Punched FCH

WRD Exp. (GW)
Aug. 1964

Verified PMJ

U. S. DEPARTMENT OF THE INTERIOR — GEOLOGICAL SURVEY

Water Resources Division Well Schedule Form

MASTER CARD

Record by: D. AARONSON — Source of data: FILE — Date: 6/24/65 — Map: COUNTY HWY 1:63,360

State: IOWA [16] — County (or town): IDA [47]

Latitude: 42 29 15 N — Longitude: 095 3 — Sequential number: 2

Lat-long accuracy: 2 — T 89 [✓ N] S, R 40 E [✓ W], Sec 35, NW ¼, NW ¼, NW ¼, 5 B & M

Local well number: 089-40W35bbb — Other number: W-0010

Local use: 00010 23CITY 2 — Owner or name: TOWN OF HOLSTEIN

Owner or name: HOLSTEIN IØWA — Address: HOLSTEIN IOWA

Ownership: (C) County, (F) Fed Gov't, [✓ (M) City], (N) Corp or Co, (P) Private, (S) State Agency, (W) Water Dist — 67 M

Use of water: (A) Air cond, (C) Comm, (D) Dewatering, (F) Fire, (H) Dom, (I) Irr, (N) Ind, [✓ (P) ~~P S~~], (S) Stock, (T) Instit, (U) Unused — 68 P

Use of well: (A) Anode, (D) Drain, (G) Seismic, (O) Obs, (P) Oil-gas, (R) Recharge, (S) Spring, (T) Test, (U) Unused, [✓ (W) Withdraw], (X) Waste, (Z) Destroyed — 69 W

DATA AVAILABLE: Well data 70 [1] — Freq. W/L meas.: INTERMITTENT 71 [I] — Field aquifer char. 72 [ ]

Hyd. lab. data: 73 [ ]

Qual. water data; type: COMPLETE 74 [C]

Freq. sampling: INTERMITTENT 75 [I] — Pumpage inventory: yes no, period: 76 [ ]

Aperture cards: yes 77 [ ]

Log data: GEOLOGIST LOG 78 [G] 79 [ ]

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD (1–19) — Depth well: 2040 ft [2040] (20–23) — Meas. [✓ rept] accuracy 24 [6]

Depth cased: (first perf.) 550 ft [550] (25–28) — Casing type: STEEL; Diam. 8 in [8] (29–30)

Finish: (C) porous concrete, (F) gravel w. (perf.), (G) gravel w. (screen), (H) horiz. gallery, (O) open end, (P) perf., (S) screen, (T) sd. pt., (W) shored, [✓ (X) open hole], (Z) other — 31 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, (Z) other — 32 [ ]

Date Drilled: 1923 [923] (33–35) — Pump intake setting: 600 ft [600] (36–38)

Driler: THORPE BROS. (CARL ALLEN) — name, address

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 — 39 [ ] — Deep Shallow 40 [D]

Power (type): diesel, elec, nat gas, gasoline, hand, LPG gas, wind; H.P. — 41 [ ] — Trans. or meter no.

Descrip. MP: CURB SP ft above below lsd, Alt. MP 1452

Alt. LSD: 1452 [1452] (42–45) — Accuracy: (source) ALT 47 [7]

Water Level: 270 ft above [✓ below] MP; Ft above below lsd [ ] (48–51) — Accuracy: REPORTED 52 [6]

Date meas.: [ ] (53–55) — Yield: 75 gpm [275] (56–60) — Method determined 61 [ ]

Drawdown: 0 ft [0] (63–64) — Accuracy: REPT 65 [6] — Pumping period hrs [ ] (66–68)

QUALITY OF WATER DATA: Iron 1.2 ppm 69 [5] — Sulfate 682.5 ppm 70 [8] — Chloride 11.0 ppm 71 [1] — Hard. 844 ppm 72 [8]

Sp. Conduct K x 10^6 73 [ ] — Temp. 57 °F [57] (74–76) — Date sampled DEC. 1936 [D3] (77–79)

Taste, color, etc.

089-40W-35bbb

Well Number 42, 29, 15 [✓ N] S 095, 32, 35
d m s d m s

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD (1–19)

Physiographic Province: CENTRAL LOWLAND | 1 | 2 | (20–21)

Section: WEST LAKE | B | (22)

Drainage Basin: LITTLE SIOUX | 3 | 6 | C | (23–25)

Subbasin: ______ | | (26)

Topo of well site: (D) local depression, (F) flat surface, [✓ (H) hilltop], (S) hillside, (T) terrace, (V) valley flat, UPLAND DIVIDE (27) | H |

MAJOR AQUIFER: CAMBRO-ORD (system), ______ (series) | W | | (28–29) ______ (aquifer, formation, group) | X | | (30–31)

Lithology: ______ | | | (32–33) Origin: MARINE | 6 | (34) Aquifer Thickness: ______ ft

| | | | (35–37) Length of well open to: 213 ft | 2 | 1 | 3 | (38–40) Depth to top of: 1550 ft | A | 5 | 5 | (41–43)

MINOR AQUIFER: ______ (system), ______ (series) | | | (44–45) ______ (aquifer, formation, group) | | | (46–47)

Lithology: ______ | | | (48–49) Origin: ______ | | (50) Aquifer Thickness: ______ ft

| | | | (51–53) Length of well open to: ______ ft | | | | (54–56) Depth to top of: ______ ft | | | | (57–59)

Intervals Screened: ______

Depth to consolidated rock: 380 ft | | 3 | 8 | | (60–63) Source of data: WELL CUTTINGS (64) | |

Depth to basement: 2010 ft | 2 | 0 | 1 | 0 | (65–68) Source of data: WELL CUTTINGS (69) | |

Surficial material: SANDY TILL | 8 | T | (70–71) Infiltration characteristics: POOR (72) | 4 |

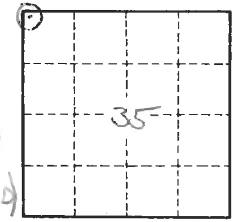
Coefficient Trans: ______ gpd/ft | | | | (73–75) Coefficient Storage: ______ | | | | (76–78)

Coefficient Perm: ______ gpd/ft^2; Spec cap: $\frac{75}{0}$ gpm/ft; Number of geologic cards: ______ | | (79)

CASING

0 - 382 16" CASING
0 - 550 12" CASING
0 - 861' 10" CASING (PERFORATED)
0 - 1900 8" CASING (PERFORATED)

LEAD CAP ON TOP



161' S. OF 2ND ST.
84' W. OF KEILS

W-0010

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

RECORD OF WELL

Location:

Town: Holstein (N E / S W):County Ida

1977 field check NW NW NW NW sec. 35 T. 89 N R. 40 W

SW-NW - NW-NW sec. 35 T 89 N., R. 40 E. W. Twp.

Well name and number City No. 2

161' s. of 2nd St.
84' W. of Keil St.

Owner Address

Tenant Address

Contractor Thorpe Well Co. Address

Drillers

Drilling dates finished August 1, 1923

Well data: Topo elev = 1452'

Elevations: Drilling curb 1452 feet; Land surface feet

Determined by

Topographic position upland divide

Total depth: Reported 2040 feet, Measured feet

Drilling method

Hole and casing data 16" casing - 382'

Crooked hole.

12" pipe from 0 to 550' lead seal at top

10" pipe from 0 to 861' perforated

8" pipe from 0 to 1900' perforated

Original depth to water ft. above/below Date

Original elevation of water level ft.; Source of data

Sources of water: Principal 1550'; Others 275', 750', 1900'

Production data: Date

Static depth to water 319'11 Measuring point
Pumping level 331' 10" at 140 g.p.m.
334' 4" 240

Specific capacity g.p.m. per ft. drawdown; Temperature 56 1/2 °F.

