WRD Exp. (GW)
April 1966

Well No. 076-13W-15 BBB

WELL SCHEDULE

U. S. DEPT. OF THE INTERIOR — GEOLOGICAL SURVEY — WATER RESOURCES DIVISION

MASTER CARD

Record by D. Geckel Source of data File Date 9-21-66 Map County Hwy.

State Iowa [16] County (or town) Keokuk [54]

Latitude: [41233 4 N] deg min sec S Longitude: [092210] degrees min sec Sequential number: [1]

Lat-long accuracy: [2] T 076 N S, R 13 W E Sec 15, NW ¼, NW ¼, NW ¼ 5 B & M

Local well number: [Q 76 13 W 15 B B B] Other number: W-0108

Local use: [001 0B] Owner or name: What Cheer

Owner or name: [WHAT CHEER CITY] Address: What Cheer, Ia.

Ownership: (C) County, (F) Fed Gov't, (M) City, (N) Corp or Co, (P) Private, (S) State Agency, (W) Water Dist [C]

Use of water: (A) Air cond, (B) Bottling, (C) Comm, (D) Dewater, (E) Power, (F) Fire, (H) Dom, (I) Irr, (M) Mad, (N) Ind, (P) P S, (R) Rec, (S) Stock, (T) Instit, (U) Unused, (V) Repressure, (W) Recharge, (X) Desal-P S, (Z) Desal-other, Other [P]

Use of well: (A) Anode, (D) Drain, (G) Seismic, (H) Heat Res, (O) Obs, (P) Oil-gas, (R) Recharge, (T) Test, (U) Unused, (W) Withdraw, (X) Waste, (Z) Destroyed. [W]

DATA AVAILABLE: Well data [1] Freq. W/L meas.: Inventory [X] Field aquifer char. [ ]

Hyd. lab. data: [ ]

Qual. water data; type: Complete [C]

Freq. sampling: Original [X] Pumpage inventory: yes (no) period: [ ]

Aperture cards: yes [ ]

Log data: Geologist log Driller's log [G D]

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD Depth well: 198.7 ft [1919] Meas. rept accuracy Driller's log [3]

Depth cased; (first perf.) 53.9 ft [54] Casing type: steel; Diam. 8 in [8]

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. open end, (Φ) gallery, (P) perf., screen, sd. pt., (S) shored, (T) open hole, (W) other (X) (Z) [X]

Method Drilled: (A) air rot, (B) bored, (C) cable, (D) dug, (H) hyd rot., (J) jetted, (P) air percussion, (R) reverse rotary, (T) trenching, (V) driven, (W) drive wash, other (Z) [C]

Date Drilled: Dec. 1934 [934] Pump intake setting: [ ] ft [ ]

Driller: C. D. Nolan (name), Cedar Rapids (address), Ia.

Lift (type): (A) air, (B) bucket, (C) cent, (J) jet, (L) multiple (cent.), (M) multiple (turb.), (N) none, (P) piston, (R) rot, (S) submerg, (T) turb, (Z) other [ ] Deep Shallow [D]

Power (type): diesel, elec, gas, gasoline, hand, gas, wind; nat LP; H.P. [ ] Trans. or meter no. [ ]

Descrip. MP LSD ft above below LSD, Alt. MP 740

Alt. LSD: 740 [7410] Accuracy: (source) Altimeter [T]

Water Level 17.6 ft above (below) MP; Ft above (below) LSD [18] Accuracy: Driller's log [D]

Date meas: Dec. 1934 [D 34] Yield: 60 gpm [60] Method determined [ ]

Drawdown: 143.4 ft [143] Accuracy: Drl's log [3] Pumping period [ ] hrs [ ]

QUALITY OF WATER DATA: Iron .2 ppm [2] Sulfate 8246 ppm [8] Chloride 28 ppm [2] Hard. 729 ppm [8]

Sp. Conduct [ ] K x 10^6 [ ] Temp. 53.6 °F [54] Date sampled Dec. 1934 [D 34]

Taste, color, etc. [ ]

Verified ERC

Punched FCH

Well No. 076-13W-15 BBB

Well No. 076-13W-15 BBB

Latitude-longitude 41 d 23 m 33 s (N) S 092 d 21 m 10 s

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD [1–19] Physiographic Province: Central lowland [20–21] Section: Dissected Till Plain [E, 22] Drainage Basin: SKunk [23–25] Subbasin: [26]

Topo of well site: (D) depression, (C) stream channel, (E) dunes, (F) flat, (H) hilltop, (K) sink, (L) swamp, (Φ) offshore, (P) pediment, (S) hillside, (T) terrace, (U) undulating, (V) valley flat [V, 27]

MAJOR AQUIFER: Miss system, Lower series [MI, 28–29] Osage aquifer, formation, group Burl. [XB, 30–31]

Lithology: Cherty Dolo. [QD, 32–33] Origin: Marine [6, 34] Aquifer Thickness: [35–37] ft

Length of well open to: 48.3 ft [48, 38–40] Depth to top of: 150 ft [150, 41–43]

MINOR AQUIFER: Miss system, Lower series [MI, 44–45] Osage aquifer, formation, group Keokuk [XK, 46–47]

Lithology: Cherty Dolo. [QD, 48–49] Origin: Marine [6, 50] Aquifer Thickness: 50 ft [51–53]

Length of well open to: 50 ft [50, 54–56] Depth to top of: 100 ft [100, 57–59]

Intervals Screened: none

Depth to consolidated rock: 30 ft [30, 60–61] Source of data: well Cuttings [C, 64]

Depth to basement: ft [65–68] Source of data: [69]

Surficial material: [70–71] Infiltration characteristics: [72]

Coefficient Trans: gpd/ft [73–75] Coefficient Storage: [76–78]

Coefficient Perm: gpd/ft^2; Spec cap: .41 gpm/ft; Number of geologic cards: [79]

39'1" of 12" casing
53'9" of 8" casing

15

Well No. 076-13W-15 BBB

GPO 857-700

December 14, 1949

Keokuk

Mr. Charles D. Mullinex
Howard R. Green Engineering Co.
208-210 Bever Building
Cedar Rapids, Iowa

Dear Mr. Mullinex:

A preliminary analysis made upon the sample of water collected during the What Cheer town well pumping test of December 6, 1949, gave the following results:

Soap hardness	1300 ppm
Iron	24.5 ppm

As the amount of iron seemed somewhat high a second test was made and gave the same figure.

Very truly yours,

James B. Cooper

JBC:AM

March 16, 1935

SUBJECT: FINAL REPORT ON WHAT CHEER WELL

TO: A. E. Michel, Chief Engineer
Iowa Emergency Relief Administration
Des Moines, Iowa

NAME OF PROJECT: What Cheer city well, IERA Project.

LOCATION: About 4/10 mile south of business district, and on east side of city pump house, adjacent to old shallow wells.

CONTRACTOR: C. D. Nolan Well Co., Cedar Rapids, Iowa.

CURB ELEVATION: 740 ft. TOTAL DEPTH: 198 ft. 9 in.

