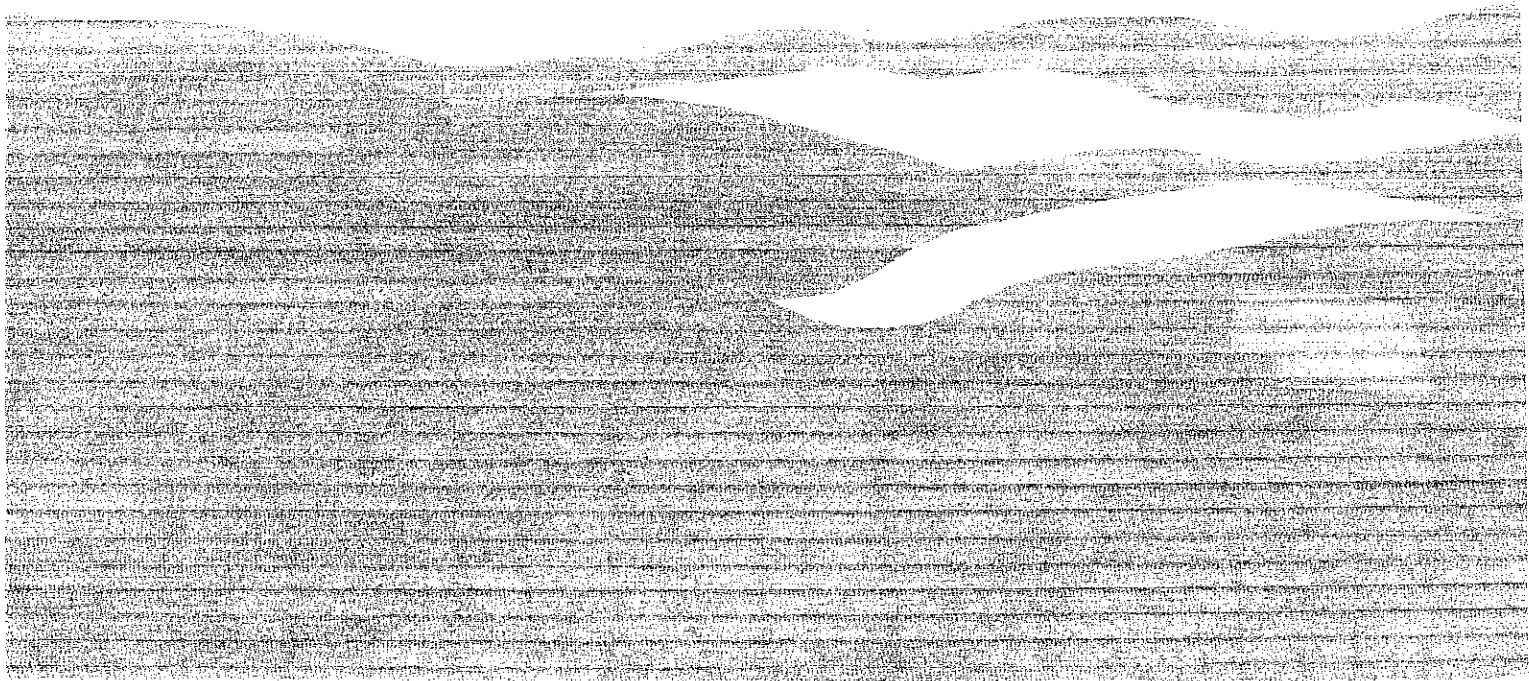


LEWIS & CLARK NRD  
GROUNDWATER  
MANAGEMENT PLAN  
UPDATE  
DWR approved 5/95



## ABSTRACT

The Lewis & Clark NRD is adding an amendment to its original plan to comply with state legislation. Goals and objectives of the plan remain similar, but some objectives have been modified.

Additional information has been incorporated into the amendment under a format outline proposed by Dept of Environmental Quality and Department of Water Resources. NRD directors have provided input in the draft process and the amendment was reviewed at public meetings and hearings. Specific data relating to the Lewis & Clark NRD is still strictly limited although it is likely that some water quality problems are point-source related. It is presently premature to consider a Groundwater Management or Special Protection Area because of the lack of supporting information, the relative small size of areas having concern on water quality, and the positive response to voluntary education and incentive programs in such areas.

Modified objectives include continued and intensified monitoring efforts to determine the "scope and trend" of contaminant levels in critical areas of the District. Voluntary Preventive Programs are offered District wide or targeted to concentrate their effectiveness. They include:

1. Deep Soil Testing Program
2. Sealed Well Abandonment Program
3. Wellhead Assistance Program
4. Information and Education Program
5. Rural Water Distribution Projects
6. Chemigation Permit and Inspection Program
7. Other Projects that become legally available

The Lewis and Clark NRD will resort to regulatory authorities under state law by means of Management or Special Protection Areas as "scope and trend" of contamination dictate. That significant point for water quality will be when 50% of the samples taken over a large area shows an increasing trend for 3 years that reaches 90% of Maximum Contaminant Level.

The NRD believes voluntary programs have been popular and effective as well as preventative. Existing data in some areas attributes contamination to previous poor well construction and consequently point-source origins. For these reasons regulatory programs at this time do not appear necessary or practical.

LEWIS & CLARK NRD

E. GROUNDWATER MANAGEMENT PLAN AMENDMENTS -- 1993

I. INTRODUCTION:

Action by the 1991 Nebraska legislature enacted with LB 51, required Natural Resource Districts across the state to amend their individual Groundwater Management Plans by July 1, 1993. The purpose of this effort will be to define more specifically, groundwater contamination potential and solutions to consider for management of the groundwater resources. This amendment section will not address quantity issues unless they might relate to quality concerns. The district believes it has made significant progress concerning original objectives, especially in areas of data collection and program options regarding quality aspects of the original plan. This amendment will follow the reference outline of July, 1992 provided by DEQ and DWR.

The Lewis & Clark NRD will utilize current information that is available to supplement the existing 1986 plan. In some cases technical data will be presented here that will update that plan or provide additions to it. A review of comments made on the original plan indicated that technical portions of the plan were well written, based on information available, so that this amendment section will not repeat that data. Individual sections will be reviewed and revised according to current information available, as appropriate. It should be acknowledged here, that present data is not adequate to make specific planning decisions for some plan components.

II. Hydrogeologic Characterization

This information was presented in the original groundwater management plan, as it relates to aquifer description, groundwater recharge, and other related soils and hydrogeologic data. Additional vulnerability information is available from the DRASTIC map (shown on Map #11). This describes areas that may be susceptible to contamination in generalized situations. Out of a class rating of 1 to 8 on degree of vulnerability, 86% of the district falls under a rating of 4 or less indicating low risk in those areas. More current information on the Bedrock Geology is available now through the Sioux City Quadrangle map I-1879 (1988) produced by US Geological Survey which better illustrates information previously covered in the initial Groundwater Plan. The entire NRD is located in the glacial till area of Eastern Nebraska which separates it from other parts of the state in regards to groundwater quality impact. Those distinctions make hydrogeologic generalizations quite difficult and consequently severely limit plan components.

Limited information is available on Vadose Zone description. Sampling done in Knox county at 6 sites in 1990, sponsored by the

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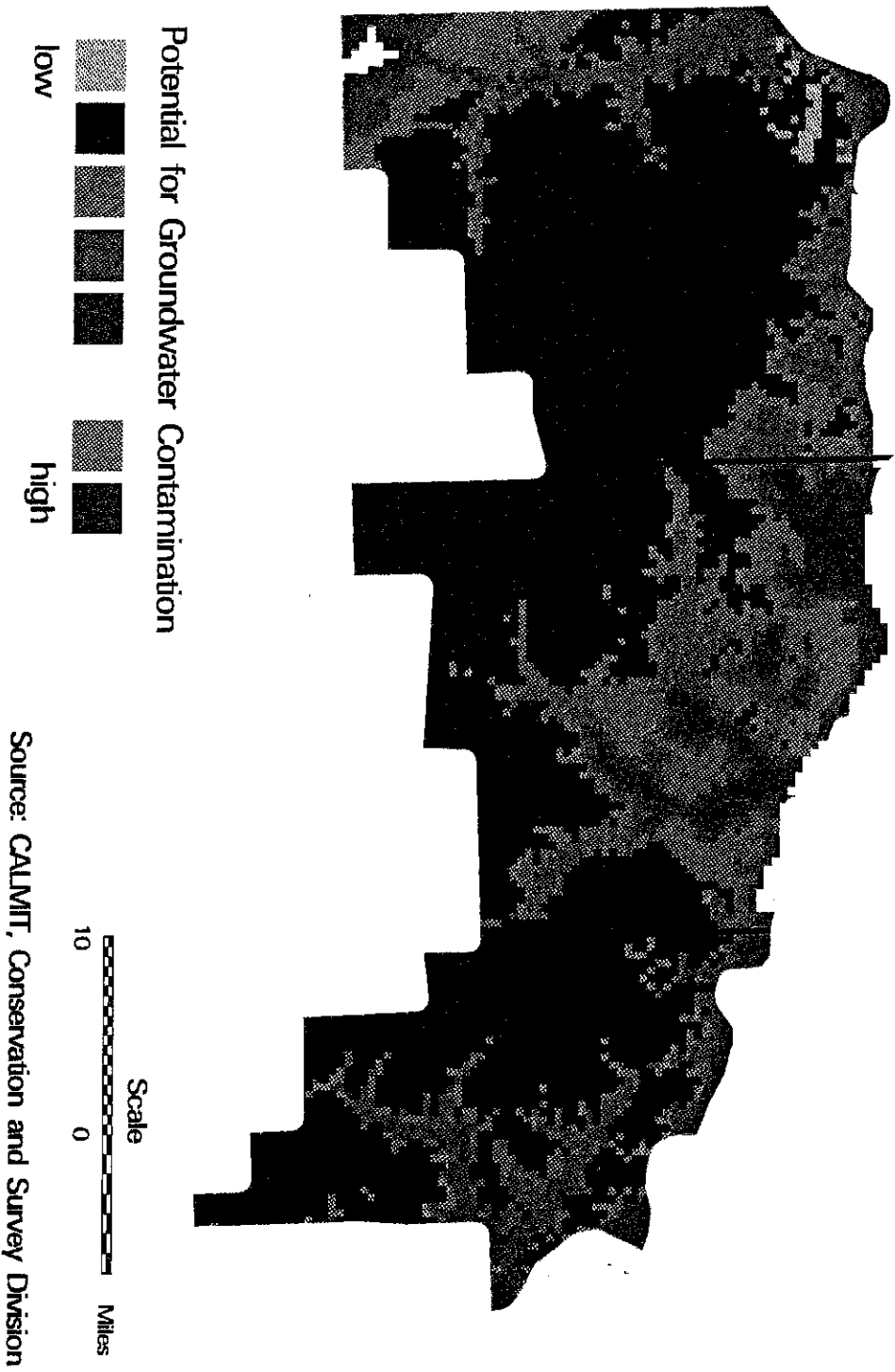
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# Groundwater Vulnerability to Contamination Using the DRASTIC Method Lewis and Clark Natural Resource District

MAP #11



Lewis and Clark Natural Resources District, revealed significant amounts of nitrate-nitrogen at levels up to 28 feet deep. Total accumulated nitrate-nitrogen on one well was 1928# at 20'. The data was not conclusive to establish scope or trends however. Testing done in nearby Upper Elkhorn NRD in 1992 indicated vadose zone residual nitrogen levels at 5 times higher rates in irrigated cropland compared to unfertilized pasture. There is a need for more technical research into vadose zone impacts on groundwater quality as this can be termed a data deficiency. The NRD plans to look further into studies of this kind.

Irrigation usage has not increased significantly since 1986. At that time there were 509 total registered wells in the NRD, that figure now stands at 558 (NRC 12/92). It is estimated that only about 8% of the acres of the NRD are presently irrigated based on NRC figures. (79,295 acres out of a total 933,660) Although 20% more acres could be irrigated from a soils standpoint, low yielding wells limit that capability, so that significant future irrigation growth is not considered likely.

Groundwater monitoring of static water levels continue to indicate insignificant fluctuation of water quantities (see table VIII). In the last 10 years, there has been less than 6 feet of variation in water tables and the trend is quite constant. If a 10% drop in baseline levels is observed over a 5 year period for a substantial area of the NRD this would be a basis for consideration of a management or control area. The district will consider all options legally available at that time to regulate usage and implement the most feasible methods to control depletion of aquifer supplies.

The district has investigated the presence of natural recharge areas and wetlands in the NRD. Maps obtained from US Fish and Wildlife service indicate most wetlands are in Riverine or Palustrine classification. The Riverine is in conjunction with the Missouri River and major tributaries such as Bazile Creek and Bow Creek; and the Palustrine covers mostly artificial impoundments found through out the grassland portions of the NRD. Investigation of Hydric soils of the NRD through UNL Conservation and Survey Division document that probably less than 3% or an estimate 26,400 acres of the District are sufficiently wet under undrained conditions to support hydrophytic vegetation. Hydric soils are an important factor for identifying wetland areas, but present information shows limited extent of such areas. The District believes recharge areas and wetlands presently make an insignificant impact on the management of groundwater. Additional data on this aspect may change that consideration.