Pump data: Type pump cylinder Column Dia. Length 641' 2"
Cylinder or bowls: Dia. Length Suction pipe 5
Power Electricity 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. 4, 1936			
Sampled by	H.G. Hershey			
Total solids	1473.0			
Insoluble matter	9.0			
Alkalinity (Meo)	265.0			
Alkalinity (Phn)	0.0			
pH	7.3			
Fe_2O_3+ Mn_2O_3+Al_2O_3	6.0			
Alkali as sodium	49.60			
Calcium	228.70			
Magnesium	65.70			
Iron (unfiltered)	1.2			
Manganese	0.07			
Nitrate	0.89			
Fluoride	tr.			
Chloride	11.0			
Sulfate	682.50			
Bicarbonate	323.30			
Hardness (ppm)	844.0			
Hardness (gpg)				

Remarks

Laboratory data: Sample storage location

Sample range 10-2040 No. spls. 190 No. dupls. & cond. 75 p-g
Spls. prepared by Washed range by
Driller's log and cond.
Insoluble residues: Prepared by Studied by Strip log
Microscopic study ✓ Gulf strip log gulf
Gen. log Correl. by gulf

Sheet No. 1 Name of Well City Well # 2 Survey No. W-0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

Curb elevation: 1452'

00 (No sample)

10 Silt-yel. to buff; highly calc.; mica abund; heterogeneous mineral content;

20 Clay-green; laminated; somewhat calcareous; granules of clear a-C qtz; 1-4 m.m.

30 Clay-buff; highly calc; 15% s.s. maj. gr. $\frac{1}{4}$-$\frac{1}{8}$ m.m. prin. subsid. 1-$\frac{1}{2}$ m.m.; sand is qtz. sulfides, silicates;

40 Clay-buff; highly calc, stained with iron oxide; s.s. & silt 10%; 1-$\frac{1}{2}$ m.m. sand, s a C.;

50 Clay-buff; highly calc., some Fe-oxide staining; ±15% a-C qtz. maj. grade $\frac{1}{4}$-$\frac{1}{8}$ m.m.; 10-15% silt present.

60 Clay-gray; calcareous; ±10% sand; grains up to two m.m.; igneous rock frags. present.

70 Till-gray; calcareous; 10-15% C pebbles up to 10 m.m.; principally ls, but igneous & metamorphic rocks also present. ±10% a-C s.s.; 5-10% silt; unoxidized & unleached;

80 Till-gray; unoxidized & unleached; 10-15% C, granules; principally ls, & qtz.; highly calc;

90 Till- similar to sample from 80'-90'.

100

eet No. 2 Name of Well City Well # 2 Survey No. W0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

100 Till - ±50% soluble; unoxidized; gray; pebbles up to 10 m.m.

110 Drift very calcareous; unoxidized & unleached; sand & pebbles ± 5%; lt. gray; ±60% clay.

120 Drift - non-calcareous; med. gray.; ± 5% sand and granules, ± 90% clay.

130 Drift - yellow brown; oxidized; highly calcareous; ± 10% coarse sand & granules principally f limestone and quartz; ± 50% clay;

140 Drift - gray; tilly; calcareous; ± 25% granules & pebbles; principally ls.; some oxidation has taken place; ± 35% clay; 5-10% silt & sand.

150 Drift. - lt. buff; slightly oxidized; very calcareous; ± 35% clay; 5-10% poorly sorted sand; a-c qtz. principal mineral of sand.

160

No sample

170 Drift - gray; very calcareous; ± 40% clay; ± 25% silt & sand; some granules & pebbles present; varied mineral content.

180 Drift - gray; very calcareous; ± 30% clay; ± 20% silt & sand; ± 20% granules & pebbles of varied composition.

190 Drift - gray; very calcareous; tilly; unoxidized; ± 30% clay; ± 20% silt & sand; ± 20% granules & pebbles; minerals principally limestone & quartz but igneous & metamorphic fragments are also present.

At 200

Sheet No. 3 Name of Well City Well #2 Survey No. W 0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

200 Drift-gray; unleached, unoxidized; tilly; very calcareous; ± 40% clay; ± 20% silt & sand; ± 20% granules & pebbles

210 Drift-lt. gry.; tilly; unleached; unoxidized, calcareous; ± 40% clay; ± 20% silt & sand; ± 20% granules & pebbles up to 10 m.m. 2-3% gypsum in frags; cinders 10-15%;

220 Drift-lt. gray; clay ± 80%; slightly calcareous; ± 10% sand, a-C, composed of quartz & limestone principally;

230 Drift-lt. gray; clay ± 60%; very calcareous; fragments of limestone 10-15%; ± 5% a-C, qtz.; pebbles present.

240 Drift-lt. gray to buff; clay ± 50%; very calcareous; frags. of limestone ± 10%; ± 5% a-C, qtz; granules & pebbles present;

250 Drift-lt. gray; clay ± 70%, calcareous; ± 5% a C, qtz. grns.; frags of limestone ± 10%;

260 Drift-lt. gray; clay ± 70%; calcareous; ls. frags. ± 5%; ± 5% sand consisting principally of a C, qtz., but also of igneous rock frags;

270 Drift-lt. gray; clay ± 60%; calcareous; 10-15% a-C sand; Maj. grade ½-¼ m.m.

280 Drift-gray to buff; clay ± 60%; calcareous; sand ± 10%; principally a-C qtz. but a typical drift assemblage of minerals is present.

290 Drift-gray; clay ± 60%; calcareous ± 10% a-C sand;

00

Sheet No. 4 Name of Well City Well #2 Survey No. W0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

300 Drift-gray; ±70% clay; calcareous; ±10% a-C sand grains, maj. grade 1-$\frac{1}{2}$ m.m.; principally qtz. but rock frags. also present; 2-3% cinders;

10

20

Clay-lt. gray ±90%; ±5% calcareous; ±5% sand; a-C; maj. grade $\frac{1}{4}$-$\frac{1}{8}$

330 Clay-lt. gray ±80%; ±5% calcareous; ±15% sand; a-C, maj. grade $\frac{1}{4}$-$\frac{1}{8}$; 2-3% cinders; with the exception of the cinders the sand from this sample appears to be at least 95% quartz;

Perhaps shale below drift

340 Clay-lt. gray, ±80%; ±5% calcareous; 10-15% sand a-C; maj. grade $\frac{1}{4}$-$\frac{1}{8}$; 2-3% cinders; ±1% frags. of ls.

350

Clay-lt. gray ±85%; ±5% calcareous; ±10% sand a-C; maj. grade $\frac{1}{4}$-$\frac{1}{8}$ m.m.; ±98% quartz;

360 Clay-lt. gray ±80%; 5-10% calcareous; ±10% sand a-C; maj. grade 1-$\frac{1}{2}$ m.m. casing scale & cinders present; one C pebble of ls. observed;

370 Drift-tilly; gray to buff; calcareous; somewhat oxidized; ±25% granules & pebbles of ls., igneous & metamorphic rocks; ±10% sand; ±30% soluble; (This sample possibly out of place)

380

Ns

90

00

Sheet No. 5 Name of Well City Well # 2 Survey No. W-0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

400

10

Ns.

Shale - gray; 5-10% soluble; ± 5% sand up to 2 m.m.; <1% mica; drift pebbles not observed.

at 420

Shale - gray, buff and red; very slightly calcareous; becomes very sticky when moistened; 3-4% red concretions composed of a sideritic carbonate <1% qtz, $\frac{1}{4}$-$\frac{1}{8}$ m.m.;

430

Shale - lt. gray; very sticky when wet; 5-10% red concretions up to 4 m.m. in size; <1% qtz; $\frac{1}{4}$-$\frac{1}{8}$ m.m.; cinders present;

440

Shale - lt. gry and red; sticky when wet; 2-4% red concretions up to 4 m.m. in size; <1% qtz

50

Ns

60

Shale - lt. gry and red; not as cohesive as similar shales above; 2-4% concretions; no effervescence with HCl;

470

Shale - blue green & red; sticky when wet; 2-4% concretios; no effervescence;

480

Ns

90

Shale - blue green & red; sticky when wet; 2-4% concretions; no effervescence;

500

Sheet No. 6 Name of Well City Well #2 Survey No. W-0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

500 Shale - lt. to dk. gray; sticky when wet; practically 100% clay;

510 Shale - green & red; sticky when wet; concretions of siderite ± 20%; no effervescence with HCl;

520 Shale: green and red; sticky; concretions of siderite ±10%; no effervescence with HCl.

530 Shale - similar to sample from 520-530;

540 Shale - 75% lt. gray; 25% red; sticky when wet; no effervescence with HCl; ± 30% brown concretions;

550 Shale - gray; no effervescence with HCl; ± 5% silt;

560 Shale - gray; non-calcareous; ± 5% silt;

570 Shale - gray; non-calcareous ± 5% silt; < 1% mica;

580 Sandstone; major grade 1-½ m.m. C; prin. subsid. ¼ - ⅛ a; < 1% siderite concretions; slightly calcareous;

Maj. Grd.
Prin. Sub.

