

Results of Production Test and Chloride Studies
ON

City of Mt. Pleasant Well 4
Mt. Pleasant, Iowa
April, 1946

Well Name: City of Mt. Pleasant Well 4.
Location: NE $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 9, T. 71 N., R. 6 W. Center twp. Henry county.
Elevation: Drilling curb, top of 20-inch pipe, about 731.7 feet above sea level.
Owner: City of Mt. Pleasant.
Contractor: Thorpe Bros. Well Company, Des Moines, Iowa.
Engineers: Howard R. Green Engineering Company, Cedar Rapids, Iowa.
Drillers: Guy Elam, Ray McGraw and Pat West.
Drilling dates: Started, January 4, 1945. Finished drilling, March 15, 1946.
Depth: 2648 feet below top of 20-inch pipe. (By Cable measurement)

Casing and hole sizes:

About 50 feet of 32-inch curbing from 0 to 50 feet.	} Cemented in from bottom to top with neat cement.
About 68 feet of 34-inch curbing from 0 to 68 feet.	
623 feet of 20-inch pipe set in 29-inch hole from 0 to 623 feet.	
Open 19-inch hole from 623 to 2248 feet.	
190'2" of 16-inch liner set in 19-inch hole from 2248 to 2438 feet. (Shoe at bottom and top of liner.)	
178'11" of 12-inch liner set in 15-inch hole and into 16-inch liner from 2405 to 2584 feet. (Shoe at bottom and top of liner. Burlap wrapper near top and bottom of liner.)	
64 feet of open 12-inch hole from 2584 to 2648 feet.	

Test Pump: Turbine pump setting, 277 feet below top of 20-inch pipe with
22 feet of suction pipe. Pump powered by Dionel engine with belt drive.

Pump base: A special pump base was constructed for this test. The hole for
the pump head was offset to one side so that the pump would be near the
wall of the 20-inch pipe. Another hole was cut in the pump base to allow
a bailer to be lowered into the well at any time.

Bailer: The bailer used to collect water samples was 4-inches in diameter
and 29.8 feet long. Ball type valves were in place at the top and near
the bottom of the bailer. As the bailer was lowered in the water the
balls were raised off the seat which allowed passage of water through the
bailer. When coming up the hole the balls would seat and trap the water
in the bailer at the point where the bailer was stopped or surged. The bailer
was tied to the sand line of the drilling rig. The sample from the bailer was
collected through a tapped hole in wall of bailer about 3 feet from bottom of
bailer.

Water level measurements: The water level in Well 4 was referred to the rim of
the hole in the pump base through which the bailer was inserted at an elevation
of 2.25 feet above the top of the 20-inch pipe.
The water level in Well 2 was referred to the plate over the casing, 1.22
feet above the pump house floor and 1.7 feet below the measuring point for
Well 4.

Discharge measurements: The discharge from well 4 was measured with a rectangular
box type weir with baffle plates.

Temperature measurements: The temperature of the water from Well 4 was measured
at the end of 68 feet of 10-inch discharge pipe.

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Time	Discharge Well 4 (GPM)	Depth to Water (feet) Well 2 Well 4	Temp. of Water Well 4	Depth of Water Sample (feet)	Chlorides (Parts per Million)	Remarks
April 2						
11:45 am		152.74				Well 2 & 4 not pump- ing. Water level in Well 4 depressed because of muddy water in hole.
11:54		152.72				
12:00 n		134.17				
12:10 pm						Started pumping Well 2 by air lift.
12:11		161.25				
12:12		162.43				
1:23		167.8				Discharge rate at Well 2 estimated at 165 gal. per minute.
1:33			153.11			
1:39		167.99				
1:48		169.14				Water Sample from Well 2.
1:49						
1:50		149.40				
1:51		140.00				Stopped pumping Well 2. Recovery measurements.
1:52		137.50	152.04			
1:53		136.61				
1:54		136.58				
1:55		136.35				
1:56		136.34				
1:57		136.05				
1:58		135.90				
1:59		135.81				
2:00		135.77				
2:01		135.60				
2:02		135.52	152.95			
2:03		135.56				
2:04		135.38				
2:05		135.31				
2:06		135.24				
2:09			152.89			
2:14			152.85			
2:19			152.83			
2:54			152.64			
3:14		133.87				
4:51		133.69				
4:54			152.42			
1/7:37				1830	227	Water dirty.
1/7:54		133.74		2437	399	Water dirty.
1/8:08				2640	394	Water dirty.

1/ The water sample collected from the bailer to determine chlorides was apparently not representative of the water at the depth to which the bailer was lowered. The bailer was brought up the hole at the rate of 6 feet per sec. or faster. The sample was collected from the bailer after letting the water flow out the tapped hole for less than 30 seconds. Later tests showed that bringing the bailer up this fast caused a fluttering of the lower ball valve or both ball valves which permitted water to enter through the bottom of the bailer as it moved up the hole. Thus in the lower part of the bailer water was present which was picked up from a depth of 1800 feet to the water surface. Later by bringing

Time	Discharge Well 4 (GPM)	Depth to Water (feet) Well 2	Temp. of Water Well 4	Depth of Water Sample (feet) Well 4	Chlorides Water Sample (Parts per Million)	Remarks
up the bailer at a rate of 2 feet per second or less the fluttering was stopped and nearly representative samples were obtained.						
8:18 pm		152.33				
9:30						Started pumping Well 4.
9:34		159.97				Water dirty.
9:36	370	160.50				Water dirty.
9:40	382	161.61	55°F.			Water cloudy.
9:45		134.61			Discharge 339	
9:48		162.96				
9:50	370		61°F.			Water cloudy.
9:51		163.38	63°F.			Water very dirty.
9:53		134.73				
9:56		158.37				
10:03		153.60				Pumping level raised as muddy water was pumped out.
10:07	420					Water very dirty.
10:08		152.30			Discharge 139.6	
10:11		135.00				
10:16	435		154.02	65°		Water clearing some- what.
10:20		135.09				
10:23	435		155.20	69°		Water clearing some- what.
10:30					Discharge 1594	
10:31	435			70°		Water clearing slightly
10:34		155.64				
10:35		135.14				
10:38		154.73				Air temperature 55°F.
10:41	435			72°		Water dirty.
10:44		154.23				
1/11:00				2640	3670	
11:07			73°			
11:15	435		152.44	73.5°		Water dirty.
11:21		135.39				
11:29		135.42				
11:31	435		151.80	74°		Water clearing slightly
11:36				74°		Pumping rate increased.
11:40			159.45			
11:50				74°		
11:55	635					
12:00 m		136.02			Discharge 2765	
April 3						
12:21 am			158.98			
12:23	650			74°		
12:30		136.20				
12:38	650			74°		
1/12:40				2640	2280	

Time	Discharge	Depth to Water	Temp. of	Depth of	Chlorides	Remarks
	Well 4 (GPM)	(feet) Well 2 Well 4	Water Well 4	Water Sample (feet)	(Parts per Million)	
April 3						
1:00 am						
1:05		136.25		156.33		
1:20				154.57		
1:34		136.24				
1:50	677					
1:55					Discharge 1769	
2:09		136.23				
2:14				153.88		
2:29	680		73.5°			Water dirty.
1/2:32				2640	1572	Water dirty.
2:50	665		73.5°			
3:05					Discharge 1537	
3:07		136.25				
3:20				153.05		
3:21						Pumping rate increased.
3:23				156.63		
3:27	767		73.5°			
3:30				156.67		
3:55	767		73.5°		Discharge 1400	
4:05				156.70		
4:08				156.65		
4:13		136.55				
1/4:24				2580	1303	
4:41	767			156.20		
4:44						Pumping rate increased.
4:45				159.5		
4:49	870		73°			Water cloudy.
4:55				159.2		
5:00		136.86			Discharge 1240	
5:20		137.02				
5:25	870			158.6		
1/2:5:40				2640	1190	Sample from near bottom of bailer.
				2640	1695	Sample after flow of 3 min. out of bailer.
2/ The flow from the bailer through the tapped hole was negligible after 4 minutes.						
5:50					Discharge 1140	
6:00	860		157.60 73°			
6:03						Pumping stopped at Well 4.
6:04						Recovery measurements.
6:05				141.45		
6:06				141.11		
6:07				140.31		
6:08				139.83		
6:25				138.65		
6:30				138.72		
6:35				138.62		
6:45				138.48		
6:48		134.86				
6:50				138.44		
1/7:00				2580	1200	Water sample from near bottom of bailer.
				2580	2950	Water sample after flow of 3 min. from bailer.

