

Memo

August 4, 2014

To: Allen Merritt, IDWR Southern Regional Manager

From: Ken Neely, Technical Hydrogeologist, and Sean Vincent, Hydrology Section Manager

RE: Relationship of the Low Temperature Geothermal Aquifer in the vicinity of Water Right Application 47-17614 to the Snake River.

The area of interest is in northwestern Twin Falls County, about 8 miles northwest of the city of Buhl (Figure 1). The issue at hand is the relationship of the low temperature geothermal aquifer to the Snake River under the property owned by Douglass and Clarelyn Elgan. The Elgans have filed an application to drill a domestic well on their property in Township 8 South, Range 14 East, Section 33, NWNW. The area in the application is within the boundaries of the Banbury Hot Springs Ground Water Management Area which was established by IDWR in 1983. The area in the application is also within the Trust Water area of the Snake River Basin (Figure 2). According to IDWR's Geothermal Database, there are two wells in the vicinity of the Elgan Water Right Application.

Kopp Well

The Kopp well is located at the southeast corner of the Elgan property (Figure 3). The Kopp well was drilled in 1983 to a depth of 1,275 feet, with 6-inch casing set to 361 feet and sealed with cement grout (Figure 4). The water temperature on the well driller's report is 130 degrees Fahrenheit (°F); and the shut-in pressure is 85 pounds per square inch (psi). The lithology can be divided into four intervals:

<u>Well Depth</u>	<u>Lithologic Description</u>
0 to 280 feet	Mostly sand and clay, with some basalt. Two zones of cold water.
280 to 455 feet	Mostly black basalt
455 to 1,242 feet	Mostly blue clay and blue shale. One zone of water.
1,242 to 1,275 feet	Reddish brown rhyolite. Water.

The well driller's report list water temperatures as follows:

60 °F to 210 feet.

110 °F from 210 to 342 feet.

130 °F from 1,242 to 1,275 feet.

Elgan Well

The Elgan well is located at the southwest corner of the Elgan property (Figure 2). The Elgan well was drilled in 1986 to a depth of 1,380 feet (Figure 5). Three strings of casing were set: 12 ¾ inch to 49 feet; 8 5/8 inch to 447 feet; and 6 5/8 inch from 400 to 815 feet. The first string of casing was sealed from the land surface to the bottom of the casing with cement grout. The driller reported that "cement was pressure grouted from the bottom of all strings of casing." The water temperature on the well driller's report is listed as 104°F. The well was reported to flow, but the shut-in pressure was not recorded by the well driller. The lithologies in the Elgan well are more mixed than in the Kopp well, and only two intervals can be identified:

<u>Well Depth</u>	<u>Lithologic Description</u>
0 to 637 feet	Mostly sand and sandstone with two thin clay zones. Water zones occur from 126 to 637 feet.
637 to 1,380 feet	Mostly gray shale with interbedded rhyolite.

Conclusions

Three observations indicate that the deep, low-temperature geothermal aquifer in this area is hydraulically separate from the shallow, cold water aquifer, and thus the low-temperature geothermal aquifer is not tributary to the Snake River:

1. Existence of thick clay layers. The Kopp well has clay and shale from 455 feet to 1,242 feet, and the producing zone is below these layers. The Elgan well has 466 feet of clay and shale in the interval from 637 feet to 1,380 feet. The clay and shale layers constitute 63% of this interval. The producing zone or zones in the Elgan well are below 815 feet, probably from the rhyolites interbedded in the clay and shale layers.
2. Flowing artesian conditions. Both wells flow at the land surface indicating the water is coming from confined aquifers with significant pressure. The Kopp well had a recorded shut-in pressure of 85 psi.
3. Thermal gradients significantly exceed average gradient. The average thermal gradient is about 1.5°F per 100 feet (Freeze and Cherry, 1979). The Kopp well has a thermal gradient of 5.9°F per 100 feet; the Elgan well has a gradient of 3.8°F per 100 feet. The higher than average thermal gradients in the two wells indicate that low temperature geothermal aquifers are not in communication with the overlying cold water aquifers.

Finally, the proposed location of the new Elgan well is within about 400 feet of the Kopp well, but over 1,200 feet from the Elgan well. Thus, it is expected that the lithologic section will be more similar to the Kopp well which had greater thicknesses of clay and a higher thermal gradient, both of which strongly indicate the low-temperature geothermal aquifer is hydraulically isolated from the overlying cold water aquifer.

