

# Ground Water Report, Oregon Trail Subdivision, Twin Falls, Idaho

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## **Abstract**

This report presents monitoring results for ground water samples collected during 2004 at the Oregon Trail subdivision, located along Rock Creek about 5 miles southeast of Twin Falls, Idaho (Figure 1). The purpose of the sampling program was to establish ambient ground water nitrate conditions in the subdivision by sampling private domestic wells. The subdivision consists of lots in a 70-acre parcel of farm ground that historically was irrigated by flood irrigation. The original canal water shares were transferred to the lot owners but many people stopped using canal water because of problems with the distribution system. Five of the lots are 5 acres in size and the remainder of the lots range from 1.5 to 3.5 acres in size.

Lots in the subdivision are bordered by Rock Creek. Runoff from the lots can enter Rock Creek as overland flow or as shallow ground water return flow to the creek. Historically, Rock Creek has been contaminated by sediment, nutrients, E. coli bacteria, and high water temperatures. There were concerns that over-application of fertilizer coupled with uneven irrigation water distribution was contributing nutrients to Rock Creek either by direct surface runoff or to shallow ground water that discharged to Rock Creek.

Samples were collected from 20 locations during 2004. Samples were analyzed for calcium, magnesium, sodium, potassium, chloride, sulfate, total iron, total manganese, nitrate-nitrogen, total phosphorus, ammonia, arsenic, total coliform, E. coli, and the field parameters water temperature, pH, specific conductance, and dissolved oxygen.

The report provides baseline ground water quality information prior to implementation of subdivision-wide fertilizer and irrigation water management activities.

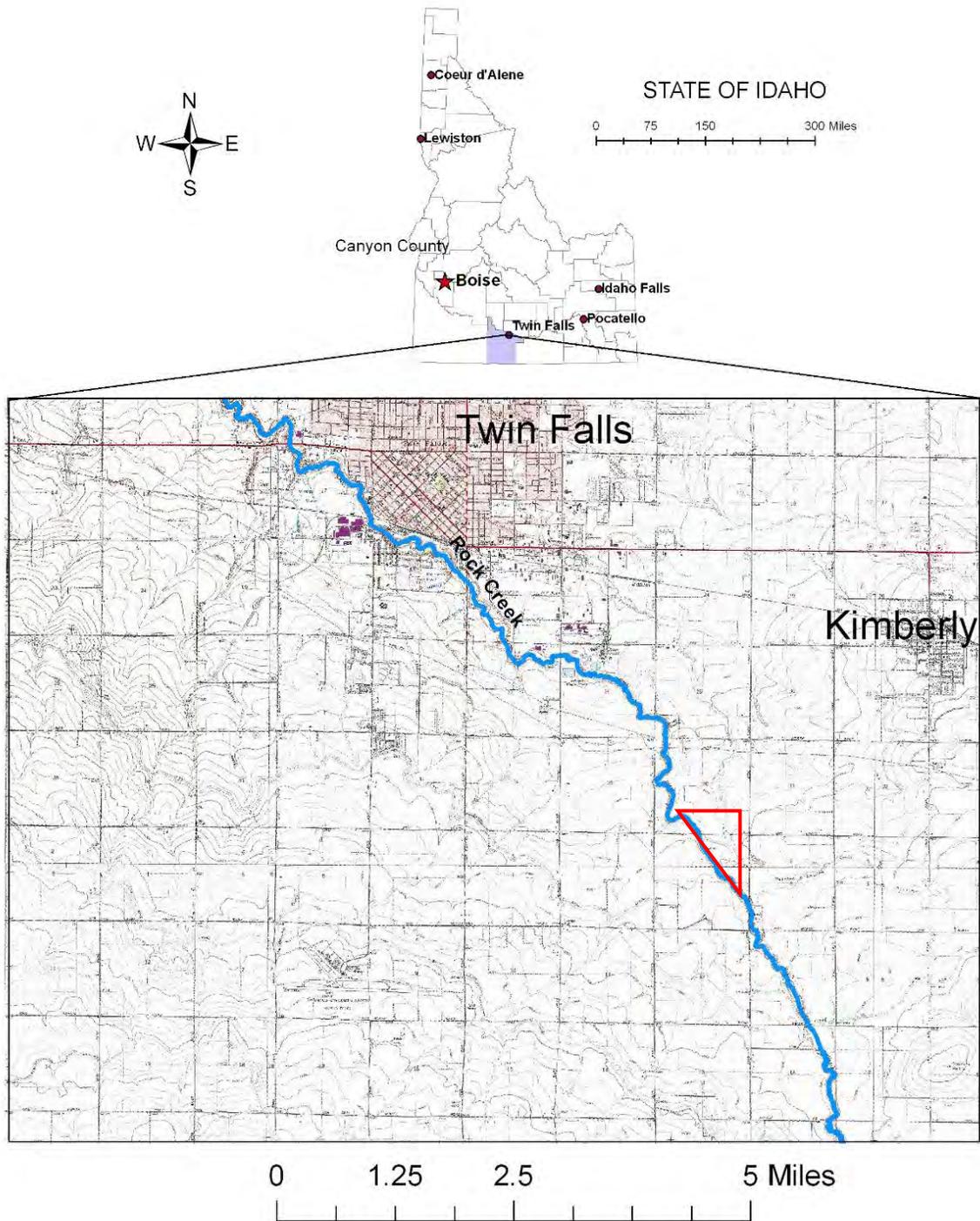
## **Introduction**

The purpose of this study was to evaluate ground water quality within the Oregon Trail subdivision, located south of Twin Falls, Idaho, in Township 11 South, Range 17 East, Northeast 1/4 of Section 1, and to provide baseline ground water quality information prior to implementation of subdivision-wide fertilizer and irrigation water management activities. The subdivision is located within the Twin Falls nitrate priority area (Figure 1), and is an isolated subdivision that was developed on 70 acres of farm ground. Lot sizes in the subdivision are 5 acres or less, and all lots are served by individual wells and onsite wastewater treatment systems (septic tank and drain field systems). (Appendix A describes the well numbering system used in this report.)

The lots are large by urban standards and each lot has some acreage devoted to pasture or other crops; animals are commonly kept on the lots. The original farm ground was flood-irrigated and the water rights and canal shares were retained as the land was subdivided, with some allocated to each lot. However, most lot owners discontinued use of the irrigation water and began using their domestic wells for irrigation. This was a violation of Idaho Department of Water Resources water rights requirements, which prohibit irrigating more than 0.5 acres with water withdrawn from a private domestic well. A pressurized irrigation system was installed for all lots and lot owners were taught to design fertilizer and water management plans. At the same time, there was a concern that fertilization practices and irrigation methods, combined with septic tank effluent discharge, were contributing nutrients to Rock Creek, which is contaminated by sediment, nutrients, E. coli bacteria, and high water temperatures.

To address these problems, the Rock Creek Demonstration Project was developed as a partnership between the Natural Resources Conservation Service (NRCS), the University of Idaho, the mid-Snake River Advisory Group, the Department of Environmental Quality (DEQ), and the residents of the Oregon Trail subdivision. The goals of the demonstration project were to offer education programs to the residents on efficient soil fertilization and water management, to reduce irrigation water runoff to Rock Creek and to protect ground water from contamination. Shallow ground water on either side of Rock Creek discharges to the creek.

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**Figure 1.** Location of Oregon Trail subdivision (red triangle) south of Twin Falls, Idaho.

