

IOWA GEOLOGICAL SURVEY
Iowa City, Iowa

Results of Pumping Test Following Acidizing
Tipton City Well No. 1
June 3-4, 1943

Location of well: NE $\frac{1}{4}$ SW $\frac{1}{4}$ NW $\frac{1}{4}$ NW $\frac{1}{4}$ sec. 6, T. 80 N., R. 2 W., Center Twp.
Ground elevation: 815
Total depth: 2696 $\frac{1}{2}$ feet, filled in to about 1300 feet (with some obstruction in the well at a depth of about 246 feet)
Date drilled: Prior to 1889 (recased in 1889)
Contractor: J. P. Miller
Casing: Reported to be 225 feet of 8-inch casing from 0-225 feet
Pump: Sterling turbine, with 10 H.P. General Electric motor
120 feet of 6-inch column
5 feet (9 stages) of 6-inch bowls
14 $\frac{1}{2}$ feet of 6-inch tailpipe with slotted end
All depths to water given in feet below pump base. Depths measured by airline, length of airline is 128 feet below pump base.
Productions measured with manometer tube in 5-inch discharge pipe with 2 $\frac{1}{2}$ -inch orifice.
Measurements before 7:00 p.m., June 4 made by M. V. Stephenson, public health engineer with the State Department of Health; after that time by Mr. Stephenson and K. E. Anderson of the State Geological Survey.

<u>Time</u>	<u>Air Gauge (in feet)</u>	<u>Depth to water (in feet)</u>	<u>Manometer (inches)</u>	<u>Production (g.p.m.)</u>	<u>Remarks</u>
June 3, 1943					
3:27 p.m.	71	57	0		Pump started.
3:28	19	109	30 $\frac{1}{2}$	126	Water muddy.
3:30	4	124	28 $\frac{1}{2}$	122	
3:32	2	126	26 $\frac{1}{2}$	118	
3:34	1	127	25 $\frac{1}{2}$	115	
3:36	0	128+	25	115	
3:38	0	128+	25	115	
3:40	0	128+	24	112	
3:42	0	128+	24	112	
4:00	0	128+	22 $\frac{1}{2}$	108	Water cloudy
4:15	0	128+	22 $\frac{1}{2}$	108	
4:30	0	128+	22	107	
4:45	0	128+	21 $\frac{1}{2}$	106	
5:00	0	128+	21	105	Water clear
6:00	0	128+	20 $\frac{1}{2}$	103	Pump running at 6:15 returned at 6:55 and pump idle--two fuses burned out in switch box. Pump started.
7:18					Pump started.
7:30	0	128+	22	107	
8:30	0	128+	20	102	
9:30	0	128+	20	102	
10:30	0	128+	20	102	
11:30	0	128+	19 $\frac{1}{2}$	101	

cc to Mr. Jack Sturdy, Tipton, June 8, 1943.

Mr. M. V. Stephenson, Manchester, June 8, 1943.

<u>Time</u>	<u>Air Gauge (in feet)</u>	<u>Depth to water (in feet)</u>	<u>Manometer (inches)</u>	<u>Production (g.p.m.)</u>	<u>Remarks</u>
June 4, 1943					
12:30 a.m.	0	128+	19 $\frac{1}{2}$	101	
1:30	0	128+	19 $\frac{1}{2}$	101	
1:35					Pump stopped.
1:36	19	109			
1:37	44	84			
1:38	50	78			
1:39	52	76			
1:40	54	74			
1:42	55	73			
1:45	58	70			
1:50	60	68			
1:55	61	67			
2:00	62	66			
2:05	63	65			
2:10	64	64			
2:15	65	63			
2:30	66	62			
10:15 a.m.	71	57			Pump started.
10:16	19	109	31 $\frac{1}{2}$	128	Water muddy.
10:17	9	119	30	125	
10:18	6	122	29	123	
10:19	4	124	28	121	
10:20	3	125	27	119	
10:21	3	125	27	119	
10:22	2	126	26	117	
10:23	2	126	26	117	
10:24	1	127	25 $\frac{1}{2}$	116	
10:25	1	127	25	115	Water cloudy.
10:30	0	128+	24	112	
10:35	0	128+	23 $\frac{1}{2}$	111	
10:40	0	128+	23	110	Water clear.
10:45	0	128+	22 $\frac{1}{2}$	109	
11:00	0	128+	22	107	
11:15	0	128+	21 $\frac{1}{2}$	106	
11:30	0	128+	21 $\frac{1}{2}$	106	
11:45	0	128+	21	105	
12:00 (noon)	0	128+	21	105	
1:00 p.m.	0	128+	20 $\frac{1}{2}$	103	
2:00	0	128+	20	102	
3:00	0	128+	20	102	
4:00	0	128+	20	102	
5:00	0	128+	19	100	
6:00	0	128+	19	100	
7:00	0	128+	19	100	pH = 6.8.
8:00	0	128+	19	100	
9:00	0	128+	19	100	pH = 6.8.
9:05	0	128+	19	100	Pump stopped to lower impellers.
9:06	46	82			
9:07	48	80			
9:08	50	78			