TOPOGRAPHIC POSITION: In valley flat south of town.

TYPE OF FORMATIONS: Soil, loess, and glacial drift from curb to 25 ft.; Pennsylvanian shale and sandstone 25 ft. to 38 ft. 6 in.; Mississippian limestone, shale, sandstone, and dolomite from 38 ft. 6 in. to 198 ft. 9 in. T.D.

GENERALIZED LOG:

Formation	Thickness Ft.	Thickness In.	From Ft.	From In.	To Ft.	To In.
Till, yellow, gray to black, clayey, sandy	21	5	0		21	5
Till, gravelly, sandy	3	7	21	5	25	
Shale, light gray, abundant carbonaceous fragments	7	3	25		32	3
Sandstone, fine grained, with inter-bedded plastic shale	6	2	32	3	38	5
Limestone, gray, dense, fossiliferous	1	7	38	5	40	
Sandstone, gray, fine grained	10		40		50	
Limestone, cream to brownish gray, very cherty	4	7	50		54	7
Sandstone, calcareous, glauconitic, fossiliferous	12	2	54	7	66	9
Shale, gray, calcareous	4	4	66	9	71	1
Limestone, gray, dense, sandy	1	10	71	1	72	11
Shale, greenish gray, tough, dolomitic in lower part	16	11	72	11	89	10

Dolomite, gray to brownish gray, cherty	55	5	89	10	145	3
Shale, greenish gray, tough	2	9	145	3	148	
Dolomite, yellowish gray, glauconitic, cherty	5	2	148		153	2
Shale, green, tough	9	10	153	2	163	
Dolomite, cream to light gray, soft, cherty	29	5	163		191	5
Shale, greenish gray, hard, calcareous, soft in lower portion, underlain by gray dolomite	7	4	191	5	198	9

WATER PRODUCING FORMATIONS: First water in fine sandstone between 45 ft. and 50 ft.; second water in sandstone and limestone beds between 55 ft. 5 in. and 66 ft. 9 in.; no water increase or loss between 66 ft. 9 in. and bottom of hole at 198 ft. 9 in. Upper water zone between 45 ft. and 50 ft. shut off by cement.

DATA ON CONSTRUCTION OF WELL:

STARTED: September 12, 1934. COMPLETED: December 13, 1934. Drilling completed October 16, 1934.

CONSTRUCTION DELAYS: Waiting for pipe, cement, setting of cement, and pumping for city use caused numerous long delays.

METHOD OF CONSTRUCTION: Drilled with cable and tools.

DIAMETER OF HOLE: 14 in. hole from curb to 39 ft. 1 in.; 11 in. hole from 39 ft. 1 in. to 198 ft. 9 in. T.D.

CASING RECORD: 12 in. O.D. wrought iron casing from curb to 39 ft. 1 in. set in hard limestone and cemented on outside from below and above; 8 in. W.I. casing from curb to 53 ft. 9 in. cemented inside of 12 in. pipe and to rock wall; open hole from 53 ft. 9 in. to 198 ft. 9 in. T.D.

CASING ABOVE CURB: Both the 12 in. O.D. and the 8 in. casing extend 1 ft. 6 in. above curb.

SHOE: Steel drive shoe on 12 in. pipe.

CEMENTING OR SEALING RECORD: First cement seal between hole and 12 in. O.D. pipe from surface to 39 ft., neat mixture quick setting cement in lower part and sand and cement in upper part; second cement seal below 12 in. pipe and 8 in. pipe, from surface to 64 ft. 5 in., set with plug below 8 in. pipe and forced behind pipe by air pressure and forcing plug inside 8 in. pipe and above cement; neat mixture Hawkeye Supreme quick setting cement, 4½ gallons of water to one sack of cement used.

SHOOTING WELL: Dynamite charge of 20 pounds of 62% Du Pont blasting dynamite set at 65 ft. Discharged by electric circuit controlled at surface. No cement in hole at this time; 12 in. pipe set at 39 ft. Shot at 3:30 p.m. November 1, 1934.

CAP AT TOP: 8 in. cast iron cap, 2½ in. thick, threaded on.

GENERAL REMARKS: Construction of well difficult due to trouble in cementing off upper water zone after shooting the lower zone. Total of 31 sacks of cement and 2100 pounds of sand used in shut-off and cementing pipe.

FIELD SUPERVISION: D. O. Stookey, Field Geologist.

DATA ON WATER:

TOTAL PRODUCTION: Approximately 20,000 gallons per day available from this well without effecting other nearby shallow city wells.

NATURAL RATE: Natural flow of upper zone of water (45 ft. to 50 ft.) is 32 gallons per minute; natural flow of upper and lower zones together is 48 g.p.m. after 14 hours of pumping. Lower water zone (57 ft. to 66 ft.) produces 15 g.p.m.

STATIC HEAD: 17 feet 6 inches below curb; drawdown to 106 ft. 10 in. in 15 min. of pumping at 60 g.p.m.

REMARKS ON WATER PRODUCTION: Best pumping capacity at 15 g.p.m. with drawdown to 58 ft. For short periods of pumping (1 to 2 hours) rate of 20 g.p.m. can be used with drawdown to 68 ft.

WATER ANALYSIS: No. 91716. Collected Dec. 16, 1954.

Total Solids	426.0
Susp. Solids	0.0
Diss. Solids	426.0
pH	0.0
Alkalinity (MeO)	340.0
Alkalinity (phn)	0.0
Insol. Matter	14.0
R_2O_3	0.0
Alkalies (as Na)	16.6
Ca	122.7
Mg	37.1
Fe	0.5
Mn	0.25
Al	1.2
F	0.5
Cl	7.5
SO_4	84.6
HCO_3	414.8
PO_4	.03
NO_3	0.0
Nitrites	Tr.
Nitrates	0.0
Calc. Hardness	413.0

This is analysis of old 75' well according to part 3 of our records. See anal # 91682 July 31.

REMARKS ON QUALITY OF WATER: Chemically the water is of good quality for domestic and normal city use. When pumped during the last test, the water had a "fishy" odor. This aroused comment at What Cheer, but need not concern the city. The odor will last for several days or a week of pumping and is caused by the shooting of the well. As soon as air has had time to circulate and after the well has been properly chlorinated, the water will clear in color and odor. Attention should be called to the need for proper treatment of the water as it is badly contaminated now. The well should be thoroughly chlorinated and not depend on the machine to treat the water.

STERILIZATION: Well has not been sterilized waiting installation of pump. Instructions of State Board of Health should be followed when this work is completed.

SUMMARY REMARKS: The area around the pump house should be cleaned and better provision made to protect the old city wells from surface waters. Since the old wells and the new well draw supplies from different zones the wells can be used to supplement the supplies when extreme demands must be met.

A. C. Tester,
Assistant State Geologist
Supervisor, IERA Project
S-E6-1085

Enclosure: Blue print
showing log of formations
and construction of well.

