

## **Chapter 5. DATA COLLECTION**

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## CHAPTER 5. DATA COLLECTION

### 5.1 Ground Water Levels

The ground water table levels in the Twin Platte Natural Resources District have remained relatively stable during the period of monitoring by the District.

The ground water is well understood within the District. The District began a ground water table levels monitoring program in 1976 and continues to monitor 84 sites annually during the early spring and the fall.

Figure 14 shows the locations of the sites monitored. Appendix A is the complete data of record. Appendix B is spring Ground Water Level Changes for Major Land Resource Areas showing the baseline year 1983 compared to the average for 1993, 1994 and 1995.

The District initiated the Ground Water computer model study titled "Hydrogeology of Parts of the Twin Platte and Middle Republican Natural Resources Districts, Southwestern Nebraska" (NE Water Survey Paper 70) in cooperation with the Middle Republican Natural Resources District, the University of NE Conservation and Survey Division, and the U.S. Geological Survey. The study report was published in April, 1992. The study report is on file in the Twin Platte Natural Resources District offices.

The study indicates that the saturated thickness varies in the study area within the Twin Platte Natural Resources District from 200 feet in southeastern Keith County to 550 feet east of the City of North Platte. The model in the study was used to assess the effect of three irrigation development scenarios representing: (1) Minimum development, (2) Continued development at the 1970-1980 rate, and (3) Maximum development. Each scenario was based on a determination of remaining irrigable acres as of 1980 and development of those acres to the year 2020 at a rate of 0 percent (minimum development, no new well after 1980), 2.5 percent per year (continued development), and 10 percent per year (maximum development). Each development rate was in turn coupled with various amounts of water applied by the wells in place by 1980 or by those added to develop the irrigable acres. Rates of water applied assumed no return to the aquifer and included rates of 6, 9, 12, 15, and 18 inches per year. By adding 4 to 5 inches to amounts of water applied, the total inches pumped can be approximated. The study indicated that the application rate of 12 inches per year coupled with 2.5 percent development rate may provide the most realistic assessment of what might be expected across the area up to the year 2020. At that application rate, approximately 16 to 17 inches would be pumped. In the Twin Platte Natural Resources District, at the application rate of 12 inches per year coupled with 2.5 percent development rate, the model shows 0 to 10 feet of declines by the year 2000 and 0 to 40 feet of declines by the year 2020. The application rate of 12 inches per year coupled with a 0 percent development rate is currently the most realistic assessment of what might be expected across the area up to the year 2020. At that application rate, approximately 16 to 17 inches would be pumped. In the Twin Platte Natural Resources District, at the application rate of 12 inches per year coupled with 0 percent development rate, the model

shows no declines by the year 2000 and no declines by the year 2020. It is therefore assumed by the Twin Platte Natural Resources District , that there would be no declines by the year 2020 in the study area.

The District initiated the Ground Water computer model study titled "Simulation of Ground Water Movement in the High Plains Aquifer, Southern Sandhills Area, West Central Nebraska" (U.S.Geological Survey Open File Report 94-XXXX) in cooperation with the Upper Loup Natural Resources District, the University of NE Conservation and Survey Division, and the U.S. Geological Survey. The study is expected to be completed late in calendar year 1995. The District has viewed a draft of the study report. The study report is not available for release.

The draft of the study indicates that the saturated thickness varies in the study area within the Twin Platte Natural Resources District from 100 feet in the western part of the Platte River Valley to 800 feet in the north-central part of the Twin Platte Natural Resources District . The model in the study was used to assess the effect of maximum irrigation development. The maximum irrigation development was based on a determination of remaining irrigable acres as of 1990 and development of those acres for 20 years at a rate of one additional well in each township annually for 10 years and 2 additional wells in each township annually for the next 10 years. The development rate was in turn coupled with an amount of water applied by the wells in place or by those added to develop the irrigable acres. The rate of water applied of 13.2 inches assumed no return to the aquifer. The total pumped was assumed to be 16.5 inches. In the Twin Platte Natural Resources District , at the application rate of 13.2 inches per year coupled with the maximum development rate, the model shows declines up to 2.02 feet in 10 years and declines up to 9.63 feet in 20 years. That maximum development rate coupled with no more than 6 wells in place before new development would cause development of 35% to 40% of a township in the first 10 years and 85% to 100% of a township in the next 10 years. The most realistic assessment of what might be expected across the area in the next 20 years would be a development rate much below the maximum assumed in the model. It is therefore assumed by the Twin Platte Natural Resources District , that there would be no declines in the next 20 years in the study area.

