

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.

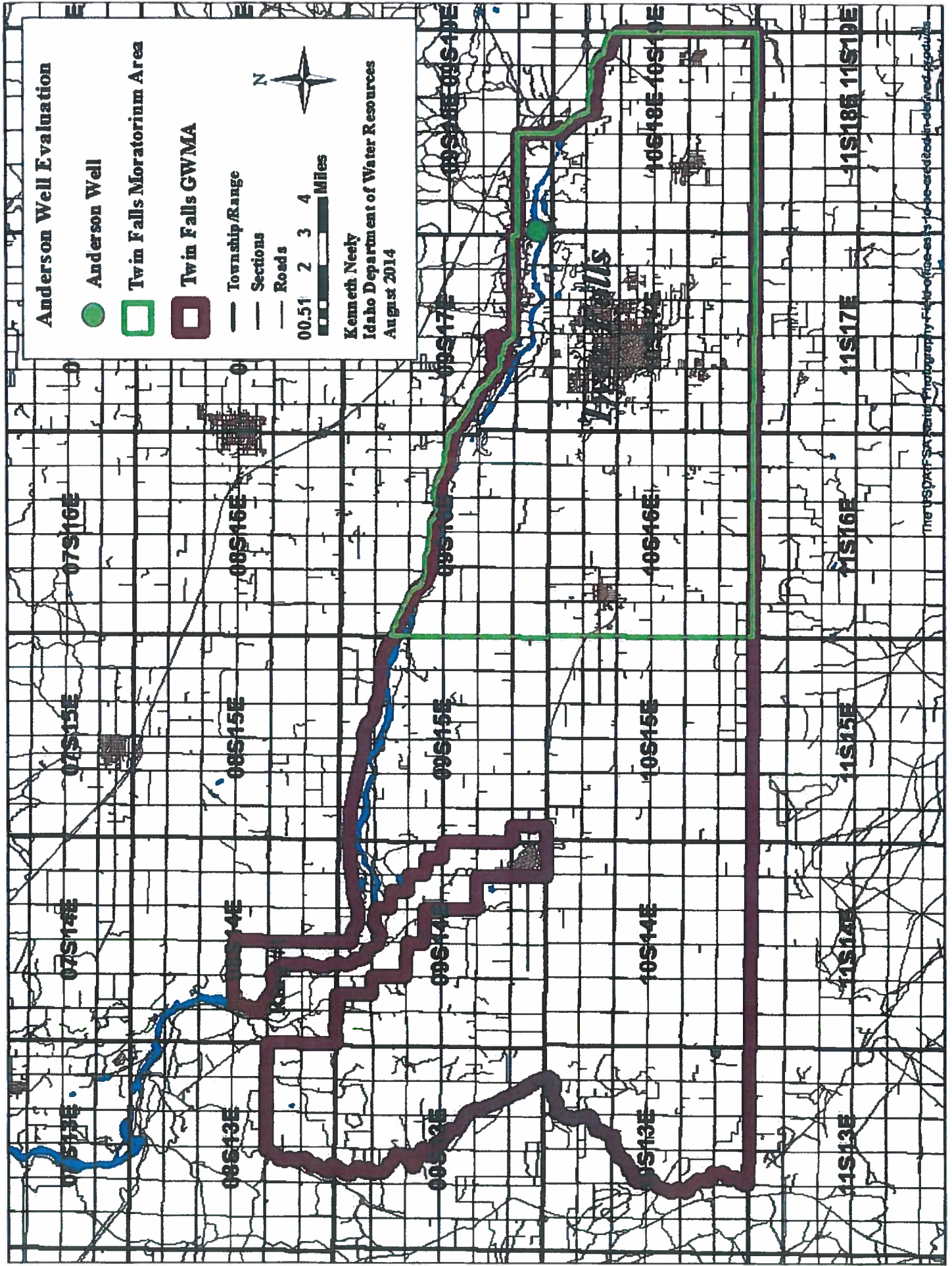


Figure 1. Location Map for the Anderson Well.

