WELL TEST REPORT

11111 Some Lane, Fort Bragg, CA USA
August 18, 2020

Estabrook Services LLC

Richard Estabrook, Owner
restabro62@gmail.com • (707) 272-0160
estabrookservicesLLC.com

Water well test results for 11111 Some Lane, Fort Bragg, CA
August 18, 2020

Conclusions

1. The sustainable flow rate of this well is 14,400 gallons per day (10.0 gallons per minute). This is a rate that could be maintained indefinitely assuming there is no depletion of the aquifer. Note that this test was done in mid-August, about half-way through the dry season (May – October), when water levels tend to be somewhat higher than they are at the end of the dry season. Water depletion throughout the dry season could lower aquifer levels and reduce the sustainable flow rate. This rate also assumes these test results can be extrapolated to the entire assumed thickness of the aquifer as indicated in the well completion report.

2. Based on a total sustainable flow rate of 14,400 gallons per day, this well should be capable of supporting household water usage for 4 people, assuming an average usage of 91 gallons per day per person, in addition to some landscaping or gardening as shown in the following table[1]:

Type of plant	Maximum sustainable area (acres)
Trees, shrubs, vines, groundcover	3.4
Herbaceous perennials	3.4
Desert adapted plants	5.6
Annual flowers and bedding plants	2.1
General turfgrass, lawns	2.8
Home vegetables	1.7

There were no issues or concerns identified during the test.

[1] Water usage rates are based on: University of California, Center for Landscape & Urban Horticulture, https://ucanr.edu/sites/UrbanHort/Water_Use_of_Turfgrass_and_Landscape_Plant_Materials/SLIDE___Simplified_Irrigation_Demand_Estimation/ (see "Typical water usage rates for Mendocino County" on the last page of this report)

Well Test and Analysis

A well test is conducted by flowing the well at one more rates while monitoring the water level in the well. For this test, both flow rate and water level were automatically measured and recorded every 10 seconds. Raw data from the entire test are shown in Figure 1. The black dots represent drawdown and correspond to the left-hand Y axis. The blue dots represent flow rate and correspond to the blue scale on the right-hand Y-axis.

The methodology requires a constant flow rate for relatively long periods of time. In theory, the sustainable gallon-per-minute rating of the well's capacity will be the same regardless of what flow rate is used for the test. In practice, however, if the flow rate is too low there will not be sufficient resolution of the drawdown data to perform a meaningful analysis. If the flow rate is too high, the drawdown will reach the pump and pumping will stop before gathering enough data to perform an analysis.

For this well I used 7.4 gallons per minute as an initial test rate based on the flow rate indicated on the well completion report (see Attachment). This rate seemed to provide the desired results, so I maintained this rate for about 2½ hours (see "Low-rate test" in Figure 1). After that, I increased the flowrate to 9.9 gallons per minute for 1 ½ hours to obtain additional information about the well ("High-rate test" in Figure 1).

Figure 2 shows the drawdown data from the Low-rate test plotted against the log of time. As with Figure 1, the black dots indicate the raw data collected during the test. A straight line indicates periods of transient flow (a brief discussion of this given in the Appendix). The slope of the straight line is proportional to the transmissivity of the aquifer, the determination of which is the primary goal of the test. From Figure 2, the slope of the straight line is 2.892 feet/log-cycle, which yields a transmissivity of 90.2 ft^2/day.

The high-rate test data were not used in this report.

Based on the aquifer transmissivity, the sustainable flow rate of this well is 10.0 gallons per minute with a 79-foot drawdown. The 79-foot drawdown was determined by subtracting the static water level (10.9 feet) from the likely setting depth of the pump, which is 90 feet. The well completion report shows the potential aquifer ("blue clay w/gravel" and "sandstone w/clay") extending to the bottom of the wellbore.

