

Memo

September 4, 2014

To: Allen Merritt, IDWR Southern Regional Manager

From: Ken Neely, Technical Hydrogeologist

RE: Relationship of ground water in the Anderson well in Jerome County to the Snake River.

The area in this investigation is in south-central Jerome County, Idaho. The Anderson well is located about 4 miles northeast of the city of Twin Falls, in Township 9 South, Range 18 East, Section 31, NENWSW. The well is located within the boundaries of the Twin Falls Ground Water Management Area which was established by IDWR in 1984 (Figure 1). The well is also located in the Twin Falls Geothermal Moratorium Area, which was established in 1987, and has been extended in 1992, 1997, 2002, 2008, and 2013 (Figure 1). The well is within the Trust Water Area of the Snake River Basin (Figure 2).

Anderson Well

The Anderson well is located in Jerome County, about 250 feet north of the Snake River (Figure 3). The well was completed in March 1993, and is 1,120 feet in total depth (Figure 4). The lithology is predominately multicolor lava (red, gray, brown, green, and black). Rhyolite was recorded in only two intervals and these were in the upper portion of the well (from 291 feet to 348 feet, and from 391 feet to 404 feet). A sequence of four clay layers were encountered near the bottom of the well with a total thickness of 107 feet. The lower portion of this sequence contains blue green clay. The well has three strings of casing: nominal 12-inch diameter from ground surface to 27 feet; nominal 8-inch diameter from ground surface to 668 feet; and nominal 6-inch diameter from 648 feet to 1,093 feet. The well driller reported cement grout seal to 1,093 feet. Water was detected in two main parts of the well, designated the Upper and Lower Water Zones. The Upper Water Zone is from 124 feet to 490 feet; this zone is behind the 8 inch casing. The Lower Water Zone is from 985 feet to 1120 feet, the lithology is black and green lava, and the lower portion of this zone (1,093 feet to 1,120 feet) is uncased.

Kestler Well

The Kestler well is located about ½ mile south of the Anderson well on the south side of the Snake River in Twin Falls County (Figure 3). This well was completed in January, 1987, and is 1,300 feet deep. The lithology of the well can be divided into two sections – Upper and Lower. The Upper Section is made up of basalt, gravel, sand and clay from the surface to 150 feet. The Lower Section from 150 feet to 1,300 feet is primarily rhyolite with interbedded clays. Most of these clay layers are thin (3 feet to 21 feet). However, a sequence of three clay layers near the bottom of the well has a total thickness of 94 feet. The lower portion of this sequence is described as “greenish-gray shale and clay”. The well has three strings of casing: 10 inch from ground surface to 6.5 feet; 8 inch from ground surface to 149 feet; and 6 inch from ground surface to 1,173 feet. The well driller reported cement grout seal to 6.5 feet.

In a previous analysis conducted in 2013 on the Kestler well, the Department concluded “the low-temperature geothermal producing zone in this well is not tributary to the Snake River”.

Comparisons of Elevations of Select Horizons in the Anderson and Kestler wells

Well	Land Surface Elevation (feet above Sea Level)	Water Level Elevation (feet above Sea Level)	Top of Clay Sequence above Producing Zone (feet above Sea Level)	Top of Low Temperature Geothermal aquifer (feet above Sea Level)
Anderson Well	3,408	3,766	2,530	2,423
Kestler Well	3,595	3,775	2,561	2,445
Difference between Anderson and Kestler wells	-187	-9	-31	-22

Conclusions

Five observations suggest that the deep, low-temperature geothermal aquifer in the Anderson well is hydraulically isolated from any shallow, cold water aquifer in the area, and thus the low-temperature geothermal aquifer is not tributary to the Snake River:

1. Similarities in the thick clay sequences in the Anderson and Kestler wells. The Anderson well has 107 feet of clay directly overlying the producing zone. The nearby Kestler well has 100 feet of clay that overlies the producing zone. The lower 50+ feet of these clay sequences is described as "greenish" in both wells.
2. Flowing artesian conditions. Both wells flow at the land surface indicating the water is coming from confined aquifers with significant pressure. Both wells have similar reported flow rates (175 gallons per minute (gpm) for the Anderson well, and 200 gpm for the Kestler well).
3. Similar water level elevations. The water level elevations for the two wells are almost identical, suggesting that they are in hydraulic communication.
4. Similar elevations for the Top of the Low Temperature Geothermal Aquifer. The elevations of the water-bearing zones for the two wells were within 22 feet, which strongly suggest that they are correlated.
5. Elevated thermal gradients. The average thermal gradient is about 1.5°F per 100 feet (Freeze and Cherry, 1979). The Anderson well has a thermal gradient of 11.2°F per 100 feet; the Kestler well has a gradient of 9.4°F per 100 feet. The higher-than-average thermal gradients in the two wells suggest that low temperature geothermal aquifer is hydraulically isolated from the overlying cold water aquifers.