Sheet No. 1 Name of Well Wilbert Cheon Survey No. WK-0102

Location ..... Date Drilled ..... Analyst M. Elias

00 — 0
Clay, dk. grayish brown non-calc.
2
" " " " " "
3½
" " " " " "
5½0
" med. " " " "
8
" yellow & grayish brown, sandy, little gumbotill?
10
12
" yellow, slightly sandy
15½
" yellowish & brownish gray, sandy
20
20½3
" brownish gray, sandy, v. gravelly, v. slightly calc.
22'11
23'6 sand, glacial, 15% clayey, v. slightly calc.
24'6 clay, med. gray, 30% " " " "
25
27 " or sh. lt. gray, poor lam., slightly sandy, non calc.
27½ " " " pale gray " " " " " "
28
" " " " " " " " " " "
30
31 clay, lt. gray, non-calc., plastic, underclay-?, with about 10% small coal fragments, 3% pyrite
32'8 Sh. " " sandy
36 " " " v. sandy, pyritic, 5% coaly streaks
38'5 ls. v. dolo. med. to dk. (drabish) gray, v. fn., porous, slightly sandy
40
41 ls. as in 38 to 40' and 55, fn. ang. lt. gray
SS. calc. cement, fn. to med., A-a; 10% pyrite
45
" " " ; 50% ls. slightly dolo. lt. brownish gray, lith. with venules + large clear fragments of chert Xlc+
48
50 SS. calc. to ls. (slightly dolo.) sandy, lt. brownish gray to lt. drab, lith. ; 5% chert, opaque, pale gray to buff
Chert dolomitic, lt. to dk. gray, opaque, little drab, with streaks of clear qtz. Xls. + chalcedony
53'5 25% ls. pale buff, flowery
dolo. lt. drab, v. fn. to fn. sach. sandy; 50% fn. to med. sand, little coarse
64'7 SS. v. micac. dolomitic cement, fn. to med. dolo. cement is lt. drab.
56'5 dolo v. sandy, lt. drab, v. fn. to fn. sach. porous. 5% chert-coarse?
59'4
60
dolo. calc, v. sandy, lt. gray to lt. drab, v. fn. to fn. sach., many foss. casts, glauconitic? (1%)
61'4 " " " " lt. drab " " " " , fragments large milky Xls.
62'5
64'11 " " sandy, lt. to med. gray to drab, " " " " , foss. casts
N S
66'9 dolo. as in 62-64'
68'9 sh. slightly calc. lt. gray, lam., pyritic (3%)
70
71'11 dolo. lt. (slightly) drabish gray, v. fn.
72'11 Sh. calc, lt. gray, lam., glauconitic (1%)
79'4 sh. slightly calc. lt. to med. brownish gray, poor lam.; 50% dolo. v. calc, lt. to med. drab, v. fn. to fn.
80
81 sh. med. gray slightly calc. salt and sh. med. brownish gray, calc, hard.
83 sh. calc. med. gray, slightly brownish, lam.
87'4 dolo. v. calc. (or ls. dolo.) med. to dk. gray to drab, fn. to med. sach. in part, drusy, 1% glauconite
89'10
90
dolo " " " " " drab, fn. med. in druses; 25% sh. slightly calc. med. gray, well lam. micac.
92'4
93'6 sh. calc., lt. to med. greenish gray, lam., micac.; 30% dolo. calc. med. drab, fn.
95 dolo. oolic, med. to dk. drab, fn. to med.
00
99'4

Verdi = St. Louis
Springvale = Kansas City Gp.

Sheet No. 2 Name of Well Wheat Cheer Survey No. W-0108 2

Location ..... Date Drilled ..... Analyst M. Elias

100 sh. slightly calc., tr. greenish gray, lam.; 30% dolo. med. drab, fn. sach.; 15% chert med. to dk. drab, little pinkish gray oolitic mottling, opaque

101 dolo. med. to dk. drab, fn. to med. sach. porous; 10% chert dk. drab, little lt. gray mottling

1022 dolo. med. brown, v. fn. to fn., v. calc.; 50% chert, dk. drab + drabish gray, with lt. gray mottling, brachiopod casts pieces

1039 " " " " " " 70% " " " " " " " "

1048 " " " " " " 60% " " " " " " " "

1051 dolo. calc. lt. to dk. drab + drabish gray, v. fn. to fn.; 25% chert " " " "

1057 dolo. v. calc., lt. drabish gray, v. fn. to fn., little porous 10% chert

110 calc.

10 dolo. lt. to med. drab + drabish gray, v. fn. to fn., little med., with small black shiny grains, glauconite (?); 30% chert as above

1121.5 dolo. calc. lt. to dk. drab + drabish gray, fn. to med.; 35% chert

1172 ls. dolomitic, lt. gray to buff, v. fn. to fn.; 50% chert, lt. tinted gray, some dk. drab speckling.

1184.0 " " " " " " 60% " " " " dk. drab mottling, little dead.

20 1207.0 " " lt. tinted gray to drab, fn. tinted, porous; 30% chert " " " "

1223 ls. " lt. tinted " " " ", 30% chert lt. to dk., gray + drab

129 ls. " lt. gray to drab, fn., porous; 40% chert lt. to med. gray to drab, little dk. gray spots, few chalcedony pieces

1373 " " " " lt. drab, fn. to med. sach. porous; spot glauconite ?; 35% chert lt. gray to drab, little med., finely speckled with transl. specks

30 132 " " lt. drabish gray, fn. tinted, sach. porous; 30% chert lt. gray to lt. drab, dark spots, speckled with transl. specks, little dead.

1373 ls., dolo., lt. slightly drabish gray, v. fn. to fn. sach. porous, glauconitic (1%); 15% chert, lt. to med. gray, drab mottling

40 1404 dolo, calc., lt. grayish drab, fn. tinted, sach. porous, glauconite 1%; 5% chert, lt. gray, opaque to transl.

1453 " " lt. tinted " " " " " " ; 25% sh. slightly calc., med. green gray, lam. 2% chert

198 dolo. " " " " " " " " 5% chert, dolomitic, lt. gray + drab

50 151 " " " " " " " " glauconitic 2%); 3% chert " "

1532 " " " " " " " " " " 3%; 15% chert, dolomitic, pale to lt. gray.

156 20% sh. med. gray, lam. slightly calc.

1577.0 dolo, calc., lt. drabish gray, fn. glauconite 2%; 15% chert lt. gray, dolomitic, opaque to transl. 30% sh. slightly dolo, lam. med. gray

60 " " " " " " sach. porous " 3%; 10% " " " " " "

1635 " " lt. tinted drab + grayish drab, fn. tinted, sach. porous, glauconite 2%; 5% chert, lt. gray dolomitic, opaque to transl.

163 dolo. lt. grayish drab, med. sach., v. porous, glauconite 1%; 10% chert, slightly glauconitic, lt. tinted gray

166 dolo, v. calc., pale buff, v. fn. (trace glauconite) 25% dol. as in 163-66'; 20% chert lt. tinted. bluish gray, opaque, piece of bal. echinoderm

1692 " calc. pale buff " v. fn. to fn. sach.; 30% chert lt. bluish + drabish gray, opaque, slightly dolom.

