DRAFT WATER SYSTEM FACILITY PLAN

For

ROSE LAKE WATER SYSTEM

SUBMITTED TO THE ROSE LAKE WATER ASSOCIATION

MARCH 2015

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DRAFT WATER SYSTEM FACILITY PLAN

ROSE LAKE WATER SYSTEM

PROJECT NO. 41113

SUBMITTED TO THE:

ROSE LAKE WATER ASSOCIATION

PROFESSIONAL ENGINEER
LICENSED
8276
3/17/15
STATE OF IDAHO
STEVEN B CORDES

MARCH 2015

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EXECUTIVE SUMMARY

The Rose Lake Water Association has procured the services of Welch Comer & Associates, Inc. to complete a Water System Facility Plan for the Rose Lake Water System. This Plan reviews the current service area, expected growth of the system, analyzes the existing system components and their operation, and provides recommendations for system modifications and improvements necessary to serve existing customers. A summary of the major findings of this report is provided below.

The following is a summary of the existing system deficiencies with respect to current demands:

- Source:
  - The current source capacity is deficient by 11 gallons per minute according to the 2009 IDAPA Ground Water Source Redundancy rule.
  - Currently, Well No. 4 has tested over the MCL (Maximum Contaminant Limit) for Arsenic and Radium and has high amounts of iron (which the residents complain frequently about).
- Storage:
  - The current storage is sufficient and has a surplus of 50,353 gallons to serve the system.
- Distribution:
  - The existing distribution system is sufficient to provide the current peak hour production and maintain a minimum pressure of 40 psi throughout the system except for at the following locations:
    - 21820 E Doyle
    - 22239 E Doyle
    - 22709 E Doyle
    - 25773 E Doyle
    - 24785 E Doyle and 25235 E Doyle[1]
  - The current distribution system consists of approximately 56,500 linear feet of waterline. Of this, approximately 37 percent (21,000 linear feet) is under 3 inch line, approximately 15 percent (8,000 linear feet) is 4 inch line, and approximately 46 percent (26,000) is 6 inch line. The majority of the system is depreciated PVC and AC. System loss has been calculated at approximately 28.8 percent. Due to the age and condition of the system, there is risk for a large line break which could potentially cause de-pressurization and contamination of the system, which is a threat to public health and safety.

[1] These properties do not have junctions or nodes at their service locations (in reference to modeling), but based on elevations, these properties also do not meet the requirement.

Future demands were projected based on the anticipated annual growth within the Association's service area, utilizing a 1.5 percent annual growth rate. The following is a summary of the existing system deficiencies with respect to projected future demands for the projected annual growth:

- Source - Based on the 2009 IDAPA Ground Water Source Redundancy rule, the current source capacity is deficient as follows:
  - 10-Year – 17.8 gallons per minute
  - 15-Year – 21.4 gallons per minute
  - 20-Year – 25.4 gallons per minute
  - 30-Year – 34.4 gallons per minute
  - 40-Year – 44.7 gallons per minute
- Storage - Under the current system configuration, the reservoir is sufficient(with surplus) as follows:
  - 10-Year – 48,817 gallons
  - 15-Year – 47,973gallons
  - 20-Year – 47,051 gallons
  - 30-Year – 41,613 gallons
  - 40-Year – 34,380gallons
- Distribution - The existing distribution system was not analyzed for specific future demands because it is unknown how and where growth will occur. Rather, the District should require potential developers to fund a detailed hydraulic analysis of the system prior to agreeing to serve additional demand.

The Association's Board has rated providing reliable service to the existing customers as a high priority. Thus, several options were developed in order to address the above-mentioned deficiencies with respect to current demands and current requirements. Some options were eliminated due to feasibility and constructability; the principal alternatives considered are summarized on the following page.

	Estimated Project Cost
Source Options	
Option A: Drill New Well	$284,000
Storage and Booster Options	
Option D: Individual Booster Pumps at services needing boosting (not meeting pressure requirements)	$24,990
Distribution System Options	
Option A: Meter Replacement throughout System (20% needing full meter/service replacement)	$79,240
Option B: Leak Detection throughout System	$4,125
Treatment System Options	
Option A: Precipitative Oxidation Filtration System at Well No. 4 to remove Arsenic, Radium and Iron	$452,650
Option B: Adsorption System at Well No. 4 to remove Arsenic with supplemental system to remove Iron	$635,980
Option D: Precipitative Oxidation Filtration System at Well No. 4 to remove Arsenic and Iron; POU for Radium	Arsenic (Option A): $305,290 Radium (POU): $125 to $350 per unit ($15,000 to $42,000 for all 120 connections)

1. INTRODUCTION

1.1. PURPOSE

The Rose Lake Water Association ("Association") has authorized Welch Comer and Associates, Inc. to prepare this water system report for the Rose Lake water system, located in Kootenai County, Idaho. The system (Idaho Department of Environmental Quality ("IDEQ") PWS No. 1280161) is owned and operated by the Association. The purpose do this report is to identify existing and future sub-standard components of the system and to develop a facility plan to implement the improvements necessary to provide an adequate supply of water to its users for the next 20 years.

1.2. SCOPE

This report is intended to serve as the Facility Plan for the Rose Lake water system. This report will include the following:

- Population and Growth
  - Identify current service area
  - Project the size of future growth
- Demands
  - Review historic demands
  - Project future demands based on growth projections
- Source
  - Review current water rights
  - Review existing pump capacities and status
  - Evaluate capacity and condition of pumps
- Storage
  - Evaluate capacity and condition of storage
- Distribution System
  - Evaluate capacity and condition of existing system
- Hydraulic Model
  - Construction based on current system conditions
  - Calibration based on field tests
  - Evaluation of current system to support
    - Current peak hour, maximum day, and average day demands
- Financial
  - Identify potential capital improvements and opinions of probable cost

1.3. OWNER PROJECT RESPONSIBILITY

The Association can fund improvements through the operation and maintenance

funds collected from the Association users. They also have the technical qualifications and facilities to carry out the project since they have hired Welch Comer & Associates, Inc. as an engineer and can hire or train their operator to suit the needs of the facility. The Association has not completed any major upgrades to the system since the 1990's. The Association has completed several minor improvements since the system was constructed in the 1970s.

If property acquisition is required by the improvements discussed in this project, the Association will follow the process required by Idaho Code, through obtaining an appraisal, entering into negotiations with the land owner, and finally purchasing the property. If property owned by the Association requires disposal, the Association will follow the appropriate protocols established by Idaho Code and their bylaws.

2. Existing Conditions

2.1. Ownership and Management

The Rose Lake Water System is owned and operated by the Rose Lake Water Association, Inc. ("Association"). The Association is a non-profit organization established for the mutual benefit of its members with an elected Board of Directors.

2.2. System Background

The system currently consists of two groundwater wells located on the east (Well No. 4) and west (Well No. 3) side of Rose Lake (Well No. 3 is located on Doyle Road and Well No. 4 is located off Watson Road near the boat ramp access). These wells pump through approximately 13,000 linear feet of 3, 6, and 8 inch mains into one ground level concrete reservoir located off of Doyle Road (near the Rose Lake Cemetery). The reservoir feeds the system by gravity. Refer to Figure 2.1 on the following page for a map depicting the existing system.

2.2.1. Geography

A graphic of the entire water system and the existing service area is provided as Figure 2.2 on the following page. A larger copy is provided in Appendix A. The system is located in parts of Sections 3, 4, 9 of Township 48N, Range 1W and 27-29, 32-35 of Township 49N, Range 1W.

2.3. Existing Service Area Characteristics

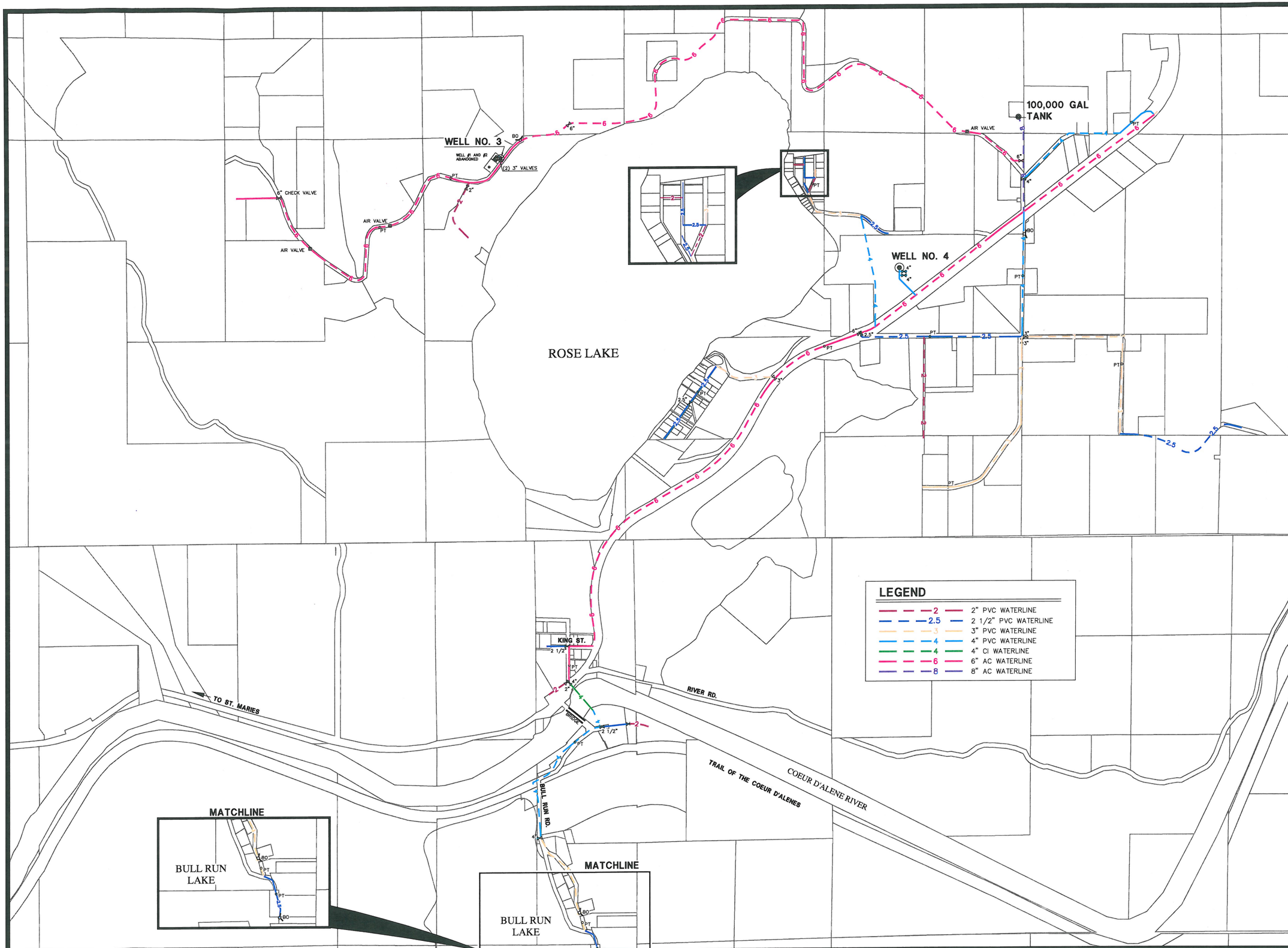
2.3.1. Current Boundaries

The Existing Service Area Map is provided as Figure 2.2 (a large copy is provided in Appendix A) and shows the service area for the existing system. The current Association boundary (as derived from the active and non-active service connections) is also included in this map. The majority of the connections are single-family residences. The existing service area represents those parcels that currently have a meter and receive water service.

Also refer to Section 8 for a discussion of the existing environmental conditions.

2.3.2. Planning Area

The Association does not intend on growing beyond the current areas served by the Association's system. Within the areas served by the Association's system, there are several parcels that are not currently served but desire to be connected to the system. If the system's capacity allows for increased connections, the Association desires to serve additional connections. Refer to Section 3.1 for a discussion of growth within the Association.



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GRAPHIC SCALE

600 0 300 600 1200

(IN FEET)

11x17 SCALE 1" = 1200 ft.
24X36 SCALE 1" = 600 ft.

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NO.	DATE	REVISION DESCRIPTION	BY

ROSE LAKE WATER ASSOCIATION

EXISTING WATER SYSTEM MAP

FIGURE 2.1

PROJECT NO.:	41113
DESIGNED BY:	A.M.W.
DRAWN BY:	J.A.L.
CHECKED BY:	
DWG NAME:	41113DS01.DWG
DATE:	11-18-13
SHEET NO:	

FIG. 2.1

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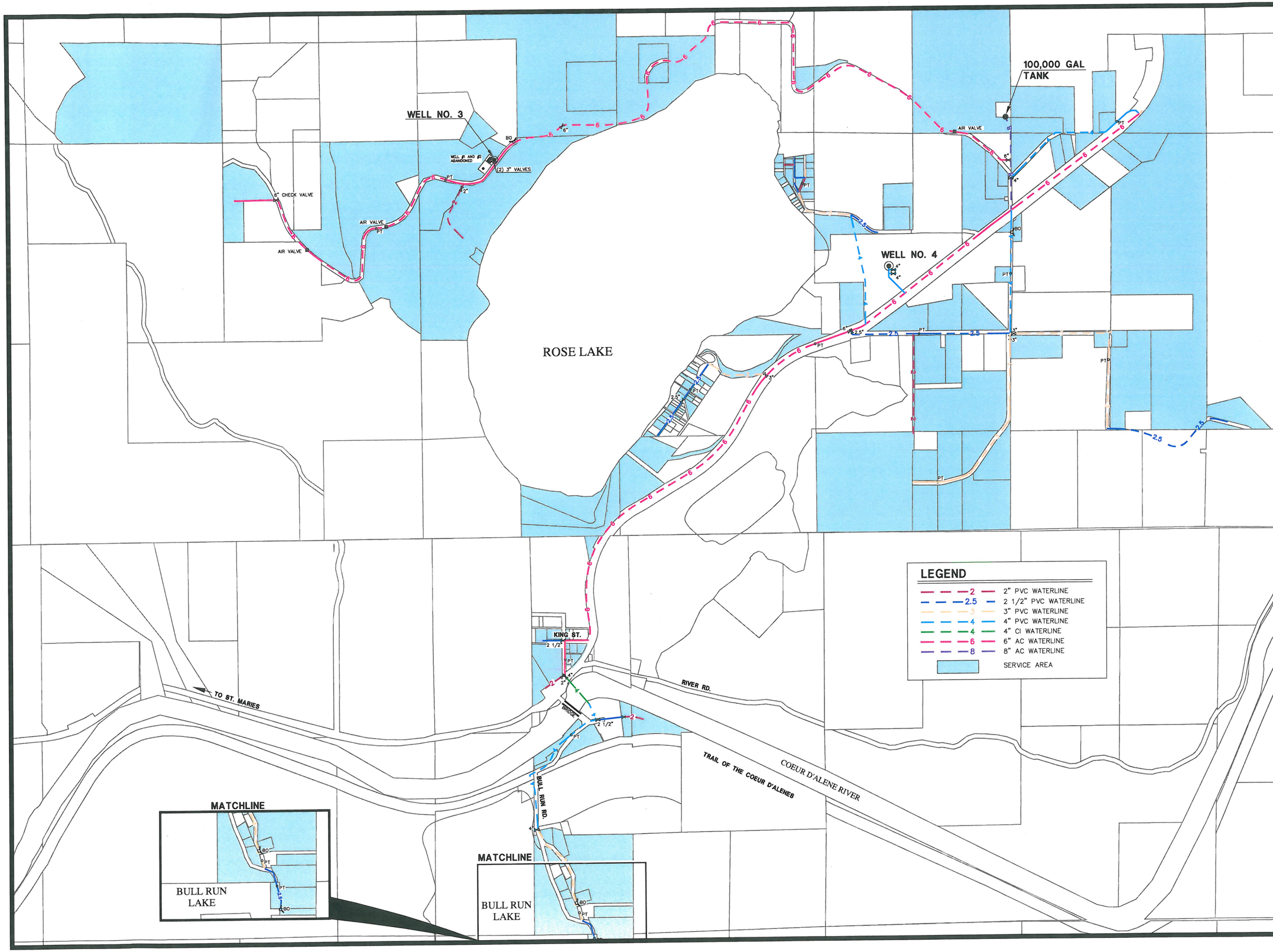

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NO.	DATE	REVISION DESCRIPTION	BY

ROSE LAKE WATER ASSOCIATION

EXISTING WATER SYSTEM SERVICE AREA

FIGURE 2.2

PROJECT NO.:	41113
DESIGNED BY:	A.M.W.
DRAWN BY:	J.A.L.
CHECKED BY:	
DWG NAME:	41113DS01.DWG
DATE:	11-18-13
SHEET NO:	

FIG. 2.2

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2.4. WATER RATES

The water rate structure was established by the Board of Directors. The Association bills its customers on a monthly basis and each connection within the system pays a base rate, as summarized in Table 2-1 below. Meters are read on the first of every month and read May through October. The water use limit for May through September is 25,000 gallons per month (125,000 gallons). The water use limit for the winter (other 7 months meter is not read) is 120,000 gallons. Overage charges begin at 1,000 gallons over the limit.

Table 2-1: Water Rates for One Month Billing Cycle

		Base Rate per Connection	Gallons Allowed Within Base Rate	Additional Charge per 1,000 Gallons Used Over Gallons Allowed
All Connections	Winter (Oct. through May)	$30.00	120,000 (total)	N/A
	Summer (June through Sept.)	$30.00	25,000 (each month)	**Based on amount overage, refer to table below

Notes:
1. Rates were set in 1993 and have not been modified since that time.

Table 2-2: Overage Charge for Summer Usage (June through Sept.)

Segment			Overage Rate per 1,000 gal.	Cumulative Segment Charge
1	-	5,000	$1.25	
5,001	-	10,000	$2.50	$18.75
10,001	-	15,000	$3.75	$37.50
15,001	-	20,000	$5.00	$62.50
20,001	-	25,000	$6.25	$93.75
25,001	-	30,000	$7.50	$131.25
30,001	-	35,000	$8.75	$218.75
35,001	-	40,000	$10.00	$268.75
40,001	-	45,000	$11.25	$325.00
45,001	-	50,000	$12.50	$387.00
50,001	-	55,000	$13.75	$456.25
55,001	-	60,000	$15.00	$531.25
60,001	-	65,000	$16.25	$621.50
65,001	-	70,000	$17.50	$709.00
70,001	-	75,000	$18.75	$802.75
75,001	-	80,000	$20.00	$902.75
80,001	-	85,000	$21.25	$1,009.00
85,001	-	90,000	$22.50	$1,121.50

Notes:
1. EXAMPLE: July use 62,240 gallons; 37,240 gallons overage; thus in the 35,001 to 40,000 segment: $218.75 cumulative + (2.24 x $10.00) = $241.15

As can be seen above, the Association charges each connection a base rate, for the billing period. In addition, the Association assesses an overage charge per 1,000 gallons used over the allotted amount, during the summer meter readings.

The Association's operation and maintenance budget is set each year. The budget for 2013 can be found in Appendix B.

2.5. INVENTORY OF EXISTING FACILITIES

2.5.1. WATER RIGHTS

The District holds one water right for the diversion of groundwater, as can be seen in Table 2-3 below. Copies of this water right can be found in Appendix C.

Table 2-3: Inventory of Water Rights

Water Right No.	Basis	Beneficial Use	Period of Use	Priority Date	Diversion Rate	Volume Limitation
94-7367	License	Municipal	Jan. 1 to Dec. 31	4/8/1996	0.2 cfs	145 AFA
Maximum Diversion for License:					**0.2 cfs**	**145 AFA**

The Idaho Department of Water Resources (IDWR) is currently conducting an adjudication of all the water rights (that were put into beneficial use on or prior to November 12, 2008) in the Coeur d'Alene and Spokane River water systems. The Association filed an adjudication claim, which can be found in Appendix C, with IDWR for the licensed right in August, 2013. It is important to note that the amount of water right available (approximately 90 gpm) is not sufficient to serve the source capacity (refer to Section 2.5.2 below). Additional water right capacity will need to be sought by the Association.

2.5.2. SOURCE

The system is supplied by two production wells; one is located on E Doyle Road and is referred to as Well No. 3, and the other is located near the Idaho Department of Fish and Game sportsman's access off of Watson Road and is referred to as Well No. 4. Table 2-4 provides a summary of the wells.

Table 2-4: Inventory of Source

	Year Drilled[1]	Year Current Pump/ Motor Installed	Casing Dia. (inch)	Static Water Level (ft)	Motor HP	Pump Model	Pump Operating Point (gpm)	Back-up Power Supply	Pump Type
Well No. 3	1996/ 2009[2]	2009	6[3]	6	7.5[4]	Goulds[4]	30	None	Submersible
Well No. 4	1997	1997	8	50	25	Goulds	150	None	Submersible

Notes:

1. Available well logs are included in Appendix D. Other information on the well pumps was obtained from the 2008 Beneficial Use Field Report performed by the Idaho Department of Water Resources.
2. Well No. 3was initially drilled in 1996 but was re-drilled in 2009. The information included here is based on the 2009 well log, unless otherwise noted.
3. Casing diameter obtained from the 1996 well log.
4. Well pump information was obtained from 2008 Beneficial Use Field Report.

The wells pump to the reservoir, and are controlled by floats. Well No. 3 turns on when the reservoir is at a depth of 12 feet 10 inches and turns off at a depth of 13 feet 3 inches. Well No. 4 turns on when the reservoir is at a depth of 12 feet 5 inches and turns off at a depth of 12 feet 9 inches. Well No. 3 is used primarily in the winter, and both wells are used during the summer (blending during the summer).

Well No. 3

Well Building

Mechanical Piping

Well No. 4

Well Building

Mechanical Piping

2.5.3. WATER QUALITY

The District follows sampling regulations stipulated by IDEQ. Drinking water quality testing was summarized and is included in Appendix D for reference. The levels of regulated contaminants were found to be below state and federal standards, with the exception of Arsenic[2] and Radium in Well No. 4. Arsenic levels have ranged from 0.006 to 0.011 ppm (parts per million); the MCL (Maximum Contaminant Level) set by the Environmental Protection Agency is 0.010 ppm. Radium levels have ranged from

[2] There were some positive coliform tests found within the system; however upon further testing, the repeat sampling did not result in positive coliform test results.

0.27 to 5.6pCi/L (picocuries per liter); the MCL (Maximum Contaminant Level) set by the Environmental Protection Agency is 5 pCi/L.

2.5.4. STORAGE

There is one partially buried reservoir on the system, located near the Rose Lake Cemetery off of Doyle Road. Table 2-5 provides a summary of the reservoir information.

Table 2-5: Inventory of Storage

	Date Constructed	Material	Type	Overflow Elevation[1] (feet)	Depth[2] (feet)	Volume (gallons)
Reservoir	1970	Reinforced Concrete	Partially Buried	2,341	15.4	100,000

Notes:

1. Overflow elevations were based on the available record drawings for the reservoir and the elevations obtained for the model. Thus, the overflow elevation presented here is accurate to ± 10 meters, or approximately 32 feet.
2. Depth for the reservoirs was pulled from the record drawings for the large reservoir.

2.5.5. DISTRIBUTION SYSTEM

The following table provides an inventory of the system piping based on the WaterCAD model of the system.

Table 2-6: Inventory of Pipes

Diameter (inch)	Material	Total Length (feet)
2	PVC	3,364
2.5	PVC	7,073
3	PVC	10,557
4	PVC	7,626
4	Cast Iron	368
6	AC	25,961
8	AC	1,264
	Total System:	**56,250**

The current distribution system consists mostly of depreciated PVC and Asbestos Cement (AC) pipe which was installed in the 1970s. It should be noted that there are no fire hydrants in the system and thus no fire flow is provided to the users.

2.6. SANITARY SURVEY

The sanitary survey of the system was completed by IDEQ on February 3, 2010, during which several system deficiencies were identified. The Association provided information to IDEQ stating that all the deficiencies had been addressed or would be addressed. Also listed in the survey were Additional Requirements, Follow Up, and Recommendations. These have not been addressed to date. A copy of the Sanitary

Survey and the Association's response can be found in Appendix D.

2.7. HYDRAULIC MODELING

2.7.1. MODELING SOFTWARE

The hydraulic analysis of the water system was performed using the WaterCAD Water Distribution Modeling Software, Version 7.0, which was developed and distributed by Haestad Methods, Inc. The water system model is shown in Appendix E.

2.7.2. MODEL CONSTRUCTION

The water system model used for analysis of the distribution system was constructed based on waterline location, length, size and material information obtained from record drawings (if available) and information provided by the Association and the system operator. Elevations were obtained from the Digital Elevation Model provided by Data Depot and are on the NAVD 88 vertical datum. It should be noted, however, that the elevations are accurate to ±10 meters (approximately 33 feet). Therefore the results of the model are subject to inaccuracies.

One of the major factors that affect the performance of a distribution system is the demand and the distribution of that demand. In WaterCAD, demand is assigned to individual nodes throughout the system. In order to accurately model the pressure losses within the system, the demand distribution in the model must accurately represent that of the existing system. In order to establish the existing demand distribution, demand was added to each node based on the number of active EDUs within the vicinity of that node[3]. EDUs were assigned to each parcel that currently has a meter (both active and inactive) based on the following:

- Residential connections were assumed to represent 1 EDU
- The number of EDUs represented by each commercial connection was determined based on the metered usage for October 2012 through October 2013, as described in Section 2.8.1.
- Residential connections that are considered "larger users" were accounted for by equivalent EDU usage[4].

2.7.3. MODEL CALIBRATION

Once the model has been constructed, its accuracy should be tested through calibration. Calibration is the process of comparing model results to field observations

---

[3] Connections located between two nodes were included in the upstream node.

[4] Larger users are considered metered services that have two or more consecutive months of overuse (greater than 25,000 gallon allotment), not including the winter months. The average use for a larger user over the entire year was found to be 174,734 gallons. The usage for 1 EDUs over the entire year was found to be 60,225 gallons. Thus, a larger user utilizes approximately 2.9 EDUs, on average, instead of the 1 EDU they are allotted. This was accounted for within the model in order to model where the larger demands take place within the system, for residential users.

and making any necessary adjustments to the model. System characteristics that often need to be adjusted include, but are not limited to, the following: demands, demand distribution, pipe characteristics, pump settings, elevations, and valve settings. By adjusting these factors the model can be adjusted to better represent the field conditions.

Observed static pressures at services (in most cases, hose bibs) throughout the system (taken with a handheld instantaneous pressure gauge) were compared to those predicted by the model.

Table 2-7 below summarizes the predicted pressures (based on the calibrated model) with respect to the observed pressures at several locations throughout the system.

Table 2-7: Calibration Summary

			"Static" Pressure During Average Demand		
Node Label	Location	Elevation	Model (psi)	Observed, 9/20/13 (psi)	Service Location[1]
J-194	(Stevens) 21820 E Doyle Rd	2286	22.7	22	
J-200	(Palmer) 22709 E Doyle Rd	2301	16.2	19	
J-189	(Gibbs) 23005 E Doyle Rd	2204	58.2	52	6 feet
J-217	(Hendrix) 26110 E Doyle Rd	2235	45.1	42	
J-174	(Hathaway) 25325 E Robin Dr	2193	63.3	55	13 feet
J-176	(Shoshone County Fire District) 26502 E Doyle Rd	2190	64.2	57	3 feet
J-153	(Yanzick) 27562 E Doyle Rd	2243	41.3	48	(13 feet)
J-151	(Johnston) 25265 E Meadow Rd	2247	39.6	39	
J-80	(Spielman) 24414 E Meadow Rd	2198	60.8	56	
J-123	(Heidt) 14221 S Highway 3	2170	73.0	65	6 feet
J-113	(Watsons Rose Lake Resort) 13057 S Main Dr	2188	65.0	60	
J-145	(Leeds) 23554 E Park Rd	2155	78.7	73	2 feet
J-188	(Gibson) 14820 S Queen St	2144	83.6	87	
J-175	(Peck) 17931 S Bull Run Rd	2148	82.0	74	
J-142	(Peterson) 16035 S Winton Rd	2175	70.0	74	(8 feet)
J-86	(Long) 16190 S Bull Run Rd	2145	83.1	80	(5 feet)

Notes:

1. Service locations indicate the approximate elevation difference between the main and the service location. A positive value indicates a service above the main (in elevation), and a negative value (-) indicates a service below the main (in elevation). This can provide an explanation as to why some observed values are different than those found in the model. If no note is made, there is a minor difference in elevation between the main and the service.

As can be seen, the model predicted results fit nicely within an acceptable error margin around the observed pressures. The variation in the observed and model predicted results may be attributed to the following factors:

- Inaccuracy in the measuring equipment.

- The actual operating characteristics of the system during the time pressure was measured are unknown. These include:
  - Demand and demand distribution
  - Water levels in reservoirs
  - Pump status and discharges
- Service locations where measurements were taken were higher or lower in elevation than the main, and the size and condition of the services could contribute some errors.

The Haestad Methods "Water Distribution Modeling, First Edition," gives guidelines for acceptable calibration levels. The reference states that for master planning of small systems (systems with smaller than 24 inch pipe), "The model should accurately predict hydraulic grade line (HGL) to within 5-10 feet at calibration data points during fire flow tests and to the accuracy of the elevation and pressure data during normal demands."

The AWWA "Modeling, Analysis and Design of Water Distribution Systems" reference states that "A key use of a calibrated model is to determine relative differences in the results of various actions. In other words, it is not so much that the model has been precisely calibrated, but rather that it can be used as a basis for comparison; thus, it is the differential values that become important."

Following the Haestad recommendations for master planning the pressure data obtained from the model should be as accurate as the data gathered from the field. The difference between the field results and the model results may be attributed to errors in data collection, the difference in demand estimated for each location, and the actual pipe roughness. Because the predicted pressures are within an acceptable range of the observed pressures, and because it would not be practical to precisely track demand at each junction and roughness of each pipe in the system, the model was accepted as calibrated at this point.

Since the model results are only as accurate as the elevations entered into the model, as previously discussed, a measure of caution should be used when applying the model results. As more accurate elevation information becomes available from additional surveys within the system, the elevation information in the model should be updated to achieve the most accurate results.

2.8. Existing System Demand

The Association reads the production well at least once a week and the individual consumption meters monthly for May through October. Meters are not read from November through April. In to account for the winter usage, therefore, demand presented within this report is based on meter readings for October 2012 through October 2013.

The total production for October 2012 through October 2013 was determined by summing the metered gallons produced for both wells (Well No. 3 and Well No. 4) for that time period. Likewise, the total consumption for 2012-2013 was determined by summing the metered gallons consumed for that time period. Theoretically, the

metered production and the metered consumption should match. However, there is always a discrepancy between production and consumption. This difference is known as system loss and will be discussed further in Section 2.9.4.2.

The annual production and metered consumption, based on data for October 2012 through October 2013, is as follows:

- Total Production: 9,669,600 gallons
- Total Metered Consumption: 6,883,022 gallons

2.8.1. EQUIVALENT DWELLING UNIT

The term "equivalent dwelling unit" or EDU will be used extensively throughout this document. An EDU is defined in the IDEQ Rules for Public Drinking Water Systems (IDAPA 58.01.08) as a unit of measure that standardizes all land use types (housing, retail, office, etc.) to the level of demand created by a single-family detached housing unit within a water system. The demand for one EDU is equivalent to the amount of water provided to the average single-family detached housing unit within a water system. For example, if a typical single-family household within a given system uses 300 gallons per day (i.e. one EDU equals 300 gpd) and a particular commercial connection uses 600 gallons per day, that commercial connection would account for 2 EDUs within that system.

Individual account information was provided by the Association and each account was identified as either residential or commercial. The consumption meters are read monthly from May through October. Meters are typically read around the 1st of the month and are read within a single day. In order to account for a full year's worth of consumption, the time period that will be used for determination of demand is October 2012 through October 2013.

During this time period, the average daily metered water use per active residential connection was 165 gallons. Therefore, on an average basis, 1 EDU for the system is 165 gallons per day. The average daily metered use per commercial connection varied significantly among the five commercial connections. Table 2-8 summarizes this information.

Table 2-8: Average Daily Metered Use

	October 2012 through October 2013[1]			
	Total Consumption (gallons)	Total Connections	Average Daily Consumption per Connection (gpd)	Equivalent EDUs
Total Residential Connections	6,367,600	106	165	106
Total Commercial Connections	515,422	5	338	8.2
Rose Lake Historical Society	309,380	1	848[2]	5.1
Crossroads Baptist Church	161,610	1	443	2.7
Watson's Rose Lake Resort	42,752	2	59	0.35
Shoshone Fire Station	1,680	1	5	0.03

Notes:

1. Calculation is based on active connections, which includes customers with some usage during the year. Any customer with no usage over the entire year (Oct. 2012 through Oct. 2013) was considered not active.
2. The usage for the Rose Lake Historical Society seems high given its size. The usage should be reviewed further in the upcoming years to determine if this usage is plausible or if it is due to leaking or metering error.

Active users have been accounted for in the above calculation. There are 9 connections that are not active (metered usage was 0 gallons for the entire time period). Thus, the total current number of EDUs is 124.

2.8.2. AVERAGE DAILY PRODUCTION (ADP)

The average day production (ADP) is the average volume of water used by a given system calculated over the course of a year and is often expressed on a per EDU basis. System losses throughout the distribution system have a direct effect on the demand a system experiences. For instance, the demand at a given service connection is equal to the water that particular user consumes whereas the demand at the production well includes the actual consumption as well as the system loss. Systems that experience significant loss will exhibit a significant difference between production and consumption demands. Therefore, it is important to recognize the difference and use the appropriate demand for each analysis. The demand used within this report will be based on production and will therefore include system losses. ADP will be presented on a gallons per day per EDU basis.

The following ADP values were based on the production well meter data provided by the Association for October 2012 through October 2013 and have been throughout this report and associated analyses:

- ADP = 230 gallons per day per EDU

2.8.3. MAXIMUM DAILY PRODUCTION (MDP)

Maximum day production (MDP) is the maximum gallons of water produced in one day over a period of one year. Because the Association does not record daily production volumes, the peak day cannot be readily determined from meter data. A peaking factor must therefore be used to determine peak day production based on average day production.

Based on weekly production meter readings for October 2012 through October 2013, the average day for the peak month is 1.16 times the ADP.

The MDP, however, can be significantly different than the average day of the peak month. Therefore, a peaking factor of 2.5 times the ADP will be assumed throughout this report. It should also be noted that the Design Manual recommends that peaking factors for maximum day productions range between 1 and 3 and the American Water Works Association (AWWA) Manual of Water Supply Practices states that peaking factors for maximum day production are "usually observed to vary between 1.2 and 2.5." A peaking factor of 2.5, therefore, is believed to be conservative.

It is important to note, however, that since the system loss is significant, the peaking factor was applied only to the consumption portion of the ADP in determining the MDP since the loss is independent of varying demands and should therefore remain constant. In order to accomplish this, the peaking factor was applied to the average day production based on consumption and the average loss per EDU (approximately 65 gallons per day) was then added to determine the MDP, which yielded the following:

- MDP = 478 gallons per day per EDU

2.8.4. PEAK HOUR PRODUCTION (PHP)

Peak hour production is the maximum gallons of water produced in one hour over a period of one year and is generally reported in gallons per minute. Equation 5-1 (provided below) from the December 2009 Washington State Department of Health Water System Design Manual (Design Manual) was used to estimate the peak hour production.

Equation 5-1:

PHP = (MDD/1440) x [(C x N) + F] + 18

Where:

PHP = Peak Hourly Production, (gallons per minute)

C = Coefficient Associated with Ranges of EDUs (2 for EDU range of 101 to 250)

N = Number of EDUs

F = Factor Associated with Ranges of EDUs (75 for EDU range of 101 to 250)

MDP = Maximum Day Production, (gpd/EDU)

Application of Equation 5-1 yields the following, which will be used within this report:

- PHP = 120 gallons per minute

2.8.5. FIRE FLOW REQUIREMENTS

The system is located within the Shoshone County Fire Protection District #2. The Association does not provide fire flow to the area.

2.9. EXISTING SYSTEM ANALYSIS

2.9.1. ANALYSIS CRITERIA

The system analysis of source, storage, distribution, and treatment was performed in accordance with the IDEQ Rules for Public Drinking Water Systems, IDAPA 58.01.08. In addition, the Washington State Department of Health (WSDOH) Water System Design Manual is referenced as a design guide.

Table 2-9 on the following pages outlines the performance and design criteria used within this report to analyze the various system components.

Table 2-9: Analysis Criteria

System Component	Analysis and Design Criteria	Reference/Rule
Source	1. A community water system shall have a minimum of two sources and the total source capacity, with any source out of service, should be capable of producing either the PHD or the MDD plus equalizing storage 2. The system should be able to simultaneously supply the MDD and replenish fire suppression storage (FSS) within a 72-hour period given the total available source capacity of the system. 3. The capacity of a public drinking water system shall be at least 800 gallons per day per residence provided the system has equalization storage sufficient to compensate for peak hour demand. 4. New source and booster pumps are required to have dedicated standby-power or standby-storage sufficient to pressurize the system for a minimum of eight hours during a power outage.	IDAPA Section 501.17 Ground Water Source Redundancy Recommended Design Standard IDAPA Section 552.01 Quantity and Pressure Requirements. IDAPA Section 501.07 Reliability and Emergency Operation
Equalization Storage	1. ES = (peak hour demand – Qs)*(150 min) but in no case less than zero Where: ES = Equalizing storage component in gallons peak hour demand = Peak hourly demand, in gpm. Qs = Sum of all installed and active source of supply capacities, except emergency, in gpm.	WSDOH Water System Design Manual: Equation 9-1 AND IDEQ Guidance for Determining Equalization Water Storage for Public Water Systems (March 2013)
Standby Storage	1. SBTMS = (2 days)*(average day demand)*(N) – tm*(QS-QL) Where: SBTMS = Total standby storage component for a multiple source system; in gallons average day demand = Average daily demand for the system in gpd/ERU N = Number of ER's QS = Sum of all installed and continuously available source of supply capacities, except emergency, in gpm QL = The largest capacity source available to the system in gpm tm = Time that remaining sources are pumped on the day when the largest source is not available, in minutes, (1440 minutes unless restricted otherwise)	WSDOH Water System Design Manual: Equation 9-3
Distribution System	1. Water systems shall maintain a minimum pressure of forty (40) psi throughout the distribution system, during peak hour demand conditions, excluding fire flow. 2. Water systems shall maintain a minimum pressure of twenty (20) psi throughout the distribution system, during maximum day demand conditions, including fire flow.	IDAPA 552 .01 Quantity and Pressure Requirements IDAPA 552 .01 Quantity and Pressure Requirements

2.9.2. SOURCE

The first source analysis criteria listed in Table 2-9 which requires redundancy in ground water sources is the result of the new 2009 IDAPA rules. These rules have been adopted and are currently being enforced by IDEQ.

The "Reliability and Emergency Operation" rule requires new sources and booster pumps to have either standby power or standby storage sufficient to provide 8 hours of average day production plus fire flow in the event of a power outage. This rule does not apply to the existing system.

The "Ground Water Source Redundancy" rule requires systems with all existing sources constructed prior to July 1, 1985 to have a minimum of two sources and a total source capacity capable of producing the MDP with any source out of service upon substantially modifying the system after July 2002. As can be seen in Table 2-10, the system's current source capacity is deficient by 11 gallons per minute to supply the MDP with the largest source offline.

Table 2-10: Source Capacity Analysis – MDP with Largest Pump Offline Based on Current Demand

Source Capacity (gpm)	EDUs	Current MDP (gpd)	Available Source Capacity with Largest Source Down (gpd)	Source Capacity Surplus or Deficit (-) (gpd)	Source Capacity Surplus or Deficit (-) (gpm)
Production Wells (180gpm)	124	59,255	43,200	(16,055)	(11)

It is important to note that system loss (refer to Section 2.9.4.) may be contributing to this issue. If production could be reduced (by eliminating system loss), this deficiency may be eliminated also.

2.9.3. STORAGE

The storage requirements for the water system will be discussed within this section. Storage within a system can be broken into the following components:

- Operating Storage (OS)
- Dead Storage (DS)
- Equalizing Storage (ES)
- Standby Storage (SS)
- Fire Suppression Storage (FSS)

Each of these components will be discussed in the following sections. These sections include the Design Manual recommended equations for estimating the minimum requirements for each storage type and any IDAPA rules applying to storage requirements. It is important to note that the storage components are additive and cannot be nested, per the IDAPA rules.

The system currently has one 100,000 gallon reservoir. Refer to Table 2-5 for more information on this reservoir.

2.9.3.1. OPERATING STORAGE (OS)

Operating storage is the volume of water used from the time the pump feeding the reservoir turns off until it turns back on. This volume is usually determined by one of two things; the manufactures specifications on how frequently the pump can cycle, or the minimum water level change in the tank required by the pump control sensors.

The reservoir is fed by the system's production wells. Well No. 3 turns on when the reservoir is at a depth of 12 feet 10 inches and turns off at a depth of 13 feet 3 inches. Well No. 4 turns on when the reservoir is at a depth of 12 feet 5 inches and turns off at a depth of 12 feet 9 inches. Well No. 3 is used primarily in the winter, and both wells are used during the summer (blending during the summer). Thus, the current total operating storage required is 9 vertical inches of the reservoir, or approximately 5,066 gallons.

2.9.3.2. DEAD STORAGE (DS)

Dead storage is calculated as the volume of water not available to all customers at a minimum pressure of 40 pounds per square inch (psi), as required by IDEQ. There are currently several residential connections that experience less than 40 psi pressure due to the elevation of their service[5]. This issue will be evaluated in Section 2.9.4. The determination of dead storage assumes that the maximum service elevation (below the residential connections mentioned above, approximately 2,245 feet) has a pressure of 40 psi, resulting in approximately 35,059 gallons of dead storage.

2.9.3.3. EQUALIZING STORAGE (ES)

Equalizing storage is required in the event that peak hour productions for the water system cannot be met by the source pumping capacity. Equalizing storage must be provided at an elevation that provides a minimum pressure of 40 psi to all service connections. Equalizing storage was determined using Equation 9-1 (below) from the Design Manual:

Equation 9-1:

ES = (peak hour production – Qs)*(150 min) but in no case less than zero

Where:

ES = Equalizing storage component in gallons

peak hour production = Peak hourly production, in gpm.

Qs = Sum of all installed and active source of supply capacities, except emergency, in gpm.

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[5] The following addresses represent the residential connections which are assumed (or have been measured) to see less than 40 psi at their service connection: 21820 E Doyle, 22239 E Doyle, 22709 E Doyle (property uses boosting to pump water from service to home), 24785 E Doyle (may use boosting to pump water from service to home), 25235 E Doyle, 25773 E Doyle.

Equation 9-1 was used to estimate the minimum equalizing storage requirements. If water use records indicate values for equalizing storage that are different from those determined by Equation 9-1, actual records should be used. Since records are not sufficient to determine peak hour production, Equation 9-1 was utilized for this analysis.

As shown in Table 2-11, the total capacity of the production well is greater than the peak hour production for the system, and thus no equalization storage is required.

Table 2-11: Equalization Storage Requirements Based on Current Demand

EDUs	Total Source Capacity (gpm)	PHP (gpm)	Equalization Storage Required (gallons)
124	180	120	0

2.9.3.4. STANDBY STORAGE (SS)

Standby storage should be provided for in the event that the water system's source fails, there is a power outage, or if unusual conditions impose higher demands than anticipated. There are three measures by which to evaluate standby storage presented in the Analysis Criteria (Table 4-9). Equation 9-3 in the Design Manual considers source supply as a factor in determining the standby storage volume. Although this equation provides a guideline for design, it can lead to excessive storage volume since two times the average day production is provided for with the largest source offline. For this reason, and because IDEQ has established a rule for standby storage (discussed below), Equation 9-3 will not be used for storage analyses within this report.

The Design Manual also recommends that the system provide at least 200 gallons of standby storage per EDU. This results in 24,800 gallons of standby storage for the system.

The third criteria presented for standby storage is based on the 2009 IDAPA Rule for Reliability and Emergency Operation which requires on-site standby power or standby storage sufficient to provide a minimum of eight hours of average day production in addition to the required fire flow. Based on this requirement and the current ADP for the system, 9,522 gallons of standby storage are required.

Although this rule only applies to new or substantially modified water systems or new water sources, it provides a reasonable guideline for current operations. Table 2-12 provides a summary of the standby storage requirements based on the IDAPA rule, which will be used for the purposes of this report.

Table 2-12: Standby Storage Requirements Based on Current Demand

EDUs	ADP (gpd)	Standby Storage Required (gallons)
124	28,565	9,522

2.9.3.5. *FIRE SUPPRESSION STORAGE (FSS)*

If fire flow is to be provided, storage reservoirs must be capable of delivering fire flows in accordance to standards made by the local fire protection authority. A minimum pressure of 20 psi must be maintained throughout the system during fire flow conditions. Fire flow is not provided in this system and thus, fire flow is not included in the analysis of the storage reservoir.

2.9.3.6. *TOTAL STORAGE*

Table 2-13 below provides a summary of the current storage requirements as have been discussed above. It is important to note that the various storage requirements are additive and cannot be nested. As can be seen, the system currently has a storage surplus of 50,353 gallons.

Table 2-13: Storage Requirements Based on Current Demand

EDUs	Dead Storage (gallons)	Operating Storage (gallons)	Equalization Storage (gallons)	Standby Storage (gallons)	Fire Suppression Storage (gallons)	Total Storage Required (gallons)	Total Storage Available (gallons)	Storage Surplus or Deficit (-) (gallons)
124	35,059	5,066	0	9,522	N/A	49,647	100,000	50,353

2.9.4. *DISTRIBUTION SYSTEM*

A hydraulic analysis of the existing distribution system was completed for the current demands using the WaterCAD model. This analysis was used to identify needed system improvements and allow for the identification of any special operational needs. The following modeling scenario was run:

1. Scenario 1 – Steady state analysis with peak hour production throughout the system under the condition where all equalizing storage volume has been depleted and assuming that all sources, except emergency, are under normal operation. The objective is to maintain a minimum pressure of 40 psi at each node.[6]

[6] Based on IDAPA 58.01.08-Idaho Rules for Public Drinking Water Systems (Updated 2009), Subsection 552.01.b: part ii) "The following public water systems or service areas of public water systems shall maintain a minimum pressure of forty (40) psi throughout the distribution system, during peak hour demand conditions, excluding fire flow…"

2.9.4.1. *MODEL ANALYSIS BASED ON CURRENT DEMANDS*

The above scenario was run in the model based on the current demands and the various facilities were modeled based on current configurations and capacities. A complete set of results can be found in Appendix E.

Scenario 1: (Peak Hour Production, Maintain 40 psi Throughout the System)

The objective of this scenario is to maintain a minimum pressure of 40 psi during peak hour production under the condition where all equalizing storage has been depleted and the well and boosters are operating as normal. The following is a summary of the operating conditions modeled in this scenario:

- Sources operating:
  - Well No. 3 and 4 on
- Reservoir levels:
  - Reservoir full

The results of this scenario show that the existing distribution system is sufficient to supply the current peak hour productions at a minimum pressure of 40 psi except for the following locations:

- 21820 E Doyle
- 22239 E Doyle
- 22709 E Doyle
- 25773 E Doyle
- 24785 E Doyle and 25235 E Doyle[7]

2.9.4.2. *SYSTEM LOSS*

System loss may be in the form of "lost" water or "unaccounted" for water. Water is lost when leaks occur in distribution lines or when there is unauthorized use or illegal service connections. Unaccounted for water is a result of accounting errors, inaccurate source or customer meters, and/or water leaving the system for unmetered usage such as flushing of mains and fire flows. For most water systems, system loss is between 10 and 20 percent of the total water supplied to the system[8]. AWWA's Leak Detection and Accountability Committee gave a recommendation of 10 percent for system loss in 1996.

System loss for the system was calculated as the difference between total metered production (9,669,600 gallons) and total metered consumption (6,883,022 gallons) for October 2012 through October 2013.

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[7] These properties do not have junctions or nodes at their service locations, but based on elevations, these properties also do not meet the requirement.

[8] Civil Engineering Reference Manual, Sixth Edition, Michael R. Lindeburg, 1992.

- System Loss = 2,786,578 gallons (28.8% of total production)

There are several potential sources for water lost or unaccounted for, two primary sources are aging meters and depreciated water lines. Aging meters likely accounts for a portion of the system loss since meter accuracy deteriorates with age (resulting in more water passing through the meter than is being tracked). The depreciated water lines also likely account for a portion of the system loss since the lines were installed in the 1970s and are in unknown condition.

2.10. Existing System Deficiencies

This section summarizes the source, storage, and distribution system deficiencies determined in the above analysis under current system demands.

- Source:
  - The current source capacity is deficient by 11 gallons per minute according to the 2009 IDAPA Ground Water Source Redundancy rule.
  - Currently, Well No. 4 has tested over the MCL for Arsenic and Radium and has high amounts of iron (which the residents complain frequently about).
- Storage:
  - The current storage is deficient by 200,207 gallons to serve the system
- Distribution:
  - The existing distribution system is sufficient to provide the current peak hour production and maintain a minimum pressure of 40 psi throughout the system except for at the following locations:
    - 21820 E Doyle
    - 22239 E Doyle
    - 22709 E Doyle
    - 25773 E Doyle
    - 24785 E Doyle and 25235 E Doyle[9]
  - The current distribution system consists of approximately 56,500 linear feet of waterline. Of this, approximately 37 percent (21,000 linear feet) is under 3 inch line, approximately 15 percent (8,000 linear feet) is 4 inch line, and approximately 46 percent (26,000) is 6 inch line. The majority of the system is depreciated PVC and AC. System loss has been calculated at approximately 28.8 percent. Due to the age and condition of the system, there is risk for a large line break which could potentially cause de-pressurization and contamination of the system, which is a threat to public health and safety.

[9] These properties do not have junctions or nodes at their service locations, but based on elevations, these properties also do not meet the requirement.

These deficiencies can be improved by a series of recommended improvements, which are identified in Section 4.

3. Future Conditions

3.1. Growth Projections

Growth within the Association has been steady over the past several years. Currently, the number of memberships is capped and is not anticipated to grow beyond the current number of services.

There are many properties within the Association's area that are not served by the water system but have expressed interest in becoming served by the water system in the future (if capacity is available). Since the Association's water system encompasses such a large area and the served properties are checker-patterned within that area, estimating the location and number of properties potentially served by the system in the future (if the Association decided to increase the number of memberships) would be difficult.

Given the information above, the Association does not intend to grow beyond its existing number of memberships at this time. However, for the purposes of this report, analysis of the Association's system will include growth. Growth is included so that at such time that the Association does decide to extend its number of connections, the facilities have been analyzed.

The Association assumes that growth will occur within the current area served by the system and will occur at a steady rate.

Model analysis will not be completed for projected growth. However, an analysis of source and storage capacity will be completed for the projected growth. It is recommended that, prior to approving growth (or increased number of connections), the Association requires the developer or property owner to fund a detailed hydraulic analysis and any necessary water system improvements required to provide service to the new development without decreasing the level of service provided to the existing service area.

3.2. Demand Forecast

The Kootenai County Comprehensive Plan (approved December, 2010) states that "an average annual growth rate of at least 2% for the next ten years would not be unreasonable to assume for the planning process." A growth rate of 1.5% was chosen due to the rural nature of the Association area.

The estimates for future demands are based on the assumption that the demand per EDU will remain constant throughout the growth period (refer to Section 2.8.1 for a discussion on the EDU determination). It should be noted, however, that if several large users are added to the system or system loss is decreased significantly, these estimates may change. Table 3-1 shows the estimated future demand that has been used for the purposes of this report. It should be recognized that growth and demand have been estimated and will not likely occur exactly as shown in Table 3-1 on the following page.

Table 3-1: Future EDUs and Demand

	Total System			
	EDUs	ADP (gpd)	MDP (gpd)	PHP (gpm)
2013	124	28,565	59,255	129
2014	126	29,026	60,211	131
2015	128	29,487	61,167	134
2016	130	29,948	62,123	136
2017	132	30,408	63,078	138
2018	134	30,869	64,034	140
2019	136	31,330	64,990	142
2020	138	31,790	65,945	144
2021	140	32,251	66,901	146
2022	142	32,712	67,857	148
10-Year (2023)	144	33,173	68,813	150
2024	146	33,633	69,768	152
2025	148	34,094	70,724	154
2026	150	34,555	71,680	157
2027	153	35,246	73,113	160
15-Year (2028)	155	35,707	74,069	162
2029	157	36,167	75,025	164
2030	160	36,859	76,459	167
2031	162	37,319	77,414	169
2032	165	38,010	78,848	172
20-Year (2033)	167	38,471	79,804	174
30-Year (2043)	194	44,691	92,706	202
40-Year (2053)	225	51,832	107,520	235

3.3. FUTURE SYSTEM ANALYSIS

3.3.1. SOURCE

The future source analysis is based on the IDAPA Ground Water Source Redundancy rule which requires a system to supply the MDP with the largest source offline. These are the same criteria that were used in the analysis of the existing source capacity in Section 2.9.2. Source requirements were based on the projected number of EDUs and the associated demand as presented in Section 3.2. Table 3-2 on the following page provides a summary of the analysis. As can be seen, the current source capacity is deficient to serve projected growth based on the Ground Water Source Redundancy rule.

Table 3-2: Source Capacity Analysis – MDP with Largest Pump Offline Based on Future Demand

Source Capacity (gpm)	Growth Phase	EDUs	Current MDP (gpd)	Available Source Capacity with Largest Source Down (gpd)	Source Capacity Surplus or Deficit (-) (gpd)	Source Capacity Surplus or Deficit (-) (gpm)
Production Wells (180 gpm)	Current	124	59,255	43,200	(16,055)	(11)
	10-Year	144	68,813	43,200	(25,613)	(17.8)
	15-Year	155	74,069	43,200	(30,869)	(21.4)
	20-Year	167	79,804	43,200	(36,604)	(25.4)
	30-Year	194	92,706	43,200	(49,506)	(34.4)
	40-Year	225	107,520	43,200	(64,320)	(44.7)

3.3.2. STORAGE

The future storage analysis was performed based on the same analysis criteria, and will evaluate the same storage components as, the current storage analysis. Storage requirements for the system were evaluated based on the projected number of EDUs and associated demands as presented in Section 3.2.

Table 3-3: Storage Requirements Based on Future Demand (Current Source Capacity)

Growth Phase	EDUs	Dead Storage (gallons)	Operating Storage (gallons)	Equalization Storage (gallons)	Standby Storage (gallons)	Fire Suppression Storage (gallons)	Total Storage Required (gallons)	Total Storage Available (gallons)	Storage Surplus or Deficit (-) (gallons)
Current	124	35,059	2,066	0	9,522	N/A	49,647	100,000	50,353
10-Year	144	35,059	5,066	0	11,058	N/A	51,183	100,000	48,817
15-Year	155	35,059	5,066	0	11,902	N/A	52,027	100,000	47,973
20-Year	167	35,059	5,066	0	12,824	N/A	52,949	100,000	47,051
30-Year	194	35,059	5,066	3,365	14,897	N/A	58,387	100,000	41,613
40-Year	225	35,059	5,066	8,217	17,277	N/A	65,620	100,000	34,380

As can be seen, the existing storage facilities will be sufficient for each growth phase.

3.3.3. DISTRIBUTION SYSTEM

As discussed above, distribution system analysis was not completed for projected growth. Rather, we recommend that prior to approving growth on the system, the Association require the developer or property owner to fund an analysis of the impacts to the distribution system. The level of analysis will be determined by the Association on a case by case basis.

3.4. ANALYSIS RESULTS

This section summarizes the source and storage deficiencies determined in the above analysis under projected system demands.

- Source - Based on the 2009 IDAPA Ground Water Source Redundancy rule, the current source capacity is deficient as follows:
  - 10-Year – 17.8 gallons per minute
  - 15-Year – 21.4 gallons per minute
  - 20-Year – 25.4 gallons per minute
  - 30-Year – 34.4 gallons per minute
  - 40-Year – 44.7 gallons per minute
- Storage - Under the current system configuration, the reservoir is sufficient (with surplus) as follows:
  - 10-Year – 48,817 gallons
  - 15-Year – 47,973gallons
  - 20-Year – 47,051 gallons
  - 30-Year – 41,613 gallons
  - 40-Year – 34,380gallons

4. Development and Initial Screening of Alternatives

4.1. Description of Deficiencies to be Corrected by Project

In the previous analysis sections, specifically Sections 2.10 and 3.4, system deficiencies were identified. These deficiencies are addressed with the alternatives listed and described below.

4.2. Development and Evaluation of Alternatives

4.2.1. Source

The options for the source improvements are discussed below. Refer to Figure 4.1 on page 35 for a graphic representation of these options.

4.2.1.1. Option A: Drill New Well

The Association currently relies on two wells, neither with standby power, to serve the system. As was discussed previously, the smallest well (Well No. 3) is not large enough to serve maximum day (refer to Section 2.9.2). In order to address this issue, a third production well would be constructed and a pump capable of producing 150 gallons per minute (in order to mirror the capacity of Well No. 4 and provide a back-up in case of failure or power outage). According to calculations, an additional 45 gallons per minute would be sufficient (in the future scenario); however since Well No. 3 has a significant drawdown and has already once been re-drilled, it might be prudent to drill a new well which would provide the necessary flow in case Well No. 3 fails or stops producing.

The new well would be installed within the District. If the new well were to be drilled adjacent to Well No. 4, there is potential for the new well to have high Arsenic levels. If so, it would need to be treated (refer to Section 4.2.4 below for Treatment System options).

Environmental impacts associated with Source Option A can be found in Section 8.2.1.1.

4.2.1.2. Option B: Add Capacity to Well No. 3

As an alternative to Option A, Well No. 3 could be re-drilled to add additional capacity in order to satisfy the capacity needs, 45 gallons per minute as noted above. This may not be feasible as this well was already re-drilled and at that time it had reduced capacity (50 gallons per minute to 30 gallons per minute) and a considerable drawdown. This could indicate that re-drilling Well No. 3 a second time may not produce favorable results.

Environmental impacts associated with Source Option B can be found in Section 8.2.1.2.

This option was ultimately eliminated due to the instability of re-drilling Well No. 3 a second time.

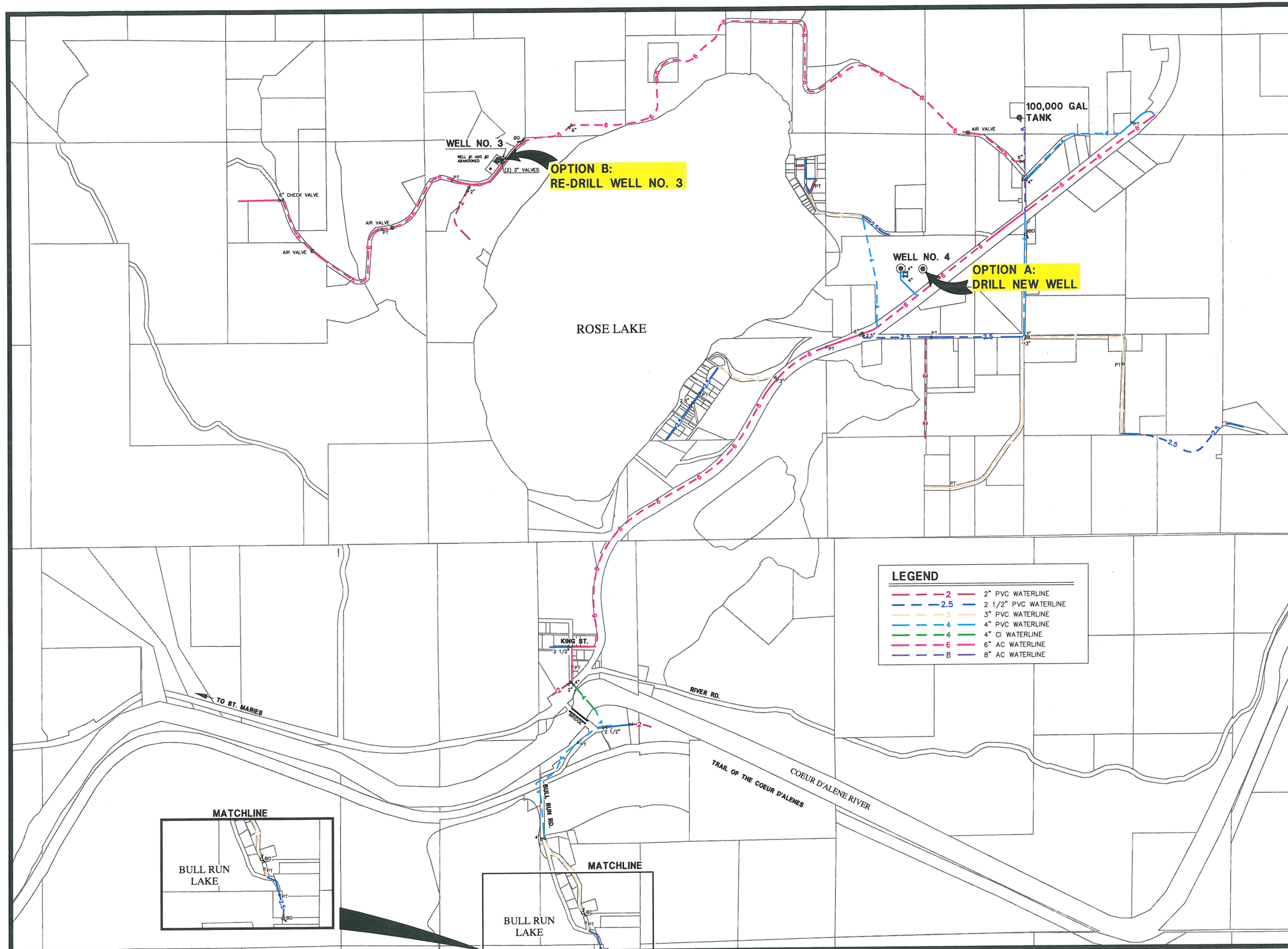
4.2.1.3. OPTION C: NO ACTION

As indicated above the Association relies on two wells, neither with standby power, to serve the system. The smallest well (Well No. 3) is not large enough to serve the maximum day; thus, if Well No. 4 were to fail or power were to go out, Well No. 3 would not have enough capacity to serve the system. Since growth is not likely at this time, "no action" would be an option until such time as the Association decides to add connections[10]. Once growth is added to the system, this option is no longer valid.

It is important to note that reducing system loss may eliminate the current source capacity deficiency (refer to Section 2.9.2) and thus may allow for no action for the source improvements. In other words, if leaks within the system are identified through Distribution Option B and those are remedied, the current deficiency in source capacity could be eliminated.

Environmental impacts associated with Source Option C can be found in Section 8.2.1.3.

[10] According to IDAPA 58.01.08, Section 513.02, the Association would not need to comply with the ground water source redundancy requirements stated in Section 501.17 unless a "modification is made to the system which increases the population served or number of service connections, increases the length of transmission and distribution water mains, or increases the peak or average water demand."



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NO.	DATE	REVISION DESCRIPTION	BY

ROSE LAKE WATER ASSOCIATION

SOURCE OPTIONS
OPTIONS A AND B

FIGURE 4.1

PROJECT NO.:	41113
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DRAWN BY:	J.A.L.
CHECKED BY:	
DWG NAME:	41113DS01.DWG
DATE:	11–18–13
SHEET NO:	

FIG. 4.1

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4.2.2. STORAGE AND BOOSTER

As discussed in previous sections, there are several services on the Doyle Rd waterline which do not meet the pressure requirements. Several alternatives have been developed in order to address this issue. Refer to Figure 4.2 and Figure 4.3 on page 37 and 38 for a graphic representation of these options.

4.2.2.1. OPTION A: ADD BOOSTER PUMP STATION

A booster pump station could be added to the Doyle Rd waterline in order to boost the pressure at the services with lacking pressure. This would also reduce the capacity requirements for the storage reservoir. A pressure reducing system would also need to be incorporated as there are several services along the Doyle Rd waterline which would have unacceptably high pressures at their services. Additionally, since Well No. 3 is located on this waterline, it would need to be modified or abandoned (and a new well drilled at a separate location) since it currently operates on a gravity datum, not the new boosted datum. Thus, this alternative would only be feasible if combined with Source Option A or B.

Environmental impacts associated with Storage and Booster Option A can be found in Section 8.2.2.1.

Option A was ultimately eliminated due to the significant capital cost[11] necessary in order to address the few (approximately five services) issues with pressure along the Doyle Rd waterline.

4.2.2.2. OPTION B: ADD DEDICATED TRANSMISSION MAIN AND BOOSTER

Option B is similar to Option A and would include the booster pump station. However, in lieu of combining it with Source Option A or B, a dedicated transmission main (approximately 10,500 linear feet) could be installed from Well No. 3 to the storage reservoir. This would eliminate the need to modify Well No. 3 in order to operate at the boosted datum.

Environmental impacts associated with Storage and Booster Option B can be found in Section 8.2.2.2.

Similar to Option A above, Option B was eliminated due to the significant capital cost[12] necessary in order to address the few (approximately five services) issues with pressure along the Doyle Rd waterline.

4.2.2.3. OPTION C: ADD NEW STORAGE

Option C would involve constructing a new storage reservoir along the Doyle Rd waterline, at a higher elevation, in order to service the high elevation services. It would also be designed to provide the additional capacity required (220,000 gallons in the future scenario). Well No. 3 would need to be modified in order to be able to pump to the new storage reservoir. Thus, a version of Source Option B would need to be

---

[11] A preliminary, budgetary cost estimate for this improvement is $194,400, not including the necessary source improvements.

[12] A preliminary, budgetary cost estimate for this improvement is $2,105,190.

combined with this alternative (which was eliminated, as discussed above, due to the instability of Well No. 3).

Environmental impacts associated with Storage and Booster Option C can be found in Section 8.2.2.3.

Option C was ultimately eliminated due to the significant capital cost[13] necessary in order to address the few (approximately five services) issues with pressure along the Doyle Rd waterline.

4.2.2.4. OPTION D: INDIVIDUAL BOOSTER PUMPS

Since there are only approximately five services scattered along the Doyle Rd waterline that require higher pressure, Option D involves installing individual booster pumps at each of these services. These booster pumps would be installed and maintained by the Association and would provide the necessary pressure to the higher elevation services[14]. It is important to note that these would need to be approved by IDEQ as they are allowed on a case-by-case basis.

Environmental impacts associated with Storage and Booster Option D can be found in Section 8.2.2.4.

4.2.2.5. OPTION E: NO ACTION

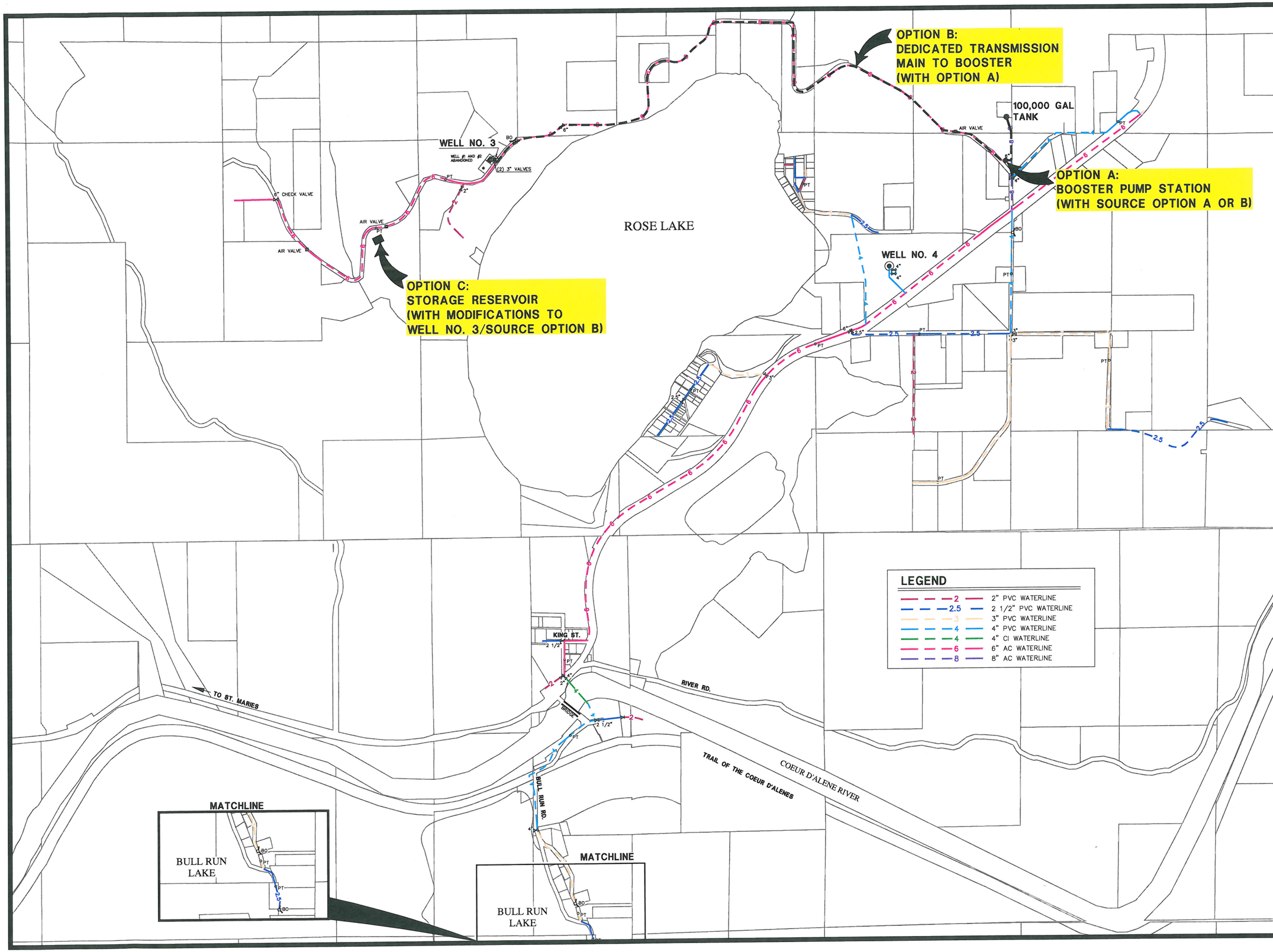
As there are locations within the Association's system that cannot maintain minimum pressure of 40 psi (or 20 psi in a few locations) throughout the whole system, during peak hour demand, several customers experience sub-standard pressure at their services, which is not in compliance with current IDAPA standards. If no action is taken, sub-standard pressure will continue throughout the system and customers will experience sub-standard water service.

Environmental impacts associated with Storage and Booster Option E can be found in Section 8.2.2.5.

---

[13] A preliminary, budgetary cost estimate for this improvement is $409,050, which includes modifications to Well No. 3, which may not be feasible.

[14] It's important to note that the mainline will still experience sub-standard pressure in these locations even if the individual boosters are installed at each of the services mentioned.



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NO.	DATE	REVISION DESCRIPTION	BY

ROSE LAKE WATER ASSOCIATION

STORAGE AND BOOSTER OPTIONS A, B AND C

FIGURE 4.2

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DESIGNED BY:	A.M.W.
DRAWN BY:	J.A.L.
CHECKED BY:	
DWG NAME:	41113DS01.DWG
DATE:	11-18-13
SHEET NO:	

FIG. 4.2

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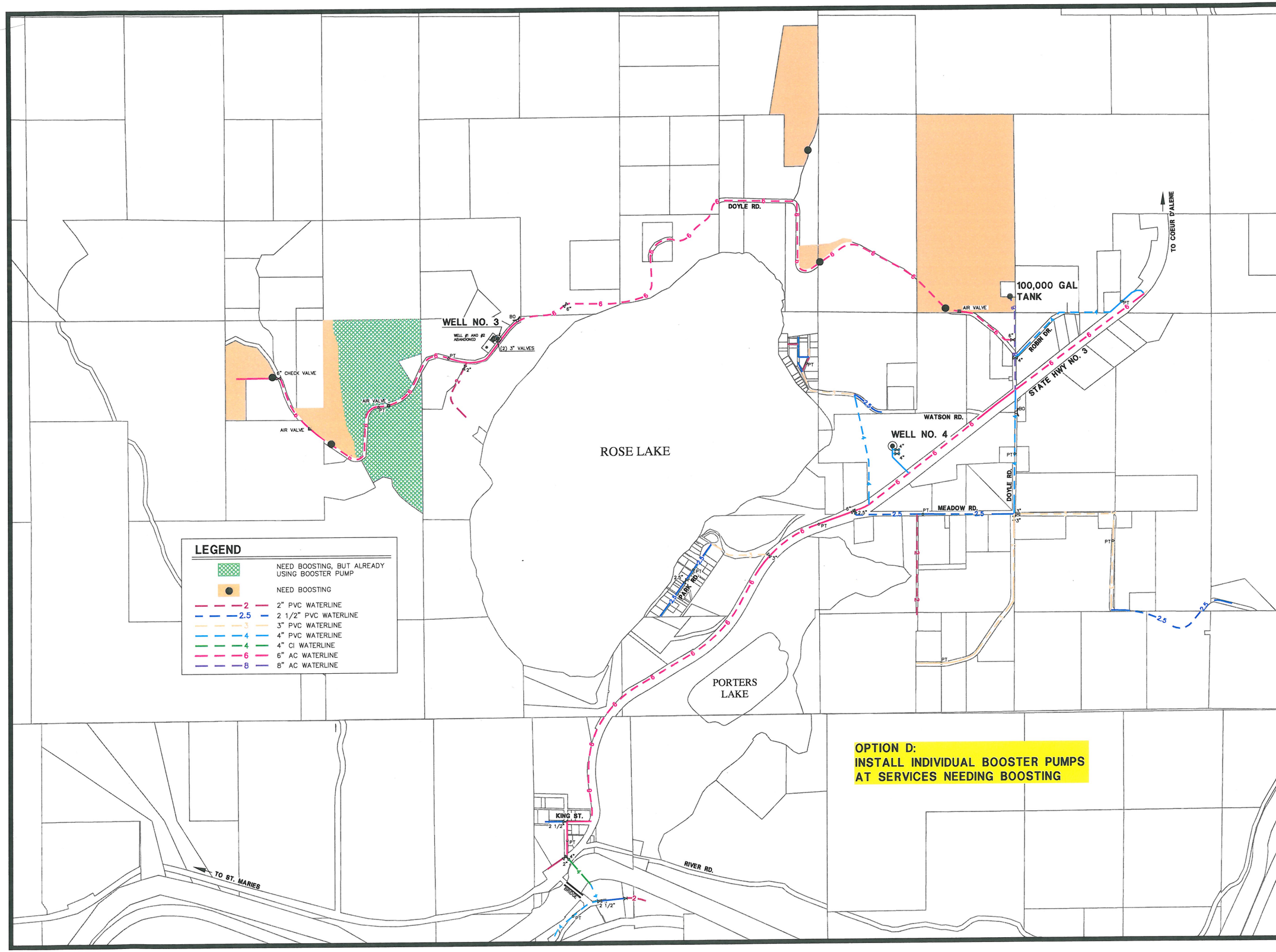

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NO.	DATE	REVISION DESCRIPTION	BY

ROSE LAKE WATER ASSOCIATION
STORAGE AND BOOSTER
OPTION D

FIGURE 4.3

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CHECKED BY:	
DWG NAME:	41113DS01.DWG
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FIG. 4.3

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4.2.3. DISTRIBUTION SYSTEM

The main deficiencies associated with the distribution system involve the pressure issues (discussed and addressed with the storage and booster options above) and the water loss experienced in the system. Since the pressure issues have been addressed with the storage and booster options, this section focuses on resolving the water loss experienced in the system. Refer to Figure 4.4 on page 40 for a graphic representation of these options.