## **Climate**

The area around the Oregon Trail subdivision is characterized by warm, dry summers and cool, moist winters (Molenaar, 1988). The mean annual precipitation for the period 1963-2005 at the Twin Falls Weather Service Office (WSO) was 10.08 inches (Western Region Climate Center, 2005).

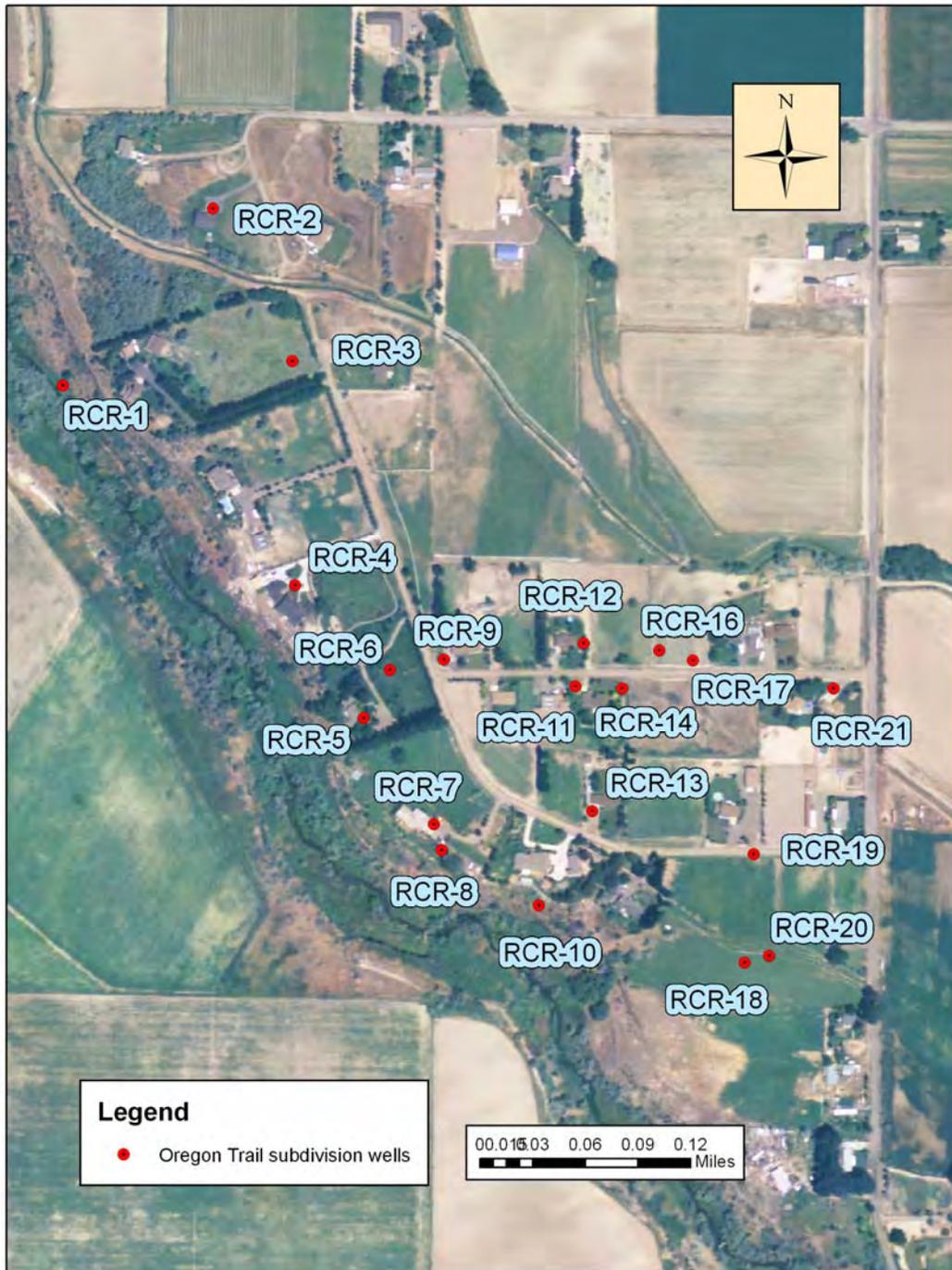
## **Hydrogeology**

The Oregon Trail area is situated on the southern edge of the Eastern Snake River Plain (ESRP) regional aquifer system, on the south side of the Snake River. The aquifer is composed of layered basalt flows and interbedded cinder deposits. Buried soil horizons, which drillers identify as shale in drillers' logs, and ash deposits which may be identified in drillers' logs as talc, are also interbedded within the basalt flows. Gravel units that also are noted on drillers' logs, could represent former channels of the Snake River or possibly drainages associated with Rock Creek. Examples of drillers' logs from wells in the subdivision are included in Appendix B.

The ESRP aquifer is an unconfined aquifer. On the south side of the Snake River, ground water generally flows north toward the river. On either side of Rock Creek, ground water flows toward the creek and is a source of water in the creek. The depth to water in the drillers' logs included in Appendix B ranges from 26 to 75 feet below land surface. The shallow water levels may reflect perched aquifers where water accumulates on low permeability basalt flows.

## **Methods**

Ground water monitoring was conducted at private domestic wells in the subdivision to evaluate ambient ground water quality. Twenty wells were sampled during 2004. Locations of the wells are shown on the map in Figure 2. Analytes included the field parameters pH, specific conductance, dissolved oxygen, and water temperature. Inorganic analytes included calcium, magnesium, sodium, potassium, chloride, sulfate, total iron, total manganese, total arsenic, nitrate-nitrogen, total phosphorus, and ammonia. Total coliform and *Escherichia coli* (commonly, *E. coli*) bacteria also were analyzed. Samples were collected four times during 2004 at most wells.



**Figure 2.** Locations of private domestic wells sampled in the Oregon Trail subdivision during 2004.

**Results**

Nitrate results are listed in Table 1, included with the nitrate results discussion. Results for the field parameters are listed in Table 2, total coliform and E. coli results are listed in Table 3, and the major ion results are listed in Table 4, all three of which are provided at the end of the report.

***Field Parameters and Major Ions***

Field parameters measured at the time of sample collection included pH, specific conductance, dissolved oxygen, and water temperature. Specific conductance is an indication of the mineral content of water. Water with a higher mineral content has a higher specific conductance value. Specific conductance values in Oregon Trail samples ranged from 542 to 1,469 microSiemens per centimeter ( $\mu\text{S}/\text{cm}$ ) with a mean of 845 and a median of 821  $\mu\text{S}/\text{cm}$  (n=75). Eighty-eight percent of the Oregon Trail samples had a specific conductance value less than 1,000  $\mu\text{S}/\text{cm}$ . Neely (2001) reported a median specific conductance value of 872  $\mu\text{S}/\text{cm}$  for wells sampled in the Twin Falls hydrogeologic subarea.

Elevated chloride concentrations can be an indicator of ground water contamination. The secondary maximum contaminant level (MCL) for chloride is 250 mg/L. Sources of chloride to ground water include chloride in precipitation, chloride in septic tank effluent, chloride from road salting, and chloride from crop fertilizers such as potassium chloride. Chloride concentrations in Oregon Trail subdivision samples ranged from 26 to 69 mg/L with a mean of 45 mg/L (n = 56).

