GROUND WATER

RESOURCES

Story County

Open File Report 82-85 WRD

Compiled by CAROL A. THOMPSON

GROUND-WATER RESOURCES OF STORY COUNTY

Introduction

Approximately 80% of the residents of Story County rely on groundwater as the source of their drinking water. It is estimated that the use of groundwater in the county currently approaches 3.2 billion gallons per year. For comparison, this amount would provide each new resident with 122 gallons of water a day during the year. Actually, few if any households use this much water, and the rather large annual per capita use reflects the greater water requirements of the county's industries, agribusinesses and municipalities.

The users of ground water in the county draw their supplies from several different geologic sources. Various factors must be considered in determining the availability of groundwater and the adequacy of a supply source:

distribution - having water where it is needed

accessibility - affects the costs for drilling wells and pumping water

yield - relates to the magnitude of the supply that can be sustained

quality - determines for what purposes the water can be used

In terms of these factors, there are few locations in Story County where the availability of groundwater is not limited to some degree. The most common limitation is poor water quality, that is, highly mineralized groundwater. Secondary limitations are generally related to poor distribution, small yields from some sources, and poor accessibility due to the great depths to adequate sources.

Occurrence of Ground Water in Story County

The occurrence of groundwater is influenced by geology -- the position and thickness of the rock units, their ability to store and transmit water, and their physical and chemical make-up. Geologic units that store and transmit water and yield appreciable amounts to wells are called aquifers. The best aquifers are usually composed of unconsolidated sand and gravel, porous sandstone, and porous or fractured limestone and dolostone. Other units composed of materials such as clay and silt, shale, siltstone, and mudstone yield little or no water to wells. These impermeable units are called aquicludes or aquitards, and commonly separate one aquifer unit from another.

In Story County, there are two principal sources from which users obtain water supplies: the loose, unconsolidated materials near the land surface that comprise the surficial aquifer, and several deep-rock aquifers. Between the surficial aquifer and the deep Cambro-Ordovician aquifer are two other major water-bearing units, the Mississippian and the Devonian aquifer systems. However, throughout Story County the water contained in these aquifers is highly mineralized and often of too poor quality for human or livestock use. Figure 1 shows the geologic relations of aquifers beneath the county. Each aquifer has its own set of geologic, hydrologic, and water-quality characteristics which determine the amount and potability (suitability for drinking) of water it will yield.

Surficial Aquifers

Unconsolidated deposits at the land surface are comprised of mixtures of clay, silt, sand, gravel, and assorted boulders. The water-yielding potential of surficial deposits is greatest in units composed mostly of sand and/or gravel. Three types of surficial aquifers are used: the alluvial aquifer, the drift aquifer, and the buried channel aquifer.

The alluvial aquifers consist mainly of sand and gravel transported and deposited by modern streams and make up the floodplains and terraces in major valleys. Alluvial deposits are shallow, generally less than 50-60 feet, and thus may be easily contaminated by the infiltration of surfacewater.

The drift aquifer is the thick layer of clay- to boulder-size material (till) deposited over the bedrock by glacial ice which invaded the county at least twice in the last two million years. The composition of the glacial drift varies considerably, and in many places does not yield much water. There are however, lenses or beds of sand and gravel in the drift, which are thick and widespread enough to serve as dependable water sources. Usually one or two sand layers can be found in most places that will yield minimum water supplies for domestic wells.

The buried channel aquifer consists of stream alluvium of partially filled valleys that existed before the glacial period. The valleys were overridden by the glaciers, and are now buried under the glacial drift. They may or may not coincide with present day alluvial valleys.

The distribution, yield, and water-quality characteristics for the surficial aquifers are summarized in Figures 2 and 9 and Table 3. An indication of accessibility can be obtained by comparing the elevations of the top (the land surface) and the bottom (the bedrock surface) of the surficial deposits in Figures 4 and 5. The thickness of the glacial drift or the depth of buried channels, is determined by subtracting the elevations at selected locations.

Rock Aquifers

Below the drift and other surficial materials is a thick sequence of layered rocks, formed from deposits of rivers and shallow seas that alternately covered the state during the last 600 million years. The geologic map (Figure 3) shows the geologic units which form the surface of this rock sequence and Table 1 lists the geologic and hydrogeologic characteristics of the rock units underlying Story County. Over two thirds of the county rocks of Pennsylvanian age lie directly below the glacial drift. These rocks in Story County are primarily shales, siltstones, sandstones, thin coal beds and minor limestone beds. Because shales predominate, the Pennsylvanian sequence acts as an aquiclude and only locally can water be produced. Most of the water from the Pennsylvanian is found in the sandstone layers within the Cherokee Group. Water quality data extrapolated from Polk and Warren Counties indicate that in general, the water is highly mineralized, with high concentrations of dissolved solids, sulfate, and sodium.

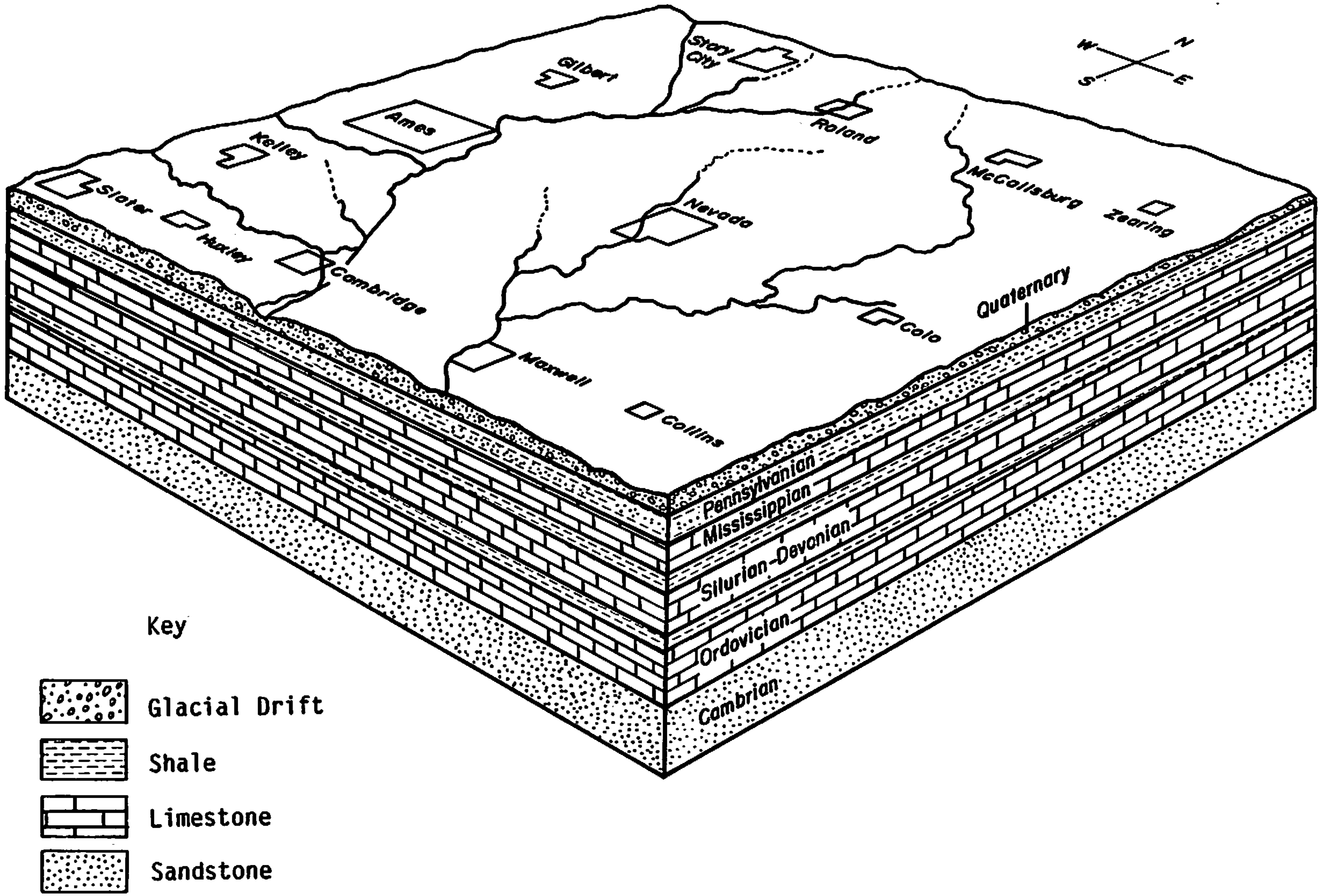


Figure 1

BLOCK DIAGRAM SHOWING THE GEOLOGY OF STORY COUNTY

The Mississippian Aquifer is heavily used in Story County, and consists of a series of limestones and dolostones. Yields range from 10-75 gpm. The Devonian-Silurian aquifer is used by several communities in Story County and locally by rural residents. The main water-producing units in the Devonian-Silurian are a series of limestones and dolostones. The Cambro-Ordovician aquifer is the major deep aquifer in the county, and includes the St. Peter Sandstone, the Prairie du Chien dolomite, and the Jordan Sandstone, the latter being the major water producer. The maps in Figure 12 refer to the Jordan Aquifer, the lower two units of the Cambro-Ordovician aquifer. The St. Peter, being highly friable, is generally cased-out in the deep wells.

The relative accessibility of groundwater in rock aquifers depends on the depth to the aquifer. The deeper a well must be, the greater the cost for well construction and pumping. The depths to, and thicknesses of, units at specific sites, will vary somewhat because of irregularities in the elevation of the land surface, and in the elevation of the underlying rock units. Estimates of depths and thicknesses can be made by comparing Figure 4 with the maps of aquifer elevations in Figures 10, 11, and 12. The range in depth below land surface to the top of the county's principal bedrock aquifers is given for each township in Figure 6.

A second factor affecting groundwater accessibility is the level to which the water will rise in a well (the static water level). Throughout the county, water in the rock aquifers is under artesian pressure, and rises in wells once the aquifer is penetrated. This can reduce the cost of pumping. Average static water levels for Story County wells are shown in Figures 10, 11, and 12.

Average rates of yield and water quality characteristics for each of the aquifers are summarized in the maps in figures 10, 11, 12, and Table 4.