4.2.3.1. OPTION A: METER REPLACEMENT

A meter replacement program would work to replace the aging meters, including some full meter replacements since some meters have been known to flood on a regular basis. This would involve full replacement (including meter setter, piping, valves, meter, and meter box) for 80 percent of the meters in the system and a simple meter replacement (meter only) for 20 percent of the meters in the system.

Environmental impacts associated with Distribution System Option A can be found in Section 8.2.3.1.

4.2.3.2. OPTION B: LEAK DETECTION

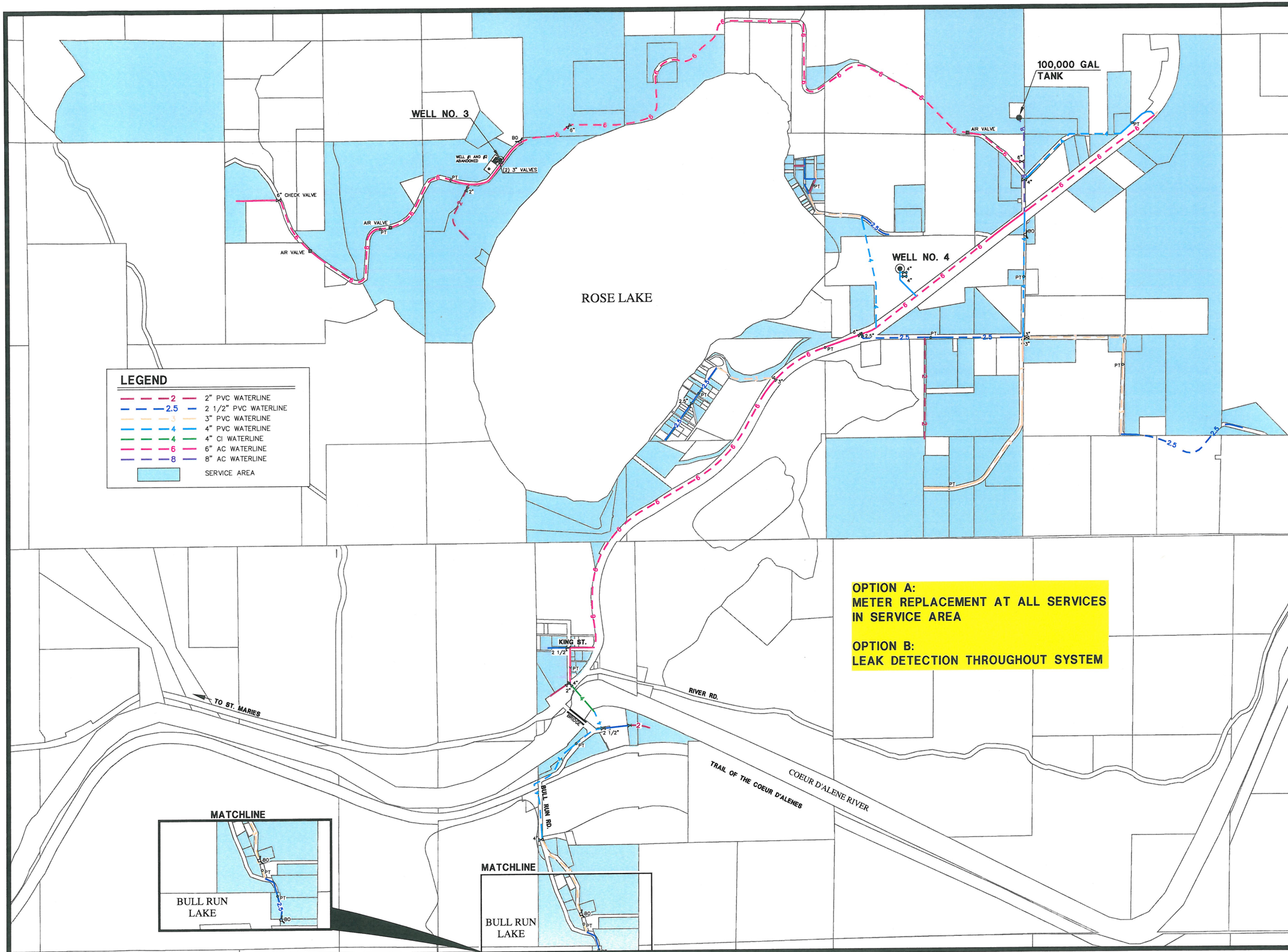
Since it is unknown where, if any, leaks occur within the system, waterline replacement is not feasible at this point. Thus, utilizing a leak detection specialist to investigate the system would provide insight on locations where leaks may be occurring. Once areas are identified, a replacement program could be initiated to replace the leaking waterlines.

Environmental impacts associated with Distribution System Option B can be found in Section 8.2.3.2.

4.2.3.3. OPTION C: NO ACTION

If no action is taken, the distribution system will continue to experience water loss. Investigation of potential reasons for the loss can lead to increased system reliability and efficiency by identifying if the loss is due to aging meters or leaking waterlines or both. If left un-detected and un-resolved, the Association will continue to lose production water and could eventually experience significant waterline failures, system depressurization and contamination.

Environmental impacts associated with Distribution System Option C can be found in Section 8.2.3.3.



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ROSE LAKE WATER ASSOCIATION

DISTRIBUTION
OPTIONS A AND B

FIGURE 4.4

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FIG. 4.4

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4.2.4. TREATMENT SYSTEM

As mentioned in previous sections, Well No. 4 experiences high Arsenic and Radium levels, in addition to high Iron levels. It is important to note that while the level of Radium is on an increasing trend in Well No. 4, it has not reached a level where it is consistently above the MCL. Treatment for this constituent has been included in this plan in order to maximize the opportunity to install treatment at Well No. 4 with Arsenic treatment, or to assist in phasing of projects to address this constituent as it becomes necessary.

The following section explores three (and briefly a fourth) treatment systems that could be used to address the Arsenic and Radium levels in Well No. 4 and potentially address the high Iron levels as well. All four treatment systems are described below. Refer to Figure 4.5 on page 48 for a graphic representation of Option A and B.

4.2.4.1. OPTION A: PRECIPITATIVE OXIDATION FILTRATION SYSTEM

Arsenic

A precipitative iron/manganese oxidation process is "used to remove iron and manganese [which] leads to the formation of hydroxides that remove soluble arsenic by precipitation or adsorption reactions" (EPA, 2000). Primary technology used for this process is green sand filtration. The arsenic removal in this process includes oxidation, ion exchange, and adsorption. Iron (either raw or added through ferric chloride) is oxidized with chlorine injection, allowing the iron ion to combine with the arsenic. This then allows the arsenic to be removed through coagulation and precipitation. Greensand must be regenerated when it has been exhausted, but it is not spent. For further information on precipitative process, refer to the EPA's *Technologies and Costs for Removal of Arsenic from Drinking Water* (2000).

Radium

Prior to the process discussed above, in order to remove radium Hydrous Manganese Oxide (HMO) is introduced after chlorine injection and prior to filtration. HMO filtration is identified by the EPA as a Small System Compliance Technology (SSCT) for radium removal. This technique adds a pre-formed manganese oxide to water to adsorb radium which is later removed by filtration. It is considered by the EPA as a cost effective method for small systems that requires minimal maintenance and operator attention with a basic skill level.

Proposed Technology

The ATEC arsenic and radium removal system, using their proprietary Pyrolusite (manganese dioxide mineral ore) for arsenic, radium, iron, and manganese removal, was explored for this option. The media is robust and has a very high adsorptive capacity. Additionally, the process allows for arsenic, radium, iron and manganese removal in one system, which achieves the necessary treatment goals for the Association.

The backwash water from the filter will either need to be recycled or will need to be disposed. The recycle option was explored during the pilot testing phase in 2013 (see Section 4.2.4.2 below). Another option, which is preferred, is to dispose of the water through a drainfield on the adjacent Idaho Department of Fish and Game (IDFG)

property. Discussions have begun between the Association and the IDFG and seem positive. The drainfield option would be preferred over the recycle, simply due to less complicated operation for the system's operator provided a suitable site can be secured.

In either case (recycle or discharge), backwash water will first go to a settling basin (properly ventilated, see Section 4.2.4.3 below). Only the supernatant would be recycled or sent to a drainfield. The solids (primarily oxidized iron, containing arsenic and radium) will need to be periodically removed and properly disposed. The solids would be pumped to a sand drying bed (used primarily in the summer months). The solids would then be shoveled into a drum and prepared for disposal (picked up by a disposal facility). Special requirements may be required from the disposal facility[15]. Handling of the residual (solids) will be discussed in Section 4.2.4.3 below.

Environmental impacts associated with Treatment System Option A can be found in Section 8.2.4.1.

4.2.4.2. ATEC Filtration Pilot Test for Iron, Arsenic, and Manganese Removal

After initial research on the ATEC system, a pilot test was completed in August 2013 to determine if the system would be appropriate for treatment of Arsenic at the Association's Well No. 4 and if so, what the appropriate operating parameters would be. Well No. 4 was in operation for at least one month prior to the test in order to represent a normal operating condition. Water quality samples were taken during the test to determine pre- and post-treatment conditions (refer to Appendix F for water quality sample results).

Arsenic removal was excellent; finished water arsenic varied from non-detect to 3.7 µ/L with an average of 1.3 µ/L (13 percent of the limit 10 µ/L or approximately 87 percent removal). Iron removal was also excellent; finished water iron varied from non-detect to 0.030 mg/L with an average of 0.012 mg/L (4 percent of the secondary limit of 0.300 mg/L or approximately 99.3 percent removal). Chlorine was added to influent water in varying amounts with an average 1.41 mg/L. Total Chlorine concentration in the finish water averaged at 0.86 mg/L. Chlorine demand did not vary a great deal during the test.

The backwash portion of the pilot test was used to determine characteristics of the recycle process, if it is used in lieu of the drainfield option. The backwash water was drained into a 300 gallon holding tank and settled. The recycle water was pumped from a 5 gallon container (which was skimmed off the surface of the backwash holding tank). The recycle water was then dosed into the influent stream at a reduced rate (1.04 gpm or a 1.8% recycle rate). The recycle water was tested for water quality (see results for Aug. 21st, No. 5 from the certified lab which revealed the arsenic level was

[15] Tests such as TCLP and Paint Filter Test may be required before discharging to a special (private) facility in Washington (either Kent or Pasco) which handles hazardous waste. Other requirements may be required in addition to the tests mentioned above, depending on concentration of Radium and Arsenic and quantity of settled backwash material. It is important to note that the Association does not have an agreement with a facility to receive the waste stream from the treatment.

roughly the same as the incoming raw water stream); during the recycle scenario, the treated water was tested also (see Aug. 21st, No. 6 from the certified lab). It is important to note that the chlorine dose was not adjusted during the recycle scenario, which explains the peak in chlorine in the water quality results). The recycle scenario seems viable and can be used in lieu of the drainfield option, if needed.

Based on pilot test results it was determined that (6) 30-inch diameter vertical filters with 60-inch side walls containing 42-inches of AS 741 M media (Pyrolusite), preceded by (2) 30-inch diameter empty filters to provide approximately two minutes of retention to aid in arsenic removal.

For more information on the pilot test, refer to Appendix F.

4.2.4.3. ATEC Filtration Pilot Test for Radium, Iron, Arsenic and Manganese Removal

After the initial test pilot was conducted, radium concentrations began to trend upward, approaching the maximum contaminate level (MCL) of 5 pCi/L (picocuries per liter). In August 2014 the initial test pilot was repeated with the addition of Hydrous Manganese Oxide (HMO) to determine if radium could potentially be removed simultaneously with the other contaminants. As in previous tests, water quality samples were tested pre- and post-treatment conditions (refer to Appendix F for water quality sample results).

Radium removal was good, reducing radium concentrations to 0.7 pCi/L[16]. with an average of 1.9 pCi/l (38 percent of the limit 5 pCi/l or approximately 62 percent removal). Iron removal was excellent; finished water iron varied from non-detected to 0.09 mg/L with an average of 0.003 mg/L (less than 1 percent of the secondary limit of 0.300 mg/L or approximately 99.8 percent removal). Arsenic removal was also excellent; finished water arsenic varied from non-detected to 1.9 ppb with an average of 0.3 ppb (3 percent of the limit of 10 ppb or approximately 97 percent removal). Lastly, Manganese removal was also excellent; finished water manganese varied from non-detected to 0.028 mg/L with an average of 0.005 mg/L (10 percent of the secondary limit of 0.05 mg/L or approximately 96 percent removed.

The backwash portion of this pilot test was more condensed when compared to the 2013 test. The backwash was settled and it appeared to settle very quickly (approximately 80 percent in the first hour), based on observations by ATEC and by the system's operator. The recycle option for the backwash water was not tested in this pilot test. It appears that the drainfield option will likely be preferable to the recycle option (based on discussions with IDFG and with the Association) and thus it was not tested in the 2014 pilot.

Based on pilot test results it was determined that (8) 30-inch diameter vertical

[16] It is important to note that the first and last day of the pilot testing should be excluded from analysis. On the first and last day of the test, the HMO dosing pump lost prime and thus the operator switched the pumps. Additionally, on the last day, the operator ran out of HMO. In order to address this in the full-scale treatment, it is recommended that the Association purchase back-up dosing pumps and sufficient quantity of chemicals for back-up/emergency purposes.

filters with 60-inch side walls containing 42-inches of AS 741 M media (Pyrolusite), preceded by (2) 30-inch diameter empty filters to provide approximately two minutes of retention to aid in arsenic and radium removal.

For more information on the pilot test for radium, iron, arsenic and manganese refer to Appendix F.

4.2.4.4. ATEC FILTRATION: RESIDUAL HANDLING

The backwash water (solid and liquid) contains both arsenic and radium. This can lead to a special classification of waste. Calculations supporting this information can be found in Appendix J.

Arsenic

For the arsenic liquid waste stream, it must have less than 5.0 mg/L for it to be classified as non-hazardous (EPA, 2003). This requirement is met since the backwash water was tested in the 2013 test and found to be approximately 0.0123 mg/L. Additionally, the disposer (in this case the Association) can be considered a Conditionally Exempt Small Quantity Generator (CESQG) if the arsenic *solid* waste stream has less than 5.0 mg/L (IDEQ, 2007). The Association would still meet this requirement if the amount of arsenic in the solid waste was approximately 5-10 times[17] the amount in the liquid waste stream. The other qualification to this is that the quantity of waste must be less than 100 kg/month (IDEQ, 2007). Based on initial calculations, the Association would produce approximately 0.15 kg/year. Therefore, the Association would meet the CESQG requirements.

Radium

The radium is a naturally occurring radionuclide and thus treating it creates a waste stream that is considered *"technologically enhanced naturally occurring radioactive materials" or TENORM* (EPA, 2005). Additionally, according to the EPA document, "A Regulators' Guide to the Management of Radioactive Residuals", radium is not considered a source material and would not be considered a byproduct material when present in water treatment residuals (2005). The liquid and solid waste streams can be considered "unimportant quantities" (and not subject to special permit requirements) if they contain less than 0.05 percent by weight. Based on initial calculations, the Association would only contain approximately 6.66×10^{-15}percent by weight of Radium (assuming 100 percent removal).

Hazardous or Mixed Waste

The waste stream for the ATEC system will contain both radium and arsenic. This could be considered mixed waste. However, mixed waste is defined as waste that includes *"both hazardous waste and source…or byproduct material"* (EPA, 2005). Radium is not considered a source or byproduct material; therefore, the waste would not be considered mixed, only hazardous (since it contains arsenic).The waste can still

[17] The Association's concentration could be as much as 406 times the amount in the liquid waste stream before they would be over the requirement stated here.

be sent to the facilities in Washington, as discussed previously.

Care shall still be taken by the Operator due to potential exposure to radiation and the hazardous waste. Measures that are anticipated are the following (Set low (EPA), 2004):

- Personal protection equipment (PPE) such as masks and if necessary respiratory devices
- Ventilation all buildings or areas that waste is contained
- Protective gloves and frequently washing hands
- Avoid eating and drinking in the vicinity of the facility
- Shower after exposure and wash work clothing separately
- Work boots or shoes should be wiped and cleaned at the treatment site and kept there.

4.2.4.5. OPTION B: ADSORPTION SYSTEM

An adsorption arsenic-removal system uses a process in which ions in the raw water are absorbed to an oxidized media surface. The contaminant ions (arsenic, in this case) are exchanged with the surface hydroxides on the media. A new removal technique utilizes granular ferric hydroxide (GFH) as the media. The new technique combines the advantages of a coagulation-filtration process with adsorption on media, and simple processing. GFH does not require pre-oxidation, but spent GFH cannot be directly disposed and must be handled appropriately. In addition to arsenic removal, radium can also be removed by this system. According to the EPA this type of technology is effective but is not considered or listed as one of the Best Available Technologies. For further information about the GFH process, refer to the EPA (2000) reference above.

The Siemens arsenic removal system utilizing their proprietary GFH media was explored for this option. As stated above, the media will need to be exchanged[18] and disposed appropriately, approximately every 5 years (dependent on the specific water quality parameters). A separate iron removal system would be needed to remove the iron in the raw water (which is an aesthetic water quality goal for the Association). No chlorine dosing would be required for this system; although HMO injection is likely.

It is likely that the waste stream for this system would be handled much like the ATEC system, creating hazardous waste (not mixed). The backwash water would be sent to a settling basin, with the solids periodically pumped to a sand drying bed and the supernatant to a drainfield.

Environmental impacts associated with Treatment System Option B can be found in Section 8.2.4.2.

4.2.4.6. OPTION C: REVERSE OSMOSIS

Reverse osmosis (RO) system is used for the removal of contaminants by means

[18] Spent media would need to be disposed of at an approved facility, off-site. Siemens provides media exchange and disposal assistance.

of a pressure driven membrane process that removes contaminants larger than the membrane pores. It is considered by the EPA as a Best Available Technologies for the removal of arsenic, fluoride, microbes, nitrate, radium, and uranium. RO treatment has relatively higher costs than other treatment options and requires an advanced operator skill level. Along with higher operating costs membranes have a tendency to foul easily from calcium and magnesium and be damaged by chlorine, high iron, and chloramines. Pretreatment to remove particulates and organics may be necessary to prevent damage. Due to higher treatment costs, advanced operator skill level and damage to membranes from high iron concentration, RO will not be considered as an option for contaminant treatment.

4.2.4.7. OPTION D: POINT OF USE TREATMENT

It is unclear at this time if a waste facility will be able to receive and process the waste stream from the Arsenic and Radium filtration as discussed. Due to this, another option has been presented which includes Point of Use (POU) treatment. POU treatment involves installing individual treatment filters at each residence or connection (often in-home). The Association would be responsible for operation and maintenance of POU treatment. The Association would need to have 100 percent participation and secure access agreements from each property owner in order to maintain these filters. It appears that the waste from these POU filters/treatment could be deposited at a landfill.

The implementation of this option would consist of installing Arsenic treatment (either Option A or B) at Well No. 4[19]. After this project is complete, the Association would then begin pilot testing POU treatment for Radium.

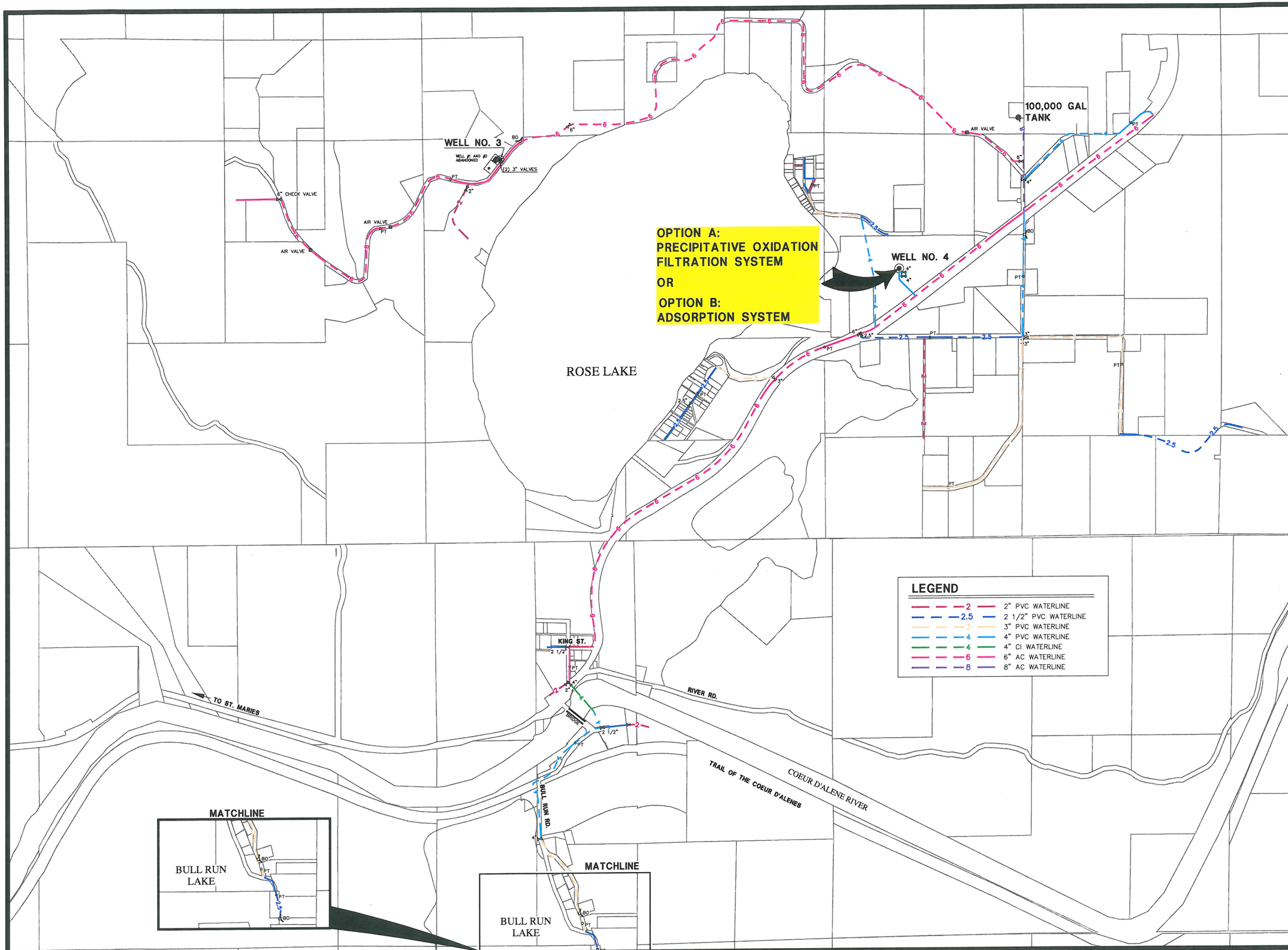
Environmental impacts associated with Treatment System Option D can be found in Section 8.2.4.3.

4.2.4.8. OPTION E: NO ACTION

The high level (above EPA limits) of Arsenic and Radium in Well No. 4 must be treated in order to improve the quality of the water and to improve public health. Additionally, removing the iron is a priority for the Association as it causes aesthetic issues that the Association system users complain about. Thus, if no action is taken, the public health issue presented by the high levels of Arsenic and Radium will continue.

Environmental impacts associated with Treatment System Option E can be found in Section 8.2.4.4.

[19] The Association would provide provisions in the building for treatment of Radium at Well No. 4 if it became positive that the waste stream could be received by a waste facility. This would eliminate the need for POU treatment, but since this is unclear at this time, POU treatment remains a viable option.



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GRAPHIC SCALE
600 0 300 600 1200
(IN FEET)
11x17 SCALE 1" = 1200 ft.
24X36 SCALE 1" = 600 ft.

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NO.	DATE	REVISION DESCRIPTION	BY

ROSE LAKE WATER ASSOCIATION

TREATMENT
OPTIONS A AND B

FIGURE 4.5

PROJECT NO.:	41113
DESIGNED BY:	A.M.W.
DRAWN BY:	J.A.L.
CHECKED BY:	
DWG NAME:	41113DS01.DWG
DATE:	11-18-13
SHEET NO:	

FIG. 4.5

\\Nas-01\cad\Civil3D Projects\41113\Production Drawings\41113DS01.dwg, 11/19/2013 10:49:20 AM, julie, 1:2

4.3. Public Input

This will be completed after the public meeting, scheduled for Spring 2015.

4.4. System Classification and Operator Licensure

The system classification worksheets published by IDEQ were reviewed and preliminarily completed for the options above (refer to Appendix I for copies of these preliminary worksheets). The only options that would change the system's classification would be the Treatment Options. Option A, Option B, and Option C would result in a Class I Treatment System classifications; the system would retain its current Distribution classification (Very Small Public Water System) in these options. The system is currently classified as a Very Small Public Water System (with no treatment classification). Due to these potential changes in system classification, the operator license requirements will be increased if Treatment Option A, B, or C is selected.

5. Final Screening of Principal Alternatives

5.1. Principal Alternatives

The principal improvement options recommended for consideration are as follows:

- Source:
  - Option A: Drill New Well
  - Option C: No Action
- Storage and Booster
  - Option D: Individual Booster Pumps
  - Option E: No Action
- Distribution System
  - Option A: Meter Replacement
  - Option B: Leak Detection
  - Option C: No Action
- Treatment System
  - Option A: Precipitative Oxidation Filtration System
  - Option B: Adsorption System
  - Option D: POU Treatment (for Radium); Option A (for Arsenic)
  - Option E: No Action

5.2. Evaluation of Costs

5.2.1. Capital Costs and Financing Plan

For the purpose of comparison, the estimated project cost for each improvement option is included in Table 5-1. The cost for the No Action options ($0) has not been included in the Table. Detailed cost estimates can be found in Appendix G.

Table 5-1: Capital Costs for Each Option

	Estimated Project Cost
Source Options	
Option A: Drill New Well	$284,000
Storage and Booster Options	
Option D: Individual Booster Pumps	$24,990
Distribution System Options	
Option A: Meter Replacement	$79,240
Option B: Leak Detection	$4,125
Treatment System Options	
Option A: Precipitative Oxidation Filtration System (Radium and Arsenic)	$452,650
Option B: Adsorption System (Radium and Arsenic)	$635,980
Option D: POU Treatment (for Radium); Option A (for Arsenic)	Arsenic (Option A): $305,290 Radium (POU): $125 to $350 per unit[20] ($15,000 to $42,000 for all 120 connections)

As can be seen from the table above, there are many low cost options. Additionally, these options can be combined with each other in order to meet the Association's goals and needs. Within the Treatment System Options, Option D is the lowest capital cost.

5.2.2. Operation and Maintenance Costs

The operation and maintenance costs for the options presented may vary and are thus analyzed in this section.

The operation and maintenance associated with Source Option A may be minor when considering this option provides a redundant well source and is not anticipated to run concurrently with Well No. 4. The costs associated with Storage and Booster Option D are minor (small amount of additional power usage and minor maintenance attention by the Association may be needed) and are not included in this analysis. The Distribution options are not anticipated to increase operation costs.

The treatment options are comparable in terms of operational costs. The only additional energy usage associated with Option A is the chlorine and HMO dosing pumps, which uses a very minor amount of energy in order to operate, and the disposal costs (estimated at this planning level). The main difference between the two systems is the media replacement, which is shown in Table 5-2.

[20] These estimates are based on the IDEQ Point of Use Guidance (August 2006) document. These costs can be refined after pilot testing is complete.

Table 5-2: Treatment Option Operation and Maintenance Cost Comparison

	Option A: Precipitative Oxidation Filtration (Radium and Arsenic)	Option B: Adsorption (Radium and Arsenic)	Option D: Option A for Arsenic and POU for Radium
Media Replacement	$1,000 per year	$58,100 every 5 years[1]	Arsenic (Option A): $500 per year Radium (POU): $250 to $350 per unit per year[2] ($30,000 to $42,000 per year for all 120 connections)

Notes:

1. This is based on a preliminary estimate from Siemens for a 150 gpm system for Arsenic Removal, using the GFH media, upscaled by 40% to account for the addition of Radium treatment. A more thorough analysis of water quality would be necessary to estimate this more specifically.
2. These estimates are based on the IDEQ Point of Use Guidance (August 2006) document. These costs can be refined after pilot testing is complete.

As can be seen above, there is a significant cost for media replacement on the adsorption system option. Additionally, the POU treatment operation and maintenance cost could be considerable (although this would be refined during pilot testing and may be less than the estimate presented).

5.2.3. Cost Escalation Factors for Energy Use

Since the amount of energy use is not anticipated to significantly change from the existing use, cost escalation for energy use has not been estimated to affect the selection of alternatives in this case.

5.2.4. Present Worth Analysis

A "present worth" analysis consists of comparing various alternatives on an "apples to apples" basis. This was done by computing 20 years of O&M expenses to a present worth value, assuming 3 percent interest. Then the present value of O&M is added to the estimated capital project cost, in order to determine the "present worth" value with which to compare alternatives.

The present worth analysis was conducted utilizing the current operation and maintenance costs in addition to the capital costs presented in Section 5.2.1 above. The following table (Table 5-3) presents the results of this analysis.

Table 5-3: Present Worth Analysis

	Estimated Capital Project Cost	Annual O&M[1]	Total Present Worth[2]
Source Options			
Option A: Drill New Well	$284,000	-	$284,000
Storage and Booster Options			
Option D: Individual Booster Pumps	$24,990	-	$24,990
Distribution System Options			
Option A: Meter Replacement	$79,240	-	$79,240
Option B: Leak Detection	$4,125	-	$4,125
Treatment System Options			
Option A: Precipitative Oxidation Filtration System (Radium and Arsenic)	$452,650	$1,000	$467,530
Option B: Adsorption System (Radium and Arsenic)	$635,980	$58,100 every 5 years	$671,050
Option D: Option A for Arsenic and POU for Radium	$305,290 + $125 to $350 per unit ($15,000 to $42,000 for all 120 connections)	$500 + $250 to $350 per unit per year ($30,000 to $42,000 per year for all 120 connections)	$312,730 + $3,850 to $5,560 per unit ($461,325 to $666,860 for all 120 connections)

Notes:

1. Annual O&M is anticipated to be similar to the O&M utilized currently.
2. An annual interest rate of 3% was assumed for a 20 year period.

Since the operation and maintenance costs are expected to remain similar to what the Association spends now (with the exception of Option D), the present worth only reveals the further cost difference between the treatment system options. As can be seen, Option A remains the least expensive option for treating Arsenic, Radium, and Iron in Well No. 4 (if the waste stream can be received by a waste facility).

5.2.5. COMPARISON OF COSTS OF ALTERNATIVES

The present worth analysis conducted above shows that since the operation and maintenance costs are expected to remain similar to what the Association spends now, the Source, Storage and Booster, and Distribution options remain cost effective. The cost of Treatment Option A is the least when reviewing the three treatment options (if the waste stream can be received by a waste facility).

5.3. Reliability of Supply Source

Both existing sources have provided sufficient capacity since their installation (and re-drilling for Well No. 3). The addition of another well (Source Option A) would provide the necessary redundancy for the current and future scenario.

5.4. Alternative Comparison (Environmental)

Refer to Section 8.3 for the environmental comparison analysis of each alternative.

5.5. Final Public Input

This will be completed after the public meeting and comment period, scheduled for Spring 2015.

6. Recommended Plan Description (Capital Improvement Plan)

6.1. Recommended Improvements

In consideration of the information presented in Section 4 and Section 5, the following improvements are recommended to address the deficiencies identified in Section 2 and Section 3:

- Short-Term Improvements:
  - Storage and Booster: Option D (Individual Booster Pumps). This option addresses the need at the approximately five scattered services in the system that require higher pressure. The other options reviewed were determined to be cost prohibitive.
  - Distribution System: Option B (Leak Detection). Due to the age of the system, this would be a cost effective method for reviewing areas significantly contributing to the system's loss.
  - Treatment System: Option D (Option A for Arsenic and POU for Radium). This option would consist of the following:
    - Install Option A (ATEC Filtration) for Arsenic only. Provide provisions in the building expansion and mechanical piping for potential future filtration for Radium. Test the waste stream to determine more accurate parameters for waste facility receiving.
    - Begin pilot testing Radium POU treatment at residence(s).
    - At the point that Radium is over the MCL, implement either filtration at Well No. 4 (Option A) or POU, whichever is more cost effective at the time.
- Long-Term Improvements:
  - Source: Option A (Drill New Well). This option addresses the small deficiency in the source capacity; redundant capacity (to Well No. 4) is recommended. This option would be implemented at the time that the Association adds connections (or grows).
  - Distribution: Option A (Meter Replacement). Pending the results of the leak detection services, the Association may wish to further reduce system loss by replacing meters.

6.2. Selected Improvements

This section will be completed upon option selection.

7. Implementation Arrangements

7.1. Financing Arrangements

The following table shows potential funding sources that may be explored for the Rose Lake Water Association water system improvements.

Table 7-1: Financing Options

Federal Options
Stag Grant (Congressional Appropriation)
USDA – RD Grant/Loan
State Options
IDEQ Loan
ICDBG – Block Grant (LMI Income Survey)
District Option
LID

We recommend a non-public meeting be held with representatives from the agencies listed above. LID formation (District Option) is presented for the Association, if they decided to form a District in order to fund these improvements.

7.1.1. Federal

7.1.1.1. State and Tribal Assistance Grant (STAG)

This type of grant is available to all public and private nonprofit institutions and individuals, and is therefore a highly competitive grant. STAG grants are awarded to applicants who propose projects with significant technical merit and relevance to EPA's mission. STAG grants are awarded congressionally. An application must be filed with a local congressional representative.

7.1.1.2. USDA-Rural Development Grant

Rural development funds are allocated for rural systems for communities with a population of 10,000 or less. Funding is provided by Federal Budget Appropriation and distributed to applicants for repair, improvement, or expansion of water facilities. The maximum amount that a Rural Development grant would cover would be 55 percent of the total project costs, requiring a minimum 45 percent match from the community.

7.1.2. State

7.1.2.1. IDEQ Loan

The primary source of loan assistance for improvements to the water system is through the IDEQ. Loan funds are allocated on the basis of a statewide priority list.

7.1.2.2. IDAHO DEPARTMENT OF COMMERCE (IDOC)-IDAHO COMMUNITY DEVELOPMENT BLOCK GRANT (ICDBG)

These grants are available for assistance to Idaho cities and counties with a population of less than 50,000. The purpose of this type of grant is to aid the development of public infrastructure and housing in order to support and stimulate economic diversification and growth. Funds received from the U.S. Department of Housing and Urban Development are allocated into the six available grant types. The maximum amount that an IDOC grant would cover would be 55 percent of the total project costs, requiring a minimum 45 percent match from the community.

7.1.3. LOCAL MATCH FUNDING

7.1.3.1. LID

A Local Improvement District (LID) is formed by public hearing process, but it can only be formed for an existing District. The Association would have to form a District prior to creating an LID to finance the improvements. An LID bond is repaid by assessments against real property, which is benefited by the public improvement. Any owner of property which is proposed to be assessed under the LID, regardless of residency, has the right to support or object to formation of the LID. This factor could make the proposal more democratic to out-of-state property owners who cannot vote in an election. If 60 percent of the property owners within the LID object to the LID formation, then the Association cannot proceed without resubmitting the LID after 6 months' time, or without appeal to the Board of County Commissioners.

All property owners have two options regarding financing the LID. Each property owner can either pay the amount of the LID assessment in full after completion of the project and prior to finalization of the assessment roll, or the owner can choose to amortize the amount at a set interest rate for a fixed number of years (typically 10 to 20 years). An LID assessment, which is amortized, becomes a lien on the property as security for repayment of the assessment. Or in the case of leased property, a promissory note will be written for the assessment. Refer to Table 7-2 on the following page for the LID procedures per Idaho Code.

Table 7-2: LID PROCESS PER IDAHO CODE

1.	LID Initiated By Resolution
2.	Resolution Of Intent To Create The LID
3.	Notice Of Hearing Published And Mailed To Property Owners
4.	Public Hearing To Consider Protests And Support
5.	Ordinance Creating LID Adopted
6.	Engineer Authorized To Prepare Plans And Bidding Documents
7.	Construction Phase
8.	Prepare Final Costs And Assessment Roll
9.	Notice Of Final LID Hearing
10.	Hearing On Objections To Assessment Roll
11.	Confirmation Of Assessment Roll
12.	Notice Of Final Assessment To Property Owners
13.	30-Day Pre-payment Period
14.	Assessments Not Pre-Paid Will Be Amortized At LID Bond Term And Rate

7.2. Operation and Maintenance Requirements

This will be completed when options are selected.

7.3. Project Schedule

This will be completed when options are selected.

7.4. Certification of Operator

This will be completed when options are selected.

8. Environmental Information

8.1. Existing Environmental Conditions

8.1.1. Physiography, Topography, Geology, and Soils

The Association's water system is located approximately 26 miles southeast of the City of Coeur d'Alene in Kootenai County, Idaho. The system is generally located around Rose Lake and bisected by Highway 3 and the Coeur d'Alene River. The Association provides water to residents in the Rose Lake area. The majority of the connections are single-family year-round residences. The system and service area are located within parts of Sections 3, 4, 9 of Township 48N, Range 1W and 27-29, 32-35 of Township 49N, Range 1W.

The current service area generally surrounds Rose Lake. The area consists primarily of sloped treed and agricultural areas with steeper hillsides on the northern and eastern portion of the Association. The elevation of the system varies from 2,294 feet on the northwestern of the service area to 2,135 feet on the southeastern side of the Lake and across the Coeur d'Alene River. The area is primarily forested with some flatter agricultural areas on the eastern portion of the Association. The service area consists of primarily residential development with a small number of commercial customers. Rose Lake, the smaller Porters Lake, and the Coeur d'Alene River are the primary surface water bodies within the service area.

For the purpose of the environmental review, an Area of Potential Effect (APE) and a Proposed Project Planning Area (PPPA) have been developed. These areas delineate the expected effect area and project planning area. For this Association, the APE/PPPA will consist of the existing service area (growth areas are anticipated to occur within the APE/PPPA area). As is implied, the APE and PPPA are one in the same for this Association and proposed project. This boundary is delineated on a map (Environmental Review Area) in Appendix H1.

The existing topography is variable throughout the Association area. There are flatter areas in the eastern and southern part of the Association with steeper hillsides in the northern and western part of the Association. There are wetlands bordering Rose Lake, Porters Lake, and the Coeur d'Alene River, which are discussed in more detail in Section 8.1.7. Refer to Appendix H1 for a topographical map.

The surface geology in the area has been mapped (Lewis et al., 2002). The types of rock present are:

- Holocene Deposits – Alluvial deposits (Holocene)
- Older Sediments – Sediment (Miocene)
- Belt Supergroup– Burke Formation; Prichard Formation, undivided; Prichard Formation, upper part; Prichard Formation, lower part (Middle Proterozoic)

Detailed descriptions of these deposits and bedrock can be found in Appendix H1. There are several high-angle faults in the northern portion of the Association.

However, the associated description of the map does not identify major, active faults in this area. The Miocene and Younger Faults in Idaho Map (included in Appendix H1), was also consulted and found that the faults do not appear to be active. The Fault map also indicates that the project area is within the Lewis and Clark Fault Zone (a pre-Miocene fault zone with possible Miocene and younger strike-slip motion). Additionally, there are a few instances of "strike and dip of compositional layering interpreted as bedding" throughout the Association (as indicated on the geologic map).

The soils in the area mapped as silt loam by the USDA Soil Survey. These soils are generally well drained and have a moderate shrink-swell potential. There is a large percentage (~52 percent) of soils that have a possibility of erosion[21] since they are silt loams with low portions of larger grain sizes. The soils have a possibility of erosion due to the fine grained particle size. A soils map, description, and key, derived from information from the Natural Resources Conservation Service's Web Soil Survey, are provided in Appendix H1. In addition, the erosion potential information is included in Appendix H1.

8.1.2. SURFACE AND GROUND WATER HYDROLOGY

8.1.2.1. SURFACE WATER

The primary surface water bodies within the Association are Rose Lake, Porters Lake, and the Coeur d'Alene River. Rose Lake is most likely of good water quality and is listed as an "unassessed water" in the 2010 Integrated Report by IDEQ. Porters Lake is not included in the Report. The Coeur d'Alene River (for the portion included in the APE/PPPA) is listed for physical substrate habitat alterations, cadmium, lead, zinc, sedimentation/siltation, and temperature. A TMDL has not been developed, but has been identified as needed for this portion of the Coeur d'Alene River. Lastly, Rose Lake-Stream Order 1&2 is a tributary to Rose Lake; it is listed for temperature. As with the Coeur d'Alene River, Rose Lake-Stream Order 1&2 does not have a TMDL, but has been identified as needing one. There are other small streams located in the area which are tributaries to Rose Lake and other waters in the area. Refer to the topographical map in Appendix H1 for an overview of the surface water in the APE/PPPA.

8.1.2.2. GROUND WATER

The system is supplied by two wells. The wells are located within the source area of the Spokane Valley-Rathdrum Prairie Aquifer (see Appendix H2 for a map of the Aquifer); however the wells most likely draw from other ground water sources. The Aquifer is classified as a sole source aquifer by the US Environmental Protection Agency. A sole source aquifer classification indicates that the aquifer supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. Extensive

[21] Erosion was determined using an erosion factor, K, which "indicates the susceptibility of a soil to sheet and rill erosion by water. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water." (USDA, NRCS Web Soil Survey)

analysis of the ground water in the area, water quality, and water rights is included in Sections 2.5.2, 2.5.3, and 2.5.1, respectively.

8.1.3. FAUNA, FLORA, AND NATURAL COMMUNITIES

The area is treed and is home to many wildlife species. A list of endangered, threatened, and candidate species for Kootenai County was obtained from the US Fish and Wildlife Service's website and is included in Appendix H3. Threatened species include the following: Canada Lynx, Bull Trout, Spalding's Catchfly, and Water Howellia. Candidate species include the following: Yellow-billed Cuckoo. Proposed species include the following: North American Wolverine. In addition, critical habitat has been identified in the Columbia River Basin for the protection of Bull Trout. After consulting the US Fish and Wildlife Service's Critical Habitat Mapper[22], the Association is within a critical habitat area for Bull Trout due to proximity to the Coeur d'Alene River. Refer to Appendix H3 for a map of the critical habitat for Bull Trout in the area.

Essential fish habitat (EFH) for ocean going fish was also examined for the Association. Chinook Salmon are identified as an ocean going fish in the state of Idaho (primarily in central Idaho). After reviewing a map of EFH in Idaho, provided by IDEQ, the Association is outside of this habitat area. Refer to Appendix H3 for the map of EFH in Idaho.

8.1.4. HOUSING, INDUSTRIAL, AND COMMERCIAL DEVELOPMENT

The residences served by the system are primarily single family year-round dwellings. There are a few commercial properties within the Association, which include: Shoshone Fire Station, Crossroads Baptist Church, Rose Lake Community Historical Society, and Watson's Rose Lake Resort. The zoning designation for the area is designated by Kootenai County. The zones included in the APE/PPPA are generally agriculture, agriculture-suburban, and rural. Refer to the zoning map included in Appendix H4.

8.1.5. CULTURAL RESOURCES

There is one historic resource within the Association area: Rose Lake School II. A search of the Kootenai County, Idaho sites listed on National Register of Historic Places, provided in Appendix H4, shows other sites located in the area (approximately 3.5-5.5 miles away) to the east and south of the Association. A list of the properties located in the area (including the Rose Lake School II) is included with a map in Appendix H4. In addition, the Association is not located in a tribal reservation area.

8.1.6. UTILITY USE

The utilities used by the system are primarily power provided by Avista Utilities. The system uses Frontier for telemetry communications.

[22] The US Fish and Wildlife Service Critical Habitat Mapper does not contain all designated habitat, but provides a reference.

8.1.7. FLOODPLAINS AND WETLANDS

FEMA (Federal Emergency Management Agency) has determined floodplain boundaries which are found in the Flood Insurance Rate Maps (FIRMs). These boundaries were utilized to determine if the Association is in a floodplain. It appears that there are several floodplain areas, referred to as Special Flood Hazard Areas (SFHAs), subject to inundation by the 1% annual chance flood, Zone AE on the FIRMs. Zone AE denotes that the area has been hydraulically analyzed and base flood elevations have been determined. There are floodplain areas throughout the Association. Refer to Appendix H5 for the FEMA floodplain map for the Association area.

United States Fish and Wildlife Service provide a National Wetlands Inventory database[23]. A map of wetlands within the project area was prepared using the database and is included in Appendix H5. The map indicates that there are several areas designated as wetlands in the Association, the primary being Rose Lake, Porters Lake and the Coeur d'Alene River.

8.1.8. WILD AND SCENIC RIVERS

The nearest designated Wild and Scenic River is a segment of the Saint Joe River approximately 36 miles to the southeast of the Association. Therefore, no designated Wild and Scenic Rivers are located within the APE/PPPA. A map of the Wild and Scenic Rivers in the United States can be found in Appendix H5 as well as an enlargement of this map to show the Association area and the Saint Joe River.

8.1.9. PUBLIC HEALTH AND WATER QUALITY CONSIDERATIONS

As mentioned in Section 2.5.3, the water quality of the system is monitored according to IDEQ rules and regulations. The levels of most regulated contaminants were below state and federal standards, with the exception of some high arsenic levels in Well No. 4. The last positive coliform sample was taken in October 2012 (refer to Section 2.5.3 for discussion of this sample). The water from the wells is only chlorinated in case of emergency, and the water is chlorinated at the well pump houses (prior to being pumped to the system).

8.1.10. IMPORTANT FARMLANDS PROTECTION

Prime agricultural classification is provided as part of the USDA Soil Survey conducted for the soil information in Section 8.1.1. According to the Soil Survey, "farmland classification identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops." There are soils listed as prime farmland (with varying clauses or conditions) within the Association area. A map of the soils within the Association, with a key

[23] The geodatabase is only effective as of the date of extraction (2012). Also the dataset represents the extent, approximate location and type of wetlands and deepwater habitats in the US. Refer to http://www.fws.gov/wetlands/Data/Wetlands-Geodatabase-User-Caution.html for more information on the geodatabse.

including the farmland information, is provided in Appendix H1. These soils are present in approximately 62 percent of the area.

8.1.11. SOLE SOURCE AQUIFER PROXIMITY

The system is within the Source Area for the Spokane Valley-Rathdrum Prairie Aquifer (see Appendix H2 for a map of the Aquifer). The Aquifer is classified as a sole source aquifer by the US Environmental Protection Agency. A sole source aquifer classification indicates that the aquifer supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer.

8.1.12. LAND USE AND DEVELOPMENT

The existing land use in the area consists of open space limited residential and timber. The land use map for the APE/PPPA (derived from Kootenai County land use designations) can be found in Appendix H4.

8.1.13. PRECIPITATION, TEMPERATURE, AND PREVAILING WINDS

The following climate information for the Rose Lake area (Cataldo, Idaho) was obtained from weather.com, based on monthly averages:

- Average Annual Temperature High – 58°F
- Average Annual Temperature Low – 36°F
- Average Annual Precipitation – 33.4 inches
- Average Annual Snow Fall – 32.5 inches[24]

The prevailing wind in the area is North, Northeast, according to the Western Regional Climate Center.

8.1.14. AIR QUALITY AND NOISE

The State of Idaho has been delegated authority to regulate air quality through the EPA and the Clean Air Act. The State Implementation Plan provides the rules and regulations to maintain acceptable air quality standards within the state and site specific plans delineating areas that do not meet air quality standards. Areas that do not meet specific air quality standards are known as Nonattainment Areas. A map showing Nonattainment Areas and Areas of Concern for the State of Idaho is provided in Appendix H6. The Association is not located in a Nonattainment Area or an area of concern. Noise from the existing facilities is not disruptive and has not been an issue for the residents.

8.1.15. ENERGY PRODUCTION AND CONSUMPTION

The Association currently meters individual water consumption with service meters at all connections monthly for May through October. Users are charged a base rate which includes an allotted amount of water, based on connection type. Additional fees are charged for water use in excess of the base allotment of water. The rate

[24] Average annual snow fall for Rose Lake was obtained from NOAA, for the Coeur d'Alene station.

structure discourages wasteful use of water and reduces overall water and energy consumption.

8.1.16. SOCIOECONOMIC PROFILE OF AFFECTED COMMUNITY

The system serves a population of approximately 294[25] residents through 124 EDUs. The population of the current service area is fairly stable and is not anticipated to increase. The majority of the homes served by the Association are primary, year-round single family dwelling units. Although no social-economic data is available specifically for this project planning area, the US Census Bureau reports that 12.9 percent of the population in Rose Lake (zip code 83810) is below the poverty level (generally, 12.8 percent in Kootenai County). The median household income in 2010 was reported as $40,515 (generally, $48,075 in Kootenai County).

8.2. ENVIRONMENTAL IMPACTS FOR PROPOSED ALTERNATIVES

8.2.1. SOURCE

8.2.1.1. OPTION A: DRILL NEW WELL

The primary environmental impacts associated with installation of a third well consist of drilling for the new well. The installation of the improvements would impact the following existing environmental conditions:

- Physical aspects (minor long-term impact due to excavation for the new well and well house),
- Socioeconomics of the area (increased user rates will provide improved service over the long-term),
- Water quality (minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate BMPs),
- Cultural resources (potential impact due to installation in new, undisturbed areas),
- Flora and fauna (minor short-term impact due to construction activity),
- Agricultural lands (potential impact due to installation in new, undisturbed areas),
- Air quality (minor short-term impact due to construction activity),
- Energy (improved overall system efficiency), and
- Public health (positive impact to system service and reliability in the long-term)

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect, or cumulative impacts.

8.2.1.2. OPTION B: ADD CAPACITY TO WELL NO. 3

The primary environmental impacts associated with installation of additional

[25] Average persons per household for 2010 for Rose Lake (2.37) multiplied by the number of EDUs equaling an approximate population.

capacity at Well No. 3 well consist of re-drilling for the capacity. The installation of the improvements would impact the following existing environmental conditions:

- Physical aspects (minor long-term impact due to excavation for the additional well depth),
- Socioeconomics of the area (increased user rates will provide improved service over the long-term),
- Water quality (minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate BMPs),
- Flora and fauna (minor short-term impact due to construction activity),
- Air quality (minor short-term impact due to construction activity),
- Energy (improved overall system efficiency), and
- Public health (positive impact to system service and reliability in the long-term)

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect, or cumulative impacts.

8.2.1.3. OPTION C: NO ACTION

Since there would be no action taken to improve the current system, there would be no environmental impacts due to new construction. However, since the smallest well (Well No. 3) is not large enough to serve the system during a maximum day condition (with Well No. 4 out of service). It is possible that some customers may not receive optimum service during a situation such as this; but, since the deficiency is relatively small, it may not be necessary to complete the improvements to the source[26]. If the deficiency is not addressed, the Association would have no potential for growth or expansion without first improving the well source capacity.

8.2.2. STORAGE AND BOOSTER

8.2.2.1. OPTION A: ADD BOOSTER PUMP STATION

The primary environmental impacts associated with adding a booster pump station would consist of the pump and piping in addition to a building and standby generator. The installation of the improvements would impact the following existing environmental conditions:

- Physical Aspects (minimal long-term impact and short-term impact for the excavation, piping, and pump installation),
- Socioeconomics of the area (increased user rates will provide improved system pressure and service over the long-term),
- Water quality (minor short-term impact to water quality due to ground

[26] According to IDAPA 58.01.08, Section 513.02, the Association would not need to comply with the ground water source redundancy requirements stated in Section 501.17 unless a "modification is made to the system which increases the population served or number of service connections, increases the length of transmission and distribution water mains, or increases the peak or average water demand." So unless the Association intends to increase their number of connections or expand the distribution system, improvements to the source are not necessary.

disturbance, to be mitigated through appropriate BMPs),
- Cultural resources (potential impact due to installation in new, undisturbed areas),
- Flora and fauna (minor short-term impact due to construction activity),
- Agricultural lands (potential impact due to installation in new, undisturbed areas),
- Air quality (intermittent long-term impact due to standby generator),
- Energy (improved overall system efficiency, but additional pumping due to increased pumping capacity resulting in negligible impact), and
- Public health (positive impact to system service and reliability in the long-term).

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect, or cumulative impacts. As noted previously, this option would need to be combined with Source Option A or B, so the environmental impacts associated with those would be included here as well (refer to Section 8.2.1).

8.2.2.2. OPTION B: ADD DEDICATED TRANSMISSION MAIN AND BOOSTER

The primary environmental impacts associated with the dedicated transmission main consist of trench excavation for approximately 10,500 linear feet of waterline installation. The installation of the improvements would impact the following existing environmental conditions:

- Physical Aspects (minimal long-term impact and short-term impact for the waterline installation),
- Socioeconomics of the area (increased user rates will provide improved service over the long-term),
- Floodplains (minor short-term impact due to transmission main within the Rose Lake floodplain),
- Wetlands and water quality (minor short-term impact due to transmission main installation within wetland area, minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate best management practices (BMPs)),
- Cultural resources (potential impact due to waterlines in new areas),
- Flora and fauna (minor short-term impact due to construction activity),
- Agricultural lands (potential impact due to installation of waterlines in new areas),
- Air quality (minor short-term impact due to construction activity), and
- Public health (positive impact to system service and reliability in the long-term)

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect, or cumulative impacts. As noted previously, this option would need to be combined with Option A above, so the environmental

impacts associated with that option would be included here as well (refer to Section 8.2.2.1).

8.2.2.3. OPTION C: ADD NEW STORAGE

The primary environmental impacts associated with adding a new storage facility would consist of the excavation and installation for the new storage facility. The installation of the improvements would impact the following existing environmental conditions:

- Physical Aspects (minimal long-term impact and short-term impact for the reservoir and necessary site piping excavation and installation),
- Socioeconomics of the area (increased user rates will provide improved service over the long-term),
- Water quality (minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate BMPs),
- Cultural resources (potential impact due to site of new reservoir),
- Flora and fauna (minor short-term impact due to construction activity),
- Agricultural lands (potential impact due to installation of new reservoir),
- Air quality (minor short-term impact due to construction activity), and
- Public health (positive impact to system service and reliability in the long-term)

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect, or cumulative impacts. As noted previously, this option would need to be combined with a version of Source Option B, so the environmental impacts associated with that option would be included here as well (refer to Section 8.2.1.2).

8.2.2.4. OPTION D: INDIVIDUAL BOOSTER PUMPS

The primary environmental impacts associated with adding individual booster pumps to select services would consist of the pump and minor site piping adjustments. The installation of the improvements would impact the following existing environmental conditions:

- Physical Aspects (minimal long-term impact and short-term impact for the excavation, piping, and pump installation),
- Socioeconomics of the area (minor increased user rates will provide improved pressure and service over the long-term for the services modified),
- Wetlands (depending on location) and water quality (minor short-term impact due to individual booster pump installation within wetland area, minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate best management practices (BMPs)),
- Cultural resources (potential impact due to site of each pump),
- Flora and fauna (minor short-term impact due to construction activity),
- Agricultural lands (potential impact due to construction of each pump),

- Air quality (minor short-term impact due to construction activity), and
- Energy (minor additional consumption due to minor additional pumping)

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect, or cumulative impacts.

8.2.2.5. OPTION E: NO ACTION

As there are locations within the Association's system that cannot maintain minimum pressure of 40 psi (or 20 psi in a few locations) throughout the whole system, during peak hour demand, several customers experience sub-standard pressure at their services, which does not meet current IDAPA standards. If no action is taken, sub-standard pressure will continue throughout the system and customers will experience sub-standard water service. Lastly, the Association would have no potential for growth or expansion without first improving their existing system.

8.2.3. DISTRIBUTION SYSTEM

8.2.3.1. OPTION A: METER REPLACEMENT

The primary environmental impacts associated with replacing meters would consist of installing the meter and minor site piping adjustments. The installation of the improvements would impact the following existing environmental conditions:

- Physical Aspects (minimal long-term impact and short-term impact for the excavation, piping, and meter installation),
- Socioeconomics of the area (minor increased user rates will provide improved service over the long-term and more accurate estimations of use),
- Wetlands (depending on location) and water quality (minor short-term impact due to individual meter replacement within wetland area, minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate best management practices (BMPs)),
- Cultural resources (potential impact due to site of each meter),
- Flora and fauna (minor short-term impact due to construction activity),
- Agricultural lands (potential impact due to installation of each meter),
- Air quality (minor short-term impact due to construction activity), and
- Energy (more accurate estimate of usage, leading to change in pumping/energy requirements over the long-term)

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect, or cumulative impacts.

8.2.3.2. OPTION B: LEAK DETECTION

There are no anticipated environmental impacts associated with this option as it consists of no excavation but is intended as a system analysis. Resulting improvements (not included in this document, but generally may include waterline replacement or repair) could potentially have impacts.

8.2.3.3. *OPTION C: NO ACTION*

Since there would be no action taken to improve the current system, there would be no environmental impacts from new construction. However, the Association currently experiences a relatively high loss (approximately 28.8 percent), pointing to the existence of waterline leaks, which could also become a source of system contamination, and/or aging meters. The potential for contamination pose a threat to public health and safety.

8.2.4. *TREATMENT SYSTEM*

8.2.4.1. *OPTION A: PRECIPITATIVE OXIDATION FILTRATION SYSTEM*

The primary environmental impacts associated with installation of a precipitative oxidation filtration system consist of installing the filter, expanding the well house, and disposing of the backwash water. The installation of the improvements would impact the following existing environmental conditions:

- Physical aspects (minor long-term impact due to excavation for the well house expansion),
- Socioeconomics of the area (increased user rates will provide improved service over the long-term),
- Water quality (minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate BMPs and minor long-term impact due to backwash storage in drainfield (if utilized in lieu of recycle); positive long-term impact by addressing water quality issues in raw well water),
- Cultural resources (potential impact due to site of well house expansion),
- Flora and fauna (minor short-term impact due to construction activity),
- Agricultural lands (potential impact due to installation of well house expansion and backwash storage (if utilized in lieu of recycle)),
- Air quality (minor short-term impact due to construction activity),
- Energy (minor increased pumping due to chlorine dosing pump), and
- Public health (positive impact to water quality and service in the long-term)

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect, or cumulative impacts.

8.2.4.2. *OPTION B: ADSORPTION SYSTEM*

The primary environmental impacts associated with installation of an adsorption system consist of installing the media system, expanding the well house, and disposing of the spent media[27]. The installation of the improvements would impact the following existing environmental conditions:

[27] As indicated previously, spent media would need to be disposed of at an approved facility, off-site. Siemens provides media exchange and disposal assistance.

- Physical aspects (minor long-term impact due to excavation for the new well house),
- Socioeconomics of the area (increased user rates, including funds to dispose of spent media, will provide improved service over the long-term),
- Water quality (minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate BMPs; positive long-term impact by addressing water quality issues in raw well water),
- Cultural resources (potential impact due to site of well house expansion),
- Flora and fauna (minor short-term impact due to construction activity),
- Agricultural lands (potential impact due to installation of well house expansion),
- Air quality (minor short-term impact due to construction activity), and
- Public health (positive impact to water quality and service in the long-term)

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect, or cumulative impacts.

8.2.4.3. OPTION D: PRECIPITATIVE OXIDATION FILTRATION SYSTEM FOR ARSENIC AND POU FOR RADIUM

The primary environmental impacts associated with installation of a precipitative oxidation filtration system (for Arsenic only) consist of installing the filter, expanding the well house, and disposing of the backwash water. The primary environmental impacts associated with the installation of POU (for Radium) are very minor in that they would likely be installed in-home. The installation of the improvements would impact the following existing environmental conditions:

- Physical aspects (minor long-term impact due to excavation for the well house expansion),
- Socioeconomics of the area (increased user rates will provide improved service over the long-term),
- Water quality (minor short-term impact to water quality due to ground disturbance, to be mitigated through appropriate BMPs and minor long-term impact due to backwash storage in drainfield (if utilized in lieu of recycle); positive long-term impact by addressing water quality issues in raw well water),
- Cultural resources (potential impact due to site of well house expansion),
- Flora and fauna (minor short-term impact due to construction activity),
- Agricultural lands (potential impact due to installation of well house expansion and backwash storage (if utilized in lieu of recycle)),
- Air quality (minor short-term impact due to construction activity),
- Energy (minor increased pumping due to chlorine dosing pump), and
- Public health (positive impact to water quality and service in the long-term)

The majority of these impacts is expected to be short-term and is not anticipated to create long-term, indirect, or cumulative impacts.

8.2.4.4. Option E: No Action

The high level (above EPA limit) of Arsenic and (trending toward EPA limit) Radium in Well No. 4 must be treated in order to improve the quality of the water and to improve public health. Additionally, removing the iron is a priority for the Association as it causes aesthetic issues that the Association system users complain about. Thus, if no action is taken, the public health issue presented by the high levels of Arsenic (and increasing trend for Radium) will continue.

8.3. Alternative Comparison

An additional comparison of the alternatives has been included in Appendix H7. This comparison highlights the major impacts anticipated for each alternative discussed above.

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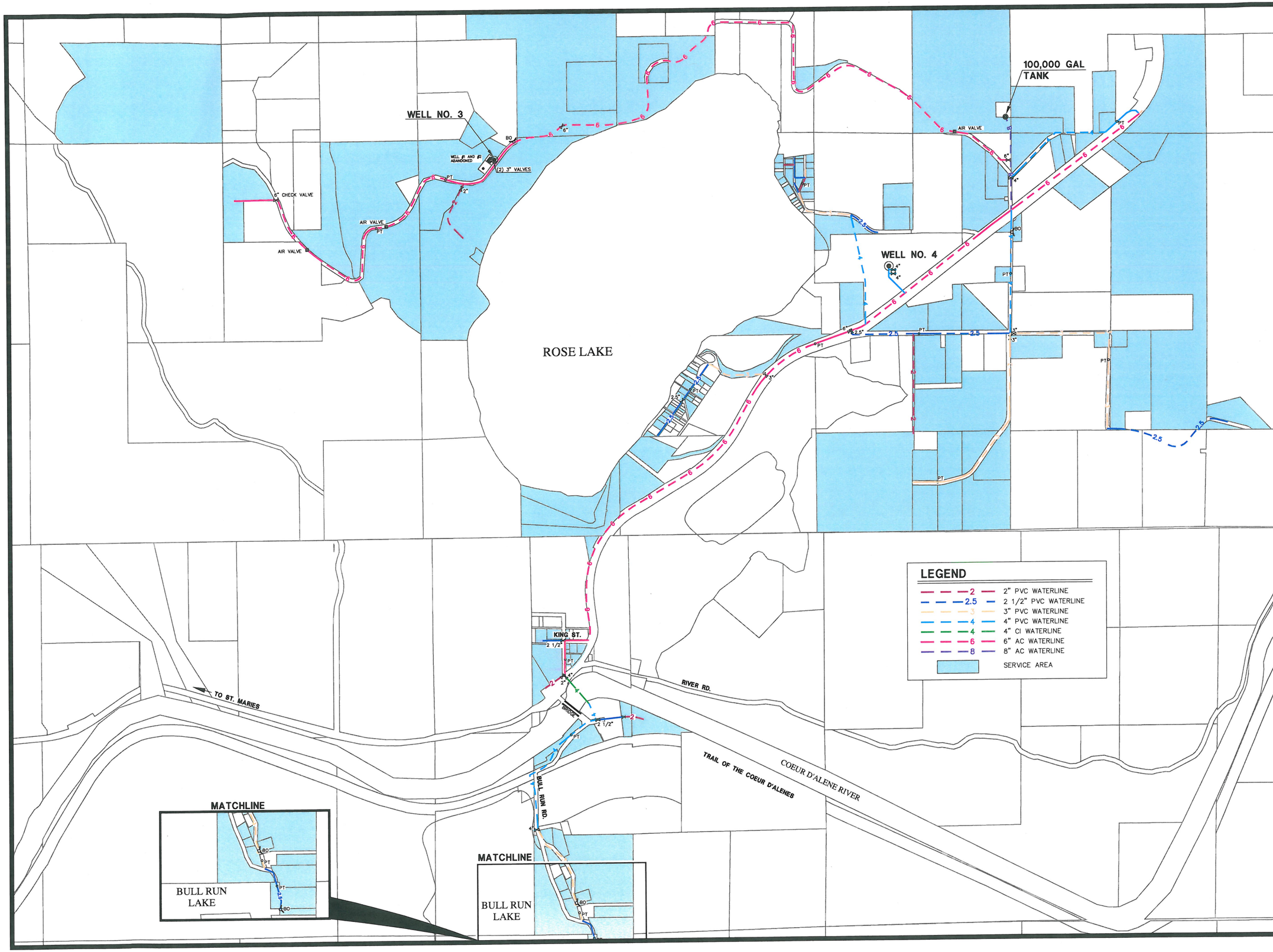
APPENDIX A:
SYSTEM MAPS

WELCH-COMER
ENGINEERS | SURVEYORS



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GRAPHIC SCALE

600 0 300 600 1200

(IN FEET)

11x17 SCALE 1" = 1200 ft.
24X36 SCALE 1" = 600 ft.

WELCH-COMER
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(fax) 208-664-5946

NO.	DATE	REVISION DESCRIPTION	BY

ROSE LAKE WATER ASSOCIATION

EXISTING WATER SYSTEM SERVICE AREA

FIGURE 2.2

PROJECT NO.:	41113
DESIGNED BY:	A.M.W.
DRAWN BY:	J.A.L.
CHECKED BY:	
DWG NAME:	41113DS01.DWG
DATE:	11-18-13
SHEET NO:	

FIG. 2.2

\\Nas-01\cad\Civil3D Projects\41113\Production Drawings\41113DS01.dwg, 11/19/2013 10:49:16 AM, julie, 1:2

APPENDIX B:

ASSOCIATION FINANCIAL INFORMATION

WELCH-COMER
ENGINEERS | SURVEYORS

2013 Operating Budget

Rose Lake Water Association, Inc.
PO Box 178
Cataldo, Idaho 83810

CASH OPERATING INCOMES, SECTION A:	2012 BUDGET	2012 ACTUAL	2013 BUDGET
Number of water users 120@ $30.00/month	$43,200.00	$44,000.00	$43,200.00
Overage amounts	$700.00	$700.00	$700.00
Other income	$300.00	$552.00	$300.00
TOTAL CASH OPERATING INCOME:	$44,200.00	$45,252.00	$44,200.00
CASH OPERATING EXPENSES, SECTION B:			
Salaries and Wages	$10,100.00	$12,600.00	$12,600.00
Accounting/Audits/Legal	$2,000.00	$2,300 .00	$2,000.00
Utilities (Phone2700.00/Power 4316.00)	$7,200.00	$7,200.00	$7,200.00
Insurance	$3,351.00	$2,756.00	$2,756.00
Maintenance and Repairs	$7,000.00	$3,600.00	$3,000.00
Supplies-Operating	$2,000.00	$4,800.00	$4,800.00
Water Fees	-$360.00	$600.00	-0-
Testing and Water Quality	$1,000.00	$2,700.00	$1,000.00
Office Supplies/Postage/Bank Charges	$800.00	$1,568.00	$1,000.00
Travel	$1,900.00	$2,560.00	$1,400.00
CEU-Education			$500.00
Taxes	$700.00	$922.00	$1,000.00
Dues (includes DEQ)	$900.00	$900.00	$900.00
Depreciation	$5,860.00		$5,860.00
TOTAL CASH OPERATING EXPENSES	$42,451.00	$42,606.00	$43,216.00
NET CASH OPERATING INCOME = (A+B)	$1,749.00	$2,646.00	
OTHER CASH RECEPTS, SECTION C:			
Payment to others			$15,000.00
Fixed Assets		$78,724.00	$6,000.00
Transfer to Replacement Reserve			
Cash - Total			$115,000.00
Land			$23,841.00
Buildings/Furniture			$54,882.00

EXCESS - DEFICIT

This Budget was discussed and approved at the Membership Annual Meeting 2-21-2013

Rosemary Crast, Secy Appropriate Official

THE ROSE LAKE WATER ASSOCIATION, INC.
P.O. Box 178
Cataldo, Idaho 83810
(208) 682-4451

In case of an emergency or maintenance problem on the water system call:
Mike White – Maintenance – (208) 682-2643
Rosemary Coast – Sec./Treasurer – (208) 682-4451

The Water Use Limit is 240,000 gallons per year. Meters are read May 1st for the year and again in June, July, August, and October 1st (last meter read). The Water Use Limit for the months of May through September is 25,000 gals. per month. The Overage Charge begins at $1.25 per 1,000 gallons over the limit. It increases an additional $1.25 per 1,000 gallons every 5,000 gallons over the limit. These overage charges will apply only during the meter reading months May-September. The base rate of $1.25 per 1,000 gallons will apply for the winter months. Winter gallons allowed is 120,000 gallons for the 7 months that the meters are not read.

Overage Charges:

Segment		Total Segment Charge	Cumulative Segment Charge
1- 5,000	$1.25/1,000 gals.	$6.25	
5,001- 10,000	$2.50	$12.50	$18.75
10,000- 15,000	$3.75	$18.75	$37.50
15,001- 20,000	$5.00	$25.00	$62.50
20,001- 25,000	$6.25	$31.25	$93.75
25,001- 30,000	$7.50	$37.50	$131.25
30,001- 35,000	$8.75	$43.75	$218.75
35,001- 40,000	$10.00	$50.00	$268.75
40,001- 45,000	$11.25	$56.25	$325.00
45,001- 50,000	$12.50	$62.50	$387.50
50,001- 55,000	$13.75	$68.75	$456.25
55,001- 60,000	$15.00	$75.00	$531.25
60,000- 65,000	$16.25	$81.25	$621.50
65,000- 70,000	$17.50	$87.50	$709.00
70,001- 75,000	$18.75	$93.75	$802.75
75,001- 80,000	$20.00	$100.00	$902.75
80,001- 85,000	$21.25	$106.25	$1,009.00
85,001- 90,000	$22.50	$112.50	$1,121.50

Examples:

July Use 62,240 gals. minus 25,000 allowed = 37,240 Overage
$175.00 Cumulative + ($10.00 X 3) = $205.00 Overage Charge

July Use 26,600 gals. minus 25,000 allowed = 1,600 Overage
$0.00 Cumulative + ($1.25 X 2) = $2.50 Overage Charge

There is a $10.00 fee charged for all checks returned by the bank.

the system. The secretary called the lab and ask Faye Smythe, who is on our water system, how we did according to the results. She said everything looked okay except for four (4) high copper tests. She said the DEQ will probably get ahold of us in a couple weeks concerning the test results.

The secretary reported to the board on the progress of the contracts being drawn up by the attorney with the property owners. He should have them done pretty soon. He said he has been having trouble getting together with Jim DeSmet, our engineer, to describe the locations of the proposed test wells.

The board looked at the letter and billing going to GTE for digging into and breaking our main waterline on August 19, 1993. The letter was reworded and the charges for Buck's hours will be $10.00 an hour to cover costs.

A rate increase was discussed at length. It was agreed the board will have to raise the rates considerably if not double them to keep up with all the expenses of updating the system mandated by the EPA and DEQ. The board reached this decision with much regret. It was agreed to contact the FmHA for grant/loan funding as we cannot continue to drain our financial resources. The secretary will call the FmHA office in CDA and find out what needs to be done. A motion was made by Bill Sawyer and seconded by Red McDaniel to raise the monthly water rate to $30.00 beginning November 1, 1993. Motion carried. A notice will be sent with the October billing informing the membership of the rate increase. The notice to read as follows:

> Due to the new federal requirements implemented by the DEQ (Division of Environmental Quality) it is impossible to operate on our current rates. The rates will be raised to $30.00 per month beginning November 1, 1993, and we will be billing monthly. If you have any questions, feel free to call one of the board members or Carolyn Stricklan, Sec/Treas at (208) 682-2808.

Buck's hours and wages were discussed as he is putting in alot of extra hours because of the new regulations, problems on the system and GTE burying new phone lines. Dan will talk to Buck and see if he is okay with the present pay or needs something changed.

A motion was made by Bill Sawyer and seconded by Red McDaniel to adjourn the meeting. Motion carried. Meeting adjourned.