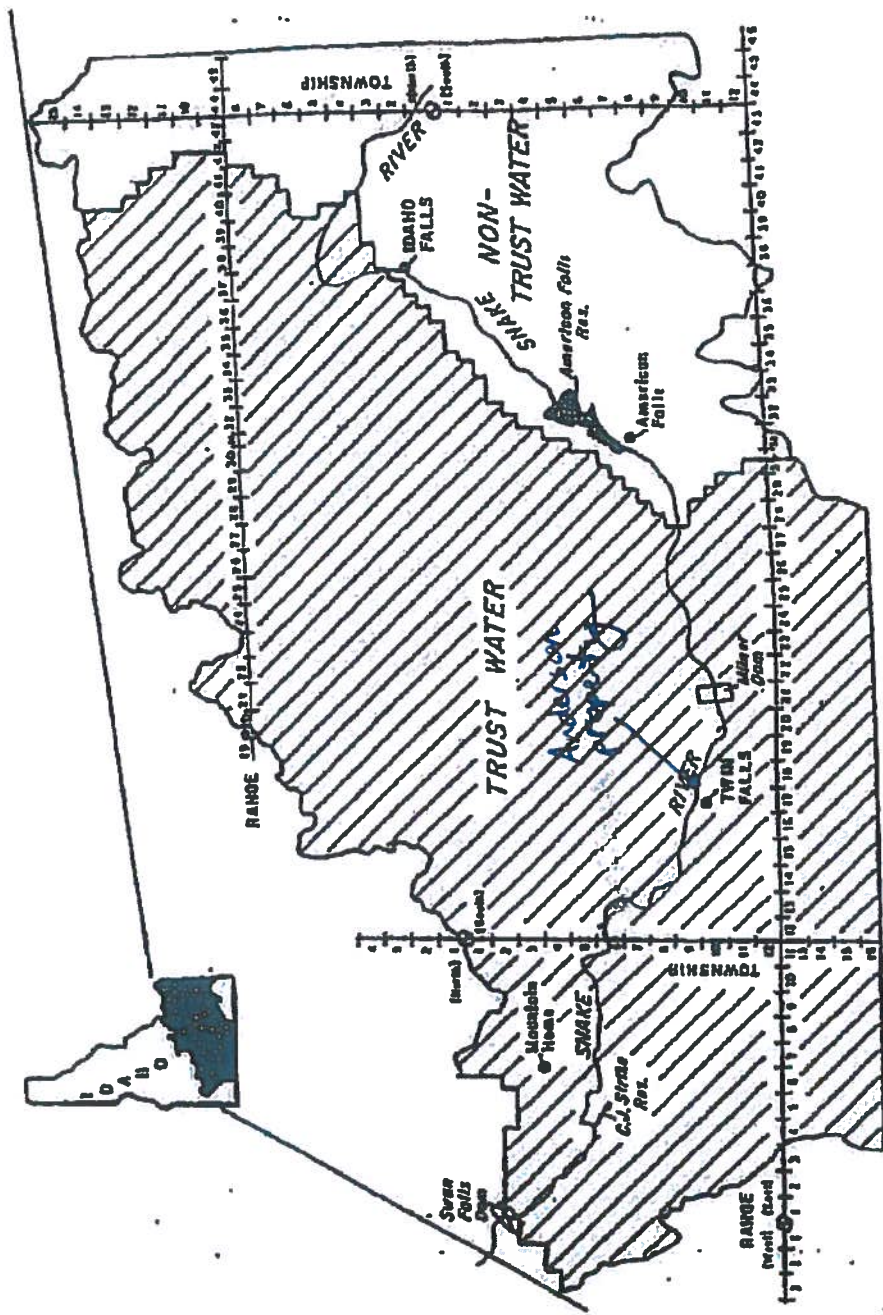


Figure 2. Trust water area of the Snake River Basin.