***Nitrate***

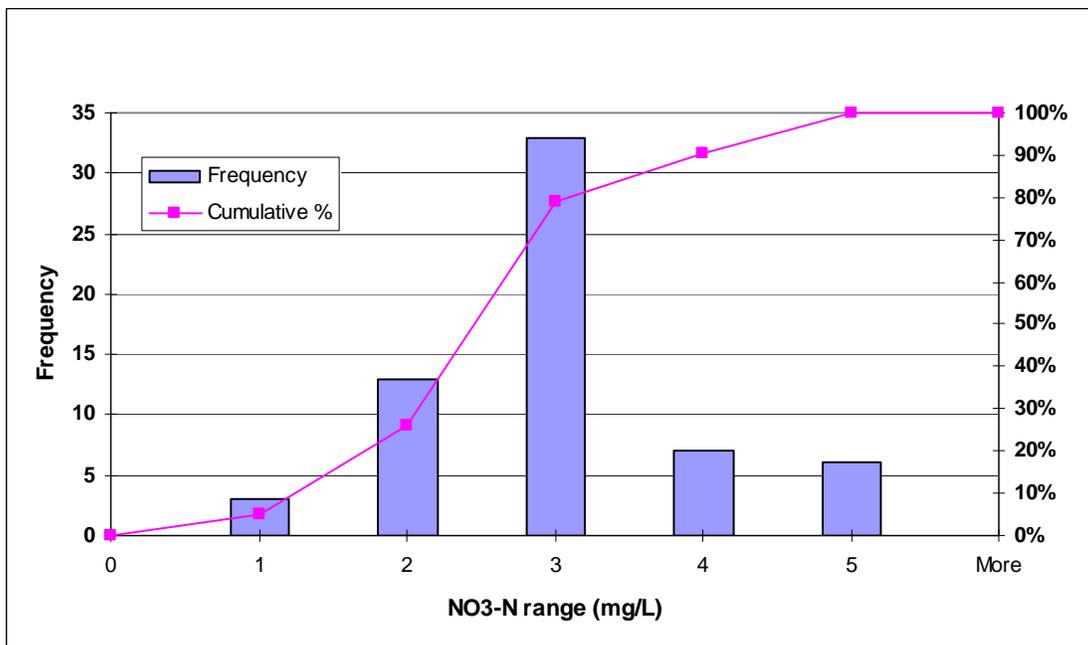
Table 1 lists mean nitrate concentrations for samples collected from wells in the subdivision. Wells were sampled from 2 to 4 times during 2004, and mean  $\text{NO}_3\text{-N}$  concentrations per well ranged from 1.24 to 4.10 milligrams per liter (mg/L). Individual  $\text{NO}_3\text{-N}$  sample results ranged from 0.39 to 4.51 mg/L (Table 1).

**Table 1.** Mean  $\text{NO}_3\text{-N}$  concentrations for samples collected from wells in the Oregon Trail subdivision in 2004. n = number of samples.

Site ID	n	Mean $\text{NO}_3\text{-N}$	$\text{NO}_3\text{-N}$ std. dev.
RCR-1	4	2.25	0.41
RCR-2	3	2.56	0.12
RCR-3	4	2.18	0.77
RCR-4	3	2.15	0.09
RCR-5	3	1.38	0.30
RCR-6	4	2.08	0.47
RCR-7	2	2.00	0.21
RCR-8	4	3.32	1.45
RCR-9	4	3.81	0.76
RCR-10	2	1.24	0.52
RCR-11	2	2.13	0.15
RCR-12	2	2.18	0.13
RCR-13	3	2.02	0.03
RCR-14	2	2.31	0.16

RCR-16	2	4.10	0.40
RCR-18	2	2.98	0.11
RCR-19	4	2.77	0.43
RCR-20	4	2.23	0.47
RCR-21	2	3.65	0.32

Figure 3, a histogram of NO<sub>3</sub>-N values for samples collected during the sample events, shows that 80 percent of the sample concentrations were less than 3 mg/L and 100 percent were less than 5 mg/L. In Idaho, if the nitrate concentration in 25 percent of wells sampled in an area exceeds one half the NO<sub>3</sub>-N MCL (NO<sub>3</sub>-N MCL = 10 mg/L), the area can be designated a Nitrate Priority Area. The mean nitrate concentration for all wells in the subdivision was less than 5 mg/L. An evaluation for nitrate trends or seasonality could not be conducted because too few samples were collected.



**Figure 3.** Histogram of NO<sub>3</sub>-N concentrations for samples collected during 2004 at Oregon Trail subdivision wells.

***Bacteria***

Samples collected in 2004 were analyzed for total coliform and E. coli. Results, listed in Table 3, show that total coliform was detected in 4 samples. There were no E. coli detections in any of the samples.

***Arsenic***

The Idaho Ground Water Quality Standard for arsenic in ground water is 50 µg/L (0.050 mg/L). The Environmental Protection Agency (EPA) drinking water MCL for arsenic is 10 µg/L. All residents in the subdivision use ground water as their drinking water source so arsenic concentrations should be evaluated with respect to the arsenic MCL of 10 µg/L. Arsenic is a trace element that can occur naturally in ground water. Neely (2001) noted that arsenic concentrations greater than 10 µg/L occurred throughout the Twin Falls hydrogeologic subarea. Of the 20 wells sampled in the Oregon Trail

subdivision, only three wells had arsenic concentrations below 10 µg/L for all sample events. The remainder of the wells had arsenic concentrations that were greater than 10 µg/L for one or more sample events. Arsenic concentrations ranged from less than the laboratory detection limit of 5 µg/L (0.005 mg/L) to 39 µg/L (0.039 mg/L).

### ***Phosphorus***

The Rock Creek Total Maximum Daily Load (TMDL) is included in the Upper Snake-Rock TMDL. The ground water TMDL limit is 0.020 mg/L as total phosphorus. Levels above this limit indicate contamination. Levels below this limit are basically meeting the TMDL water quality standard for this creek. Phosphorus results, as listed in Table 4 show that the phosphorus TMDL was equaled or exceeded in 14 of the 20 wells for one or more sample events.

### **Conclusions**

Samples were collected from 20 domestic wells in the Oregon Trail subdivision during 2004 to evaluate ground water conditions. A pressurized irrigation system supplied by canal water was installed at all lots to reduce surface runoff and also to reduce contaminants in shallow ground that discharges to Rock Creek. Lot owners were educated on soil fertility, fertilization practices, and methods for efficient irrigation water management.

The mean field specific conductance value for 75 samples was 845 µS/cm, and the median value was 821 µS/cm. In a study conducted across Twin Falls County, the median specific conductance value was 872 µS/cm.

Chloride concentrations in samples ranged from 26 to 69 mg/L with a mean of 45 mg/L (n = 56). This is well below the secondary MCL for chloride of 250 mg/L. Neely (2001) found that mean chloride concentrations across Twin Falls County were about 41 mg/L.

The mean nitrate concentration for 20 wells sampled in the subdivision ranged from 1.24 to 4.10 mg/L. Individual nitrate concentrations for all samples ranged from 0.39 to 4.51 mg/L. Eighty percent of nitrate concentrations in the samples were less than 3 mg/L and 100 percent were less than 5 mg/L. An evaluation for trends or seasonality in nitrate concentrations could not be conducted because too few samples were collected.

There were four detections of total coliform bacteria in the samples. E. coli bacteria were not detected in any of the samples.

