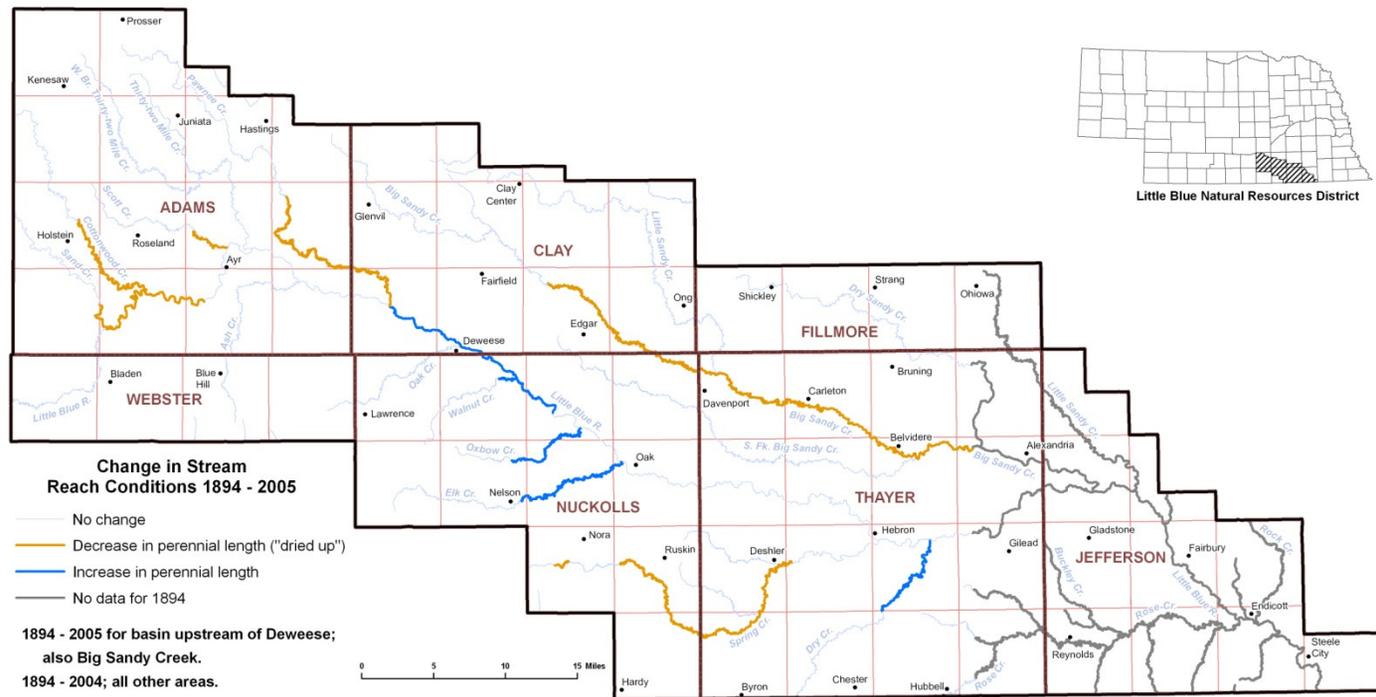
- 1) 85% of the time from May 1 through September 30, (153 days), or
- 2) 65% of the time from July 1 through August 31 (62 days)

Year	Days Flows Unmet 5/1 - 9/30	Days Flows Unmet 7/1 - 8/31	Compliance with Criteria 1 (In Percent)	Compliance with Criteria 2 (In Percent)
1978	1	0		
1980	52	52		
1981	5	5		
1988	50	20		
1991	45	15		
2002	31	24	95.88%	95.24%
2003	0	0	95.88%	95.24%
2004	10	0	95.56%	95.24%
2005	22	22	94.84%	93.47%
2006	25	25	94.02%	91.45%
2007	0	0	94.02%	91.45%
2008	0	0	95.65%	93.06%
2009	14	14	95.20%	91.94%
2010	0	0	95.20%	91.94%
2011	0	0	96.67%	93.15%
2012	67	37	94.48%	92.10%
2013	22	22	93.76%	90.32%

