Harney Basin Groundwater Study

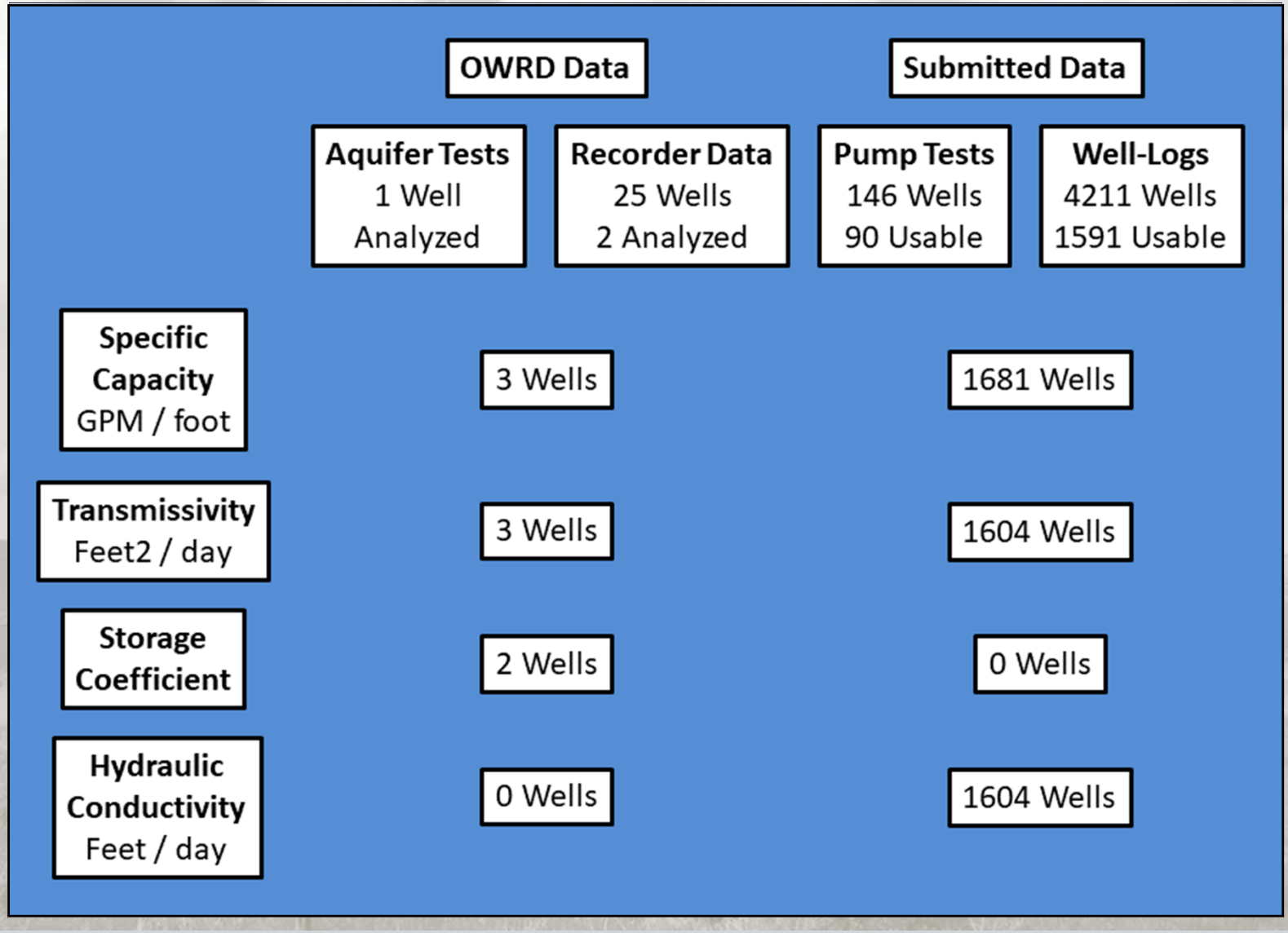
Aquifer Hydraulic Properties

Harney GW SAC Meeting
Burns, Oregon
17 October 2019

OREGON WATER RESOURCES DEPARTMENT

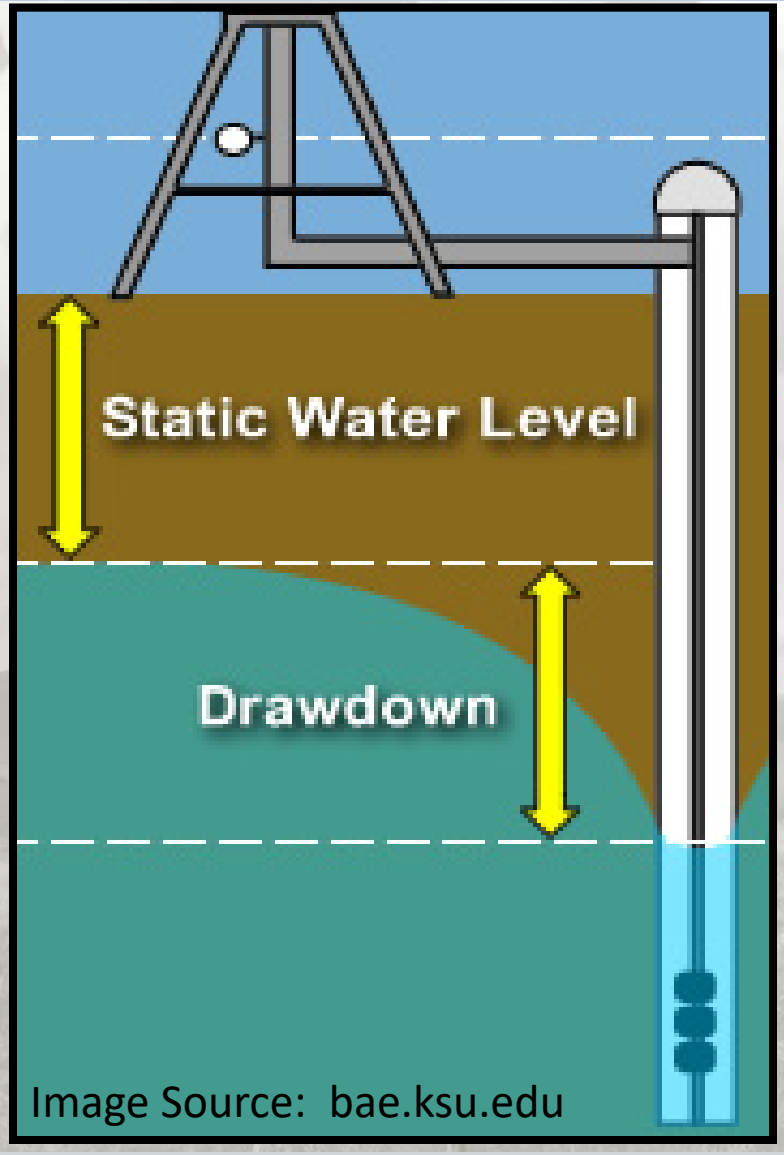
Jerry Grondin & Darrick Boschmann
OWRD Hydrogeologist

Aquifer Hydraulic Properties



Aquifer Property Data Sources

Aquifer Hydraulic Properties



Specific Capacity
gpm / ft. drawdown

A well's **specific capacity** equals the discharge rate (in gpm) divided by the water level drawdown (in feet).

For example a well with a pumping rate of 200 gpm with a 10 foot drawdown has a **specific capacity** of 20 gpm/ft of drawdown.