590 Sandstone; major grade 1-½ m.m. C; prin. subsid. ½ - ¼ a - C; ± 1% siderite concretions; slightly calcareous;

00

Sheet No. 7 Name of Well City Well #2 Survey No. W-0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

600 Sandstone – major grade 1-½ m.m.; C; prin. subsid. ¼-⅛, a; < 1% siderite concretions; slightly calcareous;

Cretaceous

610 Sandstone – maj. grade -½ m.m. C -; ±30% Frags of limestone; < 1% siderite concretions.

620 Sandstone - maj. grade ½-¼ m.m. a-C; well sorted; ±3% siderite concretions; slightly calcareous; secondary enlargement not important;

Dolom-Limestone

630 Sandstone - maj. grade -½ m.m. a-C; prin. subsid. ½-¼ m.m. a; ± 30% ls. frags; ± 1% siderite concretions;

640 Sandstone - maj. grad. ½ m.m. a-C; prin. sub. ½-¼ m.m. a; 30-40% ls. frags lt. cream color; finely x-lline; most likely interbedded ls. & s.s.

650 Sandstone - maj. grade 1-½ m.m.; prin. subsid. ½-¼ m.m. A-a-C; many grains show well crystallized secondary outlines; 30-40% ls. frags; lt gray. dense, compact, finely x-lline; ls. & s.s. apparently interbedded; several large fragments of pulverulent silica (porous chert) present; fossilif. - see capsule.

660 Sandstone - maj. grade ½-¼ m.m.; prin. subsid. 1-½ m.m.; ¼-⅛ also abund; a-C; ±25% ls. frags; cream; dense; finely x-lline; calcite rhombs and dog tooth spar x-ls. up to 2 m.m.; ±2%; rhomps of siderite, reddish brown, with irridescent surfaces, ¼-⅛ m.m. in size = 3-5%; ±5% pulverulent silica;

670 Sandstone - maj. grade 1-½ m.m. C; prin subsid. ½-¼ m.m. a-C; ± 40% ls. frags. dense finely x-lline; ±2% calcite rhombs; 1-2% siderite rhombs, ¼-⅛ m.m.; 2-3% pulverulent silica, some frags enclosed by limestone; s.s. & ls. probably interbedded.

680 Sandstone - maj. grade ½-¼ m.m. a-C; prin. subsid. 1-½ m.m. C; some euhedral x-ls present; 40-50% frags. of limestone; gray, dense; finely x-lline; ±1% siderite rhombs;

690 Sandstone - interbedded with Limestone; 40-50% sand, major grade 1-½ m.m.; a-C; prin. subsid ½-¼ m.m. a; some euhedral x-tals; 40-50% cream to buff, dense pure, finely x-lline; ± 5% pulverulent silica; ±1% siderite rhombs;

700

Sheet No. 8 Name of Well City Well #2 Survey No. W-0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

700 Sandstone - interbedded with Limestone (simila to sample from 690-700)

710 Sandstone: major grade 1-½ m.m. C, frosted; prin. subsid. ½-¼; a-C; ±30% limestone, gray, dense, fine x-lline, pure; ±1% siderite rhombs. 2-3% mottled white chert;

St. Peter? out of place

Blank

720 Sandstone-in Shale: Sand ±65%; maj. grade ½-¼ m.m.; prin. subsid. 1-½ mm; a-C; some euhedral grains; ±35% Shale, green, breaks into fissile frags 2-5 m.m. thick; breaks irregularly across bedding, contains ±5% pyrite; non-calcareous;

730 Limestone.. gray to buff; dense, fine x-lline, pure; some frags. Fe-stained; ≤1% pyrite 1% C qtz.

740 Limestone similar to sample 730-740

750 Limestone - interbedded with sandstone: ls. dolomitic, buff to gray, dense finely x-lline, pure ls ±60%: s.s. maj. grade 1-½ m.m. C; prin. subsid. ½-¼ m.m. a-C; ss ±40%; 1-3% siderite in rhombs. & concretions; ≤1% pyrite;

760 Limestone - interbedded with sandstone. sample similar to that from 750-760.

770 Limestone - dolomitic: gray to buff, dense, finely x-lline, pure; ±30% sandstone maj. grade ½-¼ m.m. A-a-C, many euhedral grains; 2-3% pyrite; ±1% siderite concretions.

80 Limestone - dolomitic: gray to buff, dense, finely x-lline, pure; 40-50% sandstone, maj. grade ½-¼ m.m. A-a-C, many euhedral grains; ±1% pyrite; ±1% siderite;

90 Limestone: gray to buff, dense, finely x-lline. ±10% sand maj. grade 1-½ m.m. C; ±1% pyrite;

00

Sheet No. 9 Name of Well City Well #2 Survey No. W-0010

Location Holstein Iowa Date Drilled 1924 Analyst Pyre

800 Limestone - interbedded with sandstone and shale; 40-50% ls. buff, dense finely crystalline; 25-30% blue green shale, fissility somewhat developed 25-30% sandstone maj. grade 1-½ m.m. c.; some grains euhedral; ±1% pyrite;

810 Limestone - interbedded with shale and sandstone; ±40% ls., gray, dense; ±35% shale, green spotted with black, brittle, conchoidal surfaces; ±25% sandstone maj. grade 1-½ m.m

820 Limestone - dolomitic: lt. gray, dense; ±20% sand ; maj. grade 1-½ m.m.; ±1% pyrite; 2-3% frags of green shale from above.

830 Limestone - dolomitic: lt. gray, dense, x-lline, med. grained; ±10% sand, maj. grade 1-½ m.m. ±1% iderite concretions; ±1% pyrite;

840 Limestone - dolomitic: lt. - med. gray, dense; ±20% sand maj. grade ½-¼ m.m. c; prin. subsid ½ m.m. c; ±1% siderite concretions; ±1% pyrite;

850 Sandstone - limestone - shale: ±40% sandstone a-c; maj. grade 1-½ m.m. prin. subsid. ½-¼; 30-40% shale green, speckled, brittle, conchoidal fracture, fossiliferous; ±30% limestone, dolomitic, light gray, dense; ±1% pyrite;

860

870 Ns

880 Leave out

Drift out of place

Drift - buff, ±30% soluble; ±55% clay; ±15% a-c qtz. grains, poorly sorted; ±1% granules of igneous & metamorphic origin.

At. 890

Top of Galena? De 890'

Dolomite: gray-buff; <1% quartz; <1% pyrite;

900

Sheet No. 10 Name of Well City Well #2 Survey No. W-0010

Location Holstein, Iowa Date Drilled 1929 Analyst Pyre

900	Dolomite - light gray; ± 1% calcite rhombs; <1% qtz. C, up to 1 mm; <1% pyrite.
910	Dolomite - gray, mottled, dense; <1% pyrite
920	Dolomite - lt. to med. gray, mottled; medium sized crystals; ± 1% calcite rhombs; <1% pyrite.
930	Dolomite: lt. gray to buff; granular but tough; ± 1% calcite rhombs, <1% pyrite
940	Dolomite - gray; granular but tough; ± 5% calcite rhombs; <1% pyrite;
950	Dolomite - lt. gray to blue gray; medium sized crystals; 3-4% calcite rhombs <1% pyrite
960	Dolomite - lt. to med gray; fine to medium sized crystals; ± 2% calcite rhombs; <1% qtz. <1% pyrite.
970	Dolomite gray; fine grained; ± 2% calcite rhombs; <1% pyrite;
980	Dolomite - lt. gray; fine to medium grained; ± 1% calcite rhombs; ± 1% pyrite, ± 1% quartz, C.
990	Dolomite - lt. gray to blue gray; dense, fine to medium grained; ± 2% calcite rhombs; ± 1% casing scale; <1% pyrite;
1000	

Sheet No. 11 Name of Well City Well # 2 Survey No. W-0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

1000 Dolomite – lt. to med. gray; lt. gray is fine grained, med. gray is med. grained; 2-3% calcite rhombs; <1% pyrite,

1010 Dolomite - ±70% dull lead gray, med. grained, dense; ±30% limestone lt. cream, fine grained, friable; ±1% pyrite; <1% quartz in @ grains;