Compliance with Compact Flows

- May 1 – Sept 30 (20-Yr Rolling Ave.) = 93.76%
- July 1 – Aug 1 (20 Yr Rolling Ave.) = 90.32%
- Since Inception of Compact = 94.97%
- Since River Flow Records (1910) = 95.4%

Change in Stream Reach Condition 1894 - 2005



Conservation and Survey Division
School of Natural Resources
Institute of Agriculture and Natural Resources
University of Nebraska-Lincoln
June 2007

Financial support provided by the Little Blue Natural Resources

Perennial Stream Reaches in Thayer, Jefferson, and Nuckolls
Counties in the Little Blue Natural Resources District

Open-File Report No. 80

Joeckel, R.M., Howard, L.M., Summerside, S.E., and Myers, W.F.

UNIVERSITY OF
Nebraska
Lincoln

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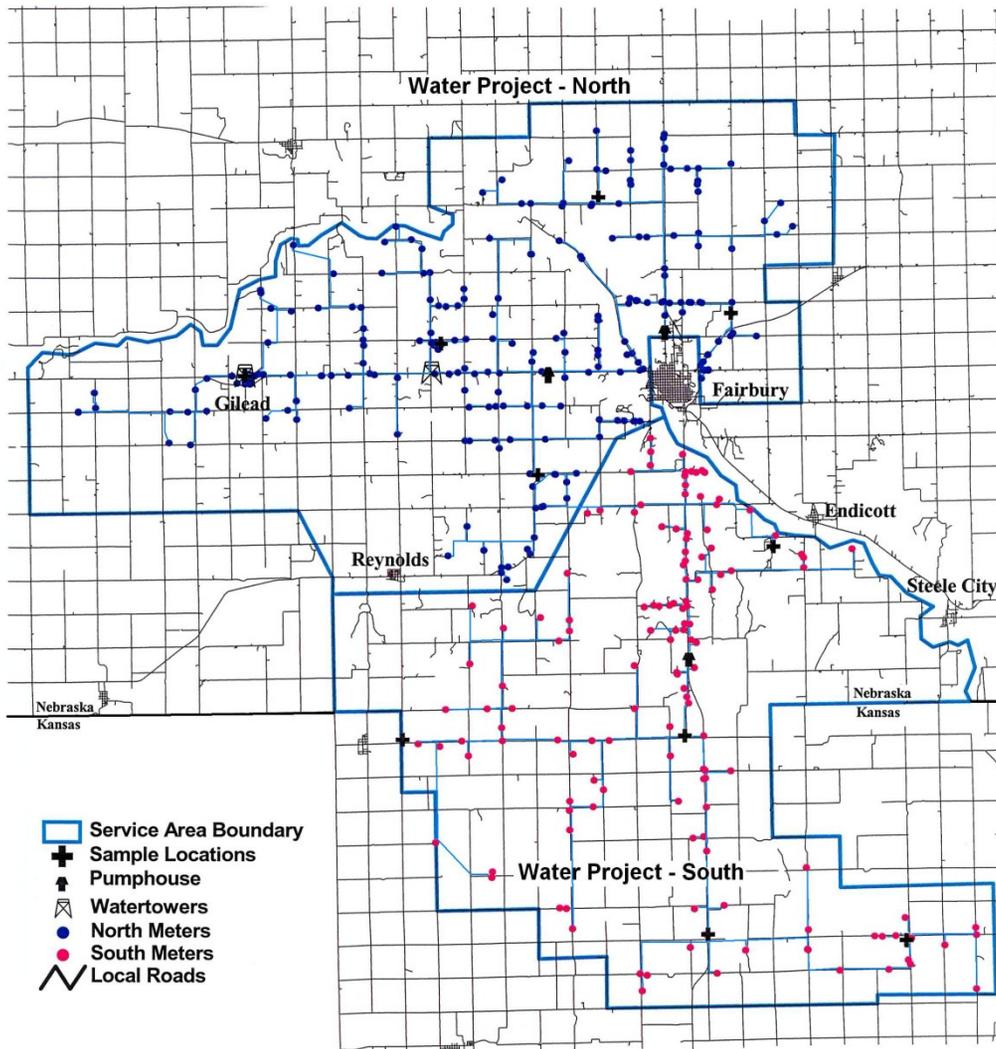
Little Blue Public Water Projects