Aquifer Hydraulic Properties

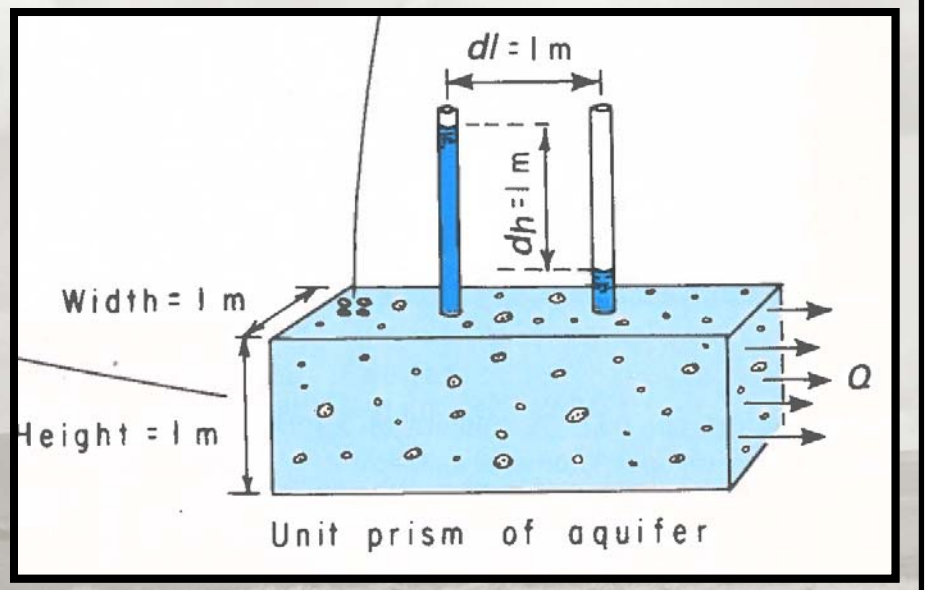


Image Source: USGS WSP 2220

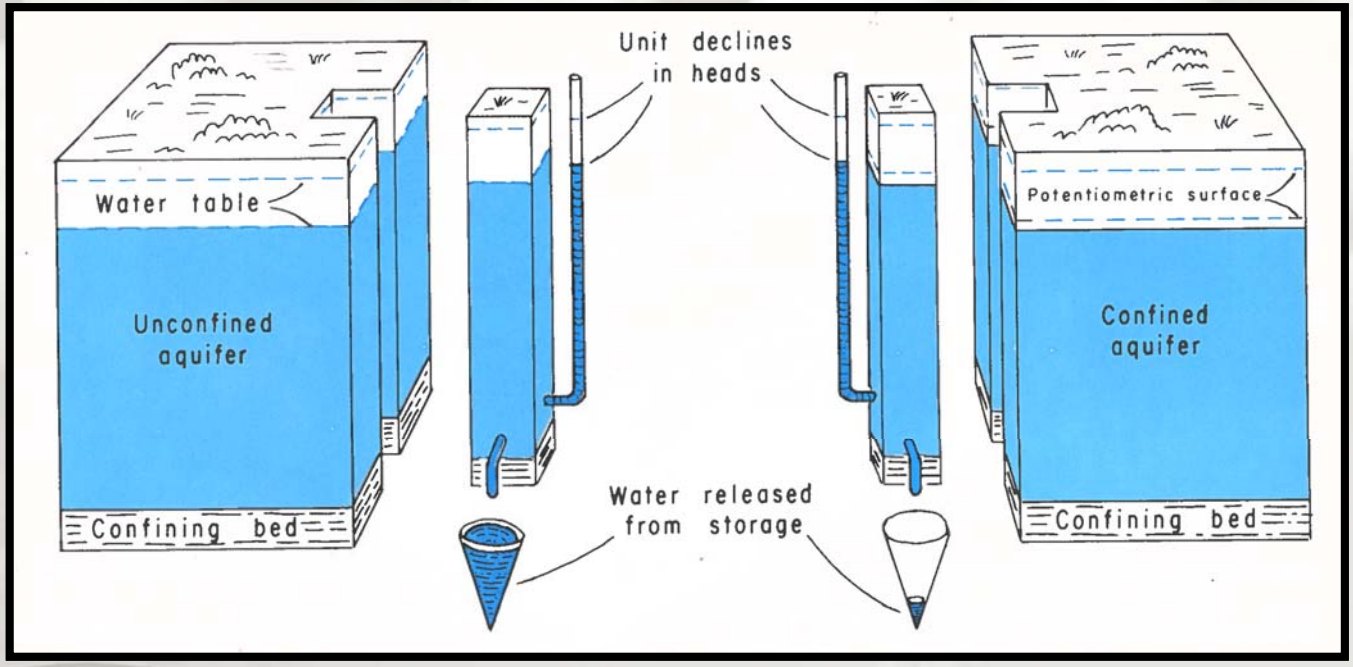
Transmissivity
Ft2 / day

General: The degree to which a medium allows something to pass through it.

Hydrogeology: The rate at which a volume water passes through a unit width of the aquifer under a unit hydraulic gradient.

$$Q = T\,w\,[dh / dl]$$

Aquifer Hydraulic Properties



$$S = V / [(A)(dh)]$$

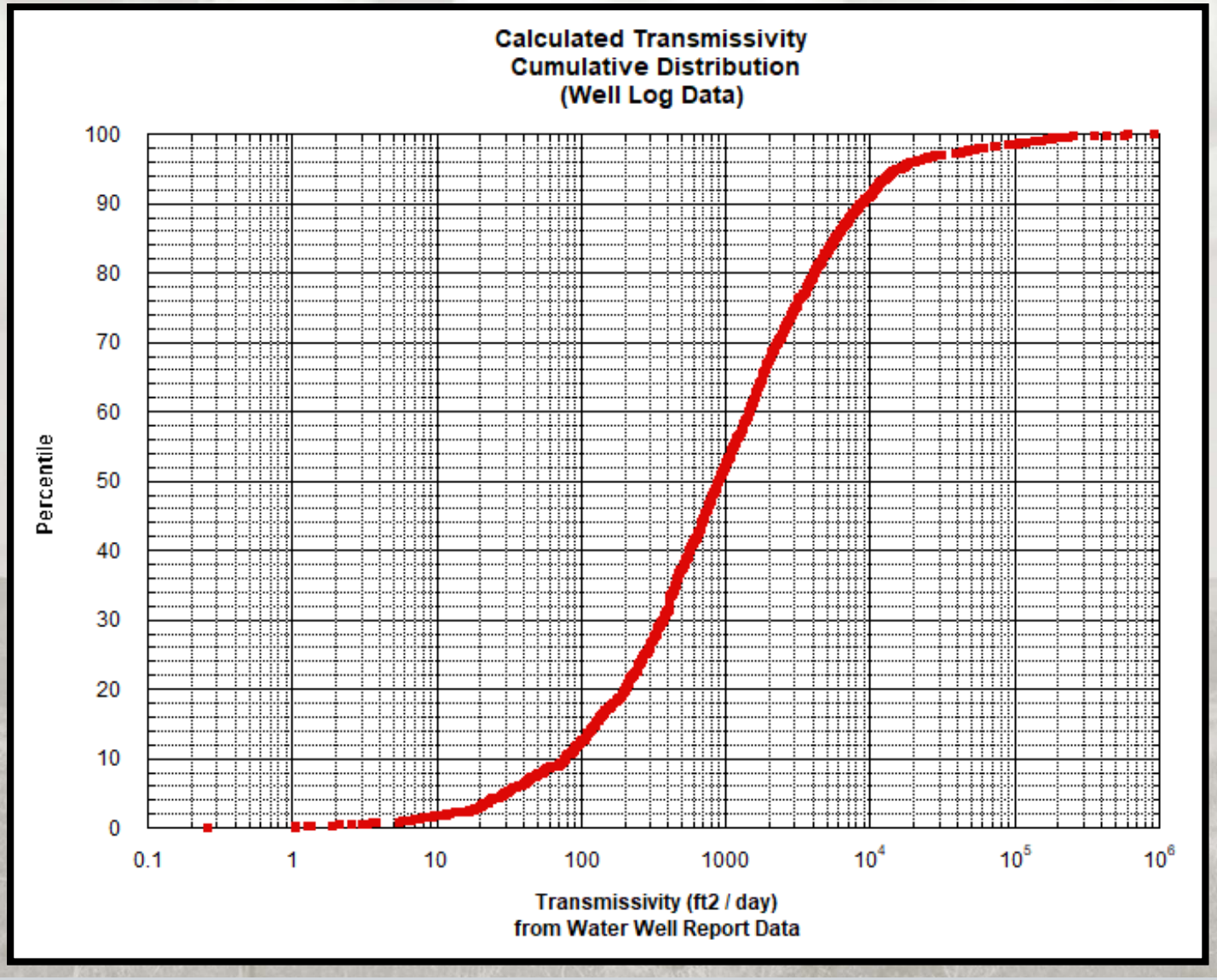
Image Source:
USGS WSP 2220

Storage Coefficient (or Storativity)

General: The ability of a medium to store water. An indicator of how a medium stores and releases water (dominantly gravity drainage or dominantly water pressure &/or aquifer change).

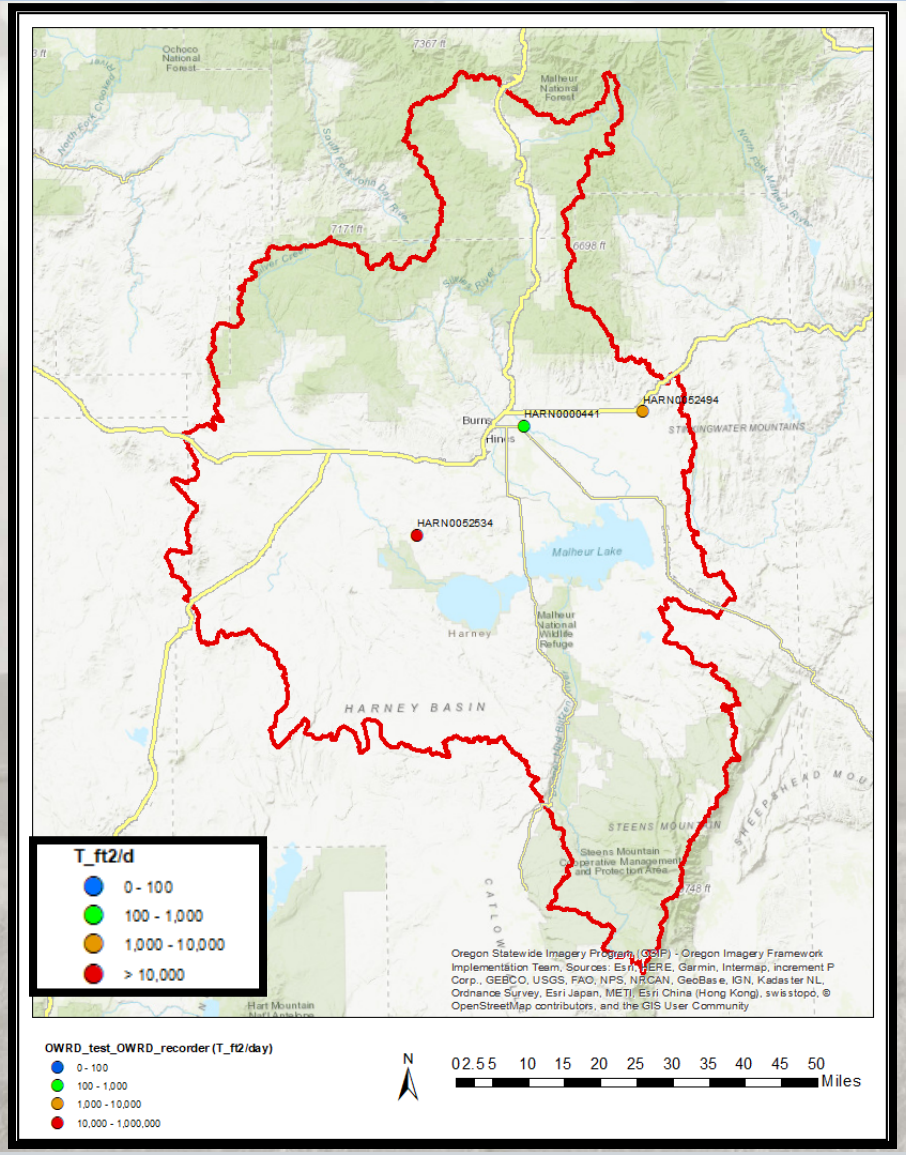
Hydrogeology: The volume of water an aquifer releases or takes in per unit aquifer surface area per unit change in head.

