John C. Moore Corporation, Rochester, N. Y. Binder and holes in leaves Patented. FORM 410546

5:11
0:04
4:37

240

| | D/w (uncorr) | DW corrected | $\forall_{t_1}$ | $t_1$ | T |
|---|---|---|---|---|---|
| 5:11 pm | | Shut down old well pumping | | 0 | 277 |
| 5:12 | 126.0 | 123.85 | 298 | 1 | 278 |
| 5:12:30 | 114.4 | 112.25 | 185 | 1.5 | 278.5 |
| 5:13 | 100.4 | 98.25 | 139 | 2 | 279 |
| 5:14 | 82.27 | 80.12 | 93.2 | 3 | 280 |
| 5:15:30 | 61.8 | 59.65 | 62.5 | 4.5 | 281.5 |
| 5:16 | 56.62 | 54.47 | 56.4 | 5 | 282 |
| 5:17 | 49.60 | 47.45 | 47.2 | 6 | 283 |
| 5:18 | 45.10 | 42.95 | 40.6 | 7 | 284 |
| 5:19 | 43.08 | 40.93 | 35.7 | 8 | 285 |
| 5:20 | 42.20 | 40.05 | 31.8 | 9 | 286 |
| 5:21 | 41.75 | 39.60 | 28.7 | 10 | 287 |
| 5:22 | 41.45 | 39.30 | 26.2 | 11 | 288 |
| 5:24 | 41.00 | 38.85 | 22.3 | 13 | 290 |
| 5:26 | 40.70 | 38.55 | 19.5 | 15 | 292 |
| 5:28 | 40.40 | 38.25 | 17.3 | 17 | 294 |
| 5:30 | 40.20 | 38.05 | 15.6 | 19 | 296 |
| 5:35 | 39.83 | 37.68 | 12.5 | 24 | 301 |
| 6:06 | 38.79 | 36.64 | 6.0 | 55 | 332 |
| 6:15 | 38.69 | 36.54 | 5.3 | 64 | 341 |
| 6:40 P | 38.38 | 36.23 | 4.1 | 89 | 366 |
| 7:00 | 38.23 | 36.08 | 3.5 | 109 | 386 |
| 7:30 P | 38.05 | 35.90 | 3.0 | 139 | 416 |

old well pumping at 7:30 P

W. E. Hale
K. E. Andersen

John C. Moore Corporation, Rochester, N. Y. Binder and holes in leaves Patented. FORM 410546

Garwin (Tama Co.)

KEA
3-20-43

City Well No. 1
T.D. 166'
SWL - 30' (originally +15' reported)
Casing - 166' of 6" 0-166 (old 8" well)
Production - 60 gpm est.
Date - 1913
Contractor - E. A. Ford, Marshalltown

perf
126½-156½'

Location -

Elevation - same as city well #2 = 898.5'

Water sample collected
Jug - G - 211
Time - 12:20 pm
Air temp - 85°F
Water temp - 51°F
Topog - Valley
Pump - cylinder 4" cyl 24" stroke
28 str. per min.
West. 10 HP elec. motor power (calc gpm)

Collected when pumping 9 pm for
4 hrs 20 min.

Collected 6' from pump after passing
through 6' of 4" pipe.

Cyl. pump set at 63' col. 3' cyl 4' taper

Andrew Christensen, W. Supt., Garwin

John C. Moore Corporation, Rochester, N. Y. Binder and holes in leaves Patented. FORM 410546

Garwin (Tama Co.)

City well No. 2 Loc = ICEA.
Elev = 898.5' 3-20-43

TD - 171'
Casing - 125 of 10" 0 - 125'
cemented - 25 sacks neat pumped from bottom - 5 sacks with sand at top
53' of 8" liner 118' - 171' (7' lap)
8" perforated ~~from~~ 146' - 166'

SWL after drilling - 31 - 32'

Date - completed 3/20/43 (3-4 wks drlng)
Contr - Hoeg & Ames, Lincoln
Ed Martin, driller

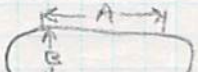
(Log)
Drift 0 - 107
Shale 107 - 143
(some sh) Good rock at 143
Rock 150 - 171 (water 155' - 160')

Test pump - 163' of 4" col. (inc. 15' bowls - 3' tp)
Airline 153 ft. long.

Tested 3/19 with 113' column + bowls

90 gpm cld to 113'

Spl. collected at ~~1110 pm~~ ~~3:00 pm~~ 4:00 pm (~~96 gpm~~ 87 gpm)
Jug G-200
Air = 26°
Water = 50°

Meas tank = 

A = ~~1 1/2~~ '
B = ~~2~~ "
(17½ gals to inch of depth)

John C. Moore Corporation, Rochester, N. Y. Binder and holes in leaves Patented. FORM 410546

Garwin (Tama Co.)

KEA
3-20-43

Elevations (Hand Level)

B.M. Elev. top of rail opposite C.N.W. Ry depot
= 896' above sea level

| Sta. | + | H.I. | − | Elev. |
|---|---|---|---|---|
| City well #2 (drilling curb) | 3.9 | 103.9 | | 100.0 |
| T.P. 1 | 5.0 | 107.4 | 1.5 | 102.4 |
| T.P. 2 | 2.1 | 100.4 | 9.1 | 98.3 |
| B.M. at depot (rail) | 4.3 | 99.1 | 5.6 | 94.8 |
| T.P. 3 | 5.4 | 100.7 | 3.8 | 95.3 |
| T.P. 4 | 5.9 | 104.4 | 2.2 | 98.5 |
| T.P. 5 | 3.3 | 102.0 | 5.7 | 98.7 |
| City well (as above) | | | 4.7 | 97.3 |
| Check | 29.9 | | 32.6 | 100.0 |
| | | | 29.9 | 97.3 |
| | | | 2.7 = | 2.7 |

Use return trip as best

∴ Drilling platform at city well No. 2
= 896.0 + (97.3 − 94.8) = 898.5'

Copper tack & washer (USGS-BM) set in NE corner of rest room about 25' SW of well No. 2 and about 4' above ground.

Elev. of this washer = 901.8'
Elev. of top of 10" casing = 898.65'
Elev. of meas. pt. for pump test March 20 = 898.8'
Elev. of drilling curb = 898.5'

W. E. Hale - Instrument
K. E. Anderson - Rod & Notes

John C. Moore Corporation, Rochester, N. Y. Binder and holes in leaves Patented. FORM 410546

Results of Pumping Test
March 20, 1943
Garwin City Well No. 2

Location: SW¼-NW¼-NE¼-sec. 14 - T. 84 N - R 16W - Carlton Twp.
Elevation: 898.5 feet
Total Depth: 171 feet
Contractor: Hoeg & Ames, Lincoln
Driller: Ed Martin
Date Completed: March 18, 1943
Casing: 125' of 10" casing from 0-125' cemented in a 12" hole by pumping 25 sacks of neat cement in at bottom under pressure. 5 sacks added from surface.

53' of 8" liner from 118'-171', perforated from 146'-166'.

Test pump: Fairbanks-Morse turbine; 4" column, 7" bowls 160 ft. to bottom of bowls with 3' of tail pipe.
Powered by gasoline engine, shaft driving the gear head on pump.

All depth to water measured in feet below top of test pump base which is 0.3 ft. above drilling curb and 0.15 ft. above top of 10" casing. Elevation of measuring point = 898.8 ft.

Copper washer stamped U.S.G.S.-B.M. set in Northeast corner post of rest room building, approximately 25 ft. S.W. of well No. 2 and about 4 ft above ground. Elevation of washer = 901.8 feet.

Well No. 1 is 12 feet North of well No. 2. The pump in well No. 1 was operating almost continuously during this pumping test at a rate of about 40 gallons per minute.