Time	Discharge Well 4 (GPM)	Depth to Water (feet) Well 2 Well 4	Temp. of Water Well 4	Depth of Water Sample (feet)	Chlorides (Parts per Million)	Remarks
April 3						
7:19				138.40		Pumping started.
7:20				150.5		
7:21				151.15		
7:23				152.95		
7:25	845			153.25		Water dirty.
7:29				153.75		
7:33		135.80				
7:34	828			153.42	72°F.	Water dirty.
7:43	828			153.63		
7:50				153.63		
7:52		136.25				
7:53	828			153.40	73°F.	Water dirty.
8:16				153.13		
8:20		136.49				
8:32	828			153.07		Water cloudy (white)
8:49				152.83		
8:51		136.62				
9:08	828			152.88		Water cloudy (white)
9:24				152.91		
9:41	812			152.80		Water cloudy.
9:44		136.78				
10:09	828			152.79		Water cloudy.
10:37	828			152.78		
10:40		136.94				
10:55	828			152.75	73°F.	Water cloudy.
1/11:15					2600 840	Sample from near bottom of bailer.
					2600 855	Sample from near top of bailer.
1/11:40					2205 820	Sample from near bottom of bailer.
					2205 840	Sample from near top of bailer.
11:52				152.54		
12:05 pm					Discharge 777	
1:32	875			153.73	73°F.	Water cloudy.
1:37		137.18				
1/ 1:55					2600 731	Sample from near bottom of bailer.
					2600 1400	Sample from near top of bailer.
2:05					Discharge 702	
1/ 2:15					2200 703	Sample from near bottom of bailer.
					2200 930	Sample from near top of bailer.
2:27	875			153.52	73.5°F.	
3:20				153.99	73°	Water cloudy.
3:22		137.32				

Time	Discharge Well 4 (GPM)	Depth to Water Well 2	Water Well 4	Temp. of Water Well 4	Depth of Water Sample (feet)	Chlorides (Parts per Million)	Remarks
April 3							
3:28 pm	875				2600	687	Sample from near bottom of bailer.
<u>1</u> /3:45					2600	1112	Sample after flow of 3 min. from bailer.
3:52					Discharge 651		Pumping stopped.
4:27							
4:37			138.00				
4:42			137.50				
4:45			137.51				Steel tape reading.
4:52			137.30				
4:55		135.31					
5:02			137.14				
5:09			137.03				
5:18			136.96				
5:20		134.94					
6:48			136.59				
6:56		134.37					
7:05			136.55		2600	650	Sample from near top of bailer.
<u>1</u> /7:15							
7:30		134.20					Pumping resumed at Well 4.
7:32							
7:43			159.5				
7:49			160.29				
7:53		136.55					
7:55	1043		160.60	73°F.			Water very dirty.
8:02			160.47				
8:13		137.01					Water clearing.
8:34	1043		159.80	73°			
9:05		137.59					Water clearing.
9:13	1043		159.52	73°			
9:31			159.56		2600	574	Sample from near bottom of bailer.
<u>1</u> /9:40					2600	1068	Sample from near top of bailer.
9:55					Discharge 563		Water sample collected for complete analysis.
10:20		138.00					Water cloudy (white).
10:24	1043		159.58	73°			
11:25	1060		159.28				
11:31		138.25					
April 4							
12:20 am			159.5				
12:25	1043			73°			
12:27		138.35			2600	485	Sample from near bottom of bailer.
<u>1</u> /12:34					2600	1163	Sample from near top of bailer.
12:50					Discharge 469		Water cloudy (white).

Time	Discharge Well 4 (GPM)	Depth to Water Well 2	Temp. of Water Well 4	Depth of Water Sample (feet)	Chlorides (Parts per Million)	Remarks
April 4						
5:45	1060		159.5			
5:47		138.43				
1/5:50				2600	398	Sample after flow of 30 sec. from bailer.
				2600	423	Sample after flow of 1 min. 30 sec. from bailer.
				2600	860	Sample after flow of 2 min. 30 sec. from bailer.
5:50				Discharge 466		
6:07	1860		159.5			
6:08						Pumping stopped.
6:09			140.00			
6:10			139.10			
6:11			138.69			
6:13			138.67			
6:15		136.76				
6:17			138.20			
6:23			137.77			
6:29			137.52			
7:02			136.80			
1/7:10				2600	422	Sample after flow of 1 min. 30 sec. from bailer.
				2600	1260	Sample after flow of 2 min. 30 sec. from bailer.
7:25			136.75			
7:29		135.30				
7:47			136.30			
7:48			156.45			Pumping started.
7:51			157.30			
7:53			159.26			
7:58			161.24			
8:00		137.08				
8:03	1075		161.16	73°		Water dirty.
8:15			160.65			
8:39			158.8			
9:05			159.8			
9:18						Pumping stopped. Motor failed.
9:25						Pumping resumed.
9:30		138.01				
1/9:35				2600	392	Sample after flow of 30 sec. from bailer.
				2600	406	Sample after flow of 1 min. 30 sec. from bailer.
				2600	439	Sample after flow of 2 min. 30 sec. from bailer.
9:51			158.70			
10:10	1075		158.60	73°		Water cloudy.
1/10:30				2600	357	Sample after flow of 30 sec. from bailer.
				2600	731	Sample after flow of 1 min. 30 sec. from bailer.
				2600	2430	Sample after flow of 2 min. 30 sec. from bailer.

Time	Discharge Well 4 (GPM)	Depth to Water Well 2	Temp. of Water Well 4	Depth of Water Sample (feet)	Chlorides (Parts per Million)	Remarks
April 4						
10:30 am				Discharge 340		
1/10:50				2200	382	Sample after flow of 30 sec from bailer.
				2200	798	Sample after flow of 1 min. 30 sec. from bailer.
				2200	3210	Sample after flow of 2 min. 30 sec. from bailer.
1/11:10				2600	375	Sample after flow of 1 min. 30 sec. from bailer.
				2600	702	Sample after flow of 2 min. 30 sec. from bailer.
11:35	1060	159.0	73°F.			Water cloudy (white)
12:40 pm				Discharge 322		
1/12:45				2600	348	Sample after flow of 30 sec from bailer.
				2600	595	Sample after flow of 1 min. 30 sec. from bailer.
				2600	3040	Sample after flow of 2 min. 30 sec. from bailer.
1:05				Discharge 318		Water sample collected for complete mineral analysis.
1/1:15				2100	404	Sample after flow of 1 min. 30 sec. from bailer.
				2100	1621	Sample after flow of 2 min. 15 sec. from bailer.
1:26		159.10				Pumping stopped at Well 4.
1:28		159.80				Recovery measurements.
1:29		159.80				
1:32		158.37				
1:35		158.10				
1:39		137.82				
1:41		137.74				
1:43		136.86				
1:54		137.31				
2:20		136.92				
2:28		136.77				
2:42						Pumping resumed.
2:45	797					
2:50		149.0				
3:00	797	149.33	72°			Water almost clear.
3:12				Discharge 345		
3:15	797	150.3	72°			Water cloudy.
3:28	797	149.4	72.5°			Water clearing.
3:42	797	149.46		Discharge 368		
1/2/3:50				2620	981	Sample after flow of 1 min. 20 sec. from bailer.
				2620	3940	Sample after flow of 2 min. 15 sec. from bailer.

3/ The water from the bailer was more cloudy than that being discharged from the pump.

Time	Discharge Well 4 (GPM)	Depth to Water Well 2	Temp. of Water Well 4	Depth of Water Sample (feet)	Chlorides (Parts per Million)	Remarks
April 4						
4:03 PM	797	149.70	72 $\frac{1}{2}$ °F.			
4:18				Discharge 317		
4:31	797	150.20	72 $\frac{1}{2}$ °			Water almost clear.
4:45				Discharge 304		
1/4:45				2620	397	Sample after flow of 1 min. 20 sec. from bailer.
				2620	1670	Sample after flow of 2 min. 15 sec. from bailer. Pumping rate reduced.
5:00						
5:07	490	143.63				
5:46	490	142.25		Discharge 334		
6:30	490	142.35	72 $\frac{1}{2}$ °	Discharge 332		Water clear.
1/6:45				2620	1363	Sample after flow of 1 min. 20 sec. from bailer.
				2620	4230	Sample after flow of 2 min. 15 sec. from bailer.
1/7:00				1800	338	Sample after flow of 1 min. 20 sec. from bailer.
				1800	348	Sample after flow of 2 min. 15 sec. from bailer.
7:10				Discharge 336		
7:29	505	142.40	72 $\frac{1}{2}$ °			Water almost clear. Air Temperature 47° F.
7:45				Discharge 325		
1/7:45				2620 488		Sample after flow of 1 min. 20 sec. from bailer.
				2620	2750	Sample after flow of 2 min. 15 sec. from bailer.
1/8:00				2100	1161	Sample after flow of 1 min. 20 sec. from bailer.
				2100	1452	Sample after flow of 2 min. 15 sec. from bailer.
1/4/10:00				2620	365	Sample after flow of 1 min. 20 sec. from bailer.
				2620	867	Sample after flow of 2 min. 15 sec. from bailer.
4/ Upper ball was tied to top of guide so that upper hole was open as the bailer was brought out of well. This apparently gave less reliable samples than that using both ball valves.						
10:20	1075					Pumping rate increased.
10:25	1075		72 $\frac{1}{2}$ ° F			
10:30		160.0				
10:40	1075	153.0				
10:50				Discharge 304		
1/5/11:55				2620	269	Sample after flow of 30 sec from bailer.
				2620	292	Sample after flow of 1 min. 15 sec. from bailer.
				2620	333	Sample after flow of 2 min. from bailer.