Carolyn M. Stricklan

Carolyn M. Stricklan
Secretary/Treasurer

APPENDIX C:
WATER RIGHT INFORMATION

WELCH-COMER
ENGINEERS | SURVEYORS

Close

IDAHO DEPARTMENT OF WATER RESOURCES
Water Right Report

11/27/2013

WATER RIGHT NO. 94-7367

Owner Type	Name and Address
Current Owner	ROSE LAKE WATER ASSN PO BOX 178 CATALDO, ID 83810-0178 (208)682-4451

Priority Date: 04/08/1996
Basis: License
Status: Active

Source	Tributary
GROUND WATER	

Beneficial Use	From	To	Diversion Rate	Volume
MUNICIPAL	01/01	12/31	0.2 CFS	145 AFA
Total Diversion			0.2 CFS	

Location of Point(s) of Diversion:

GROUND WATER	NWNW Lt 3	Sec. 33	Township 49N	Range 01W	KOOTENAI County
GROUND WATER	NWNW Lt 3	Sec. 33	Township 49N	Range 01W	KOOTENAI County
GROUND WATER	SWNW	Sec. 34	Township 49N	Range 01W	KOOTENAI County

Place(s) of use: Large POU Info

Conditions of Approval:

1.	057	The rate of diversion of water for irrigation under this right and all other water rights on the same land shall not exceed 0.03 cubic feet per second for each acre of land.
2.	01M	After specific notification by the department, the right holder shall install a suitable measuring device or shall enter into an agreement with the department to determine the amount of water diverted from power records and shall annually report the information to the department.
3.	004	The issuance of this right does not grant any right-of-way or easement across the land of another.
4.	075	Irrigation of large projects such as parks, golf courses, or sports activities fields is not authorized under this right.
5.	128	Place of use is within the area served by the public water supply system # 1280161 of Rose Lake Water Association. The place of use is generally located within Lot 3 , 5,6,11,12, T49N, R01W.
6.	180	A map depicting the place of use boundary for this water right at the time of this approval is attached to this document for illustration purposes.

Dates:
Licensed Date: 10/10/2008
Decreed Date:
Permit Proof Due Date: 6/1/1998
Permit Proof Made Date: 5/18/1998
Permit Approved Date: 6/13/1996
Permit Moratorium Expiration Date:
Enlargement Use Priority Date:
Enlargement Statute Priority Date:
Water Supply Bank Enrollment Date Accepted:
Water Supply Bank Enrollment Date Removed:
Application Received Date: 04/08/1996
Protest Deadline Date:
Number of Protests: 0

Other Information:
State or Federal:
Owner Name Connector:
Water District Number:
Generic Max Rate per Acre:
Generic Max Volume per Acre:
Civil Case Number:
Old Case Number:
Decree Plantiff:
Decree Defendant:
Swan Falls Trust or Nontrust:
Swan Falls Dismissed:
DLE Act Number:
Cary Act Number:

Mitigation Plan: False

Close

State of Idaho
Department of Water Resources

Water Right License

WATER RIGHT NO. 94-07367

Priority: April 08, 1996

Maximum Diversion Rate: 0.20 CFS
Maximum Diversion Volume: 145.0 AF

It is hereby certified that ROSE LAKE WATER ASSN
PO BOX 178
CATALDO ID 83810-0178 has complied with the terms and conditions of the permit, issued pursuant to Application for Permit dated April 08, 1996; and has submitted Proof of Beneficial Use on May 18, 1998. An examination indicates that the works have a diversion capacity of 0.54 cfs of water from:

SOURCE
GROUND WATER

and a water right has been established as follows:

BENEFICIAL USE	PERIOD OF USE	DIVERSION RATE	ANNUAL DIVERSION VOLUME
MUNICIPAL	01/01 to 12/31	0.20 CFS	145.0 AF

LOCATION OF POINT(S) OF DIVERSION:
GROUND WATER L3 (NW¼NW¼) Sec. 33, Twp 49N, Rge 01W, B.M. KOOTENAI County
GROUND WATER L3 (NW¼NW¼) Sec. 33, Twp 49N, Rge 01W, B.M. KOOTENAI County
GROUND WATER SW¼NW¼ Sec. 34, Twp 49N, Rge 01W, B.M. KOOTENAI County

CONDITIONS OF APPROVAL

1. The rate of diversion of water for irrigation under this right and all other water rights on the same land shall not exceed 0.03 cubic feet per second for each acre of land.
2. After specific notification by the department, the right holder shall install a suitable measuring device or shall enter into an agreement with the department to determine the amount of water diverted from power records and shall annually report the information to the department.
3. The issuance of this right does not grant any right-of-way or easement across the land of another.
4. Place of use is within the area served by the public water supply system # 1280161 of Rose Lake Water Association The place of use is generally located within Lot 3 , 5,6,11,12, T49N, R01W.
5. A map depicting the place of use boundary for this water right at the time of this approval is attached to this document for illustration purposes.

This license is issued pursuant to the provisions of Section 42-219, Idaho Code. The water right confirmed by this license is subject to all prior water rights and shall be used in accordance with Idaho law and applicable rules of the Department of Water Resources.

Signed and sealed this 10th day of October, 2008.

DAVID R. TUTHILL, JR.
Director

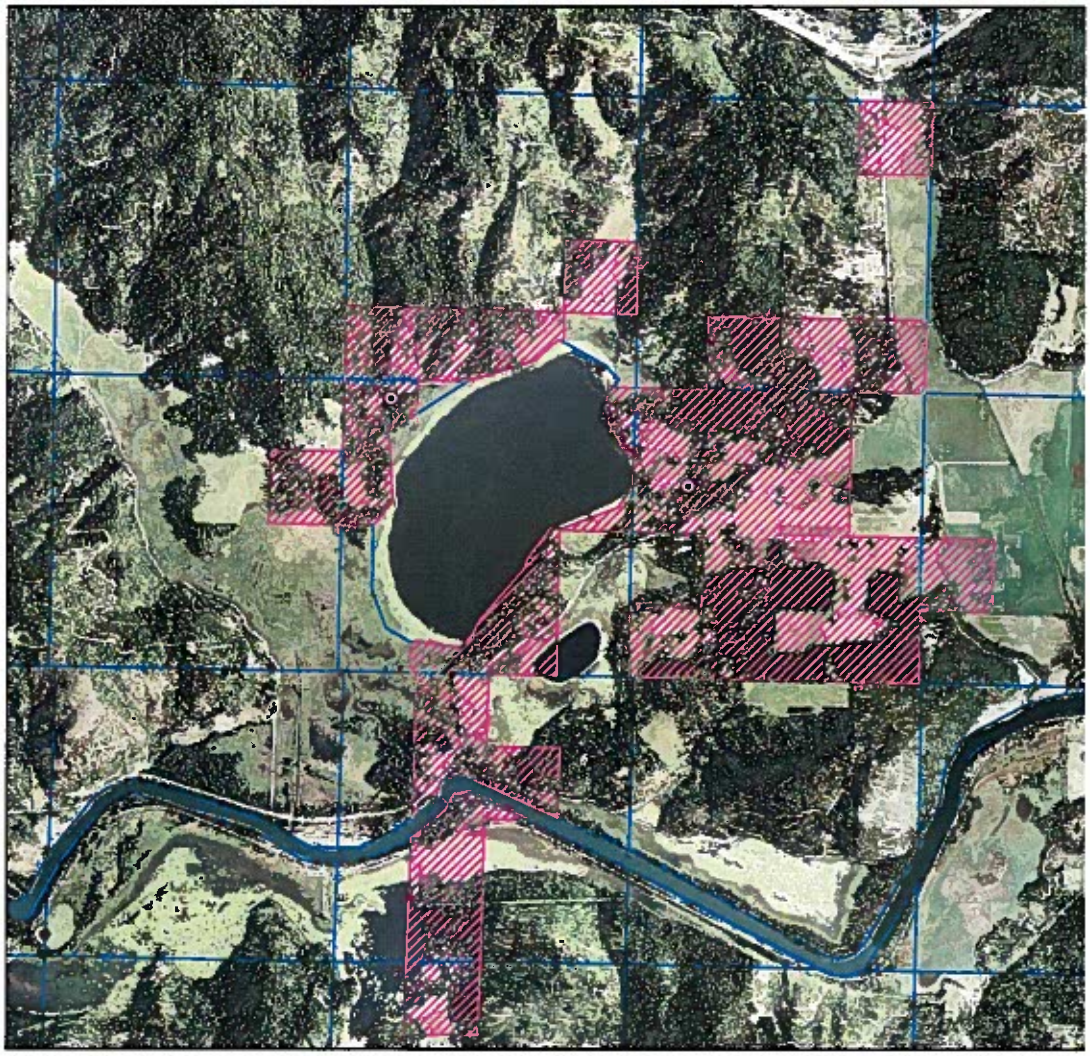
State of Idaho
Department of Water Resources

Water Right License

NO. 94-7367

Digital Boundary for ROSE LAKE WATER ASSN

October 10, 2008



Legend

0 165 330 660 990 1,320 Meters

N
W E
S

⊙ Right POD

Right POU

SCANNED
OCT 14 2008

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES
BENEFICIAL USE FIELD REPORT

A. GENERAL INFORMATION

Permit No: 94-7367
Exam Date: 7/31/2008

1. Current Owner: ROSE LAKE WATER ASSN
PO BOX 178
CATALDO ID 83810-0178
(208)682-4451

2. Accompanied by: MIKE WHITE
Phone No: 208-682-4451
Address: 22935 E KING ST CATALDO ID 83810
Relationship to Permit Holder: PRESIDENT

3. **SOURCE** **TRIBUTARY**
GROUND WATER

B. OVERLAP REVIEW

1. Other water rights with the same place of use:
2. Other water rights with the same point of diversion:

C. DIVERSION AND DELIVERY SYSTEM

1. **LOCATION OF POINT(S) OF DIVERSION:**

GROUND WATER KOOTENAI County	L3 NW1/4NW1/4	Sec. 33,	Twp 49N,	Rge 01W, B.M.
GROUND WATER KOOTENAI County	L3 NW1/4NW1/4	Sec. 33,	Twp 49N,	Rge 01W, B.M.
GROUND WATER KOOTENAI County	SW1/4NW1/4	Sec. 34,	Twp 49N,	Rge 01W, B.M.

2. MAP AND GPS

Method of Determination:

3. ___ Delivery System Diagram Attached (required). Indicate all major components and distances between components. Indicate weir size/pipe as applicable.
___ Map Attached Showing Location(s) of point(s) of diversion and place(s) of use (required). Scale must be 1:24,000 or greater.
___ Aerial Photo Attached (required for irrigation of 10+ acres).
___ Photo of Diversion and System Attached

FLOW CALCULATIONS

PUMP EQUATIONS		WELL#1 (94-94-N-007-000)				
WATER RIGHT No.		94-7367				
		HP	H in feet	Efficiency as a decimal	Pumping lift in feet	System pressure in PSI
Q =	HP*8.8*Eff	3	312.2109	0.7	185	55
Q =	0.059 cfs		26.6 gpm			

PUMP EQUATIONS		WELL # 3 (94-96-N-002-000)				
WATER RIGHT No.		94-7367				
		HP	H in feet	Efficiency as a decimal	Pumping lift in feet	System pressure in PSI
Q =	HP*8.8*Eff	7.5	337.2109	0.7	210	55
Q =	0.137 cfs		61.6 gpm			

PUMP EQUATIONS		WELL #4 (DOO10076)				
WATER RIGHT No.		94-7367				
		HP	H in feet	Efficiency as a decimal	Pumping lift in feet	System pressure in PSI
Q =	HP*8.8*Eff	25	448.2109	0.7	321	55
Q =	0.344 cfs		154.5 gpm			

PLACE OF USE: MUNICIPAL

Twp Rge Sec	NE				NW				SW				SE				Totals
	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	NE	NW	SW	SE	
48N 01W 4			X L 6		X L 3			X L 5	X L 12			X					
48N 01W 9					X												
49N 01W 27	X											X			X	X	
49N 01W 28											X	X L 3	X		X L 2		
49N 01W 32				X													
49N 01W 33	X L 1			X L 5		X L 3	X L 4					X L 10		X L 7	X L 11		
49N 01W 34		X	X		X	X	X	X	X		X	X	X	X	X	X	
49N 01W 35										X							

Method of Determination:

3. _____ Delivery System Diagram Attached (required). Indicate all major components and distances between components. Indicate weir size/pipe as applicable.
   ✓ Map Attached Showing Location(s) of point(s) of diversion and place(s) of use (required). Scale must be 1:24,000 or greater.
   ✓ Aerial Photo Attached (required for irrigation of 10+ acres).
   ✓ Photo of Diversion and System Attached

4.

Well or Diversion ID No.*	Motor Make	Hp	Motor Serial No.	Pump Make	Pump Serial No. or Discharge Size	
94-94-N-001		3	—	Goulds	.055 cfs	Well #1
94-96-N-002		7.5	L0311761	Goulds	.137 cfs	Well #3
D001076		25	RJ8HE6	Goulds	.344 cfs	Well #4

*Code to correspond with No. on map and aerial photo

D. FLOW MEASUREMENTS

1.

Measurement Equipment	Type	Make	Model No.	Serial No.	Size	Calib. Date

2. Measurements:

E. FLOW CALCULATIONS ✓ Additional Computation Sheets Attached

Measured Method:

F. VOLUME CALCULATIONS

1. Volume Calculations for Irrigation:

$V_{I.R.}$ = (Acres Irrigated) x (Irrigation Requirement) = 60 ac X 3AF= 180AF

$V_{D.R.}$ = [Diversion Rate (cfs)] x (Days in Irrigation season) x 1.9835 =

V = Smaller of $V_{I.R.}$ and $V_{D.R.}$ = 180 AF

2. Volume Calculations for Other Uses: Domestic 120 Homes X 0.6AF= 72 AF

.2cfs x 365 days per year = 145AF

G. NARRATIVE/REMARKS/COMMENTS : The annual volume to be 145 AFA based on the (Diversion rate X 365 days per year) = 145.00 AFA. The Irrigation and Domestic volume combined is 252 AF that will not be a volume that can be reached by the rate of flow 0.2cfs per year. This water right needs to be amended to Municipal use and add well # 4 POD.

Have conditions of permit approval been met? _x_ Yes _____ No

H. RECOMMENDATIONS

1. Recommended Amounts

BENEFICIAL USE	PERIOD OF USE	DIVERSION RATE	ANNUAL VOLUME
MUNICIPAL	01/01 to 12/31	0.200 CFS	145.00 AF
	Totals:	0.200 CFS	145.00 AF

2. Recommended Amendments

✓ Change P.D. as reflected above ___ Add P.D. as reflected above ___ None

✓ Change P.U. as reflected above ___ Add P.U. as reflected above ___ Other

I. AUTHENTICATION

Field Examiner's Name [signature] Date 9-8-2008

Reviewer [signature] Date 10/2/8

Form 238-7
1/94

POSTED

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT

Use Typewriter or Ball Point Pen

1. DRILLING PERMIT NO. 94 - 94 - N - 0007 - 000
Other IDWR No. 94-07367

2. OWNER:
Name ROSE LAKE WATER ASSOCIATION #2
Address BOX 178
City CATALDO State ID Zip 83810

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

N / W / E / S — X

Twp. 49 North ☒ or South ☐
Rge. 01 East ☐ or West ☒
Sec. 33, ____ 1/4 NW (10 acres) 1/4 NW (40 acres) 1/4 (160 acres)
Gov't Lot ____ County Kootenai

Address of Well Site N DOYLE ROAD
City ____
(Give at least name of road + Distance to Road or Landmark)

Lt. ____ Blk. ____ Sub. Name ____

4. PROPOSED USE:
☒ Domestic ☐ Municipal ☐ Monitor ☐ Irrigation
☐ Thermal ☐ Injection ☐ Other ____

5. TYPE OF WORK
☒ New Well ☐ Modify or Repair ☐ Replacement ☐ Abandonment

6. DRILL METHOD
☐ Mud Rotary ☒ Air Rotary ☐ Cable ☐ Other ____

7. SEALING PROCEDURES

SEAL/FILTER PACK Material	From	To	AMOUNT Sacks or Pounds	METHOD
BENTONITE	0	30	9 sacks	Crumbles

Was drive shoe used? Y ☒ N ☐
Was drive shoe seal tested? Y ☐ N ☒ How? ____

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
6"	+2	84	250	Steel	☒	☐	☒	☐
					☐	☐	☐	☐
					☐	☐	☐	☐

Length of Headpipe 5' Length of Tailpipe 5'

9. PERFORATIONS/SCREENS
☐ Perforations Method ____
☒ Screens Screen Type ____

From	To	Slot size	Number	Diameter	Material	Casing	Liner
84	94	50/40		5"	Steel	☒	☐
						☐	☐
						☐	☐

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

NWNW 33 49N 1W

11. WELL TESTS:
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
55+			6 hrs

Water Temp. Cold Bottom hole temp. ____
Water Quality test or comments: ____

12. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia.	From	To	Remarks: Lithology, Water Quality & Temperature	Water Y	Water N
8	0	2	TOP SOIL DARK BROWN SOFT		X
8	2	28	LARGE GRAVELS LITTLE SAND		
			BROWN SOFT		X
8	28	80	SILTY SAND W/CLAY LENSE		
			GRAYISH SOFT	X	
8	80	84	FINE SANDS LT BROWN SOFT	X	
8	84	90	COARSE SANDS W/SMALL GRAVELS		
			BROWNISH SOFT	X	
8	90	100	SMALL GRAVELS, COARSE SANDS		
			BROWNISH SOFT	X	
8	100	114	SHALE PURPLISH FRACTURED		X
6	114	165	SHALE PURPLISH MEDIUM		X

RECEIVED
AUG 1 1994
NORTHERN REGION
IDWR

Completed Depth 90' (Measurable)
Date: Started 07/11/94 Completed 07/13/94

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 H2O WELL SERVICE INC Firm No. 448
Firm Official John Wheeler Date 7-27-94
and
Supervisor or Operator Mark L. Lee Date 7-22-94
(Signature if Firm Official & Operator)

FORWARD WHITE COPY TO WATER RESOURCES

RECEIVED
FEB 16 1996
IDWR

Form 238-7
395
Starship Consulting and Management Services
#244

3

IDAHO DEPARTMENT OF WATER RESOURCES
WELL DRILLER'S REPORT 096840
Use Typewriter or Ballpoint Pen

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

1. DRILLING PERMIT NO. ~~94-96-N-002-001~~ 000
Other IDWR No. 94-07367 STATE COPY

2. OWNER
Name ROSE LAKE WATER ASSOC #3
Address PO BOX 178
City CATALDO State ID Zip 83810-178

3. LOCATION OF WELL by legal description
sketch map location must agree with written location

N / W / E / S — X

Twp. 49 ☒ North or ☐ South
Rge. 01 ☐ East or ☒ West
Sec. 33 ____ 1/4 NE 1/4 SE 1/4
Gov't Lot ____ County KOOTENAI
Lat: : : Long: : :
Address of Well Site N DOYLE RD
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 ____

7. SEALING PROCEDURES

SEAL/FILTER PACK			AMOUNT	METHOD
Material	From	To	Sacks or Pounds	
BENTONITE	0	50	4 SACKS	POWDER

Was drive shoe used? ☒ Y ☐ N Shoe Depth(s) 58
Was drive shoe seal tested? ☐ Y ☐ N How? ____

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
6	+2	58	.250	STEEL	☒	☐	☒	☐
4	-5	285	.160	PVC	☐	☒	☐	☐

Length of Headpipe ____ Length of Tailpipe ____

9. PERFORATIONS/SCREENS
☒ Perforations Method SAWCUT
☐ Screens Screen Type

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
245	285	1/16	60	4	PVC	☐	☒

10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:
23 ft. below ground Artesian pressure ____ lb.
Depth flow encountered ____ ft. Describe access port or control devices:
NESE 33 49N 1W

11. WELL TESTS:
☐ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
50+			2.5 HR

Water Temp. ____ Bottom Hole Temp ____
Water Quality test or comments: ____
Depth first Water encountered ____

12. LITHOLOGIC LOG:(Describe repairs or abandonment)

Bore Diam	From	To	Remarks: Lithology, Water Quality, Temperature	Water Y	Water N
8	0	1	Topsoil, Brown	☐	☒
8	1	14	Clay Cobbles Brownish Tan	☐	☒
8	14	23	Clays Sands Gravels	☒	☐
8	23	50	Clay Shales Brownish	☐	☒
6	50	200	Broken Shale Black	☒	☐
6	200	285	Broken Shale, Black	☒	☐
	0	0	Note: 1x6" Bolt on Cap	☐	☐
	0	0	Granite/Shale	☐	☐

Completed Depth 285' (Measurable)
Date: Started 02/06/96 Completed 02/07/96

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 H20 WellService, Inc. Firm No. 448
Firm Official [signature] Date 2-13-96
and
Supervisor or Operator [signature] Date 2/14/96
(Sign Once if Firm Official and Operator)

RECEIVED

4

Form 238-7
3/95
Starships Consulting and Management Services

NOV 21 1997
NORTHERN REGION
IDWR

IDAHO DEPARTMENT OF WATER RESOURCES

WELL DRILLER'S REPORT

Use Typewriter or Ballpoint Pen

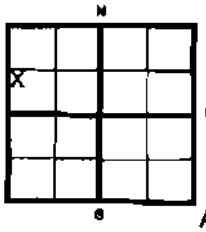
096842

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

1. DRILLING PERMIT NO. 94-97-N-0040-000
Other IDWR No. D3478
94-07367

2. OWNER **Well Number:** 626
Name Rose Lake Water
Address PO BOX 178
City CATALDO State ID Zip 83810-017

3. LOCATION OF WELL by legal description
sketch map location must agree with written location



Twp. 49 ☑ North or ☐ South
Rge. 01 ☐ East or ☑ West
Sec. 34 NW 1/4 SW 1/4 NW 1/4
Gov't Lot _____ County KOOTENAI
Lat: : : Long: : :
Address of Well Site _____
City CATALDO
(Give at least name of road + Distance to Road or Landmark)
_____ 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 _____

7. SEALING PROCEDURES

SEAL/FILTER PACK Material	From	To	AMOUNT Sacks or Pounds	METHOD
			8 BAGS	DRY
BENTONITE	0	40	200	GAL SLURRY

Was drive shoe used? ☑ Y ☐ N Shoe Depth(s) 88
Was drive shoe seal tested? ☐ Y ☐ N How?

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
8	+2	88	.250	STEEL	☑	☐	☑	☐
6	-5	420		PSI PVC	☐	☑	☐	☐

Length of Headpipe _____ Length of Tailpipe _____

9. PERFORATIONS/SCREENS
☑ Perforations Method SKILLSAW
☐ Screens Screen Type

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
360	420	1/8X4	400	6	PVC	☐	☑

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

11. WELL TESTS:
☐ Pump ☐ Bailer ☑ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
150 GPM			

Water Temp. _____ Bottom Hole Temp _____
Water Quality test or comments: _____
_____ Depth first Water encountered _____

12. LITHOLOGIC LOG:(Describe repairs or abandonment)

Bore Diam	From	To	Remarks: Lithology, Water Quality, Temperature	Water Y	Water N
12	0	2	Topsoil	☐	☑
12	2	20	Cemented Gravel w/Clay Yellowish Ta	☐	☑
10	20	82	Cemented Gravel W/Clay	☐	☑
8	82	177	Shale Redish Green Soft	☐	☑
8	177	191	Shale Gray Medium	☐	☑
8	191	194	Shale Fractured Gray & Green W/Wate	☑	☐
8	194	310	Shale Gray & White Medium Hard	☐	☑
8	310	407	Shale Gray & White W/Water 150 GP	☑	☐
8	407	420	Shale Gray & White Medium Hard	☐	☑
	0	0	One 8" Bolt on Cap	☐	☐
	0	0	One 6"x8" Formation Packer	☐	☐

Completed Depth 420' (Measurable)
Date: Started 11/7/97 Completed 11/10/97

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 H20 WellService, Inc. Firm No. 448
Firm Official _____ Date 11/10/97
and
Supervisor or Operator _____ Date 11/10/97
(Sign Once if Firm Official and Operator)

NWSWNW 34 49N 1W

(Louie Hanner)

7.5 HP PUMP DATA.JPG

IMG_0582.JPG

METER 1.JPG

METER .JPG

PSI.JPG

PUMP HOUSE 1.JPG

PUMP HOUSE 2.JPG

SYSTEM.JPG

TAG 10076.JPG

WELL 1 .JPG

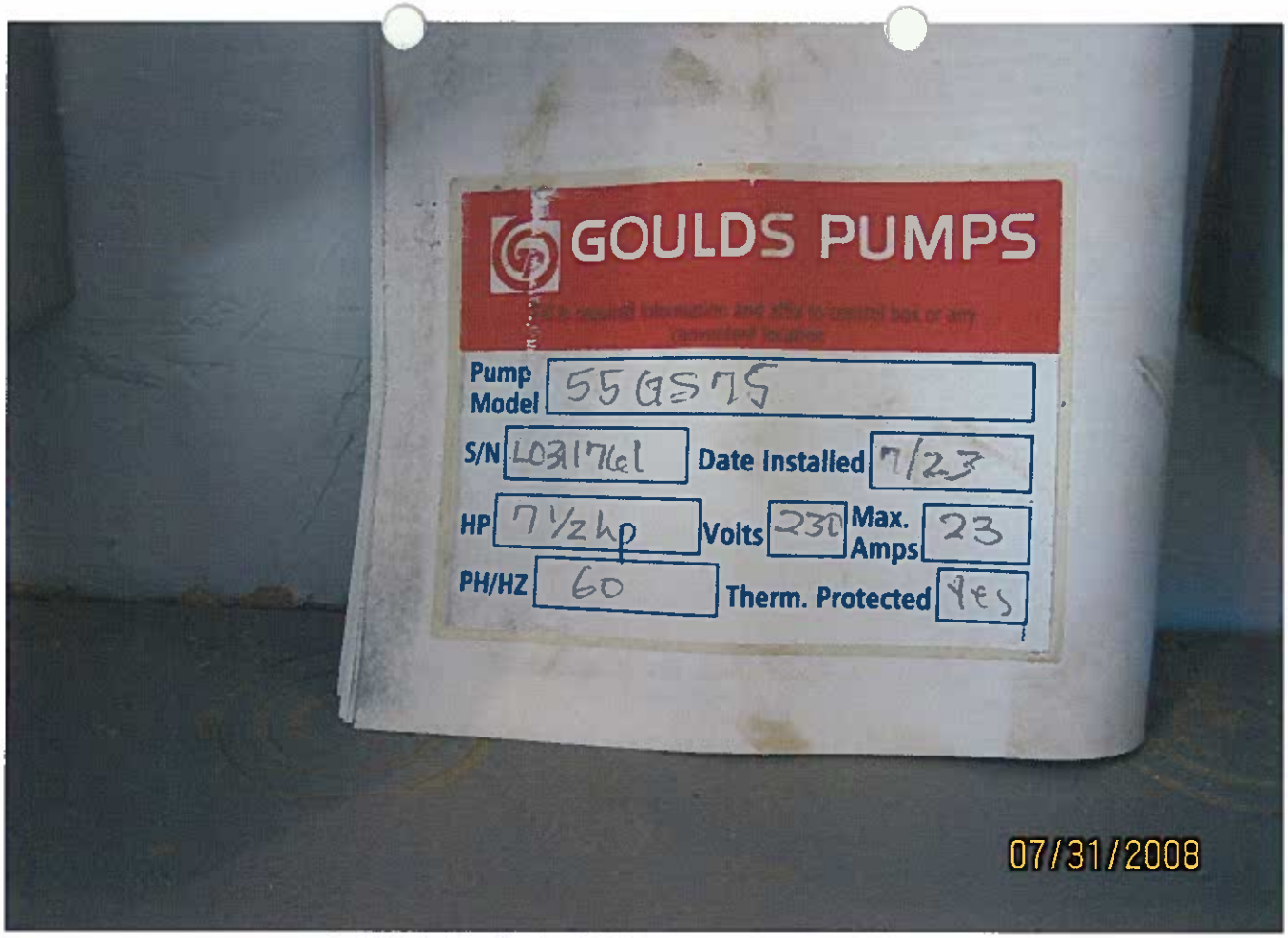
WELL 1 DATA.JPG

WELL 2 .JPG

WELL 3 DATA.JPG

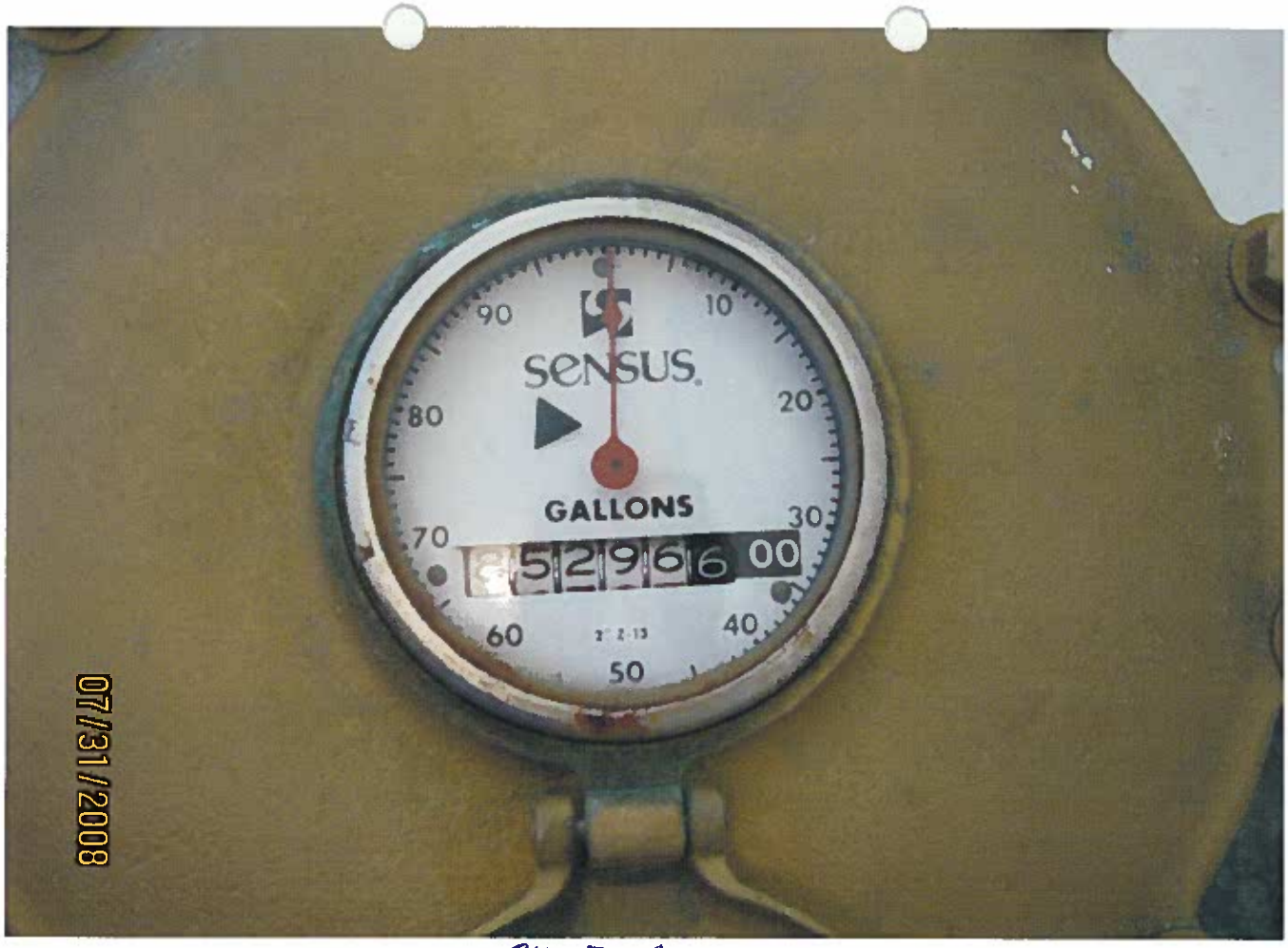
WELL 4.JPG

94-7367


GOULDS PUMPS
Pump Model 55GS75
S/N L031761 Date Installed 7/23
HP 7½hp Volts 230 Max. Amps 23
PH/HZ 60 Therm. Protected Yes
07/31/2008

94-7367

07/31/2008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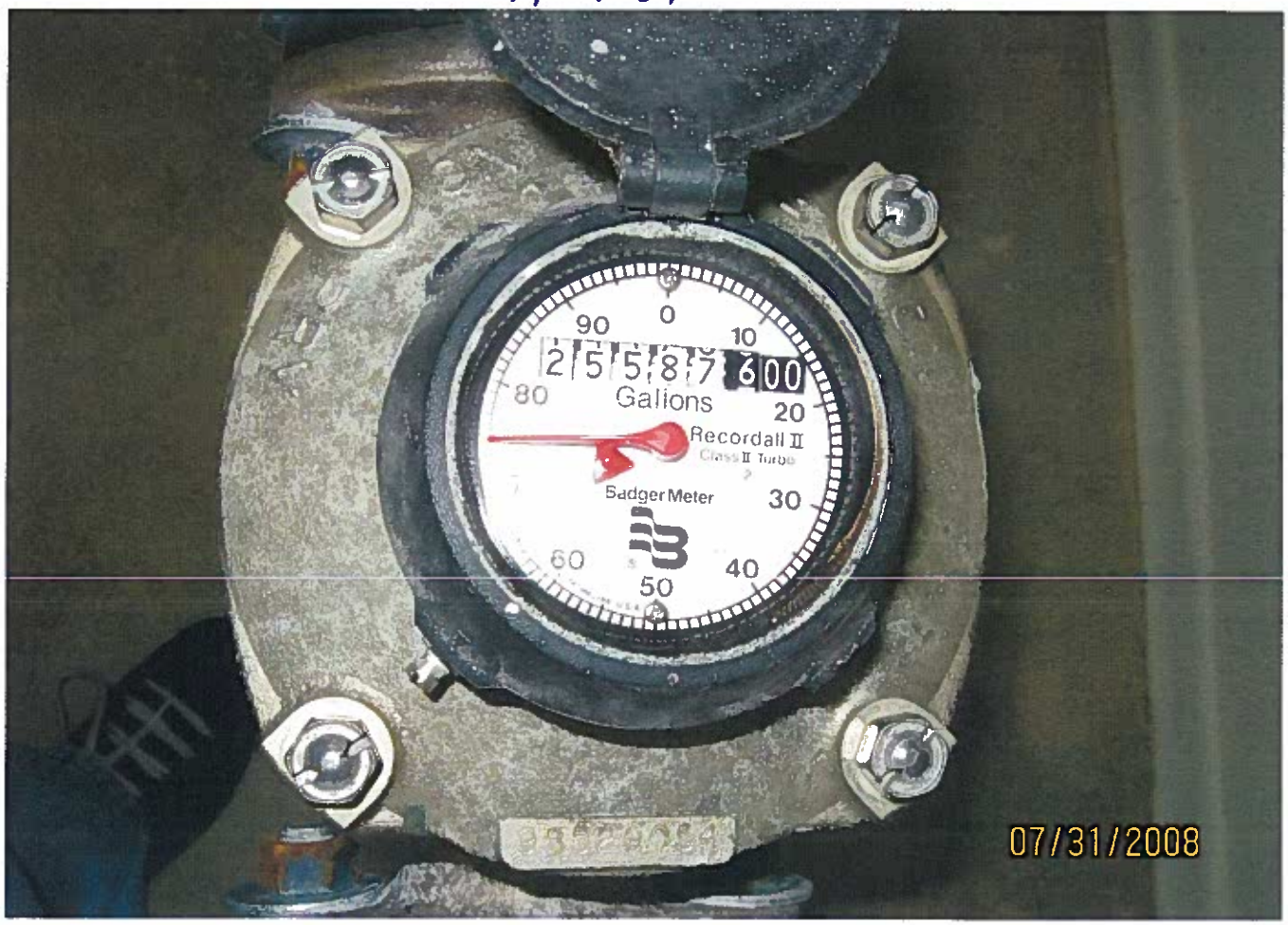
GALLONS
5296600
07/31/2008

94 -7367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Recordall II
Class II Turbo
Badger Meter
07/31/2008

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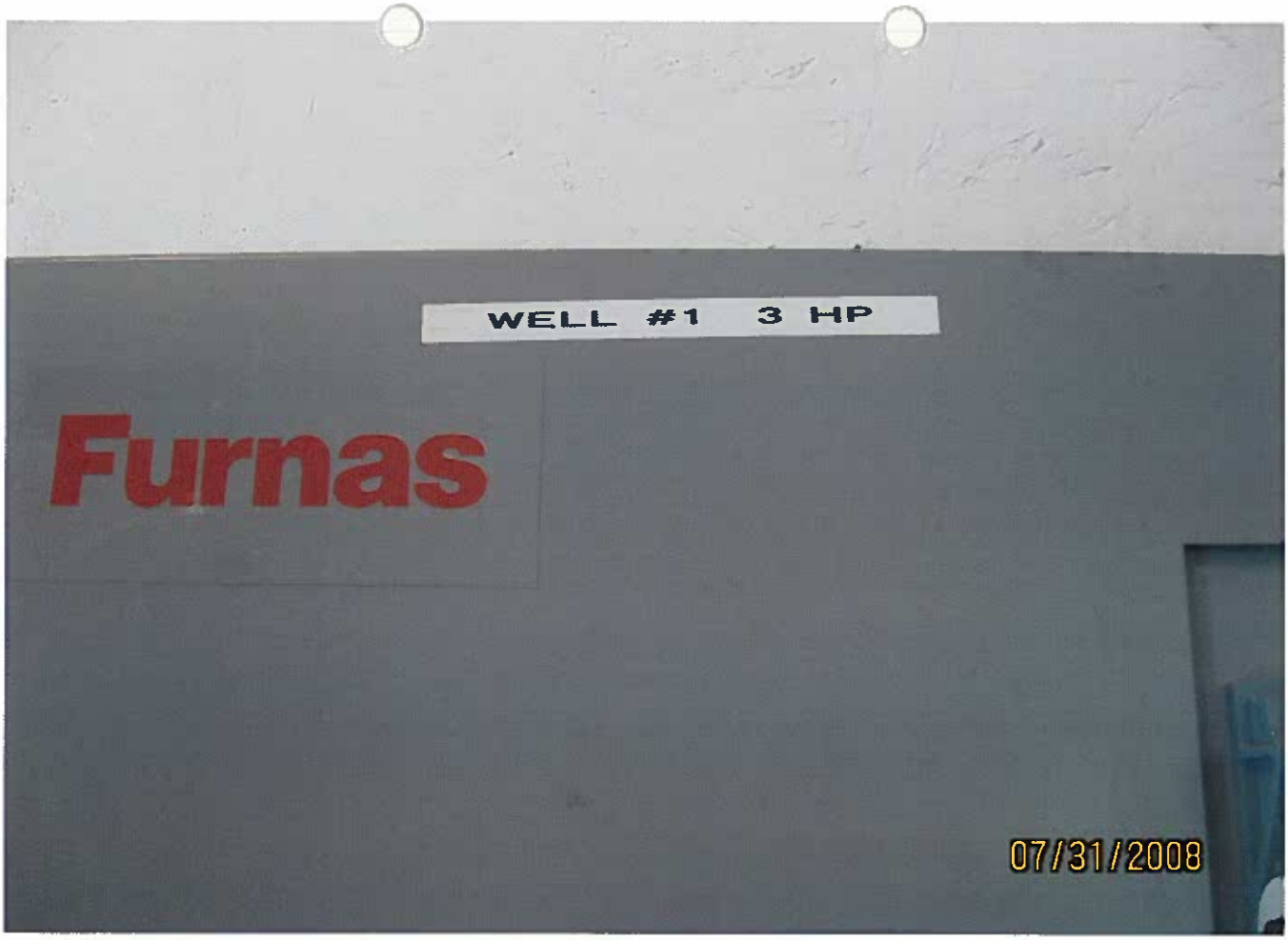
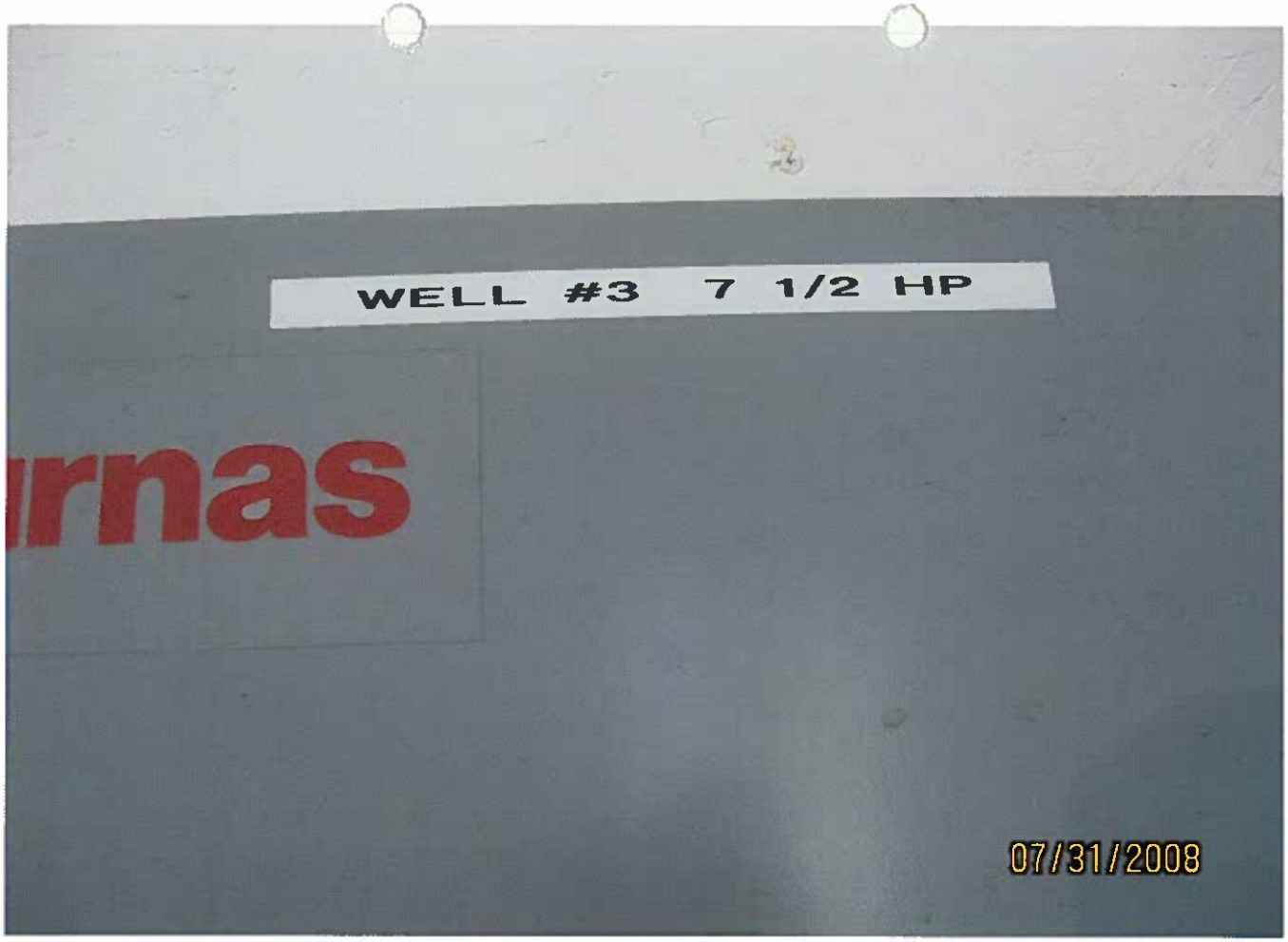


94-7367



94-7367

IN THE DISTRICT COURT OF THE FIFTH JUDICIAL DISTRICT OF THE STATE OF IDAHO, IN AND FOR THE COUNTY OF TWIN FALLS

IN RE THE GENERAL ADJUDICATION OF RIGHTS TO THE USE OF WATER FROM THE COEUR D'ALENE-SPOKANE RIVER BASIN WATER SYSTEM

CIVIL CASE NUMBER: 49576
Ident. Number: 94-7367

Date Received: 8/14/2013
N050074
Received By:

NOTICE OF CLAIM TO A WATER RIGHT ACQUIRED UNDER STATE LAW

1. Name of Claimant(s)

ROSE LAKE WATER ASSN Phone:(208)682-4451
PO BOX 178
CATALDO ID 83810-0178

2. Date of Priority: 4/8/1996

3. Source: GROUND WATER Tributary to:

4. Point of Diversion:

Township	Range	Section	1/4 of 1/4 of 1/4		Lot	County	Type
49N	01W	33	NW	NW	3	KOOTENAI	
49N	01W	33	NW	NW	3	KOOTENAI	
49N	01W	34	SW	NW		KOOTENAI	

5. Description of diverting works:

6: Water is used for the following purposes:

Purpose	From	To	C.F.S.	(or) A.F.A
MUNICIPAL	01/01	12/31	0.2	145

7. Total Quantity Appropriated is: 0.2 C.F.S. and/or 145 A.F.A

8. Non-irrigation uses:

9. Place of use:

Within the boundaries of the Rose Lake Water Assn Total Acres

10. Place of use in counties:

11. Do you own the property listed above as place of use? Yes

12. Other Water Rights Used:

13. Remarks:

Priority date description:

Description of use: Water Use Description

MUNICIPAL

14. Basis of Claim: License

15. Signature(s)

(a.) By signing below, I/We acknowledge that I/We have received, read and understand the form entitled "Ho

For Individuals: I/We do solemnly swear or affirm under penalty or perjury that the statements contained in the foregoing document are true and correct.

Signature of Claimant(s): Rosemary Const. Date: 8-14-2013

_____ Date: _____

For Organizations: I do solemnly swear or affirm under penalty or perjury that I am

Secretary/Treasurer of R_____,
Title Organization

That I have signed the foregoing document in the space below as

Please print name

APPENDIX D:

EXISTING FACILITY DOCUMENTS

WELL LOGS
DRINKING WATER QUALITY TESTING RESULTS
SANITARY SURVEY AND ASSOCIATION RESPONSE

WELCH-COMER
ENGINEERS | SURVEYORS

RECEIVED FEB 16 1996 Starships Consulting Engr Management Services #244 IDWR

Form 238-7 3/95

IDAHO DEPARTMENT OF WATER RESOURCES

POSTED

WELL DRILLER'S REPORT 096840

Use Typewriter or Ballpoint Pen

Office Use Only
Inspected by_____
Twp____ Rge____ Sec____
____1/4____1/4____1/4
Lat: : : Long: : :

1. DRILLING PERMIT NO. 94-96-N-002-~~001~~ 000
Other IDWR No. 94-073667 STATE COPY

2. OWNER
Name ROSE LAKE WATER ASSOC #3
Address PO BOX 178
City CATALDO State ID Zip 83810-178

3. LOCATION OF WELL by legal description
sketch map location must agree with written location

N / W / E / S — X

Twp. 49 [X] North or [ ] South
Rge. 01 [ ] East or [X] West
Sec. 33 ____ 1/4 NE 1/4 SE 1/4
Gov't Lot ____ County KOOTENAI
Lat: : : Long: : :
Address of Well Site N DOYLE RD
City ____
(Give at least name of road + Distance to Road or Landmark)
Lt. ____ Blk. ____ Sub. Name ____

4. USE:
[X] Domestic [ ] Municipal [ ] Monitor [ ] Irrigation
[ ] Thermal [ ] Injection [ ] Other ____

5. TYPE OF WORK check all that apply (Replacement, etc.)
[X] New Well [ ] Modify [ ] Abandonment [ ] Other ____

6. DRILL METHOD
[X] Air Rotary [ ] Cable [ ] Mud Rotary [ ] Other ____

7. SEALING PROCEDURES

SEAL/FILTER PACK Material	From	To	AMOUNT Sacks or Pounds	METHOD
BENTONITE	0	50	4 SACKS	POWDER

Was drive shoe used? [X] Y [ ] N Shoe Depth(s) 58
Was drive shoe seal tested? [ ] Y [ ] N How?

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
6	+2	58	.250	STEEL	[X]	[ ]	[X]	[ ]
4	-5	285	.160	PVC	[ ]	[X]	[ ]	[ ]

Length of Headpipe ____ Length of Tailpipe ____

9. PERFORATIONS/SCREENS
[X] Perforations Method SAWCUT
[ ] Screens Screen Type ____

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
245	285	1/16	60	4	PVC	[ ]	[X]

10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:
23 ft. below ground Artesian pressure ____ lb.
Depth flow encountered ____ ft. Describe access port or control devices:
NESE 33 49N 1W

11. WELL TESTS:
[ ] Pump [ ] Bailer [X] Air [ ] Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
50+			2.5 HR

Water Temp. ____ Bottom Hole Temp ____
Water Quality test or comments: ____
Depth first Water encountered ____

12. LITHOLOGIC LOG:(Describe repairs or abandonment

Bore Diam	From	To	Remarks: Lithology, Water Quality, Temperature	Water Y	Water N
8	0	1	Topsoil, Brown	[ ]	[X]
8	1	14	Clay Cobbles Brownish Tan	[ ]	[X]
8	14	25	Clays Sands Gravels	[X]	[ ]
8	25	50	Clay Shales Brownish	[ ]	[X]
6	50	200	Broken Shale Black	[X]	[ ]
6	200	285	Broken Shale, Black	[X]	[ ]
	0	0	Note: 1x6" Bolt on Cap	[ ]	[ ]
	0	0	Granite/Shale	[ ]	[ ]

Completed Depth 285' (Measurable)
Date: Started 02/06/96 Completed 02/07/96

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 H20 WellService, Inc. Firm No. 448
Firm Official [signature] Date 2-13-9
and
Supervisor or Operator Mark L. Lee Date 2/14/9
(Sign Once if Firm Offical and Operator)

Form 238-7
3/95-C96

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. DRILLING PERMIT NO. - - -
Other IDWR No. D 0056648

2. OWNER:
Name Rose Lake Water Assn.
Address P. O. Box 178
City Cataldo State ID Zip 83810

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

N
W E
S

Twp. 49 North ☒ or South ☐
Rge. 1 East ☐ or West ☒
Sec. 33 1/4 (10 acres) NW 1/4 (40 acres) NW 1/4 (160 acres)
Gov't lot _____ County Kootenai
Lat: 47: 33: 408 Long: 116: 28: 642
Address of Well Site N. Doyle Road
City Rose Lake
(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 _____

7. SEALING PROCEDURES

SEAL/FILTER PACK			AMOUNT	METHOD
Material	From	To	Sacks or Pounds	

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
4"	20	400	250	PVC	☐	☒	☐	☐
					☐	☐	☐	☐
					☐	☐	☐	☐

Length of Headpipe _____ Length of Tailpipe _____

9. PERFORATIONS/SCREENS
☒ Perforations Method saw cut 1/8" x 6" slot
☐ Screens Screen Type _____

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
360	400	1/8	36	4"	PVC	☐	
						☐	☐
						☐	☐

10. STATIC WATER LEVEL OR ARTESIAN PRESSURE:
6 ft. below ground Artesian Pressure ____ lb
Depth flow encountered ____ ft. Describe access port or control devices: _____

11. WELL TESTS:
☒ Pump ☐ Bailer ☒ Air ☐ Flowing Artesian

Yield gal/min	Drawdown	Pumping Level	Time
30+			
33.5	110'		1 hr

Water Temp. _____ Bottom hole temp. _____
Water Quality test or comments: Cold and clear
Depth first Water Encountered 6'

12. LITHOLOGIC LOG: (Describe repairs or abandonment)

Bore Dia	From	To	Remarks: Lithology, Water Quality & Temp.	Water Y	Water N
6"	281	284	Rusty mud and silt		
	284	290	Shale, very broken, dark grey		
	290	293	Shale, very broken, caving	☒	
	293	307	Shale, dark grey, medium		
	307	326	Shale, dark grey, soft lenses	☒	
	326	349	Shale, dark grey, medium		
	349	361	Shale, dark grey, soft lenses		
	361	366	Shale, dark grey, hard		
	366	373	Shale, dark grey, fractures	☒	
	373	394	Shale, dark grey, medium		
	394	400	Shale, dark grey, hard		

Completed Depth: 400 (Measurable)
Date Started 07/31/09 Completed 07/31/09

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 McCarty Drilling & Pump Inc Firm No. 586
Firm Official [signature] Date 8/5/09
Supervisor or Operator _____ Date _____
(Sign once if Firm Official & Operator)

Date: 8/5/2009 Time:12:03:43 PM

Form 238-7
3/95
Starships Consulting and Management Services

RECEIVED NOV 21 1997 NORTHERN REGION IDWR

IDAHO DEPARTMENT OF WATER RESOURCES

WELL DRILLER'S REPORT

Use Typewriter or Ballpoint Pen

096842

Office Use Only
Inspected by_____
Twp____ Rge____ Sec____
____1/4____1/4____1/4
Lat: : : Long: : :

1. DRILLING PERMIT NO. 94-97-N-0040-000
Other IDWR No. D3478

2. OWNER 94-07367 **Well Number:** 626
Name Rose Lake Water
Address PO BOX 178
City CATALDO State ID Zip 83810-017

3. LOCATION OF WELL by legal description
sketch map location must agree with written location

N / W / E / S

Twp. 49 ☑ North or ☐ South
Rge. 01 ☐ East or ☑ West
Sec. 34 NW 1/4 SW 1/4 NW 1/4
Gov't Lot ____ County KOOTENAI
Lat: : : Long: : :
Address of Well Site
City CATALDO
(Give at least name of road + Distance to Road or Landmark)
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 ____

7. SEALING PROCEDURES

SEAL/FILTER PACK Material	From	To	AMOUNT Sacks or Pounds	METHOD
			8 BAGS	DRY
BENTONITE	0	40	200	GAL SLURRY

Was drive shoe used? ☑ Y ☐ N Shoe Depth(s) 88
Was drive shoe seal tested? ☐ Y ☐ N How?

8. CASING/LINER:

Diameter	From	To	Gauge	Material	Casing	Liner	Welded	Threaded
8	+2	88	.250	STEEL	☑	☐	☑	☐
6	-5	420		PSI PVC	☐	☑	☐	☐

Length of Headpipe ____ Length of Tailpipe ____

9. PERFORATIONS/SCREENS
☑ Perforations Method SKILLSAW
☐ Screens Screen Type

From	To	Slot Size	Number	Diameter	Material	Casing	Liner
360	420	1/8X4	400	6	PVC	☐	☑

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

11. WELL TESTS:
☐ Pump ☐ Bailer ☑ Air ☐ Flowing Artesian

Yield gal./min.	Drawdown	Pumping Level	Time
150 GPM			

Water Temp. ____ Bottom Hole Temp ____
Water Quality test or comments: ____
Depth first Water encountered ____

12. LITHOLOGIC LOG:(Describe repairs or abandonment)

Bore Diam	From	To	Remarks: Lithology, Water Quality, Temperature	Water Y	Water N
12	0	2	Topsoil	☐	☑
12	2	20	Cemented Gravel w/Clay Yellowish Ta	☐	☑
10	20	82	Cemented Gravel W/Clay	☐	☑
8	82	177	Shale Redish Green Soft	☐	☑
8	177	191	Shale Gray Medium	☐	☑
8	191	194	Shale Fractured Gray & Green W/Wate	☑	☐
8	194	310	Shale Gray & White Medium Hard	☐	☑
8	310	407	Shale Gray & White W/Water 150 GP	☑	☐
8	407	420	Shale Gray & White Medium Hard	☐	☑
	0	0	One 8" Bolt on Cap	☐	☐
	0	0	One 6"x8" Formation Packer	☐	☐

Completed Depth 420' (Measurable)
Date: Started 11/7/97 Completed 11/10/97

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 H20 WellService, Inc. Firm No. 448
Firm Official ____ Date 11/10/97
and
Supervisor or Operator ____ Date 11/10/97
(Sign Once if Firm Official and Operator)

(Louie Hanner)

NWSWNW 34 49N 1W

Arsenic

Date	Sampling Location	Results	MCL
12/20/2010	Well #4	0.01	0.01
12/22/2010	Well #3	ND	0.01
1/3/2012	Well #4	0.006	0.01
8/15/2012	Well #4	0.009	0.01
5/20/2013	Well #4	0.011	0.01

Coliform

Date	Location	Type	Total Coliform	E. Coli	
1/21/2010	22935 E. King St	RS-Routine	Absent	Absent	
2/11/2010	22935 E. King St	RS-Routine	Absent	Absent	
3/18/2010	22935 E. King St	RS-Routine	Absent	Absent	
4/29/2010	22935 E. King St	RS-Routine	Absent	Absent	
5/27/2010	26502 E. Doyle Rd	RS-Routine	Absent	Absent	
6/23/2010	22935 E. King St	RS-Routine	Absent	Absent	
7/15/2010	26502 E. Doyle Rd	RS-Routine	Absent	Absent	
8/30/2010	22935 E. King St	RS-Routine	Absent	Absent	
9/23/2010	22935 E. King St	RS-Routine	Absent	Absent	
10/28/2010	26502 E. Doyle Rd	RS-Routine	Absent	Absent	
11/18/2010	26502 E. Doyle Rd	RS-Routine	Absent	Absent	
12/13/2010	22935 E. King St	RS-Routine	Present	Absent	
12/15/2010	22935 E. King St	P-Repeat	Absent	Absent	
	Well #3	W-Untreated	Absent	Absent	
	15699 S. Highway 3	U-Upstream	Absent	Absent	
	14917 E. Queen St	D-Downstream	Absent	Absent	
1/28/2011	Well #3	RS-Routine	Absent	Absent	
	23645 E. Doyle Rd	RS-Routine	Absent	Absent	
	15699 S. Highway 3	RS-Routine	Absent	Absent	
	22935 E. King St	RS-Routine	Absent	Absent	
	14917 E. Queen St	RS-Routine	Absent	Absent	
2/23/2011	22935 E. King St	RS-Routine	Absent	Absent	
3/11/2011	26502 E. Doyle Rd	RS-Routine	Absent	Absent	
4/21/2011	22935 E. Doyle Rd	RS-Routine	Absent	Absent	
5/25/2011	22935 E. King St	RS-Routine	Absent	Absent	
6/23/2011	26502 E. Doyle Rd	RS-Routine	Absent	Absent	
7/21/2011	22935 E. King St	RS-Routine	Absent	Absent	
8/29/2011	22935 E. King St	RS-Routine	Absent	Absent	
9/29/2011	22935 E. King St	RS-Routine	Absent	Absent	
10/27/2011	22935 E. King St	RS-Routine	Absent	Absent	
11/28/2011	22935 E. King St	RS-Routine	Absent	Absent	
12/5/2011	26502 E. Doyle Rd	RS-Routine	Absent	Absent	
1/26/2012	22935 E. King St	RS-Routine	Absent	Absent	
2/27/2011	26994 E. Doyle Rd	RS-Routine	Absent	Absent	
3/21/2012	14221 Highway 3	RS-Routine	Absent	Absent	
4/19/2012	14820 Queen St	C-Construction	Absent	Absent	
	22935 King St	C-Construction	Absent	Absent	
4/26/2012	26502 E. Doyle Rd	RS-Routine	Absent	Absent	
5/25/2012	26994 E. Doyle Rd	RS-Routine	Absent	Absent	
6/21/2012	26379 E. Doyle Rd	RS-Routine	Absent	Absent	
7/20/2012	14221 Highway 3	RS-Routine	Absent	Absent	
8/29/2012	26502 E. Doyle Rd	RS-Routine	Present	Absent	note
8/31/2012	26994 E. Doyle Rd	U-Upstream	Absent	Absent	
	26379 E. Doyle Rd	D-Downstream	Absent	Absent	
9/7/2012	Well #3	W-Untreated (source)	Absent	Absent	

Coliform

	Well #4	W-Untreated (source)	Absent	Absent	
	26502 E. Doyle Rd	P-Repeat	Absent	Absent	
10/31/2012	24677 Shore Dr	RS-Routine	Absent	Absent	
	22937 King St	RS-Routine	Absent	Absent	
	14325 Highway 3	RS-Routine	Present	Absent	note
	24910 Meadow/Shop	RS-Routine	Absent	Absent	
	23645 E. Doyle Rd	RS-Routine	Absent	Absent	
11/14/2012	14325 Highway 3	P-Repeat	Present	Absent	
	14221 Highway 3	U-Upstream	Absent	Absent	
	23514 E. Park Rd	D-Downstream	Absent	Absent	
11/28/2012	22902 E. King St	RS-Routine	Absent	Absent	
	23514 E. Park Rd	RS-Routine	Absent	Absent	
	14221 Highway 3	RS-Routine	Absent	Absent	
	24910 Doyle Rd	RS-Routine	Absent	Absent	
	23645 E. Doyle Rd	RS-Routine	Absent	Absent	
12/21/2012	26994 E. Doyle Rd	RS-Routine	Absent	Absent	

12/10/2010 Well #3

	Result	MCL
Barium	0.02	2
Cadmium	ND	0.005
Chromium	ND	0.1
Mercury	ND	0.002
Ttl(NO2/NO3)	ND	10
Nitrate	ND	10
Nitrite	ND	1
Selenium	ND	0.05
Cyanide		
Nickel	ND	0.1
Antimony	ND	0.006
Beryllium	ND	0.004
Thallium	ND	0.002
Arsenic	ND	0.01
Fluoride	0.3	4
Sodium	9.1	
Sulfate	19	250

12/23/2010 Well #4

	Result	MCL
Barium	0.09	2
Cadmium	ND	0.005
Chromium	ND	0.1
Mercury	ND	0.002
Ttl(NO2/NO3)	ND	10
Nitrate	ND	10
Nitrite	ND	1
Selenium	ND	0.05
Cyanide		
Nickel	ND	0.1
Antimony	ND	0.006
Beryllium	ND	0.004
Thallium	ND	0.002
Arsenic	0.01	0.01
Fluoride	0.3	4
Sodium	13.9	
Sulfate	3.6	250

12/4/2011 Well #3

	Result	MCL
Barium		2
Cadmium		0.005
Chromium		0.1
Mercury		0.002
Ttl(NO2/NO3)		10
Nitrate	ND	10
Nitrite		1
Selenium		0.05
Cyanide		
Nickel		0.1
Antimony		0.006
Beryllium		0.004
Thallium		0.002
Arsenic		0.01
Fluoride		4
Sodium		
Sulfate		250

12/30/2011 Well #4

	Result	MCL
Barium		2
Cadmium		0.005
Chromium		0.1
Mercury		0.002
Ttl(NO2/NO3)		10
Nitrate		10
Nitrite		1
Selenium		0.05
Cyanide		
Nickel		0.1
Antimony		0.006
Beryllium		0.004
Thallium		0.002
Arsenic	0.006	0.01
Fluoride		4
Sodium		
Sulfate		250

3/21/2012 Well #3

	Result	MCL
Barium		2
Cadmium		0.005
Chromium		0.1
Mercury		0.002
Ttl(NO2/NO3)		10
Nitrate	ND	10
Nitrite		1
Selenium		0.05
Cyanide		
Nickel		0.1
Antimony		0.006
Beryllium		0.004
Thallium		0.002
Arsenic		0.01
Fluoride		4
Sodium		
Sulfate		250

3/16/2012 Well #4

	Result	MCL
Barium		2
Cadmium		0.005
Chromium		0.1
Mercury		0.002
Ttl(NO2/NO3)		10
Nitrate	ND	10
Nitrite		1
Selenium		0.05
Cyanide		
Nickel		0.1
Antimony		0.006
Beryllium		0.004
Thallium		0.002
Arsenic		0.01
Fluoride		4
Sodium		
Sulfate		250

5/24/2012 Well #4

	Result	MCL
Barium		2
Cadmium		0.005
Chromium		0.1
Mercury		0.002
Ttl(NO2/NO3)		10
Nitrate	ND	10
Nitrite		1
Selenium		0.05
Cyanide		
Nickel		0.1
Antimony		0.006
Beryllium		0.004
Thallium		0.002
Arsenic		0.01
Fluoride		4
Sodium		
Sulfate		250

8/10/2012 Well #4

	Result	MCL
Barium		2
Cadmium		0.005
Chromium		0.1
Mercury		0.002
Ttl(NO2/NO3)		10
Nitrate		10
Nitrite		1
Selenium		0.05
Cyanide		
Nickel		0.1
Antimony		0.006
Beryllium		0.004
Thallium		0.002
Arsenic	0.009	0.01
Fluoride		4
Sodium		
Sulfate		250

11/30/2012 Well #3

	Result	MCL
Barium		2
Cadmium		0.005
Chromium		0.1
Mercury		0.002
Ttl(NO2/NO3)		10
Nitrate	ND	10
Nitrite		1
Selenium		0.05
Cyanide		0.2
Nickel		0.1
Antimony		0.006
Beryllium		0.004
Thallium		0.002
Arsenic		0.01
Fluoride		4
Sodium		
Sulfate		250

11/30/2012 Well #4

	Result	MCL
Barium		2
Cadmium		0.005
Chromium		0.1
Mercury		0.002
Ttl(NO2/NO3)		10
Nitrate	ND	10
Nitrite		1
Selenium		0.05
Cyanide	ND	0.2
Nickel		0.1
Antimony		0.006
Beryllium		0.004
Thallium		0.002
Arsenic		0.01
Fluoride		4
Sodium		
Sulfate		250

12/10/2010 Well #4

	Result	MCL
1,2,4-Trichlorobenzene	ND	70
cis-1,2-Dichloroethylene	ND	70
Trihalomethanes-Total	ND	100
Bromodichloromethane	ND	
Bromoform	ND	
Chloroform	ND	
Dibromochloromethane	ND	
Xylenes-Total	ND	1000
Dichloromethane	ND	5
o-Dichlorobenzene	ND	600
p-Dichlorobenzene	ND	75
Vinyl Chloride	ND	2
1,1-Dichloroethylene	ND	7
trans-1,2-Dichloroethylene	ND	100
1,2-Dichloroethane	ND	5
1,1,1-Trichloroethane	ND	200
Carbon Tetrachloride	ND	5
1,2-Dichloropropane	ND	5
Trichloroethylene	ND	5
1,1,2-Trichloroethylene	ND	5
Tetrachloroethylene	ND	5
Monochlorobenzene	ND	100
Benzene	ND	5
Toluene	ND	1000
Ethylbenzene	ND	700
Styrene	ND	100

3/16/2012 Well #4

	Result	MCL
1,2,4-Trichlorobenzene	ND	70
cis-1,2-Dichloroethylene	ND	70
Trihalomethanes-Total	ND	100
Bromodichloromethane	ND	
Bromoform	ND	
Chloroform	ND	
Dibromochloromethane	ND	
Xylenes-Total	ND	1000
Dichloromethane	ND	5
o-Dichlorobenzene	ND	600
p-Dichlorobenzene	ND	75
Vinyl Chloride	ND	2
1,1-Dichloroethylene	ND	7
trans-1,2-Dichloroethylene	ND	100
1,2-Dichloroethane	ND	5
1,1,1-Trichloroethane	ND	200
Carbon Tetrachloride	ND	5
1,2-Dichloropropane	ND	5
Trichloroethylene	ND	5
1,1,2-Trichloroethylene	ND	5
Tetrachloroethylene	ND	5
Monochlorobenzene	ND	100
Benzene	ND	5
Toluene	ND	1000
Ethylbenzene	ND	700
Styrene	ND	100

6/21/2012 Well #4

	Result	MCL
1,2,4-Trichlorobenzene	ND	70
cis-1,2-Dichloroethylene	ND	70
Trihalomethanes-Total	ND	100
Bromodichloromethane	ND	
Bromoform	ND	
Chloroform	ND	
Dibromochloromethane	ND	
Xylenes-Total	ND	1000
Dichloromethane	ND	5
o-Dichlorobenzene	ND	600
p-Dichlorobenzene	ND	75
Vinyl Chloride	ND	2
1,1-Dichloroethylene	ND	7
trans-1,2-Dichloroethylene	ND	100
1,2-Dichloroethane	ND	5
1,1,1-Trichloroethane	ND	200
Carbon Tetrachloride	ND	5
1,2-Dichloropropane	ND	5
Trichloroethylene	ND	5
1,1,2-Trichloroethylene	ND	5
Tetrachloroethylene	ND	5
Monochlorobenzene	ND	100
Benzene	ND	5
Toluene	ND	1000
Ethylbenzene	ND	700
Styrene	ND	100

11/30/2012 Well #4

	Result	MCL
1,2,4-Trichlorobenzene	ND	70
cis-1,2-Dichloroethylene	ND	70
Trihalomethanes-Total	ND	100
Bromodichloromethane	ND	
Bromoform	ND	
Chloroform	ND	
Dibromochloromethane	ND	
Xylenes-Total	ND	1000
Dichloromethane	ND	5
o-Dichlorobenzene	ND	600
p-Dichlorobenzene	ND	75
Vinyl Chloride	ND	2
1,1-Dichloroethylene	ND	7
trans-1,2-Dichloroethylene	ND	100
1,2-Dichloroethane	ND	5
1,1,1-Trichloroethane	ND	200
Carbon Tetrachloride	ND	5
1,2-Dichloropropane	ND	5
Trichloroethylene	ND	5
1,1,2-Trichloroethylene	ND	5
Tetrachloroethylene	ND	5
Monochlorobenzene	ND	100
Benzene	ND	5
Toluene	ND	1000
Ethylbenzene	ND	700
Styrene	ND	100

1/7/2011 Well #4 Composite

	Result	MCL
Groos Alpha Activity	3.5 +/- 1.4	
Uranium, Combined	ND	30
Net Alpha		15pCi/L
Radium-226	1.8 +/- 0.3	
Radium-228	1.7 +/- 0.8	
Radium, Combined	3.5 +/- 0.8	5pCi/L
Gross Beta/Photo Activity		4mREM
Radium 222		

3/16/2012 Well #4 Composite

	Result	MCL
Radium 226	1.6 +/- 0.3	
Radium 228	3.5 +/- 0.9	5
Alpha Activity	6.8 +/- 1.1	15
Total Measured Radium	5.2 +/- 0.9	5
Uranium, Natural	ND	30

5/24/2012 Well #4

	Result	MCL
Radium 226	1.1 +/- 0.2	
Radium 228	2.0 +/- 0.7	5
Alpha Activity	-2+/-1	15
Total Measured Radium	3.1 +/- 0.7	5
Uranium, Natural	ND	30

5/24/2012 Well #4

	Result	MCL
Radium 226	1.2 +/- 0.2	
Radium 228	2.6 +/- 0.8	5
Alpha Activity	0.9+/-1.2	15
Total Measured Radium	3.8 +/- 0.8	5
Uranium, Natural	ND	30

10/19/2012 Well #4

	Result	MCL
Radium 226	1.24 +/- 0.26	
Radium 228	2.62 +/- 0.65	5
Alpha Activity	ND+/-2.37	15
Total Measured Radium	3.86	5
Uranium, Natural	ND	30

STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

2110 Ironwood Parkway, Coeur d'Alene, ID 83814 (208) 769-1422

C. L. "Butch" Otter, Governor
Toni Hardesty, Director

March 2, 2010

Rose Lake Water Assn
Mike White
22935 E King St
Cataldo, ID 83810

Subject: **Report of Sanitary Survey**, Rose Lake Water Assn, ID1280161

Dear Mr. White:

I would like to thank Mike White for taking the time to assist with the sanitary survey that DEQ performed on the Scenic Mobile Estates on February 3, 2010. He was very helpful during the survey.

Listed below is a summary of issues identified during the survey inspection. Please consult with Jean Felker within 30 days of receipt of this report on the water system's plan to correct the significant deficiencies listed below. A written plan of correction that includes timelines in which significant deficiencies will be corrected is required to be submitted to the Department within 120 days of receipt of this report.

Significant Deficiencies

1. Rose Lake Water has an air vacuum relief valve in the distribution system. This valve must be vented to the top of vault or outside the vault if possible.
2. Rose Lake Water must develop and actively enforce a cross connection control program. Please submit a copy of the cross connection control program to the Department.
3. Rose Lake Water must physically disconnect well #1 from the water system.
4. Rose Lake Water must replace the missing bolt to ensure that the well cap is secured to the well properly.

Additional Requirements

1. Rose Lake Water must alter the ground surrounding the well to ensure that water does not collect around the well. When fixing this issue the casing for the well must continue to extend 18 inches above the final ground surface.
2. When hoses are connected to any threaded sample taps, atmospheric vacuum breakers must be used to provide protection against possible cross connection contamination.
3. Rose Lake Water must flush all the dead end lines at a velocity of 2.5 ft/sec every 6 months.
4. Rose Lake Water must provide the Department with a Total Coliform sampling plan.

5. When Rose Lake Water alters the pump house for well #4 a vent must be installed in the building.
6. Rose Lake Water must screen the drain and overflow with a 24 mesh screen to prevent contaminants from entering the reservoir.
7. A rubber gasket must be installed on the reservoir hatch to prevent insects and other contaminants from entering the reservoir.
8. Rose Lake Water must have all assemblies inspected on an annual basis by a certified backflow tester.

Follow Up

1. Rose Lake Water must provide the Department with the new well log for well #3.
2. Rose Lake Water must provide the Department with the well log for well #4.
3. Rose Lake Water must contact Jean Felker at the Department to change the sample schedule so that they include the required sampling from well #4.

Recommendations

1. DEQ recommends all valves are exercised on an annual basis.
2. DEQ recommends the reservoir is cleaned and inspected every five years.
3. The Department recommends that Rose Lake Water insulate the vent pipe, in the air vacuum relief vault, to prevent freezing and install a drain in the vault to avoid the vault from filling up with water.

Please contact the Department at 208-769-1422 with any questions or concerns you may have regarding these issues.

Sincerely,

Troy Wassink
Drinking Water Analyst
Troy.Wassink@deq.idaho.gov

Enclosure: Rose Lake Water Survey Narrative

c: Jean Felker, Drinking Water Analyst Jean.Felker@deq.idaho.gov
Suzanne Scheidt, Drinking Water Program Supervisor Suzanne.Scheidt@dep.idaho.gov
ID1280161 Rose Lake Water, in TRIM

Drinking Water Supply Report
Idaho Department of Environmental Quality

System: Rose Lake Water **County:** Kootenai **PWS #:** ID1280161
Date of Survey: February 3, 2010
System Representatives Present at Survey: Mike White
Surveyed by: Troy Wassink and Mike Camin
Available Sources: 2 Wells
Primary Source: Ground Water
Water System Type: Community
Population: 300 **Service Connections:** 120

Rose Lake Water

Rose Lake Water is located about 30 miles east of Coeur d'Alene. There are two wells that Rose Lake Water uses to supply water to the water system. One of these wells is located north of the Rose Lake, while the other is located on the south side of the lake. A GWUDI analysis was done on the both wells on February 3, 2010 and it was determined that well #4 is supplied by ground water while well #3 needs further analysis to determine if it is ground water. A Source Water Assessment was conducted on December 11, 2000 on the wells. Results of the Source Water Assessment are included at the conclusion of this report.

