IOWA GEOLOGICAL SURVEY
In Cooperation with U. S. Geological Survey

W-0207

RECORD OF WELL

Location:

Town: Monona (N E S W); County Clayton E.

SE-NE-SE sec. 11 T. 95 N., R. 5 W. Monona Twp.

Well name and number Interstate Power Co. #1

Owner Interstate Power Co. Address

Tenant Address

Contractor F. M. Gray & Co. Address Milwaukee

Drillers

Drilling dates 1922 Repaired by Thorpe Dec '34 to Jan '35

Well data:

Elevations: Drilling curb 1216 feet; Land surface feet

Determined by

Topographic position Upland.

Total depth: Reported feet, Measured 814 feet

Drilling method

Hole and casing data 145' of 10" casing 0-145'; 630' of 8" casing 0-630.9'
(Give amount, size, kind, and depth of all casing; type and
6¼" sleeve from 589.4' to 630.9'
position of seals and packers; cementing; how finished--perforated pipe, screen,
gravel pack, open hole, etc.)

Original depth to water above ft. below Date

Original elevation of water level ft.; Source of data

Sources of water: Principal Jordan; Others St. Peter

Production data: Date 3/29/37

Static depth to water _____ Measuring point Curb

Pumping level _____ at 75 g.p.m.

_____ _____

_____ _____

_____ _____

Specific capacity _____ g.p.m. per ft. drawdown; Temperature 52 °F.

Pump data; Type pump Cylinder Column Dia. _____ Length _____

Cylinder or bowls: Dia. _____ Length _____ Suction pipe _____

Power Electric Airline _____

Estimated rate of production: _____ g.p.m. for _____ hrs. a day

Use of water Industry

WATER ANALYSES (in parts per million)

Date sampled	3/29/37			
Sampled by	A.C. Tester			
Total solids	252			
Insoluble matter	9.4			
Alkalinity (Meo)	210.0			
Alkalinity (Phn)	0.0			
pH	7.1			
Fe_2O_3+ Mn_2O_3+Al_2O_3	4.0			
Alkali as sodium	11.8			
Calcium	64.4			
Magnesium	19.4			
Iron (unfiltered)	0.4			
Manganese	0.04			
Nitrate	0.22			
Fluoride	Tr.			
Chloride	10.0			
Sulfate	39.7			
Bicarbonate	256.2			
Hardness (ppm)	241.0			
Hardness (gpg)	14.2			

Remarks _____

Laboratory data: Sample storage location _____

Sample range _____ No. spls. _____ No. dupls. & cond. _____

Spls. prepared by _____ Washed range _____ by _____

Driller's log and cond. _____

Insoluble residues: Prepared by _____ Studied by _____ Strip log _____

Microscopic study F.T. Thwaites strip log _____

Gen. log _____ Correl. by _____

WATER LEVEL DATA

Measuring point _____

Date	Depth to water	Altitude	Remarks

REMARKS

Chlorinated at the following depths from the surface 297'; 749'; 695'; 569'; 635'; 507'. in Dec. 1936.

MONONA

Final Analyses of Water Collected as Part of Pollution Study

Collected by W. O. George, Field Geologist

	1 No.97987	2 No.97988	3 No.87527	4 No.97920	5 No.97921	6 No.97938	7 No.97939
Total Solids	605.0	17680.0	290.0	1150.0	1320.0	980.0	970.0
Susp. Solids	155.0	17095.0	-----	40.0	150.0	-----	-----
Diss. Solids	450.0	585.0	290.0	1110.0	1170.0	980.0	970.0
Insol. Matter	3.6	11.6	10.8	22.8	22.6	21.2	36.4
pH	7.3	7.0	7.2	7.4	7.1	7.0	6.8
Alkalinity (MeO)	184.0	252.0	232.0	354.0	360.0	320.0	324.0
" (phn)	0.0	0.0	0.0	0.0	0.0	0.0	0.0
R_2O_3	2.0	5.8	2.0	3.6	4.2	4.0	6.8
N as NH_4	0.0	0.0	---	0.0	0.0	0.0	0.15
N as NO_2	0.003	0.04	Tr.	0.002	0.008	0.008	0.25
N as NO_3	0.0	0.2	0.0	25.0	33.0	27.0	23.0
Alkalies as Na	12.6	17.0	7.0	50.6	58.3	39.6	39.4
Ca	55.7	88.2	64.6	177.6	182.2	138.0	147.0
Mg	18.7	34.9	27.0	69.1	70.9	59.7	58.7
Fe (unfilt.)	30.0	200.0	----	15.0	8.0	----	----
Fe (filtered)	0.1	0.3	Tr.	0.0	0.0	0.3	1.3
Mn	0.0	0.2	Tr.	0.0	0.1	0.0	0.0
Al	0.9	2.7	1.0	1.9	2.1	1.9	2.6
F	0.0	0.0	0.0	0.0	0.0	0.0	0.5
Cl	17.0	23.0	6.0	100.5	101.0	73.0	71.0
SO_4	41.2	95.5	40.8	240.2	259.4	168.8	172.7
HCO_3	224.5	307.4	283.0	431.9	439.2	390.4	395.3
PO_4	0.0	0.0	0.16	0.005	0.005	0.02	0.15
BO_3	0.5	1.0	1.5	0.5	0.5	0.5	0.5
Calc. Hard.	216.0	365.0	273.0	727.0	747.0	591.0	611.0