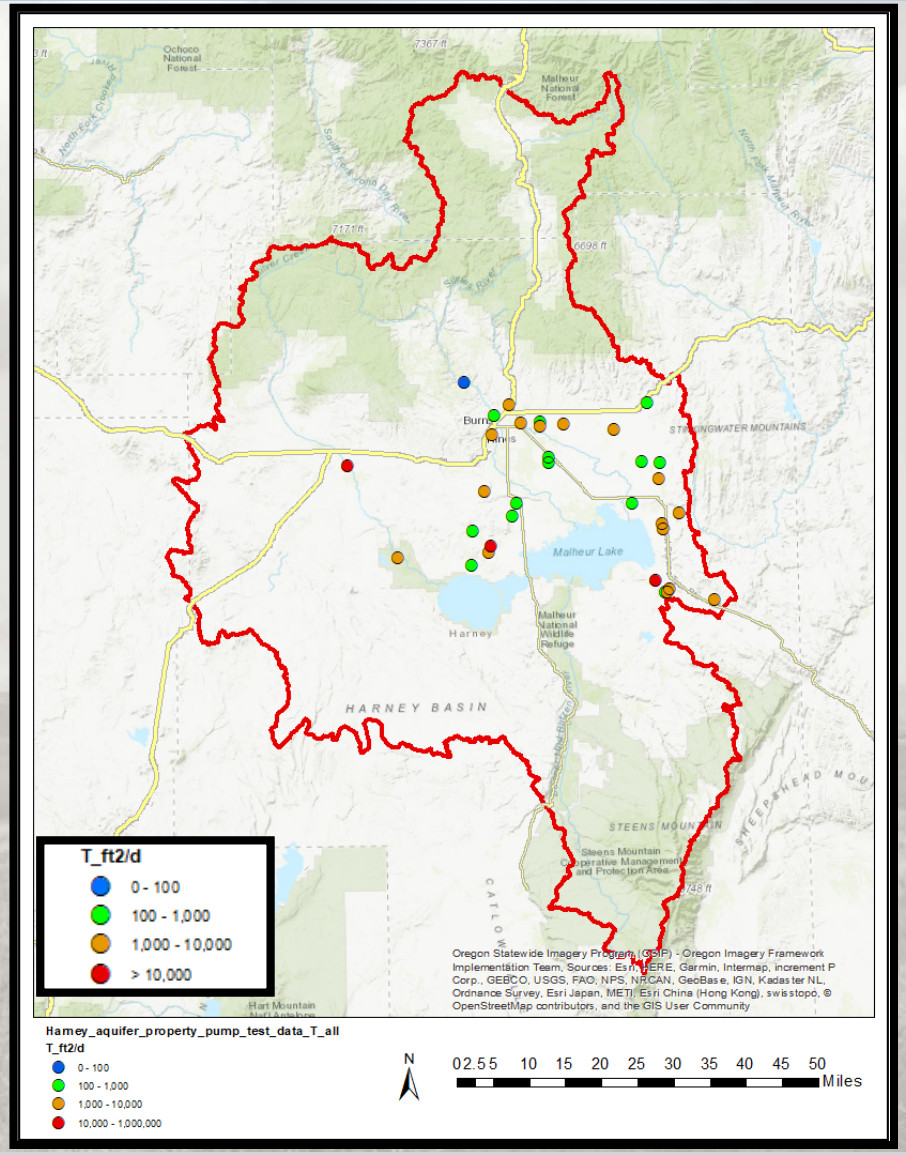
Aquifer Hydraulic Properties



Calculated Transmissivity Value Range (1525 Well-Log Data)

