Punched FCI

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 R. W. COBLE Source of data FILE Date 6/30/65 Map COUNTY HWY 1:63,360

State IOWA [1 6] County (or town) POCAHONTAS [7 6]

Latitude: [4 2 ...] N Longitude: [0 9 4 4 2 1 0] Sequential number: [1]

Lat-long accuracy: [2] T ___ S, R ___ W, Sec ___

Local well number: [0 9 3 3 3 W 3 5 a a b b] Other number: B & M W-0566

Local use: [566 37 CITY 2] Owner or name: CITY OF HAVELOCK

Owner or name: [ELOCK IOWA] Address: HAVELOCK, IA

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

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 [ ]

DATA AVAILABLE: Well data [ ] Freq. W/L meas.: INVENTORY [Ø] Field aquifer char. [ ]

Hyd. lab. data: [ ]

Qual. water data; type: COMPLETE [ ]

Freq. sampling: [Ø] Pumpage inventory: yes no, period: [ ]

Aperture cards: yes [ ]

Log data: GEOLOGIC AND DRILLERS [ ]

WELL-DESCRIPTION CARD

SAME AS ON MASTER CARD Depth well: 400 ft [4 0 0] Meas. rept DRL accuracy [ ]

Depth cased: (first perf.) 189 ft [1 8 9] Casing type: STEEL ; Diam. 8 in [ ]

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 [ ]

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 [ ]

Date Drilled: AUG 1939 [9 3 9] Pump intake setting: ___ ft [ ]

Driller: McCUTCHEN (name), DES MOINES (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 [ ] Deep Shallow [ ]

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

Descrip. MP LAND S E ft above below lsd, Alt. MP 1229

Alt. LSD: 1229 [1 2 2 9] Accuracy: (source) ALT. [7]

Water Level 28' 1" ft above below MP; Ft above below lsd [2 8] Accuracy: DRL [3]

Date meas.: AUG 1939 [8 3 9] Yield: 70.3 gpm [7 0] Method determined [ ]

Drawdown: 137 ft [1 3 7] Accuracy: DRL [3] Pumping period ___ hrs [ ]

QUALITY OF WATER DATA: Iron 0.0 ppm [0] Sulfate 341 ppm [7] Chloride 8.0 ppm [0] Hard. 541 ppm [8]

Sp. Conduct ___ K x 10^6 [ ] Temp. 49 °F [4 9] Date sampled 8/11/37 [8 3 7]

Taste, color, etc.

93-33W-35 aabb

Well Number 42 , , 03 N/S 094 42 ,
d m s d m s

HYDROGEOLOGIC CARD

SAME AS ON MASTER CARD (1–19) | Physiographic Province: CENT. LOW [20–21] | Section: WEST
LAKE [22] | Drainage Basin: [23–25] | Subbasin: [26]

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

MAJOR AQUIFER: CRETACEOUS, ... ER system, series [28–29] DAKOTA SANDSTONE aquifer, formation, group [30–31] D

Lithology: MED GRAIN SANDSTONE [32–33] 3 | Origin: MARINE [34] | Aquifer Thickness: ft

[35–37] 5 | Length of well open to: 41 ft [38–40] 41 | Depth to top of: 145 ft [41–43] 45

MINOR AQUIFER: MISS, LOWER system, series [44–45] M 1 | KINDERHOOK aquifer, formation, group [46–47] K X

Lithology: FINE limestone [48–49] 2 L | Origin: MARINE [50] 6 | Aquifer Thickness: 45 ft

[51–53] 45 | Length of well open to: 35 ft [54–56] 35 | Depth to top of: 310 ft [57–59] 31

Intervals Screened: PERF 189-205; 275-300; 320-400

Depth to consolidated rock: 120 ft [60–63] | Source of data: SAMPLES [64]

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

Surficial material: SANDY ... [70–71] | Infiltration characteristics: POOR [72]

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

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

CASING
8"
6" ... - 321
5" 320-400

PERF 189-205
275-300
320-400

HAVELOCK, POCAHONTAS COUNTY

CITY WELL #2

Sample 190-195 ft.

Screen Opening Inches	Individual Weight Grams	Individual Percent Retained	Cumulative Percent Retained
0.0195	2.32	5.7	5.7
0.0097	30.80	76.3	82.0
0.0049	6.90	17.1	99.1
0.0024	0.28	0.7	99.8
-0.0024	0.01	0.2	
Totals	40.31	100.0	100.0

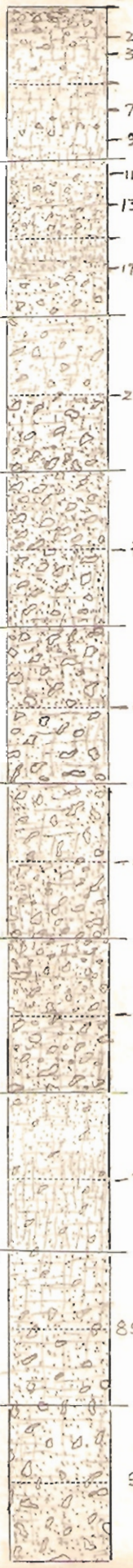
Sample 195-200 ft.

0.0195	1.87	5.8	5.8
0.0097	5.83	17.9	23.7
0.0049	24.41	75.2	98.9
0.0024	0.273	0.8	99.7
-0.0024	0.09	0.3	
Totals	32.47	100.0	100.0

Sheet No. 1 Name of Well. Havelock (Pocahontas Co.) Ia. City Well Survey No. W-0566

Location NW, NE, NE, S. 35, T 93N, R 33 W. Date Drilled July-Aug., 1937 Analyst Frye

Curb Elevation, 1229'



Soil, dark grey-buff, containing silt, clay and Sand. Sand, curvalinear-sub-angular, ¼-1mm.

Clay and silt, lt. buff, Sand, cv.-subagr., wh.-pnk., chunks of black peaty mat.

Loess, lt. grey buff; 10-15% sand grains cv.-sub. angr. A few rounded clay pebbles, iron stain on surface, <1% Carbonate.

Loess, lt grey-buff; 5-10% Sand grains cv.-sub-ang. A few rounded Clay-iron St. pebbles. <1% peaty material. Simelar to above.

Loess, lt. grey-buff; 5-10% sand grains, cv.-s.Ang.; 5-10% large angular quartz, 1-2% shale pebbles, dk. gr., lacmi-ated. Simelar to above.

Loess, lt. grey-buff; 5-10% Sand grs., cv.-s.ang.; dolomite fragments; simelar to above

Loess, lt. grey-buff; 15-20% sand grs, cv-s.ang.; 15% fragments - 1-2 mm. dia, Qtz., dolo., Chert.; Black coaley material, 3-5%.