Sources

Drinking water for Rose Lake Water is supplied by two wells. Well #3 was drilled on February 6, 1996 to a depth of 285 ft, produces 50 gpm at the time it was drilled and is located 75 feet west of well house. This well was re-drilled in the summer of 2009. The Department has not received the new well log for this well. Rose Lake Water must provide the Department with the new well log for well #3.

Well #3

Well #3 pump house consists of a flow meter, pressure gauge and raw water sample tap. At the time of the survey well #3 was missing two bolts on the well cap. Rose Lake Water must replace the missing bolt to ensure that the well cap is secured to the well properly. Rose Lake Water

must properly repair a section of pipe that was repaired with some green tape, which is not NSF 60 approved in order to prevent the water from be contaminated

Well #3 pump house

Well #3 pump house

The second well that provides water is well #4 that produces 120 gpm. The Department was unable to find copies of the well log for this well. Please provide the Department with the well log for well #4. This well is only used in the high usage summer months. At the time of the survey the well was offline. The operator stated that he pumps the well to waste for 6-8 hours prior to using the well. Well #4 pump house consists of a flow meter, pressure gauge, air vacuum relief valve, raw water sample tap and a control valve to reduce water hammer.

The Department recommends that Rose Lake Water take a raw water total coliform sample from this well prior to using it in the summer months. At the time of the survey there was standing water around well #4. Rose Lake Water must alter the ground surrounding the well to ensure that water does not collect around the well. When fixing this issue, the casing for the well must continue to extend 18 inches above the final ground surface.

Well #4

Water around Well #4

At the time of the survey well #4 had a few loose bolts on the well cap; please tighten these bolts to ensure that the well cap is secured to the well properly. The pump house located near well #4 does not have a vent. The operator indicated that Rose Lake Water is planning on making some alterations to the pump house; at this time Rose Lake Water must install a vent in the pump house to ensure vents the building properly. Well #4 does not currently have a sample schedule associated to it. Rose Lake Water must contact Jean Felker at the Department to ensure proper sampling is completed on well #4.

Well #4 pump house

Well #1 is a well that is located near well #3 but has been abandoned. This well is still physically connected to the water system. Rose Lake Water must physically disconnect this well from the water system. Well #2 has also been abandoned but has been physically disconnected from the water system. Historically Rose Lake Water used a spring as their primary source; this source has been abandoned and physically disconnected from the water system.

Disinfection

Disinfection is located at both pump houses using a chlorinator that feeds an NSF approved sodium hypochlorite solution. Rose Lake Water does not chlorinate their water. They have the chlorinators there in case of an emergency. According to the operator Rose Lake Water has never had to use the chlorinators. Rose Lake Water must contact the Department prior to chlorinating the water system.

Well #3 Chlorinator (not connected)

Storage

Water then goes to a 100,000 gallon concrete finished water reservoir. The water level in the reservoir is controlled by a series of four probes that signal the well pumps to turn on and off. When the reservoir calls for water it turns on well #3 first; then if they reach the next probe, the reservoir signals for well #4 to turn on. When the reservoir is filling up it first turns off well #4

and then well #3 when the reservoir is full. The reservoir has a shared drain and overflow but it is not properly screened. Rose Lake Water must screen the drain and overflow with a 24 mesh screen to prevent contaminants from entering the reservoir. A rubber gasket must be installed on the reservoir hatch to prevent insects and other contaminants from entering the reservoir. At the time of the survey there was leakage evident on the side of the reservoir. The Department recommends the storage tank be inspected and cleaned every 5 years.

Reservoir

Reservoir

Distribution

The Rose Lake Water serves water to 120 connections, all of which are metered. Rose Lake Water has 6-, 5-, 4-, 3- and 2½-inch mains. The mains consist of PVC and ductile iron pipes. Rose Lake Water does not have any fire hydrants on the water system. All dead end lines must be flushed at a velocity of 2.5 ft/sec every 6 months. Rose Lake Water has an air vacuum relief valve in the distribution system. This valve must be vented to the top of the vault or outside the vault if possible. The Department recommends that Rose Lake Water insulate the vent pipe to prevent freezing and install a drain in the vault to avoid the vault from filling up with water.

Rose Lake Water does not have a cross connection control program. According to IDAPA Section 158.01.08.552.06 of the Idaho Rules for Public Drinking Water Systems, Rose Lake Water must develop and actively enforce a cross connection control program. Please submit a copy of the cross connection control program to the Department. In order to do that, the system operator (if trained in backflow prevention) or a third party trained in backflow prevention must inspect facilities annually to ensure adequate backflow prevention assemblies and devices are provided where required. Rose Lake Water must have all assemblies inspected on an annual basis by a certified backflow tester. The Department recommends that all valves are exercised on an annual basis.

Monitoring

Rose Lake Water is required to collect Total Coliform samples monthly and the last positive sample for Total Coliform was 10/02/2009. Rose Lake Water has had 11 positive Total Coliform samples in the past 10 years. Rose Lake Water must provide the Department with a Total Coliform sampling plan. The table below shows all of the current sampling requirements for Rose Lake Water, but Rose Lake Water will need to contact Jean Felker at the Department to change the sample schedule so that they include the required sampling from well #4.

Sample Type	Frequency	Sample Location
Total coliform	1 every month	Distribution
Nitrate	1 every year	Well #3
Nitrite	1 every 9 years	Well #3
Rads	1 every 6 years	Well #3
Gross Alfa	1 every 9 years	Well #3
Fluoride	1 every 9 years	Well #3
Sodium	1 every 3 years	Well #3
Uranium	1 every 9 years	Well #3
VOCs	1 every 6 years	Well #3
Arsenic	1 every 3 years	Well #3
Lead and Copper	5 every 3 years	Distribution
DBP	1 every 6 years	Distribution
IOC	1 every 6 years	Well #3

Financial & Management Capacity

Rose Lake Water is owned by the homeowner association. Mike White is the administrative contact and direct operator; he has a Distribution Class 1 certification. Rose Lake Water is governed by a Board of Directors that meets monthly.

Source Water Assessment and Drinking Water Protection Plan

A Source Water Assessment report for the Rose Lake Water was written on December 11, 2000. The table below shows the susceptibility of the wells according to the Source Water Assessment Report.

Well #3

Hydrologic	Moderate Susceptibility
System Construction	Low Susceptibility
IOCs	High Susceptibility
VOCs	Low Susceptibility
SOCs	Low Susceptibility
Microbial	Low Susceptibility

Well #4

Hydrologic	Low Susceptibility
System Construction	Low Susceptibility
IOCs	High Susceptibility
VOCs	Low Susceptibility
SOCs	Low Susceptibility
Microbial	Low Susceptibility

Conclusion

At the time of the survey it was evident that Rose Lake Water takes the responsibility of providing adequately treated water to the users seriously; their efforts are appreciated by DEQ.

The water system was found to be mostly in compliance with the Idaho Rules for Public Drinking Water Systems.

Listed below is a summary of issues identified during the survey inspection. Please consult with DEQ staff within 30 days of receipt of this report on the water system's plan to correct the issues below. A written plan of correction will be required to be submitted to the Department within 120 days of receipt of this report.

Significant Deficiencies

1. Rose Lake Water has an air vacuum relief valve in the distribution system. This valve must be vented to the top of the vault or outside the vault if possible.
2. Rose Lake Water must develop and actively enforce a cross connection control program. Please submit a copy of the cross connection control program to the Department.
3. Rose Lake Water must physically disconnect well #1 from the water system.
4. Rose Lake Water must replace the missing bolt to ensure that the well cap is secured to the well properly.

Additional Requirements

1. Rose Lake Water must alter the ground surrounding the well to ensure that water does not collect around the well. When fixing this issue the casing for the well must continue to extend 18 inches above the final ground surface.
2. When hoses are connected to any threaded sample taps, atmospheric vacuum breakers must be used to provide protection against possible cross connection contamination.
3. Rose Lake Water must flush all the dead end lines at a velocity of 2.5 ft/sec every 6 months.
4. Rose Lake Water must provide the Department with a Total Coliform sampling plan.
5. When Rose Lake Water alters the pump house for well #4, a vent must be installed in the building.
6. Rose Lake Water must screen the drain and overflow with a 24 mesh screen to prevent contaminants from entering the reservoir.
7. A rubber gasket must be installed on the reservoir hatch to prevent insects and other contaminants from entering the reservoir.
8. Rose Lake Water must have all assemblies inspected on an annual basis by a certified backflow tester.

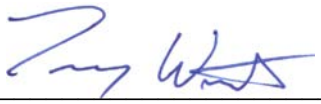
Follow Up

1. Rose Lake Water must provide the Department with the new well log for well #3.
2. Rose Lake Water must provide the Department with the well log for well #4.
3. Rose Lake Water must contact Jean Felker at the Department to change the sample schedule so that they include the required sampling from well #4.

Recommendations

1. DEQ recommends all valves are exercised on an annual basis.
2. DEQ recommends the reservoir is cleaned and inspected every five years.

3. The Department recommends that Rose Lake Water insulate the vent pipe in the air vacuum relief vault to prevent freezing and install a drain in the vault to avoid the vault from filling up with water.



Troy Wassink, Drinking Water Analyst

Date

ROSE LAKE WATER ASSOCIATION, INC.

Deficiencies:

1. Air vacuum relief valve in the distribution system will be completed by April 15, 2012.

2. Missing bolt on well cap has been replaced and all other bolts have been properly secured.

3. Cross connection control survey has been sent to each member of the association and copy submitted to DEQ.

4. Well #1 has been physically disconnected from the water system, flow meter has been removed and pipe has been capped, this was done right after February 3, 2010.

APPENDIX E:
WATER SYSTEM MODEL

WELCH-COMER
ENGINEERS | SURVEYORS

Scenario: Scenario - 1
Current Time Step: 0.000Hr
FlexTable: Junction Table

ID	Label	Elevation (ft)	Zone	Demand (gpm)	Hydraulic Grade (ft)	Pressure (psi)
150	J-171	2,140.05	Gravity	0	2,337.25	85.3
155	J-188	2,144.49	Gravity	9	2,337.72	83.6
118	J-86	2,144.87	Gravity	1	2,336.92	83.1
140	J-149	2,145.12	Gravity	4	2,337.25	83.1
162	J-187	2,145.66	Gravity	0	2,337.71	83.1
125	J-118	2,145.66	Gravity	0	2,337.71	83.1
114	J-89	2,145.80	Gravity	5	2,337.74	83.0
177	J-223	2,146.11	Gravity	0	2,337.68	82.9
113	J-90	2,146.17	Gravity	1	2,336.91	82.5
120	J-88	2,146.32	Gravity	3	2,337.72	82.8
128	J-116	2,146.98	Gravity	1	2,337.48	82.4
138	J-148	2,147.31	Gravity	11	2,338.49	82.7
178	J-224	2,147.64	Gravity	4	2,337.54	82.2
129	J-117	2,147.96	Gravity	1	2,337.70	82.1
107	J-92	2,147.96	Gravity	0	2,337.49	82.0
147	J-175	2,147.97	Gravity	2	2,337.43	82.0
117	J-91	2,148.67	Gravity	0	2,337.50	81.7
123	J-115	2,149.64	Gravity	4	2,338.08	81.5
179	J-225	2,150.38	Gravity	0	2,337.78	81.1
111	J-78	2,151.90	Gravity	0	2,339.11	81.0
144	J-139	2,151.90	Gravity	0	2,339.07	81.0
136	J-140	2,152.23	Gravity	0	2,338.94	80.8
105	J-82	2,152.24	Gravity	1	2,338.14	80.4
110	J-85	2,153.57	Gravity	3	2,336.93	79.3
134	J-144	2,154.68	Gravity	9	2,336.72	78.8
146	J-145	2,154.94	Gravity	5	2,336.92	78.7
166	J-196	2,155.92	Gravity	1	2,338.92	79.2
161	J-191	2,156.84	Gravity	1	2,338.93	78.8
132	J-119	2,157.87	Gravity	3	2,338.79	78.3
109	J-81	2,158.29	Gravity	1	2,338.15	77.8
130	J-122	2,160.23	Gravity	0	2,338.93	77.3
156	J-192	2,160.32	Gravity	1	2,338.82	77.2
139	J-147	2,160.96	Gravity	2	2,336.70	76.0
121	J-121	2,162.74	Gravity	2	2,338.82	76.2
124	J-114	2,164.82	Gravity	3	2,338.25	75.0
181	J-227	2,165.06	Gravity	0	2,336.95	74.4
131	J-124	2,165.96	Gravity	1	2,338.71	74.7
108	J-84	2,168.10	Gravity	2	2,338.33	73.6
127	J-123	2,170.23	Gravity	1	2,339.05	73.0
115	J-83	2,172.16	Gravity	0	2,338.33	71.9
133	J-142	2,175.22	Gravity	1	2,336.97	70.0
141	J-138	2,177.95	Gravity	0	2,338.83	69.6
122	J-120	2,178.60	Gravity	2	2,338.74	69.3
151	J-177	2,179.69	Gravity	0	2,339.16	69.0
142	J-137	2,179.80	Gravity	1	2,338.83	68.8
143	J-152	2,182.16	Gravity	2	2,338.39	67.6
119	J-87	2,184.03	Gravity	1	2,338.25	66.7
135	J-141	2,186.18	Gravity	2	2,336.98	65.2
126	J-113	2,188.12	Gravity	0	2,338.28	65.0
148	J-176	2,190.28	Gravity	0	2,338.68	64.2
154	J-174	2,192.54	Gravity	2	2,338.82	63.3
153	J-172	2,196.98	Gravity	2	2,338.77	61.3
106	J-80	2,198.26	Gravity	1	2,338.74	60.8
112	J-79	2,199.31	Gravity	0	2,338.76	60.3
182	J-228	2,200.02	Gravity	0	2,345.83	63.1
176	J-146	2,200.02	Gravity	0	2,346.12	63.2
116	J-93	2,200.30	Gravity	14	2,338.55	59.8

183	J-229	2,201.69	Gravity	0	2,339.73	59.7
152	J-173	2,202.17	Gravity	0	2,338.82	59.1
159	J-195	2,202.79	Gravity	3	2,338.84	58.9
175	J-222	2,203.67	Gravity	0	2,338.53	58.3
160	J-189	2,204.04	Gravity	2	2,338.93	58.4
165	J-193	2,214.36	Gravity	0	2,338.93	53.9
169	J-150	2,217.92	Gravity	0	2,339.12	52.4
172	J-217	2,234.60	Gravity	0	2,338.81	45.1
180	J-226	2,239.69	Gravity	0	2,338.47	42.7
137	J-153	2,243.12	Gravity	2	2,338.50	41.3
145	J-151	2,247.01	Gravity	1	2,338.48	39.6
173	J-218	2,258.35	Gravity	0	2,338.80	34.8
164	J-199	2,258.35	Gravity	0	2,338.80	34.8
157	J-198	2,263.33	Gravity	5	2,338.80	32.7
163	J-197	2,278.08	Gravity	1	2,338.93	26.3
168	J-194	2,286.22	Gravity	1	2,338.93	22.8
174	J-221	2,300.25	Gravity	0	2,338.93	16.7
167	J-200	2,301.31	Gravity	1	2,338.93	16.3
170	J-216	2,301.40	Gravity	0	2,338.77	16.2
171	J-215	2,341.54	Gravity	0	2,338.75	-1.2

\\Nas-01\cad\Civil3D Projects\41113\Hydr Model\41113_HYDRO_MODEL_v8.wtg

Scenario: Scenario - 1
Current Time Step: 0.000Hr
FlexTable: Tank Table

ID	Label	Zone	Elevation (Base) (ft)	Elevation (Minimum) (ft)	Elevation (Initial) (ft)	Elevation (Maximum) (ft)	Volume (Inactive) (gal)	Diameter (Calculated) (ft)	Status (Calculated)	Flow (Out net) (gpm)	Hydraulic Grade (ft)	Percent Full (%)
186	Reservoir	Gravity	2,326.00	2,326.50	2,341.00	2,341.38	0.00	33.82	Emptying	130	2,341.00	97.5

\\Nas-01\cad\Civil3D Projects\41113\Hydr Model\41113_HYDRO_MODEL_v8.wtg

Scenario: Scenario - 1
Current Time Step: 0.000Hr
FlexTable: Pump Table

ID	Label	Elevation (ft)	Pump Definition	Status (Initial)	Hydraulic Grade (Suction) (ft)	Hydraulic Grade (Discharge) (ft)	Flow (Total) (gpm)	Pump Head (ft)
187	WP 4	1,879.02	Well No. 4 - Estimated	Off	1,879.02	2,339.52	0	0.00
188	WP 3	1,942.23	Well No. 3 - Estimated	Off	1,942.23	2,340.66	0	0.00

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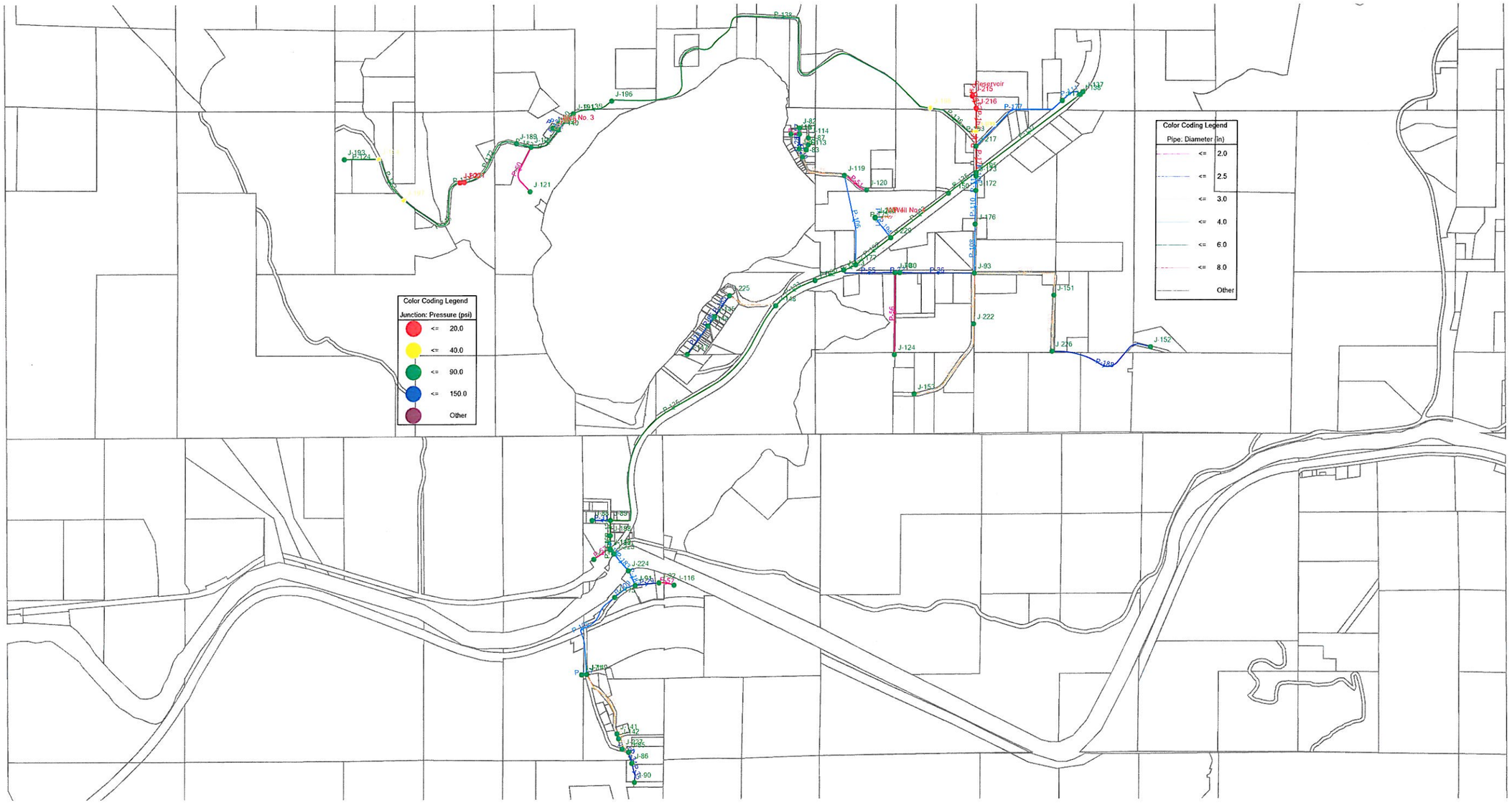
Scenario: Scenario - 1



Title: Rose Lake Water System
41113_HYDRO_MODEL_v8.wtg
11/26/2013

Welch Comer Engineers
27 Siemon Company Drive Suite 200 W Watertown, CT 06795 USA +1-203-755-1666

Project Engineer.
Bentley WaterCAD V8i (SELECTseries 3)
[08.11.03.19]

APPENDIX F:

PILOT TEST REPORT AND RESULTS

WELCH-COMER
ENGINEERS | SURVEYORS

Memorandum (by email)

DATE: August 30, 2013

TO: Mr. Steve Cordes, Vice President
Welch, Comer Engineers
350 East Kathleen Ave.
Coeur d'Alene, Idaho, 83815

FROM: Cullen J. Wilder, P.E.

SUBJECT: Summary of Pilot Testing, Rose Lake Well No. 4

As proposed in my letter of May 6, 2013, on August 19 – 22, 2013, we pilot tested Well 4 belonging to the Rose Lake Water Association. The objective was to determine the efficacy of the ATEC system in removing arsenic, iron and manganese from the water of this well and to identify the optimal ATEC filtration equipment for treatment that will reliably remove these constituent to less than the following limits set by the USEPA: arsenic to less than its Maximum Contaminant Level (MCL) of 10 µ/L, iron to less than one-half its Secondary Maximum Contamination Level (SMCL) of 0.300 mg/L, and manganese to less than one-half its SMCL of 0.050 mg/L. The filtration system must have a capacity of 150 gpm.

The pilot filter system is designed to simulate actual operation of an ATEC filter system on a small scale in terms of retention, media depth, flow per cubic foot of media, flow per square foot of media (loading rate) and so forth. For the test, differing amounts of chlorine and ferric chloride are applied to the raw water and the loading rates are varied to determine the most economical filtration equipment necessary to meet the treatment objectives. During the pilot testing the pilot trailer's field lab was used to determine chlorine, iron, manganese, H_2S and ammonia concentrations in the raw and finished water. Arsenic samples were sent to a certified lab.

Excellent pilot test results were attained for this well. Based on these results, an ATEC filter system comprised of (6) 30-inch diameter vertical filters with 60-inch side walls containing 42-inches of AS 741 M media (pyrolusite), preceded by (2) 30-inch diameter empty filters to provide about two minutes of retention to aid in arsenic removal, is recommended for treatment. This system would be shipped on two skids each having 3 filters and 1 empty filter, finished painted with underdrain support, underdrain, piping, manifolds and valves shop assembled.

The remainder of the report discusses the pilot testing and the recommended system. This report is meant to summarize and document the results of the pilot testing and the basis for the recommended system. This pilot test report should be helpful in preparing a technical report,

but is not meant to wholly satisfy the requirements of the State of Idaho or other government agencies.

Treated Water Objectives

ATEC's guarantees the removal of iron and manganese to less than one-half their SMCLs, 0.150 mg/L for iron and 0.025 mg/L for manganese. These values provide a margin of safety against exceeding the SMCL if the raw water quality changes and are less than the amounts we have found will cause odor, taste and staining problems.

ATEC's usual objective is to remove arsenic to less than one-half the MCL.

Ammonia and H_2S can also be the cause of taste and odor problems. Although not given as an objective, the ATEC system will also reduce the concentrations of these constituents, if present.

General Description of the ATEC Iron, Manganese and Arsenic Removal Process

ATEC Systems uses its proprietary AS-700 Series Filter Media, based on manganese dioxide mineral ore (Pyrolusite) as the basis for its high rate arsenic, iron, and manganese removal systems. This media is unusually robust, has a very high adsorptive capacity, and lends itself to the design of relatively simple treatment systems that do not require multi-media filter beds or the use of anthracite caps thus eliminating the need for surface wash and air scour systems. Currently ATEC has approximately 350 systems in operation. We have never supplied equipment that has failed to meet its treatment objectives.

The iron is oxidized to its insoluble state and filtered while the manganese is adsorbed on the surface of the media where it is secured and oxidized in place. Chlorine is injected immediately upstream of the filters. The chlorine is used to oxidize the iron and to maintain the filter bed in an oxidized state, not to oxidize and precipitate the manganese as is the case with most other treatment systems. This key difference allows for high loading rates and correspondingly small equipment footprints.

This is in sharp contrast with the more commonly used oxidation-precipitation-filtration methods where the iron is typically oxidized first with the addition of chlorine; manganese is often oxidized later with potassium permanganate prior to filtration.
Depending on the pH of the water and other factors, detention often follows the introduction of these oxidants to allow for the chemical reactions, usually manganese oxidation, to occur and for the oxidized iron and manganese to form a filterable floc. The presence of H_2S, ammonia, and/or organic matter (organic carbon) can make iron and manganese removal more difficult.

For arsenic removal, if the raw water does not contain enough iron, ferric chloride is added to the raw water providing a ferric ion which combines with the arsenic allowing arsenic to be removed through coagulation and precipitation. This process is aided by providing 30 seconds to two minutes of retention after the application of ferric chloride, ahead of the filters.

In this pilot test, doses of chlorine were introduced to the influent immediately before a 60-inch length of 6-inch diameter pipe providing approximately 2 minutes of retention ahead of four 6-inch diameter filter columns with 60-inch filter sidewalls. The filters are manifolded together at the inlet and outlet and filled with 42-inches of AS-741M Filter Media. The pilot test characteristics are detailed in Tables 1 and 2.

The natural ferric concentration in the raw water of Well 4 was sufficient to combine with the arsenic for removal. Therefore, ferric chloride was not added to the raw water.

Pilot testing results for the well are tabulated in Tables 3 and 4 and shown graphically in Figures 1, 2, 3 and 4 of this report.

Raw Water Quality

As shown in Table 4 the raw water arsenic concentration varied from a low of 8.2 µ/L to 11.2 µ/L, averaging 10.0 µ/L, equal to the MCL of 10 ppb. Three samples taken were above the MCL.

The iron content was quite high. Concentrations varied between 1.26 mg/L and 2.12 mg/L, averaging 1.74 mg/L, almost 6 times the SMCL of 0.300 mg/L. Manganese content was also quite high and varied from 0.119 mg/L to 0.142 mg/L, averaging 0.126 mg/L or about two and one-half times the SMCL. Iron and Manganese at these levels probably would be the cause of problems with taste, odor and staining.

Two sample of H_2S and two samples of ammonia were taken. The concentration of H_2S averaged 0.003 mg/L and ammonia content averaged 0.025 mg/L for the two samples taken.

Raw Water Quality

Parameter	Low	High	Average
Arsenic	8.2 µ/L	11.2 µ/L	10.0 µ/L
iron	1.260 mg/L	2.120 mg/L	1.749 mg/L
Manganese	0.119 mg/L	0.142 mg/L	0.126 mg/L
Ammonia	0.020 mg/L	0.030 mg/L	0.025 mg/L
H_2S	0.003 mg/L	0.003 mg/L	0.003 mg/L

Pilot Test Results

Pilot testing was done on August 19 – August 22, 2013. Samples were taken on an hourly basis for a total of 73 samples. Breakthrough, indicated by the spike in finish water iron and manganese concentrations, occurred four times during the test.

Influent flow was varied from a low of 3.03 gpm to a high of 5.24 gpm corresponding to loading rates of 3.85 gpm/sf and 6.67 gpm/sf with an average loading rate of 5.05 gpm/sf.[1]

[1] Area of the filter testing equipment is 0.784 sf.

Chlorine was added to the influent water in varying amounts from a low of 0.99 mg/L to a high of 4.89 mg/L, averaging 1.41 mg/L. Total Chlorine concentration in the finish water varied from a low of 0.44 mg/L to a high of 1.06 mg/L,[2] averaging 0.86 mg/L. Chlorine demand averaged 0.55 mg/L and did not vary a great deal during the test.

The natural iron content of the raw water was high enough for combination with the arsenic present for form a filterable flock. Therefore, ferric chloride was not added.

Arsenic removal was excellent. Finish water arsenic varied from non-detect to 3.7 µ/L with an average finished arsenic concentration of 1.3 µ/L or 13 % of the 10 µ/L MCL.

Iron removal was excellent as well. Disregarding the high values during breakthrough, finish water iron concentration varied from less than could be detected to 0.030 mg/L, averaging approximately 0.012 mg/L, or 4 % of the SMCL.
Manganese removal was also excellent. As with iron, disregarding the high values during breakthrough, finish water manganese concentration varied from non-detect to 0.005 mg/L, averaging 0.001 mg/L, or 2 % of the SMCL of 0.05 mg/L.

Finish ammonia content of the two samples taken were non-detect. Finish water H_2S concentrations were also at non-detect.

The levels of iron and manganese are well below those that cause problems with taste, odor and staining.

The following table summarizes the pilot testing.

Pilot Test Summary

Parameter	Low	High	Average	Percent of MCL or SMCL
Arsenic	Non-detect	3.7 µ/L	1.3 µ/L	13 %
Iron	Non-detect	0.030 mg/L	0.012 mg/L	4 %
Manganese	Non-detect	0.005 mg/L	0.001 mg/L	2 %
Chlorine Residual	0.44 mg/L	1.06 mg/L	0.86 mg/L	-
Loading Rate	3.85 gpm/sq ft	6.67 gpm/sq ft	5.05 gpm/sq ft	-

Recommended System

To meet the objective of reducing the arsenic to less than one-half the MCL at the 150 gpm required capacity, the recommended system would be comprised of (6) 30-inch diameter filters preceded by 2 empty filters to provide about two minutes of retention. This system would have

[2] Samples 23 – 25 were disregarded.

a loading rate of 5.10 gpm/sf during production and 6.12 gpm/sf during backwash when one filter is out of service.

The water quality of the backwash decant after settling was similar to that of the well source water. The designer may wish to bring the backwash decant to the headworks of the filter system for recycling. If the amount recycled were at the maximum rate of 15 gpm (10 % of the treatment system's rated capacity), the loading rate would be increased to 5.61 gpm/sq ft.

The recommended system would be shipped finish painted on two skids each with three filters and one empty filter for retention. The system will come pre-plumbed, pre-wired, fusion epoxy coated tanks and manifolds, 0.25-inch heads and sidewalls. This includes 4-inch inlet and outlet manifolds, 3-inch backwash line, and available as an option, shipped loose, a 60-inch backwash assembly comprised of a gate valve and meter to regulate backwash to 137 gpm, and a sight glass. It also will include a120 VAC automatic controller. Media is shipped in supersacks or 60 pound bags at the customer's option.

As stated earlier, ATEC guarantees this system will remove iron and manganese to less than one-half their SMCL values. On the basis of the pilot test, we expect that arsenic will be removed to considerably less than one-half its MCL.[3]

Backwash

Breakthrough occurred four times during the pilot test, at Sample 14, Sample, 29, Sample 51 and Sample 68. These four breakthroughs occurred after the treatment of approximately 3,606, 2,995, 6,005 and 3587 gallons of water with an average of the amount of water treated between breakthroughs of 4,048 gallons. The average is equivalent to 197 Empty Bed Volumes (EBVs) of the pilot test equipment. In the full sized system 197 EBVs is equal to 151,600 gallons or 16.8 hours of production at 150 gpm. Backwash should be set to occur at approximately this interval, then monitored for several weeks to determine if the interval needs to be decreased or can be increased.

Preliminary drawings for this system are included in this report. Dimensions are subject to change and points of connections can be revised to suit field conditions.

Operating Characteristics of the Recommended Filter System

Parameter	Value
Production Rate	150 gpm
Loading Rate	5.10 gpm/sf
Backwash Rate	28 gpm/sf
Backwash Flow	137 gpm
Backwash Duration	5-minutes per filter

[3] The backwash decant water quality was similar to the well source water and therefore, in view of the excellent treatment shown in the pilot test, ATEC is confident of treatment efficacy with the slightly higher loading rate during recycle.

Backwash Frequency	16.8 hours of production
Backwash Amount	4,110 gallons
Production Between Backwash Cycles	151,600 gallons
Backwash as a Percentage of Production	2.71 %

Please contact me if you have any questions or need further information.

Yours truly,

Cullen Wilder

Cullen J. Wilder, P.E.
Vice President
ATEC Systems Associates, Inc.
858-755-7702 (direct)

Table 1
Pilot Test Equipment Characteristics

Pilot Filters[1]	
Sidewall Height (inches)	48 to 60
Overall Height (inches)	62 to 74
Diameter (inches)	6
Filter Surface Area (each) ($ft.^2$)	0.1964
Total Filter Surface Area (ft^2)	0.7854
Underdrain	Stainless Steel Wedgewire, 0.01" slots
Media Support	¾" minus crushed granite, 4"
Source Water Connections	¾" Standard Hose
Recommended Minimum/Maximum Working Pressure	20/90 psi
Filter Media[2]	
Depth in Filters (inches)	36 to 48
Volume in Filters (ft^3)	2.36 to 3.15
Approximate Weight in Filters (lbs.)	285
Weight (lbs./ft^3)	120.5
Physical Size (mm)	0.32 –to-0.85
Maximum Removal Capacity	
Iron Removal (mg/L)	10
Manganese Removal (mg/L)	10
Hydrogen Sulfide Removal (mg/L)	5
Non-Adsorptive Removal (microns)	>20
Chemical Dosing Equipment[3]	
Stenner Peristaltic Solution Metering Pumps (up to 17.0 gpd @ 100 psi)	
LMI Solution Metering Pumps (various capacities)	
Analytical Equipment	
See following page.	

1/ The pilot filter plant consists of four, 6" filter columns connected by common manifolds for influent, effluent and backwash water. Each filter is controlled by a three-way ball valve. The system is set up to closely mimic a full-scale filter system in terms of media depth, application rates in terms of both area (gpm/ft^2 of filter area) and volume (gpm/ft^3 of media), and backwash characteristics to the extent possible. Source water is metered using a totalizing flow meter. Pressure is measured on the influent and effluent manifold to determine headloss. Chemical injection points are located as close to the filter as possible to simulate actual operation. In cases where extended contact time is desired before the source water enters the filters, a pipe section of pre-determined volume is placed between the chemical injection points and the filters to provide accurate contact time measurement. Sidewall height is variable to a maximum of 60" without modification, allowing a maximum media bed depth of 48".

2/ AS-721M and AS-741M Filter Media, 0.85 to 2.36mm and 0.42mm to 0.85mm, respectively, are both granular manganese dioxide media, derived from naturally occurring pyrolusite, and are certified to ANSI/NSF Standard 61.

3/ Solution metering pumps are available for the injection of up to three chemicals, if needed. Normally, the only chemical injected is chlorine. And in the case of arsenic, ferric chloride. There are, however, provisions for special circumstances, such as pH adjustment for corrosion control or the treatment of water at fish hatcheries that do not permit chlorine.

Table 2 Analytical Equipment

The following analytical equipment is normally carried on our pilot trailers.

Spectrophotometer, Model DR/2800, Hach Co., Loveland, CO
Digital Titrator, Hach Co., Loveland, CO
pH Meter, Model 266, Orion Co., Boston, MA
Stir Plate, Hach Co., Loveland, CO
0.45-Micron Filter, Nalgene

Glassware—beakers, flasks, columns, sample cells, 10 and 25 ml

Although not normally carried in each trailer, a turbidity meter is available.

Reagents for the following field tests:

Spectrophotometer

Free Chlorine, DPD, Method 8021 and 10059 (300 tests)
Total Chlorine, DPD, Method 8167 or 10060 (300 tests)

Iron, FerroZine Method, Method 8147 (500 tests)
Iron, Total, FerroVer Method, Method 8008 (300 tests)

Manganese, Low Range, PAN Method, Method 8149 (500 tests)

Nitrogen, Ammonia, Salicylate Method, Method 8155 (100 tests)

Sulfide, Methylene Blue Method, Method 8131 (100 tests)

Silica, Molybdate Method, Method 8282 (100 tests)

Digital Titrator

Alkalinity, Phenolphthalein and Total Method, Method 8203 (100 tests)
Hardness, Phenolphthalein and Total Method, Method 8203 (100 tests)
Total Chlorine, Iodometric Method, Method 8209 (100 tests)

Field tests not listed above may be available. Please note that we send all tests for arsenic and other contaminants that require digestion or distillation to a commercial laboratory.

ATEC Iron and Manganese Removal Pilot Plant

The exterior of ATEC Systems' pilot trailer is shown above. The source and product water connections are shown entering and exiting the trailer. Inside dimensions are 14' x 6' x6½'.

The front one-half of the trailer is shown above. The instrument foreground on the wall is an in-line chlorine analyzer. The smaller boxes on the wall above the light are electronic flow meters used to monitor cumulative as well as instantaneous flow for each treatment train in the pilot plant.

Picture above shows the interior of the pilot plant trailer from the rear. The sample outlets and the analytical equipment are on the desk in the front of the trailer.

The picture on the left shows one set of filters. Source water enters through the hose inlet in the wall, passes through a flow meter, past a chlorine injection point, through an in-line static mixer, into the inlet manifold, down through the filter media. Product water is discharged through the wall. The pail holding the sodium hypochlorite solution can be seen to the right of the filter vessels and the in-line chlorine analyzer is on the wall above the NaOCl container. The sample ports and analytical equipment is forward of the chlorine analyzer. A second container of Ferric Chloride solution and feed pump is provided for pilot testing for arsenic removal.

Table 3
Summary of Pilot Study Test Conditions
Rose Lake Water Association, Well 4
August 19 - 22, 2013

Date	Sample Number	Time	Meter Reading (Gallons)	Average Flow (gpm)	Loading Rate (gpm/ft^2)	Loading Rate (gpm/ft^3)	Media Contact Time (Minutes)	Cl_2 Dose (mg/L)	Temp °C
8/19	Start	16:00	-	3.65	4.65	1.33	7.17	1.63	12.7
	1	17:00	192.5	4.02	5.12	1.46	4.39	1.34	12.6
	2	18:00	382.7	3.17	4.04	1.15	5.57	1.70	12.7
	3	19:00	625.7	4.05	5.16	1.47	4.36	1.23	12.1
	4	20:00	872.9	4.12	5.25	1.50	4.28	1.20	12.1
	5	21:00	1,113.5	4.01	5.11	1.46	4.40	1.24	12.1
	6	22:00	1,409.4	4.93	6.28	1.79	3.58	1.01	12.1
	7	23:00	1,683.6	4.57	5.82	1.66	3.86	1.09	NT
8/20	8	0:00	1,958.5	4.58	5.83	1.67	3.85	1.08	NT
	9	1:00	2,233.1	4.58	5.83	1.66	3.86	1.08	NT
	10	2:00	2,507.7	4.58	5.83	1.66	3.86	1.08	NT
	11	3:00	2,782.2	4.58	5.83	1.66	3.86	1.08	NT
	12	4:00	3,056.8	4.58	5.83	1.66	3.86	1.08	NT
	13	5:00	3,331.4	4.58	5.83	1.66	3.86	1.08	NT
	14	6:00	3,606.0	4.58	5.83	1.66	3.86	1.08	NT
	15	7:00	3,880.6	4.58	5.83	1.66	3.86	1.08	12.6
	16	8:00	4,194.9	5.24	6.67	1.91	3.37	0.95	12.8
	17	9:00	4,377.6	3.05	3.88	1.11	5.80	1.63	11.9
	18	10:00	4,604.5	3.78	4.81	1.38	4.67	1.31	12.6
	19	11:00	4,867.6	4.39	5.58	1.60	4.03	1.13	11.9
	20	12:00	5,097.0	3.82	4.87	1.39	4.62	1.30	12.3
	21	13:00	5,297.7	3.35	4.26	1.22	5.28	1.48	12.9
	22	14:00	5,501.9	3.40	4.33	1.24	5.19	1.46	13.4
	23	15:00	5,566.1	1.07	1.36	0.39	16.50	4.64	12.4
	24	16:00	5,627.0	1.01	1.29	0.37	17.39	4.89	13.0
	25	17:00	5,690.4	1.06	1.35	0.38	16.71	4.70	12.2
	26	18:00	5,911.9	3.69	4.70	1.34	4.78	1.34	12.7
	27	19:00	6,129.9	3.63	4.63	1.32	4.86	1.37	12.8
	28	20:00	6,361.1	3.85	4.91	1.40	4.58	1.29	12.8
	29	21:00	6,601.7	4.01	5.11	1.46	4.40	1.24	12.7
	30	22:00	6,901.3	4.99	6.36	1.82	3.54	0.99	NT
	31	23:00	7,200.9	4.99	6.36	1.82	3.54	0.99	NT
	32	0:00	7,500.6	5.00	6.36	1.82	3.53	0.99	NT
8/21	33	1:00	7,800.2	4.99	6.36	1.82	3.54	0.99	NT
	34	2:00	8,099.9	5.00	6.36	1.82	3.53	0.99	NT
	35	3:00	8,399.5	4.99	6.36	1.82	3.54	0.99	NT
	36	4:00	8,699.2	5.00	6.36	1.82	3.53	0.99	NT
	37	5:00	8,998.8	4.99	6.36	1.82	3.54	0.99	NT
	38	6:00	9,298.5	5.00	6.36	1.82	3.53	0.99	NT
	39	7:00	9,597.9	4.99	6.35	1.82	3.54	0.99	12.5
	40	8:00	9,877.0	4.65	5.92	1.69	3.79	1.07	12.0
	41	9:00	10,172.9	4.93	6.28	1.79	3.58	1.04	11.9
	42	10:00	10,411.3	3.97	5.06	1.45	4.44	1.29	12.3
	43	11:00	10,615.7	3.41	4.34	1.24	5.18	1.50	12.0
	44	12:00	10,888.9	4.55	5.80	1.66	3.88	1.12	12.5
	45	13:00	11,079.1	3.17	4.04	1.15	5.57	1.61	12.2
	46	14:00	11,365.2	4.77	6.07	1.73	3.70	1.07	12.5
	47	15:00	11,605.0	4.00	5.09	1.45	4.42	1.28	12.0
	48	16:00	11,862.3	4.29	5.46	1.56	4.12	1.19	12.6
	49	17:00	12,118.6	4.27	5.44	1.55	4.13	1.20	12.2
	50	18:00	12,359.0	4.01	5.10	1.46	4.41	1.28	12.3
	51	19:00	12,606.2	4.12	5.25	1.50	4.28	1.24	12.3
	52	20:00	12,821.8	3.59	4.58	1.31	4.91	1.42	NT
	53	21:00	13,037.7	3.60	4.58	1.31	4.91	1.42	NT
	54	22:00	13,253.5	3.60	4.58	1.31	4.91	1.42	NT
	55	23:00	13,469.4	3.60	4.58	1.31	4.91	1.42	NT
8/22	56	0:00	13,685.2	3.60	4.58	1.31	4.91	1.42	NT
	57	1:00	13,901.1	3.60	4.58	1.31	4.91	1.42	NT
	58	2:00	14,116.9	3.60	4.58	1.31	4.91	1.42	NT
	59	3:00	14,332.8	3.60	4.58	1.31	4.91	1.42	NT
	60	4:00	14,548.6	3.60	4.58	1.31	4.91	1.42	NT
	61	5:00	14,764.5	3.60	4.58	1.31	4.91	1.42	NT
	62	6:00	14,980.3	3.60	4.58	1.31	4.91	1.42	NT
	63	7:00	15,196.4	3.60	4.59	1.31	4.90	1.42	12.4
	64	8:00	15,392.5	3.27	4.16	1.19	5.40	1.57	12.0
	65	9:00	15,615.8	3.72	4.74	1.35	4.74	1.38	12.5
	66	10:00	15,797.3	3.03	3.85	1.10	5.84	1.69	12.1
	67	11:00	16,002.8	3.43	4.36	1.25	5.15	1.49	12.6
	68	12:00	16,193.5	3.18	4.05	1.16	5.55	1.61	12.1
	69	13:00	16,454.8	4.35	5.54	1.58	4.05	1.18	12.7
	70	14:00	16,665.3	3.51	4.47	1.28	5.03	1.46	12.1
	71	15:00	16,866.8	3.36	4.28	1.22	5.26	1.52	12.5
	72	16:00	17,097.8	3.85	4.90	1.40	4.59	1.33	12.7
	Total or Average		**17,097.80**	3.96	5.05	1.44	4.96	1.41	12.4

NA, indicates Not Applicable for this test
Not Dosed, (ND) indicating the period of the test
Not Tested, (NT) indicating no value entered because there was no sample to test
Media contact time = Empty bed contact time

150 gpm, 60 psi (well cycling, not in hand)
Used 42" AS-741 media
Used 6" X 60" contact tank
Sodium Hypochlorite titrated @ 3885.0
BW start of the test
Used Rochelle Salts
On Sampler 23:00 - 06:00
Backwashed (8/20) 7:12 - 07:28 (10 hrs effective run time) 3932.2 - 4049.9
Hardness = 222 mg/L as $CaCO_3$
Alkalinity = 255 mg/L as $CaCO_3$
Raw iron at about 2.0 mg/L when the well is operating, about 1.30 mg/L when it is not
13:45, Reduced flow to about 1 gpm/ft^2, Began dosing supernate at 1 gph
14:09, Split line from well to attempt to bleed off sufficient water to keep well running
17:11, Increased flow, Ended dosing supernate
Backwashed (8/20) 21:07 - 21:23 (12 hrs effective run time) 6652.8 - 6870.0
On Sampler 23:00 - 06:00
Backwashed (8/21) 07:07 - 07:26 (10 hrs effective run time) 9627.2 - 9874.3
Calibrated pH meter
Sodium Hypochlorite titrated @ 3685.2 (08:25, 8/21)
Backwashed (8/21) 19:03 - 19:20 (11 hrs effective run time) 12619.5 - 12705.4
On Sampler 20:00 - 06:00
Backwashed (8/22) 12:03 - 12:20 (16 hrs effective run time at 4.5 gpm/ft^2) 16205.9 - 16314.3
Backwash effluent arsenic lab test = 12.3

BW end of the test

Table 4
Summary of Pilot Test Results
Rose Lake Water Association, Well 4
August 19 - 22, 2013

	Source Water								Product Water									
Sample Number	**pH (Units)**	**Fe (mg/L)**	**Mn (mg/L)**	**H_2S (mg//L)**	**Ammonia (mg//L)**	**Silica (mg/L)**	**As (lab) (ppb)**	**PSI**	**pH (Units)**	**Cl_2 (F) (mg/L)**	**Cl_2 (T) (mg/L)**	**Fe (mg/L)**	**Mn (mg/L)**	**H_2S (mg//L)**	**Ammonia (mg//L)**	**Silica (mg/L)**	**As (lab) (ppb)**	**PSI**
Start	**8.37**	1.85	0.142			22.10		36	**7.97**	**0.78**	**1.02**	0.01	0.005			22.10		32
1	**7.98**	1.95	0.132			22.20	10.0	36	**7.92**	**0.24**	**0.46**	-	0.002			22.20	3.7	32
2	**7.70**	1.58	0.132	0.003				32	**7.72**	**0.56**	**0.70**	-	-	-				29
3	**7.72**	1.92	0.120		0.020			28	**7.72**	**0.52**	**0.71**	-	-		-		2.0	24
4	**7.68**	1.90	0.132					26	**7.60**	**0.50**	**0.68**	-	-					27
5	**7.68**	1.87	0.130					27	**7.60**	**0.51**	**0.70**	0.02	-				2.6	27
6	**7.60**	1.95	0.125					30	**7.59**	**0.53**	**0.76**	-	-					27
7	**NT**	NT	NT					NT	**7.88**	**0.07**	**0.48**	0.01	-					NT
8	**NT**	NT	NT					NT	**7.85**	**0.68**	**0.81**	-	-					NT
9	**NT**	NT	NT					NT	**7.86**	**0.77**	**0.92**	0.03	-					NT
10	**NT**	NT	NT					NT	**7.85**	**0.70**	**0.85**	0.12	0.001					NT
11	**NT**	NT	NT					NT	**7.86**	**0.61**	**0.76**	0.14	0.003					NT
12	**NT**	NT	NT					NT	**7.85**	**0.65**	**0.78**	0.21	0.004					NT
13	**NT**	NT	NT					NT	**7.83**	**1.03**	**1.05**	0.29	0.002					NT
14	**NT**	NT	NT					NT	**7.85**	**1.01**	**1.03**	0.35	0.003					NT
15	**7.88**	1.39	0.120					29	**7.95**	**0.93**	**1.06**	0.40	0.004					23
16	**7.80**	1.26	0.121					30	**7.80**	**0.78**	**0.93**	0.01	-					28
17	**7.89**	2.01	0.126				11.2	30	**7.88**	**0.72**	**0.80**	-	-				1.6	28
18	**7.82**	1.35	0.120					28	**7.93**	**0.70**	**0.87**	-	-					24
19	**7.87**	1.79	0.126					30	**7.72**	**0.88**	**1.01**	0.01	-					26
20	**7.75**	1.93	0.126	0.003	0.030	22.10		29	**7.65**	**0.52**	**0.65**	0.02	-	-	-	22.10	1.6	25
21	**7.67**	1.53	0.121					31	**7.73**	**0.67**	**0.74**	-	-					27
22	**7.81**	1.26	0.127					44	**7.64**	**0.35**	**0.47**	-	-					47
23	**7.78**	1.92	0.123					42	**7.69**	**1.97**	**2.18**	-	-				1.7	41
24	**7.81**	1.65	0.126					42	**7.70**	**1.83**	**2.15**	-	-					41
25	**7.80**	1.97	0.124					44	**7.77**	**1.84**	**2.02**	0.01	-				1.6	42
26	**7.95**	1.65	0.130					32	**7.94**	**0.98**	**1.09**	0.01	-					28
27	**7.82**	2.12	0.124					32	**7.85**	**0.87**	**1.03**	0.02	-					27
28	**7.87**	1.75	0.126					33	**7.84**	**0.91**	**1.07**	0.08	0.001					27
29	**7.86**	1.42	0.131					34	**7.83**	**0.77**	**0.85**	0.13	-					26
30	**NT**	NT	NT					NT	**8.09**	**0.68**	**0.81**		-					NT
31	**NT**	NT	NT					NT	**7.98**	**0.77**	**0.92**							NT
32	**NT**	NT	NT					NT	**8.03**	**0.70**	**0.85**							NT
33	**NT**	NT	NT					NT	**8.01**	**0.61**	**0.76**							NT
34	**NT**	NT	NT					NT	**8.02**	**0.65**	**0.78**							NT
35	**NT**	NT	NT					NT	**7.98**	**0.88**	**0.97**							NT
36	**NT**	NT	NT					NT	**8.02**	**0.78**	**0.91**							NT
37	**NT**	NT	NT					NT	**8.02**	**0.83**	**0.89**							NT
38	**NT**	NT	NT					NT	**7.97**	**0.78**	**0.93**							NT
39	**8.30**	1.33	0.119					26	**8.26**	**0.46**	**0.57**	0.16						20
40	**8.23**	1.45	0.121					30	**8.08**	**0.53**	**0.67**	0.01	0.005					28
41	**7.47**	2.02	0.125				10.6	30	**7.46**	**0.56**	**0.70**	-	-				-	28
42	**7.55**	1.98	0.123					30	**7.53**	**0.61**	**0.73**	-	-					28
43	**7.37**	1.47	0.120					30	**7.37**	**0.57**	**0.71**	-	-					28
44	**7.35**	1.73	0.127					30	**7.36**	**0.56**	**0.70**	0.02	0.001					27
45	**7.32**	2.05	0.125					30	**7.43**	**0.34**	**0.44**	0.01	-				-	27
46	**7.35**	1.36	0.119					28	**7.37**	**0.57**	**0.70**	-	-					23
47	**7.34**	1.79	0.127					30	**7.43**	**0.60**	**0.70**	-	-					27
48	**7.42**	1.86	0.126					28	**7.38**	**0.56**	**0.64**	0.01	-					22
49	**6.84**	2.00	0.126				10.4	30	**6.86**	**0.52**	**0.63**	0.03	-				1.7	26
50	**7.08**	1.87	0.127					27	**7.09**	**0.56**	**0.61**	0.07	-					21
51	**7.21**	1.73	0.125					28	**7.15**	**0.61**	**0.73**	0.15	0.001					21
52	**NT**	NT	NT					NT	**7.57**	**0.98**	**1.09**	-	0.004					NT
53	**NT**	NT	NT					NT	**7.56**	**0.87**	**1.03**	0.02	0.002					NT
54	**NT**	NT	NT					NT	**7.59**	**0.91**	**1.07**	-	-					NT
55	**NT**	NT	NT					NT	**7.56**	**0.77**	**0.85**	-	-					NT
56	**NT**	NT	NT					NT	**7.58**	**0.68**	**0.81**	0.01	-					NT
57	**NT**	NT	NT					NT	**7.58**	**0.77**	**0.92**	0.01	-					NT
58	**NT**	NT	NT					NT	**7.59**	**0.70**	**0.85**	-	-					NT
59	**NT**	NT	NT					NT	**7.60**	**0.61**	**0.76**	-	0.005					NT
60	**NT**	NT	NT					NT	**7.61**	**0.65**	**0.78**	-	0.003					NT
61	**NT**	NT	NT					NT	**7.58**	**0.88**	**0.97**	-	-					NT
62	**NT**	NT	NT					NT	**7.54**	**0.78**	**0.91**	0.02	-					NT
63	**8.26**	1.58	0.129				8.2	32	**7.76**	**0.66**	0.78	0.01	-				-	29
64	**7.45**	1.94	0.124					33	**7.47**	**0.68**	**0.79**	0.01	-					29
65	**7.58**	1.49	0.131					33	**7.58**	**0.85**	**0.96**	0.02	-					29
66	**7.45**	1.90	0.131					33	**7.40**	**0.62**	**0.75**	0.03	0.003					28
67	**7.38**	2.08	0.129					34	**7.31**	**0.56**	**0.69**	0.05	0.003				-	28
68	**7.36**	2.06	0.128					38	**7.39**	**0.58**	**0.67**	0.27	0.003					32
69	**7.38**	1.65	0.121					33	**7.40**	**0.61**	**0.77**	0.01	0.004					33
70	**7.35**	1.97	0.130					32	**7.40**	**0.56**	**0.68**	-	-					29
71	**7.43**	1.36	0.120					32	**7.37**	**0.65**	**0.79**	-	-					29
72	**7.36**	1.45	0.131				9.6	32	**7.36**	**0.59**	**0.63**	-	-				-	29
Total or Average	**7.64**	**1.74**	**0.126**	**0.003**	**0.025**	**22.13**	**10.0**	**32**	**7.68**	**0.72**	**0.86**	**0.04**	**0.001**	**-**	**-**	**22.13**	**1.3**	28
Average as Percent of MCL		***578.8%***	***251.9%***									***14.53%***	***1.84%***					
Average Removal Rate												***97.5%***	***99.27%***					

Non Detect, indicating the absence of a metal or chemical at or above the method detection limit is shown as "-" and calculated in the total or average as zero.

Figure 1
Pilot Test Results
Chlorine Dosage and Free Residual Concentrations
Rose Lake Water Association, Well 4
August 19 - 22, 2013

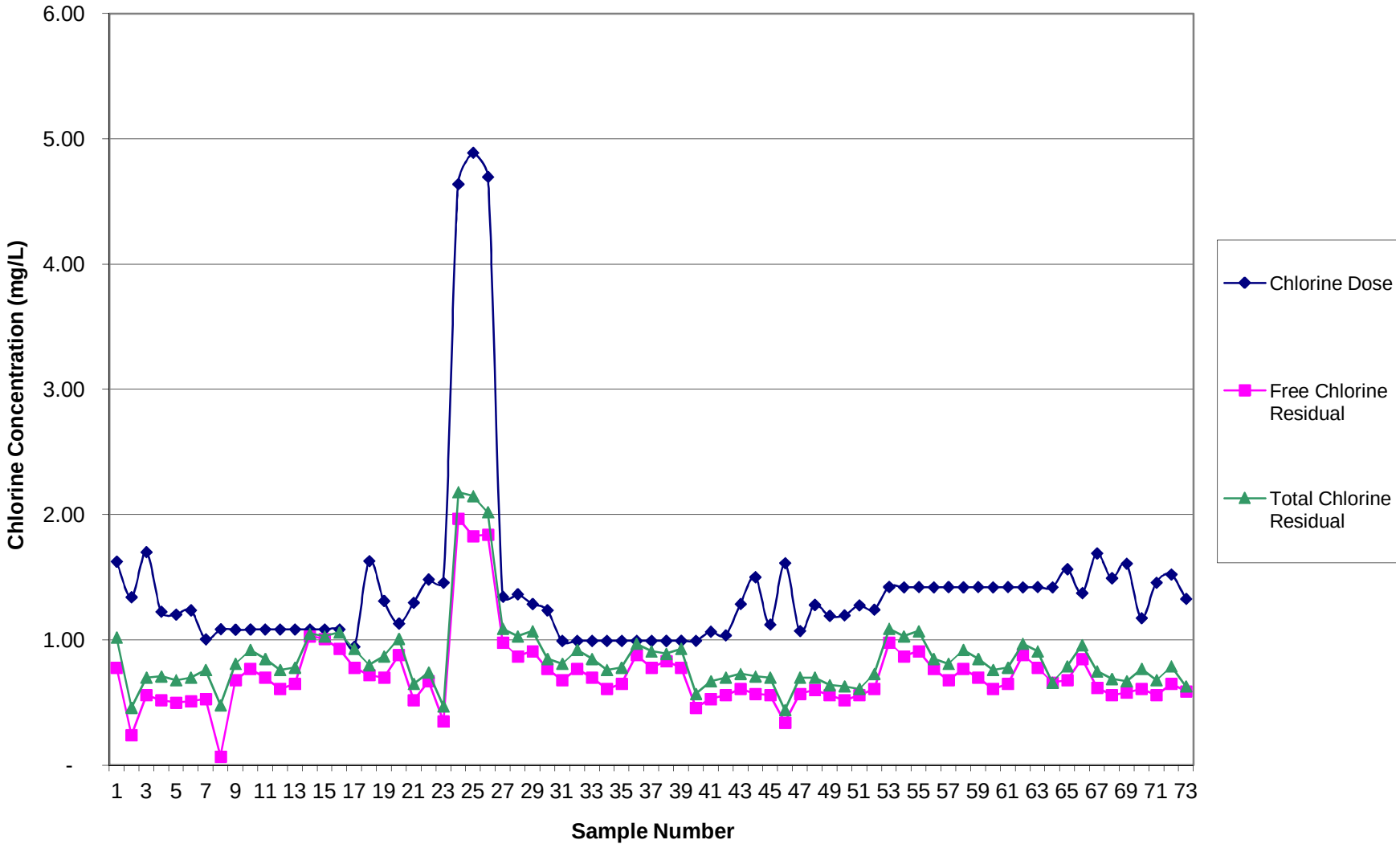


Figure 2
Pilot Test Results
Arsenic Removal Using AS-741M Filter Media
Rose Lake Water Association, Well 4
August 19 - 22, 2013

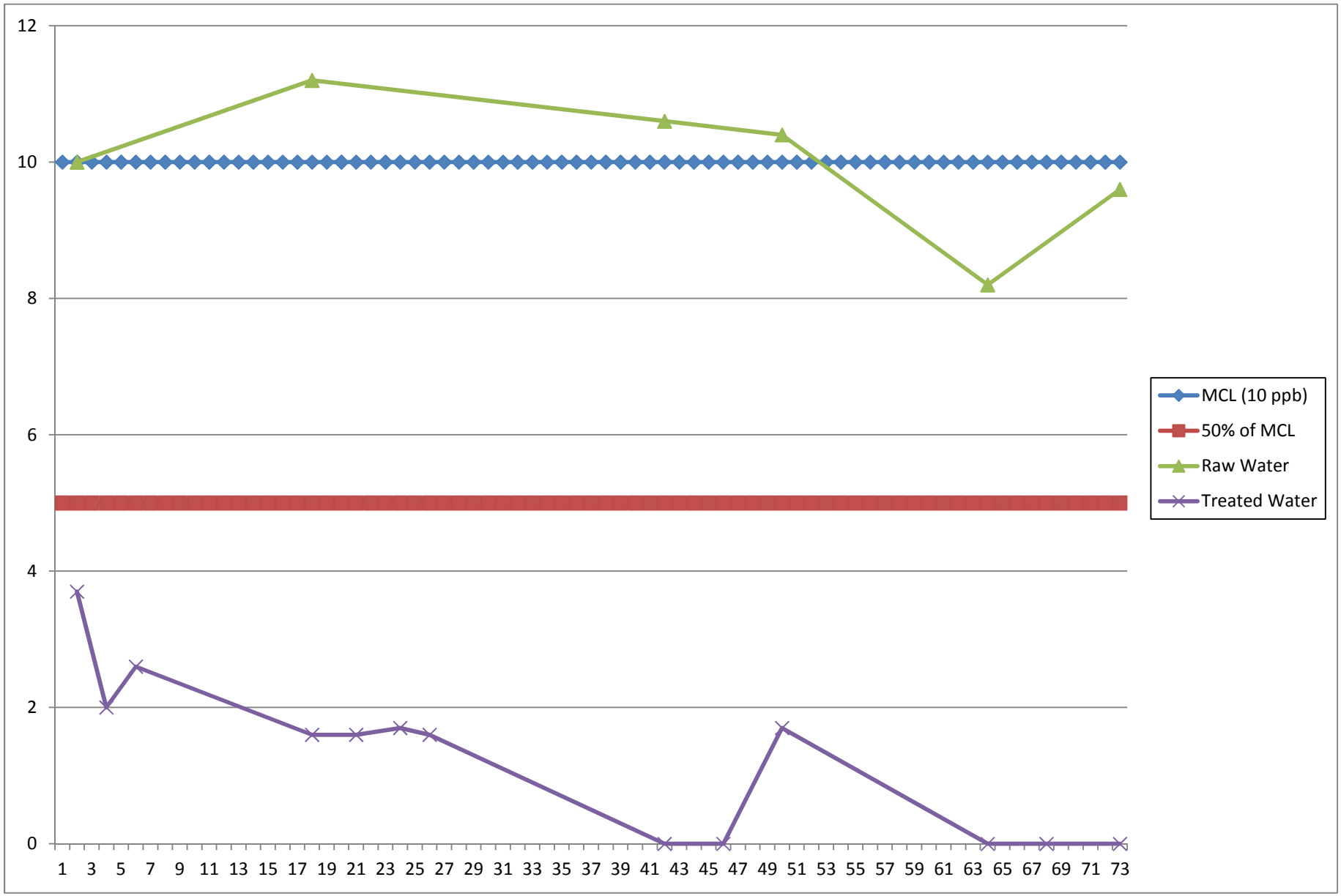


Figure 3
Pilot Test Results
Manganese Removal Using AS-741M Filter Media
Rose Lake Water Association, Well 4
August 19 - 22, 2013

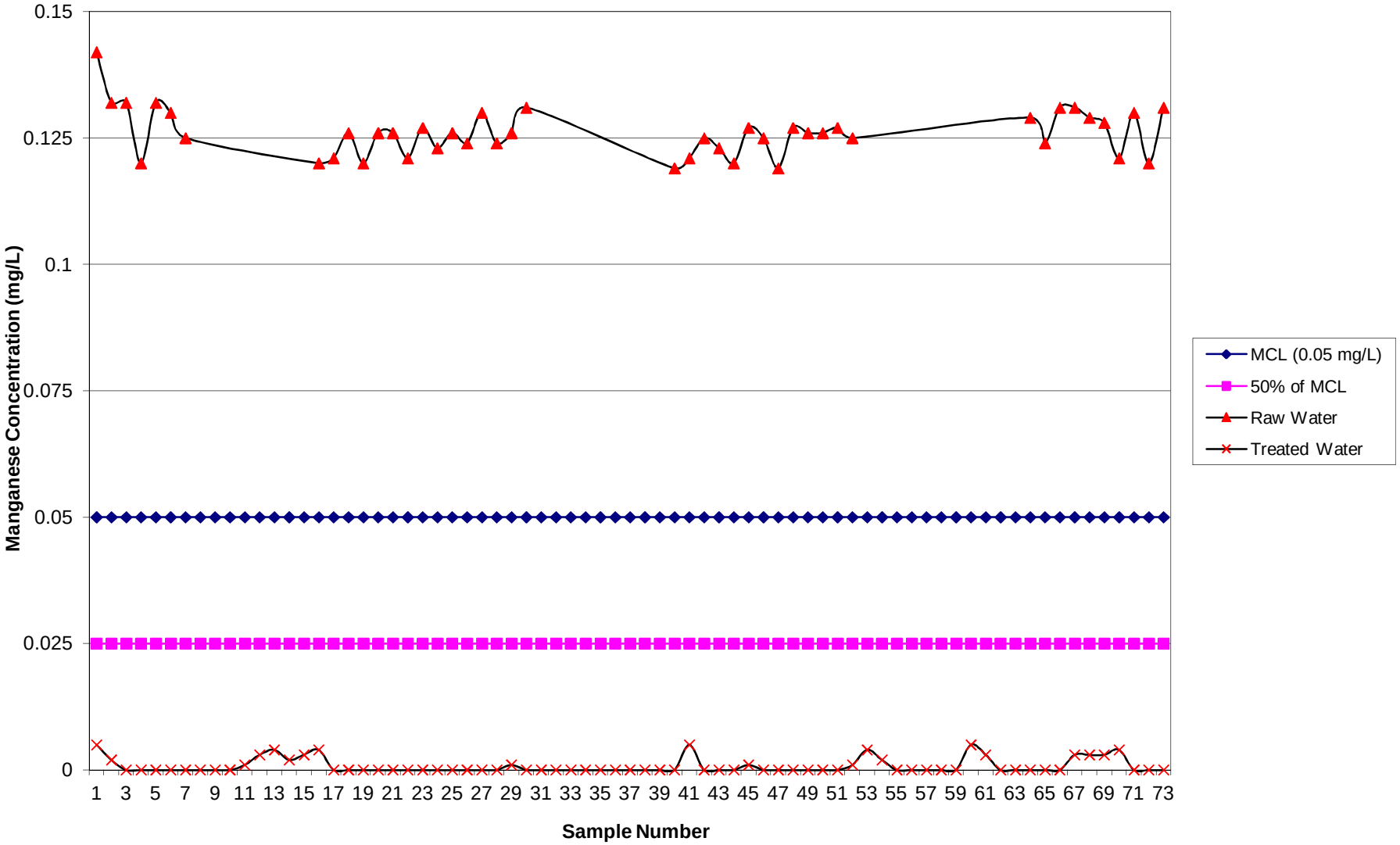
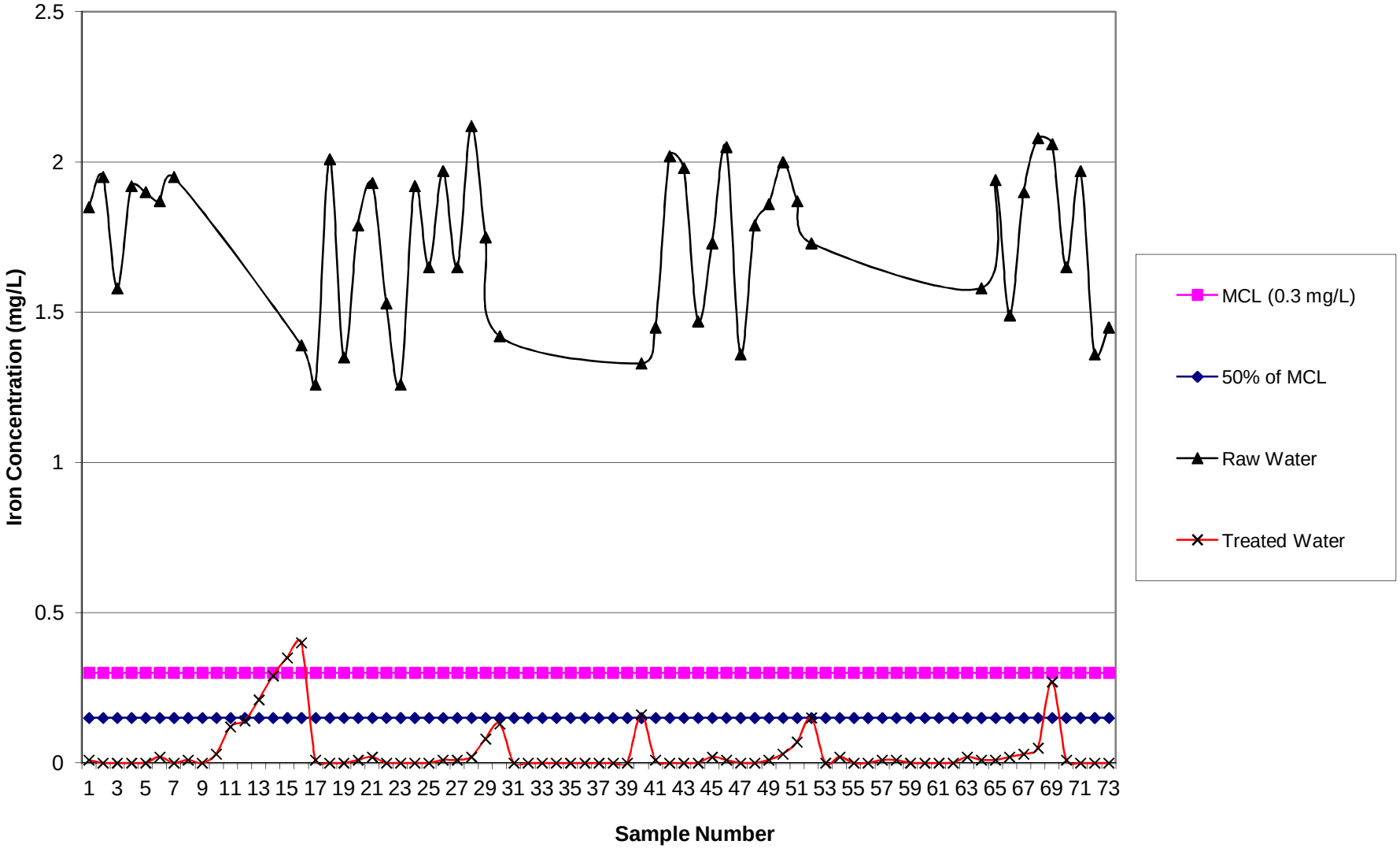
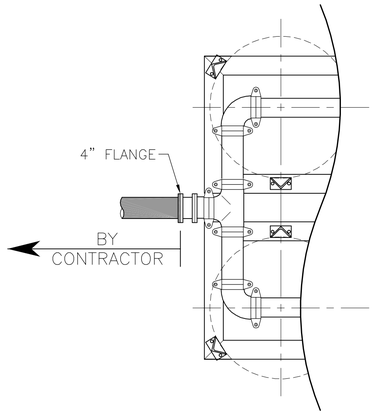
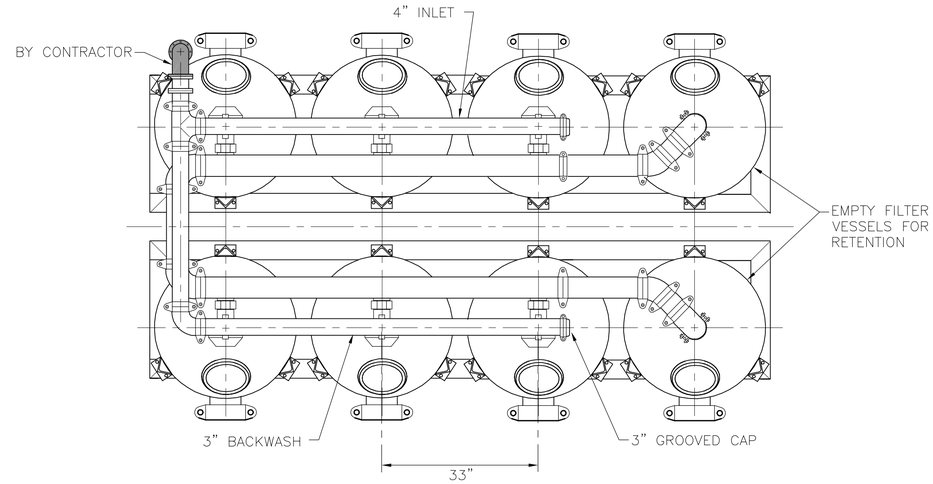


Figure 4
Pilot Test Results
Iron Removal Using ATEC AS-741M Filter Media
Rose Lake Water Association, Well 4
August 19 - 22, 2013

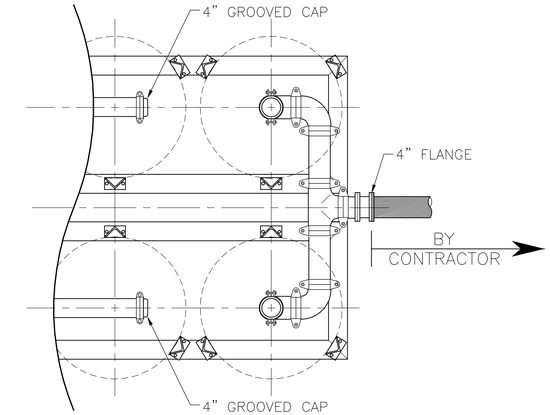




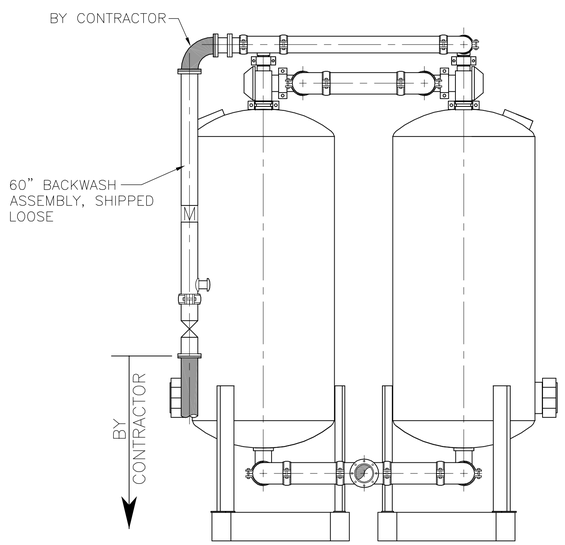
LEFT SIDE, FILTERS REMOVED



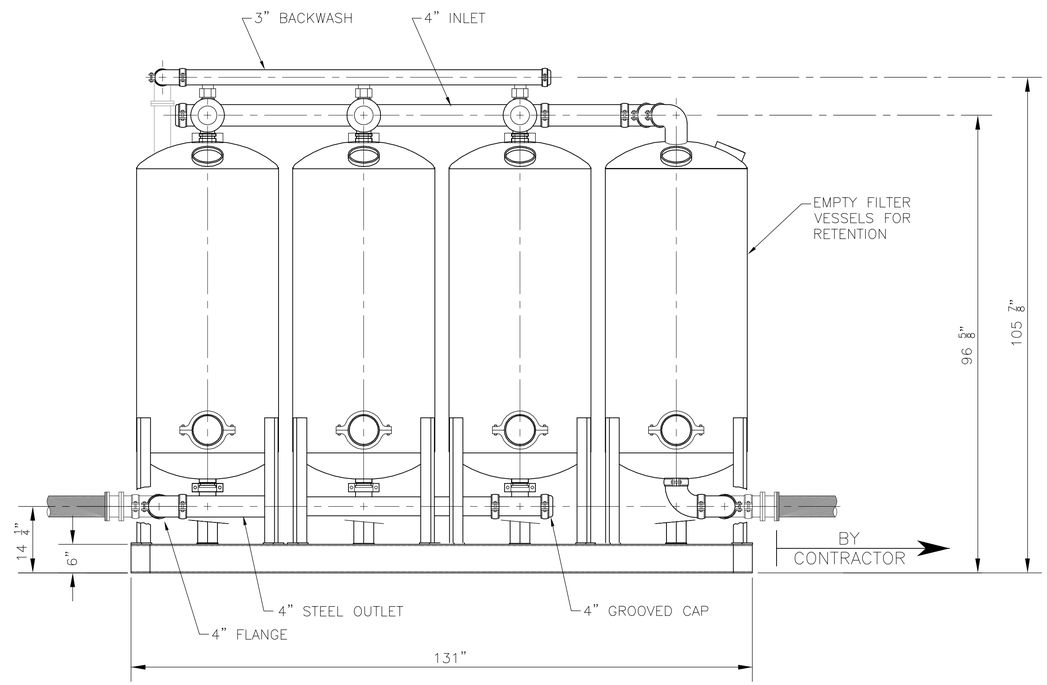
PLAN VIEW



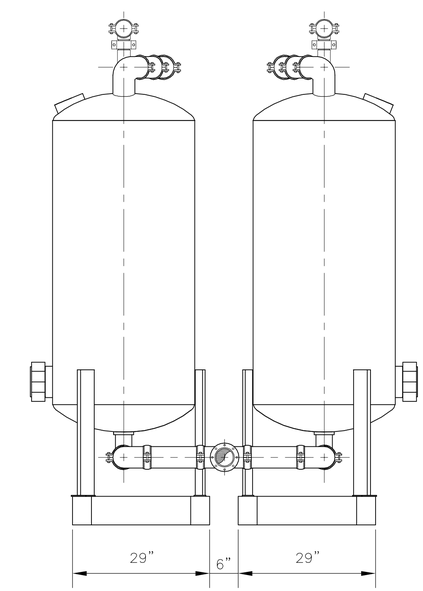
RIGHT SIDE, FILTERS REMOVED



LEFT ELEVATION



FRONT ELEVATION



RIGHT ELEVATION

NOTE: 1. A 60" LONG, 3-INCH BACKWASH FLANGED BACKWASH ASSEMBLY WITH REGULATING VALVE, METER AND SIGHT GLASS WILL BE SHIPPED LOOSE TO REGULATE BACKWASH TO 137 GPM.

