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FOREWORD

Legislative Bill 1106, adopted by the Eighty-Eighth Legislature, Second Session (1984) states in paragraph 37 in part: Prior to January 1, 1986, each district shall prepare a groundwater management plan based upon the best available information and submit such plan to the director for review and approval.

The Plan shall include, but not be limited to, the identification to the extent possible of:

(1) Proposed geographic and stratigraphic boundaries of the management area;
(2) Groundwater supplies within the area including transmissivity, saturated thickness maps, and other groundwater reservoir information, if available;
(3) Local recharge characteristics and rates from any sources, if available;
(4) Average annual precipitation and the variations within the area;
(5) Crop water needs within the area;
(6) Current groundwater data collection programs;
(7) Past, present, and potential groundwater use within the area;
(8) Groundwater quality concerns within the area;
(9) Proposed water conservation and supply augmentation programs for the area;
(10) The availability of supplemental water supplies, including the opportunity for groundwater recharge;
(11) The opportunity to integrate and coordinate the use of water from different sources of supply;
(12) Groundwater management objectives, including a proposed groundwater reservoir life goal for the area;
(13) The controls enumerated in Section 46-673.08 to 46-673.12 proposed to achieve the groundwater reservoir life goal, and the impact of such controls on the goal;
(14) Existing subirrigation uses within the area; and
(15) The relative economic value of different uses of groundwater proposed or existing within the area.

In 1991, the Nebraska Legislature enacted Legislative Bill 51 which requires that "prior to July 1, 1993, each district shall amend its groundwater management plan to identify to the extent possible the levels and sources of groundwater contamination within the area, groundwater quality goals, long-term solutions necessary to prevent the levels of groundwater contaminants from becoming too high and to reduce high levels sufficiently to eliminate health hazards, and practices recommended to stabilize, reduce, and prevent the occurrence, increase, or spread of groundwater contamination."

Tri-Basin NRD formed a groundwater quality management area in 1989 that was authorized and approved without amendments to our original groundwater management plan, the district chose to present the Groundwater Quality Management Plan in 1995 as a separate section to the plan. The amount of material that the district accumulated to justify the need for the groundwater quality management area led to that decision.

Groundwater quantity management is an emerging issue in this NRD. Groundwater levels across most of the district are still above groundwater levels in the 1980s. The current version of the groundwater management plan contains a significantly revised section on groundwater quantity management that is intended to improve the board's ability to respond to any groundwater quantity declines. The plan will be followed if the NRD Board of Directors determine that action is needed to protect groundwater supplies.

Groundwater quality is an issue that Tri-Basin NRD has been working to resolve for more than a decade. A rise in groundwater nitrate-nitrogen contamination levels from 1980 levels triggered action in the groundwater management plan. Public hearings were held and the support for a groundwater quality management area was greater than anyone anticipated. The Tri-Basin NRD Groundwater Quality Management Area (GQMA) was initiated November 15, 1989, with controls going into effect for the 1990 crop year.

Management of interconnected groundwater and surface water resources was not a statutory responsibility of NRDs when the groundwater management plan was amended in 1995. LB 108, which authorized NRDs to managem groundwater and surface water for the mutual benefit of both resources, was passed by the Unicameral in 1996. Shortly after that law was passed, Tri-Basin NRD and three other NRDs in the Republican River Basin submitted requests to the (then) Nebraska Department of Water Resources, asking the state to enter into a joint action plan to manage inter-connected water resourcesin that basin. The joint action plan process was suspended when the State of Kansas filed a lawsuit against Nebraska in 1998. The joint action plan process was reinitiated in 2003. The current version of the Groundwater Management Plan contains a section on management of interconnected water resources.

PART I
GROUNDWATER QUANTITY

INTRODUCTION

Tri-Basin Natural Resources District encompasses Kearney, Phelps and Gosper Counties in south central Nebraska. Its boundary is the same as that of the three counties. It has an area of 1520 square miles. Population of the district, according to the 2000 census, is 18,772. Nearly half of the people live in Holdrege and Minden, the remainder live either in rural areas or in towns with a population of 1000 or fewer.