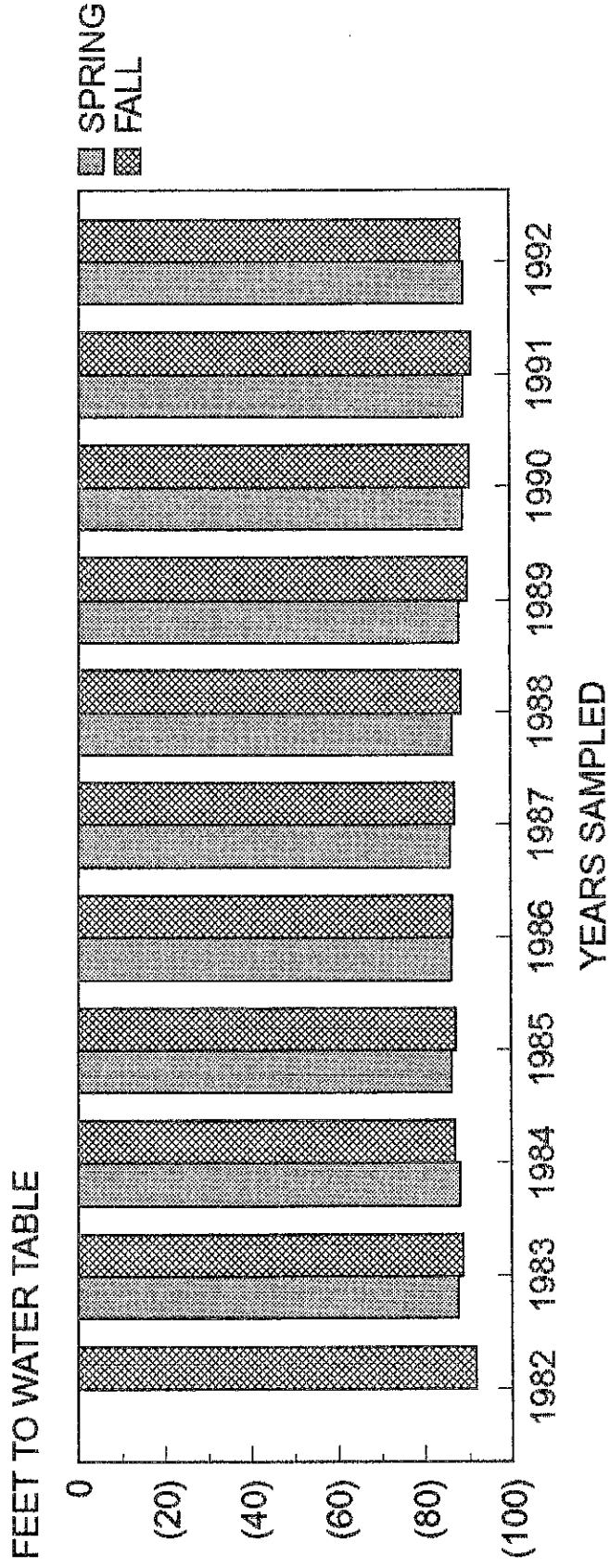
### III. WATER QUALITY INVENTORY

The 1986 plan addressed the lack of an adequate water quality data base in the counties of Knox, Cedar and Dixon. In an effort to establish information on the concentration, scope, and trends of potential contaminants the Lewis & Clark NRD initiated a monitoring program in 1987. The first year testing sampled for the presence of nitrate-nitrogen, pesticides, herbicides, and volatile organic compounds. Altogether 19 chosen sites provided sample information

# TABLE VIII

## LEWIS & CLARK NRD

### AVERAGE DEPTH TO WATER FROM 30 WELLS



1982-1992 = 3.4% Raise

that was analyzed for up to 76 potential contaminants each. Only three sites (16%) showed nitrate-nitrogen information exceeding 10 ppm and one site near Creighton showed Atrazine at .326 ppb. Follow up tests for atrazine showed no re-occurrence, and samples in successive years were taken for nitrate-nitrogen only. Annual sampling continues for nitrate-nitrogen and a pesticide scan as well has been rescheduled for 45 present sample sites in the NRD for groundwater quality data base (Map #12). Pesticide scans are planned to continue at 5 year intervals.

The NRD also started efforts in 1987 to utilize DEQ funding for an area of south central Knox County to determine additional data base information. The effort resulted in the cooperation of 3 other NRD's with other local agencies in the Bazile Triangle Groundwater Quality Study, 1990. Indications of the study which included 125 wells, showed 25% having nitrate-nitrogen greater than 10 ppm. In addition, the study revealed a likely connection of groundwater contamination with fertilizer-application practices. The study was inconclusive on the trends of contamination, however; so the Lewis & Clark NRD in Knox county continues to monitor nitrate-nitrogen concentrations annually.

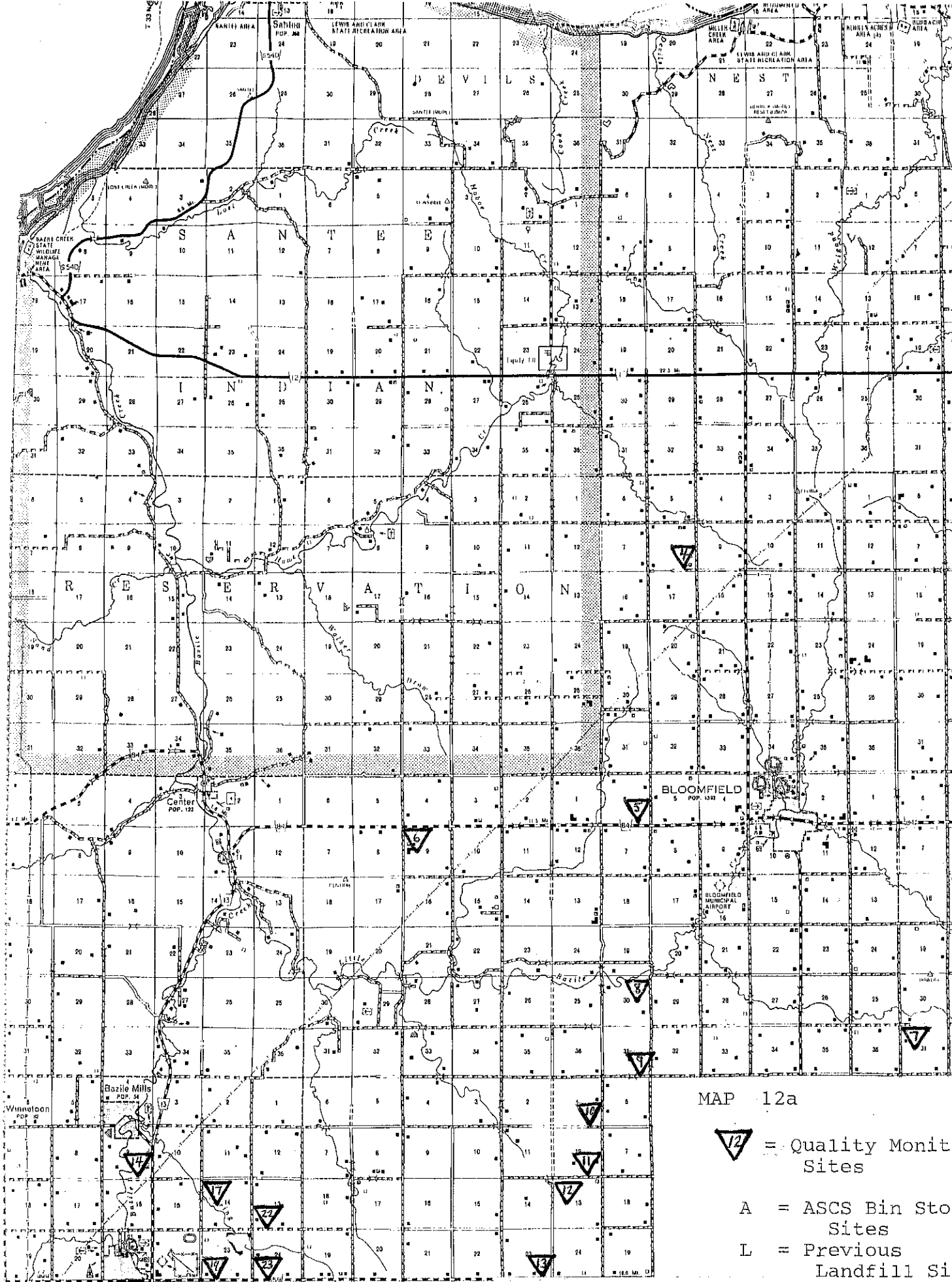
Comparisons of local monitoring results between 1989 to 1990 and 1990-1991 have the same number of wells in the Bazile area decrease in nitrate-nitrogen levels, as increased. The average sample results taken in those two terms actually decreased for the Bazile Triangle location of south central Knox county. For reasons of excess rainfall in 1992, and the resulting non-activity of irrigation wells; no samples were taken that year.

All of the monitor wells are registered irrigation wells so that construction details can be considered in the results. Geologic data was examined at each site to originally select wells to obtain samples from the Pleistocene, Ogallala and Niobrara Aquifer formations. Their locations were selected at random in 1987 and results documented (Table IX.) Sampling for nitrate-nitrogen followed training and procedures dictated by the Dept of Health lab who analyzes the data. Pesticide scans also follow prescribed methods to meet EPA requirements. Analysis scheduled for 1992 and postponed to 1993 will feature a Nebraska Scan of 12 pesticides and VOC's, as well as, nitrate-nitrogen. NRD personnel are certified as Water Well Monitoring Supervisors by Dept of Health.


The NRD also considered other information available to indicate the status of Water Quality. In reviewing EPA STORET groundwater quality data provided by NRC, Data Bank, it was found that much of that information was either included in the NRD's own information (Table IX) or of an age factor, (1935-1952) and quality control concern as to be questionable for valid use. The data does give some base information on nitrate-nitrogen levels. Average sample results were 3.3 for 50 samples with a range of 0 to 149 ppm.

Dept of Health in 1987 conducted a survey of domestic well water in counties of the NRD. That information was subsequently incorporated in Roy F. Spalding's report entitled "Assessment of Statewide Groundwater Quality Data for Domestic wells in Rural Nebraska." (1991). That report indicated "about 26% of the