2. CONTROLLER TO BE SHIPPED LOOSE FOR MOUNTING ON WALL

ATEC SYSTEMS ASSOCIATES
P.O. BOX 10239
BAINBRIDGE ISLAND, WASHINGTON 98110-0329
PHONE: (360) 842-3862 FAX: (360) 397-0375

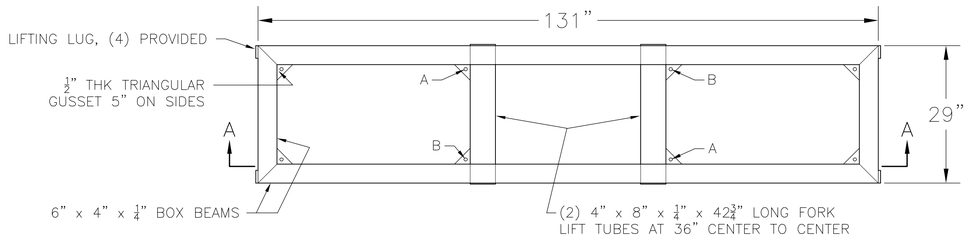
DESIGN BY: .					
DRAWN BY: .					
CHECKED BY: .					
APR'D BY: .	NO.	DATE		BY	APVD

0 2 4
SCALE IN FEET
NOTE: CHECK SCALE
SCALEABLE IN 22x34 - 3/4" = 1'-0"
SCALEABLE IN 11x17 - 3/8" = 1'-0"

ROSE LAKE WELL No. 4
ARSENIC, IRON AND MANGANESE
TREATMENT SYSTEM

FILTER DETAILS

SHEET NO. 1 of 2
DWG. NO.
DATE: 08-29-13
FILE: Rose Lake #4

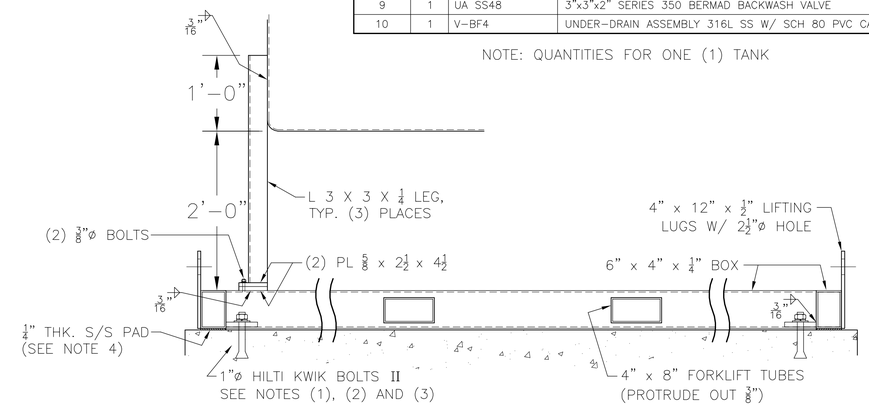


SKID PLAN
(4FILTER)

0 1 2
SCALE IN FEET
NOTE: CHECK SCALE
SCALEABLE IN 22x34 - 3/4" = 1'-0"
SCALEABLE IN 11x17 - 3/8" = 1'-0"

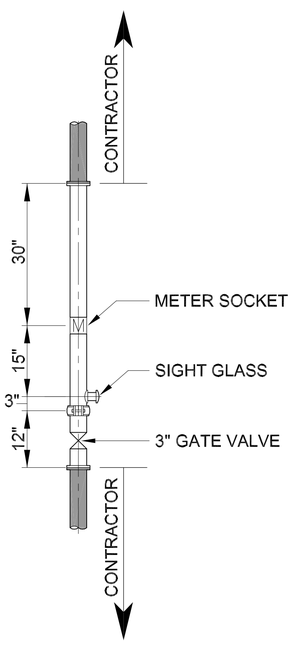
BILL OF MATERIAL			
ITEM	QTY	PART NO.	DESCRIPTION
1	1	PFS–CPL03	3" GROOVED COUPLING, CAST IRON W/ BOLTS & GASKET
2	3	PFS–CPL04	4" GROOVED COUPLING, CAST IRON W/ BOLTS & GASKET
3	1	PFS–CAP08	8" GROOVED END CAP
4	1	PFS–CPL08	8" GROOVED COUPLING, CAST IRON W/ BOLTS & NUTS
5	1	PFS=HHP11	11"x15" HAND HOLE PLATE
6	1	PFS–HHG11	11"x15" HAND HOLE GASKET
7	1	PFS–HHGS11	11"x15" HAND HOLE BOLT SET
8	1	PFS–HHCR11	11"x15" HAND HOLE HOLD DOWN CRAB
9	1	UA SS48	3"x3"x2" SERIES 350 BERMAD BACKWASH VALVE
10	1	V–BF4	UNDER–DRAIN ASSEMBLY 316L SS W/ SCH 80 PVC CAP COMPLETE

NOTE: QUANTITIES FOR ONE (1) TANK

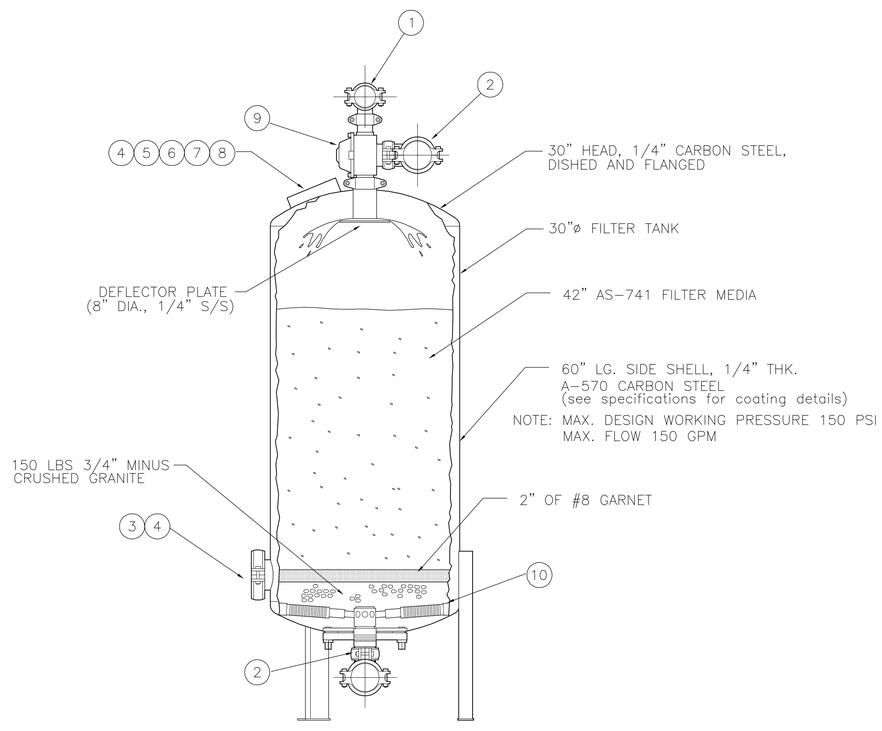


SECTION A–A
SCALE 1" = 1'–0"

0 1 2
SCALE IN FEET
NOTE: CHECK SCALE
SCALEABLE IN 22x34 - 1" = 1'-0"
SCALEABLE IN 11x17 - 1/2" = 1'-0"



BACKWASH ASSEMBLY
(SHIPPED LOOSE)



FILTER/SYSTEM INFORMATION	
ITEM	
CAPACITY	150 GPM
LOADING RATE	5.10 GPM/Sq.Ft.
BACKWASH	137 GPM
DIAMETER OF TANK	30"
No. OF TANKS	6
COLOR	INTERIOR BLUE
OPERATING PRESSURE	60 PSI
SHIPPING ADDRESS	
PHONE No.	
WEIGHT	
Fe	1.749 mg/L
Mg	0.126 mg/L
As	10 ppb

NOTES:
(1) DESIGNER SHALL DETERMINE NO. AND DEPTH OF ANCHOR BOLTS TO SUIT LOCAL CODE REQUIREMENTS. FOUR BOLTS ARE REQUIRED AS A MINIMUM AT EXTERIOR GUSSETS.

(2) ANCHOR BOLT HOLES ARE TO BE DRILLED INTO CONCRETE FOUNDATION THROUGH OVERSIZED DRILL HOLES IN GUSSETS IN SKID ASSEMBLY BY INSTALLATION CONTRACTOR.

(3) IF LESS THAN 8 BOLTS ARE SPECIFIED FOR 4 AND 5 FILTER SKIDS, MIDDLE BOLTS SHALL BE AT LOCATIONS "A" OR "B" (DIAGONAL FROM EACH OTHER)

(4) 1/4" THICK S/S PADS ARE PROVIDED UNDER SKIDS FOR CLEARANCE BETWEEN SKIDS AND CONCRETE FOUNDATION. SIX PADS ARE PROVIDED FOR 2 & 3 FILTER SKIDS, EIGHT PADS FOR 3–14 FILTER SKIDS

NOTE:
DIMENSIONS GIVEN ARE FOR THE CONTRACTOR'S INFORMATION BUT WILL VARY BECAUSE OF NORMAL FABRICATION TOLERANCES. CONTRACTOR SHALL CONNECT EXTERIOR PIPING TO FIT THE ATEC UNIT AS SHIPPED.

FILTER TANKS AND MANIFOLDS ON THIS SHEET SUPPLIED BY ATEC SYSTEMS:

THE CONTRACTOR WILL BE RESPONSIBLE FOR:
1. UNLOADING THE UNITS AND PLACING THEM IN THE CORRECT INSTALLED LOCATION.
2. ATTACH MANIFOLDS CONNECTING THE TWO BANKS OF FILTERS.
3. LOADING THE AS–741 FILTER MEDIA INTO THE FILTER VESSELS (2 EACH 2,250# BULK BAGS PER VESSEL.
4. CONNECTING POWER SUPPLY TO FILTER BACKWASH PLC (120 VAC, SWITCHED CIRCUIT).

ATEC SYSTEMS ASSOCIATES
P.O. BOX 10239
BAINBRIDGE ISLAND, WASHINGTON 98110-0329
PHONE: (360) 842-3862 FAX: (360) 397-0375

DESIGN BY: .				
DRAWN BY: .				
CHECKED BY: .				
APR'D BY: .	NO.	DATE	BY	APVD

0 2 4
SCALE IN FEET
NOTE: CHECK SCALE
SCALEABLE IN 22x34 - 3/4" = 1'-0"
SCALEABLE IN 11x17 - 3/8" = 1'-0"

ROSE LAKE WELL No. 4
ARSENIC, IRON AND MANGANESE
TREATMENT SYSTEM

FILTER DETAILS

SHEET NO. 2 of 2
DWG. NO.
DATE: 08-29-13
FILE: Rose Lake #4

Accurate Testing Labs, LLC
7950 Meadowlark Way
Coeur d'Alene, ID 83815
Phone (208) 762 8378 Fax (208) 762 9082
www.accuratetesting.com
info@accuratetesting.com

Certificate of Analysis

Order No.: **2013080526**

Welch Comer & Associates
350 E. Kathleen
Coeur d'Alene , ID 83815

Project: Rose Lake Well 4

Date Received: 08/22/2013 08:25

Sample: **1**
Location: # 11 Raw
Sample Type: Raw Water

Matrix: Drinking Water
D/T Collected: 08/21/2013 09:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0106	mg/L	EPA 200.5	0.0014	08/22/13	WM

Sample: **2**
Location: # 12 Treated
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/21/2013 09:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	08/22/13	WM

Sample: **3**
Location: # 13 Treated
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/21/2013 13:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	08/22/13	WM

Sample: **4**
Location: # 14 Raw
Sample Type: Raw Water

Matrix: Drinking Water
D/T Collected: 08/21/2013 17:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0104	mg/L	EPA 200.5	0.0014	08/22/13	WM

Comments:

Laboratory Supervisor, Walter Mueller Date: 08/23/13

ND: Not Detected PQL: Practical Quantitation Limit

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7950 Meadowlark Way
Coeur d'Alene, ID 83815
Phone (208) 762 8378 Fax (208) 762 9082
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Certificate of Analysis

Order No.: **2013080526**

Sample:	**5**	Matrix:	Drinking Water
Location:	# 15 Treated	D/T Collected:	08/21/2013 17:00
Sample Type:	A (After Treatment)	Collected by:	Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0017	mg/L	EPA 200.5	0.0014	08/22/13	WM

Comments:

Laboratory Supervisor, Walter Mueller Date: 08/23/13

ND: Not Detected PQL: Practical Quantitation Limit

Chain of Custody

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E-mail: mueller@accuratetesting.com | Internet: http://www.accuratetesting.com

Results & Invoice to:

Name: Ashley Williams / WELCH · COMER
Address: 350 E Kathleen Ave
CdA, ID 83815
Phone: 208-664-9352 Fax:
awilliams@welchcomer.com

Reporting Requirements:

Preliminary: FAX ☐ Verbal ☐ by: __/__/__
Final Report: FAX ☐ Verbal ☐ by: __/__/__
Rushes: 48 hrs. ☐ Other: ☑ 24 hr

Name of Sampler: MAC

Project Information:

Project Name: Rose Lake
Project Number: W-11 4
Purchase Order Number: Pilot test only

ANALYSIS REQUEST

	Lab #	Sample ID	Date	Time	Matrix	NO. OF CONTAINERS	As	Remarks/Sample Conditions
080526-1	11	Raw	8/21	09 00	DW		X	
-2	12	Treated	8/21	09 00	DW		X	
-3	13	Treated	8/21	1300	DW		X	
-4	14	Raw	8/21	1700	DW		X	
-5	15	Treated	8/21	1700	DW		X	

Relinquished by:	Date Time	Received by:	Date Time
[signature]	8-22-13	[signature]	8-22-13 8:25

Chain of Custody Seals
☐ Yes ☐ No ☐ N/A
☐ UPS ☐ FedEx
☐ Bus ☐ Hand

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Certificate of Analysis

Order No.: **2013080492**

Welch Comer & Associates
350 E. Kathleen
Coeur d'Alene , ID 83815

Project: Rose Lake Well 4

Date Received: 08/21/2013 08:27

Sample: **1**
Location: # 5 Raw
Sample Type: Raw Water

Matrix: Drinking Water
D/T Collected: 05/20/2013 09:00
Collected by: Mac Pennington

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0112	mg/L	EPA 200.5	0.0014	08/21/13	WM

Sample: **2**
Location: # 6 Treated
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 05/20/2013 09:00
Collected by: Mac Pennington

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0016	mg/L	EPA 200.5	0.0014	08/21/13	WM

Sample: **3**
Location: # 7 Treated
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 05/20/2013 12:00
Collected by: Mac Pennington

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0016	mg/L	EPA 200.5	0.0014	08/21/13	WM

Comments:

Laboratory Supervisor, Walter Mueller Date: 08/22/13

ND: Not Detected PQL: Practical Quantitation Limit

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Certificate of Analysis

Order No.: **2013080492**

Sample:	**4**	Matrix:	Drinking Water
Location:	# 8 Treated W/Recycle	D/T Collected:	05/20/2013 15:00
Sample Type:	A (After Treatment)	Collected by:	Mac Pennington

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0017	mg/L	EPA 200.5	0.0014	08/21/13	WM

Sample:	**5**	Matrix:	Drinking Water
Location:	# 9 BW Effluent	D/T Collected:	05/20/2013 13:34
Sample Type:	Other	Collected by:	Mac Pennington

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0123	mg/L	EPA 200.5	0.0014	08/21/13	WM

Sample:	**6**	Matrix:	Drinking Water
Location:	# 10 Treated W/Recycle	D/T Collected:	05/20/2013 17:00
Sample Type:	A (After Treatment)	Collected by:	Mac Pennington

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0016	mg/L	EPA 200.5	0.0014	08/21/13	WM

Comments:

Laboratory Supervisor, Walter Mueller Date: 08/22/13

ND: Not Detected PQL: Practical Quantitation Limit

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Certificate of Analysis

Order No.: **2013080440**

Welch Comer & Associates
350 E. Kathleen
Coeur d'Alene , ID 83815

Project: Rose Lake

Date Received: 08/20/2013 08:18

Sample: **1**
Location: Well 4 Raw
Sample Type: Plant Tap

Matrix: Drinking Water
D/T Collected: 08/19/2013 17:00
Collected by: Welch-Comer

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0100	mg/L	EPA 200.5	0.0014	08/21/13	WM

Sample: **2**
Location: Well 4 Treated
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/19/2013 17:00
Collected by: Welch-Comer

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0037	mg/L	EPA 200.5	0.0014	08/21/13	WM

Sample: **3**
Location: Well 4 Treated
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/19/2013 19:00
Collected by: Welch-Comer

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0020	mg/L	EPA 200.5	0.0014	08/21/13	WM

Comments:

Laboratory Supervisor, Walter Mueller Date: 08/21/13

ND: Not Detected PQL: Practical Quantitation Limit

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Certificate of Analysis

Order No.: **2013080440**

Sample:	**4**	Matrix:	Drinking Water
Location:	Well 4 Treated	D/T Collected:	08/19/2013 21:00
Sample Type:	A (After Treatment)	Collected by:	Welch-Comer

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0026	mg/L	EPA 200.5	0.0014	08/21/13	WM

Comments:

Laboratory Supervisor, Walter Mueller Date: 08/21/13

ND: Not Detected PQL: Practical Quantitation Limit

Pilot testing - not reportable

Chain of Custody

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E-mail: mueller@accuratetesting.com | Internet: http://www.accuratetesting.com

Results & Invoice to: Ashley Williams

Name: Welch-Comer Engineers
Address: 350 E Kathleen Ave
CdA, ID
Phone: 208-664-9382 Fax:

Reporting Requirements:

Preliminary: FAX ☐ Verbal ☐ by: __/__/__
Final Report: FAX ☐ Verbal ☐ by: __/__/__
Rushes: 48 hrs. ☐ Other: ☒ 24 hr
awilliams@welchcomer.com

Name of Sampler: Mac

Project Information:

Project Name: Rose Lake
Project Number: Well 4
Purchase Order Number:

Lab #	Sample ID	Date	Time	Matrix	NO. OF CONTAINERS	AS	Remarks/Sample Conditions
080440 1	Raw	8/19	1700	Gas		X	AS
2	Treated	8/19	1700			X	
3	Treated	8/19	1900			X	
4	Treated	8/19	2100			X	

Relinquished by:	Date Time	Received by:	Date Time
[signature]	8-20-13 8:12	[signature]	8-20-13 8:12

Chain of Custody Seals
☐ Yes ☐ No ☐ N/A
☐ UPS ☐ FedEx
☐ Bus ☐ Hand

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Certificate of Analysis

Order No.: **2013080544**

Welch Comer & Associates
350 E. Kathleen
Coeur d'Alene , ID 83815

Project: Rose Lake Well 4

Date Received: 08/23/2013 07:10

Sample: **1**
Location: # 16 Raw
Sample Type: Raw Water

Matrix: Drinking Water
D/T Collected: 08/22/2013 07:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0082	mg/L	EPA 200.5	0.0014	08/23/13	WM

Sample: **2**
Location: # 17 Treated
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/22/2013 07:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	08/23/13	WM

Sample: **3**
Location: # 18 Treated
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/22/2013 11:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	08/23/13	WM

Sample: **4**
Location: # 19 Raw
Sample Type: Raw Water

Matrix: Drinking Water
D/T Collected: 08/22/2013 16:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0096	mg/L	EPA 200.5	0.0014	08/23/13	WM

Comments:

Laboratory Supervisor, Walter Mueller Date: 08/23/13

ND: Not Detected PQL: Practical Quantitation Limit

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Certificate of Analysis

Order No.: **2013080544**

Sample:	**5**	Matrix:	Drinking Water
Location:	# 20 Treated	D/T Collected:	08/22/2013 16:00
Sample Type:	A (After Treatment)	Collected by:	Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	08/23/13	WM

Comments:

Laboratory Supervisor, Walter Mueller Date: 08/23/13

ND: Not Detected PQL: Practical Quantitation Limit

Chain of Custody

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E-mail: mueller@accuratetesting.com | Internet: http://www.accuratetesting.com

Results & Invoice to:

Name: Ashley Williams / WELCH Comer
Address: 350 E Kathleen Ave
CdA, ID 83815
Phone: 208-664-9382 Fax:
awilliams@welchcomer.com

Reporting Requirements:

Preliminary: FAX ☐ Verbal ☐ by: ___/___/___
Final Report: FAX ☐ Verbal ☐ by: ___/___/___
Rushes: 48 hrs. ☐ Other: ☒
24hr -

Name of Sampler: MAC

Project Information:

Project Name: Rose Lake Pilot Test
Project Number: Well 4
Purchase Order Number: Pilot Test Only
0805744 -

ANALYSIS REQUEST

	Lab #	Sample ID	Date	Time	Matrix	NO. OF CONTAINERS	14 VOC-1C	Remarks/Sample Conditions
-1	16	Raw	8/22	07:00	DW		X	
-2	17	Treated	8/22	07:00	DW		X	
-3	18	Treated	8/22	11:00	DW		X	
-4	19	Raw	8/22	1600	DW		X	
-5	20	Treated	8/22	1600	DW		X	

Relinquished by:	Date Time	Received by:	Date Time
		CWM 8-23-13	7:10

Chain of Custody Seals
☐ Yes ☐ No ☐ N/A
☐ UPS ☐ FedEx
☐ Bus ☒ Hand

ATEC SYSTEMS ASSOCIATES

DATE: October 23, 2014

TO: Steve Cordes, Vice President
Welch, Comer Engineers

FROM: Mac Pennington

SUBJECT: Summary Pilot Testing, Well 4, Rose Lake Water Association for the Removal of Radium, Arsenic, Iron, and Manganese

ATEC Systems previously tested the subject water successfully for the removal of arsenic, iron, and manganese. Since that time, radium concentrations have risen, approaching the MCL of 5 pCi/L (picocuries). Since the removal of iron, manganese and arsenic was good in the first test, on August 25-29, 2014, we repeated the previous pilot test with the addition of HMO to determine if we could simultaneously reduce the radium concentration while maintaining the previous removal rates for the other contaminants. We understand the capacity of the system at well 4 is to be 150 gpm.

Pilot Test Notes

Detailed results of the pilot test and pilot test conditions have been provided previously. The plan was to pilot test dosing ≈0.50 mg/L of HMO (all HMO values are as Mn) on the first day, ≈1.00 mg/L on the second day, ≈1.50 mg/L on the third day, and 2.00 mg/L on the fourth day. The HMO was not fully precipitated when we started testing. We also were testing with both wells 3 and 4 in automatic mode, so there is no reliable expectation we were testing water from only Well 4 at any time. Despite these concerns, removal of radium was good, reducing the radium to 0.7 pCi/L. We decided to retest with HMO at ≈ 0.50 mg/L (as Mn) on the fifth and final day. Unfortunately we ran out of HMO early on day 5, and despite our best efforts to combine the residual with water, it is unlikely we were actually dosing much HMO on the final day. That combined with a spike in the raw radium to 7.6 PCi/L resulted in unacceptable and anomalous results for day five.

Iron was reduced from an average of 1.66 mg/L in the raw water to less below the detection level. Manganese averaged 0.131 mg/L in the raw water and was reduced to 0.005 mg/L, about one tenth of the MCL. Arsenic concentrations in the raw water were just over the MCL, averaging 10.3 µ/L, which was reduced to 0.3 µ/L or about 3% of the MCL.

Discarding the anomalous results from day five, radium removal was very good, reducing the total radium concentration from an average of not quite 4.1 pCi/L raw water to just 0.94 pCi/L or 0.20 % of the MCL. It is worth noting that, except for day 5, the radium concentrations in the treated water did not exceed 2 µg/L and most readings were below 1 µg/L pCi/L. The complete results are listed in Table 1 below.

P. O. Box 10329, Bainbridge Island, Washington 98110 ● 360-414-9223 ● Fax 360-397-0375

Rose Lake Radium Pilot Test Data Comparison

Date/Time	Water Source	Loading Rate	HMO Dose	Raw Water			Treated Water		
				226	228	Total	226	228	Total
25-Aug	Combined 3/4								
10:00	Both in Auto	3.5	0.217	1.1	2.6	3.8	0.2	-0.2	0.7
14:00		3.2	0.438				0.2	-0.1	0.7
17:00		5.77	0.483				0.1	0.3	0.7
26-Aug	Combined 3/4								
10:00	Both in Auto	3.02	0.649	1.2	2.8	4.0	0.2	-0.5	0.5
14:00		4.11	0.935				0.09	0.5	0.4
17:00		4.59	1.09				0.04	0.3	0.3
27-Aug	Well 4								
10:00	In Auto	3.09	1.372	1.4	2.8	4.2	0.1	1.9	2.0
14:00		3.95	1.655				0.1	1.4	1.5
17:00		5.83	1.184				0.08	2.0	2.0
28-Aug	Well 4								
10:00	In Auto	2.44	2.104	1.3	2.9	4.2	0.2	1.2	1.4
14:00		3.71	1.835				0.1	1.1	1.1
17:00		5.95	2.112				0.3	0.5	0.6
29-Aug	Well 4								
10:00	In Auto	3.65	0.409	4.7	2.9	7.6	5.1	0.7	5.8
14:00		4.56	0.518				4.6	1.0	5.6
17:00		5.85	0.784				4.7	0.5	5.0

Based on the pilot test conducted on well 4, we recommend a loading rate of 4 gpm/sf or less except during backwash when the loading rate will increase.

There is naturally adequate iron in the source water to allow for the effective co-precipitation of the arsenic without the addition of ferric chloride to remove the arsenic to levels well below the MCL.

HMO will need to be dosed to remove the radium to levels consistently and reliably below the MCL. We recommend dosing the HMO at between 0.5 mg/L as Mn and 1.0 mg/L as Mn. If the radium level increases significantly this dose will likely need to be increased and provisions should be made to permit any needed increase in the HMO dose.

The design should include one set of contact tanks. We also recommend the use of a static mixer, as was used during the pilot study.

Treatment System Recommendation

Based on these results, a filter system comprised of (8) 30-inch diameter vertical filters with 60-inch side walls containing 42-inches of AS 741-M media (Pyrolusite), is recommended for treatment. This system would be preceded by two each (2) 30-inch diameter empty filters to provide about two minutes of retention to aid in arsenic and radium removal.

This system would be shipped on two skids, each with one contact tank and 4 filters, finished painted with underdrain support, underdrain, piping, manifolds and valves shop assembled.

Table 3
Summary of Pilot Study Test Conditions
Rose Lake Water Association, Well 4
August 25 - 29, 2014

Date	Sample Number	Time	Meter Reading (Gallons)	Average Flow (gpm)	Loading Rate (gpm/ft^2)	Loading Rate (gpm/ft^3)	Media Contact Time (Minutes)	Cl_2 Dose (mg/L)	HMO (mg/L) as Mn	Temp °C
8/25	Start	8:00	-	2.72	3.46	0.99	9.63	2.71	ND	12.7
	1	9:00	163.2	2.72	3.46	0.99	6.49	2.92	0.097	12.6
	2	10:00	327.9	2.75	3.50	1.00	6.43	2.27	0.217	13.0
	3	11:00	485.6	2.63	3.35	0.96	6.72	1.73	0.301	12.5
	4	12:00	615.6	2.17	2.76	0.79	8.15	2.88	0.362	13.0
	5	13:00	754.8	2.32	2.95	0.84	7.61	2.69	0.370	12.7
	6	14:00	905.6	2.51	3.20	0.91	7.02	2.93	0.438	13.1
	7	15:00	1,057.5	2.53	3.22	0.92	6.97	2.91	0.443	12.7
	8	16:00	1,316.9	4.32	5.50	1.57	4.08	1.71	0.400	13.1
	9	17:00	1,589.0	4.54	5.77	1.65	3.89	1.63	0.483	13.1
	10	18:00	1,853.2	4.40	5.61	1.60	4.01	1.67	0.365	12.5
8/26	11	8:00	-	2.84	3.62	1.03	6.22	2.60	1.060	12.5
	12	9:00	94.8	2.11	2.68	0.77	8.38	3.50	0.893	12.3
	13	10:00	177.9	2.37	3.02	0.86	7.43	3.11	0.649	12.4
	14	11:00	328.5	2.51	3.20	0.91	7.03	2.94	0.659	12.6
	15	12:00	547.8	3.66	4.65	1.33	4.83	2.02	1.064	12.3
	16	13:00	754.4	3.44	4.38	1.25	5.13	2.14	0.860	12.7
	17	14:00	948.1	3.23	4.11	1.17	5.47	2.28	0.935	12.4
	18	15:00	1,200.9	4.21	5.36	1.53	4.19	1.75	0.941	13.1
	19	16:00	1,464.2	4.39	5.59	1.60	4.02	1.68	0.807	12.6
	20	17:00	1,727.7	4.39	5.59	1.60	4.02	1.68	1.090	12.4
	21	18:00	1,988.7	4.35	5.54	1.58	4.06	1.70	0.984	12.3
8/27	22	8:00	2,099.9	2.47	3.15	0.90	7.14	2.53	1.671	12.3
	23	9:00	2,286.7	3.11	3.96	1.13	5.67	2.00	1.616	12.4
	24	10:00	2,432.4	2.43	3.09	0.88	7.27	2.57	1.372	12.6
	25	11:00	2,636.8	3.41	4.34	1.24	5.18	1.83	1.435	12.7
	26	12:00	2,828.1	3.19	4.06	1.16	5.54	1.96	1.554	12.3
	27	13:00	3,048.4	3.67	4.67	1.34	4.81	1.70	1.530	12.8
	28	14:00	3,234.4	3.10	3.95	1.13	5.69	2.01	1.655	12.4
	29	15:00	3,505.5	4.52	5.75	1.64	3.91	1.38	1.431	13.0
	30	16:00	3,765.7	4.34	5.52	1.58	4.07	1.44	1.362	12.8
	31	17:00	4,040.5	4.58	5.83	1.67	3.85	1.36	1.184	12.5
	32	18:00	4,336.8	4.94	6.29	1.80	3.57	1.26	0.842	12.9
8/28	33	8:00	4,491.4	2.81	3.58	1.02	6.28	2.22	1.742	11.4
	34	9:00	4,657.5	2.77	3.52	1.01	6.38	2.25	2.136	12.5
	35	10:00	4,772.5	1.92	2.44	0.70	9.21	3.26	2.104	12.8
	36	11:00	4,932.0	2.66	3.38	0.97	6.64	2.35	2.204	12.7
	37	12:00	5,176.2	4.07	5.18	1.48	4.34	1.53	2.141	12.4
	38	13:00	5,410.7	3.91	4.98	1.42	4.52	1.60	1.510	12.9
	39	14:00	5,585.3	2.91	3.71	1.06	6.07	2.14	1.835	12.7
	40	15:00	5,782.4	3.28	4.18	1.20	5.37	1.90	1.847	12.4
	41	16:00	6,034.0	4.19	5.34	1.53	4.21	1.49	2.013	12.6
	42	17:00	6,314.6	4.68	5.95	1.70	3.77	1.33	2.112	13.0
	43	18:00	6,572.4	4.30	5.47	1.56	4.11	1.45	1.793	12.5
8/29	44	8:00	6,774.3	2.69	3.43	0.98	6.56	2.32	0.376	12.4
	45	9:00	6,937.0	2.71	3.45	0.99	6.51	2.30	0.478	12.5
	46	10:00	7,108.8	2.86	3.65	1.04	6.17	2.18	0.409	12.3
	47	11:00	7,301.0	3.20	4.08	1.17	5.51	1.95	0.513	12.6
	48	12:00	7,511.1	3.50	4.46	1.27	5.04	1.78	3.760	12.5
	49	13:00	7,768.2	4.28	5.46	1.56	4.12	1.46	0.487	12.9
	50	14:00	7,983.1	3.58	4.56	1.30	4.93	1.74	0.518	12.5
	51	15:00	8,218.3	3.92	4.99	1.43	4.50	1.59	0.482	13.0
	52	16:00	8,455.3	3.95	5.03	1.44	4.47	1.58	0.623	12.5
	53	17:00	8,730.9	4.59	5.85	1.67	3.84	1.36	0.784	13.1
	54	18:00	8,986.9	4.27	5.43	1.55	4.14	1.46	0.612	13.0
	Total or Average		**10,840.10**	3.42	4.35	1.24	5.55	2.05	1.103	12.6

NA, indicates Not Applicable for this test
Not Dosed, (ND) indicating the period of the test
Not Tested, (NT) indicating no value entered because there was no sample to test
Media contact time = Empty bed contact time

150 gpm, 60 psi (***well cycling, not in hand***)
With wells 3 & 4 both in auto, there is no way to tell which water is being tested
and what water quality belongs to which well
Used 42" AS-741 media
Used 6" X 60" contact tank, followed by a second 4" X 84" contact tank with a static mixer
Sodium Hypochlorite titrated @ 4084.8
BW start of the test
Used Rochelle Salts
Began Dosing HMO @ 7:25
Aerated HMO mixture throughout the weeks pilot test run
Target dose = 0.500 mg/L HMO (as Mn) 8/25
Backwashed filters after each daily run
15:54 (8/25), lost prime in HMO meter pump, Switched Pumps
Target dose = 1.000 mg/L HMO (as Mn) 8/26
Power outage 08:55- 9:25
10:15 (8/26), well 3 shut off for week
Well 4 in auto to avoid overflowing the reservoir
Sodium Hypochlorite titrated @ 5616.6
Mixed an additional batch of HMO, seeing the original 5 gallons wasn't going to last the full test time
Target dose = 1.500 mg/L HMO (as Mn) 8/27
HMO appeared slightly purple/lavender at the start of testing
Target dose = 2.000 mg/L HMO (as Mn) 8/28
Target dose = 0.500 mg/L HMO (as Mn) 8/29
12:11 (8/29), lost prime in HMO meter pump, Switched Pumps
16:13 (8/29) ran out of HMO, added water to tank and mixed well, reset the dose hoping to get a sufficient dose
Post injection sample fairly black, flushed until lighter
End test 18:00, BW filter train

Table 4
Summary of Pilot Test Results
Rose Lake Water Association, Well 4
August 25 - 29, 2014

	Source Water									Product Water										
Sample Number	**pH (Units)**	**Fe (mg/L)**	**Mn (mg/L)**	**H_2S (mg//L)**	**Ammonia (mg//L)**	**Silica (mg/L)**	**As (lab) (ppb)**	**Ra (lab) pCi/L**	**PSI**	**pH (Units)**	**Cl_2 (F) (mg/L)**	**Cl_2 (T) (mg/L)**	**Fe (mg/L)**	**Mn (mg/L)**	**H_2S (mg//L)**	**Ammonia (mg//L)**	**Silica (mg/L)**	**As (lab) (ppb)**	**Ra (lab) pCi/L**	**PSI**
Start	**8.31**	1.84	0.128			23.50			40	**8.12**	**0.36**	**0.62**	0.06	0.007			20.10			38
1	**7.81**	1.42	0.120	-					40	**7.68**	**1.59**	**2.26**	-	0.003	-					38
2	**7.53**	1.67	0.120				10.2	3.8	40	**7.45**	**1.39**	**1.48**	-	0.007				1.9	0.7	38
3	**7.49**	1.78	0.133		0.05				32	**7.49**	**0.39**	**0.56**	-	0.005		-				29
4	**7.43**	1.83	0.131			16.90			32	**7.32**	**0.75**	**0.86**	-	0.003			23.90			30
5	**7.62**	1.71	0.127						30	**7.55**	**0.02**	**0.03**	-	0.007						28
6	**7.50**	1.48	0.135						30	**7.29**	**1.16**	**1.28**	-	0.014				-	0.7	28
7	**7.43**	1.78	0.132	-					29	**7.23**	**0.90**	**1.03**	-	0.012	-					26
8	**7.27**	1.84	0.126		0.06				23	**7.27**	**0.83**	**1.21**	-	0.009		-				19
9	**7.27**	1.62	0.133						23	**7.26**	**0.93**	**1.17**	-	0.011				-	0.7	19
10	**7.42**	1.87	0.142						20	**7.26**	**0.71**	**0.76**	-	0.002						25
11	**7.70**	1.80	0.091		0.60				38	**7.59**	**1.21**	**1.39**	-	-		-				36
12	**7.32**	1.78	0.097	-					34	**7.02**	**1.07**	**1.20**	-	-	-					32
13	**7.34**	1.77	0.109				10.1	4.0	32	**7.09**	**0.92**	**1.02**	-	-				-	0.5	28
14	**7.23**	1.88	0.113		0.05				29	**7.05**	**0.96**	**1.13**	-	-						25
15	**7.35**	1.89	0.132			22.00			25	**7.10**	**0.67**	**0.73**	-	-			22.10			21
16	**7.27**	1.79	0.118						28	**7.06**	**0.74**	**0.93**	-	-						24
17	**7.47**	2.02	0.130						31	**7.27**	**0.75**	**0.86**	-	-				1.4	0.4	29
18	**7.40**	1.59	0.126						25	**7.26**	**0.81**	**0.88**	-	-						26
19	**7.38**	1.80	0.131						25	**7.26**	**0.76**	**0.85**	-	-		-				20
20	**7.44**	1.53	0.125						29	**7.35**	**0.76**	**0.88**	-	-				-	0.3	24
21	**7.54**	1.62	0.124						26	**7.32**	**0.78**	**0.91**	-	-						20
22	**7.83**	1.63	0.113						30	**7.62**	**1.13**	**1.40**	-	0.003						29
23	**7.83**	1.77	0.136						37	**7.87**	**1.26**	**1.38**	-	0.004						35
24	**7.57**	1.74	0.139		0.01		10.4	4.2	30	**7.41**	**1.36**	**1.57**	-	0.006		-		1.9	2.0	29
25	**7.41**	1.77	0.133		0.04				28	**7.35**	**1.12**	**1.23**	-	0.005		-				24
26	**7.64**	1.84	0.135						30	**7.38**	**1.02**	**1.20**	-	0.007						28
27	**7.63**	1.55	0.137						29	**7.36**	**1.25**	**1.36**	-	0.005						25
28	**7.59**	1.16	0.137						28	**7.36**	**1.13**	**1.25**	-	0.009				-	1.5	24
29	**7.51**	1.32	0.144						21	**7.34**	**1.23**	**1.34**	-	0.004						18
30	**7.45**	1.57	0.138		0.03				22	**7.28**	**0.98**	**1.13**	-	0.007		-				18
31	**7.38**	1.64	0.143						28	**7.32**	**1.13**	**1.21**	-	0.010				-	2.0	22
32	**7.45**	1.74	0.139						24	**7.28**	**1.13**	**1.21**	-	0.011						18
33	**7.78**	1.96	0.142						36	**7.53**	**0.63**	**0.75**	0.09	0.028						34
34	**7.62**	1.90	0.129		0.02				32	**7.50**	**1.14**	**1.28**	-	-		-				30
35	**7.54**	0.93	0.139				12.4	4.2	33	**7.42**	**1.34**	**1.42**	-	-				-	1.4	30
36	**7.45**	1.65	0.143		0.01				28	**7.32**	**1.09**	**1.17**	-	-		-				24
37	**7.46**	1.88	0.137						35	**7.33**	**0.76**	**0.91**	-	-						20
38	**7.44**	0.97	0.144						31	**7.31**	**1.11**	**1.23**	-	-						25
39	**7.47**	1.72	0.137						28	**7.23**	**1.00**	**1.17**	-	0.003				-	1.1	24
40	**7.48**	1.85	0.134						29	**7.30**	**1.02**	**1.19**	-	0.006						24
41	**7.41**	1.75	0.134		0.12				22	**7.31**	**0.76**	**0.89**	-	0.005		-				16
42	**7.46**	1.25	0.145						24	**7.24**	**1.00**	**1.14**	-	0.007				-	0.6	18
43	**7.47**	1.65	0.138						23	**7.29**	**0.62**	**0.73**	-	0.006						19
44	**7.62**	1.67	0.139						32	**7.50**	**1.18**	**1.31**	-	0.001						29
45	**7.53**	1.72	0.133						33	**7.35**	**1.05**	**1.19**	-	0.001						30
46	**7.28**	1.94	0.139				8.6	7.6	36	**7.27**	**1.07**	**1.30**	-	-				-	5.8	34
47	**7.35**	1.58	0.127		0.02				27	**7.27**	**0.94**	**1.27**	-	-		-				23
48	**7.47**	1.64	0.128						27	**7.24**	**1.13**	**1.40**	-	-						23
49	**7.40**	1.41	0.133						28	**7.24**	**1.04**	**1.20**	-	0.003						23
50	**7.37**	1.72	0.132						30	**7.33**	**0.05**	**0.12**	-	0.001				-	5.6	26
51	**7.41**	2.04	0.146						28	**7.30**	**1.14**	**1.24**	-	-						23
52	**7.47**	1.78	0.134						25	**7.35**	**1.08**	**1.25**	-	0.002						20
53	**7.44**	1.31	0.138						26	**7.35**	**1.10**	**1.21**	-	0.055				-	5.0	20
54	**7.45**	1.18	0.136						29	**7.35**	**1.11**	**1.30**	-	0.005						24
Total or Average	**7.49**	**1.66**	**0.131**	**-**	**0.09**	**20.80**	**10.3**	**4.8**	**29**	**7.35**	**0.96**	**1.11**	**0.00**	**0.005**	**-**	**-**	**22.03**	**0.3**	**1.9**	26
Average as Percent of MCL		***554.8%***	***2468.2%***										***0.91%***	***9.96%***						
Average Removal Rate													***99.8%***	***99.60%***						

Non Detect, indicating the absence of a metal or chemical at or above the method detection limit is shown as "-" and calculated in the total or average as zero.

Raw manganese values include raw manganese and HMO dose (as Mn)

Figure 1
Pilot Test Results
Chlorine Dosage and Free Residual Concentrations
Rose Lake Water Association, Well 4
August 25 - 29, 2014

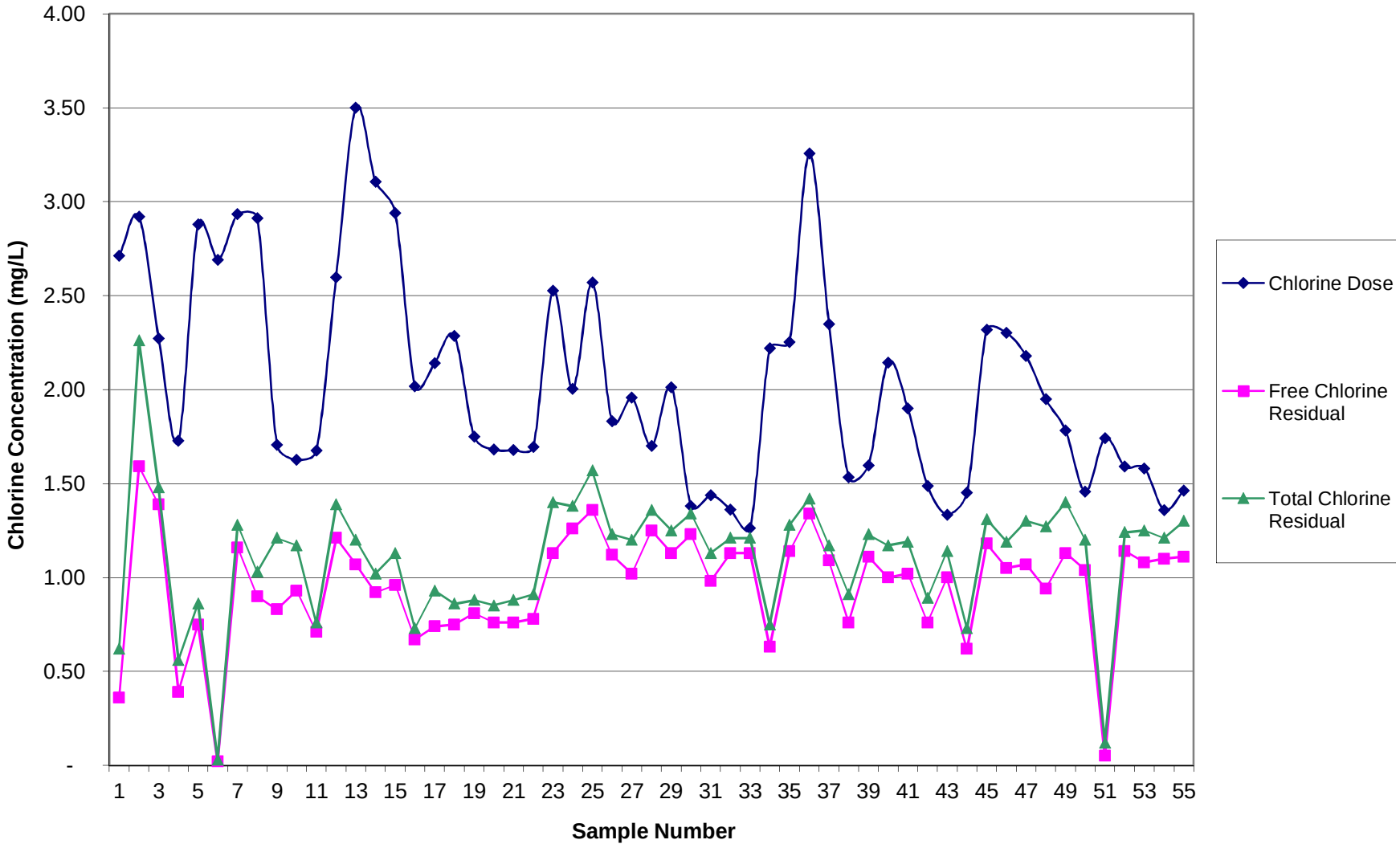


Figure 2
Pilot Test Results
Arsenic Removal Using AS-741M Filter Media
Rose Lake Water Association, Well 4
August 25 - 29, 2014

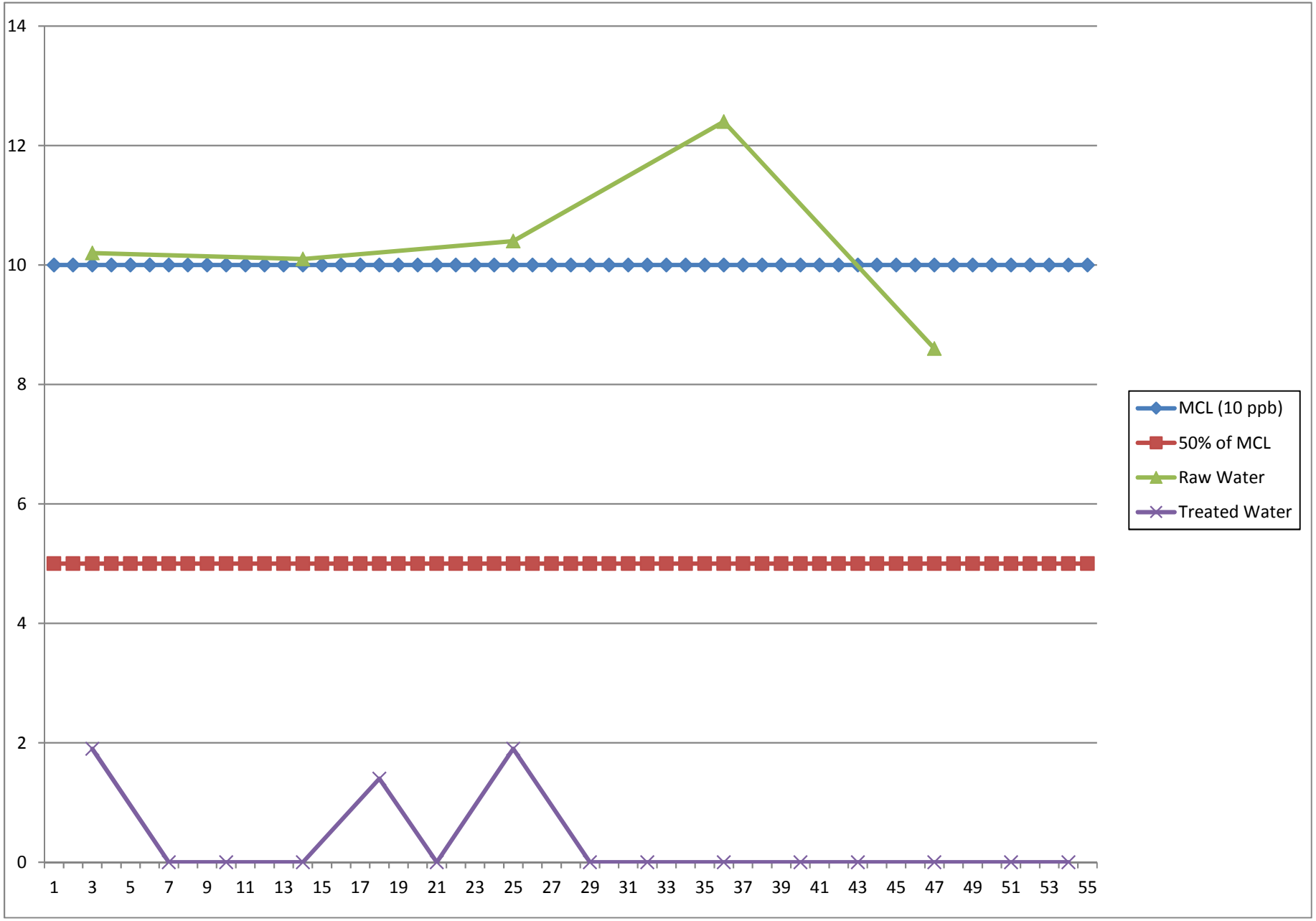


Figure 3
Pilot Test Results
Manganese Removal Using AS-741M Filter Media
Rose Lake Water Association, Well 4
August 25 - 29, 2014

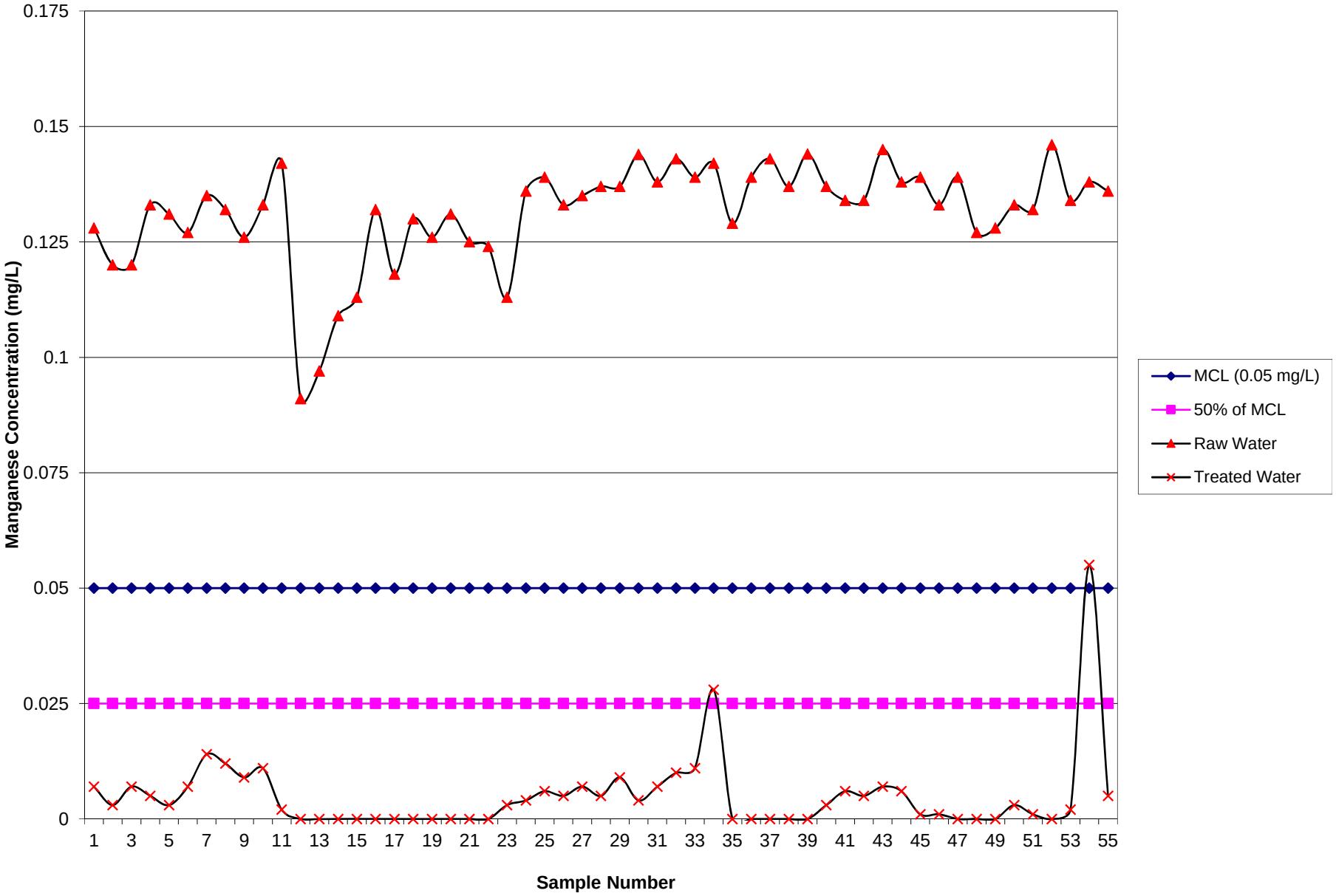


Figure 4
Pilot Test Results
Iron Removal Using AS-741M Filter Media
Rose Lake Water Association, Well 4
August 25 - 29, 2014

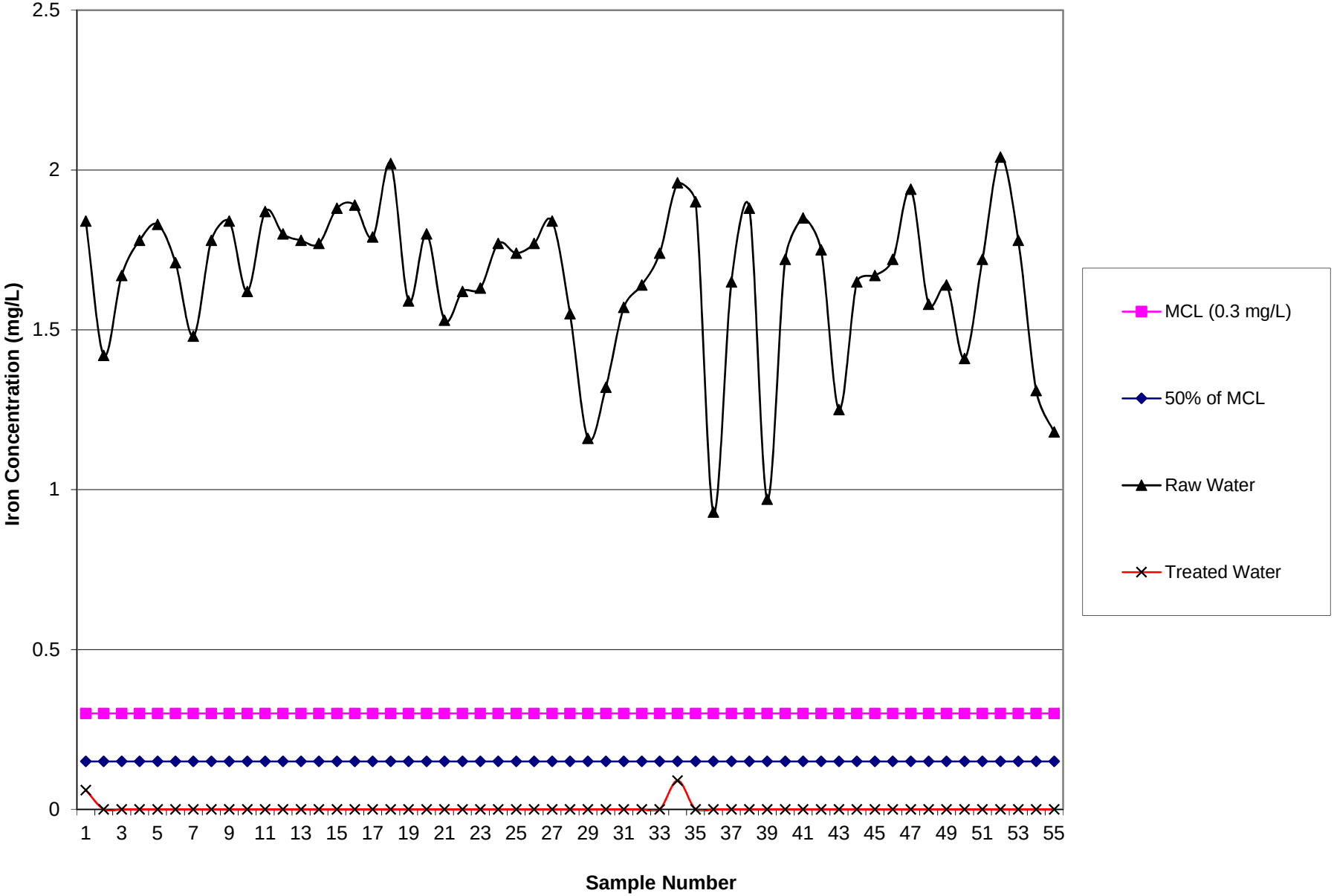
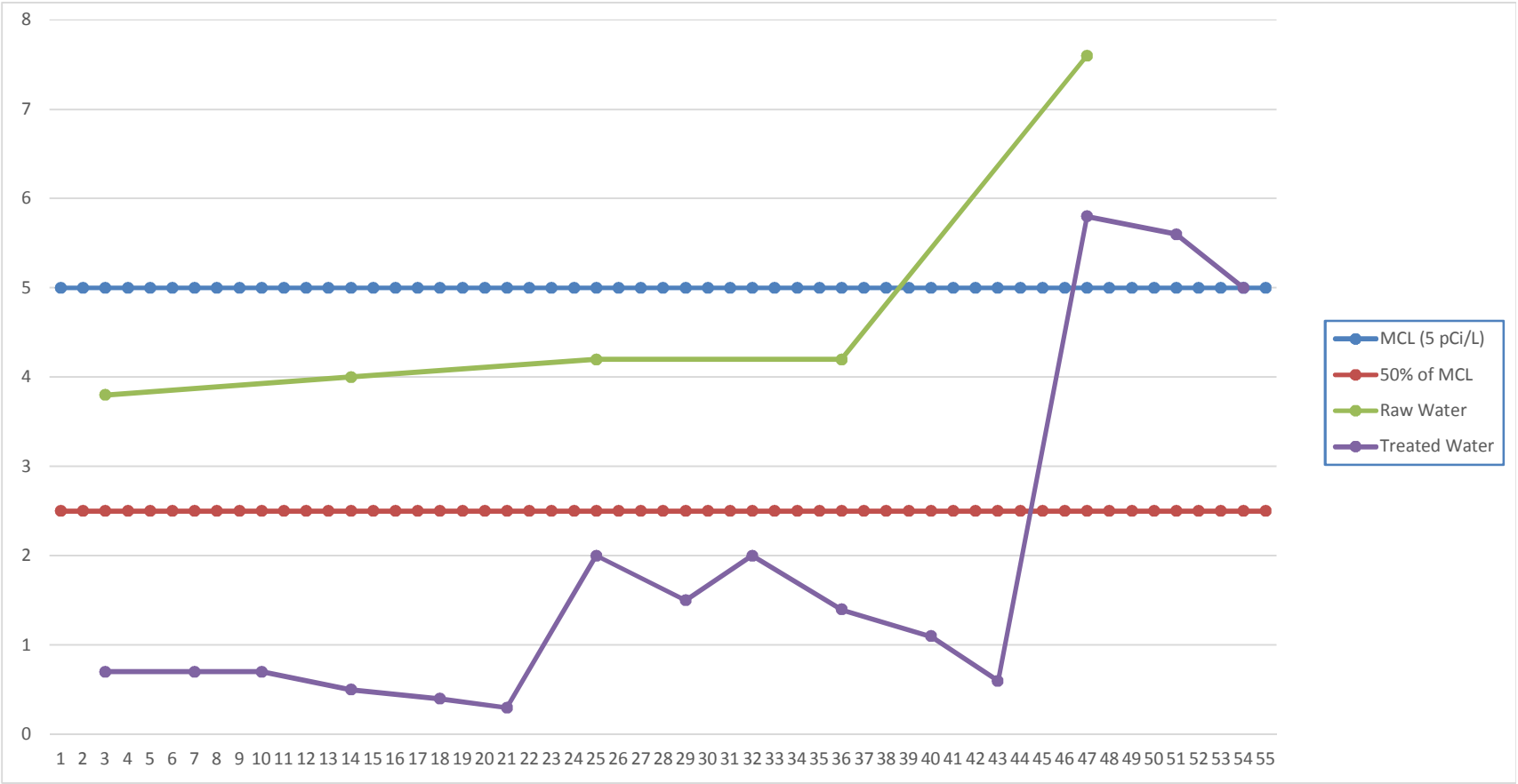


Figure 5
Pilot Test Results
Radium Removal Using AS-741M Filter Media
Rose Lake Water Association, Well 4
August 25 - 29, 2014



Accurate Testing Labs, LLC
7950 Meadowlark Way
Coeur d'Alene, ID 83815
Phone (208) 762 8378 Fax (208) 762 9082
www.accuratetesting.com
info@accuratetesting.com

Certificate of Analysis

Order No.: **2014080450**

Rose Lake Water Assn
P.O. Box 178
Cataldo , ID 83810

Project: Well #4 Pilot

Date Received: 08/26/2014 07:30

Sample: **1**
Location: Well 4 Sample 1
Sample Type: Plant Tap

Matrix: Drinking Water
D/T Collected: 08/25/2014 10:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0102	mg/L	EPA 200.5	0.0014	09/05/14	WM

Sample: **2**
Location: Well 4 Sample 2
Sample Type: Plant Tap

Matrix: Drinking Water
D/T Collected: 08/25/2014 10:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0019	mg/L	EPA 200.5	0.0014	09/05/14	WM

Sample: **5**
Location: Well 4 Sample 5
Sample Type: Plant Tap

Matrix: Drinking Water
D/T Collected: 08/25/2014 14:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	09/05/14	WM

Sample: **7**
Location: Well 4 Sample 7
Sample Type: Plant Tap

Matrix: Drinking Water
D/T Collected: 08/25/2014 17:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	09/05/14	WM

Comments:

Laboratory Supervisor, Walter Mueller Date: 09/05/14

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Order No.: **2014080450**

If the RESULT is 'ND' (Not Detected) or 'Absent', that means the concentration is less than the PQL (Practical Quantitation Limit for this method).

Comments:

Laboratory Supervisor, Walter Mueller Date: 09/05/14

Lab EPA ID No.: ID00912	Lab Sample#: 153812
Date Received: 08/26/2014	Date Reported by Lab: 10/02/14
Compliance or Replacement Sample:	
Date Collected: 08/25/2014	Time Collected: 10:08
Sample Type: Plant Tap	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Well 4 Sample 3	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
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E-mail: info@accuratetesting.com

Lab Order No.: 2014080450 3

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	1.1 +/-0.3	pCi/L		0.2	09/15/14	ENG	EPA 903.0
4030	Radium 228	2.6 +/-1	pCi/L	5	0.9	09/08/14	ENG	EPA 904.0
4010	Total Measured Radium	3.8 +/-1.0	pCi/L	5	0.9	09/17/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
Leslie Abrams
P.O. Box 178
Cataldo, ID 83810

10/02/14

Laboratory Supervisor *Walter Mueller*

Lab EPA ID No.: ID00912	Lab Sample#: 153813
Date Received: 08/26/2014	Date Reported by Lab: 10/02/14
Compliance or Replacement Sample:	
Date Collected: 08/25/2014	Time Collected: 14:08
Sample Type: Plant Tap	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Well 4 Sample 4	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
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Lab Order No.: 2014080450 4

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	0.2 +/-0.2	pCi/L		0.2	09/15/14	ENG	EPA 903.0
4030	Radium 228	-0.2 +/-1.1	pCi/L	5	1.1	09/08/14	ENG	EPA 904.0
4010	Total Measured Radium	0.7 +/-1.1	pCi/L	5	1.2	09/17/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
Leslie Abrams
P.O. Box 178
Cataldo, ID 83810

Walter Mueller

10/02/14

Laboratory Supervisor *Walter Mueller*

Lab EPA ID No.: ID00912	Lab Sample#: 153815
Date Received: 08/26/2014	Date Reported by Lab: 10/02/14
Compliance or Replacement Sample:	
Date Collected: 08/25/2014	Time Collected: 14:08
Sample Type: Plant Tap	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Well 4 Sample 6	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
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E-mail: info@accuratetesting.com

Lab Order No.: 2014080450 6

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	0.2 +/-0.2	pCi/L		0.2	09/15/14	ENG	EPA 903.0
4030	Radium 228	-0.1 +/-0.9	pCi/L	5	1	09/08/14	ENG	EPA 904.0
4010	Total Measured Radium	0.7 +/-0.9	pCi/L	5	1	09/17/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
Leslie Abrams
P.O. Box 178
Cataldo, ID 83810

10/02/14

Laboratory Supervisor *Walter Mueller*

Lab EPA ID No.: ID00912	Lab Sample#: 153817
Date Received: 08/26/2014	Date Reported by Lab: 10/02/14
Compliance or Replacement Sample:	
Date Collected: 08/25/2014	Time Collected: 17:08
Sample Type: Plant Tap	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Well 4 Sample 8	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
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Web site: www.accuratetesting.com
E-mail: info@accuratetesting.com

Lab Order No.: 2014080450 8

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	0.1 +/-0.2	pCi/L		0.2	09/15/14	ENG	EPA 903.0
4030	Radium 228	0.3 +/-1.1	pCi/L	5	1.1	09/08/14	ENG	EPA 904.0
4010	Total Measured Radium	0.7 +/-1.1	pCi/L	5	1.1	09/17/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
Leslie Abrams
P.O. Box 178
Cataldo, ID 83810

Walter Mueller 10/02/14

Laboratory Supervisor *Walter Mueller*

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Certificate of Analysis

Order No.: **2014080491**

Rose Lake Water Assn
P.O. Box 178
Cataldo , ID 83810

Project: Well 4 Pilot

Date Received: 08/27/2014 08:00

Sample: **1**
Location: Raw # 9
Sample Type: Raw Water

Matrix: Drinking Water
D/T Collected: 08/26/2014 10:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0101	mg/L	EPA 200.5	0.0014	09/05/14	WM

Sample: **2**
Location: Treated # 10
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/26/2014 10:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	09/05/14	WM

Sample: **5**
Location: Treated # 15
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/26/2014 14:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0014	mg/L	EPA 200.5	0.0014	09/05/14	WM

Sample: **7**
Location: Treated # 18
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/26/2014 17:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	09/05/14	WM

Comments:

Laboratory Supervisor, Walter Mueller Date: 09/05/14

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Certificate of Analysis

Order No.: **2014080491**

If the RESULT is 'ND' (Not Detected) or 'Absent', that means the concentration is less than the PQL (Practical Quantitation Limit for this method).

Comments:

Laboratory Supervisor, Walter Mueller Date: 09/05/14

Lab EPA ID No.: ID00912	Lab Sample#: 153898
Date Received: 08/27/2014	Date Reported by Lab: 10/02/14
Compliance or Replacement Sample:	
Date Collected: 08/26/2014	Time Collected: 10:08
Sample Type: Raw Water	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Raw # 11 & 12	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
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Web site: www.accuratetesting.com
E-mail: info@accuratetesting.com

Lab Order No.: 2014080491 3

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	1.2 +/-0.2	pCi/L		0.1	09/15/14	ENG	EPA 903.0
4030	Radium 228	2.8 +/-0.7	pCi/L	5	0.6	09/08/14	ENG	EPA 904.0
4010	Total Measured Radium	4.0 +/-0.7	pCi/L	5	0.6	09/17/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
Leslie Abrams
P.O. Box 178
Cataldo, ID 83810

10/02/14

Laboratory Supervisor *Walter Mueller*

Lab EPA ID No.: ID00912	Lab Sample#: 153899
Date Received: 08/27/2014	Date Reported by Lab: 10/02/14
Compliance or Replacement Sample:	
Date Collected: 08/26/2014	Time Collected: 10:08
Sample Type: A (After Treatment)	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Treated # 13 & 14	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
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Lab Order No.: 2014080491 4

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	0.2 +/-0.1	pCi/L		0.1	09/15/14	ENG	EPA 903.0
4030	Radium 228	-0.5 +/-0.6	pCi/L	5	0.7	09/08/14	ENG	EPA 904.0
4010	Total Measured Radium	0.5 +/-0.6	pCi/L	5	0.7	09/17/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
Leslie Abrams
P.O. Box 178
Cataldo, ID 83810

Walter Mueller

10/02/14

Laboratory Supervisor *Walter Mueller*

Lab EPA ID No.: ID00912	Lab Sample#: 153901
Date Received: 08/27/2014	Date Reported by Lab: 10/02/14
Compliance or Replacement Sample:	
Date Collected: 08/26/2014	Time Collected: 14:08
Sample Type: A (After Treatment)	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Treated # 16 & 17	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
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Lab Order No.: 2014080491 6

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	0.09 +/-0.1	pCi/L		0.1	09/15/14	ENG	EPA 903.0
4030	Radium 228	0.5 +/-0.6	pCi/L	5	0.6	09/08/14	ENG	EPA 904.0
4010	Total Measured Radium	0.4 +/-0.6	pCi/L	5	0.6	09/17/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
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P.O. Box 178
Cataldo, ID 83810

10/02/14

Laboratory Supervisor *Walter Mueller*

Lab EPA ID No.: ID00912	Lab Sample#: 153903
Date Received: 08/27/2014	Date Reported by Lab: 10/02/14
Compliance or Replacement Sample:	
Date Collected: 08/26/2014	Time Collected: 17:08
Sample Type: A (After Treatment)	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Treated # 19 & 20	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
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Web site: www.accuratetesting.com
E-mail: info@accuratetesting.com

Lab Order No.: 2014080491 8

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	0.04 +/-0.09	pCi/L		0.1	09/15/14	ENG	EPA 903.0
4030	Radium 228	0.3 +/-0.6	pCi/L	5	0.6	09/08/14	ENG	EPA 904.0
4010	Total Measured Radium	0.3 +/-0.6	pCi/L	5	0.6	09/17/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
Leslie Abrams
P.O. Box 178
Cataldo, ID 83810

10/02/14

Laboratory Supervisor *Walter Mueller*

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Certificate of Analysis

Order No.: **2014080531**

Rose Lake Water Assn
P.O. Box 178
Cataldo , ID 83810

Project: Well # 4 Pilot

Date Received: 08/28/2014 07:25

Sample: **1**
Location: Raw # 21
Sample Type: Raw Water

Matrix: Drinking Water
D/T Collected: 08/27/2014 10:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0104	mg/L	EPA 200.5	0.0014	09/05/14	WM

Sample: **2**
Location: Treated # 22
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/27/2014 10:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0019	mg/L	EPA 200.5	0.0014	09/05/14	WM

Sample: **5**
Location: Treated # 27
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/27/2014 14:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	09/05/14	WM

Sample: **7**
Location: Treated # 30
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/27/2014 17:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	09/08/14	WM

Comments:

Laboratory Supervisor, Walter Mueller Date: 09/08/14

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Certificate of Analysis

Order No.: **2014080531**

If the RESULT is 'ND' (Not Detected) or 'Absent', that means the concentration is less than the PQL (Practical Quantitation Limit for this method).