Table 1

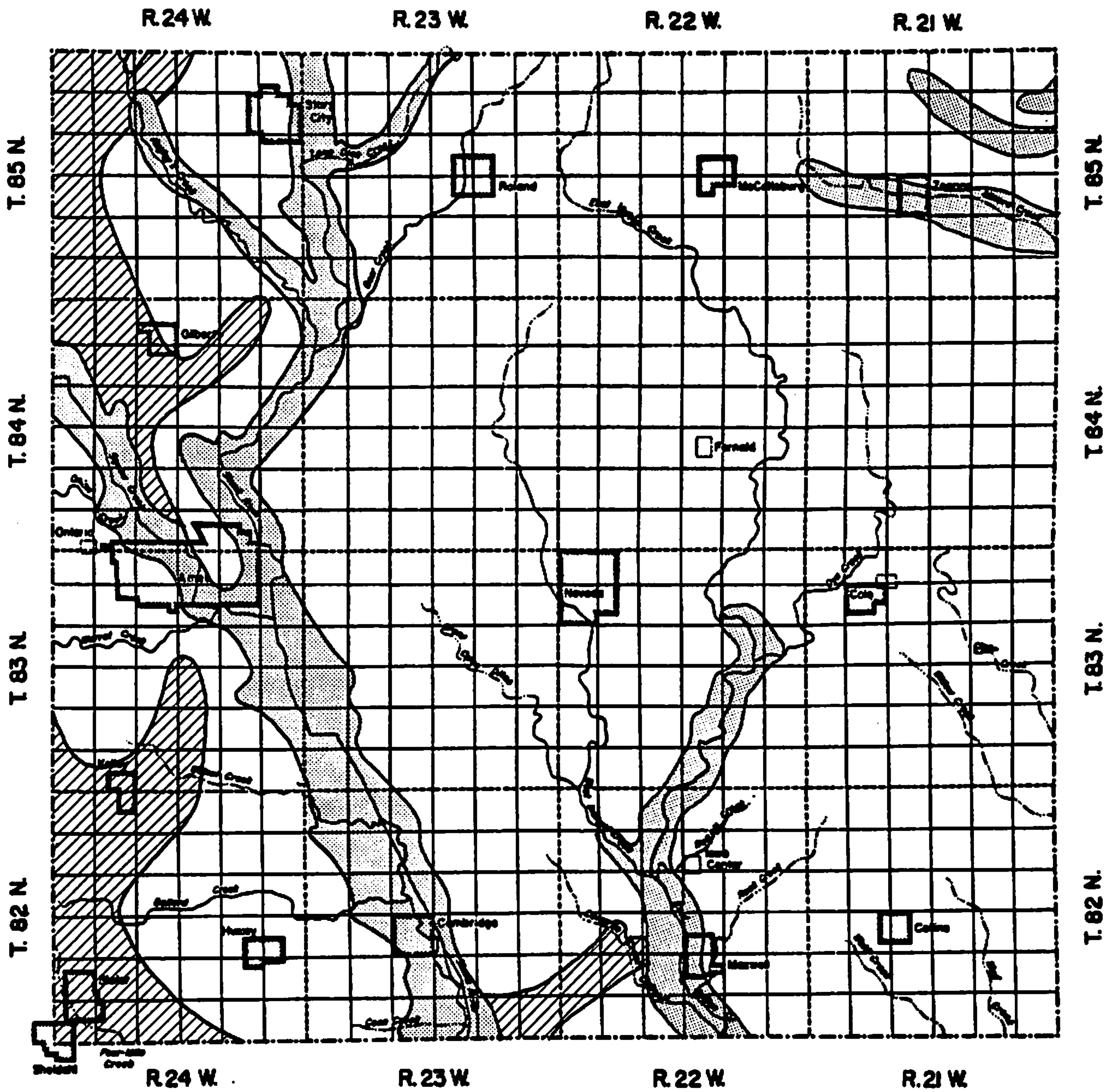
GEOLOGIC AND HYDROGEOLOGIC UNITS IN STORY COUNTY

Age	Rock Unit	Description	Thickness Range	Hydrogeologic Unit	Water-Bearing Characteristics
Quaternary	Alluvium	Sand, gravel, silt and clay	0-400 (feet)	Surficial aquifer	Fair to large yields (10 to 500 gpm)
	Glacial drift (undifferentiated)	Predominantly till containing scattered irregular bodies of sand and gravel			Low yields (less than 10 gpm)
	Buried channel	Sand, gravel, silt and clay			Small to large yields
Pennsylvanian	Marmaton Group	Alternating shale and limestone; thin coal and sandstone	0-215	Aquiclude	Low yields only from limestone and sandstone
	Cherokee Group	Shale, clay, siltstone, sandstone and coal beds, mostly thin			
Mississippian	Meramec Series	Sandy limestone	100-300	Mississippian aquifer	Fair to low yields
	Osage Series	Limestone and dolostone, cherty; shale			
	Kinderhook Series	Limestone, oolitic, and dolostone, cherty			
Devonian	Maple Mill Shale Sheffield Formation Lime Creek Formation	Shale, limestone in lower	150-250	Devonian aquiclude	Does not yield water
	Cedar Valley Limestone Wapsipinicon Formation	Limestone and dolostone, contains evaporites (gypsum) in southern half of Iowa	500-550	Devonian aquifer*	Fair to low yields
Silurian	Undifferentiated	Dolostone	90-125	Silurian aquifer	Low yields
Ordovician	Maquoketa Formation	Shale and dolostone	1000-1075	Maquoketa aquiclude	Does not yield water
	Galena Formation	Dolostone and chert		Minor aquiclude	Low yields
	Decorah Formation-Platteville Formation	Limestone, dolostone and thin shale, includes sandstone in SE Iowa		Aquiclude	Does not yield water
	St. Peter Sandstone	Sandstone		Cambro-Ordovician aquifer	Fair yields
	Prairie du Chien Formation	Dolostone, sandy and cherty			High yields (over 500 gpm)
Cambrian	Jordan Sandstone	Sandstone			
	St. Lawrence Formation	Dolostone		Aquitard	Low yields
	Franconia Sandstone	Sandstone and shale			
	Dresbach Group	Sandstone		Dresbach aquifer*	High to low yields
Precambrian	Undifferentiated	Coarse sandstone: crystalline rocks		Base of ground water reservoir	Not known to yield water

*not significant in Story County owing to highly mineralized water contained.