5/ In addition to tying the upper ball to top of guide, the bailer was surged for 15 min. before bringing bailer up the well.

Time	Discharge Well 4 (GPM)	Depth to Water Well 2	Temp. of Water Well 4	Depth of Water Sample (feet)	Chlorides (Parts per Million)	Remarks
April 4 12:00 M				Discharge 271		
April 5 7:40 am	1090	158.6	72.8°	2620	269	Water cloudy. Sample after flow of 30 sec from bailer.
1/5/7:50				2620	292	Sample after flow of 1 min. 15 sec. from bailer.
				2620	351	Sample after flow of 2 min. 15 sec. from bailer.
8:15 1/6/8:40				Discharge 252		
				2620	257	Sample after flow of 30 sec from bailer.
				2620	286	Sample after flow of 1 min. 15 sec. from bailer.
				2620	1261	Sample after flow of 2 min. 15 sec. from bailer.
6/ Bailer not surged, both ball valves in operation.						
1/7/9:20				2620	259	Sample after flow of 30 sec from bailer.
				2620	285	Sample after flow of 1 min. 15 sec. from bailer.
				2620	695	Sample after flow of 2 min. 15 sec. from bailer.
7/ Bailer surged 30 times using 20 foot strokes. Both ball valves in operation.						
1/8/10:35				2620	263	Sample after flow of 30 sec from bailer.
				2620	293	Sample after flow of 1 min. 15 sec. from bailer.
				2620	1039	Sample after flow of 2 min. 15 sec. from bailer.
8/ Bailer surged for 1 hour. Both ball valves in operation.						
1/9/11:15				1830	235	Sample after flow of 30 sec from bailer.
				1830	233	Sample after flow of 2 min. 15 sec. from bailer.
9/ Bailer was not surged. Both ball valves in operation.						
11:45 1/9/12:30 pm				Discharge 232		
				1900	227	Sample after flow of 30 sec from bailer.
				1900	378	Sample after flow of 2 min. 15 sec. from bailer.
1:03				200	236	Sample after flow of 2 min. 15 sec. from bailer.
3:00 1/9/ 3:45				Discharge 217		
				2000	236	Sample after flow of 30 sec from bailer.
				2000	490	Sample after flow of 2 min. 15 sec. from bailer.

Time	Discharge Well 4 (GPM)	Depth to Water Well 2	Temp. of Water Well 4	Depth of Water Sample (feet)	Chlorides (Parts per Million)	Remarks
April 5						
<u>1/2/4:00 pm</u>				2100	236	Sample after flow of 30 sec from bailer.
				2100	1045	Sample after flow of 2 min. 15 sec. from bailer.
<u>1/2/4:30</u>				2200	236	Sample after flow of 30 sec from bailer.
				2200	243	Sample after flow of 1 min. 15 sec. from bailer.
				2200	413	Sample after flow of 2 min. 15 sec.
<u>1/2/4:45</u>				2300	349	Sample after flow of 30 sec from bailer.
				2300	634	Sample after flow of 2 min. 15 sec. from bailer.
5:00				Discharge 225		
<u>1/2/6:15</u>				2400	211	Sample after flow of 30 sec from bailer.
				2400	213	Sample after flow of 2 min. 15 sec. from bailer.
6:30				Discharge 211		
<u>10/7:00</u>				2500	1927	Sample after flow of 30 sec from bailer.
				2500	5140	Sample after flow of 1 min. 15 sec. from bailer.
				2500	6120	Sample after flow of 2 min. 15 sec. from bailer.
<u>10/ Bailer was brought up the hole at the rate of 2 feet per second. After 7:00 pm April 5, bailer samples were collected by bringing the bailer up the hole at the rate of 2 feet per second or less. The samples collected from near the top of the bailer are probably nearly representative of the water at the depth to which the bailer was lowered.</u>						
<u>11/7:40</u>				2620	4115	Sample after flow of 30 sec from bailer.
				2620	5530	Sample after flow of 1 min. 15 sec. from bailer.
				2620	5940	Sample after flow of 2 min. 15 sec. from bailer.
<u>11/ Bailer was not surged.</u>						
<u>12/8:20</u>				2620	4900	Sample after flow of 30 sec. from bailer.
				2620	6000	Sample after flow of 1 min. 15 sec. from bailer.
				2620	6275	Sample after flow of 2 min. 15 sec. from bailer.
<u>12/ Bailer was surged. Samples collected after this date were obtained by surging the bailer. The high chloride water appeared to have high iron content.</u>						
8:45				Discharge 210		
April 6						
7:15 am	1078		158.05	72.5		Water cloudy.
7:27		139.2				
7:30				Discharge 192		

Time	Discharge Depth to Water		Temp. of Depth of		Chlorides (Parts per Million)	Remarks
	Well 4 (GPM)	Well 2 Well 4	Water	Water Sample (feet)		
April 6						
7:40 am				1830	209	Sample after flow of 30 sec. from bailer.
				1830	218	Sample after flow of 1 min. 15 sec. from bailer.
				1830	210	Sample after flow of 2 min. 15 sec. from bailer.
8:10				1900	970	Sample after flow of 30 sec from bailer.
				1900	1280	Sample after flow of 1 min. 15 sec. from bailer.
				1900	1237	Sample after flow of 2 min. 15 sec.
8:35				2000	4218	Sample after flow of 30 sec. from bailer.
				2000	5680	Sample after flow of 1 min. 15 sec. from bailer.
				2000	5975	Sample after flow of 2 min. 15 sec. from bailer.
9:10				2100	4805	Sample after flow of 30 sec. from bailer.
				2100	5740	Sample after flow of 1 min. 15 sec. from bailer.
				2100	6030	Sample after flow of 2 min. 15 sec. from bailer.
10:08				2200	5250	Sample after flow of 30 sec from bailer.
				2200	6175	Sample after flow of 1 min. 15 sec. from bailer.
				2200	6210	Sample after flow of 2 min. 15 sec. from bailer.
10:15				Discharge 186		Water almost clear.
10:40				2300	4010	Sample after flow of 30 sec. from bailer.
				2300	5855	Sample after flow of 1 min. 15 sec. from bailer.
				2300	6170	Sample after flow of 2 min. 15 sec. from bailer.
11:20				2400	5355	Sample after flow of 30 sec from bailer.
				2400	6265	Sample after flow of 1 min. 15 sec. from bailer.
				2400	6320	Sample after flow of 2 min. 15 sec. from bailer.
1:30 pm				2500	4040	Sample after flow of 30 sec. from bailer.
				2500	5910	Sample after flow of 1 min. 15 sec. from bailer.
				2500	6260	Sample after flow of 2 min. 15 sec. from bailer.

Time	Discharge Well 4 (GPM)	Depth to Water Well 2	Temp. of Water Well 4	Depth of Water Sample (feet)	Chlorides Sample (Parts per Million)	Remarks
April 6						
2:00				2620	4680	Sample after flow of 30 sec. from bailer.
				2620	5880	Sample after flow 1 min. 15 sec. from bailer.
				2620	6270	Sample after flow of 2 min. 15 sec. from bailer.
10/2:45				2645	6050	Sample after flow of 1 min. 15 sec. from bailer.
				2645	6230	Sample after flow of 2 min. 15 sec. from bailer.
13/	Sample some what cloudy. Some fine sand in bottom of bailer.					
4:00 pm	Attempted to lower bottle filled with fluorescein dye to bottom of well but bottle broke at base of pump.					
5:40	1075	1584	72.0° F.	Discharge		Water sample collected for complete mineral analysis.
5:48						Pumping stopped at Well 4
5:53		138.60				Recovery measurements.
5:55		138.41				
5:56		138.30				
5:59		138.11				
6:04		137.91				
6:12		137.88				
6:25	1075					Pumping resumed at Well 4.
7:00	Attempted to lower bottle filled with fluorescein dye to bottom of well. Bottle placed inside 15 foot length of 4-inch pipe. Bottle broke before reaching bottom.					
8:30						Pumping stopped at Well 4.
April 8						
8:27 am		135.51				Well 4 not pumping.
8:45				570	179	Sample after flow of 30 sec. from bailer.
				570	176	Sample after flow of 1 min. 30 sec. from bailer.
9:10				1830	167	Sample after flow of 1 min. from bailer.
				1830	141	Sample after flow of 2 min. from bailer.
9:40				1900	3522	Sample after flow of 45 sec. from bailer.
				1900	4930	Sample after flow of 2 min. from bailer.
10:10				2000	3002	Sample after flow of 30 sec. from bailer.
				2000	4875	Sample after flow of 1 min. 15 sec. from bailer.
				2000	5720	Sample after flow of 2 min. 15 sec. from bailer.
10:55				2100	2635	Sample after flow of 30 sec. from bailer.
				2100	4980	Sample after flow 1 min. 15 sec. from bailer.
				2100	5915	Sample after flow of 2 min. 15 sec. from bailer.

