
Kansas Geological Survey

LETTER REPORT TO SCOTT ROSS, DIVISION OF WATER
RESOURCES, KANSAS DEPARTMENT OF AGRICULTURE
CONCERNING THE ANALYSIS OF DATA PERTAINING TO FILES
44,203 and 44,246

By

P. Allen Macfarlane

Kansas Geological Survey Open File Report 2000-58
October 2000

GEOHYDROLOGY



The University of Kansas, Lawrence, KS 66047 Tel.(785) 864-3965

**KANSAS GEOLOGICAL SURVEY
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**LETTER REPORT
TO
SCOTT ROSS, DIVISION OF WATER RESOURCES,
KANSAS DEPARTMENT OF AGRICULTURE
CONCERNING THE ANALYSIS OF DATA PERTAINING
TO FILES 44,203 AND 44,246**

**By
P. Allen Macfarlane
Kansas Geological Survey**

**Kansas Geological Survey
Open-file Report 2000-58**

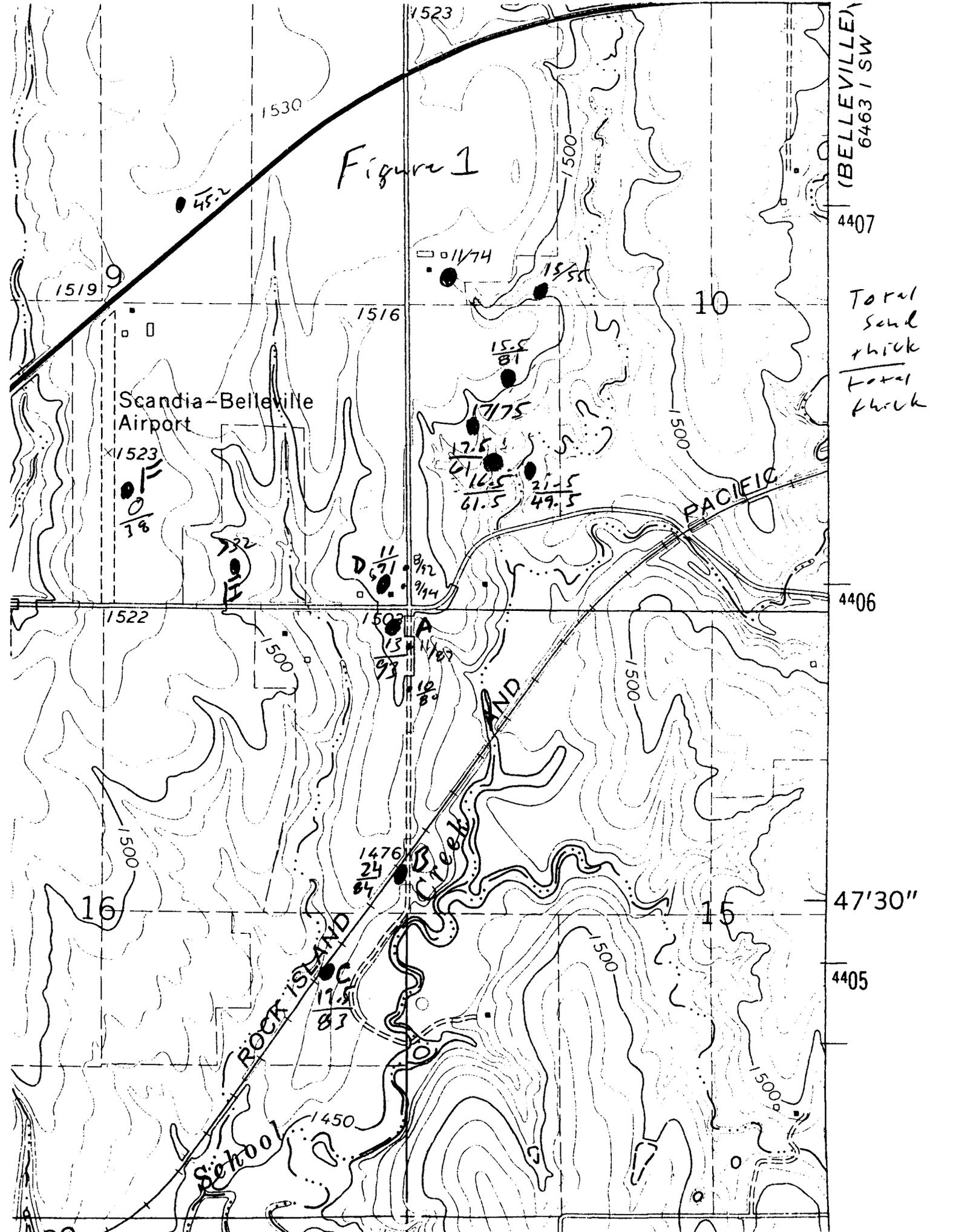


Figure 1

Scandia-Belleville
Airport

(BELLEVILLE)
6463 1 SW

Total
sand
thick

Total
thick

PACIFIC

ROCK ISLAND
Creek

SCHOOL
ROCK ISLAND

1519

1516

10

1522

1500

4406

16

1476

47'30"

4405

1450

45.2

1523

1530

11/74

15.5/81

17.5/61

16.5/61.5

21.5/49.5

11/571

8/92

9/94

13/93

11/80

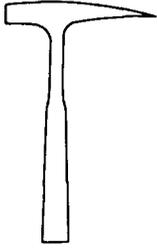
12/80

1476/24

84

17.5/83

83



KANSAS GEOLOGICAL SURVEY

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The University of Kansas
Lawrence, Kansas 66047-3726
phone 785-864-3965
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October 11, 2000

Scott Ross
Water Commissioner, DWR
Stockton Field Office
P.O. Box 192
Stockton, KS 67669-0192

Re: Analysis of the data
pertaining to File Nos.
44,203 and 44,246

Dear Scott:

Per our telephone conversation of September 29, I have reviewed the data you sent pertaining to File Nos. 44,203 and 44,246. Glenwood Farms (File No. 44,203) proposes to divert 66 acre-ft of water from a battery of two wells in the SW, NW of Section 10, T. 3 S., R. 4 W. at a rate of 300 gal/min. To the south in the SW quarter of Section 10, Valley Vegetable Cooperative proposes to divert 50 acre-ft of water at a rate of 110 gal/min. The pumping by Glenwood Farms would begin approximately July 1 each year and continue for approximately 50 days and the pumping by the vegetable cooperative would typically begin August 1 and continue for approximately 103 days. In our September 29 conversation you asked that I assess the potential impact of pumping by the vegetable cooperative on the wells proposed by Glenwood Farms. Your concern is the impact on water levels in the Glenwood Farms wells due to pumping by the vegetable cooperative in the period of time where both wells are in production. This was reiterated in a later telephone conversation on October 9.

The information provided by you included a map of what you believed to be the aquifer extent from the Construction Materials Inventory for Republic County (No. 29), the logs of the test holes for the wells proposed by Glenwood Farms, and a letter report by Ground Water Associates on a potential ground-water supply for the Valley Vegetable Cooperative. Included in that report are the logs from two test-holes and the pumping-test results from test well 3-00.

Bob Vincent of Ground Water Associates has also sent logs of additional test holes drilled on behalf of his client and other water-level information collected during the course of the pumping test.

I retrieved additional records of wells from the WWC-5 data base at KGS. Construction Materials Inventory No. 29 was not available, but the county soil survey and an older USGS construction materials report circular were available.

The test-hole and WWC-5 driller's logs are at odds with your aquifer extent map, our 1:500,000 scale map of Kansas Geology (M-1), and the older KGS geology and ground water resources bulletin for Republic and northern Cloud counties (Bulletin 73). The driller's logs show significant thicknesses of water-saturated sediments in the east half of the SE quarter of Section 9 and the NE quarter of Section 16. For example, the WWC-5 logs in the SESESE Section 9 and the NENENE Section 16 show that more than 90 feet of unconsolidated sediments overlie bedrock at these locations. The total thickness of sand reportedly encountered by some of these test holes is in the range of sand thicknesses reported in the logs for both Glenwood Farms and the Valley Vegetable Cooperative test holes (Figure 1). The number and distribution of logs in the eastern half of Section 9 is not sufficient to define in detail the western edge of the aquifer. However, the amount of sand encountered and the total thickness of sediments above bedrock decreases toward the center of Section 9. The log of well F, near the north-south centerline of the section in Figure

2, shows sand not being present and bedrock within 40 ft of land surface. I have concluded that the western edge of this aquifer probably coincides with the north-south drainage in the SE quarter of Section 9.

The eastern and northern extents of the aquifer cannot be defined because there are no logs of wells to the north of Glenwood Farms in the NW quarter of Section 10 and west of the tributary to School Creek in Section 10. The KGS Bulletin 73 and Map M-1 show bedrock in the stream bottom to the north. KGS Map M-1 shows loess capping the north-south ridge running through the center of Section 10, while KGS Bulletin 73 shows Carlile Shale at the surface. The nearest log is a WWC-5 record of a well drilled near the northwest corner of Section 11. To honor the worst-case scenario, I have arbitrarily defined the north and east boundaries of the aquifer as shown in the accompanying figure.

The descriptions of the unconsolidated sediments contained in the driller's logs reveal that in nearly all cases the sand/sand and gravel fraction is less than 30%. Sand/sand and gravel lenses occur sporadically in the silt-clay sediments but are most common and are coarser-grained near the bedrock surface. Water levels in the test holes are above the level of top of the coarser sediment lenses where the wells are predominantly screened.

In their investigation for Valley Vegetable Cooperative, Ground Water Associates conducted a pumping test of well 3-00 and using 1-00 to observe water level changes during the test. They pumped well 3-00 for 1,530 min during which they collected water-level measurements to determine drawdown. Observations of recovery for collected for 90 min after pumping ceased. From the test they concluded that the aquifer behaved as a leaky, confined system. They used the Jacob method to analyze the drawdown data. This method is most appropriate for a confined aquifer analysis. They estimated a transmissivity range of 21,700-25,400 gal/d/ft (2,901-3,396 ft²/day) and storativity of 0.00295. Neither a leakage coefficient nor the other related leakage parameters associated with the aquitard were calculated from the test results.

I reanalyzed the pumping test results using SUPRPUMP. SUPRPUMP is a software package that uses nonlinear, least-squares regression and sensitivity analysis to fit a curve to drawdown data. The aquifer parameters and their associated 95% confidence limits are then calculated based on the fitted curve and its degree of fit. The following is my analysis of the drawdown data collected from that test in the observation well 1-00 located 14.5 ft west of the test well 3-00.

In figure 3, the plot shows the drawdown as a function of log time. The drawdown curve for the early part of the test is marked by a straight-line portion up to about 0.02 days. This straight-line segment suggests pumping under confined conditions. The aquifer property values and their associated 95% confidence limits derived from the best-fit line are a transmissivity of 3300 ± 93 ft²/day and a storativity of $3.44 \times 10^{-4} \pm 0.52 \times 10^{-4}$. The best-fit line has a low root mean square error of 0.01741 ft for the first 11 data points from the test. The transmissivity calculated from SUPRPUMP is well within the range of values estimated by Ground Water Associates from their analysis of this test, but the storativity is one order of magnitude lower.

I agree with Ground Water Associates that the drawdown curve is more consistent with the behavior of pumping from a leaky confined aquifer. This interpretation is consistent with the geology. As mentioned earlier, the driller's logs from wells and test borings indicate less than 30% sand/sand and gravel with most of these deposits near bedrock at the base of the unconsolidated sediments. In my analysis, I assumed a leaky, confined aquifer where the storage of water in the overlying aquitard does not change with time. However, water is allowed to move across the aquitard from overlying, fully-saturated sand lenses. Using the drawdown data from the first 6 hours of the test, the SUPRPUMP-derived aquifer parameters are a transmissivity of $3,242 \pm 114$ ft²/day and a storativity of $3.577 \times 10^{-4} \pm 0.66 \times 10^{-4}$. These values are identical to the aquifer properties derived from the Theis analysis of the of early time data up to about 0.02 days. The leakage coefficient is $1.104 \times 10^{-3} \pm 1.74 \times 10^{-4}$ ft². Figure 4 shows the fit of the curve to the drawdown data. The best-fit line has a low root mean square error of 0.02598 ft for the first 30 data points from the test.

