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# Nebraska's Groundwater

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# N E B R A S K A' S  G R O U N D  W A T E R

By

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## Importance

To begin the story of Nebraska's ground water and its importance to Nebraska we must first look backward. Beginning a few million years ago as Nebraska was being developed, we see this area as a great inland sea bottom. This eventually, through deposits, erosion, pressure, plus four glacial attacks, gave the basic bedrock surface gouged with deep valleys filled with porous materials. This in turn became one of the largest underground water complexes in the United States. The spongy sandy surface materials would soak up water while the vast permeable gravel, sand, and Dakota sandstone-filled valleys trapped vast wealths of ground water.

The next fact which becomes of interest is a more current-day matter involving the amount of rainfall which adds to this great reserve of water. The southeastern area receives the largest amount of precipitation, varying from 20 to 55 inches and averaging close to 36 inches for an annual average. The sandhill region has from 9 to 25 inches and averages around 16 inches annually. State-wide, the rainfall has an annual average of 22 inches.

A third facet we should look into is the climate which is directly related to the subject of ground water. The area varies from semi-humid regions of the southeast to the notable and sometimes parched semi-arid regions in the western portion of the state.

It is mainly the more arid portion of the state which will become the shining flower when water is applied. The western and middle sections of the state were vastly different in climate from what the farmers were accustomed to farther east. They had not known the bitter dry cold and heat to be found in Nebraska. When the farmer began to learn more about the conditions with which he had to cope in this state, he began to think of ways he could change things to better benefit himself. Falsely, he began to plant trees and other vegetation in the hope that by this means he could change the overall weather picture.

During the nineteenth century the railroads were in need of water to keep their steam locomotives running. This meant following existing water supplies and storing the water in tanks or towers for use when it was needed. The use of manual labor, at times 24 hours a day, to man the pumps kept these sources filled. Later when ground water was being exploited, the windmill was used to better get at this source of liquid gold.

N. H. Darton of the United States Geological Survey in 1898 began to investigate the underground water that existed in Nebraska. He became aware of what this water resource would mean to the state's economy. The drought in the area at this same period started others thinking strongly about what Darton had been saying. Other studies

were begun all over the state and other adjoining areas. These studies encompassed large areas like the whole Platte River Valley. The people wanted to use this newly talked about water supply for irrigation. They wanted to know more of how much water was there and the cost of getting this water into their fields. The cooperative investigation of ground water began July 1, 1930, under the supervision of O. E. Meinzer of the U. S. Geological Survey and G. E. Condra, called the father of geology in Nebraska, who was the State Geologist.

How does Nebraska benefit? The ground water first has helped the farmer and municipal or small towns. It must be remembered that this constant use without any regard to the matter will bring such great demand on the supply that only through great expense will it be available. Steps must be taken to see that this vast supply of natural resource doesn't become non-existent. Along this line, irrigation and flood protection were to be an answer. There had to be control to save the water during periods of heavy runoff in order to utilize this during the dry seasons. The Tri-County area, including Lake McConaughy, around the Holdrege and Minden areas, was developed as a water-shed program. This gave water greater importance to the state through a five-point system: The first is flood protection through controlled damming; then irrigation during July and August when the farmers most need the water for their fields; third, electric power generation giving this state the cheapest source of usable energy of the combined fifty states; fourth, recreational areas which draw on the natives of the area and tourists for all kinds of aquatic pleasures and enjoyment; and last and most important for this topic, is ground water recharge. This subsequent value supports the heaviest concentration of pump irrigation and stabilizes the ground water for further municipal and industrial uses. This aspect of the ground water situation then makes us more aware of the importance of ground water and demands of us to take stock of our actions. We should promote legislation and use ground water to its fullest extent, but use it judiciously.

## Utilization

Nebraska is endowed with a virtual underground reservoir, an underground flow which runs from west to east. The sand dune area, known as the Sand Hills region, acts as a ground water recharge area. This region is so immense that the overflow of underground water alone feeds all the streams leading from this area. The estimated value of this resource is 17 billion dollars yearly.

Underground water storage is estimated at 547 trillion gallons and maintains a constant temperature of 52-54° throughout the state. If all this ground water were above the surface, our state would be covered with 34 feet of water.

### Agriculture:

Who in Nebraska is taking advantage of this natural gift? Agriculture utilizes ground water in nearly all phases of operation.

About 2 million acres of farmland benefit from it annually. Approximately 4 million acres can be irrigated by surface and underground water in the future.

Before the farmer can make use of this resource, adequate means of extracting the water are essential. First, a test well must be drilled to a suitable aquifer (water-bearing source), preferably gravel or sand. If possible, drilling down to a level directly above bedrock formation would create the ideal condition for continual water sustainance. Laboratory tests must be conducted to determine if the samples of water are suitable for use. The water quality must meet minimum specifications.