Time	Discharge Well 4 (GPM)	Depth to Water Well 2	Temp. of Water Well 4	Depth of Water Sample (feet)	Chlorides (Parts per Million)	Remarks
April 8						
11:40				2300	3160	Sample after flow of 30 sec. from bailer.
				2300	4545	Sample after flow of 1 min. 15 sec. from bailer.
				2300	6050	Sample after flow of 2 min. 15 sec. from bailer.
12:25 pm				2620	3860	Sample after flow of 30 sec. from bailer.
				2620	5490	Sample after flow of 1 min. 15 sec. from bailer.
				2620	5950	Sample after flow of 2 min. 15 sec. from bailer.
1:30				850	195	Sample after flow of 2 min. 15 sec. from bailer.

5:00 pm A special tube with attachments was prepared for lowering a can filled with fluorescein dye to bottom of well and opening it at the bottom. This was done by inserting the can near bottom of tubing and placing a plunger in a guide at the bottom of bailer. As the tube hit the bottom of the well, the plunger was forced up through the can. The tube was then surged to flush out dye in can. The tube was left near the bottom of the well for a few hours.

5:03						Pumping started at Well 4.
5:05	1075					
5:08				Discharge 192		
5:15						No trace of dye.
5:45				Discharge 616		Water cloudy, some sand.
6:00				Discharge 495		" " " "
6:25				Discharge 433		Water slightly cloudy.
7:20				Discharge 334		Trace of sand.
8:00				Discharge 307		Water clear.
9:00				Discharge 277		
10:00				Discharge 256		Raised tubing. Dye had been flushed from can.
10:25						No trace of dye in discharge.
April 9						
3:15 am						No trace of dye in discharge.
3:25						Faint show of dye in discharge. (Green)
3:30				Discharge 212		
3:45						Good show of dye in discharge. (Green)
4:00						Strong show of dye in discharge. (Green)
4:30						Strong show of dye in discharge (Green)
6:25				Discharge 205		Strong show of dye in discharge. (Green)
7:15						Faint show of dye in discharge.
7:30				Discharge 199		
8:20				1900		Water has fair color but not as strong as that in discharge at 4:00 am

April, 1946

Time	Discharge Well 4 (GPM)	Depth to Water Well 2	Temp. of Water Well 4	Depth of Water Sample (feet)	Chlorides (Parts per Million)	Remarks
April 9						
14/8:50 am				2300	5600	Sample after flow of 1 min 15 sec. from bailer.
				2300	6090	Sample after flow of 2 min 15 sec. from bailer.
14/	Water has faint green tint but not as strong as water from depth of 1900 feet.					
15/9:30				2620	6220	Sample after flow of 1 min 15 sec. from bailer.
				2620	6220	Sample after flow of 2 min 15 sec. from bailer.
15/	No trace of dye in water sample.					
16/10:30				2648	6390	Sample after flow of 50 sec. from bailer.
16/	No trace of dye in bailer sample. 7 feet of sand and cuttings in bottom of bailer.					
10:40				Discharge 188		
1:05 pm				Discharge 188		
1:35	1075	1564				Pumping stopped at Well 4. Recovery measurements.
1:42		138.22				
1:46		137.93				
2:03		137.33				
2:50		136.80				
April 10						
3:30 pm	Lowered tubing with can of fluorescein dye to bottom of well and broke can at bottom. After surging the tubing for some time the tubing was removed from the well.					
	The ball type bailer was then lowered to 2500 feet and a sample was collected at that depth. The color of the sample was pale green and the sample was saved for comparison. A sample was also collected from a depth of 2600 feet. This sample was a vivid green.					
	No pumping was to be done. Samples were to be collected the following day to determine the direction of movement of the lower water.					
April 11						
3:20 pm		136.11				
3:25				850		No trace of dye in sample.
3:40				1830		No trace of dye in sample.
4:00				1900		Faint green show. Water salty.
4:30				2000		Faint green show. Water salty.
4:50				2100		Faint green show. Water salty.
5:30				2200		Faint green show. Water salty.
7:00				2300		No trace of dye in sample. Water salty.
7:30				2400		No trace of dye in sample. Water salty.
8:30				2500		No trace of dye in sample. Water salty.

Time	Discharge Depth to Water		Temp. of Depth of		Chlorides	Remarks
	Well 4 (GPM)	Well 2	Well 4	Well 4 (feet)	Water Sample (Parts per Million)	
April 11						
11:45 pm	Lowered can with potassium permanganate to bottom of well and punctured can. Withdrew tubing after surging for some time. A bailer sample collected from a depth of 2400 feet showed only a faint trace of color. A reaction took place between the potassium permanganate and the iron in the lower water so that in looking for traces of the water effected by the solution, a brown to purple colored water was to be expected.					
April 12						
8:10 am		135.87				Well 4 not pumping.
9:00				1900		Water had very faint green tint.
9:30				2000		Water clear, salty taste.
10:00				2100		Water colored dark brown.
10:30				2200		Salty taste.
11:00				2300		Water colored pale brown, salty taste.
11:30				2400		Water colored pale brown, salty taste.
12:45		134.21				
1:00 pm				2500		Water very pale brown, salty taste.
1:40				2600		Water very pale brown, salty taste.

STATE OF IOWA
IOWA GEOLOGICAL SURVEY
GEOLOGY ANNEX

IOWA CITY
Results of Production Test and Chloride Studies
on City of Mt. Pleasant Well 4
Mt. Pleasant, Iowa
April, 1946

Well Name: City of Mt. Pleasant Well 4.

Location: NE $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 9, T. 71 N., R. 6 W. Center Twp. Henry County.

Elevation: Drilling curb, top of 20-inch pipe, about 731.7 feet above sea level.

Owner: City of Mt. Pleasant.

Contractor: Thorpe Bros. Well Company, Des Moines, Iowa.

Engineers: Howard R. Green Engineering Company, Cedar Rapids, Iowa.

Drillers: Guy Elam, Ray McGrew and Pat West.

Drilling dates: Started January 4, 1945. Finished drilling, March 15, 1946.

Depth: 2648 feet below top of 20-inch pipe. (By Cable measurement)

Casing and hole sizes:

About 50 feet of 38-inch curbing from 0 to 50 feet.) Cemented in
About 68 feet of 34-inch curbing from 0 to 68 feet.) from bottom to
623 feet of 20-inch pipe set in 29-inch hole from 0 to 623 feet.) top with neat cement.
Open 19-inch hole from 623 to 2248 feet.
190'2" of 16-inch liner set in 19-inch hole from 2248 to 2438 feet.
(Shoe at bottom and top of liner.)
178'11" of 12-inch liner set in 15-inch hole and into 16-inch liner from
2435 to 2584 feet. (Shoe at bottom and top of liner. Burlap wrapper near
top and bottom of liner.)
64 feet of open 12-inch hole from 2584 to 2648 feet.

Plugging data: The well was plugged back from 2648 to 2602 feet with cuttings that had been taken from the well. A cement plug was constructed with 23 sacks of cement which extended from 2602 to 2572 feet (into the 12-inch liner).

A bridge was constructed at a depth of 2045 feet and the well was filled with crushed rock and cement up to 2030 feet. A cement plug extending from 2030 to 1980 feet was poured using 106 sacks of cement. The top of the plug appeared to be solid when struck with the bailer.

Test Pump: Turbine pump setting, 177 feet below top of 20-inch pipe with 22 feet of suction pipe. Pump powered by Diesel engine with belt drive.

Pump base: A special pump base was constructed for this test. The hole for the pump head was offset to one side so that the pump would be near the wall of the 20-inch pipe. Another hole was cut in the pump base to allow a bailer to be lowered into the well at any time.

Bailer: The bailer used to collect water samples was 4-inches in diameter and 29.8 feet long. Ball type valves were in place at the top and near the bottom of the bailer. As the bailer was lowered in the water the balls were raised off the seat which allowed passage of water through the bailer. When coming up the hole the balls would seat and trap the water in the bailer at the point where the bailer was stopped or surged. The bailer was tied to the sand line of the drilling rig. The sample from the bailer was collected through a tapped hole in wall of bailer about 3 feet from bottom of bailer.

Water level measurements: The water level in Well 4 was referred to the rim of the hole in the pump base through which the bailer was inserted at an elevation of 2.25 feet above the top of the 20-inch pipe.

The water level in Well 2 was referred to the plate over the casing, 1.22 feet above the pump house floor and 1.7 feet below the measuring point for Well 4.

Discharge measurements: The discharge from Well 4 was measured with a rectangular box type weir with baffle plates.

Temperature measurements: The temperature of the water from Well 4 was measured at the end of 68 feet of 10-inch discharge pipe.