Silt and clay, lt. grey-buff, 40-50%; Sand, cv-s.ang., ¼-1m.m. 35-40%; Fragments of Qtz, Chert, dolo, ang-s.ang., 1-3 m.m., 5%; Clay and Shale pebbels cv. s.rd., 5%; Black Coaley material, 1-3%. Silt and S. Contain Carbonate.

Sand, containing, Qtz, dolo., sh., chert, black mica, and other minor constituents, 40-50%; Silt, 35-45%, containing carbonate, lt grey-buff.; plant material, 1-3%; Shale pebbles and chert, 1-5 mm., 5%, cv.-ang.;

Till, Calcareous. Silt, buff-drab, and clay 50%; Angular fragments of chert, dolo., Shale 30%; Sand grs., s-round to cv. and s. Ang., 20%.

Till, calcareous. composed of silt, buff-drab, and a small amount of Clay, 50%; Sand. cv. Quartz, 10%; Angular, s.ang., and cv fragments of Chert, dolo, Shale, and Siltstone, varrying from ¼ mm to 3mm., 40%.

Till, calc., Silt, buff-drab and a small amt. of clay, 40%; Grains and fragments from ⅛ mm to 5mm, Curv. to s. ang Qtz. ½-2mm., Ang.-S.ang. Chert ½-3m.m., Curv. dolo, 1-5mm., Basic ig. Rk., s.ang.-curv. 3m.m., Shale, black-grey, curv. 1-5 m.m., + several minor types, 60%.

Till; silt and clay, brown-tan, calc.; Fine Sand ranging through fragments 10-12 m.m. in dia, ang. to Cv., Chert, Qtz., basic ig., Lms, dolo.; Some pyrite, mica, black shale in the finer constituents. - Silt and Clay 20%, Fine-Med. S. 30%, C. Sand, 20%, Grit 30%.

Till; silt and clay, tan-brown, Calc, 25%; Fine sand, Containing Lms, Mica, Pyrite dominently Qtz and Chert, 40%; ang. to cv. fragments up to 6-8 m.m., Lms. chert, Qtz, dolo, Shale black and grey, basic ig; 35% Simelar to above with slightly less coarse constituents.

Till; silt and clay, calc., buff-tan, 20%; Fine sand, Qtz, Chert, Jasper, Lms, ang-cv., 45%; Coarse Sand and Grit, Qtz, Chert, Lms., dolo, basic ig., Shale, black to grey; 30%; Lms. fragments, 10-12 m.m., 5%. Simelar to above.

Till; silt and clay, buff-tan, calc., 20%; Fine sand, ang.-cv., Qtz, Chert, (Jasper), basic ig., Lms, dolo., 35%; Coarse Sand, ang.-cv., Qtz, chert, basic ig., Lms., dolo., 25%; Grit fragments up to 10 mm., s.ang, to Cv., Lms., dolo., 20%; Simelar to above.

Till; silt and clay, buff-tan, calc, 20%; Fine Sand, ang.-cv. 35% Coarse sand, ang.-cv. 25%; Fragments up to ½ mm. dia., of Dolo, chert, grey and tan shale, etc. 20%. Simelar to above.

Till; silt with some clay, grey-buff, calc., 15%; Fine Sand 30%; Coarse Sand 30%; Grit and fragments up to 15 mm 25%; Cv. to Ang.; Qutz., Dolo, Chert (with Jasper), basic ig. Rk., grey, tan and black Shale, Lms.,

Till; silt with some clay, grey-buff., calc., 15%; Fine sand 30%; Coarse Sand 30%; Grit and Fragments up to 15 m.m. 25%; Cv. to Ang. grains; Lms.; Qtz., dolo, Chert, basic ig., shale.; Simelar to above.

Till; silt with some clay, grey-buff, calc, 15%; Fine Sand 25%; Coarse Sand 30%; Grit and fragments up to 15 mm. 30%; Lms, dolo, Qtz, Chert (Inc. Jasper, and black and smokey varieties), basic ig. Rk, Tan and black shale. Grains Cv. to Ang.; Simelar to above.

Till (Soil): Silt and clay, grey-buff, calcareous 80%; Black, soft, peaty material 5%; Fine Sand, Cv. to s.ang., Qtz, chert, etc.; Coarse sand Cv.-S.Ang., 3%; Fragments of Lms, Dolo, Basic Ig., shale, up to 8 mm. dia., 2%.

Loess (Soil): Silt and clay, grey-buff, calcareous, 75%; black, soft peaty material, 3-5%; Fine Sand, cv.-Ang., Qtz, Chert (Jasper), Lms., dolo, basic ig., 10-15%; Coarse Sand, cv.-ang., Qtz, dolo., Lms., Chert, basic ig., shale, siltstone, 5-10%.

Loess; Silt and Clay, grey-buff, calcareous, 75%; Fine Sand, cv-ang., Qtz, chert, Lms, dolo, basic ig., black shale, 15%; Coarse Sand and fragments up to 5 m.m. dia, cv.-ang., dominently ang., chert, Qtz, shale, grey to black, Lms, dolo., 10%.

Till; Silt and clay, grey-buff, highly calcareous 50%; Fine Sand, cv.-ang., Qtz, Lms, dolo., chert, dark ig Rk., 40%; larger fragments, up to 3 mm., ang.-cv., dolo, Qtz., 10%.

Till; Clay with silt, grey-buff, calcareous, 60%; Fine Sand, cv.-s.ang., Qtz, chert, lms., dolo., 25%; Coarse Sand dolo., lms., Qtz, dark ig. Rk., ang.-cv., 15%

Till; clay with silt, grey-buff, calcareous, 50%; Fine sand, cv.-s.ang, Qtz, chert (Jasper), basic ig, dolo., Lms., Pyrite, 30%; Coarse Sand and fragments up to 6 m.m., ang.-cv., Dolo, Red, and green basic ig. Rk., Qtz, (red and Smokey) Chert, Lms., 20%.

Sheet No. 2 Name of Well Havelock (Pocahontas Co.) Ia. City Well Survey No. W-0566

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

Till; clay and silt, grey-buff, calcareous, 40%; Coase and Fine Sand, Cv. to Ang., Qtz, basic ig, grey shale, dolo, Lms., chert, 50%; Grit, fragments up to 6-8 m.m., Lms., dolo, basic ig., 10%.

Sand and Silt; Sd. Fine, silt coarse; gr-buff, slightly gnsh; maj. grade clear, ang.- S.ang.; < 5% 2-1mm, frosted, curv.- S.round; Max. size 8mm.; grains of Qtz, Chert, basic ig., dolo, dark and white mica. etc.

Sand and Silt; Sd. Fine, silt coarse; gr-buff, slightly gnsh; major-grade clear, ang.- S.ang.; < 5% 2-1mm., frosted, cv.- S.rd.; Max. size 8m.m.; grains of Chert, Qtz., basic ig., dolo., dark and white mica; simelar to above, coarser constituents more abundent.