- Rural Domestic Water Supply for Areas of Need
- Thayer & Jefferson and Northern Washington Co.
- Water purchased from Fairbury

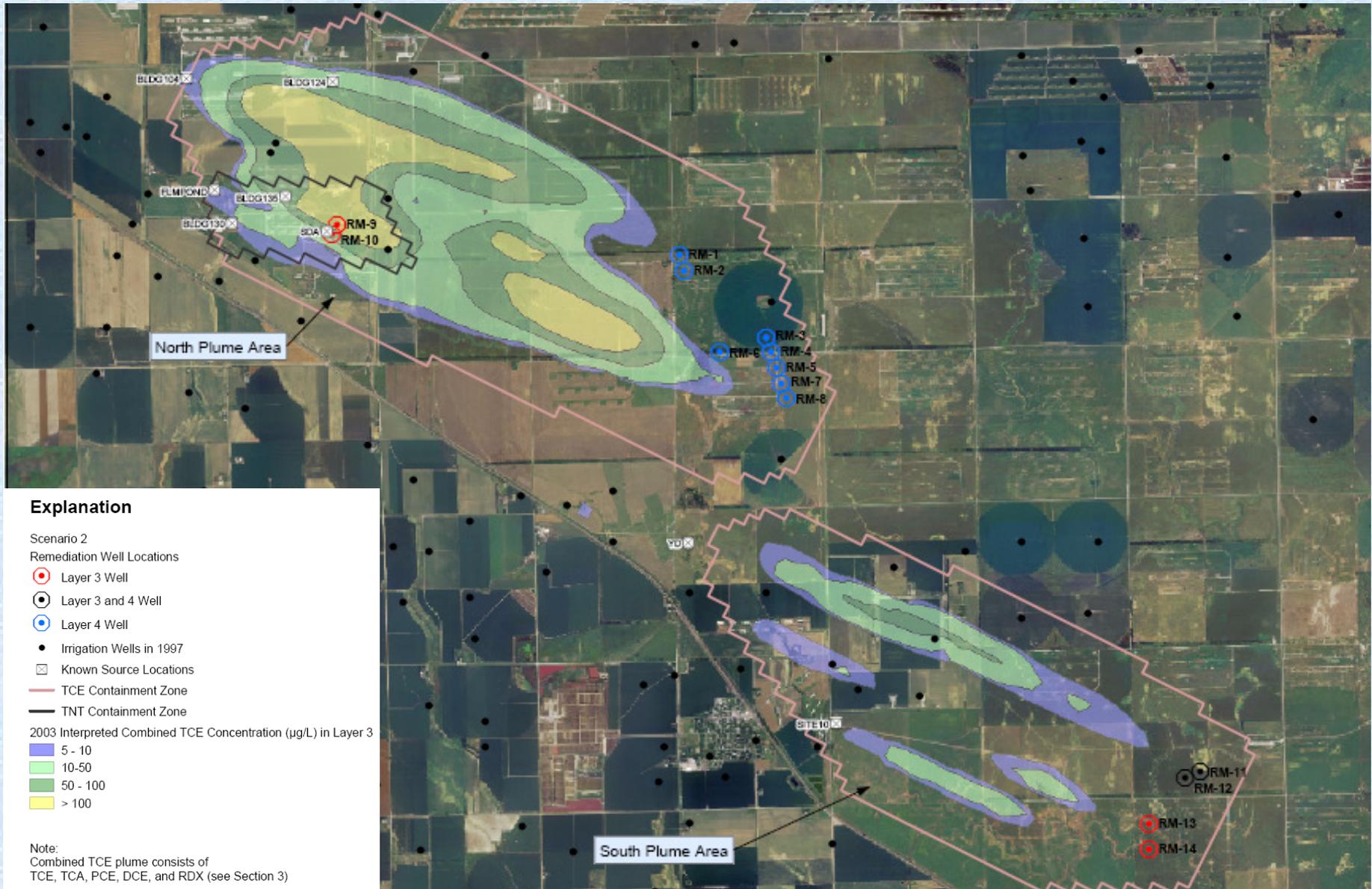