1020 Dolomite - ± 90% gray, med. grained, dense; ±10% ls. lt. cream, fine grained friable, ±1% pyrite, ±1% quartz.

1030 Dolomite - ±90%, gray, med. grained, dense, ±10% ls. lt. cream; <1% pyrite <1% qtz.

1040 Dolomite - lt. to med. gray; dense; ±1% qtz. grains; <1% pyrite

1050 Dolomite - lt. cream to gray; dense, mottled; <1% quartz; <1% pyrite; ±1% casing scale; <1% globules of solder from above; ±1% green shale from above;

1060 No sample

70

at 1080 Dolomite - lt. to med. gray; dense; 2-3% white chert, (secondary for some includes pyrite crystals) ± 1% pyrite; ±1% quartz. ±1% green shale from above;

Dolomite - similar to sample at 1080

1090 Dolomite - lt. gray; dense; ±10% white chert; ±1% pyrite; ±1% quartz; 2-3% rhombs of calcite,

00

Sheet No. 12 Name of Well City Well # 2 Survey No. W-0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

1100 Dolomite - lt. gray; dense; 5-10% white chert; ± 1% quartz; ± 1% pyrite;

10 Dolomite - light gray, dense; 15-20% white chert; ± 1% pyrite; ± 1% quartz;

1120 Dolomite - ± 80% lt. to med. gray; ± 20% white chert; < 1% quartz; shale frags from above

1130 Shale — Sandstone - Chert: ± 35% green shale mottled with dark specks, fissile; ± 35% sand, C, maj. grade ½-¼ m.m., prin. subsid 1-½ m.m., some euhedral grains; ± 20% white chert, fossiliferous; 2-3% pyrite in part cementing sandstone; 3-4% calcite;

???

40 Dolomite - ± 60% lt. gray; dense; ± 40% white chert; < 1% pyrite < 1% quartz;

1150 Dolomite - lt. gray; dense; 3-4% white chert < 1% pyrite; < 1% quartz

1160 Dolomite - lt. to med. gray; no chert; < 1% pyrite; < 1% quartz; < 1% green shale frags.

1170 Dolomite - lt. gray; dense, med. grained; ± 1% white chert; < 1% pyrite; < 1% quartz; ± 1% green shale frags from above;

1180 Dolomite - lt. gray; dense, med. grained; ± 1% white chert; < 1% pyrite; < 1% quartz; ± 1% coal frags from above;

1190 Dolomite - lt. gray; dense, med. grained; ± 1% white chert; < 1% pyrite; < 1% quartz; ± 1% casing scale; 2-3% calcite rhombs.

1200

Sheet No. 13 Name of Well City Well # 2 Survey No. W-0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

1200

Dolomite – lt. gray; dense, med. grained; < 1% chert; < 1% pyrite; ± 1% casing scale,

1210

Dolomite – lt. gray; similar to sample from 1200-1210;

1220

Dolomite – lt. gray; dense, med. grained; no chert; < 1% pyrite; ± 1% casing scale

1230

Dolomite – lt. gray; dense, med. grained; no chert; < 1% pyrite < 1% quartz;

1240

Dolomite – buff to gray ± 75%; dense, medium grained; ± 25% chert, white; < 1% pyrite; < 1% quartz; ± 1% casing scale; ± 1% green shale from above;

1250

Dolomite – lt. gray; dense, med. grained; < 1% pyrite; < 1% quartz; 3-4% white chert; 2-3% calcite rhombs.

1260

Dolomite – lt. gray; dense, med. grained; ± 1% pyrite; < 1% quartz; ± 1% casing scale; ± 1% green shale from above; no chert;

1270

Dolomite – lt. gray; dense, med. grained; no chert; < 1% pyrite, < 1% quartz; ± 1% green shale from above; 2-3% calcite rhombs.

1280

Dolomite – lt. gray; dense, med. grained, 3-4% chert; ± 1% pyrite; < 1% quartz; 2-3% calcite rhombs;

1290

Dolomite – lt. gray; dense, med. grained; ± 1% pyrite; 2-3% calcite rhombs;

1300

Sheet No. 19 Name of Well City Well #2 Survey No. W-0010

Location Holstein Iowa Date Drilled 1924 Analyst Pyre

1300 Dolomite - lt. gray; dense, med. grained; 2-3% chert; ±1% pyrite; ±1% casing scale;

1310 Dolomite - lt. gray; dense, med. grained; 2-3% chert; 3-5% pyrite; ± 5% casing scale; ±1% quartz; ±1% green shale from above; < 1% flattened pyrite concretions $\frac{1}{8}$-$\frac{1}{16}$ m.m. size;

1320 Dolomite - lt. gray, dense, med. grained; ±1% chert; ±1% pyrite; 2-3% casing scale; <1% quartz; ±1% frags of broken glass;

30 Dolomite - lt. to med. gray; dense, med. grained; <1% chert; <1% pyrite; ±1% casing scale; 2-3% green shale from above;

40 Dolomite - shale: sample finely ground up by drill so as to make individual characteristics rather indeterminate; ±60% soluble; 2-3% pyrite; 2-3% casing scale;

1350 Sandstone - Shale - Dolomite; 40-50% sandstone C, major grade 1-$\frac{1}{2}$ m.m.; prin. subsid $\frac{1}{2}$-$\frac{1}{4}$ m.m.; some euhedral x-ls. ±40% shale, bright green to dull gray green, speckled; ±20% lt. gray. dolomite; ±3% pyrite in part replacing fossils (bryozoa); shale is 5-10% soluble;

Top Glenwood

1360 Shale - 40-50% soluble; green, brittle, conchoidal fracture, slightly fissile; 2-3% pyrite;

1370 Shale - similar to sample from 1360-1370.

1380 Shale - ±40% soluble; light green, somewhat fissile, with irregular to conchoidal fracture; fragments ls. & dol., ±15%; ±1% pyrite.

1390 Limestone - Shale -; 50-60% lt. to dk. gray limestone, pure to argillaceous, fossiliferous; ±40% green to dk. gy. shale, calcareous, brittle; 2-3% pyrite;

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Sheet No. 15 Name of Well City Well #2 Survey No. W-0010

Location Holstein, Iowa Date Drilled 1929 Analyst Pyre

1400

Shale - green, speckled, fissile, brittle, non-calcareous, dolomite frags ±30%; ±1% pyrite;

10

Shale - dolomite; ±60% lt. green shale, speckled, hackly, brittle; non-calcareous; Dolomite ±40% lt. gray, dense; ±1% pyrite.

Base Glenwood

Top St Peter

20

Sandstone - C, some a, major grade ½-¼ m.m.; prin. subsid. 1-½ m.m.; Frosted; green shale frags similar to 1910-1920 = ±25%; dol. frags. 3-5%. <1% pyrite.

30

Sandstone: - C, well sorted, maj. grade ½-¼ m.m; frosted; <1% pyrite cementing sand grains; ±20% green shale frags from above; 2-3% dol. frags;

Base St P.

P. du Ch.

40

Dolomite - lt. gray dense, medium grained; Chert 1-2%, white; pyrite >1%, 2-3% casing scale; <1% qtz;

50

Ns

60

Dolomite - lt. gray, dense, medium grained 70-80%, ±20% green to brown shale (probably from above) ±5% a-C, qtz; ±5% chert some chert & some dolomite oölitic

70

Sandstone - a-C maj. grade ½-¼ m.m.; 15-20% green shale from above;

80

Dolomite - lt. gray, dense, medium grained; ±1% a-C qtz; 3-4% green shale from above ±1% casing scale;

90

Ns.

00

Sheet No. 16 Name of Well City Well # 2 Survey No. W-0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

1500

Dolomite - oolitic, lt. gray, dense, medium grained; ±25% green shale from above; 1-3% qtz. up to 1.5 m.m.; ±5% white oolitic chert;

At 1510

20

Ns

30

Dolomite - oolitic, buff to lt. gray, medium grained, dense; 10-15% green shale from above; ± 5% white, mottled, oolitic chert; 1-3% a-e qtz.

oolitic?

At 1540

Dolomite - buff to lt. gry; med. grained, dense; ± 20% white chert; <1% quartz;

Duplicate - s.s. maj. grd. ½-¼; well sorted; a.-e; ±3% green shale frags from above;

1550

Dolomite - lt. gray to buff dense, med. grained; ±25% white chert, mottled; <1% qtz. <1% pyrite; (crinoid stem ?)

