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INFORMAL REPORT

AQUIFER TESTS NEAR THE IDAHO FALLS FOOTHILLS, IDAHO

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Idaho National Engineering Laboratory

Managed by the U.S. Department of Energy

EG&G Idaho

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AQUIFER TESTS NEAR THE IDAHO FALLS FOOTHILLS

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AQUIFER TESTS NEAR THE IDAHO FALLS FOOTHILLS

ABSTRACT

Ground water pumping tests were performed in two wells located in the foothills east of Idaho Falls to determine the aquifer characteristics at these locations. These data were used to differentiate this aquifer from the Snake River Plain aquifer. The wells were pumped at rates of 11 and 14 gallons per minute with 0.03 and 0.04 ft of drawdown measured in the pumping wells. The transmissivity is estimated to be 525,000 gpd/ft and 450,000 gpd/ft, respectively. The hydraulic conductivity is 925 ft/day and 1,070 ft/day, respectively. These hydraulic conductivities are similar to those measured in the Snake River Plain aquifer. Water level data in these wells are consistent with the water table in the Snake River Plain aquifer and indicates ground water movement from the foothills toward the Plain. The high transmissivity suggests water may move rapidly from the foothills area to mix with water in the Snake River Plain aquifer. Elevated water temperatures (76 and 70°F) and high specific conductivities in these wells indicate the presence of a foothills aquifer with characteristics that can be used to seperate the two aquifer systems.

AQUIFER TESTS NEAR THE IDAHO FALLS FOOTHILLS

1. INTRODUCTION

Pumping tests were performed at two wells in the foothills east of Idaho Falls to determine the aquifer characteristics in their respective areas. Locations of the test sites are presented in Figure 1. Tests were performed at the Ritter well on August 14, 1991 and the Walton well on August 29, 1991. These wells were chosen because they are close to areas being considered for the new Bonneville County landfill. The wells are located near the boundary of the Snake River Plain Aquifer and the foothills aquifer.

2. TEST METHODOLOGY

Single well pumping tests were performed in the wells. Water level measurements were made in the well with a Solinst electric water level tape with gradations of 0.02 ft. Readings of 0.01 ft can be estimated. Water level readings were recorded before, during, and after pumping. Pumping continued until the water level reached steady state conditions. Discharge was recorded by measuring the discharge in a calibrated measuring container for a given time period.

3. RITTER WELL DATA

The Ritter well is located in the NE 1/4 of the NW 1/4 of Section 29, Township 2 N, Range 39 E in the foothills east of Idaho Falls at an approximate elevation of 5060 ft. The well was drilled in 1977 for Mike Watson. Static water table at the time of drilling was 365 ft below land surface. Water level at the time of the pump test was 355 ft below the top of the casing. Differences in water level suggest the water level has risen approximately nine feet since the well was drilled. Water level elevation is presently at approximately 4705 ft.

The Ritter well obtains water from what is interpreted as volcanic tuff (described as sandstone) and broken rhyolite (Appendix 1). Most of the water