## **5.2 Ground Water Contamination**

The ground water nitrate levels in the Twin Platte Natural Resources District have remained relatively stable during the period of monitoring by the District.

The ground water quality in regard to nitrates is fairly well understood within the District. The District began a ground water quality monitoring program for nitrates in 1982 and continues to monitor 78 sites annually during either the early spring or the fall.

Figure 15 shows the locations of the sites monitored. Appendix C is the complete data of record. Appendix D is Ground Water Nitrate Data for Major Land Resource Areas for the years 1988 through 1995 and the average for the last three years, 1993, 1994 and 1995.

The District initiated the Ground Water computer model study titled "Hydrogeology of Parts of the Twin Platte and Middle Republican Natural Resources Districts, Southwestern Nebraska" (NE Water Survey Paper 70) in cooperation with the Middle Republican Natural Resources District, the University of NE Conservation and Survey Division, and the U.S. Geological Survey. The study report was published in April, 1992. The study report is on file in the TPNRD offices.

Within the study area in the Twin Platte Natural Resources District , 5 wells were sampled in Lincoln County, 4 wells were sampled in Arthur County, 3 wells were sampled in McPherson County and 4 wells were sampled in Keith County during 1978. The chemical analysis was for Specific Conductance (MICROMHOS), PH (Units), Temperature (Degree C), Color (PLATINUM-COLBALT UNITS), Hardness (MG/L as CaCO<sub>3</sub>), Hardness Noncarbonate (MG/L CaCO<sub>3</sub>), Calcium Dissolved (MG/L as CA), Magnesium Dissolved (MG/L as MG), Sodium Dissolved (MG/L as NA), Sodium Adsorption Ratio, Potassium Dissolved (MG/L as K), Bicarbonate (MG/L as HCO<sub>3</sub>), Carbonate (MG/L as CO<sub>3</sub>), Alkalinity (MG/L as CaCO<sub>3</sub>), Sulfate Dissolved (MG/L as SO<sub>4</sub>), Chloride Dissolved (MG/L as CL), Fluoride Dissolved (MG/L as F), Silica Dissolved (MG/L as SiO<sub>2</sub>), Solids Residue as 180 Degrees C Dissolved (MG/L), Solids Sum of Constituents Dissolved (MG/L), Solids Dissolved (Tons per AC-FT), Nitrogen NO<sub>2</sub>+NO<sub>3</sub> Dissolved (MG/L as N), Phosphorus Dissolved (MG/L as P), Arsenic Dissolved (UG/L as AS), Boron Dissolved (UG/L as B), Cadmium Dissolved (UG/L as CD), Chromium Dissolved (UG/L as CR), Copper Dissolved (UG/L as CU), Iron Dissolved (UG/L as FE), Lead Dissolved (UG/L as PB), Manganese Dissolved (UG/L as MN), Mercury Dissolved (UG/L as HG), and Zinc Dissolved (UG/L as ZN).

Within the study area in the Twin Platte Natural Resources District, 16 wells were sampled in Lincoln County and outside the study area 3 wells were sampled in McPherson County during 1979. The chemical analysis was for Specific Conductance (MICROMHOS), PH (Units), Temperature (Degree C), Color (PLATINUM-COLBALT UNITS), Hardness (MG/L as CaCO<sub>3</sub>), Hardness Noncarbonate (MG/L CaCO<sub>3</sub>), Calcium Dissolved (MG/L as CA), Magnesium Dissolved (MG/L as MG), Sodium Dissolved (MG/L as NA), Sodium Adsorption Ratio, Potassium Dissolved (MG/L as K), Bicarbonate (MG/L as HCO<sub>3</sub>), Alkalinity (MG/L as CaCO<sub>3</sub>), Sulfate Dissolved (MG/L as SO<sub>4</sub>), Chloride Dissolved (MG/L as CL), Fluoride Dissolved (MG/L as F), Silica Dissolved (MG/L as SiO<sub>2</sub>), Solids Sum of Constituents Dissolved (MG/L), Solids Dissolved (Tons per AC-FT), Nitrogen NO<sub>2</sub>+NO<sub>3</sub> Dissolved (MG/L as N), Phosphorus Dissolved (MG/L as P), Boron Dissolved (UG/L as B), Iron Dissolved (UG/L as FE), and Manganese Dissolved (UG/L as MN).