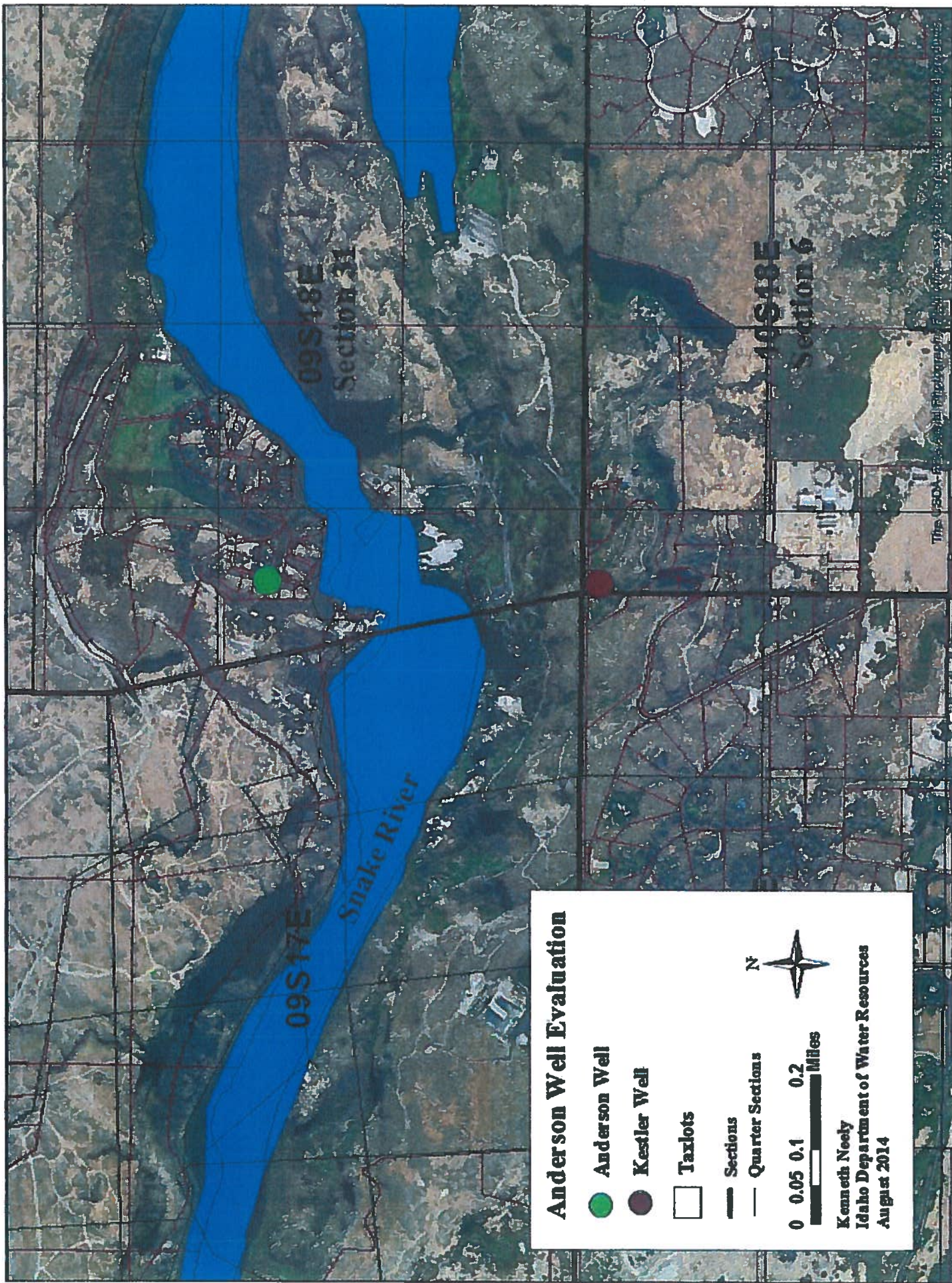
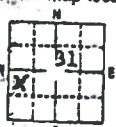


Figure 3. Locations of Anderson and Kestler wells

Form 230-7
4/82STATE 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.