Topography varies from "canyon country" in southern Gosper and Phelps Counties to the nearly-level valley of the Platte River. Gently rolling plains are found throughout much of the three-county area. Soils for the most part are deep and fertile. Holdrege soils are predominant although there is a sandhill area along the south side of the Platte Valley in Phelps and Kearney Counties. Soil types in the Platte Valley vary greatly but are generally productive.

Much of the district land area is well suited for furrow (gravity) irrigation. There are now nearly 4600 irrigation wells in the district supplying water for an estimated 575,000 acres. The Central Nebraska Public Power and Irrigation District (CNPPID or Central) supplies water to over 107,000 acres of cropland in the portion of the NRD that lies within the Platte watershed. Groundwater supplies vary greatly in the district. Generally that portion of the NRD in or adjacent to the Central Nebraska Public Power and Irrigation District irrigated area has experienced a rise in groundwater levels since the district began operation. Other areas of the NRD, especially the southwest corner and along the southern border of Phelps and Kearney Counties have experienced periods of short-term declines in groundwater levels.

Over 95% of groundwater use is for irrigation with the remainder used for municipal, industrial and domestic purposes. Groundwater is the primary source of drinking water in the district.

Tri-Basin Natural Resources District (NRD) has recognized the importance of groundwater since its inception in 1972. Although most of the NRD is in an area of a steady to rising water table due to the influence of the Central Nebraska Public Power and Irrigation District's surface water irrigation project, small areas with fluctuating water levels became apparent in the mid-1970s. A groundwater monitoring program was started in 1977 and expanded in 1978 so that now the NRD monitors 87 irrigation wells and 55 dedicated observation wells in those areas of the district that are not served by CNPPID. Central has their own groundwater observation well network, which is the NRD's primary source for groundwater data in the Platte Basin. These groundwater data collection systems have been in operation long enough to give an indication of how the water table responds to changes in climate and water use demands.

Several studies have been initiated by the Tri-Basin Natural Resources District to monitor the groundwater system. In 1980, the NRD entered into a cooperative agreement with the Conservation and Survey Division - University of Nebraska, to establish a chemical baseline for groundwater quality in our three county area. The results of this study are explained more fully in the groundwater quality section of this plan.

Tri-Basin NRD contacted the Nebraska Department of Environmental Quality December 30, 1988, and requested a Special Protection Area study around the town of Wilcox in southwestern Kearney County. The reason for this study request was that Wilcox's public water supply had exceeded the Maximum Contaminant Level (MCL) for nitrates since 1983. The results of this study tended to verify the validity of the formation of the Groundwater Quality Management Area. The Department of Environmental Quality recommended adding 41 square miles to the Phase II area of the management area rather than formation of a Special Protection Area. This study is also more fully explained in the groundwater quality section of this plan.

In 1983, the engineering firm of Henningson, Durham and Richardson, Inc. (HDR) was selected to conduct a groundwater recharge study of the NRD. The first phase of this study was completed

along with a preliminary investigation of diverting drainage water from the lower reaches of Central District's Phelps Canal system near Minden into Sand Creek to be used for groundwater recharge. Selection of ten possible reservoir sites along Sand Creek was included in the study. Opposition to any diversion of water to Sand Creek by local landowners and the unfavorable cost-benefit ratio of reservoir construction costs to recharge benefits led the board to discontinue the program.

Another study which has been a valuable tool in formulating this amended Groundwater Management Plan is the U.S. Geological Survey Water Resources Investigations Report 87-4176, a joint venture of Tri-Basin NRD, the U.S. Geological Survey, the Nebraska Natural Resources Commission and Lower Republican NRD. The study was devised to gather the information necessary to resolve future water resource problems that might result from extensive irrigation development in that part of the Platte-Republican watershed which includes Dawson, Franklin, Furnas, Gosper, Harlan, Kearney, Phelps and part of Webster Counties. This study filled a gap between studies already underway in Lincoln and Frontier Counties on the west and the Big and Little Blue River Basins on the east. The report was completed in 1987. Many of the maps used in this plan are taken from this report. Although this report deals primarily with water quantity, the information on hydrogeologic characteristics is applicable to water quality as well.