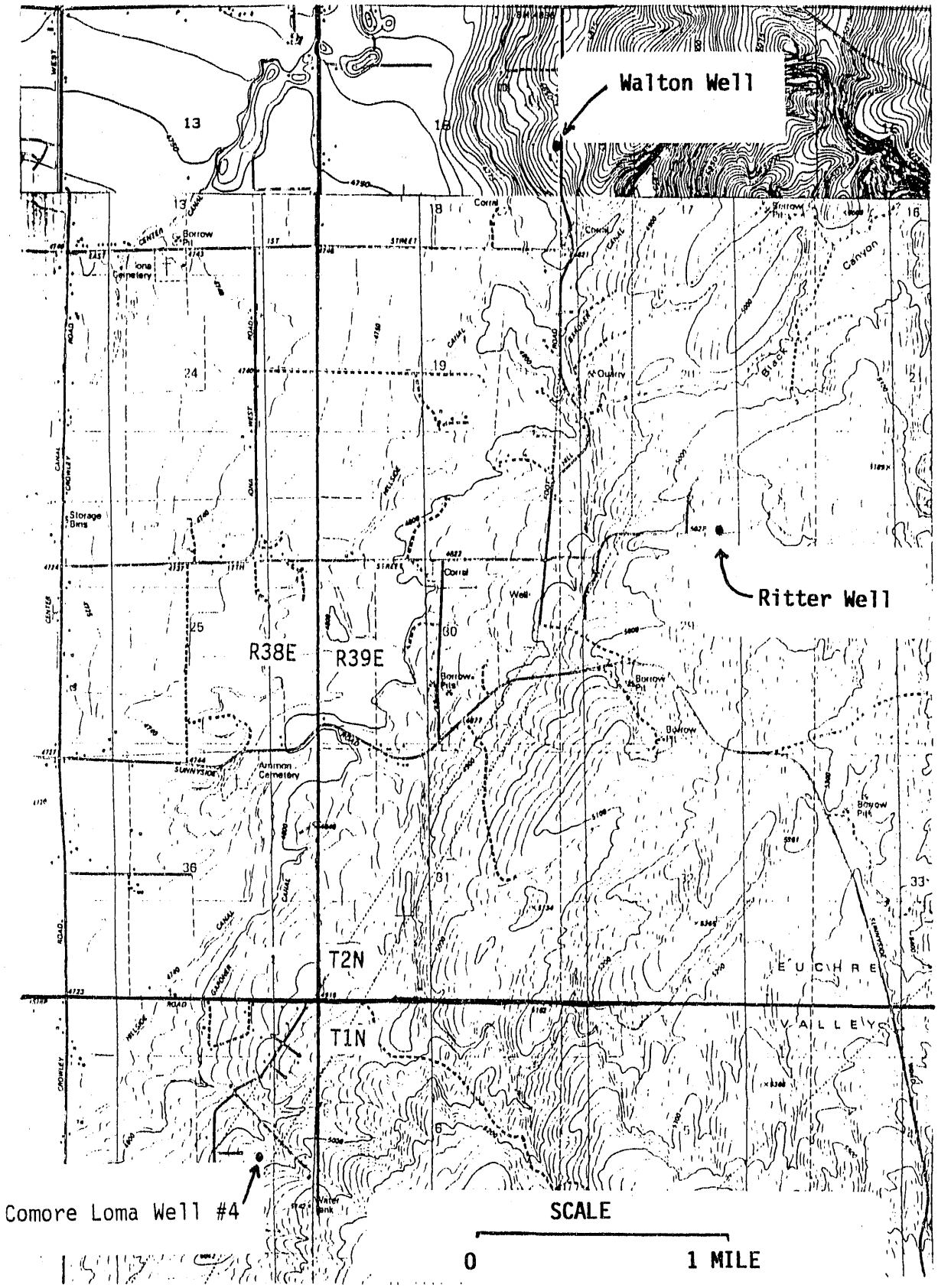


Figure 1. Location of wells.

is probably obtained from fractured rhyolite. The well is uncased from 37 feet to the bottom of the well at 431 ft. Water level in the well is at 355 ft, indicating 76 ft of saturation.

Water was pumped from the well at a rate of 10 to 14 gallons per minute. The well had 0.04 ft of drawdown during the test. All of the drawdown occurred in the first four minutes of the test, after which the water level did not change. This water level response precludes determination of transmissivity using classical methods based on the Theis analysis. Driscoll (1986) presents an empirical equation to estimate transmissivity:

$$Q/s = T/1500$$

where Q is discharge in gallons per minute (gpm), s is drawdown in ft, and T is transmissivity in gallons per day per ft. This well has a specific capacity of 350 gpm/ft and an estimate of transmissivity of 525,000 gpd/ft. Dividing this by a 76 ft saturated thickness gives an estimate of hydraulic conductivity of 6900 gpd/ft^2 (925 ft/day). These estimates are equivalent to those found in highly permeable basalts, karst limestones, clean sands, or gravel (Freeze and Cherry, 1979). The pumping water level in the well recovered to the original water level in 2 1/2 minutes after the pump was turned off. The hydraulic conductivity from this pump test is similar to the value determined by the pump test on well Comore Loma #4 (1300 ft/day).