<u>Time</u>	<u>Air Gauge (in feet)</u>	<u>Depth to water (in feet)</u>	<u>Manometer (inches)</u>	<u>Production (g.p.m.)</u>	<u>Remarks</u>
June 4, 1943 (cont.)					
9:09 p.m.					Pump started.
9:10					Pump stopped.
					Bearing trouble.
9:25					Impellers raised.
					Pump started.
9:28	0	128+	22 $\frac{1}{2}$	108	
10:30	0	128+	20	102	
10:35					Pump stopped.
10:35:30	49	79			
10:36	47	81			
10:37	47	81			
10:39	50	78			
10:40	52	76			
10:42	54	74			
10:44	55	73			
10:47	58	70			
10:50	60	68			
10:55	61	67			
11:00	62	66			
11:05	62	66			
11:15	64	64			
11:45	66	62			Last measurement.

IOWA GEOLOGICAL SURVEY
Iowa City, Iowa

Acidizing of Tipton City Well No. 1, Tipton, Iowa

May 27-29, 1943

On Thursday morning, May 27, a program of acidizing of the city well No. 1 at Tipton, Iowa was started. The pump had been pulled the previous day and the well made ready for the acidizing.

Since the casing (8-inch) did not extend above floor level in the pump house, an extension was made which was sealed against the casing with a rubber gasket. As tight as possible a seal was secured, although some leakage did develop during subsequent treatment of the well.

The top of this extension had a welded cap to seal the well. A pressure gage was installed to be able to determine pressures at any time within the well. The drop pipe used for introducing the acid was one-inch black pipe, oiled on the inside to resist attack by the acid. An attachment was provided on the casing extension to allow connection of a fire hose so that the well could be backwashed and also so that a rough estimate of the results obtained by acidizing could be obtained after the introduction of each batch of acid.

The plan was to introduce hydrochloric (muriatic) acid through the drop pipe using a positive displacement pump. One hundred gallons were to be introduced at a depth of 301 feet below the pump base, another 100 gallons at a depth of 289 feet, and 200 gallons at a depth of 246 feet. After each batch of acid was introduced, and after allowing sufficient time for reaction, the well was to be tested by introducing water through the fire hose into the well and the amount of water taken by the well and the pressure in the well noted. A meter was provided in the fire hose line to check the quantity introduced. The pressure in the fire hose was maintained by the standpipe, and was about 50 pounds for each of the tests.

The work of acidizing was done by city employees, under the direction of Mr. Jack Sturdy, Water Superintendent, and Mr. Dewey E. Edwards, well driller from West Branch, Iowa.

The various stages of acidizing and testing were witnessed by either Mr. M. V. Stephenson, public health engineer with the State Department of Health, or Mr. K. E. Anderson, geologist with the State Geological Survey.

The results of the program are expressed in tabular form below:

<u>Date and Time</u>	<u>Depth to water</u> <u>(in feet)</u>	<u>Gallons per minute</u> <u>of water pumped</u>	<u>Remarks</u>
	<u>above or below</u> <u>pump base</u>	<u>into well (allowing</u> <u>for leakage)</u>	
May 25, 1943	56. below		Static level measured by water superintendent after pump had been removed and well had not been pumped for a period of 12 hours.

cc to Mr. Jack Sturdy, Tipton, June 8, 1943
Mr. M. V. Stephenson, Manchester, June 8, 1943