Results of Production Test and Chloride Studies
on
City of Mt. Pleasant Well 4
Mt. Pleasant, Iowa
April, 1946

Time	Discharge Well 4 (GPM)	Depth to Water (feet) Well 2 Well 4	Temp. of Water Well 4	Depth of Water Sample (feet)	Chlorides (Parts per Million)	Remarks
April 19						
11:03 AM						
11:20		133.77				
11:25						
				Discharge	92	From Well No. 3 in City Park.
11:37						
11:40						Pumping started at Well 4.
11:45						
11:47	1012					Water very dirty (Dark brown)
11:48						
11:53	1012		69° F.			Water very dirty (Dark brown)
11:55						
12:00				Discharge	178	Water clearing somewhat. Contains mostly cement particles.
						Water very dirty. Cement particles.
12:05 PM						Water very dirty. Cement particles.
12:15				Discharge	1349	Water very dirty.
12:30	1043		73°	Discharge	998	Water very dirty.
12:38	1043		73°			Water clearing slightly. (Dark gray).
12:40		137.40				
12:45	1043			Discharge	785	Water gray, very dirty. (Cement particles)
						Water clearing.
12:54	1043		73°	Discharge	669	Water light gray, dirty.
1:00				Discharge	539	Water light gray, cloudy.
1:30	1050		73°	Discharge	421	Water cloudy. Air lift well pumping.
2:10	1050					
2:35	1050		73°	Discharge	386	Water cloudy.
2:55	1050		73°	Discharge	353	
1/3:05				1980	6400	After flow of 15 seconds from bailer.
				1980	6250	After flow of 1 minute from bailer.
				1980	855	After flow of 4 minutes from bailer.
1/ Cuttings in bottom of bailer. Bailer samples very muddy.						
3:30						
3:45						
4:00	1075					Water cloudy.

Time	Discharge Well 4 (GPM)	Depth to Water (feet) Well 2 Well 4	Temp. of Water Well 4	Depth of Water Sample (feet)	Chlorides (Parts per Million)	Remarks
April 19						
4:25 PM	1075	168.40	73°	Discharge	295	Water cloudy.
5:00	1075	168.35	73°	Discharge	274	Water slightly cloudy.
5:25	1075	168.05	73°	Discharge		Water slightly cloudy.
5:30				Discharge	262	
6:00	1075	167.80	73°	Discharge	258	
6:52	1075	166.70	73°	Discharge	272	Water cloudy.
7:20		166.70				
7:45				1800	251	After flow of 30 seconds from bailer.
				1800	250	After flow of 1 min. 15 sec. from bailer.
				1800	254	After flow of 2 min. 15 sec. from bailer.
8:00				Discharge	237	
8:15				1900	1558	After flow of 30 sec. from bailer.
				1900	1275	After flow of 1 min. 15 sec. from bailer.
				1900	1560	After flow of 2 min. 15 sec. from bailer.
8:55				Discharge	227	
11:30	1106	167.0		Discharge	205	
April 20						
12:25 AM		167.3				
2/ 1:00				1982	6250	After flow of 30 sec. from bailer.
2/ Water in bailer samples very dirty.						
2:30				Discharge	194	
5:00				Discharge	187	
7:40				Discharge	181	
8:50	1106	167.4	73	1800	186	Water slightly cloudy.
9:05				1800	189	After flow of 30 sec. from bailer.
				1800	188	After flow of 1 min. 15 sec. from bailer.
				1800	177	After flow of 2 min. 15 sec. from bailer.
					177	Water slightly cloudy.
9:30				1900	742	After flow of 30 sec. from bailer.
2/ 9:40				1900	1170	After flow of 1 min. 15 sec. from bailer.
				1900	1232	After flow of 2 min. 15 sec. from bailer.
3/ Water from bailer was cloudy.						
4/10:15				1950	5430	After flow of 30 sec. from bailer.
				1950	6050	After flow of 1 min. 15 sec. from bailer.
				1950	6080	After flow of 2 min. 15 sec. from bailer.
4/ Water from bailer is very dirty.						
11:20				Discharge	170	
12:10				Discharge	117	From well No. 2.
12:50				Discharge	167	
1:00						Pumping stopped.

Time	Discharge Well 4 (GPM)	Depth to Water (feet) Well 4	Depth of Water Sample (feet)	Chlorides (Parts per Million)	Remarks
April 22					
8:50 am					Pumping started.
8:55	1075 ⁺	163 ⁺			Pumping rate kept constant.
9:00			Pump discharge	176	
9:15			" "	121	
9:30			" "	464	
9:45			" "	359	
10:00			" "	303	
10:30			" "	273	
11:20			1900	2155	After flow of 1 min. from bailer.
			1900	2240	After flow of 2 min. 25 sec. from bailer.
11:30			Pump discharge	240	
5/ 12:30 pm			1950	5350	After flow of 45 sec. from bailer.
			1950	5920	After flow of 2 min. from bailer.
5/ Water sample from bailer was dirty.					
1:05			Pump discharge	207	
6/ 1:30			1980	6200	After flow of 1 min. from bailer.
			1980	5510	After flow of 2 min. from bailer.
6/ Water sample from bailer was dirty.					
3:15				190	
3:30			1900	1420	After flow of 1 min. from bailer.
			1900	1560	After flow of 2 min. from bailer.
4:40			Pump discharge	184	
6:00			1880	1280	After flow of 1 min. from bailer.
			1880	1352	After flow of 2 min. from bailer.
6:35			Pump discharge	185	
6:40					Pumping stopped .

STATE OF IOWA
IOWA GEOLOGICAL SURVEY
GEOLOGY ANNEX
IOWA CITY

**Results of Production Test and Chloride Studies
on City of Mt. Pleasant Well 4
Mt. Pleasant, Iowa
April, May, 1946**

Well Name: City of Mt. Pleasant Well 4.

Location: NE $\frac{1}{4}$ NW $\frac{1}{4}$ NE $\frac{1}{4}$ Sec. 9, T. 71 N., R. 6 W., Center Twp., Henry County.

Elevation: Drilling curb, top of 20-inch pipe about 731.7 ft. above sea level.

Owner: City of Mt. Pleasant.

Contractor: Thorpe Well Company, Des Moines, Iowa.

Engineers: Howard R. Green Engineering Co., Cedar Rapids, Iowa.

Drillers: Guy Egan, Ray McGrew and Pat West.

Drilling dates: Started January 4, 1945, Finished drilling March 15, 1946.

Depth: 2648 ft. below top of 20-inch pipe.

Casing and hole sizes:

About 50 ft. of 38-inch curbing from 0-50 ft.

About 68 ft. of 34-inch curbing from 0-68 ft.

623 ft. of 20-inch pipe set in 28-inch hole from 0-623 ft.)

} Cemented from bottom to
top with neat cement.

Open 19-inch hole from 623 to 2248 ft.

190'2" of 16-inch liner set in 19-inch hole from 2248 to 2438 ft. (Shoe at bottom
and top of liner).

178'11" of 12-inch liner set in 15-inch hole and into 16-inch liner from 2405 to
2584 ft. (Shoe at bottom and top of liner. Burlap wrapper near top and bottom
of liner).

64 ft. of open 12-inch hole from 2584 to 2648 ft.

Plugging data: The hole is plugged at the bottom up into the 12-inch liner. A bridge
was placed in the hole so that the base of a plug composed of well cuttings and
cement is at 2030 feet. The plug is 50 feet thick extending to 1980 feet. Another
plug was constructed on top of this when salty water was found to get past the
first. This second plug extends up to 1860 feet and is composed of cutting
packed in gummy socks and tamped with the bit and also some cement on top. The
plug was allowed to set more than 24 hours and the driller reported that it was
solid when struck with the bailer.

Test Pump: Turbine pump setting, 177 feet below top of 20-inch pipe with 22 feet
of suction pipe. Pump powered by Diesel engine with belt drive.

Pump base: A special pump base was constructed for this test. The hole for the
pump head was offset to one side so that the pump would be near the wall of
the 20-inch pipe. Another hole was cut in the pump base to allow a bailer to
be lowered into the well at any time.

Bailer: The bailer used to collect water samples was 4-inches in diameter and 29.8
feet long. Ball type valves were in place at the top and near the bottom of
the bailer. As the bailer was lowered in the water the balls were raised off
the seat which allowed passage of water through the bailer. When coming up
the hole the balls would seat and trap the water in the bailer at the point
where the bailer was stopped or surged. The bailer was tied to the sand line
of the drilling rig. The sample from the bailer was collected through a tapped
hole in wall of bailer about 3 feet from bottom of bailer.

Water level measurements: The water level in Well 4 was referred to the rim of
the hole in the pump base through which the bailer was inserted at an elevation
of 2.25 feet above the top of the 20-inch pipe.

The water level in Well 2 was referred to the plate over the casing, 1.22 feet
above the pump house floor and 1.7 feet below the measuring point for Well 4.

Discharge measurements: The discharge from Well 4 was measured with a rectangular
box type weir with baffle plates.

Temperature measurements: The temperature of the water from Well 4 was measured
at the end of 68 feet of 10-inch discharge pipe.