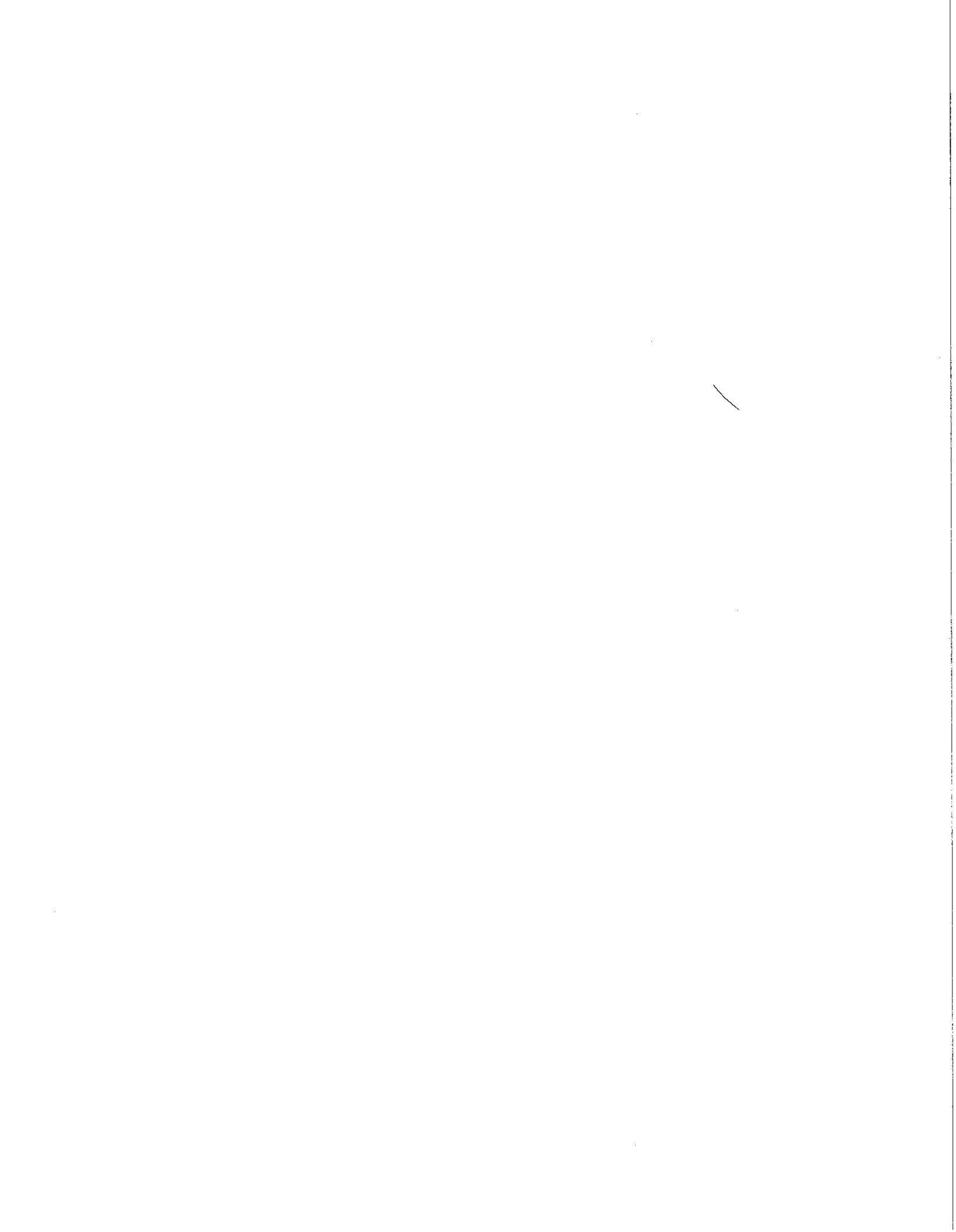




MAP 12a

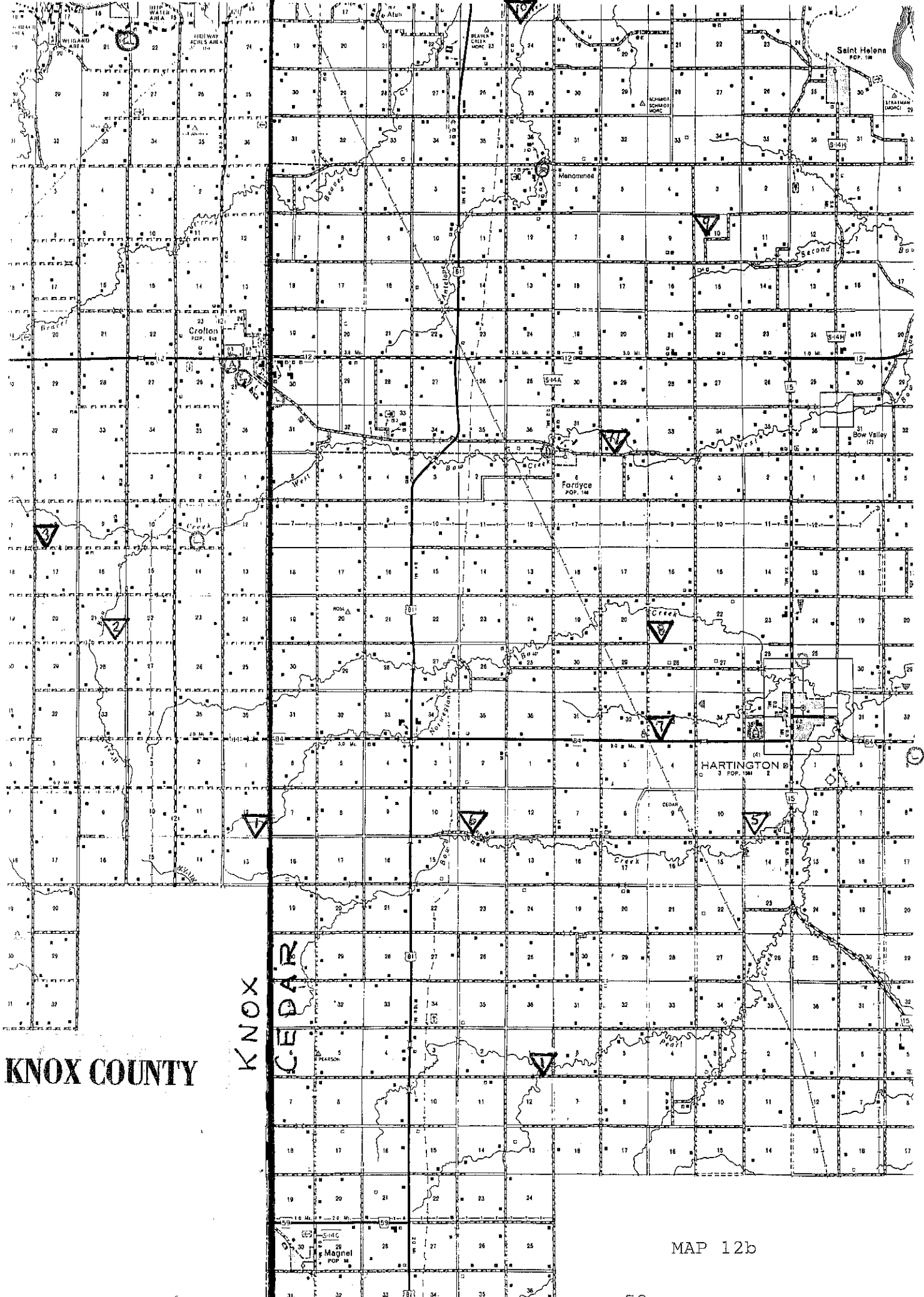
-  = Quality Monitor Sites
- A = ASCS Bin Storage Sites
- L = Previous Landfill Site

**KNOX COUNTY**

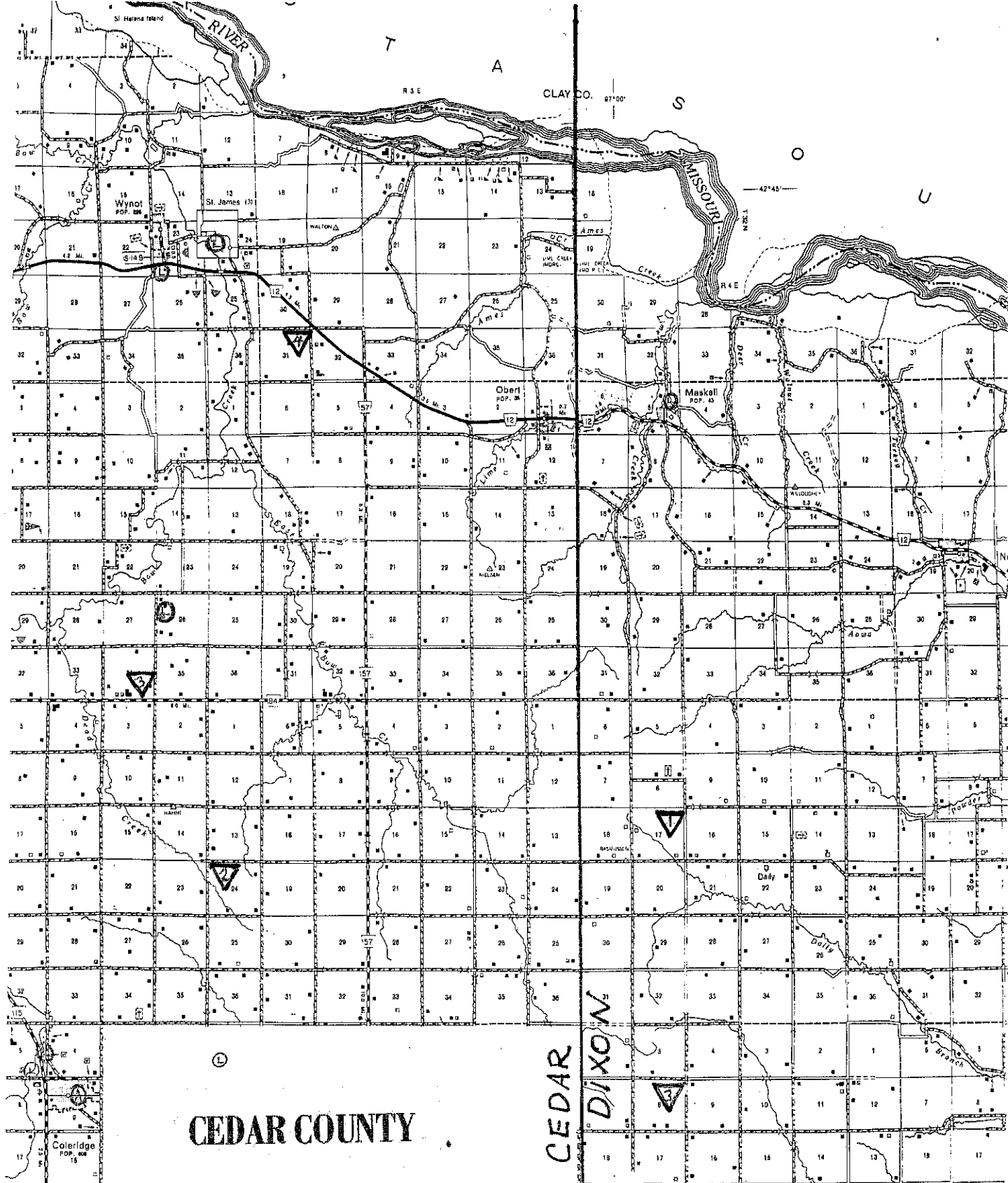


# KNOX COUNTY

KNOX  
CEDAR

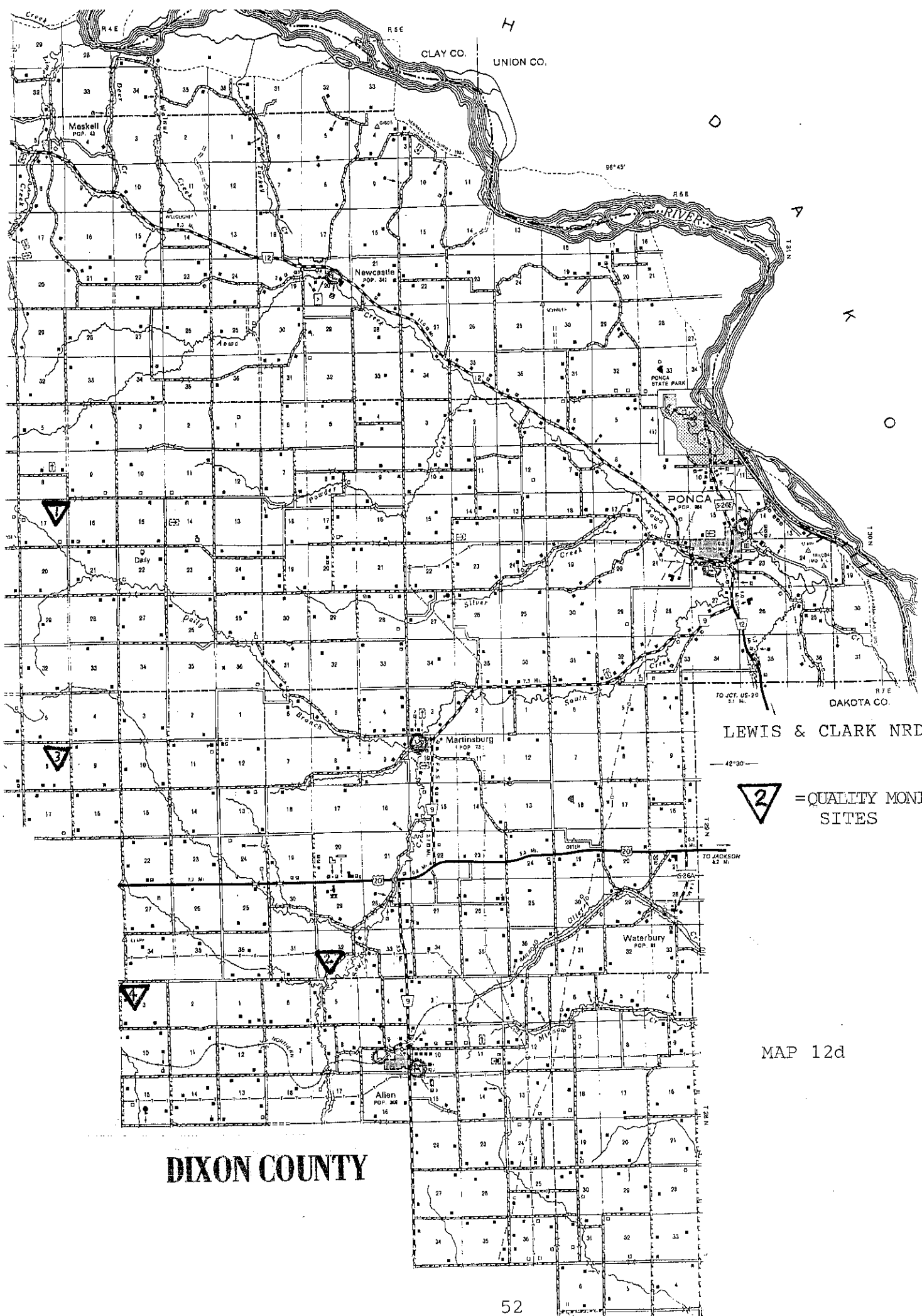


MAP 12b



MAP 12c

**WIS AND CLARK  
RESOURCES DISTRICT**



DAKOTA CO.  
LEWIS & CLARK NRD

**2** = QUALITY MONITORING SITES

MAP 12d

**DIXON COUNTY**

TABLE IX

## GROUNDWATER QUALITY MONITORING RESULTS

Since 1987, the Lewis & Clark NRD has been sampling Groundwater at selected locations across the District. This information provides a data base to monitor changes in water quality. Site location was based on active irrigation wells having accessible collection points. These also gave well log data to determine aquifer characteristics including all but the Dakota Aquifer. Samples are taken in summer months by trained District personnel and submitted to State Dept of Health for analysis. Following their required procedures.

First year testing sampled for the presence of nitrate-nitrogen, pesticides, herbicides and volatile organic compounds. Since only nitrate-nitrogen concentrations were found to be of concern, sampling for other parameters are not done annually. Following are the results of nitrate-nitrogen levels found by years (1992-1994 data incomplete). Locations of the numbers can be found on Map 12.

<u>LOCATION</u>	1987	1988	1989	1990	1991
<u>DIXON CO</u>					
D1 (Morton)	4.4	4.0	3.6	3.1	3.3
D2 (Haisch)	--	0.3	0.8	0.6	0.6
D3 (George)	1.8	0.2	0.5	0.4	0.4
D4 (Eckert)	--	3.9	5.1	6.0	6.6
<u>CEDAR CO</u>					
C1 (Arens)	--	7.9	9.7	7.8	10.6
C2 (Papenh)	4.0	5.1	7.7	8.1	4.4
C3 (Stone)	6.8	13.9	6.9	14.5	7.8
C4 (Kaiser)	--	0.8	0.5	0.9	1.4
C5 (Kathol)	<0.1	<0.1	<0.1	<0.1	<0.1
C6 (Lindeman)	1.9	0.2	0.1	2.3	0.2
C7 (Pick)	13.5	1.0	0.8	0.4	0.6
C8 (Seim)	0.9	0.6	0.4	0.4	0.4
C9 (Hoelsing)	--	<0.1	<0.1	<0.1	<0.1
C10 (Zavadiil)	--	<0.1	<0.1	<0.1	<0.1
C11 (Sudbeck)	--	<0.1	<0.1	<0.1	<0.1

<u>KNOX CO</u>	<u>1987</u>	<u>1988</u>	<u>1989</u>	<u>1990</u>	<u>1991</u>
K1 (Moline)	1.8	0.2	3.1	0.1	0.1
K2 (Hochstei)	15.5	15.5	15.8	15.9	17.2
K3 (Mackepra)	--	8.0	8.0	7.8	6.9
K4 (Braunsro)	--	<0.1	<0.1	<0.1	<0.1
K5 (Mills E)	4.0	3.0	2.8	2.5	2.9
K6 (Mills W)	--	4.4	4.9	5.9	5.9
K7 (Frevert)	<0.1	<0.1	<0.1	<0.1	<0.1
K8 (Doerr H)	--	--	--	9.9	0.2
K9 (Doerr Br)	--	--	10.3	10.5	11.3
K10 (Stevens)	--	--	8.2	7.3	7.0
K11 (Doerr K)	6.3	3.9	11.5	5.8	5.0
K12 (Ober D)	--	--	6.2	5.4	5.8
K13 (Doerr Bl)	--	--	19.6	8.6	8.3
K14 (Ober M)	7.7	6.7	6.6	4.3	4.2
K15 (Condon S)	3.8	3.6	4.2	4.4	4.5
K16 (Condon N)	6.4	7.0	8.0	9.1	7.8
K17 (Ebel)	--	--	13.6	18.1	15.6
K18 (Doerr D)	--	--	8.2	7.2	8.3
K19 (Hansen)	--	--	6.4	--	--
K20 (Paesl)	--	--	--	8.2	8.5
K21 (Fuchtm J)	--	--	8.4	17.6	17.3
K22 (Fuchtm K)	11.7	15.9	18.2	16.1	16.2
K23 (Doerr KS)	--	--	11.5	13.9	13.2
K24 (Rice)	--	--	8.0	7.4	8.3
K25 (Bartak)	--	--	16.4	12.2	15.6
K26 (McGill)	--	--	8.7	7.8	8.2
K27 (Eggerl)	--	--	4.1	--	--
K28 (Schlote)	--	--	11.3	13.4	11.2
K29 (Wostrel)	--	--	6.6	7.0	8.5

domestic wells in the eastern glaciated parts of Nebraska contained levels of nitrate-nitrogen exceeding the MCL." He further comments that concentrations are extremely varied within this glaciated area and that; "most contamination appears to be associated with point sources that are characteristic of older household and barnyard complexes." He theorized that as more of the old wells are replaced the incidence of high nitrate-nitrogen should decrease. Spalding also noted high correlations of nitrate-nitrogen to bacteria in northeast Nebraska. The area also had a rather high occurrence of gross alpha activity which indicates a uranium concentration in the soil. These both may be issues for future consideration as data deficiency items but are not a priority concern at this time.