907H100

1. WELL OWNER Name <u>Larrey Anderson</u> Address <u>P.O. Box 2037 Twin Falls, ID 83303</u> Drilling Permit No. <u>36-93-S-0008-000</u> Water Right Permit No. _____		7. WATER LEVEL Static water level <u>0</u> feet below land surface. Flowing? ☒ Yes ☐ No G.P.M. flow <u>175</u> Artesian closed-in pressure <u>155</u> p.s.i. Controlled by: ☒ Valve ☐ Cap ☐ Plug Temperature <u>110</u> °F. Quality <u>Good</u> Describe artesian or temperature zones below: _____																																																																																																																																																																																																							
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 ☐ Bailer ☐ Air ☐ Other _____ <table border="1"> <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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4. METHOD DRILLED ☒ Rotary ☒ Air ☐ Auger ☐ Reverse rotary ☐ Cable ☐ Mud ☐ Other _____ (backhoe, hydraulic, etc.)		10. Work started <u>3-8-93</u> finished <u>3-25-93</u>																																																																																																																																																																																																							
5. WELL CONSTRUCTION Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____ <table border="1"> <thead> <tr> <th>Thickness</th> <th>Diameter</th> <th>From</th> <th>To</th> <th>Feet</th> </tr> </thead> <tbody> <tr><td>250</td><td>12</td><td>0</td><td>27</td><td>27</td></tr> <tr><td>250</td><td>8</td><td>27</td><td>668</td><td>641</td></tr> <tr><td>250</td><td>6</td><td>668</td><td>1093</td><td>425</td></tr> </tbody> </table> 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 <u>1093'</u> Material used in seal: ☒ Cement grout ☐ Bentonite ☐ Pudding clay ☐ _____ Sealing procedure used: ☐ Slurry pit ☐ Overbore to seal depth ☐ Temp. surface casing ☐ Threaded ☒ Welded Method of joining casing: ☐ Solvent Weld ☒ Cemented between strata Describe access port _____ Valve _____		Thickness	Diameter	From	To	Feet	250	12	0	27	27	250	8	27	668	641	250	6	668	1093	425	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 <u>Elsing Drilling</u> Firm No. <u>31</u> Address <u>P.O. Box 219</u> Date <u>4-9-93</u> Signed by Drilling Supervisor <u>[Signature]</u> and <u>[Signature]</u> (Operator) <u>[Signature]</u> (If different than the Drilling Supervisor)																																																																																																																																																																																			
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6. LOCATION OF WELL Sketch map location must agree with written location.  Subdivision Name <u>Country Club Estates</u> Lot No. <u>10</u> Block No. <u>2</u> County <u>Jerome</u> Address of Well Site <u>752 Falls View Twin Falls</u> (give at least name of road) NW 1/4 SW 1/4 Sec. <u>31</u> T. <u>18</u> N or S ☒ R. <u>18</u> E or W ☐		10. Started flowing 50 GPM at 1052' increased from 1052' on to bottom, 1120' to 175GPM																																																																																																																																																																																																							

WLE =
3766'Top of Aquifer =
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Figure 4. Anderson Well Driller's Report

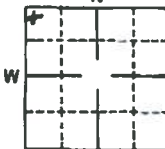
STATE OF IDAHO
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WELL DRILLER'S REPORTUSE TYPEWRITER OR
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State law requires that this report be filed with the Director, Department of Water Resources
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Department of Water Resources

1. WELL OWNER Name <u>Mike Kestler</u> Address <u>NE 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.)</u> Artesian closed-in pressure <u>78</u> p.s.i. Controlled by: ☒ Valve ☐ Cap ☐ Plug Temperature <u>108</u> °F. Quality <u>good</u> Describe artesian or temperature zones below																																																																																																																																																																																
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USE ADDITIONAL SHEETS IF NECESSARY - FORWARD THE WHITE COPY TO THE DEPARTMENT

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3775'

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RECEIVED

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORTUSE TYPEWRITER OR
BALLPOINT PEN

JAN 12 1987

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 INFORMATION 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>																																																																																																										
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