Temperature and specific conductivity were measured in this well. The temperature of the water was 76°F (the well owners stated the water temperature has been measured as high as 80°F after extended pumping). The temperature is elevated above those measured in the Snake River Plain Aquifer and is similar to, but higher than measurements obtained from the Comore Loma #4 well (71°F). The specific conductivity was measured as 860 micromohs. This is similar to, but also higher than measurements from the Comore Loma well #4 (800 micromhos). The hydraulic, temperature, and chemical properties measured in the Ritter well are similar to those measured in the Comore Loma Well #4, tested previously. This infers the hydrologic conditions are similar between the sites, and the two wells may obtain water from the same aquifer.

4. WALTON WELL DATA

The Walton well is located in the NE 1/4 of the SE 1/4 of Section 18, Township 2, Range 39 in Bonneville County (Figure 1). This well is located one and 3/4 miles northwest of the Ritter well. This well is located closer to the Snake River Plain aquifer than the Ritter or Comore Loma #4 well and is at an elevation of 4860 ft, 200 ft lower than the Ritter well.

The well was drilled for Harold Lund in 1975. The depth to water is 167 ft below land surface. The water level was recorded at a depth of 164 ft below land surface at the time of drilling. Since the casing is located approximately one foot below land surface, this indicates the water level has dropped three to four feet since the well was drilled.

The water level elevation is approximately 4693 ft, about 12 ft lower than the water table in the Ritter well. Since ground water flow in the Snake River Plain aquifer is generally toward the southeast, the water level in wells in the Plain near the Ritter's well would be anticipated to be lower than in the Walton well. The hydraulic gradient near this site is estimated to be 20 ft per mile (Mundorff et. al. 1964). Projecting this gradient to this site suggests an approximate 20 ft head difference between the Ritter's well and a well in the Snake River Plain aquifer. This indicates the direction of ground water flow is from the foothills toward the Plain. Since, the elevations are taken off of topographic maps these measurements are only estimates, accurate to about 10 ft.

Water is obtained from pumice that underlies alternating layers of basalt and cinders. The well is uncased from 170 ft to the bottom of the well at 220 ft. The water level in the well is at a depth of 167 ft, indicating 56 ft of saturation.

Water was pumped from the well at a rate of nine to 11 gallons per minute. The well had a total of 0.03 ft of drawdown during the test. All of the drawdown occurred in the first half minute of the test and after which the water level stayed constant. This water level response precludes

determination of transmissivity using classical methods based on the Theis analysis. The equation listed above was used to estimate a transmissivity of 450,000 gpd/ft using the calculated specific capacity of 300 gpm/ft. Dividing this by a 56 ft saturated thickness gives an estimate of the hydraulic conductivity of 8000 gpd/ft^2 (1070 ft/day). The hydraulic conductivity of the Walton well is very close to values obtained from Comore Loma #4 and the Ritter well. These estimates are equivalent to those found in highly permeable basalts, karst limestones, and clean sands or gravel (Freeze and Cherry, 1979). The water level in the well recovered in two and a half minutes to the original water level following pump shutoff.

The temperature of the water was 70°F during the pumping test. The temperature is elevated above those measured in the Snake River Plain aquifer and is similar to measurements obtained from the Comore Loma #4 well (71°F). The specific conductivity was measured as 580 micromohs. This is significantly lower than values measured in the Comore Loma well #4 or the Ritter well (800 and 860 micromhos, respectively).