SUMMARY OF WELL AND TEST PARAMETERS

General Information:

Customer name:
Date of test: 08/18/2020
Street address: 11111 Some Lane, Fort Bragg, CA

Well Information:

Lat./Long.: 39˚ 25’ 4.79” N, 123˚ 46’ 49.46” W
Well type: drilled
Casing size: 5 inches
Casing material: PVC
Static water level prior to test: 10.9’, determined with bubbler tubing
Depth: not measured
Depth reference: top of casing
Completion type: slotted casing
Pump installed: yes
Pump make/model: 1 hp submersible pump (based on pump controller)
Pump setting depth: unknown
Aquifer type: unconfined
Drill log obtained: yes
- Date drilled: 08/04/2004
- Borehole diameter: 8.75 inches
- Slotted interval: 30-100 feet
- Flow test information: 18 gallons per minute for 3 hours

Surface Equipment:

Pump control box: Yes (CentriPro, 1hp, 230 Volts)
Pressure tank: Yes (estimated 85 gallon)
Filtration: Yes (2 filter canisters)
Ultraviolet treatment: No
Ozone treatment: No
Holding tank: No
Booster pump: No
Other equipment: None

Test information:

Well shut-in time, date: unknown, but probably several days prior
Time shut in prior to test: Guessing 24 hours minimum
Water level method: bubbler set at 60 feet
Water flow rate method: magnetic flow meter
Logging rate: every 10 seconds
Discharge location: 50 feet from wellbore
Barometric pressure: 1010.0 hPa