John C. Moore Corporation, Rochester, N. Y. Binder and holes in leaves Patented. FORM 410548

3-20-43

Garwin Well

| Time | DW | Air Line | GPM | Remarks |
|---|---|---|---|---|
| 12:24P | 34.09 | 120 | | old well pumping |
| 12:33P | 34.10 | 120 | | " " " |
| 12:34P | | | | Pump started |
| 12:35P | 58.27 | | | old well pumping |
| 12:36P | 80.75 | | | |
| 12:38P | 86.04 | | | |
| 12:39P | 90.81 | | | |
| 12:42P | 101.10 | | | |
| 12:44P | 106.91 | | | |
| 12:46P | 190.87 | 42 | | |
| 12:48P | 113.55 | | | |
| 12:50P | 115.15 | 40 | | |
| 12:52P | 116.95 | 39 | | |
| 12:54P | 119.55 | | | |
| 12:58P | 121.30 | 34 | 110 | |
| 1:02P | 123.47 | | | |
| 1:05P | 125.25 | 30 | | |
| 1:10P | 126.50 | 28 | | |
| 1:15P | 127.85 | | 110 | |
| 1:18:30P | | | | old pump shut down |
| 1:20 P | 126.40 | | | |
| 1:22:30P | 125.90 | | | old pump started |
| 1:30P | 130.20 | | | |
| 1:35P | 132.72 | | | |
| 1:40P | 132.65 | | | |
| 1:44P | | 25 | | |
| 1:45P | 130.00 | | 110 | |
| 1:50P | 131.01 | 26.5 | | |
| 1:56P | 131.00 | | | |
| 2:02P | 131.23 | 26.0 | | Temp. Air = 26°F. Water = 50°F |
| 2:08P | 144.55 | 12 | | Pump speeded up |
| 2:19P | 150.45 | | 131 | water gray |
| 2:18P | | 12 | | |
| 2:20P | 145.65 | | | clearing |
| 2:25P | 150+ | | | |
| 2:35P | | | 125 | |
| 2:53P | ~~135.85~~ | | | Decreased speed |
| 2:55P | 135.05 | | | |
| 3:00P | 133.60 | 35 | 96 | Temp. Water = 50°F |

John C. Moore Corporation, Rochester, N. Y. Binder and holes in leaves Patented. FORM 410546

3-20-43

Garwin

| Time | DW | air line | GPM | Remarks |
|---|---|---|---|---|
| 3:05P | 116.45 | 40 | | |
| 3:10P | 114.45 | | | |
| 3:15P | 113.10 | | 96 | |
| 3:18P | | | | Pump slowed down |
| 3:20P | 103.65 | | | |
| 3:23P | 98.15 | | 79 | |
| 3:27P | 99.02 | | | |
| 3:32P | 99.60 | | | |
| 3:42P | 99.45 | | | |
| 3:48P | 98.85 | 56 | 91 | |
| 3:56P | | | | Temp. Water = 50 °F |
| 4:05P | 98.50 | | | Sample collected for analysis. |
| 4:06:30P | 98.65 | | 138 | Speed up pump |
| 4:13P | | | | slow down pump |
| 4:17P | 143.95 | | | |
| 4:22P | 147.95 | | | |
| 4:23P | | | | shut down old well |
| 4:24P | 147.25 | | | |
| 4:25P | 146.80 | | | |
| 4:27P | 145.80 | | | |
| 4:28P | 145.60 | | | |
| 4:30P | 145.90 | | | |
| 4:32P | 145.60 | | | |
| 4:42P | 149.33 | | 131 | Temp. Water = 50 °F. |
| 4:46P | 150.26 | | | |
| 4:46:30P | | | | start old well pumping |
| 4:48P | 151.75 | | | |
| 4:48:15P | | | | stop old well pumping |
| 4:55P | 147.57 | | | |
| 4:57:30P | | | | start old well pumping |
| 5:03P | 153.50 | | | |
| 5:10P | 154.58 | | 129 | Water clear, pumping some shale particles |
| 5:11P | | | | shut down new well |
| | | | | old well still pumping |

1663

# WELL SCHEDULE

US GEOLOGICAL SURVEY

IOWA DISTRICT WRD

WELL NO. _____ CO. TAMA

OWNER GARWIN CITY #2 ADDRESS GARWIN

DRILLER HOEG AND AMES DATE DRLD 3-20-43

MAP _____

SOURCE OF DATA FILE

DESCRIPTION M. P LSD FEET (ABOVE) (BELOW) LSD _____

MASTER CARD - A 9-26-69 RP 11-23-70

| STATE | COUNTY | LATITUDE DEG | LATITUDE MIN | LATITUDE SEC | N. or S. | LONGITUDE DEG. | LONGITUDE MIN. | LONGITUDE SEC | SEQ. NO |
|---|---|---|---|---|---|---|---|---|---|
| 1 2 | 3 4 | 5 6 | 7 8 | 9 10 | 11 | 12 13 14 | 15 16 | 17 18 | 19 |
| 19 | 86 | 42 | 05 | 33 | N | 092 | 40 | 38 | 1 |

| CONTINUED FROM ABOVE | ACCURACY | LOCAL WELL NUMBER T | R | E/W | SEC. | QUARTERS | LOCAL USE W-NUMBER | LOCAL USE OPTIONAL | OWNER OR NAME | OWNERSHIP | WATER USE | WELL USE | WELL DATA | FREQ W/L | FIELD CHAR | HYD LAB | QW-DATA | QW-FREQ. | PUMPAGE | APERTURE | LOG DATA | CARD DESIG. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 20 | 21 22 23 | 24 25 | 26 | 27 28 | 29 30 31 32 33 34 | 35 36 37 38 39 | 40 41 42 43 44 45 46 47 48 49 50 51 | 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 | 67 | 68 | 69 | 70 | 71 | 72 | 73 | 74 | 75 | 76 | 77 | 78 79 | 80 |
| | 2 | 084 | 16 | W | 14 | ABA | | /143CITY | 2GARWIN | MP | W | W | 7 | | | | C | I | | | G | A |

WELL-DESCRIPTION CARD - B

| DUPLICATE CARD A CC 1-19 | DEPTH OF WELL | ACCURACY | DEPTH CASED OR FIRST PERF. | DIAM. INCHES | WELL FINISH METH. DRILLED | YEAR DRILLED | PUMP SETTING | METH. LIFT | DEEP/SHALLOW | POWER | ALTITUDE OF LSD (FEET) | ACCURACY | WATER LEVEL (FEET) | ACCURACY | DATE MONTH | DATE YEAR | YIELD OF WELL (GPM) | METH. DET | DRAW-DOWN (FEET) | ACCURACY | PUMPING PERIOD (HOURS) | QUALITY OF WATER IRON | SULF. | CHLOR | HARD | SP. COND. | TEMP | DATE SAMPLED | CARD DESIG. |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 20 21 22 23 | 24 | 25 26 27 28 | 29 30 | 31 | 32 33 34 35 | 36 37 38 | 39 | 40 | 41 | 42 43 44 45 46 | 47 | 48 49 50 51 | 52 | 53 54 55 | | 56 57 58 59 60 | 61 | 62 63 64 | 65 | 66 67 68 | 69 | 70 | 71 | 72 | 73 | 74 75 76 | 77 78 79 | 80 |
| | 171 | 3 | 146 | 8 | PC | 943 | | T | 3 | | 8987 | | | | | | 110 | 3 | 97 | 3 | | | | | | | | | B |

HYDROGEOLOGIC CARD - C

| DUPLICATE CARD A CC 1-19 | PHYS-IOG-RAPHY PROV. | PHYS-IOG-RAPHY SEC. | DRAINAGE BASIN | SUBBASIN | TOPO SETTING | MAJOR AQUIFER SYSTEM | SERIES USGS | SERIES ISB | UNIT | LITH-OLOGY | ORIG. | THICK-NESS | LENGTH WELL OPEN TO | DEPTH TO TOP OF | MINOR AQUIFER SYSTEM | SERIES USGS | SERIES ISB | UNIT | LITH-OLOGY | ORIG. | THICK-NESS | LENGTH WELL OPEN TO | DEPTH TO TOP OF | DEPTH TO CONSOL-DATED ROCK | SOURCE | DEPTH TO BASEMENT | SOURCE | SURF MAT LITH-OLOGY | SURF MAT INFIL | COEF TRAN SIG FIG | COEF TRAN XIO | COEF STOR SIG FIG | COEF STOR XIO- | CARD DESIG |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 20 21 | 22 | 23 24 25 | 26 | 27 | 28 | 29 | 30 | 31 | 32 33 | 34 | 35 36 37 | 38 39 40 | 41 42 43 | 44 | 45 | 46 | 47 | 48 49 | 50 | 51 52 53 | 54 55 56 | 57 58 59 | 60 61 62 63 | 64 | 65 66 67 68 | 69 | 70 71 | 72 | 73 74 | 75 | 76 77 | 78 | 79 80 |
| | 12 | E | 25 | D | V | D | 3 | U | L | L | 6 | | | 20146 | | | | | | | | | | 105 | D | | | Q | 2 | | | | | C |

CASING AND SCREEN (SIZE, TYPE, INTERVALS):

125' OF 10", 0-125'

53' OF 8" LINER 118'-171'

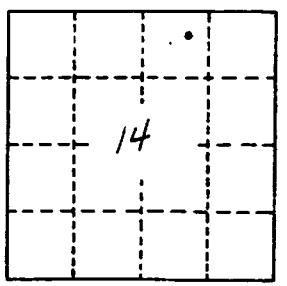
8" PERFORATED FROM 146'-166'

CODED BY HEXUM DATE 6/21/72

PUNCHED BY HEXUM DATE 6/23/72

VERIFIED BY _____ DATE _____

SKETCH ON REVERSE: YES _____ NO _____



UNITED STATES DEPARTMENT OF THE INTERIOR
Geological Survey
Water Resources Division

084-16W-14ABA
GARWIN CITY #2

1663

Water Quality
(ppm)

Card Q

State: IØWA [19] (1-2) County: TAMA [86] (3-4) Town: GARWIN

Well No. Latitude [4205333N] (5-11) Longitude [0924038] (12-18) Seq. No. [1] (19) Date M D Y [032043] (20-25)