<u>Date and Time</u>	<u>Depth to water (in feet) above or below pump base</u>	<u>Gallons per minute of water pumped into well (allowing for leakage)</u>	<u>Remarks</u>
May 27, 1943			
11:00 a.m.	53.3 below		Static level before working on the well.
11:03 a.m.			Water started pumping into well. Meter reading of 257,986 cu. ft. Pressure in mains of 50 lbs.
11:12	66. above	210	
11:28	69. above	210	
11:30			Water stopped pumping. Meter reading 258,814 cu. ft.
11:33	? below		Water level dropping at rate of 6.7 ft. per min.
11:37	? below		Water level dropping at rate of 3.2 ft. per min.
11:40	? below		Water level dropping at rate of 1.7 ft. per min.
11:48	? below		Water level dropping at rate of 0.5 ft. per min.
1:00 p.m.	50.5 below		
1:45			Started pumping acid. Bottom of drop pipe at 301 ft. below pump base.
2:00			Finished pumping 100 gallons of acid (8 carboys)
3:00 to 4:00			No pressure indicated on pressure gage, but reaction audible in well according to water superintendent.
8:00			Water started pumping into well. Meter reading of 258,814 cu. ft. Pressure in mains of 50 lbs.
8:03	65. above	248	
8:05	70. above	236	
8:07	70. above	250	
8:10	71. above	246	
8:13	71. above	236	
8:15	72. above	242	
8:18	72. above	236	
8:20	72. above	240	
8:27	72. above	242	
9:00			Stopped pumping water. Meter reading of 259,741 cu. ft.
9:10			Started pumping acid. Bottom of drop pipe at 269 feet below pump base.
			Finished pumping 112.5 gallons of acid (9 carboys). Added 150 gallons of water on top of acid.

<u>Date and Time</u>	<u>Depth to water (in feet) above or below pump base</u>	<u>Gallons per minute of water pumped into well (allowing for leakage)</u>	<u>Remarks</u>
May 27, 1943 9:30 to --			Strong reaction audible in well. Pressure not indicated on gage, but gasket at top of casing was leaking under the pressure generated. Started pumping water. Meter reading of 259,761 cu. ft. Pressure in mains of 50 lbs.
1:10 p.m.			
1:16	65. above	262	
1:23	65. above	250	
1:26	65. above	251	
1:28	65. above	251	
1:31	65. above	247	
1:34	65. above	251	
1:36	65. above	252	
1:37			
3:35			Stopped pumping water. Meter reading of 260,724 cu. ft. Started pumping acid into well. Bottom of drop pipe at 241 feet.
3:50			Finished pumping 200 gallons of acid (16 carboys) Pressure in well of 10 lbs. per square inch.
4:05			Pressure in well lowered to zero.
5:00			
May 29, 1943 9:23 a.m.			
9:25	59. above	264	Started pumping water. Meter reading of 260,724 cu. ft. Pressure in mains of 50 lbs.
9:26	55. above	?	
9:29	54. above	?	Bad leakage developing
9:30	54. above	?	
9:34	54. above	?	
9:39			
10:04			Stopped pumping water to locate source of excessive leakage. Meter reading of 261,323 cu. ft.
10:05	44. above	?	Started pumping water. Meter reading of 261,323 cu. ft. Pressure in mains of 50 lbs.
10:07	49. above	?	Leakage still very bad.
10:09	50. above	?	
10:15	52. above	?	
10:20:30			Stopped pumping water. Meter reading of 261,972 cu. ft. Began pulling drop pipe from well.

In summary form, the following information was obtained on the approximate specific capacity of the well at each time it was tested by pumping water into the well:

Test No.	Static level (feet below pump base)	Pumping level (feet above pump base)	Total head (in feet)	Production (in gpm)	Spec. Capacity (g.p.m. per foot head)	Remarks
1.	55.*	69	125	210	1.65	Before acidizing.
2.	56.	72	128	242	1.89	After 100 gal. acid at 301°.
3.	56.	65	121	251	2.08	After 112½ gal. acid at 289°.
4.	56.	—**	—	—	—	After 200 gal. acid at 241°.

* As measured by water superintendent on May 25, 1943.

** Results not obtainable due to excessive leakage during the time water was being pumped into the well under pressure. See comments below.

These figures would indicate that an approximate increase in yield of 12.5 percent had been obtained with the first 100 gallons of acid, with an additional increase of about 11.5 percent after the second 100 gallons of acid. A bad leak developed near the top of the well casing in an old tee that had been cemented, but which broke loose during the acidizing and pressure of water. No idea of the improvement in production from the well due to the last, and largest, batch of acid is therefore obtainable at the present time.

Following the acid treatment, the pump will be put back into the well and a pumping test run to determine the actual improvement obtained by acidizing.