Hydrogeologic data from the Anderson well correlate strongly with the Kestler well except for some of the lithologic descriptions (i.e., the well driller reported mostly lava in the Anderson well, while the well driller reported mostly rhyolite in the Kestler well). The similarities in clay sequences, artesian pressures, elevations of key horizons, and thermal gradients indicate the two wells are very similar. Since the Department has previously established that the low temperature aquifer in the Kestler well is not tributary to the Snake River, it is concluded that the low temperature aquifer in the Anderson well is hydraulically isolated from the overlying cold water aquifer, and thus not tributary to the Snake River.

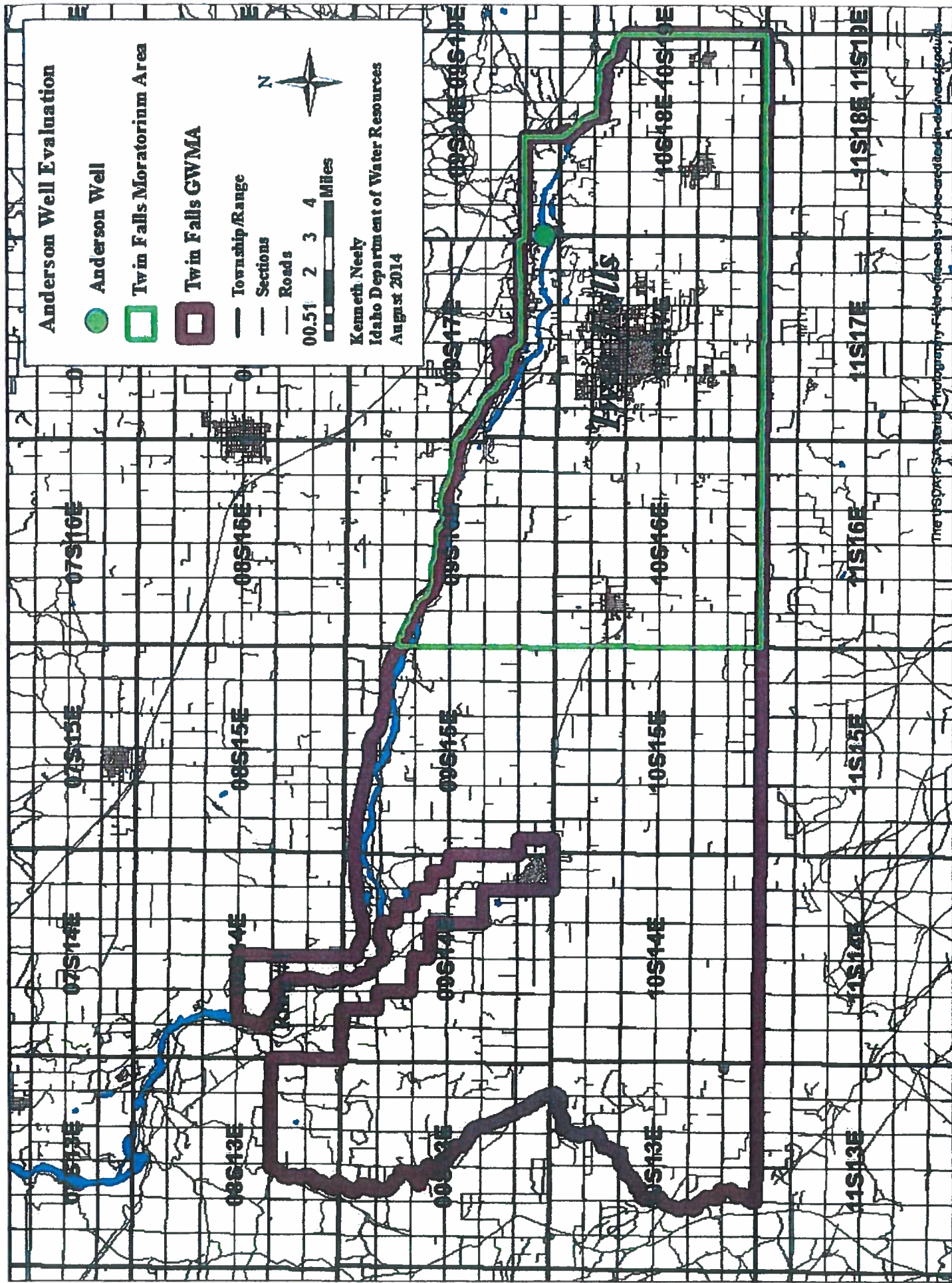


Figure 1. Location Map for the Anderson Well.

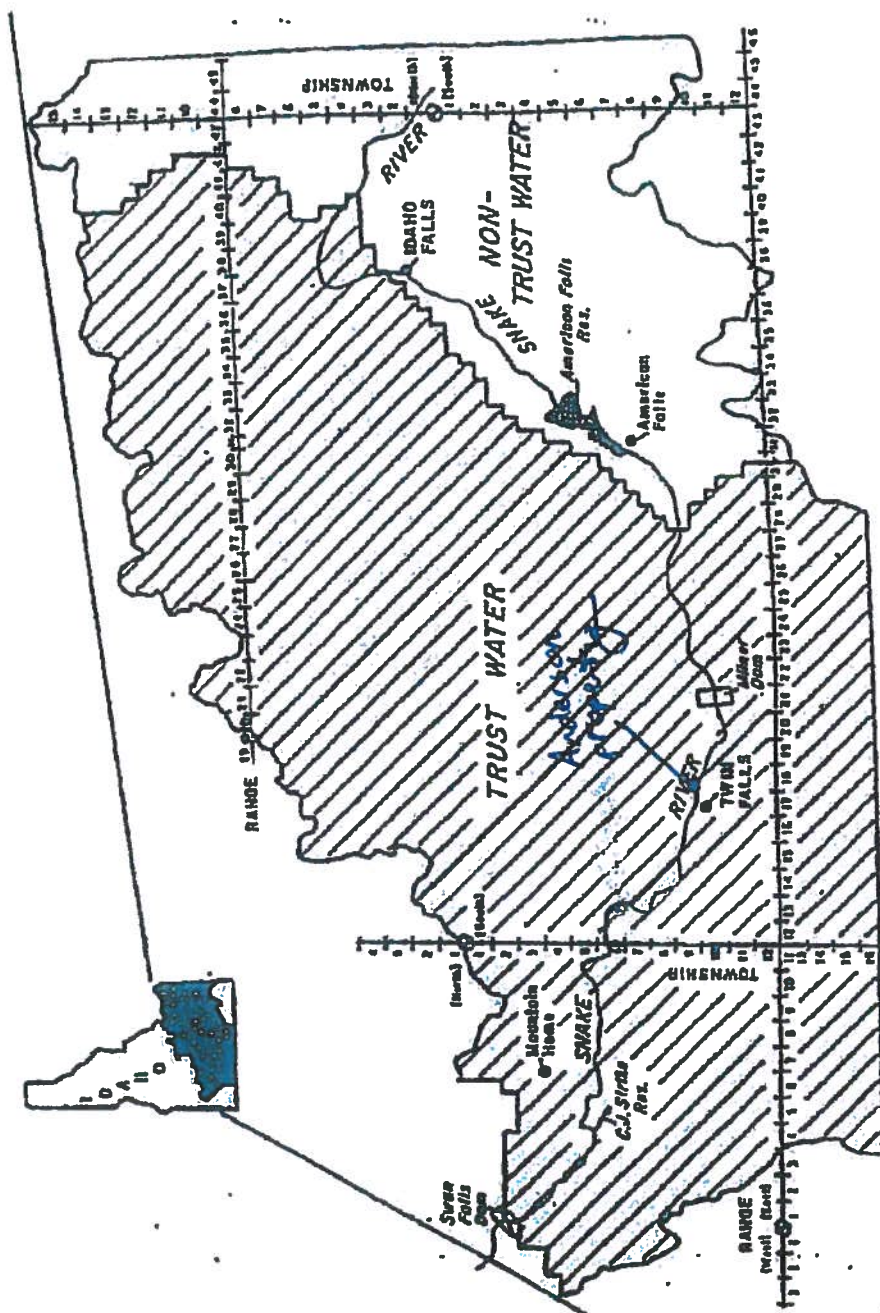


Figure 2. Trust water area of the Snake River Basin.