Sand and Silt; Sd. Fine, silt coarse; gr.-buff, slightly gnsh; maj. grade clear, ang.- S.ang; < 5% 2-1mm, frosted, cv.; Max. size 4 m.m.; grains of Qtz, cherty basic ig., black and white mica, etc.; Simelar to above, somewhat more varried mineral suite.

Silt and Sand with some clay; buff gray, slightly bluish. Small concretions, ½ - 2 mm. dia, of siderite, 2%., angular to cv. fragments of ig., Chert Qtz. etc., non calcareous.

Till; clay and some silt, lt. blue-grey, small concretions of siderite, 1%, carbonaceous material and coal.

Till; clay and silt, lt. blue-gray. A few siderite concretions. Coal fragments, from surface.

Till; Silt and clay, lt. ash-grey, slightly blueish; a few sand grains, scattered ang. fragments lms., blockey Tough coal (from surface).

Till; Silt, med-fine; ash grey; and clay; a few angular fragments of tan siltstone, quartz sand grains. Shale, blue gray in flattish pebbles. Ang.- Sub.ang. Qtz. fragments probably cave. Coal < 1%.

Silt and some clay; ash grey and tan. Clay, bluish grey. A few sand grains, Cv.. Simelar to above.

Silt; grey-buff. even grained, mostly Qtz. and mica - A few scattered sand grains.

Sand ; lt. grey, Qtz. and some mica. ½ - ¼ mm, 50%, ¼ - ⅛ mm. 40% larger grains show considerable secondary growth.

Silt and Very fine Sand and clay; grey and maroon-buff. A few scattered Sand grains.

Silt, clay and Sand; brick red to red buff clay and fine silt. ash grey fine sand and Coarse silt. A few coarse sand grs. of Qtz. S.ang.- Cv. fragments chert and ig. Rk.; < 1%, probably cave.

Silt; lt. brick red, and ash grey, a few small hematite nodules.

Silt and fine Sand; blue grey, ash grey, and lt. brick red; some clay. Small concretions of siderite < 1%; A few cv., coarse Sand grains, and < 1% shale pebbles.

Silt and clay ⟶ Fine silt and clay. Ash grey fine St. and clay, steel grey silt, clay, and shale. Iron stained clay in small quantities. Carbonaceous material < 1%.

Sand and Clay; Sand 50%, Cv.- ang., maj. gr. 1-½ mm.- Coarse Sand grs, Cv.- S.rd., Clay, blue grey, 30%. Ang. fragments of Chert, Quartz and ferrugenous cemented S.S., 20%, up to 15mm. dia.

Sand and Clay; Sand 75%, cv.- ang, major grade 1-½ m.m. Small pellets of lt. blue grey clay - Ang. fragments of chert, and Qtz. grains, 2-6 mm. dia.

Sand; Sd. 60%, cv.- ang., maj. gr. 1-½ mm. - Clay, blue grey, in pebbles and pellets, encrusted with sand. Ang. fragments of chert. < 1% ig. Rk. types.

Sand and Silt; sd fine, silt coarse; gry-bf, slightly grnh; maj. grade, clear, ang-s.angs
<5% 2-1 mm. frosted, curv-sard; max. size 8mm; grains of qtz, chert, basic. ign,
dolo, dark and white mica, etc.

Sheet No. 3 Name of Well Haverhock (Pocahontas Co.) Jay City Well Survey No. W-0566

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

Sand and Chert; Sand, cv.-s.ang., ½-2mm., Sandstone in ang. fragments held by tough ferrugenuous cement. Ang. fragments up to 2 cm. dia, dominently Chert, some Qtz. (white and rose). Fragment of Brachiopod cast on chert.

Sand, Silt and Chert; Chert, ang. fragments to 15 m.m. dia., and Qtz., fragments of ferrugenous s. stone. 50%, scattered fragments of lg. Rk.; fine to coarse Sand, mostly ang.-s.ang. with a few large grs. s.rd.-cv., frosted. sand more prominent at bottom of sample with small quantity of Silt.

Sand; Crs. Sand, ang.-cv., contains grs. of pyrite and oölites of siderite, fragments of Coarse sand to silt very loosely cemented. Chert in angular fragments. Some clay forming agregates in The Sample.

Sand; Crs. Sand ang.-cv., sizes from coarse silt to coarse sand., lt. ash grey clay; dk. blue grey clay; ang. fragments of Chert.

Sand and Silt; lt. buff. fine sand and silt, coarser grains mostly s.ang.-cv., small quantity of clay. Material occurs in tight aggregates in sample. Fragments, angular, of Chert.

Sand and Silt; lt. grey buff, fine sand, Silt, and some clay, occurs in aggregates in sample. Chert in ang. fragments.

Sand; lt. grey buff, fine to Crs. Snd.; Ang. fragments of Chert, 40%; Some aggregates occured in the sample, held togeather by clay.

Sand, Silt and Clay; sand, s.ang.-cv., 30%; silt and some clay, lt. grey buff., 50%; angular fragments of chert.

Sand and Silt; Sand, s.ang.-cv., 50%; Silt, lt. grey buff, fragments of chert, angular, up to 12 mm dia.

Sand and Silt; Sand, s.ang.-cv., 50%, Silt, and some clay, lt. grey buff. Fragments of chert, angular, up to 10-12 mm. Sample Simelar to above.

Sand and Silt; Sand, s.ang.-cv., 40%, Silt with some clay, lt. grey buff, 40%, Fragments of Chert, ang, 20%. Small Concretions of Siderite. Simelar to above.

Sand and Silt; Sand, s.ang.-cv., 40%, Silt with some clay, lt. grey buff. 50%, Ang. Fragments Chert. 10%, Simelar to above.

Sand, Silt; Sand, Fine to Coarse, s.ang.-cv., 35%; Silt and some clay, lt. grey buff, 40%; Chert, ang. fragments, up to 15 mm. dia., dark grey to lt. grey, 25%; Simelar to above.

Sand, Silt; Sand, Fine to Coarse, s.ang.-cv., 40%; Silt and some clay, lt. grey buff, 45%; Chert., ang. fragments, up to 10mm, dia., dark grey, 15%; Simelar to above.

Sand and Silt; Fine to Coarse Sand, s.ang.-cv. (s.rd.), 50-60%; Silt and a small amt. of Clay, lt. tan-grey, 40%; ang. fragments of Chert, 5-10%.

Sand and Clay; Fine to Coarse sand, ang.-cv., 80%; Clay, lt. blue grey, 10%; Chert, small angular fragments, 10%.