More recently, Tri-Basin NRD cooperated with the NE Republican River Management Districts and the US Geological Survey to develop a computer hydrologic model of groundwater and surface water interaction in the Republican Basin. This study was initiated in 1997. It was suspended and later abandoned due to the *Kansas v. Nebraska* lawsuit over Republican Basin water use. As part of the *Kansas v. Nebraska* settlement, a computer model of the groundwater and surface water resources of the Republican River basin is being jointly developed by Kansas, Nebraska and Colorado to track water use in the basin for the Republican River Compact.

Another hydrologic modeling effort is underway in the Platte Basin. Tri-Basin NRD, along with other NRDs, irrigation districts, municipalities, environmental groups and state agencies, sponsors the Cooperative Hydrology Study of the Platte River Basin (COHYST). This study will likely be completed during 2004.

I. TECHNICAL REQUIREMENTS

A. Proposed Geographic and Stratigraphic Boundaries

1. The geographic boundaries for groundwater quantity management are the same as those of the Tri-Basin Natural Resources District as certified by the Secretary of State of Nebraska when Natural Resources Districts were formed. This area includes all of Gosper, Phelps and Kearney Counties. See Map #1 in Section II - Maps and Graphs.

2. The stratigraphic boundaries for groundwater quantity management are from the land surface down to the base of the underlying layers of Pliocene and Pleistocene water bearing sands and gravels which make up the groundwater reservoir of the entire district. The major sources of groundwater are undifferentiated Pleistocene deposits and the Pliocene Ogallala formation. Most wells in the Tri-Basin area draw water from the Pleistocene formation although many newer wells are drilled deeper into the Ogallala formation.

B. Groundwater Supplies Within the District

1. Quantity: Tri- Basin Natural Resources District contains substantial groundwater supplies. Map #2 shows groundwater in storage by townships in acre feet. The total for the NRD is 50,104,000 acre feet, based on figures compiled by the Nebraska Natural Resources Commission for our groundwater recharge study in 1983.

2. Saturated Thickness - the layers of sand and gravels that make up the groundwater reservoir lie generally from 40 to 200 feet below the land surface and vary in thickness from 0 to 400 feet across the NRD. One test hole drilled in northwest Gosper County in 1981 by the Conservation and Survey Division, University of Nebraska, had over 500 feet of water-bearing sand and gravel. The water-bearing formations are thicker in the north and taper off to the south to such an extent that there is not enough saturated thickness to sustainably supply high capacity (500 gpm or more) irrigation wells in some areas along the south boundary of the NRD. Maps #4 to #10 show north-south geologic cross-sections across the district from west to east. Maps #4 and #5 are from US Geological Survey Water Supply Paper Number 779 dated 1938. They are very general in nature but give an indication of the pre-development water table. Maps #6 through #10 are from CNPPID's application for a permit for incidental underground water storage and recovery for Gosper, Phelps and Kearney Counties, submitted to the State of Nebraska, Department of Water Resources, in October 1984. Some of these cross-sections were extended to shale to give an indication of the thickness of the aquifer. Also note that the maps show both the pre-development (1952) and 1983 groundwater elevations. Map #11 is a configuration of the base of the aquifer taken from USGS Water Resources Investigations Report 87-4176. Map #12, also from the same source, shows the thickness of the principal aquifer.

3. Transmissivity is the rate at which an aquifer transmits water. It is expressed in thousands of gallons per day per foot of saturated thickness. Transmissivity can limit the pumping rate of a well and in many instances is more of a factor in irrigation development than groundwater in storage. The distribution of transmissivity for 1940 and 1981 is shown in figure 3 and figure 3A. Transmissivity values increased from 1940 to 1981 in the northern part of the district. The transmissivity of the aquifer is a good indicator of potential well yield at a given location. In areas where transmissivity values are large, conditions are favorable for developing wells with high yields. Groundwater flows in the direction of decreasing head which follows water table contours. The flow pattern is toward discharge

areas and away from recharge areas. The rate of movement of pollutants in the aquifer is also partially regulated by discharge and recharge.

4. Groundwater Level Contour Maps: Maps #13 and #14 are contour maps of the water table expressed in feet above sea level and show the water table before development and in 1984. These maps are taken from CNPPID's water right application for underground water storage and recovery and would be the most up-to-date maps of the area. Note the groundwater mound shown on Map #14. As water migrates out from this ridge of high water levels it is believed to enhance recharge in a large area of the district. The area believed to receive some benefit from this enhanced recharge is outlined on Map #15.