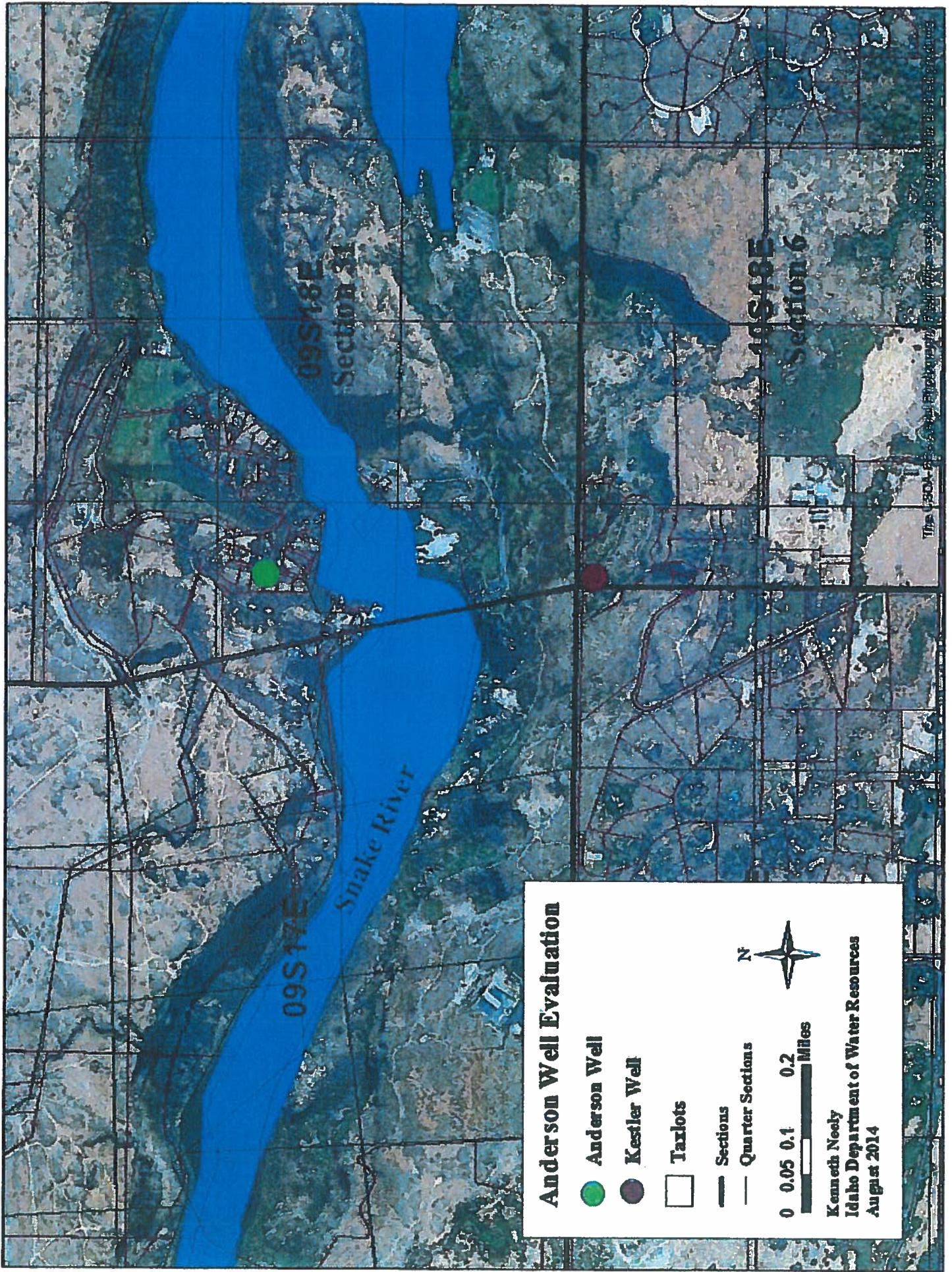


Figure 3. Locations of Anderson and Kestler wells

Elev = 3408'