We can estimate the aquitard vertical hydraulic conductivity knowing the leakage coefficient, the transmissivity of the aquifer, and the aquitard thickness, using the relation:

Figure 3

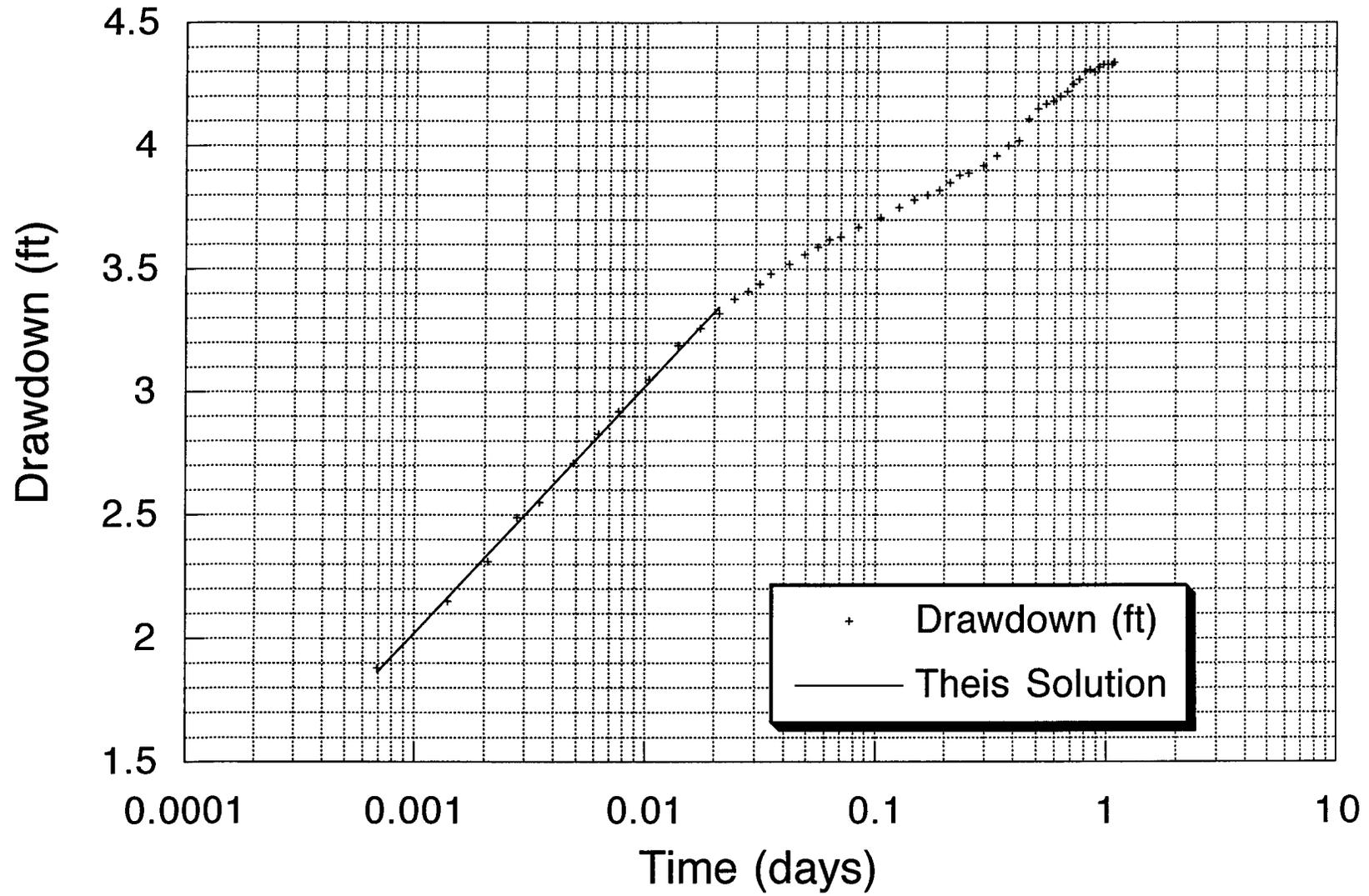
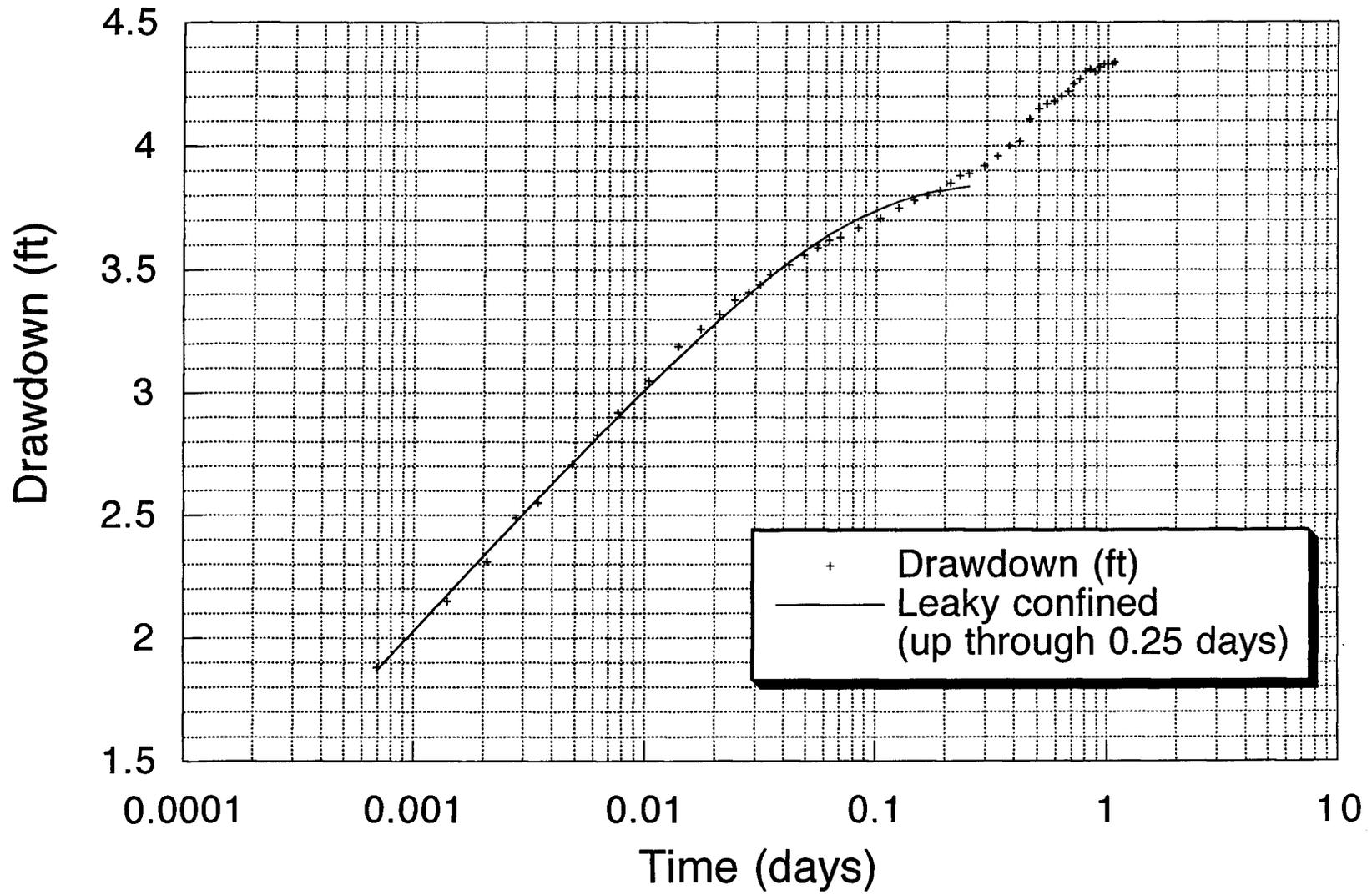


Figure 4



$$K' = L^2Tb',$$

where K' is the aquitard vertical hydraulic conductivity, T is the aquifer transmissivity, and b' is the thickness of the aquitard. If we assume that aquitard is saturated from the water table to the top of the sand and gravel aquifer near the pumping well, then $b' = 23$ ft. Thus $K' = 0.077$ ft/day which is within the range of hydraulic conductivity values for loess and silt.

The last part of the test cannot be modeled easily with SUPRPUMP. One explanation for the drawdown after 0.25 days is that this is an unconfined aquifer and the early part of the curve is the early response of the aquifer to pumping followed by downward drainage of water, which in this case we have simulated as leakage. The later part of the curve could be interpreted as the effects of pumping after the delayed drainage has reached the water table. Near the end of the test, the curve again flattens out, suggesting that another source of recharge is beginning to supply water to the expanding cone of depression. However, there is no indication that the water table ever gets below base of the silt and clay, i.e., a change from leaky, confined to unconfined conditions. Unfortunately the pumping test was not long enough to definitely resolve this issue.

Another explanation for the later time behavior of the drawdown curve is that the staircase appearance of the drawdown curve reflects the progressive drainage of water from overlying sand lenses as the cone of depression expands. Thus, the later time behavior is explained as a reduction of leakage as sand lenses nearer the pumping are drained followed by draining of more distant sand lenses as the cone of depression continues to expand through time. The leakage to the aquifer is episodic as the test continues which results in a variable rate of drawdown increase over time.

I assumed the latter hypothesis and used SUPRPUMP in the design mode to estimate the drawdown at the Glenwood Farms wells after 103 days of pumping at the proposed location of the Valley Vegetable Cooperative well at 110 gal/min (Figure 5). I ran two basic model formulations: (1) the leaky confined aquifer where it is assumed that the storage in the overlying aquitard is constant and (2) a fully confined aquifer. The assumption of constant storage in the aquitard (no release of water from the aquitard) is probably not strictly valid for this case but it seems to be the most appropriate. However, it is even less likely that the aquifer is fully confined and thus this scenario should be considered extreme. Nevertheless, a comparison of the results from the two models should give you some idea of the magnitude of the impact of the Valley Vegetable Cooperative pumping on the Glenwood Farms wells.

The aquifer is bounded on three sides by impermeable boundaries and extends to south for an infinite distance. In the leaky confined aquifer version of this model, recharge is assumed to be adequate to maintain the water table at its current elevation. In the Theis version of this model the aquifer is perfectly confined and flow can only enter the model region from the south because of the three no-flow boundaries to the west, east, and north. Thus, recharge from precipitation is not considered. The assumed aquifer properties for the Theis confined aquifer version of the model are the early time transmissivity and storativity and for the leaky confined aquifer I added the leakage coefficient calculated from the pumping tests.

In the confined aquifer formulation the estimated drawdowns after 103 days of pumping are 52.6 ft at the west well and 53.2 ft at the east well of Glenwood Farms. However, when leakage is considered, the estimated drawdowns are reduced dramatically to 0.47 ft and 0.46 ft at the west and the east wells, respectively. If we use the lowest leakage coefficient in the 95% confidence interval from the pumping test, the expected drawdowns at the west and east wells only increase to 0.67 ft and 0.66 ft, respectively.