STATE OF IOWA
IOWA GEOLOGICAL SURVEY
GEOLOGY ANNEX
IOWA CITY

Production Results
Mt. Pleasant No. 4
April 29 - 30, 1946

Time	Discharge Well #4 G.P.M.	Depth to Water (feet) Well #4	Temp. of Water Well #4	Depth of Water Sample (feet)	Chlorides P.P.M.	Remarks
April 29, 1946						
10:30 AM	145.2					Not yet pumping.
10:40				(1650 B 0:30)*	190	
				(1650 B 1:15)	196	
				(1650 B 2:15)	191	
11:10				(1800 B 0:30)	163	
				(1800 B 1:15)	166	
				(1800 B 2:15)	166	
11:40				(1855 B 0:30)	210	
				(1855 B 1:15)	218	
				(1855 B 2:15)	220	
12:05				(1830 B 0:30)	156	
				(1830 B 1:15)	191	
				(1830 B 2:15)	217	
12:54 PM		145.56				Not yet pumping.
1:03						Pumping started.
1:05		158.87				Slowed.
1:07		153.66				
1:09		153.55				Speeded.
1:11		160.59				
1:13		155.97 ?				
1:14	750	158.10				Water dirty.
1:15				Pump discharge	125	
1:16		157.43				
1:17		156.63				
1:20		155.72				
1:24	750	155.19				
1:26		155.00				Water dirty.
1:28		154.72				
1:30		154.52	70½	Pump discharge	163	
1:34		151.19				Clearing but cloudy.
1:40		153.90				
1:45		153.79			246	
1:50		153.68	71½			Clearing but cloudy.
1:55		153.54				
2:00		153.55		Pump discharge	202	
2:05		153.50				Nearly clear
2:10		153.43				

*Bailer sample taken at 1650 feet after flow of 30 seconds from bailer.

Time	Discharge Well #4 G.P.M.	Depth to Water (feet) Well #4	Temp. of Water Well #4	Depth of Water Sample (feet)	Chlorides P.P.M.	Remarks
2:15		153.37		Pump discharge	186	
2:20		153.34				
2:30		153.27		Pump discharge	176	
2:41		153.28				
2:52		153.20	72			Cloudy.
3:01		153.08		Pump discharge	175	
3:16		153.09				
3:30				Pump discharge	163	
3:47	750	152.96				
3:48						Speeded pump.
3:49		161.00				
3:49 1/2		161.84				
3:51		162.35				
3:52	1000	162.62				
3:56						Speeded one notch.
3:57		164.00				
3:58	1050					
3:59						Speeded one notch.
4:00		167.84		Pump discharge	157	
4:02	1040					
4:06		167.98				
4:08		167.74				
4:10	1075		72			
4:20		167.31				
4:26		166.80				
4:32	1043	166.54		Pump discharge	159	
4:45		165.80		Pump discharge		
5:01		167.31		Pump discharge	157	
5:30	1075	168.47		Pump discharge	154	
6:00		170.32		Pump discharge	152	
7:00	1100	171.16		Pump discharge	145	
8:00	1100	170.83		Pump discharge	142	
8:57		171.10		Pump discharge	138	
10:02		171.17		Pump discharge	134	
11:00	1100	171.25		Pump discharge	131	
12:00 M		171.58		Pump discharge	131	
April 30, 1946						
3:00 AM				Pump discharge	125	
6:00				Pump discharge	126	
7:00	1100	172.00	72	Pump discharge	126	
8:00		171.73		Pump discharge	122	
9:00				Pump discharge	122	
9:30		171.54				
10:00				Pump discharge	119	
10:00				(1830 B 0:30)	154	
				(1830 B 1:15)	135	
				(1830 B 2:15)	143	
11:00				(1855 B 0:30)	1360	
				(1855 B 1:15)	1630	
				(1855 B 2:30)	791	
11:05				Pump discharge	119	

Time	Discharge Well #4 G.P.M.	Depth to Water (feet) Well #4	Temp. of Water Well #4	Depth of Water Sample (feet)	Chlorides P.P.M.	Remarks
11:55				Pump discharge	122	
1:00 PM				Pump discharge	119	Water white, cloudy.
				(1855 B 0:30)	131	
				(1855 B 1:15)	287	
				(1855 B 2:15)	370	
1:32	1090	171.17				Water clear.
1:50				(1855 B 0:30)	920	
				(1855 B 1:15)	615	
				(1855 B 2:15)	570	
2:15				Pump discharge	119	
2:45				(1855 B 0:30)	1010	
				(1855 B 1:15)	1080	
				(1855 B 2:15)	715	
3:10				Pump discharge	112	
				Pump discharge	113	
4:00	1070	170.50	72	Pump discharge	119	
4:30		171.20				
		Recovery				
4:32		132.14				Stopped pumping.
4:33		136.62				
4:35		138.19				
4:36		137.94				
4:37		137.90				
4:38		137.81				
4:39		137.70				
4:40		137.64		Weir		Sample for analysis.
4:41		137.54				
4:42		137.48				
4:43		137.44				
4:44		137.38				
4:45		137.31				
4:50		137.14				
4:55		136.97				
5:00		136.85				
5:10		136.68				
5:23		136.53				
5:33		136.42				
5:43		136.37				
5:53		136.27				
6:03		136.21				

Results of Production Test and Chloride Studies
on City of Mt. Pleasant Well 4
Mt. Pleasant, Iowa
April, May, 1946

Time	Discharge Well 4 (GPM)	Depth to Water (feet) Well 4	Temp. of Water Well 4	Depth of Water Sample (feet)	Chlorides Water Sample (Parts per Million)	Remarks
May 2						
5:40 pm				1650	98	After flow of 30 sec. from bailer
				1650	88	After flow of 1 min. 15 sec. from bailer.
				1650	89	After flow of 2 min. 15 sec. from bailer.
5:56		135.33				
6:02				1800	93	After flow of 30 sec. from bailer
				1800	90	After flow of 1 min. 15 sec. from bailer.
				1800	92	After flow of 2 min. 15 sec. from bailer.
7:00				1830	94	After flow of 30 sec. from bailer
				1830	94	After flow of 1 min. 15 sec. from bailer.
				1830	96	After flow of 2 min. 15 sec. from bailer.
7:45				1855	510	After flow of 30 sec. from bailer
				1855	275	After flow of 1 min. 15 sec. from bailer.
				1855	332	After flow of 2 min. 15 sec. from bailer.
8:02		135.30				
8:10						Pumping started.
8:12		144.5				
8:20	495					
8:22		142.70				
8:24		142.75				
8:25						Pump discharge 120
8:26		142.75				
8:28	520		67.5			
8:31		142.77				
8:36		142.83				
8:40	520	142.79	70			Pump discharge 90
8:45		142.77				
8:55						Pump discharge 88
9:10		143.15			99	Water clear.
9:18	520	143.15	71.5			
9:25					116	
9:35					1855	2449
					1855	1140
					1855	771
						After flow of 30 sec. from bailer
						After flow of 1 min. 15 sec. from bailer.
						After flow of 2 min. 15 sec. from bailer.
9:40						Pump discharge 123
9:55						" " 140
10:11	520	143.16	72			Water clear.
10:30						" " 173
11:10		143.23				" " 145

Time	Discharge Well 4 (GPM)	Depth to Water (feet) Well 4	Temp of Water Well 4	Depth of Water Sample (feet)	Chlorides (Parts per Million)	Remarks
May 2						
11:25 pm				1860 1860 1860	1634 2240 772	After flow of 5 sec. from bailer. After flow of 30 sec. from bailer. After flow of 1 min. 15 sec. from bailer.
1/ Water from bailer was cloudy (white).						
11:40					144	
May 2						
12:10 am	520	143.43	72	Pump discharge	145	
2:00				" "	140	
3:00				" "	140	
4:00				" "	140	
5:00				" "	140	
6:00				" "	138	
7:30	525	143.61	72			
7:35				1860 1860 1860	489 1015 715	After flow of 5 sec. from bailer. After flow of 30 sec. from bailer. After flow of 1 min 15 sec. from bailer.
7:40				Pump discharge	136	
8:10		143.55				
8:11						Discharge rate increased.
8:14	767					
8:16		150.70				
8:17		150.73				
8:19		150.77				
8:20		150.86				
8:25				Pump discharge	115	
8:28	767	151.11	72			
8:38				Pump discharge	128	
8:40		151.18				
9:25	767	151.35		" "	136	
9:57		151.50				
10:15				1860 1860 1860	1094 1362 790	After flow of 20 sec. from bailer. After flow of 45 sec. from bailer. After flow of 1 min. 30 sec. from bailer.
10:52	750	151.27				
10:55					107	
11:30	760	151.38		Pump discharge	128	
1:20	767	151.54		" "	127	
2:30				" "	126	
3:10		151.63		" "	125	
3:30				" "	127	
4:10	760	151.52	72	" "	127	
4:30				" "	125	
5:10	760	151.52		" "	126	
5:30		151.51		" "	125	
7:05		151.54		" "	126	
7:30				1860 1860 1860	1208 1692 803	After flow of 30 sec. from bailer. After flow of 1 min. from bailer. After flow of 1 min. 30 sec. from bailer. Pumping stopped.
7:46						