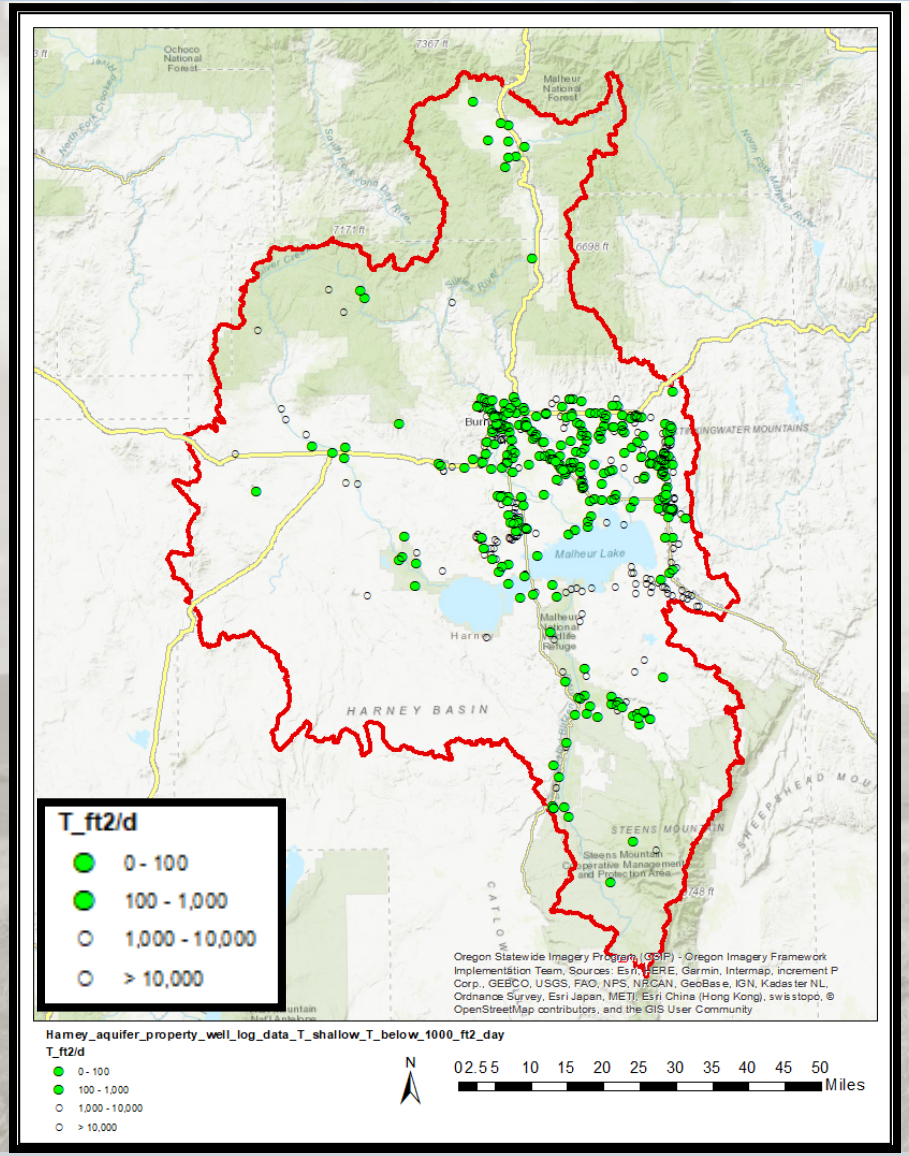
Aquifer Hydraulic Properties

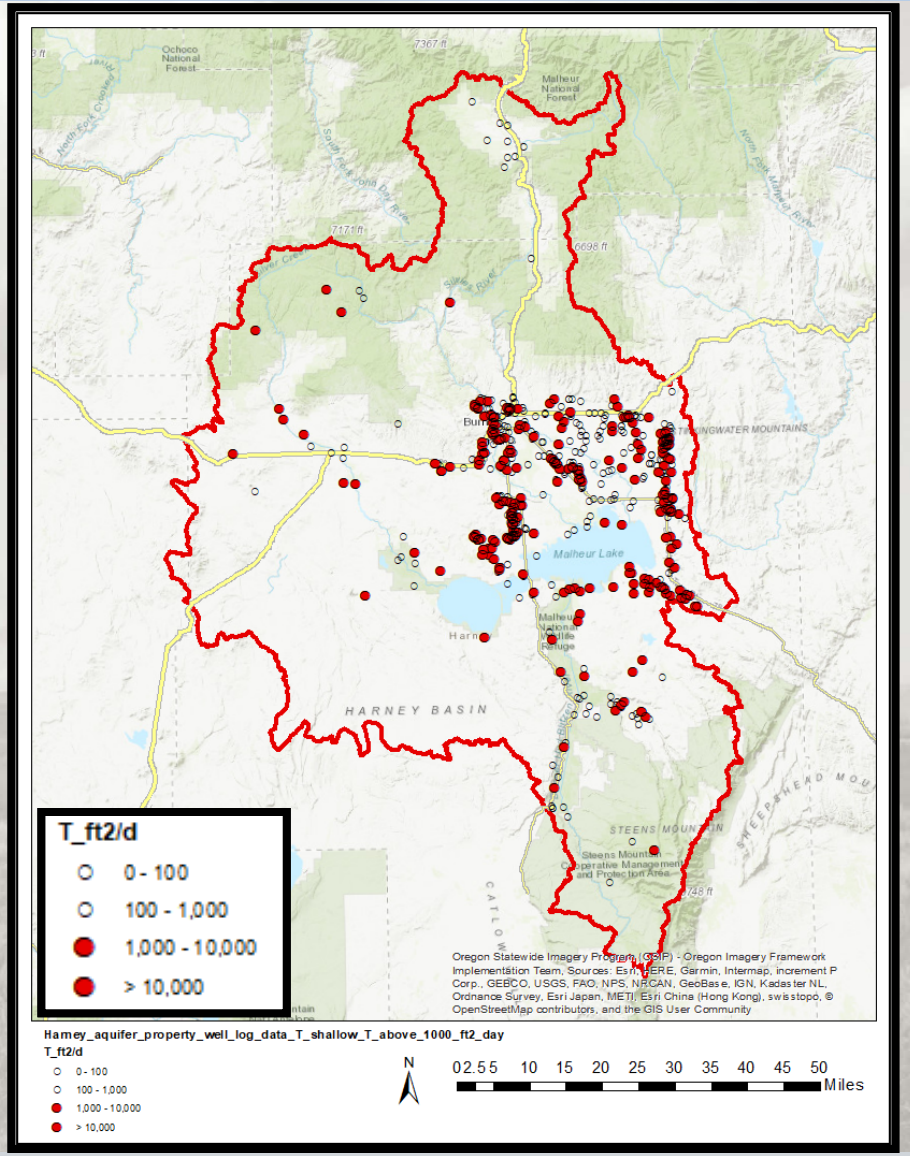




Calculated Transmissivity Distribution (Data: 3 OWRD & 33 Pump Test)