These results provide insight into the sensitivity of the aquifer to leakage from the interbedded and overlying silts that form the bulk of the unconsolidated sediments at the site. As I mentioned earlier, the pumping-test run by Ground Water Associates did not run long enough to provide the data needed to determine whether a leaky, confined or unconfined aquifer model is most appropriate. If further testing is contemplated, I would recommend a longer 3-4 day pumping test of test well 3-00 with monitoring not only of the closest well (1-00 of Ground Water Associates) but also both of the Glenwood Farms wells. If possible additional monitoring wells in the sand lenses above the main sand and gravel aquifer could provide enough data from a pumping

test to determine which leakage model is most appropriate. Also, additional surface mapping or drilling might provide more information on the lateral extent of the aquifer. In the models I have presented here, I have attempted to be conservative in defining aquifer lateral extent in keeping with your worst case scenario approach. Obviously, if the no-flow boundaries are closer to the pumping well than I have assumed, the expected drawdowns will be greater at the Glenwood Farms wells because there will be less water available to the expanding cone of depression during pumping.

This is as far as I can take the analysis of the available data. I trust that if you have any questions, you will contact me at my office.

Sincerely yours,



P. Allen Macfarlane

**DOCUMENTATION PROVIDED BY
SCOTT ROSS, WATER COMMISSIONER, DWR, KDA**

STATE OF KANSAS

BILL GRAVES, GOVERNOR
Jamie Clover Adams, Secretary

DIVISION OF WATER RESOURCES
David L. Pope, Chief Engineer-Director

STOCKTON FIELD OFFICE
Scott E. Ross, Water Commissioner
820 South Walnut, P.O. Box 192
Stockton, Kansas 67669-0192
(785) 425-6787 FAX (785) 425-6842



KANSAS DEPARTMENT OF AGRICULTURE

October 2, 2000

KANSAS GEOLOGICAL SURVEY
P ALLEN MACFARLANE
1930 CONSTANT AVE
CAMPUS-WEST-UNIV OF KANSAS
LAWRENCE KS 66045

Re: Application, File Nos.44,203 and
44,246 - Aquifer analysis

Dear Mr. MacFarlane:

As per our conversation of September 29, 2000, I have attached the information we need to have evaluated. Included with this correspondence, you will find the following:

1. A report from Robert Vincent on the well(s) proposed by the Valley Vegetable Cooperative.
2. A topographic map assembled by this office, based on an evaluation of information from the KDOT material inventory for Republic County and the most recent KGS bulletin for Republic County.

The map outlines that area we feel is most representative of the aerial extent of the aquifer in question. It locates the test holes used by Mr. Vincent as well as the proposed locations of the wells under the Glenwood Farms, application.

The specific details of the applications are as follows:

File No. 44,203 of Glenwood Farms proposes to divert 66 acre-feet of water from the wells located on the enclosed map for irrigation. The exact well locations are defined as being a battery of two (2) wells whose locations are one (1) well located 2,700 feet North by 4,600 feet West and (1) well located 2,800 feet North by 4,050 feet West, both measured from the Southeast Corner of Section 10. The application proposes to divert this quantity at a rate of 300 gallons per minute.

File No. 44,246 of Valley Vegetable Cooperative proposes to divert 50 acre-feet from a well located as shown on the attached map as Vested Right, File No. TH-001. They are proposing to divert water for a vegetable processing plant at a rate of 110 gallons per minute.

October 2, 2000

In our conversation, you asked for the pumping schedule. While I cannot be sure, we can assume the irrigation project under File No. 44,203 would begin approximately July 1 and continue for approximately 50 days. The vegetable processing would most likely begin on August 1 and proceed for approximately 103 days. We do not have the exact details on a planned pumping schedule so I would suggest a "worst case scenario" be evaluated.

The parties are very anxious to complete these applications, so time is important in this matter. Please feel free to contact this office if other questions arise during your examination of this information.

Sincerely,



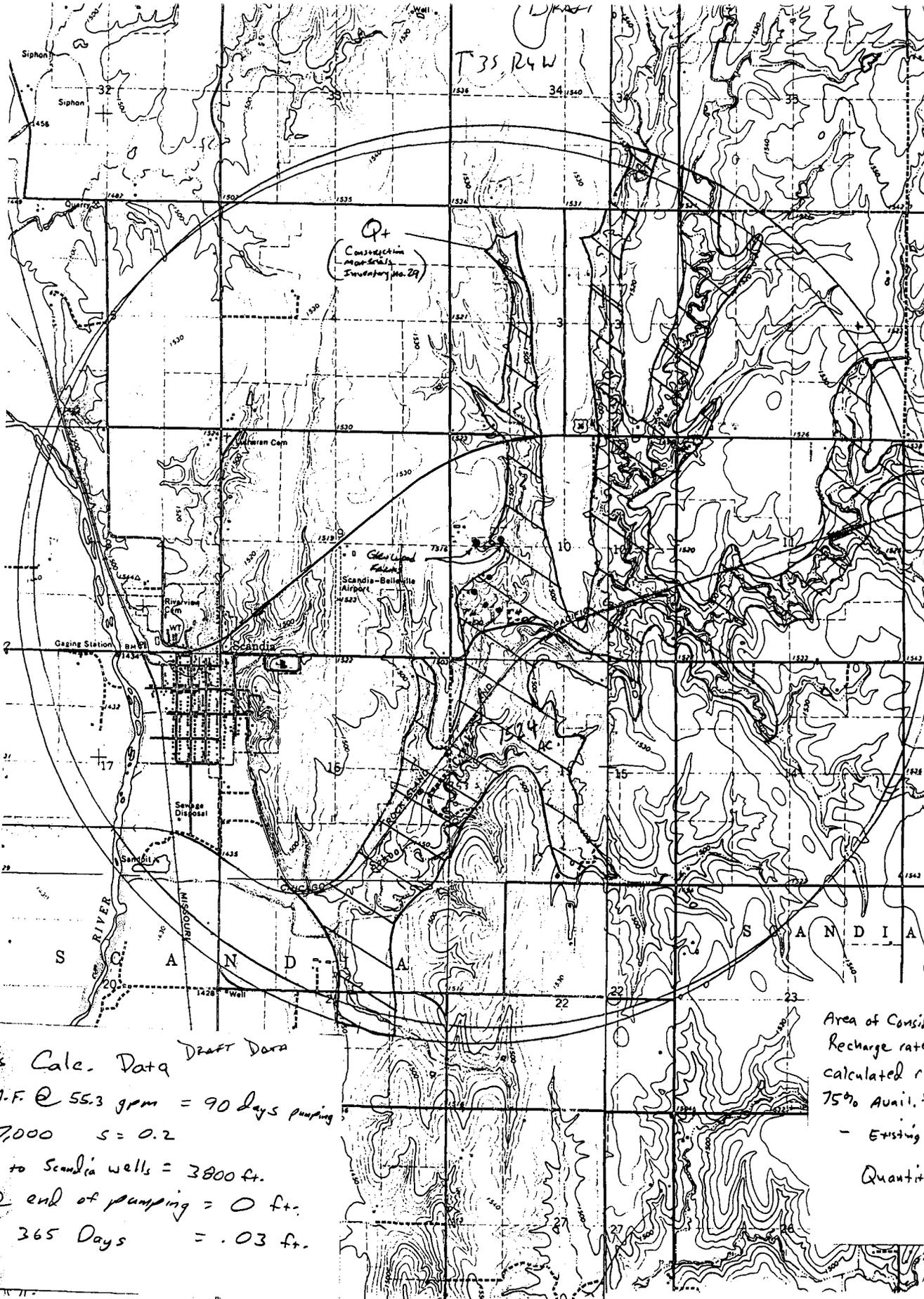
Scott E. Ross

Water Commissioner

SER:nld

Enclosures

pc: Kenneth A. Kopp



Calc. Data DRAFT DATA
 1. F @ 55.3 gpm = 90 days pumping
 7,000 s = 0.2
 to Scandia wells = 3800 ft.
 end of pumping = 0 ft.
 365 Days = .03 ft.

Area of Cons'd
 Recharge rate
 calculated r
 75% Avail.
 - Existing
 Quantit

KE

Attachment

44246

Ground Water Associates, Inc.

610 N. MAIN, P.O. BOX 3834 • WICHITA, KANSAS 67201 • 316-262-3322

September 6, 2000

Lowell Thoman
Route 3, Box 13
Concordia, Kansas 66901

Subject: Water Supply
Scandia Corn Plant

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KS Dept of Agriculture

SEP 11 2000

Stockton Field Office
Division of Water Resources

Dear Mr. Thoman:

This letter is written to provide a report concerning the investigation for a water supply to serve the proposed Scandia Corn Plant. Four test holes and one test well were drilling and the well was test pumped. It is our understanding that the plant will need 70 to 90 gpm and that their total water need will be 17 to 22 acre-feet per year. A map, a test hole summary sheet, the test pumping data and our analyses of these data are attached.

Conclusion

The six inch cased test well will readily yield the required 80,000 gallons per day (when the plant is operating) at a rate of 90 gpm. And, based upon the pumping test, the aquifer appears to be quite capable of sustaining that production over time. Pumping from this well at the rate and total amount listed herein will not impair other water rights in the area.

The Geology and Investigation

The investigation for the water supply was conducted in the west one-half of the southwest quarter of Section 10, T3S, R4W, Republic County, Kansas. The surface formation in this area is of Pleistocene age deposits composed principally of clay and silt in the upper portion and sand and gravel in the lower portion. A deeper channel runs on the west side of School Creek and approximately parallel with it. This is the same channel that the city of Scandia wells are completed in, and they are located near the center of the east side of Section 16 (see map). Note that the top of the shale elevation at the site of Test Hole 1-00 (the deepest one) in the SW ¼ of Section 10 is at an approximate elevation of 1409', whereas the shale elevation at the city of Scandia's well sites is at an elevation of 1386'.

Two test holes (1-99 and 2-99) were drilled in the north one-half of the 80 acres, and then later two test holes (1-00 and 2-00) were drilled in the south one-half. (See map) Of these holes, Test Hole 1-00 found the best well site because it is closer to the center of the channel, and thus the greatest saturated thickness (40.1'). (See summary sheet) Additionally, the sand and gravel appeared to be



Lowell Thoman
Page 3
September 6, 2000

After the well was developed by bailing and pumping, a continuous 1530 minute pumping test was conducted at a rate of 94 gpm. Water level measurements were taken in both the well and Test Hole 1-00. The pumping water level in the well declined 7.50' after pumping 1020 minutes, and then for all practical purposes remained the same throughout the end of the test. The observation well drawdown a total of 4.34'. See attached tabulations of the drawdown and recovery water levels.

The plots of the water levels are shown on the attached semi-logarithmic sheets. These reveal a well that is pumping under confined (or artesian) conditions for approximately 25 minutes, and then leakage begins to occur and the well pumps under semi-confined conditions throughout the remainder of the test.

The capability of an aquifer to transmit water is called its Transmissivity (T). It is determined by the characteristics of the sand and gravel, in this case. Such things as clean, dirty, size of particles, uniformity, thickness, etc. all play a part in determining the T value along with the head of water in the aquifer. The plots (attached) of the drawdown and recovery against time show T values that vary from 21,700 to 25,400 gallons per day per foot (g/d/ft), and the distance-drawdown plot shows 23,400. These average 24,200 g/d/ft, and in my opinion, this is a reasonable T value for this aquifer.

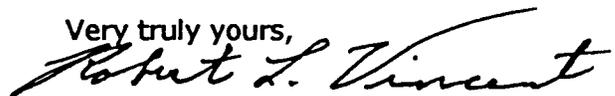
The storage coefficient (S) is a measure of the volume of water released from or taken into storage in the aquifer per unit surface area of the aquifer per unit change in head. The S value has been calculated from the distance-drawdown plot to be 0.00295. Again, this appears to be reasonable for a semi-confined aquifer.