5/25/43

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

File No. { Washington
District
870 6-9333

Data from Edwards on Pumping test at Tipton

Time	Draw down	Water Level											
11:00	0		Pumping started										
:01	30'6"												
:02	36'												
:03	38'1/2'												
:04	40'												
:05	40'11"												
:10	43'3"		95 gpm.										
:30	44'7"												
:45	45'3"												
12:00	45'7"												
1:00	46'4 1/2"												
2:00	46'8 1/2"												
3:00	46'10 1/2"		Pumping stopped	88 1/2 gpm.									
:01	19'9 1/2"		Recovery from 46'10 1/2"										
:02	19'3"												
:03	17'3"												
:04	15'5 3/4"												
:05	13'11 1/2"												
:06	12'6 3/4"												
:07	11'5 1/2"												
:08	10'6 3/4"												
:09	9'9 3/4"												
:10	9'3 3/4"												
:15	6'1 1/2"												
:20	4'10 1/4"												
:25	4'0"												
:30	3'1 1/2"												
:35	2'5 1/2"												
:40	1'10"												
:45	1'4 3/4"												
:50	0'11 3/4"												
:55	0'8"												

this is 1200' well at Tipton

300' - 400'

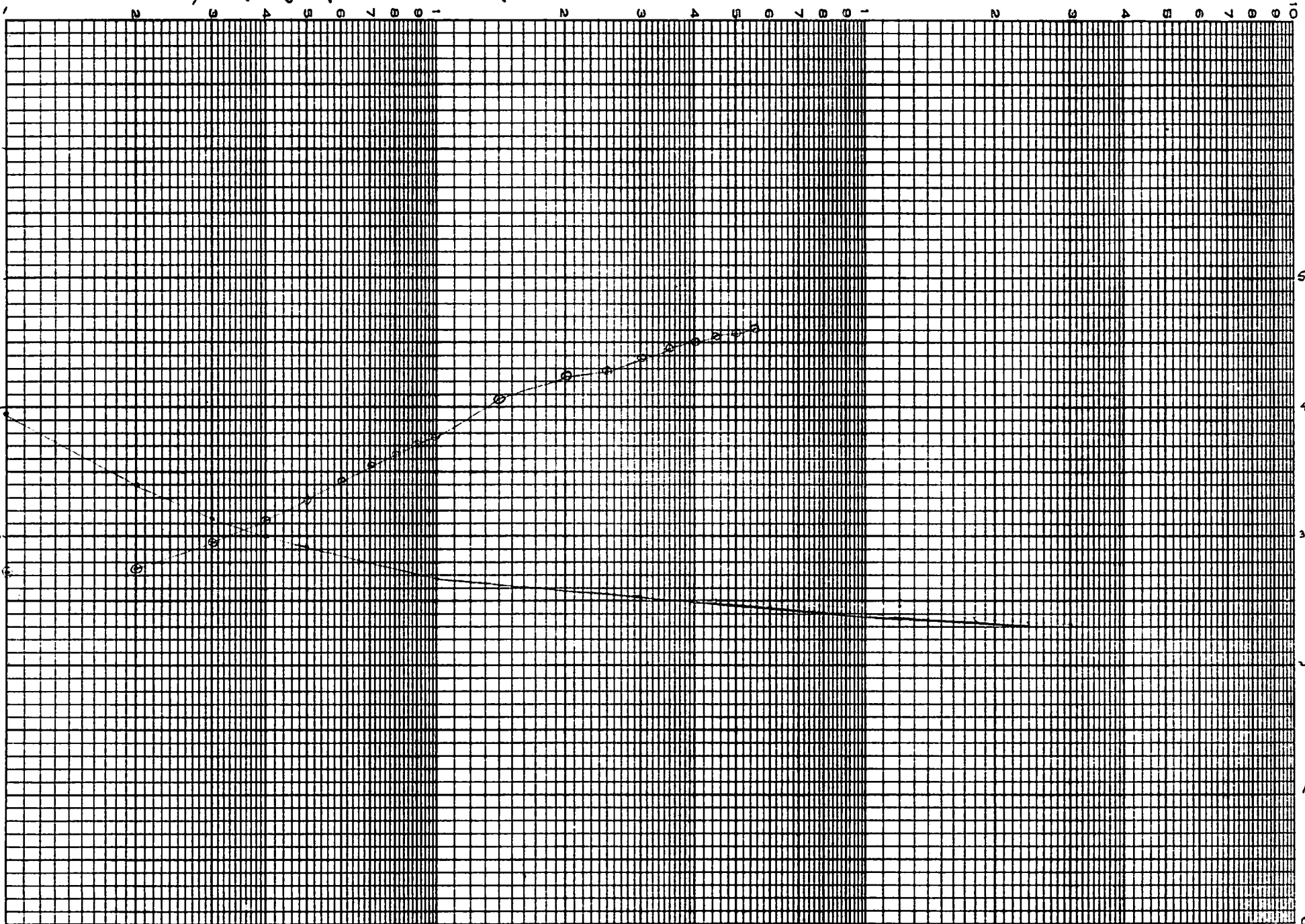
Static level is 65'8 1/2" below pump base
after shut down of 40 min.