As a further effort to build on base data available, the NRD is also considering the prospects of getting updated test sampling of the locations listed in Table IV (original plan). The 1978 data included a wide spectrum of parameters, however many of the sample sites no longer exist as producing wells. The district plans to research the location information to see where current data may be obtainable.

#### IV. LAND USE AND CONTAMINATION SOURCE INVENTORY

##### A. Land Use

Digitized Land Use Surveys are not available for the Lewis & Clark NRD as of this writing. When they become available the NRD intends to examine the impact land use has on areas of recharge and potential contamination locations.

##### B. Contamination Source Inventory

###### Non-point

Residential areas are limited in Lewis & Clark NRD so that almost all non-point source contamination comes from Agricultural activity. From Spaldings Report (1991), and based on the Bazile Triangle Study (1990), the most likely source is fertilizer-manure application practices together with over watering of irrigated crops. Documentation on exactly where this is occurring is presently speculative until monitoring efforts indicate concentration increases. It is worth noting however that fertilizer consumption in Nebraska is on the increase in the last 5 years. Almost 1.9 million ton was sold in the state in 1990. Cedar County has 9,250 ton. Dixon County has 2,085 ton and Knox County 9,968 ton (ref Ag Statistics, 1990). Location of large fertilizer storage sites has been noted by means of director surveys. (Map 13)

###### Point Source

The Dept of Environmental Quality has provided this NRD with a listing of current point source activity (1992). What follows is a summary of those locations and type of activity in the Lewis & Clark NRD:

##### 1. Wellhead Protection Areas

Delineated by DEQ at Creighton, Waterbury, Newcastle, and Maskell. The Lewis and Clark NRD continues to assist those communities on this.



## 2. Feedlots

Exact locations are available but there are currently 7 in Knox County, 14 in Cedar County, and 4 in Dixon County. An area west of Bloomfield has a concentrated area of 3 hog confinements and egg production facility. The area warrants future consideration for expanded monitoring activity.

## 3. Hazardous Waste Site (RCRIS)

Seven locations in the NRD are presently registered with EPA to deal with hazardous substances; either to generate, store or for transporting. They are Hesse, Inc, and Sexauer Co., Crofton, NE; Hydraulic Components Industry, Hartington, NE; George Van Cleave, Allen, Bloomfield Monitor, Bloomfield, Robert Youst, Coleridge, and Northland Transportation Inc, Magnet.

## 4. Hazardous Substance Storage

The Emergency Planning and Community Right to Know Act lists businesses that use, store, or release hazardous substances. There are 14 listed community locations for storage of pesticides: Allen, Bloomfield (2), Coleridge (2), Creighton, Fordyce, Hartington (3), Magnet, Newcastle, Ponca and Wynot.

There are also 28 locations where petroleum products are stored. They include all of the previous listed towns plus Crofton and St. Helena.

## 5. Leaking Underground Storage Tanks (LUST Sites)

A 1992 listing of all leaking underground storage tanks lists 10 locations in the Lewis & Clark NRD. In all cases the leaking product was identified as either gasoline, diesel fuel or waste oil. Those sites by community include: Allen, Bloomfield, Coleridge, Creighton (6), Crofton, Hartington (3), Newcastle, Magnet, Ponca (3), and Wynot.

## 6. EPA Hazardous Substance Spill Site (CERCLIS)

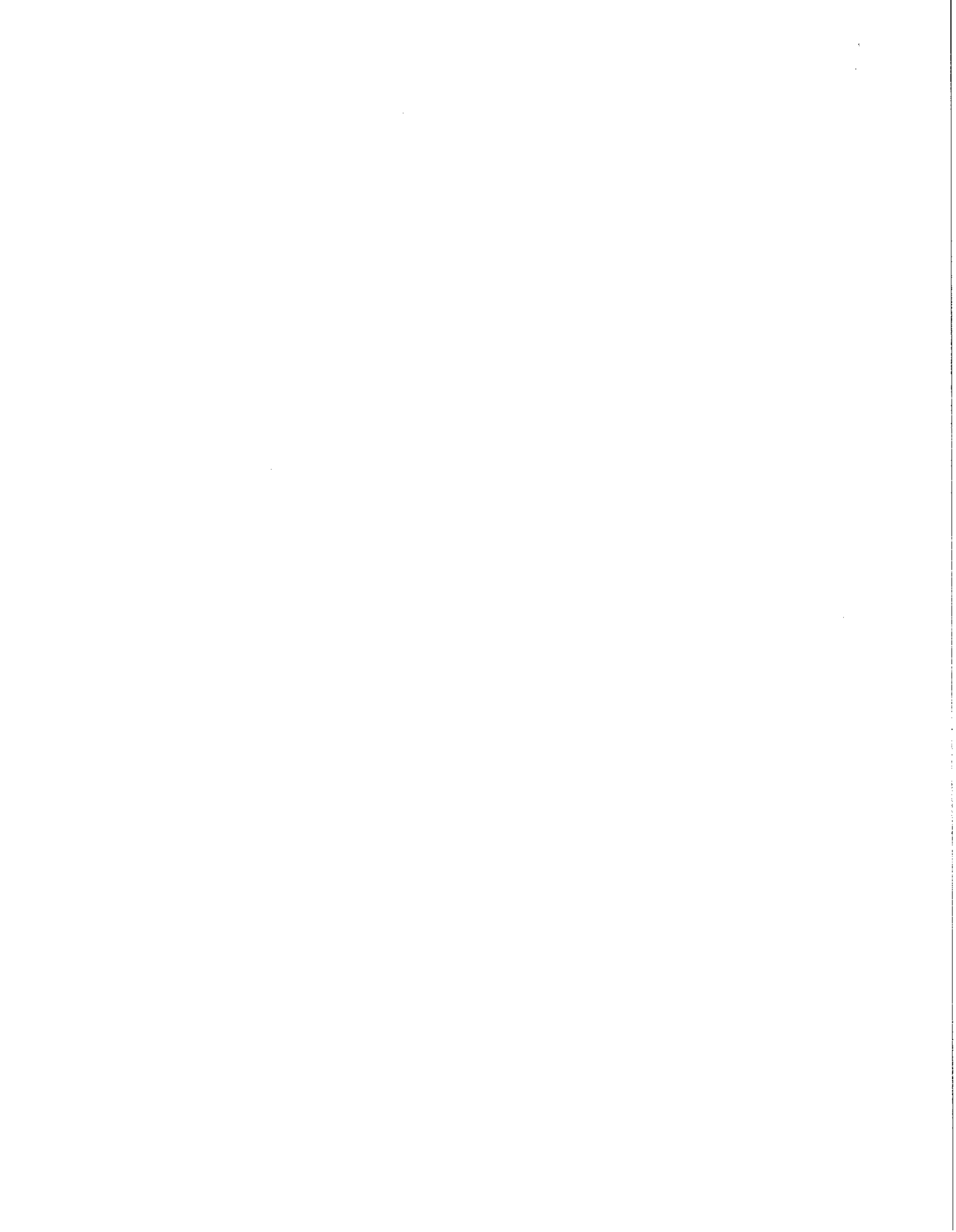
There are two locations in the NRD which state and federal authorities have identified as being contaminated with a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Information System. They include George Van Cleave of Allen, NE and Village of Fordyce, Fordyce, NE.

## 7. Landfills

Most landfills in the District are being closed or have been at this time based on information provided by DEQ. Fordyce and Magnet have closed and Creighton and Hartington area in the process. Landfills at St Helena and Newcastle are unlicensed and presently scheduled for additional study. The only licensed landfill remaining in the NRD is, Arens Sanitation, near Crofton. It has a listed design of 12 acres and a life span of 35 years. Plans are underway at Hartington to locate a Central Transfer Station to receive garbage for re-transport to the LB Gill licensed landfill located at Jackson, NE. Several communities are expected to cooperate in this method of disposal.

## 8. NPDES Permits

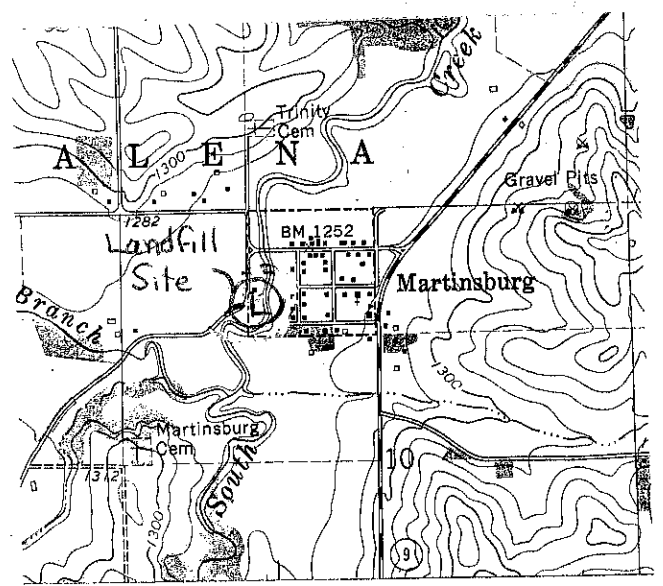
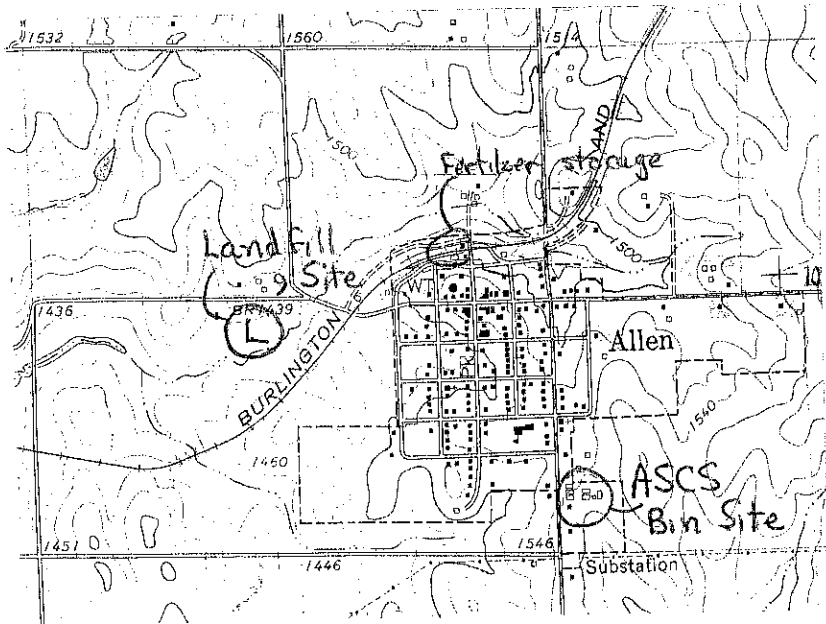
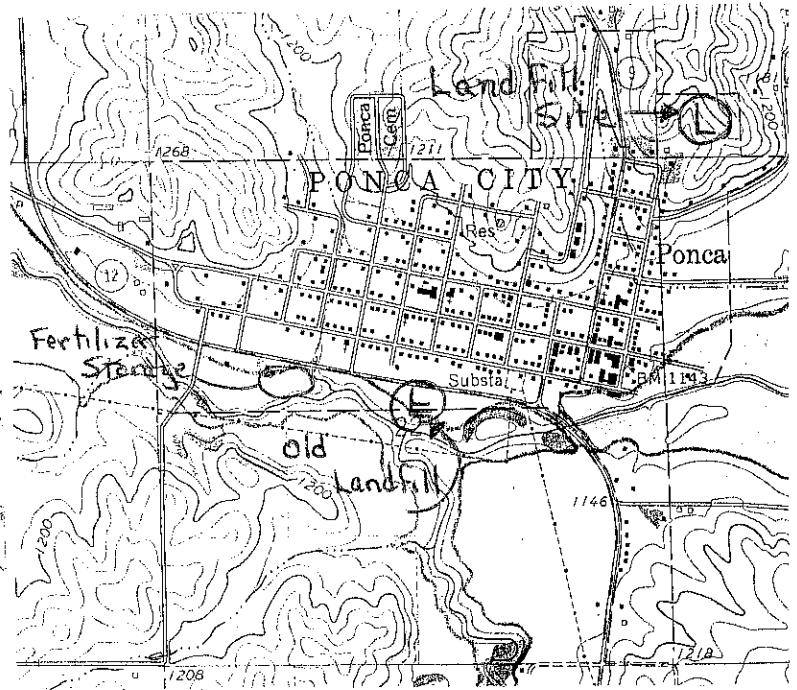
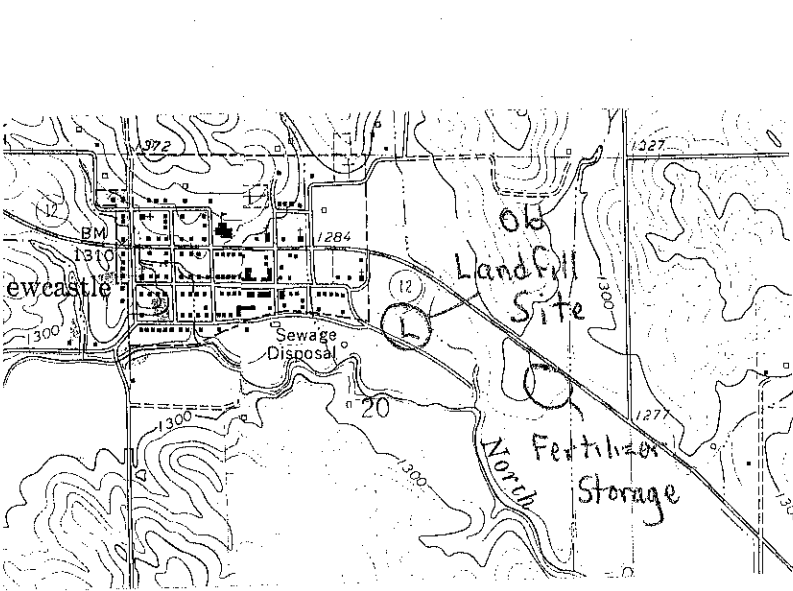
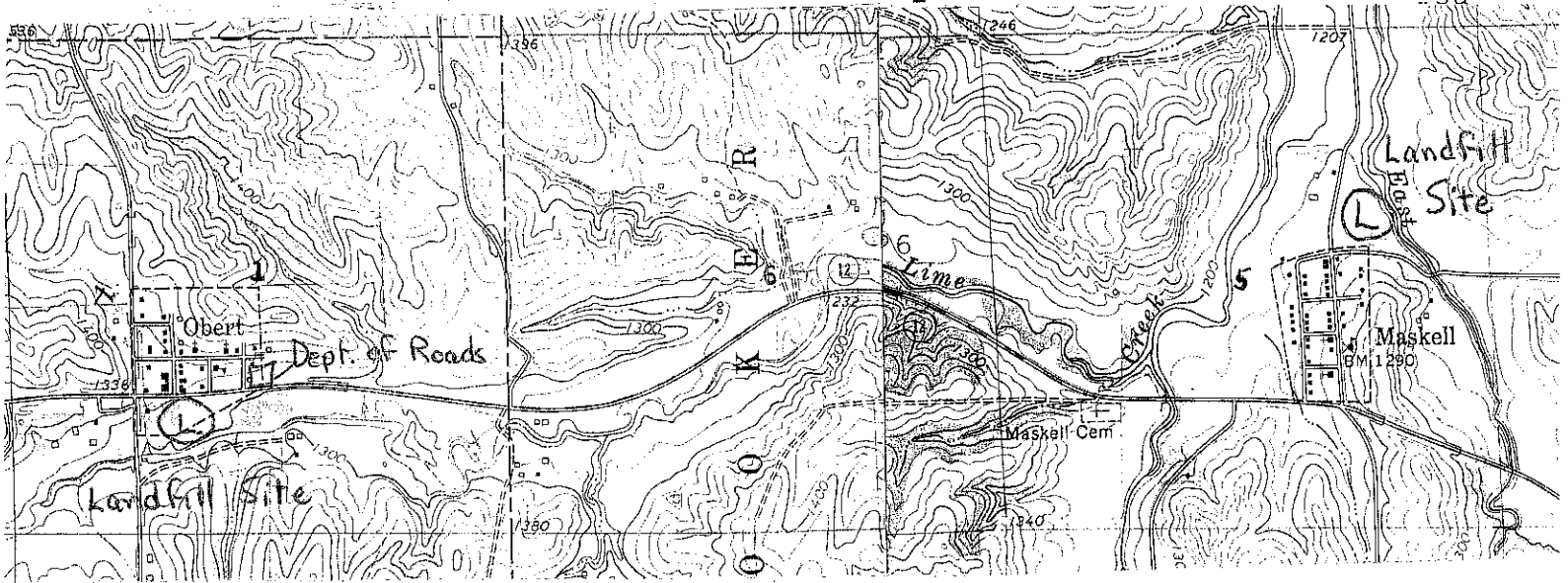
National Pollution Discharge Elimination System permits have been issued to 19 facilities in the NRD, 12 of these are for Waste Water Treatment Facilities of local communities. The others related to individual discharge facilities that provide annual reports to DEQ.