The aquifer characteristics along with the apparent areal extent of the aquifer show that the proposed corn plant water requirements can be met from Test Well 3-00. Additionally, it should be noted that the cone of depression extends out from the pumped well a distance of approximately 1600'. Therefore, it should have no effect on the next closest permitted well, which is the city of Scandia's north well that is located approximately 3650' to the south-southwest of Test Well 3-00. And, due to the nominal drawdown in the pumped well when operating at a rate of 94 gpm, the domestic wells located within the cone of depression will not be impaired. (All are over 660' from the pumped well.)

A partial analysis of the water pumped from Test Well 3-00 is attached. It shows water that is very usable for most purposes. It is hard water, but it is low in chloride, iron, and manganese, and the nitrate content is acceptable for drinking purposes.

Please advise me if you have comments or questions concerning this letter-report.

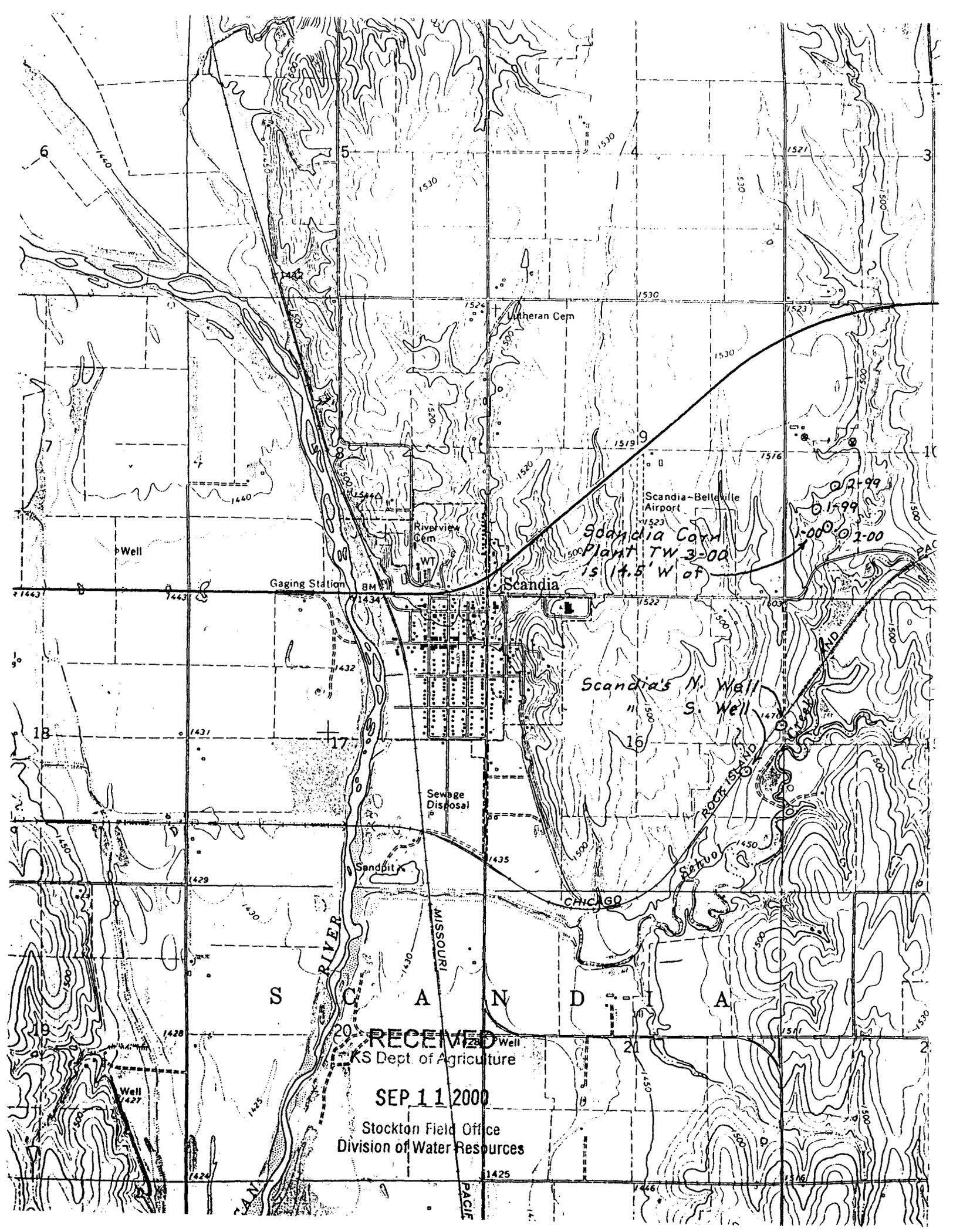
Very truly yours,



Robert L. Vincent, C.P.G.
Ground Water Associates, Inc.

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Kt. Dept. of Agriculture

SEP 11 2000



Lutheran Cem

Scandia-Belleville Airport

Scandia Corn Plant TW 3-00 is 14.5' W of

Scandia

Scandia's N. Well S. Well

Sewage Disposal

Sandhill

School

Rock Island

CHICAGO

S C A N D I A

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Stockton Field Office
Division of Water Resources

Well 1427

Well 1428

Well 1429

Well 1431

Well 1443

Well 1443

Well

Well 1425

Well 1446

Well 1436

Well 1500

AQUIFER TEST

NAME Scandia Corn Plant DATE 31 Jul 00

LOCATION TW 3-00 WELL NO. Pumping TW 3-00 JOB NO. _____

Meas. Pt is 1.4' AGL

TIME OF DAY	ELAPSED TIME IN MINUTES	TAPE READING	WATER LEVEL BELOW MS PT	DRAWDOWN IN FEET	PUMPING RATE OF TEST WELL
	S.W.L.		22.8'		
11:30 am	0	Pump On			
	1			4.90'	
	2			5.18	
	3			5.35	
	4			5.55	
	5			5.60	89 gpm
	7			5.80	
	9			6.03	
	11			6.13	
	15			6.16	94 gpm
	20			6.32	
	25			6.40	
Noon	30			"	
	35			6.48	
	40			6.50	
	45			6.60	
	50			6.58	
	60			6.60	
	70			6.63	
	80			6.67	
13:00	90			6.73	
	100		29.53'	6.73	
	120			6.79	
	150			6.81	
	180			6.87	
	210			"	
	240			6.93	
	270			6.97	94 gpm
	300			6.98	
	330			7.00	
17:30	HOURLY 360			7.01	
	420			7.06	
	480		29.91	7.11	
	540			7.16	
	600			7.21	
	660			7.28	
23:30	720		30.10	7.30	
1 Aug 00:30	780			7.36	
	840			7.36	
	900			7.40	
	960			7.40	
	1020		30.30	7.50	
	1080		30.29	7.49	
6:30	1140			"	
	1200			"	
	1260			"	
	1320			7.46	94 gpm
	1380			7.47	
	1440			7.45	
12:30	1500			7.44	
13:00	1530		30.25	7.45	

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 Stockton Field Office
 Division of Water Resources

AQUIFER TEST

NAME Scandia Corn Plant DATE 31 Jul 00

LOCATION Obs. Well TH1-00 14.5' E of → WELL NO. TW 3-00 ^{Pumping} JOB NO. _____

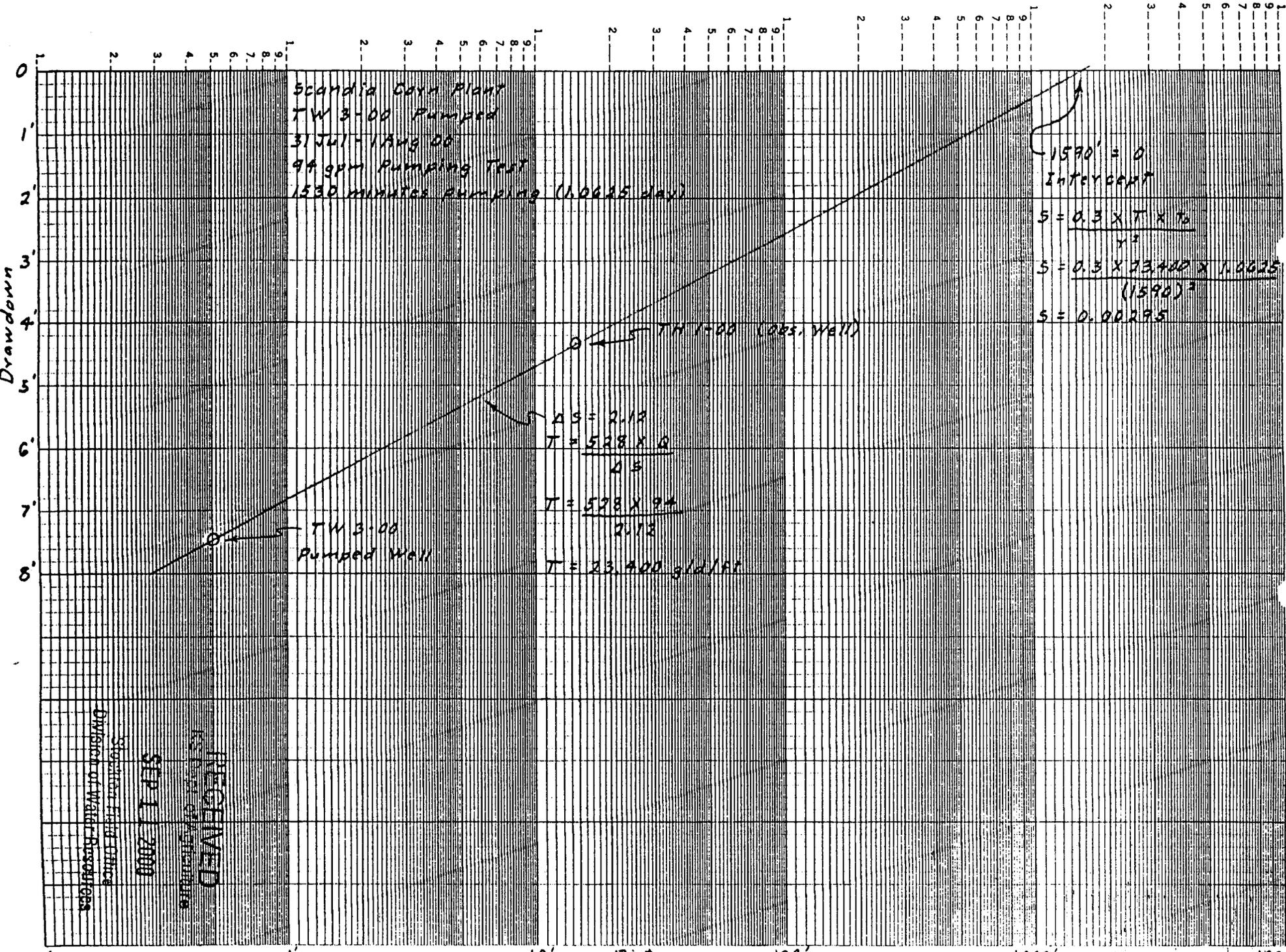
Meas. Pt. is 1.9' AGL

TIME OF DAY	ELAPSED TIME IN MINUTES	TAPE READING	WATER LEVEL BELOW MS PT	DRAWDOWN IN FEET	PUMPING RATE OF TEST WELL
	S.W.L.		22.59		
11:30	0	Pump On in TW 3-00			
	1			1.88	
	2			2.15	
	3			2.31	
	4			2.49	
	5			2.55	
	7			2.71	
	9			2.83	
	11			2.92	
	15			3.05	
	20			3.19	
	25			3.26	
Noon	30			3.32	
	35			3.38	
	40			3.41	
	45			3.44	
	50			3.48	
	60			3.52	
	70			3.56	
	80			3.59	
13:00	90			3.62	
	100			3.63	
	120			3.67	
	150			3.71	
	180			3.75	
	210			3.78	
	240			3.80	
	270			3.82	
	300			3.85	
	330			3.88	
17:30	HOURLY 360			3.89	
	420			3.92	
	480			3.96	
	540			4.00	
	600			4.07	
	660			4.11	
23:30	720			4.13	
1 Aug 00:30	780			4.17	
	840			4.18	
	900			4.20	
	960			4.22	
	1020			4.25	
	1080			4.27	
6:30	1140			4.30	
	1200			4.31	
	1260			4.30	
	1320			4.32	
	1380			4.33	
	1440			4.33	
12:30	1500			4.33.5	
13:00	1530			4.34	