Arsenic concentrations ranged from less than the laboratory detection limit of 5 µg/L (0.005 mg/L) to 39 µg/L (0.039 mg/L). Samples from three wells were all below the arsenic MCL of 10 µg/L (0.010 mg/L); samples from the rest of the wells all exceeded the MCL for one or more sample events.

Samples from 14 of 20 wells equaled or exceeded the phosphorus TMDL of 0.02 mg/L on one or more sample events. Additional nitrate and phosphorus sample analysis should be conducted in the future to evaluate the effectiveness of the fertilizer and water management activities.

## **References**

Neely, K.W, 2001. Ground water quality in the Twin Falls Hydrogeologic subarea, 1991-2000: Idaho Department of Water Resources, Water Information Bulletin No. 50, part 4, 66p.

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**Table 2.** Field parameters for private domestic wells sampled in the Oregon Trail subdivision.

Site ID	Sample	Temp	D.O. <sup>a</sup>	Sp Cond <sup>c</sup>	pH
	Date	deg C	mg/L <sup>b</sup>	uS/cm <sup>d</sup>	Units
RCR-1	5/12/2004	13.51	6.73	1243	6.92
RCR-1	10/25/2004	13.96	4.49	1349	7.23
RCR-1	12/1/2004	13.02	5.29	960	7.04
RCR-1	12/20/2004	13.35	5.1	948	7.12
RCR-2	11/1/2004	14.3	5.16	943.4	7.36
RCR-2	11/30/2004	13.35	5.74	776	7.48
RCR-2	12/22/2004	12.93	5.63	793	7.46
RCR-3	5/12/2004	12.82	8.5	1175	7.05
RCR-3	6/2/2004	-	-	-	-
RCR-3	10/25/2004	13.78	5.06	1469	7.25
RCR-3	12/1/2004	12.37	3.25	845	7.3
RCR-3	12/20/2004	12.52	5.74	821	7.44
RCR-4	10/27/2004	13.75	4.96	1035	7.36
RCR-4	11/29/2004	13.33	5.6	781	7.21
RCR-4	12/21/2004	13.46	6.27	750	7.23
RCR-5	10/27/2004	14.35	4.38	840	7.26
RCR-5	11/29/2004	14.14	5.23	715	7.26
RCR-5	12/21/2004	14.19	5.06	718	7.3
RCR-6	5/12/2004	13.95	6.32	942	7.02
RCR-6	10/25/2004	14.16	3.93	956	7.38
RCR-6	11/1/2004	-	-	-	-
RCR-6	12/1/2004	13.93	5.28	730	7.22
RCR-6	12/20/2004	13.83	5.09	729	7.28
RCR-7	10/27/2004	14.55	4.18	797	7.3
RCR-7	11/30/2004	14.33	4.58	646	7.16
RCR-7	12/21/2004	13.73	4.77	652	7.29
RCR-8	5/12/2004	13.99	6.73	1055	6.97
RCR-8	10/25/2004	14.68	3.84	855	7.11
RCR-8	12/1/2004	14.25	5.17	827	7.05
RCR-8	12/20/2004	13.95	5.26	846	7.18
RCR-9	10/25/2004	14.6	5.12	946	7.5
RCR-9	12/1/2004	13.36	5.38	774	7.25
RCR-9	12/20/2004	13.33	5.25	786	7.42
RCR-10	5/12/2004	15.86	6.38	891	6.88
RCR-10	5/12/2004	13.79	6.83	910	6.97
RCR-10	10/25/2004	15.89	3.68	735	7.18
RCR-10	10/25/2004	14.37	7.88	791	7.24
RCR-10	12/1/2004	15.3	4.31	641	7.09
RCR-10	12/20/2004	15.04	4.78	659	7.24

**Table 2 (concluded).** Field parameters for private domestic wells sampled in the Oregon Trail subdivision.

RCR-11	10/27/2004	14.68	4.9	1097	7.24
RCR-11	11/29/2004	14.41	4.5	719	7.15
RCR-11	12/21/2004	14.52	4.55	706	7.21
RCR-12	10/27/2004	14.48	5.06	910	7.29
RCR-12	11/29/2004	13.4	4.65	729	7.24
RCR-12	12/21/2004	13.53	5.34	732	7.39
RCR-13	11/1/2004	13.97	4.94	830.2	8.31
RCR-13	11/29/2004	13.36	4.95	691	7.25
RCR-13	12/22/2004	13.11	5.71	668	6.8
RCR-14	10/27/2004	14.38	5.62	1163	7.26
RCR-14	11/29/2004	13.76	5.45	861	7.14
RCR-14	12/21/2004	13.92	5.34	846	7.2
RCR-16	10/27/2004	13.68	4.95	996	7.61
RCR-16	11/29/2004	11.75	5.45	769	7.23
RCR-16	12/21/2004	11.4	5.75	777	7.26
RCR-17	5/12/2004	14.13	6.18	973	7.11
RCR-18	10/27/2004	13.92	4.88	906	7.35
RCR-18	11/29/2004	12.86	5.39	728	7.22
RCR-18	12/21/2004	12.53	5.29	722	7.32
RCR-19	5/12/2004	13.17	6.63	971	6.75
RCR-19	5/12/2004	13.32	6.27	876	6.92
RCR-19	10/25/2004	13.08	5.46	919	7.26
RCR-19	12/1/2004	11.85	5.74	745	7.25
RCR-19	12/20/2004	11.14	5.39	727	7.1
RCR-20	10/25/2004	9.52	4.85	843	7.11
RCR-20	12/1/2004	13.22	5.16	691	7.15
RCR-20	12/20/2004	12.86	5.09	702	7.28
RCR-21	10/27/2004	13.03	5.28	903	7.46
RCR-21	11/29/2004	12.93	5.58	726	7.27
RCR-21	12/21/2004	12.91	6.06	749	7.33
a. D.O. – dissolved oxygen b. mg/L – milligrams per liter c. Sp Cond – specific conductance d. uS/cm – microSiemens per centimeter					

**Table 3.** Total coliform and E. coli results for private domestic wells sampled in the Oregon Trail subdivision. Dash (-) indicates no sample was collected.

Site ID	Sample	T Coliform	E. coli.
	Date	MPN/100 mL	MPN/100 mL
RCR-1	5/12/2004	0	0
RCR-1	10/25/2004	<1	<1
RCR-1	12/1/2004	<1	<1
RCR-1	12/20/2004	<1	<1
RCR-2	11/1/2004	<1	<1
RCR-2	11/30/2004	<1	<1
RCR-2	12/22/2004	<1	<1
RCR-3	5/12/2004	Presence <1/100ml.	Presence <1/100ml.
RCR-3	6/2/2004	<1	<1
RCR-3	10/25/2004	1	<1
RCR-3	12/1/2004	1	<1
RCR-3	12/20/2004	<1	<1
RCR-4	10/27/2004	1	<1
RCR-4	11/29/2004	<1	<1
RCR-4	12/21/2004	27	<1
RCR-5	10/27/2004	<1	<1
RCR-5	11/29/2004	<1	<1
RCR-5	12/21/2004	<1	<1
RCR-6	5/12/2004	0	0
RCR-6	10/25/2004	-	-
RCR-6	11/1/2004	<1	<1
RCR-6	12/1/2004	<1	<1
RCR-6	12/20/2004	<1	<1
RCR-7	10/27/2004	<1	<1
RCR-7	11/30/2004	<1	<1
RCR-7	12/21/2004	<1	<1
RCR-8	5/12/2004	0	0
RCR-8	10/25/2004	1	<1
RCR-8	12/1/2004	<1	<1
RCR-8	12/20/2004	<1	<1
RCR-9	10/25/2004	<1	<1
RCR-9	12/1/2004	<1	<1
RCR-9	12/20/2004	<1	<1
RCR-10	5/12/2004	Presence	0
RCR-10	5/12/2004	0	0
RCR-10	10/25/2004	<1	<1
RCR-10	10/25/2004	3	<1
RCR-10	12/1/2004	<1	<1
RCR-10	12/20/2004	<1	<1
RCR-11	10/27/2004	1	<1
RCR-11	11/29/2004	<1	<1
RCR-11	12/21/2004	<1	<1

**Table 3 (concluded).** Total coliform and E. coli results for private domestic wells sampled in the Oregon Trail subdivision.