1560

1570

Ns

80

Dolomite - lt. gray, dense, med grained; no chert, ± 1% green shale and ± 1% coal frags from above; <1% qtz; <1% pyrite.

At 90

Dolomite - lt. gray, dense, med. grained; no chert; ± 1% green shale from above; <1% qtz.; <1% pyrite

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Sheet No. 17 Name of Well City Well #2 Survey No. W-0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

1600 Dolomite – lt. gray; dense, med. grained; ± 3% green shale; 2-3% casing scale; <1% qtz; <1% pyrite;

1610 Dolomite - lt. gray, dense, med. grained, 1-2% green shale from above; ±1% casing scale; <1% pyrite; <1%

1620 Oneota / Jordan 1621

Sandstone - maj. grade 1-½ m.m. prin. subsid. ½-¼ m.m.; dolomite ±30%; some in well formed rhombs; ±1% gleuconite; ±1% casing scale;

1630 Sandstone - maj. grad 1-½ m.m. prin. subsid ½-¼ m.m; a-c 30-40% dolomite which strongly cements the sand particles; ± 5% green shale frags from above;

1640 Sandstone - similar to that from 1630 - 1640

Sand[illegible] grade ½ - [illegible], prin. subsid. ¼ - ⅛ a; ±20% dolomite in cementing x-tals; ±5% green shale frags. from above,

1650 Sandstone – major grade ½-¼ m.m., c; prin. subsid ¼-⅛; a; ±20% dolomite in xtals. cementing sand grains; ± 5% green shale frags from above; <1% pyrite; ±1% casing scale;

60 Sandstone - maj. grade ¼-⅛, a; prin. subsid ½-¼, c; ±30% dolomite in cementing x-tals; 2-3% green shale from above; <1% pyrite; ±1% casing scale

Jordan / Lodi & St. Law. 1667

70 Dolomite - lt. gray; occurs in well crystallized rhombs principally ⅛-1/16 m.m. in size, which are intergrown; qtz. sand ± 20%; feldspar authigenic ±10%; 2-3% shale frags from above; ±1% casing scale ±1% pyrite.

80 Dolomite - lt. gray; medium grained (well crushed by bit); ±15% qtz. and (feldspar)?; 3-4% green shale; <1% pyrite; <1% casing scale.

90 Dolomite - lt. gray to buff, med. grained, dense; 2-3% green shale frags from above; ±1% qtz; <1% pyrite; <1% casing scale;

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Sheet No. 18 Name of Well City Well #2 Survey No. W-0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

1700

Dolomite - lt. to med. gray; dense; med. grained; 2-3% glauconite; ±1% quartz; 3-4% green shale from above; <1% pyrite; <1% casing scale; (glauconite associated with the darker gray dolo.)

1710

Dolomite - lt. gray; dense, med. grained; ±1% quartz; 2-3% green shale from above; <1% pyrite; ±1% casing scale;

1720

No sample

30

Lodi & St. Law

Dolomite - lt. gray, fine grained; ±1% qtz. grains; <1% pyrite; <1% sphalerite; ±1% casing scale.

—At. 1740

Fran.

Shale - lt. gray; ± 50% soluble; <1% qtz. grains; ± 5% frags. of dolomite with glauconite; <1% pyrite; ±1% casing scale; ± 1% green shale frags from above,

1750

Shale - simila sample 1740-1750

1760

Dolomite - lt. gray; med. grained, dense; 3-5% glauconite; <1% qtz. grains; 1-2% green shale frags from above? (one frag. is highly micaceous; ±1% casing scale; <1% pyrite;

1770

Dolomite - lt. gray; fine to med. grained; argillaceous ±35% clay minerals; <1% pyrite; <1% casing scale; 1-3% glauconite; (dolomite & shale very likely inter-laminated, as frags. of dolomite and frags of faintly greenish fissile shale may be distinguished;

1780

Dolomite - lt. gray; fine to med. grained; argillaceous, ±90% clay minerals; some $CaCO_3$ frags; glauconite 2-3%; <1% pyrite; <1% casing scale; <1% qtz. frags.

1790

Dolomite - lt. gray; fine to med. grained; argillaceous ±25% clay minerals; 2-3% glauconite frags; <1% pyrite; ±1% casing scale; 2-3% quartz fragments;

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Sheet No. 19 Name of Well City Well #2 Survey No. W-0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

1800

Dolomite - lt. gry., med. grained; argillaceous; ±50% faintly greenish shale particles; 2-3% glauconite; ±1% qtz; ±1% casing scale; <1% pyrite;

1810

Dolomite - lt. gray, med. grained; argillaceous; ±30% greenish shale particles; ±1% glauconite <1% pyrite; <1% casing scale; ±1% quartz;

1820

Shale - gray-green; fissile, brittle; some is micaceous; tough; 15-20% soluble ±20% dolomite frags; ± % siderite; <1% glauconite; <1% pyrite;

1830

No sample

40

Shale - green, fissile, brittle, somewhat micaceous; ±10% soluble; ±15% dolomite frags (from above?)

At 1850

Shale - green, fissile, somewhat micaceous; ±10% soluble; ±10% dolomite frags (from above?)

60

NS.

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Shale - similar to sample at 1850.

At 1880

Dolomite - lt. gray on freshly broken surface, although fragments are stained buff; dense, med. grained; ±5% glauconite in C grains principally ½-¼ m.m. ±5% qtz. maj. grade 1-½ m.m., C; <1% pyrite; ±5% shale frags from above; ±1% casing scale;

1890

Shale - green, fissile, brittle, non-calcareous; ±20% dolomite frags similar to that from 1880-1890, containing glauconite, ±5% casing scale; ±1% qtz; <1% pyrite;

1900

Sheet No. 20 Name of Well City Well # 2 Survey No. W-0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

	1900	Shale - gray-green, fissile, brittle, non-calcareous, micaceous; ±25% dolomite lt. gray, dense, med. grained; ±5% glauconite; ±5% casing scale; <1% qtz; <1% pyrite;
	1910	Dolomite - lt. gray, dense, med. grained, 5-10% glauconite; ±40% Shale, gray-green, fissile, brittle, (From above ?); 2-3% casing scale; ±1% quartz; <1% pyrite;
	1920	Shale - gray-green, fissile, brittle, non-calcareous, slightly micaceous; ±40% dolomite; lt. gray, med. grained, glauconitic; glauconite ±5%; casing scale 2-3%; quartz <1%; pyrite <1%.
	1930	Shale - gray-green, fissile, brittle, non-calcareous, slightly micaceous; ±25% dolomite; lt. gry., med. grned, glauconitic; 2-3% casing scale.
	940	Shale - gray-green, similar to sample 1930-1940; ±15% dolomite; ±1% glauconite; ±1% qtz; <1% pyrite; ±1% casing scale
	1950	Shale - gray-green, ground up by drill; non-calcareous; ±10% dolomite frags; ±1% glauconite;
Fran.	960	Shale - gray-green similar to sample 1950-1960
Gales.	1970	Sandstone - red-Fe-stained; maj. grade 1-½ m.m; prin. subsid. ½-¼ m.m.; a-C; ±15% oolites of Fe-oxide, hematite, some large enough to be called pisolites; maj. grade 2-1 m.m. ±10% dolomite some containing glauconite; ±5% green shale (From above).
	1980	Sandstone - stained red by Fe; some aggregates cemented by hematite; major grade 1-½ m.m; prin. subsid. ½-¼ m.m.; a-C; 10-15% oolites of Fe-oxide maj. grade 2-1 m.m. ±5% dolomite frags; 2-3% green shale from above;
	1990	Sandstone - stained red by Fe; some cemented by hematite; maj. grade ½-¼; prin. subsid: 1-½; a-C; ±10% oolites of Fe-oxide maj. grade 2-1 m.m. ±5% dol frags; 2-3% green shale from above;
	2000	

Sheet No. 21 Name of Well City Well #2 Survey No. W-0010

Location Holstein, Iowa Date Drilled 1924 Analyst Pyre

2000 Sandstone - stained faint pink; maj. grade 1-½ m.m.; prin. subsid. ½-¼ m.m.; a-C; no oolites; no Fe cement; 3-9 % green shale from above;

20 10 Sandstone - similar to sample 2000 - 2010. (half of sample 2010-2020) 5-10% green shale from above;