5. Depth to Groundwater: The distance from ground level to the static water level varies across the NRD from less than 10 feet to over 200 feet. Depth to water from wells in the observation well network varied from 8.37 feet (Well K-34) in northern Kearney County near the Platte River to 217.96 feet (Well P-14) in southern Phelps County in 1992. Maps #6 through #10 show an approximate groundwater depth. Note the extreme variations on Maps #6 and #7.

C. Recharge Characteristics and Rates

The following paragraph is from the Groundwater Recharge Program Phase I status report prepared for the district by HDR as explained in the introduction:

> "The most suitable surface and soil conditions for recharge projects are concentrated along the northern border of the District across the eastern half, and at a few other scattered locations along the southern border of the District in the western half. The Sand Creek area rates quite high from a surface soil suitability standpoint. Some of the better soil conditions for recharge also occur in the southwest corner of Gosper County where a current and projected decline area exists. Soils everywhere in the district are generally very permeable, and have not limited the amount of recharge that has occurred from canals and surface application in the area."

These same characteristics hold true for the movement of contaminants through the vadose zone and into the aquifer.

Recharge from the CNPPID system which has gone on now for over 40 years is estimated at 6.5 to 7.0 million acre-feet. From this it can be concluded that if (or when) a recharge program is initiated soil conditions will not be a limiting factor. The rate of recharge is difficult to assess. Factors such as soil type, amount and concentration of rainfall influence it. Estimates of natural recharge from precipitation vary from 1.0 to 6.0 inches per year across the district according to the groundwater recharge study by HDR (See Map #16). The largest amount of recharge was in those townships with very sandy soils and shallow groundwater levels. This rate of natural recharge equals 163,800 acre feet per year for the entire NRD.

D. Average Annual Precipitation and Variations

South-central Nebraska has a semi-humid climate. The variable weather in the region is typical of the interior of a large land mass in the temperate zone. It lies between the rain shadow of the Rocky Mountains and more humid regions to the east, so the amount of precipitation varies considerably from year to year in response to small changes in prevailing winds. Nearly all moisture is carried by warm winds from the Gulf of Mexico and the Caribbean. When these currents maintain a more easterly direction, drought conditions can develop.

Average annual precipitation in the Tri-Basin area varies from 24 inches in the east to less than 22 inches in the west (see map #17). Averages are misleading - average precipitation during the 10 wettest years on record is more than 2 times that received during the 10 driest years on record. Generally, more than three-fourths of annual precipitation falls during April through September. However, because of the extreme variations in frequency and amounts of rainfall from month to month and year to year, current crop production without irrigation is not economically sustainable in most parts of the district.

E. Crop Water Needs

Corn, sorghum, alfalfa and soybeans are the crops irrigated in the area with corn being the main one. Soybeans have probably edged out alfalfa as the second most irrigated crop as they have gained in popularity the last few years. Sorghum, primarily milo, is grown under irrigation in areas with a limited water supply as it can withstand moisture deficiency conditions longer than corn without a reduction in yield. Much alfalfa acreage is irrigated with "off-season" irrigation water. Wheat is also irrigated during spring and fall in this area.

Crop consumptive water use demand is partially met by precipitation during the growing season plus any moisture in the root zone carried over from the previous fall and spring. This will vary from year to year but will usually average from 10-14 inches. The following table shows the probable water needs for the main production crops in the area, assuming 12 inches of water is supplied by precipitation.

CROP	TOTAL NEEDED	TOTAL IRRIGATION REQUIREMENT
Corn	26 - 28"	14 - 16"
Sorghum	12 - 24"	10 - 12"
Soybeans	22 - 24"	10 - 12"
Alfalfa	30 - 36"	18 - 24"

Assuming a 70% irrigation efficiency rate, 16" to 18" of irrigation water should meet average crop needs within the NRD. This would vary from year to year depending on amounts and timing of precipitation.