1. Well No. 1, T.D. 814'. Sampled at 420'.
2. Well No. 1, T.D. 814'. Sampled at 805'.
3. Well No. 2, T.D. 850'. Sampled at pump, August 28, 1934.
4. Well A, T.D. 415'. Abandoned. Sampled at 163'.
5. Well A, T.D. 415'. Abandoned. Sampled at 412'.
6. Well D, T.D. 285'. Sampled at 161'.
7. Well D, T.D. 285'. Sampled at 284'.

"MONONA WELL No. 1"

In view of the fact that the past bacteriological analyses of Well No. 1 have been consistently bad, even after the recasing of this well in June 1935, we have introduced large quantities of calcium chloride at three different occasions, thereby attempting to thoroughly sterilize any contaminated areas or crevices in the well.

The first treatment of sterilizing the well was done on Friday, November 27th. Assisted by Mr. Wuerth and Mr. Welter, we mixed a solution of 25 lbs. of chlorinated lime (approximately 7½ lbs. of free chlorine) in 10 gallons of water and introduced it uniformly into the well at the top of the 6" drop pipe with a stream of water for twenty minutes. The water was supplied from a 2" pipe connected in the discharge line of the pump on Well No. 2. Water was introduced into the well at the rate of about 175 GPM for 10 minutes, when the well overflowed between the drop pipe and 8" casing. Water flow was then reduced to 80 GPM. The well was flushed with a stream of water of 80 GPM for 5 minutes each day until another treatment was given. The piston and rods were removed previous to the above treatment and were not replaced until the final treatment was completed.

The second treatment was given on Thursday, December 3rd. Water was introduced into the well at the top of the drop pipe while 25 pounds of calcium hypochloride, CCH (approximately 12½ pounds of free chlorine) was added uniformly in dry form for 30 minutes. The water flow into the well was regulated so as to keep the well full during this treatment and was estimated at about 80 GPM. After the first 30 minutes of the above treatment, additional water was run into the well at the same rate for 15 minutes. The well was again flushed with a stream of water of 175 GPM for 5 minutes each day until December 23rd. This was done with the thought that the additional flushing would force the chlorinated solution toward the bottom of the well.

The third treatment was given on Monday, December 28th, by lowering 1½" pipe to within one foot of the bottom of the well. A solution of 13 lbs. of calcium hypochloride CCH (55% available chlorine) in 10 gallons of water was introduced to the bottom of the well, through the 1½" pipe, with water flowing at the rate of 20 GPM for fifteen minutes. Then 48' of pipe were removed and another quantity of chlorine solution, same as above, was introduced into the well. Additional dosages of chlorine solution (13 lbs. calcium hypochloride and about 7 lbs. free chlorine) were introduced into the well after removing another 54 ft. of pipe, then 36 ft, and again after removing 18 ft. Then another dose of the same chlorine solution was introduced at the top of the 6" drop pipe which extends down into the well 507 ft. This solution was added gradually to a stream of water for a period of 15 minutes.