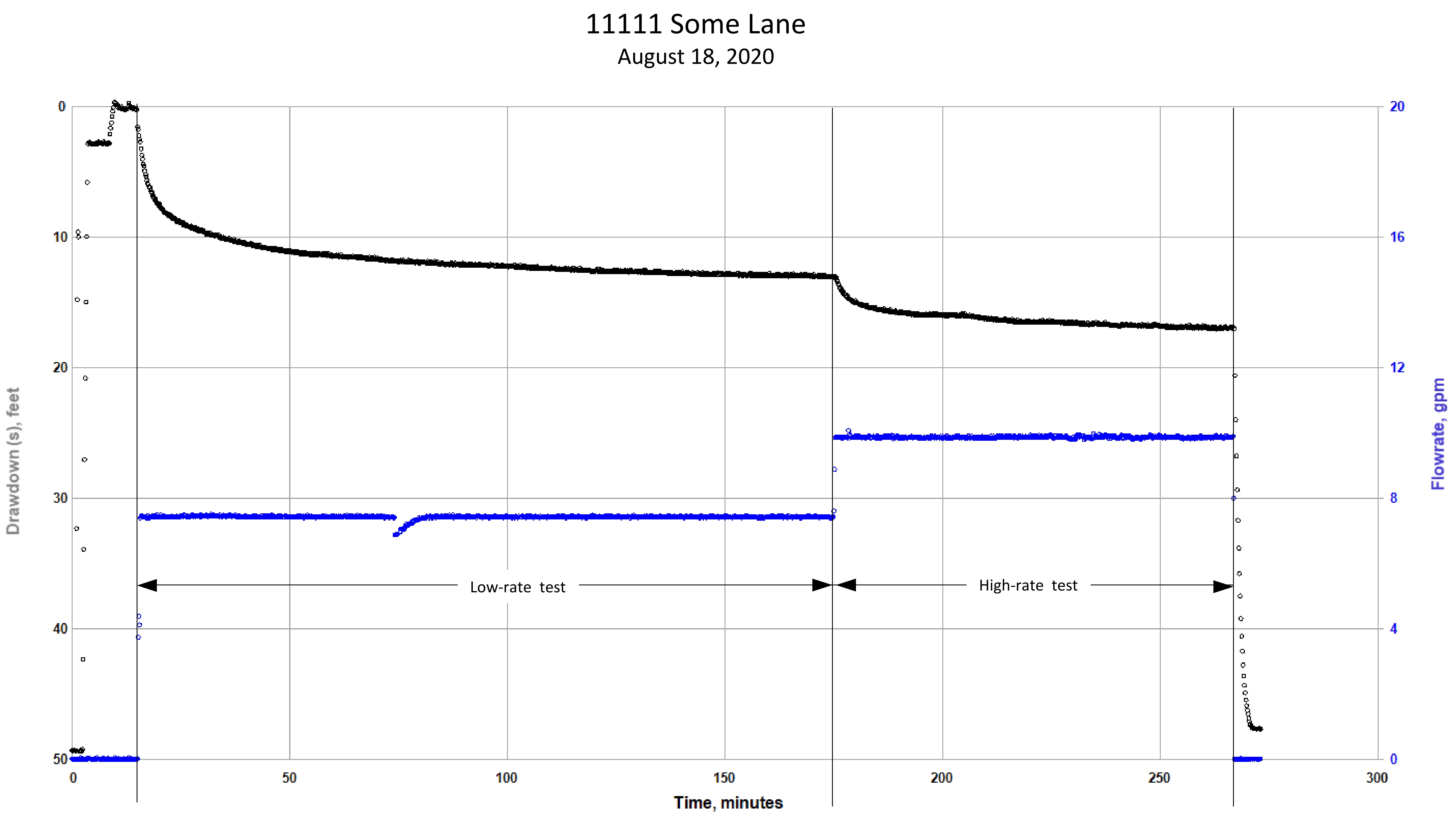

Figure 1, Well test summary

11111 Some Lane

August 18, 2020

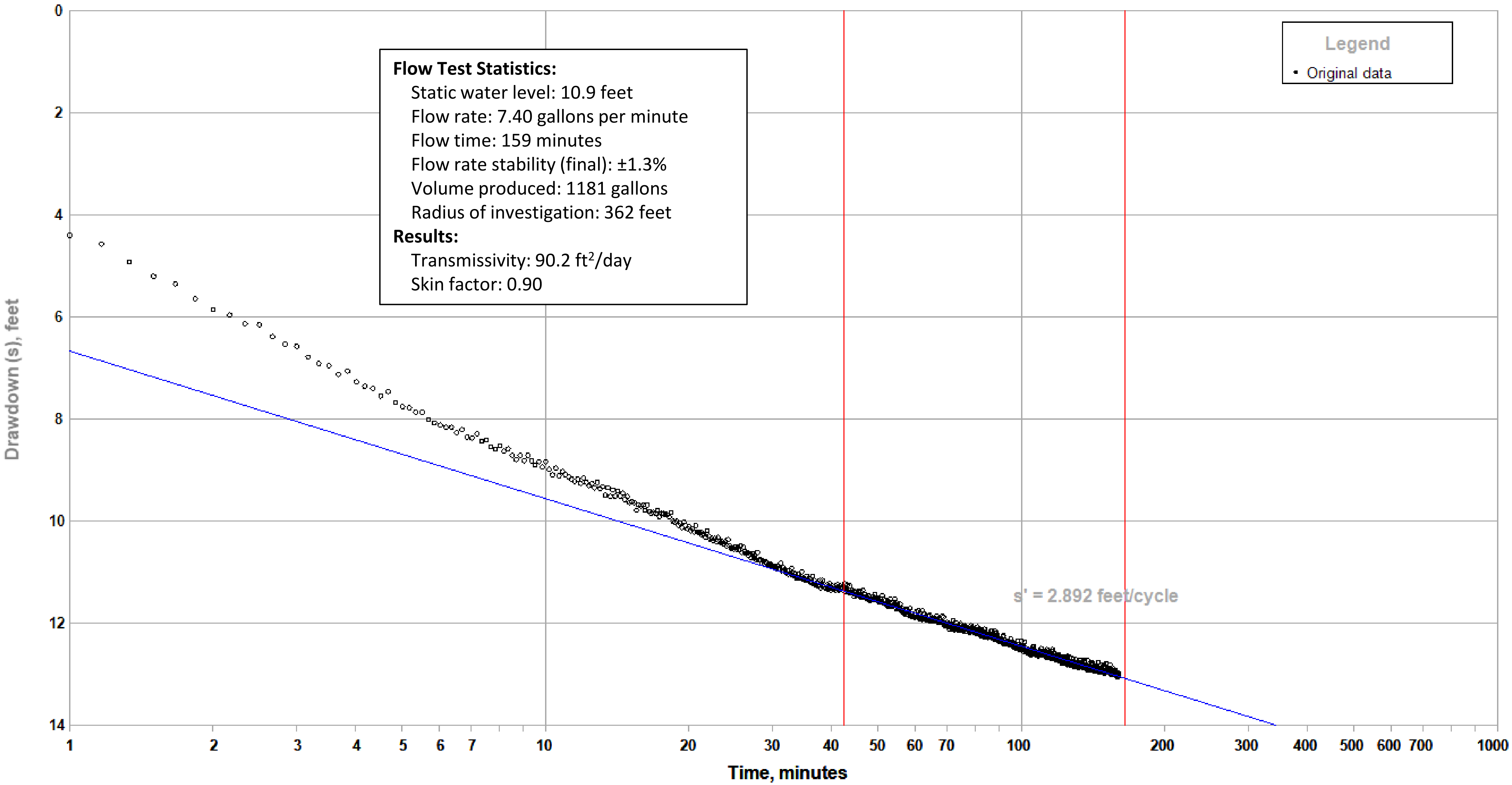

Figure 2, Analysis of drawdown test

STATE OF CALIFORNIA

WELL COMPLETION REPORT

No. 0965

DWR USE ONLY — DO NOT FILL IN

STATE WELL NO. STATION NO.

LATITUDE LONGITUDE

APN / TRS / OTHER

OWNER'S WELL No. 52

Date Work Began 8/2/04 Ended 8/3/04

Local Permit Agency Mendocino

Permit No. 166 Permit Date 3/2/2004

GEOLOGIC LOG

ORIENTATION Vertical Degree of Angle

DEPTH TO FIRST WATER ......(ft.) BELOW SURFACE

DEPTH FROM SURFACE Ft.	Ft.	DESCRIPTION
0	2	top soil
2	28	brown sand
28	32	blue clay
32	90	blue clay w/ gravel
90	100	sandstone w/ clay

TOTAL DEPTH OF BORING 100 (Feet)

TOTAL DEPTH OF COMPLETED WELL 100 (Feet)

WELL OWNER

Fort Bragg CA 95437

WELL LOCATION

Address 11111 Some Lane

City Ft. Bragg County Mendocino

Apn Book 019 Page Parcel

or Township Range Section 1/4 1/4

or Latitude NORTH Longitude WEST

Deg. Min. Sec. Deg. Min. Sec.

LOCATION SKETCH

RECEIVED

AUG 1 2 2004

MENDO. ENV. HEALTH-FB

ACTIVITY NEW WELL PLANNED USE(S) Domestic Water

DRILLING METHOD ROTARY AIR FLUID Bentonite

DEPTH OF STATIC WATER LEVEL 20 (Ft.) & DATE MEASURED Aug 3, 2004

ESTIMATED YIELD * 18 (G.P.M.) & TEST TYPE AIR

TEST LENGTH. 3 (Hrs.) TOTAL DRAWDOWN 95 (FT.)

*May not be representative of a well's long-term yield.

CASING