5. CONCLUSIONS

Single well pumping tests were performed in two wells in the foothills east of Idaho Falls, near the proposed sanitary landfill locations. Results from pumping tests indicate these wells have high hydraulic conductivities of approximately 1000 ft/day. The high hydraulic conductivities from the tests are comparable to those measured in the Snake River Plain aquifer. Water level data in these wells are consistent with the water table in the Snake River Plain aquifer and indicates ground water movement from the foothills toward the Plain. The high transmissivity suggests that water may move rapidly from the foothills area to mix with water in the Snake River Plain aquifer. Elevated water temperatures and high specific conductivities in these wells suggest the presence of a foothills aquifer that has distinguishable characteristics that could be used to separate the aquifers.

6. RECOMMENDATIONS

Elevated temperatures and higher specific conductivity in wells in the foothills east of Idaho Falls suggest a distinguishable aquifer system that extends from the Thunder Ridge area through Rim Rock to the Comore Loma subdivision. This area should be characterized to determine the boundary of the Snake River Plain Aquifer in this region. This can be done by examining the geology, hydrology and geochemical characteristics of wells in this area. Static water level measurements combined with well elevation surveys could be used to determine ground water flow directions and the hydraulic gradients in this region. Temperature and chemical data would help delineate the location of the boundary of the Snake River Plain aquifer and the foothills aquifer.

7. REFERENCES

1. Freeze R. A. and J. A. Cherry, 1979. *Groundwater*, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, 604 pp.

2. Mundorff, M. J., E. C. Crosthwaite, and C. Kilburn, 1964. *Groundwater for Irrigation in the Snake River Basin in Idaho*, U.S.Geological Survey Water-Supply Paper 1654, 244 pp.

APPENDIX A
DRILLER'S LOGS

USE TYPEWRITER OR BALL POINT PEN

State of Idaho
Department of Water Resource

WELL DRILLER'S REPORT

10-TG 1

RECEIVED
JUL 27 1977
Department of Water Resources
Eastern District Office

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

Name MIKE WATSON (Ritter)

Address 511 Davidson St. Idaho Falls, ID

Owner's Permit No. _____

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement

☐ Abandoned (describe method of abandoning)

3. PROPOSED USE

☒ Domestic ☐ Irrigation ☐ Test ☐ Other (specify type)

☐ Municipal ☐ Industrial ☐ Stock ☐ Waste Disposal or injection

4. METHOD DRILLED

☐ Cable ☒ Rotary ☐ Dug ☐ Other

5. WELL CONSTRUCTION

Diameter of hole 8 inches Total depth 431 feet

Casing schedule: ☒ Steel ☐ Concrete

Thickness	Diameter	From	To
.250 inches	8 inches	+1 feet	37 feet
_____ inches	_____ inches	_____ feet	_____ feet
_____ inches	_____ inches	_____ feet	_____ feet
_____ inches	_____ inches	_____ feet	_____ feet
_____ inches	_____ inches	_____ feet	_____ feet

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

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 _____

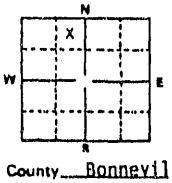
Placed from _____ feet to _____ feet

Surface seal depth 18' Material used in seal ☐ Cement grout ☒ Puddling clay ☐ Well cuttings

Sealing procedure used ☐ Slurry pit ☐ Temporary surface casing ☐ Overbore to seal depth

6. LOCATION OF WELL

Sketch map location must agree with written location.



Subdivision Name _____

Lot No. _____ Block No. _____

County Bonneville

NE ¼ NW ¼ Sec. 29 T. 2 N/S R. 39 E/W

7. WATER LEVEL

Static water level 365 feet below land surface

Flowing? ☐ Yes ☒ No G.P.M. flow _____

Temperature _____ ° F. Quality _____

Artesian closed-in pressure _____ p.s.i.