The study indicates that dissolved chemical constituents in water are important because the amounts and combinations of dissolved ions in solution determine the water's suitability for most uses. Generally, water that has low concentrations of dissolved solid is considered to be of good quality, whereas, highly mineralized water is considered to be of poor quality. The study, however, indicates that this is an arbitrary designation that depends on the use of the water.

The study indicates that water is considered suitable if it can be used safely for human and animal consumption or other domestic uses, or if it can be used for crop watering without harm to the crops to which it is applied. Drinking water suitability is based on maximum contaminant levels (MCL) established by the US Environmental Protection Agency (EPA). MCLs for constituents measured on samples from the study area are fluoride, 4 MG/L, and nitrate as nitrogen (N), 10 MG/L. Concentrations of fluoride, a constituent that occurs naturally in water, were well below the MCL in all samples within the Twin Platte Natural Resources District . Concentrations of nitrate as nitrogen was below the MCL in all samples within the Twin Platte Natural Resources District .

The nitrate levels in the ground water within the District are fairly well understood due to the Districts monitoring program which has been in place for 13 years. The data is collected from sites uniformly distributed throughout the District. The sites were selected based on location and availability and the wells are primarily private domestic wells. The drilling information for each well in many cases is not available and therefore the geology of the well in most cases is not known.

Contamination from other non-point sources is not well understood within the District. Snapshots of information is available from the sampling done in 1978 and 1979, but established long term monitoring programs have not been done.

The Board of Directors on March 9, 1995 approved a Ground Water Quality Study to be done by the University of Nebraska Conservation and Survey Division. The study is to begin July 1, 1995 and a final report is to be completed by June 30, 1997. The study will establish base-line water quality conditions of the major ground water bearing units in the District and develop a ground water monitoring program to monitor future conditions as they relate to nonpoint contamination. The approach used in the study will interpret ground water quality data and develop a monitoring strategy in the context of the geologic materials in the subsurface and local hydrologic variables such as precipitation and irrigation. The study will be conducted in two phases.

#### Phase I (July 1, 1995 to April 30, 1996) Activities.

1. Compile geologic data, construct geologic cross sections and define hydrogeologic units. The anticipated products will be a hydrogeologic data base and maps showing distribution and thickness of hydrostratigraphic units.
2. Compile ground water quality data from all known available sources. The anticipated products will be a ground water quality data base; and maps and tables showing the distribution of ground water quality characteristics.
3. Compile soil and landuse maps. The anticipated products will be soil and land-use maps showing locations of water quality samples.

4. Compile agrichemical application data, types and amounts. The anticipated products will be agrichemical application data and figures showing relations to landuse and crop type and provide the basis for selecting water quality parameters to be analyzed.
5. Compile ground water level data and hydrographs and construct seasonal water table maps. The anticipated products will be water-table maps for the District showing general ground water flow directions.
6. Compile stream discharge data and hydrographic maps. The anticipated products will be graphs showing variations in stream flows along the Platte River and maps showing distributions of surface drainages and canals, which may affect water quality.
7. Compile climatological data. The anticipated products will be graphs showing variations in precipitation data.
8. Evaluate historical ground water quality data in the context of available ancillary data sets and develop ground water monitoring plan. The anticipated products will be a report that focuses the interpretation of ground water quality data in terms of the ground water system and hydrologic variables and present a plan for further sampling to better constrain baseline conditions where data gaps exist.

Phase II (April 30, 1996 to June 30, 1997) Activities.

1. Establish a monitoring well network using available wells based on spatial and vertical hydrogeologic variability across the District.
2. Water sampling. 150 samples for NO<sub>3</sub> and immunoassay of selected pesticides and herbicides. If pesticides and/or herbicides are indicated, wells will be resampled and sent to an appropriate lab. 50 of the samples will be analyzed for major ions.
3. Evaluate and interpret the new data using information collected in Phase I.

The anticipated products will be a report entitled "The Twin Platte Natural Resources District Ground Water Quality Study". The report will include recommendations for the design of a monitoring network for long-term analysis of ground water quality. The results of the report will be incorporated in the TPNRD's Ground Water Program.