2015 Granite - in aggregates also broken into individual angular grains of pink feldspar (orthoclase & microcline) quartz, biotite (altering to chlorite), apatite;

20 20 Granite - pink, med. grained,: ±2% qtz. C, from above; 5-10% green shale from above;

2030 Granite - mostly broken into angular fragments; 10-15 % C quartz from above; ±15 % green shale from above;

2040 T.D.

50

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UNITED STATES DEPARTMENT OF THE INTERIOR
Geological Survey
Water Resources Division

Local Well No. 089-40W-35BBB
Aquifer Code(s) WX
Owner's Name HOLSTEIN CITY (1923)
W Number 00010

Water Quality
(ppm)

Card Q

State: IOWA 19 (1 2) County: IDA 47 (3 4) Town: HOLSTEIN, IOWA

Well No. Latitude	422915N	5 11
Longitude	0953235	12 18
Seq. No.	2	19
Date M D Y	062234	20 25
Sampling Depth	2040	26 29
Type	1	30
Kx10^6		31 35
pH	7.7	36 38
Temp. °F		39 41
SiO_2		42 44
Ca	190.	45 49
Mg	82.	50 53
Na +K	141.	54 58
K	.C	59 61
HCO_3	332	62 65
CO_3		66 67
SO_4	768.	68 72
Cl	13.	73 78
Source No.	3	79
	Q	80

Card R

Duplicate Columns 1-25 from Card Q

F	1.0	26 28
NO_3	.5	29 32
PO_4		33 35
B		36 38
Al		39 41
Fe	1.5	42 45
Mn	.1	46 49
Cu		50 52
Pb		53 54
Zn		55 57
Solids Determined	1500	58 63
Solids Calc.		64 69
Hardness Ca,Mg	812	70 73
Hardness Non-Carb.	540	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 $CaCO_3$	272	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: D. AARONSON

Punched by: ______ Date: ______

Published: ______

HOLSTEIN 2

089-40W-35BBB2

CSM

W 0010

UNITED STATES DEPARTMENT OF THE INTERIOR
Geological Survey
Water Resources Division

Water Quality
(ppm)

Card Q

State: IOWA 1 6 (1 2) County: IDA 4 7 (3 4) Town: HOLSTEIN

Well No.	Latitude 4 2 2 9 1 5 N	Longitude 0 9 5 3 2 3 5	Seq. No. 2	Date	M 1 2	D 4	Y 3 6
	5 11	12 18	19		20		25
Sampling Depth	2 0 4 0	Type 1	Kx10^6	pH 7.3	Temp. °F 5 7		
	26 29	30	31 35	36 38	39 41		
SiO$_2$	.	Ca 2 2 9.	Mg 6 6.	Na +K 5 0.	K D .C		
	42 44	45 49	50 53	54 58	59 61		
HCO$_3$	3 2 3	CO$_3$ 0	SO$_4$ 6 8 3.	Cl 1 1.	Source 3	No. Q	
	62 65	66 67	68 72	73 78	79	80	

Card R

Duplicate Columns 1-25 from Card Q

F	TRACE .	NO$_3$ .2	PO$_4$ 0.0	B .	Al .	Fe 1.2
	26 28	29 32	33 35	36 38	39 41	42 45
Mn	.0 7	Cu .	Pb .	Zn .		
	46 49	50 52	53 54	55 57		
Determined	Solids 1 4 7 0	Calc.	Hardness Ca,Mg 8 4 4	Non-Carb. 5 7 9		
	58 63	64 69	70 73	74 77		
Color		No. R				
	78 79	80				

Card S

Duplicate Columns 1-25 from Card Q

Br	.	I .	Alk. as CaCO$_3$ 2 6 5	Free CO$_2$	SAR
	26 28	29 31	32 35	36 38	39 41
RSC		ABS .	.		
	42 44	45 47	48 50		
Alpha (pc/l)		Beta (pc/l)	Ra (pc/l) .	U (ug/l) .	
	55 57	58 60	61 63	64 66	

Verified PMJ

Punched FCH

No. S
80

Recorded by: D. AARONSON

Punched by: ________ Date: ________

Published: ________

THORPE BROS. WELL CO. REPORT ON

HOLSTEIN, IOWA

Well No. 2 Kind of well: Drilled Depth: 2040 feet

Size hole started: 20 inches Finish: 8 inches

G. P. M. 200 Static head: 290 feet

Water was first encountered at: 510 feet in Dakota sand, very fine, 30 feet.

Remarks: Other water was encountered at 750 feet in Dolomite; 1550 feet in Dolomite; and 1790 to 1910 feet.

Record of Permanent Pipe

Size	Depth to bottom of pipe
16"	382'
12"	550'
10"	861'
8"	1900'

Driller: Mr. Carl Allen

DRILLERS LOG

AMT. IN FEET	KIND OF SOIL OR FORMATION	TOTAL DEPTH
20	Till, drab, clayey	20
10	Clay, blue, gritty	30
10	Clay, light greenish drab, hard	40
10	Till, clayey, pale yellow, small pebbles of igneous rocks and limestone	50
10	Clay	60
50	Till, drab, clayey	110
10	Clay, gritty with coarse sand	120
10	Clay, drab, hard	130
10	Clay, gray-buff	140
20	Till, gray-buff	160
40	Till, drab, clayey	200
10	Till, drab, sandy	210
70	Till, drab, clayey	280
10	Fine sand	290
10	Till, light drab, clayey, gritty	300
10	Clay, sandy, brownish drab	310
20	Clay	330
40	Clay, dark gray, gritty	370
10	Very fine sand	380
130	Shale, drab, gray and red, plastic	510
30	Sand, shale	540
70	Mississippian sandstone, light yellow-gray	610
10	Limestone, light yellow-gray	620
10	Sandstone	630
50	Limestone	680
10	Limestone, drab	690
20	Limestone, magnesian, or dolomite, light buff	710
10	Limestone, gray and light yellow	720
10	Shale, hard, blue-green	730
20	Limestone, dolomite, blue-gray	750
50	Limestone, dolomite-drab	800
10	Limestone, dolomite, blue-drab	810
10	Limestone-dolomite, blue and yellow gray	820
20	Limestone-dolomite, light gray	840
10	Limestone-dolomite, drab, hard	850
10	Limestone, dolomite, light yellow gray	860
270	Limestone, dolomite, gray and blue-gray	1130
10	Shale, greenish, drab, hard	1140
20	Limestone, dolomite, light gray	1160
150	Limestone, dolomite, blue and yellow-gray	1310
20	Limestone, dolomite, yellow-gray with some drab shale	1330

10	Limestone, dolomite, blue	1340
10	Shale, light green-gray	1350
10	Sandstone	1360
30	Shale, bright green and blue-gray	1390
10	Limestone, response rapid, gray, with shale	1400
10	Shale, green and light brown	1410
10	Limestone, gray	1420
20	Sandstone, St. Peter	1440
10	Limestone, dolomite, light yellow-gray	1450
20	Limestone, dolomite, drab	1470
10	Sandstone	1480
30	Limestone, dolomite, gray	1510
30	Limestone, dolomite, gray	1540
10	Limestone, dolomite, light yellow-gray	1550
70	Limestone, dolomite, gray and buff	1620
10	Sandstone	1630
50	Limestone, dolomite, gray	1680
10	Shale, green-gray	1690
50	Limestone, dolomite	1740
20	Shale, gray	1760
10	Sandstone	1770
20	Shale, green-gray	1790
10	Sandstone	1800
10	Shale	1810
10	Sandstone, gray	1820
60	Shale, greenish and blue-gray	1880
10	Limestone, dolomite, buff	1890
10	Shale, greenish	1900
20	Limestone, dolomite, gray	1920
30	Shale, drab	1950
20	Shale, hard, green-gray	1970
30	Sandstone, red	2000
10	Sandstone	2010
30	Granite, pink	2040

Schaller, Iowa,
November 29, 1936

Dear Dr. Tester:-

Yesterday was spent at Holstein. The pump line was partially clogged and the air jets were not working properly. When I arrived I found that the pump line had been removed and that Russell Rasmussen had taken the jets to Sioux City to be repaired. He returned about noon and they started immediately to replace the pump line, which took until 9 p.m. I remained on the job hoping to get a test on capacity, temperature and a sample. When they started to pump, however, the discharge pressure was so great that the water could not be deflected into a barrel, nor could a temperature be obtained. Before the water was clear enough to sample - it was pumped less than 20 minutes - the pumping test was stopped and the pipes were hooked up for regular use.