Form 230-7
4/82

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

USE TYPEWRITER (BALLPOINT PEN

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

907H100

1. WELL OWNER
Name Larrey Anderson
Address P.O. Box 2037 Twin Falls, ID 83303
Drilling Permit No. 36-93-S-0008-000
Water Right Permit No. _____

7. WATER LEVEL
Static water level 0 feet below land surface.
Flowing? ☒ Yes ☐ No G.P.M. flow 175
Artesian closed-in pressure 155 p.s.i.
Controlled by: ☒ Valve ☐ Cap ☐ Plug
Temperature 110 °F. Quality Good
Describe artesian or temperature zones below.

WLE =
3766'

2. NATURE OF WORK
☒ New well ☐ Deepened ☐ Replacement
☐ Well diameter increase ☐ Modification
☐ Abandoned (describe abandonment or modification procedures such as liners, screen, materials, plug depths, etc. in lithologic log, section 9.)

8. WELL TEST DATA
☐ Pump ☐ Bailor ☐ Air ☐ Other _____

3. PROPOSED USE
☒ Domestic ☐ Irrigation ☐ Monitor
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

Discharge G.P.M.	Pumping Level	Hours Pumped

4. METHOD DRILLED
☒ Rotary ☒ Air ☐ Auger ☐ Reverse rotary
☐ Cable ☐ Mud ☐ Other _____ (backhoe, hydraulic, etc.)

9. LITHOLOGIC LOG

Bore Diam.	Depth		Material	Water	
	From	To		Yes	No
15"	0	28	Brown sand		X
12"	28	124	Red Lava		X
	124	148	Brown lava		X
	148	170	Gray lava	X	
	170	198	Brown lava	X	
	198	258	Gray lava	X	
	258	291	Brown lava	X	
	291	348	Brown rhyolite	X	
	348	354	Black lava		X
	354	373	Broken brown lava	X	
	373	391	Black lava		X
	391	404	Brown rhyolite		X
	404	486	Black lava	X	
	486	490	Broken brown lava	X	
	490	506	Black lava		X
	506	523	Brown lava		X
	523	670	Black lava		X
8"	670	688	Black lava		X
	688	698	Brown sandstone		X
	698	716	Brown clay		X
	716	770	Brown lava		X
	770	788	Black lava		X
	788	806	Brown lava		X
	806	849	Black lava		X
	849	851	Red siltstone		X
	851	878	Black lava		X
	878	919	Red clay, soft rock		X
	919	935	Brown sandy clay		X
	935	950	Blue green sandy clay		X
	950	983	Hard green clay		X
	983	1093	Soft black lava		X
6"	1093	1120	Broken black and green lava	X	
			Started flowing 50 GPM at 1052'		
			increased from 1052' on to		
			bottom, 1120' to 175GPM		

Top of Aquifer =
-2423'

5. WELL CONSTRUCTION
Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____
Thickness _____ Diameter _____ From _____ To _____
250 inches 12 inches + 1 feet 27 feet
250 inches 8 inches + 2 feet 668 feet
250 inches 6 inches 648 feet 1093 feet
Was casing drive shoe used? ☒ Yes ☐ No
Was a packer or seal used? ☒ Yes ☐ No
Perforated? ☐ Yes ☒ No
How perforated? ☐ Factory ☐ Knife ☐ Torch ☐ Gun
Size of perforation? _____ inches by _____ inches
Number _____ From _____ To _____
_____ perforations _____ feet _____ feet
_____ perforations _____ feet _____ feet
_____ perforations _____ feet _____ feet
Well screen installed? ☐ Yes ☒ No
Manufacturer _____ Type _____
Top Packer or Headpipe _____
Bottom of Tailpipe _____
Diameter _____ Slot size _____ Set from _____ feet to _____ feet
Diameter _____ Slot size _____ Set from _____ feet to _____ feet
Gravel packed? ☐ Yes ☒ No ☐ Size of gravel _____
Placed from _____ feet to _____ feet
Surface seal depth 1093' Material used in seal: ☒ Cement grout
☐ Bentonite ☐ Puddling clay ☐ _____
Sealing procedure used: ☐ Slurry pit
☐ Temp. surface casing ☐ Overbore to seal depth
Method of joining casing: ☐ Threaded ☐ Welded
☐ Solvent Weld ☐ Cemented between strata
Describe access port _____ Valve _____