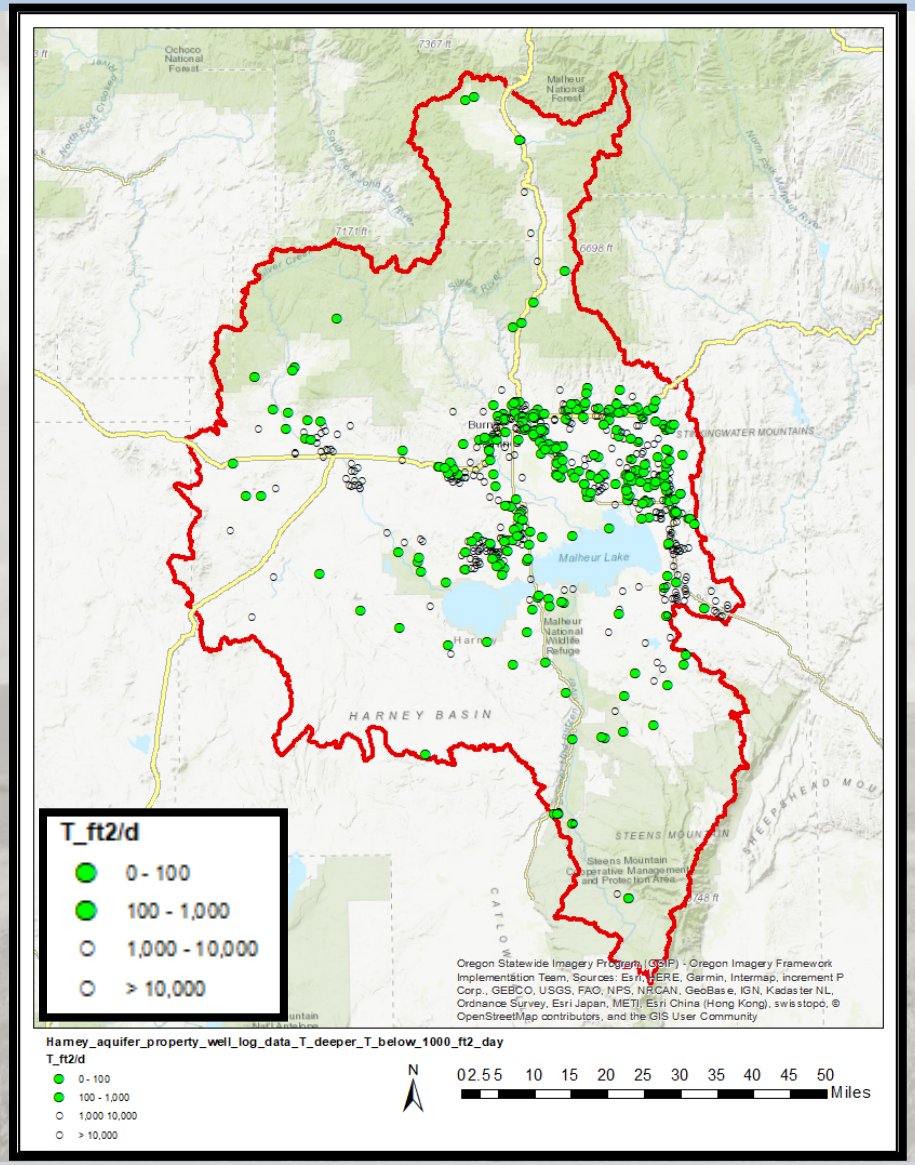
Aquifer Hydraulic Properties

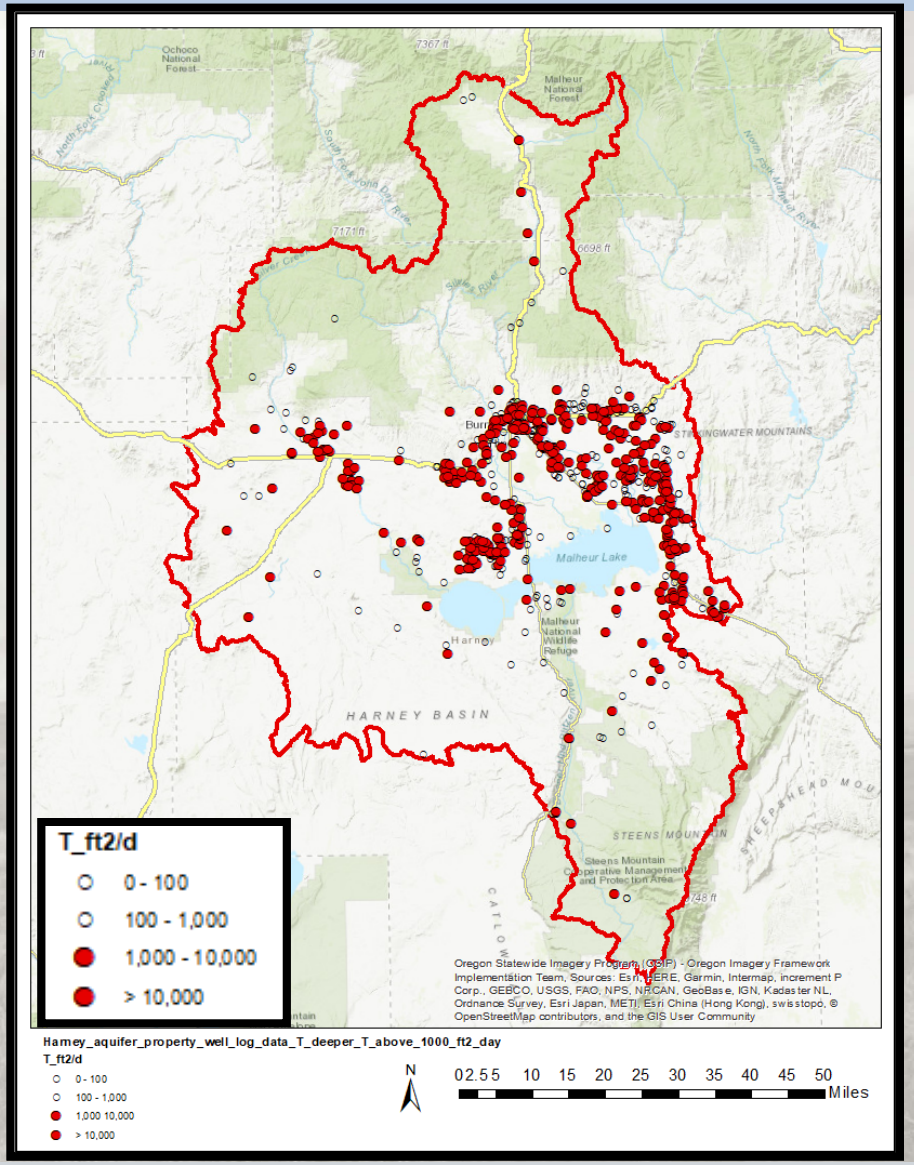




Calculated Transmissivity Aerial Distribution: 555 Shallow Wells

Aquifer Hydraulic Properties

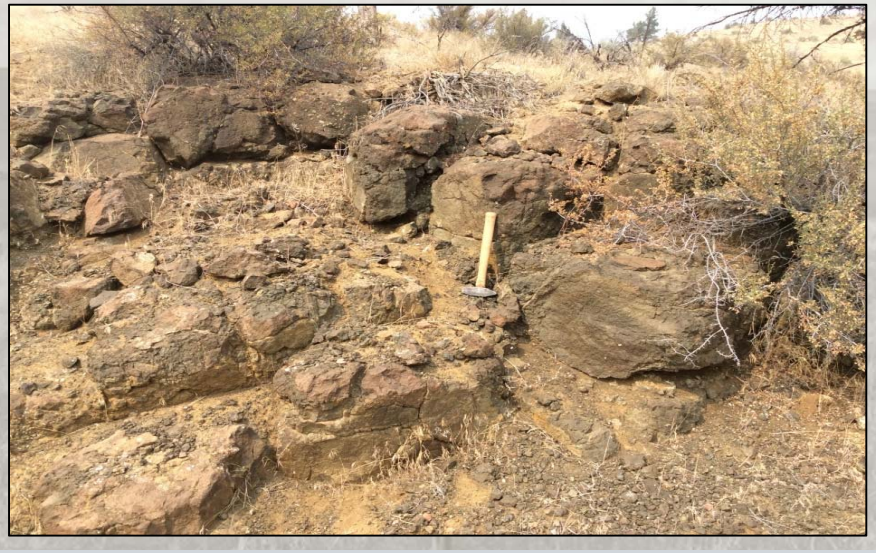




Calculated Transmissivity Aerial Distribution: 708 Deeper Wells

Aquifer Hydraulic Properties

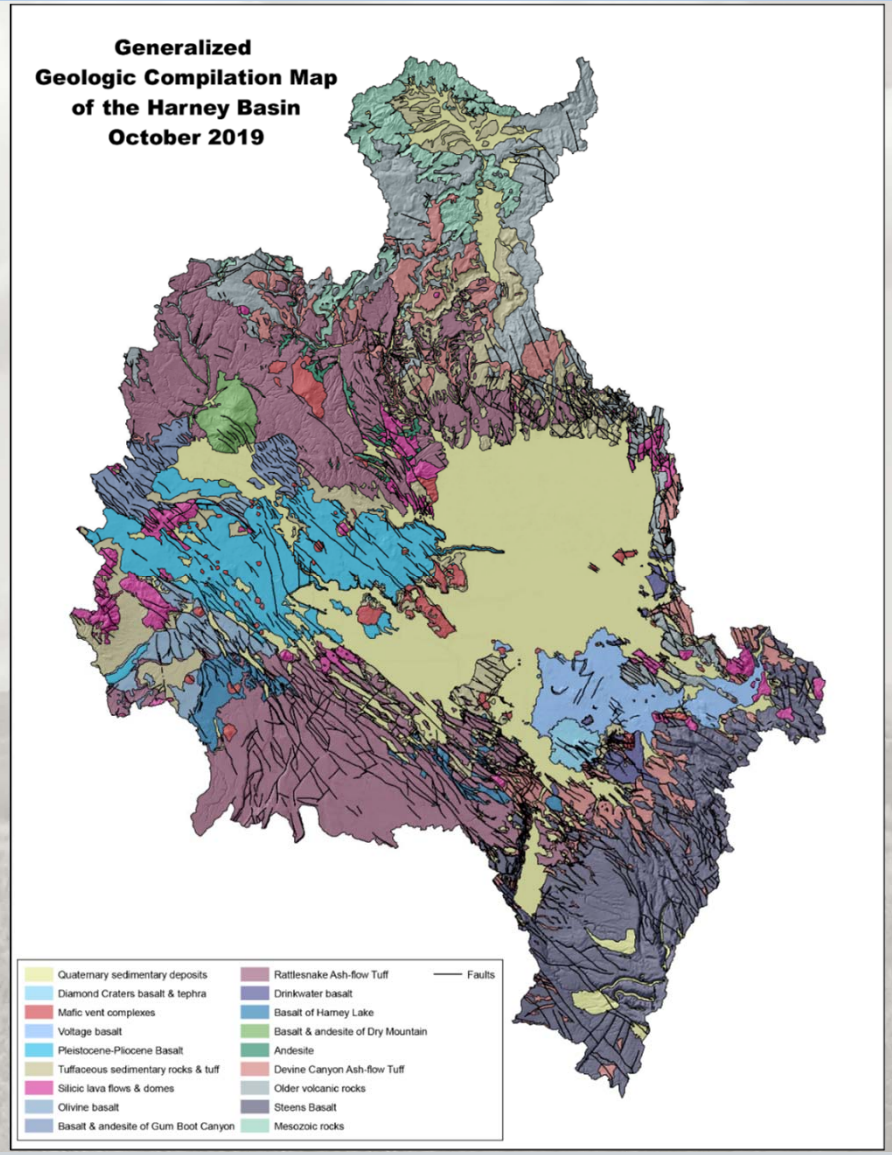
- Aquifers are made up of rocks & sediments
- Groundwater recharge, flow, and discharge are fundamentally controlled by the geology
- Porosity, permeability, and storage potential vary widely between different rock types
- A wide variety of rock types exist in the Harney Basin
- Understanding the distribution of rock types is crucial for understanding the GW flow system



Why Do We Care About Rocks? A Quick Reminder

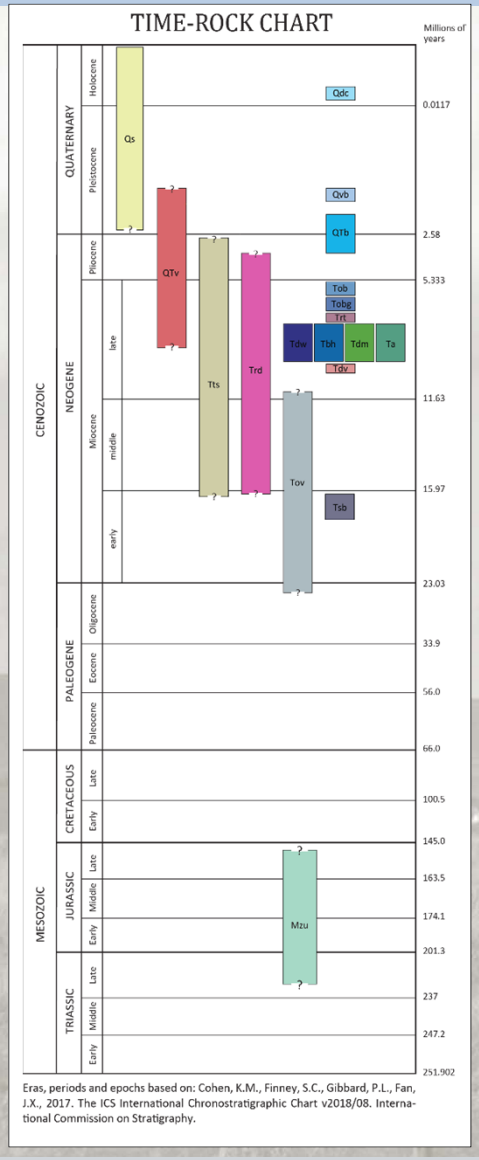
Aquifer Hydraulic Properties

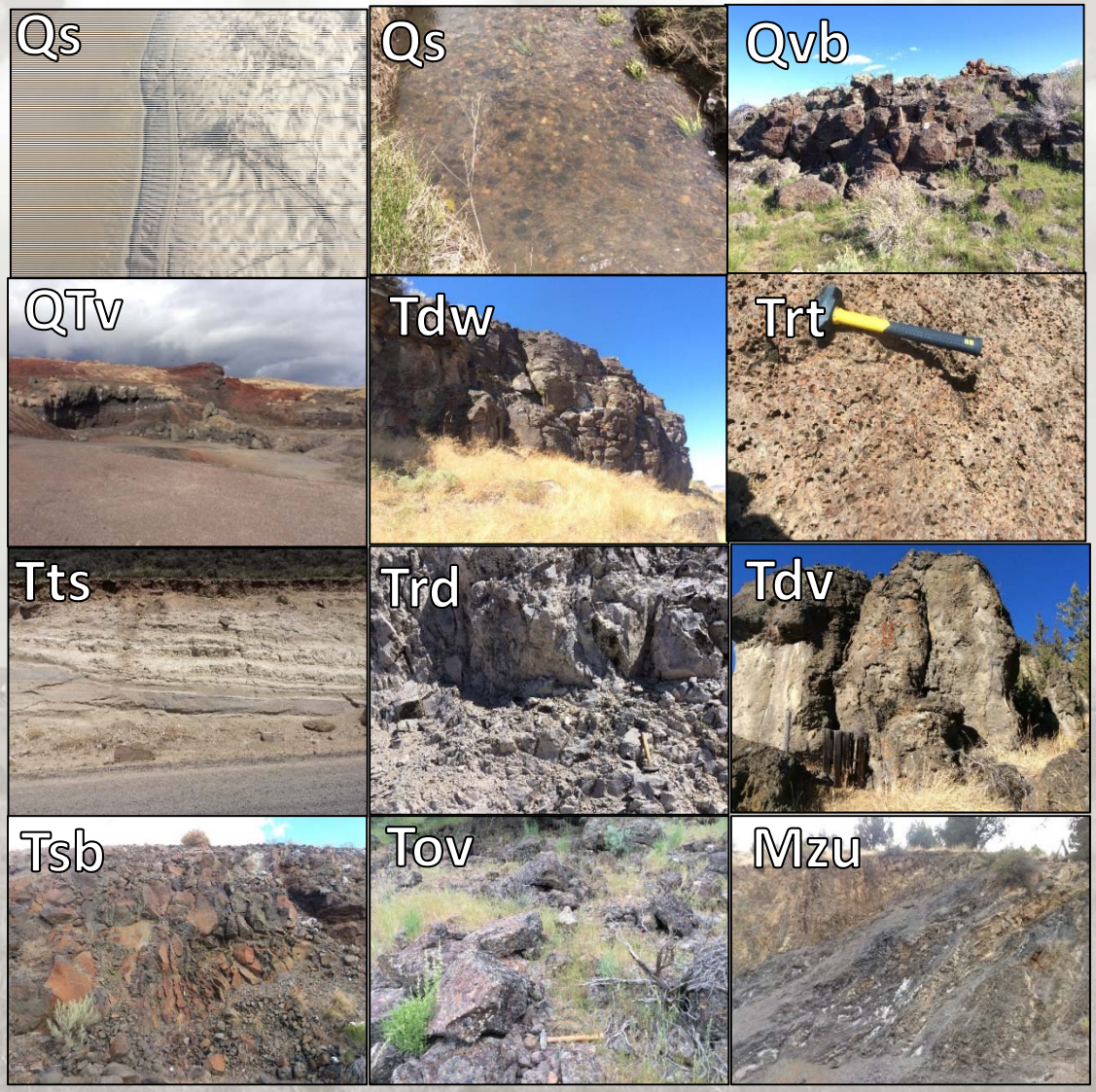
Qs	Quaternary sedimentary deposits
Qdc	Diamond Craters basalt & tephra
QTv	Mafic vent complexes
Qvb	Voltage basalt
QTb	Pleistocene-Pliocene Basalt
Tts	Tuffaceous sedimentary rocks & tuff
Trd	Silicic lava flows & domes
Tob	Olivine basalt
Tobg	Basalt & andesite of Gum Boot Canyon
Trt	Rattlesnake Ash-flow Tuff
Tdw	Drinkwater basalt
Tbh	Basalt of Harney Lake
Tdm	Basalt & andesite of Dry Mountain
Ta	Andesite
Tdv	Devine Canyon Ash-flow Tuff
Tov	Older volcanic rocks
Tsb	Steens Basalt
Mzu	Mesozoic rocks