F. Current Groundwater Data Collection Programs

Tri-Basin Natural Resources District began its groundwater level monitoring program in the spring of 1977 at which time 43 wells were chosen for measurement. Forty-one wells were added to the program in the fall of 1978 to give a more representative overview of groundwater fluctuations in the district. Five wells in Kearney County, formerly measured by the United States Geological Survey, were added to the network in 1982. The well network was planned to avoid duplication of wells already monitored by the Conservation and Survey Division, UNL, and CNPPID throughout its surface water delivery area.

Spring and fall water level measurements are made in selected wells. Measurements are made by lowering a chalked steel tape down a well and recording the static (non-pumping) water level in that well. These measurements are sent to cooperating well owners for their information and also to the US Geological Survey, where the readings become part of a state-wide database coordinated by the UN-L Conservation and Survey Division.

The locations of these observation wells are shown on Map #18. The wells within the shaded areas showed a decline in the static water level from the spring of 1983 to the spring of 2003. These declines range from zero to ten feet.

Graph #19 shows a rising groundwater level in that part of the district monitored by the NRD. This graph shows the overall trend and individual wells may vary significantly from this trend. The average water level in the NRD was seven feet higher in 2003 than in 1983.

G. Groundwater Use

1. Past: The first irrigation wells were drilled in this area in 1934, but there was no substantial increase in well numbers until the mid 1950's. Well installation from 1957 to 2003 is shown in Graph #20.

2. Present: Map #21 shows the location of the irrigation, commercial and industrial wells in Tri-Basin NRD. The following table shows the number of wells registered December 31, 2003.

COUNTY	IRRIGATION	MUNICIPAL	INDUSTRIAL	DOMESTIC, OTHER
Gosper	678	11	3	111
Phelps	1933	30	2	214
Kearney	1937	20	1	244
	---	---	---	---
Totals	4548	61	6	569

Many irrigation wells registered over the past few years are wells that were drilled previously and are just now being registered. An increasing number of replacement wells are also being drilled, replacing wells constructed in the 1950's and 1960's. This trend is expected to continue as many wells have been in service over 30 years.

3. Future: Irrigation development is expected to continue, but at a rate below anything anticipated in the groundwater recharge study completed in 1983. In this study it was assumed that future well development would occur at a rate one-half of that experienced from 1970 to 1980. Present economic conditions and increased energy costs are the primary factors in keeping this development rate down.

H. Groundwater Quality (See Groundwater Quality Section)

I. Availability of Supplemental Water Supplies

Supplemental water is supplied to the Tri-Basin NRD area by CNPPID from Platte River natural flow and storage water in Lake McConaughy near Ogallala. The CNPPID Diversion Dam is located just below the confluence of the North Platte and South Platte Rivers approximately 50 miles downstream from Kingsley Dam. The Diversion Dam diverts natural stream flow of the Platte River and storage water releases from Lake McConaughy into the headgates of a 75.5 mile long Supply Canal.

The CNPPID Supply Canal has a capacity of 2250 cfs. It extends from the Diversion Dam to the Johnson Hydro #2 Return, located south and east of Lexington. There are 27 impoundments ranging in size from less than one surface acre to 2,500 surface acres of water along the Supply Canal. The Supply Canal diverts water on a year-round basis and furnishes water for three

hydroelectric power plants and cooling water for the Canaday Steam Plant. Jeffrey and Johnson Reservoirs serve as regulating reservoirs for the Jeffrey and Johnson No. 1 Power Plants. The Johnson No. 2 Power Plant is located on the Supply Canal about six miles below the Johnson No. 1 Power Plant. The Supply Canal also serves as the water supply for three district irrigation systems. Water pumped or siphoned from the Supply Canal irrigates approximately 7500 acres in Lincoln, Dawson and Gosper Counties.

The CNPPID irrigation water delivery system consists of three separate feeder canals; Lateral E65, Lateral E67 and the Phelps County Canal. They have a combined length of 120 miles of main canals with approximately 480 miles of distribution laterals and buried pipelines. These are used to irrigate 106,000 acres in the three county area of Gosper, Phelps and Kearney Counties.