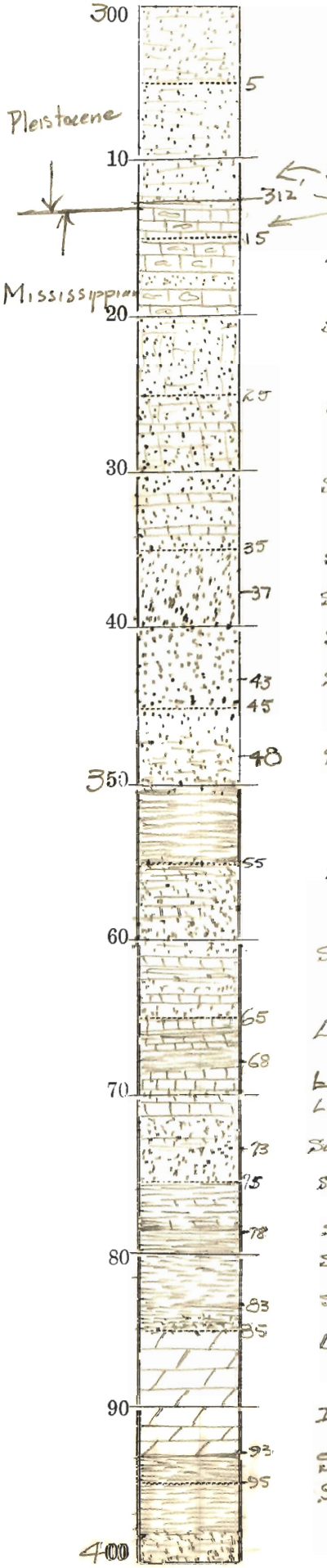
Sand and Silt; Fine to Coarse Sand, ang.-cv., 70%; Silt with a small amt. of clay, grey buff, 30%.

Silt; grey-buff with small portions of Sand and Clay 75%; Angular fragments of Chert, up to 2 cm., some pyrite, Fe Cemented fine sd., Qtz., Siderite etc. 25%

Sand and Silt; Sand, med.-fine, s.ang.-cv, 50%; Silt and clay, lt. grey-buff. 40%; Ang. fragments of Chert, up to 10 mm. dia. Simelar to above. Washed sample shows Chert, Qtz, Siderite, pyrite, Hematite, Fine sand in nodules cemented by hematite, etc.

Sheet No. 4 Name of Well Havelock (Pocahontas Co.) To. City Well Survey No. W-0566

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



Sand and Silt; Sand ang.- cv., interstices filled with yellow brown clay, hematite (or an Oxide of Fe), and in some cases fine silt. 75%; Silt, buff-grey; Some angular fragments of Chert, Trace fine carbonaceous material.

Sand and Silt; Sand, ang.- cv., 50%; silt with a trace of clay, grey-tan; A few ang. fragments of chert. Calcareous probably a weathered lms. zone at the base of the Pleistocene.

Sand and Silt and Lms; Sand, ang.- cv.; Silt, grey-buff, Siltstone in ang. fragments, olive-drab, Chert and Limestone in ang. fragments.

Limestone and Sandstone; Limestone, lt. grey to dark grey; dense, Very cherty - large fragments show gradation Contact chert and lms, Small quantity of S.S., Silt and trace of Clay.

Sand and Silt; lt. grey-buff, fine sand and silt with some small angular fragments of chert. Very small amt. of clay.

Sand and Silt; lt. grey-buff, fine sand and silt, small quantities of ash grey clay. Massive, fine, dark grey lms. & in small ang. frogments.

Sand, silt and Lms; Med.- fine sand, crs. silt, trace of clay - sd., ang.- cv., fragments of lt. grey- cream chert. Limestone, dark-grey, granular. Lms. lt. grey - cream, Oolitic, containing grains of pyrite.

Sand and silt; Fine to med. sd., ang.- cv., lt. blue-grey silt and some clay.

Sand; med., ang.- cv., some silt. Flakes of dark grey granular Lms., and of lt. grey-cream lms.

Sand; med., ang.- cv., Contains lms. oolites and many grains of Pyrite

Sand and silt; ang.- cv., similar to above with a slight increase of silt.

Sand and silt; sd., med.- fine, s.ang.- cv., Silt, lt. ash grey.

Silt; st., lt. grey-buff, and some sand. Trace of clay.

Shale and Clay; Shale with clay, blue-grey, slightly greenish. Contains some sand and silt, irregular masses of pyrite, and fragments of Chert and black shale.

Sand, med-fine, ang.- cv., some grains show secondary growth. Ang. fragments of lms., chert. green shale with large percentage of pyrite grains. Grains of pyrite in sand.

Sand and lms; med.- fine sand and silt, grs. cv.- ang.; ang fragments of grey crystaline lms., grains of pyrite, green-grey shale with grains of pyrite.

Limestone and Shale, with some sand; Lms, lt. grey, finely crystaline; Shale, lt. green-grey, a few flakes of black mica and pyrite. Sand, fine - crs., ang.- cv.

Limestone, lt. grey - pyrite and considerable sand.

Limestone and Sand; lt. grey finely crystaline lms.; Sand, med.-fine cv.- ang. - fragments of lt. green-grey shale.

Sand; and silt, sand med.- fine, cv.- ang. - fragments of lms. and Sh.

Shale, lt. greenish grey. Some lms. fragments, lt. grey fine.

Shale and Siltstone; Sh- grey-blue, and siltstone, lt. greenish grey micaceous.

Siltstone, lt. green-grey, micaceous, fine, siltstone; fragments of chert and dolo.

Siltstone; greenish-grey, micaceous, fine siltstone; some lt. lead-grey shale; Sand, med.- fine, ang.- cv.; fragments of lms.

Dolomite, lt. grey-tan, fine gr.; fragments of blue-green shale and green-grey siltstone

Dolomite; lt. grey-buff, fine grained; abundent pyrite grains, fragments of lt. green-grey shale.

Shale -; lt. grey-green, micaceous; Sand Cave; some pyrite.

Shale -; grey-green, fine-gr., micaceous, slt.st., and shale; fine to med., ang.- cv.; Dolo. in small fragments; numerous pyrite grains occur individually and in aggregates.

093-33W-15 AABB

DMC

W-0566

UNITED STATES DEPARTMENT OF THE INTERIOR
Geological Survey
Water Resources Division

Water Quality
(ppm)

Card Q

State: IOWA (1 2) County: POCAHONTAS (3 4) Town: HAVELOCK

Well No. (5–11) Latitude: 42 50 03 N; Longitude: 094 42 10 (12–18); Seq. No. (19): 1; Date (20–25) M D Y: 8 11 37

Sampling Depth (26–29): 400; Type (30): 1; Kx10^6 (31–35); pH (36–38): 6.8; Temp. °F (39–41): 49

SiO_2 (42–44); Ca (45–49): 14; Mg (50–53): 46; Na+K (54–58): 30; K (59–61): .C

HCO_3 (62–65): 273; CO_3 (66–67): 0; SO_4 (68–72): 341; Cl (73–78): 80; Source No. (79–80): 3 Q

Card R

Duplicate Columns 1-25 from Card Q

F (26–28): .0; NO_3 (29–32): 1.8; PO_4 (33–35); B (36–38); Al (39–41); Fe (42–45): .00