Site ID	Sample	T Coliform	E. coli.
	Date	MPN/100 mL	MPN/100 mL
RCR-12	10/27/2004	<1	<1
RCR-12	11/29/2004	<1	<1
RCR-12	12/21/2004	<1	<1
RCR-13	11/1/2004	<1	<1
RCR-13	11/29/2004	<1	<1
RCR-13	12/22/2004	<1	<1
RCR-14	10/27/2004	1	<1
RCR-14	11/29/2004	<1	<1
RCR-14	12/21/2004	<1	<1
RCR-16	10/27/2004	3	<1
RCR-16	11/29/2004	<1	<1
RCR-16	12/21/2004	<1	<1
RCR-17	5/12/2004	0	0
RCR-18	10/27/2004	<1	<1
RCR-18	11/29/2004	<1	<1
RCR-18	12/21/2004	<1	<1
RCR-19	5/12/2004	0	0
RCR-19	5/12/2004	0	0
RCR-19	10/25/2004	<1	<1
RCR-19	12/1/2004	<1	<1
RCR-19	12/20/2004	<1	<1
RCR-20	10/25/2004	<1	<1
RCR-20	12/1/2004	<1	<1
RCR-20	12/20/2004	<1	<1
RCR-21	10/27/2004	2	<1
RCR-21	11/29/2004	<1	<1
RCR-21	12/21/2004	<1	<1

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**Table 4.** Analytical results from the Oregon Trail subdivision. (Ca = calcium, Cl = chloride, Total Fe = total iron, Mg = magnesium, Total Mn = total manganese, NO<sub>3</sub>-N = nitrate as nitrogen, Total P = total phosphorus, K = potassium, Na = sodium, SO<sub>4</sub> = sulfate, NH<sub>4</sub> = ammonia, As = arsenic, TDS = total dissolved solids). Dash (-) indicates sample was not collected.

Site ID	Sample Date	Ca mg/L	Cl mg/L	Total Fe mg/L	Mg mg/L	Total Mn mg/L	NO <sub>3</sub> -N mg/L	Total P mg/L	K mg/L	Na mg/L	SO <sub>4</sub> mg/L	NH <sub>4</sub> mg/L	As mg/L
RCR-1	5/12/2004	195	55	<0.05	30.2	<0.05	2.8	-	4.2	36.2	260	<0.04	
RCR-1	10/25/2004	191	59.1	<0.01	31	<0.002	1.8	0.029	4.4	36	287	<0.005	0.011
RCR-1	12/1/2004	181	54.9	0.02	31	<0.002	2.16	0.025	4.5	35	252	<0.005	0.009
RCR-1	12/20/2004	177	54.4	0.02	31	<0.002	2.25	0.023	4.7	36	235	<0.005	0.006
RCR-2	11/1/2004	-	-	-	-	-	-	-	-	-	-	-	-
RCR-2	11/30/2004	109	54.9	0.02	42	<0.002	2.51	0.019	8.3	51	192	<0.005	<0.005
RCR-2	12/22/2004	113	57.9	0.02	43	<0.002	2.7	0.018	8.2	52	200	<0.005	<0.005
RCR-3	5/12/2004	203	39	<0.05	26.7	<0.05	1.04	-	3.4	31	313	<0.04	-
RCR-3	6/2/2004	-	-	-	-	-	-	-	-	-	-	-	-
RCR-3	10/25/2004	254	68.7	<0.01	32	<0.002	2.72	0.032	3.9	34	428	<0.005	0.033
RCR-3	12/1/2004	136	49.2	<0.01	37	<0.002	2.49	0.019	7	41	219	<0.005	0.01
RCR-3	12/20/2004	130	46.6	<0.01	39	<0.002	2.48	0.015	7.3	43	205	<0.005	0.007
RCR-4	10/27/2004	-	-	-	-	-	-	-	-	-	-	-	-
RCR-4	11/29/2004	119	53.7	<0.01	38	<0.002	2.1	0.016	5.2	39	160	<0.005	<0.005
RCR-4	12/21/2004	119	57.1	<0.01	36	<0.002	2.25	0.019	5.1	39	148	<0.005	<0.005
RCR-5	10/27/2004	-	-	-	-	-	-	-	-	-	-	-	-
RCR-5	11/29/2004	130	40.4	0.06	26	<0.002	1.41	0.016	4.6	31	132	<0.005	<0.005
RCR-5	12/21/2004	133	43.3	<0.01	26	<0.002	1.66	0.017	4.6	32	140	<0.005	<0.005
RCR-6	5/12/2004	128	43	<0.05	29.3	<0.05	2.62	-	4.2	38.7	171	<0.04	-
RCR-6	10/25/2004	118	38.3	<0.01	26	<0.002	1.5	0.02	4.4	37	153	<0.005	0.015
RCR-6	11/1/2004	-	-	-	-	-	-	-	-	-	-	-	-
RCR-6	12/1/2004	121	40.1	0.02	29	<0.002	1.98	0.019	4.5	37	149	<0.005	0.014
RCR-6	12/20/2004	124	41.3	<0.01	29	<0.002	2.21	0.02	4.3	38	145	<0.005	0.014
RCR-7	10/27/2004	-	-	-	-	-	-	-	-	-	-	-	-
RCR-7	11/30/2004	102	34.7	<0.01	26	<0.002	1.85	0.023	4.1	34	104	<0.005	0.015
RCR-7	12/21/2004	109	36.2	<0.01	28	<0.002	2.14	0.02	4.1	35	110	<0.005	0.014
RCR-8	5/12/2004	133	58	<0.05	36.8	<0.05	4.24	-	4.4	42.1	137	<0.04	-
RCR-8	10/25/2004	100	36.9	0.02	24	<0.002	1.18	0.035	3.7	34	86.6	<0.005	0.013
RCR-8	12/1/2004	130	54	<0.01	37	<0.002	3.66	0.021	4.6	44	131	<0.005	0.007
RCR-8	12/20/2004	138	56.5	<0.01	39	<0.002	4.21	0.022	4.5	46	139	<0.005	0.005

Ground Water Report, Oregon Trail Subdivision, Twin Falls, Idaho

**Table 4 (continued).** Analytical results for sample locations in the Oregon Trail subdivision study area. (Ca = calcium, Cl = chloride, Total Fe = total iron, Mg = magnesium, Total Mn = total manganese, NO<sub>3</sub>-N = nitrate as nitrogen, Total P = total phosphorus, K = potassium, Na = sodium, SO<sub>4</sub> = sulfate, NH<sub>4</sub> = ammonia, As = arsenic, TDS = total dissolved solids).