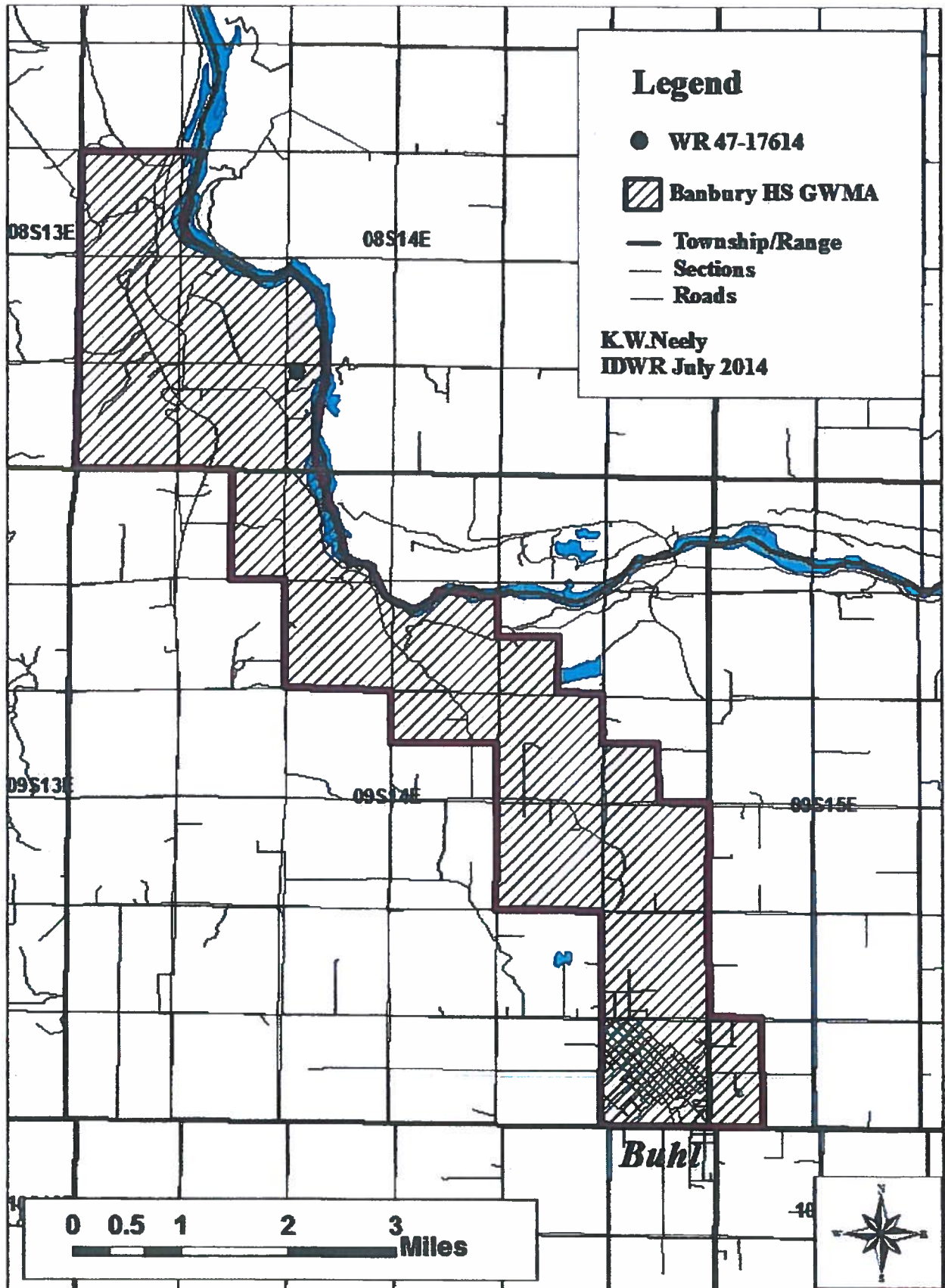


Figure 1. Location Map for Water Right Application 47-17614