Controlled by ☐ Valve ☐ Cap ☐ Plug

8. WELL TEST DATA

☐ Pump ☐ Bailer ☒ Other Air

Discharge G.P.M.	Draw Down	Hours Pumped
25		

9. LITHOLOGIC LOG

Hole Diam.	Depth From	Depth To	Material	Water Yes	Water No
8	0	23	Clay		X
	23	40	Riolite		X
	40	73	Red Riolite & Clay		X
	73	106	Greystone		
	106	109	Riolite		
	109	157	Sandstone		
	157	165	Riolite		
	165	181	Grey Sandstone		
	181	190	Red Sandstone		X
	190	374	Sandstone	X	
	374	431	Broken Riolite	X	

10.

Work started 7/8/77 finished 7/11/77

11. DRILLERS CERTIFICATION

Firm Name DOUG CUSHMAN DRILLING CO. Firm No. 72

Address 945 S. Broadway Blkft., ID Date 7/13/77

Signed by (Firm Official) Doug Cushman

and

(Operator) Doug Cushman

875

USE TYPEWRITER OR BALL POINT PEN

State of Idaho
Department of Water Resources

WELL DRILLER'S REPORT

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

Name Harold Lund (walton)

Address Route 1 Box 184 Idaho Falls, Idaho

Owner's Permit No. _____

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement

☐ Abandoned (describe method of abandoning)

3. PROPOSED USE

☒ Domestic ☐ Irrigation ☐ Test ☐ Other (specify type)

☐ Municipal ☐ Industrial ☐ Stock ☐ Waste Disposal or Injection

4. METHOD DRILLED

☐ Cable ☒ Rotary ☐ Dug ☐ Other

5. WELL CONSTRUCTION

Diameter of hole 6 inches Total depth 220 feet

Casing schedule: ☒ Steel ☐ Concrete

Thickness	Diameter	From	To
.250 inches	6 inches	+ 1 feet	170 feet
_____ inches	_____ inches	_____ feet	_____ feet
_____ inches	_____ inches	_____ feet	_____ feet
_____ inches	_____ inches	_____ feet	_____ feet
_____ inches	_____ inches	_____ feet	_____ feet

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

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 _____

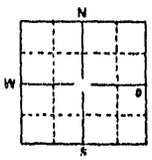
Placed from _____ feet to _____ feet

Surface seal depth 19+ Material used in seal ☐ Cement grout Bentonite ☒ Puddling clay ☐ Well cuttings

Sealing procedure used ☐ Slurry pit ☐ Temporary surface casing ☒ Overbore to seal depth

6. LOCATION OF WELL

Sketch map location must agree with written location.



Subdivision Name _____

Lot No. _____ Block No. _____

County Bonneville

NE ¼ SE ¼ Sec. 18, T. 2 N/S, R. 39 E/W

7. WATER LEVEL

Static water level 164 feet below land surface

Flowing? ☐ Yes ☒ No G.P.M. flow _____

Temperature _____ ° F. Quality Good

Artesian closed-in pressure _____ p.s.i.

Controlled by ☐ Valve ☐ Cap ☐ Plug

8. WELL TEST DATA

☐ Pump ☐ Bailer ☐ Other

Discharge G.P.M.	Draw Down	Hours Pumped

9. LITHOLOGIC LOG

Hole Diam.	Depth From	Depth To	Material	Water Yes	Water No
6	0	6	Topsoil		
	6	25	Firm Gray Basalt		
	25	27	Cinders		
	27	35	Firm Gray Basalt		
	35	38	Cinders		
	38	53	Firm Gray Basalt		
	53	55	Cinders		
	55	97	Firm Gray Basalt		
	97	135	Brown Pumice		
6	135	220	White Pumice	x	
			Water 165' to 180'		
			190' to 220'		

RECEIVED
DEC 22 1975
Department of Water Resources
Eastern District Office

10.