Sampling Depth [146] (26-29) Type [1] (30) Kx10$^6$ (31-35) pH [73] (36-38) Temp. °F [50] (39-41)

$SiO_2$ (42-44) Ca [120] (45-49) Mg [77] (50-53) Na [184] (54-58) K [C] (59-61)

$HCO_3$ [234] (62-65) $CO_3$ (66-67) $SO_4$ [810] (68-72) Cl [80] (73-78) Source No. [3] [9] (79-80)

Card R

Duplicate Columns 1-25 from Card Q

F [0.5] (26-28) $NO_3$ [00] (29-32) $PO_4$ (33-35) B (36-38) Al (39-41) Fe [0.3] (42-45)

Mn [00] (46-49) Cu (50-52) Pb (53-54) Zn (55-57)

Determined Solids [1117] (58-63) Calc. (64-69) Ca,Mg Hardness [619] (70-73) Non-Carb. [427] (74-77)

Color (78-79) No. [8] (80)

Card S

Duplicate Columns 1-25 from Card Q

Br (26-28) I (29-31) Alk. as $CaCO_3$ [192] (32-35) Free $CO_2$ (36-38) SAR (39-41)

RSC (42-44) ABS (45-47) (48-50)

Alpha (pc/l) (55-57) Beta (pc/l) (58-60) Ra (pc/l) (61-63) U (ug/l) (64-66)

No. [5] (80)

Recorded by: HEXUM

Punched by: HEXUM Date: 6/72

Published:

084-16W-14 ABA
CITY OF GARWIN

1663

UNITED STATES DEPARTMENT OF THE INTERIOR
Geological Survey
Water Resources Division

Water Quality
(ppm)

Card Q

State: IOWA [19] (1-2) County: TAMA [86] (3-4) Town: GARWIN

Well No. Latitude [4205335N] (5-11) Longitude [09240384] (12-18) Seq. No. [1] (19) Date M D Y [061666] (20-25)

Sampling Depth [1460] (26-29) Type [1] (30) Kx10$^6$ [17400] (31-35) pH [76] (36-38) Temp. °F [ ] (39-41)

$SiO_2$ [76] (42-44) Ca [116.] (45-49) Mg [705] (50-53) Na [160.] (54-58) K [7.9] (59-61)

Source No. [3] [9] (79-80)

$HCO_3$ [242] (62-65) $CO_3$ [0] (66-67) $SO_4$ [721.] (68-72) Cl [6.] (73-78)

Card R

Duplicate Columns 1-25 from Card Q

F [0.8] (26-28) $NO_3$ [0.4] (29-32) $PO_4$ [ ] (33-35) B [ ] (36-38) Al [ ] (39-41) Fe [0.68] (42-45)

Mn [0.05] (46-49) Cu [ ] (50-52) Pb [ ] (53-54) Zn [ ] (55-57)

Solids Determined [1325] (58-63) Calc. [ ] (64-69) Ca,Mg [580] (70-73) Hardness Non-Carb. [382] (74-77)

Color [ ] (78-79) No. [R] (80)

Card S

Duplicate Columns 1-25 from Card Q

Br [ ] (26-28) I [ ] (29-31) Alk. as $CaCO_3$ [198] (32-35) Free $CO_2$ [ ] (36-38) SAR [ ] (39-41)

RSC [ ] (42-44) ABS [ ] (45-47) [ ] (48-50) [ ]

Alpha (pc/l) [ ] (55-57) Beta (pc/l) [ ] (58-60) Ra (pc/l) [ ] (61-63) U (ug/l) [ ] (64-66)

No. [S] (80)

Recorded by: HEXUM

Punched by: HEXUM Date: 6/72

Published:

084-16W-14ABA
CITY OF GARWIN

1663

UNITED STATES DEPARTMENT OF THE INTERIOR
Geological Survey
Water Resources Division

Water Quality
(ppm)

Card Q

State: IOWA (19) County: TAMA (86) Town: GARWIN

Well No. Latitude 42°05'33"N (5–11) Longitude 092°40'38" (12–18) Seq. No. 1 (19) Date M D Y 11 18 70 (20–25)

Sampling Depth 146 (26–29) Type 1 (30) Kx10$^{e}$ 1700 (31–35) pH 7.1 5 (36–38) Temp. °F 48 (39–41)

$SiO_2$ 70 (42–44) Ca 124 (45–49) Mg 66 (50–53) Na 160 (54–58) K 9.0 (59–61)

Source No. 3 Q

$HCO_3$ 229 (62–65) $CO_3$ 0 (66 67) $SO_4$ 740 (68–72) Cl 5 (73–78)

Card R

Duplicate Columns 1-25 from Card Q

F 1 (26–28) $NO_3$ 05 (29–32) $PO_4$ (33–35) B (36–38) Al (39–41) Fe 0.12 (42–45)

Mn 0.05 (46–49) Cu 0 (50–52) Pb 01 (53 54) Zn .03 (55–57)

Solids Determined 1340 (58–63) Calc. (64–69) Ca,Mg 580 (70–73) Hardness Non-Carb. 392 (74–77)

Color (78 79) No. R (80)

Card S

Duplicate Columns 1-25 from Card Q

Br (26–28) I (29–31) Alk. as $CaCO_3$ 188 (32–35) Free $CO_2$ (36–38) SAR (39–41)

RSC (42–44) ABS (45–47) (48–50)

Alpha (pc/l) (55–57) Beta (pc/l) (58–60) Ra (pc/l) (61–63) U (ug/l) (64–66)

No. S (80)

Recorded by: HEXUM

Punched by: HEXUM Date: 6/72

Published:

## Notes on Garwin City Well #2

The Garwin city well samples were good. The section was as expected and forecast by K. E. Anderson except that the Maple Mill was twenty-five feet thicker than expected. The light green calcareous shale, here called Maple Mill, may well be Sheffield. Its stratigraphic position is that of the Sheffield. However, the Godfrey Otto well to the east has a similar shale 120 feet thick without any limestone or dolomite break indicating that this is Maple Mill rather than Sheffield. This correlation is carried westward. The Lime Creek limestone is typical. It is light brown, phenoclastic and very fossiliferous, bearing the diagnostic fossil assemblage; charophytes, ostracodes, tentaculites, small cylindrical crinoid stem plates, brachiopod fragments and scalecodont fragments.

Apparently the Lime Creek limestone is a fairly good aquifer in this region.

S. E. Harris, Jr.

Notes on Garwin City Well #2

The Garwin city well samples were good. The section was as expected and forecast by K. E. Anderson except that the Maple Hill was twenty-five feet thicker than expected. The light green calcareous shale, here called Maple Hill, may well be Sheffield. Its stratigraphic position is that of the Sheffield. However, the Godfrey Otto well to the east has a similar shale 120 feet thick without any limestone or dolomite break indicating that this is Maple Hill rather than Sheffield. This correlation is carried westward. The Lime Creek limestone is typical. It is light brown, phenoclastic and very fossiliferous, bearing the diagnostic fossil assemblage; charophytes, ostracodes, tentaculites, small cylindrical crinoid stem plates, brachiopod fragments and scalecodont fragments.

Apparently the Lime Creek limestone is a fairly good aquifer in this region.

S. E. Harris, Jr.

OFFICE COPY

IOWA GEOLOGICAL SURVEY
Iowa City, Iowa

# Results of Pumping Test
March 20, 1943
Garwin City Well No. 2

Location: SW¼ NW¼ NE¼ sec. 14, T. 84 N., R. 16 W., Carlton Twp.
Elevation: 898.5 feet
Total depth: 171 feet
Contractor: Hoeg and Ames, Lincoln
Driller: Ed Martin
Date completed: March 18, 1943
Casing: 125' of 10" casing from 0-125' cemented in a 12" hole by pumping 25 sacks of neat cement in at bottom under pressure. 5 sacks added from surface.
53' of 8" liner from 118'-171', perforated from 146-166'.

Test pump: Fairbanks-Morse turbine; 4" column, 7" bowls. 160' to bottom of bowls with 3' of tail pipe. Powered by gasoline engine, shaft driving the gear head on pump.

All depth to water measured in feet below top of test pump base which is 0.3 feet above drilling curb and 0.15 feet above top of 10" casing. Elevation of measuring point = 898.8 feet.

Copper washer stamped U.S.G.S.-B.M. set in northeast corner post of rest room building, approximately 25' SW of well No. 2 and about 4' above ground. Elevation of washer = 901.8 feet.