Figure 2

SURFICIAL MATERIALS



Buried Channel

Alluvium

Drift

Figure 3

GEOLOGIC MAP

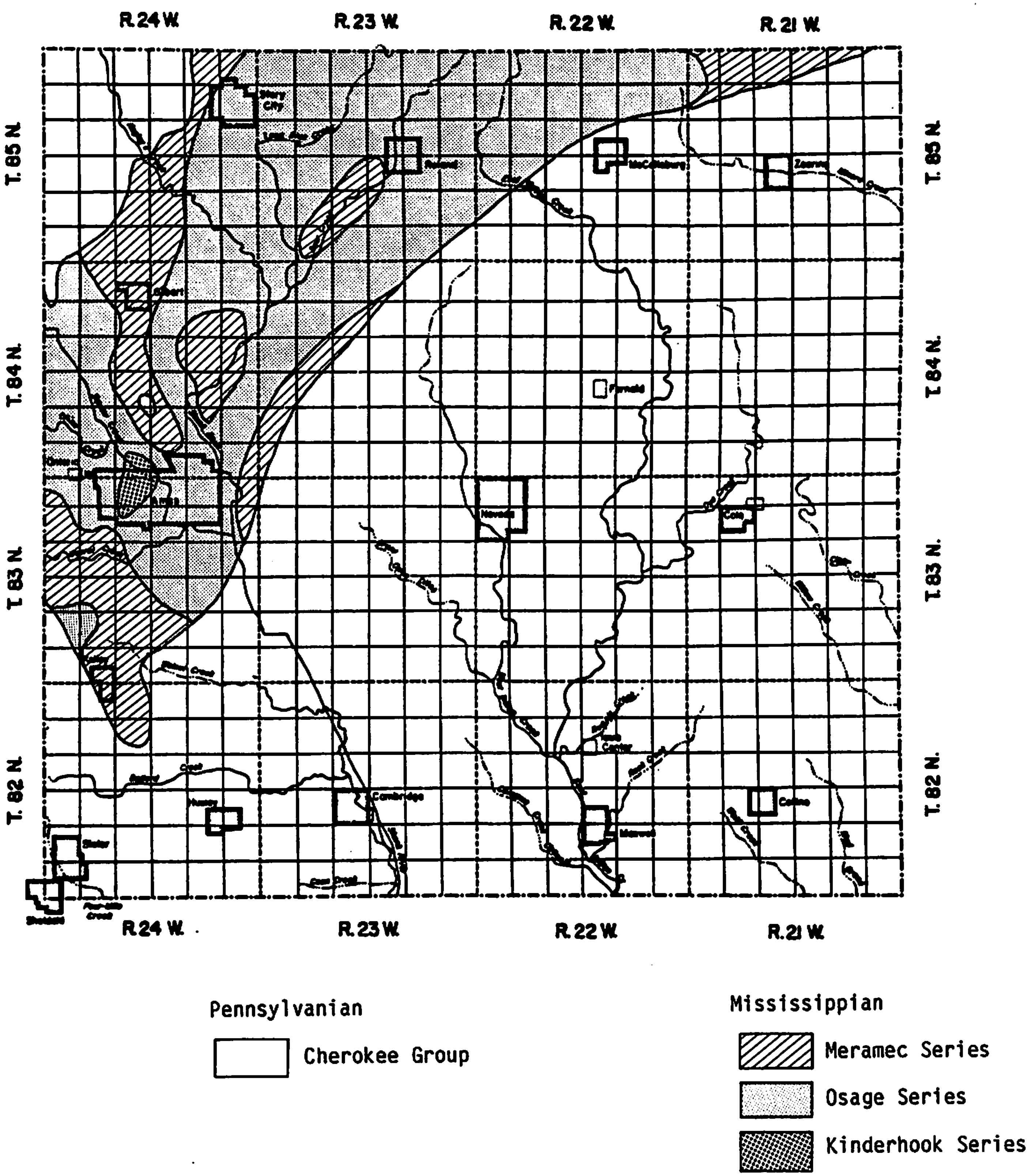


Figure 4

ELEVATION OF LAND SURFACE IN FEET ABOVE MEAN SEA LEVEL

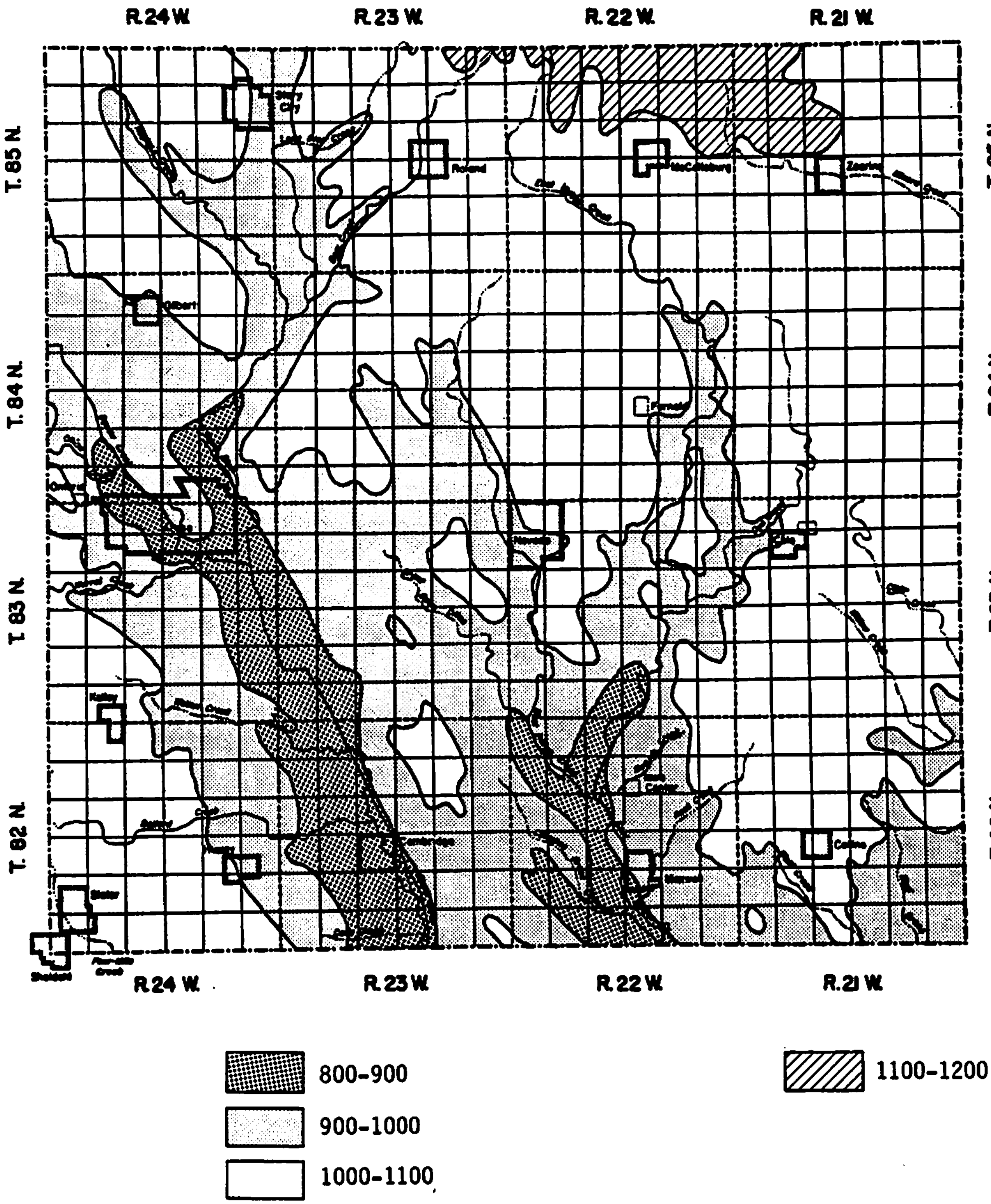


Figure 5

ELEVATION OF BEDROCK SURFACE IN FEET ABOVE MEAN SEA LEVEL

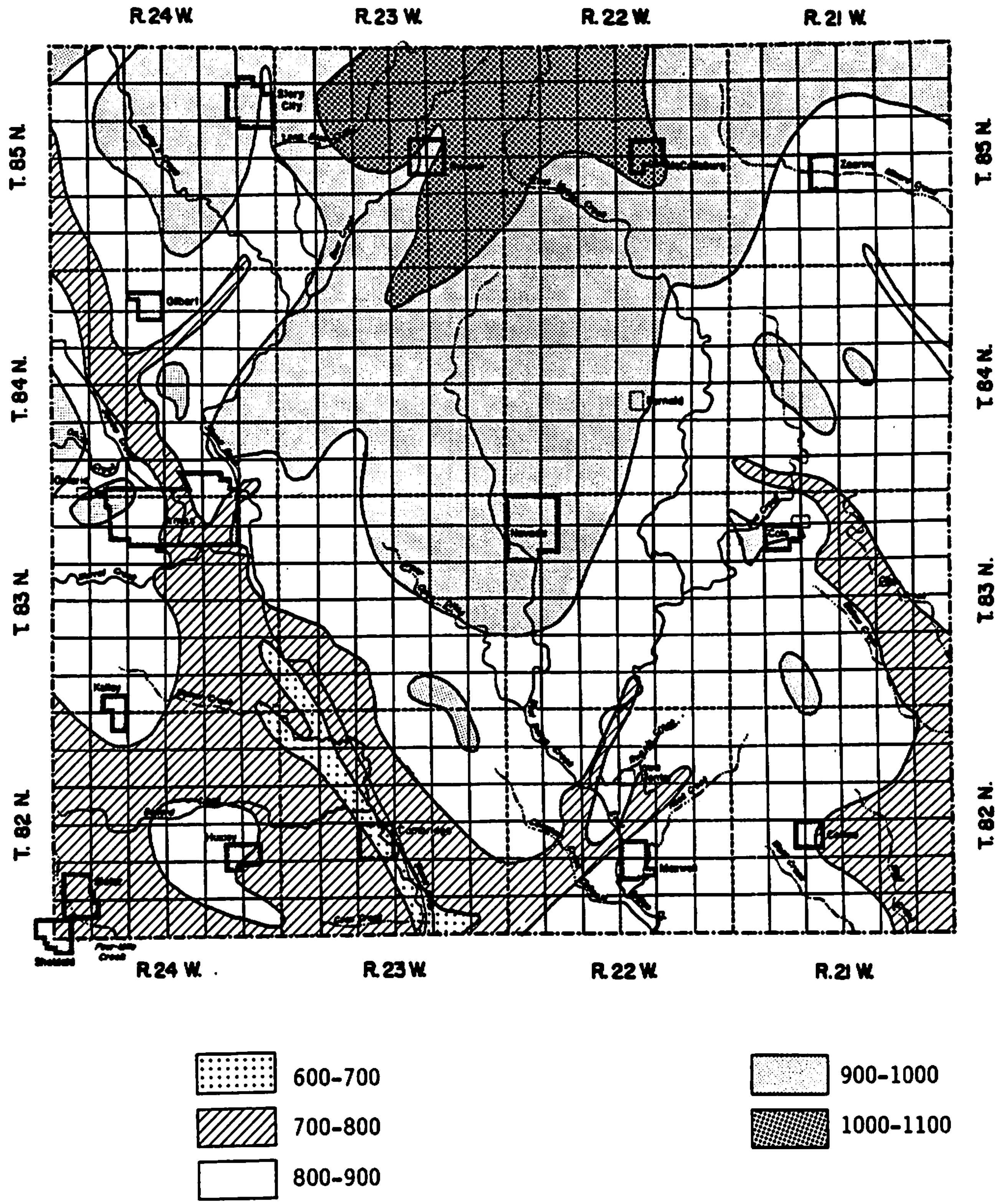


Figure 6

RANGE IN DEPTH TO STORY COUNTY'S PRINCIPAL ROCK AQUIFERS

	R.24W.	R.23W.	R.22W.	R.21W.	
T.85N.	BEDROCK 0-110 MISSISSIPPIAN 0-260 DEVONIAN 350-525 CAMBRO-ORDOVICIAN 1350-1625	BEDROCK 0-100 MISSISSIPPIAN 0-200 DEVONIAN 300-600 CAMBRO-ORDOVICIAN 1250-1400	BEDROCK 0-150 MISSISSIPPIAN 35-250 DEVONIAN 475-550 CAMBRO-ORDOVICIAN 1275-1650	BEDROCK 0-250 MISSISSIPPIAN 100-350 DEVONIAN 500-650 CAMBRO-ORDOVICIAN 1400-1800	T.85N.
T.84N.	BEDROCK 0-220 MISSISSIPPIAN 40-500 DEVONIAN 300-500 CAMBRO-ORDOVICIAN 1350-1500	BEDROCK 0-100 MISSISSIPPIAN 25-225 DEVONIAN 350-745 CAMBRO-ORDOVICIAN 1375-1825	BEDROCK 0-150 MISSISSIPPIAN 100-285 DEVONIAN 650-775 CAMBRO-ORDOVICIAN 1500-1950	BEDROCK 0-310 MISSISSIPPIAN 175-310 DEVONIAN 600-675 CAMBRO-ORDOVICIAN 1800-1875	T.84N.
T.83N.	BEDROCK 0-325 MISSISSIPPIAN 125-350 DEVONIAN 500-750 CAMBRO-ORDOVICIAN 1350-1925	BEDROCK 0-200 MISSISSIPPIAN 150-200 DEVONIAN 600-750 CAMBRO-ORDOVICIAN 1400-1825	BEDROCK 0-150 MISSISSIPPIAN 150-300 DEVONIAN 550-700 CAMBRO-ORDOVICIAN 1775-2925	BEDROCK 0-275 MISSISSIPPIAN 150-300 DEVONIAN 550-700 CAMBRO-ORDOVICIAN 1800-1925	T.83N.
T.82N.	BEDROCK 0-375 MISSISSIPPIAN 150-375 DEVONIAN 500-875 CAMBRO-ORDOVICIAN 1600-2075	BEDROCK 0-245 MISSISSIPPIAN 200-350 DEVONIAN 650-715 CAMBRO-ORDOVICIAN 1825-2035	BEDROCK 0-200 MISSISSIPPIAN 150-325 DEVONIAN 525-700 CAMBRO-ORDOVICIAN 1750-1925	BEDROCK 0-300 MISSISSIPPIAN 175-325 DEVONIAN 575-675 CAMBRO-ORDOVICIAN 1775-1900	T.82N.
	R.24W.	R.23W.	R.22W.	R.21W.	