The E65 System headgate on the Supply Canal is located north of Elwood just upstream from where the Supply Canal enters Johnson Reservoir. The E-65 system consists of 54.7 miles of main canal and 188 miles of distribution laterals and pipelines which provide water to 42,359 acres in Gosper and Phelps Counties. Elwood Reservoir is located just south of Johnson Reservoir and is filled during the non-irrigation season by the Carl T. Curtis pumping station. Elwood Reservoir has an active capacity of 24,715 acre feet. Water is released from the reservoir during the peak irrigation season to supplement the E65 Diversion from the Supply Canal. Nine deep wells supplying a total of 31 cfs were installed in 1954. Eight remain in use. They are used to supplement canal flows in the area northeast of Loomis.

The E67 System diverts water from the Supply Canal just east of Johnson Reservoir. It is 9.3 miles in length and has 16 miles of distribution laterals which provide water to 5,678 acres in northern Gosper County.

The Phelps County Canal is the District's largest irrigation canal. It begins at the Johnson #2 Hydro Return and consists of 56.7 miles of main canal and 276 miles of distribution laterals and buried pipelines. It provides water to 57,318 acres in Gosper, Phelps and Kearney Counties.

The distribution system of the three irrigation canals consists of earthen laterals and approximately 80 miles of buried pipeline. A majority of laterals have been rehabilitated by compaction and reshaping to reduce seepage losses.

This surface water benefits the groundwater supply of the district in two ways. First, it supplies surface water to over 105,000 acres of irrigable land, most of which would probably have been developed for groundwater irrigation, if surface water had not been available. Second, seepage of water from canals and laterals, along with deep percolation of surface irrigation water when it is applied to cropland, has actually raised the groundwater level under much of the NRD (see maps #13-#15). According to CNPPID's figures from 1984 through 1992, an average of 221,251 acre feet of water was diverted into the irrigation systems from the main Supply Canal and an average of 108,784 acre feet was actually delivered to water users. Much of these conveyance losses entered the groundwater reservoir. Improvements to the canal system, such as replacement of open laterals with pipelines and lining of canals has reduyced those conveyance losses in recent years.

The Catherland Project would have been another supplemental water supply for one area of the Tri-Basin NRD with a declining water table. This project proposed to divert 125,000 acre feet of water annually from the Johnson Hydro #2 return in northeast Gosper County, transport it through the CNPPID Phelps County Canal to near Axtell, Nebraska, then run it through a canal and down the Little Blue River to a reservoir near Campbell. The project was designed to irrigate 66,500 acres in Kearney, Adams, Webster and Nuckolls Counties. Seven thousand acres in southeast Kearney County would have been served by this project.

The Catherland Reclamation District, formed to sponsor the project, included two townships in southeast Kearney County where groundwater recharge is anticipated from the supply canal and Campbell Reservoir as well as from the surface irrigation. Unfortunately, water rights for this project were denied by the Department of Water Resources after years of litigation and

controversy because the DWR Director determined that the project was not in the best interest of the State of Nebraska.

J. Opportunity to Integrate and Coordinate the Use of Water From Different Sources

An opportunity exists to develop a recharge project on Sand Creek south and east of Minden in Kearney County using drainage water from a large area along the lower end of the Phelps County Canal. Through the years, due to land improvement in the Axtell to Minden area, CNPPID has accepted several thousand acres of drainage into their Phelps Canal system. Under the present rehabilitation plan for this system, this water could be diverted to Sand Creek and used for recharge purposes. As mentioned in the Introduction, under present conditions this does not seem feasible because of the lack of support of landowners on Sand Creek and the unfavorable cost-benefit ratio of reservoir construction cost to recharge benefits. Flood control benefits on Sand Creek are low as are recreation benefits on a reservoir of the size that were designed for this project.

K. Existing Subirrigated Uses

The only portion of Tri-Basin NRD where crops are naturally sub-irrigated is the Platte River valley. Some alfalfa fields and meadows of native grasses which are cut for hay benefit from this condition. The acreage is small compared to total irrigated cropland acreage of the District.

It has been said that the difference between subirrigation and a seepage problem is a six inch rise in the water table. There are areas where the groundwater mound is the correct depth below the land surface for beneficial subirrigation uses. However, when this condition does exist, it is usually just a prelude to seepage problems unless proper drainage is installed. There is a potential benefit to properly managing high groundwater levels in the northern part of the NRD for subirrigation, but no effort to do that has been brought to the attention of the NRD. The usual practice in high groundwater table areas is to use drainage ditches lower the water table far enough so that irrigated row crops can be grown.