Well No. 1 is 12' north of well No. 2. The pump in well No. 1 was operating almost continuously during this pumping test at a rate of about 40 gallons per minute.

| Time | Depth to water | Air line | G.P.M. | Remarks |
|---|---|---|---|---|
| March 20, 1943 | | | | |
| 12:24 p.m. | 34.09 | 120 | | Old well pumping. |
| 12:33 | 34.10 | 120 | | Old well pumping. |
| 12:34 | | | | Pump started. |
| 12:35 | 58.27 | | | Old well pumping. |
| 12:36 | 80.75 | | | |
| 12:38 | 86.04 | | | |
| 12:39 | 90.81 | | | |
| 12:42 | 101.10 | | | |
| 12:44 | 106.41 | | | |
| 12:46 | 110.87 | 42 | | |
| 12:48 | 113.55 | | | |

Copies to: (on March 24, 1943) S. R. Ames, Lincoln, Iowa
The Mayor, Garwin, Iowa
Lewis F. Whitney, Cedar Rapids, Iowa
U. S. G. S. files

| Time | Depth to water | Air line | G.P.M. | Remarks |
|---|---|---|---|---|
| March 30, 1943 (cont.) | | | | |
| 12:50 p.m. | 115.15 | 40 | | |
| 12:52 | 116.95 | 39 | | |
| 12:54 | 119.55 | | | |
| 12:58 | 121.30 | 34 | 110 | |
| 1:02 | 123.47 | | | |
| 1:05 | 125.25 | 30 | | |
| 1:10 | 126.50 | 28 | | |
| 1:15 | 127.85 | | 110 | |
| 1:18:30 | | | | Old pump shut down. |
| 1:20 | 126.40 | | | |
| 1:22:30 | 125.90 | | | Old pump started. |
| 1:30 | 130.20 | | | |
| 1:35 | 132.72 | | | |
| 1:40 | 132.65 | | | |
| 1:44 | | 25 | | |
| 1:45 | 130.03 | | 110 | |
| 1:50 | 131.01 | 26.5 | | |
| 1:56 | 131.00 | | | |
| 2:02 | 131.23 | 26.0 | | Temp.: Air = 26°F. Water = 50°F. |
| 2:08 | 144.55 | 12 | | Pump speeded up. |
| 2:13 | 150.45 | | 131 | Water gray. |
| 2:18 | | 12 | | |
| 2:20 | 145.65 | | | Clearing. |
| 2:25 | 150+ | | | |
| 2:35 | | | 125 | |
| 2:50 | | | | Decreased speed. |
| 2:55 | 135.05 | | | |
| 3:00 | 123.60 | 35 | 96 | Temp.: Water = 50°F. |
| 3:05 | 116.45 | 40 | | |
| 3:10 | 114.45 | | | |
| 3:15 | 113.10 | | 96 | |
| 3:18 | | | | Pump slowed down. |
| 3:20 | 109.65 | | | |
| 3:29 | 98.15 | | 79 | |
| 3:37 | 99.02 | | | |
| 3:52 | 99.60 | | | |
| 3:42 | 99.45 | | | |
| 3:48 | 98.85 | 56 | 91 | |
| 3:56 | | | | Temp.: Water = 50°F. |
| 4:05 | 98.50 | | | Sample collected for analysis. |
| 4:06:30 | 98.65 | | 138 | Speed up pump. |
| 4:13 | | | | Slow down pump. |
| 4:17 | 143.95 | | | |
| 4:22 | 147.95 | | | |
| 4:23 | | | | Shut down old well. |
| 4:24 | 147.25 | | | |
| 4:25 | 146.80 | | | |
| 4:27 | 145.90 | | | |

| Time | Depth to water | Air line | G.P.M. | Remarks |
|---|---|---|---|---|
| March 20, 1943 (cont.) | | | | |
| 4:28 p.m. | 145.60 | | | |
| 4:30 | 145.90 | | | |
| 4:32 | 145.60 | | | |
| 4:42 | 149.33 | | 131 | Temp. water = 50°F. |
| 4:46 | 150.26 | | | |
| 4:46:30 | | | | Start old well pumping. |
| 4:48 | 151.75 | | | |
| 4:48:15 | | | | Stop old well pumping. |
| 4:56 | 147.57 | | | |
| 4:57:30 | | | | Start old well pumping. |
| 5:03 | 153.50 | | | |
| 5:10 | 154.55 | | 129 | Water clear, pumping some shale particles. |
| 5:11 | | | | Shut down new well; old well still pumping. |
| 5:12 | 123.85 | | | |
| 5:12:30 | 112.25 | | | |
| 5:13 | 98.25 | | | |
| 5:14 | 80.12 | | | |
| 5:15:30 | 59.65 | | | |
| 5:16 | 54.47 | | | |
| 5:17 | 47.45 | | | |
| 5:18 | 42.95 | | | |
| 5:19 | 40.93 | | | |
| 5:20 | 40.05 | | | |
| 5:21 | 39.60 | | | |
| 5:22 | 39.30 | | | |
| 5:24 | 38.85 | | | |
| 5:26 | 38.55 | | | |
| 5:28 | 38.25 | | | |
| 5:30 | 38.05 | | | |
| 5:35 | 37.68 | | | |
| 6:06 | 36.64 | | | |
| 6:15 | 36.54 | | | |
| 6:40 | 36.23 | | | |
| 7:00 | 36.08 | | | |
| 7:30 | 35.90 | | | Old well still pumping. |

# City Wells at Garwin

## Tama County, Iowa

Garwin is located in west central Tama County in secs. 11 and 14, T. 84 N., R. 16 W. (Carlton twp.). The town had a population of 517 in 1940. The Chicago and North Western Railroad runs through the town. State highway 229 runs east from Garwin to U. S. Highway 63, 5 miles east.

The town has had a public water supply system since 1913, the date when the number one well was drilled. The water is pumped to a water tower which creates a pressure of 52 pounds in the mains. About 40,800 gallons of water are used daily.

City well No. 1: The well is located in SW¼ NW¼ NE¼ sec. 14, T. 84 N., R. 16 W. (NW corner of city park). This well was drilled 8 inches in diameter to a depth of 166 feet in 1913 by E. A. Ford, Marshalltown. Some 8-inch casing was put in the hole. A force pump with a 6-inch cylinder and 24-inch stroke was installed. a 10 horse-power motor drove the pump jack at a rate of 28 strokes to the minute, resulting in a discharge of about 76 gallons a minute. Water was coming principally from aquifers at a depth of 126 feet ± and 156 feet ±. The original water level was reported to be 15 feet above land surface. At present it is about 30 feet below land surface. Because of excessive caving the well was reased with 6-inch casing to a depth of 166 feet and slotted at a depth of 126 feet and 156 feet. The pump cylinder was reduced to a 4-inch cylinder and the well is now pumped at the rate of about 36.5 gallons a minute. The pump setting is reported to be 66 feet.

City well No. 2: This well is located about 12 feet south of well No. 1. Well drilled 10 inches and 8 inches in diameter to a depth of 171 feet in March 1943 by Hoeg and Ames of Lincoln, Iowa. The well is cased with 10-inch pipe to a depth of 125 feet and was cemented from bottom with 25 sacks of neat cement. Five sacks of sand were put around the casing at the top, and with 53 feet of 8-inch liner from 118 feet to 171 feet. The 8-inch liner is perforated from 146 feet to 166 feet. The static water level is reported to be between 31 and 32 feet below land surface when No. 1 is not pumping. A pumping test was made on No. 2 well on March 20, 1943. See pumping test.

OFFICE COPY

IOWA GEOLOGICAL SURVEY
Generalized Log Based on Detailed
Description of Drill Cuttings

Name of Well Garwin City Well No. 2 Survey No. W- 1663

Location NE¼ NW¼ NE¼ sec. 14, T. 84 N., R. 16 W., Garwin, Tama County

Drilled by Hoeg and Ames, Lincoln Date March 18, 1943

Total Depth 171 ft. Curb Elevation 893.5 ft. Static Level 34 ft.

Pumping Test 4 Hours 45 Min; Gal. per min. 110 Drawdown 97 ft. in — min.

Casing Data 125' of 10-inch casing from 0 to 125', cemented in a 12-inch hole by pumping 25 sacks of neat cement in at bottom under pressure. 5 sacks of cement with sand added from surface. 53' of 8-inch liner from 118 to 171 feet, perforated from 146 to 166 feet.

| No. | Description of Formations | Thick. | From (feet) | To |
|---|---|---|---|---|
| | **Pleistocene system** | | | |
| 1. | Soil and silt, medium brown, uniform, noncalcareous, derived from loess | 5 | 0 | 5 |
| 2. | Till, light gray to light yellow brown, noncalcareous, with much silt and sand scattered throughout | 20 | 5 | 25 |
| 3. | Till, light medium brown, very slightly calcareous, very sandy grading to silty at the base | 15 | 25 | 40 |
| 4. | Sand, light drabbish brown, coarse, with some gravel of igneous and limestone pebbles, calcareous | 5 | 40 | 45 |
| 5. | Till, medium brown, sandy, many limestone fragments, calcareous | 5 | 45 | 50 |
| 6. | Till, drabbish gray to gray, silty, pebbly, calcareous | 30 | 50 | 80 |
| 7. | Till, gray, silty, but not pebbly except at the base, calcareous | 25 | 80 | 105 |
| | **Mississippian system** | | | |
| | Kinderhook group | | | |
| | Maple Mill formation | | | |
| 8. | Shale, light green, calcareous, nonlaminated, moderately hard, with scattered calcite crystals | 20 | 105 | 125 |

Notes:

cc to A. H. Wieters, State Department of Health, Des Moines, Iowa, September 30, 1943.
S. R. Ames, Lincoln, Iowa, October 7, 1943.