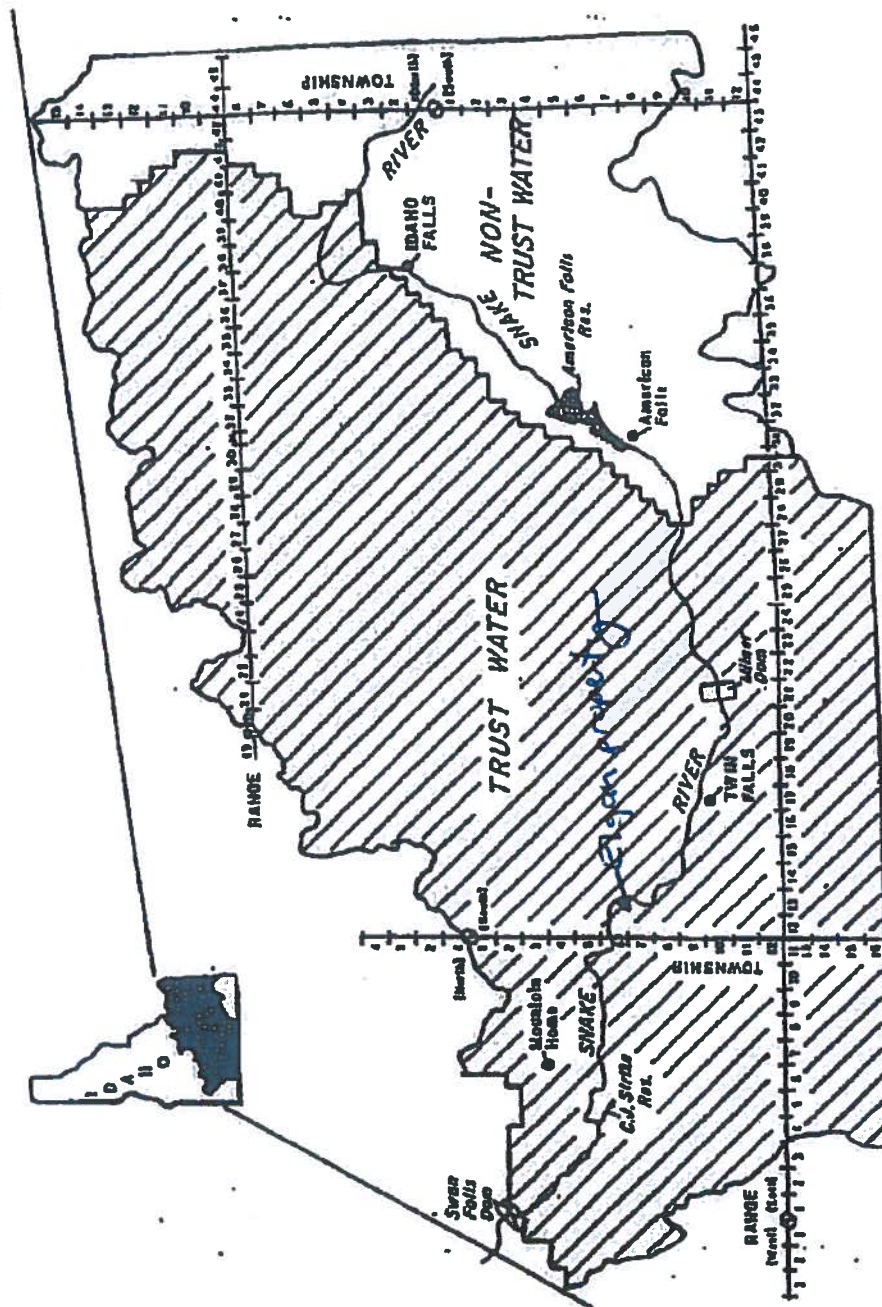


Figure 2. Trust water area of the Snake River Basin.