Little Blue Natural Resources District Rural Water Districts

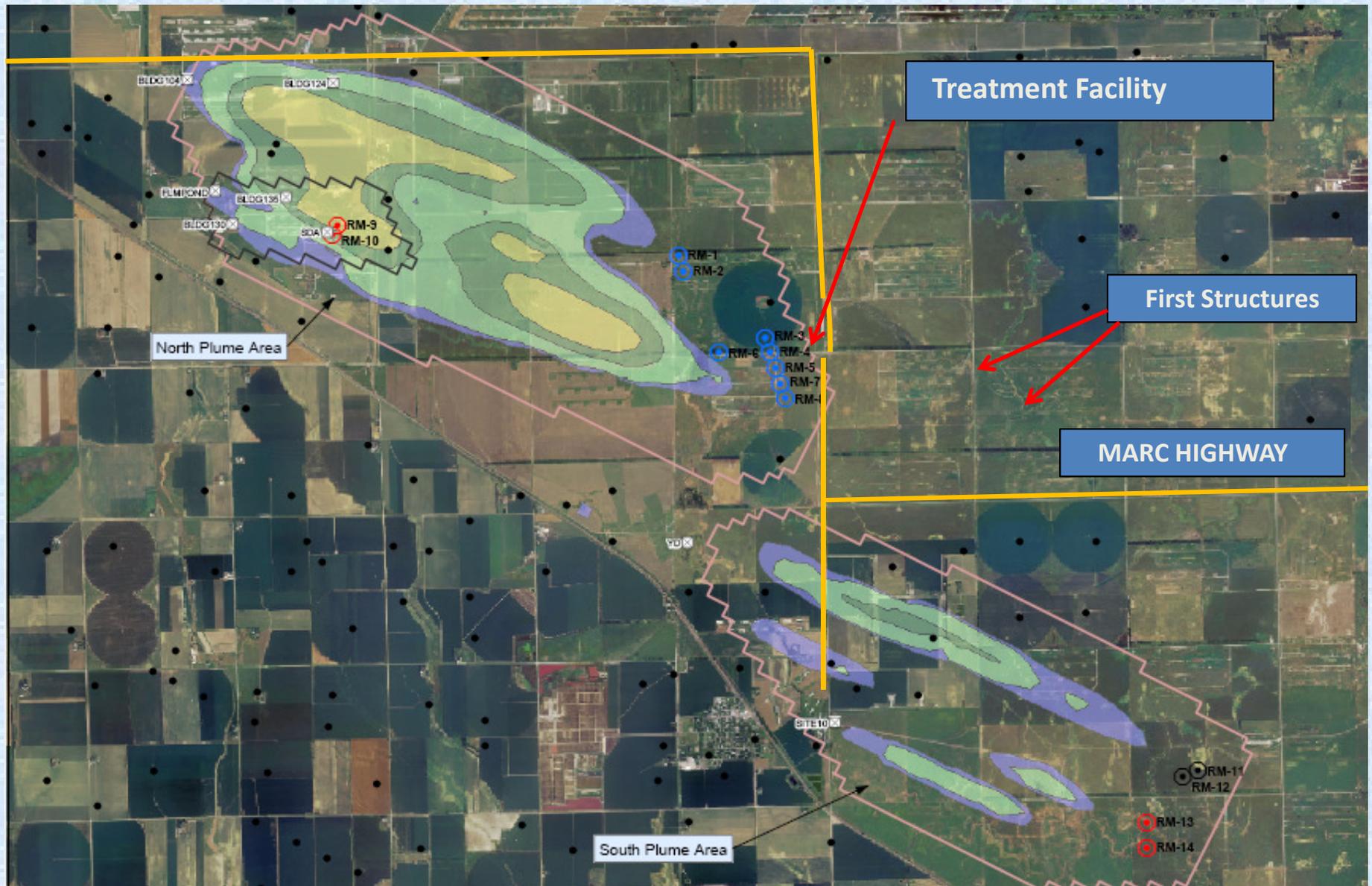


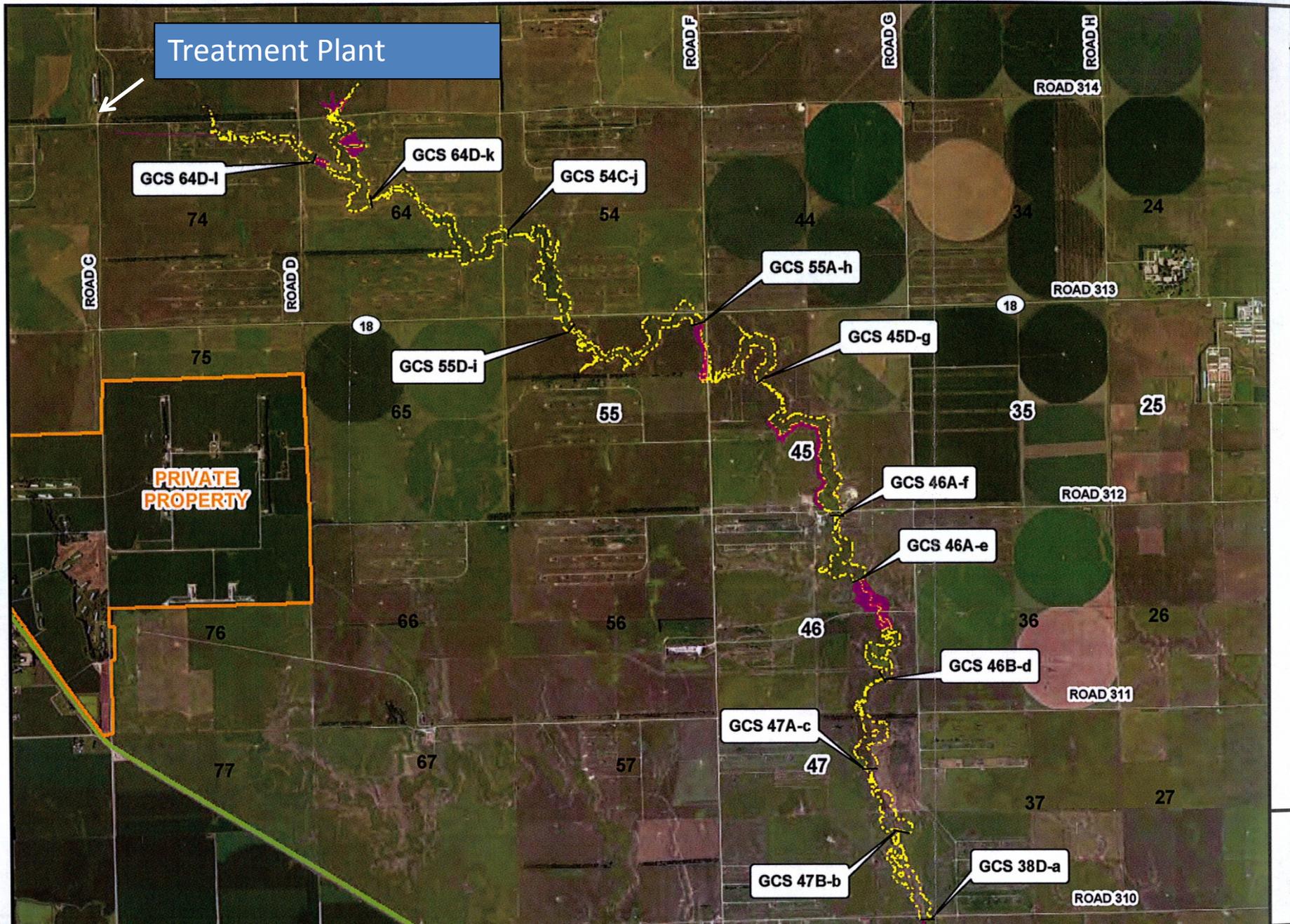
- Serves 400 units
- Population = 1,545
- 260 miles of pipeline
- Hog units, 2 dairies, Endicott Clay Products
- Sales: 50 million gal./yr
- Project is self-supporting
- Ave. Water Bills
 - No. - \$40.00/mo
 - So. - \$75.00/ mo