70 1723.1 " " " " " " " " ; 50% " lt. bluish gray (little drabish gray), opaque, in part dead

1761 " slightly calc, pale to lt. buff, v. fn. dense to fn. sach. (transl.); 35% chert, slightly dolo, lt. bluish gray, v. fn. crs. rel. cast.

1784 " " " " " " " " ; 45% " " " " " " " "

80 1808 " v. calc., " " fn. to med. sach., transl.; 55% " dolomite with drab rhombs, lt. to med. bluish gray opaque, part dead Few dk. gray specks.

1825 " " pale to lt. buff to buff-sh gray, fn. to med. sach.; 35% chert, dolo. lt. bluish gray.

1847 dolo. calc., " " " to drab, fn. to med.; dense to sach., transl.; 40% chert, v. dolo. lt. bluish gray, little dark.

1875 dolo. v. calc. (or ls. dolo.) lt. grayish drab, med. sach., porous, trace glauconite; 35% chert, dolo., lt. to dk. gray, little dead.

1898 ls. dolo., " " fn., siliceous, trace glauconite

90 1907.0 20% chert, dolo., lt. to med. gray

1915 ls. siliceous, dolo., pale to lt. drabish gray, blowy to fn., glauconite 1%; 5% chert; soft lt. green gray calc. sh. -

1926 ls. +30% chert as in 188-190'; 20% sh. calc., lt. greenish gray lam.

1941 ls. dolo. siliceous, pale to lt. " " fn., glauconitic 2%

1957 " " " " " " " " trace glauconite; 25% chert lt. gray, opaque to transl.

1965 " " " " " " " " glauconite 1%; 10% " " " " " "

1975 " " " " " " " " " " 5% " " " " " "

1987 " " pale slightly drabish gray " " "

200

October 1, 1940

Honorable Mayor and Town Council
What Cheer, Iowa

Gentlemen:

Inclosed is a tabulation of the measurements which Mayor Hemmley and I made on the What Cheer IERA well and the old dug well on September 14 and 15, 1940.

Although the IERA well did not react normally during the early part of the pumping test it is apparent that the maximum production of the well is 7.5 g.p.m. at a pumping level of 84'0". It is obvious that there is leakage of water from the old dug well into the IERA well because the level in the dug well dropped during the time the IERA well was being pumped. It is my belief that the leakage is of small magnitude but that it should be carefully considered in any planning for future development at that site.

If the Iowa Geological Survey can be of further service, please let us hear from you.

Very truly yours,

H. C. Hershey

HCH:H

Inc.

cc to Howard R. Green
T. W. Thorpe
E. V. Grimes

Everett Hemsley, Mayor
Carl G. Draegert, Solicitor & Clerk
Ethel Manary, Treasurer
B. T. Lawrence, Marshal
Frank Replinger, Deputy Marshal
Leslie Blacketer, Assessor

COUNCILMEN
Fred Stephenson
Walter Biewen
Matthew Manion
Hurley Ogden
Chester Zook

3

TOWN OF WHAT CHEER

WHAT CHEER, IOWA

September 16, 1940

Dr. H. G. Hershey
Asst State Geologist
Geology Annex
Iowa City, Iowa

Dear Sir:

Our Mayor, Mr. Everett Hemsley, has asked that I inform you as to the draw-down in the large dug well. He states that he permitted the pump in the IERA well to pump continuously all Saturday night and until 8:30 Sunday morning, at which time the water in the large dug well had dropped 4½ inches after your last measurements, which when added to the one inch which the well water dropped while you were here would make a total draw-down of 5½ inches.

Yours very truly,

CARL G. DRAEGERT
Town Clerk

CGD:MAB

4

February 28, 1940

Mr. Elvin V. Grimes
402 Jackson Street
Sigourney, Iowa

Dear Mr. Grimes:

Since talking with you in Sigourney I have restudied both of the What Cheer wells. We have a fair set of samples from both of them and if the samples were properly collected our results should be fairly satisfactory.

The samples from the two wells do not check in the top one hundred feet. Below that, however, they correspond almost precisely and drawings of the various percentages of materials in the well when matched fit together very well.

From the work that I have done it is my opinion that the shale found in the bottom of the IERA well will not continue with depth. From a comparison with the new town well drilled last year by the Thorpe Well Company, I would expect gray to brown dolomite and dolomitic limestone to start immediately below the present bottom of the IERA well and continue to a depth of approximately 226 feet. At that depth I would expect 5 to 10 feet of very fine light gray sandstone underlain by more dolomite and dolomitic limestone containing a small amount of chert or flint. This lower unit should continue to a depth of approximately 277 feet where the top of the Kinderhook siltstone and shale should be reached.

It would seem therefore that there is a possibility of obtaining some additional water by deeper drilling in the old IERA well. Such additional drilling, however, should certainly not be carried below the top of the Kinderhook, and of course a matter of any additional drilling is a matter of personal opinion.

I am sending you the results of our study in the belief that you will be interested in them.

I will be very glad to hear from you of any new developments on the What Cheer project. If I can be of service at any time, please feel free to call on me.

Very truly yours,

HGH:N

H. G. Hershey

IOWA GEOLOGICAL SURVEY
Iowa City, Iowa

Results of Pumping Test on IERA Well

What Cheer, Keokuk County

September 14, 1940

Time	Water level Corrected	Production G.P.M.	Temperature Air °F.	Temperature Water °F.	
11:00 a.m.	18'8"				SWL
					Dug well, SWL 7'6"
11:15	18'8"				
11:16	23'0"				
11:17	27'1"				
11:20	37'7"				
11:25	50'7"				
11:30	57'3"				
11:35	60'8"				
11:40	63'10"				
11:45	66'4"	9			
11:50	66'11"	8			
11:55	67'2"	7	69	53*	
12:05 p.m.	68'0"	8.6			
12:15	69'6"				
12:45	69'7"	8.5	71	53.2	
1:15	71'11"	8.3			
1:45	82'1"				
2:15	84'0"	7.5			
2:30	84'0"	7.5			
2:45	84'0"	7.5	72	53.6	Dug well, SWL 7'6"
3:15	84'0"	7.5			Pumping continued.

Sept. 15:
8:30 a.m. Mayor Hemsley reports SWL of dug well 7'11½" or a drop of 5½" from 11:15 a.m. Sept. 14 to 8:30 a.m. Sept. 15 with IERA well pumping continuously during that period.

* At end of 30' pipe.