MIN. after pumping started or stopped

Tipton well

draw down

Recovery



April 4, 1977

City of Tipton
Tipton, Iowa 52772

Attn: Pete K.

Pete:

The following discussion relates to our conversation concerning the abandonment of the deep Tipton City well.

Proper plugging of any well is fundamental to the preservation of ground water quality. The objective is to effectively isolate the major aquifers thus preventing mixing of different quality waters and loss of head. Plugging materials most commonly used are cement and drilling mud. The drilling mud is usually a mixture of commercially prepared bentonite and water, but an ordinary clay can be used in place of the bentonite. If clay is used it is a good practice to add chlorine to the mixture to kill any bacteria in the clay. The mud should be mixed to the consistency of a heavy slurry having a weight of about 14 lbs/gal. Standard procedure is to have a cement plug about 20 ft. long placed at the bottom and top of each hydrogeologic unit and to have the intervening space filled with drilling mud. The use of sand and gravel as a substitute for the drilling mud is strongly discouraged.

With the foregoing in mind I would recommend the following schedule:

<u>Depth (ft)</u>	<u>Materials</u>
2696 - 1710	mud
1710 - 1690	cement
1690 - 1080	mud
1080 - 1060	cement
1060 - 1040	mud
1040 - 1020	cement
1020 - 510	mud
510 - 490	cement
490 - 130	mud

cont'd.

City of Tipton

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April 4, 1977

Depth (ft)

Material

130 - 110

cement

110 - 20

mud

20 - 0

cement

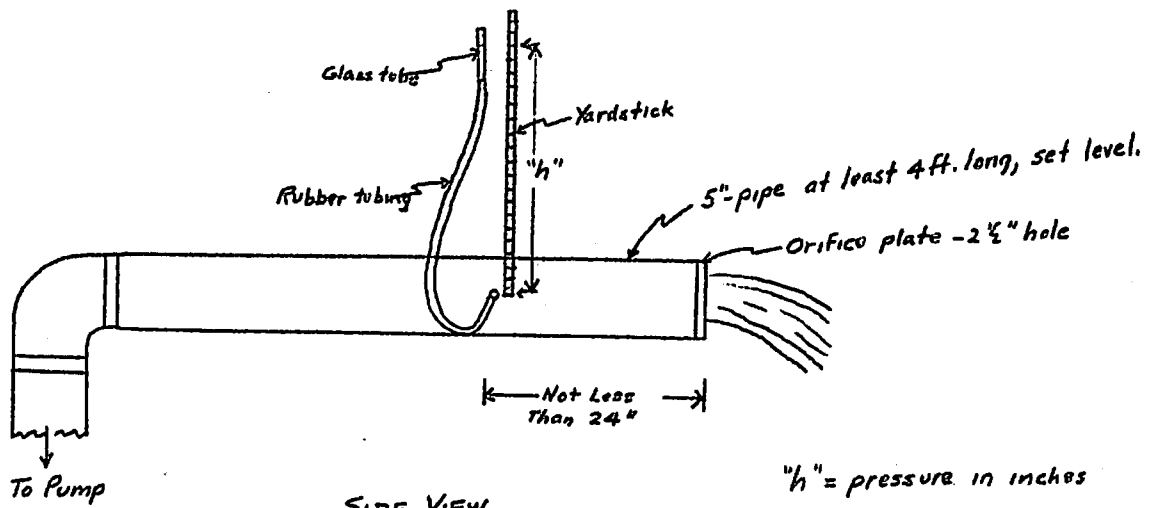
We would appreciate a copy of the final plugging record when completed.

If you should have any further questions feel free to contact me.

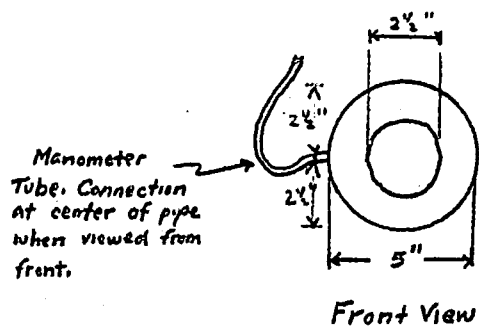
Very truly yours,

Jack L. Gilmore
Chief, Subsurface Geologist

JLG/bam



SIDE VIEW



Front View