Survey No. W-1663

| Description | Thick. | From | To |
|---|---|---|---|
| 9. Shale, light green, calcareous, soft, unctuous | 21 | 125 | 146 |
| Devonian system<br>Lime Creek formation<br>Owen-Cerro Gordo members | | | |
| 10. Limestone, pale brown to very light gray, fine-grained, very slightly pyritic, with up to 40% shale, light grey | 4 | 146 | 150 |
| 11. Limestone, light brown, fine-grained, earthy, very fossiliferous (ostracodes, charophytes, crinoid fragments, tentaculites), very slightly pyritic, with rhombs of white calcite | 5 | 150 | 155 |
| 12. Limestone, light brown, fragmental, fine-grained, very slightly pyritic, very fossiliferous as from 150 to 155 feet | 16 | 155 | 171 |

Total depth, 171 feet

Iowa Geological Survey
Iowa City, Iowa

Garwin, Tama County
Garwin City well No. 2
Contractor: Hoeg & Ames
Driller: Ed Martin

Folder

| | |
|---|---|
| 0-16 | Yellow clay |
| 16-20 | Sand |
| 20-40 | Blue clay |
| 40-47 | Sand and gravel |
| 47-84 | Blue clay |
| 84-107 | Shale |
| 107-120 | Rock and Shale |
| 120-125 | Limestone |

Set and cemented 10" pipe at 125'

| | |
|---|---|
| 125-143 | Rock bands and shale |
| 143-153 | Limestone (soft) |
| 153-171 | Limestone (good) |

IOWA GEOLOGICAL SURVEY
Water Well Data Sheet

Survey Number W-1663

Town Garwin County Tama T. 84 N., R. 16 W.

Name Garwin City Well #2 Location NE NW ¼ NE ¼, Sec. 14

Contractor Horg & Ames Driller Ed. Martin Use city supply

Construction Drilled Drilling Dates 2-22-43 / Drilling Depth

Topog. Valley Curb Elev. 898 Ref. Hand level. Total Depth 170

Final Static Level ____ above / below curb Pumping Level ____ Draw down ____ gpm ____ Time pumped ____ Date ____

Depth to bot. pump ____ ft. with ____ ft. suction pipe. Calc. g/ft. drawdown ____ Prin. Prod. ____

Producing Horizons ____

Water levels and pumping tests on various horizons during drilling:

| Depth Range | Stat. Level | Pump Level | Draw down | gpm. | Temp. | Producing horizons | Producing formations | Formations cased out |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |
| | | | | | | | | |
| | | | | | | | | |

Additional information

Laboratory Data

Sample range 0-170 Number samples 34 Number Duplicates 22 Cond. fair

Log Yes (No) Cond. ____ Boxed Heydon Range 0-165 Date 3-8-43

Remarks

| | | | | | |
|---|---|---|---|---|---|
| Microscopic Study Range | | Strip Log | Gen. Log | Blue Print | Samples Washed |
| Insol.Res. Study Range | | Strip Log | Gen. Log | Insol.Res. Prepared | Well Corel. |

# Notes on Garwin City Well #2

The Garwin city well samples were good. The section was as expected and forecast by K. E. Anderson except that the Maple Mill was twenty-five feet thicker than expected. The light green calcareous shale, here called Maple Mill, may well be Sheffield. Its stratigraphic position is that of the Sheffield. However, the Godfrey Otto well to the east has a similar shale 120 feet thick without any limestone or dolomite break indicating that this is Maple Mill rather than Sheffield. This correlation is carried westward. The Lime Creek limestone is typical. It is light brown, phenoclastic and very fossiliferous, bearing the diagnostic fossil assemblage; charophytes, ostracodes, tentaculites, small cylindrical crinoid stem plates, brachiopod fragments and scalecodont fragments.

Apparently the Lime Creek limestone is a fairly good aquifer in this region.

S. E. Harris, Jr.

Notes on Garwin City Well #2

The Garwin city well samples were good. The section was as expected and forecast by K. E. Anderson except that the Maple Hill was twenty-five feet thicker than expected. The light green calcareous shale, here called Maple Hill, may well be Sheffield. Its stratigraphic position is that of the Sheffield. However, the Godfrey Otto well to the east has a similar shale 120 feet thick without any limestone or dolomite break indicating that this is Maple Hill rather than Sheffield. This correlation is carried westward. The Lime Creek limestone is typical. It is light brown, phenoclastic and very fossiliferous, bearing the diagnostic fossil assemblage; charophytes, ostracodes, tentaculites, small cylindrical crinoid stem plates, brachiopod fragments and scalecodont fragments.

Apparently the Lime Creek limestone is a fairly good aquifer in this region.

S. E. Harris, Jr.

September 30, 1943

Mr. A. H. Wieters, Director
Division of Public Health Engineering
State Department of Health
Des Moines, Iowa

Dear Mr. Wieters:

On September 10 you wrote to me concerning the well recently constructed at Garwin, Iowa. At that time, although we had samples we did not have them studied nor described. That work has just been completed and I am inclosing a copy of our usual generalized log.

Mr. S. E. Harris who studied our samples reports that the drift below 50 feet and the Maple Mill shale are predominantly "tight" and clay-like.

I hope the log contains the information that you desire. If not, and if I can furnish additional information please let me hear from you.

Very truly yours,

H. G. Hershey

HGH:N

Inc.

WALTER L. BIERRING, M. D
COMMISSIONER

State of Iowa
Department of Health
Des Moines 19

DIVISION OF
PUBLIC HEALTH ENGINEERING
AND INDUSTRIAL HYGIENE

September 10, 1943

Dr. H. G. Hershey
Assistant State Geologist
Iowa Geological Survey
Iowa City, Iowa

Dear Dr. Hershey:

On a recent routine inspection trip Mr. R. C. Hanlon, one of our District Engineers, reports that he found a new well had been constructed at Garwin, Iowa, and it appears that no plans were submitted to this Department nor did we have any knowledge that a new well was being constructed. Unfortunately, the well is located rather close to existing sewers.

If you have any information on the log or construction of the well, we would appreciate very much having it so that our recommendations can be more specific.

Very truly yours,

A. H. Wieters, Director
Division of Public Health Engineering

AHW/mm

February 22, 1943

Mr. S. R. Ames
Lincoln, Iowa

Dear Mr. Ames:

The following is a brief report on ground-water possibilities at Garwin, based on the information in our files.

We have little record of the thickness of the drift at Garwin, or of the possibilities of obtaining a satisfactory water supply for the town from sand or gravel beds in the drift. Your experience in drilling the well for the creamery at Garwin will no doubt furnish you with this information. We estimate the drift to be about 100 feet thick.

Bedrock at Garwin should be either Maple Mill shale or limestones and shales of the Lime Creek formation, depending upon the thickness of the drift. The top of the Lime Creek should be reached at a depth of about 120 feet if the drift is not thicker than this figure.

Some water may be expected in these limestones, though it is questionable whether they will furnish enough for a town supply. It may be that acidizing of any water-bearing horizons found would increase the amount sufficiently.

The Juniper Hill shale should lie between depths of 180 and 275 feet, underlain by the limestones of the Shell Rock-Cedar Valley formations. The combined thickness of these formations, together with the underlying dolomites of the Wapsipinicon and Silurian formations should be slightly greater than 500 feet, and a satisfactory water supply could probably be developed in these formations. Some gypsum beds are likely to be found at a depth of about 430 feet and because they would produce a very hard water it would be desirable to develop the well above that point if possible.

A summary of these formations with their estimated depth range is given below. All depths are based on a starting elevation of 895 feet which is the elevation of the railroad depot at Garwin. The depths would be correspondingly greater if the well is drilled on higher land in town.

| Formation | Thickness | From | To |
|---|---|---|---|
| Pleistocene | | | |
| Glacial drift (clay, sand, gravel) | 100± | 0 | 100± |
| Mississippian | | | |
| Maple Mill-Sheffield formations (shale) | 20± | 100± | 120 |

| Formation (cont.) | Thickness | From | To |
|---|---|---|---|
| Devonian | | | |
| Lime Creek formation | | | |
| Owen-Cerro Gordo members (limestone, some shale) | 60 | 120 | 180 |
| Juniper Hill member (shale) | 95 | 180 | 275 |
| Shell Rock-Cedar Valley formations (limestone, dolomite) | 140 | 275 | 415 |
| Wapsipinicon formation (dolomite, with gypsum) | 235 | 415 | 650 |
| Silurian formations (cherty dolomite) | 160 | 650 | 810 |
| Ordovician | | | |
| Maquoketa formation (shale, some dolomite) | — | 810 | — |

Because Garwin is located in such a critical position with regard to these upper formations, we would appreciate it greatly if you would have your driller save a complete set of samples from the surface down from any drilling done at Garwin. If you need any sample sacks or log books for this purpose, we will be glad to furnish them.