Time	Discharge Well 4 (GPM)	Depth to Water (feet) Well 4	Temp. of Water Well 4	Depth of Water Sample (feet)	Chlorides Parts per Million	Remarks
May 3						
7:55				1860	1055	After flow of 30 sec. from bailer.
				1860	1230	After flow of 1 min. from bailer.
				1860	618	After flow of 1 min. 45 sec. from bailer.
May 5						
8:05 pm				1830	94	After flow of 30 sec. from bailer.
				1830	93	After flow of 1 min. from bailer.
				1830	92	After flow of 1 min. 45 sec. from bailer.
8:50				1860	397	After flow of 30 sec. from bailer.
				1860	415	After flow of 1 min. from bailer.
				1860	576	After flow of 1 min. 45 sec. from bailer.
9:30				1220	94	After flow of 30 sec. from bailer.
				1220	93	After flow of 1 min from bailer.
10:45		135.0				
11:30						
11:32	520					Pumping started.
11:35		142.5				
11:40			65.5	Pump discharge	117	
11:50			68.5	" "	119	
12:00 m			70	" "	90	
May 6						
12:05				" "	92	
12:15				" "	123	
12:20				" "	92	
12:25				" "	94	
12:30				" "	95	
12:35				" "	100	
12:40				" "	107	
12:45				" "	120	
12:50				" "	131	
12:55				" "	132	
1:00				" "	137	
1:05				" "	143	
1:10				" "	144	
1:15				" "	147	
1:20				" "	145	
1:25				" "	149	
1:30				" "	147	
1:35				" "	148	
1:40				" "	145	
1:45				" "	147	
1:50				" "	146	
1:55				" "	145	
2:00	520	143.2		" "	146	
2:05				" "	148	
2:10				" "	145	
2:15				" "	142	
2:20				" "	147	
2:25				" "	143	
2:30				" "	145	
2:40				" "	144	
2:50				" "	142	

Time	Discharge Well 4 (GPM)	Depth to Water (feet) Well 4	Temp. of Water Well 4	Depth of Water Sample (feet)	Chlorides (Parts per Million)	Remarks
May 6						
3:00 am				Pump discharge	145	
3:15				" "	143	
3:30				" "	146	
3:45				" "	141	
4:00				" "	143	
4:30				" "	141	
5:00				" "	142	
5:30				" "	140	
6:00				" "	141	
6:30	520	143.55		" "	140	
7:00				" "	140	
7:30				" "	140	
7:30 a				1860	2203	After flow of 30 sec. from bailer
				1860	1395	After flow of 1 min. from bailer.
				1860	1845	After flow of 1 min. 45 sec. from bailer.
8:00				Pump discharge	139	
8:30				" "	102	
9:00				" "	137	
9:12						Pumping rate increased.
9:15	754	150.45				
9:30				Pump discharge	139	
9:45				" "	139	
10:00				" "	141	
10:15				" "	140	
10:30				" "	142	
10:45	744	150.7		" "	138	
11:00				" "	132	
11:15				" "	134	
11:45				" "	132	
12:00 n				" "	131	
12:15 pm	744	150.8		" "	132	
12:20						Pumping stopped.
1:00					116	Discharge from air lift well.



MAR. 18, 1946

Log of Mt. Pleasant City Well No. 4

#1

Started Jan. 4, 1945

- 0-5 soil drilling 34" hole Driller Guy Elam.
 5-10 yellow clay - 1" of sandstone at 50'
 10-68 yellow & blue clay
 68-77 Gray lime drilling 29" hole at 68' - Set 68' of 34" long casing
 77-90 blue shale next casing 24' of 45" casing
 90-115 " " & lime shells 50' of 38" casing set at 50'
 115-145 Gray lime with streaks of shale 32" casing set at 95'
 145-220 Gray lime Start 29" hole at 95'
 220-225 lime & shale
 225-233 green shale
 233-252 gray lime, hard (hole muddy)
 252-255 shale
 255-262 Gray lime (mud at 262')
 262-330 Blue shale
 330-400 Brown shale
 400-480 Blue shale (carrying muddy hole)
 480-520 Brown shale
 520-535 green shale
 535-540 gray lime hard
 540-550 green shale
 550-554 gray lime hard
 554-563 green shale
 563-575 gray lime, hard
 575-580 lime and shales of shale
 580-585 gray lime hard
 585-602 Brown lime hard
 602-605 shale

- 3-18-45 to 7-6-45 (fishing job)
 605-620 Gray lime, hard (Setting 20" casing at 620' center gauge
 (at 60-115-242-375-567+620, cleaned hole
 (cemented using 1187 sacks - put in with
 2-inch line. Couldn't pull 38+34 inches
 (casing, poured in 1290 sacks add.
 410 sacks between 34+38" casing)

no cement found in 20" hole for 20'



Mt. Pleasant #4

Drillers log

2

(2)

620-700	gray lime	drilling 19" hole no water since setting pipe at 620'
700-766	brown lime	
766-770	gray shale	
770-802	gray lime	
802-832	green shale	(Got water at 832' - rose to 242' below top of casing)
832-845	Brown sandy lime	
845-1104	Brown lime	SWH 1220' at 900' depth " 190' at 990' "
1104-1110	sand	
1110-1115	sand, soft	
1115-1128	sand	1 foot hole from 1119-1120 SWH rose to 180'
1128-1145	green shale	
1145-1150	slate & shale	(casing material)
1150-1180	sand, soft piece	
1180-1325	Brown lime	hole casing while drilling 1275-1475
1325-1475	Gray lime	
Stopped to cement and casing material		(piped in bridge at 1150 to cement out case. " in 260 caulked off cement through 2" pipe SWH after cementing and drilling out 190'
1475-1515	gray lime	
1515-1550	" " hard	
Shut down to put in cables		SWH rose to 150'
1550-1717	gray lime	
1717-1745	Jordan sand	
1745-1825	sand with lime	
1825-1832	sand	
1832-1890	gray lime	SWH 145' at 1832' depth Reduced to 15" hole at 1835' No cutting from 1840-1850 water was clear
1890-2010	Brown lime	
		15" hole to 1925' - 12" hole to 1930 and 11" hole started at 1930'
2010-2040	Gray lime	
2040-2130	Sand with lime streaks	
2130-2180	Gray lime	
2180-2215	Brown lime, hard	



#3

Mt Pleasant #4 Driller's log

(3)

- 2215 - 2285 sandy lime
 2285 - 2290 sandy shale red
 2290 - 2355 sandy shale, brown + green
 2355 - 2375 green shale
 2375 - 2415 green + gray shale Hole started to cave at 2380'

Reamed hole to 19" from 1837' to 2437 feet

from 11-6-45 to 12-13-45

- 2415 - 2430 Blue shale hole caving (drilling 19" hole)
 2430 - 2435 red shale

hole caving badly so decided to set 16" liner pipe would not go

Straightening hole 12-28-45 to 2-18-46

set 190' 2" of 16" liner at 2438 feet. drilling 15" hole

- 2435 - 2480 Blue and red shale ^{started} hole caving came at depth of 2480
 2480 - 2525 Brown shale SWL at 145'
 2525 - 2560 gray shale
 2560 - 2570 red shale
 2570 - 2580 red shale sandy
 2580 - 2610 sand

(Hole reduced to 12" at 2584')

SWL lowered to 152'

set 178' 11" of 12" liner (shown bottom + top of pipe. at 2584)

- 2610 - 2620 - reddish sand
 2620 - 2645 white sand, soft. on 3-16-46

Guy Elam }
 Pat West } drillers
 Ray McGrew }



UM IIII IIII IIII

MT Pleasant #4

April 2, 1946

depth to water

Measurements to upper pump base by tape

2.13 above casing

2.26 above casing

#4

time	waterlevel	weir	temp	remarks
4:54	152.42			
8:19	152.33			
9:30	159.77			
9:34	159.97			started pump
9:36	160.5	5"		
9:40	161.61	5 1/8"	58°	water cloudy
9:48	162.96			
9:50		5"	61°	cloudy
9:51	163.38		63°	very dirty
9:56	158.37			
10:03	153.60			
10:07		5 1/2		very dirty
10:08	152.30			
10:16	154.02	5 5/8	68°	clearing somewhat
10:23	155.20	5 1/2	69°	clearing
10:31	155.66	5 1/2	70° -	clearing slightly
10:34	155.64			
10:38	154.73			Air Temp 55°F
10:41		5 1/2	72°	little muddier
10:44	154.23			
11:07			73°	
11:10				B-24 trailer bottom
11:15	152.44	5 1/2	73 1/2°	dirty
11:30	151.80	5 1/2	74° -	clearing very slight
11:36				pump speeded
11:40			74°	
11:50	159:45			
11:55		7 3/8	74°	
Apr. 3				
12:21	158.98			
12:23		7 1/2	74°	



Mt Pleasant #4 April 3, 1946

Time	DW	Weir	temp	Remarks
12:38		7 1/2	74	
1:00 p	166.35			spl 2640 U.S. 30
1:30 p	164.57			
1:50		7 3/4		67.882 gpm
2:14	163.88			
2:29		7 3/4	73 1/2°	water dirty
2:32				G-123 from 2640
2:50	153.38	7 5/8	73 1/2°	
3:20	153.05			
3:21	Pumping rate increased			
3:23	156.63			
3:27		8 1/2	73 1/2°F	
3:30	156.67			
3:55	156.70	8 1/2	73 1/2°F	
4:08	156.65			
4:24		Water sample from depth of 2580		
4:41	156.20	8 1/2 - 767		water cloudy
4:44	159.5	Motor speeded up		
4:45	159.5			
4:49		9 3/8 - 870	73°F	- water cloudy
4:55	159.2			
5:25	158.6	9 3/8 - 870		
5:40		G-123	top of boiler	
		-	bottom of boiler	
5:45		Samples at Discharge		