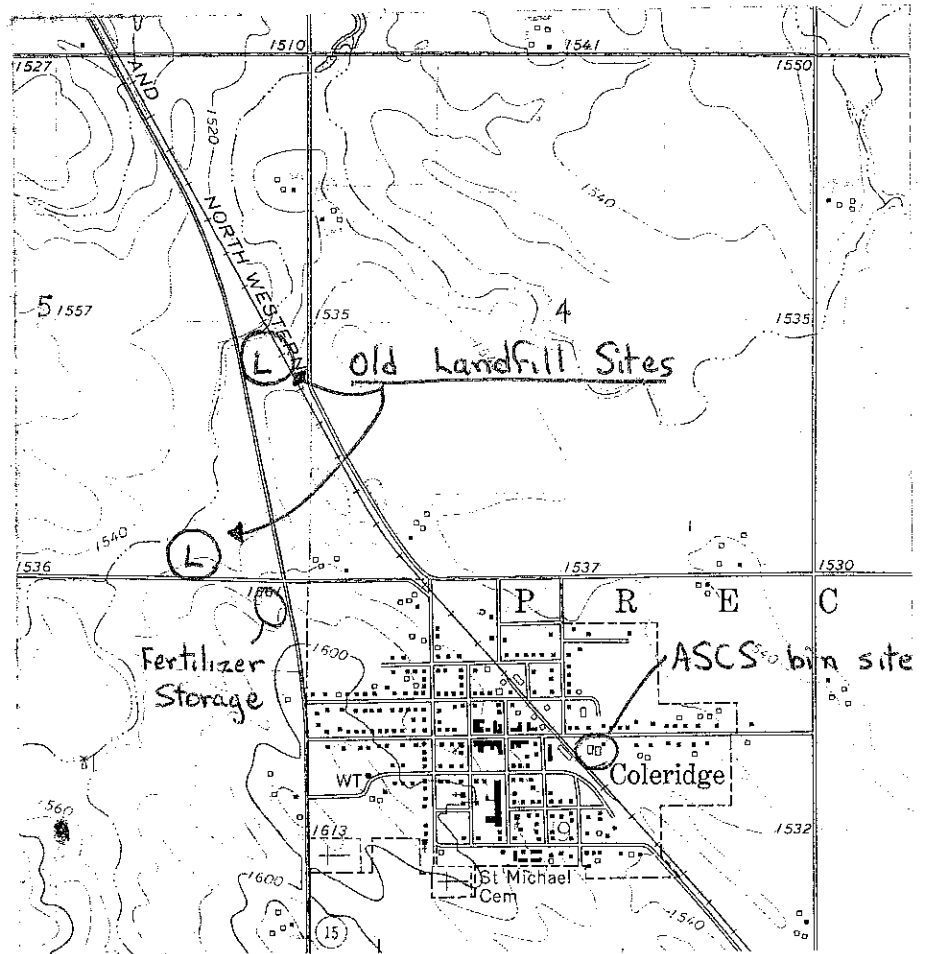
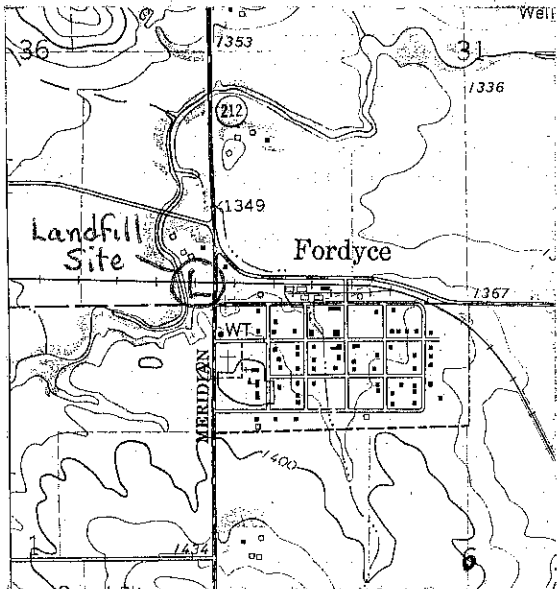
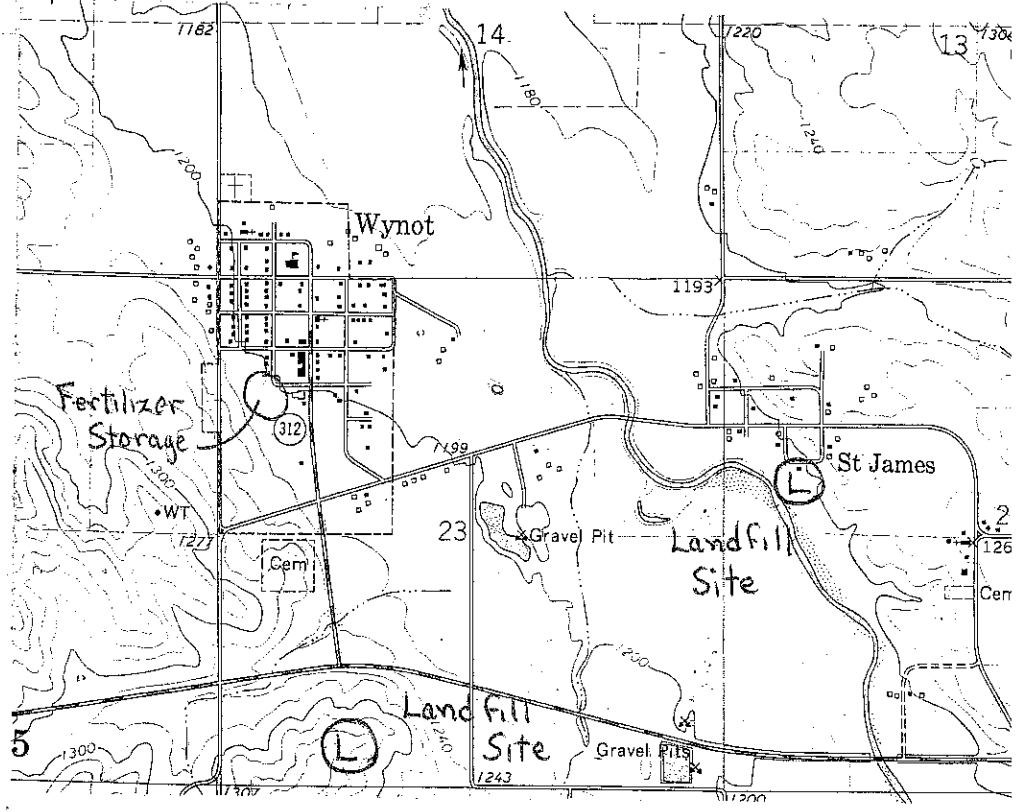
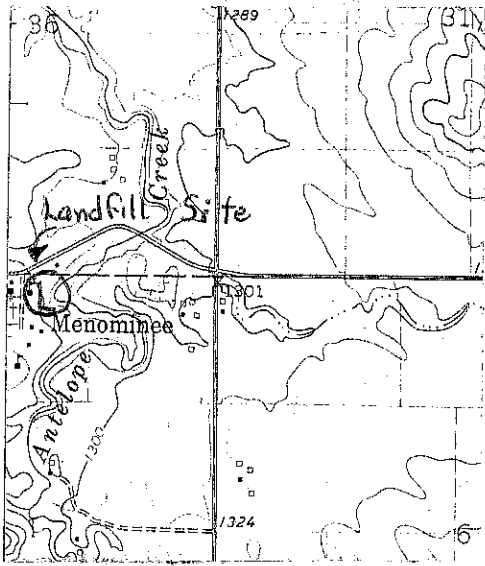