I trust that this information will be of help to you. If we can be of any further service, please feel free to call upon us.

Thank you very much for the samples from the Wapello, Thompson, Dysart and Beaman wells. They are of much interest to us.

Very truly yours,

H. G. Hershey

HGH:N

Memorandum

To: H. G. Hershey
From: K. E. Anderson
Subject: Ground-water possibilities at Garwin (Tama Co.) Iowa

Mr. S. R. Ames
Lincoln, Iowa

Dear Mr. Ames:

The following is a brief report on ground-water possibilities at Garwin, based on the information in our files.

We have little record of the thickness of the drift at Garwin, or of the possibilities of obtaining a satisfactory water supply for the town from sand or gravel beds in the drift. Your experience in drilling the well for the creamery at Garwin will no doubt furnish you with this information. We estimate the drift to be about 100 feet thick.

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A summary of these formations, with their (estimated) depth range is given below. All depths are based on a starting elevation of 895 feet which is the elevation of the railroad depot at Garwin. The depths would be correspondingly greater if the well is drilled on higher land in town.

| Formation | Thickness | From | To |
|---|---|---|---|
| Pleistocene | | | |
| Glacial drift (clay, sand, gravel) | ~~75 ??~~ 100 ± | 0 | ~~75 ??~~ 100 ± |
| Mississippian | | | |
| Maple Mill (-Sheffield) formations (shale) | ~~45 ??~~ 20 ± | ~~75 ??~~ 100 ± | 120 |
| Devonian | | | |
| Lime Creek formation | | | |
| Owen-Cerro Gordo members (limestone, some shale) | 60 | 120 | 180 |
| Juniper Hill member (shale) | 95 | 180 | 275 |
| Shell Rock-Cedar Valley formations (limestone, dolomite) | 140 | 275 | ~~415~~ 515 |
| Wapsipinicon formation (dolomite, with gypsum) | ~~[illegible]~~ 235 | 415 | 650 |
| Silurian formations (cherty dolomite) | 160 | 650 | ~~810~~ |
| Ordovician | | | |
| Maquoketa formation (shale, some dolomite) | — | 810 | — |

Because Garwin is located in such a ~~[illegible]~~ critical position with regard to these upper formations, we would appreciate it greatly if you would have your driller save a complete set of samples from the surface down from any drilling done at Garwin. If you need any sample sacks or log books for this purpose, we will be glad to furnish them.

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Very ~~t~~uly yours,

P.S. Might thank him for the Wapello, Thompson, Dysart, and Beaman samples!

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City Wells at Garwin

Tama County, Iowa

Garwin is located in west central Tama County in secs. 11 and 14, T. 84 N., R. 16 W. (Carlton twp.). The town had a population of 517 in 1940. The Chicago and North Western Railroad runs through the town. State highway 229 runs east from Garwin to U. S. Highway 63, 5 miles east.

The town has had a public water supply system since 1913, the date when the number one well was drilled. The water is pumped to a water tower which creates a pressure of 52 pounds in the mains. About 40,800 gallons of water are used daily.

City well No. 1: The well is located in SW¼ NW¼ NE¼ sec. 14, T. 84 N., R. 16 W. (NW corner of city park). This well was drilled 8 inches in diameter to a depth of 166 feet in 1913 by E. A. Ford, Marshalltown. Some 8-inch casing was put in the hole. A force pump with a 6-inch cylinder and 24-inch stroke was installed. a 10 horse-power motor drove the pump jack at a rate of 28 strokes to the minute, resulting in a discharge of about 76 gallons a minute. Water was coming principally from aquifers at a depth of 126 feet ± and 156 feet ±. The original water level was reported to be 15 feet above land surface. At present it is about 30 feet below land surface. Because of excessive caving the well was recased with 6-inch casing to a depth of 166 feet and slotted at a depth of 126 feet and 156 feet. The pump cylinder was reduced to a 4-inch cylinder and the well is now pumped at the rate of about 36.5 gallons a minute. The pump setting is reported to be 66 feet.

1943

City well No. 2: This well is located about 12 feet south of well No. 1. Well drilled 10 inches and 8 inches in diameter to a depth of 171 feet in March 1943 by Hoeg and Ames of Lincoln, Iowa. The well is cased with 10-inch pipe to a depth of 125 feet and was cemented from bottom of casing with 25 sacks of neat cement. Five sacks of sand were put around the casing at the top, and with 53 feet of 8-inch liner from 118 feet to 171 feet. The 8-inch liner is perforated from 146 feet to 166 feet. The static water level is reported to be between 31 and 32 feet below land surface when No. 1 is not pumping. A pumping test was made on No. 2 well on March 20, 1943. See pumping test.

# City Wells at Garwin

## Tama County, Iowa

Garwin is located in west central Tama County in secs. 11 and 14, T. 84 N., R. 16 W. (Carlton twp.). The town had a population of 517 in 1940. The Chicago and North Western Railroad runs through the town. State highway 229 runs east from Garwin to U. S. Highway 63, 5 miles east.

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IOWA GEOLOGICAL SURVEY
Generalized Log Based on Detailed
Description of Drill Cuttings

Name of Well Garwin City Well No. 2 Survey No. W- 1663

Location NE¼ NW¼ NE¼ sec. 14, T. 84 N., R. 16 W., Garwin, Tama County

Drilled by Hoag and Ames, Lincoln Date March 18, 1943

Total Depth 171 ft. Curb Elevation 898.5 ft. Static Level 34 ft.

Pumping Test 4 Hours 45 Min; Gal. per min. 110 Drawdown 97 ft. in — min.

Casing Data 125' of 10-inch casing from 0 to 125', cemented in a 12-inch hole by pumping 25 sacks of neat cement in at bottom under pressure. 5 sacks of cement with sand added from surface. 53' of 8-inch liner from 118 to 171 feet, perforated from 146 to 166 feet.

| No. | Description of Formations | Thick. | From (feet) | To |
|---|---|---|---|---|
| | **Pleistocene system** | | | |
| 1. | Soil and silt, medium brown, uniform, noncalcareous, derived from loess | 5 | 0 | 5 |
| 2. | Till, light gray to light yellow brown, noncalcareous, with much silt and sand scattered throughout | 20 | 5 | 25 |
| 3. | Till, light medium brown, very slightly calcareous, very sandy grading to silty at the base | 15 | 25 | 40 |
| 4. | Sand, light drabbish brown, coarse, with some gravel of igneous and limestone pebbles, calcareous | 5 | 40 | 45 |
| 5. | Till, medium brown, sandy, many limestone fragments, calcareous | 5 | 45 | 50 |
| 6. | Till, drabbish gray to grey, silty, pebbly, calcareous | 30 | 50 | 80 |
| 7. | Till, gray, silty, but not pebbly except at the base, calcareous | 25 | 80 | 105 |
| | **Mississippian system** | | | |
| | Kinderhook group | | | |
| | Maple Mill formation | | | |
| 8. | Shale, light green, calcareous, nonlaminated, moderately hard, with scattered calcite crystals | 20 | 105 | 125 |

Notes:

Survey No. S-1663

| Description | Thick. | From | To |
|---|---|---|---|
| 9. Shale, light green, calcareous, soft, unctuous | 21 | 125 | 146 |
| Devonian system<br>Lime Creek formation<br>Owen-Cerro Gordo members | | | |
| 10. Limestone, pale brown to very light gray, fine-grained, very slightly pyritic, with up to 40% shale, light gray | 4 | 146 | 150 |
| 11. Limestone, light brown, fine-grained, earthy, very fossiliferous (ostracodes, charophytes, crinoid fragments, tentaculites), very slightly pyritic, with rhombs of white calcite | 5 | 150 | 155 |
| 12. Limestone, light brown, fragmental, fine-grained, very slightly pyritic, very fossiliferous as from 150 to 155 feet | 16 | 155 | 171 |

Total depth, 171 feet

Sheet No. 1 Name of Well. Garwin City Well No. 2 Survey No. W-1663.

Location Garwin (Tame) Date Drilled. Analyst. Harris

00 Soil, silt, med brn, uniform, non-calc from loess

Till, mostly silt some sd. a few small pieces gravel lt. gr to lt. yel

10 sand, yel brn, v. dirty (possibly till) med to crse, A, mostly qtz some ig non-calc

Till (perhaps loess) lt gr to yel brn, mostly silt qtz some fn mica flakes

20 sd (till?) yel brn as in 10-15

Till v.v. sdy lt-med brn v. sltly calc looks as though it has been washed hard

30 Ditto almost entirely sd

Till, gr, v. silty clay sltly calc

40 Sd, lt. drbish brn crse some gravel, ig + ls pbls Keokuk Cht

Till, med brn much ls v. sdy clay Keokuk cht

50 Till, drbish gr. pbly clay + silt fresh

Till, gr. pbly, silty

60 Till, ditto

Till, ditto

70 Till, gr. fresh pbly clay

ditto

80 ditto but not pebbly

ditto

90 ditto

ditto

00

Sheet No. 2 Name of Well Garwin City Well Survey No. W-1663

Location - Date Drilled Analyst Harris

100

till, lt med gr. clay & silt somewhat pbly
some lt. grn sh frags

sh lt. grn, calc, non-lam., calcite xtls, rather dull

10

sh ditto rather hard

sh ditto

20

sh lt. grn ditto

3/16/43

sh, lt. grn, calc, soft, rather unct

30

sh ditto

sh ditto

40

cht, wh, op

sh ditto

sh, lt. gr.