Mt. Pleasant, Iowa
City Well No. 4 -

Apr 1946

Time	DW	Weir	Temp
Apr 3			
6:00 a	157.6	9'4"	73°F
6:03		shut down	
6:04	141.45	Recommencing	
6:05	141.11		
6:06	140.31		
6:07	139.83		
6:25	138.65		
6:30	138.72		
6:35	138.62		
6:45	138.48		
6:50 a	138.44		

7:00 a				Bailer samples from 2580' (bottom bails)
7:19	138.40			" " (top bails)
7:19	138.40			start pumping.
7:20	150.5			
7:21	152.15			
7:23	152.95			
7:25	153.25	9 1/8		Water dirty
7:29	153.75			
7:34	153.42	9.0	72°F	Water dirty
7:43	153.63	9.0		
7:50	153.65			
7:53	153.40	9.0 (828)	73°F	Water dirty
8:16	153.13			
8:32	153.07	9.0		Water cloudy white
8:49	152.88			
9:08	152.80	9.0		ditto
9:24	152.91			
9:41	152.80	8 7/8		Water cloudy
10:09	152.79	9.0		"
10:37	152.78	9.0		"
10:55	152.75	9.0 (828)	73°F	"



MT. Pleasant Aly Well No. 4

Apr. 3, 1946
(Remarks)

Time	No. 4	Weir	Temp.	Remarks
Apr. 3				
11:15a	Bailer sample	Depth 2600 feet	G-65	bottom
			G-123	top
	Little leakage			
11:37	Bailer sample	Depth 2205'	G-63	bottom
			G-52	top
11:52	152.54			
1:32	153.73	9 3/8	73°	Water cloudy
2:27	153.52	9 3/8	73°	" "
3:20	153.59		73°	" "
3:28		9 3/8		
3:45	bailer spl	2600'	G 35	bottom
			G 52	top
3:52	discharge spl		G 63	
4:27		Pumping stopped		
4:37	138.0			
4:42	137.15			
4:45	137.51	tape		
4:52	137.30	tape		
5:02	137.14	tape		
5:09	137.03			
5:18	136.96			
6:48	136.59			
7:05	136.55			
7:15	Bailer sample collected from 2600'	G-123		
7:32	pumping started			
7:43	159.5			
7:49	160.29			
7:55	160.60	10 3/4 (1043)	73°F	
8:02	160.47			Water very dirty
8:34	159.80	10 3/4 (1043)	73°F	Water clearing
9:13	159.52	10 3/4	73°	water a little clearer
9:31	159.56			
9:40	Bailer sample from depth of 2600 feet	top - G-63		
	(Sanded)	bottom - G-123		
9:55	Collect sample from well discharge line	G-52		
10:24	159.58	10 3/4	73° Air 50°	Water milky

160.55
25

1,

April 3

11:25	159.28	10 7/8	73°	cloudy white
12:20 ^{April}	159.5			
12:25 ^{April}		10 3/4	73°	" "
12:34	bailer spl	2600		
5:45		10 7/8		cloudy, white
5:50	bailer spl	2600'		
6:07	159.5	10 7/8		
6:08	S. shut down			
6:09	140.0			
6:10	139.1			
6:11	138.69			
6:12	138.67			
6:17	138.20			
6:23	137.77			
6:29	137.52			
7:02	136.80			
7:10	Bailer sample -			
			G-3 1:30	
			G-65 - 2:30	
			4 peaks in 2:45	
7:25	136.75			
7:47	136.3			
7:48	156.45			
7:51	157.30			
7:53	159.26			
7:58	161.24			
8:08	161.16			
8:10				
8:15	160.65			
8:39	158.8			
9:05	159.8			
9:18				
9:23				
9:51	158.7			
10:10	158.6	11 1/2		
10:30	Bailer sample at 2600ft - discharge sample			

Spl G-20 after 30 sec
 spl G-41 after 1:30
 spl No 6 " 2:30
 folie 4 min
 Pump sample G-35
 pump on
 added fertilizer
 11- 73° water dirty
~~met~~ started
 pump started



Time DN Weir Temp.

Apr 4
6:45 p Bailer sample at 2620'

7:00 p " " " 1800'

7:29 p 142.40 505 72.4°F Water almost clear with 47°F

7:45 Bailer sample at 2620'

8:00 Bailer sample from 2100'

10:00 Bailer sample from 2620 (upper ball feed open)

10:20 Pumping rate increased from 500 to

10:25 11"-1075 temp 72.8°F Water fairly clear

10:30 160'

10:40 11"-1075 158'

10:50 Water sample collected from discharge

11:55 bailer sample at 2620 after considerable surging with upper ball valve ball open

APR 5

7:40 A 11 1/2"-1090 158.60' temp 72.5°F Water cloudy

7:50 Bailer sample 2620 - upper ball open surged 15 times raising bailer 25'. Water clear from bailer no apparent leakage. Bailer not stopped up hole.

8:40 Bailer sample - Both balls down - no surging Repln 2620

9:20 Bailer sample - Both balls down surged 20' strokes for 30 times - 2620'

10:35 Bailer sample - Both balls down surged for half hour 2620

11:15 Bailer at 1800' - Both balls down - no surge

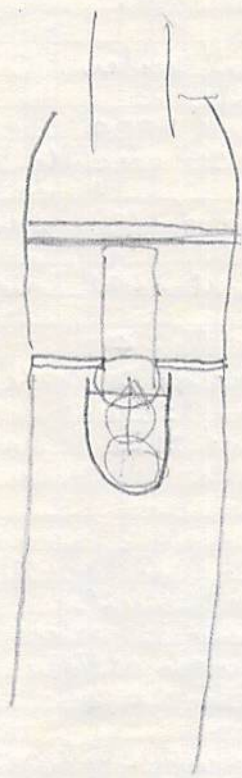




- 12:45a Discharge sample
 12:30 Bailor sample 1900' - 2 balls down - No surge
 Not much leakage
 1:03 P - sample from 200' to check chlorides
 1:05 p Bailor at 2000 - 2 balls down - no surge
 — out Bad leak
 1:15 Pouring water down between pump column
 and casing to eliminate possibility of chloride
 in this section.
 3:00p shut off water. Collect Discharge sample
 3:45 Bailor at 2000 - 2 balls down - No surge
 water slightly cloudy
 4:00 Bailor at 2100 same
 4:30 Bailor at 2200' - same
 6:15 Bailor at 2400'
 6:30 Discharge sample
 7:00 Bailor at 2500' - raised at 2'/sec
 7:40 Bailor at 2620 - same
 8:20 Bailor at 2620 - surged raised 1.3'/sec

Apr 6

- 7:15A 158.05 10⁷/₈ - 10⁷/₅ Water temp 72¹/₂°F Cloudy
 7:27 Well No 2 139.2'
 7:30 Discharge sample
 7:40 Bailor sample at 1830 - 2 balls down surged
 brought back at 2'/sec 1.7'/sec
 8:10 - Bailor sample at 1900' Same - no leakage
 8:35 " " " 2000' same " "
 9:10 " " " 2100' same " "
 10:08 " " " 2200' " " "
 10:15 Discharge sample
 10:40 " " " at 2300' some leakage in tubes
 11:20 " " " at 2400'





Apr. 6

11:30 - air lift started
 1:30 Bailers at 2500'-
 2:00p " " 2620'-
 2:45 Bailer at bottom

5:48 Shut down G-3 shut down
 5:53 - 138.60
 5:55 - 138.41
 5:56 138.30
 5:59 138.11
 6:04 137.91
 6:12 137.58
 6:15 Pumping started
 8:20 p - bottom
 8:27 p



Mt Pleasant No. 2

Apr 1946

Time DW

Apr 2 134.61

9:45	134.61
9:53	134.78
10:11	135.00
10:20	135.09
10:35	135.14
11:21	135.39
11:29	135.42
12:00	136.02
Apr. 3	
12:30 am	136.20
1:05	136.25
1:34	136.24
2:09	136.23
3:07	136.25
4:13	136.55
5:00	136.88
5:20	137.02
6:48	134.86
7:33	135.80
7:52	136.25
8:20	136.49
8:51	136.62
9:44	136.78
10:40	136.94
1:37	137.18
3:22	137.32
4:55	135.31
5:20	134.94
6:56 p	134.37
7:30	134.20
8:53	136.55
8:13	137.01 (maybe 137.21)
9:05	137.59
10:20	138.00
11:31	138.25
12:27	138.35
5:47	138.43
6:15	136.76

MP No 2 is 1.7' below M.P No. 4



Mt P #2

Apr 4

7:29	135.30
8:00	137.08
9:30	138.01
1:43	136.86
2:52	137.00
3:35	137.63
4:41	137.71
6:33	136.60
7:34 p	136.62
8:23 a	139.15

Apr 5

$$6200x + 100(1-x) = 186$$

$$6200x + 100 - 100x = 186$$

$$x = 159 \text{ ppm lower water}$$