Some farmers in Tri-Basin NRD use sub-surface “drip” irrigation systems on small fields. This method of irrigation shows promise as a water-efficient alternative to gravity irrigation in small, odd-shaped fields. Tri-Basin NRD and the USDA Natural Resources Conservation Service provide cost-share funds and technical assistance to farmers who want to try out this emerging technology.

L. Relative Economic Value of Different Proposed or Existing Uses of Groundwater

Irrigation is and probably always will be the primary use of groundwater resources in Tri-Basin NRD. Municipal, industrial and domestic uses now account for less than 5% of the groundwater consumed. Most municipal and industrial wells, except for Wilcox and Atlanta, are within Central's recharge area and have not experienced any sustained declines. Therefore, competition for groundwater between different categories is insignificant and the comparison of their relative economic value is unnecessary.

III. **POLICY REQUIREMENTS**

A. Groundwater Management Goal

The surface and groundwater supply and management goal developed for Tri-Basin NRD's Master Plan in August 1979 is as follows:

"Goal: All water supplies within the Tri-Basin NRD, whether their origin be groundwater or surface water, will be used in a beneficial manner, efficiently managed and properly utilized to preserve the present quality and quantity of this vital resource."

B. Reservoir Life Goal

Tri-Basin NRD has the following groundwater reservoir life goal: "All groundwater supplies within the Tri-Basin NRD will be used in a beneficial manner, efficiently managed and properly utilized to preserve the present quantity of this vital resource forever."

C. Controls Proposed to Achieve Groundwater Reservoir Life Goal

Tri-Basin NRD will continue to refine our groundwater level measurement program, which was initiated in 1977. The NRD also analyzes groundwater level data gathered by Central Nebraska Public Power and Irrigation District for the Platte Basin portion of the district. If information gathered by the NRD indicates that there is potential for sustained declines in groundwater levels, the board will take action to arrest these declines. Once the Tri-Basin NRD Board of Directors decide to establish a Groundwater Quantity Management Area, the Board of Directors will adopt one or more controls from the following list of controls set forth in Nebraska state statutes (including any future revisions to those statutes) to alleviate conditions that lead to designation of the management area. Statutory controls available to the district (as of 12/31/2003) are:

"(a) It may determine the permissible total withdrawal of ground water for each day, month, or year and allocate such withdrawal among the ground water users;

(b) It may adopt a system of rotation for use of ground water;

(c) It may adopt well-spacing requirements more restrictive than those found in sections 46-609 and 46-651;

(d) It may require the installation of devices for measuring ground water withdrawals from water wells;

(e) It may adopt a system which requires reduction of irrigated acres pursuant to subsection (2) of section 46-656.26;

(f) It may limit or prevent the expansion of irrigated acres;

(g) It may require the use of best management practices;

(h) It may require the analysis of water or deep soils for fertilizer and chemical content;

(i) It may provide educational requirements, including mandatory educational requirements, designed to protect water quality or to stabilize or reduce the incidence of ground water depletion, conflicts between ground water users and surface water appropriators, disputes over

interstate compacts or decrees, or difficulties fulfilling the provisions of other formal state contracts or agreements;

(j) It may require water quality monitoring and reporting of results to the district for all water wells within all or part of the management area;

(k) It may close all or a portion of the management area to the issuance of additional permits or may condition the issuance of additional permits on compliance with other rules and regulations adopted and promulgated by the district to achieve the purpose or purposes for which the management area was designated. This subdivision may be implemented whenever the district determines the impact on surface water supplies or the depletion or contamination of the ground water supply in the management area or any portion of the management area cannot be protected through implementation of reasonable controls specified in subdivisions (1)(a) through (1)(j) of this section; and

(l) It may adopt and promulgate such other reasonable rules and regulations as are necessary to carry out the purpose for which a management area was designated.

(2) In adopting, amending, or repealing any control authorized by subsection (1) of this section or sections 46-656.26 and 46-656.27, the district's considerations shall include, but not be limited to, whether it reasonably appears that such action will mitigate or eliminate the condition which led to designation of the management area or will improve the administration of the area."