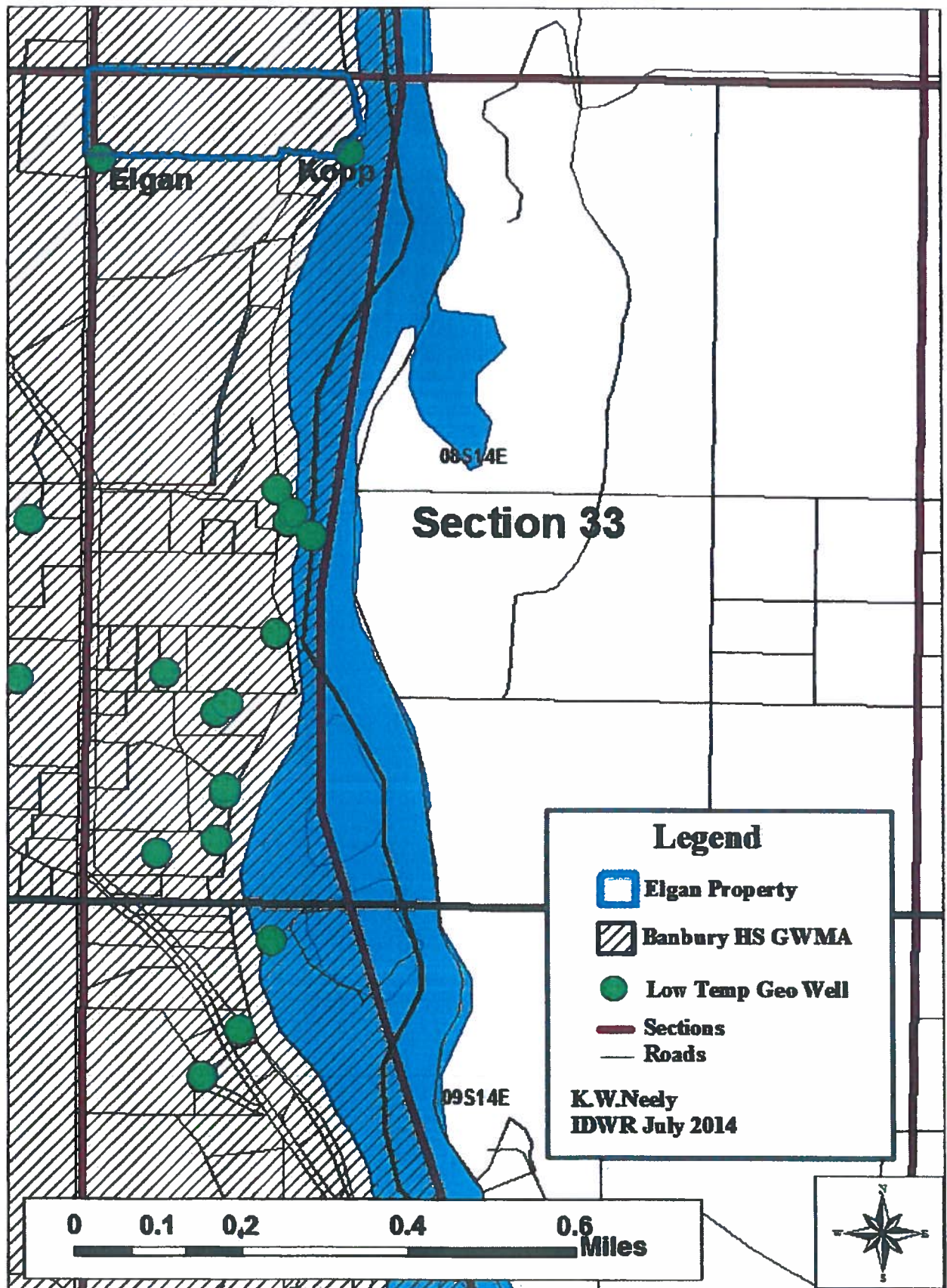


Figure 3, Locations of Kopp and Elgan wells

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

1. WELL OWNER Name <u>Dick Tapp</u> Address <u>Buhl, Idaho</u> Owner's Permit No. <u>47-7841</u> 2. NATURE OF WORK ☒ New well ☐ Deepened ☐ Replacement ☐ Abandoned (describe abandonment procedures such as materials, plug depths, etc. in lithologic log) 3. PROPOSED USE ☐ Domestic ☐ Irrigation ☐ Test ☐ Municipal ☐ Industrial ☐ Stock ☐ Waste Disposal or Injection ☒ Other <u>Heating House</u> (specify type) 4. METHOD DRILLED ☒ Rotary ☒ Air ☐ Hydraulic ☐ Reverse rotary ☐ Cable ☐ Dug ☐ Other _____ 5. WELL CONSTRUCTION Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____ <table style="width: 100%;"> <thead> <tr> <th>Thickness</th> <th>Diameter</th> <th>From</th> <th>To</th> </tr> </thead> <tbody> <tr> <td><u>250</u> inches</td> <td><u>6</u> inches +</td> <td><u>1</u> feet</td> <td><u>361</u> feet</td> </tr> <tr> <td>_____ inches</td> <td>_____ inches</td> <td>_____ feet</td> <td>_____ feet</td> </tr> <tr> <td>_____ inches</td> <td>_____ inches</td> <td>_____ feet</td> <td>_____ feet</td> </tr> <tr> <td>_____ inches</td> <td>_____ inches</td> <td>_____ feet</td> <td>_____ feet</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 Size of perforation _____ inches by _____ inches <table style="width: 100%;"> <thead> <tr> <th>Number</th> <th>From</th> <th>To</th> </tr> </thead> <tbody> <tr> <td>_____ perforations</td> <td>_____ feet</td> <td>_____ feet</td> </tr> <tr> <td>_____ perforations</td> <td>_____ feet</td> <td>_____ feet</td> </tr> <tr> <td>_____ perforations</td> <td>_____ feet</td> <td>_____ feet</td> </tr> </tbody> </table> Well screen installed? ☐ Yes ☒ No Manufacturer's name _____ Type _____ Model No. _____ 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>362</u> 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 <u>1" x 1 1/2" pipe</u> 6. LOCATION OF WELL <u>Permit # 47-7841</u> Sketch map location must agree with written location. N W 33 X E S Subdivision Name _____ <u>MICROFILMED</u> Lot No. <u>10</u> Block No. _____ County <u>Swin Falls</u> Twp. <u>N 1/2 Sec. 33, T. 8 N R. 14 E W.</u>	Thickness	Diameter	From	To	<u>250</u> inches	<u>6</u> inches +	<u>1</u> feet	<u>361</u> feet	_____ inches	_____ inches	_____ feet	_____ feet	_____ inches	_____ inches	_____ feet	_____ feet	_____ inches	_____ inches	_____ feet	_____ feet	Number	From	To	_____ perforations	_____ feet	_____ feet	_____ perforations	_____ feet	_____ feet	_____ perforations	_____ feet	_____ feet	7. WATER LEVEL Static water level <u>0</u> feet below land surface. Flowing? ☒ Yes ☐ No G.P.M. flow <u>900-1000</u> Artesian closed-in pressure <u>85</u> p.s.i. Controlled by: ☒ Valve ☐ Cap ☐ Plug Temperature <u>130</u> °F. Quality <u>good</u> Describe artesian or temperature zones below. 8. WELL TEST DATA ☐ Pump ☐ Baller ☐ Air ☐ Other _____ <table style="width: 100%;"> <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> 9. LITHOLOGIC LOG <u>88584</u> <table style="width: 100%;"> <thead> <tr> <th>Bore Diam.</th> <th>Depth From To</th> <th>Material</th> <th>Water Yes No</th> </tr> </thead> <tbody> <tr><td>6</td><td>0 31</td><td>Clay</td><td>X</td></tr> <tr><td></td><td>31 33</td><td>Shale</td><td>X</td></tr> <tr><td></td><td>33 125</td><td>Clay</td><td>X</td></tr> <tr><td></td><td>125 140</td><td>shale</td><td>X</td></tr> <tr><td></td><td>140 179</td><td>Black Basalt Cold</td><td>X</td></tr> <tr><td></td><td>179 220</td><td>Clay</td><td>X</td></tr> <tr><td></td><td>220 235</td><td>shale Cold</td><td>X</td></tr> <tr><td></td><td>235 280</td><td>Clay</td><td>X</td></tr> <tr><td></td><td>280 315</td><td>Black Basalt</td><td>X</td></tr> <tr><td></td><td>315 319</td><td>Crystalline</td><td>X</td></tr> <tr><td></td><td>319 365</td><td>shale to black basalt</td><td>X</td></tr> <tr><td></td><td>365 465</td><td>Heavy sand Black basalt</td><td>X</td></tr> <tr><td></td><td>465 572</td><td>Blue Clay</td><td>X</td></tr> <tr><td></td><td>572 650</td><td>Blue Shale</td><td>X</td></tr> <tr><td></td><td>650 670</td><td>Banner Blue shale</td><td>X</td></tr> <tr><td></td><td>670 785</td><td>Blue Clay</td><td>X</td></tr> <tr><td></td><td>785 935</td><td>Blue shale hard</td><td>X</td></tr> <tr><td></td><td>935 1149</td><td>Blue Clay</td><td>X</td></tr> <tr><td></td><td>1149 1242</td><td>Blue shale</td><td>X</td></tr> <tr><td></td><td>1242 1275</td><td>Blue Clay</td><td>X</td></tr> <tr><td></td><td>1275 