Comments:

Laboratory Supervisor, Walter Mueller Date: 09/08/14

Lab EPA ID No.: ID00912	Lab Sample#: 153991
Date Received: 08/28/2014	Date Reported by Lab: 09/19/14
Compliance or Replacement Sample:	
Date Collected: 08/27/2014	Time Collected: 10:08
Sample Type: Raw Water	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Raw # 23 & 24	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
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Lab Order No.: 2014080531 3

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	1.4 +/-0.2	pCi/L		0.1	09/15/14	ENG	EPA 903.0
4030	Radium 228	2.8 +/-0.6	pCi/L	5	0.5	09/16/14	ENG	EPA 904.0
4010	Total Measured Radium	4.2 +/-0.7	pCi/L	5	0.5	09/17/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
Leslie Abrams
P.O. Box 178
Cataldo, ID 83810

09/19/14

Laboratory Supervisor *Walter Mueller*

Lab EPA ID No.: ID00912	Lab Sample#: 153992
Date Received: 08/28/2014	Date Reported by Lab: 09/19/14
Compliance or Replacement Sample:	
Date Collected: 08/27/2014	Time Collected: 10:08
Sample Type: A (After Treatment)	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Treated # 25 & 26	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
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E-mail: info@accuratetesting.com

Lab Order No.: 2014080531 4

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	0.1 +/-0.1	pCi/L		0.1	09/15/14	ENG	EPA 903.0
4030	Radium 228	1.9 +/-0.6	pCi/L	5	0.6	09/16/14	ENG	EPA 904.0
4010	Total Measured Radium	2.0 +/-0.6	pCi/L	5	0.6	09/17/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
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Walter Mueller 09/19/14

Laboratory Supervisor *Walter Mueller*

Lab EPA ID No.: ID00912	Lab Sample#: 153994
Date Received: 08/28/2014	Date Reported by Lab: 09/19/14
Compliance or Replacement Sample:	
Date Collected: 08/27/2014	Time Collected: 14:08
Sample Type: A (After Treatment)	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Treated # 28 & 29	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
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Lab Order No.: 2014080531 6

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	0. 1+/-0.1	pCi/L		0.1	09/15/14	ENG	EPA 903.0
4030	Radium 228	1.4 +/-0.6	pCi/L	5	0.5	09/16/14	ENG	EPA 904.0
4010	Total Measured Radium	1.5 +/-0.6	pCi/L	5	0.5	09/17/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
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P.O. Box 178
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09/19/14

Laboratory Supervisor *Walter Mueller*

Lab EPA ID No.: ID00912	Lab Sample#: 154324
Date Received: 08/28/2014	Date Reported by Lab: 09/19/14
Compliance or Replacement Sample:	
Date Collected: 08/27/2014	Time Collected: 17:08
Sample Type: A (After Treatment)	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Treated # 31 & 32	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
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Lab Order No.: 2014080531 8

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	0.08 +/-0.1	pCi/L		0.1	09/15/14	ENG	EPA 903.0
4030	Radium 228	2.0 +/-0.6	pCi/L	5	0.5	09/16/14	ENG	EPA 904.0
4010	Total Measured Radium	2.0 +/-0.6	pCi/L	5	0.6	09/17/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
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P.O. Box 178
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09/19/14

Laboratory Supervisor *Walter Mueller*

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Certificate of Analysis

Order No.: **2014080564**

Rose Lake Water Assn
P.O. Box 178
Cataldo , ID 83810

Project: Well 4 Pilot

Date Received: 08/29/2014 07:17

Sample: **1**
Location: Raw # 33
Sample Type: Raw Water

Matrix: Drinking Water
D/T Collected: 08/28/2014 10:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0124	mg/L	EPA 200.5	0.0014	09/08/14	WM

Sample: **2**
Location: Treated # 34
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/28/2014 10:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	09/08/14	WM

Sample: **5**
Location: Treated # 39
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/28/2014 14:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	09/08/14	WM

Sample: **7**
Location: Treated # 42
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/28/2014 17:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	09/08/14	WM

Comments:

Laboratory Supervisor, Walter Mueller Date: 09/08/14

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Certificate of Analysis

Order No.: **2014080564**

If the RESULT is 'ND' (Not Detected) or 'Absent', that means the concentration is less than the PQL (Practical Quantitation Limit for this method).

Comments:

Laboratory Supervisor, Walter Mueller Date: 09/08/14

Lab EPA ID No.: ID00912	Lab Sample#: 154047
Date Received: 08/29/2014	Date Reported by Lab: 09/25/14
Compliance or Replacement Sample:	
Date Collected: 08/28/2014	Time Collected: 10:08
Sample Type: Raw Water	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Raw # 35 & 36	
Collector: Mac	Phone: (208) 667-0726

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E-mail: info@accuratetesting.com

Lab Order No.: 2014080564 3

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	1.3 +/-0.3	pCi/L		0.1	09/22/14	ENG	EPA 903.0
4030	Radium 228	2.9 +/-0.6	pCi/L	5	0.5	09/16/14	ENG	EPA 904.0
4010	Total Measured Radium	4.2 +/-0.7	pCi/L	5	0.5	09/22/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
Leslie Abrams
P.O. Box 178
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09/25/14

Laboratory Supervisor *Walter Mueller*

Lab EPA ID No.: ID00912	Lab Sample#: 154048
Date Received: 08/29/2014	Date Reported by Lab: 09/25/14
Compliance or Replacement Sample:	
Date Collected: 08/28/2014	Time Collected: 10:08
Sample Type: A (After Treatment)	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Treated # 37 & 38	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
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Lab Order No.: 2014080564 4

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	0.2 +/-0.2	pCi/L		0.2	09/22/14	ENG	EPA 903.0
4030	Radium 228	1.2 +/-0.7	pCi/L	5	0.6	09/16/14	ENG	EPA 904.0
4010	Total Measured Radium	1.4 +/-0.7	pCi/L	5	0.7	09/22/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
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P.O. Box 178
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09/25/14

Laboratory Supervisor *Walter Mueller*

Lab EPA ID No.: ID00912	Lab Sample#: 154050
Date Received: 08/29/2014	Date Reported by Lab: 09/25/14
Compliance or Replacement Sample:	
Date Collected: 08/28/2014	Time Collected: 14:08
Sample Type: A (After Treatment)	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Treated # 40 & 41	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
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Lab Order No.: 2014080564 6

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	0.1 +/-0.2	pCi/L		0.2	09/22/14	ENG	EPA 903.0
4030	Radium 228	1.1 +/-0.6	pCi/L	5	0.6	09/16/14	ENG	EPA 904.0
4010	Total Measured Radium	1.1 +/-0.6	pCi/L	5	0.6	09/22/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
Leslie Abrams
P.O. Box 178
Cataldo, ID 83810

09/25/14

Laboratory Supervisor *Walter Mueller*

Lab EPA ID No.: ID00912	Lab Sample#: 154052
Date Received: 08/29/2014	Date Reported by Lab: 09/25/14
Compliance or Replacement Sample:	
Date Collected: 08/28/2014	Time Collected: 17:08
Sample Type: A (After Treatment)	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Treated # 43 & 44	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
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7950 Meadowlark Way
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Web site: www.accuratetesting.com
E-mail: info@accuratetesting.com

Lab Order No.: 2014080564 8

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	0.3 +/-0.2	pCi/L		0.1	09/22/14	ENG	EPA 903.0
4030	Radium 228	0.5 +/-0.6	pCi/L	5	0.6	09/16/14	ENG	EPA 904.0
4010	Total Measured Radium	0.6 +/-0.6	pCi/L	5	0.6	09/22/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
Leslie Abrams
P.O. Box 178
Cataldo, ID 83810

09/25/14

Laboratory Supervisor *Walter Mueller*

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Certificate of Analysis

Order No.: **2014090001**

Rose Lake Water Assn
P.O. Box 178
Cataldo , ID 83810

Project: Well 4 Pilot

Date Received: 09/02/2014 07:14

Sample: **1**
Location: Raw # 45
Sample Type: Raw Water

Matrix: Drinking Water
D/T Collected: 08/29/2014 10:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	0.0086	mg/L	EPA 200.5	0.0014	09/08/14	WM

Sample: **2**
Location: Treated # 46
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/29/2014 10:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	09/08/14	WM

Sample: **5**
Location: Treated # 51
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/29/2014 14:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	09/08/14	WM

Sample: **7**
Location: Treated # 54
Sample Type: A (After Treatment)

Matrix: Drinking Water
D/T Collected: 08/29/2014 17:00
Collected by: Mac

Analyte	Result	Unit	Method	PQL	Test Date	Analyst
Arsenic	ND	mg/L	EPA 200.5	0.0014	09/08/14	WM

Comments:

Laboratory Supervisor, Walter Mueller Date: 09/08/14

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Certificate of Analysis

Order No.: **2014090001**

If the RESULT is 'ND' (Not Detected) or 'Absent', that means the concentration is less than the PQL (Practical Quantitation Limit for this method).

Comments:

Laboratory Supervisor, Walter Mueller Date: 09/08/14

Lab EPA ID No.: ID00912	Lab Sample#: 154082
Date Received: 09/02/2014	Date Reported by Lab: 09/25/14
Compliance or Replacement Sample:	
Date Collected: 08/29/2014	Time Collected: 10:08
Sample Type: Raw Water	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Raw # 47 & 48	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
Accurate Testing Labs, LLC
7950 Meadowlark Way
Coeur d'Alene, ID 83815
Phone (208) 762 8378 Fax (208) 762 9082
Web site: www.accuratetesting.com
E-mail: info@accuratetesting.com

Lab Order No.: 2014090001 3

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	4.7 +/-3.0	pCi/L		2.6	09/22/14	ENG	EPA 903.0
4030	Radium 228	2.9 +/-0.8	pCi/L	5	0.6	09/17/14	ENG	EPA 904.0
4010	Total Measured Radium	7.6 +/-3.1	pCi/L	5	2.6	09/22/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
Leslie Abrams
P.O. Box 178
Cataldo, ID 83810

Walter Mueller 09/25/14

Laboratory Supervisor *Walter Mueller*

Lab EPA ID No.: ID00912	Lab Sample#: 154083
Date Received: 09/02/2014	Date Reported by Lab: 09/25/14
Compliance or Replacement Sample:	
Date Collected: 08/29/2014	Time Collected: 10:08
Sample Type: A (After Treatment)	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Treated # 49 & 50	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
Accurate Testing Labs, LLC
7950 Meadowlark Way
Coeur d'Alene, ID 83815
Phone (208) 762 8378 Fax (208) 762 9082
Web site: www.accuratetesting.com
E-mail: info@accuratetesting.com

Lab Order No.: 2014090001 4

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	5.1 +/-3.0	pCi/L		2.5	09/22/14	ENG	EPA 903.0
4030	Radium 228	0.7 +/-0.6	pCi/L	5	0.6	09/17/14	ENG	EPA 904.0
4010	Total Measured Radium	5.8 +/-3.1	pCi/L	5	2.6	09/22/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
Leslie Abrams
P.O. Box 178
Cataldo, ID 83810

09/25/14

Laboratory Supervisor *Walter Mueller*

Lab EPA ID No.: ID00912	Lab Sample#: 154085
Date Received: 09/02/2014	Date Reported by Lab: 09/25/14
Compliance or Replacement Sample:	
Date Collected: 08/29/2014	Time Collected: 14:08
Sample Type: A (After Treatment)	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Treated # 52 & 53	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
Accurate Testing Labs, LLC
7950 Meadowlark Way
Coeur d'Alene, ID 83815
Phone (208) 762 8378 Fax (208) 762 9082
Web site: www.accuratetesting.com
E-mail: info@accuratetesting.com

Lab Order No.: 2014090001 6

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	4.6 +/-2.6	pCi/L		2.2	09/22/14	ENG	EPA 903.0
4030	Radium 228	1.0 +/-0.8	pCi/L	5	0.8	09/17/14	ENG	EPA 904.0
4010	Total Measured Radium	5.6 +/-2.8	pCi/L	5	2.4	09/22/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
Leslie Abrams
P.O. Box 178
Cataldo, ID 83810

09/25/14

Laboratory Supervisor *Walter Mueller*

Lab EPA ID No.: ID00912	Lab Sample#: 154087
Date Received: 09/02/2014	Date Reported by Lab: 09/25/14
Compliance or Replacement Sample:	
Date Collected: 08/29/2014	Time Collected: 17:08
Sample Type: A (After Treatment)	
PWS No.: 1280161 RE	PWS Name: Rose Lake Water Assn
Sample Location: Treated # 55 & 56	
Collector: Mac	Phone: (208) 667-0726

Laboratory Name:
Accurate Testing Labs, LLC
7950 Meadowlark Way
Coeur d'Alene, ID 83815
Phone (208) 762 8378 Fax (208) 762 9082
Web site: www.accuratetesting.com
E-mail: info@accuratetesting.com

Lab Order No.: 2014090001 8

Public Drinking Water System RADIOLOGICAL ANALYSIS REPORT:

FRDS	Contaminant	Results	Units	MCL	MDL	Analysis Date	Analyst	Method
4020	Radium 226	4.7 +/-2.7	pCi/L		2.3	09/22/14	ENG	EPA 903.0
4030	Radium 228	0.5 +/-0.7	pCi/L	5	0.7	09/17/14	ENG	EPA 904.0
4010	Total Measured Radium	5.0 +/-2.8	pCi/L	5	2.4	09/22/14	ENG	

ND = Not detected within sensitivity of instrument
Empty = No analysis performed for this contaminant
MDL = Method detection limit
MCL - Maximum Contaminant Level
Sub_Lab: Energy Laboratories

Rose Lake Water Assn
Leslie Abrams
P.O. Box 178
Cataldo, ID 83810

09/25/14

Laboratory Supervisor *Walter Mueller*

APPENDIX G:

ENGINEER'S OPINION OF PROBABLE COST

WELCH-COMER
ENGINEERS | SURVEYORS

Rose Lake Water Association

Treatment Option A: ATEC Filtration System

ENGINEER's OPINION OF PRELIMINARY PROJECT COSTS

Prepared By:	Ashley M. Williams, PE	Date:	January 28, 2015		
Project Manager:	Steve Cordes, PE	Date:			
Segment	Description	Unit	Quantity	Unit Price	Total
	Mobilization	LS	1	$ 18,000.00	$ 18,000.00
	ATEC Filtration System	LS	1	$ 137,500.00	$ 137,500.00
	Mechanical Piping	LS	1	$ 42,000.00	$ 42,000.00
	Well Building Expansion	LS	1	$ 42,000.00	$ 42,000.00
	Backwash Water System	LS	1	$ 35,000.00	$ 35,000.00
	Electrical	LS	1	$ 49,000.00	$ 49,000.00
	Radiation Protection Measures	LS	1	$ 3,000.00	$ 3,000.00
	Chemical Dosing Equipment	LS	1	$ 10,000.00	$ 10,000.00
	SWPPP	LS	1	$ 10,000.00	$ 10,000.00
				Subtotal =	$346,500.00
				10% Contingency =	$34,650.00
				Total Estimated Construction =	$381,150.00
ENGINEERING					
	Design Phase Services				$38,100.00
	Bidding Phase Services				$3,500.00
	Construction Phase Services				$38,100.00
	SWPPP				$5,500.00
	Start-Up/O&M Manuals				$2,500.00
	Post Construction Phase				$2,500.00
ESTIMATED TOTAL PROJECT COST					**$471,350.00**

Rose Lake Water Association

Treatment Option B: Siemens Filtration System

ENGINEER's OPINION OF PRELIMINARY PROJECT COSTS

Prepared By:	Ashley M. Williams, EIT	Date:	December 5, 2014		
Project Manager:	Steve Cordes, PE	Date:			
Segment	Description	Unit	Quantity	Unit Price	Total
	Mobilization	LS	1	$ 22,500.00	$ 22,500.00
	Siemens Filtration System	LS	1	$ 172,872.00	$ 172,872.00
	Mechanical Piping	LS	1	$ 42,000.00	$ 42,000.00
	Well Building Expansion	LS	1	$ 70,000.00	$ 70,000.00
	Backwash Water System	LS	1	$ 56,000.00	$ 56,000.00
	Electrical	LS	1	$ 49,000.00	$ 49,000.00
Optional:	Iron Removal System	LS	1	$ 63,000.00	$ 63,000.00
				Subtotal (with Optional) =	$475,380.00
				10% Contingency =	$47,500.00
				Total Estimated Construction =	$522,880.00
ENGINEERING					
	Design Phase Services				$52,300.00
	Bidding Phase Services				$3,500.00
	Construction Phase Services				$52,300.00
	Start-Up/O&M Manuals				$2,500.00
	Post Construction Phase				$2,500.00
ESTIMATED TOTAL PROJECT COST					**$635,980.00**

Rose Lake Water Association

Treatment Option D: ATEC Filtration System (Arsenic Only)

ENGINEER's OPINION OF PRELIMINARY PROJECT COSTS

Prepared By:	Ashley M. Williams, EIT	Date:	November 8, 2013		
Project Manager:	Steve Cordes, PE	Date:			
Segment	Description	Unit	Quantity	Unit Price	Total
	Mobilization	LS	1	$ 9,100.00	$ 9,100.00
	ATEC Filtration System	LS	1	$ 91,300.00	$ 91,300.00
	Mechanical Piping	LS	1	$ 15,000.00	$ 15,000.00
	Well Building Expansion	LS	1	$ 42,000.00	$ 42,000.00
	Backwash Water System	LS	1	$ 25,000.00	$ 25,000.00
	Electrical	LS	1	$ 30,000.00	$ 30,000.00
	Chemical Dosing Equipment	LS	1	$ 5,000.00	$ 5,000.00
	SWPPP	LS	1	$ 7,500.00	$ 7,500.00
				Subtotal =	$224,900.00
				10% Contingency =	$22,490.00
				Total Estimated Construction =	$247,390.00
ENGINEERING					
	Design Phase Services				$24,700.00
	Bidding Phase Services				$3,500.00
	Construction Phase Services				$24,700.00
	Start-Up/O&M Manuals				$2,500.00
	Post Construction Phase				$2,500.00
ESTIMATED TOTAL PROJECT COST					

Rose Lake Water Association

Source Option A: Drill New Well

ENGINEER's OPINION OF PRELIMINARY PROJECT COSTS

Prepared By:	Ashley M. Williams, EIT	Date:	November 8, 2013		
Project Manager:	Steve Cordes, PE	Date:			
Segment	Description	Unit	Quantity	Unit Price	Total
	Mobilization	LS	1	$ 13,500.00	$ 13,500.00
	Drill New 6 Inch Well	VF	350	$ 50.00	$ 17,500.00
	New Well Pump (150 gpm)	EA	1	$ 20,000.00	$ 20,000.00
	Site Piping	LS	1	$ 15,000.00	$ 15,000.00
	Mechanical Piping	LS	1	$ 45,000.00	$ 45,000.00
	Well Building	LS	1	$ 75,000.00	$ 75,000.00
	Electrical	LS	1	$ 20,000.00	$ 20,000.00
				Subtotal =	$206,000.00
				10% Contingency =	$20,600.00
				Total Estimated Construction =	$226,600.00
ENGINEERING					
	Design Phase Services				$22,700.00
	Obtain Add'l Water Right				$3,500.00
	Bidding Phase Services				$3,500.00
	Construction Phase Services				$22,700.00
	Start-Up/O&M Manuals				$2,500.00
	Post Construction Phase				$2,500.00
ESTIMATED TOTAL PROJECT COST					**$284,000.00**

Rose Lake Water Association

Source Option B: Add Capacity to Well No. 3

ENGINEER's OPINION OF PRELIMINARY PROJECT COSTS

Prepared By:	Ashley M. Williams, EIT	Date:	November 8, 2013		
Project Manager:	Steve Cordes, PE	Date:			
Segment	Description	Unit	Quantity	Unit Price	Total
	Mobilization	LS	1	$ 13,500.00	$ 13,500.00
	Drill Additional Capacity (6 Inch)	VF	100	$ 50.00	$ 5,000.00
	New Well Pump (75 gpm, VFD)	EA	1	$ 15,000.00	$ 15,000.00
	Site Piping	LS	1	$ 15,000.00	$ 15,000.00
	Mechanical Piping	LS	1	$ 45,000.00	$ 45,000.00
	Electrical	LS	1	$ 20,000.00	$ 20,000.00
THIS IS NOT REALLY FEASIBLE, DRILLING FURTHER DOWN REDUCED CAPACITY, NOT INCREASED					
				Subtotal =	$113,500.00
				10% Contingency =	$11,350.00
				Total Estimated Construction =	$124,850.00
ENGINEERING					
	Design Phase Services				$12,500.00
	Bidding Phase Services				$3,500.00
	Construction Phase Services				$12,500.00
	Start-Up/O&M Manuals				$2,500.00
	Post Construction Phase				$2,500.00
NOTES					
1.	Additional drilling length is estimated, testing will need to be conducted to confirm additional capacity available at this well				
ESTIMATED TOTAL PROJECT COST					**$158,350.00**

Rose Lake Water Association

Storage and Booster Options A-C

ENGINEER's OPINION OF PRELIMINARY PROJECT COSTS

Prepared By:	Ashley M. Williams, EIT	Date:	November 8, 2013		
Project Manager:	Steve Cordes, PE	Date:			
Segment	Description	Unit	Quantity	Unit Price	Total
A. ADD BOOSTER PUMP STATION					
	Booster Pump	EA	1	$ 4,000.00	$ 4,000.00
	Electrical	LS	1	$ 15,000.00	$ 15,000.00
	Site Piping	LS	1	$ 10,000.00	$ 10,000.00
	Mechanical Piping	LS	1	$ 25,000.00	$ 25,000.00
	Building	LS	1	$ 50,000.00	$ 50,000.00
	Generator	LS	1	$ 40,000.00	$ 40,000.00
					$ 194,400.00
	**Requires either Source Option A or B				
B. ADD DEDICATED TRANSMISSION MAIN AND BOOSTER					
	10 Inch C905 PVC	LF	10500	$ 130.00	$ 1,365,000.00
	Booster Pump	LS	1	$ 194,400.00	$ 194,400.00
					$ 2,105,190.00
C. ADD NEW STORAGE					
	New Storage (220,000)	LS	1	$ 253,000.00	$ 253,000.00
	Modifications to Well 3	LS	1	$ 50,000.00	$ 50,000.00
					$ 409,050.00
NOTES:	Contingency and Engineering have been estimated and added to each sum.				
			RANGE	**$ 409,100**	**$ 2,105,200**

Rose Lake Water Association

Storage and Booster Option D: Individual Booster Pumps

ENGINEER's OPINION OF PRELIMINARY PROJECT COSTS

Prepared By:	Ashley M. Williams, EIT	Date:	November 8, 2013		
Project Manager:	Steve Cordes, PE	Date:			
Segment	Description	Unit	Quantity	Unit Price	Total
	Mobilization	LS	1	$ 900.00	$ 900.00
	Booster Pump	EA	5	$ 2,500.00	$ 12,500.00
	Electrical	EA	5	$ 500.00	$ 2,500.00
	Site Piping	EA	5	$ 500.00	$ 2,500.00
				Subtotal =	$18,400.00
				10% Contingency =	$1,840.00
				Total Estimated Construction =	$20,240.00
ENGINEERING					
	Design Phase Services				$2,000.00
	Bidding Phase Services				$750.00
	Construction Phase Services				$2,000.00
ESTIMATED TOTAL PROJECT COST					**$24,990.00**

Rose Lake Water Association

Distribution Option A: Meter Replacement

ENGINEER's OPINION OF PRELIMINARY PROJECT COSTS

Prepared By:	Ashley M. Williams, EIT	Date:	November 8, 2013		
Project Manager:	Steve Cordes, PE	Date:			
Segment	Description	Unit	Quantity	Unit Price	Total
	Mobilization	LS	1	$ 8,400.00	$ 8,400.00
	Meter Replacement	EA	25	$ 1,400.00	$ 35,000.00
	Meter Setter				
	Meter				
	Meter Box				
	Insulation Foam				
	Labor				
	Equipment				
	Meter Replacement	EA	95	$ 200.00	$ 19,000.00
	Meter				
				Subtotal =	$62,400.00
				10% Contingency =	$6,240.00
				Total Estimated Construction =	$68,640.00
ENGINEERING					
	Design Phase Services				$4,800.00
	Bidding Phase Services				$1,000.00
	Construction Phase Services				$4,800.00
ESTIMATED TOTAL PROJECT COST					**$79,240.00**

Rose Lake Water Association

Distribution Option B: Leak Detection

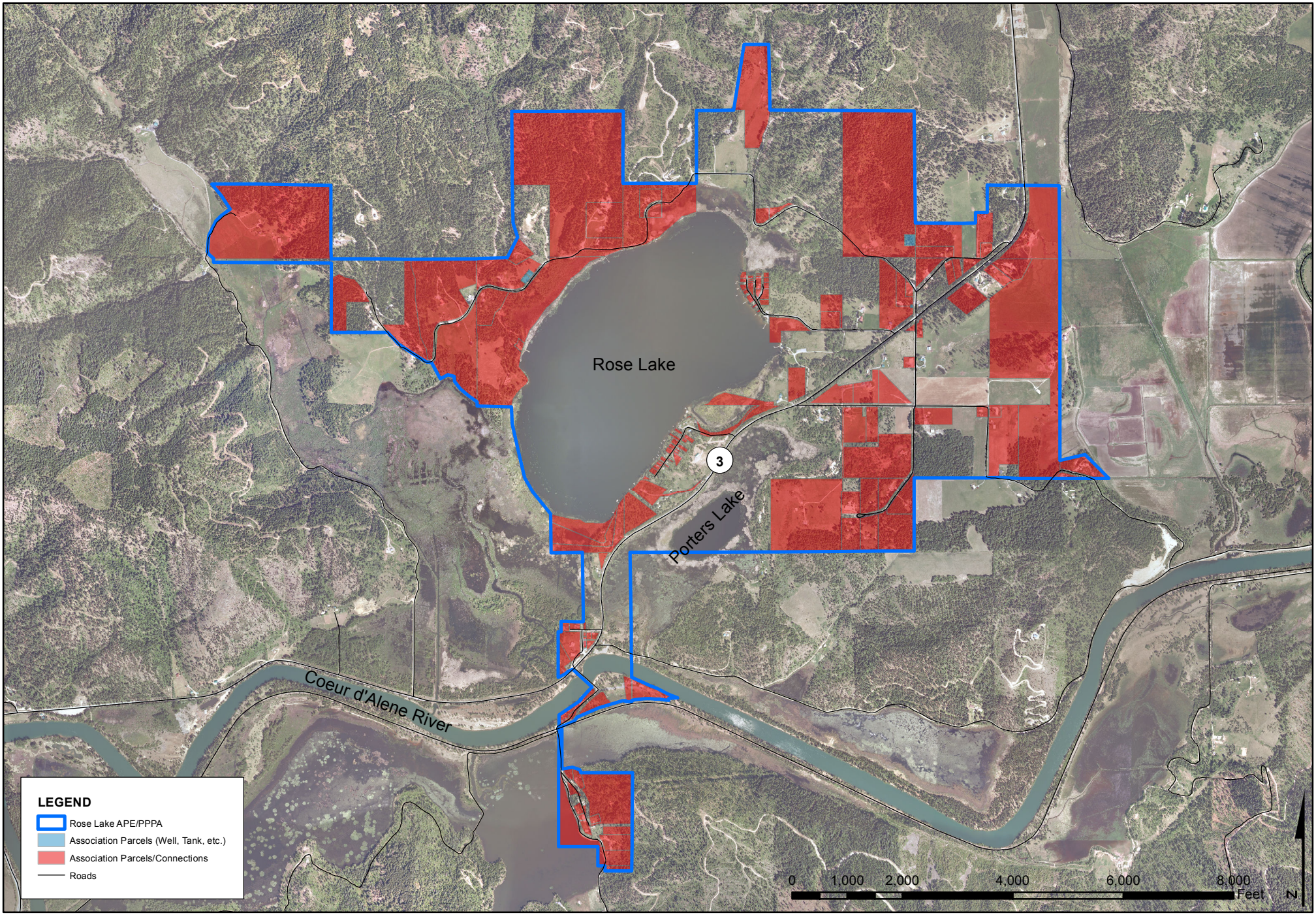
ENGINEER's OPINION OF PRELIMINARY PROJECT COSTS

Prepared By:	Ashley M. Williams, EIT	Date:	November 8, 2013		
Project Manager:	Steve Cordes, PE	Date:			
Segment	Description	Unit	Quantity	Unit Price	Total
	Mobilization	LS	1	$ 150.00	$ 150.00
	Leak Detection (through Sub-Consultant)	LS	1	$ 3,600.00	$ 3,600.00
	Daily Charge				
	Report				
	Travel Charge				
				Subtotal =	$3,750.00
				10% Contingency =	$375.00
				Total Estimated Construction =	$4,125.00
ESTIMATED TOTAL PROJECT COST					**$4,125.00**

APPENDIX H1:

PHYSIOGRAPHY, TOPOGRAPHY, GEOLOGY, AND SOILS INFORMATION

WELCH-COMER
ENGINEERS | SURVEYORS



WELCH-COMER
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350 E. Kathleen Ave.
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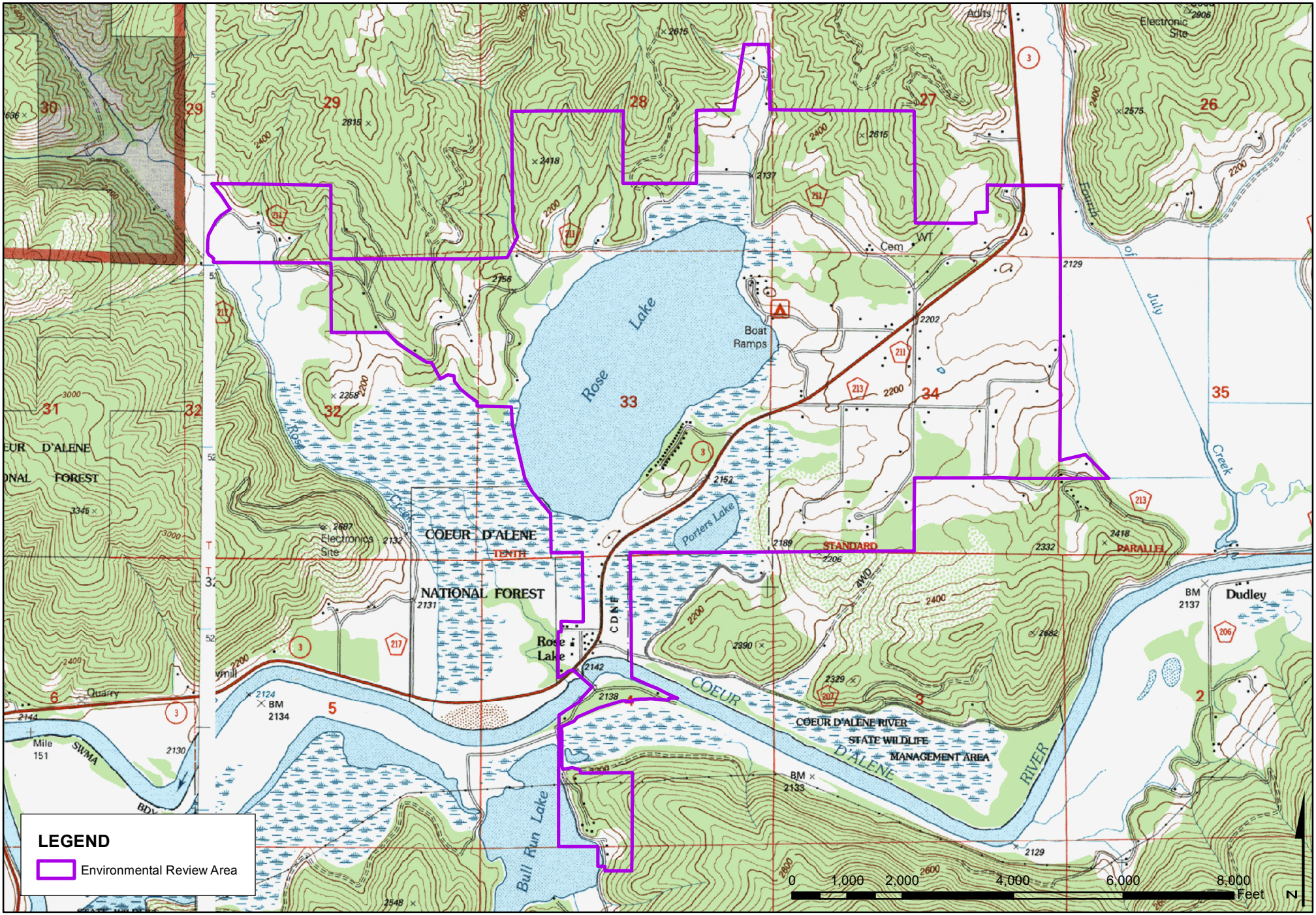
(toll free) 877-815-5672
(fax) 208-664-5946

Rose Lake Water Association

APE / PPPA (Environmental Review Area) Overview

Sources:
Kootenai County GIS Department
Dept. of Interior Aerial (Spokane, WA 2009)

PROJECT NO.....41113
DRAWN BY.....AW
FILENAME.....APEPPPA
DATE.....9/20/13



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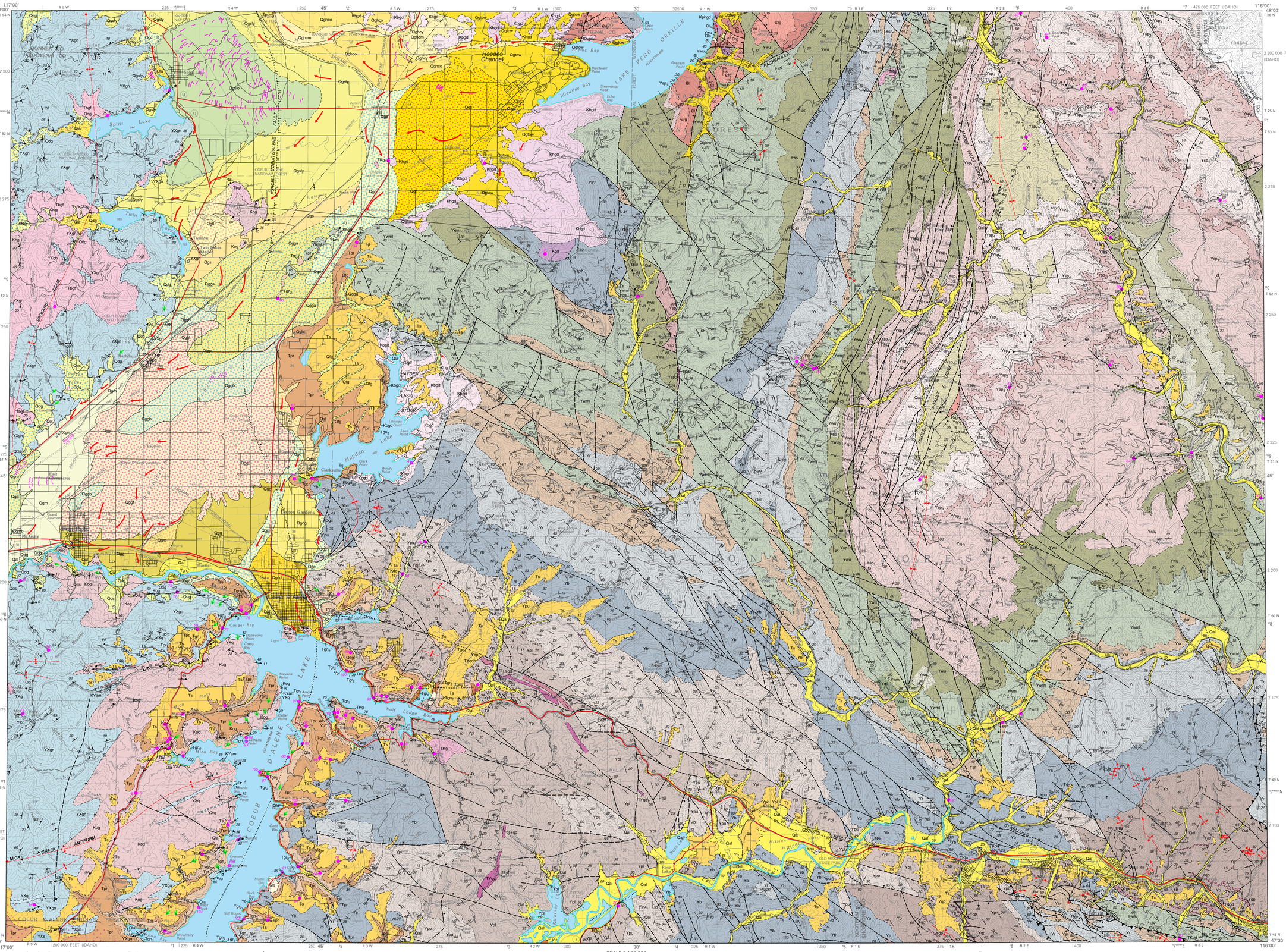
(fax) 208-664-5946

Rose Lake Water Association

Topography

Sources:
Kootenai County GIS Department
Dept. of Interior Aerial (Spokane, WA 2009)
PROJECT NO.....41113
DRAWN BY.....AW
FILENAME.....Topography
DATE.....9/20/13



Base map from digitally scanned USGS 1:100,000 composite film base, 1987.
Roads from USGS, 1:100,000 Digital Line Graph data.
Projection and 10,000-meter grid, zone 12, Universal Transverse Mercator.
25,000 foot grid ticks based on Idaho coordinate system, west zone.
1927 North American Datum.

UTM Grid and 1971 Magnetic North Declination at Center of Map

SCALE 1:100,000

KILOMETERS — MILES

Contour Interval 50 Meters

IDAHO
QUADRANGLE LOCATION

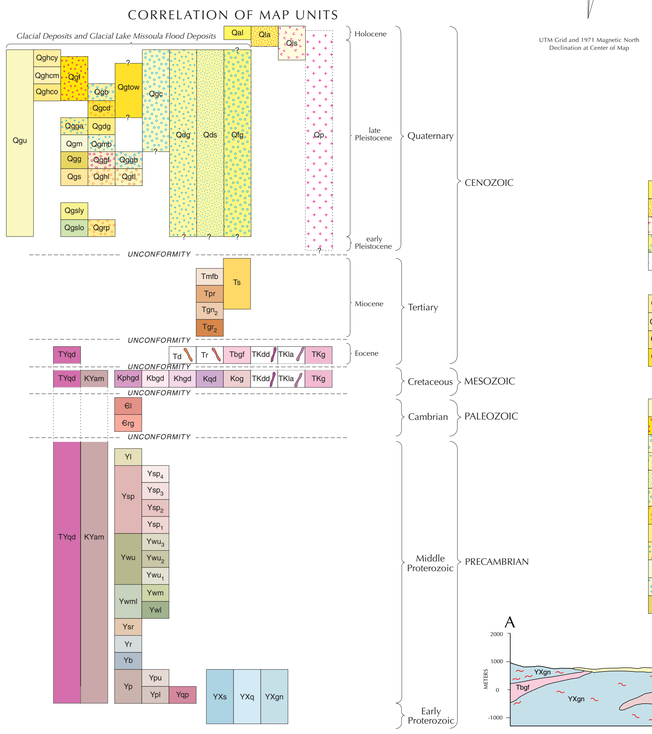
Prepared in cooperation with the U.S. Geological Survey.
This geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program.
Digital cartography and GIS data capture by Jane S. Freed, Loudon R. Stanford, Vance T. MacKubbin, and Alan K. Schlerf.
Map edited by Roger C. Stewart.

Note on printing: The map is reproduced at a high resolution of 600 dots per inch. The inks are resistant to run but not to the fading caused by long-term exposure to light.
Map version 8-23-2006.

Geologic Map of the Coeur d'Alene 30 x 60 Minute Quadrangle, Idaho

Compiled and mapped by
Reed S. Lewis, Russell F. Burmester, Roy M. Breckenridge, Mark D. McFaddan, and John D. Kauffman
2002

CORRELATION OF MAP UNITS



MAP UNITS

Unit descriptions in accompanying booklet

HOLOCENE DEPOSITS

- Qal — Alluvial deposits (Holocene)
- Qla — Lacustrine sediments and alluvium (Holocene)
- Qls — Landslide deposits (Holocene)
- Qfg — Fluvial gravel (Pleistocene and Holocene)
- Qa — Palouse Formation (Pleistocene and Holocene)*(pattern only)*

DEPOSITS OF GLACIAL ORIGIN

- Qghcy — Gravel of Hoodoo channel, younger (late Pleistocene)
- Qghcm — Gravel of Hoodoo channel, middle (late Pleistocene)
- Qghco — Gravel of Hoodoo channel, older (late Pleistocene)
- Qgtow — Bouldery till and outwash deposits (late Pleistocene)

CATASTROPHIC FLOOD DEPOSITS AND REWORKED OUTWASH

- Qgu — Gravel, undivided (Pleistocene) *(cross section only)*
- Qgf — Gravel of Farragut State Park (Pleistocene)
- Qgc — Channel gravel, undivided (Pleistocene)
- Qdg — Distal gravel deposits (Pleistocene)
- Qds — Distal sand and silt deposits (Pleistocene)
- Qgb — Gravel of Beck Road (Pleistocene)
- Qgcd — Gravel of Coeur d' Alene (Pleistocene)
- Qgdg — Gravel of Dalton Gardens fan (Pleistocene)
- Qgga — Gravel of Garwood (Pleistocene)
- Qgm — Gravel of McGuire (Pleistocene)
- Qgmb — Gravel of McGuire, bar facies (Pleistocene)
- Qgg — Gravel of Green Ferry (Pleistocene)
- Qggf — Gravel of Green Ferry, fan facies (Pleistocene)
- Qggb — Gravel of Green Ferry, bar facies (Pleistocene)
- Qgs — Gravel of Scarcello Road (Pleistocene)
- Qgh — Gravel of Hayden Lake (Pleistocene)
- Qgtl — Gravel of Twin Lake (Pleistocene)
- Qgsly — Gravel of Spirit Lake, younger (Pleistocene)
- Qgslo — Gravel of Spirit Lake, older (Pleistocene)
- Qgrp — Gravel of Ross Point (Pleistocene)

OLDER SEDIMENTS

- Ts — Sediment (Miocene)

COLUMBIA RIVER BASALT GROUP

Saddle Mountains Formation(?)

- Tmfb — Basalt of Mica Flats (Miocene)

Wanapum Formation

- Tpr — Priest Rapids Member (Miocene)

Grande Ronde Formation

- Tgr_{N2} — Grande Ronde N_2 magnetostratigraphic unit (Miocene)
- Tgr_{R2} — Grande Ronde R_2 magnetostratigraphic unit (Miocene)

INTRUSIVE ROCKS

- Tr — Rhyolite dikes (Eocene)
- Td — Dacite dikes (Eocene)
- Tbgf — Fine-grained biotite granite (Eocene)
- TKdd — Diabase and diorite dikes (Tertiary or Cretaceous)
- TKla — Lamprophyre dikes (Tertiary or Cretaceous)
- TKg — Granitic rocks, undivided (Tertiary or Cretaceous)
- TYqd — Quartz diorite dikes and sills (Tertiary, Cretaceous, or Proterozoic)
- Kphgd — Porphyritic hornblende-biotite granodiorite (Cretaceous)
- Kbgd — Biotite granodiorite (Cretaceous)
- Khgd — Hornblende-biotite granodiorite (Cretaceous)
- Kqd — Biotite-hornblende quartz diorite (Cretaceous)
- Kog — Orthogneiss (Cretaceous)
- KYam — Amphibolite (Cretaceous or Proterozoic)

PALEOZOIC ROCKS

- Ꞓl — Lakeview Limestone (Cambrian)
- Ꞓrg — Rennie Shale and Gold Creek Quartzite (Cambrian)

BELT SUPERGROUP

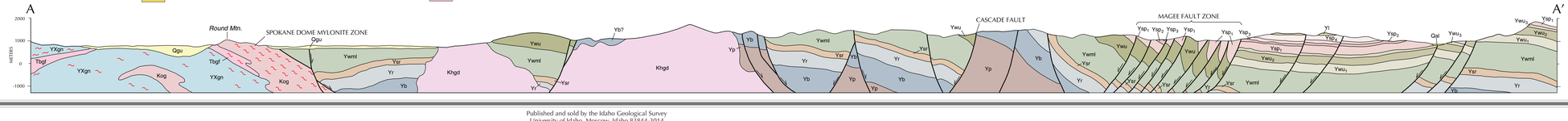
- Yl — Libby Formation (Middle Proterozoic)
- Ysp — Striped Peak Formation, undivided (Middle Proterozoic)
- Ysp_4 — Striped Peak Formation, member four (Middle Proterozoic)
- Ysp_3 — Striped Peak Formation, member three (Middle Proterozoic)
- Ysp_2 — Striped Peak Formation, member two (Middle Proterozoic)
- Ysp_1 — Striped Peak Formation, member one (Middle Proterozoic)
- Ywu — Wallace Formation, upper member, undivided (Middle Proterozoic)
- Ywu_3 — Wallace Formation, upper member three (Middle Proterozoic)
- Ywu_2 — Wallace Formation, upper member two (Middle Proterozoic)
- Ywu_1 — Wallace Formation, upper member one (Middle Proterozoic)
- Ywml — Wallace Formation, middle and lower members, undivided (Middle Proterozoic)
- Ywm — Wallace Formation, middle member (Middle Proterozoic)
- Ywl — Wallace Formation, lower member (Middle Proterozoic)
- Ysr — St. Regis Formation (Middle Proterozoic)
- Yr — Revett Formation (Middle Proterozoic)
- Yb — Burke Formation (Middle Proterozoic)
- Yp — Prichard Formation, undivided (Middle Proterozoic)
- Ypu — Prichard Formation, upper part (Middle Proterozoic)
- Ypl — Prichard Formation, lower part (Middle Proterozoic)
- Yqp — Quartzite of the Prichard Formation (Middle Proterozoic)

BELT SUPERGROUP OR PRE-BELT METAMORPHIC ROCKS

- YXs — Schist of the Priest River metamorphic complex (Proterozoic)
- YXq — Quartzite of the Priest River metamorphic complex (Proterozoic)
- YXgn — Gneiss of the Priest River metamorphic complex (Proterozoic)

MAP SYMBOLS

- Contact: dashed where approximately located
- High-angle fault: dashed where approximately located; dotted where concealed
- Normal fault: dashed where approximately located; dotted where concealed; ball and bar on downthrown side
- Detachment fault: dashed where approximately located; dotted where concealed; hachures on downthrown side
- Strike-slip fault: dashed where approximately located; dotted where concealed
- Thrust fault: approximately located; dotted where concealed; teeth on upper plate; includes steep (reverse) faults
- Fold axis: dotted where concealed; arrow indicates plunge direction
- Syncline
- Anticline
- Overturned syncline
- Overturned anticline
- 21 — Strike and dip of compositional layering interpreted as bedding
- Strike of vertical bedding
- Horizontal bedding
- 71 — Strike and dip of bedding; ball indicates bedding known to be upright
- 20 — Overturned bedding
- 17 — Strike and dip of foliation
- Strike of vertical foliation
- 40 — Bearing and plunge of lineation, type unknown
- 5 — Bearing and plunge of mineral lineation
- 10 — Bearing and plunge of crenulation lineation
- 25 — Bearing and plunge of small fold axis
- 15 — Bearing and plunge of asymmetrical small fold showing counterclockwise rotation viewed down plunge
- 9 — Bearing and plunge of asymmetrical small fold showing clockwise rotation viewed down plunge
- 20 — Strike and dip of fracture cleavage
- Strike of vertical fracture cleavage
- Vein
- 6 — Sample location
- Giant current ripple field
- Abandoned channels of Glacial Lake Missoula floods drainageways
- Channels scoured in bedrock by Glacial Lake Missoula floods
- Mylonite (cross section only)



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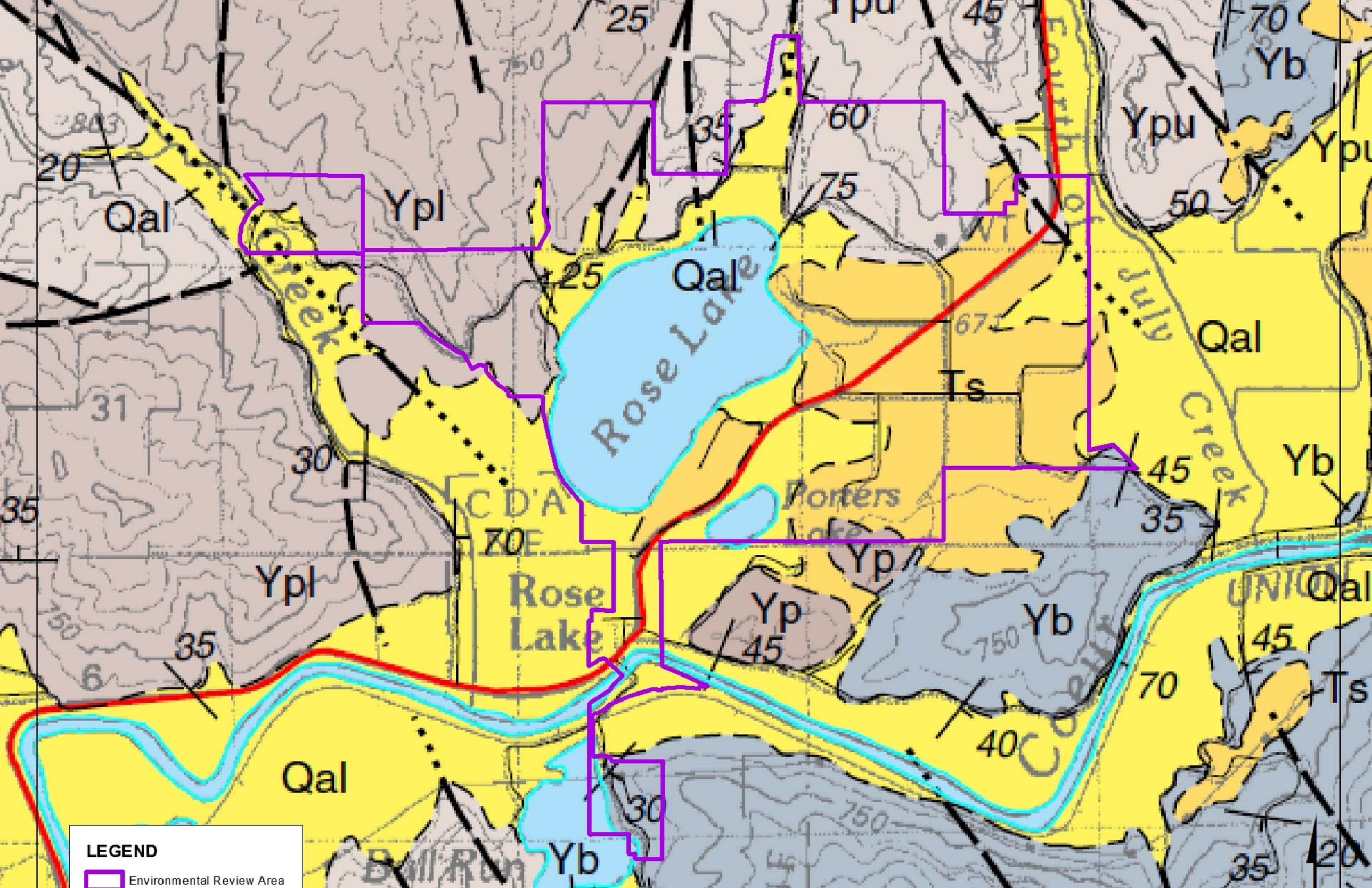
LEGEND
Environmental Review Area
Qal
Ypl
Ypu
Yb
Yp
Ts
Rose Lake
C D'A
Rose Lake
Ponders Lake
Bull Run
Fourth of July Creek
Coeur d'Alene River
UNION
25
45
70
Yb
Ypu
20
35
60
75
50
Qal
Ypl
25
Qal
Qal
31
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70
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6
Yp
45
Yb
45
Ts
70
40
Qal
30
Yb
35
20

Geologic Map of the Coeur d'Alene 30 X 60 Minute Quadrangle, Idaho

Compiled and Mapped by Reed S. Lewis, Russell F. Burmester, Roy M. Breckenridge, Mark D. McFaddan, and John D. Kauffman

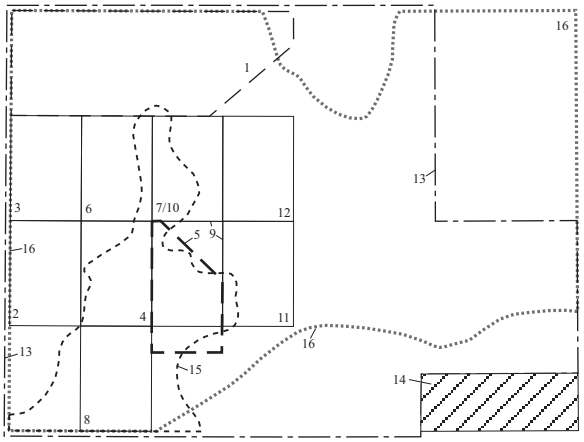
2002

INTRODUCTION

This compilation of the geology of the 1:100,000-scale Coeur d'Alene 30' x 60' quadrangle relied extensively on previous mapping. The principal sources were the seven unpublished 1:62,500-scale field maps used to prepare the 1:250,000-scale map of Griggs (1973). We supplemented Griggs' data with extensive field work in 1999, primarily in the northeast corner of the quadrangle. Basalt stratigraphy is based on the regional framework developed by Wright and others (1973) and Swanson and others (1979a, 1979b). Quaternary mapping in the Rathdrum Prairie area is based on our past unpublished and new work. The areal extent of the sources are shown on Figures 1 and 2. The geology of the Coeur d'Alene 1:100,000 quadrangle will also be published as a digital version in the Digital Data Series (see the Idaho Geological Survey's Web site: www.idahogeology.org).

The oldest and most abundant rocks in the Coeur d'Alene quadrangle are Precambrian (Figures 3 and 4). These include low-grade metasedimentary rocks of the Belt Supergroup and high-grade (amphibolite facies) metamorphic rocks whose protolith is either the Belt Supergroup or the basement rocks that predate the Belt metasedimentary rocks. The high-grade rocks are exposed in a metamorphic core complex in the western part of the map area (Priest River complex in Figure 4). Previously unmapped, deformed granitic rock (orthogneiss) of probable Cretaceous age is included in the core complex. Plutonic rocks of Cretaceous age are also present as intrusions within the low-grade Belt Supergroup. Relatively undeformed Eocene igneous rocks are exposed as plutons in the northwestern part of the map area and as a few rhyolite and dacite dikes in the central part. Flows of Miocene Columbia River basalt cover much of the western part of the quadrangle, although in places these flows are covered with Miocene sediments. Abundant Quaternary gravels in and near the Rathdrum Prairie were deposited by catastrophic floods derived from Glacial Lake Missoula.

This geologic map was funded in part by the USGS National Cooperative Geologic Mapping Program.



1. R.M. Breckenridge, unpublished geologic mapping, 1995-1999
2. R.M. Breckenridge and K.L. Othberg, 1998a
3. R.M. Breckenridge and K.L. Othberg, 1998b
4. R.M. Breckenridge and K.L. Othberg, 1999a
5. R.M. Breckenridge and K.L. Othberg, 2000a
6. R.M. Breckenridge and K.L. Othberg , 1999b
7. R.M. Breckenridge and K.L. Othberg, 2000b
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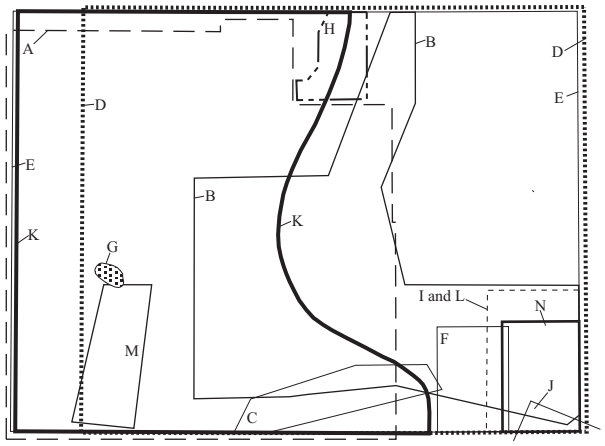
Figure 1. *Previous mapping used as primary sources of data.*



A. Anderson, 1940
B. Boleneus and others, 2001
C. Bookstrom and others, 1999
D. Griggs, 1968
E. Griggs, 1973
F. Hayden, 1992
G. Hosterman and others, 1960
H. Kun, 1970
I. Ransome and Calkins, 1908
J. Shenon and McConnel, 1939
K. Swanson and others, 1979a
L. Umpleby and Jones, 1923
M. Wavra and Reid,1990-1992
N. Willoughby, 1986

Figure 2. *Previous mapping used as secondary sources of data.*

DESCRIPTION OF ROCK UNITS

Intrusive rocks are classified according to IUGS nomenclature using normalized values of modal quartz (Q), alkali feldspar (A), and plagioclase (P) on a ternary diagram (Streckeisen, 1976). Mineral modifiers are listed in order of increasing abundance for both igneous and metamorphic rocks. Grain size classification of unconsolidated and consolidated sediment is based on the Wentworth scale.

HOLOCENE DEPOSITS

Qal—Alluvial deposits (Holocene)—Stream deposits in modern drainages. Most deposits are composed of stratified, poorly sorted, and laterally discontinuous beds of sandy gravel with sand and silt lenses. Thickness of 3 m or less.

Qla—Lacustrine sediments and alluvium (Holocene)—Moderately to well-sorted, silt and sand deposits in bays of Coeur d'Alene Lake and Hayden Lake. The deposits are mainly located within the lakes' high-water zones and are interbedded with and grade upstream into alluvium of tributary streams. Soils are deep and poorly drained and include muck of the Pywell series and silt loam of the Cald, Cougar Bay, Pywell, and Ramsdell series (Weisel, 1981). Thickness as much as 5 m.

Qls—Landslide deposits (Holocene)—Nonsorted and poorly sorted, stratified angular basalt clasts mixed with silt and clay. Mass-movement slope deposits are mainly associated with steep basalt rimrock and the interbedded fine-grained sediments and weathering surfaces. Locally may include columns of basalt carried either by mass movement processes or by Glacial Lake Missoula floods. Gradations from talus to smaller landslide deposits are present and difficult to distinguish. Thickness as much as 12 m.

Qfg—Fluvial gravel (Pleistocene and Holocene)—Moderately to poorly sorted sandy gravel and sandy silt in abandoned drainageways of the latest Glacial Lake Missoula floods. The Coeur d'Alene and Hayden Lake basins were inundated by the largest releases from Glacial Lake Missoula. Unit is mostly reworked Miocene sediment and colluvium that were previously carried and deposited by lower energy Missoula floods in slack-water areas. Includes various thicknesses of Holocene alluvium and wetland bog deposits. Thickness as much as 3 m.

Qp—Palouse Formation (Pleistocene and Holocene)—Loess composed of massive silt and clayey silt of the Palouse hills in the eastern Columbia Plateau. Consists of many layers that represent periods of rapid loess deposition followed by long surface exposure and soil development. Depositional and soil units within the Palouse Formation form complex surface and subsurface patterns that are discontinuous and difficult to map. Thick, welded, clayey B horizons of paleosols are locally exposed through erosion, especially on steep amphitheater-shaped slopes with northerly aspects, and form low knobs below the high ridge crests of the Palouse hills. Where the loess is thin, it is mostly composed of late Pleistocene and Holocene deposits. The Palouse Formation has previously been restricted to only Pleistocene loess deposits, but some workers have included Holocene loess in it. The Palouse Formation overlies a Miocene-Pliocene surface primarily developed on the basalt of the Priest Rapids Member (Wanapum Basalt) and Tertiary alluvial deposits. Soils include the Santa and the Taney series (Weisel, 1981). Shown only by an overlay pattern without well-defined boundaries. Thickness less than 3 m. Thin to absent on surfaces scoured by Glacial Lake Missoula floods.

DEPOSITS OF GLACIAL ORIGIN

Qghcy—Gravel of Hoodoo channel, younger (late Pleistocene)—Poorly sorted, coarse boulder outwash gravel that forms the lowest terrace of Hoodoo channel and records the meltwater flow through Granite Lake to the Pend Oreille

River. Graded to the outlet of Pend Oreille Lake at Bayview at an elevation of 670 m (2,200 feet). Contains kettles from melted blocks of ice. Probably records overflow of the lake during the last phase of alpine glaciation in the region. Moraines of alpine valley glaciers in the Selkirk and Cabinet Mountains are still intact and postdate the retreat of Cordilleran ice from the southern end of the Purcell Trench. Postdates the last Cordilleran ice dam at Clark Fork about 12,000 years ago. Thickness as much as 18 m.

Qghcm—Gravel of Hoodoo channel, middle (late Pleistocene)—Poorly sorted very coarse boulder gravel with a granule and sand matrix; the gravel forms the middle terrace of Hoodoo channel and records the lowest elevation of flow through the Spirit Lake part of the Hoodoo channel. Graded to an elevation of 700 m (2,300 feet). Probably resulted from overflow of the Pend Oreille Lake basin during Cordilleran deglaciation of the Purcell Trench, or from a late ice-marginal and noncatastrophic drainage of Glacial Lake Missoula. Thickness as much as 30 m.

Qghco—Gravel of Hoodoo channel, older (late Pleistocene)—Poorly sorted, very coarse boulder gravel that forms the highest terrace of Hoodoo channel; graded to approximately 730 m (2,400 feet). Probably represents the last emptying cycle of a much diminished and shallow Glacial Lake Missoula. Thickness as much as 30 m.

Qgtow—Bouldery till and outwash deposits (late Pleistocene)—Nonsorted, bouldery clay till and boulder outwash deposits that form a modified end moraine at the south end of Lake Pend Oreille. Clay till recorded in well logs and exposed by excavations in Farragut State Park. Probably equivalent in age to the gravel of Farragut State Park and the distal facies of the oldest gravel of Hoodoo channel (*Qghco*). Thickness as much as 25 m.

CATASTROPHIC FLOOD DEPOSITS AND REWORKED OUTWASH

Qgu—Gravel, undivided (Pleistocene)—Shown only in cross section. Bouldery flood gravels of Rathdrum Prairie undivided for the purpose of the cross section. Fills a deep paleovalley between Round Mountain and Twin Lakes (Adema, 1999). Thickness as much as 180 m.

Qgf—Gravel of Farragut State Park (Pleistocene)—Poorly sorted, sandy boulder gravel at the Glacial Lake Missoula flood breakout from the south end of Lake Pend Oreille. Probably represents the last drainage from Glacial Lake Missoula and outwash from late Wisconsin glacial retreat. Includes reworked outwash facies from the bouldery till moraine (*Qgtow*) at the southern end of Lake Pend Oreille. Thickness from 10 to 30 m.

Qgc—Channel gravel, undivided (Pleistocene)—Latest Wisconsin catastrophic flood and outwash gravel and sand deposited in channelways cut into high energy fans and bars of Glacial Lake Missoula flood origin. Deposited during declining stages of last catastrophic flood event. The last overland flood event was post-"S" ash (13,000 years ago) and pre-Glacier Peak ash (11,200 years ago), perhaps 12,800 years ago (Stradling and Kiver, 1986). Moderately sorted and stratified in the lower flow regimes. The channels are commonly developed at the margin of the Rathdrum Prairie because the larger boulders armor the center of the flood path. Locally includes angular basalt columns derived from the basalt rimrock. Soil is gravelly loam of the Kootenai series (Weisel, 1981). Thickness from 3 to 12 m.

Qdg—Distal gravel deposits (Pleistocene)—Moderately sorted, sandy flood gravels. These deposits form eddy bars at the mouths of the tributary valleys to the Rathdrum Prairie. Lower energy eddy flows deposit finer facies behind the main bar form. May be mantled by post-Glacial Lake Missoula flood lacustrine silt and alluvial deposits. Thickness as much as 60 m.

Qds—Distal sand and silt deposits (Pleistocene)—Moderately sorted sand and silt with some gravel deposited in a lower energy, Glacial Lake Missoula flood regime; represents slack-water sediments in waning floodwaters or finer facies of pendant bar deposits. Includes planar medium-bedded sand of low flow regime. Overlain by postflood lacustrine silt and peat deposits in local basins. Thickness from 3 to 10 m.

Qgb—Gravel of Beck Road (Pleistocene)—Poorly sorted flood gravel graded to the lowest valley-filling episode of flooding continuous with the Spokane Valley, about 640 m (2,100 feet) at the Idaho-Washington state line. The gravel is associated with the most developed incision representing a large abandoned river channel meandering westward into Washington (Gerstel and Palmer, 1994). Two separate sets of thick-bedded foresets are exposed in deep gravel pits. Soil is very stony and includes the gravelly silt loam of the Garrison series (Weisel, 1981). Thickness in excess of 25 m.

Qgcd—Gravel of Coeur d'Alene (Pleistocene)—Mixed deposits of poorly to moderately sorted, stratified cobbly sand and sandy gravel carried by outburst floods and currents of reverse outflow from inundation of the Coeur d'Alene basin. Composes the deposits damming Coeur d'Alene Lake and forming giant current ripples on the lake bottom shown

in seismic profiles (Breckenridge and Othberg, 1999a). Soil is gravelly silt loam of the McGuire series (Weisel, 1981). Thickness from 6 to 25 m.

Qgdg—Gravel of Dalton Gardens fan (Pleistocene)—Poorly sorted sandy gravel deposited in a large fan formed downstream from Hayden Lake outlet. Lobate in form at the downstream margin. Soil is fine gravelly silt loam of the Avonville series (Weisel, 1981). Thickness from 3 to 15 m.

Qgga—Gravel of Garwood (Pleistocene)—Poorly to moderately sorted sandy gravel deposited in a large fan formed downstream from the flood outlet of Lake Pend Oreille. Probably represents waning stages of the last recognizable flood event or a very small late flood. Includes local fans composed of gravel contributed from side drainages and rimrock basalt. Soils are gravelly silt loam of the Kootenai series and silt loam of the Bonner series (Weisel, 1981). Thickness from 3 to 15 m.

Qgm—Gravel of McGuire (Pleistocene)—Poorly sorted sandy flood gravel graded to an intermediate level of 650 m (2,140 feet) near Post Falls. Though extensive, the gravel unit appears to be characterized by incision and scour unconformities of a waning flood; the surface is marked by channel erosion and lag deposits. Soil is gravelly silt loam of the Garrison series (Weisel, 1981). Thickness from 20 to 30 m.

Qgmb—Gravel of McGuire, bar facies (Pleistocene)—Coarse, poorly sorted, imbricate flood gravel with parallel bedding. Forms a large longitudinal bar extending several miles west to the Idaho-Washington state line. Graded to the gravel of McGuire. Soil is very stony silt loam of the Garrison series. Thickness from 6 to 12 m.

Qgg—Gravel of Green Ferry (Pleistocene)—Coarse flood gravel. Consists of an extensive sheet of flood deposits in the quadrangle. Has poor sorting and variation in bedding; graded to about 670 m (2,200 feet) at Post Falls. Probably represents the last episode of major flood events about 12,800 years ago. Soil is gravelly silt loam of the McGuire-Marble association (Weisel, 1981). Thickness in excess of 30 m.

Qggf—Gravel of Green Ferry, fan facies (Pleistocene)—Poorly sorted, sandy flood gravel with channel cut and fill structures. The deposits form a large coalescing fan complex characterized by scour and fill features and concentrations of lag boulders, dissected by waning phases of flooding and smaller, later flood events. The depositional morphology of the fan tends to form lobes. Soils are fine gravelly silt loam of the Avonville series and gravelly silt loam of the Garrison series (Weisel, 1981). Thickness from 3 to 25 m.

Qggb—Gravel of Green Ferry, bar facies (Pleistocene)—Bouldery flood gravel. Coarse, poorly sorted imbricate flood gravel with large-scale foreset bedding. Forms a large channel bar with well-developed current ripples at the surface. Soil is gravelly silt loam of the Avonville series (Weisel, 1981). Thickness as much as 12 m.

Qgs—Gravel of Scarcello Road (Pleistocene)—Mixed deposits of poorly to moderately sorted, stratified cobbly sand and sandy gravel carried by outburst floods. Forms a well-developed terrace at about 720 m (2,360 feet) in elevation. Soil is gravelly silt loam of the Kootenai series (Weisel, 1981). Thickness from 6 to 25 m.

Qghl—Gravel of Hayden Lake (Pleistocene)—Coarse, poorly sorted gravel forms a terrace at about 700 m (2,300 feet) along the eastern margin of Rathdrum Prairie. Characteristically contains columns of basalt eroded from the nearby rimrock and large rip-up clasts of clay from the Latah Formation. Soils are fine gravelly silt loam of the Avonville series and gravelly silty loam of the Kootenai series (Weisel, 1981). Thickness from 12 to 15 m.

Qgtl—Gravel of Twin Lake (Pleistocene)—Poorly sorted, bouldery flood gravel deposited as a major pendant bar in the lee of Round Mountain, a scoured bedrock knob. Soils are gravelly silt loam of the Kootenai series and the Kootenai-Rathdrum association (Weisel, 1981). Thickness as much as 25 m.

Qgsly—Gravel of Spirit Lake, younger (Pleistocene)—Poorly sorted, bouldery flood gravel deposited as a large fan directly from the earlier and larger flood breakouts from Lake Pend Oreille. Forms the second (youngest and lower) of two high fan surfaces isolated by later flood erosion. Soil is cobbly silt loam of the Kootenai series (Weisel, 1981). Thickness as much as 30 m.

Qgslo—Gravel of Spirit Lake, older (Pleistocene)—Poorly sorted, bouldery flood gravel deposited as a large fan directly from the earlier and larger flood breakouts from Lake Pend Oreille. Forms the first (oldest and highest) of two high fan surfaces isolated by later flood erosion. Locally contains some very large boulders greater than 5 m that were probably carried in icebergs. Surface marked by giant current ripples up to 150 m (500 feet) between crests and 12 m (40 feet) in height. Pattern of current ripples shows divergent flow directions both north toward the Pend Oreille River drainage and south down Rathdrum Prairie as the floodwaters were deflected by the Mount Spokane uplands. Soils are gravelly

silt loam and silt loam of the Kootenai-Rathdrum association mantled by loess and Mazama volcanic ash (Weisel, 1981). Thickness in excess of 30 m.

Qgrp—Gravel of Ross Point (Pleistocene)—Poorly to moderately sorted, coarse, stratified sandy gravel forms the highest preserved remnant flood terrace south of Spirit Lake at about 713 m (2,340 feet) in elevation. Represents the earliest of the flood deposits recognized in the area; may be equivalent to the gravel of Spirit Lake. Has the most soil development of all the Rathdrum Prairie gravel units: the gravelly and sandy silt loam of the Avonville series and the McGuire-Marble association (Weisel, 1981). Thickness in excess of 50 m.

OLDER SEDIMENTS

Ts—Sediment (Miocene)—Mostly deeply weathered yellow to orange silt and clay, but also quartzite pebbles and cobbles, and sand. Clasts derived primarily from the Belt Supergroup. Typical thickness is 5-15 m. Cobble and pebble gravels consist of mature, rounded quartzite and other rock types derived from the Precambrian Belt Supergroup and the Mesozoic-Tertiary intrusions. In the western part of the area, the unit forms a flat to gently sloping upland surface 730-790 m (2,400-2,600 feet) in elevation that is underlain by basalt of the Priest Rapids Member (Wanapum Basalt). The unit grades laterally into thick colluvium or residuum of pre-Tertiary rocks. These deposits are probably graded to high base levels formed when the Miocene plateau basalt flows blocked and diverted stream drainages (McDaniel and others, 1998). These basalt-related sediments are considered part of the Latah Formation. The age of the deposits in the eastern part of the area is unknown, and these deposits are not included in the Latah Formation. Unit includes clay-rich interbeds of sediment between flows of Columbia River Basalt Group exposed 2 km west of Coeur d'Alene. Most interbeds are too poorly exposed or too thin to show at map scale, so they are included in the basalt map units.

COLUMBIA RIVER BASALT GROUP

Saddle Mountains Formation(?)

Tmfb—Basalt of Mica Flats (Miocene)—Medium gray to dark gray, fine-grained basalt. Microphyric with abundant plagioclase laths and needles, typically < 1 mm in length; a few scattered plagioclase phenocrysts as laths as much as 4 mm in length, or as clear to waxy clots and clusters as much as 4 mm across. Diktytaxitic cavities common but irregularly distributed. Freshly broken surfaces commonly have a rough, irregular texture. Known only from outcrops along U.S. Highway 95 and in a small rock quarry west of the highway, just south of Mica, and in the Idaho Highway Department's quarry east of Mica. Stratigraphically above Priest Rapids Member (Rosalia chemical type) where exposed along the highway. Probably underlain there by an interbed containing quartzite pebbles and cobbles. Unit consists of one known flow having reverse magnetic polarity. The mean paleomagnetic direction for the basalt of Mica Flats is distinct from the mean direction for Priest Rapids' Rosalia flows from nearby locations. Chemically the unit is also distinct from Priest Rapids, as well as from other known Wanapum and Saddle Mountains Basalt chemical types. Because of its position above Priest Rapids (Rosalia chemical type), it is tentatively correlated with Saddle Mountains Basalt. Additionally, it does not appear to be time-correlative with younger Priest Rapids (Lolo chemical type), the uppermost Wanapum unit found farther to the south, because the paleomagnetic direction differs significantly from that of the Lolo unit. At least 12 m is exposed in the quarry east of Mica, although the base of the unit has not been uncovered.