Sheet No. 1 Name of Well What Cheer Survey No. W-0108

Location What Cheer, Iowa Date Drilled Analyst Stookey

Surf elev. 740'

00
26" clay, yel. gr. to brnsh blk, silty to sandy, fine to coarse quartz sand. Pockets white kaolin (?) coal frags. + finely divided carb. matter.
3'4" Clay, uniform dark brnsh gr., silty, finely mic., grit-size quartz and coal frags.
5'10" Clay, as above, slightly lighter in color. Few rounded sand to grit-size frags pink quartz, chert, coal, quartzite.
8'0" Clay, as above
10 Clay, med. yel. gr, finely mic., very sandy; fine to coarse rounded quartz sand. Yelwsh to brnsh nodules + streks.
12' Silt, lt. yel. gr. with reddish to brnsh stains, uniform, micac., few sand grains
15'4" Clay, silty, med. gr., abund. sub-ang. to sub-rnd fine quartz sand. Finely mic.
20
21'5" Gravel, grit to boulders + prly sorted sand. Quartz, chert, basalt, granite, ls.
22'11" Sand, coarse, sub-ang. to curv., arkosic. Quartz, partially kaolinized feldspars, greenstones, chert, basalt, pink quartz. Fresh chips pink granite.
23'6" Same as above, and clay, med. to dk. gr.
24'6" Drift
25'6" Penn.
27'0" Clay or shale, lt gr., soft, plast, elongate xtls pyrite, small frags bright coal, ± sand as above, probably caprings.
30 Clay or shale, light gray, soft, plastic, with soft round aggregates of pyrite, resembling oolites. From 28'0" to 31'0" shows abund frags brnsh black dense cannel coal.
31'0" Clay, lt gr., soft, plastic, + sand, fine, quartz "underclay"
32'3" Sand, fine even, secondary enlargement, pure quartz, mixed and interbedded with soft plastic clay. ± Finely disseminated pyrite and frags coaly material.
36'0" Sand as above, and clay, lt. gr. to white, soft
38'5" Penn
40'0" Miss Limestone, med. gr. to dark gr., dense to fine xtln, hard, magnesian, shelly fract., abund pyrite finely disseminated and veins pockets clear calc. xtls.
41'0" Sandstone, gray, fine, rather even grain quartz, glauconite, sub-ang. to curv. White clay cement. ± calc. cement.
45'0" Sandstone, as above, few scattered xtls of pyrite, calc. clay cement. Few grns pink quartz and few black grns.
Sandstone, as above
48'0" Sandstone, as above, in part green due to abundance of glauconite, matrix and limestone conglomerate with rounded gray ls frags 4-5 mm in lt gr.
50 Limestone, creamy wh. to brnsh gr., dense, hard, xtln aggr. of pyrite. White to gray chert very abund (50-60%).
53'5" Limestone, creamy white, dense, ± pyritic, and sandstone, clear quartz
54'7" fine to medium, very abund calc cement, few large recrystallized shells, well rnd.
56'5" sandstone, as above, 20% creamy ls with veinlets of pyrite, few frags gray chert, Occas. grain sec. enl.
59'4" Sandstone, as above. Very abund glauconitic + magnesian ls. cement. Borders on sandy ls.
60
61'4" Sandstone, as above. Contains molds of Bryozoans and rugose brachs.
62'5" Sandstone, as above, except calc cement ± more abund., almost a limestone
64'11" Sandstone, as above, grading into sandy to silty gray limestone or dol.
66'9" Sandstone, as above, grading into sandy gray ls.
Shale, lt. bl-gr., limy, soft, in part grnsh. gr.
70
71'1" Limestone, dense, ± earthy, med. gr., ± sandy lower 1-2", effervesces rather slowly.
72'11" Shale, med grnsh gr., soft, mass. bed., clayey, in part ± limy
79'1" Shale, grnsh gr. rather hard, limy 85%, and dolomite, brnsh
80 gr., rather hard, even crystalline, ± granular in appearance, 15%
81'0" Shale, blsh to grnsh gr, finely mic, mass bed, rather hard
83'0" Shale, grnsh to medium gray, as above
87'1" Shale, as above, to 89'0", then dolomite, yel brn to brnsh gr., finely to
89'10" coarse xtln., very abundant xtls of isometric pyrite
90
92'4" Dolomite, as above, in part quite dense and earthy, effervesces slowly
93'1" Shale, brnsh gr hard, limy, grades to soft ls.
95'10" Dolomite, yel brn calc fine even grn, glauconite, locally fine sandy, crinoid rem.
97'1" Dolomite, as above, locally much pyrite, color varies from yel gr to dark gr.
99'5" 00 Dolomite, as above, and shale, gray, limy, rather hard, few chert frags.

Sheet No. 2 Name of Well West Cheer Survey No. W-0108

Location ..... Date Drilled ..... Analyst .....

101'0"	00	Dolomite, like above, with few frags brn chert with reinlets of opaline SiO_2
102'2"		Dolomite, brnish to med gr, dense to finely xtln., effervesces slowly, + shale, gray, hard
103'3"		Dolomite, lt brnish gr, very finely xtln., cherty
104'8"		Dolomite, as above, 50% grey to brn chert with opaline to agate-like areas
105'10"		Dolomite, as above
107'0"		Dolomite, as above and shale, hard, gray, limy
		Dolomite, lt yel gr., fine grained, few chert frags., sparingly glauconitic.
110'0"	10	
		Dolomite, lt. gr. to yel. gr., fine grained, glauc., + 15% chert, brnish with areas of opaline SiO_2
112'5"		Dolomite, med. gr. dense, + shale, gray, limy, hard. ± xtln pyrite. Locally ± porous. Also shale, soft, gray, plastic.
113'11"		
117'2"		Dolomite, lt. gr. to lt. yel. gr. fine grained, soft, 25% chert, gray, with opaline areas.
118'10"		
	20	Dolomite, as above, cherty
120'10"		Dolomite, as above. "
122'3"		Dolomite, as above "
124'0"		
127'3"		As above. Chert locally shows agate-like banding.
	30	As above. Chert is light gray in color
132'0"		D
		Dolomite, as above
137'3"		Dolomite, light gray, fine grained, 80%, + chert, light gr., 20%.
	40	
140'2"		Dolomite, as above. Glauconitic, and shale, limy, gray, rather hard, 50-50
143		
145'3"		Shale, greenish gr; hard, non calc, mass-bed.
148'0"		Dolomite, lt. gr. to yel. gr. fine grnd, glauc., 10% chert.
	50	
151'1"		Dolomite, 75% as above, and shale, grn, hard, mass bed. with pyrite
153'2"		Shale, green, hard, mass bed, finely mic.
156'0"		Shale, as above
	60	
160'8"		Shale, as above, (50%) and dolomite, lt yel gr, fine grained, few frags wh. chert.
163'0"		Dolomite, lt gr, fine grained, very little chert, ± glauconite
166'6"		Dolomite, lt gr, to creamy wh, finely xtln, soft, cherty, thin strks blue sh.
169'2"	70	Thin reinlets of pyrite.
		Dolomite, creamy wh., fine grained, soft, white to lt-gr. chert 90%. Dol. shows glauconitic areas. Chert mottled with medium gr.
172'3"		Dolomite and chert, as above
176'1"		Dolomite + chert, as above
178'4"		Dolomite + chert, as above, few minute xtls pyrite
	80	
180'8"		Dolomite + chert, as above
182'5"		" " " " "
184'7"		" " " " "
187'6"		" " " " "
188'8"		" " " " ", in part showing pale grnsh cast.
190'10"	90	" " " " ", and shale, gray, soft, greasy
191'5"		Shale, grnsh gr., hard, limy
192'6"		" " " "
194'1"		" " " "
195'7"		" " " soft, plastic
196'5"		" " " "
197'5"		" " " "
198'9"		Dolomite, lt gr, fine grained, ± pyrite, few chert frags. Top at 198'9"
	00	