50

ls, pale brn to v. lt. gr, fn, [illegible] py

ls, lt. brn, fn, earthy v. fos, ostr charophytes, scelecodont
wh cal rh crl, tentaculites py

3/16/43

3/22/43

ls, lt. brn, fragmental, fn calcite cleav rhombs

60

abundant crinoid stem plates, & ostracodes charophytes, brach py

py

ls ditto lt. grayish brn

v. fossilif frag cri, ost brach py

ls drbish gr to lt. brn, fragmental phen o

70

ost cri charophytes py

(Generalized Log - by K. E. Anderson, Sept. 11, 1943)

80

90

00

City Wells at Garwin

Tama County, Iowa

Garwin is located in west central Tama County in secs. 11 and 14, T. 84 N., R. 16 W. (Carlton twp.). The town had a population of 517 in 1940. The Chicago and North Western Railroad runs through the town. State highway 229 runs east from Garwin to U. S. Highway 63, 5 miles east.

The town has had a public water supply system since 1913, the date when the number one well was drilled. The water is pumped to a water tower which creates a pressure of 52 pounds in the mains. About 40,800 gallons of water are used daily.

City well No. 1: The well is located in SW¼ NW¼ NE¼ sec. 14, T. 84 N., R. 16 W. (NW corner of city park). This well was drilled 8 inches in diameter to a depth of 166 feet in 1913 by E. A. Ford, Marshalltown. Some 8-inch casing was put in the hole. A force pump with a 6-inch cylinder and 24-inch stroke was installed. a 10 horse-power motor drove the pump jack at a rate of 28 strokes to the minute, resulting in a discharge of about 76 gallons a minute. Water was coming principally from aquifers at a depth of 126 feet ± and 156 feet ±. The original water level was reported to be 15 feet above land surface. At present it is about 30 feet below land surface. Because of excessive caving the well was recased with 6-inch casing to a depth of 166 feet and slotted at a depth of 126 feet and 156 feet. The pump cylinder was reduced to a 4-inch cylinder and the well is now pumped at the rate of about 36.5 gallons a minute. The pump setting is reported to be 66 feet.

City well No. 2: This well is located about 12 feet south of well No. 1. Well drilled 10 inches and 8 inches in diameter to a depth of 171 feet in March 1943 by Hoeg and Ames of Lincoln, Iowa. The well is cased with 10-inch pipe to a depth of 125 feet and was cemented from bottom with 25 sacks of neat cement. Five sacks of sand were put around the casing at the top, and with 53 feet of 8-inch liner from 118 feet to 171 feet. The 8-inch liner is perforated from 146 feet to 166 feet. The static water level is reported to be between 31 and 32 feet below land surface when No. 1 is not pumping. A pumping test was made on No. 2 well on March 20, 1943. See pumping test.

W. E. Hale

IOWA GEOLOGICAL SURVEY
Iowa City, Iowa

# Results of Pumping Test
March 20, 1943
Garwin City Well No. 2

Location: SW¼ NW¼ NE¼ sec. 14, T. 84 N., R. 16 W., Capiton Twp.
Elevation: 898.5 feet
Total depth: 171 feet
Contractor: Hoag and Ames, Lincoln
Driller: Ed Martin
Date completed: March 18, 1943
Casing: 125' of 10" casing from 0-125' cemented in a 12" hole by pumping 25 sacks of neat cement in at bottom under pressure. 5 sacks added from surface.
53' of 8" liner from 118'-171', perforated from 146-166'.

Test pump: Fairbanks-Morse turbine; 4" column, 7" bowls, 160' to bottom of bowls with 3' of tail pipe. Powered by gasoline engine, shaft driving the gear head on pump.

All depth to water measured in feet below top of test pump base which is 0.3 feet above drilling curb and 0.15 feet above top of 10" casing. Elevation of measuring point = 898.8 feet.

Copper washer stamped U.S.G.S.-S.M. set in northeast copper post of rest room building, approximately 25' SW of well No. 2 and about 4' above ground. Elevation of washer = 901.8 feet.

Well No. 1 is 12' north of well No. 2. The pump in well No. 1 was operating almost continuously during this pumping test at a rate of about 40 gallons per minute.

| Time | Depth to water | Air line | G.P.M. | Remarks |
|---|---|---|---|---|
| March 20, 1943 | | | | |
| 12:24 p.m. | 34.09 | 120 | | Old well pumping. |
| 12:33 | 34.10 | 120 | | Old well pumping. |
| 12:34 | | | | Pump started. |
| 12:35 | 58.27 | | | Old well pumping. |
| 12:36 | 80.75 | | | |
| 12:38 | 86.04 | | | |
| 12:39 | 90.81 | | | |
| 12:42 | 101.10 | | | |
| 12:44 | 106.41 | | | |
| 12:46 | 110.87 | 42 | | |
| 12:48 | 113.55 | | | |

| Time | Depth to water | Air line | G.P.M. | Remarks |
|---|---|---|---|---|
| March 20, 1943 (cont.) | | | | |
| 12:50 p.m. | 115.15 | 40 | | |
| 12:52 | 116.95 | 39 | | |
| 12:54 | 119.55 | | | |
| 12:58 | 121.30 | 34 | 110 | |
| 1:02 | 123.47 | | | |
| 1:05 | 125.25 | 30 | | |
| 1:10 | 126.50 | 28 | | |
| 1:15 | 127.85 | | 110 | |
| 1:18:30 | | | | Old pump shut down. |
| 1:20 | 126.40 | | | |
| 1:22:30 | 125.90 | | | Old pump started. |
| 1:30 | 130.20 | | | |
| 1:35 | 132.72 | | | |
| 1:40 | 132.65 | | | |
| 1:44 | | 25 | | |
| 1:45 | 130.00 | | 110 | |
| 1:50 | 131.01 | 26.5 | | |
| 1:56 | 131.00 | | | |
| 2:02 | 131.23 | 26.0 | | Temp.: Air = 26°F. Water = 50°F. |
| 2:08 | 144.55 | 12 | | Pump speeded up. |
| 2:13 | 150.45 | | 131 | Water gray. |
| 2:18 | | 12 | | |
| 2:20 | 145.65 | | | Clearing. |
| 2:25 | 150+ | | | |
| 2:35 | | | 125 | |
| 2:53 | | | | Decreased speed. |
| 2:55 | 135.05 | | | |
| 3:00 | 123.60 | 35 | 96 | Temp.: Water = 50°F. |
| 3:05 | 116.45 | 40 | | |
| 3:10 | 114.45 | | | |
| 3:15 | 113.10 | | 96 | |
| 3:18 | | | | Pump slowed down. |
| 3:20 | 103.65 | | | |
| 3:23 | 98.15 | | 79 | |
| 3:27 | 99.02 | | | |
| 3:32 | 99.60 | | | |
| 3:42 | 99.45 | | | |
| 3:48 | 98.85 | 56 | 91 | |
| 3:56 | | | | Temp.: Water = 50°F. |
| 4:05 | 98.50 | | | Sample collected for analysis. |
| 4:06:30 | 98.65 | | 138 | Speed up pump. |
| 4:13 | | | | Slow down pump. |
| 4:17 | 143.95 | | | |
| 4:22 | 147.95 | | | |
| 4:23 | | | | Shut down old well. |
| 4:24 | 147.25 | | | |
| 4:25 | 146.80 | | | |
| 4:27 | 149.90 | | | |

| Time | Depth to water | Air line | G.P.M. | Remarks |
|---|---|---|---|---|
| March 20, 1943 (cont.) | | | | |
| 4:28 p.m. | 145.60 | | | |
| 4:30 | 145.90 | | | |
| 4:32 | 145.60 | | | |
| 4:42 | 149.33 | | 131 | Temp. water = 50°F. |
| 4:46 | 150.26 | | | |
| 4:46:30 | | | | Start old well pumping. |
| 4:48 | 151.75 | | | |
| 4:48:15 | | | | Stop old well pumping. |
| 4:55 | 147.57 | | | |
| 4:57:30 | | | | Start old well pumping. |
| 5:03 | 153.50 | | | |
| 5:10 | 154.55 | | 129 | Water clear, pumping some shale particles. |
| 5:11 | | | | Shut down new well; old well still pumping. |
| 5:12 | 123.85 | | | |
| 5:12:30 | 112.25 | | | |
| 5:13 | 98.25 | | | |
| 5:14 | 80.12 | | | |
| 5:15:30 | 59.65 | | | |
| 5:16 | 54.47 | | | |
| 5:17 | 47.45 | | | |
| 5:18 | 42.95 | | | |
| 5:19 | 40.93 | | | |
| 5:20 | 40.05 | | | |
| 5:21 | 39.60 | | | |
| 5:22 | 39.30 | | | |
| 5:24 | 38.85 | | | |
| 5:26 | 38.55 | | | |
| 5:28 | 38.25 | | | |
| 5:30 | 38.05 | | | |
| 5:35 | 37.68 | | | |
| 6:06 | 36.64 | | | |
| 6:15 | 36.54 | | | |
| 6:40 | 36.23 | | | |
| 7:00 | 36.08 | | | |
| 7:30 | 35.90 | | | Old well still pumping. |

Pumping test by KEA+WEH.