Stratigraphy Refresher

Aquifer Hydraulic Properties





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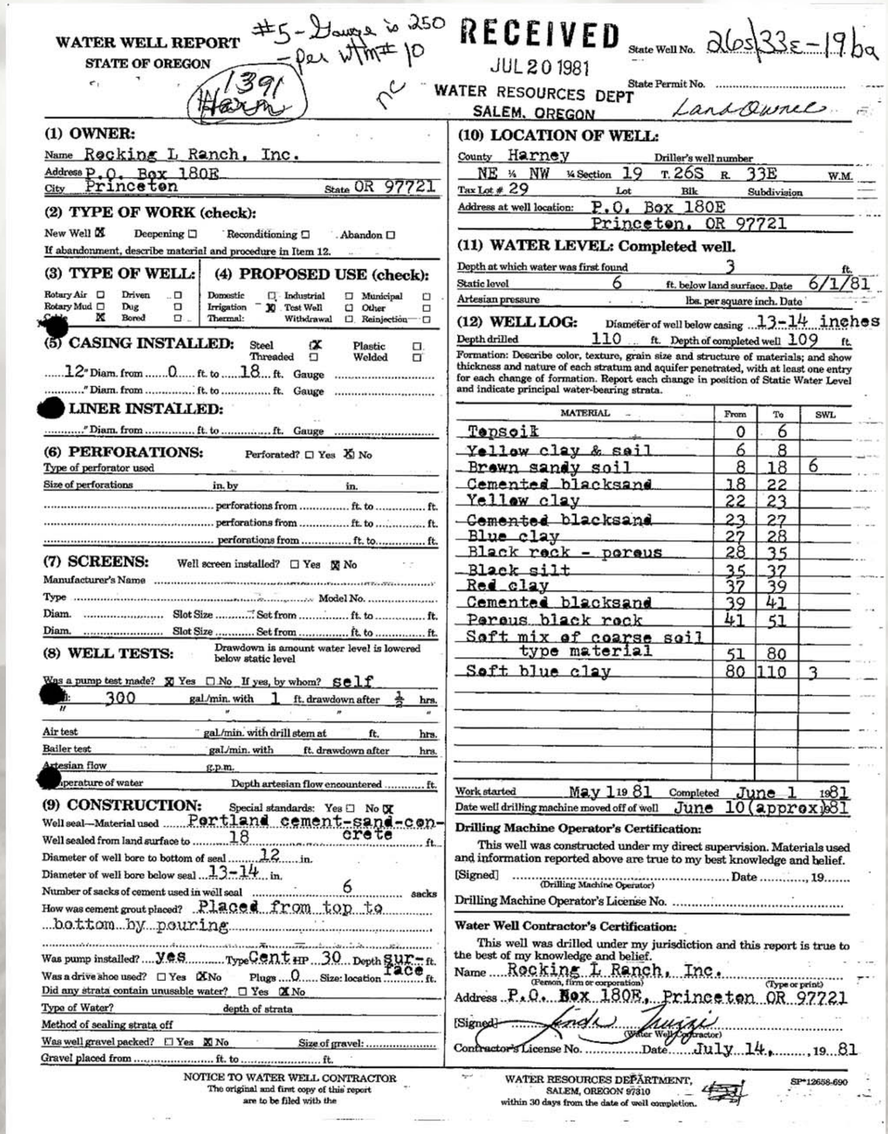


WATER WELL REPORT
STATE OF OREGON

#5 - Gauge is 250 - per wtm# 10

1391 Harn

RECEIVED
JUL 20 1981
WATER RESOURCES DEPT
SALEM, OREGON

State Well No. 26S/33E-19ba
State Permit No.
Land Owner

(1) OWNER:
Name Rocking L Ranch, Inc.
Address P.O. Box 180R
City Princeton State OR 97721

(2) TYPE OF WORK (check):
New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL: Rotary Air ☐ Rotary Mud ☐ Cable ☒ Driven ☐ Dug ☐ Bored ☐

(4) PROPOSED USE (check): Domestic ☐ Irrigation ☒ Thermal: Industrial ☐ Test Well ☐ Withdrawal ☐ Municipal ☐ Other ☐ Reinjection ☐

(5) CASING INSTALLED: Steel ☒ Plastic ☐ Threaded ☐ Welded ☐
12" Diam. from 0 ft. to 18 ft. Gauge

LINER INSTALLED:

(6) PERFORATIONS: Perforated? ☐ Yes ☒ No

(7) SCREENS: Well screen installed? ☐ Yes ☒ No

(8) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? self
Yield: 300 gal./min. with 1 ft. drawdown after ½ hrs.

(9) CONSTRUCTION: Special standards: Yes ☐ No ☒
Well seal—Material used Portland cement-sand-concrete
Well sealed from land surface to 18 ft.
Diameter of well bore to bottom of seal 12 in.
Diameter of well bore below seal 13-14 in.
Number of sacks of cement used in well seal 6 sacks
How was cement grout placed? Placed from top to bottom by pouring
Was pump installed? yes Type Cent HP 30 Depth surface ft.
Was a drive shoe used? ☐ Yes ☒ No Plugs 0 Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Was well gravel packed? ☐ Yes ☒ No

(10) LOCATION OF WELL:
County Harney
NE ¼ NW ¼ Section 19 T. 26S R. 33E W.M.
Tax Lot # 29
Address at well location: P.O. Box 180E Princeton, OR 97721

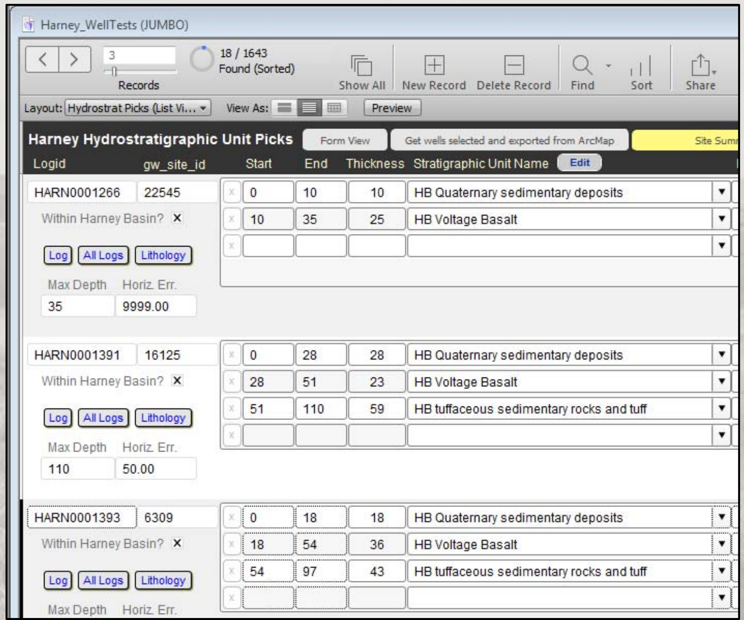
(11) WATER LEVEL: Completed well.
Depth at which water was first found 3 ft.
Static level 6 ft. below land surface. Date 6/1/81

(12) WELL LOG: Diameter of well below casing 13-14 inches
Depth drilled 110 ft. Depth of completed well 109 ft.