DEPTH FROM SURFACE Ft.	To Ft.	BORE-HOLE DIA.	TYPE	Material / Grade	Dia.	Gauge	Slot size
0	30	10 5/8	Blank	F480 PVC	5	160	
30	100	8.75	Perfs	F480 PVC	5	200	Factory

ANNULAR MATERIAL

DEPTH FROM SURFACE Ft.	To Ft.	Seal Material	Filter Pack (Type / Size)	
0	20	Bentonite		
20	100		Well Pack Sand	

Attachments

no Geologic Log

no Well Construction Diagram

no Geophysical Logs

no Soil Water Chemical Analyses

no Other

CERTIFICATION STATEMENT

I, the undersigned, certify that this report is complete and accurate to the best of my knowledge and belief.

NAME Fisch Bros. Drilling, Inc.

(PERSON, FIRM, OR CORPORATION) (TYPED OR PRINTED)

5001 Gravenstein Hwy No. Sebastopol CA 95472

Signed Dale Theiss Ashley Savidd 8-4-04 399226

WELL DRILLER / AUTHORIZED REPRESENTATIVE DATE SIGNED C-57 LICENSE NUMBER

APPENDIX

Explanation of Terms and Test Results

Bottom line, what do I need to know?

The most important information from the test results is the maximum sustainable flow rate which is the average continuous flow the well can sustain without exceeding the drawdown listed. You should use this rate as the basis for continuous water demands such as daily household use, gardening, landscaping, and agricultural use. Higher rates are achievable for shorter periods of time. Aquifer depletion will reduce the amount of achievable drawdown which will reduce the maximum sustainable flow rate.