Figure 7

INDEX MAP FOR TYPICAL WELLS IN STORY COUNTY

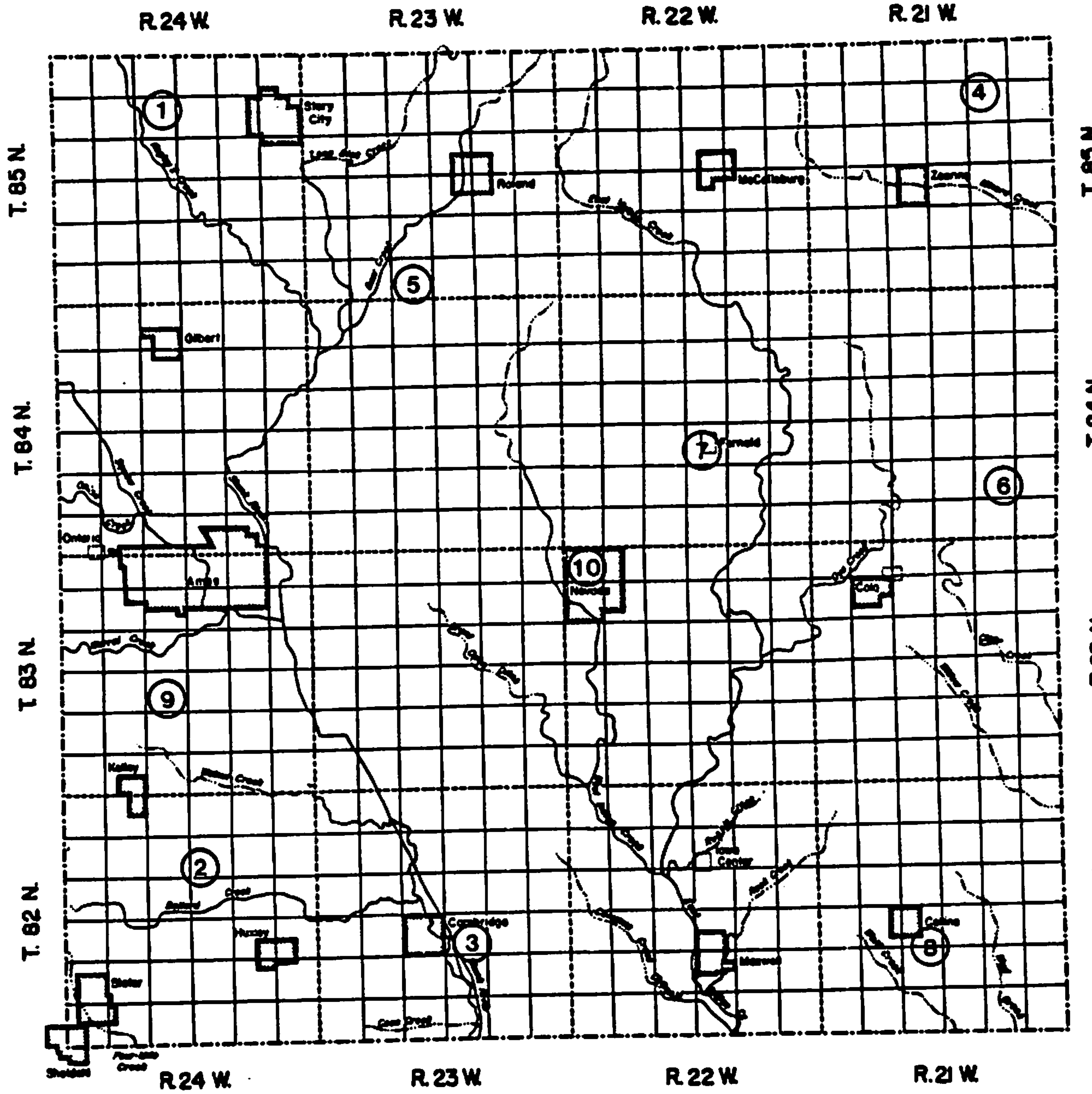


Figure 8

TYPICAL WELLS IN POLK COUNTY

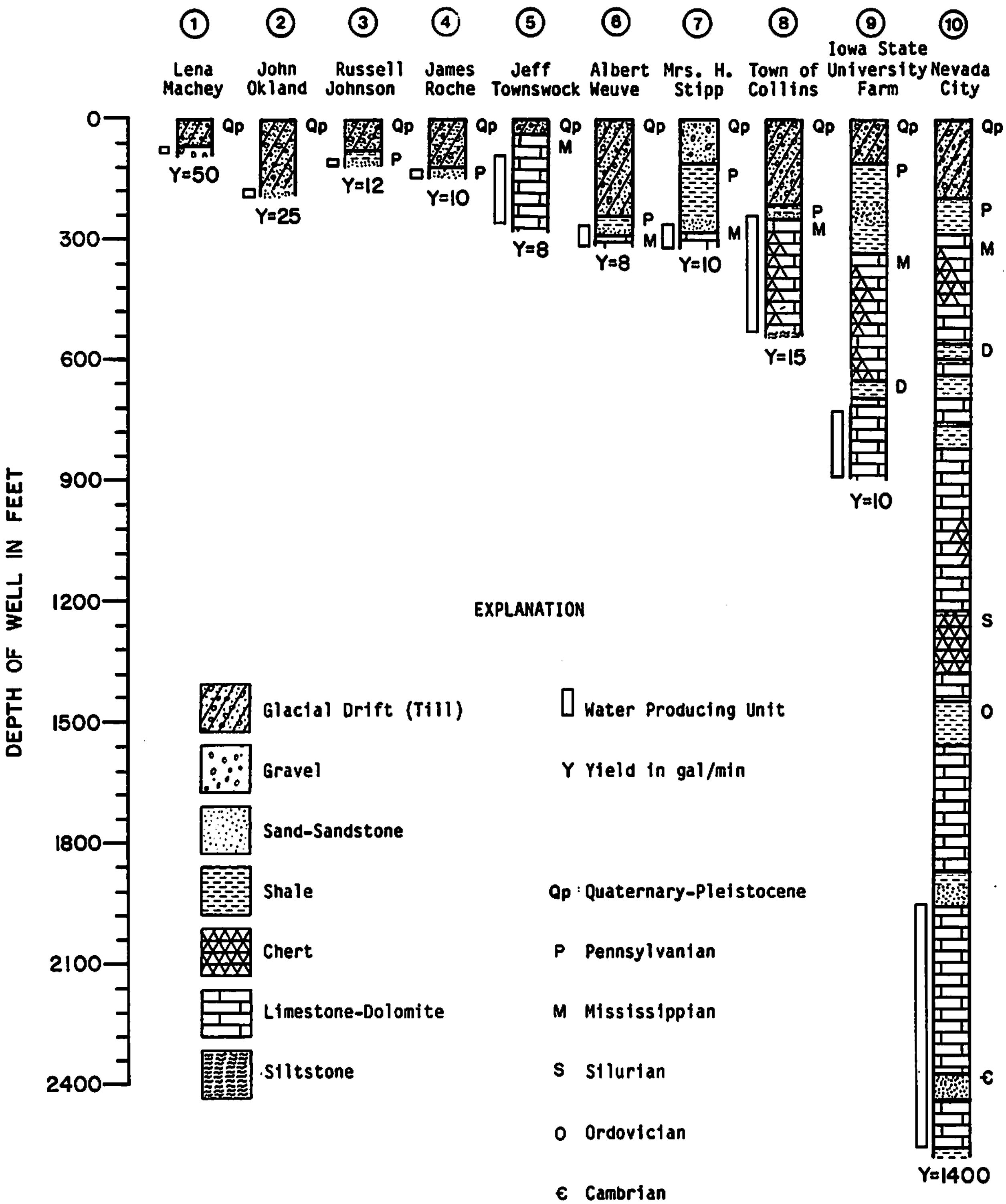


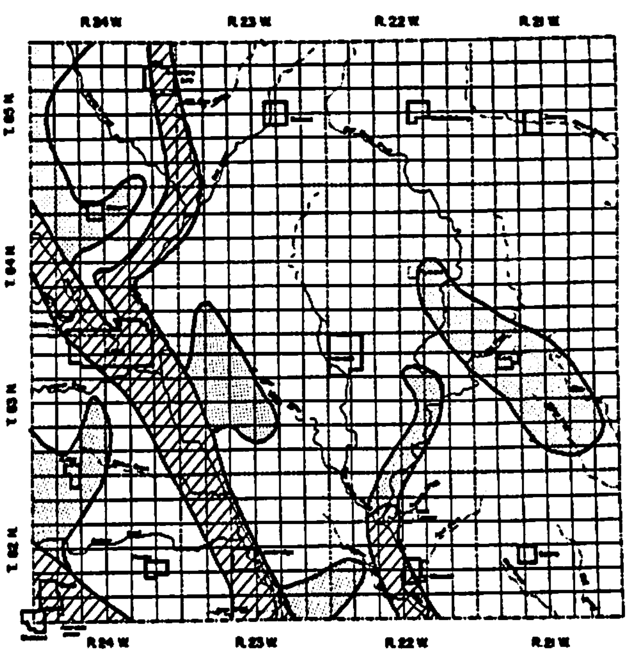
Figure 9

SURFICIAL AQUIFERS

Water Levels

Water levels in the surficial aquifers are difficult to analyze, because water rises to different levels in wells drilled into alluvial, buried-channel, and drift aquifers. The water table in the shallow drift aquifer generally slopes from high land areas toward the streams, and, changes noticeably throughout the year in response to recharge from precipitation. Water levels in the alluvial aquifer fluctuate somewhat in the same way as those in the shallow drift aquifer; however, the main influence on the alluvial aquifer is the stage (level) of the associated streams. Water levels will be high during periods of high stream stage and low during the low-stage periods. The intermediate and deep drift and buried channel aquifers are under confined (artesian) condition and are generally unaffected by local recharge-discharge relationships.