Wanapum Formation

Tpr—Priest Rapids Member (Miocene)—Medium gray to dark gray basalt. Typically has a grainy, felty texture caused by abundant small plagioclase and olivine phenocrysts and by microvesicles and diktytaxitic cavities. The denser parts of the flows are dark gray to black and fine grained; they lack the grainy texture, although small plagioclase phenocrysts are apparent. Outcrops weather gray-brown to reddish brown. In thick flows, large, poorly defined basal columnar zones 3-6 m thick change upward to slabby, platy zones that are typically medium bluish gray on fresh surfaces. Above the platy zones, flows commonly have a thick blocky to hackly entablature, 15 m or more thick, and in places well-developed thin, vertical to radiating columns. The top of the entablature grades upward into an increasingly vesicular, rubbly in places, flow top. Thin flows are more vesicular throughout and generally have only weakly developed basal columns and a vesicular flow top. Pillow-palagonite complexes are locally common at the base of flows or flow units (series of chemically similar thin flows that grade laterally into a single flow). The Priest Rapids Member consists of one or more flows of Rosalia chemical type and has reverse magnetic polarity. Thicknesses of individual flow units range from 8 to 25 m for thin units and as much as 180 m for thick units.

Grande Ronde Formation

Tgn_2—Grande Ronde N_2 magnetostratigraphic unit

(Miocene)—Dark gray to black, fine-grained aphyric to very sparsely plagioclase-phyric basalt. Locally, at least one flow near the top of this unit has a Priest Rapids-like grainy, felty texture. Large columns of the basal colonnade are generally visible only in quarry cuts. Natural exposures are typically of the thick entablature, consisting of either thin, well-developed and commonly radiating columns, or poorly developed columns with a blocky, hackly character. These entablature exposures are commonly cliff-forming masses that can be traced laterally for several miles. Individual flows are generally over 30 m thick and may be more than 60 m thick. Locally, hyaloclastic material is associated with the top of individual flows, especially near contacts with basement rocks.

Grande Ronde N_2 has normal magnetic polarity and is the lowermost basalt unit exposed on most of the Coeur d'Alene quadrangle; generally, its base either is not exposed or lies directly on prebasalt basement rocks. However, on the east side of Coeur d'Alene Lake near the south edge of the Coeur d'Alene quadrangle, the top of a Tgr_2 flow is exposed along the shoreline beneath the base of Tgn_2; this Tgr_2 flow is also present beneath the Tgn_2 along the west shoreline of the lake at University Point and Black Rock, but is too thin to show at map scale. Tgn_2 is overlain by either *Ted* or *Tpr* flows.

Tgr_2—Grande Ronde R_2 magnetostratigraphic unit (Miocene)—Dark gray to black, fine-grained aphyric to very sparsely plagioclase-phyric basalt similar to Tgn_2. One flow, with reverse magnetic polarity, is the lowermost basalt unit exposed along the Coeur d'Alene Lake shoreline. Only the vesicular top and upper part of the blocky entablature of this flow are exposed.

INTRUSIVE ROCKS

Tr—Rhyolite dikes (Eocene)—Light gray rhyolite dikes, most or all of which are porphyritic. Phenocrysts are quartz, andesine, and biotite. Present only in the area southeast of Beauty Bay, where Anderson (1940) mapped these dikes as rhyolite porphyry.

Td—Dacite dikes (Eocene)—Gray, porphyritic dacite dikes. Phenocrysts of plagioclase, biotite, quartz, and hornblende are set in a fine-grained groundmass. Present only at the mouth of Wolf Lodge Creek.

Tbgf—Fine-grained biotite granite (Eocene)—Gray, fine-grained, biotite granite. Locally forms lit-par-lit injection into *YXgn*. Potassium feldspar is interstitial. Termed the Rathdrum Mountain Granite by Rhodes and Hyndman (1984). Unpublished U-Pb zircon data of M.E. Bickford indicate an approximate 52 Ma age for this rock (Rhodes and others, 1989).

TKdd—Diabase and diorite dikes (Tertiary or Cretaceous)—Fine- to medium-grained, pyroxene-bearing mafic dikes mapped by Hobbs and others (1965) in and near the Coeur d'Alene mining district. Most are probably quartz diorite or diorite in the IUGS classification scheme (Streckeisen, 1976).

TKla—Lamprophyre dikes (Tertiary or Cretaceous)—Lamprophyre dikes with biotite or hornblende phenocrysts or microphenocrysts in a fine-grained groundmass. These dikes were mapped in and near the Coeur d'Alene mining district by Hobbs and others (1965).

TKg—Granitic rocks, undivided (Tertiary or Cretaceous)—Predominantly medium-grained granite and granodiorite, but may include diorite. Largest intrusion is the Beauty Creek stock, a porphyritic biotite granite described by Anderson (1940) as porphyritic quartz monzonite. Composed of 25 percent quartz, 30 percent zoned andesine, 30 percent orthoclase, 15 percent biotite, and trace amounts of zircon, apatite, and magnetite (Anderson, 1940).

TYqd—Quartz diorite dikes and sills (Tertiary, Cretaceous, or Proterozoic)—Dark green, fine-grained, hornblende quartz diorite. Previously considered Precambrian in age (Griggs, 1973), but many dikes cross-cut stratigraphy and are thus unlike the Precambrian sills in the Prichard Formation north and east of the map area. All or part of unit may be Cretaceous or Eocene in age.

Kphgd—Porphyritic hornblende-biotite granodiorite (Cretaceous)—Light gray, limonite-stained, highly porphyritic, hornblende-biotite granodiorite. Matrix is fine grained. Average composition is 30 percent quartz, 30 percent plagioclase, 20 percent orthoclase, 8 percent biotite, 7 percent hornblende, and 5 percent calcite, epidote, zoisite, apatite, and zircon (Kun, 1970). Plagioclase has prominent zoning and is typically altered. Unit continues to the north along east side of Pend Oreille Lake where a sample of presumably similar rock yielded a K-Ar date (biotite) of 87.7 Ma (recalculated from Miller and Engels, 1975).

Kbgd—Biotite granodiorite (Cretaceous)—Light gray, medium-grained, equigranular, biotite granodiorite of the Hayden Lake stock. Readily weathers to grus. Composed of 25 percent quartz, 40 percent zoned andesine, 15 percent interstitial microcline, 15 percent biotite, and extraordinarily large amounts of epidote in addition to chlorite, sphene, zircon, allanite, zoisite, sericite, and apatite (Anderson,

1940). K-Ar date on biotite is 83.8 Ma (recalculated from Miller and Engels, 1975).

Khgd—Hornblende-biotite granodiorite (Cretaceous)—Gray, medium-grained, hornblende-biotite granodiorite. Mafic mineral content varies, and unit probably is composed of multiple plutons or plutonic phases. Three typical samples contain 22-23 percent quartz, 41-43 percent plagioclase, 10-19 percent microcline, 11-13 percent biotite, and 6-15 percent hornblende (Gillson, 1927). A mafic marginal phase at Cape Horn east of Bayview contains 25 percent biotite and 5 percent hornblende (Gillson, 1927). Biotite is typically in thick euhedral books. Mafic phase mapped to the north as granodiorite of Salee Creek (Miller and others, 1999). Includes hornblende-bearing phases of the Kelso Lake pluton. Termed the Bayview batholith by Gillson, (1927) and Anderson (1940). A K-Ar date on biotite of 74.6 Ma (recalculated from Miller and Engels, 1975) is from the less mafic central part of the exposed pluton or plutons.

Kqd—Biotite-hornblende quartz diorite (Cretaceous)—Dark gray, equigranular, medium-grained quartz diorite. Rock contains about 13 percent quartz, 55 percent plagioclase, 15 percent biotite, 30 percent altered hornblende, and no potassium feldspar. Trace amounts of sphene, apatite, magnetite, and zircon; trace pyroxene in cores of hornblende. Appears to be a marginal phase to the *Khgd* unit. Extent is uncertain.

Kog—Orthogneiss (Cretaceous)—Gray, moderately to strongly foliated, moderately lineated biotite- and hornblende-biotite tonalite, granodiorite, granite, and quartz diorite. Muscovite bearing at the eastern edge of Round Mountain and magnetite-rich phase in roadcuts along U.S. Highway 95 near the mouth of Cougar Creek. Rocks mapped as *Kog* are heterogeneous and range in composition from granite to quartz diorite. Contains amphibolite bodies up to 100 m wide with contacts approximately parallel to foliation. Foliation is overprinted locally by s-c fabric (see Simpson and Schmid, 1983) with top-to-the-east sense of shear. Radiometric dates do not exist, but orthogneiss is considered to be Cretaceous based on similarities with deformed, approximately 94-Ma phases of the Cretaceous Idaho batholith near Lowell (Toth and Stacey, 1992) and to the Cretaceous Newman Lake orthogneiss exposed immediately west of the map area (Armstrong and others, 1987).

KYam—Amphibolite (Cretaceous or Proterozoic)—Black to dark gray, fine- to medium-grained, foliated to lineated hornblende-plagioclase meta-igneous rock. Present in schist considered by some workers as metamorphosed Prichard Formation (Griggs, 1973) and thus may be metamorphosed Proterozoic basaltic sills. However, those associated with *Kog* unit and those with relict pyroxene are probably Cretaceous.

PALEOZOIC ROCKS

Ꞓl—Lakeview Limestone (Cambrian)—Light to dark gray, thin- to thick-bedded, blocky limestone (Griggs, 1973). Includes blocky gray dolomite unit in upper part; contains some silty to sandy intervals and is metamorphosed to marble or hornfels adjacent to granitic intrusive rocks. Unit was mined for lime at Bayview (Savage, 1969). Thickness at least 2,000 feet (610 m), with the top eroded (Griggs, 1973).

Ꞓrg—Rennie Shale and Gold Creek Quartzite (Cambrian)—Rennie Shale is a fissile olive-colored fossiliferous shale, about 30 m (100 feet) thick, that is poorly exposed (Griggs, 1973). Underlying the shale is white to pale pink, vitreous coarse-grained quartzite. Contains some pebble conglomerate at its base. Thickness according to Griggs (1973) is about 500 feet (152 m).

BELT SUPERGROUP

Yl—Libby Formation (Middle Proterozoic)—Dark gray argillite and light gray to green siltite, green and red siltite, pink, fine-grained quartzite, and minor chert. Nonresistant and poorly exposed. Lower part is predominantly dark gray argillite and lighter-colored siltite. Coarsens upward into siltite and quartzite that contain dark green chert as thin beds and rounded clasts. Upper part eroded, but at least 200 m remain.

Ysp—Striped Peak Formation, undivided (Middle Proterozoic)—Quartzite and interbedded siltite and argillite. Probably consists largely (or entirely?) of Ysp_1. Shown only where lack of mapping prevented subdivision.

Ysp_4—Striped Peak Formation, member four (Middle Proterozoic)—Light gray to red, fine- to medium-grained arkosic quartzite and interbedded siltite and argillite. Characterized by 30- to 40-cm-thick tabular beds of flat-laminated, pink quartzite with red argillite caps and wavy laminated green siltite-green argillite in zones 10-30 cm thick. Less common are centimeter-scale-thick “apple green” argillite-siltite beds, and 1- to 2-m-thick beds of pink quartzite that locally contain large-scale, tangential cross-stratification. Thickest quartzite beds and quartzite with medium-grained sand lag deposits are present low in the unit. Mudchips are common throughout, as are conspicuous detrital muscovite flakes. Quartzite contains less potassium feldspar and more plagioclase (as much as 20 percent) than is present to the south (Lewis and others, 2000) and southeast (Lewis, 1998).

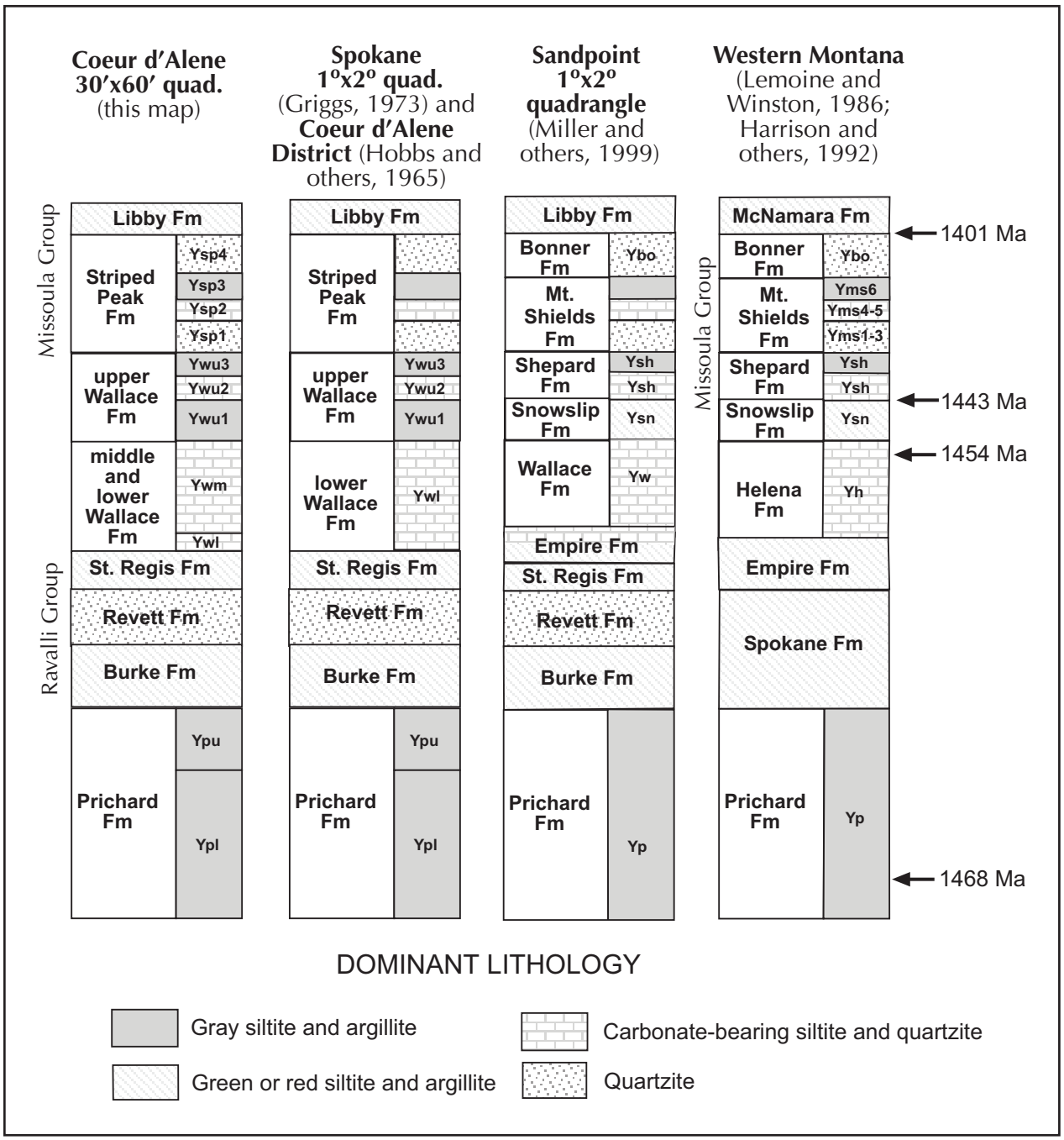


Figure 3. *Summary of Belt Supergroup nomenclature in the Coeur d'Alene quadrangle and surrounding area. Ages are U-Pb zircon dates of sills (Prichard Formation; Evans and others 2000) and volcanic rocks (Helena and younger formations; Anderson and Davis 1995).*

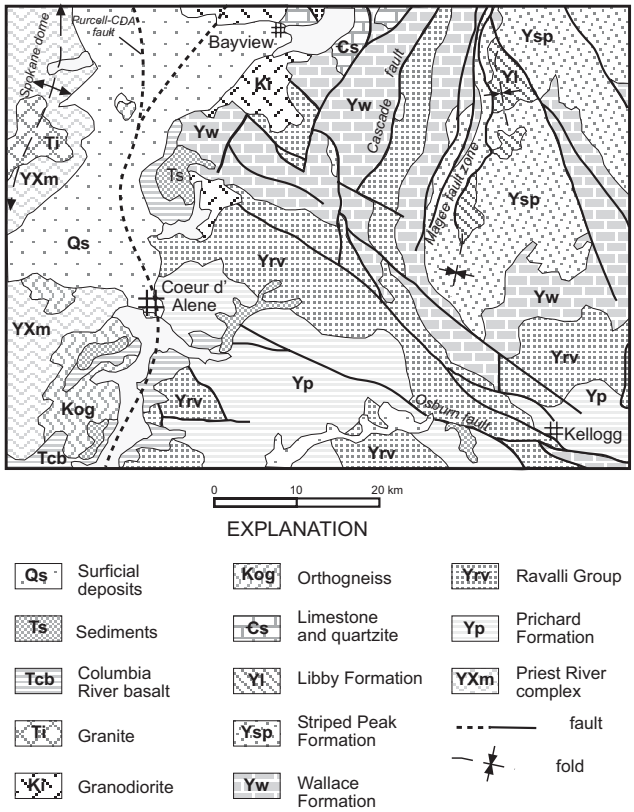


Figure 4. *Simplified geologic map of the Coeur d'Alene 30′x 60′ quadrangle.*

Red chert clasts were noted at one quartzite locality on the ridge east of Calamity Creek in the northeast corner of the map area. Below this quartzite at this locality is a 20-cm-thick ash(?) bed with no internal structure and a conchoidal fracture pattern. Base of Ysp_4 is drawn at the lowest appearance of 20- to 30-cm-thick tabular light green quartzite. Upper contact is the lowest appearance of dark gray argillite and gray siltite of *Yl*. Equivalent to uppermost Striped Peak Formation (quartzite member of Harrison and Jobin, 1963) near Clark Fork and to the Bonner Quartzite (Nelson and Dobell, 1961) present in the Missoula area (Figure 3). Thickness approximately 280 m in the northeastern part of the area.

Ysp_3—Striped Peak Formation, member three (Middle Proterozoic)—Rusty weathering, wavy laminated, dark gray siltite and dark gray to black argillite, and lesser amounts of gray to greenish gray quartzite in thin beds as much as 10-cm thick. Totally black argillite is rare. Thin, dark gray argillite chips occur sparsely within some 10-cm-thick, dark gray argillite layers. Unit is equivalent to member six of the Mount Shields Formation (Figure 3) described to the northeast in the Kalispell quadrangle (Harrison and others, 1992) and to the laminated argillite and siltite member of the Striped Peak Formation in the Clark Fork area (Harrison and Jobin, 1963). Thickness approximately 120 m in the northeastern part of the area.

Ysp_2—Striped Peak Formation, member two (Middle Proterozoic)—Tan-weathering, white stromatolitic dolomite and tan-weathering, green dolomitic siltite. The dolomitic siltite is low in the unit and grades upward from carbonate-free siltite and argillite of Ysp_1. Unit weathers recessively, forming benches. Distinctive "boxwork" weathering pattern formed by resistant, millimeter-scale-thick vertical and horizontal siliceous stringers. Algal mats typically flat, rarely as scattered, low algal domes. Rare 5- to 10-cm-thick layers of ooids. This carbonate interval is mapped as the dolomite member of the Striped Peak Formation to the north near Clark Fork (Harrison and Jobin, 1963) and as members four (green dolomitic siltite) and five (boxwork dolomite) of the Mount Shields Formation (Figure 3) to the northeast in the Kalispell quadrangle (Harrison and others, 1992). Thickness approximately 100 m in the northeastern part of the area.

Ysp_1—Striped Peak Formation, member one (Middle Proterozoic)—Pale purplish red, fine-grained, flat-laminated quartzite and green and red argillite and siltite. Equivalent to the argillite, siltite, and quartzite member of the Striped Peak Formation near Clark Fork (Harrison and Jobin, 1963) and to the lower three members of the Mount Shields Formation to the northeast (Harrison and others, 1992). Lowest part (Mt. Shields member 1 equivalent; Figure 3) is characterized by fine- to very fine-grained, pink, flat-laminated quartzite in beds 20-30 cm thick, capped by red argillite layers as much as 3 cm thick. Mudcracks, mudchips, and ripple marks common. Uncommon 20-cm-thick beds of pale green quartzite are present near the base.

Middle part (Mt. Shields member 2 equivalent) is characterized by flat-laminated 0.5- to 1.0-m-thick beds of fine- to medium-grained quartzite that form 15- to 30-m-thick cliffs with blocky talus. Diffuse brown wisps of carbonate in the quartzite average a few centimeters in thickness and 10-15 cm in length. Uppermost part of this quartzite is medium grained and distinctly coarser than all other quartzite in the area except the thin sand lags in the Ysp_4 unit. Thin red argillite drapes at the tops of the quartzite beds are commonly rippled. Mudcracks and mudchips are less common than in the underlying interval. Flat-laminated to low domal stromatolites occur both near the base and at the top of this quartzite interval. The stromatolites are interbedded with centimeter-scale-thick calcitic white quartzite and locally with layers as much as 20 cm thick of cross-stratified ooids. Salt casts increase in abundance

upward in this subunit.

Upper part of unit (Mt. Shields member 3 equivalent) is characterized by thin quartzite beds, green and red siltite and argillite, and abundant salt casts. The quartzite is most abundant in the lower part of this subunit. The upper part of the subunit contains distinctive dark green siltite beds. Quartzite in Ysp_1 contains more potassium feldspar (12-25 percent) and less plagioclase (1-15 percent) than is present to the south (Lewis and others, 2000) and southeast (Lewis, 1998). Overall thickness of Ysp_1 uncertain but about 350 m in the northeastern part of the area.

Ywu—Wallace Formation, upper member, undivided (Middle Proterozoic)—Predominantly green and dark gray siltite and argillite, but locally contains unmapped carbonate intervals equivalent to upper member two. Shown where lack of mapping or poor exposure prevents subdivision.

Ywu_3—Wallace Formation, upper member three (Middle Proterozoic)—Rusty weathering, dark gray, laminated and thinly laminated siltite and argillite. Lower part is unevenly laminated light green to white siltite with thin gray to black argillite caps. Rare, very fine-grained white quartzite containing scattered black mudchips is also present in beds as much as 20 cm thick. Above this are 5- to 10-cm-thick beds of slightly dolomitic, dark green siltite interstratified with uneven laminations and thin (< 3 cm thick) graded beds (couplets) of dark green siltite and pale green argillite identical to rock types in Ywu_2. The uppermost part of the unit is unevenly laminated dark green siltite and pale green argillite similar to lower rock types but lacking any trace of carbonate. Includes rare 10-m-thick beds of light green quartzite and green decimeter-scale-thick siltite beds. Contact with the overlying Mt. Shields Formation (Ysp_1) is the lowest occurrence of centimeter-scale-thick, very fine-grained pink quartzite with red argillite caps. Lower contact is very gradational and best placed above the highest dolomitic siltite of Ywu_2. Equivalent to the nondolomitic upper part of the Shepard Formation (Figure 3) in western Montana (Lemoine and Winston, 1986). Relationship to Clark Fork section (Harrison and Jobin, 1963) uncertain, as are the relationships of other Wallace units to the Clark Fork section. Thickness about 80 m in the northeastern part of the area.

Ywu_2—Wallace Formation, upper member two (Middle Proterozoic)—Tan- and brown-weathering, dolomitic green siltite and argillite with minor interstratified, 10- to 20-cm-thick beds of dolomitic, very fine-grained quartzite. Argillite and siltite are thinly laminated, microlaminated, and in couplets. Lower contact placed at the lowest appearance of carbonate. Uneven laminations of dark green siltite and pale green argillite at the base of unit pass upward into intervals of thicker uneven couplets of dark green siltite and pale green argillite. Weathered outcrops are distinctive brown (siltite) and tan (argillite) as dolomite content increases up section. Scattered dolomitic quartzite layers as much as 20 cm thick also are present. Bedding locally discontinuous in middle and upper parts, with thin gray limestone pods and silty and sandy ripple trains within the thicker argillites. Centimeter-wide straight cracks that penetrate bedding to 10-cm depths are associated with layers of flat rip-up pebble conglomerates as much as 5 cm thick near the middle. Upper part is uneven siltite-argillite couples (graded beds over 3 cm thick) and uneven laminations of slightly dolomitic siltite and argillite. Upper contact problematic but placed at the highest, thick dolomitic laminated unit. Equivalent to the middle and lower parts of the Shepard Formation (Figure 3) in western Montana (Lemoine and Winston, 1986). Thickness about 300 m in the northeastern part of the area.

Ywu_1—Wallace Formation, upper member one (Middle Proterozoic)—Rusty weathering green siltite and dark green and gray argillite, and subordinate pale green fine-grained quartzite. Quartzite beds as much as 5 cm thick are locally common, although not abundant. Couplets of planar-laminated dark gray argillite and green siltite are near the base of the unit. At stratigraphically higher levels, decimeter-scale-thick green siltite beds are more common. Large, straight-sided cracks, visible on bedding-plane surfaces, commonly disrupt laminations to a depth of several centimeters. These are rarely associated with mudchips and are interpreted as water-escape structures; only near the upper contact are true desiccation cracks and mudchips common. Unit is at the stratigraphic level of the Snowslip Formation (Figure 3) mapped to the northeast in Montana (Harrison and others, 1992), but the lack of red zones and the paucity of mudcracks distinguish it from the Snowslip. Thickness about 300 m in the northeastern part of the area.

Ywml—Wallace Formation, middle and lower members, undivided (Middle Proterozoic)—Calcareous and noncalcareous, very fine-grained quartzite or siltite, black argillite, and green dolomitic siltite and argillite. Shown where the lack of mapping or poor exposure prevents subdivision. Equivalent to the lower Wallace unit of Griggs (1973) and Hobbs and others (1965) as shown in Figure 3. Relationship to Clark Fork section (Harrison and Jobin, 1963) uncertain, as are relationships of other Wallace units to the Clark Fork section. Thickness highly uncertain but about 1,200 m.

Ywm—Wallace Formation, middle member (Middle Proterozoic)—Gray, calcareous, very fine-grained quartzite or siltite and black argillite and lesser amounts of

noncalcareous white quartzite. A green dolomitic siltite and argillite interval may also be present, but it was only observed east of the map area. Alternatively, the green interval might represent the upper part of the lower member. Vertical calcite ribbons, horizontal pods, and molar tooth structures are common in some siltites over 20 cm thick. White quartzite also occurs as hummocky cross-stratified planar beds 15-30 cm thick. Quartzite contains 5-13 percent potassium feldspar and approximately 15-20 percent plagioclase. Characterized by graded beds (couplets and couples) that have the pinch and swell sediment type of Winston (1986) in which scours and loads of quartzite cut or deform the tops of subjacent black argillite. Argillite caps commonly contain ptygmatically folded siltite- or quartzite-filled cracks that taper downward. On bedding plane surfaces, the cracks are generally discontinuous and sinuous, occurring as isolated "birdsfoot" cracks, short parallel cracks, or radial cracks around loads. Relatively thin interval of green, dolomitic siltite and argillite that closely resembles the lower member may be present in the lower third of the unit. Equivalent to the middle member of Wallace as mapped by Harrison and others (1986). Mapped as part of the lower Wallace by Griggs (1973). Thickness highly uncertain but about 1,000 m.

Ywl—Wallace Formation, lower member (Middle Proterozoic)—Massive green siltite and thinly laminated green siltite-argillite couplets with varied amounts of carbonate (dolomite) and recessive-weathering calcite pods. Subdivided only in a few localities. Best exposed east of the area at the mouth of Shoshone Creek, where an orange-weathering dolomitic siltite appears to be at the top of the unit. Equivalent to the lower member of Wallace as mapped by Harrison and others (1986). Thickness highly uncertain but about 200 m.

Ysr—St. Regis Formation (Middle Proterozoic)—Pale purple to gray siltite, argillite, and quartzite. Also, light green siltite and darker green argillite or dark green siltite and light green argillite couplets. Typically mudcracked, 1-cm-thick siltite-argillite couplets but with thin (2-5 cm) and rarer thick (10-20 cm), tabular, fine-grained quartzite beds with green argillite caps similar to those of the Revett Formation. Abundant mudchips. Thickness about 250 m.

Yr—Revett Formation (Middle Proterozoic)—Quartzite with siltite and argillite. Characteristically 20-cm- to rare 1-m-thick beds of fine-grained to rare medium-grained quartzite. Some vitreous; most feldspathic with orange-brown spots. Feldspar is mostly potassium feldspar in the central and eastern part of the area (12-20 percent; 3 percent plagioclase), but two samples from the southwestern part contain subequal amounts of plagioclase and potassium feldspar. Rippled tops and ripple cross lamination more common than trough cross lamination; much is flat laminated. Thickness about 600 m.

Yb—Burke Formation (Middle Proterozoic)—Siltite and quartzite. Pale green siltite in 10- to 20-cm-thick beds, typically with macroscopic magnetite octahedra and darker green argillite partings. Includes some flat-laminated, fine-grained, gray to white quartzite in scattered beds and zones. Includes hornfelsed siltite and quartzite in the South Chilco Mountain area south of Lake Pend Oreille (Griggs, 1973) that may alternatively be a downdropped block of the Striped Peak Formation. Thickness uncertain but about 1,000 m.

Yp—Prichard Formation, undivided (Middle Proterozoic)—Gray, rusty-weathering siltite and minor quartzite. Minor discontinuous carbonate layers. Rare mudcracks. Shown where the lack of mapping or poor exposure prevents subdivision. See Hobbs and others (1965), Griggs (1973), or Cressman (1989) for more detail.

Ypu—Prichard Formation, upper part (Middle Proterozoic)—Map unit of Griggs (1973) described as dark to medium gray, very thinly bedded argillite commonly interlaminated with light gray siltite and also containing some thicker siltite beds. Grades upward into an interbedded and interzoned argillite, siltite, and quartzite sequence. Upper contact placed at highest dark gray argillite by Browne (2000a), similar to mapping by Griggs (1973), but ASARCO geologists placed contact lower than these two workers (at first light-colored quartzitic interval; Larry Appelgate, written commun., 1998). Total thickness is 2,500-3,500 feet (760-1070 m) according to Griggs (1973).

Ypl—Prichard Formation, lower part (Middle Proterozoic)—Map unit of Griggs (1973) described as predominantly medium to light gray, thin- and evenly bedded siltite, and laminated in part; some argillite laminae and beds. Some beds or zones of gray to white quartzite have been subdivided locally (*Yqp* unit). Thickness according to Griggs (1973) 7,500+ feet (2,290+ m); base not exposed.

Yqp—Quartzite of the Prichard Formation (Middle Proterozoic)—Nearly white to light gray impure to pure quartzite mapped by Hobbs and others (1965) in the southeast part of the area. Individual quartzite zones probably as much as 50 m thick are discontinuous laterally.

BELT SUPERGROUP OR PRE-BELT METAMORPHIC ROCKS

High-grade (amphibolite facies) metasedimentary rocks in

the western part of the area are part of the Priest River metamorphic complex. Meta-igneous rocks to the north and northwest within this complex have U-Pb ages that range from 1,576 to 2,651 Ma, indicating a pre-Belt age (Clark, 1973; Evans and Fischer, 1986; Armstrong and others, 1987; Doughty and others, 1998). However, some may be basement upon which the sedimentary rocks were deposited rather than intrusive into the sedimentary package (Doughty and others, 1998). Thus, all or part of the complex may be younger than the intrusions and correlate with the lower part of the Belt Supergroup.

YXs—Schist of the Priest River metamorphic complex (Proterozoic)—Fine-grained garnetiferous muscovite schist. Mapped as Prichard Formation by Griggs (1973).

YXq—Quartzite of the Priest River metamorphic complex (Proterozoic)—Strongly lineated and foliated light gray to white quartzite. Contains 5 percent or less muscovite and 15 percent feldspar. Coarsely recrystallized, and resembles vein quartz. Areas of *YXq* within *Kog* are either remnants of unmelted country rock or extremely large quartz veins.

YXgn—Gneiss of the Priest River metamorphic complex (Proterozoic)—Purplish brown sillimanite-biotite gneiss. Locally schistose and includes minor amounts of quartzite and amphibolite. Layering probably inherited from sedimentary protolith. Predominant mineral assemblage is quartz, plagioclase, potassium feldspar, biotite, and sillimanite. Includes rocks mapped as the Hauser Lake gneiss of Weisenborn and Weis (1976), gneiss of Cable Peak (Weis, 1968) and metamorphic rocks, undivided (Weis, 1968). See Rhodes (1986) and Doughty and others (1998) for a more detailed description of the Hauser Lake gneiss.

BELT SUPERGROUP NOMENCLATURE

Nomenclature for Belt Supergroup units is complicated by the many formation names in northern Idaho that differ from those developed in western Montana (Figure 3). We have adopted "Idaho terminology" similar to that of Hobbs and others (1965) and Griggs (1973), with the exception of that for the lower Wallace Formation. Here, we follow the usage of Harrison and others (1986) and subdivide the lower Wallace of Hobbs and others (1965) and Griggs (1973) into informal middle and lower members. A regional stratigraphic nomenclature is currently being pursued by Don Winston and the authors. A likely outcome involves assigning formation rank to the present members of the upper Wallace Formation and carrying the easily recognized Shepard Formation west into Idaho.

GEOLOGIC HISTORY

Most of the Coeur d'Alene quadrangle is underlain by a thick sequence of fine-grained siliciclastic and carbonate-bearing clastic rocks of the Belt Supergroup (Figures 3 and 4). These rocks were deposited between about 1,470 and 1,400 Ma during the Middle Proterozoic (Anderson and Davis, 1995; Evans and others, 2000). Continental reconstructions suggest that the Belt basin was intracratonic (e.g., Moores, 1991; Dalziel, 1991; Doughty and others, 1998; Burrett and Berry, 2000); a rifting event may have triggered initial subsidence. The lower part of the Belt (Prichard Formation) was deposited in relatively deep water under anoxic conditions. Intrusion of tholeiitic magmas formed extensive sills north and east of the area (Bishop, 1973). Units above the Prichard were deposited in relatively shallow water (near or above wave base) and under more oxidizing conditions. Algal mats and sedimentary structures such as mudcracks and salt casts are well preserved in the younger Belt rocks (Winston, 1986). Protoliths for high-grade (amphibolite facies) metasedimentary rocks in the western part of the quadrangle (units *YXgn*, *YXq*, and *YXs*) may have been deposited at the same time as the Belt Supergroup. Alternatively, some or all of these units may be the basement of the Belt (see discussions by Armstrong and others, 1987; Doughty and others, 1998; and Rhodes and Hyndman, 1988).

Deformation and magmatism during the East Kootenai orogeny at about 1,300-1,350 Ma affected rocks to the north in Canada (McMechan and Price, 1982) and may have affected rocks in the study area as well. Rifting of the former continent in the Late Proterozoic led to the accumulation of sedimentary and volcanic rocks of the Windermere Group in northeastern Washington (Miller, 1994). Rocks of this age are not found in the Coeur d'Alene quadrangle, although they may have once existed. Later rifting that formed the continental margin to the west lead to the deposition of Cambrian sedimentary rocks on a regional angular unconformity (Campbell, 1959), indicating that the Belt rocks were folded or faulted during one or both of the events above. No record exists of additional sedimentation or deformation in the Paleozoic or early Mesozoic.

The region was subjected to compressional deformation during the Cretaceous Sevier Orogeny, when the Belt Supergroup was strongly folded and faulted (Fillipone and Yin, 1994; Rhodes and Hyndman, 1988). Contractional faults and a strong cleavage formed in the southeastern part of the area (Clark, 1970). At the present level of exposure, all of these faults are relatively steep (reverse). We believe these structures are related to regional thrusting in the

Cretaceous and refer to them as thrust faults regardless of present dip. An example is the Alhambra fault south of Kellogg. During this time, rocks in the western part of the area were deformed at deeper levels and acquired a foliation (S_2 of Rehrig and others, 1987) as well as a lineation defined by sillimanite.

Magmatism in the Cretaceous affected the western half of the quadrangle (Figure 4). The Hayden Lake stock and similar rocks to the north were intruded into the Belt Supergroup. These plutonic rocks lack significant fabric and presumably were emplaced at relatively shallow crustal levels or after much of the deformation in the area. Biotite K-Ar dates of 75 Ma and 83 Ma provide minimum emplacement ages. Even less certain are the ages of some of the other intrusive rock units (*TKdd*, *TKla*, *TKg*, *TYqd*). The greatest uncertainty is for quartz diorite dikes (*TYqd*) that were previously assigned to the Proterozoic and thought to represent sills in the Prichard Formation (Griggs, 1973). Some may indeed be Proterozoic, but because many tend to be discordant to bedding and are concentrated in areas of faulting, a Cretaceous or Eocene age seems more likely.

Orthogneiss southwest of Coeur d'Alene (*Kog*) formed from plutons that resided at deeper crustal levels than the Hayden Lake stock and related rocks. The Cretaceous age is suggested because chemically and mineralogically the orthogneiss more closely resembles the Na- and Ca-rich Idaho batholith than the K-rich Proterozoic orthogneiss in the region. Widespread K-Ar cooling ages of 46-52 Ma (Miller and Engels, 1975; Harms and Price, 1992; Doughty and Price, 1999) indicate that this orthogneiss and the surrounding amphibolite facies metasedimentary rocks of the Priest River metamorphic complex were brought to near-surface levels during the Eocene. The timing details and the role that the Purcell-Coeur d'Alene detachment fault played in this unroofing event are still being debated.

Most of the mylonites in the footwall of the Purcell-Coeur d'Alene fault may have formed during late Cretaceous compressional strain before the intrusion of the fine-grained biotite granite of Rathdrum Mountain (*Tbgf*) at about 52 Ma (Rhodes and Hyndman, 1984, 1988; Rhodes and others, 1989; Doughty and Price, 1999). Of the three foliations in the area, only the latest may have formed or been superimposed upon earlier fabrics during down-to-the-east faulting along the Purcell-Coeur d'Alene fault in the Eocene (Rehrig and others, 1987). The mylonitic fabric in the footwall of the fault has kinematic indicators that show top-to-the-east motion. This mylonitic fabric was later folded into the Spokane dome (Rhodes and Hyndman, 1984) contemporaneously with uplift.

Doughty and Price (1999) have suggested that there is a relatively steep normal fault within the Purcell Trench to the north that cuts the Spokane dome mylonite zone. One is likely to be present in the Coeur d'Alene area as well. We speculate that a relatively steep normal fault extends from north of Athol south through Coeur d'Alene Lake. It appears to intersect (and cut) the Purcell-Coeur d'Alene fault southeast of Round Mountain but is entirely covered by surficial deposits. Alternatively, the Purcell-Coeur d'Alene fault may extend the entire length of the map area and not be offset by a younger fault. The trace of the northern extension of the Purcell-Coeur d'Alene fault from Athol north to Sandpoint is uncertain, partly because of cover by glacial deposits and partly because the exposed bedrock is largely granitic rocks that have little or no fabric. We show the Purcell-Coeur d'Alene fault (mylonite zone) continuing due north from Round Mountain more or less where McCarthy and others (1993) suggested it might be located. Alternatively, it may continue as a steeper structure north of Athol.

Extension in the central and eastern part of the quadrangle was probably localized along north-northeast-striking faults such as the Cascade fault. Both the steep bedding and some faults in the Magee fault zone probably originated during contractional deformation, but the present configuration appears strongly dependent on down-to-the-west normal faulting. West-northwest faults such as the Osburn fault are thought to have had right-lateral strike-slip motion at this time and served to transfer the extension from the area of the Priest River metamorphic complex eastward into Montana (Sheriff and others, 1984; Rehrig and others, 1987). Movement on the Purcell-Coeur d'Alene fault had ended by Miocene time (about 16 Ma) when drainages in the area were invaded by Columbia River basalt. No offset of basalt is apparent across the fault. The Columbia River basalt disrupted drainages in the area and established a new base level. Drainage systems that previously had transported sediment out of the area now deposited their sediment at the margins of the basalt flows, or upstream from them. These sediments (*Ts*) are widespread in the region south of the map area.

During the Pleistocene, a lobe of the Cordilleran ice sheet moved south down the Purcell Trench from Canada into northern Idaho. Glacial Lake Missoula was formed when this lobe blocked the Clark Fork drainage near its mouth into Lake Pend Oreille. At its maximum, the lake was over 610 m (2,000 feet) deep against the ice dam. Repeated failures and re-formations of the Clark Fork ice dams resulted in catastrophic outbursts of as much as 2,000 cubic km (500 cubic miles) of water flowing across northern Idaho and into the Channeled Scabland of Washington (Waitt,

1985). The main path of the floods was from the southern end of Lake Pend Oreille across Rathdrum Prairie and through the Spokane Valley. The enormous energy of the flood water transported coarse boulder gravel downstream. This gravel forms the Rathdrum-Spokane aquifer, which is the sole source of ground water for the area's urban and rural population. The largest of the floods would have removed evidence of earlier flood events, so only the physical record for the late Wisconsin floods and ice advances remains. Similar floods, however, likely recurred in earlier Pleistocene glaciations. Remnants of the oldest recognized gravel form high expansion flood bars at Spirit Lake (*Qgslo*, *Qgsly*) and at Ross Point (*Qgrp*). Pendant bars formed behind bedrock obstructions at Round Mountain (*Qgtl*), and eddy bars dammed the side valleys (*Qdg*). Lakes bordering the Purcell Trench (Spirit, Twin, Hayden, Coeur d'Alene, Fernan, Hauser, and Newman) formed behind bars of flood gravel deposited at the mouths of valleys (Breckenridge, 1989). Younger gravel units mapped in the Rathdrum Prairie formed gravel sheets and fans and resulted from younger and smaller floods after the late Wisconsin maximum, about 18,000 years ago. The Mount St. Helens set S tephra of approximately 13,000 years ago is associated with late flood deposits, and the last flood is immediately postdated by the Glacier Peak ashes B and G (about 11,200 years ago; Kiver and others, 1991). Small alpine glaciers postdate the Cordilleran ice retreat in the high elevations of the Selkirk and Cabinet Mountains north of the map area. Eolian deposits of silt, the loess of the Palouse Formation (*Qp*), accumulated on the Columbia Plateau throughout the Quaternary to the present and were mainly a result of ice age erosion and winds (Busacca, 1991).

GEOCHEMISTRY

Over ninety samples from the Coeur d'Alene quadrangle were analyzed by X-ray fluorescence (XRF) methods for major and trace element concentrations at Washington State University as part of this study and other related STATEMAP projects. Results for igneous intrusive rocks are presented in Table 1; those for metasedimentary rocks are in Table 2, and those for basalts are in Table 3. Sample locations are shown on the map, and their latitude and longitude are listed in the tables. Also reported here are two samples outside the map area: one, a garnet-muscovite schist from an exposure just south of the quadrangle along the west side of Coeur d'Alene Lake (99RL244); and the other, an augen gneiss of Laclede (99RL262), a Proterozoic igneous rock within the Priest River complex, but from north of the area.

The two analyzed samples from the fine-grained biotite granite unit (*Tbgf*) have significantly different chemical compositions (Table 1). Sample 99RL202 from a pluton on the northwest side of Spirit Lake has a lower SiO_2 content (68 versus 74 percent) and a lower K_2O content (3.7 versus 5.2 percent) than sample 99RL256 collected from a larger pluton extending west from Rathdrum Mountain. The pluton at Rathdrum Mountain has K_2O well in excess of Na_2O and Rb in excess of Sr, characteristics common to epizonal Eocene granite plutons in central Idaho (Lewis and Kiilsgaard, 1991). Although the pluton at Rathdrum Mountain lacks miarolitic cavities that characterize the epizonal granite, it may be similar in age and origin but was emplaced at deeper levels than those in central Idaho. A sample collected from the Beauty Creek stock (unit *TKg*, sample 99RL281) is similar in composition to the pluton of *Tbgf* on the northwest side of Spirit Lake. Both have K_2O/Na_2O ratios of 1.1 to 1.3, and SiO_2 contents in the 68-69 percent range.

Samples of biotite granodiorite from the Hayden Lake stock and the hornblende-biotite granodiorite north of Hayden Lake (units *Kbgd* and *Khgd*) have similar major element concentrations (compare 99RL208, 99RL257, and 99RL258). Most trace element concentrations are also similar. However, the sample from the Hayden Lake stock contains considerably more Sr than samples from the hornblende-bearing unit (708 ppm versus 297 and 348 ppm). Biotite K-Ar ages on the two rock units of 83.8 and 74.6 Ma (recalculated from Miller and Engels, 1975) suggest two episodes of magmatism. All three samples have K_2O in excess of Na_2O. In this regard, they are unlike the bulk of the Idaho batholith, which is relatively sodic. The higher K_2O contents and the presence of euhedral biotite books are similar to some of the satellite plutons southeast of the southern lobe of the Idaho batholith (Lewis and others, 1987; Lewis, 1989, 1990) as well as the potassic series of the Boulder batholith of Montana (Tilling, 1973).

Craig Wavra and Rolland Reid analyzed thirteen samples of "deep igneous rocks" (our orthogneiss unit, *Kog*) from southwest of Coeur d'Alene that they described as granite gneiss, granodiorite gneiss, and tonalite gneiss (Rolland Reid, written commun., 1998). These rocks have a moderate SiO_2 range from 69 to 76 percent and a wider K_2O range from 2.8 to 5.9 percent. One anomalous analysis with 83 percent SiO_2 and only 1.2 percent K_2O we attribute to contamination by quartzite. Two samples of diorite gneiss from the same area have SiO_2 contents of 55-57 percent. K_2O exceeds Na_2O in ten of the samples, and Rb exceeds Sr in three samples. The four orthogneiss samples we analyzed (Table 1) have compositions that are within the range found by Wavra and Reid.

Chemical compositions of argillite-siltite from different formations of the Belt Supergroup (Table 2) largely overlap,

a result consistent with those of previous workers (e.g., Harrison and Grimes, 1970; Harrison and Hamilton, 1971). Concentrations of Sr are higher in the siltite-argillite and siltite samples of the Prichard Formation (111 and 76 ppm) relative to other noncarbonate-bearing siltite or argillite samples in the Belt (58 ppm or less). This distinction was originally noted by Jack Harrison (written commun., 1991). Copper concentrations are 44 ppm or less in all samples, with the exception of 99RL251, an argillite-siltite from the lower part of the Libby Formation that contains 148 ppm Cu. Zinc concentrations exceed 100 ppm in only two samples (99RL279 and 98RL052), both from the Prichard Formation. Concentrations of K_2O are highest (greater than 4 percent) in the argillite-siltite samples from the Prichard, St. Regis, lower Wallace, and Striped Peak Formations. K_2O content of siltite-argillite in the middle and upper members of the Wallace and in the Libby Formation ranges more widely (2.6 to 5.4 percent K_2O). Carbonate-bearing samples have low total oxides because CO_2 was not analyzed. These carbonate-bearing rocks also have low K_2O concentrations (0.8-3.8 percent) relative to the noncarbonate rocks and, as expected, high CaO concentrations. Quartzite samples have lower K_2O concentrations (1.4 to 3.8 percent) as a result of the high quartz sand content in these rocks. Sample 98RL176 is from the "lower green marker" in the Sunshine Mine and has an unusually high silica content (80.35%).

Seven samples of metasedimentary gneiss and schist from the Priest River metamorphic complex (units *YXgn* and *YXs*) have an expected moderate range in chemical composition. The most schistose sample (99RL244) also has the lowest SiO_2 content (62 percent) and the highest Al_2O_3 content (23 percent). This sample is from just south of the map area. Metasedimentary rocks from the Priest River metamorphic complex are compositionally similar in many respects to the Belt Supergroup. However, they typically have higher Sr concentrations (all but one sample exceed 143 ppm). This may be a metamorphic effect, as Sr is known to increase with increasing metamorphic grade in this region (Harrison and Hamilton, 1971). Alternatively, all or some of the metasedimentary rocks of the Priest River complex may predate the Belt Supergroup, as discussed in the previous section. All of the analyses of Columbia River basalt (Table 3) match well with previously published results (Griggs, 1978; Swanson and others, 1979b; Wright and others, 1973, 1979, 1980). Significant differences exist in both major and trace element contents of the different units, but variations within the units are small. One important result was from an analysis of samples collected on Mica Flat southwest of Coeur d'Alene. These samples are from a previously unknown flow with a chemical composition unlike that of the underlying Priest Rapids member.

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Table 1. XRF analyses of intrusive rocks from the Coeur d'Alene 30' x 60' quadrangle. Sample without map number is from northwest of the area near Priest River.

Map no.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Sample no.	99RL202	99RL256	99RL281	99RL208	99RL257	99RL258	99RL207	99RL246
Mineralogy	biotite	biotite	biotite	biotite	hornblende-biotite	hornblende-biotite	hornblende-biotite	
Lithology	**granite**	**granite**	**granite**	**granodiorite**	**granodiorite**	**granodiorite**	**quartz diorite**	**orthogneiss**
Form	pluton	pluton	stock	stock	pluton	pluton	pluton	pluton
Unit	Tbgf	Tbgf	TKg	Kbgd	Khgd	Khgd	Kqd	Kog
30' x 60' quad.	Coeur d'Alene	Coeur d'Alene	Coeur d'Alene	Coeur d'Alene	Coeur d'Alene	Coeur d'Alene	Coeur d'Alene	Coeur d'Alene
7.5' quad.	Spirit Lake W.	Rathdrum	Mt. Coeur d'Alene	Hayden Lake	Athol	Bayview	Spades Mtn.	Mica Bay
Lat.	47.943521	47.840934	47.601721	47.757873	47.920039	47.918792	47.870128	47.555151
Long.	-116.922807	-116.964141	-116.660813	-116.679304	-116.698476	-116.621699	-116.573267	-116.816263
				Unnormalized results (weight %)				
SiO_2	68.07	74.36	69.56	65.40	66.85	64.66	55.39	65.12
Al_2O_3	15.74	14.07	15.25	16.17	15.16	15.62	16.97	17.24
TiO_2	0.621	0.126	0.467	0.664	0.529	0.673	1.363	0.456
FeO*	3.57	1.27	2.67	4.50	3.85	4.87	8.79	3.67
MnO	0.050	0.039	0.054	0.095	0.079	0.095	0.143	0.099
CaO	2.75	1.07	2.31	4.46	3.90	4.36	8.00	3.86
MgO	1.07	0.29	1.17	1.67	1.54	2.03	4.77	0.94
K_2O	3.68	5.17	4.45	3.68	3.93	3.83	1.77	4.21
Na_2O	3.40	3.10	3.47	2.46	2.72	2.57	1.44	3.42
P_2O_5	0.200	0.049	0.165	0.256	0.159	0.192	0.335	0.189
Total	99.15	99.54	99.57	99.35	98.72	98.90	98.97	99.20
LOI	--	--	--	--	--	--	--	--
				Normalized results (weight %)				
SiO_2	68.66	74.70	69.86	65.83	67.72	65.38	55.97	65.64
Al_2O_3	15.88	14.13	15.32	16.28	15.36	15.79	17.15	17.38
TiO_2	0.626	0.127	0.469	0.668	0.536	0.681	1.377	0.460
FeO*	3.60	1.28	2.68	4.53	3.90	4.92	8.88	3.70
MnO	0.050	0.039	0.054	0.096	0.080	0.096	0.144	0.100
CaO	2.77	1.07	2.32	4.49	3.95	4.41	8.08	3.89
MgO	1.08	0.29	1.18	1.68	1.56	2.05	4.82	0.95
K_2O	3.71	5.19	4.47	3.70	3.98	3.87	1.79	4.24
Na_2O	3.43	3.11	3.49	2.48	2.76	2.60	1.46	3.45
P_2O_5	0.202	0.049	0.166	0.258	0.161	0.194	0.339	0.191
				Trace elements (ppm)				
Ni	4	4	10	4	1	4	6	6
Cr	6	0	23	3	16	27	113	11
Sc	14	12	9	21	18	18	39	15
V	45	9	39	102	69	92	217	83
Ba	2054	773	904	882	634	845	629	1059
Rb	88	167	180	132	174	178	70	98
Sr	605	140	472	708	297	348	369	1280
Zr	261	113	218	210	147	169	164	206
Y	19	24	23	33	21	27	33	28
Nb	12.1	14.6	17.6	18.4	12.6	14.4	16.6	14.1
Ga	18	17	17	21	16	19	22	21
Cu	3	2	2	5	7	8	12	12
Zn	56	29	43	54	51	60	84	131
Pb	14	30	28	15	33	28	9	27
La	79	38	35	51	8	33	28	40
Ce	103	74	89	79	28	56	55	85
Th	12	16	18	12	7	10	5	13

Major elements normalized on a volatile-free basis; FeO is total Fe expressed as FeO; LOI is loss on ignition.
"†" denotes values > 120% of highest standard in lab.

Table 1. XRF analyses of intrusive rocks from the Coeur d'Alene 30' x 60' quadrangle (continued).

	9	**10**	**11**	**12**	
Sample no.	99RL299	98TF807	98TF806B	98TF806A	99RL262
Mineralogy		biotite	hornblende-plagioclase		biotite
Lithology	orthogneiss	orthogneiss	orthogneiss	amphibolite	augen gneiss
Form	pluton	pluton	sill	sill	pluton
Unit	Kog	Kog	Kog	KYam	Yag
30' x 60' quad.	Coeur d'Alene	Coeur d'Alene	Coeur d'Alene	Coeur d'Alene	Sandpoint
7.5' quad.	Rockford Bay	Rockford Bay	Rockford Bay	Rockford Bay	Laclede
Lat.	47.579986	47.58002	47.60413	47.60413	48.156111
Long.	-116.897718	-116.89739	-116.88085	-116.88085	-116.795833
		Unnormalized results (weight %)			
SiO_2	71.06	69.81	61.91	51.28	71.85
Al_2O_3	15.65	15.97	19.05	13.61	14.10
TiO_2	0.215	0.292	0.366	1.597	0.373
FeO*	2.11	2.57	5.00	14.18	2.26
MnO	0.036	0.042	0.083	0.251	0.046
CaO	2.68	2.82	5.45	8.57	1.52
MgO	0.71	0.84	1.69	4.79	0.60
K_2O	2.59	2.70	1.19	0.97	5.21
Na_2O	4.52	4.53	4.66	2.17	3.24
P_2O_5	0.061	0.086	0.160	0.140	0.139
Total	99.63	99.66	99.56	97.56	99.34
LOI	--	0.35	1.86	1.69	--
		Normalized results (weight %)			
SiO_2	71.32	70.05	62.18	52.56	72.33
Al_2O_3	15.71	16.02	19.13	13.95	14.19
TiO_2	0.216	0.293	0.368	1.637	0.375
FeO*	2.12	2.58	5.03	14.53	2.27
MnO	0.036	0.042	0.083	†0.26	0.046
CaO	2.69	2.83	5.47	8.78	1.53
MgO	0.71	0.84	1.70	4.91	0.60
K_2O	2.60	2.71	1.20	0.99	5.24
Na_2O	4.54	4.55	4.68	2.22	3.26
P_2O_5	0.061	0.086	0.161	0.144	0.140
		Trace elements (ppm)			
Ni	6	1	5	13	5
Cr	2	5	9	34	0
Sc	10	7	17	†53	6
V	24	28	46	367	27
Ba	962	782	675	192	1334
Rb	56	65	25	9	145
Sr	411	385	693	126	382
Zr	134	126	132	85	234
Y	6	6	14	32	17
Nb	9.3	7.3	6.1	8.1	20.1
Ga	17	18	20	19	16
Cu	6	1	14	13	6
Zn	27	30	54	141	36
Pb	11	9	10	4	28
La	35	21	20	8	94
Ce	39	41	43	0	149
Th	4	2	20	13	27

Major elements normalized on a volatile-free basis; FeO is total Fe expressed as FeO; LOI is loss on ignition. "†" denotes values > 120% of highest standard in lab.

Table 2. XRF analyses of metasedimentary rocks from the Coeur d'Alene 30' x 60' quadrangle. Sample without map number (99RL244) is from just south of the area along the west shore of Coeur d'Alene Lake.

Map no.	**13**	**14**	**15**	**16**	**17**	**18**		**19**
Sample no.	99RL201	99RL252	99RL274	99RL275	99RL278	99RL301	99RL244	99RL279
Color								gray
Mineralogy	sillimanite-biotite	sillimanite-biotite	sillimanite-biotite	sillimanite-biotite	sillimanite-biotite	sillimanite-biotite	garnet-muscovite	sulfide-rich
Lithology	schist	gneiss	gneiss	gneiss	gneiss	gneiss	schist	siltite-argillite
Form	layer	layer	layer	layer	layer	layer	layer	bed
Formation								Prichard
Member								lower
Unit	YXgn	YXgn	YXgn	YXgn	YXgn	YXgn	YXs	Ypl
7.5' quad.	Spirit Lake E.	Rockford Bay	Rockford Bay	Post Falls	Coeur d'Alene	Post Falls	Harrison	Mt. Coeur d'Alene
Lat.	47.957538	47.5197	47.622179	47.656482	47.68791	47.693625	47.4375	47.606983
Long.	-116.873545	-116.977488	-116.987625	-116.967448	-116.865475	-116.990134	-116.797777	-116.686793
				Unnormalized results (weight %)				
SiO_2	69.14	71.56	75.60	67.78	71.73	72.09	61.70	61.06
Al_2O_3	19.07	15.09	14.28	17.94	14.30	14.07	22.82	20.26
TiO_2	0.981	0.676	0.683	0.918	0.675	0.566	1.097	0.796
FeO*	4.62	3.72	2.78	5.36	5.18	3.45	4.96	6.52
MnO	0.046	0.033	0.025	0.039	0.029	0.042	0.075	0.085
CaO	0.19	1.04	0.42	0.38	0.75	0.87	0.12	0.70
MgO	1.09	1.38	1.11	1.39	1.01	1.14	0.79	1.98
K_2O	2.54	3.34	3.57	4.27	3.26	4.71	5.61	5.06
Na_2O	0.45	1.93	1.10	0.85	2.03	2.08	0.62	1.73
P_2O_5	0.025	0.052	0.037	0.043	0.053	0.054	0.046	0.078
Total	98.15	98.83	99.60	98.97	99.02	99.08	97.84	98.27
				Normalized results (weight %)				
SiO_2	70.44	72.41	75.90	68.49	72.44	72.76	63.06	62.14
Al_2O_3	19.43	15.27	14.34	18.13	14.44	14.20	23.32	20.62
TiO_2	0.999	0.684	0.686	0.928	0.682	0.571	1.121	0.810
FeO*	4.71	3.77	2.79	5.41	5.23	3.49	5.07	6.63
MnO	0.047	0.033	0.025	0.039	0.029	0.042	0.077	0.086
CaO	0.19	1.05	0.42	0.38	0.76	0.88	0.12	0.71
MgO	1.11	1.40	1.11	1.40	1.02	1.15	0.81	2.01
K_2O	2.59	3.38	3.58	4.31	3.29	4.75	5.73	5.15
Na_2O	0.46	1.95	1.10	0.86	2.05	2.10	0.63	1.76
P_2O_5	0.025	0.053	0.037	0.043	0.054	0.055	0.047	0.079
				Trace elements (ppm)				
Ni	9	5	7	4	10	13	30	29
Cr	71	42	39	60	37	32	108	68
Sc	24	13	16	18	13	14	28	25
V	107	70	61	111	67	59	108	98
Ba	482	902	1198	1409	572	1103	824	895
Rb	127	146	140	164	175	196	180	254
Sr	59	150	203	223	143	182	79	111
Zr	307	265	306	307	298	268	269	225
Y	44	41	36	40	35	31	144	50
Nb	33.0	14.9	16.4	17.8	15.5	16.7	22.1	17.5
Ga	27	20	19	22	19	16	26	24
Cu	5	15	5	29	18	11	1	31
Zn	75	67	62	71	91	80	89	117
Pb	4	19	10	6	13	36	34	30
La	27	47	58	62	58	38	151	68
Ce	75	96	113	130	104	88	118	111
Th	13	15	15	24	17	10	23	19

Major elements normalized on a volatile-free basis; FeO is total Fe expressed as FeO
"†" denotes values > 120% of highest standard in lab.

Table 2. XRF analyses of metasedimentary rocks from the Coeur d'Alene 30' x 60' quadrangle (continued).

Map no.	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**
Sample no.	98RL052	99RL250	99RL290	99RL218	99RL280	99RL217	99RL289	98RL176
Color			light gray	light gray	light gray	purple	purple	green
Mineralogy								
Lithology	siltite	siltite	quartzite	quartzite	quartzite	siltite-argillite	siltite-argillite	argillite
Form	bed	bed	bed	bed	bed	bed	bed	bed
Formation	Prichard	Burke	Burke	Revett	Revett	St. Regis	St. Regis	St. Regis
Member	lower							(lower marker)
Unit	Ypl	Yb	Yb	Yr	Yr	Ysr	Ysr	Ysr
7.5' quad.	Lane	Carlin Bay	Cataldo	Lamb Peak	Mt. Coeur d'Alene	Lamb Peak	Kellogg West	Kellogg East
Lat.	47.520017	47.538143	47.576756	47.812433	47.576593	47.810453	47.618272	47.50139
Long.	-116.51493	-116.78136	-116.252755	-116.372503	-116.730963	-116.368252	-116.209661	-116.07000
				Unnormalized results (weight %)				
SiO_2	66.22	76.08	90.78	92.91	82.04	65.79	66.93	80.35
Al_2O_3	17.18	13.66	4.95	4.36	10.37	17.65	16.09	12.46
TiO_2	0.744	0.530	0.115	0.167	0.319	0.554	0.590	0.214
FeO*	4.29	2.35	0.70	0.20	1.49	5.25	4.70	1.36
MnO	0.130	0.002	0.003	0.000	0.006	0.017	0.014	0.001
CaO	0.41	0.05	0.06	0.01	0.17	0.14	0.33	0.09
MgO	2.20	0.60	0.19	0.03	0.38	1.67	2.67	0.32
K_2O	4.46	3.83	1.35	1.71	2.67	6.31	5.37	4.08
Na_2O	1.83	2.14	1.60	0.11	2.41	1.11	1.27	0.10
P_2O_5	0.106	0.020	0.026	0.014	0.051	0.088	0.155	0.044
Total	97.57	99.27	99.77	99.52	99.90	98.58	98.12	99.02
				Normalized results (weight %)				
SiO_2	67.87	76.64	90.99	93.36	82.12	66.74	68.22	81.15
Al_2O_3	17.61	13.76	4.96	4.38	10.38	17.90	16.40	12.58
TiO_2	0.763	0.534	0.115	0.168	0.319	0.562	0.601	0.216
FeO*	4.40	2.37	0.70	0.20	1.49	5.32	4.79	1.37
MnO	0.133	0.002	0.003	0.000	0.006	0.017	0.014	0.001
CaO	0.42	0.05	0.06	0.01	0.17	0.14	0.34	0.09
MgO	2.25	0.60	0.19	0.03	0.38	1.69	2.72	0.32
K_2O	4.57	3.86	1.35	1.72	2.67	6.40	5.47	4.12
Na_2O	1.88	2.16	1.60	0.11	2.41	1.13	1.29	0.10
P_2O_5	0.109	0.020	0.026	0.014	0.051	0.089	0.158	0.044
				Trace elements (ppm)				
Ni	25	13	6	6	6	24	24	8
Cr	56	31	4	7	25	43	36	6
Sc	20	10	2	11	13	19	14	5
V	88	44	9	9	21	84	58	16
Ba	829	768	216	198	495	854	1064	289
Rb	184	176	41	55	103	285	239	179
Sr	76	57	21	7	86	25	33	4
Zr	251	223	154	422	189	195	228	145
Y	45	38	20	17	28	43	43	25
Nb	17.7	15.3	4.8	6.3	9.2	15.7	13.9	12.9
Ga	22	16	5	5	9	24	22	12
Cu	27	13	2	9	1	2	1	1
Zn	137	55	2	0	17	89	72	6
Pb	15	9	3	3	6	2	3	0
La	53	39	19	23	7	51	44	28
Ce	94	82	49	68	59	102	101	69
Th	15	11	5	7	10	15	13	10

Major elements normalized on a volatile-free basis; FeO is total Fe expressed as FeO
"†" denotes values > 120% of highest standard in lab.

Table 2. XRF analyses of metasedimentary rocks from the Coeur d'Alene 30' x 60' quadrangle (continued).

Map no.	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**
Sample no.	99RL216	99RL215	99RL285	99RL288	99RL220	99RL223	99RL287	99RL226
Color	green	light gray	gray	gray	gray	gray	green	green
Mineralogy		calcareous	carbonate-bearing	carbonate-bearing				dolomitic
Lithology	siltite-argillite	quartzite	quartzite	siltite	siltite-argillite	argillite-siltite	siltite-argillite	siltite-argillite
Form	bed	bed	bed	bed	bed	bed	bed	bed
Formation	Wallace	Wallace	Wallace	Wallace	Wallace	Wallace	Wallace	Wallace
Member	lower	middle	middle/lower	middle/lower	upper	upper one	upper one	upper two
Unit	Ywl	Ywm	Ywml	Ywml	Ywu	Ywu_1	Ywu_1	Ywu_2
7.5' quad.	Lamb Peak	Lamb Peak	Grizzly Mtn.	Kellogg West	Cataract Peak	Pond Peak	Pond Peak	Pond Peak
Lat.	47.80839	47.808874	47.73797	47.622968	47.847385	47.7627	47.780657	47.792518
Long.	-116.359267	-116.356737	-116.003272	-116.195062	-116.499577	-116.058304	-116.001308	-116.00243
				Unnormalized results (weight %)				
SiO_2	67.07	80.66	67.20	35.76	76.52	73.70	66.21	59.07
Al_2O_3	17.23	6.85	6.78	8.49	11.94	13.48	17.43	12.88
TiO_2	0.587	0.248	0.282	0.348	0.523	0.624	0.764	0.540
FeO*	3.41	0.30	1.08	5.02	3.47	3.21	4.95	3.97
MnO	0.003	0.019	0.032	0.215	0.009	0.018	0.029	0.114
CaO	0.13	5.53	13.48	19.61	0.14	0.13	0.30	6.21
MgO	3.55	0.11	1.50	13.10	1.78	1.92	1.95	6.71
K_2O	4.21	0.93	1.86	2.51	2.93	3.73	4.45	3.78
Na_2O	1.93	2.81	1.80	0.88	1.63	1.67	1.66	0.84
P_2O_5	0.086	0.040	0.048	0.077	0.085	0.089	0.129	0.097
Total	98.20	97.50	94.06	86.01	99.02	98.58	97.87	94.21
				Normalized results (weight %)				
SiO_2	68.30	82.73	71.45	41.58	77.27	74.77	67.65	62.70
Al_2O_3	17.55	7.03	7.21	9.87	12.06	13.67	17.81	13.67
TiO_2	0.598	0.254	0.300	0.405	0.528	0.633	0.781	0.573
FeO*	3.47	0.31	1.14	5.84	3.50	3.26	5.06	4.21
MnO	0.003	0.019	0.034	0.250	0.009	0.018	0.030	0.121
CaO	0.13	5.67	14.33	†22.80	0.14	0.13	0.31	6.59
MgO	3.61	0.11	1.59	15.23	1.80	1.95	1.99	7.12
K_2O	4.29	0.95	1.98	2.92	2.96	3.78	4.55	4.01
Na_2O	1.97	2.88	1.91	1.02	1.65	1.69	1.70	0.89
P_2O_5	0.088	0.041	0.051	0.090	0.086	0.090	0.132	0.103
				Trace elements (ppm)				
Ni	22	5	1	7	20	17	19	22
Cr	51	13	12	22	35	46	57	48
Sc	18	12	5	0	13	16	25	19
V	71	19	19	51	52	59	101	82
Ba	932	216	362	969	437	668	910	871
Rb	190	33	62	136	114	147	195	153
Sr	20	94	133	187	34	37	53	76
Zr	189	159	306	125	318	384	285	167
Y	46	22	23	47	39	36	47	34
Nb	16.4	8.0	9.8	12.0	13.4	14.9	19.4	12.5
Ga	22	7	8	16	13	17	23	15
Cu	2	44	2	0	38	13	6	15
Zn	51	15	15	48	37	70	66	42
Pb	0	9	20	5	8	12	5	15
La	44	12	10	48	46	41	52	39
Ce	89	55	62	55	99	76	72	58
Th	15	5	9	11	12	15	15	13

Major elements normalized on a volatile-free basis; FeO is total Fe expressed as FeO
"†" denotes values > 120% of highest standard in lab.

Table 2. XRF analyses of metasedimentary rocks from the Coeur d'Alene 30' x 60' quadrangle (continued).

Map no.	**36**	**37**	**38**	**39**	**40**	**41**	**42**	**43**
Sample no.	99RL283	99RL224	99MDM048	99MDM031	99RL228	99RL229	99RL282	99RL221
Color	gray-green	dark gray	green	purple	pink	light gray		dark gray
Mineralogy	dolomitic							
Lithology	siltite-argillite	argillite-siltite	siltite	quartzite	quartzite	dolomite	dolomite	siltite-argillite
Form	bed	bed	bed	bed	bed	bed	bed	bed
Formation	Wallace	Wallace	Striped Peak	Striped Peak	Striped Peak	Striped Peak	Striped Peak	Striped Peak
Member	upper two	upper three	one	one	one	two	two	three
Unit	Ywu_2	Ywu_3	Ysp_1	Ysp_1	Ysp_1	Ysp_2	Ysp_2	Ysp_3
7.5' quad.	Jordan Creek	Pond Peak	Cathedral Peak	Pond Peak	Cathedral Peak	Jordan Creek	Pond Peak	Spyglass Peak
Lat.	47.878251	47.759684	47.958224	47.850574	47.99894	47.947386	47.809899	47.798196
Long.	-116.121964	-116.104522	-116.144345	-116.113326	-116.193074	-116.121284	-116.122981	-116.203191
				Unnormalized results (weight %)				
SiO_2	66.20	66.69	72.11	78.48	90.90	24.89	19.07	68.51
Al_2O_3	14.53	17.09	11.51	6.74	5.06	3.38	3.41	16.72
TiO_2	0.602	0.794	1.044	0.179	0.128	0.255	0.194	0.746
FeO*	4.05	4.87	3.56	1.98	0.62	1.68	1.64	3.35
MnO	0.037	0.009	0.014	0.051	0.001	0.153	0.209	0.005
CaO	1.76	0.13	0.54	2.80	0.01	29.55	32.57	0.04
MgO	4.22	2.10	3.93	3.30	0.26	19.15	20.13	2.45
K_2O	4.25	5.35	4.34	3.28	2.74	1.24	0.83	4.65
Na_2O	1.32	0.67	0.91	0.36	0.06	0.20	0.56	1.32
P_2O_5	0.121	0.124	0.335	0.055	0.018	0.081	0.078	0.075
Total	97.09	97.83	98.29	97.22	99.79	80.58	78.69	97.86
				Normalized results (weight %)				
SiO_2	68.18	68.17	73.36	80.72	91.09	30.89	24.23	70.01
Al_2O_3	14.97	17.47	11.71	6.93	5.07	4.19	4.33	17.08
TiO_2	0.620	0.812	1.062	0.184	0.128	0.316	0.247	0.762
FeO*	4.17	4.98	3.62	2.03	0.62	2.09	2.09	3.42
MnO	0.038	0.009	0.014	0.052	0.001	0.190	†0.27	0.005
CaO	1.81	0.13	0.55	2.88	0.01	†36.67	†41.39	0.04
MgO	4.35	2.15	4.00	3.39	0.26	23.76	25.58	2.50
K_2O	4.38	5.47	4.42	3.37	2.75	1.54	1.05	4.75
Na_2O	1.36	0.68	0.93	0.37	0.06	0.25	0.71	1.35
P_2O_5	0.125	0.127	0.341	0.057	0.018	0.101	0.099	0.077
				Trace elements (ppm)				
Ni	27	21	38	14	9	0	0	15
Cr	55	76	80	14	7	14	14	62
Sc	16	27	12	10	0	0	0	18
V	80	98	56	26	12	34	21	88
Ba	991	979	456	795	267	101	176	469
Rb	170	202	107	81	62	46	40	205
Sr	46	31	36	64	12	59	76	40
Zr	198	317	919	213	145	266	191	315
Y	30	38	66	22	13	19	25	35
Nb	15.8	18.5	22.5	6.4	5.0	6.9	4.7	17.9
Ga	18	21	13	10	4	7	5	23
Cu	4	31	9	1	3	4	2	14
Zn	41	38	80	22	4	18	14	20
Pb	6	12	7	3	0	8	2	33
La	39	22	72	21	0	22	17	62
Ce	73	34	156	40	17	56	59	121
Th	15	18	26	3	5	11	6	14

Major elements normalized on a volatile-free basis; FeO is total Fe expressed as FeO
"†" denotes values > 120% of highest standard in lab.

Table 2. XRF analyses of metasedimentary rocks from the Coeur d'Alene 30' x 60' quadrangle (continued).