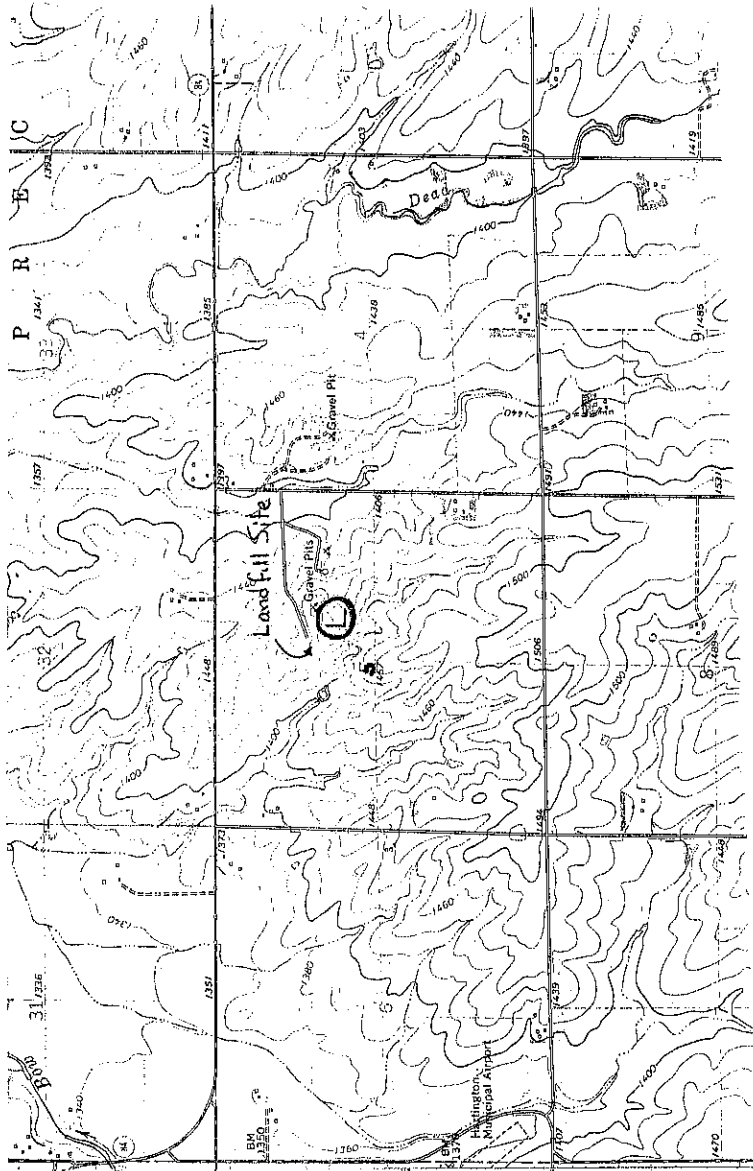
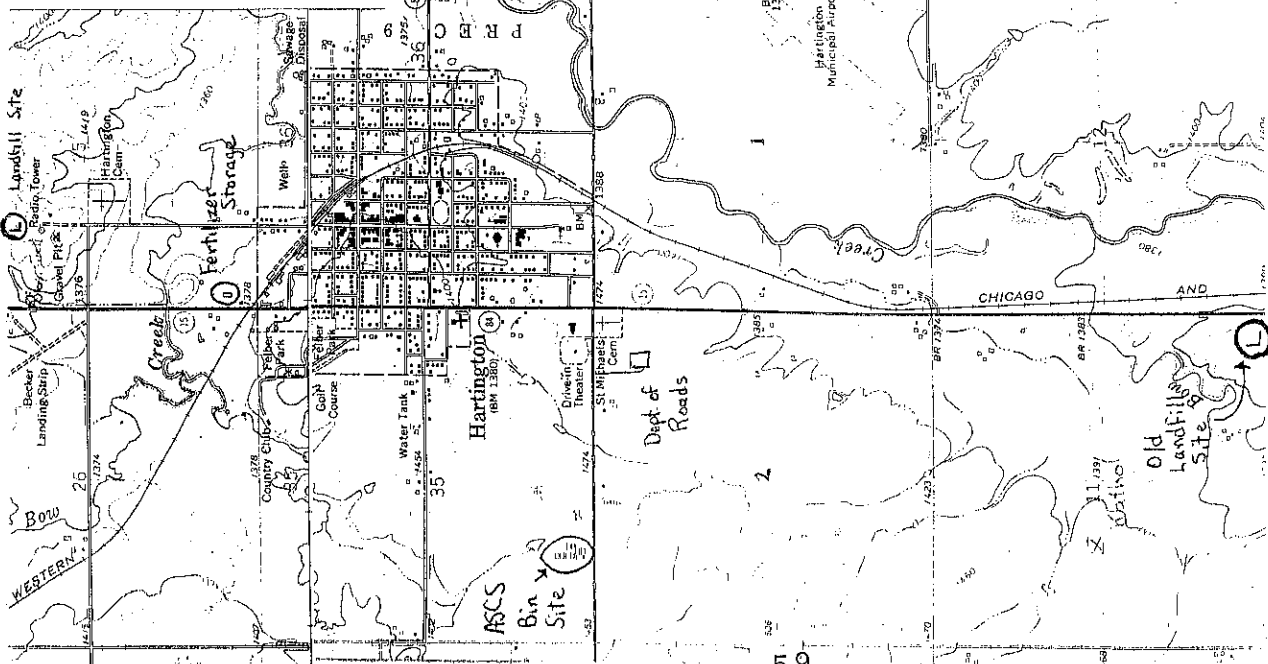
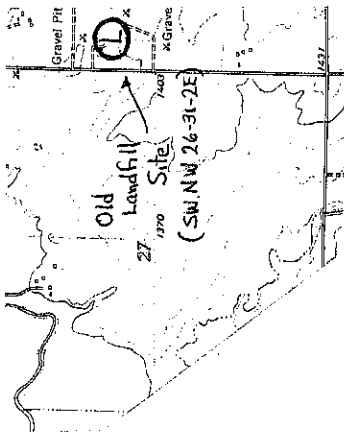
# DIXON COUNTY

## INVENTORY OF POINT SOURCE LOCATIONS -1993-

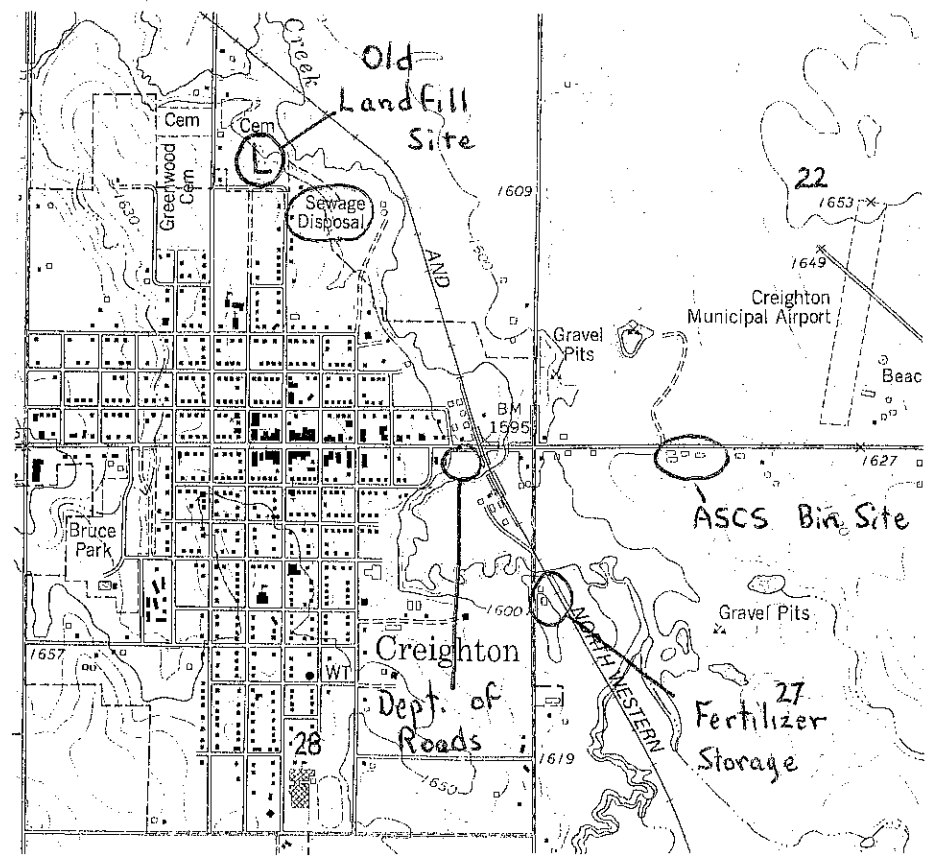
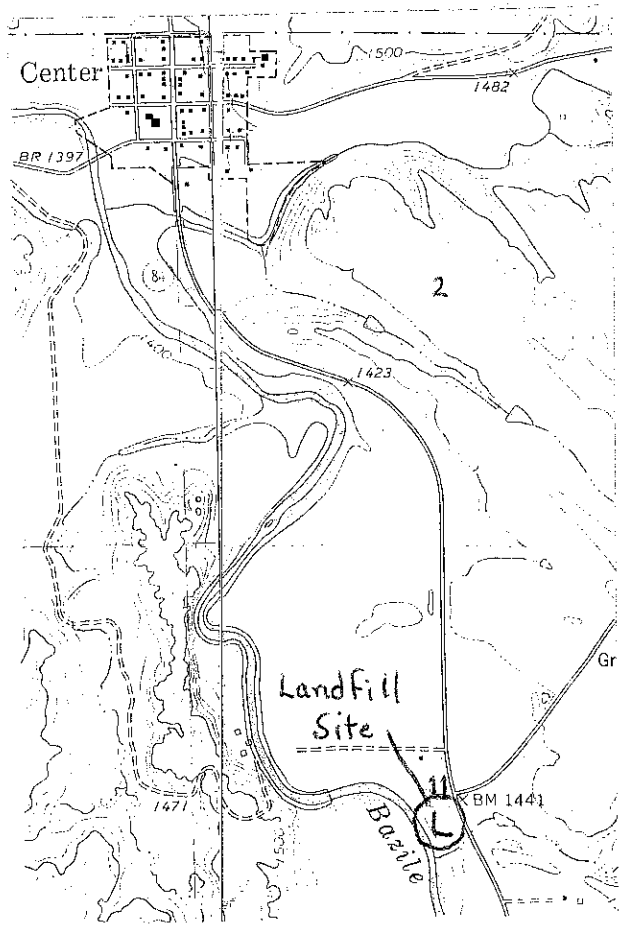
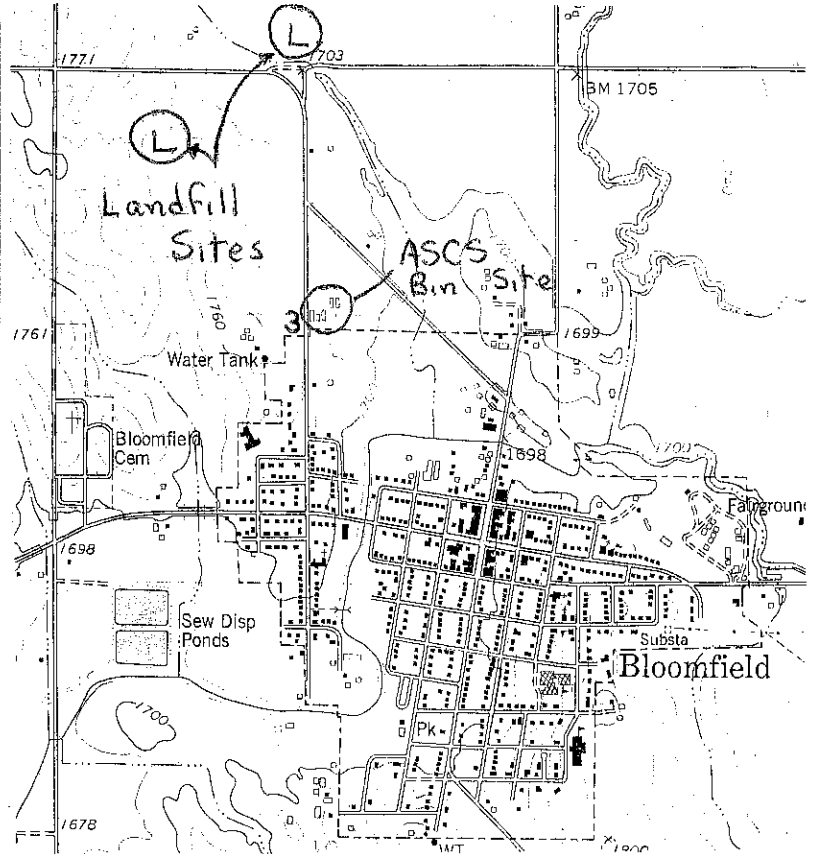
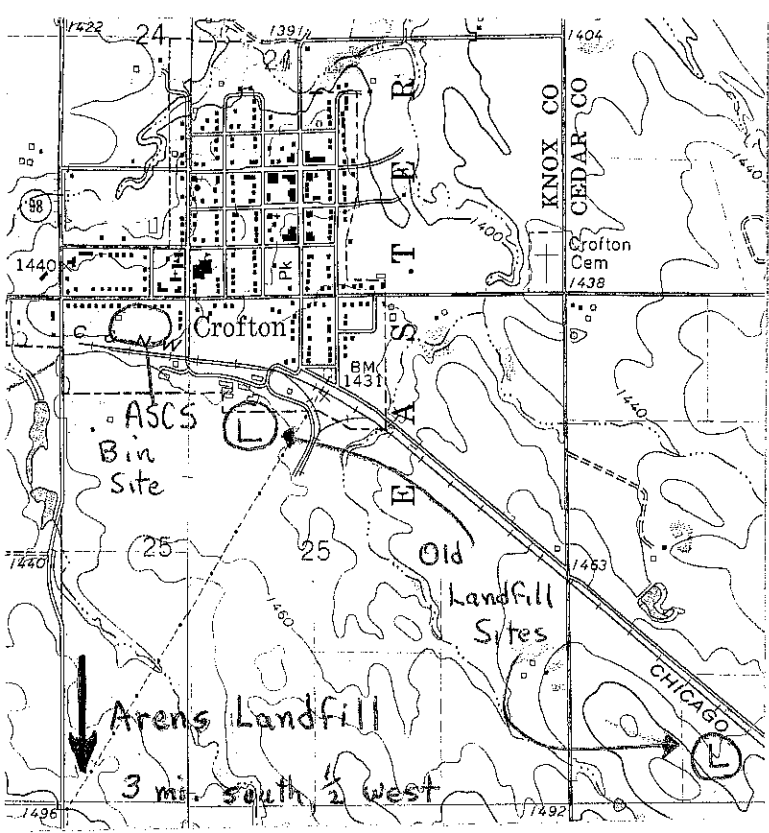
13a







HARTINGTON AREA ... Reduced Scale



## 9. ASCS Grain Storage Sites

By utilization of NRD director participation survey, the NRD has located six former ASCS grain bin storage sites. The presences of Carbon Tetrachloride in groundwater at Bloomfield and other state locations have raised the issue of possible future concern. These locations are noted for the record on Map 13.

## V. WATER USAGE AND DEMAND

Groundwater usage in the Lewis & Clark NRD primarily goes to domestic and agricultural use. As discussed in the original Groundwater plan. Aquifer characteristics allow limited availability of groundwater supplies and static water levels have remained fairly constant (Table VIII). Outside of relatively high naturally occurring total dissolved solids, groundwater in the NRD is generally suitable for current and potential use.

Population Density has declined in the Lewis & Clark NRD over the last 10 years. NRD population by 1990 census was 16,572 compared to 19,428 in 1980. That represents about a 15% decline. Comparisons of municipalities alone show the same proportion, so that the decline can be described as uniform across the entire NRD, regardless of rural-urban associations. Water use by municipalities, from limited information collected by UNL Conservation and Survey and USGS, does not reflect significant trends in comparison since 1980. Not enough information is available to adequately project if municipal usage is increasing or decreasing as this is an area of data deficiency among state agencies.

Future demand for domestic water will likely not increase for population requirements. It can be expected however that if groundwater quality declines, some communities as well as private individuals will be looking for alternate sources of water or treatment of existing sources. Such problems have already occurred at Creighton, NE which has installed a water treatment plant for nitrate removal. For like reasons Obert has contracted to the Lewis & Clark NRD - Cedar Knox Rural Water Project to join with St. Helena which also depends 100% on rural water as a source. Crofton supplements their wells at present with rural water. All other communities in the NRD presently depend on groundwater wells as their source of drinking water. Expansion situations of the rural water project to serve other communities is not anticipated except in limited situations, so that future quality concerns will likely need to be dealt with by municipal treatment methods. Bazile Mills and Waterbury are two communities that are working on decisions for nitrate-nitrogen alternatives. The NRD continues to assist those communities that encounter such problems.