MATERIAL	From	To	SWL
Topsoil	0	6	
Yellow clay & soil	6	8	
Brown sandy soil	8	18	6
Cemented blacksand	18	22	
Yellow clay	22	23	
Cemented blacksand	23	27	
Blue clay	27	28	
Black rock - porous	28	35	
Black silt	35	37	
Red clay	37	39	
Cemented blacksand	39	41	
Porous black rock	41	51	
Soft mix of coarse soil type material	51	80	
Soft blue clay	80	110	3

Work started May 1 1981 Completed June 1 1981
Date well drilling machine moved off of well June 10 (approx) 1981

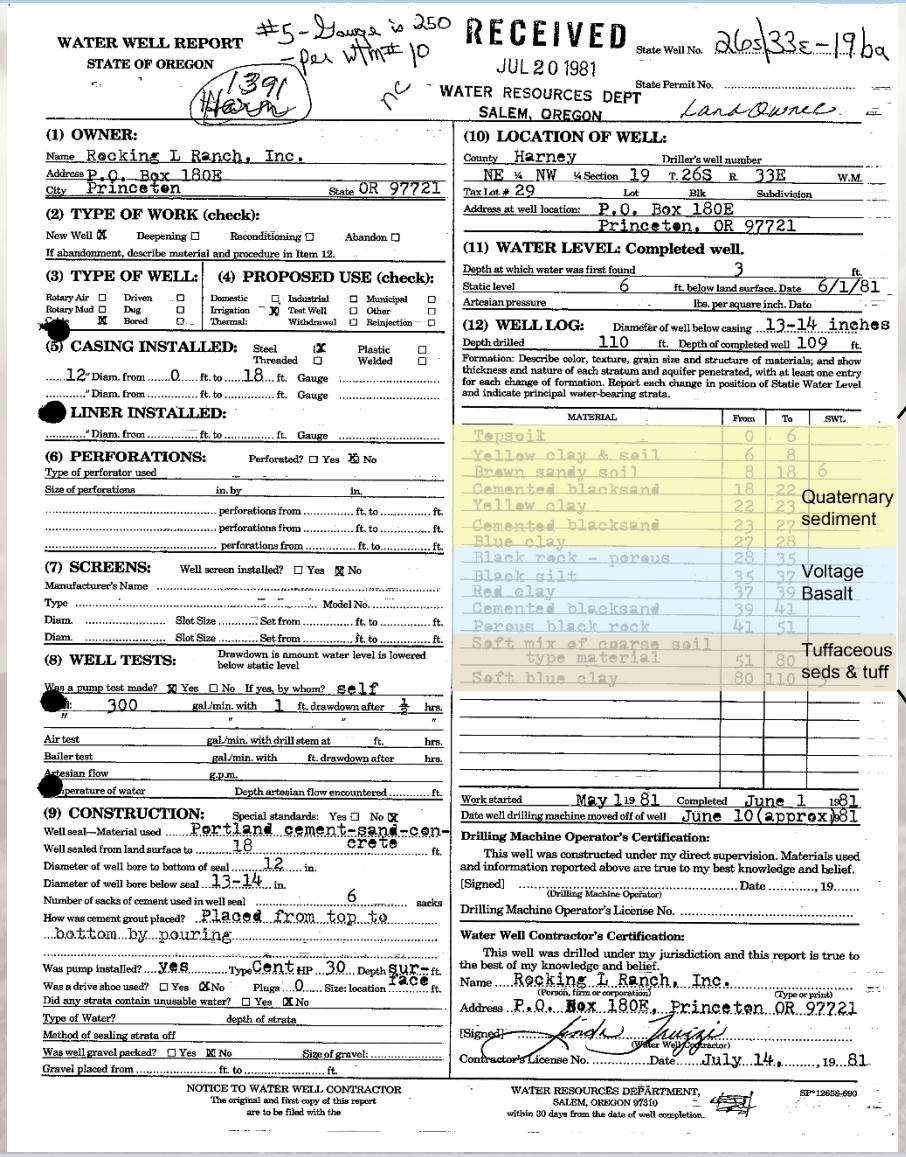
Water Well Contractor's Certification:
Name Rocking L Ranch, Inc.
Address P.O. Box 180R, Princeton OR 97721
Date July 14, 1981



- Interpreting drillers records within the context of the stratigraphic framework
- 1,600+ Wells Strat-Coded
- Prioritize wells with pump tests

"Strat-Coding"

Aquifer Hydraulic Properties



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SALEM, OREGON

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State Permit No. Land Owner

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City Princeton State OR 97721

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New Well ☒ Deepening ☐ Reconditioning ☐ Abandon ☐
If abandonment, describe material and procedure in Item 12.

(3) TYPE OF WELL: Rotary Air ☐ Driven ☐ Rotary Mud ☐ Dug ☐ ☒ Bored ☐

(4) PROPOSED USE (check): Domestic ☐ Industrial ☐ Municipal ☐ Irrigation ☐ Test Well ☒ Other ☐ Thermal: ☐ Withdrawal ☐ Reinjection ☐

(5) CASING INSTALLED: Steel ☒ Threaded ☐ Plastic ☐ Welded ☐
12" Diam. from 0 ft. to 18 ft. Gauge
" Diam. from ft. to ft. Gauge

LINER INSTALLED:
" Diam. from ft. to ft. Gauge

(6) PERFORATIONS: Perforated? ☐ Yes ☒ No
Type of perforator used
Size of perforations in. by in.
perforations from ft. to ft.
perforations from ft. to ft.
perforations from ft. to ft.

(7) SCREENS: Well screen installed? ☐ Yes ☒ No
Manufacturer's Name
Type Model No.
Diam. Slot Size Set from ft. to ft.
Diam. Slot Size Set from ft. to ft.

(8) WELL TESTS: Drawdown is amount water level is lowered below static level
Was a pump test made? ☒ Yes ☐ No If yes, by whom? self
300 gal/min. with 1 ft. drawdown after ½ hrs.
" " "
Air test gal/min. with drill stem at ft. hrs.
Bailer test gal/min. with ft. drawdown after hrs.
Artesian flow g.p.m.
Temperature of water Depth artesian flow encountered ft.

(9) CONSTRUCTION: Special standards: Yes ☐ No ☒
Well seal—Material used Portland cement-sand-concrete
Well sealed from land surface to 18 ft.
Diameter of well bore to bottom of seal 12 in.
Diameter of well bore below seal 13-14 in.
Number of sacks of cement used in well seal 6 sacks
How was cement grout placed? Placed from top to bottom by pouring
Was pump installed? yes Type Cent HP 30 Depth sur-face ft.
Was a drive shoe used? ☐ Yes ☒ No Plugs 0 Size: location ft.
Did any strata contain unusable water? ☐ Yes ☒ No
Type of Water? depth of strata
Method of sealing strata off
Was well gravel packed? ☐ Yes ☒ No Size of gravel:
Gravel placed from ft. to ft.

(10) LOCATION OF WELL:
County Harney Driller's well number
NE ¼ NW ¼ Section 19 T. 26S R. 33E W.M.
Tax Lot # 29 Lot Blk Subdivision
Address at well location: P.O. Box 180E Princeton, OR 97721

(11) WATER LEVEL: Completed well.
Depth at which water was first found 3 ft.
Static level 6 ft. below land surface. Date 6/1/81
Artesian pressure lbs. per square inch. Date

(12) WELL LOG: Diameter of well below casing 13-14 inches
Depth drilled 110 ft. Depth of completed well 109 ft.
Formation: Describe color, texture, grain size and structure of materials; and show thickness and nature of each stratum and aquifer penetrated, with at least one entry for each change of formation. Report each change in position of Static Water Level and indicate principal water-bearing strata.

MATERIAL	From	To	SWL	
Topsoil	0	6		
Yellow clay & soil	6	8		
Brown sandy soil	8	18	6	Quaternary sediment
Cemented blacksand	18	22		
Yellow clay	22	23		
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Black rock - porous	28	35		Voltage Basalt
Black silt	35	37		
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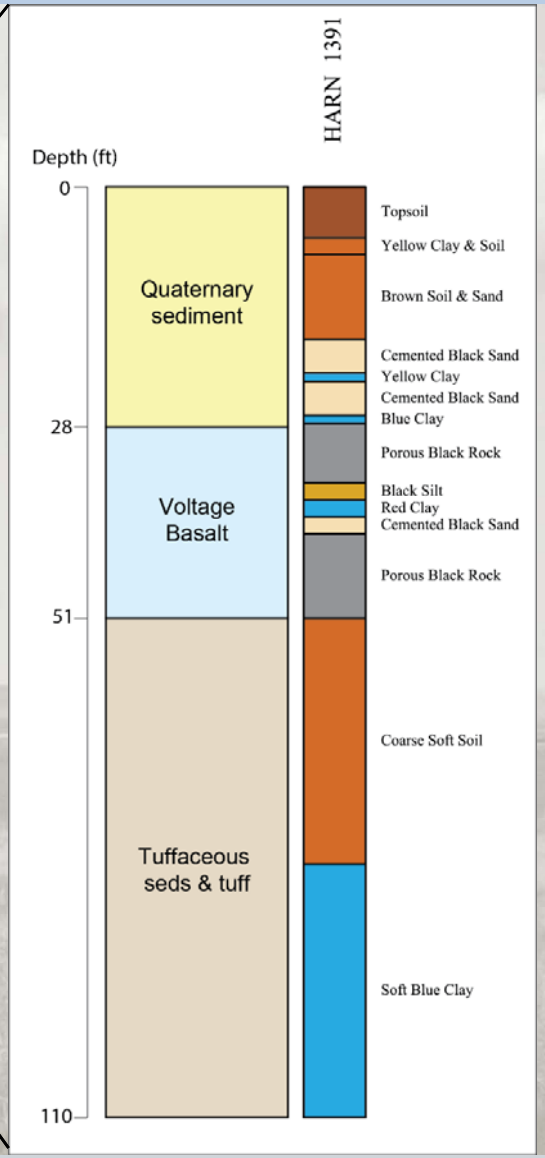
Cemented blacksand	39	41		
Porous black rock	41	51		
Soft mix of coarse soil type material	51	80		Tuffaceous seds & tuff
Soft blue clay	80	110		

Work started May 1 19 81 Completed June 1 19 81
Date well drilling machine moved off of well June 10 (approx) 81

Drilling Machine Operator's Certification:
This well was constructed under my direct supervision. Materials used and information reported above are true to my best knowledge and belief.
[Signed] (Drilling Machine Operator) Date ..., 19...
Drilling Machine Operator's License No.