John C. Moore Corporation Rochester, N. Y. Binder and holes in leaves, [illegible]h Patented 1906. 200687

MOORE'S MODERN METHODS

What Cheer, Keokuk Co

I.E.R.A. Town Well - Present depth 172'10"

Sept. 14, 1940

	Water Level	Water level [corr.]	Production G.P.M	Temperature Air °F	Temperature Water °F	
11:00 am	18'8"	18'8"				SWL. * Dug well SWL = 7'6"
11:15	18'8"	18'8"				
11:16	23'0	23'0"				
11:17	27'1"	27'1"				
11:20	37'7"	37'7"				First yellow str
11:25	50'7"	50'7"				Second " "
11:30	56'0"	57'3				3
11:35	59'6"	60'8"				4
11:40	62'7"	63'10"				5
11:45	65'1"	66'4	9			6
11:50	65'8"	66'11"	8			No string
11:55 am	65'11"	67'2"	7	69	53*	
12:05 pm	66'9"	68'0"	8.6			
12:15	67'3"	69'6				
12:45	68'4"	69'7"	8.5	71	53.2	
1:15	70'8"	71'11"	8.3			
1:45	82'1	82'1"				
2:15	84'0"	84'0"	7.5			
2:30	84'0"	84'0"	7.5			
2:45	84'0"	84'0"	7.5	72	53.6	Dug well SWL-7'6"
3:15	84'0"	84'0"	7.5			Pumping continued

Sept 15.

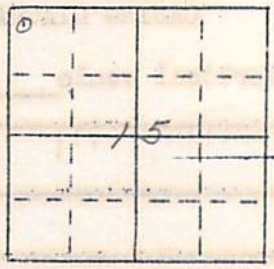
8:30 am — Mayor Hemsley reports SWL of Dug well 7'11½" or a drop of 5½" from 11:15 am Sept 14 to 8:30 am Sept 15 with I.E.R.A. well pumping continuously during that period.

* At end of 30' pipe

IOWA GEOLOGICAL SURVEY. W-0108

In Cooperation with U. S. Geological Survey

RECORD OF WELL



Location:

Town: What Cheer (N E) (S W):County Keokuk

NW-NW-NW sec. 15 T 76 N., R. 13 W. Washington Twp.

Well name and number What Cheer City Well (IERA)

Owner City of What Cheer Address

Tenant Address

Contractor C.D. Nolan. Address Cedar Rapids.

Drillers

Drilling dates Sept. 12, 1934 to Dec. 15, 1934

Well data:

Elevations: Drilling curb 740 feet; Land surface 739 feet

Determined by

Topographic position Valley flat south of Town.

Total depth: Reported feet, Measured 198' 9" feet

Drilling method Cable.

Hole and casing data 14" hole from curb to 39' 1"; 11" hole from 39' 1" to 198' 9" T.D.

39' 1" 12" O.D. casing from curb to 39' 1"; 53' 9" of 8" casing from curb to 53' 9". cemented inside of 12" pipe and to rock wall

Open hole from 53' 9" to 198' 9".

Original depth to water ft. above/below Date

Original elevation of water level ft.; Source of data

Sources of water: Principal ; Others

Production data: Date _____

Static depth to water 17'6" Measuring point curb.
Pumping level 106'10" at 60 g.p.m.

Specific capacity _____ g.p.m. per ft. drawdown; Temperature 53.6 °F.

Pump data; Type pump _____ Column Dia. _____ Length _____
Cylinder or bowls: Dia. _____ Length _____ Suction pipe _____

Power _____ Airline _____

Estimated rate of production: _____ g.p.m. for _____ hrs. a day
Use of water City Supply

WATER ANALYSES (in parts per million)

Date samples	Dec. 12, 1934	Sept. 14, 1946 +		
Sampled by	D. G. Stookey	H. G. Hershey		
Total solids	1660	485.0		
Insoluble matter	31.8	20.5		
Alkalinity (Meo)	300.0	282.0		
Alkalinity (Phn)	0.0	0.0		
pH	7.2	7.3		
Fe_2O_3+ Mn_2O_3+Al_2O_3	4.4	1.5		
Alkali as sodium	231.6	30.3		
Calcium	238.4	98.3		
Magnesium	32.4	30.5		
Iron (unfiltered)	0.2	1.2		
Manganese	Trace	0.00		
Nitrate	9.4	2.2		
Fluoride	1.0	1.0		
Chloride	28.	6.0		
Sulfate	824.6	132.9		
Bicarbonate	366.0	344.0		
Hardness (ppm)	229.0	373.		
Hardness (gpg)	42.6	21.8		

Remarks + Not in use

Laboratory data: Sample storage location _____

Sample range 0-2500 No. spls. 98 No. dupls. & cond. 95 P-6,
Spls. prepared by _____ Washed range _____ by _____
Driller's log and cond. _____
Insoluble residues: Prepared by _____ Studied by _____ Strip log _____
Microscopic study Eliss-Stookey strip log Eliss
Gen. log Yes Correl. by Eliss