1300</td><td>Hardish Brown Reality</td><td>X</td></tr> <tr><td></td><td>1300 1342</td><td>60 Degrees - to 210°</td><td></td></tr> <tr><td></td><td>210-342</td><td>110°</td><td></td></tr> <tr><td></td><td>1242-1275</td><td>130°</td><td></td></tr> <tr><td></td><td></td><td>Cemented pipe in at 360</td><td></td></tr> <tr><td></td><td></td><td>10 yds. cement from 360</td><td></td></tr> <tr><td></td><td></td><td>to ground level</td><td></td></tr> <tr><td></td><td></td><td>Buhl 310 PSI</td><td></td></tr> </tbody> </table> 10. Work started <u>2-26-83</u> finished <u>4-7-83</u> 11. DRILLERS CERTIFICATION <u>ee</u> I/We certify that all minimum well construction standards were complied with at the time the rig was removed. Firm Name <u>Chris Drilling</u> Firm No. <u>31</u> Address <u>PO Box 719</u> Date <u>4-18-83</u> Signed by (Firm Official) <u>Arnold Elroy</u> and (Operator) <u>Mike Lee</u>	Discharge G.P.M.	Pumping Level	Hours Pumped										Bore Diam.	Depth From To	Material	Water Yes No	6	0 31	Clay	X		31 33	Shale	X		33 125	Clay	X		125 140	shale	X		140 179	Black Basalt Cold	X		179 220	Clay	X		220 235	shale Cold	X		235 280	Clay	X		280 315	Black Basalt	X		315 319	Crystalline	X		319 365	shale to black basalt	X		365 465	Heavy sand Black basalt	X		465 572	Blue Clay	X		572 650	Blue Shale	X		650 670	Banner Blue shale	X		670 785	Blue Clay	X		785 935	Blue shale hard	X		935 1149	Blue Clay	X		1149 1242	Blue shale	X		1242 1275	Blue Clay	X		1275 1300	Hardish Brown Reality	X		1300 1342	60 Degrees - to 210°			210-342	110°			1242-1275	130°				Cemented pipe in at 360				10 yds. cement from 360				to ground level				Buhl 310 PSI	
Thickness	Diameter	From	To																																																																																																																																																														
<u>250</u> inches	<u>6</u> inches +	<u>1</u> feet	<u>361</u> feet																																																																																																																																																														
_____ inches	_____ inches	_____ feet	_____ feet																																																																																																																																																														
_____ inches	_____ inches	_____ feet	_____ feet																																																																																																																																																														
_____ inches	_____ inches	_____ feet	_____ feet																																																																																																																																																														
Number	From	To																																																																																																																																																															
_____ perforations	_____ feet	_____ feet																																																																																																																																																															
_____ perforations	_____ feet	_____ feet																																																																																																																																																															
_____ perforations	_____ feet	_____ feet																																																																																																																																																															
Discharge G.P.M.	Pumping Level	Hours Pumped																																																																																																																																																															
Bore Diam.	Depth From To	Material	Water Yes No																																																																																																																																																														
6	0 31	Clay	X																																																																																																																																																														
	31 33	Shale	X																																																																																																																																																														
	33 125	Clay	X																																																																																																																																																														