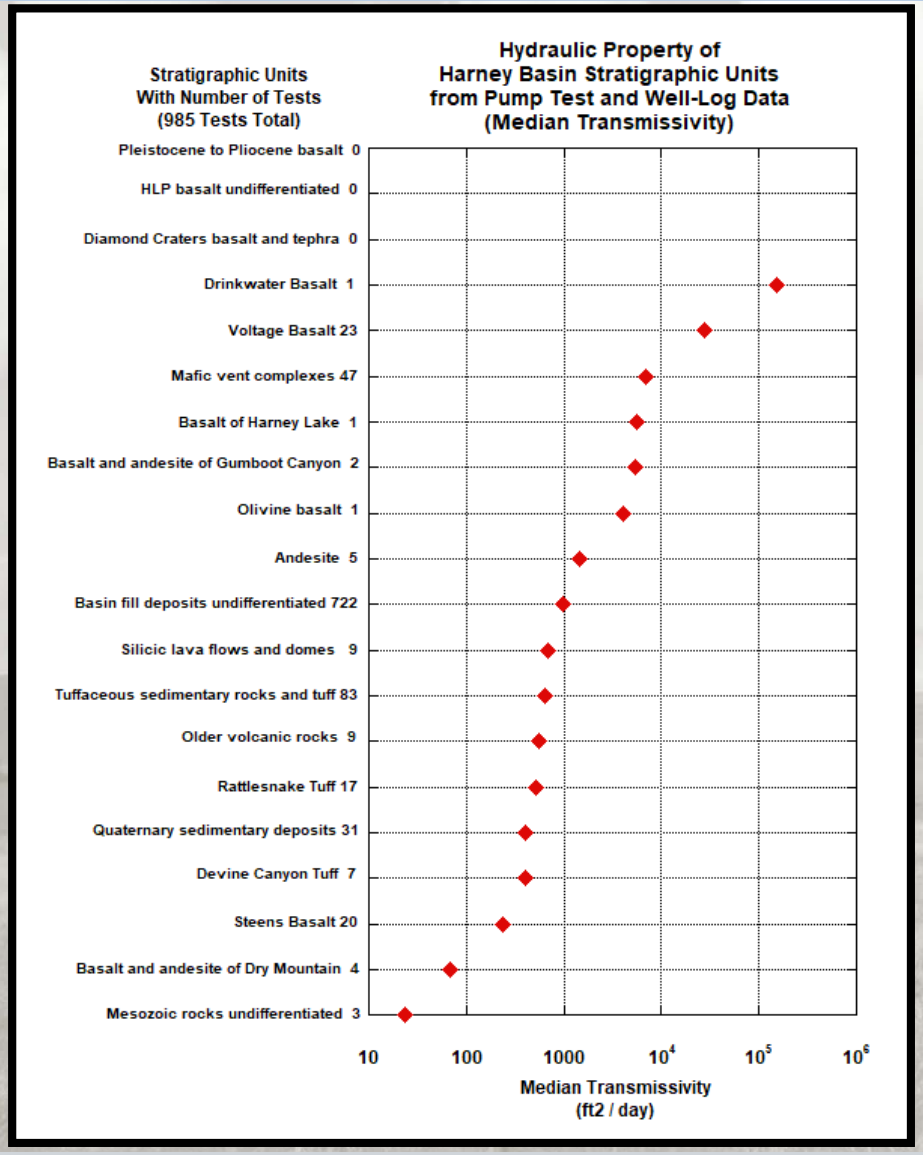
Water Well Contractor's Certification:
This well was drilled under my jurisdiction and this report is true to the best of my knowledge and belief.
Name Rocking L Ranch, Inc. (Person, firm or corporation) (Type or print)
Address P.O. Box 180E, Princeton OR 97721
[Signed] (Water Well Contractor)
Contractor's License No. Date July 14, 19 81

NOTICE TO WATER WELL CONTRACTOR
The original and first copy of this report are to be filed with the
WATER RESOURCES DEPARTMENT, SALEM, OREGON 97310 within 30 days from the date of well completion.
SP-12658-690



"Strat-Coding"

Aquifer Hydraulic Properties



985 Tests Total

Well-Log Data

Pump Test Data

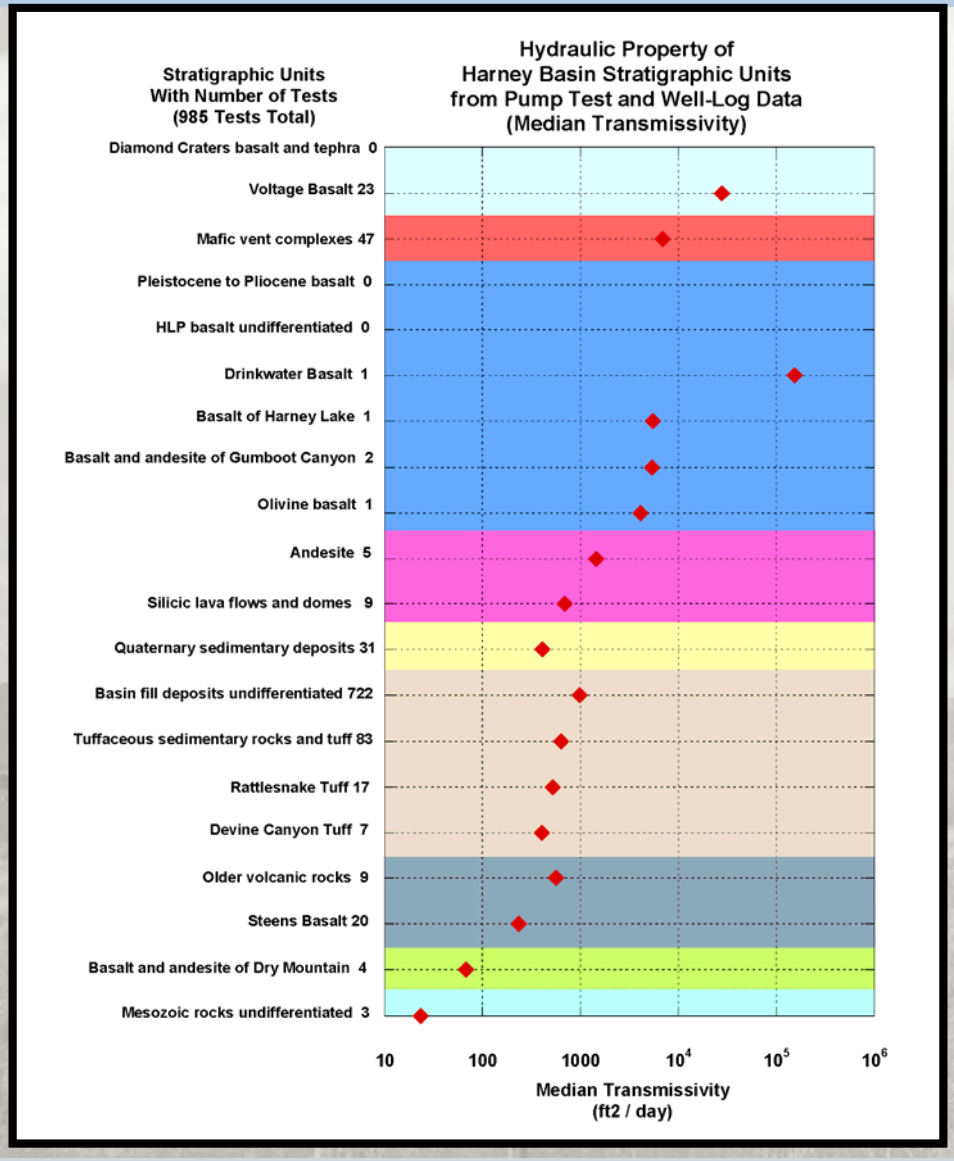
Strat Unit = 90 to 100% Open Interval

0 feet drawdown included (21 Tests)

Median Values Shown

Calculated Transmissivity Stratigraphic Distribution

Aquifer Hydraulic Properties



985 Tests Total

Well-Log Data

Pump Test Data

Strat Unit = 90 to 100% Open Interval

0 feet drawdown included (21 Tests)

Median Values Shown

Hydrostratigraphic Units

- UPPER BASIN FILL
- QUATERNARY BASALT
- PROXIMAL VENT DEPOSITS
- HIGH LAVA PLAINS BASALT
- LOWER BASIN FILL
- DRY MOUNTAIN LAVAS
- SILICIC FLOWS AND DOMES
- UPLAND VOLCANIC ROCKS
- PRE-CENOZOIC ROCKS

Calculated Transmissivity Hydro-Stratigraphic Distribution

Harney Basin GW Study

Thank You