Additional water was run into the well for 20 minutes, regulating it at a rate of flow to keep the well full to the top during this period. By this method of chlorinating, a quantity of chlorine solution was released in the well at the following depths from the curb of the well--

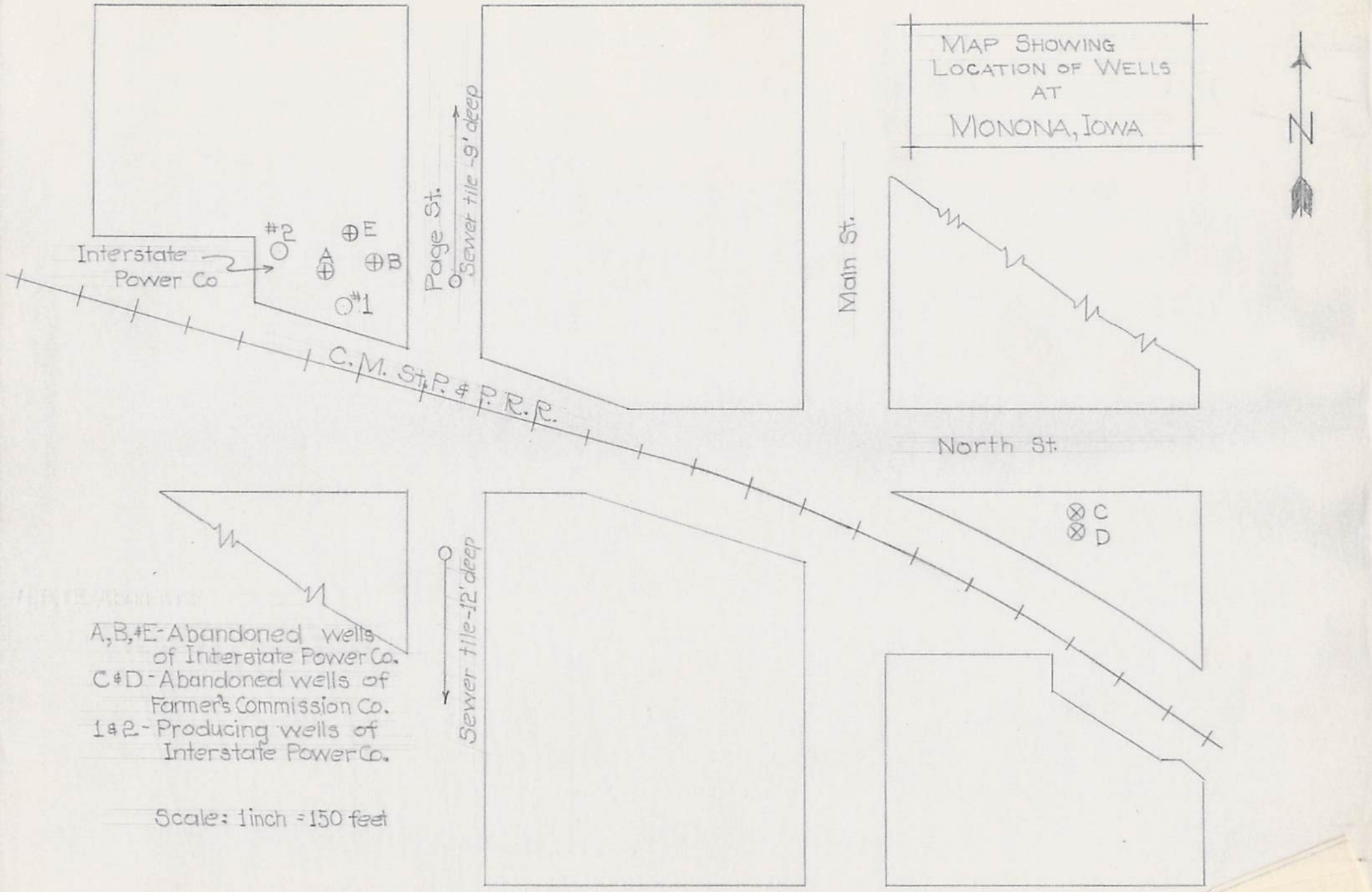
797 ft. ; 749 ft. ; 695 ft. ; 659 ft. ; 635 ft. ; 507 ft.

It is planned to replace the piston rods within the next few days and, before replacing the pumping head, to fill the 6" drop pipe with a chlorine solution made up of 15 lbs. of hypochloride, thereby thoroughly sterilizing the pump rods. The old leathers on the piston will be replaced with new ones. The water first pumped will be discharged to waste until the heavy chlorinated water has been removed, after which the water will be pumped into the railroad tank for about a week or ten days, and then samples will be taken for analyses.