The day was not completely lost because I got information on static level, length and dimentions of pipe in the pump lines, and pumping equipment.

While looking over the equipment in the pumphouse I found a well marked set of samples from the well. I asked the mayor's permission to take a part of each sample. He said he thought it would be alright, but he was of the opinion that

1.3

One sample for interval 300 - 330

~~No sample~~ 310 - 330

No sample 380 - 410

450 - 460

480 - 490

860 - 890

1060 - 1070

1130 - 1140

1450 - 1460

1490 - 1500

1510 - 1530

1560 - 1580

1720 - 1730

1830 - 1840

1860 - 1870

2015 - 2040

Granite or granitic gneiss -

T. D. 2040

a set of samples had been sent to Iowa City. Does the Survey have a set of samples from the Holstein well or shall I get a set from the town?

Very truly yours,

H.G. Hershey.

December 1, 1936

Dr. H. Garland Hershey
General Delivery
Holstein, Iowa

Dear Hershey:

With reference to the set of samples from the well at Holstein, will say that we have a partial set from the well drilled about forty years ago with eighteen samples representing the interval from 1575 to 1975 feet. If the samples that you mention apply to this well, then it will be desirable to obtain a fraction or a cut of the set on hand at the city.

The well drilled in 1924 by Thorpe was reported in Volume 33, and the samples apparently described by Norton. This well has a total depth of 2040 feet. We have made a descriptive log of the set of samples in the laboratory and show granite or a granitic gneiss between 2015 and 2040 feet. I would suggest that you examine the samples at Holstein, and if this interval is different then get some of the samples for revision of our set.

There are a number of missing intervals in our set of samples, and in case you can fill in these intervals please do so. Our missing intervals are as follows:

310-330
380-410
450-460
480-490
860-890
1060-1070
1130-1140
1450-1460
1490-1500
1510-1530
1560-1580
1720-1730
1830-1840
1860-1870.

Yours very truly,

ACT:A

A. C. Tester

C/o H. O. Michel,
Holstein, Iowa,
Dec. 2, 1936.

Dear Dr. Tester:

Your letters of November 30 and December 1 and the package of supplies have been received. Thank you very much. ✓

All of today was spent in Holstein interviewing town officials, gathering data for the report and checking over the samples of the well now in use which has a reported depth of 2040 feet. Six samples were found which you list as missing from our set. I could find no trace of the samples from the old well.

Apparently I did not make myself clear concerning the sampling and temperature reading at the time the Holstein well was being repaired. The sample was not taken because the water was still very dirty at the end of the short pumping test. The pressure did, however, prevent taking a temperature. Discharge was through a three inch pipe and was very irregular. First there would be a surge which would throw the water 50 feet from the end of the discharge pipe, within a few seconds the water would fall to the ground only a few feet from the end of the dischage to be fallowed in a few ~~m~~ seconds by another surge. I experimented with a pencil and feel sure that to have held the thermometer at the end of the discharge line would have resulted in breaking the thermometer. An accurate temperature could not be obtained away from the end of the discharge line because the thermometer was exposed to the air between surges. The difficulty could have been overcome by using an elbow to deflect the water vertically downward into a barrel, but no elbow was available.

Your letter to Mr. A. J. N. Schmitz, Clerk of Odebolt which was overlooked in assembling the Odebolt report is enclosed.

✓ filed with Odebolt

Tomorrow I plan to go to Schaller and get a sample of water from the town well No. 2., and then continue to Sac City to check up on developments there. I will inform Mr. Murdock of your suggested location of the proposed test hole. I feel that he and the town council should know of the revised site as soon as possible.

Very truly yours,

H. G. Hershey.

Holstein, Iowa,
Dec 4, 1936.

Dear Dr. Tester:-

Your letter of December 3 concerning Buck Grove, Iowa reached me today. I will ✓ work it in as early as possible.

Enclosed is the water sample data sheet on the Holstein well. The sample will be ✓ sent tomorrow.

You will notice many questionable points on the data sheet. I have Thorpe's casing record but it is known to be wrong. The static level may be as high as 230 feet below curb, but I believe that the figure given is nearly correct. Before accurate data on the source of the water can be had, a restudy of the well cuttings must be made. On this point the drillers log, vol. 33 and our data on Municipal Water Supplies do not agree. All of the above statements will be more fully explained in the Holstein report.

Field work on the Holstein report is complete except for a few details which will be cleared up tomorrow. Tomorrow also I plan to do the necessary work on the well 3½ miles East of Quimby in Cherokee County and if time permits begin work on writing up the Holstein report.

No information has been obtained on

farm wells around Holstein. I will not spend time on this phase of the report unless you think it necessary.

The itinerary for the execution of the work outlined in your letter of November 28 has not yet been worked out. I will send it to you just as soon as possible.

Very truly yours,
H.G. Hershey.

December 7, 1936

Dr. H. Garland Hershey
C/O H. O. Micheel
Holstein, Iowa

Dear Hershey:

Your description of the circumstances of the testing of the Holstein well is very vivid and reminds me of similar experiences that I have had in attempting to take samples and temperatures with airlift wells. I believe that an accurate temperature can be read by inserting the entire thermometer case in the water, as the hole in the bottom of the metal case will permit water to circulate around the glass tube. The principal precaution is to be sure the instrument remains in the water long enough for a complete circulation and equalization of temperature in the metal case. This might also be applied when you lower the thermometer into the bottom of a well, as at Schaller. The chief hazard in holding the thermometer in a surging, pulsating, erupting type of pump is that one usually gets quite wet which must be avoided in this type of weather. I note you record a temperature of 56½ degrees with an air temperature of 16 degrees, measured 8 feet above curb, for the sample taken from the Holstein well. I take it that this position was outside of the pump house and the pipe was exposed to the 16 degree temperature and would influence the water temperature from the well. Although the water temperature is higher than is normal for glacial drift water or shallow indurated rock water, it would suggest that some water was coming from below the 750 foot depth for the Devonian(?).

Another point that interests me very much is your statement that the hole is bridged at 314 feet. How was this fact determined? Do you have any way of knowing how solid the bridge is and whether it could act as an impervious barrier to water from lower levels? The static head is about 50 feet higher than reported in Volume 33. This may be due, of course, to an inaccuracy in information available when 33 was published, or it may be due to the fact that the bridge cuts out all lower water and, of course, maintains the static level of the higher aquifers. Did Rasmussen make any attempt to break or clean the bridge? I will be interested to see your report concerning the differences in the driller's log as shown in Volume 33 and our data on municipal water supplies. According to my black book, it seems to check fairly closely with Volume 33, so I am anxious to see what new information you have. I believe the whole proposition at Holstein requires considerable study, as the situation is unusual.

Yours very truly,

. C. Tester

ACT:A

3

January 4, 1937

Mr. Fred C. Hamil
City Clerk
Holstein, Iowa

Dear Sir:

You will recall the work which Dr. Hershey, of the Geological Survey, did at Holstein and the sample of water which he took from your deep well following the repair work which was completed the last of November. For your information I am sending herewith a copy of the final chemical analysis of the sample of water collected by Dr. Hershey. Also, for comparative purposes you will find enclosed a similar report on water collected by Assistant Sanitary Engineer Mark on June 22, 1934. This water was collected from the same well but shows slight differences in composition.

The values for each constituent are shown in parts per million, the calculated hardness of 844 parts per million of the new analysis being the approximate equivalent of 50 grains per U.S. gallon. This is derived from the calcium or lime and magnesium and iron contents. The fluorine is low, the value being shown as a trace and, of course, this is below that which is known to be harmful to the teeth of growing children. The sulphate content is moderate although sufficient to make a combination with magnesium and form a small amount of epsom salts and for some to be combined with the lime to make a gypsum which is precipitated in pipes and boilers.

You will note by comparing the new analysis with the 1934 report that the values for sodium, magnesium, iron, sulphate, chlorine, and bicarbonate are all lower in the new report than in the old; but the calcium and calculated hardness are both higher in the new sample.

The calculated hardness obviously followed the increase in the amount of lime.