Mn (46–49): .06; Cu (50–52); Pb (53–54); Zn (55–57)

Solids Determined (58–63): 78; Calc. (64–69); Ca,Mg (70–73): 54; Hardness Non-Carb. (74–77): 317

Color (78–79); No. (80): R

Card S

Duplicate Columns 1-25 from Card Q

Br (26–28); I (29–31); Alk. as $CaCO_3$ (32–35): 224; 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. (80): S

Verified (MJ)

Recorded by: RW COBLE

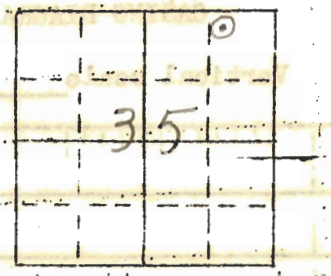
Punched by: Punched FCR Date:

Published:

IOWA GEOLOGICAL SURVEY W-0566

In Cooperation with U. S. Geological Survey

RECORD OF WELL



In old pump house

Location:

Town: Havelock (N E / S W): County Pocahontas

NW¼ NE¼ NE¼ sec. 35 T. 93 N., R. 33 W. Cummins Twp.

Well name and number City well #2 (1937)

Owner _____ Address _____

Tenant _____ Address _____

Contractor McCutcheon Well Co. Address Des Moines

Drillers F. McCutcheon, Jr.; Ellis Kester

Drilling dates July - August 1937

Well data:

Elevations: Drilling curb 1229 feet; Land surface _____ feet

Determined by _____

Topographic position _____

Total depth: Reported 400 feet, Measured _____ feet

Drilling method _____

Hole and casing data 191'1" of 8" casing from +2'1" to 189'

147'4" of 6" casing from 174' to 321'8" (perforated 189-205; 275-300)

79'8" of 5" I.J. casing to bottom (perforated)

Original depth to water 28'1" ft. below ~~above~~ curb Date _____

Original elevation of water level _____ ft.; Source of data _____

Sources of water: Principal Cretaceous Mississippian; Others _____

Production data: Date

Static depth to water 28'1" Measuring point

Pumping level 114 at 43 g.p.m.

164.9 70.3

141.7 59.2

Specific capacity g.p.m. per ft. drawdown; Temperature 49¼ °F.

Pump data: Type pump Column Dia. Length

Cylinder or bowls: Dia. Length Suction pipe

Power Airline

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

Use of water

WATER ANALYSES (in parts per million)

Date samples	Aug 11, 1937			
Sampled by	H.G. Hershey			
Total solids	781.0			
Insoluble matter	12.0			
Alkalinity (Meo)	224.0			
Alkalinity (Phn)	0.0			
pH	6.8			
$Fe_2O_3 + Mn_2O_3 + Al_2O_3$	6.5			
Alkali as sodium	30.1			
Calcium	141.2			
Magnesium	45.8			
Iron (unfiltered)	0.0			
Manganese	0.06			
Nitrate	1.8			
Fluoride	0.0			
Chloride	8.0			
Sulfate	340.9			
Bicarbonate	273.3			
Hardness (ppm)	541.0			
Hardness (gpg)	31.6			

Remarks

Laboratory data: Sample storage location

Sample range 0-400 No. spls. 102 No. dupls. & cond. 102 p to g

Spls. prepared by Washed range by

Driller's log and cond. Yes very good

Insoluble residues: Prepared by Studied by Strip log

Microscopic study strip log

Gen. log Correl. by

IOWA GEOLOGICAL SURVEY
Well Log Record No. _____

County: Pocahontas

Name of Well: New Havelock town well Town: Havelock

Location: NW¼, NE¼, NE¼ Sec. 35 T. 93 N., R. 33 E. W. Cummins Twp.

Curb Elevation: 1229 Ft. Present Depth 400 Ft. Final Depth — Ft.

Static Level: (Depth to Water (Above) (Below) Curb) 28 Ft. Pumping Level 164'0" Ft.

Contractor: McCutcheon Well Co, Des Moines Date Drilled: July-Aug 1937

Description*	FEET Thick	From	To	Description*	FEET Thick	From	To
Topsoil	5	0	5	Ls & SS with shale bands	11	337	348
Yellow clay	10	5	15	Blue shale	7	348	355
Gray sandy drift	50	15	65	SS & ls (softer 367')	8	355	363
Sandy dust brown drift	55	65	120	Limestone	10	363	373
Purple Cretaceous shale	20	120	140	Sandstone (Hard at 376	3	373	376
Lt. pink	10	140	150	Limestone (soft at 385)	17	376	393
Tan	8	150	158	Shale & rock bands	7	393	400
White sugar sand	2	158	160				
Yellow shale	5	160	165				
Orange shale	15	165	180				
Gray shale	9	180	189				
Sandstone	16	189	205				
Broken rock	5	205	210				
Tan shale & broken rock	40	210	250				
Gray	50	250	300				
Ylw	10	300	310				
Gray limestone	10	310	320				
Gray shale	3	320	323				
SS & ls bands	10	323	333				
Oolitic ls & ss. (soft at 342')	4	333	337				

*Abbreviate descriptions; use one line for each formation.

Remarks on water zones and casing: 191'1" of 8" casing from 2'1" above curb to 189'0"; 147'4" of 6" casing from 174'4" to 321'8", perforated 275'-300' & 189'0" to 205'. (5" perforated casing be put in from 310' to bottom of hole). Sample taken for mineral analysis

Temperature: Air 73 °F.; Water 49¼ °F., at 3:45 (A.M.) (P.M.) Aug. 11 1937

Record obtained from Ellis Kester Recorded by H. G. Hershey Aug 11, 1937.

Over

IOWA GEOLOGICAL SURVEY
Well Log Record

No. _____

County: _____

Name of Well: _____ Town: _____

Location: Sec. _____ T. _____ N., R. _____ W. _____ Twp.

Curb Elevation: _____ Ft. Present Depth _____ Ft. Final Depth _____ Ft.

Static Level; (Depth to Water (Above / Below) Curb) _____ Ft. Pumping Level _____ Ft.

Contractor: _____ Date Drilled: _____

Description*	Thick	From	To
Water levels			
Aug. 5, 1937 Static level 33'9" depth of well —			
" 6 " 34'2" " " " 330'			
" 7 " 34'2" " " " 345'			
" 8 " 28'9" " " " 360'			
" 9 " 31'9" " " " 375'			
" 10 " 33'5" " " " 400'			

Note: Measurements taken in morning before drilling started, except on Aug. 10.
[Driller reports that he made a 10' error in reporting a static level of 34'2" for Aug. 6. (See earlier report of H.G.H). The true static level for that date was 34'2".]

Topographic position: Upland plain

*Abbreviate descriptions; use one line for each formation.