Yours truly,

A J. Dupont

AJD:W
cc-Mr. Wisters
Dr. Tester
Mr. Wisco


MAP SHOWING
LOCATION OF WELLS
AT
MONONA, IOWA
N
Interstate
Power Co
#2
E
A
B
#1
Page St.
Sewer tile -9' deep
Main St.
C. M. St. P. & P. R. R.
North St.
C
D
Sewer tile-12' deep
A, B, & E - Abandoned wells
of Interstate Power Co.
C & D - Abandoned wells of
Farmer's Commission Co.
1 & 2 - Producing wells of
Interstate Power Co.
Scale: 1 inch = 150 feet

Iowa
Emergency Relief Administration
314 WEST EIGHTH STREET
TELEPHONE 4-6201
DES MOINES

Monona, Iowa, Aug 21, 1935

Memorandum to Dr. A. C. Tester
From W. O. George
Re Deep Well Exploration at Monona, Iowa.

The exploration was made at the request of the Interstate Power Company, who own the wells and pumping equipment which supply the City of Monona with water.

The purpose of the investigation was to determine, if possible, the source and method of exclusion of contamination which has been reported repeatedly in the No. 1 well.

Monona has 1,163 inhabitants . Aside from a monument works and a creamery , there are no industries.

The wells are located at the power plant of the Interstate Power Company on Page St. near the Milwaukee depot.

The following are considered possible sources of contamination:

1 Sewer tile. For disposing of sewage from toilets and other inside plumbing fixtures, the city uses ordinary drainage tile. No attempt has been made to seal the joints between each tile. The sewers are separate from storm drains.

The size of the tile is 6 or 8 inch depending on the slope and density of population. In the middle of the street in front of the power station where the wells are located, there is a six inch sewer buried at a depth of 9 feet. Since the power house is located on a divide between a north and south slopes, this sewer begins in front of the powerhouse and drains northward. Another sewer drains southward from a point in the middle of the street about 150 feet south of the railway tracks.

It can not be determined whether or not any sewage actually makes its way to the wells, but such a system is certainly hazardous to public health as there are undoubtedly many private , shallow wells within the corporate limits of the city.

The danger of contamination from these sewers depends a great deal upon the nature of the rock or soil in which the tile is buried. The log of No.1 well shows that the sur-

face rocks consist of glacial drift 46 feet thick. The exact nature of the drift was not determined but in general if is extremely variable in thickness and character. In places it is likely to be very sandy. In which case sewage could move very rapidly down to the underlying limestone, thence through crevices to any low point such as a well. Under these circumstances, contamination can travel long distances.

2 Well A (See sketch) is an abandoned well inside the power house located about midway between Well No. 1 and Well No. 2. The total depth of the well is 415 feet. The static level of the water is 161 feet. It was reported to be 410' deep and abandoned as a dry hole in 1920

A still test was made with the current meter and no movement of water could be detected. Samples of the water were obtained at 163feet and at 412 feet. ~~It is possible that there is more~~ A slight trickle of water could be heard in the well .

Until recently this well was buried under the concrete floor. The concrete floor was broken and the old rock walled pit about 12 feet deep was excavated. At the bottom of the pit 8-inch casing was found with a wooden plug in it. The casing was pretty well rotted out and the length of it is not known but usually in old wells of this depth, the casing extends down to solid rock. In this case it would be 46 feet. According to Mr. Welder , the local manager , the hole is reduced to 6-inch , at depth but the point where the hole is reduced is not known.

Before the well was examined , a joint of 8-inch pipe was placed over the hole and sealed with cement. The pit was then refilled, with the 8-inch rising about 3 feet above the level of the floor. This was done to prevent water in the pit from flowing into the well during the examination.

Since this well is 415 feet deep and the top of the St Peter sandstone is reported at 405 feet, it might easily facilitate the movement of contamination downward into the St. Peter and across into the other wells. This condition is especially favorable for contamination, since the static level of the water in the deep wells is about 415 feet.