Explanation of terms used in this report

Drawdown is the change in water level resulting from pumping water out of the well. The amount of drawdown depends on the pumping rate and the amount of time the well is pumped (see discussion under “Summary of Process and Analysis Method”). Drawdown is measured from the original, or “static” water level prior to turning the pump on (see Figure A.1). For example, if you measured a static water level of 20 feet from the top of the casing before turning the pump on and then measured a water level of 50 feet from the top of the casing after the pump had been running for some length of time, the drawdown at that time would be 30 feet (50 feet – 20 feet). The flow rate calculations in this report are based on the maximum drawdown achievable at the time the test was conducted. Aquifer depletion from well production or leakage into springs and creeks can lower the static water level, reduce the maximum achievable drawdown, and reduce the flow rates shown in the test results.

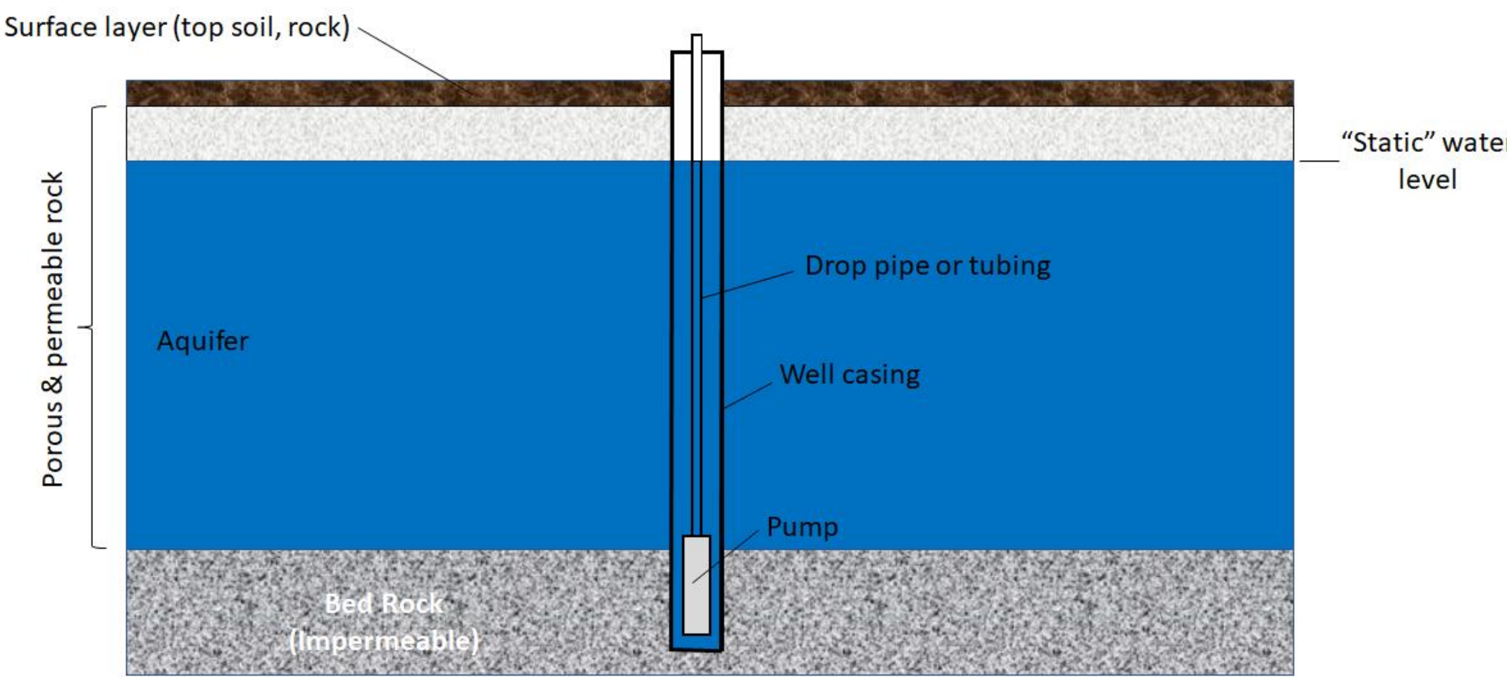

Figure A.1– Static water level after leaving the pump off for a long time

Transmissivity is hydrologic measure of how easily water can flow through the aquifer. The higher the transmissivity, the higher the potential flow rate from the well. Transmissivity is the property on which all subsequent calculations are based.