NAD Contamination Problem



NAD Containment Scenario

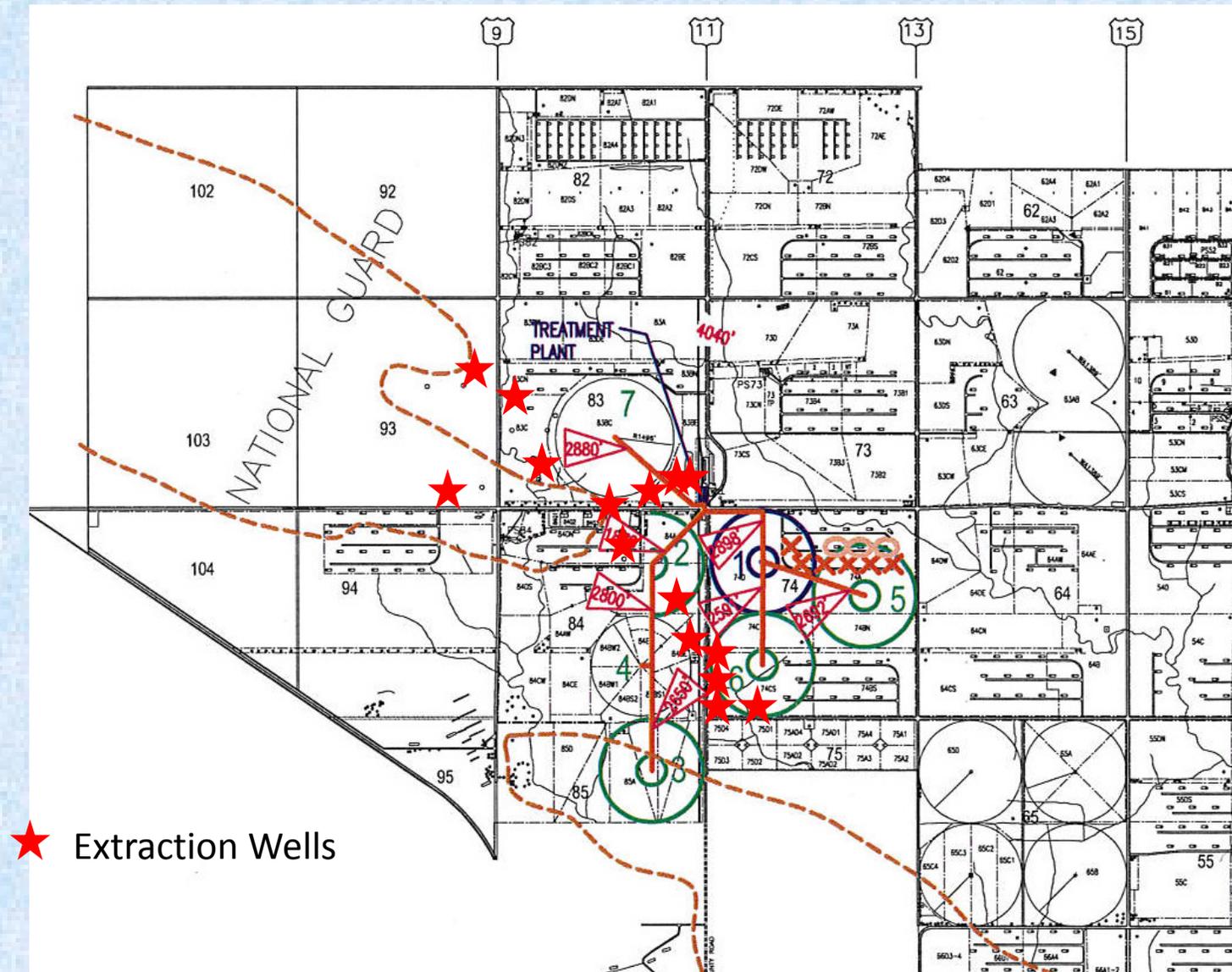




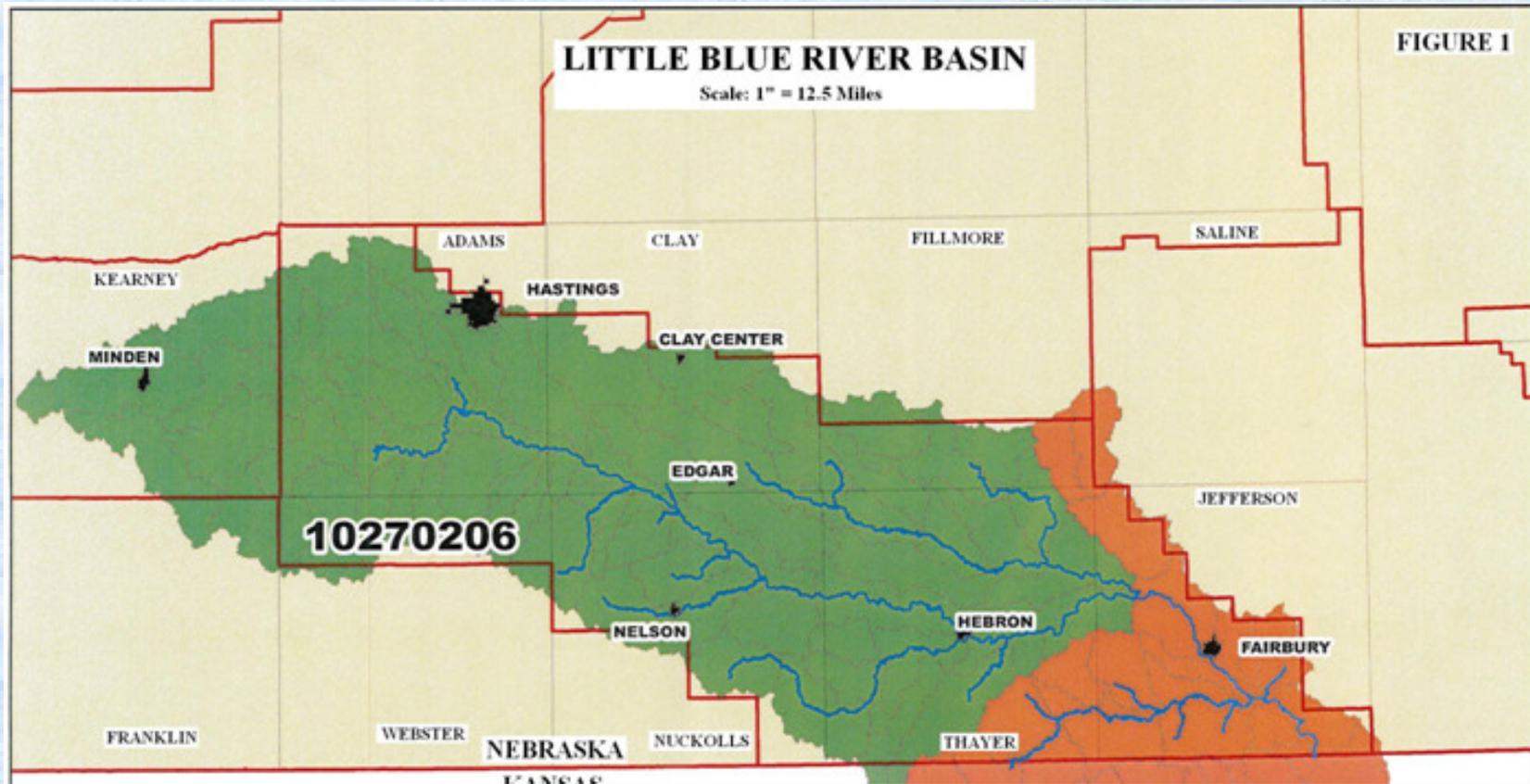
Irrigation Development on MARC

- MARC will use remediated water supply for irrigation
- MARC will pump water from the MARC Dam during the summer to:
 - offset otherwise deep well pumping
 - provides off-season storage capacity for clean-up
 - help reduce impacts of downstream flows