The above analysis in general represents a better condition of the water, although the hardness is slightly greater. Also, the change in composition, notably in the lowering of sodium and sulphate contents, and the increase in lime, suggests that the 1934 sample contained more water from lower formations and the 1936 sample contains more water from the shallow zones or those formations between 350 and 650 feet.

If there are any questions or comments concerning the chemical composition or the geological formations or the circumstances of your water production, do not hesitate to write me as I will be glad to assist in any way possible.

Yours very truly,

A. C. Tester

ACT:A
Enc. 2

2

THORPE WELL COMPANY

CONTRACTORS
LATEST ROTARY AND CABLE TOOL EQUIPMENT
THORPE PATENT GRAVEL PACKED WELLS

2340 SIXTH AVENUE
TELEPHONE 3-6107

PLEASE ADDRESS ALL REPLIES
DIRECT TO THE COMPANY

DES MOINES, IOWA

Jan. 22, 1937

Dr. A. C. Tester
Asst. State Geologist
Iowa City, Iowa

Dear Dr. Tester:

Your letter of recent date with regards to the Holstein well received.

After going back **thru** our records we find that we put in 382' of 16" pipe, and the 12" pipe goes down to a depth of 550' from the surface lapping up into the 16". The 10" goes down to 861' from the surface, and the 8"--1900' from the surface. The 8" and 10" pipe is perforated, and I think the 12" has a lead seal on top. I am of the opinion that the sandstone recorded as Mississippian belongs to the Dakota.

Trusting this information will be of some assistance to you, we are

Yours respectfully

THORPE WELL COMPANY

By T W Thorpe

T. W. THORPE

TWT:LB

IN THE THIRD GENERATION OF UNINTERRUPTED SERVICE

January 23, 1937

Mr. T. W. Thorpe
Thorpe Well Company
Des Moines, Iowa

Dear Tom:

Thank you for your letter of January 23 giving me the information on the casing in the deep well at Holstein. As I understand your statement, the 10 inch is from the surface continuously to 861 feet and the 8 inch is also from the surface continuously to 1900 feet. Or do you mean that the 10 inch starts with an overlapping of the 12 inch at approximately 550 feet and continues to 861 feet and the 8 inch is overlapped at the bottom of the 10 inch and continues to 1900 feet?

I agree with you that the sandstone recorded as Mississippian is actually of the Dakota formation.

I believe that a new well at Holstein developed in the Dakota sandstone might provide a satisfactory water supply.

I will be in Des Moines Tuesday, the 26th, and hope to see you at that time.

Yours very truly,

A. C. Tester

ACT:A

Completion 8/11/23. T.D. 2040'
Each pipe cut off to overlap in each larger casing. Lead seals between 16 & 12" & 12 & 10"
Perforated pipe @ [illegible]

April 3,1923

The City Council

Holstein,Iowa,

Gentlemen:-

As you are aware,I examined the drillings from the lower part of the new well at Holstein last Friday and Saturday, March 30 and 31. At that time I decided from my inspection that the lower twenty-five or thirty feet of the well was in granite. Since returning home I have gone over the samples again and have found no reason to change my former decision. From my inspection of the well drillings and from what the driller told me I make out the following log of the lower one-third of the well:

1435 ft. - 1490 ft. or thereabout, St.Peter sandstone
1490 ft. - 1800 ft., chiefly limestone
1800 ft. - 1880 ft., shale
1880 ft. - 1890 ft., sandstone,brownish
1890 ft. - 1970 ft., shale,greenish and gray
1970 ft. - 2000 ft., sandstone,very red
2000 ft. - 2010 ft., sandstone,pinkish
2010 ft. - 2040 ft., granite,softer above but very hard below.

There are two possibilities with regard to the granite below the bottom of the well. One is that it lies in relatively thin sheets and is interbedded with other rock. The other is that it is a solid mass and extends downward indefinitely. But in either case I would not expect it, or the interbedded strata, if there are any, to yield much water. The granite is too fine-grained and any strata which might be below it would probably be sealed off from any water supplies. This being the case it seems a waste of time and money to drill farther into the granite. There remains then, the problem of getting a suitable supply of water from the overlying beds. The sandstone from 1970 to 2000 feet is very strongly stained by iron and this iron would , of course, be taken up by the water which passed through it and would thus be made unfit for use. The pinkish sandstone at 2000 to 2010 feet is too thin to yield much water, and if it were drawn on the water from the overlying red sandstone would be drawn in and thence into your supply. Hence it too is undesirable as a source of supply. The shale from 1890 to 1970 feet will not yield much water and the same is true of the shale which the driller states extends ffom 1800 to 1880 feet. The sandstone from 1880 to 1890 feet is too thin to yield much water. The limestone beds from about 1490 to 1800 feet might yield some water, but it probably would be quite hard. The St. Peter sandstone, from 1435 to 1490 feet, more or less, is, therefore the lowest and the best source of supply for your well. The St. Peter is looked upon almost everywhere in Iowa as a good waterbearing horizon, and it usually yields abundantly

The driller states that he penetrated another sandstone between six hundred and seven hundred feet below the surface. I examined some samples from this part of the well and found them to be white, clean sand grains. This also may prove to be a valuable source of water.

If there are any questions in your minds or if you wish any further information I will be very glad to give you all the help I can.

Very truly yours,

Assistant State Geologist.

IOWA GEOLOGICAL SURVEY
GEORGE F. KAY, DIRECTOR.

City well no 2 Holstein

SCHEDULE FOR DEEP WELL

Dear Sir:

In connection with the investigation of the water resources of Iowa, the Geological Survey in endeavoring to secure all the important facts relating to the deep wells of the state. It would be a special favor if you, as the owner of such a well, would fill out the blanks in the following schedule, so far as may be possible, and return this sheet at your earliest convenience in the inclosed addressed envelope. The facts thus obtained will be placed on permanent record and in return for your co-operation it will be our pleasure to send you our full reports when published.

Yours very truly,
W. H. NORTON, Asst. in charge of Artesian Wells.

Locality; Town Holstein *County, qr.* Ida *qr.* *sec. tp* *R*

Owner City

Name and address of driller Thorpe Bros.

Depth 2040 feet *Diameters from top to bottom* Top 12 inches- Bottom 6 inches

Date of completion March 20th 1924 *Elevation relative to railway grade at station*

✓ *Depth at which principal supply of water was found* X 275 feet first flow-second 750 feet third flow 1550 feet

✓ ~~*Depths of other water beds*~~ X 1900 feet.

~~*If a flowing well, how high would water rise above surface in pipe on completion*~~ *of well?*

✓ ~~*How high will it rise in pipe at present?*~~ ~~*Flow in gallons per minute on completion*~~

X ~~*Present flow*~~ X *If a non-flowing well, how near the surface did the water rise on completion*

✓ *How near the surface does it now rise?* Between 280 and 300 feet.

✓ *Pumping capacity on completion* 200 gallon per minute. ✓ *at present* 200 gallon per minute.

✓ *Depth of cylinder* of pump 600 feet. *Effect of continuous pumping on level of water*

If the flow or pumping capacity has diminished, can you assign cause?

Have you any records to show the heights at which the water stood as the well was being drilled?

Temperature

Casing: size, length and where placed

Packing: kind and place

Quality of water, hard, soft, salty, alkaline, iron or sulphur bearing

Effect on boilers

Effect on health of users

✓ *If you have an* **analysis of water** *please place on back of this sheet.*

✓ *If you have* **record of the beds passed** *through, please place it on back of this sheet.*

Names of persons who may have samples of drillings Henry Bremer.

✓ *Cost of well* $34,000.00 *Cost of pumping machinery* $4,000.00

NAMES AND ADDRESSES OF OWNERS OF OTHER WELLS RECENTLY DRILLED

Date *Signed* Henry Bremer

5368

The new well is 160' from the old well

WATER ANALYSIS Feb 19th 1926.

Laboratory # 28701. Iowa City, Iowa.

Source of samplo Reservoir well 1900 feet.

Date Collected Feb 8th 1926.

Odor- Slight Earth.

Color- Slight Green and yellow.

Turbidity-Slight

Sediment- Slight Floc

Ammonia Nitrogen-	.600
Albuminoid Nitrogen	.060
Nitrite Nitrogen	.014
Nitrate Nitrogen	0.1
Chlorine	13
Oxygen Consumed	X
Alkalinity	X
Iron	X

Bacterium coli group organisms- Absent in quanity eaxamined.

Remarks - Satisfactory at this time.