The following statutory provisions may also be considered and included in the rules and regulations for an integrated management area with the aforementioned controls.

Ground Water Allocations: If the Tri-Basin NRD Board of Directors adopts allocations as a control, then the district reserves the authority to vary water allocations for different distribution systems, or varying climatic, hydrologic, geologic, or soil conditions, different hydrologic relationships between ground and surface water, or for wells constructed before or after the designation of the integrated management subarea or another date set by the district (Neb. Rev. Stat. §46-656.25(5,6)).

If one of the previously mentioned allocation exceptions is not exercised, the ground water will be allocated equally per irrigated acre. The allocation will specify the total number of acre-inches that are allocated per irrigated acre per year (Neb. Rev. Stat. §46-656.26(1)).

Review of Allocation, Rotation, or Reduction Control: The district will review any allocation, rotation, or reduction control imposed in an integrated management subarea at least every five years, or may do so as often as every year. The review will consider new development, additional ground water uses within the subarea, more accurate data or information that was not available at the time of the order, changes in ground water recharge, or other factors as the district deems appropriate.

Rotation or Reduction of Irrigated Acres: If annual rotation or reduction of irrigated acres is adopted for use of ground water for irrigation purposes in an integrated management subarea, the nonuse of irrigated acres shall be a uniform percentage reduction of each landowner's irrigated acres within the integrated management subarea. The uniform reduction may be adjusted for each landowner based upon crops grown on his or her land to reflect the varying consumptive use requirements of different crops (Neb. Rev. Stat. §46-656.26(2)).

Replacement Wells: A replacement well will be subject to the same provisions as the well it replaces (Neb. Rev. Stat. §46-656.25(6)(c)).

Intentional or incidental underground water storage and recovery permitholders: The district will, prior to adopting or amending any rules or regulations for an integrated water management area, consult with holders of permits for intentional or incidental underground water storage and recovery issued pursuant to sections 46-226.02, 46-233, 46-240, 46-241, 46-242, or 46-297 as required by state statute 46-656.23.

Voluntary groundwater conservation measures have been encouraged by Tri-Basin NRD for many years through educational programs, demonstrations and irrigation efficiency improvement cost-share assistance to landowners. The district annually reserves 50% of Nebraska Soil and Water Conservation Program funds for irrigation efficiency practices. Water conservation is also stressed through enforcement of the Groundwater Management and Protection Act groundwater runoff rules and regulations.

REFERENCES

1. Application for a Permit for Incidental Underground Water Storage and Recovery for Gosper, Phelps, and Kearney Counties; Central Nebraska Public Power and Irrigation District; October 1984.

2. Areal Groundwater Quality in the Tri-Basin Natural Resources District, 1978-1980: Mary E. Spalding; An open file report prepared in fulfillment of a cooperative agreement between the Tri-Basin NRD and the Conservation and Survey Division, Institute of Agriculture and Natural Resources, University of Nebraska, Lincoln; September 1981.

3. Aspects of Groundwater quality; Proceedings of the 1985 Water Resources Seminar Series; Nebraska Water Resources Center; May 1985.

4. Geology and Groundwater Resources of South-Central Nebraska; Geological and Survey Water Supply Paper 779; 1938.

5. Groundwater Reservoir Management: a policy issue study for the State Water Planning and Review Process; Nebraska Natural Resources Commission; March 1982.

6. Handbook for the Preparation of Groundwater Management Plan; a Contract report for the Nebraska Association of Resources Districts by the Conservation and Survey Division, University of Nebraska, Lincoln; November, 1984.

7. Long-Range Implementation Plan and Supplements; Tri-Basin Natural Resources District; October, 1979-1984.

8. Master Plan; Tri-Basin Natural Resources District; August 1979. Revised 1989.

9. Tri-Basin Natural Resources District Groundwater Recharge Program Phase I Status Report; Henningson, Durham and Richardson, Inc., Omaha; November 1983.

10. Tri-Basin NRD Public Water Supply Data 1979 through 1983; Nebraska Water Use Data Program, Conservation and Survey Division, Institute of Agriculture and Natural Resources, University of Nebraska, Lincoln.