Water levels in the drift aquifers commonly are from 10 to 50 feet below the land surface, and those in the buried-channel aquifers have been reported to be as low as 150 feet below the land surface. The water levels in alluvial wells are from 4 to 20 feet below the flood plain surface and the depth to the water surface will be accordingly deeper in wells located on terrace surfaces.



Water yields to wells in gallons per minute

Below 20

20-100

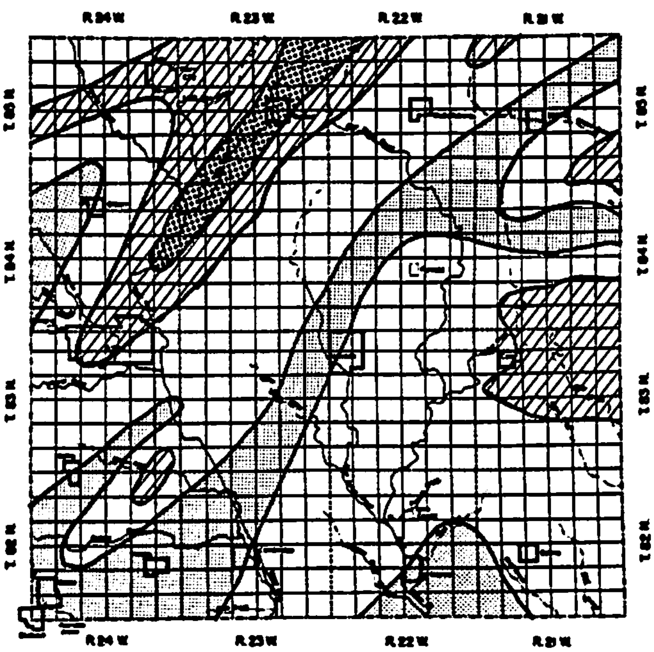
100-500

Figure 10

MISSISSIPPIAN AQUIFER

Elevation of Mississippian Aquifer in feet above mean sea level.

- 600-700
- 700-800
- 800-900
- 900-1000



Water levels in wells in feet above mean sea level.

- Below 900
- Above 1000
- 900-1000

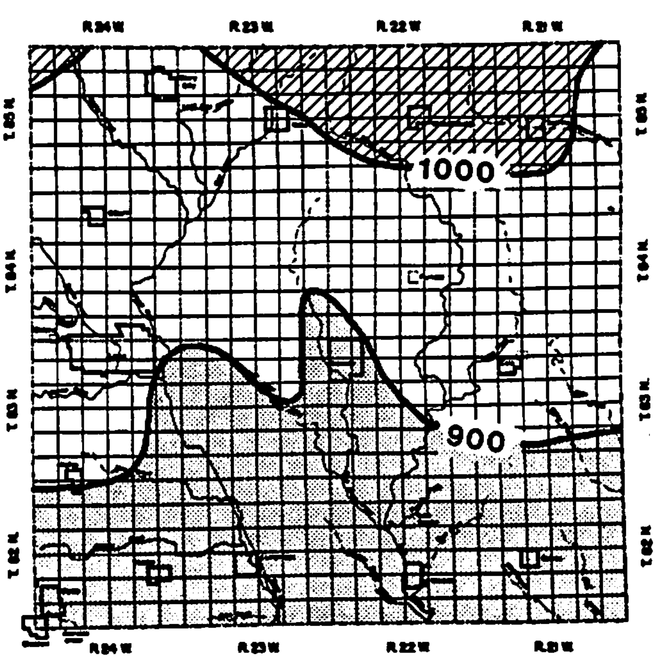


Figure 10 cont.

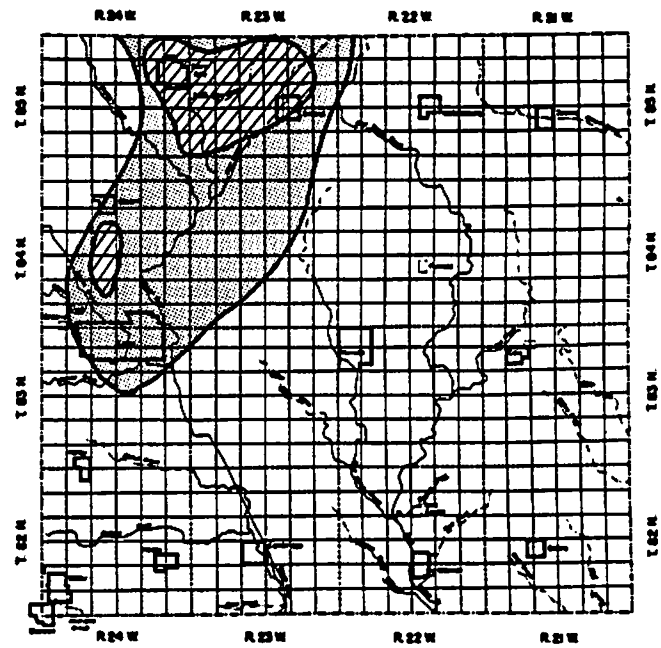
MISSISSIPPIAN AQUIFER

Water yields to wells in gallons per minute.

Below 20

20-50

50-100



Dissolved solids content in milligrams per liter (mg/l).

Below 500

500-1000

1000-1500

1500-1500

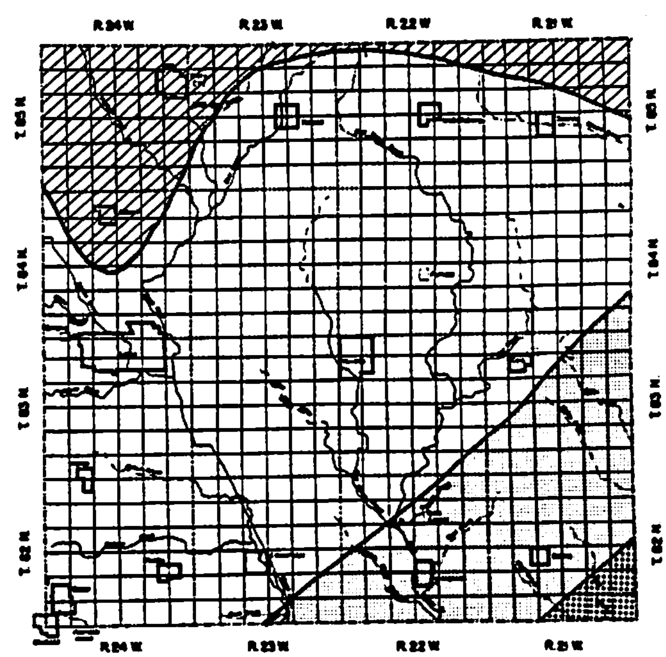
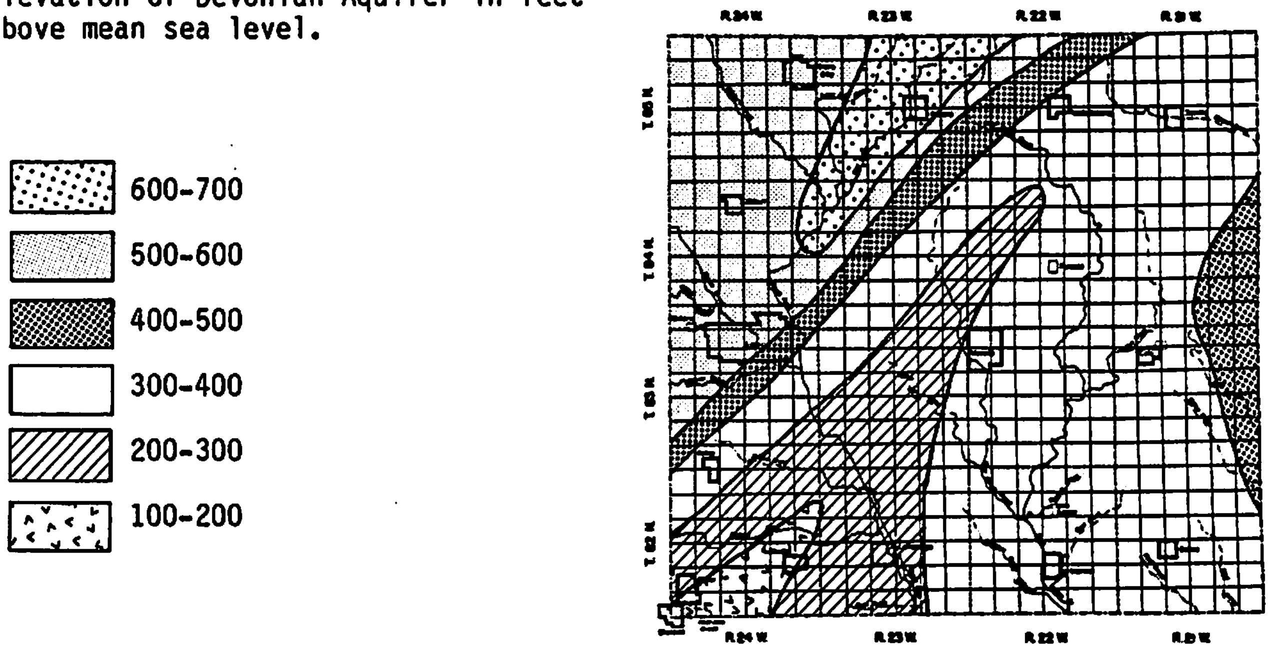


Figure 11

DEVONIAN AQUIFER

Elevation of Devonian Aquifer in feet above mean sea level.



Water levels in wells in feet above mean sea level.