The safest way to prevent this contamination is to fill the well with a mixture of neat cement and water , from top to bottom. However, where the well is cased , the cement might not be effective and the casing is probably too badly decomposed to be pulled. If the well were cemented from the bottom to 400 feet, leakage in the St. Peter could be prevented. The rest of the hole could be filled with sticky clay.

3
Well B This is also an abandoned well located inside the power house about 50 feet East of well A. It was originally drilled to a depth of 415 feet and later it was deepened to 465 feet. In 1932 it was abandoned. Advice was given by the health department in a letter from H. H. Black,Sanitary Engineer, Engr. Dept. Board of Health. "It is recommended to plug the well just above the water bearing stratum and fill with impervious material such as clay or concrete" The estimate called for 47 sacks of cement. Actually only three or four were used and the cement was mixed in the ratio of 5 to 1.

The well was not excavated for this investigation as the location is now the site of an auxillary pump.

The static level in this well is reported to have been about 200 feet. There is said to be 200 feet of 8-inch casing in the

hole and 6-inch hole from 200 feet to bottom. The capacity of the well was about 30 gp. At 40 gpm. the level of the water would fall nearly to the bottom of the well.

This well may still be considered a possible source of contamination as the cement used in cementing the hole is probably quite ineffective.

4 Well C

Well C is located in the NW. corner of a building used by The Farmers Commission Company on North Street about two blocks east of the power house. The well is cased with 6-inch tile at the surface and the total depth is 34 feet. The static level is 25 feet. These measurements were made with a steel tape. No samples were taken from this well. The chances of contaminating the power house wells at this source are remote.

5 Well D

This well is located in the back of the same building with Well. C. The total depth is 285 feet. The static level of the water is about 159 feet. As the elevation is about two feet lower than the floor of the power house, it appears that the static level is the same as in Well A and water in both wells probably rises from a common source.

Old rags are used to cover this well at the surface. When the rags are removed, two joints of 6-inch drain tile can be seen in the hole. Below this the hole is cased with iron or steel casing probably 5 inches in diameter. The length of the casing could not be determined. Considerable water can be heard falling into the well but not enough to be measured with the current meter. The volume probably does not exceed 3 gallons a minute which is quite enough to contaminate a large volume of water.

No movement of water was indicated by the current meter in any part of the hole. Samples were taken for chemical analysis at 161 feet and at 285 feet.. The sample from the bottom containes live vermin and feathers, probably from dead sparrows that have fallen or have been swept into the hole.

On account of the apparent relation between well A and Well D, Well D should be plugged.

6 Well E

Well E is located just outside and north of the power house. The The total depth of the well is 75 feet and the static level of the water is 25 feet. No samples were taken. It appears to have some 6-inch casing . There is a concrete pump platform and the casing is plugged with a short wooden plug. If the well is to be abandoned, it should be more permanently sealed although at present there is probably no contamination from this source.

Exploration of No. 1 Well

According to Vol. XXXIII of the I. G. S. this well was drilled in 1922 to a depth of 814 feet. The altitude above sea level is given as 1216 feet. Originally it was cased with 10-inch casing to a depth of 142 feet. There was also an 8-inch liner from 337 feet to 443 feet. In an effort to exclude contamination, the 8-inch liner was entirely removed and new wrought iron casing was placed in the well from the surface to a depth of 450 feet. A casing shoe was placed on the bottom of the casing and but no cement was used.

Steel Lev. 427' 6/7/36

As the odometer was broken during the exploration it was not possible to measure the static level of the water. Samples

were taken at the top of the water and at ~~the~~ a few feet above the bottom of the hole. The bottom of the hole contains a 6-inch brass cylinder 8 feet long which was dropped into the hole some time ago.

Still tests with the current meter were made at frequent intervals to the bottom of the hole. No movement could be observed.

The well is equipped with a double action cyllinder pump and 486 feet of drop pipe. The cyllinder and tail piece add ~~20~~ 22 feet making a total of 508 feet. The reported capacity of the pump is 90 gpm. The draw down has not been measured. An attempt was made to measure the draw down with the conductivity apparatus thruogh a small opening at the base of the pump but there was not enough clearance to allow the electrode to be lowered.

When the pump was reassembled , the electrode was placed in Well A and after pumping Well No 1 for an houst, no change was observed in the level of the water in Well A. At the same time a gauge was placed on the air line of well No. 2 and no change was indicated in this well. Then wells No 1 and No 2 were pumped for a half hour at the same time and no change was indicated in in well A. As the static level in well A is much higher than in the deeper wells no change was expected. If there were any direct connection between wells No.1 and No. 2 a slight lowering of the water level in No. 2 might be expected while pumping No 1.