Skin is an area of reduced transmissivity surrounding the wellbore. It is a condition of the well that inhibits the flow rate from the aquifer. Causes of skin are typically plugged slots or perforations in the casing or from a well that only produces from a fraction of the aquifer's thickness. Skin can also be caused by high flow rates into the well bore. An empirical skin factor is determined by matching the calculated drawdown with the actual drawdown data. If sufficient information from the drill log was obtained, the report will also include a theoretical skin factor based on limited aquifer penetration. A skin factor of zero means there are no areas of reduced transmissivity surrounding the well bore. A skin factor above 3 can indicate a potential for significant reductions in transmissivity around the wellbore. A negative skin factor indicates an area of enhanced permeability around between the casing and the aquifer.

Average flow rate is the average pumping rate from the well during the drawdown test.

Flow rate stability is how much the pumping rate varied over the time it flowed. This statistic is valuable because the drawdown test is very sensitive to changes in flow rate. A highly varying flow rate can render the analysis of the drawdown data impossible or increase the uncertainty of the analysis. A stability of less than ±5% is desirable.

Flowing time is the time the pump was on for the drawdown test.

Total volume produced is the amount of water produced during the flowing portion of the test.

Radius of investigation is the distance from the wellbore to the outer limit of the cone of depression resulting from the flow test. The well test is only valid for this portion of the aquifer. The radius of investigation increases as flowing time increases (see discussion under "Summary of Process and Analysis Method").

Summary of Process and Analysis Method

Overview

Pumping water out of a well results in a "cone of depression" within the aquifer (see Figures A.2 and A.3). Figure A.2 shows a cone of depression a short time after the pump is turned on and Figure A.3 shows a cone of depression a long time after the pump is turned on. As long as pumping continues at a constant rate, the cone of depression will expand until it reaches some type of boundary. The period of flow resulting in an unfettered expansion of the cone of depression is referred to as "transient" flow. The shape and extent of the cone of depression depends on pumping rate, pumping time, and the transmissivity of the aquifer. By holding the flow rate steady and monitoring the water level in the well, the average transmissivity of the aquifer within the cone of depression is determined.

Process

This test process usually involves two distinct phases: drawdown and recovery. *Drawdown* is achieved by pumping the well at a constant rate for some period of time. During this time, water level and flow rate are measured and recorded regularly (typically every 10 seconds). Water level is detected by a "bubbler" pipe or downhole pressure transducer run into the well bore, or a sonic device mounted at the top of the well. Flow rate is measured by a magnetic flow meter. The required flowing time is partially dictated by the amount of wellbore storage[2], typically determined within the first few minutes of pumping.

Recovery is initiated after the pump is shut off and the water level begins to rise. Water level continues to be measured and recorded every 10 seconds during this portion of the test.

Analysis Method

The test data are analyzed using standard hydrologic procedures found in the literature[3] and supplemented by standard oil and gas methodologies[4]. When the water level data from the drawdown phase of the test are plotted against the log of time, a straight line indicates periods of transient flow. The slope of this line is proportional to the average transmissivity of the aquifer within the radius of investigation. The higher the slope, the lower the transmissivity.

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[2] Wellbore storage is a phenomenon where the water level changes measured during early stages of both the drawdown and recovery tests are primarily due to water being removed from or added to the wellbore, rather than the aquifer. Data collected during periods of wellbore storage are not used for aquifer analysis.