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KS Dept. of Agriculture

SEP 1 1 2000

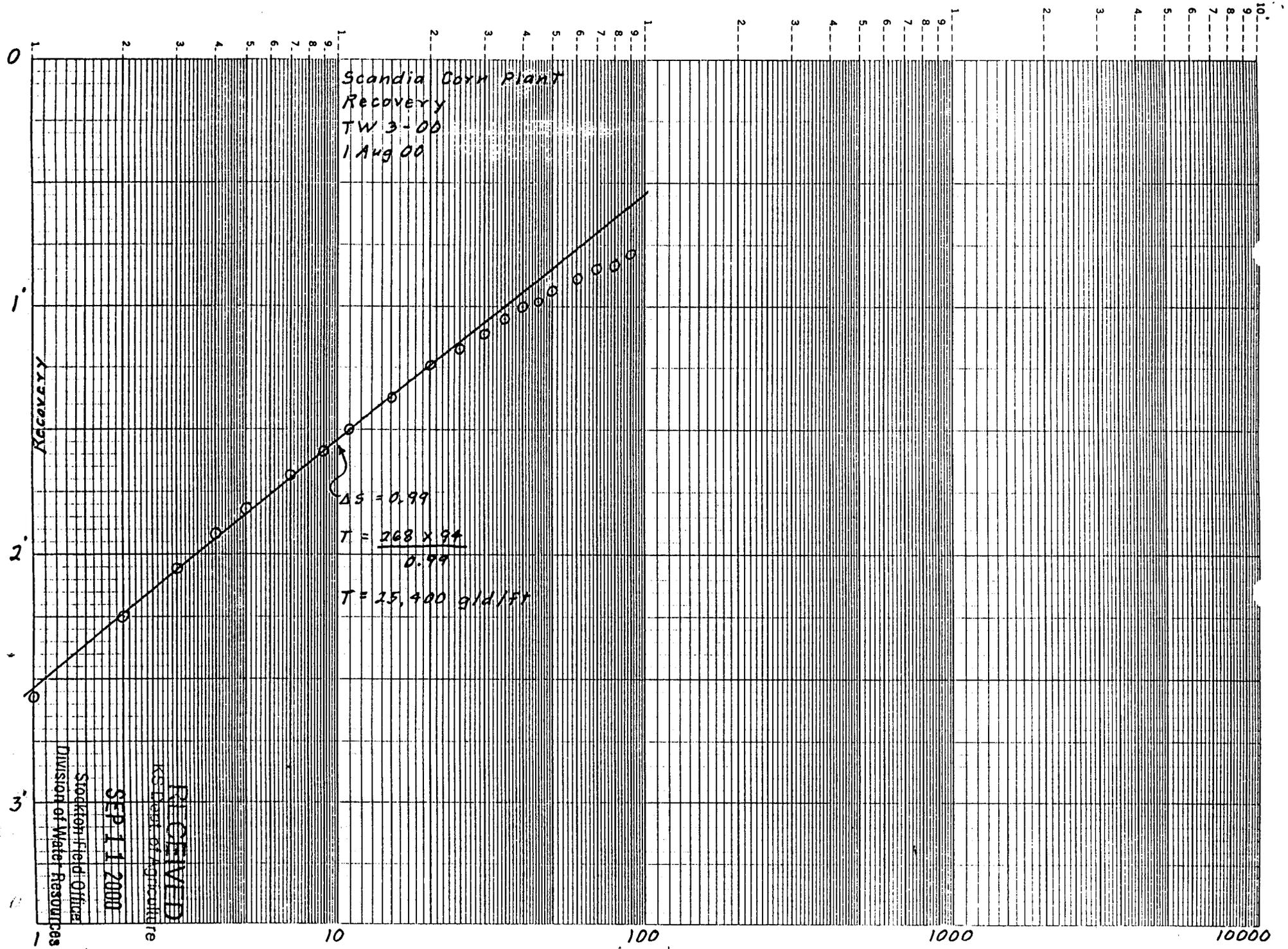
Stockton Field Office
Division of Water Resources

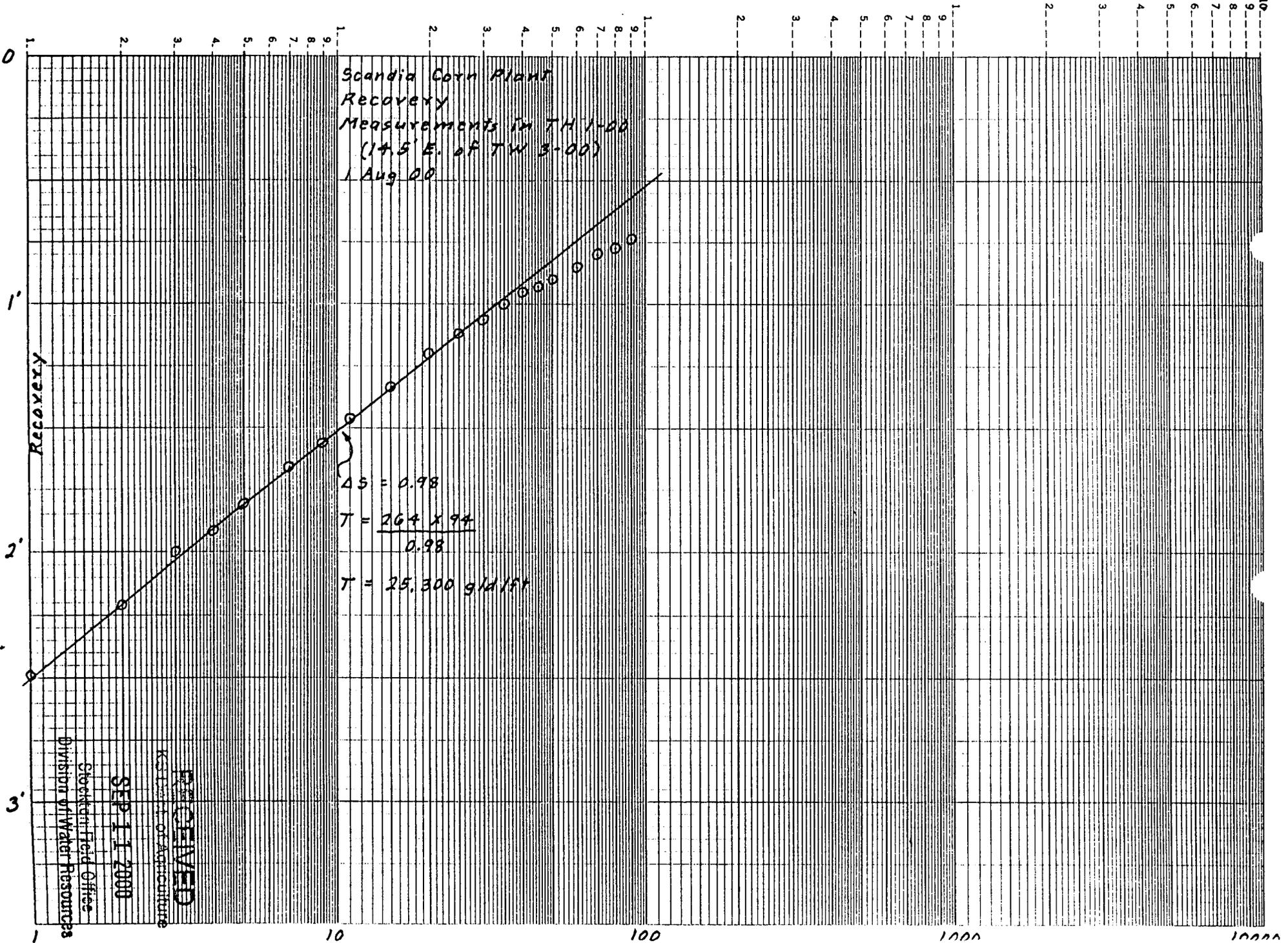


Stoughton Field Office
 Division of Water Resources

SEP 11 2000

RECEIVED
 DIVISION OF WATER RESOURCES





RECEIVED
 KS Dept. of Agriculture
 State Field Office
 Division of Water Resources
 SEP 11 2000

INFORMATION COLLECTED FROM THE WWC-5 WATER WELL FILE AT KGS

LOCATION OF WATER WELL: Fraction SE 1/4 SE 1/4 NE 1/4 Section Number 1.6 Township Number T 3 S Range Number R 4

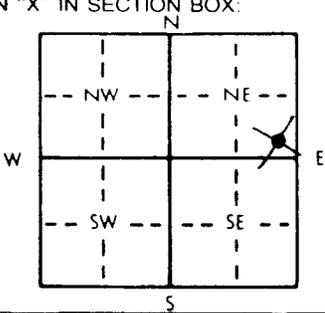
County: Republic Distance and direction from nearest town or city street address of well if located within city?

1 mile East & 1/4 mile South of Scandia

WATER WELL OWNER: City of Scandia
 R#, St. Address, Box #: c/o Schwab-Eaton
 City, State, ZIP Code: 1125 Garden Way, Manhattan, KS

Board of Agriculture, Division of Water Resources
 Application Number: 41,146

LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX: DEPTH OF COMPLETED WELL: 84 ft. ELEVATION:



Depth(s) Groundwater Encountered: 1 ft. 49 ft. 2. ft. 3. ft.
 WELL'S STATIC WATER LEVEL: 31 ft. below land surface measured on mo/day/yr 8-30-95
 Pump test data: Well water was _____ ft. after _____ hours pumping _____ gpm
 Est. Yield: 300 gpm. Well water was 15 ft. after 8 hours pumping 160 gpm
 Bore Hole Diameter: _____ in. to 87 ft. and _____ in. to _____ ft.
 WELL WATER TO BE USED AS:
 1 Domestic 3 Feedlot 6 Oil field water supply 9 Dewatering 12 Other (Specify below)
 2 Irrigation 4 Industrial 7 Lawn and garden only 10 Monitoring well
 Was a chemical/bacteriological sample submitted to Department? Yes No
 If yes, mo/day/yr sample was submitted _____
 Water Well Disinfected? Yes No

TYPE OF BLANK CASING USED:
 1 Steel 3 RMP (SR) 5 Wrought iron 8 Concrete tile CASING JOINTS: Glued Clamped _____
 2 ~~SPVC~~ 4 ABS 6 Asbestos-Cement 9 Other (specify below) Welded
 7 Fiberglass Threaded _____

Blank casing diameter: 12 in. to 64 ft. Dia. 12 in. to 87 ft. Dia. _____ in. to _____ ft.
 Casing height above land surface: 12 in. weight: 49.56 lbs./ft. Wall thickness or gauge No. _____

TYPE OF SCREEN OR PERFORATION MATERIAL:
 1 Steel 3 Stainless steel 5 Fiberglass 7 PVC 10 Asbestos-cement
 2 Brass 4 Galvanized steel 6 Concrete tile 9 ABS 11 Other (specify) _____
 12 None used (open hole)

SCREEN OR PERFORATION OPENINGS ARE:
 1 Continuous slot 3 ~~Wire slot~~ 5 Gauzed wrapped 8 Saw cut 11 None (open hole)
 2 Louvered shutter 4 Key punched 6 Wire wrapped 9 Drilled holes
 7 Torch cut 10 Other (specify) _____

SCREEN-PERFORATED INTERVALS: From 64 ft. to 84 ft. From _____ ft. to _____ ft.
 From _____ ft. to _____ ft. From _____ ft. to _____ ft.
 GRAVEL PACK INTERVALS: From 56 ft. to 87 ft. From _____ ft. to _____ ft.
50% sand 50% holeplug 25 ft. to 56 ft. From _____ ft. to _____ ft.