Site ID	Sample Date	Ca mg/L	Cl mg/L	Total Fe mg/L	Mg mg/L	Total Mn mg/L	NO <sub>3</sub> -N mg/L	Total P mg/L	K mg/L	Na mg/L	SO <sub>4</sub> mg/L	NH <sub>4</sub> mg/L	As Mg/L
RCR-9	10/25/2004	107	40.2	<0.01	31	<0.002	2.76	0.021	3.4	45	145	<0.005	0.022
RCR-9	12/1/2004	112	51.4	0.01	34	<0.002	4.23	0.02	3.6	49	146	<0.005	0.019
RCR-9	12/20/2004	118	53	0.01	36	<0.002	4.47	0.019	3.6	51	152	<0.005	0.018
RCR-10	5/12/2004	118	57	<0.05	26	<0.05	1.6	-	3.4	34.8	89	<0.04	-
RCR-10	5/12/2004	127	48	<0.05	25.4	<0.05	2.27	-	3.5	35.1	123	<0.04	-
RCR-10	10/25/2004	95	26.2	0.02	22	<0.002	0.87	0.037	3.5	28	71.6	<0.005	0.016
RCR-10	10/25/2004	104	29.6	0.11	22	<0.002	1.2	0.029	3.4	32	83	<0.005	0.017
RCR-10	12/1/2004	106	33.3	0.04	25	<0.002	2	0.035	3.8	31	107	<0.005	0.014
RCR-10	12/20/2004	113	35.3	<0.01	26	<0.002	2.17	0.029	3.7	32	117	<0.005	0.012
RCR-11	10/27/2004	-	-	-	-	-	-	-	-	-	-	-	-
RCR-11	11/29/2004	132	36	0.11	24	<0.002	2.02	0.022	2.4	35	143	<0.055	0.031
RCR-11	12/21/2004	131	37.8	0.05	24	<0.002	2.23	0.02	3.4	35	140	<0.005	0.026
RCR-12	10/27/2004	-	-	-	-	-	-	-	-	-	-	-	-
RCR-12	11/29/2004	1.8	36.9	0.01	0.3	<0.002	2.09	0.024	0.8	220	115	<0.005	0.028
RCR-12	12/21/2004	0.3	38.5	<0.01	<0.1	<0.002	2.27	0.023	0.3	225	124	<0.005	0.026
RCR-13	11/1/2004	-	-	-	-	-	-	-	-	-	-	-	-
RCR-13	11/29/2004	100	43.1	<0.01	34	<0.002	1.99	0.016	5.2	37	117	<0.005	<0.005
RCR-13	12/22/2004	102	44.9	<0.01	32	<0.002	2.04	0.017	5	36	115	<0.005	<0.005
RCR-14	10/27/2004	-	-	-	-	-	-	-	-	-	-	-	-
RCR-14	11/29/2004	157	51.6	0.02	29	<0.002	2.2	0.021	3.6	41	204	<0.005	0.03
RCR-14	12/21/2004	160	52.7	0.01	30	<0.002	2.42	0.02	4	40	206	<0.005	0.02
RCR-16	10/27/2004	-	-	-	-	-	-	-	-	-	-	-	-
RCR-16	11/29/2004	113	48.1	0.01	34	<0.002	3.81	0.018	4	48	150	<0.005	0.017
RCR-16	12/21/2004	119	51.6	0.01	36	<0.002	4.38	0.019	4	50	158	<0.005	0.015
RCR-17	5/12/2004	118	46	<0.05	33.8	<0.05	3.76	-	3.6	47	176	<0.04	-
RCR-18	10/27/2004	-	-	-	-	-	-	-	-	-	-	-	-
RCR-18	11/29/2004	119	41.1	0.1	29	<0.002	2.9	0.021	3.8	38	140	<0.005	0.025
RCR-18	12/21/2004	122	42.4	0.1	30	0.002	3.06	0.023	3.7	39	143	<0.005	0.025

Ground Water Report, Oregon Trail Subdivision, Twin Falls, Idaho

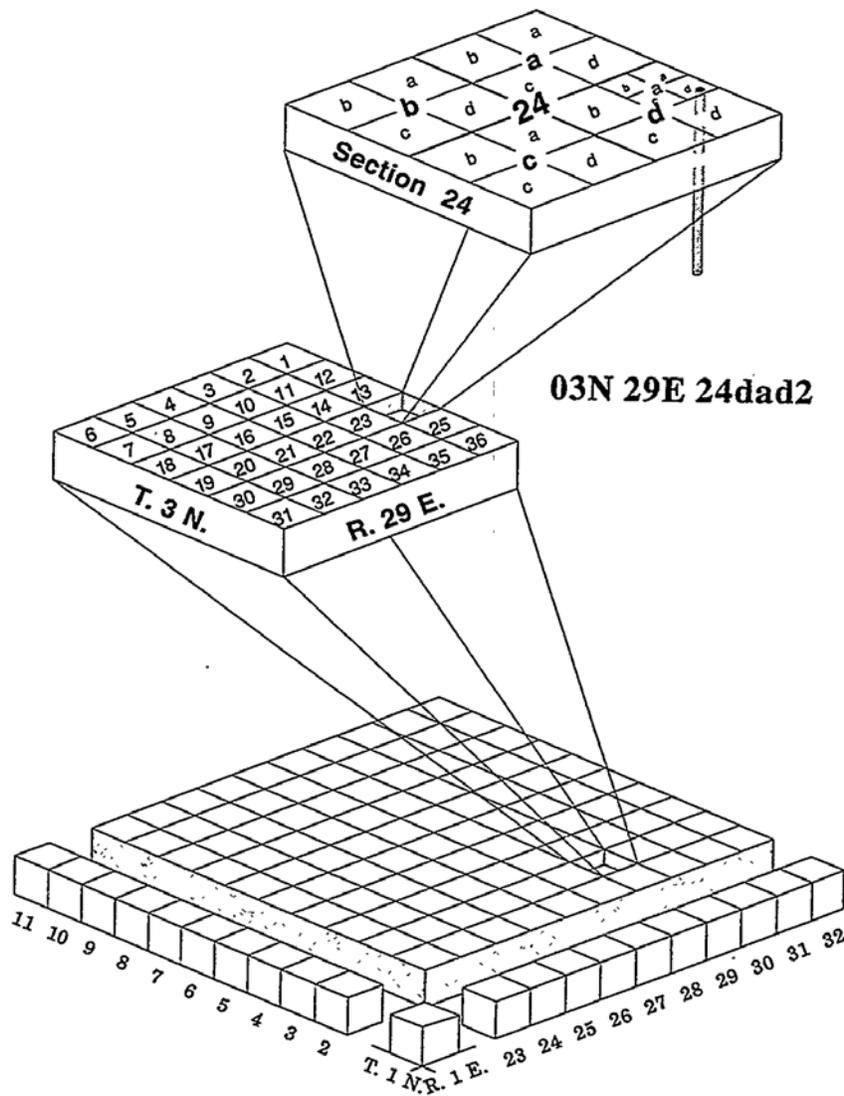
**Table 4 (concluded).** Analytical results for sample locations in the Oregon Trail subdivision study area. (Ca = calcium, Cl = chloride, Total Fe = total iron, Mg = magnesium, Total Mn = total manganese, NO<sub>3</sub>-N = nitrate as nitrogen, Total P = total phosphorus, K = potassium, Na = sodium, SO<sub>4</sub> = sulfate, NH<sub>4</sub> = ammonia, As = arsenic, TDS = total dissolved solids).