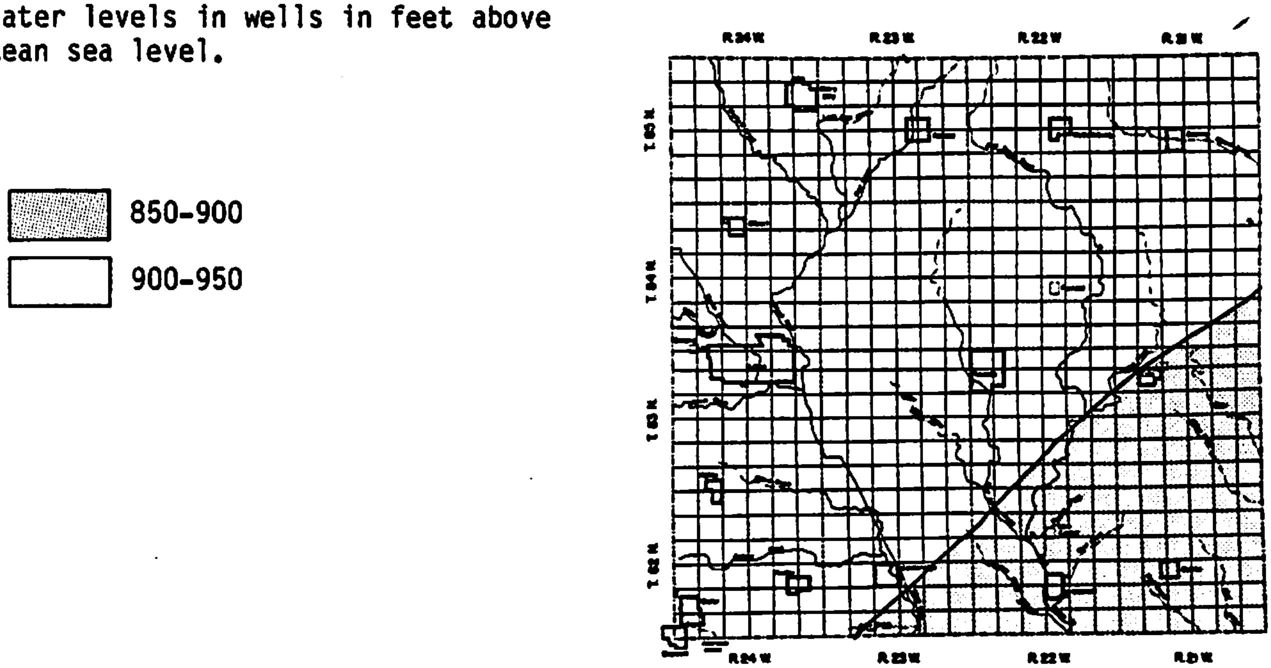


Figure 11 cont.

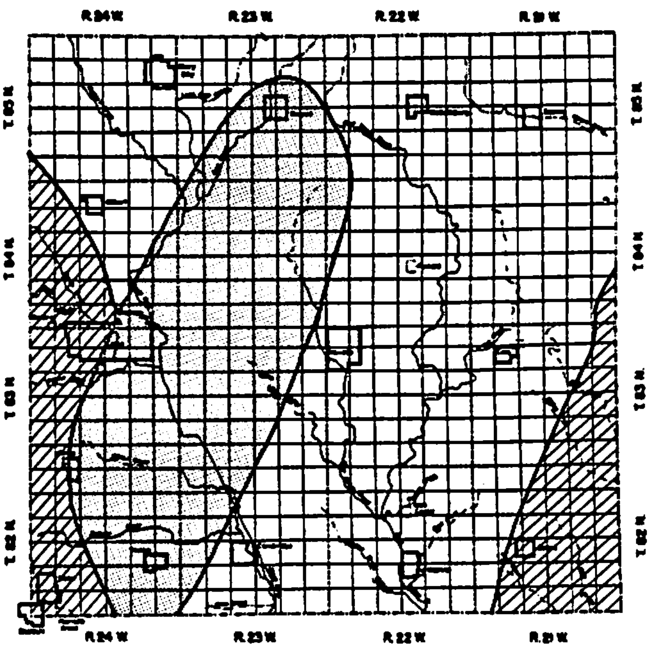
DEVONIAN AQUIFER

Water yields to wells in gallons per minute

Below 20

20-50

50-100



Dissolved solids content in milligrams per liter (mg/l).

Below 500

500-1000

1000-1500

1500-2500

Above 2500

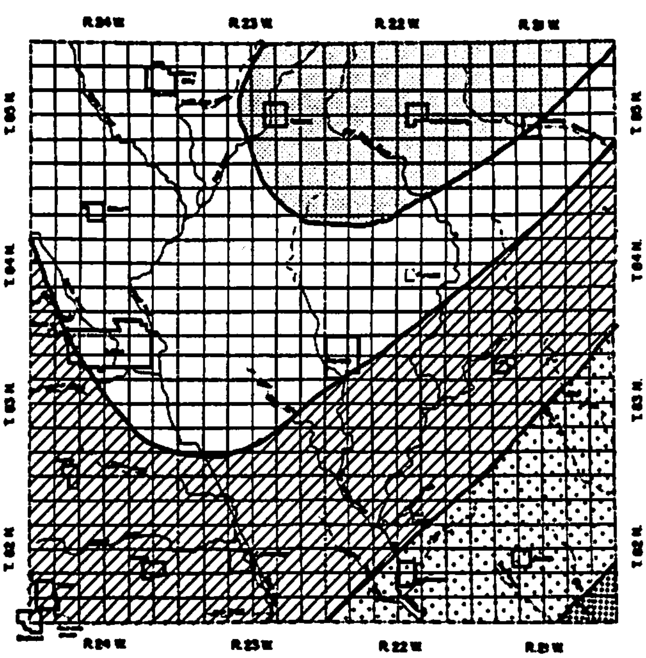
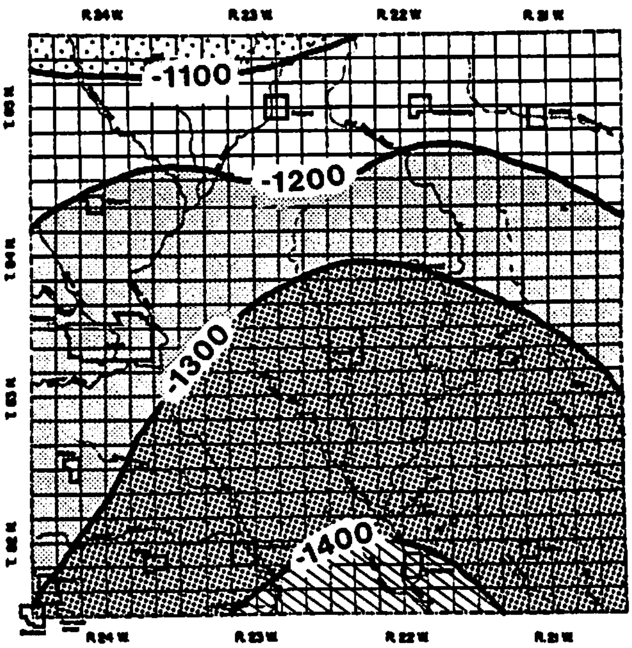


Figure 12

CAMBRO-ORDOVICIAN (JORDAN) AQUIFER

Elevation of Cambro-Ordovician (Jordan) Aquifer in feet below mean sea level.

(-)1400-1500
(-)1300-1400
(-)1200-1300
(-)1100-1200
(-)1000-1100



Water levels in wells in feet above mean sea level.

Above 800
750-800
700-750
650-700
600-650

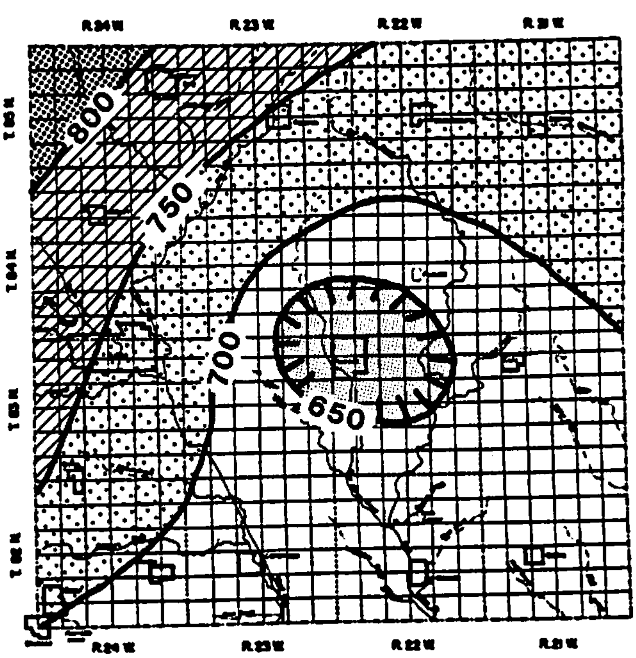
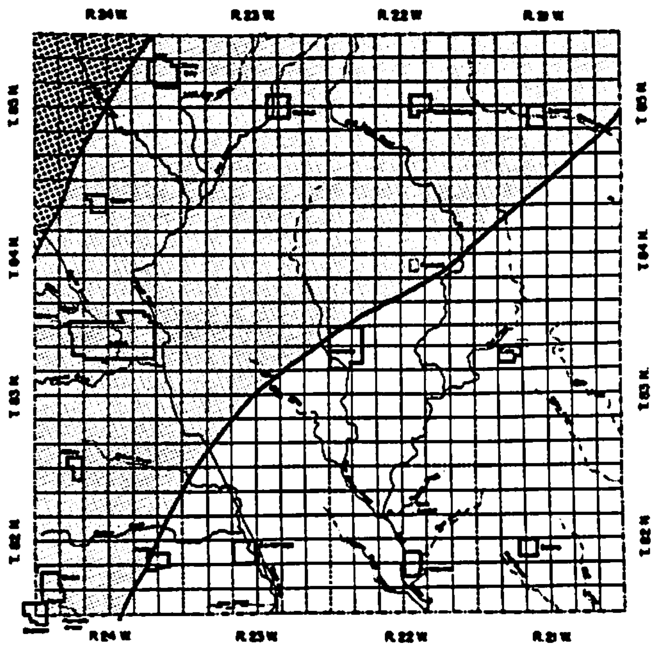


Figure 12 cont.