GROUT MATERIAL: 1 Neat cement 2 Cement grout 3 Bentonite 4 Other _____
 Grout intervals: From 5 ft. to 25 ft. From _____ ft. to _____ ft. From _____ ft. to _____ ft.

What is the nearest source of possible contamination: No contamination within 1/4 mile
 1 Septic tank 4 Lateral lines 7 Pit privy 1/4 mile 11 Fuel storage 14 Abandoned water well
 2 Sewer lines 5 Cess pool 8 Sewage lagoon 12 Fertilizer storage 15 Oil well/Gas well
 3 Watertight sewer lines 6 Seepage pit 9 Feedyard 13 Insecticide storage 16 Other (specify below) _____

Direction from well? _____ How many feet? _____

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0	4	Top Soil			
4	14	Brown Clay			
14	40	Silty Tan Clay			
40	43	Brown Clay & Limestone Pieces			
43	48	Brown Clay			
48	56 1/2	Brown Clay & Limestone Pieces			
56 1/2	65	Fine to Course Sand Some Gravel			
65	66	Brown Clay			
66	72	Fine to Course Sand Some Gravel			
72	74 1/2	Brown Clay			
74 1/2	84	Fine to course Sand, Limestone, Gravel & Clay			
84	87	Gray Shale			

CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) 8-30-95 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 1.38 This Water Well Record was completed on (mo/day/yr) 9-27-95
 Under the business name of Peterson Irrigation Inc. by (signature) Mike Peterson

INSTRUCTIONS: Use typewriter or ball point pen. PLEASE PRESS FIRMLY and PRINT clearly. Please fill in blanks, underline or circle the correct answers. Send top three copies to Kansas Department of Health and Environment, Bureau of Water, Topeka, Kansas 66620-0001. Telephone: 913-296-5545. Send one to WATER WELL OWNER and retain one for your records.

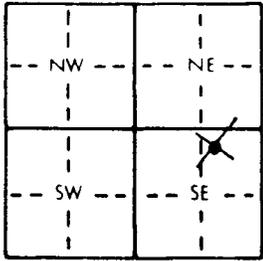
LOCATION OF WATER WELL: Fraction NW 1/4 NE 1/4 SE 1/4 Section Number 16 Township Number T 3 S Range Number R 4

County: Republic Distance and direction from nearest town or city street address of well if located within city?

1 mile East & 1/2 mile South of Scandia

WATER WELL OWNER: City of Scandia
 PR# St. Address, Box #: c/o Swab-Eaton
 City, State, ZIP Code: 1125 GardenWay, Manhattan, KS
 Board of Agriculture, Division of Water Resources
 Application Number: 61,635

LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX: DEPTH OF COMPLETED WELL: 86 ft ELEVATION:



Depth(s) Groundwater Encountered 1. ~~27.55~~ 35 ft. 2. ft. 3. ft.
 WELL'S STATIC WATER LEVEL 29.37 ft. below land surface measured on mo/day yr 9-6-95
 Pump test data: Well water was ft. after hours pumping gpm
 Est. Yield 300 gpm Well water was 20.48 ft. after 8 hours pumping 188 gpm
 Bore Hole Diameter in to 86 ft., and in to ft.
 WELL WATER TO BE USED AS: 5 Public water supply 8 Air conditioning 11 Injection well
 1 Domestic 3 Feedlot 6 Oil field water supply 9 Dewatering 12 Other (Specify below)
 2 Irrigation 4 Industrial 7 Lawn and garden only 10 Monitoring well
 Was a chemical/bacteriological sample submitted to Department? Yes No If yes, mo/day/yr sample was submitted
 Water Well Disinfected? Yes No

TYPE OF BLANK CASING USED: 5 Wrought iron 8 Concrete tile CASING JOINTS: Glued Clamped
 1 Steel 3 RMP (SR) 6 Asbestos-Cement 9 Other (specify below) Welded
 2 PVC 4 ABS 7 Fiberglass Threaded

Blank casing diameter 12 in. to 63 ft. Dia 12 in. to 86 ft. Dia in. to ft.
 Casing height above land surface 12 in. weight 12.518 lbs./ft. Wall thickness or gauge No.

TYPE OF SCREEN OR PERFORATION MATERIAL: 7 PVC 10 Asbestos-cement
 1 Steel 8 Stainless steel 5 Fiberglass 8 RMP (SR) 11 Other (specify)
 2 Brass 4 Galvanized steel 6 Concrete tile 9 ABS 12 None used (open hole)

SCREEN OR PERFORATION OPENINGS ARE: 5 Gauzed wrapped 8 Saw cut 11 None (open hole)
 1 Continuous slot 3 1/4 in. .490 6 Wire wrapped 9 Drilled holes
 2 Louvered shutter 4 Key punched 7 Torch cut 10 Other (specify)

SCREEN-PERFORATED INTERVALS: From 63 ft. to 83 ft. From ft. to ft.
 GRAVEL PACK INTERVALS: From 55 ft. to 86 ft. From ft. to ft.
 50% Sand 50% holeplug From 25 ft. to 55 ft. From ft. to ft.

GROUT MATERIAL: 1 Neat cement 2 Cement grout 3 Bentonite 4 Other
 Grout Intervals: From 5 ft. to 25 ft. From ft. to ft. From ft. to ft.

What is the nearest source of possible contamination? None within 1/2 mile 10 Livestock pens 14 Abandoned water well
 1 Septic tank 4 Lateral lines 7 Pit privy 11 Fuel storage 15 Oil well/Gas well
 2 Sewer lines 5 Cess pool 8 Sewage lagoon 12 Fertilizer storage 16 Other (specify below)
 3 Watertight sewer lines 6 Seepage pit 9 Feedyard 13 Insecticide storage

Direction from well? How many feet?

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0	5	Top Soil			
5	9	Dark Brown Clay			
9	31	Silty Brown Clay			
31	34 1/2	Loose Med. Sand & Limestone			
34 1/2	45	Gray Clay			
45	55	Brown Clay			
55	64	Course Sand, Brown Clay, & Limestone			
64	66 1/2	Brown Clay			
66 1/2	83	Course Sand, Large Limestone Pieces, Tan Clay			
83	86	Gray Shale			

CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was (1) constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) 9-6-95 and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's License No. 138 This Water Well Record was completed on (mo/day/yr) 9-27-95 under the business name of Peterson Irrigation Inc. by (signature) Mike Peterson

Vincent's well 3-00

G

WATER WELL RECORD Form WWC-5 KSA 82a-1212 ID No.

1] LOCATION OF WATER WELL: Fraction near 1/4 center 1/4 SW 1/4 Section Number 10 Township Number T 3 S R 4 Range Number 4 <input checked="" type="checkbox"/> KW

Distance and direction from nearest town or city street address of well if located within city?

1 1/2 miles East of Scandia, KS

2] WATER WELL OWNER: Republic Co. Commission	Board of Agriculture, Division of Water Resources
RR#, St. Address, Box #: c/o Larry Blocklinger, P.O. Box 280	Application Number:
City, State, ZIP Code: Belleville, KS 66935	

3] LOCATE WELL'S LOCATION WITH AN "X" IN SECTION BOX:	4] DEPTH OF COMPLETED WELL: 63 ft. ELEVATION:
	Depth(s) Groundwater Encountered 1. ft. 2. ft. 3. ft.
	WELL'S STATIC WATER LEVEL: 21.4 ft. below land surface measured on mo/day/yr 7/30/00
	Pump test data: Well water was ft. after hours pumping gpm
	Est. Yield 200-250 gpm: Well water was ft. after hours pumping gpm
Bore Hole Diameter: 12 in. to 63 ft., and in. to ft.	WELL WATER TO BE USED AS:
	5 Public water supply 8 Air conditioning 11 Injection well
	1 Domestic 3 Feedlot 6 Oil field water supply 9 Dewatering 12 Other (Specify below)
	2 Irrigation <input checked="" type="checkbox"/> Industrial 7 Domestic (lawn & garden) 10 Monitoring well
	Was a chemical/bacteriological sample submitted to Department? Yes. No. <input checked="" type="checkbox"/> X ; If yes, mo/day/yr sample was submitted
	Water Well Disinfected? Yes <input checked="" type="checkbox"/> X No

5] TYPE OF BLANK CASING USED:	5 Wrought iron	8 Concrete tile	CASING JOINTS: Glued. <input checked="" type="checkbox"/> X Clamped.
1 Steel	3 RMP (SR)	6 Asbestos-Cement	9 Other (specify below)
<input checked="" type="checkbox"/> PVC	4 ABS	7 Fiberglass	Welded
Blank casing diameter: 6 in. to 43.6 ft., Dia 6 in. to 60.5 to ft., Dia in. to			Threaded.
Casing height above land surface: 12 in., weight 3.36 lbs./ft. Wall thickness or gauge No. 255			
TYPE OF SCREEN OR PERFORATION MATERIAL:	<input checked="" type="checkbox"/> PVC	10 Asbestos cement	
1 Steel	<input checked="" type="checkbox"/> Stainless steel	5 Fiberglass	8 RMP (SR)
2 Brass	4 Galvanized steel	6 Concrete tile	9 ABS
11 Other (specify)			12 None used (open hole)
SCREEN OR PERFORATION OPENINGS ARE:	5 Gauzed wrapped	8 Saw cut	11 None (open hole)
<input checked="" type="checkbox"/> Continuous slot	3 Mill slot	6 Wire wrapped	9 Drilled holes
2 Louvered shutter	4 Key punched	7 Torch cut	10 Other (specify) ft
SCREEN-PERFORATED INTERVALS: From PVC 43.6 ft. to 50.5 ft., From ft. to ft.			
steel From 50.5 ft. to 60.5 ft., From ft. to ft.			
GRAVEL PACK INTERVALS: From 39 ft. to 63 ft., From ft. to ft.			
From ft. to ft., From ft. to ft.			

6] GROUT MATERIAL:	1 Neat cement	<input checked="" type="checkbox"/> Cement grout	<input checked="" type="checkbox"/> Bentonite	4 Other
Grout Intervals: From 32 ft. to 39 ft., From 10 ft. to 32 ft., From 4 ft. to 10 ft.				
What is the nearest source of possible contamination:	Bentonite	concrete	holeplug-bentonite	
1 Septic tank	4 Lateral lines	7 Pit privy	10 Livestock pens	14 Abandoned water well
2 Sewer lines	5 Cess pool	8 Sewage lagoon	11 Fuel storage	15 Oil well/Gas well
3 Watertight sewer lines	6 Seepage pit	9 Feedyard	12 Fertilizer storage	16 Other (specify below)
13 Insecticide storage				
Direction from well?			How many feet?	

FROM	TO	LITHOLOGIC LOG	FROM	TO	PLUGGING INTERVALS
0	3	Topsoil			
3	14	Dark Brown Clay			
14	25	Brown, Green Clay			
25	35	Brown Clay			
35	43	Green Clay			
43	60.5	Medium to Coarse Sand & Limestone Gravel			
60.5	61	Limestone			
61	63	Gray Shale			

7] CONTRACTOR'S OR LANDOWNER'S CERTIFICATION: This water well was **X** constructed, (2) reconstructed, or (3) plugged under my jurisdiction and was completed on (mo/day/year) **8/2/00** and this record is true to the best of my knowledge and belief. Kansas Water Well Contractor's Licence No. **138** This Water Well Record was completed on (mo/day/yr) **8/8/00** under the business name of **Peterson Irrigation, Inc.** by (signature) *Mike Peters*

**ADDITIONAL INFORMATION PROVIDED BY GROUND WATER ASSOCIATES
SUBSEQUENT TO A TELEPHONE CONVERSATION WITH ROBERT VINCENT**



Ground Water Associates, Inc.