Site ID	Sample Date	Ca mg/L	Cl mg/L	Total Fe mg/L	Mg mg/L	Total Mn mg/L	NO <sub>3</sub> -N mg/L	Total P mg/L	K mg/L	Na mg/L	SO <sub>4</sub> mg/L	NH <sub>4</sub> mg/L	As mg/L
RCR-19	5/12/2004	127	37	<0.05	31.4	<0.05	2.97	-	4.1	42.2	177	<0.04	-
RCR-19	5/12/2004	116	36	<0.05	26.5	<0.05	2.1	-	3.5	36.9	130	<0.04	-
RCR-19	10/25/2004	120	34.3	<0.01	27	<0.002	2.13	0.028	3.5	38	138	<0.005	0.025
RCR-19	12/1/2004	119	50.1	0.01	29	<0.002	3.03	0.026	3.9	40	144	<0.005	0.023
RCR-19	12/20/2004	120	43.9	0.02	30	<0.002	2.93	0.026	3.8	41	149	<0.005	0.02
RCR-20	10/25/2004	103	31.7	<0.01	25	<0.002	1.62	0.033	3.4	34	94.6	<0.005	0.02
RCR-20	12/1/2004	111	37.7	0.08	28	0.006	2.61	0.021	3.9	38	132	<0.005	0.015
RCR-20	12/20/2004	115	37.9	0.01	28	0.002	2.6	0.026	3.7	38	139	<0.005	0.015
RCR-21	10/27/2004	-	-	-	-	-	-	-	-	-	-	-	-
RCR-21	11/29/2004	105	38.3	<0.01	33	<0.002	3.42	0.018	3.5	46	140	<0.005	0.019
RCR-21	12/21/2004	113	41.9	0.01	35	<0.002	3.87	0.021	3.4	50	149	<0.005	0.018

< symbol indicates analytical result was less than the laboratory detection limit.

## Appendix A – Well numbering system

The U.S. Geological Survey in Idaho numbers well locations within the official rectangular subdivision of the public lands, with reference to the Boise base line and Meridian. For example, the first segment (3N) of well number 03N-29E-24dad2 designates the township north or south, the second (29E), the range east or west, and the third (24), the section in which the well is located. Letters (dad) following the section number indicate the well's location within the section and are assigned in counterclockwise order beginning with the northeast quarter. The first letter (d) denotes the 1/4 section (160-tract), the second (a) denotes the 1/4-1/4 section (40-acre tract), and the third (d) denotes the 1/4-1/4-1/4 section (10-acre tract). The last number (2) is a serial number assigned when the well was inventoried.



**Appendix B – Drillers' logs for select Oregon Trail area wells**

Form 238-7  
11/97 JGE

App 877648 Permit 804158 ID 375645

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

Office Use Only		
Inspected by _____		
Twp _____ Rge _____ Sec _____		
1/4 _____ 1/4 _____ 1/4 _____		
Lat: _____ Long: _____		

**1. WELL TAG NO. D0016751**  
DRILLING PERMIT NO. \_\_\_\_\_  
Other IDWR No. \_\_\_\_\_

**2. OWNER:**  
Name Joe Mendonca  
Address 603 Gem drive  
City kimberly State ID Zip 83341

**3. LOCATION OF WELL by legal description:**  
Sketch map location must agree with written location. *CA*

N E S	W E S	Twp. <u>11</u> North <input type="checkbox"/> or South <input checked="" type="checkbox"/>
		Rge. <u>17</u> East <input checked="" type="checkbox"/> or West <input type="checkbox"/>
		Sec. <u>1</u> 1/4 SW 1/4 NE 1/4
		Gov't Lot _____ County <u>Twin falls</u> Long: _____

Address of Well Site Oregon Trail Lane  
City Kimberly  
Lt. 2 Blk. 16 Sub. Name Southeast Estates

**4. USE:**  
 Domestic  Municipal  Monitor  Irrigation  
 Thermal  Injection  Other

**5. TYPE OF WORK:** check all that apply (Replacement etc.)  
 New Well  Modify  Abandonment  Other

**6. DRILL METHOD:**  
 Air Rotary  Cable  Mud Rotary  Other

**7. SEALING PROCEDURES:**

Seal/Filter Pack Material	From	To	AMOUNT Sacks or Pounds	METHOD
bentonite	0	19	250 lbs.	dry pour

Was drive shoe used?  Y  N Shoe Depth(s) \_\_\_\_\_  
Was drive shoe seal tested?  Y  N How? \_\_\_\_\_

**8. CASING/LINER:**

Diameter	From	To	Guage	Material	Casing	Liner	Welded	Threaded
6"	+1	19	.250	steel	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Length of Headpipe 1' Length of Tailpipe \_\_\_\_\_

**9. PERFORATIONS/SCREENS:**  
 Perforations Method \_\_\_\_\_  
 Screens Screen Type \_\_\_\_\_

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
						<input type="checkbox"/>	<input type="checkbox"/>

**10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:**  
40 ft. below ground Artesian pressure \_\_\_\_\_ lb.  
Depth flow encountered \_\_\_\_\_ ft. Describe access port or control devices: well cap

**11. WELL TESTS:**

Yield gal./min.	Drawdown	Pumping Level	Time
20+			

Water Temp. <85 Bottom hole temp. <85  
Water Quality test or comments: \_\_\_\_\_  
Depth first Water Encounter \_\_\_\_\_

**12. LITHOLOGIC LOG:** (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water
8	0	4	top soil	
8	4	5	broken lava	
8	5	16	black lava	
8	16	17	crevice	
8	17	19	hard lava	
6	19	35	black lava	
6	35	39	red/black ash	
6	39	49	black lava	
6	49	54	red ash	
6	54	67	black lava	
6	67	68	broken lava & brown silt	X
6	68	135	black lava	
6	135	140	gravel	X

**RECEIVED**  
JUL 14 2003  
Department of Water Resources  
Southern Region

Completed Depth 137' (Measurable)  
Date: Started 6/28/2003 Completed 6/28/2003

**13. DRILLER'S CERTIFICATION:**  
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.  
Company Name Eaton Drilling & pump Service, Inc. Firm No. 26  
Firm Official [Signature] Date 6/28/2003  
and  
Driller or Operator [Signature] Date 6/28/2003  
(Sign once if Firm Official & Operator)

FORWARD WHITE COPY TO WATER RESOURCES

Ground Water Report, Oregon Trail Subdivision, Twin Falls, Idaho

Form 238-7  
3/95

IDAHO DEPARTMENT OF WATER RESOURCES  
**WELL DRILLER'S REPORT 67060**  
Use Typewriter or Ballpoint Pen

Office Use Only	
Inspected by _____	_____
Twp _____ Rge _____ Sec _____	_____
1/4 _____ 1/4 _____ 1/4 _____	_____
Lat: _____ Long: _____	_____
<input checked="" type="checkbox"/> Air	<input type="checkbox"/> Flowing Artesian

1. DRILLING PERMIT NO. 47-98-S-0164-000  
Other IDWR No. D0002827

2. OWNER:  
Name John Bringham  
Address 3336 Oregon Trail Drive  
City Kimberly State Id Zip 83341

3. LOCATION OF WELL by legal description:

Sketch map location must agree with written location.