CAMBRO-ORDOVICIAN (JORDAN) AQUIFER

Water yields of wells in gallons per minute

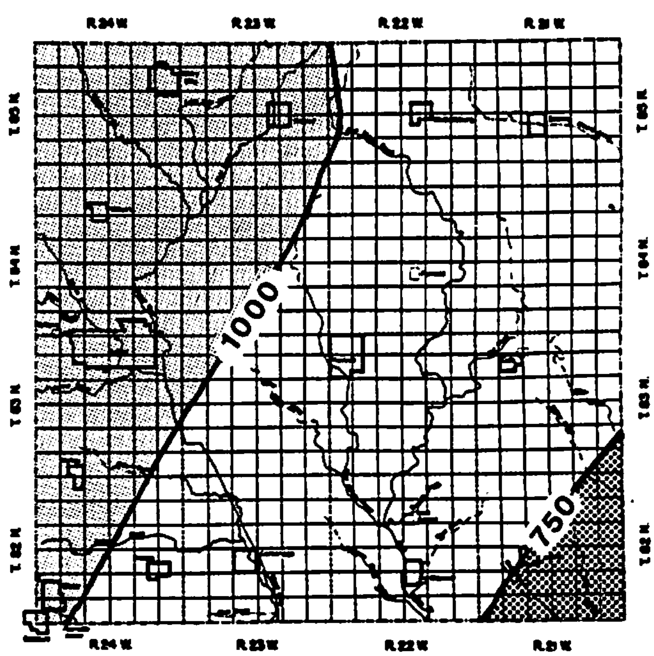


200-500

500-1000

Over 1000

Dissolved solids content in milligrams per liter (mg/l).



500-750

750-1000

1000-1250

Table 2

SIGNIFICANCE OF MINERAL CONSTITUENTS AND PHYSICAL PROPERTIES OF WATER

Constituent or Property	Maximum Recommended Concentration	Significance
Iron (Fe)	0.3 mg/l	Objectionable as it causes red and brown staining of clothing and porcelain. High concentrations affect the color and taste of beverages. Iron is not listed in the following tables, as there are often major differences between reported and actual concentrations. It may be added to water from well casings, pumps, and pipes. The concentration also is affected by micro-organisms. Special sampling and analytical techniques are needed for accurate study.
Manganese (Mn)	0.05 mg/l	Objectional for the same reason as iron. When both iron and manganese are present, it is recommended that the total concentration not exceed 0.3 mg/l. Micro-organisms also affect the concentration. Special techniques are needed for an accurate study.
Calcium (Ca) and Magnesium (Mg)		Principal causes for hardness and scale-forming properties of water. They reduce the lathering ability of soap.
Sodium (Na) and Potassium (K)		Impart a salty or brackish taste when combined with chloride. Sodium salts cause foaming in boilers.
Sulfate (SO_4)	250 mg/l	Commonly has a laxitive effect when the concentration is 600 to 1,000 mg/l, particularly when combined with magnesium or sodium. The effect is much less when combined with calcium. This laxitive effect is commonly noted by newcomers, but they become acclimated to the water in a short time. The effect is noticeable in almost all persons when concentrations exceed 750 mg/l. Sulfate combined with calcium forms a hard scale in boilers and water heaters.
Chloride (Cl)	250 mg/l	Large amounts combined with sodium impart a salty taste.
Fluoride (F)	2.0 mg/l	Concentrations of 0.8 to 1.3 mg/l are considered to play a part in the reduction of tooth decay. However, concentrations over 2.0 mg/l will cause the mottling of the enamel of children's teeth.
Nitrate (NO_3)	45 mg/l	Waters with high nitrate content should not be used for infant feeding as it may cause methemoglobinemia or cyanosis. High concentrations suggest organic pollution from sewate, decayed organic matter, nitrate in the soil, or chemical fertilizer. High nitrates in the natural waters of central Iowa are limited to isolated occurrences, usually from shallow dug wells on farms. Since the high concentrations are characteristic of individual wells and not of any one aquifer, nitrate will not be discussed in this report.
Dissolved Solids	500 mg/l	This refers to all of the material in water that is in solution. If affects the chemical and physical properties of water for many uses. Amounts over 2,000 mg/l will have a laxitive effect on most persons. Amounts up to 1,000 mg/l are generally considered acceptable for drinking purposes if no other water is available.
Hardness (as $CaCO_3$)		This affects the lathering ability of soap. It is generally produced by calcium and magnesium. Hardness is expressed in parts per million equivalent to $CaCO_3$ as if all the hardness were caused by this compound. Water becomes objectionable for domestic use when the hardness is above 100 mg/l; however, it can be treated readily by softening.
Temperature		Affects the desirability and economy of water use, especially for industrial cooling and air conditioning. Most users want a water with a low and constant temperature.
Suspended Sediment		Causes water to have a cloudy or muddy appearance. It must be settled or filtered out before the water is used. It is the material that "silts-up" reservoirs, and it is the major cause of the reduction of reservoir life.

To the user, the quality of groundwater is as important as the amount of water that an aquifer will yield. As groundwater moves through soil and rock materials, it dissolves some of the minerals which, in turn, affect water quality. In addition to mineral content, bacterial and chemical contamination may be introduced through poorly constructed wells and seepage from other pollution sources.

Recommended standards for the common mineral constituents in water are described in the table above. These are accepted as guidelines for acceptable drinking water supplies. Limits for uses other than drinking often differ from these. For instance, water that is unacceptable for drinking and household use may be completely satisfactory for industrial cooling.

From past analyses of groundwater, the averages (A) and ranges (R) of values in milligrams per liter (mg/l) for several constituents are summarized in Tables 3 and 4 for the surficial and bedrock aquifers in Story County. Recommended concentrations for some constituents are often exceeded without obvious ill effects, although the water may be unpalatable. Water-quality analyses for individual wells should be obtained to determine if concentrations of constituents that affect health are exceeded.

Table 3

CHEMICAL CHARACTER OF GROUND WATER

Surficial Aquifers

Average (A) and range (R)	Dissolved solids	Hardness (as $CaCO_3$)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO3)	Sodium (Na)	Iron (Fe)	Manganese (Mn)
					Alluvial aquifer				
A	462	375	49	.6	.5		27		
R	330-632	295-468	8-113	.5-18	2-.9		12-66		
					Shallow drift aquifer				
A	498	395	95	18.8	.26	.51	13.6	4.9	.31
R	403-537	344-417	17-120	1-35	.1-.45	<.1-1.5	12-24	.12-8.5	.07-.46
					Intermediate drift aquifer				
A	447	326	34.6	6.8	.5	.61	45.2	4.9	.08
R	316-610	216-450	.5-130	<.5-33	.3-.8	<.1-2.5	12-84	.8-8.3	.01-.15
					Deep drift and buried channel aquifer				
A	695	345	260	3.7	.5	.82	99.5	1.2	.12
R	453-1320	216-515	63-740	1-8	.3-.8	<.1-4.4	58-200	0.4-2.4	.01-.54

The alluvial aquifers yield the least mineralized water of all groundwater sources in central Iowa. In the alluvial aquifers, manganese, iron, and dissolved solids are slightly high, but all other constituents are well below recommended standards. Water temperatures average 55°F (13°C) and the range of these temperatures is from 46°F to 60°F (8°C to 16°C).

In the shallow drift aquifers, the water is hard and contains undesirable concentrations of iron and manganese. Locally sulfate, nitrate, and bacteria concentrations may exceed recommended limits, but this is due to well contamination from surface runoff and is representative of natural water-quality conditions in the shallow drift aquifer. The water in the shallow drift aquifer is usually acceptable for most purposes if wells are constructed properly and located suitable distances from sources of contamination. Nitrate content should be checked carefully in these wells, and any water supply containing over 45 mg/l should not be used for infant feeding. Water temperatures average 54° (12°C), and the range of these temperatures is from 50°F to 60°F (10°C to 16°C).

The water in the intermediated drift aquifer in Story County is similar to that in the shallow drift aquifer. The water is hard and contains high concentrations of iron and manganese and higher sodium levels. Water temperatures average 54°F (12°C).

In the deep drift and buried channel aquifers, the water is somewhat more mineralized, contains higher concentrations of dissolved solids, iron and manganese. Water temperatures range between 54°F and 57°F (12°C to 14°C).

Table 4

CHEMICAL CHARACTER OF GROUND WATER

Bedrock Aquifers

Average (A) and range (R)	Dissolved solids	Hardness (as $CaCO_3$)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO3)	Sodium (Na)	Iron (Fe)	Manganese (Mn)
				Mississippian Aquifer					
A	657	389	205.1	10.3	1.3	.4	71.4	1.3	.11
R	315-1690	164-840	.6-870	<.5-31	.3-3.9	<.1-2.4	13-400	<.01-9	<.05-.33
				Devonian Aquifer					
A	686	423	247.3	5.5	1.8	.44	100.9	1.8	.12
R	283-1900	313-974	17-1000	<.5-14	.6-215	<.1-4.4	10-190	.3-7	<.1-.99
				Cambro-Ordovician Aquifer					
A	1033	509	505	40	2.0	1.1	156.6	1.6	.02
R	631-2280	326-1110	210-1200	19-61	1.2-3.3	<.1-2.9	82-250	0.8-6.9	<.01-<.07

The Mississippian Aquifer is the most heavily used of the bedrock aquifers in Story County. The water quality in the aquifer is generally better to the northwest in Story County where the Mississippian outcrops, as opposed to where it is overlain by the Pennsylvanian. The dissolved solids content is generally below 1000 mg/l throughout the county and below 500 mg/l in the northern half. The water is softer in this part of central Iowa; however the softer water is usually accompanied by higher fluoride concentrations. Sulfate concentration is below 250 mg/l in the north but ranges up to 900 mg/l to the south. Iron and manganese concentrations are high. The water temperature averages 53°F (12°C) and ranges from 50-57°F (10-14°C).

The water form the Devonian-Silurian Aquifer throughout central and western Iowa is of poor quality; however, it is used locally within Story County. Total dissolved solids and sulfate are lower in areas where Pennsylvanian rocks are absent. Hardness averages less than 500 mg/l but increases to 1500 mg/l in the northwest and southeast corners of the county. Sodium concentrations increase to the south and iron and manganese concentrations generally exceed recommended limits.