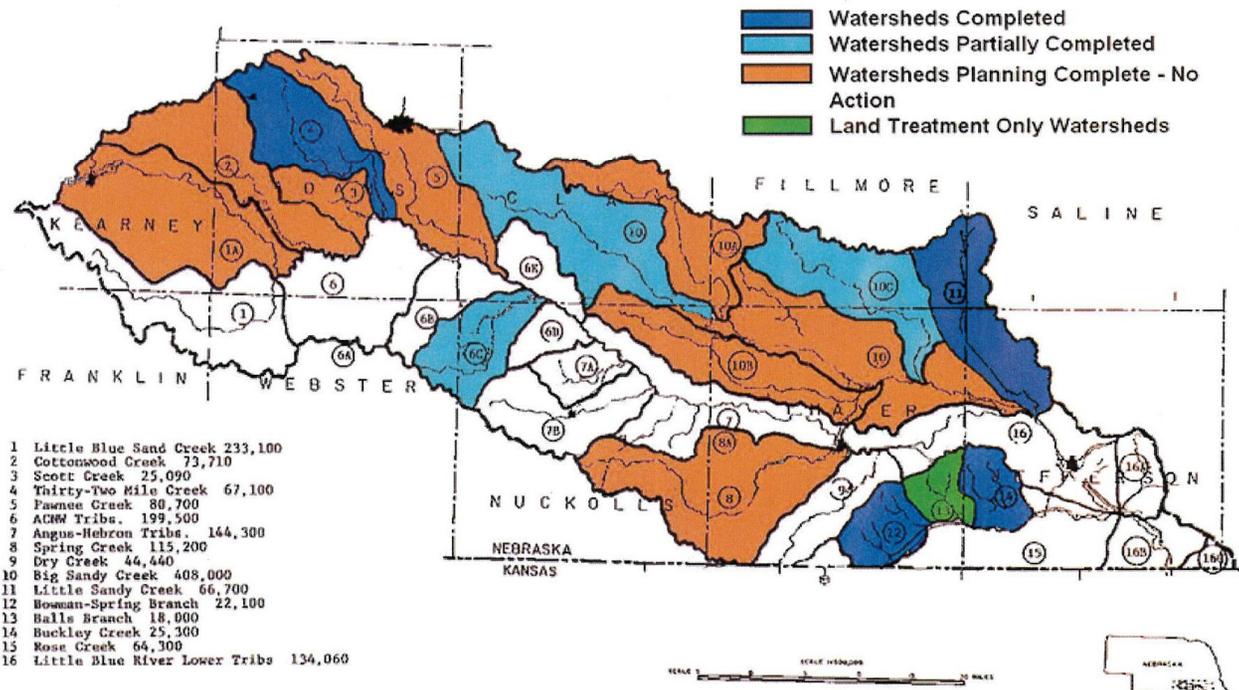
North Sump Irrigation Plan



Water Quality Planning Process



Surface Water Storage Opportunities



Watershed Dams Promote Recharge



Watershed Rehabilitation



32-Mile Dam K
Repairs Est. = \$80,000

Nebraska has 100,s of watershed dams, many nearing their life expectancy, all providing silent protection against floods.



Needs:

- Studies for identifying safe water supplies
- Projects to support municipalities with water supplies
- Rural water project assistance
- Flow augmentation projects
- Surface water storage project
- Groundwater recharge projects
- Watershed Dam Rehabilitation

THANK YOU

Questions?