IOWA EMERGENCY RELIEF ADMINISTRATION

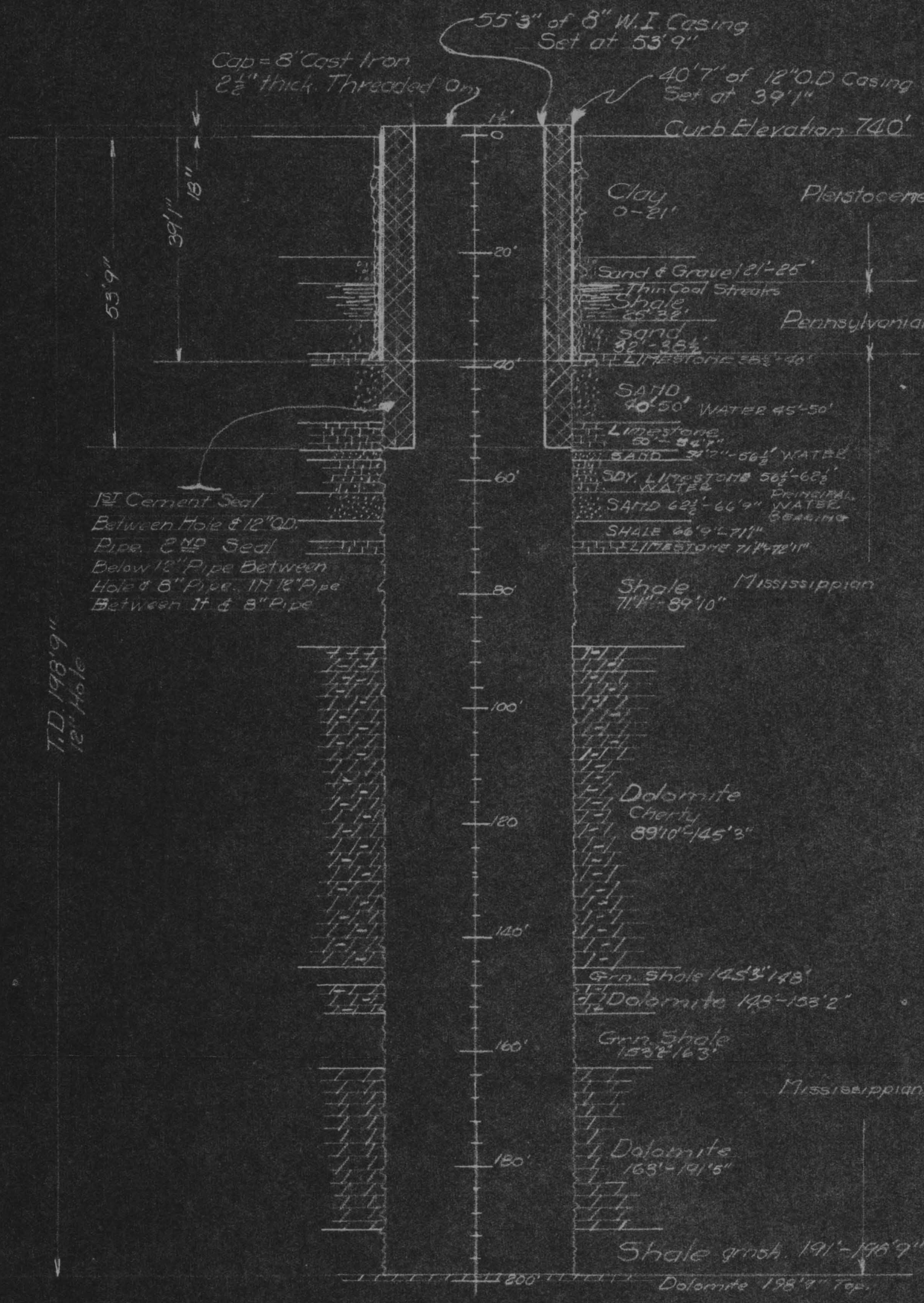


DIAGRAM OF WELL CONSTRUCTED FOR CITY OF WHAT CHEER

KEOKUK CO.

Completed Dec. 15, 1934

C. D. NOLAN
Contractor

Specification & Supervision by
A. C. TESTER, ASST STATE GEOLOGIST
Iowa City, Iowa

E. S. BOUDINOT
Drouth Relief Engr.

148 9
39.1
1578

DRILLER'S NOTEBOOK

WELL RECORD

Driller.....

Address.....

.....

Farm or Town What Cheer

Owner.....

.....

RETURN TO
IOWA GEOLOGICAL SURVEY
Des Moines, Iowa

WHEN RECORD IS COMPLETED PUT IN ENVELOPE AND MAIL TO

THE DIRECTOR

IOWA GEOLOGICAL SURVEY

DES MOINES, IOWA

Sample No.	DEPTH From	DEPTH To	THICKNESS	DESCRIPTION OF BEDS — KIND OF ROCK, COLOR, HARD OR SOFT WATER, ETC.
1	0'	2'	2	Soil, brnsh blk, crumbly, mixed with gray clay, in part, upper 6" fill
2	2'	3'4"	1'4"	Clay, dark gr., scat. sand grns. + frags of coal, ± silty
3	3'4"	5'10"	2'6"	Clay, like #2, slightly lighter in color
4	5'10"	8.0'	2'2"	Clay, yel. gr, silty
5	8.0'	12.0	4.0'	Like #4
6	12	15'4"	3'4"	Clay, yallowish to grnsh gray, brnsh streaks, ± silty
7	15'4"	20'3"	4'11"	Sand, gray, fine, quartz, unconsolidated 20'3"-21'5" as above Surface hard rock 21'5"
8	20'3"	22'11"	2'8"	21'5"-22'11" Gravel, rounded, poorly sorted, chert, quartz, greys., grit size to boulders. Granite, basalt
9	22'11"	23'6"	1'7"	Sand, gray, coarse, largely ~~coars~~ quartz, sub-ang. to sub-rnd. Some ang. frags granite + few pebbles of chert
10	23'6"	24'6"	1'0"	Like #9, slightly finer
11	24'6"	25'0"	~~2'6~~ 6"	Clay, brnsh gr, plastic, mixed with sand.
12	25'0"	27'0"	2'0"	Clay, lt. blsh. gr, soft, plast., elongate cavers xtln pyrite + few ~~min~~ small frags bright coal (coalified roots)?

Sample No.	DEPTH From	DEPTH To	THICKNESS	DESCRIPTION OF BEDS — KIND OF ROCK, COLOR, HARD OR SOFT WATER, ETC.
13	27'0"	27'6"	6"	Like #12
14	27'6"	28'0"	6"	" "
15	28'0"	31'0"	3'0"	" "
16	31'0"	32'3"	1'3"	As above, but coal frags more abundant.
17	32'3"	33'4"	1'1"	Clay gray, intermixed with fine sand
18 9-24-34	33'4"	36'0"	2'8"	Sandstone, dark gray to med. gr., soft, interbedded with soft gray clay. Color due to finely disseminated pyrite.
19	36'0"	38'5"	2'5"	Like #18. Sand is clear quartz, fine, rounded. Drilling is clear, #18 + 19 contain solid rock 38'5". Small amt. of water
20	38'5"	40'	1'5"	Limestone, med gr, earthy, veinlets of calcite, very abund. pyrite in scattered flakes in veins & casing set at 39'1".
21	40'	41'	1'0"	Sandstone, white, fine, friable, calcareous, mixed with limy clay. Abundant water.
22	41'	45'	3'0"	Ss, like #21 (21' of water at 535' See notebook for pumping data. Pumped 16 gal in 43 sec. after bailer reached bottom of cylinder 22.3 gal. per min.
23	45'	48'	3'0"	Ss, as above
24	48'	50'	2'0"	Siltstone, coarse, [illegible] gray, slightly calc.
25	50'	53'5"	3'5"	Limestone, light [illegible] dense, ± clayey.
				Pumped 16 gal. in 43 seconds, took 8 min. to pump to bottom of cylinder [illegible] Below pump at 43 ft. 9-21-34. 21' 8:30 A.M.