Agricultural usage through irrigation remains at a constant level. In 1985 there were 509 total registered wells. In 1992, that total increased to 558, an increase of 9.6%. Current SCS figures show total irrigatable acres represent 8% of the cropland in the NRD. Most of irrigation is applied through center pivot systems and because of aquifer characteristics limiting

availability, the location of that irrigation is predominantly on southern portions of the NRD (Map #14). No control or management areas presently are established that require metering. Consequently, data on specific gallons pumped is not available. Future growth and additional demand for Groundwater irrigation is not expected to be significant, simply because of aquifer limitations.

Water usage and demand by industrial, fish and wildlife, and recreation is not expected to change significantly; nor are they presently impacted greatly by groundwater quality in the Lewis & Clark NRD.

Analysis of impacts on endangered or threatened species have been considered. According to the Nebraska Game & Parks Commission the only species that might presently be located in habitat of the Lewis & Clark NRD is the Western Prairie Fringed Orchid. No technical data is available to identify negative impacts on this or any other presently known endangered or threatened species by planned groundwater management activity. Coordination with the Nebraska Game & Parks is anticipated to locate habitat sites that may be suitable for the Orchid or other species. The procedure for addressing endangered and threatened species shall follow four prescribed steps.

1. Recognition of the existence and/or potential existence of threatened species that may be affected by groundwater levels. At this time only Western Prairie Fringed Orchid is thought to be present in the Lewis & Clark NRD
2. Recognition that general protection of groundwater quantity and quality has many benefits including protecting the habitats of threatened species.
3. Recognition that any groundwater management activities proposed in the plan may have some impact (positive or negative) on threatened species listed in the plan.
4. Should specific adverse effects on threatened species from changing groundwater levels be identified the NRD acknowledges the potential need to modify groundwater management plans in the future. Such modifications should include actions within control or management areas consistent with the Nebraska Groundwater Management and Protection Act that could be taken by the NRDs to reduce adverse effects on species by maintaining a groundwater level that will help sustain these species.

## VI. IDENTIFICATION OF CRITICAL AREAS

To come to a consensus of groundwater contamination risk, it is necessary to again review the physical characteristics of the Lewis and Clark NRD. Located in the northeast corner of the state, the NRD has rolling hills topography leftover from



NEBRASKA NATURAL RESOURCES COMMISSION  
DATA BANK

LEWIS AND CLARK  
NATURAL RESOURCES DISTRICT

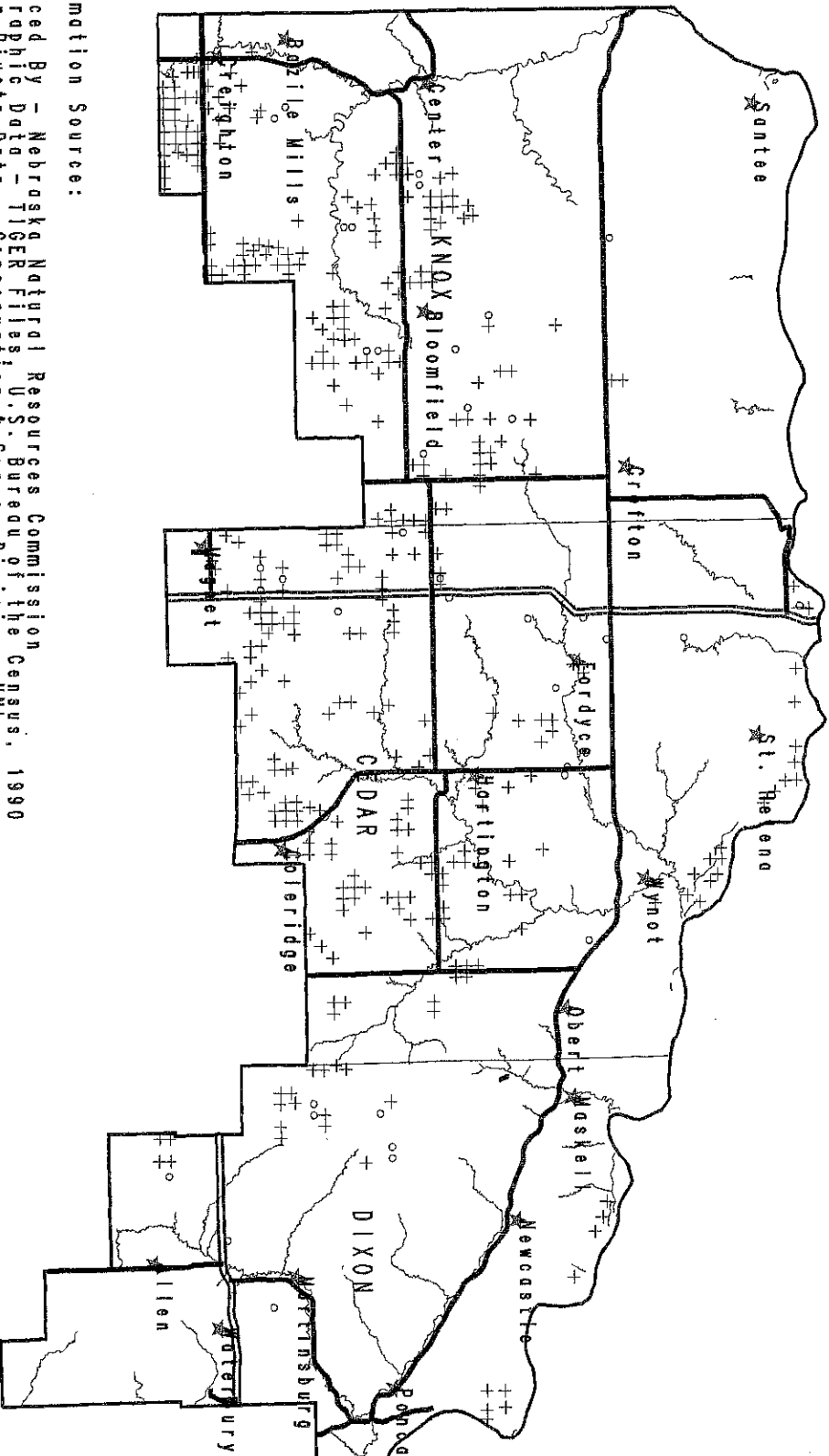
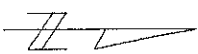
CENTER PIVOTS LOCATION MAP

LEGEND

- + Pivots sighted in 1988
- o Pivots not sighted in 1988
- == Interstates and Primary Highways
- U.S. and State Highways
- Perennial Streams and Canals

MAP #14

Scale 1:500,000



Information Sources:

Produced By - Nebraska Natural Resources Commission  
 Topographic Data - TIGER Files; U.S. Bureau of the Census, 1990  
 Center Pivots Data - Conservation & Survey Division UNL,  
 Database updated through Dec. 1988  
 GIS Process - ARC/INFO  
 Processed - March, 1993

glaciation activity. That glacial till is composed of great loads of unstratified debris made up of clay, silt, sand, gravel, and boulders. The eastern portion of the District has wind blown loess deposits. There is a well developed pattern of drywash tributaries and streams draining the surface towards the Missouri River. Beneath this topography are the Pleistocene or Holocene deposits, and the Niobrara formations described previously in this plan, which serve as the primary aquifers.

On the surface, agriculture has adapted the soil to uses as cropland, pasture and range for the production of crops and livestock. Existing land use, while generally good is subject at time to poor management by individuals who allow excessive soil erosion or overgrazing of pasture and range. Soil associations present in the NRD (discussed previously) can offset or contribute to potential problems. Map 10, (original plan) for example, illustrates some areas of sandy soil associations having excess drainage and more likely to initially show contamination from surface leaching. Where irrigation is present as well, these areas are considered "indicator zones" that would be precursors of potential problems from contamination.

The District has some areas of concerns that warrant continued or intensive monitoring. One of those areas is around Creighton. That area was the subject of an intensive groundwater study in 1989; (reference Bazile Triangle Groundwater Quality Study Paper #68 UNL Conservation & Survey). The study indicated that 25% of the irrigation well samples had nitrate-nitrogen levels exceeding the MCL. In the study conclusions however, the author states, "There is insufficient data to implement a specific groundwater management or protection strategy even though the groundwater appears to be contaminated to varying degrees." Subsequent annual sampling activity since 1989 have not identified significant trends. This part of the District will be the focus of continued monitoring and already has been targeted by USDA as part of the Bazile Triangle WQSP. As such it qualifies for special cost share eligibility through ASCS including long term agreements. ACP cost share, WC-4 and SP53. Part of east-central Cedar County and west-central Dixon County may also be considered as potential indicator zones, and will continue to be monitored.

Land uses in the areas mentioned previously may have a significant impact on groundwater quality. In the Lewis & Clark NRD, contamination of groundwater is most likely to occur in non-point source cases from fertilizer over application (ref. Gosselin, 1991), and in point source situations from poorly constructed wells (ref Spalding Study, 1991). Based on that premise, both existing and future cropland areas of the District, which receive the bulk of fertilizer activity, bears watching. That cropland base is not likely to expand, nor is the area population. Groundwater quality, however, may still decline without attention in those cases, as leaching continues to occur under both contaminated and natural conditions.

Quantity depletion is not expected to be a current or future impact on groundwater quality unless unknown factors intercede on present situations.

## VII. GROUNDWATER QUALITY GOALS AND OBJECTIVES

The District recognizes that it cannot control all factors that lead to an increase in nitrate nitrogen or other contaminants in groundwater. Climatic conditions, cropping practices, and natural breakdown of organic residue can lead to leached contaminants that would occur even with proper fertilizer application, for example. Consequently, the District would prefer a holistic approach to preserve the natural quality of groundwater by an educated management effort that includes consideration of all best management practices. The NRD feels this can best be accomplished by voluntary cooperation of landowners until scope and trends indicate otherwise. The basis for this position rests in the fact that aquifers in the NRD are not homogenous. Generalized control area solutions that would be appropriate for heavily irrigated, consistent aquifer locations in Nebraska would not necessarily fit Northeast Nebraska where irrigation is less than 10% and contamination from point source, is as likely as non-point source because of the aquifer variability.

Based on the limited hydrogeologic information available, the Lewis & Clark NRD's goal is; "to maintain infinitely the natural quality of groundwater sufficient for all beneficial uses of the water and below current established federal maximum contaminant levels (MCL's). Modified objectives developed locally through public discussion at NRD board meetings has evolved to; first, monitor and identify problem areas, and secondly, carry out voluntary preventative programs and practices to address those problems. Third, should trends become apparent that identify problems that exceed maximum contaminant levels, the board shall take steps to set boundaries and establish groundwater management or special protection areas, to institute regulatory steps as necessary. The process of accomplishing this shall be defined in Phases. Phase I and II relate to ongoing District programs or intensified efforts. Phase III involves official designation of a Groundwater Management area based on the NRD "Scope and Trends" factor to be defined here. (TABLE X)

### REVIEW OF OBJECTIVES

#### PHASE I. Monitor and identify problem areas

The areas of concern for water quality continue to be those shown on Map 10 and have been the focus of existing programs. Although no significant trends have been established, data collection continues in order to monitor quality status and will be expanded as the need arises. Additional study, for example, may be necessary to evaluate seasonal variations or the extent of contaminant stratification, to determine details on the hydrogeologic system. The NRD uses irrigation wells for locating areas of concern because of the reliable data available in registered well logs. Monitoring efforts are intensified if test results indicate increasing trends following Phase II procedures.

#### PHASE II. Voluntary Preventative Programs

Many of the authorities of a declared management or special protection area are available to implement voluntarily prior to

such declaration. Preventative groundwater quality programs that will be reviewed in Section VIII are already underway in the NRD. Concentrated efforts are focused on areas where contaminant levels have reached 50% of their MCL limits. Voluntary methods will continue and intensify at that time to include additional monitoring wells. The District will strive to add wells within 2 miles for each suspect well that show concerning results for two consecutive years. Preventative Programs in Phase II will be funded at 100% and Educational public meetings will be planned. Specific efforts will be undertaken with Conservation & Survey staff to determine within 6 months if test results are being contaminated from non-point or point sources (point sources are exempted from this Phase consideration and will be referred to DEQ). Additional studies to determine aquifer consideration depth to water, direction of flow, soils and water use development may be desirable. The District may seek study and declaration of a Special Protection Area by DEQ if that option appears more effective at that time.

#### PHASE III. Groundwater Management Area based on Scope and Trends

Official designation and regulatory actions for water quality will be established when contaminant levels and annual trends indicate the need. This process we will call the "Scope and Trends" factor which is defined as when 50% of the groundwater samples taken over a large area show an increasing trend for 3 years that reaches 90% of the MCL. The NRD will then define boundaries for the described area, which unless determined to be less by the NRD board, shall be a minimum of 18 square miles. For example, if nine or more individual wells within an 18 square mile area show a 3 year upward trend on testing results, that reach or sustain a level of 90% of the MCL for any contaminant determined to be from a non point source; the NRD will within 1 year establish boundaries along section lines based on Phase II studies. If for some reason trend factors increase substantially on less than 50% of the wells, the District reserves the right to still initiate designation and regulatory actions if it feels that to be appropriate. Specific actions in addition to Phase II Efforts shall include the following:

#### Phase III Management Action Tools

1. Restriction on fall fertilizer applications
2. Certification by area farmers on irrigation and fertilizer management.
3. Requiring "Best Management Practices" (irrigation scheduling, timing of fertilizer and pesticide application and other management programs
4. Require annual analysis of groundwater and deep soils samples for fertilizer and chemical content
5. Annual reports by area farmers on management activity.

As mentioned previously, only 8% of the District areas are under irrigation. However, if extensive irrigation use is determined to be a factor, additional tools to implement a groundwater Management Area would include:

1. Required use of flow meters and monitoring equipment
2. Allocation of water on an acre-inch basis
3. Rotation system of water usage
4. Well spacing requirements
5. Reduction of irrigated acres.