Subject City of Scandia Date 17 Oct 08

Memo to P. Allen Macfarlane
Ks. Geological Survey

AI —

This is my first day back in the office since 10 Oct., and I'm having trouble catching up on my obligations. Therefore, I'm sending you copies of mostly raw data. Not cleaned up, but I think you can make it out.

You can see by the measurements taken by the city's personnel in their Well 8 that the pumping in the corn plants' well had no effect on it. (See last page)

Bob Vincent

316-262-3322



Ground Water Associates, Inc.

Subject Scandia Date 9 Jul 91

- 1-91 366' N & 62' W of SE cor of Sec 9, T35, R4W Elev 1508
 (Well X rd is 359' S & 137' W of NE cor of Sec 16) - 55
 SWL Elev 1453
- 0-3 Topsoil
 - 3-15 Cl, y. silty, lt gy-bn 1508
 - 15-19 " " " dk bn Bedrock Elev - 94
 - 19-25 " " " lt bn } 1414
 - 25-50 " silty " Bs of S Elev + 6
 - 50-64 " lt bn av. } 1420
 - 64-76 " " w. few S & G particles (mostly ls)
 - 76-79 Cl, lt y-c-bn (looks like wea sh)
 - 79-88 S, YF-G, so. G, many ls. particles, sl. silty, tan
 - 1414 88-94 Cl. gy
 - 94-96 Sh. bk, drld tough

Clarence Berggren RR-2, Box 325 Scandia 66966
 to the S Bradley Odell, RR-2
 " " E John Nylund, RR-2 (Well in basement)

Set 2" to 88' w. part 78'-88' G to 51'; Holeplug to 36', G to 17,
 Holeplug to 3' (2 bags)

Pumped w rig AC for 15 min (est 10 gpm)
 SWL 56' from 1' AGL

C. Berggren's well is 337' W & 189' N. of SE cor of Sec 9

Pumped well for 2 hrs (w. aux. A-C) @ 8+ gpm

10 Jul Start AC @ Noon



Ground Water Associates, Inc.

Subject Scandia

Date 10 Jul 91

2-91 666' N & 40' W of SE cor of Sec 9 T35, R4W Elev 1510
88
1422

- 0-1 TS sl.
- 1-26 Silty, clayey, lt tan-bn
- 26-53 Cl, v. silty, " " "
- 53-58 " , silty, lt bn
- 58-61 " " , bn
- 61-80 " " w. few pcs G, lt bn (ls & arkosic)
- 80-88 S & G, VF-C, (many ang. ls pcs) tan (took H₂O)
- 88-92 Sh, BK

Cleaner S here than @ 1-91

G to 73', Holeplug (2 bags) to 58', G to 48, cuttings to 20,
" " to 5, cuttings to surface

John Nyland (house to E) says his well @ elev. 1480 to 1475 is 35' deep (Elev 1445 to 1440 bedrock?)

3-91 660' S & 5' W of NE cor of Sec 16, T35, R4W Elev 1498
87
1411

- 0-1 TS
- 1-9 Cl, silty, lt bn
- 9-14 " " dk bn
- 14-30 " , v. silty, lt bn
- 30-35 " " lt tan-bn
- 35-61 " , silty, lt tan-bn
- 61-66.5 " " w. a v. few G particles, lt tan-bn
- 66.5-71.5 S, VF-C, sl. silty, tan
- 71.5-75 Cl, gy-bn w. S & G stks
- 75-77 S & G, VF-C, sl. silty, tan (took H₂O)
- 77-82.5 Cl, silty, lt tan bn
- 82.5-87 S & G, VF-C, v. silty, tan, w. cl stks
- 87-92 Sh, BK

G to 49, Holeplug (2 bags) to about 33, G to about 19.5, Holeplug (3 bags) to 8', cuttings to surface



Subject Scandia Date 11 Jul 91

4-91 1358 S & 5' E of NW cor Sec 15 T35, R4W Elev 1484

- 0-1 TS
 1-26 Silt, sl. clayey, lt tan-bn
 26-45 Cl, silty, lt bn changing to bn
 45-56 " " w. thin strk of S @ 45', lt tan-bn
 56-62 " sl. silty, lt gy w. so. ye mottling, so FS strks from 60'
 62-67 S & G, VF-C, tan
 67-75 Cl, blk & bn w. S strks
 75-80 S & G, VF-C, silty, tan
 80-90 Sh, bl-gy

80
1404

Set 2" to 80' w. perf 60'-80'

G to 50, Holeplug (2 bags to 34'), G to 15', Holeplug (3 bags) to 0'.

Pumped 10.5 gpm for 10 min

38.15' SWL from GL

5-91 35' N & 20' E of SW cor of E 1/2, SE 1/4, Sec 9

Elev 1490

- 0-1 TS
 1-13 Cl, silty
 13-15 Ls & Sh, wea
 15 Ls, dense

13
1477

3 bag Holeplug 15-5, G to 1, Mud to 0



Ground Water Associates, Inc.

1484-91
1404-84

Subject Scandia Date 12 Aug 91

G-91 2050'S & 1400'E of NW cor, Sec 16, T3S, R4W Elev 1530
 1570'S of S. school line & 25'E of N-S fence 75
 0-4 TS (silt) 1455
 4-25 silt, sl. clayey, br
 25-30 Cl, silty, lt reddish-br
 30-43 silt, sl. clayey, br
 43-75 Cl, silty, br
 75-80 Ls & Sh, wea, ye-br to br-wh

G to 20', Holeplug to 0'

7-91 1365'S & 1390'E of NW cor, Sec 16, T3S, R4W Elev 1530
 885'S of S. school line & 15'E of N-S fence 63
 1467

0-3 TS (silt)
 3-16 Silt, sl. clayey, br-tan
 16-25 " " " " br
 25-35 Cl, silty, lt br
 35-44 Silt, ~~sl. clayey~~, br
 44-63 Cl, v. silty, br, caliche stK @ 58', ~~63', 65', 66', 67', 68.5'~~
 63-69 Ls & Sh, wea. lt br to lt ye-br

13 Aug 91

TH 8-91 360' N & 5' W of SE cor, NE $\frac{1}{4}$, Sec 16, T3S, R4W Republic Elev 1472
 125'S of RR X 84
 0-11 TS (silt) gy-br 1393
 11-41 Cl, silty, br
 41-44.5 STG w. many ls pcs, F.C, tan
 44.5-54 Cl, sl. silty w. ls " " tan
 54-56 " " " T sdy, tan w. so. ye-tan
 56-73 STG, F.C w. so. ls pcs, tan, few cl stks in upper part tan
 took H₂O
 73-78 S, VF.C, so.G, w. few stks of cl, tan (v. sl. silty)
 78-84.5 S, VF.C, so.G, silty w. many pcs ls & sh, dirtier 80-84
 84-90 Sh, gy

Set 2" to 84' w. perf 64'-84' , G to 20', Holeplug to 0

Pumped 15 gpm from 1:00 pm - 6:15 pm

SWL 36.3' from TO 2" PVC
2.0' AGL
 34.3'



Ground Water Associates, Inc.

Subject Scandia Date 13 Aug 91

9-91 450' W & 480' S of NE cor, SE $\frac{1}{4}$, Sec 16, T3S, R4W
RR to 0.5 sec line: 497' - Meas. 500' S & then 650' SW

Elev ¹⁴⁶⁶~~1464~~
73
1396
1393.0

- 0-8 TS (silt), br
- 8-17 Cl, silty, tan
- 17-22 Silt, clayey, tan
- 22-23 S, VF & silty, " w. so ls pcs
- 23-31 Cl, silty, tan
- 31-34 S, F-C w. so G, (8 pcs of ls), lt tan
- 34-46 Cl, silty, tan
- 46-51 S, F-C, so G & ls pcs, tan, took H₂O
- 51-54 Cl, silty, tan
- 54-58 S, VF-C, so G & ls pcs, tan to reddish-tan, took H₂O
- 58-60 Cl, silty, tan
- 60-62 S, VF-C, silty, w. so G, & ls pcs, tan, took H₂O
- 62-68 Cl, sl. silty, dk gy
- 68-70 " " " lt br
- 70-73 S & G, mostly ls but so arkasic, wh-tan
- 73-77 Sh, dk bl-gy

10-91 185' E & 300' N of SW cor, NW $\frac{1}{4}$, Sec 15, T3S, R4W
190' E of 8-91

Elev 1480
82
1398

- 0-3 TS (silt)
- 3-10 Silt, br
- 10-28 Cl, silty, tan
- 28-42 " v. silt, tan
- 42-47 S & G, VF-C, w. ls pcs, tan
- 47-61 Cl, silty, tan
- 61-65 S, VF-C, so G, & cl stks, tan, took H₂O
- 65-70 S, VF-M, so G, silty, tan
- 70-75 S, " " " , v. silty, tan
- 75-82 S & G, VF-C, many ls pcs, tan, took H₂O
- 82-85 Sh, wea, bl-gy, w. so Ss
- 85-90 " , dk bl-gy



Ground Water Associates, Inc.

Subject Scandia

Date 13 Aug 91

11-91 202' W & 360' N of SECOR, NE 1/4, Sec 16
(197' W of 8-91)

Elev	1482 or 1480
	<u>86</u> <u>96</u>
	1396 1396

- 0-3 TS (silt)
- 3-8 Silt, dk gy-br
- 8-12 " tan
- 12-16 " dk br
- 16-47 Cl, silty, tan
- 47-55 Cl, sl. silty, gy to dk gy
- 55-58 S, F-C, so G & ls pcs, gy, took H₂O
- 58-62 Cl, silty, tan
- 62-77 S & G, VF-C, so. ls pcs, tan took H₂O
- 77-83 Cl, gy
- 83-85 S, VF-C, so G, v. silty, tan
- 85-86 Cl, lt gy
- 86-87 Ss, reddish-br
- 87-92 Sh, gy

1 Bag Holeplug 56-59, 1 bag @ 43', 2 bags 20'-5'

TW 12-91 to be 16' W & 32' S of 8-91
21' W & 328' N of SE cor, NE 1/4, Sec 16, T3S, R4W

9" Hole

25' of 59'-84' screen

Guides B & T

G to 54', Holeplug to 35', G to 20', Holeplug to 0'

227-3579 Mike P home

Guy Ellis, Section Head
Page 2
September 4, 1993

N Well site

*328' N & 21' W of SE cor, NE $\frac{1}{4}$,
Sec 16, T3S, R4W*

My log of TW 12-91 is as follows:

0	- 11	'	Silt, gray-brown
11	- 41		Clay, silty, brown
41	- 44.5		Sand, fine to coarse with many pcs. of limestone gravel, tan
44.5	- 54		Clay, silty w. limestone pcs., tan
54	- 56		Clay, silty and sandy, tan with some yellow-tan
56	- 73		Sand and gravel, fine to coarse with some limestone pcs. and a few clay streaks in the upper portion, tan, took water
73	- 78		Sand, very fine to coarse with some gravel and a few streaks of clay, tan
78	- 84		Sand, very fine to coarse with some gravel, silty, with many pcs. of limestone and shale, tan
84	- 90		Shale, gray

A 5" test well was installed here and test pumped. It yielded 66 gpm at 10.65' of drawdown after six hours. The static water level was 34.10' on August 5, 1991.

A review of the literature concerning this area (KGS Bulletins 73, 115 and 188) would indicate that the deposits here are probably the Sanborn formation with the sands and gravels being the Crete member.

Our test hole drilling indicates that TW 12-91 is near the center of a buried channel that appears to extend almost straight north. A test hole 666' north and 40' west of the southeast corner of Section 9, T3S, R4W penetrated 88' of a similar unconsolidated formation. Other test holes were in between these holes.