	125 140	shale	X																																																																																																																																																														
	140 179	Black Basalt Cold	X																																																																																																																																																														
	179 220	Clay	X																																																																																																																																																														
	220 235	shale Cold	X																																																																																																																																																														
	235 280	Clay	X																																																																																																																																																														
	280 315	Black Basalt	X																																																																																																																																																														
	315 319	Crystalline	X																																																																																																																																																														
	319 365	shale to black basalt	X																																																																																																																																																														
	365 465	Heavy sand Black basalt	X																																																																																																																																																														
	465 572	Blue Clay	X																																																																																																																																																														
	572 650	Blue Shale	X																																																																																																																																																														
	650 670	Banner Blue shale	X																																																																																																																																																														
	670 785	Blue Clay	X																																																																																																																																																														
	785 935	Blue shale hard	X																																																																																																																																																														
	935 1149	Blue Clay	X																																																																																																																																																														
	1149 1242	Blue shale	X																																																																																																																																																														
	1242 1275	Blue Clay	X																																																																																																																																																														
	1275 1300	Hardish Brown Reality	X																																																																																																																																																														
	1300 1342	60 Degrees - to 210°																																																																																																																																																															
	210-342	110°																																																																																																																																																															
	1242-1275	130°																																																																																																																																																															
		Cemented pipe in at 360																																																																																																																																																															
		10 yds. cement from 360																																																																																																																																																															
		to ground level																																																																																																																																																															
		Buhl 310 PSI																																																																																																																																																															