The farmer's initial cost is about $5,000 to install a well, pumping equipment and irrigation equipment, but his advantages are many: crop yields alone of 100 per cent over and above non-irrigation; pasture acreage for livestock is reduced; two crops are virtually guaranteed; droughts have little effect on his crops with supplemental water available; fire insurance rates show a marked reduction. The future looks even brighter for the farmer as our population increases and more food is required to sustain it.

## Municipalities

Municipalities have an equal interest in Nebraska's ground water. Every community in the state uses ground water except Omaha, Chadron, and Crawford. This fact alone points out the importance of ground water for the survival of municipalities.

Lincoln obtains its water from Ashland, and has thirty-three proven shallow-water wells, which are located three-quarters of a mile from the Platte River. Lincoln proper has twenty-two proven wells. However, it rarely utilizes them because, with excessive pumping, salt from deeper formations contaminates them. Due to an adequate supply of water, local fire insurance rates are kept at a minimum.

## Industry

Nebraska's largest industrial user of underground water is the Nitrogen Division of the Allied Chemical and Dye Corporation. The water is utilized in processing and cooling, and is returned after use to the river. The Hastings Consumers Cooperative Association, which manufactures nitrogen fertilizer, uses underground water at a rate of 750,000 gallons a day. The Hallam Nuclear Power Facility, which is the only sodium graphite nuclear-powered electric plant in the Midwest, utilizes ground water in its cooling towers. Nine wells, each capable of producing 800 gallons a minute, are utilized to maintain a water level of 310,000 gallons in storage tanks.

Increasing industrialization in Nebraska will call for ever-increasing amounts of readily available ground water.

## Conservation

The conservation of any natural resource is an arduous process involving, first of all, widespread changes in attitudes. To interest people in the conservation of ground water is particularly difficult because the necessity for conservation cannot be demonstrated in dramatic ways. Spectacular forest fires and devastating floods instill feelings of urgency. Our imaginations are not particularly stirred to hear that in some areas our water table is lowering at the rate of a foot per year, making it probable that in fifty or sixty years the situation may become acute in some areas. We have the philosophy that in sixty years anything can happen, so why worry now? Then too, people cannot readily visualize ground water in the way that they can surface water. In a surface water reservoir, the amount in storage is visible and can be measured; the amount of water that is coming into and leaving the reservoir can also be measured easily. But careful investigation and evaluation of data are required on the part of geologists and hydrologists to define what is happening in a ground water reservoir.

There is much disagreement regarding the actual ownership of ground water. For the most part, we believe that the forest and rivers belong to all of us as part of our national heritage, but we are not sure about the ownership of those things which we cannot see. The farmer has long considered that the water under his land is his to use or misuse as he sees fit, in the same way that the land he plows is his. Municipalities are reaching farther and farther from their immediate environs in the search for new well fields. Industry is making its demands stridently known.

For many of our natural resources, conservation means using the resource sparingly, perhaps not at all. But ground water is of no benefit unless it is used. Conservation does not mean to save water, but to use it in a way that will provide the maximum value to the most people. The chief goal is to have water where it is needed, when it is needed, and in the amount needed. Water cannot be destroyed, nor can it be created, except in insignificant amounts. It can be used, reused, misused, or abused. Its availability cannot be guaranteed by legislation. The only way to guarantee water is by widespread education in the wisest planning and management of this resource, with such regulations as are needed occurring chiefly on a local basis. Most of the water problems which we now have and will have in the next sixty years or so will be quite localized in scope. It is true that in some areas of our state, because of intensive pump irrigation and inadequate precipitation, the water table is lowering. However, even in areas where we might have a lowering of 50 feet in fifty or sixty years, we may have a hundred feet of water-bearing material, and even under these conditions, half of the reserve would remain. This means, of course, that each well could only pump about half the amount now being pumped. Wells, therefore, would have to be deeper, have larger pumps, and the cost would be higher. And there would come a time when the dollar return could not offset the cost involved. Water is becoming more expensive and will continue to increase in cost as competition for it increases.

Water has become a magic word. There is considerable competition among public agencies for federal fund allocation for ground water study. Hydrologists, engineers, lawyers, and legislators each tend to consider the field of water as their own special field. Water is the "miracle drug" that has brought economic stability to vast areas of otherwise unproductive land. Concern on a national level has increased, culminating last year in the passage by Congress of a bill establishing Water Resources Research Institutes at a land-grant college in each state. Although only fourteen have been authorized to date because of budget limitations--Nebraska was not included--it is expected that funds will be available this next fiscal year for complete implementation, and it is anticipated that each of the 50 Institutes will spend $100,000 or more to do research on problems associated with water supply and quality.

Of great significance is the interest being generated on a local level in our ground water. Associations of pump irrigators are being formed and these groups are seeking to learn better ways to use ground water and are keeping careful records of ground water level measurements, in order to gain an insight of what is happening in their particular area.

The answer to the question of the future of Nebraska's ground water supply lies not in increased legislation, but in increased research and education in the wisest uses for this most important resource.

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