The wells located within one-half mile of the proposed well site are all domestic wells owned by the following:

- D-1 Clarence Berggren, Route 2, Box 325, Scandia, Kansas 66966
- D-2 John Nylund, Route 2, Scandia, Kansas 66966
- D-3 Bradly Odell, Route 2, Scandia, Kansas 66966

We have other test hole and pumping data available should you have need of it in your evaluation of our application. Please advise us if we need to provide these data or other information to you at this time.



Ground Water Associates, Inc.

24
1473 = W.L.
13,380
73
1396

5' on top
5" below

Subject Scandia

Date 25 May 94

TH 1-94 2120' N & 650' W. of SE cor, Sec 16, T35, R4W Elev 1473.5
 235' W of TH 9-91 & 8' higher 84.5
 15' E of RR Rt of Way Fence & 573' S of W fence 1389.0
 13.5' higher than entrance to field by NE cor of SE 1/4 Sec 16

0-10 silt, lt br
 10-17 cl, silty, br
 17-20 " " lt beige br
 20-30 silt, clayey, lt beige br
 30-35 S, VF-C w. ls. pcs, v. silty, tan
 35-38 cl, silty, lt br-gy
 38-41 S, F-C w. ls pcs, tan w so cl stks, tan
 41-50 cl, blk w. so gy
 50-56 cl, tan w. so blk cl & stks of s @ 5 ft
 56-70 S, F-C w. so G & pcs of ls, & stks of cl, tan, lo, took H₂O
 70-82 S, F-C w. G & pcs of ls, lo, tan " "
 82-84.5 S, G & F, F-C w. much ls, drld rough, tan, " "
 84.5-90 sh, gy

Set 2" to 81' w. perf 61'-81'

87.5' - 5' (cut off) - 1.5' AGL = 81' deep

G to 50', H to 32', G to 23', H-5', C-0'
3 bag 3 bag

26 May - after
 water sample
 SWL 30.33
1.50
 28.83

TH 2-94

200' N-NE along RR Rt of Way from 1-94

Elev 1473.0

80.0

1393.0

0-6 silt, lt gy
 6-12 " sl. clayey, dk br
 12-15 cl, lt rd-bn beige, v. silty
 15-20 silt, lt br
 20-36 cl, v. silty, lt tan br w. so pcs of ls @ 30'
 36-38 S, VF-C, silty, tan
 38-39 cl, lt gy
 39-46 S, VF-C w. ls pcs & cl balls, tan
 46-55 cl, lt br
 55-58 cl, v. sdy, lt br
 58-60 S, F-C, w. many ls pcs, tan, lo took H₂O
 60-68 S, F-C, w a few " " , rd-tan, lo took less H₂O
 68-76 S, F-C w. G & ls pcs, rd-tan, lo took H₂O
 76-80 S, VF-C w. a little G & ls pcs, tan, lo
 80-85 sh, gy

G to 47, H to 28, G to 22', H to 5', C to 0
3 bag



TH-94 Pumped machine

Ground Water Associates, Inc.

Subject Scandia Date 26 May 91

TH 3-94

Elev 147 ft.

7.8-5.2 = 2.6 200' S-SW of 1-91 along RR RT of Way

80.
1391..

- 0-4 TS
- 4-8 Cl. silty, gy
- 8-13 " " dk br gy
- 13-18 " " beige
- 18-30 " " lt br
- 30-34 S, F-C w. much cl, tan
- 34-36 Cl, lt gy
- 36-41 S, F-C & G w. ls pcs & gy cl, lo. tan
- 41-54 Cl, tan, sl, silty
- 54-67 S, VF-C w. G & ls pcs & much lt tan cl, tan, lo ^{so} track H₂O
- 67-71 S, VF-C w. G " " " , lo, tan
- 71-77 Cl, blk
- 77-79 S, VF-C, w. much lt gy cl, tan
- 79-80 Cl, blk w. ls pcs
- 80-82

G to 49', ^{2.5 bags} H to 30', G to 20', Sluff to 16', H to 1', C to 0'

SWL - 31.25' From TO2" C which is 1.7' AGL (TH 8-91) 34.30' GL Jul 91
 31.25 - 1.70 = 29.55'
 " - 30.30 " TO5" C " " 1.0' " (TW 12-91) 34.21' GL Jul 91
 30.30 - 1.0 = 29.30'
 " - 34.93 " TO2" C " " 2.0' " (TH 4-91) 38.15 GL - Jul 91
 34.93 - 2' = 32.93



1711-74 15 10W near RR RT of Way

Ground Water Associates, Inc.

81
82.5
89
5.5
81.5
Subject

Scandia

Date 26 May 94

TH 4-94

50' N-NE along RR RT of Way from 1-94

Elev 1473.
87.
1389.

- 0-3 TS
- 3-9 silt, sl. clayey, br
- 9-18 Clay, v. silty, rd-beige
- 18-34 " " " " lt br
- 34-36 " " gy
- 36-40 S, F-C, w G & pcs of ls, so cl, tan
- 40-44 S, F-C, " " " " " " tan
- 44-48 Cl, dk gy
- 48-52 " " gy
- 52-62.5 " " lt gy to lt br
- 62.5-70 S, F-C w. G & ls pcs, lo, w. so cl 67-70' tan
- 70-84.5 S " " " " " " " " tan
- 84.5-86 Sh, gy

Took H₂O
"
Took H₂O
"
"
"

G to 59' & sluff to 46', H to 33', G to 20', H to 3' ^{3 bags} ^{3 bags}

TH 5-94

51' S-SW of TH 1-94 along RR RT of Way 8.5' lower

Elev 1473.
82.
1490.

624' " " N. Fence

- 0-3 TS
- 3-7 silt, gy-br
- 7-14 Cl, v. silty, rd-beige
- 14-20 " " " " rd-br
- 20-32 " " silty, br
- 32-37 Cl, sl. silty, gy
- 37-42 S, VF-C, & G & ls pcs, tan
- 42-56.5 Cl, br, sl. silty
- 56.5-65 S, F-C w G & ls pcs, lo, tan
- 65-70 " " " " " " " " " w. a little cl
- 70-82.5 " " " " " " " " v. lo., tan
- 82.5-85 B @ 80' Sh, dk gy

Took H₂O
"
"

Set 5" to 82.5' w. 20' of perf 62.5'-82.5'

G to 46', H to 30', G to 22', H to 6" ^{5 bags} ^{6 bags}, C to 0

Drill prod. well between 1-94 & 5-94, but closer to 1-94

2120' N & 660' W of SE cor of Sec 16, T3S, R4W - for DWR



Subject Scandia, Ks Date 11 Feb 95

Summary of Recommended Well Design

North well to be drilled 10' N of TW 12-91 (5") or approx. 36' SW of TH 8-91 (2"). (This site is approx. 2970' N & 30' W of the SE cor of Sec 16, T3S, R4W.)

South well to be drilled 40' N-NE of TW 5-94 (5") or approx. 11' S-SW of TH 1-94 (2"). (This site is approx. 2120' N. & 650' W of the SE cor of Sec 16, T3S, R4W.)

	#8 North Well	#9 South Well
Well Depth	87'	87.5'
Depth to bottom of Aquifer	84'	84.5'
Static Water Level	29.3' on 26 May 94	28.39 on 14 Jun 94
Saturated Thickness	54.7'	56.11'
Drilled Hole Diameter	38"	38"
Screen & Casing Diameter	12" ID	12" ID
Screen Material	SS	SS
Casing Material	Steel - 0.375" Wall	Steel - 0.375" Wall
Screen Length & Opening	20' with 0.070"	20' with 0.070"
Screen Placement	64'-84'	64.5'-84.5'
Casing Placement	0-64' & 84'-87'	0-64.5' & 84.5'-87.
Bottom of Casing Sealed With	0.50" Steel Plate	0.50" Steel Plate
Guides Placement (3 sets of 4 each)	44', 63' & 85'	44.5', 63.5' & 85.5'
Annulus Fill Material		
Natural Earth Materials	0-5'	0-5'
Concrete	5'-25'	5'-25'
Roadsand & Bentonite (50-50 Mix)	25'-56'	25'-56'
Gravel	56'-87'	56'-87.5'

Note: Bentonite is to be Bariod's Holaplug or equal.

Production Well Yield at #8	160 gpm at 14.09' ND on	7 Sep 95
" " " " #9	188 " " 20.48' DD " "	13 Sep 95

AQUIFER TEST

NAME City of Scandia, Kansas DATE Sept. 7, 1995

LOCATION _____ WELL NO. 8 JOB NO. _____

Readings taken from 2.1' AGL Thru 1" PVC in well.

TIME OF DAY	ELAPSED TIME IN MINUTES	MICRO TAPE READING	WATER LEVEL BELOW MS PT	DRAWDOWN IN FEET	PUMPING RATE OF TEST WELL
9:00AM	S.W.L.	3503	32.69	0	
	1			11.45	
	2			9.60	
	3			10.15	
	4			10.52	
	5			10.63	
	7			10.69	
	9			10.90	
	11			11.15	
	15			11.20	
	20			11.60	
	25			11.78	
	30			11.87	
	35			11.99	
	40			12.06	
	50			12.17	
	60			12.34	
	70			12.40	
	80			12.46	
	90			12.57	
	100			12.59	
	120			12.74	
	150			12.93	
	180			13.03	
	210			13.20	
	240			13.26	
	270			13.35	
	300			13.40	
	360			13.60	
	420			13.88	
5:00 P.M.	480	4269		14.09	159.58 26
	RECOVERY				0
	1			2.95	
	2			3.32	
	3			3.48	
	4			3.42	
	5			3.31	
	7			3.09	
	9			2.92	
	11			2.78	
	15			2.56	
	20			2.34	
	25			2.15	
	30			2.06	
	35			1.93	
	40			1.82	
	45			1.75	
	50			1.68	
	55			1.61	
	60			1.55	

AQUIFER TEST

NAME City of Scandia, Kansas DATE Sept. 13, 1995

LOCATION Well No. 9 WELL NO. 9 JOB NO. _____

Readings from 1.4 Ft. A.G.L.

TIME OF DAY	ELAPSED TIME IN MINUTES	METER TAPE READING	WATER LEVEL BELOW MS PT	DRAWDOWN IN FEET	PUMPING RATE OF TEST WELL
7:00 AM	S.W.L.	4841	30.77	0	
	1				
	2			13.60	187.71 GPM
	3			14.39	
	4			14.85	
	5			15.33	
	7			15.89	
	9			16.32	
	11			16.55	
	15			16.58	
	20			16.75	
	25			16.40	
	30			17.20	
	35			17.48	
	40			17.52	
	50			17.71	
	60			17.85	
	70			18.02	
	80			18.60	
	90			18.72	
	100			18.80	
	120			18.93	
	150			19.24	
	180			19.11	
	210			19.86	
	240			20.05	
	270			20.25	
	300			20.50	
	360			20.24	
	420			20.22	
3:00 P.M.	480	5742		20.26	
	RECOVERY			20.48	0
	1			7.23	0
	2			6.86	
	3			6.18	
	4			5.60	
	5			5.20	
	7			4.58	
	9			4.07	
	11			3.75	
	15			3.17	
	20			2.77	
	25			2.40	
	30			2.13	
	40			1.75	
	50			1.50	
4:00 P.M.	60			1.30	



Ground Water Associates, Inc.

Subject Scandia - Water levels in Well 8 Date 9 Oct 00

Gary Cline - Mayor

Jerry Swanson - Water Supt.

335-2421

Well 8 (N)

Well 9 (S)

8:00 am 31 Jul 2000
 11:52 "
 3:50 pm
 8:05 "
 12:01 am 1 Aug 2000
 8:00 "
 11:50 "
 3:50 pm

39.67'
 40.08'
 39.50'
 40.15'
 39.83'
 40.04'
 39.71'
 40.00'

On & off
 pumping
 throughout the
 time the corn
 plant well was
 test pumped