N	
X	
E	
S	

Twp. 11 North  or South   
Rge. 17 East  or West   
Sec. 1 1/4 NW 1/4 NE 1/4  
Gov't Lot \_\_\_\_\_ County Twin Falls  
Lat: \_\_\_\_\_ Long: \_\_\_\_\_  
Address of Well Site Same  
City \_\_\_\_\_  
(Give at least name of road + distance to road or landmark)  
Lt. \_\_\_\_\_ Blk. \_\_\_\_\_ Sub. Name \_\_\_\_\_

4. USE:  
 Domestic  Municipal  Monitor  Irrigation  
 Thermal  Injection  Other \_\_\_\_\_

5. TYPE OF WORK check all that apply (Replacement etc.)  
 New Well  Modify  Abandonment  Other \_\_\_\_\_

6. DRILL METHOD  
 Air Rotary  Cable  Mud Rotary  Other \_\_\_\_\_

SEAL/FILTER PACK			AMOUNT	METHOD
Material	From	To	Sacks or Pounds	
Bentonite	5	18	3	Overbore

Was drive shoe used?  Y  N Shoe Depth(s) \_\_\_\_\_  
Was drive shoe seal tested?  Y  N How? \_\_\_\_\_

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
65/8	+2	18	250	Steel	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Length of Headpipe \_\_\_\_\_ Length of Tailpipe \_\_\_\_\_

9. PERFORATIONS/SCREENS

Perforations Method \_\_\_\_\_  
 Screens Screen Type \_\_\_\_\_

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
						<input type="checkbox"/>	<input type="checkbox"/>

10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:  
26 ft. below ground Artesian pressure \_\_\_\_\_ lb.  
Depth flow encountered \_\_\_\_\_ ft. Describe access port or control devices: \_\_\_\_\_

50 21541

11. WELL TESTS:

Yield gal./min.	Drawdown	Pumping Level	Time

Water Temp. \_\_\_\_\_ Bottom hole temp. \_\_\_\_\_  
Water Quality test or comments: \_\_\_\_\_  
Depth first Water Encountered \_\_\_\_\_

12. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water	Y	N
8"	0	2	Top soil			
	2	8	Boulders			
	8	18	Gray lava			
6"	18	24	Gray lava			
	24	26	Shale & cinder	xx		
	26	40	Brown lava			
	40	50	Red shale talc	xx		
	50	70	Brown lava			
	70	105	Red lava			
	105	125	Gray lava hard			
	125	135	Shale & cinder	xx		
	135	140	Gravel	xx		

RECEIVED  
DEC 02 1998  
Department of Water Resources

RECEIVED  
NOV 19 1998  
Department of Water Resources  
Southern Region

Completed Depth 140ft (Measurable)  
Date: Started 10/20/98 Completed 10/20/98

13. DRILLER'S CERTIFICATION  
I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name Dave Austin Drig Firm No. 196  
Firm Official Dave Austin Date 11/18/98  
and \_\_\_\_\_  
Supervisor or Operator \_\_\_\_\_ Date \_\_\_\_\_  
(Sign once if Firm Official & Operator)

FORWARD WHITE COPY TO WATER RESOURCES

Ground Water Report, Oregon Trail Subdivision, Twin Falls, Idaho

App 887521 *LODR COPY*  
 IDAHO DEPARTMENT OF WATER RESOURCES  
**WELL DRILLER'S REPORT**

Form 238-7  
6/02

Office Use Only			
Well ID No.	_____		
Inspected by	_____		
Twp	Rge	Sec	
	1/4	1/4	1/4
Lat:	:	:	Long: : :

1. WELL TAG NO. D 0034627  
 DRILLING PERMIT NO. 831602  
 Water Right or Injection Well No. \_\_\_\_\_

2. OWNER:  
 Name Jack Trotter  
 Address 3460N 3300E  
 City Kimberly State Id Zip 83341

3. LOCATION OF WELL by legal description:  
 You must provide address or Lot, Blk, Sub. or Directions to well.  
 Twp. 11 North  or South   
 Rge. 17 East  or West   
 Sec. 1 1/4 SE 40 1/4 NE 100 1/4  
 Gov't Lot \_\_\_\_\_ County Twin Falls  
 Lat: : : Long: : :  
 Address of Well Site same as above 3460N  
 City 3307E  
 Lt. \_\_\_\_\_ Blk. \_\_\_\_\_ Sub. Name per insp.

4. USE:  
 Domestic  Municipal  Monitor  Irrigation  
 Thermal  Injection  Other \_\_\_\_\_

5. TYPE OF WORK check all that apply (Replacement etc.)  
 New Well  Modify  Abandonment  Other \_\_\_\_\_

6. DRILL METHOD:  
 Air Rotary  Cable  Mud Rotary  Other \_\_\_\_\_

Seal Material	From	To	Weight / Volume	Seal Placement Method
Bentontie	5'	18'	3 bags	overbore

Was drive shoe used?  Y  N Shoe Depth(s) \_\_\_\_\_  
 Was drive shoe seal tested?  Y  N How? \_\_\_\_\_

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
65/8	+2	18	250	steel	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Length of Headpipe \_\_\_\_\_ Length of Tailpipe \_\_\_\_\_  
 Packer  Y  N Type \_\_\_\_\_

9. PERFORATIONS/SCREENS PACKER TYPE  
 Perforation Method \_\_\_\_\_  
 Screen Type & Method of Installation \_\_\_\_\_

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
						<input type="checkbox"/>	<input type="checkbox"/>

Filter Material	From	To	Weight / Volume	Placement Method

11. STATIC WATER LEVEL OR ARTESIAN PRESSURE:  
75 ft. below ground Artesian pressure \_\_\_\_\_ lb.  
 Depth flow encountered \_\_\_\_\_ ft. Describe access port or control devices: \_\_\_\_\_

12. WELL TESTS:  
 Pump  Bailor  Air  Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time

Water Temp. \_\_\_\_\_ Bottom hole temp. \_\_\_\_\_  
 Water Quality test or comments: \_\_\_\_\_

13. LITHOLOGIC LOG: (Describe repairs or abandonment) Water

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Y	N
8"	0	5	Top soil		
	5	14	Boulders		
	14	18	Gray lava		
6"	18	24	Gray lava		
	24	27	Shale & cinders		
	27	44	Brown lava		
	44	48	Red shale & cinders	X	
	48	125	Brown lava		
	125	150	Red lava		
	150	160	Cinders & taulk	λ	
	160	184	Red lava		
	184	186	Cinders & taulk	X	
	186	230	Brown lava		
	230	240	Layers - cinders & taulk	λ	

SCANNED  
APR 13 2005

RECEIVED RECEIVED  
 APR 12 2005 MAY 04 2005  
 Department of Water Resources Southern Region Department of Water Resources

Completed Depth 240 ft. (Measurable)  
 Date: Started 03/22/05 Completed 03/22/05

14. DRILLER'S CERTIFICATION  
 I/We certify that all minimum well construction standards were complied with at the time the rig was removed.  
 Company Name Dave Austin Drilling Firm No. 196  
 Principal Driller Dave Austin Date 4-12-05  
 and \_\_\_\_\_ Date \_\_\_\_\_  
 Driller or Operator II \_\_\_\_\_ Date \_\_\_\_\_  
 Operator I \_\_\_\_\_ Date \_\_\_\_\_

Principal Driller and Rig Operator Required.  
 Operator I must have signature of Driller/Operator II.

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