Remarks on water zones and casing: _____

Temperature: Air _____ °F.; Water _____ °F., at _____ (A.M. / P.M.) 193_

Record obtained from _____ Recorded by _____

Name of Well -- Havelock Town Well #2

Location --

Static Water Level --

Contractor: McCutcheon Well Company

Description

Top Soil	0-5	5
Yellow Clay	10	15
Gray Sandy Drift	50	65
Sand Dust Brown Shale	55	120
Purple Cretaceous Shale	20	140
Light Pink Cretaceous Shale	10	150
Tan Color Cretaceous Shale	8	158
White Sugar Sand	2	160
Yellow Shale	5	165
Orange Shale	15	180
Gray Shale	9	189
Sandstone	16	205
Broken Rock	5	210
Tan Shale & Broken Rock	40	250
Gray Shale & Broken Rock	50	300
Yellow Shale & Broken Rock	10	310
Gray Limestone	10	320
Gray Shale	3	323
Sandstone & Lime bands	10	333
Oolithic Limestone and Sandstone	4	337
Limestone & Sandstone and Shale Bands (soft at 342)	11	348
Blue Shale	7	355
Sandstone and Limestone	8	363
Limestone Little soft at 367	10	373
Sandstone Shale Band	3	376
Limestone Hard at 376, soft at 385	17	393
Shale & Rock Bands	7	400

Suction Lime 186' 2"

All measurements from floor water level at start 28' 1"
at 70.3 g. p. m. lowest level 164.9
at 59.2 g. p. m. lowest level 141.7
at 43.3 g. p. m. lowest level 114' 0"

SPEC. CAP: 0.51
= 0.52
= 0.50

Havelock Town Well Log Continued

Casing

189 floor level
above floor 2' 1"

163 4"
275 to 300 perforated
189 to 205 perforated

Aug. 5 36'
Aug. 6 36' 5
Aug. 7 36' 5
Aug. 8 31'
Aug. 9 34' 2
Aug.10 35' 8

Top of casing to Drum 402

Casing from floor level

189 8"
147.4 6"
336.4 Total
16 lap
320.0

Pump line 127' 36' top of casing to water
128' top of casing to water level
42 g. p. m.

5" I. J. well casing to bottom 79' 8" perforated

Havelock

Albert City, Iowa,
July 20, 1937.

Dear Mr. Tester:

While I was at the Lytton Creamery well today Mr. Mc Cutcheon called from Havelock and asked that I visit his well there today or tomorrow. He said that he believed that they were in "Dakota shale".

After leaving Lytton I went to Havelock, examined the samples, but could come to no final decision concerning them and am sending them on to you. They are certainly not what I would expect in that locality. In the same box are the samples from the Lytton Creamery well.

Mr. Mc Cutcheon was at Havelock when I arrived, but left almost immediately. He expects to see you toward the end of the week and will get your opinion on the samples at that time provided you have time to look them over meanwhile. I will be glad to have your opinion of them.

Havelock

At present there is 168 feet of casing in the Havelock well and the driller reports that they have been putting it in as quickly as possible throughout the drilling.

Very truly yours
H.G. Hershey

Albert City, Iowa,
July 22, 1937.

Memorandum

To: Mr. A. C. Tester

From: H.G. Hershey

Subject: Havelock town well, Pocahontas Co.

Mr. McCutcheon, who visited the Sundholm well today while I was there, told me that they were in sandstone at Havelock and asked that I visit the well. I arrived there this afternoon just as they finished drilling the sandstone and remained until a depth of 215 feet had been reached. Since you have probably studied the samples which I sent to Iowa City and those which Mr. McCutcheon planned to take to Des Moines to show you it will be unnecessary to go into detail regarding my observations.

Mr. McCutcheon requested that I visit the well again tomorrow.

P.S. A complete report to date on the Sundholm well is in preparation.

Albert City, Iowa,
July 23, 1937.

Memorandum

To: Dr. A. C. Tester

From: H. G. Hershey

Subject: City well at Havelock, Pocahontas County.

Although two shifts were working at Havelock, a depth of only 227 feet had been attained at 5:00 p.m. tonight. The sandstone from 189 to 205 feet has not been cased out and is masking the material below.

Samples show sandstone and chert held in a yellow mud, but there are no fragments of the yellow material to show its true character.

"Chitty" to 120'
water @ 39'

0-70 drift
70-100 Sh? to Sls or drift to silty bf. brown
100-120 - Ss, very fine, carbonized wood
120-130 - Sh, choc gray -
130-140 Sh, gry - brown tinge - non-calc
140-145 Sls + Sh - brownish-gray, Carbonized wood frags.
145-150 ylw ss + silts with black carb. - Coaly frags -
150-155 ylw siltstone
155-160 White Ss - very fine + clean
160-165 Ss, + Sls, varied red, brn + buff tower
165-170 Sh + sls, red + wh (Gypsiferous?)
170-175 like 165-170
175-180 Sh + (Gyp?) + Sls - gry with red + wh (Some carbonaceous
to 189

8' to top SS @ 189'6"

189-205 ylw
205-

Albert City, Iowa
July 29, 1937.

Dear Mr. Tester:

When I arrived at Havelock early this morning the drillers were cleaning out the hole preparatory to putting in the pumpline. This took until noon, after which the hole was measured by tape and found to be 320 feet deep. The drillers then started to put in the pumpline, but said that little, if any pumping would be done until tomorrow when Mr. Mc Cutchon is expected to be on the job. I, therefore, returned to Albert City to observe the drilling in the Superior Manufacturing Company well.

No new hole was made there, however, because sand kept coming in faster than it could be drilled and bailed out.

The chemist who is analyzing the water from test well No. 3 asked permission of the council to determine several aditional elements in order that hypothetical combinations could be made. The Council granted permission to do so.

Very truly yours,
H. G. Hershey.

Albert City, Iowa
July 30, 1937

Memorandum
To: Mr. A. C. Tester
From: A.G. Hershey
Subject: New town well at Havelock, Pocahontas Co.

The above well was pumped for 10 hours last night, in spite of the drillers statement that little or no pumping would be done until today. Frank McCutchon, Jr., who is in charge reports that starting from a static level of 33'3", pumping at a rate of 40 g.p.m., the water level fell to 109 feet during the first hour and to 127 feet during the second hour. Continued pumping for 8 hours at 40 g.p.m. effected no further drawdown. ✓

Mr. McCutchon, Sr. arrived somewhat after 9:00 am. and pumping was started almost immediately. The results are shown on an attached sheet. Observations were interrupted by a council meeting which I was requested to attend.

During the council meeting I was asked for a statement on what might be expected with deeper drilling. I explained that the formations encountered so far were not normal for the area

and that it was impossible to predict accurately where the next lower water-bearing horizon occurs.

The council decided to continue the drilling to 400 feet in the hope of increasing production to somewhere near the desired 100 gpm.

Havelock, Pocahontas Co.