Work started August 16, 1975 finished Aug. 18, 1975

11. DRILLERS CERTIFICATION

Firm Name Andrew Well Drilling Contr. Firm No. 5

Address 1268 East 17th Street Idaho Falls, Idaho 83401 Date 12-18-75

Signed by (Firm Official) Howard L. Andrew

and

(Operator) Dale Kunze

IF ADDITIONAL SHEETS IS NECESSARY FORWARD THE WHITE COPY TO THE DEPARTMENT

APPENDIX B
FIELD WATER LEVEL DATA

WATER LEVEL/PUMPING TEST RECORD

333140010

PROJECT Camore Mesa WELL Ritter SITE 7245 E. Rimrock Drive

SCREEN SETTING _____ MEASURING POINT DESCRIPTION Top of steel casing HEIGHT ABOVE GROUND SURFACE 17 inches

STATIC WATER LEVEL 355.82 mp below MEASURED WITH Solinst DATE/TIME 8/14/91

DRAWDOWN [X] START OF TEST 0930 PUMPING WELL Ritter

RECOVERY [ ] END OF TEST 0950

DISTANCE FROM WELL MEASURED TO PUMPING WELL (r) NA DISCHARGE RATE _____ ORIFICE _____

home phone 529-2076
Paul office 526-6686

DATE & TIME	WELL OR t (mins)	HELD (ft)	WET (ft)	DEPTH TO WATER (ft)	s (ft)	DEW.[1] CORR. (ft)	ART.[2] s' (ft)		Q (gpm)	MANO-METER (in)	REMARKS[3]
0920	0			355.82	0				0		
0923	0			355.82	0				0		
0926	0			355.82	0				0		
0930.00	0			355.82	0				0		turn on pump
09:30:15	.25			355.87	.05						
09:30:30	.50			355.85	.03				10		
09:30:45	.75			355.85	.03						
09:31:00	1.0			355.85	.03						
9:31:30	1.5			355.86	.04				10.7		
9:32:00	2.0			355.85	.03						
9:32:30	2.5			355.85	.03				11.5		
9:33:00	3.0			355.85	.03						
9:33:30	3.5			355.86	.04				12.5		
9:34:00	4.0			355.86	.04						
9:34:30	4.5			355.86					13		
9:35:00	5			355.86							
9:35:30	5.5			355.86					13		
9:36:00	6			355.86							
9:36:30	6.5			355.86					13.6		
9:37:00	7			355.86							
9:37:30	7.5			355.86					13.6		
9:38:00	8			355.86							
9:38:30	8.5			355.86							
9:39:00	9			355.86							
9:40:00	10			355.86							
9:41:00	11			355.86							
9:42:00	12			355.86							
9:43:00	13			355.86	↓						

1) Dewatering Correction 2) Equivalent Artesian Drawdown 3) pH, Spec. Cond., Temp., Weather, Sand, Turbidity, etc.

WATER LEVEL/PUMPING TEST RECORD (Cont'd.) · PAGE 2 OF 2

PROJECT Camarc Loma WELL Ritter SITE 7245 E. Rimrock Drive
333140010

DATE & TIME	WELL OR t (mins)	HELD (ft)	WET (ft)	DEPTH TO WATER (ft)	s (ft)	DEW.[1] CORR. (ft)	ART.[2] s' (ft)		Q (gpm)	MANO-METER (in)	REMARKS[3]
09:44:00	14			355.86	.04				14.3		
09:45:00	15			355.86							
09:45:30	15.5			355.86							Turned on faucets in house, flushed toilets
09:46:00	16			355.86							
09:47:00	17			355.86							
09:48:00	18			355.86							
					JLM						
09:49:00	19			355.86							
09:50:00	20	t"		355.86	.04						shut off water
09:50:30	20.5	0		355.86	.04						pump shut off
09:50:45	20.75	15 sec		355.84	.02						
09:51:00	21	30 sec		355.84	.02						
09:51:15	21.25	1:15		355.83	.01						Recovery
09:51:30	21.5	1:30		355.83	.01						
09:52:00	22	2:00		355.83	.01						
09:53:00	23	2:30		355.82	.00						

$Q/s = 14/.04 = 350$ gpm/ft

JMH - Checked SC: 860 µmhos and temp 76°F on 9/4/91

1) Dewatering Correction 2) Equivalent Artesian Drawdown 3) pH, Spec. Cond., Temp., Weather, Sand, Turbidity, etc.