#### VIII. GROUNDWATER QUALITY PROGRAMS AND PRACTICES

The Lewis and Clark NRD believes in preventative programs to the point where conditions are not reversible otherwise. In a risk assessment-risk management determination in 1993, the District concluded that voluntary compliance is an effective way to address current problems in the District because cooperation has been positive and affected areas are relatively small. Further, many general programs that would be part of a management area package already are now being utilized throughout the District on a voluntary basis. They include:

##### 1. Deep Soil Testing Cost Share Program

District pays 75% of actual costs for samples taken to 3 foot depth and analyzed for residual nitrogen. 320 acre limit established per cooperator. Copies of results and billing are required for payment. Annual participation is about 50 cooperators per year at a NRD cost of \$10,000. Since the program was started in 1990, results have shown a considerable drop in average residual nitrogen.

##### 2. Sealed Well Abandonment Program S.W.A.P.

Inverse cost share program to encourage proper plugging of abandoned wells. District takes \$50 application fee and then contracts by annual bid to licensed well drillers to properly close off well sites. Annual participation is about 50 cooperators per year at a NRD cost of \$10,000.

##### 3. Wellhead Assistance Program

Work with local communities by offering the previously mentioned programs and establishing protection plans in cooperation with Dept of Health. Creighton and Waterbury are currently being assisted. Creighton has an identified well recharge area that the NRD has targeted for 100% cost share assistance of #1 and #2. Waterbury is utilizing the S.W.A.P. program to address contamination concerns in and around their community.

#### 4. Information & Education Program

Public meetings to announce availability and results of programs, demonstration plots, and management efforts are being held throughout the NRD on an on-going basis. With the cooperation of Knox County Cooperative Extension and Soil Conservation Service, the Bazile Triangle WQSP has made available irrigation and fertilizer management programs with consultant supervision and federal funding. Some of the results of the project, for example, showed reduced average nitrogen application on corn by 38# per acre in Knox county (ref Jorgensen, 1993). Compared with the state average application rate of 144# per acre (Ag statistics, 1990) this would lead to significant benefits. In a survey done by Soil Science News, 1989, a survey of 158 local landowners showed the need for professional soil sampling services, and 83% knew of the practice and felt it was a major benefit. Public meetings with testimony by farmers together with television and radio coverage on successful efforts have led to a gradual adoption of "best management practices" in all areas of the NRD.

#### 5. Rural Water Distribution Projects

Where contamination on a large scale has occurred in the District and alternative sources of supply or treatment are not available; the NRD will utilize its authority for Special Improvement Program Area to develop Rural Water Distribution Systems. This involves criteria specified on page 41. Projects take local interest and need to be successful.

#### 6. Chemigation Permit and Inspection Program

Working together with DEQ, the NRD administers a preventative effort to protect groundwater supplies from chemicals applied through irrigation systems. Fertilizers and Pesticides injected into water applied to cropland prevented from backflow into wells by proper functioning equipment with inspection by NRD personnel.

#### 7. Other Programs

As the district proceeds in monitoring activity and discovers contamination of groundwater quality, it reserves the right to work with other Districts on management efforts or add other programs it deems necessary or that become legally available to implement management of activity that causes such contamination.

### IX. PLAN EVALUATION

By analysis of program response with other NRD's in Northeast Nebraska, the Lewis & Clark NRD has concluded that the programs currently presented are being favorably accepted socially and politically by area landowners, because of a proclaimed intent by the NRD to avoid regulatory measures if voluntary programs are being effective. The popularity of this approach has been significant and, the District believes, has been a successful preventative to increased contaminant levels.

While the scope of the problem areas are relatively limited, and the popularity of voluntary programs has been successful to promise best management practices, the directors feel that regulatory measures are not yet necessary. That alternative has been considered but determined to be expensive and initially counter productive because of farmers resistance to regulation and in the long run not any more effective.

Review of this evaluation as well as the Groundwater Plan itself will occur at 5 years intervals starting in 1996. Existing programs will be determined effective if contamination levels remain constant or decrease. Outside factors including farm programs, conservation plan compliance, economic considerations and other potential forces may all have a bearing on NRD program effectiveness. The decline in NRD population or improved cropping technology may also play a role.

If situations arise that indicate the capability of any district programs has been limited or made ineffective, the directors may chose to utilize other capabilities or resources in new approaches to obtain its goals in water quality.

**TABLE X - LEWIS & CLARK NATURAL GROUNDWATER QUALITY OBJECTIVES**

	<b>PHASE I</b>	<b>PHASE II</b>	<b>PHASE II</b>
<b>HEADING</b>	<b>MONITOR &amp; IDENTIFY PROBLEM AREAS</b>	<b>VOLUNTARY PREVENTIVE PROGRAMS</b>	<b>GROUNDWATER MANAGEMENT AREA</b>
<b>TRIGGER</b>	<b>ON-GOING</b>	<b>ON-GOING AND AVERAGE REACH 50% OF MCL FOR 2 CONSECUTIVE YEARS</b>	<b>50% OF WATER SAMPLES REACH 90% OF MCL FOR THREE YEARS</b>
<b>AREA</b>	<b>DISTRICT-WIDE, FOCUS: EXCESSIVELY DRAINED SOILS &amp; HIGH CONCENTRATIONS OF IRRIGATION WELLS</b>	<b>DISTRICT-WIDE, FOCUS: TWO SQUARE MILES OF WELL WITH 50% MCL</b>	<b>MINIMUM OF 18 SQ MI. ESTABLISH BOUNDARIES ALONG SECTION LINES WITHIN 1 YEAR</b>
<b>ACTIONS</b>	<b>1. MONITOR IRRIGATION WELL QUALITY 2. HYDROGEOLOGIC STUDIES</b>	<b>1. ADDITIONAL QUALITY MONITORING 2. PUBLIC MEETINGS 3. HYDROGEOLOGIC STUDIES 4. PREVENTIVE PROGRAMS, (SECTION VIII)</b>	<b>1. RESTRICT FALL FERTILIZER 2. IRRIGATION AND FERTILIZER CERTIFICATION 3. REQUIRED BEST MANAGEMENT PRACTICES 4. ANNUAL WATER AND SOIL SAMPLES 5. ANNUAL REPORTS 6. IRRIGATION REQUIREMENTS AND RESTRICTIONS</b>

APPENDIX G POINT SOURCE INVENTORY LISTING 1992 INFORMATION

1. Wellhead Protection Areas (4) refer to Map #15

2. Feedlots (25) refer to Map #16

KNOX

1. Nielsen, Lyle	SWSW 27-29N-R5W
2. Fritz, Larry	NWSW 34-30N-R5W
3. Bloom'n'Egg Farm	NE 7-30N-R3W
4. Poppe, Arlen	SE 24-32N-R3W
5. Kube, Loren	SWSW 29-32N-R2W
6. Wortmann, James	SENE 11-32N-R2W
7. Wortmann Dairy	NESE 11-32N-R2W

CEDAR

8. Anderson, Leray	SW 32-32N-R1W
9. Stevens Swiss Dairy	NENE 27-32N-R1W
10. Stevens, Dan	NE 15-31N-R1W
11. Lammers Ranch	NE 25-31N-R1W
12. Pleasant Valley Livestock	NWNW 3-30N-R1W
13. Arens Ranch	NW 27-29N-R1W
14. Hans, Gerald	SSW 35-33N-R1E
15. Hans, Mike	NENE 22-32N-R1E
16. Pinkelman, Rick	NW 33-32N-R2E
17. Leise, Jeff	W W 24-31N-R1E
18. Pork Unlimited	ENW 12-30N-R1E
19. Hansen, Dave	NESE 2-30N-R2E
20. Heimes, David	NW 29-31N-R3E
21. Karnes, Cleo	SE 8-30N-R3E

DIXON

22. Erwin, Tom	NWNW 16-29N-R4E
23. Logan Ltd Feedyard	SW 20-29N-R5E
24. Lund, Loren	NESE 28-29N-R5E
25. White, Merle J	SESE 5-29N-R6E

3. Hazardous Waste Sites RCRIS (7)

Bloomfield Monitor	110 N Broadway, Bloomfield NE 68718
Hesse's Inc	1211 W 2nd St, Crofton NE 68730
Hydraulic Components Inc	Hwy 84 & Kathol Road, Hartington, NE 68739
Northland Transportation Inc.	Hwy 59-&81 Magnet, NE 68749
Sexauer Co	1 blk SW 2nd Street off Hwy 12, Crofton NE 68730
VanCleave George	Clark Ave, Allen NE 68710
Youst, Robert B.	109 Broadway Coleridge NE 68727
Fordyce Village of	Village Hall, Fordyce NE 68736



4. Hazardous Substance Storage (28)

Farmers Coop Ass'n, Allen NE 68710	petroleum, pesticides
Village Inn, Allen NE 68710	petroleum
Farmers Coop Elevator, Bloomfield NE 68718	petroleum, pesticides
Freeman Oil, Inc. Bloomfield NE 68718	petroleum
KK Appliance Co., Bloomfield NE 68718	petroleum
Kumm Oil Co., Bloomfield NE 68718	petroleum
Mr B's Quick Stop, Bloomfield NE 68718	petroleum
Terra Internat'l, Inc. Bloomfield NE 68718	pesticides
Coleridge Elevator Co., Coleridge NE 68727	pesticides
Coleridge Oil Co. Coleridge NE 68727	pesticides, petroleum
Hefner Oil & Feed Co., Coleridge NE 68727	petroleum
Art's Propane Service, Creighton NE 68729	petroleum
Country General/S&S, Creighton NE 68729	petroleum
Municipal Airport, Creighton NE 68729	petroleum
Farmers Union Coop Ass'n, Creighton NE 68729	petroleum
Farmers Union Coop Ass'n, Creighton NE 68729	petroleum
Osmond Coop, Inc., Creighton, NE 68729	petroleum, pesticides
Pete & Judy's Corner Ser., Crofton NE 68730	petroleum
Phil's Service, Crofton NE 68730	petroleum
Steffen Service, Crofton NE 68730	petroleum
Thompson Propane Ser. Inc. Crofton NE 68730	petroleum
Fordyce Coop Lumber & Supply, Fordyce NE 68736	pesticides
Wiebelhaus Service, Fordyce NE 68736	petroleum
Casey's General Store, Hartington NE 68739	petroleum
Country General/S&S, Hartington NE 68739	petroleum
Farmers Union Coop Gas, Hartington NE	petroleum, pesticides
Ferrell Gas Inc. Hartington NE 68739	petroleum
Jerry's Service, Hartington NE 68739	petroleum
Kork & Kap, Hartington NE 68739	petroleum
*Lammers Oil Co., Hartington NE 68739	petroleum
Mid-America Dairymen, Hartington NE 68739	petroleum, acids, bases
*Sudbeck Services, Hartington NE 68739	petroleum
Terra Internat'l, Inc., Hartington NE	pesticides
Dennis Elevator Inc, Magnet, NE 68749	pesticides
Tilton Oil Co, Magnet NE 68749	petroleum
Marron's Service, Newcastle, NE 68757	petroleum
Terra Internat'l, Inc. Newcastle, NE 68757	pesticides
Cook's Country Store, Ponca NE 68770	petroleum
Farmers Coop Ass'n, Ponca NE 68770	petroleum
Knerl Ford Inc. Ponca, NE 68770	petroleum
Daryl's Oil Co, St. Helena NE 68774	petroleum
Dewey's Oil Co. Wynot NE 68792	petroleum
Terra Internat'l Inc., Wynot NE 68792	pesticides
Wynot Oil Co., Wynot NE 68792	petroleum

5. Leaking Underground Storage Tanks (LUST sites)

Wynot	5th & St James Ave	gasoline
Ponca	309 Union	gasoline
Ponca	820 4th Street	gasoline
Ponca	211 East 3rd Street	gasoline
Newcastle	Howard Firestone Tires	
Hartington	202 South Broadway	gasoline
Hartington	104 W Center	
Hartington	RR 1	waste oil
Crofton	1211 West 2nd	gasoline

Creighton	Hwy 13 & 59	gasoline
Creighton	615 Main	gasoline, kerosene & diesel
Creighton	509 Main	gasoline
Creighton	206 Main	gasoline
Creighton	East Hwy 59	diesel
Creighton	614 Main	diesel
Coleridge	1 mile North on Hiway 15	gasoline
Bloomfield	RR 1	used oil
Bloomfield		gasohol & diesel
Allen	Allen Oil Company	gasoline

6. EPA Hazardous Substance Spill Site CERCLIS

Van Cleave, George	Clark Avenue	Allen NE 68710
Village of Fordyce		Fordyce, NE 68736

7. Landfills

Arens Sanitation, Crofton NE 68730      Approved for Special Waste

8. NPDES Permits

Coleridge Wastewater Treatment Facility,		
Coleridge NE 68727	#25429	
Fordyce	Fordyce NE 68736	#52094
Hartington	Hartington NE 68739	#49115
Lewis & Clark NRD	Hartington, NE 68739	
#113832		
Mid America Dairymen, Inc	Hartington NE 68739	#124397
Magnet Wastewater Treatment Fac	Magnet NE 68749	#114821
Wynot Wastewater Treatment Facility	Wynot NE 68792	#127663
Allen Wastewater Treatment Facility	Allen, NE 68710	#31241
Martinsburg Wastewater Treatment	Martinsburg, NE	#113948
Newcastle Wastewater Treatment Fac	Newcastle NE,	#49077
Ponca Wastewater Treatment Facility	Ponca NE 86770	#21687
Waterbury Wastewater Treatment Fac	Waterbury, NE 68786	#122220
Bloomfield Wastewater Treatment Fac	Bloomfield NE 68718	#21733
Bloomfield Livestock Auction	Bloomfield NE 68718	#113883
Center Wastewater Treatment Fac	Center NE 68724	#43265
Creighton Wastewater Treatment Fac	Creighton NE 68729	#21253
Crofton Wastewater Treatment Fac	Crofton NE 68730	#49131
SID #1, Knox Kohles Acres	Knox County	#44806
SID #2, Knox Devils Nest	Knox County	#112178

9. ASCS Grain Sites

Allen,	SWSW 10-T28N-R5E
Coleridge	SWNE 9-T29N-R2E
Hartington	S SW 35-T31N-R1E
Crofton	NWNW 25-T32N-R2W
Bloomfield	Ct 3-T30N-R3W
Creighton	NENW 27-T29N-R5W