[3] "Aquifer Test Data: Analysis and Evaluation", Michael Kasenow, PhD, Water Resources Publications, LLC (ISBN 13: 978-1-887201-41-4, 10: 1-887201-41-6), 2006

[4] "Pressure Transient Testing: Design and Analysis", James T. Smith, 1984

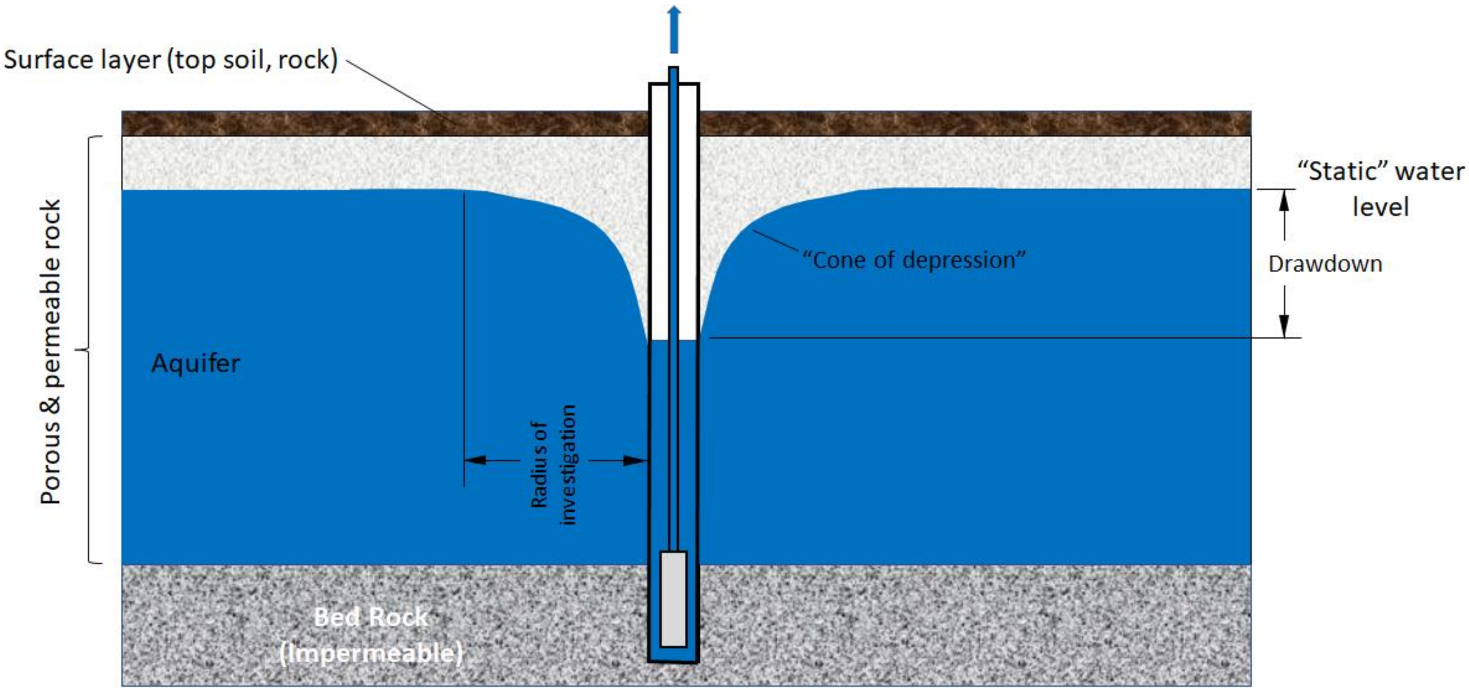

Figure A.2 – Cone of depression a short time after turning the pump on

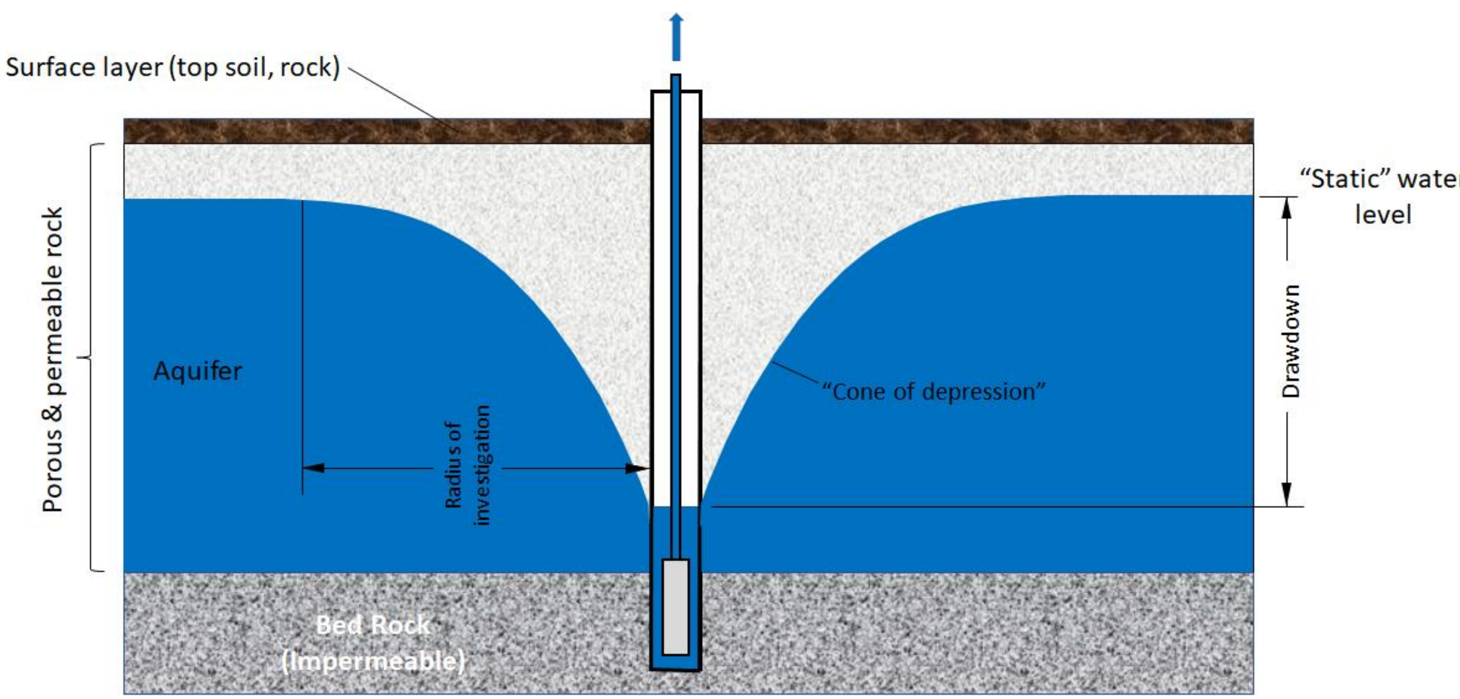

Figure A.3 – Cone of depression a long time after turning the pump on

Typical Water Usage Rates for Mendocino County

Peak Household Use (North Coast): 91 gallons per day per person[5]

Landscaping[6]:

Plant type	Peak month (July) water usage, gallons per day per 100 square feet		
	Coastal	Mountains	Inland Valleys
Trees, shrubs, vines, groundcover	4.7	5.9	7.5
Herbaceous perennials	4.7	5.9	7.5
Desert adapted plants	2.8	3.6	4.5
Annual flowers and bedding plants	7.5	9.5	12.0
General turfgrass, lawns	5.6	7.1	9.0
Home vegetables	9.4	11.8	15.0
	Peak month (July) water usage, gallons per tree		
Isolated trees	Coastal	Mountains	Inland Valleys
Home fruit, deciduous (10' canopy)	5.8	7.4	9.4
Home fruit, deciduous (20' canopy)	23.5	29.8	37.6
Home fruit, evergreen (10' canopy)	7.3	9.3	11.7
Home fruit, evergreen (20' canopy)	29.4	37.2	47.0
Non-fruit trees (10' canopy)	3.7	4.7	5.9
Non-fruit trees (20' canopy)	14.7	18.6	23.5

[5] California Water Boards, State Water Quality Control Board, https://www.waterboards.ca.gov/water_issues/programs/conservation_portal/conservation_reporting.html

[6] University of California, Center for Landscape & Urban Horticulture, https://ucanr.edu/sites/UrbanHort/Water_Use_of_Turfgrass_and_Landscape_Plant_Materials/SLIDE___Simplified_Irrigation_Demand_Estimation/