No 2 well is reported as 850 feet deep, with 10-inch casing to a depth of 450 feet. No records in the local office could be found to confirm the length of the 10-inch casing.

A Layne- Bowler centrifugal pump raised the water at the rate of 300 gpm. The static level is 416 feet as measured with the

air line. The draw down was 69 feet after the 10 minutes when the level became stationary.

Recommendations

Corrective measures are suggested in the order of their importance.

1 Extend 8-inch casing in well No. 1 to a depth of 465 470' feet and cement casing at bottom. This will require under-reaming for a depth of 15 feet. Contamination may persist for a time while afterward but in time this should clear up.

2 Plug Well A. as indicated above.

3 Plug Well D in like manner.

4. Clean out and plug Well B. This would not be necessary except as a last resort.

W. O. George
Monona , Iowa, Aug 21, 1935

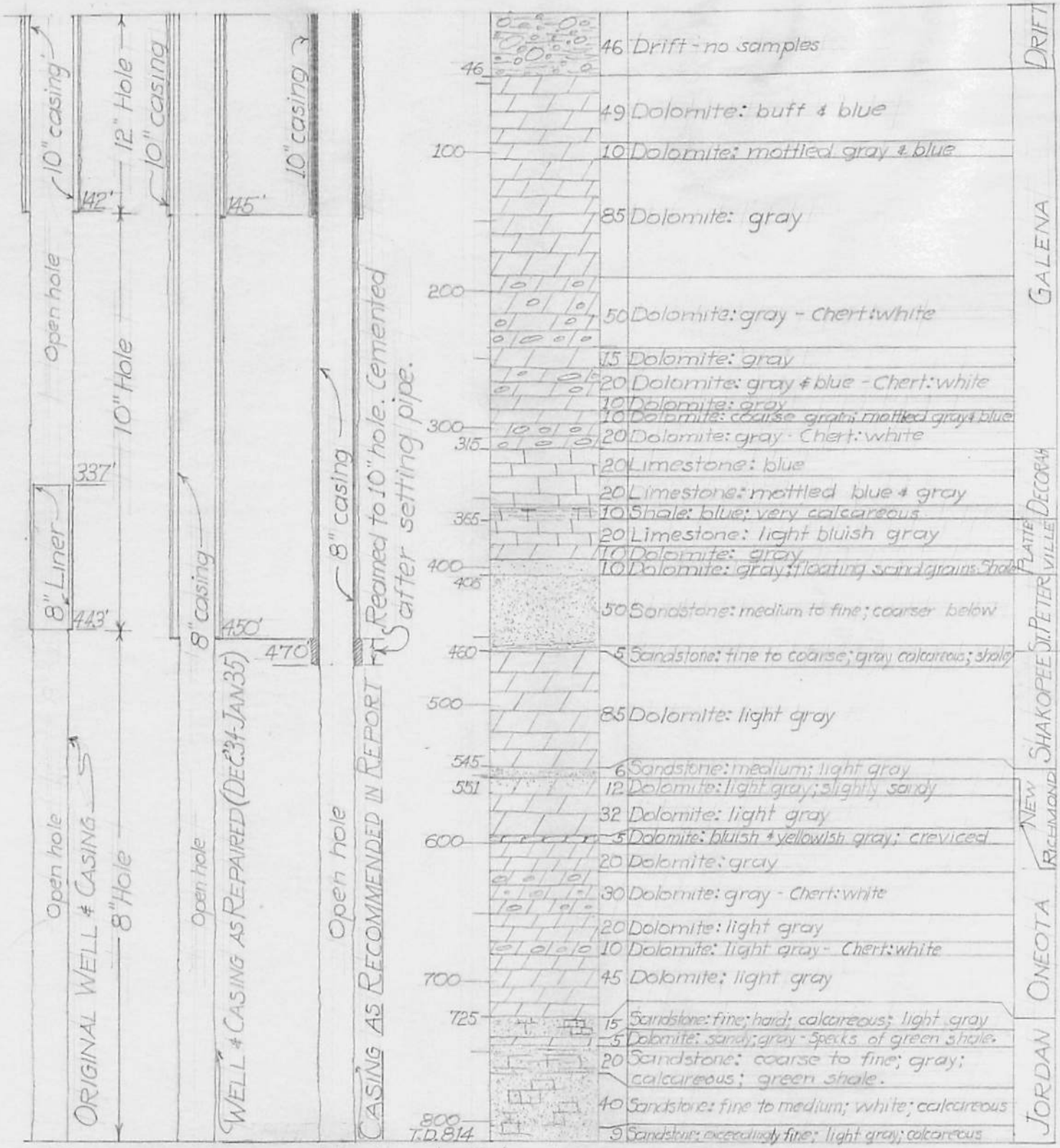
MONONA WELL NO. 1

INTERSTATE POWER COMPANY

Drilled by F.M. Gray Co.
Milwaukee, Wis. - 1922

Log published Vol. XXXIII

Samples examined by F.T. Thwaites



See report on exploration to determine source of contamination.

Supervision by A.C. Tester
Assistant State Geologist
Iowa Geological Survey

Field Work by
W.O. George, Field Geologist
I.E.R.A. 1935

MONONA WELL NO 1

INTERSTATE POWER COMPANY.

DRILLED 1922

SAMPLES EXAMINED BY - F.T. THWAITES. U.W. NOS. 70678 & 70763.

Formation	Thickness	Depth	Description
DRIFT	46'	0'-46'	Drift - no samples.
GALENA		46'-95'	Dolomite - buff and blue.
		95'-105'	Dolomite - mottled gray and blue.
		105'-190'	Dolomite - gray.
		190'-240'	Dolomite, gray - Chert, white.