The Cambro-Ordovician aquifer has the highest potential yield of the bedrock aquifers, but is also the most highly mineralized. Total dissolved solids average over 1000 mg/l and increase to the west. Sulfate also increases westward and is present in concentrations higher than the maximum reccommended level, but is considered acceptable, as most users can adapt to the water. Increasing pumpage from the Cambro-Ordovician (Jordan) Aquifer will continue to draw in poorer quality water from parts of the aquifers to the west. Temperatures in the aquifer range from 70-80°F (21-27°C).

RECOMMENDATIONS FOR PRIVATE WATER WELLS

Contracting for Well Construction

To protect your investment and guarantee satisfactory well completion, it is a good idea to have a written agreement with the well driller. The agreement should specify in detail:

size of well, casing specifications, and types of screen and well seal

methods of eliminating surface and subsurface contamination

disinfection procedures to be used

type of well development if necessary

test-pumping procedure to be used

date for completion

itemized cost list including charges for drilling per foot, for materials per unit, and for other operations such as developing and test pumping

guarantee of materials, workmanship, and that all work will comply with current recommended methods

liability insurance for owner and driller

Well Location

A well should be located where it will be least subject to contamination from nearby sources of pollution. The Iowa State Department of Health recommends minimum distances between a new well and pollution sources, such as cesspools (150 ft.), septic tanks (50 ft.), and barnyards (50-100 ft. and downslope from well). Greater distances should be provided where possible.

The well location should not be subject to flooding or surfacewater contamination. Select a well-drained site, extend the well casing a few feet above the ground, and mound earth around it. Diversion terraces or ditches may be necessary on slopes above a well to divert surface runoff around the well site.

In the construction of all wells, care should be taken to seal or grout the area between the well bore and the well casing (the annulus), as appropriate, so that the surfacewater and other pollutants cannot seep into the well and contaminate the aquifer.

Locate a well where it will be accessible for maintenance, inspection, and repairs. If a pump house is located some distance from major buildings, and wired separately for power, continued use of the water supply will not be jeopardized by fire in major buildings.

Water Treatment

Water taken from a private well should ideally be tested every six months. The University of Iowa Hygienic Laboratory will do tests for coliform bacteria, nitrate, iron, hardness, and iron bacteria in drinking water for private individuals. Special bottles must be used for collecting and sending water samples to the laboratory. A sample kit can be obtained by writing to the University Hygienic Laboratory, University of Iowa, Oakdale Campus, Iowa City, Iowa 52242. Indicate whether your water has been treated with chlorine, iodine, or bromine, as different sample bottles must be used for treated and untreated water. The charge for the bacterial test is $4; for iron hardness and nitrate, it is $5; and the iron bacteria, $10. If your well is determined to be unsafe, advice for correcting the problem can be obtained from your county or state Department of Health. Several certified private laboratories also run water analyses.

Shock chlorination is recommended following the construction and installation of a well and distribution system, and anytime these are opened for repairs or remodeling. A strong chlorine solution is placed in the well and complete distribution system to kill nuisance and disease-causing organisms. If the first shock chlorination does not rid the water supply of bacteria it should be repeated. If this does not solve the problem, the well should be abandoned or the water should be continuously disinfected with proper chlorination equipment.

Since most of the groundwater in Story County is mineralized, water-softening and iron-removal equipment may make water more palatable and pleasant to use. Softened water contains increased sodium; contact your physician before using a softener if you are on a sodium-restricted diet. Chlorination followed by filtration will remove most forms of iron and iron bacteria. Iron bacteria has no adverse effect on health, but it will plug wells, water lines, and equipment and cause tastes and odors. Iron-removal equipment can be used if problems persist.

Well Abandonment

Wells taken out of service provide easy access for pollution to enter aquifers supplying water to other wells in the vicinity. Unprotected wells may also cause personal injury. Proper abandonment procedures should be followed to restore the natural conditions that existed before well construction and prevent any future contamination. Permanent abandonment requires careful sealing. The well should be filled with concrete, cement grout, or sealing clays throughout its entire length. Before dug or bored wells are filled, at least the top 10 feet of lining should be removed so surfacewaters will not penetrate the subsurface through a porous lining or follow cracks in or around the lining. The site should be completely filled and mounded with compacted earth.

ABANDONED WELLS SHOULD NEVER BE USED FOR DISPOSAL OF SEWAGE OR OTHER WASTES.

SOURCES OF ADDITIONAL INFORMATION

In planning the development of a groundwater supply or contracting for the drilling of a new well, additional or more specific information is often required. This report section lists several sources and types of additional information.

State Agencies That May Be Consulted

Iowa Geological Survey[1]	123 North Capitol Iowa City 52242	(319) 338-1173
State Health Department[2,6]	Lucas Building Des Moines 50319	(515) 281-5787
Iowa Natural Resources Council[3]	Wallace Building Des Moines 50319	(515) 281-5914
Iowa Dept. of Environ. Quality[4]	Wallace Building Des Moines 50319	(515) 281-8854
University Hygienic Laboratory[5]	U. of IA, Oakdale Campus Iowa City 52242	(319) 353-5990
Cooperative Extension Service in[6] Agriculture and Home Economics	110 Curtis Hall, ISU Ames 50011	(515) 294-4569

Functions:

[1] Geologic and ground-water data repository, consultant on well problems, water development, and related services

[2] Drinking water quality, public and private water supplies

[3] Water-withdrawal regulation and Water Permits for wells withdrawing more than 5000 gpd

[4] Municipal supply regulation and well-construction permits

[5] Water-quality analysis

[6] Advice on water-systems design and maintenance

Well Drillers and Contractors

The listing provided here was drawn from an Iowa Geological Survey mailing list and yellow pages of major towns in phone books. Those selected are within an approximate radius of 50 miles of Polk County. For a state-wide listing, contact either the Iowa Water Well Driller's Association, 4350 Hopewell Avenue, Bettendorf, Iowa 51712, (319) 355-7528 or the Iowa Geological Survey, (319) 338-1173.

Bruinekool Well
Perry, IA 50220

Dewey Well Co.
Box 177
Slater, IA 50244

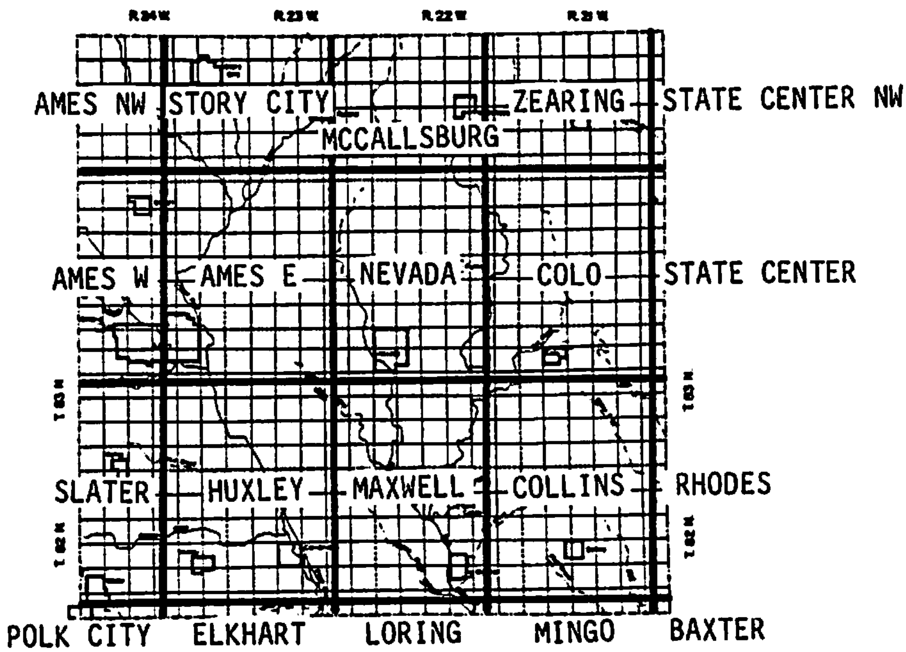
Max Larson
Larson Well Co.
Roland, IA 50236

Layne-Western Co., Inc.
705 South Duff Street
Ames, IA 50010

Jerry Reiwertz
1133 9th Street
Nevada, IA 50208

Thorpe Well Co.
1903 SE Hulsizer Avenue
Ankeny, IA 50021

Topographic Maps (Available from the Iowa Geological Survey)



Map Title	Date (Published)	Scale	Contour Interval
Ames E	1975	1:24,000	10'
Ames NW	1975	1:24,000	10'
Ames W	1975	1:24,000	10'
Baxter	1975	1:24,000	10'
Collins	1975	1:24,000	10'
Colo	1975	1:24,000	10'
Elkhart	1972	1:24,000	10'
Huxley	1975	1:24,000	10'
Loring	1972	1:24,000	10'
Maxwell	1975	1:24,000	10'
McCallsburg	1975	1:24,000	10'
Mingo	1975	1:24,000	10'
Nevada	1975	1:24,000	10'
Polk City	1972	1:24,000	10'
Rhodes	1975	1:24,000	10'
Slater	1975	1:24,000	10'
State Center	1975	1:24,000	10'
State Center NW	1975	1:24,000	10'
Story City	1975	1:24,000	10'
Zearing	1975	1:24,000	10'

Useful Reference Materials

Horick, P. J., and Steinhilber, W. L., 1973, Mississippian aquifer of Iowa, Iowa Geological Survey, Misc. Map Series No. 3.

Horick, P. J., and Steinhilber, W. L., 1978, Jordan aquifer of Iowa, Iowa Geological Survey, Misc. Map Series No. 6.

Iowa State Department of Health, 1971 Sanitary standards for water wells, State Department of Health, Environmental Engineering Service.

Twenter, F. R., and Coble, R. W., 1965, The water story in central Iowa, Iowa Geological Survey Water Atlas No. 1.

Van Eck, O. J, 1971, Optimal well plugging procedures, Iowa Geological Survey, Public Information Circular No. 1.

Van Eck, O. J, 1978, Plugging procedures for domestic wells, Iowa Geological Survey, Public Information Circular No. 11.