6. LOCATION OF WELL
Sketch map location must agree with written location.
Subdivision Name Country Club Estates
Country Jerome
Lot No. 10 Block No. 2
County Jerome
Address of Well Site 752 Falls View Twin Falls
(give at least name of road)
NW 14 SW 14 Sec. 31 T. 18 N ☐ or S ☒
R. 18 E ☐ or W ☒

10.
Work started 3-8-93 finished 3-25-93

11. DRILLER'S CERTIFICATION
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.
Firm Name Elsing Drilling Firm No. 31
Address P.O. Box 919 Date 4-9-93
Signed by Drilling Supervisor [Signature]
and
(Operator) [Signature]
(if different than the Drilling Supervisor)

Figure 4. Anderson Well Driller's Report

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORTUSE TYPEWRITER OR
BALLPOINT PENState law requires that this report be filed with the Director, Department of Water Resources
within 30 days after the completion or abandonment of the well.

1. WELL OWNER Name <u>Mike Kestler</u> Address <u>N E of City, Twin Falls, Id.</u> Owner's Permit No. <u>47-7492</u>		7. WATER LEVEL Static water level _____ feet below land surface. Flowing? ☒ Yes ☐ No G.P.M. flow <u>200 (est. min)</u> Artesian closed-in pressure <u>78</u> p.s.i. Controlled by: ☒ Valve ☐ Cap ☐ Plug Temperature <u>108</u> OF. Quality <u>good</u> Describe artesian or temperature zones below.																																																																																																																																																																																																																							
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4. METHOD DRILLED ☐ Rotary ☐ Air ☐ Hydraulic ☐ Reverse rotary ☒ Cable ☐ Dug ☐ Other _____		<table border="1"><thead><tr><th rowspan="2">Bore Diam.</th><th colspan="2">Depth</th><th rowspan="2">Material</th><th colspan="2">Water</th></tr><tr><th>From</th><th>To</th><th>Yes</th><th>No</th></tr></thead><tbody><tr><td>12"</td><td>0</td><td>1</td><td>Brown clay</td><td></td><td></td></tr><tr><td>"</td><td>1</td><td>30</td><td>Grey basalt</td><td></td><td></td></tr><tr><td>"</td><td>30</td><td>36</td><td>light clay</td><td></td><td></td></tr><tr><td>"</td><td>36</td><td>50</td><td>Brown basalt</td><td></td><td></td></tr><tr><td>"</td><td>50</td><td>64</td><td>Grey basalt</td><td></td><td></td></tr><tr><td>"</td><td>64</td><td>66</td><td>Brown clay</td><td></td><td></td></tr><tr><td>"</td><td>66</td><td>72</td><td>Red-brown basalt</td><td></td><td></td></tr><tr><td>"</td><td>72</td><td>110</td><td>Grey basalt</td><td></td><td></td></tr><tr><td>"</td><td>110</td><td>125</td><td>Grey silty clay & gravel</td><td>x</td><td></td></tr><tr><td>"</td><td>125</td><td>130</td><td>Brown basalt</td><td></td><td>x</td></tr><tr><td>"</td><td>130</td><td>135</td><td>Basalt (slightly green)</td><td></td><td>x</td></tr><tr><td>"</td><td>135</td><td>150</td><td>Gravel, silt & sand</td><td>x</td><td></td></tr><tr><td>"</td><td>150</td><td>167</td><td>Decomposed Rhyolite</td><td></td><td>x</td></tr><tr><td>"</td><td>167</td><td>369</td><td>Brown rhyolite</td><td></td><td>x</td></tr><tr><td>"</td><td>369</td><td>385</td><td>Grey-brown rhyolite</td><td></td><td></td></tr><tr><td>"</td><td>385</td><td>445</td><td>Grey rhyolite</td><td></td><td></td></tr><tr><td>"</td><td>445</td><td>465</td><td>Grey-brown rhyolite</td><td></td><td></td></tr><tr><td>"</td><td>465</td><td>492</td><td>Brown rhyolite</td><td></td><td></td></tr><tr><td>"</td><td>492</td><td>503</td><td>Grey rhyolite</td><td></td><td></td></tr><tr><td>"</td><td>503</td><td>507</td><td>Dark sand</td><td>?