Results of pumping test on new city well on July 30, 1937

Time	Water Level Read	Water Level Cor.	Interval Drawdown	Interval Time	Total Drawdown	Total Time	Remarks
7:00	28'9"	26'1"					
9:20	28'9"	26'1"	51'9"				Pump started at 9:20
9:22	80'6"	77'10"	47'4"				Production variable ±50 gpm.
:26	127'10"	125'2"			99'1"	6	
:33	144'0"	141'4"			115'3"	13	
:35	149'1"	147'3"	15'5" recovery	55	121'2"	15	Pump sucking air, water level assumed
30	134'6"	131'10"	2'7" "	30	105'9"	70	Pumping at 43.3 gpm. Water T. 49°
11:00	131'11"	129'3"		30	103'2"	100	42.0 gpm
11:30	132'3"	129'7"			103'6"	130	" " 42.0 gpm Water T. 49°

Water very cloudy at end of pumping and showed no indication of clearing

Time	Water Level Read	Water Level Cor.	Interval Recovery	Interval Time	Total Recovery	Total Time	Remarks
11:30	132'3"	129'7"					Pump stopped at 11:30
11:32	47'0"	94'4"	35'3"	2	35'3"	2	
11:33	84'6"	81'10"	12'6"	1	47'9"	3	
11:34	76'9"	74'1"	7'9"	1	55'6"	4	
11:35	71'0"	68'4"	5'8"	1	61'2"	5	
11:40	55'6"	53'10"	8'1"	5	75'9"	10	
11:45	48'2"	45'6"	3'8"	5	84'1"	15	
11:50	44'3"	41'7"	3'9"	5	88'0"	20	
11:55		39'3"	1'8"	5	90'4"	25	
12:00	40'3"	37'7"	2'1"	10	92'0"	30	
12:10	38'2"	35'6"	2'3"	20	94'1"	40	
12:30	35'11"	33'3"	1'6"	30	96'4"	60	
1:00	34'5"	31'9"			97'10"	120	

Albert City, Iowa,
August 4, 1937.

Memorandum

To: Dr. A. C. Tester

From: H.G. Hershey

Subject: New town well at Havelock, Pocahontas Co.

When drilling was resumed in the above well on Monday it was found that it had caved below 205 feet. The caved material, which had been drilled out to 315 feet at the time of my visit today, was composed chiefly of sandstone (completely broken down to individual grains) and chert, with less light and medium gray shale and a few fragments of dirty, friable sandstone, all held in a thick, light brown mud.

The driller plans to put in 6-inch casing from 182'10" to 320'0", perforated 189'-205' and 278'-300'. Drilling will then be continued below 320 feet. A second pumping test is not contemplated although it is my opinion that a pumping test would be desirable after the 6-inch casing is run and before further drilling is done.

The water sample and other results of the pumping test of July 30 probably represent water from the sandstone 189"-205" almost exclusively.

Albert City, Iowa,
August 6, 1937.

Memorandum
From: H.G. Hershey
To: Mr: A.C. Tester
Subject: New well at Havelock

A depth of 337 feet had been reached in the above well at the time of my visit this afternoon.

The log below 320 feet:

	Thick	From	To
Gray shale	3'	320'	323'
Sandstone predominating over interbedded oolitic limestone (Trace of shale 335-337)		323'	337'

Frank McCutcheon, Jr. had to leave the job because of illness and the driller now in charge is Ellis Kester. He has a local helper.

Mr. Kister very kindly offered to save samples every 2½ feet until the section becomes more normal.

Only one shift is working on this project at present.

Mr. Kister informed me that the water level, before drilling was started on August 5, was 33'9". He was not sure of the depth of the well at that time. This morning before starting to drill he measured the water level as 24'2". At that time the well was 330 feet deep.

August 10, 1937

MEMORANDUM

TO: DR. H. G. HERSHEY, ALBERT CITY, IOWA.

SUBJECT: Havelock, Pocahontas County, new well.

The matter of static water level in this well is very important, and I hope that you will urge the drillers to keep a check on the condition and level of the water each day and ~~at~~ with the change of formation. The fact that the level is relatively high, as you report 24' 2" below the surface at the depth of 330', suggests a high head which may be related to the structural condition as brought out on the new map. In other words, this well is undoubtedly in the early Paleozoic horizons and is benefited by the relatively steeper dip of the formation and is in the same influence as the Fort Dodge and several of the other deep wells of the area.

I have not yet had time to complete the full study of the samples but will do so within the next two or three days. I suggest that you send additional material just as soon as it is available.

Havelock, Pocahontas County

New Town Well
400'
Results of pumping test of August 10, 1937.

	Time	Water Level Below Curb	Interval D'down	Interval Elapsed Time	Total D'down	Total Elapsed Time	Production " G.P.M	Pumping Speed Strokes per Min.	Temperature Air	Temperature Water	Remarks
				Min.		Hrs Min					
Aug. 10, 1937	3:30	28' 1"	18' 5"	1							Static level of 28'1" may be too high, because pumpline was put in before measurement was made.
	3:31	46' 6"	14' 0"	1	18' 5"	1					
	3:32	60' 10"	9' 8"	1	32' 9"	2					
	3:33	70' 6"	5' 0"	1	42' 5"	3					
	3:34	76' 6"	6' 6"	1	47' 5"	4					
	3:35	82' 0"	7' 2"	1	53' 11"	4	45.1	19			
	3:36	89' 2"	4' 11"	1	61' 1"	6					
	3:37	93' 6"	3' 1"	1	65' 5"	7					
	3:38	96' 7"	2' 7"	1	68' 6"	8					
	3:39	99' 2"	1' 10"	1	71' 1"	9					
	3:40	101' 0"	5' 1"	5	72' 11"	10					Water very cloudy
	3:45	106' 1"	3' 5"	5	78' 0"	15					
	3:50	109' 6"	1' 8"	5	81' 5"	20					
	3:55	111' 2"	1' 4"	5	83' 1"	25	45.1	19½			
	4:00	112' 6"	3"	5	84' 5"	30		19½			
	4:05	112' 9"	9"	5	84' 8"	35					
	4:10	113' 6"	1" Rec.	5	85' 5"	40	43.9	19½			
	4:15	113' 5"	7"	15	85' 4"	45	43.6	19½			
	4:30	114' 0"	1' 2" Rec.	15	85' 11"	1-0	43.3				
	4:45	112' 10"	3" "	15	84' 9"	1-15	42.8	19			
	5:00	112' 7"	3" "	30	84' 6"	1-30	42.8	19			
	5:30	111' 9"	3"	30	83' 7"	2-0	42.2				
	6:00	111' 11"	1' 5" Rec.	30	83' 10"	2-30	41.2	18½	87	49½	
	6:30	110' 6"	7" "	30	82' 5"	3-0	41.2	19	87	49¾	
	7:00	109' 11"	6"	30	81' 10"	3-30	41.2	19	86	49¼	
	7:30	110' 5"	1' 2" Rec.	60	82' 4"	4-0	42.2	19½	85	49¼	
	8:30	109' 3"	33' 5"	10	81' 2"	5-0	42.2				
	8:40	131' 8"	6' 4"	5	103' 7"	5-10					
	8:45	138' 0"	1' 9"	5	109' 11"	5-15	59.2	25			
	8:50	139' 9"	8"	5	111' 8"	5-20					
	8:55	140' 5"	6"	5	112' 4	5-25	58.3	25			
	9:00	140' 11"	5"	10	112' 10"	5-30	58.3	25			
	9:10	141' 4"	3"	10	113' 3"	5-40					
	9:20	141' 7"	5"	10	113' 6"	5-50	59.2	25			
	9:30	141' 2"	4"	10	113' 1"	6-0	58.3				
	9:40	140' 10"	11' 0"	10	112' 9"	6-10		25			
	9:55	151' 10"	7' 4"	15	123' 9"	6-25	69.0	31			Slightly less cloudy
	10:00	159' 2"	1' 7"	5	131' 1"	6-30	70.3	30			
	10:05	160' 9"	1' 0"	5	132' 8"	6-35	70.3	30			
	10:10	161' 9"	4"	5	133' 8"	6-40	70.3	30			
	10:15	162' 1"	11"	15	134' 0"	6-45	70.3	30			
	10:30	163' 0"	4"	15	134' 11"	7-0					
	10:45	163' 4"	3"	15	135' 3"	7-15	69.0				
	11:00	163' 7"	3"	15	135' 6"	7-30	70.3	30	75	49¼	
	11:15	163' 9"	2"	15	135' 8"	7-45	69.0				
	11:30	164' 9"	1' 0"	15	136' 8"	8-0	70.3	29½	73	49¼	
	11:45	164' 8"	1"	15	136' 7"	8-15	70.3	29			Water very cloudy
	12:05	164' 8"	0"		136' 7"	8-35					28" stroke throughout