		240'-255'	Dolomite, Gray.
		255'-275'	Dolomite, gray & blue - Chert, white.
		275'-285'	Dolomite, gray.
		285'-295'	Dolomite, course grain, Mottled gray & blue.
	269'	295'-315'	Dolomite, gray - Chert, white.
DECORAH		315'-335'	Limestone, blue.
		335'-355'	Limestone, mottled blue and gray.
	50'	355'-365'	Shale, blue, very Calcareous.
PLATTE		365'-385'	Limestone, light bluish gray.
		385'-395'	Dolomite, gray.
	40'	395'-405'	Dolomite, gray, floating sand grains - Shale
ST. PETER		405'-455'	Sandstone, medium to fine - courser below
	55'	455'-460'	Sandstone, fine to Course, Gray Calcareous - Shale
SHAKOPEE	85'	460'-545'	Dolomite, light gray.
NEW RICHMOND	6'	545'-551'	Sandstone, medium, light gray.
ONEOTA		551'-563'	Dolomite, light gray, slightly sandy.
		563'-595'	Dolomite, light gray.
		595'-600'	Dolomite, bluish & yellowish gray - creviced
		600'-620'	Dolomite, gray.
		620'-650'	Dolomite, gray - Chert, white
		650'-670'	Dolomite, light gray
		670'-680'	Dolomite, light gray - Chert, white.
		680'-725'	Dolomite, light gray.
MADISON		725'-740'	Sand stone, fine, hard, calcareous, Lt. Gray.
	194'	740'-745'	Dolomite, Sandy, gray - Specks of green shale
JORDAN	25'	745'-765'	Sandstone, course to fine, gray calcareous - Shale green.
	40'	765'-805'	Sand stone, fine to medium, White, calcareous
ST. LAWRENCE	9'	805'-814'	SS, exceedingly fine, Lt. Gray, very calcareous.

ORIGINAL WELL: 12" Hole to 142'; 10" Casing to 142'; 10" Hole; 8" Casing 337' to 443'; 8" Hole.

WELL AS REPAIRED: 10" Casing to 145'; 8" Casing to 450'.

JORDAN

Dec. [illegible]

Traced [illegible] 5-28-3[illegible]

WELL OF INTERSTATE POWER CO., MONONA, IA.