</td><td>x</td></tr><tr><td>"</td><td>507</td><td>518</td><td>Black Rock (Soft & shiny)</td><td></td><td>x</td></tr><tr><td>"</td><td>518</td><td>537</td><td>Rock clay in layers</td><td></td><td></td></tr><tr><td>"</td><td>537</td><td>546</td><td>Brown clay</td><td></td><td></td></tr><tr><td>"</td><td>546</td><td>550</td><td>Brown Rhyolite</td><td></td><td></td></tr><tr><td>"</td><td>550</td><td>553</td><td>Brown clay</td><td></td><td></td></tr><tr><td>"</td><td>553</td><td>598</td><td>Grey Rhyolite</td><td></td><td></td></tr><tr><td>"</td><td>598</td><td>602</td><td>Red-brown clay</td><td></td><td></td></tr><tr><td>"</td><td>602</td><td>626</td><td>Black Rhyolite</td><td></td><td></td></tr><tr><td>"</td><td>626</td><td>631</td><td>Red-brown clay</td><td></td><td></td></tr><tr><td>"</td><td>631</td><td>635</td><td>Brown rhyolite</td><td></td><td></td></tr><tr><td>"</td><td>635</td><td>658</td><td>Tan-green shale</td><td></td><td></td></tr><tr><td>"</td><td>658</td><td>745</td><td>Andesite (very hard)</td><td></td><td></td></tr><tr><td>"</td><td>745</td><td>779</td><td>Black rhyolite & grey clay in layers</td><td></td><td></td></tr><tr><td>"</td><td>779</td><td>783</td><td>Brown clay (sticky)</td><td></td><td></td></tr></tbody></table>		Bore Diam.	Depth		Material	Water		From	To	Yes	No	12"	0	1	Brown clay			"	1	30	Grey basalt			"	30	36	light clay			"	36	50	Brown basalt			"	50	64	Grey basalt			"	64	66	Brown clay			"	66	72	Red-brown basalt			"	72	110	Grey basalt			"	110	125	Grey silty clay & gravel	x		"	125	130	Brown basalt		x	"	130	135	Basalt (slightly green)		x	"	135	150	Gravel, silt & sand	x		"	150	167	Decomposed Rhyolite		x	"	167	369	Brown rhyolite		x	"	369	385	Grey-brown rhyolite			"	385	445	Grey rhyolite			"	445	465	Grey-brown rhyolite			"	465	492	Brown rhyolite			"	492	503	Grey rhyolite			"	503	507	Dark sand	?	x	"	507	518	Black Rock (Soft & shiny)		x	"	518	537	Rock clay in layers			"	537	546	Brown clay			"	546	550	Brown Rhyolite			"	550	553	Brown clay			"	553	598	Grey Rhyolite			"	598	602	Red-brown clay			"	602	626	Black Rhyolite			"	626	631	Red-brown clay			"	631	635	Brown rhyolite			"	635	658	Tan-green shale			"	658	745	Andesite (very hard)			"	745	779	Black rhyolite & grey clay in layers			"	779	783	Brown clay (sticky)		
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USE ADDITIONAL SHEETS IF NECESSARY - FORWARD THE WHITE COPY TO THE DEPARTMENT

RECEIVED

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

USE TYPEWRITER OR
BALLPOINT PEN

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

1. WELL OWNER'S Office Name <u>Mik Kestlew</u> Address _____ Owner's Permit No. _____	7. WATER LEVEL Department of Water Resources Static water level _____ feet below land surface Flowing? ☐ Yes ☐ No G.P.M. flow _____ Artesian closed-in pressure _____ p.s.i. Controlled by: ☐ Valve ☐ Cap ☐ Plug Temperature _____ °F. Quality _____ <i>Describe artesian or temperature zones below.</i>																																																																																																																												
2. NATURE OF WORK ☐ New well ☐ Deepened ☐ Replacement ☐ Abandoned (describe abandonment procedures such as materials, plug depths, etc. in lithologic log)	8. WELL TEST DATA ☐ Pump ☐ Baller ☐ Air ☐ Other _____ <table border="1" style="width:100%; border-collapse: collapse;"> <thead> <tr> <th>Discharge G.P.M.</th> <th>Pumping Level</th> <th>Hours Pumped</th> </tr> </thead> <tbody> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </tbody> </table>	Discharge G.P.M.	Pumping Level	Hours Pumped																																																																																																																									
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