over

H.G.H.

	Time	Water Level Below Curb	Total Drawdown	Production in G.P.M.
..., 1937	2:45 pm	124' 0"	95' 11"	65.0
	3:15	122' 4"	94' 3"	61.8
	3:45	121' 11"	93' 10"	63.7
	[illegible]	122' 2	[illegible]	[illegible]

Albert City, Iowa,
August 11, 1937.

Memorandum

To: Mr. A. C. Tester

From: H.G. Hershey

Subject: Pumping test at Havelock.

Attached are the data sheets on the Havelock well. I remained there until late last night observing the pumping, but did not stay until the end of the test at 3:30 am. I returned there today to measure the static level and found that Mr. McCutcheon had visited the well, started pumping again at 9:00 am. and instructed his drillers to continue at the rate he set until this evening. He had also left a request for me to measure the pumping level. This was done and the results given to the drillers.

The water has never cleared in spite of 12 hours pumping yesterday and 7 hours today. I believe that most of the water is coming from the horizon 189'-205' feet and that the material there is a soft, dirty sandstone which will continue to make the water cloudy for some time. It appeared slightly clearer today and a fresh sample was taken

to replace the one taken last night.

Mr. Kester informed me that he made an error on the static level measurement of August 6 when the well was 330 feet deep. The true level that day, he says, was 34'2" and not ~~32'~~ 24'2" as reported earlier.

No attempt was made to show the source of the water on the water sample data sheet, as I believe that a more accurate determination can be made after a binocular study of the samples has been made and after the result of the analysis is known.

The drillers believe that the town will accept the well. They plan to remove the pumpline tomorrow and put in 5-inch perforated casing from 310'± to the bottom of the well.

All remaining samples from this well and from test well No. 3 at Albert City will be sent in tonight.

Albert City, Iowa,
August 11, 1937.

Memorandum

To: Mr. A. C. Tester

From: H.G. Hershey

Subject: New well at Havelock, Pocahontas County.

According to the drillers pumping was continued until 8:00 pm. last night at approximately 62.5 g.p.m. I visited the well this morning and made the following measurements on water level:

7:00 am.	Water level	27'2"	below curb	after	11 hrs.	rest.
8:00 am.	"	"	27'2"	"	"	"	12	"	"

The 5-inch i.j. casing arrived last night. There is 95 feet of it which is to be perforated throughout except for the bottom 5± feet and a sigment to take care of the shale between 348 and 355 feet. It will be placed with the bottom at 400 feet, that is, between 305 and 400 feet.

The drillers plan to leave Havelock early Saturday morning for Burt where a town well is to be drilled to an expected depth of from 500 to 700 feet.

Albert City, Iowa
August 12, 1937

MEMORANDUM

TO: Dr. A. C. Tester

FROM: H. G. Hershey

SUBJECT: New Town Well at Havelock, Pocahontas County.

At the Council meeting at Havelock tonight I was requested to read the log of the well and give a short discussion of where the water comes from. I was asked if, in my opinion, the well was properly finished and my answer was in the affirmative. They wanted to know where the pump should be set and I suggested at 150 feet if they did not expect to pump over 60 g.p.m. Mr. McCutcheon had suggested setting the bottom of the pump at 150 feet for 50 g.p.m., but I did not know of his recommendation at the time I made mine.

My opinion was asked if it would be necessary for them to advertise before contracting to buy a new pump. It is my understanding that it is not necessary for a town to advertise any expenditure under $5000 but I am not sure of this and informed the Council so.

Mr. DeVaul, who is a member of the Council, agreed with all of the above opinions.

The drillers had all of the 5-inch casing in the well, but had not lowered it. If it is set on the bottom as planned, the perforations will be from 315 to 345 feet and from 358 to 395 feet. The total measured length of 5-inch casing is 97 feet 9 inches.

The drillers reported that after the final pumping test the well was clean except for a plug of green-blue shale from 355-365 feet.

H. G. H.

December 10, 1927

Mr. Frank S. McCutcheon
Rogers Hotel
Des Moines, Iowa

Dear Mr. McCutcheon:

Enclosed are the screen analyses of the Dakota sandstone from the Havelock well. You will see in the sample 190-195 a very high percentage passed the screen with openings 0.0195 inches and was retained on the screen with openings 0.0097 inches. Those screens, as you know, are roughly equivalent to 10-slot and 20-slot screens, respectively. The material in the sample 195-200 feet was somewhat finer, since the larger percentage passed the screen with openings of 0.0097 inches and was almost entirely retained on the screen with 0.0049 inch openings. The latter is equivalent to a 5-slot well screen.

It should be remembered that the samples which we used were rather small and may not be exactly representative of the material in the well. For a screen test, I believe that the sample to be run should be represented by at least a pint and preferably a quart of the sand under consideration.

I am very much interested in the problem at Havelock and will be glad to do anything within my power to help solve it.

Very truly yours,

H. G. Hershey

HGH:A
Enc. 1