Drilled, 1922

Samples examined by F. T. Thwaites, U.W. Nos. 70678-70763

1" = 100'

DRIFT	46	0-46		Drift, no samples
GALENA	269	46-95		Dolomite, buff and blue
		95-105		Dolomite, mottled gray and blue
		105-190		Dolomite, gray
		190-240		Dolomite, gray; chert, white
		240-255		Dolomite, gray
		255-275		Dolomite, gray and blue; chert, white
		275-285		Dolomite, gray
		285-295		Dolomite, coarse grain, mottled gray and blue
		295-315		Dolomite, gray; chert, white
DECORAH	50	315-335		Limestone, blue
		335-355		Limestone, mottled blue and gray
		355-365		Shale, blue, very calcareous
PLATTEVILLE	40	365-385		Limestone light bluish gray
		385-395		Dolomite, gray
		395-405		Dolomite, gray, floating sand grains; shale, greenish blue
ST PETER	55	405-455		Sandstone, medium to fine, coarser below
		455-460		Sandstone, fine to coarse, gray, calcareous; shale, green
SHAKOPEE	85	460-545		Dolomite, light gray
NEW RICHMOND	6	545-551		Sandstone, medium, light gray
ONEOTA	194	551-565		Dolomite, gray, slightly sandy
		565-595		Dolomite, gray
		595-600		Dolomite, bluish & yellowish gray, crevited
		600-620		Dolomite, gray
		620-650		Dolomite, gray; chert, white
		650-670		Dolomite, light gray
		670-680		Dolomite, light gray; chert, white
		680-725		Dolomite, light gray
MADISON?		725-740		Sandstone, fine, hard, calcareous, light gray
		740-745		Dolomite, sandy, gray; specks of green shale
JORDAN	25	745-765		Sandstone, coarse to fine, gray, calcareous; shale, green
ST LAWRENCE	40	765-805		Sandstone, fine to medium, white, calcareous
	9	805-814		Ss. exceedingly fine, light gray, very calcareous

12" hole
10" pipe
142'
10" hole
443
8" hole

No. 1 Well
Monona, Iowa.

Interstate Power Company, Owner.

Drilled, 1922 Rebuilt as shown, 1936.

Samples Examined By - F.T. Thwaites.

University of Wisconsin Samples Nos. 70678 to 70763.

Curb 1216

Drift	46'	0' to 46'		Drift - No Samples.
Galena	269'	46' to 95'		Dolomite - Buff & Blue.
		95' to 105'		Dolomite - Mottled Gray & Blue.
		105' to 190'		Dolomite - Gray.
		190' to 240'		Dolomite, Gray - White Chert.
		240' to 255'		Dolomite, Gray.
		255' to 275'		Dolomite, Gray & Blue - White Chert.
		275' to 285'		Dolomite, Gray.
		285' to 295'		Dolomite, Course Grain - Mottled Gray & Blue.
		295' to 315'		Dolomite, Gray - White Chert.
Decorah	50'	315' to 335'		Limestone, Blue.
		335' to 355'		Limestone, Mottled Blue & Gray.
		355' to 365'		Shale, Blue - Very Calcareous.
Platteville	40'	365' to 385'		Limestone - Light Bluish Gray.
		385' to 395'		Dolomite, Gray.
		395' to 405'		Dolomite, Gray - Floating Sand Grains - Shale.
St. Peter	55'	405' to 455'		Sandstone, Medium to fine - Coarser Below.
		455' to 460'		Sandstone, Fine to Coarse, Gray, Calc., Shale
Shakopee	85'	460' to 545'		Dolomite - Light Gray.
New Richmond	6'	545' to 551'		Sandstone, Medium Light Gray.
		551' to 565'		Dolomite, Light Gray, Slightly Sandy.
Oneota		565' to 595'		Dolomite, Light Gray.
		595' to 600'		Dolomite, Bluish & Yellowish Gray, Creviced.
		600' to 620'		Dolomite, Gray.
		620' to 650'		Dolomite, Gray - White Chert.
Madison		650' to 670'		Dolomite, Light Gray.
		670' to 680'		Dolomite, Light Gray - White Chert.
		680' to 725'		Dolomite, Light Gray.
Jordan	194'	725' to 740'		Sandstone, Fine, Hard, Calcareous, Lt. Gray.
		740' to 745'		Dolomite, Sandy, Gray, Specks Green Shale.
	25'	745' to 765'		Sandstone, Course to fine, Gray, Calcareous, Green Shale.
St. Lawrence	40'	765' to 805'		Sandstone, fine to medium, White, Calcareous.
	9'	805' to 814'		Sandstone, Exceedingly Fine, Lt. Gray, Very Calcareous.