RECEIVED
MAY 12 1986

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

USE TYPEWRITER OR
BALLPOINT PEN

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 Page 1 of 2
Name Doug Egan
Address P. O. Box 82
Gooding, ID 83338
Owner's Permit No. _____

2. NATURE OF WORK
☒ New well ☐ Deepened ☐ Replacement
☐ Abandoned (describe abandonment procedures such as materials, plug depths, etc. in lithologic log)

3. PROPOSED USE
☒ Domestic ☐ Irrigation ☐ Test ☐ Municipal
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection
☒ Other Geothermal (specify type)

4. METHOD DRILLED
☒ Rotary ☒ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION
Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____
Thickness _____ Diameter _____ From _____ To _____
Inches 12 3/4 inches + _____ feet 49 feet
Inches 8 5/8 inches 1 1/2 feet 447 feet
Inches 6 5/8 inches 400 feet 815 feet
Inches _____ inches _____ feet _____ feet
Was casing drive shoe used? ☒ Yes ☐ No
Was a pecker or seal used? ☒ Yes ☐ No
Perforated? ☐ Yes ☒ No
How perforated? ☐ Factory ☐ Knife ☐ Torch
Size of perforation _____ inches by _____ inches
Number _____ From _____ To _____
_____ perforations _____ feet _____ feet
_____ perforations _____ feet _____ feet
_____ perforations _____ feet _____ feet
Well screen installed? ☐ Yes ☒ No
Manufacturer's name _____
Type _____ Model No. _____
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 50 Material used in seal: ☒ Cement grout
☐ Bentonite ☐ Pudding clay ☐ _____
Sealing procedure used: ☐ Slurry pit ☐ Temp. surface casing
Cement pumped ☒ Overbore to seal depth
Method of joining casing: ☐ Threaded ☒ Welded ☐ Solvent Weld
☐ Cemented between strata
Describe access port Blind flange

6. LOCATION OF WELL
Sketch map location must agree with written location.
N
W E S
County Twin Falls
NE 1/4 NE 1/4 Sec. 32 T. 8 S. 14 E. 14

7. WATER LEVEL
Static water level 0 feet below land surface.
Flowing? ☒ Yes ☐ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature 104 of. Quality _____
Describe artesian or temperature zones below.

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

9. LITHOLOGIC LOG 87973

Bore	Depth	Material	Water	
Diam.	From	To	Yes No	
16	0	5	Sand	
12	5	48	Sand & clay	
	48	126	Black basalt	
	126	150	Sandstone	X
	150	190	Sandstone	X
	190	200	Sand	Lots of water X
	200	320	Sandstone-layer of sand	X
	320	326	Sand	72° X
	326	380	Sandstone	74° X
	380	400	Sandstone	380' 80° X
	400	411	Sand	74°
	411	422	Rock	
	422	435	Sandstone	74°
	435	447	Clay	74°
	447	480	Bandbury basalt	69° X
	480	490	Clay & basalt	X
	490	520	Sandstone	69° X
	520	530	Sand	82° X
	530	635	Sandstone	93°
	635	637	Sand	104° X
	637	640	Gray shale	
	640	670	Sandstone	
	670	678	Black or dark grey rhyolite	
	678	682	Grey shale	
	682	700	Sandstone	
	700	742	Grey shale	
	742	746	Black rhyolite	
	746	760	Grey shale	
	760	790	Sandstone	
	790	860	Black rhyolite	
	860	890	Green-blue shale	108° X
	890	930	Grey shale	
	930	945	Gray/black rhyolite	
	945	947	Grey shale	
	947	954	Gray/black rhyolite	
	954	956	Gray/black shale	

10. DRILLERS CERTIFICATION
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.
Firm Name Walker Water Systems, Inc. Firm No. 15
Address 624 Pierce Street Date 4/29/86
Twin Falls, Idaho 83309
Signed by (Firm Official) Frederick B. Welch
and
(Operator) Frederick B. Welch

USE ADDITIONAL SHEETS IF NECESSARY - FORWARD THE WHITE COPY TO THE DEPARTMENT

Figure 5 Elmer Well Driller's Report.