Sample No.	DEPTH From	DEPTH To	THICKNESS	DESCRIPTION OF BEDS — KIND OF ROCK, COLOR, HARD OR SOFT WATER, ETC.
26	53'5"	54'7"	1'2"	Limestone, lt. gr., hard with ± very fine angular quartz sand.
27	54'7"	56'5"	1'10"	Sandstone, light gray, fine, subang. to subrnd., ton drops gray is like #26. Calc cement
28	56'5"	58'4"	2'11"	Limestone, gray, glauconitic, few oolites, very sandy, ang. grns clear quartz
29	58'4"	61'4"	2'0"	Ls. like #28, sandy + glauconitic, with molds of Brachiopod + Bryozoa. Has gritty appearance like dolomite,
30	61'4"	62'5"	1'1"	Ls. light gray, less sandy than above and lighter in color
31	62'5"	66'11"	3'6"	Sandstone, fine to med grn, clear quartz, rounded, glauconitic gray is cement base.
32	66'11"	66'9"	1'10"	Sandstone, light gray, variable from very fine grn to med grn subrnd. Grades to sandy ls. has abund cement of dolomite(?) ls.
33	66'9"	68'9"	2'0"	Shale - green to lt brn or soft, lam. bedded.
34	68'9"	71'1"	2'4"	Shale, like #33
10-8-37 35	71'1"	72'11"	0'10"	Limestone, lt. gr. sandy, fine grn, ± earthy, ± crystalline, slightly magnesian(?). to Mag ls 1-2" ± sandy. Argill. Shale soft, med. grnish gray, thin bed.
36	72'11"	74'4"	1'5"	As above
37	74'4"	76'2"	1'10"	" "
38	76'2"	77'6"	1'4"	" "

Sample No.	DEPTH From	DEPTH To	THICKNESS	DESCRIPTION OF BEDS — KIND OF ROCK, COLOR, HARD OR SOFT WATER, ETC.
39	77'6"	79'1"	1'7"	As above
10-1-34 40	79'1	81'0"	1'11"	hit rock = Shale, rath hard ± calc. grnsh gr. with 1 thy bed of grnsh gr rath hard limy stone.
41	81'0"	83'0"	2'0"	Shale, Blsh to grnsh gr, finely mic, non calc, mass bed, rather hard
42	83'0"	87'1"	4'1"	Shale, as above, but med. to dek. gr.
43	87'1"	89'10"	2'9"	30 Like #2 to 39'0". Then went into Limestone, med to dark gr, grnsh cast, Uniform cryst. look dolomitic. In part
44	89'10"	92'4"	2'6"	Limestone, med brnsh gr, med coarse stln, dolomitic, effervesces slowly, very porous rather soft.
45	92'4"	93'6"	1'2"	Shale, brnsh gr, rath hard, limy, grades to soft ls or dol.
46	93'6"	95'0"	1'6"	Limestone, med. gr., xtln., glauconitic dolomitic scattered dng. grains white or pale green, tough, locally.
47	95'0"	97'1"	2'1"	Limestone, med to dark gr, soft stln, grading into limy sh. May be dolomitic. Brnsh cast.
48	97'1"	99'3"	2'2"	Limestone, very earthy, soft, shaly, grades to limy sh. Uniformly stln, like dolomite. Contains dark or chert nodules with violets appearance
49	99'3"	101'	1'9"	Like #8
10-10-34 50	101'	102'2"	1'2"	Limestone, dark to med brnsh gr, soft earthy ± xtln, ± shaly
51	102'2"	103'3"	1'1"	Limestone, yel-brn to yel gr, finely xtln, dolomitic, Charty

Sample No.	DEPTH From	DEPTH To	THICKNESS	DESCRIPTION OF BEDS — KIND OF ROCK, COLOR, HARD OR SOFT WATER, ETC.
52	103'3"	104'8"	1'5"	Like #51, but chert is opaque + very abund.
53	104'8"	105'10	1'8"	Limestone, brown, finely cryst, soft, dolomitic, cherty
54	105'10"	107'0"	1'2"	Like #53, but contains light gray shale, may be shale parting or coating.
55	107'0"	110'0"	3'0"	Limestone, l-pbt yel. gr. soft, finely cryst. cherty
56	110'0"	112'5"	2'5"	Limestone, gray xtln, cherty, ~~is~~ pbt yel. to brown gr.
57	112'5"	113'11"	1'6"	As above
58	113'11"	115'4"	1'5"	Shale [illegible] soft, pbt gr, [illegible] mica
59	115'4"	117'2"	1'10"	rock at 116'9". Shale to 117' then hard, white, fine grained limestone, but dense effervesces ~~may be~~ may be dolomite
10-11-34 60	117'2"	118'10"	1'8"	Limestone, ~~white~~ fine gr angular, rather soft, effervesces slowly, ~~in~~ acid ~~is~~ in warm. Dolomitic. Color lt yel gr. cherty.
61	118'10"	120'10"	2'0"	As above
62	120'10"	122'3"	1'5"	Limestone, yel gr. soft, xtln, ± porous dolomitic; cherty
63	122'3"	124'0"	1'9"	As above
64	124'0"	127'3"	3'3"	Limestone, dolomitic, [illegible] soft, gran coarse xtln, cherty, [illegible] very soft

Sample No.	DEPTH From	DEPTH To	THICKNESS	DESCRIPTION OF BEDS — KIND OF ROCK, COLOR, HARD OR SOFT WATER, ETC.
65	127'3"	132'0"		Dolomite Limestone, lt yelw, sdy grn + porous, cherty.
66	132'0"	134'2"		As above
67	134'2"	137'3"		As above
68	137'3"	138'9"		As above
69	138'9"	140'4"		As above
70	140'4"	141'5"		Dolomite, lt gr, even xtln, porous. Sample shows ± mud, pockets, thin gry shale partings. Round glauconite. Cherty.
71	141'5	145'3"		As above.
72	145'3"	148'0"		Shale, hard, dk grn, noncalc, massive
73	148'0"	151'1"		Dolomite, lt gr, sdy, cherty, fissile xtln + grn shale bdgs
74	151'1"	153'2"		As above
75	153'2"	156'0"		Shale, grn, hard, gyp [illegible] mass bed
76	156'0"	157'10"		As above
77	157'10	160'8"		As above

Sample No.	DEPTH From	DEPTH To	THICKNESS	DESCRIPTION OF BEDS — KIND OF ROCK, COLOR, HARD OR SOFT WATER, ETC.
78	160'8"	163'0"		Shale, dk grn, hard, + dolomite, yel brn, xtln, soft
79	163'0"	166'0"		Dolomite, lt yel gr, soft, xtln,
80	166'0"	169'2"		Limestone, dolomitic(?) lt gr, finely crystl, soft, cherty, thin streaks of blue shale, veinlets of (pyrite?)
81	169'2"	172'3"		As above
82	172'3"	176'1"		As above, very cherty
83	176'1"	178'4"		As above, breaks to small frags.
84	178'4"	180'8"		As above
85	180'8"	182'5"		As above
86	182'5"	184'7"		As above
87	184'7"	187'0"		" "
88	187'0"	188'8"		Limestone, lt gr white, soft, fine grained looks ± earthy
89	188'8"	190'10"		" "
90	190'10"	191'5"		" " A-H [illegible] streaks gr sh.
#		192'6"	196'7"	

Sample No.	DEPTH From	DEPTH To	THICKNESS	DESCRIPTION OF BEDS — KIND OF ROCK, COLOR, HARD OR SOFT WATER, ETC.
91	191'5"	192'6"		Shale, grnish gr, hard, calc.
92	192'6"	194'1"		Shale, med gr, rath. hard, limy
93	194'1"	195'7"		Shale, grnish gr, limy, fairly hard
94	195'7"	196'5"		Shale, soft, grnish gr. plastic
95	196'5"	197'5"		
96	197'5"	198'9"		Hit solid