W. E. Hale Garwin, Iowa

IOWA GEOLOGICAL SURVEY
Water Analysis Report

County Tama Date Sampled March 20, 1943

Town Garwin Sampled by K. E. Anderson and W. E. Hale

Location of Well SW¼ NW¼ NE¼ sec. 14, T. 84 N., R. 16 E. W.
Carlton Twp.

Owner City of Garwin Well No. 2. Final Depth 171 ft.

Type of Well Drilled Static Level 34.09* ft. Curb Elevation 898.5 ft.

Producing Formation(s) Lime Creek formation Depth range 155-160'

Remarks on Condition of Well, Casing or Formations:

125' of 10" casing from 0-125', cemented in a 12" hole by pressure method using 25 sacks of neat cement pumped in at bottom. 5 sacks of cement added later from top.
53' of 8" liner from 118-171', perforated from 146-166'.

| Constituents | Parts Per Million | Constituents | Parts Per Million |
|---|---|---|---|
| Total Solids..... | 1117 | Iron ($Fe^{++}$) (unfiltered) (filtered) ..... | 0.3 |
| pH ..... | 7.3 | Manganese ($Mn^{++}$) ..... | 0.0 |
| Alkalinity (MeO)..... | 192.0 | Nitrogen as Nitrate ($NO_3^-$)..... | 0.0 |
| Alkalinity (Phn) .... | 0.0 | Fluoride ($F^-$) ..... | 0.5 |
| Insoluble Matter .... | 26.0 | Chloride ($Cl^-$) ..... | 8.0 |
| $Fe_2O_3 + Al_2O_3 + Mn_2O_3$ | 8.0 | Sulphate ($SO_4^{--}$) ..... | 809.8 |
| Alkalies as Sodium ($Na^+$) | 184.5 | Bicarbonate ($HCO_3^-$) ..... | 234.2 |
| Calcium ($Ca^{++}$) ..... | 120.1 | Calculated Hardness as $CaCO_3$ ..... | 619 |
| Magnesium ($Mg^{++}$) .... | 77.3 | Calculated Hardness (Grains per U. S. Gallon) ..... | 36.2 |

Temperature: Air 26 °F. Water 50 °F. measured after well had pumped 3 hours 26 mins. at 80-130 g.p.m.; 50 ft. from pump after water had passed through the 50' of 3" fire hose at 4:00 p.m.

Remarks:
*With No. 1 well pumping at approximately 40 g.p.m. for 4 hours, 20 min. This well 12' south of well No. 1.

Analysis by State Water Laboratory, Iowa City, Iowa.
Lab. No. 149042, Date April 14, 1943
Sent to:
Date:

W. E. Hale

IOWA GEOLOGICAL SURVEY
Iowa City, Iowa
Water Analysis Report

County Tama Date sampled March 20, 1943

Town Garwin Sampled by K. E. Anderson and W. E. Hale

Location of well $SW\frac{1}{4}$ $NW\frac{1}{4}$ $NE\frac{1}{4}$ sec. 14, T. 84 N., R. 16 E. W. Carlton Twp.

Owner City of Garwin Well No. 1. Final Depth 166 ft.

Type of well Drilled Static level 30* ft. Curb elevation 898.5 ft.

Producing formation (s) Lime Creek formation Depth range 150-155'

Remarks on condition of well, casing, or formations:

Unknown amount of 8" casing installed when well was drilled.
Recased by Hoeg and Ames, Lincoln, Iowa in March, 1943 as follows:
166' of 6" casing from 0-166', perforated from 126-156'.

| Constituents | Parts per million | Constituents | Parts per million |
|---|---|---|---|
| Total solids | 830 | Iron ($Fe^{++}$) (unfiltered) (~~filtered~~) | 0.2 |
| pH | 7.1 | Manganese ($Mn^{++}$) | 0.00 |
| Alkalinity (MeO) | 164.0 | Nitrogen as Nitrate ($NO_3^-$) | 0.00 |
| Alkalinity (Phn) | 0.0 | Fluoride ($F^-$) | 0.0 |
| Insoluble matter | 4.0 | Chloride ($Cl^-$) | 1.0 |
| $Fe_2O_3 + Al_2O_3 + Mn_2O_3$ | 8.0 | Sulphate ($SO_4^{--}$) | 707.4 |
| Alkalies as sodium ($Na^+$) | 142.8 | Bicarbonate ($HCO_3^-$) | 200.1 |
| Calcium ($Ca^{++}$) | 102.2 | Calculated hardness as $CaCO_3$ | 574 |
| Magnesium ($Mg^{++}$) | 77.5 | Calculated hardness (grains per U. S. gallon) | 33.5 |

Temperature: Air 85 °F. Water 51 °F. measured after well had pumped 4 hours 20 minutes at 40± g.p.m.; 6' from pump after water had passed through 6' of 4" pipe at 12:20 p.m.
Remarks:

*Reported by city officials. This well 12' north of well No. 2.

Analysis by State Water Laboratory, Iowa City, Iowa.
Lab. No. 189043, Date May 5, 1943

CODED 6/72 Hepburn

W-1663

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

RECORD OF WELL



Location:

Town: Garwin ( N E S W); County Tama E.

NE-NW-NE sec. 14 T. 84 N., R. 16 W. Carlton Twp.

Well name and number Garwin City Well #2

Owner City of Garwin Address

Tenant Address

12' south of well #1

Contractor Hoeg & Ames Address Lincoln

Drillers Ed. Martin

Drilling dates 2/22/43 - 3/18/43

Well data:

Elevations: Drilling curb 898.5 Feet; Land surface 898 feet

Determined by hand level

Topographic position valley

Total depth: Reported 171 feet, Measured feet

Drilling method cable tool

Hole and casing data 125' of 10-inch casing 0 to 125', cemented in a 12-inch hole by pumping 25 sacks of neat cement at bottom under pressure.
(Give amount, size, kind, and depth of all casing; type and position of seals and packers; cementing; how finished--perforated pipe, screen, gravel pack, open hole, etc.)
53' of 8-inch liner from 118 to 171', perforated from 146 to 166 feet

Original depth to water ft. above/below Date

Original elevation of water level ft.; Source of data

Sources of water: Principal Lime Creek 155-60; Others

Production data: Date March 20, 1943

Static depth to water 134' Measuring point 898.8'

Pumping level 131 at 110 g.p.m.

155 131

Specific capacity 1.08 g.p.m. per ft. drawdown; Temperature 50 °F.

---

Pump data; Type pump Turbine Column Dia. 4" Length 160

Cylinder or bowls: Dia. _____ Length 7" Suction pipe 3'

Power gasoline motor Airline _____

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

Use of water city supply

---

WATER ANALYSES (in parts per million)

| | | | | |
|---|---|---|---|---|
| Date sampled | March 29 1943 | | | |
| Sampled by | K.E.A & W.E.Hale | | | |
| Total solids | 1117 | | | |
| Insoluble matter | 26.0 | | | |
| Alkalinity (Meo) | 192.0 | | | |
| Alkalinity (Phn) | 0.0 | | | |
| pH | 7.3 | | | |
| $Fe_2O_3$+ $Mn_2O_3$+$Al_2O_3$ | 8.0 | | | |
| Alkali as sodium | 184.5 | | | |
| Calcium | 120.1 | | | |
| Magnesium | 77.3 | | | |
| Iron (unfiltered) | 0.3 | | | |
| Manganese | 0.0 | | | |
| Nitrate | 0.0 | | | |
| Fluoride | 0.5 | | | |
| Chloride | 8.0 | | | |
| Sulfate | 809.8 | | | |
| Bicarbonate | 234.2 | | | |
| Hardness (ppm) | 619 | | | |
| Hardness (gpg) | 36.2 | | | |

Remarks _____

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Laboratory data: Sample storage location EDI

Sample range 0-170 No. spls. 34 No. dupls. & cond. 22 fair

Spls. prepared by Heydon Washed range _____ by _____

Driller's log and cond. yes good

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

Microscopic study SEH strip log ✓ March 11 1943 SEH

Gen. log ✓ Correl. by SEHarris