AQUIFER TEST DATA

Owner John Walton Address _____ County Bonneville State ID

Date 8/29/91 Company performing test EG+G Measured by J.M Hubbell

Well No T2N, R39E, Sec 18 Distance from pumping well — Type of test Pumping Test Test No 1

Measuring equipment Solinst

Time Data
Pump on: Date _____ Time _____ (t)
Pump off: Date _____ Time _____ (t')
Duration of aquifer test: Pumping _____ Recovery _____

Water Level Data
Static water level 167.50
Measuring point Top of 8" Casing
Elevation of measuring point Unk

Discharge Data
How Q measured Bucket
Depth of pump/air line _____
Previous pumping? Yes ____ No X
Duration _____ End _____

Comments on factors affecting test data

Date	Clock time	Time since pump started t	Time since pump stopped t'	t/t'	Water level measurement	Correction or Conversion	Water level	Water level change s or s'	Discharge measurement	Rate	Comments
8/29/91	Minute										
	2:54				167.50'			—			
	2:58:09				167.52'			—			
	3:04				167.52'			—			
	3:10				167.52'			—			
	3:16				167.51'			—			
	3:25				167.51'			—			
	3:28:00									11 gpm	Water Turned on
	3:29				167.51'			—		13	
	3:30									12 gpm	
											← Pump is Probably on -
	3:30.30	.5			167.54'			.03		9 gpm	Cannot Hear -
	3:31:10				167.54'			.03		9 gpm	
	3:33:00	3			167.54'			.03		9 gpm	
	333:50	3.5								9 gpm	
	3:34:00	4.0			167.54'			.03			
	3:36:00	6.0			167.54'			.03			Temp. 69°F
	3:40:00	10.0			167.54'			.03		9 gpm	68°F
	3:43:00	13.0			167.54'			.03			Collected water sample
	3:50:00	20.0			167.54'			.03			for S.C. Determination
	3:55:00	25.0			167.54'			.03		9 gpm	Temp 70°F
	4:00:00	30.0			167.53'			.02			
	4:07:00	37.0			167.54'			.03			
	4:11				167.53			.02		9 gpm	Temp 70°F
	4:12:00										Hoses off
	4:12 30				167.52					—	pump is st. // Running
	4:13 00				167.53					—	
	4:15:00				167.52					—	
					167.51						

AQUIFER TEST DATA

Owner John Walton Address _____ County _____ State _____

Date 8/29/91 Company performing test EG+G Measured by J. McHubbell

Well No. _____ Distance from pumping well — Type of test _____ Test No. _____

Measuring equipment _____

Time Data
Pump on: Date _____ Time _____ (t)
Pump off: Date _____ Time _____ (t')
Duration of aquifer test:
Pumping _____ Recovery _____

Water Level Data
Static water level _____
Measuring point _____
Elevation of measuring point _____

Discharge Data
How Q measured _____
Depth of pump/air line _____
Previous pumping? Yes ____ No ____
Duration _____ End _____

Date	Clock time	Time since pump started t	Time since pump stopped t'	t/t'	Water level measurement	Correction or Conversion	Water level	Water level change s or s'	Discharge measurement	Rate	Comments on factors affecting test data
4/	18:20		0		167.50					—0—	Pump off – Recovery
	19:20		1.0		167.50					—	
	20:10		1h		167.50					—0	
	21:20		3.0		167.50					—	
	26 20		8.0		167.50					—	The well started
	30		10.		167.50			Test Completed			showing Recovery as
											soon as the water hose
											were turned off - due
				Specific Capacity	= 9 gpm / 0.03 ft	= 300 gpm / ft					to pressure Resistance
											in well
											S.C. of fluid 580 μmhos
											Checked temp on thermometer

END

DATE
FILMED
6/08/92