Map no.	**44**	**45**	**46**	**47**	**48**
Sample no.	99RL227	99RL238	99RL230	99RL233	99RL251
Color	red	green	green	greenish gray	black
Mineralogy					
Lithology	quartzite	siltite	siltite	siltite-argilliite	argillite-siltite
Form	bed	bed	bed	bed	bed
Formation	Striped Peak	Striped Peak	Libby	Libby	Libby
Member	four	four			
Unit	Ysp_4	Ysp_4	Yl	Yl	Yl
7.5' quad.	Cathedral Peak	Jordan Creek	Cathedral Peak	Cathedral Peak	Bumblebee Mtn.
Lat.	47.985867	47.898057	47.926448	47.932536	47.748803
Long.	-116.172226	-116.03437	-116.190461	-116.18903	-116.274757
			Unnormalized results (weight %)		
SiO_2	85.04	66.76	71.05	72.26	67.08
Al_2O_3	8.60	18.34	14.39	12.03	19.22
TiO_2	0.253	0.704	0.533	0.410	0.690
FeO*	1.44	3.24	3.63	3.03	3.86
MnO	0.003	0.015	0.020	0.076	0.017
CaO	0.08	0.15	0.29	3.00	0.09
MgO	0.41	2.32	2.78	1.92	0.84
K_2O	1.68	5.05	3.10	2.63	5.15
Na_2O	1.72	1.49	2.31	1.67	1.25
P_2O_5	0.048	0.068	0.082	0.077	0.075
Total	99.27	98.13	98.18	97.10	98.27
			Normalized results (weight %)		
SiO_2	85.66	68.03	72.37	74.42	68.26
Al_2O_3	8.66	18.69	14.66	12.39	19.56
TiO_2	0.255	0.717	0.543	0.422	0.702
FeO*	1.45	3.30	3.69	3.12	3.92
MnO	0.003	0.015	0.020	0.078	0.017
CaO	0.08	0.15	0.30	3.09	0.09
MgO	0.41	2.36	2.83	1.98	0.85
K_2O	1.69	5.15	3.16	2.71	5.24
Na_2O	1.73	1.52	2.35	1.72	1.27
P_2O_5	0.048	0.069	0.084	0.079	0.076
			Trace elements (ppm)		
Ni	13	29	18	17	25
Cr	12	65	32	28	54
Sc	11	19	13	14	21
V	30	98	63	43	79
Ba	86	827	795	1148	546
Rb	67	225	140	126	202
Sr	20	35	58	57	28
Zr	266	217	199	178	246
Y	17	24	31	46	56
Nb	7.4	16.4	13.6	11.9	17.0
Ga	8	22	19	16	21
Cu	3	0	4	3	148
Zn	10	35	61	32	25
Pb	0	0	1	6	6
La	25	39	27	41	71
Ce	41	61	59	86	125
Th	7	13	14	12	17

Major elements normalized on a volatile-free basis; FeO is total Fe expressed as FeO

"†" denotes values > 120% of highest standard in lab.

Table 3. XRF analyses of basaltic rocks from the Coeur d'Alene 30' x 60' quadrangle.

Map no.	**49**	**50**	**51**	**52**	**53**	**54**	**55**	**56**
Sample no.	97FC	97SM	98ALC	98M	98MP	97CH	00RL401	00RL402
Lithology	basalt	basalt	basalt	basalt	basalt	basalt	basalt	basalt
Form	dike	dike	flow	flow	flow	flow	flow	flow
Formation			Saddle Mtns	Saddle Mtns	Saddle Mtns	Wanapum	Wanapum	Wanapum
Member			Mica Flats	Mica Flats	Mica Flats	Priest Rapids	Priest Rapids	Priest Rapids
Unit	TKdd	TKdd	Tmfb	Tmfb	Tmfb	Tpr	Tpr	Tpr
7.5' quad.	Fernan Lake	Fernan Lake	Mica Bay	Mica Bay	Mica Bay	Athol	Coeur d'Alene	Coeur d'Alene
Lat.	47.698151	47.715555	47.617075	47.616917	47.622542	47.876111	47.749016	47.749372
Long.	-116.6864	-116.6685	-116.8747	-116.8742	-116.8605	-116.7236	-116.7726	-116.7586
				Unnormalized results (weight %)				
SiO_2	49.92	53.98	50.87	52.98	50.93	49.37	49.61	49.19
Al_2O_3	14.35	15.18	12.94	13.35	12.96	12.59	12.71	12.57
TiO_2	1.363	1.076	2.954	3.016	2.938	3.677	3.600	3.640
FeO*	7.70	7.23	14.15	12.24	14.20	14.90	14.57	15.11
MnO	0.130	0.107	0.204	0.188	0.192	0.234	0.238	0.245
CaO	7.33	6.71	8.06	8.29	8.03	8.18	8.44	8.44
MgO	6.27	8.30	3.90	3.56	3.99	4.40	4.30	4.39
K_2O	4.28	1.75	1.76	1.70	1.68	1.25	1.43	1.44
Na_2O	2.54	2.54	2.64	2.71	2.74	2.85	2.72	2.65
P_2O_5	0.831	0.284	0.282	0.297	0.297	0.782	0.785	0.796
Total	94.71	97.16	97.76	98.33	97.96	98.23	98.40	98.47
				Normalized results (weight %)				
SiO_2	52.71	55.56	52.03	53.88	51.99	50.26	50.42	49.95
Al_2O_3	15.15	15.62	13.24	13.58	13.23	12.82	12.92	12.76
TiO_2	1.439	1.107	†3.02	†3.07	†3.00	†3.74	†3.66	†3.70
FeO*	8.13	7.44	14.48	12.45	14.50	†15.17	†14.81	†15.35
MnO	0.137	0.110	0.209	0.191	0.196	0.238	0.242	0.249
CaO	7.74	6.91	8.24	8.43	8.20	8.33	8.58	8.57
MgO	6.62	8.54	3.99	3.62	4.07	4.48	4.37	4.46
K_2O	4.52	1.80	1.80	1.73	1.72	1.27	1.45	1.46
Na_2O	2.68	2.61	2.70	2.76	2.80	2.90	2.76	2.69
P_2O_5	†0.88	0.292	0.288	0.302	0.303	†0.80	†0.80	†0.81
				Trace elements (ppm)				
Ni	85	164	9	15	6	0	16	17
Cr	131	368	46	38	40	33	31	31
Sc	22	18	34	29	32	35	41	45
V	168	166	†530	†534	†512	450	433	439
Ba	†2820	627	497	628	441	659	577	554
Rb	125	45	49	51	47	30	35	33
Sr	†1103	585	257	269	255	275	287	284
Zr	366	164	182	187	183	209	217	217
Y	32	20	37	39	38	49	52	51
Nb	16.8	9.9	22.3	21.3	22.9	18.7	20.1	17.7
Ga	19	22	27	22	25	24	21	23
Cu	29	23	14	18	15	14	24	23
Zn	105	77	134	139	132	153	155	154
Pb	31	11	8	10	12	9	1	6
La	58	49	36	40	29	12	32	24
Ce	97	53	53	68	80	54	59	66
Th	10	3	9	8	8	8	5	5

Major elements normalized on a volatile-free basis; FeO is total Fe expressed as FeO
"†" denotes values > 120% of highest standard in lab.

Table 3. XRF analyses of basaltic rocks from the Coeur d'Alene 30' x 60' quadrangle (continued).

Map no.	**57**	**58**	**59**	**60**	**61**	**62**	**63**	**64**
Sample no.	98K031603	98BH	98MR	98K031901	97BR	97RB	98K031605	98K031810
Lithology	basalt	basalt	basalt	basalt	basalt	basalt	basalt	basalt
Form	flow	flow	flow	flow	flow	flow	flow	flow
Formation	Wanapum	Wanapum	Wanapum	Wanapum	Wanapum	Wanapum	Wanapum	Wanapum
Member	Priest Rapids	Priest Rapids	Priest Rapids	Priest Rapids	Priest Rapids	Priest Rapids	Priest Rapids	Priest Rapids
Unit	Tpr	Tpr	Tpr	Tpr	Tpr	Tpr	Tpr	Tpr
7.5' quad.	Coeur d'Alene	Coeur d'Alene	Coeur d'Alene	Fernan Lake	Fernan Lake	Hayden	Mica Bay	Mica Bay
Lat.	47.627096	47.678495	47.668137	47.655826	47.637526	47.786772	47.547454	47.523943
Long.	-116.8271	-116.8144	-116.8493	-116.7275	-116.6789	-116.7747	-116.8446	-116.7672
				Unnormalized results (weight %)				
SiO_2	49.81	49.54	48.62	50.00	49.57	48.99	49.29	49.84
Al_2O_3	12.84	12.68	12.28	12.95	12.62	12.61	12.53	12.56
TiO_2	3.676	3.635	3.561	3.701	3.601	3.506	3.604	3.616
FeO*	14.67	14.22	14.74	13.44	14.67	14.63	14.22	14.77
MnO	0.243	0.240	0.243	0.242	0.238	0.245	0.243	0.236
CaO	8.62	8.54	8.35	9.20	8.48	8.37	8.47	8.47
MgO	4.33	4.35	4.41	3.78	4.49	4.42	4.34	4.26
K_2O	1.20	1.41	1.31	1.28	1.35	1.25	1.34	1.15
Na_2O	2.67	2.58	2.52	2.70	2.55	2.77	2.66	2.57
P_2O_5	0.781	0.793	0.741	0.795	0.760	0.764	0.754	0.761
Total	98.84	97.99	96.78	98.09	98.33	97.55	97.45	98.23
				Normalized results (weight %)				
SiO_2	50.39	50.56	50.24	50.97	50.41	50.22	50.58	50.74
Al_2O_3	12.99	12.94	12.69	13.20	12.83	12.93	12.86	12.79
TiO_2	†3.72	†3.71	†3.68	†3.77	†3.66	†3.59	†3.70	†3.68
FeO*	†14.84	14.51	†15.23	13.70	†14.92	†14.99	14.59	†15.04
MnO	0.246	0.245	0.251	0.247	0.242	0.251	0.249	0.240
CaO	8.72	8.72	8.63	9.38	8.62	8.58	8.69	8.62
MgO	4.38	4.44	4.56	3.85	4.57	4.53	4.45	4.34
K_2O	1.21	1.44	1.35	1.30	1.37	1.28	1.38	1.17
Na_2O	2.70	2.63	2.60	2.75	2.59	2.84	2.73	2.62
P_2O_5	†0.79	†0.81	†0.77	†0.81	†0.77	†0.78	†0.77	†0.77
				Trace elements (ppm)				
Ni	3	1	2	4	3	1	4	3
Cr	31	32	30	29	29	27	29	30
Sc	34	40	35	37	33	34	29	37
V	†456	†456	431	†457	439	420	445	446
Ba	539	552	533	525	578	619	522	496
Rb	28	31	32	29	31	28	27	26
Sr	292	287	281	299	286	286	284	286
Zr	210	210	207	210	209	203	204	207
Y	50	51	49	49	49	49	49	47
Nb	18.4	19.0	18.2	19.2	18.7	17.5	17.9	18.6
Ga	23	23	23	24	26	26	24	22
Cu	15	10	13	16	13	10	16	15
Zn	154	154	147	153	152	152	148	153
Pb	7	4	7	6	2	6	7	7
La	21	26	42	15	36	31	20	25
Ce	50	63	67	86	87	51	72	75
Th	4	8	6	5	7	5	4	6

Major elements normalized on a volatile-free basis; FeO is total Fe expressed as FeO
"†" denotes values > 120% of highest standard in lab.

Table 3. XRF analyses of basaltic rocks from the Coeur d'Alene 30' x 60' quadrangle (continued).

Map no.	**65**	**66**	**67**	**68**	**69**	**70**	**71**	**72**
Sample no.	98K031811	97MH	98GR	98GRTOP	98ML	98K031704	98K031803	98K031804
Lithology	basalt	basalt	basalt	basalt	basalt	basalt	basalt	basalt
Form	flow	flow	flow	flow	flow	flow	flow	flow
Formation	Wanapum	Wanapum	Wanapum	Wanapum	Wanapum	Wanapum	Wanapum	Wanapum
Member	Priest Rapids	Priest Rapids	Priest Rapids	Priest Rapids	Priest Rapids	Priest Rapids	Priest Rapids	Priest Rapids
Unit	Tpr	Tpr	Tpr	Tpr	Tpr	Tpr	Tpr	Tpr
7.5' quad.	Mica Bay	Mica Bay	Mica Bay	Mica Bay	Mica Bay	Mount Coeur d'Alene	Mount Coeur d'Alene	Mount Coeur d'Alene
Lat.	47.512173	47.609437	47.616412	47.599277	47.607866	47.54392	47.620682	47.622282
Long.	-116.7925	-116.8707	-116.7627	-116.7516	-116.8724	-116.7369	-116.7255	-116.7312
				Unnormalized results (weight %)				
SiO_2	49.74	49.04	49.88	49.49	49.61	50.05	49.84	49.75
Al_2O_3	12.61	12.79	12.82	12.77	12.90	12.48	12.70	12.51
TiO_2	3.611	3.729	3.666	3.626	3.708	3.640	3.650	3.585
FeO*	14.52	14.74	13.61	14.17	13.83	14.17	14.37	14.77
MnO	0.244	0.249	0.233	0.245	0.236	0.236	0.237	0.248
CaO	8.50	8.61	8.62	8.61	8.66	8.50	8.61	8.51
MgO	4.43	4.47	4.32	4.29	4.18	4.27	4.20	3.68
K_2O	1.22	1.30	1.30	1.31	1.28	1.33	1.29	1.20
Na_2O	2.68	2.65	2.55	2.47	2.72	2.68	2.57	2.69
P_2O_5	0.761	0.787	0.778	0.759	0.786	0.772	0.782	0.762
Total	98.32	98.36	97.78	97.74	97.91	98.13	98.25	97.71
				Normalized results (weight %)				
SiO_2	50.59	49.86	51.01	50.63	50.67	51.00	50.73	50.92
Al_2O_3	12.83	13.00	13.11	13.07	13.17	12.72	12.93	12.80
TiO_2	†3.67	†3.79	†3.75	†3.71	†3.79	†3.71	†3.72	†3.67
FeO*	†14.77	†14.98	13.92	14.50	14.13	14.44	14.63	†15.12
MnO	0.248	0.253	0.238	0.251	0.241	0.241	0.241	0.254
CaO	8.65	8.75	8.82	8.81	8.84	8.66	8.76	8.71
MgO	4.51	4.54	4.42	4.39	4.27	4.35	4.27	3.77
K_2O	1.24	1.32	1.33	1.34	1.31	1.36	1.31	1.23
Na_2O	2.73	2.69	2.61	2.53	2.78	2.73	2.62	2.75
P_2O_5	†0.77	†0.80	†0.80	†0.78	†0.80	†0.79	†0.80	†0.78
				Trace elements (ppm)				
Ni	2	4	3	1	6	5	2	1
Cr	29	29	30	36	32	32	32	31
Sc	30	32	34	32	33	39	31	29
V	†455	452	†471	†463	442	451	448	436
Ba	517	616	548	541	488	554	555	518
Rb	29	29	29	25	28	31	29	26
Sr	286	285	288	291	291	287	293	283
Zr	204	211	210	208	208	208	209	207
Y	48	50	50	50	50	50	50	49
Nb	18.3	18.5	18.4	18.0	19.6	18.7	18.2	17.2
Ga	21	24	23	21	23	22	23	25
Cu	12	14	15	14	14	16	17	15
Zn	150	158	155	154	160	158	151	156
Pb	8	6	6	3	6	5	7	5
La	19	38	24	30	21	7	12	30
Ce	52	59	53	68	70	91	73	67
Th	6	6	7	5	7	7	7	7

Major elements normalized on a volatile-free basis; FeO is total Fe expressed as FeO
"†" denotes values > 120% of highest standard in lab.

Table 3. XRF analyses of basaltic rocks from the Coeur d'Alene 30' x 60' quadrangle (continued).

Map no.	**73**	**74**	**75**	**76**	**77**	**78**	**79**	**80**
Sample no.	00GJT	98K031912	97HI	97RD	98CB	98RR	00WLQ	98K031908
Lithology	basalt	basalt	basalt	basalt	basalt	basalt	basalt	basalt
Form	flow	flow	flow	flow	flow	flow	flow	flow
Formation	Wanapum	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde
Member	Priest Rapids							
Unit	Tpr	Tgn_2	Tgn_2	Tgn_2	Tgn_2	Tgn_2	Tgn_2	Tgn_2
7.5' quad.	Mount Coeur d'Alene	Coeur d'Alene	Coeur d'Alene	Coeur d'Alene	Coeur d'Alene	Coeur d'Alene	Fernan Lake	Fernan Lake
Lat.	47.598429	47.681389	47.693498	47.676619	47.668859	47.626358	47.638798	47.632357
Long.	-116.7432	-116.8065	-116.8706	-116.8106	-116.8294	-116.7683	-116.6263	-116.6987
				Unnormalized results (weight %)				
SiO_2	50.28	55.18	53.69	53.86	53.92	52.78	53.58	53.82
Al_2O_3	13.51	14.73	13.95	13.97	14.08	13.53	13.90	14.20
TiO_2	3.816	1.985	1.880	1.894	1.922	1.872	1.888	1.945
FeO*	13.62	9.04	11.05	10.91	9.95	11.00	11.86	9.55
MnO	0.217	0.177	0.214	0.202	0.235	0.209	0.210	0.205
CaO	9.05	8.54	8.48	8.49	8.66	8.38	8.46	8.77
MgO	3.18	3.70	4.62	4.47	4.11	4.55	4.52	4.43
K_2O	1.13	1.44	1.39	1.45	1.40	1.31	1.31	1.24
Na_2O	2.73	2.93	2.92	2.92	2.86	2.85	2.91	2.75
P_2O_5	0.823	0.387	0.375	0.389	0.429	0.372	0.394	0.392
Total	98.36	98.11	98.57	98.56	97.57	96.85	99.03	97.30
				Normalized results (weight %)				
SiO_2	51.12	56.24	54.47	54.65	55.27	54.49	54.11	55.31
Al_2O_3	13.74	15.01	14.15	14.17	14.43	13.97	14.04	14.59
TiO_2	†3.88	2.023	1.907	1.922	1.970	1.933	1.907	1.999
FeO*	13.85	9.21	11.21	11.07	10.20	11.36	11.97	9.81
MnO	0.221	0.180	0.217	0.205	0.241	0.216	0.212	0.211
CaO	9.20	8.70	8.60	8.61	8.88	8.65	8.54	9.01
MgO	3.23	3.77	4.69	4.54	4.21	4.70	4.56	4.55
K_2O	1.15	1.47	1.41	1.47	1.43	1.35	1.32	1.27
Na_2O	2.78	2.99	2.96	2.96	2.93	2.94	2.94	2.83
P_2O_5	†0.84	0.394	0.380	0.395	0.440	0.384	0.398	0.403
				Trace elements (ppm)				
Ni	13	4	1	5	7	4	9	8
Cr	34	46	46	51	41	48	44	48
Sc	48	31	32	30	33	37	33	36
V	447	289	291	284	289	291	280	301
Ba	1411	731	554	562	808	497	511	518
Rb	26	32	30	31	31	31	33	26
Sr	317	335	306	309	328	306	306	327
Zr	226	167	159	161	165	159	164	164
Y	58	38	35	35	36	36	37	38
Nb	20.4	12.1	11.2	12.2	12.6	11.8	12.0	12.4
Ga	23	22	22	20	24	25	22	21
Cu	26	25	19	20	22	20	31	21
Zn	168	125	114	112	118	118	119	128
Pb	3	5	5	6	6	5	5	7
La	20	30	18	34	24	32	31	18
Ce	53	38	48	35	40	31	40	35
Th	2	5	5	6	5	6	3	4

Major elements normalized on a volatile-free basis; FeO is total Fe expressed as FeO
"†" denotes values > 120% of highest standard in lab.

Table 3. XRF analyses of basaltic rocks from the Coeur d'Alene 30' x 60' quadrangle (continued).

Map no.	**81**	**82**	**83**	**84**	**85**	**86**	**87**	**88**
Sample no.	97HA	97YT	97OM	98K031602	98K031604	98K031703	98K031708	98K031709
Lithology	basalt	basalt	basalt	basalt	basalt	basalt	basalt	basalt
Form	flow	flow	flow	flow	flow	flow	flow	flow
Formation	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde
Member								
Unit	Tgn_2	Tgn_2	Tgn_2	Tgn_2	Tgn_2	Tgn_2	Tgn_2	Tgn_2
7.5' quad.	Fernan Lake	Fernan Lake	Hayden	Mica Bay	Mica Bay	Mica Bay	Mica Bay	Mica Bay
Lat.	47.687241	47.63275	47.845833	47.610067	47.56322	47.537472	47.588946	47.599593
Long.	-116.7373	-116.7029	-116.7864	-116.8101	-116.8244	-116.7511	-116.7932	-116.7768
				Unnormalized results (weight %)				
SiO_2	53.63	53.97	53.42	53.97	54.33	54.81	53.93	54.23
Al_2O_3	13.82	14.04	13.71	14.13	13.94	14.21	13.80	14.09
TiO_2	1.876	1.865	1.878	1.927	1.901	1.936	1.876	1.931
FeO*	11.22	11.44	11.72	10.20	10.59	9.89	10.95	10.24
MnO	0.207	0.203	0.203	0.201	0.206	0.197	0.206	0.196
CaO	8.49	8.48	8.44	8.63	8.51	8.70	8.52	8.67
MgO	4.73	4.63	4.69	4.03	4.47	4.19	4.41	4.10
K_2O	1.32	1.42	1.33	1.33	1.46	1.37	1.30	1.32
Na_2O	3.01	2.81	2.69	2.98	2.81	3.00	2.89	2.90
P_2O_5	0.374	0.380	0.386	0.387	0.376	0.389	0.369	0.396
Total	98.68	99.24	98.47	97.79	98.59	98.69	98.25	98.07
				Normalized results (weight %)				
SiO_2	54.35	54.38	54.25	55.19	55.11	55.54	54.89	55.30
Al_2O_3	14.01	14.15	13.92	14.45	14.14	14.40	14.05	14.37
TiO_2	1.901	1.879	1.907	1.971	1.928	1.962	1.909	1.969
FeO*	11.37	11.53	11.90	10.43	10.74	10.02	11.14	10.44
MnO	0.210	0.205	0.206	0.206	0.209	0.200	0.210	0.200
CaO	8.60	8.55	8.57	8.83	8.63	8.82	8.67	8.84
MgO	4.79	4.67	4.76	4.12	4.53	4.25	4.49	4.18
K_2O	1.34	1.43	1.35	1.36	1.48	1.39	1.32	1.35
Na_2O	3.05	2.83	2.73	3.05	2.85	3.04	2.94	2.96
P_2O_5	0.379	0.383	0.392	0.396	0.381	0.394	0.376	0.404
				Trace elements (ppm)				
Ni	3	4	6	7	1	3	4	4
Cr	45	45	46	44	44	45	44	51
Sc	33	31	30	34	36	32	33	34
V	295	286	295	304	299	303	302	281
Ba	542	523	603	531	478	545	495	565
Rb	30	28	28	30	29	30	31	30
Sr	301	307	312	319	308	325	310	321
Zr	156	162	163	163	158	164	159	165
Y	35	35	36	37	34	40	35	37
Nb	11.9	11.7	11.5	13.4	13.2	12.6	11.6	13.0
Ga	21	22	23	23	23	22	22	24
Cu	20	23	29	23	25	22	23	21
Zn	117	117	119	180	116	126	118	118
Pb	0	8	5	9	4	4	3	5
La	16	27	50	29	9	18	15	2
Ce	36	19	50	53	37	55	69	45
Th	6	5	5	6	1	6	6	6

Major elements normalized on a volatile-free basis; FeO is total Fe expressed as FeO
"†" denotes values > 120% of highest standard in lab.

Table 3. XRF analyses of basaltic rocks from the Coeur d'Alene 30' x 60' quadrangle (continued).

Map no.	**89**	**90**	**91**	**92**	**93**	**94**	**95**	**96**
Sample no.	98K031808	97MB	97MC	98UP	98VP	98K031801	98K031805	98K031806
Lithology	basalt	basalt	basalt	basalt	basalt	basalt	basalt	basalt
Form	flow	flow	flow	flow	flow	flow	flow	flow
Formation	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde
Member								
Unit	Tgn_2	Tgn_2	Tgn_2	Tgn_2	Tgn_2	Tgn_2	Tgn_2	Tgn_2
7.5' quad.	Mica Bay	Mica Bay	Mica Bay	Mica Bay	Mica Bay	Mount Coeur d'Alene	Mount Coeur d'Alene	Mount Coeur d'Alene
Lat.	47.60696	47.600067	47.604243	47.50596	47.60811	47.615104	47.623695	47.621353
Long.	-116.7655	-116.8602	-116.8712	-116.8741	-116.81	-116.6944	-116.7375	-116.7382
				Unnormalized results (weight %)				
SiO_2	54.37	54.35	53.67	53.63	53.48	53.88	54.25	54.58
Al_2O_3	14.27	14.39	14.38	13.97	13.87	13.90	14.16	14.06
TiO_2	1.894	1.918	1.954	1.905	1.875	1.901	1.924	1.889
FeO*	10.27	10.79	10.49	11.04	11.27	10.86	10.51	11.00
MnO	0.200	0.201	0.200	0.204	0.206	0.210	0.206	0.200
CaO	8.67	8.71	8.74	8.47	8.46	8.57	8.59	8.50
MgO	4.45	4.60	4.48	4.35	4.57	4.44	4.22	4.04
K_2O	1.26	1.21	1.20	1.30	1.26	1.35	1.37	1.38
Na_2O	2.90	3.03	3.01	2.91	3.01	2.85	2.92	2.90
P_2O_5	0.369	0.394	0.398	0.396	0.378	0.405	0.384	0.381
Total	98.65	99.59	98.52	98.18	98.38	98.37	98.53	98.93
				Normalized results (weight %)				
SiO_2	55.11	54.57	54.48	54.63	54.36	54.78	55.06	55.17
Al_2O_3	14.46	14.45	14.60	14.23	14.10	14.13	14.37	14.21
TiO_2	1.920	1.926	1.983	1.940	1.906	1.933	1.953	1.909
FeO*	10.41	10.83	10.65	11.25	11.46	11.04	10.67	11.12
MnO	0.203	0.202	0.203	0.208	0.209	0.213	0.209	0.202
CaO	8.79	8.75	8.87	8.63	8.60	8.71	8.72	8.59
MgO	4.51	4.62	4.55	4.43	4.65	4.51	4.28	4.08
K_2O	1.28	1.21	1.22	1.32	1.28	1.37	1.39	1.39
Na_2O	2.94	3.04	3.06	2.96	3.06	2.90	2.96	2.93
P_2O_5	0.374	0.396	0.404	0.403	0.384	0.412	0.390	0.385
				Trace elements (ppm)				
Ni	4	7	8	3	5	2	4	3
Cr	44	45	48	51	49	45	49	44
Sc	31	33	33	36	30	31	29	33
V	302	292	295	282	292	280	283	297
Ba	513	569	607	565	491	523	527	594
Rb	26	25	26	28	30	28	29	31
Sr	317	320	324	310	307	313	318	323
Zr	157	168	165	160	159	160	162	162
Y	36	39	40	36	36	34	41	35
Nb	11.4	13.1	12.7	12.2	14.2	12.0	11.1	13.3
Ga	22	22	19	22	21	25	24	21
Cu	22	18	19	21	27	28	27	23
Zn	119	119	123	120	121	118	121	120
Pb	6	7	1	8	3	6	6	5
La	19	19	10	24	26	2	12	13
Ce	52	46	53	31	41	50	49	52
Th	3	6	7	6	2	4	4	4

Major elements normalized on a volatile-free basis; FeO is total Fe expressed as FeO
"†" denotes values > 120% of highest standard in lab.

Table 3. XRF analyses of basaltic rocks from the Coeur d'Alene 30' x 60' quadrangle (continued).

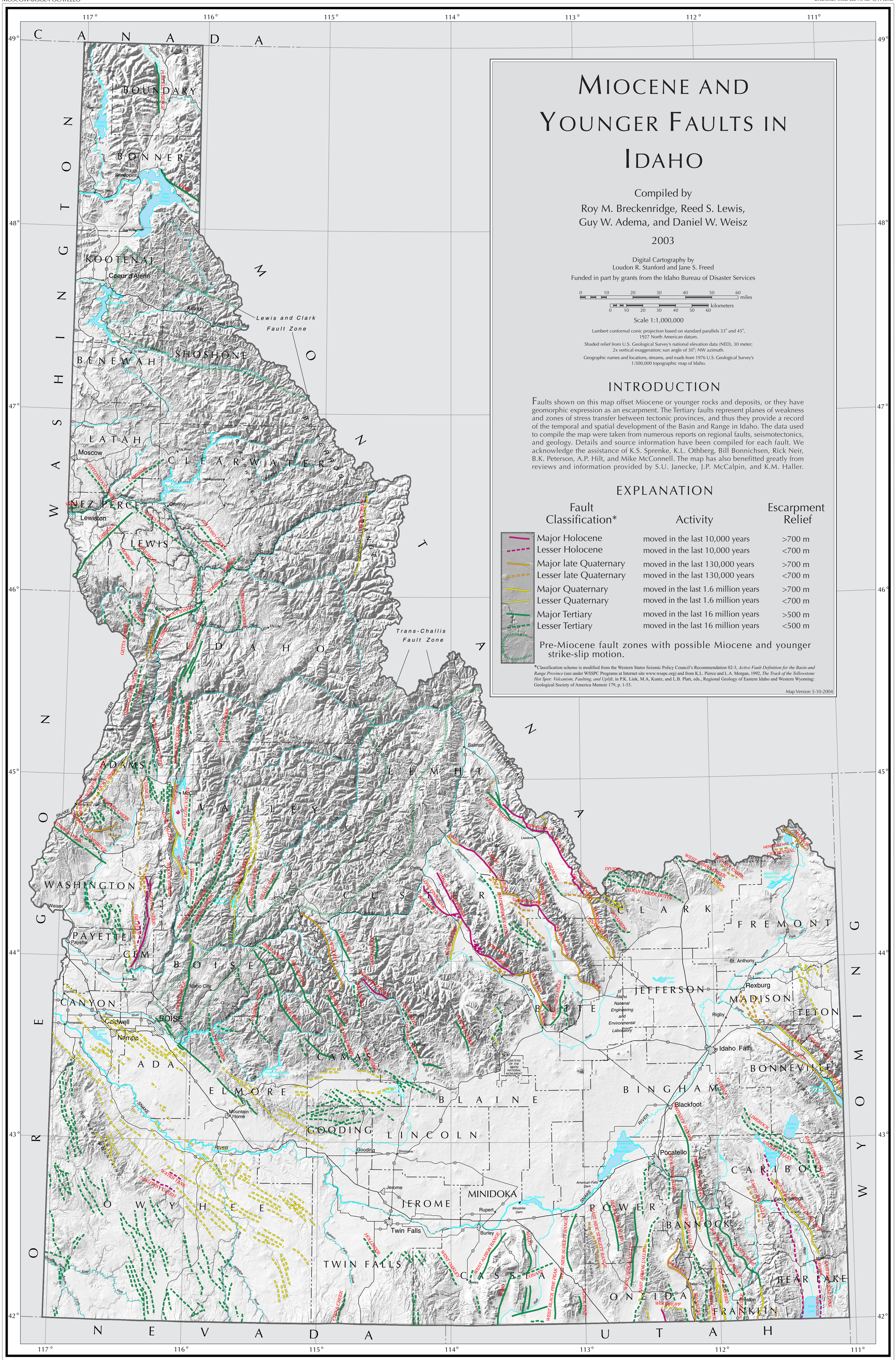
Map no.	**97**	**98**	**99**	**100**	**101**	**102**	**103**	**104**
Sample no.	98AP	98K031905	98K031909	97SB	98K031702	98K031706	98K031813	98BR
Lithology	basalt	basalt	basalt	basalt	basalt	basalt	basalt	basalt
Form	flow	flow	flow	flow	flow	flow	flow	flow
Formation	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde	Grande Ronde
Member								
Unit	Tgr_2	Tgr_2	Tgr_2	Tgr_2	Tgr_2	Tgr_2	Tgr_2	Tgr_2
7.5' quad.	Coeur d'Alene	Fernan Lake	Fernan Lake	Fernan Lake	Mica Bay	Mica Bay	Mica Bay	Mica Bay
Lat.	47.629588	47.631761	47.637079	47.646247	47.540829	47.574464	47.512593	47.518721
Long.	-116.7684	-116.7092	-116.6723	-116.7305	-116.7684	-116.771	-116.8117	-116.8473
				Unnormalized results (weight %)				
SiO_2	53.46	54.06	53.55	53.95	53.80	53.96	54.24	53.36
Al_2O_3	13.27	13.58	13.51	13.52	13.56	13.50	13.86	13.57
TiO_2	2.138	2.173	2.165	2.122	2.181	2.175	2.208	2.173
FeO*	11.72	11.69	12.40	12.38	11.89	12.26	11.09	12.06
MnO	0.199	0.193	0.199	0.198	0.194	0.200	0.201	0.182
CaO	7.54	7.75	7.65	7.58	7.67	7.63	7.70	7.53
MgO	3.77	3.55	3.78	3.82	3.71	3.74	3.47	3.22
K_2O	1.68	1.61	1.64	1.62	1.56	1.64	1.88	1.27
Na_2O	2.89	3.06	2.94	2.97	3.12	2.95	2.91	2.85
P_2O_5	0.372	0.416	0.381	0.383	0.376	0.375	0.381	0.380
Total	97.04	98.08	98.22	98.54	98.06	98.43	97.94	96.59
				Normalized results (weight %)				
SiO_2	55.09	55.12	54.52	54.75	54.86	54.82	55.38	55.24
Al_2O_3	13.67	13.85	13.76	13.72	13.83	13.72	14.15	14.05
TiO_2	2.203	2.215	2.204	2.153	2.224	2.210	2.254	2.250
FeO*	12.08	11.92	12.63	12.56	12.13	12.46	11.32	12.48
MnO	0.205	0.197	0.203	0.201	0.198	0.203	0.205	0.188
CaO	7.77	7.90	7.79	7.69	7.82	7.75	7.86	7.80
MgO	3.89	3.62	3.85	3.88	3.78	3.80	3.54	3.33
K_2O	1.73	1.64	1.67	1.64	1.59	1.67	1.92	1.31
Na_2O	2.98	3.12	2.99	3.01	3.18	3.00	2.97	2.95
P_2O_5	0.383	0.424	0.388	0.389	0.383	0.381	0.389	0.393
				Trace elements (ppm)				
Ni	10	11	9	10	12	12	14	7
Cr	29	29	26	26	31	33	33	37
Sc	34	28	27	28	27	33	32	33
V	412	416	423	402	426	416	411	408
Ba	627	632	624	651	628	631	659	615
Rb	39	41	39	41	36	39	40	30
Sr	320	331	324	327	327	326	331	341
Zr	165	167	167	169	168	167	169	171
Y	35	34	34	35	35	35	35	36
Nb	12.5	12.3	12.7	12.3	12.8	12.5	12.2	13.7
Ga	21	22	20	24	24	23	21	24
Cu	31	33	29	34	31	39	32	34
Zn	129	122	120	120	125	125	122	144
Pb	6	9	7	6	8	8	5	10
La	40	28	22	60	0	7	10	39
Ce	29	63	48	47	54	40	45	59
Th	6	6	4	4	4	5	5	7

Major elements normalized on a volatile-free basis; FeO is total Fe expressed as FeO
"†" denotes values > 120% of highest standard in lab.

Table 3. XRF analyses of basaltic rocks from the Coeur d'Alene 30' x 60' quadrangle (continued).

Map no.	**105**	**106**	**107**
Sample no.	98DP	98PR	98K031802
Lithology	basalt	basalt	basalt
Form	flow	flow	flow
Formation	Grande Ronde	Grande Ronde	Grande Ronde
Member			
Unit	Tgr_2	Tgr_2	Tgr_2
7.5' quad.	Mica Bay	Mica Bay	Mount Coeur d'Alene
Lat.	47.591642	47.541306	47.623808
Long.	-116.7994	-116.8232	-116.7403
	Unnormalized results (weight %)		
SiO_2	53.43	53.29	54.35
Al_2O_3	13.58	13.39	13.73
TiO_2	2.158	2.123	2.206
FeO*	12.36	12.98	11.12
MnO	0.197	0.195	0.181
CaO	7.57	7.59	7.73
MgO	3.57	3.64	3.35
K_2O	1.74	1.55	1.62
Na_2O	2.78	2.99	3.05
P_2O_5	0.369	0.379	0.380
Total	97.75	98.13	97.72
	Normalized results (weight %)		
SiO_2	54.66	54.31	55.62
Al_2O_3	13.89	13.65	14.05
TiO_2	2.208	2.163	2.258
FeO*	12.64	13.23	11.38
MnO	0.202	0.199	0.185
CaO	7.74	7.73	7.91
MgO	3.65	3.71	3.43
K_2O	1.78	1.58	1.66
Na_2O	2.84	3.05	3.12
P_2O_5	0.377	0.386	0.389
	Trace elements (ppm)		
Ni	8	8	9
Cr	39	37	28
Sc	33	36	29
V	408	406	414
Ba	591	657	716
Rb	35	39	37
Sr	326	333	340
Zr	168	170	172
Y	37	36	38
Nb	13.4	14.2	12.8
Ga	21	23	21
Cu	28	27	34
Zn	141	125	130
Pb	9	7	5
La	27	23	19
Ce	31	47	54
Th	6	3	7

Major elements normalized on a volatile-free basis; FeO is total Fe expressed as FeO
"†" denotes values > 120% of highest standard in lab.



Miocene and Younger Faults in Idaho

Compiled by
Roy M. Breckenridge, Reed S. Lewis,
Guy W. Adema, and Daniel W. Weisz

2003

Digital Cartography by
Loudon R. Stanford and Jane S. Freed

Funded in part by grants from the Idaho Bureau of Disaster Services

0 10 20 30 40 50 60 miles

0 10 20 30 40 50 60 kilometers

Scale 1:1,000,000

Lambert conformal conic projection based on standard parallels 33° and 45°, 1927 North American datum.

Shaded relief from U.S. Geological Survey's national elevation data (NED), 30 meter; 2x vertical exaggeration; sun angle of 30°; NW azimuth.

Geographic names and locations, streams, and roads from 1976 U.S. Geological Survey's 1:500,000 topographic map of Idaho.

INTRODUCTION

Faults shown on this map offset Miocene or younger rocks and deposits, or they have geomorphic expression as an escarpment. The Tertiary faults represent planes of weakness and zones of stress transfer between tectonic provinces, and thus they provide a record of the temporal and spatial development of the Basin and Range in Idaho. The data used to compile the map were taken from numerous reports on regional faults, seismotectonics, and geology. Details and source information have been compiled for each fault. We acknowledge the assistance of K.S. Sprenke, K.L. Othberg, Bill Bonnichsen, Rick Neir, B.K. Peterson, A.P. Hilt, and Mike McConnell. The map has also benefitted greatly from reviews and information provided by S.U. Janecke, J.P. McCalpin, and K.M. Haller.

EXPLANATION

Fault Classification*	Activity	Escarpment Relief
Major Holocene	moved in the last 10,000 years	>700 m
Lesser Holocene	moved in the last 10,000 years	<700 m
Major late Quaternary	moved in the last 130,000 years	>700 m
Lesser late Quaternary	moved in the last 130,000 years	<700 m
Major Quaternary	moved in the last 1.6 million years	>700 m
Lesser Quaternary	moved in the last 1.6 million years	<700 m
Major Tertiary	moved in the last 16 million years	>500 m
Lesser Tertiary	moved in the last 16 million years	<500 m

Pre-Miocene fault zones with possible Miocene and younger strike-slip motion.

*Classification scheme is modified from the Western States Seismic Policy Council's Recommendation 02-3, *Active Fault Definition for the Basin and Range Province* (see under WSSPC Programs at Internet site www.wsspc.org) and from K.L. Pierce and L.A. Morgan, 1992, *The Track of the Yellowstone Hot Spot: Volcanism, Faulting, and Uplift*, in P.K. Link, M.A. Kuntz, and L.B. Platt, eds., Regional Geology of Eastern Idaho and Western Wyoming: Geological Society of America Memoir 179, p. 1-53.

Map Version 5-10-2004

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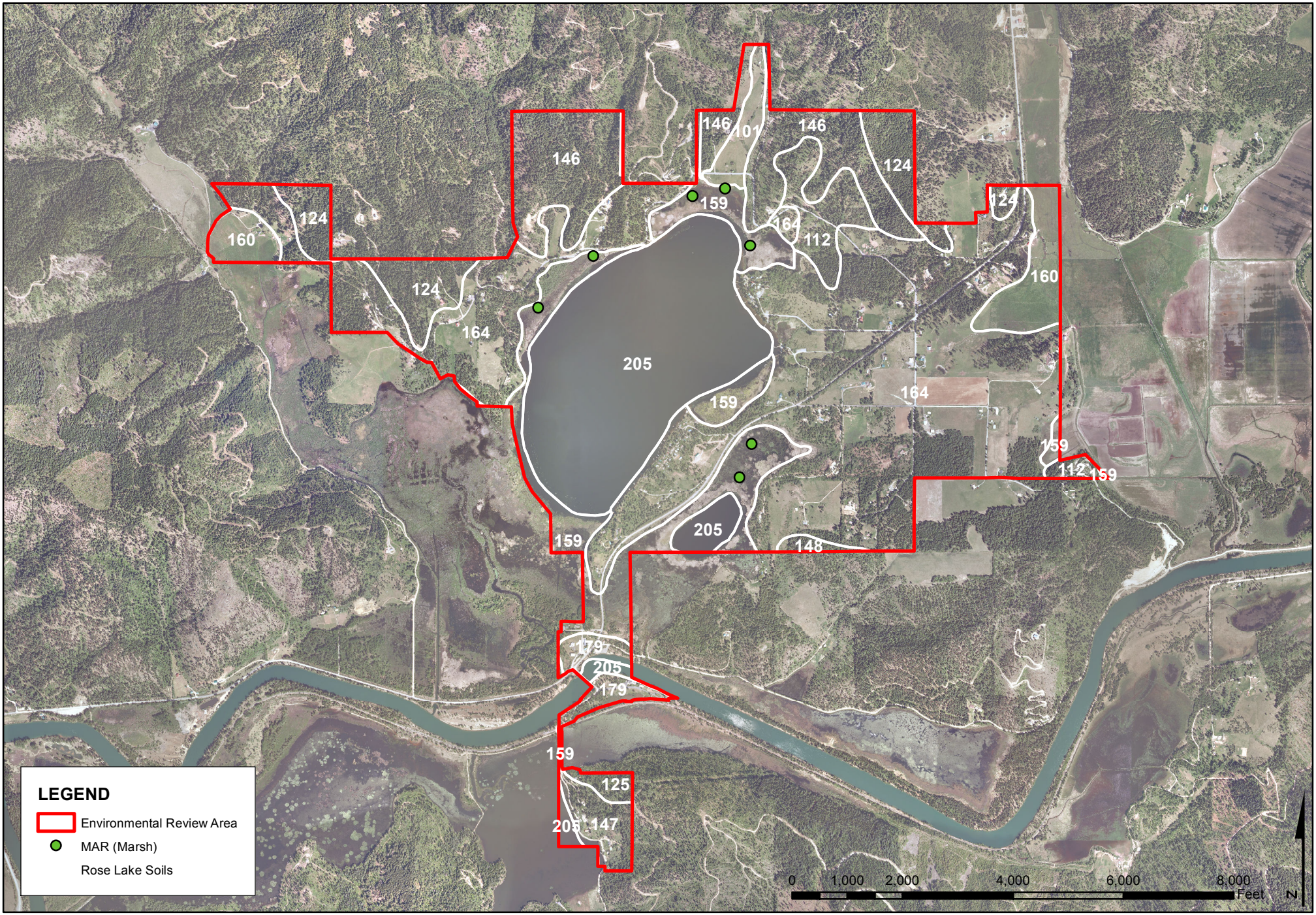

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Rose Lake Water Association

Soils Overview

Sources:
Kootenai County GIS Department
USDA, NRCS, Web Soil Survey, 2013

PROJECT NO.....41113
DRAWN BY.....AW
FILENAME.....Soils
DATE.....11/18/13

INFORMATION DERIVED FROM USDA, NRCS WEB SOIL SURVEY FOR KOOTENAI COUNTY (2013)

Key	Description	Area (Acres)	Percentage	Erosion Factor	Farmland Classification
101	Aquic Xerofluvents, nearly level	24.74	1.28%	0.49	All areas are prime farmland
112	Chatcolet cobbly loam, 7 to 25 percent slopes	57.11	2.96%	0.24	Farmland of statewide importance
124	Huckleberry-Ardenvoir association, 20 to 35 percent slopes	101.22	5.25%	0	Not prime farmland
125	Huckleberry-Ardenvoir association, 35 to 60 percent slopes	10.40	0.54%	0	Not prime farmland
146	McCrosket-Ardenvoir association, 20 to 35 percent slopes	192.79	10.00%	0	Not prime farmland
147	McCrosket-Ardenvoir association, 35 to 65 percent slopes	31.41	1.63%	0	Not prime farmland
148	McCrosket-Tekoa association, 35 to 65 percent slopes	6.76	0.35%	0	Not prime farmland
159	Pywell muck	190.07	9.86%	0.02	Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
160	Ramsdell silt loam	72.00	3.74%	0.43	Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
164	Rubson-Mokins complex, 0 to 20 percent slopes	847.84	43.99%	0.49	Farmland of statewide importance, if drained
179	Slickens	31.77	1.65%	0	
205	Water	361.14	18.74%	0	

*Erosion was determined using an erosion factor, K, which “indicates the susceptibility of a soil to sheet and rill erosion by water…The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and saturated hydraulic conductivity (Ksat). Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.” (USDA, NRCS Web Soil Survey)

**Farmland classification "identifies map units as prime farmland, farmland of statewide importance, farmland of local importance, or unique farmland. It identifies the location and extent of the soils that are best suited to food, feed, fiber, forage, and oilseed crops." (USDA, NRCS Web Soil Survey)

Kootenai County Area, Idaho

101—Aquic Xerofluvents, nearly level

Map Unit Setting

Elevation: 2,120 to 2,250 feet
Mean annual precipitation: 25 to 35 inches
Mean annual air temperature: 45 to 46 degrees F
Frost-free period: 80 to 110 days

Map Unit Composition

Aquic xerofluvents and similar soils: 75 percent
Minor components: 10 percent

Description of Aquic Xerofluvents

Setting

Landform: Stream terraces, drainageways
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Mixed alluvium

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 6.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Moderate (about 6.2 inches)

Typical profile

0 to 10 inches: Silt loam
10 to 60 inches: Stratified silt loam to gravelly sand

Minor Components

Slickens

Percent of map unit: 5 percent
Landform: Flood plains

Pywell

Percent of map unit: 5 percent
Landform: Marshes

Data Source Information

Soil Survey Area: Kootenai County Area, Idaho
Survey Area Data: Version 8, Sep 28, 2012

Kootenai County Area, Idaho

112—Chatcolet cobbly loam, 7 to 25 percent slopes

Map Unit Setting

Elevation: 2,200 to 2,800 feet
Mean annual precipitation: 25 to 30 inches
Mean annual air temperature: 37 to 43 degrees F
Frost-free period: 70 to 90 days

Map Unit Composition

Chatcolet and similar soils: 90 percent

Description of Chatcolet

Setting

Landform: Lake terraces
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Volcanic ash and/or loess over glaciolacustrine deposits and/or lacustrine deposits

Properties and qualities

Slope: 7 to 25 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high (0.20 to 0.60 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 10.7 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C
Other vegetative classification: western redcedar/ladyfern (CN540)

Typical profile

0 to 8 inches: Cobbly loam
8 to 17 inches: Cobbly loam
17 to 60 inches: Silty clay loam

Data Source Information

Soil Survey Area: Kootenai County Area, Idaho
Survey Area Data: Version 8, Sep 28, 2012

Kootenai County Area, Idaho

124—Huckleberry-Ardenvoir association, 20 to 35 percent slopes

Map Unit Setting

Elevation: 2,200 to 5,000 feet
Mean annual precipitation: 25 to 45 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 60 to 120 days

Map Unit Composition

Huckleberry and similar soils: 60 percent
Ardenvoir and similar soils: 35 percent

Description of Huckleberry

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Volcanic ash and/or loess over colluvium over residuum weathered from metasedimentary rock and/or quartzite

Properties and qualities

Slope: 20 to 35 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.8 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 6e
Hydrologic Soil Group: C
Other vegetative classification: western redcedar/queencup beadlily (CN530)

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 2 inches: Moderately decomposed plant material
2 to 13 inches: Ashy silt loam
13 to 21 inches: Channery silt loam
21 to 35 inches: Extremely channery loam
35 to 45 inches: Bedrock

Description of Ardenvoir

Setting

Landform: Ridges
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Volcanic ash and loess over residuum weathered from metasedimentary rock

Properties and qualities

Slope: 20 to 35 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 6e
Hydrologic Soil Group: B
Other vegetative classification: grand fir/twinflower (CN590)

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 17 inches: Gravelly loam
17 to 48 inches: Very cobbly loam
48 to 58 inches: Bedrock

Data Source Information

Soil Survey Area: Kootenai County Area, Idaho
Survey Area Data: Version 8, Sep 28, 2012

Kootenai County Area, Idaho

125—Huckleberry-Ardenvoir association, 35 to 60 percent slopes

Map Unit Setting

Elevation: 2,200 to 5,000 feet
Mean annual precipitation: 25 to 45 inches
Mean annual air temperature: 39 to 46 degrees F
Frost-free period: 60 to 120 days

Map Unit Composition

Huckleberry and similar soils: 60 percent
Ardenvoir and similar soils: 35 percent

Description of Huckleberry

Setting

Landform: Mountain slopes
Landform position (two-dimensional): Backslope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Volcanic ash and/or loess over colluvium over residuum weathered from metasedimentary rock and/or quartzite

Properties and qualities

Slope: 35 to 60 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.8 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: C
Other vegetative classification: western redcedar/queencup beadlily (CN530)

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 2 inches: Moderately decomposed plant material
2 to 13 inches: Ashy silt loam
13 to 21 inches: Channery silt loam
21 to 35 inches: Extremely channery loam
35 to 45 inches: Bedrock

Description of Ardenvoir

Setting

Landform: Ridges
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Volcanic ash and loess over residuum weathered from metasedimentary rock

Properties and qualities

Slope: 35 to 60 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: B
Other vegetative classification: grand fir/twinflower (CN590)

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 17 inches: Gravelly loam
17 to 48 inches: Very cobbly loam
48 to 58 inches: Bedrock

Data Source Information

Soil Survey Area: Kootenai County Area, Idaho
Survey Area Data: Version 8, Sep 28, 2012

Kootenai County Area, Idaho

146—McCrosket-Ardenvoir association, 20 to 35 percent slopes

Map Unit Setting

Elevation: 2,200 to 5,000 feet
Mean annual precipitation: 24 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 90 to 120 days

Map Unit Composition

Mccrosket and similar soils: 55 percent
Ardenvoir and similar soils: 35 percent

Description of Mccrosket

Setting

Landform: Mountains, ridges
Landform position (two-dimensional): Backslope, shoulder
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Volcanic ash and/or loess over residuum weathered from metasedimentary rock

Properties and qualities

Slope: 20 to 35 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.2 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 6e
Hydrologic Soil Group: B

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 2 inches: Moderately decomposed plant material
2 to 10 inches: Gravelly silt loam
10 to 48 inches: Extremely cobbly silt loam
48 to 58 inches: Bedrock

Description of Ardenvoir

Setting

Landform: Mountains
Landform position (two-dimensional): Backslope

Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Volcanic ash and loess over residuum weathered from metasedimentary rock

Properties and qualities

Slope: 20 to 35 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 6e
Hydrologic Soil Group: B
Other vegetative classification: grand fir/twinflower (CN590)

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 17 inches: Gravelly loam
17 to 48 inches: Very cobbly loam
48 to 58 inches: Bedrock

Data Source Information

Soil Survey Area: Kootenai County Area, Idaho
Survey Area Data: Version 8, Sep 28, 2012

Kootenai County Area, Idaho

147—McCrosket-Ardenvoir association, 35 to 65 percent slopes

Map Unit Setting

Elevation: 2,200 to 5,000 feet
Mean annual precipitation: 24 to 35 inches
Mean annual air temperature: 43 to 50 degrees F
Frost-free period: 90 to 120 days

Map Unit Composition

Mccrosket and similar soils: 55 percent
Ardenvoir and similar soils: 35 percent

Description of Mccrosket

Setting

Landform: Mountains, ridges
Landform position (two-dimensional): Backslope, shoulder
Down-slope shape: Convex
Across-slope shape: Convex
Parent material: Volcanic ash and/or loess over residuum weathered from metasedimentary rock

Properties and qualities

Slope: 35 to 65 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.2 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: B

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 2 inches: Moderately decomposed plant material
2 to 10 inches: Gravelly silt loam
10 to 48 inches: Extremely cobbly silt loam
48 to 58 inches: Bedrock

Description of Ardenvoir

Setting

Landform: Mountains
Landform position (two-dimensional): Backslope

Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Volcanic ash and loess over residuum weathered from metasedimentary rock

Properties and qualities

Slope: 35 to 65 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.6 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: B
Other vegetative classification: grand fir/twinflower (CN590)

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 17 inches: Gravelly loam
17 to 48 inches: Very cobbly loam
48 to 58 inches: Bedrock

Data Source Information

Soil Survey Area: Kootenai County Area, Idaho
Survey Area Data: Version 8, Sep 28, 2012

Kootenai County Area, Idaho

148—McCrosket-Tekoa association, 35 to 65 percent slopes

Map Unit Setting

Elevation: 2,000 to 4,000 feet
Mean annual precipitation: 20 to 30 inches
Mean annual air temperature: 45 to 50 degrees F
Frost-free period: 90 to 140 days

Map Unit Composition

Mccrosket and similar soils: 60 percent
Tekoa and similar soils: 35 percent

Description of Mccrosket

Setting

Landform: Mountains
Landform position (two-dimensional): Backslope
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Volcanic ash and/or loess over residuum weathered from metasedimentary rock

Properties and qualities

Slope: 35 to 65 percent
Depth to restrictive feature: 40 to 60 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 5.2 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: B

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 2 inches: Moderately decomposed plant material
2 to 10 inches: Gravelly silt loam
10 to 48 inches: Extremely cobbly silt loam
48 to 58 inches: Bedrock

Description of Tekoa

Setting

Landform: Mountains, ridges
Landform position (two-dimensional): Backslope
Down-slope shape: Convex

Across-slope shape: Convex
Parent material: Volcanic ash and loess over residuum weathered from quartzite

Properties and qualities

Slope: 35 to 65 percent
Depth to restrictive feature: 20 to 40 inches to paralithic bedrock
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.0 inches)

Interpretive groups

Farmland classification: Not prime farmland
Land capability (nonirrigated): 7e
Hydrologic Soil Group: C
Other vegetative classification: ponderosa pine/Idaho fescue (CN140)

Typical profile

0 to 1 inches: Slightly decomposed plant material
1 to 2 inches: Moderately decomposed plant material
2 to 9 inches: Gravelly silt loam
9 to 16 inches: Very gravelly silt loam
16 to 32 inches: Very gravelly silt loam
32 to 42 inches: Bedrock

Data Source Information

Soil Survey Area: Kootenai County Area, Idaho
Survey Area Data: Version 8, Sep 28, 2012

Kootenai County Area, Idaho

159—Pywell muck

Map Unit Setting

Elevation: 2,100 to 2,800 feet
Mean annual precipitation: 20 to 35 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 80 to 130 days

Map Unit Composition

Pywell and similar soils: 80 percent
Minor components: 15 percent

Description of Pywell

Setting

Landform: Depressions, flood plains, drainageways
Down-slope shape: Concave
Across-slope shape: Concave
Parent material: Herbaceous and/or woody organic material

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Very poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: About 0 to 24 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water capacity: Very high (about 15.6 inches)

Interpretive groups

Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
Land capability (nonirrigated): 4w
Hydrologic Soil Group: B/D

Typical profile

0 to 11 inches: Muck
11 to 60 inches: Muck

Minor Components

Cougarbay

Percent of map unit: 5 percent
Landform: Flood plains

Ramsdell

Percent of map unit: 5 percent
Landform: Flood plains

Other vegetative classification: western redcedar/devil's club (CN550)

Slickens

Percent of map unit: 5 percent
Landform: Flood plains

Data Source Information

Soil Survey Area: Kootenai County Area, Idaho
Survey Area Data: Version 8, Sep 28, 2012

Kootenai County Area, Idaho

160—Ramsdell silt loam

Map Unit Setting

Elevation: 2,100 to 2,800 feet
Mean annual precipitation: 20 to 35 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 80 to 130 days

Map Unit Composition

Ramsdell and similar soils: 90 percent
Minor components: 10 percent

Description of Ramsdell

Setting

Landform: Flood plains, stream terraces
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Mixed alluvium

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Poorly drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: About 12 to 24 inches
Frequency of flooding: FrequentNone
Frequency of ponding: None
Available water capacity: High (about 9.7 inches)

Interpretive groups

Farmland classification: Prime farmland if drained and either protected from flooding or not frequently flooded during the growing season
Land capability (nonirrigated): 5w
Hydrologic Soil Group: B/D
Other vegetative classification: western redcedar/devil's club (CN550)

Typical profile

0 to 8 inches: Ashy silt loam
8 to 15 inches: Silt loam
15 to 60 inches: Silt loam

Minor Components

Cougarbay

Percent of map unit: 5 percent
Landform: Flood plains

Pywell

Percent of map unit: 5 percent
Landform: Flood plains

Data Source Information

Soil Survey Area: Kootenai County Area, Idaho
Survey Area Data: Version 8, Sep 28, 2012

Kootenai County Area, Idaho

164—Rubson-Mokins complex, 0 to 20 percent slopes

Map Unit Setting

Elevation: 2,100 to 2,800 feet
Mean annual precipitation: 25 to 30 inches
Mean annual air temperature: 43 to 45 degrees F
Frost-free period: 80 to 135 days

Map Unit Composition

Rubson and similar soils: 55 percent
Mokins and similar soils: 35 percent

Description of Rubson

Setting

Landform: Terraces
Down-slope shape: Concave
Across-slope shape: Linear
Parent material: Volcanic ash and/or loess over glaciolacustrine deposits

Properties and qualities

Slope: 0 to 20 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.57 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: High (about 11.1 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance, if drained
Land capability (nonirrigated): 3e
Hydrologic Soil Group: B
Other vegetative classification: western hemlock/oakfern (CN565)

Typical profile

0 to 6 inches: Silt loam
6 to 16 inches: Silt loam
16 to 60 inches: Silt loam

Description of Mokins

Setting

Landform: Lake terraces
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Volcanic ash and loess over lacustrine deposits

Properties and qualities

Slope: 0 to 20 percent
Depth to restrictive feature: 20 to 40 inches to abrupt textural change
Drainage class: Moderately well drained
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.06 to 0.20 in/hr)
Depth to water table: About 12 to 30 inches
Frequency of flooding: None
Frequency of ponding: None
Available water capacity: Low (about 4.6 inches)

Interpretive groups

Farmland classification: Farmland of statewide importance, if drained
Land capability (nonirrigated): 4e
Hydrologic Soil Group: C/D
Other vegetative classification: grand fir/twinflower (CN590)

Typical profile

0 to 2 inches: Slightly decomposed plant material
2 to 8 inches: Silt loam
8 to 16 inches: Gravelly silt loam
16 to 22 inches: Silt loam
22 to 62 inches: Silty clay

Data Source Information

Soil Survey Area: Kootenai County Area, Idaho
Survey Area Data: Version 8, Sep 28, 2012

Kootenai County Area, Idaho

179—Slickens

Map Unit Setting

Elevation: 2,100 to 2,800 feet
Mean annual precipitation: 20 to 35 inches
Mean annual air temperature: 43 to 46 degrees F
Frost-free period: 80 to 130 days

Map Unit Composition

Slickens: 80 percent
Minor components: 15 percent

Description of Slickens

Setting

Landform: Flood plains

Typical profile

0 to 60 inches: Stratified silty clay loam to clay

Minor Components

Cougarbay

Percent of map unit: 5 percent
Landform: Flood plains

Ramsdell

Percent of map unit: 5 percent
Landform: Flood plains
Other vegetative classification: western redcedar/devil's club (CN550)

Pywell

Percent of map unit: 5 percent
Landform: Flood plains

Data Source Information

Soil Survey Area: Kootenai County Area, Idaho
Survey Area Data: Version 8, Sep 28, 2012

APPENDIX H2:

SURFACE AND GROUND WATER

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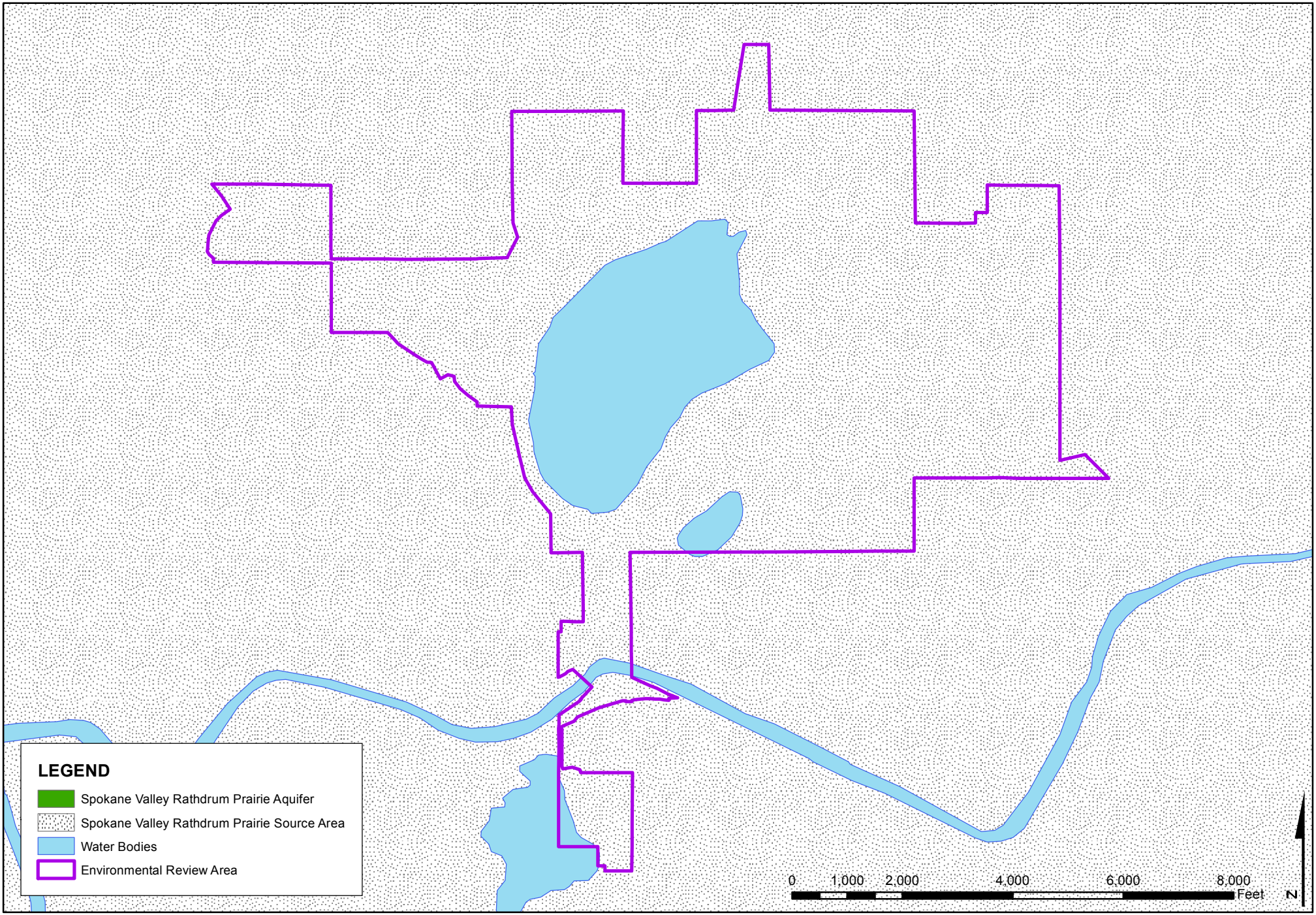

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(toll free) 877-815-5672
(fax) 208-664-5946

Rose Lake Water Association

Groundwater (Sole Source Aquifer)

Sources:
Kootenai County GIS Department
EPA Sole Source Aquifer, Region 10

PROJECT NO.....41113
DRAWN BY.....AW
FILENAME.....Aquifer
DATE.....9/23/13

APPENDIX H3:

WILDLIFE AND HABITAT INFORMATION

WELCH-COMER
ENGINEERS | SURVEYORS

United States Department of the Interior

Fish and Wildlife Service

Idaho Fish And Wildlife Office
1387 S. Vinnell Way, Room 368
Boise, Idaho 83709
Telephone (208) 378-5243
http://www.fws.gov/idaho

U.S. Fish and Wildlife Service - Idaho Fish and Wildlife Office
Endangered, Threatened, Proposed, and Candidate Species
With Associated Proposed and Critical Habitats in Idaho

This Letter and Species List

The U.S. Fish and Wildlife Service (Service) is providing this letter in response to your inquiry regarding federally listed, proposed, and candidate species, and proposed and designated critical habitats that may occur in Idaho. Use the attached Species List to ensure compliance with Sections 7 and 9 of the Endangered Species Act (Act). As a federal agent or designated non-federal representative, use this list in conjunction with best available information to assess whether a proposed action may affect these species or their habitats. If you determine a proposed action may affect a species or their habitats, contact the Service to initiate informal or formal consultation. This list is only valid for a period of 90 days. An updated list can be obtained by downloading the PDF file: www.fws.gov/idaho/species/IdahoSpeciesList.pdf.

Candidate Species Conservation

Though Candidate species have no protection under the Act, they are included in the Species List for early planning consideration. Candidate species could be proposed or listed during the project planning period. The Service advises project proponents to evaluate potential effects to Candidate species that may occur in the project area. Should the species be listed, this may expedite Section 7 consultation under the Act.

Effects Beyond Idaho

If the anticipated effects of an action extend beyond the range of Idaho, please contact the appropriate Service Contact for lists of species and habitats occurring in those adjacent states.

U.S. Fish and Wildlife Service Contacts

Idaho - Idaho Fish and Wildlife Office, Bob Kibler, bob_kibler@fws.gov, (208) 378-5255
Montana - Montana Ecological Services Field Office, (406) 449-5225
Nevada - Nevada Fish and Wildlife Office, (775) 861-6300
Oregon - LaGrande Field Office, (541) 962-8584
Utah - Utah Ecological Service Field Office, (801) 975-3330
Washington - Eastern Washington Field Office, (509) 891-6839
Wyoming - Wyoming Ecological Services Field Office, (307) 772-2374

NOAA Fisheries Species

Listed or proposed species that are under National Marine Fisheries Service's (NOAA Fisheries) jurisdiction do NOT appear on the Service's Species Lists. In Idaho, please contact NOAA Fisheries at (208) 378-5696 or visit NOAA Fisheries' webpage at http://www.nwr.noaa.gov/Species-Lists.cfm for consultation information.

Additional Information

To obtain additional information about the Act, please visit one of the Service's internet sites at http://www.fws.gov/endangered/laws-policies/index.html; http://www.fws.gov/idaho/agencies.htm; or speak with a Service Contact.

This species list was revised by the USFWS on 02/06/2013, and is valid for 90 days after .

U.S. Fish and Wildlife Service • Idaho Fish and Wildlife Office

CANDIDATE, PROPOSED AND LISTED SPECIES & PROPOSED AND DESIGNATED CRITICAL HABITAT IN IDAHO

	Herps	Birds		Mammals						Fish		Mollusks				Plants							
Common Name	**Columbia Spotted Frog (Great Basin Population)**	**Greater Sage-Grouse**	**Yellow-Billed Cuckoo**	**Canada Lynx**	**Grizzly Bear**	**Northern Idaho Ground Squirrel**	**Selkirk Mountains Woodland Caribou**	**Southern Idaho Ground Squirrel**	**North American Wolverine**	**Bull Trout**	**Kootenai River White Sturgeon**	**Banbury Springs Lanx**	**Bliss Rapids Snail**	**Bruneau Hot Springsnail**	**Snake River Physa**	**Goose Creek Milkvetch**	**MacFarlane's Four-O'Clock**	**Packard's Milkvetch**	**Slickspot Peppergrass**	**Spalding's Catchfly**	**Ute Ladies'-Tresses**	**Water Howellia**	**Whitebark Pine**
Scientific Name	*Rana luteiventris*	*Centrocercus urophasianus*	*Coccyzus americanus*	*Lynx canadensis*	*Ursus arctos horribilis*	*Spermophilus brunneus brunneus*	*Rangifer tarandus caribou*	*Spermophilus brunneus endemicus*	*Gulo gulo luscus*	*Salvelinus confluentus*	*Acipenser transmontanus*	*Lanx* sp.	*Taylorconcha serpenticola*	*Pyrgulopsis bruneauensis*	*Haitia (Physa) natricina*	*Astragalus anserinus*	*Mirabilis macfarlanei*	*Astragalus cusickii var. parkardiae*	*Lepidium papilliferum*	*Silene spaldingii*	*Spiranthes diluvialis*	*Howellia aquatilis*	*Pinus albicaulis*
Ada		C	C							T					E				P-PCH				
Adams		C		T		T		C	P	T-DCH													C
Bannock		C	C						P														
Bear Lake		C		T					P														C
Benewah				T					P	T-DCH										T		T	
Bingham		C	C						P												T		
Blaine		C	C	T					P	T-DCH													C
Boise			C	T					P	T-DCH													C
Bonner				T	T		E		P	T-DCH													C
Bonneville		C	C	T	T				P												T		C
Boundary				T-DCH	T		E-DCH		P	T-DCH	E-DCH												C
Butte		C		T					P	T-DCH													C
Camas		C		T					P	T-DCH													C
Canyon			C												E				P-PCH				
Caribou		C		T					P														C
Cassia		C	C												E	C							
Clark		C	C	T	T				P														C
Clearwater				T					P	T-DCH													C
Custer		C	C	T					P	T-DCH													C
Elmore		C	C	T					P	T-DCH			T		E				P-PCH				C
Franklin		C		T					P														
Fremont		C	C	T	T				P												T		C
Gem		C						C	P	T-DCH									P-PCH				C

Table Key: C = Candidate Species P= Proposed Species T=Threatened Species E=Endangered Species PCH= Proposed Critical Habitat DCH=Designated Critical Habitat

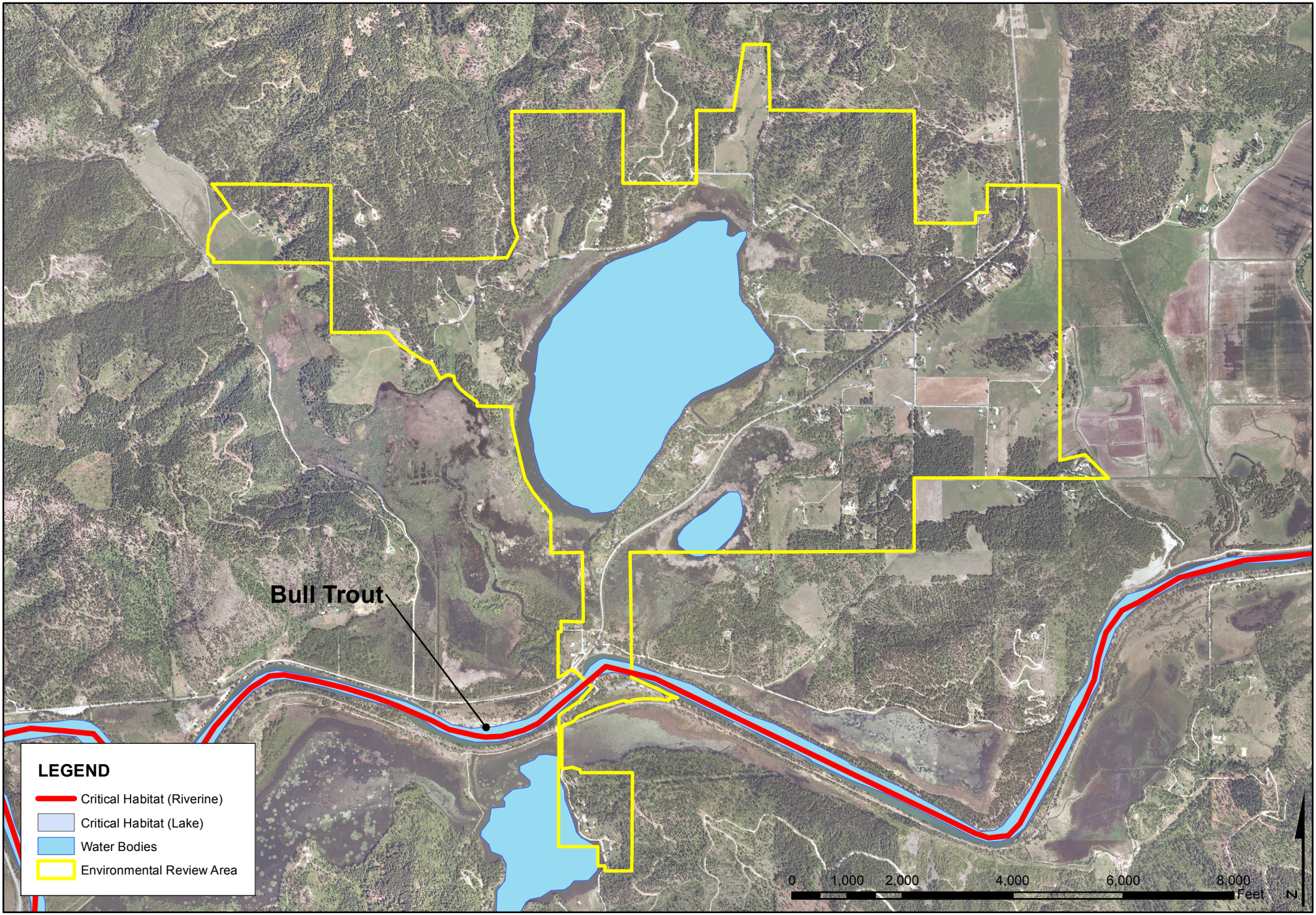
This species list was revised by the USFWS on 02/06/2013, and is valid for 90 days after .

U.S. Fish and Wildlife Service • Idaho Fish and Wildlife Office

CANDIDATE, PROPOSED AND LISTED SPECIES & PROPOSED AND DESIGNATED CRITICAL HABITAT IN IDAHO

	Herps	Birds		Mammals						Fish		Mollusks				Plants							
Common Name	**Columbia Spotted Frog (Great Basin Population)**	**Greater Sage-Grouse**	**Yellow-Billed Cuckoo**	**Canada Lynx**	**Grizzly Bear**	**Northern Idaho Ground Squirrel**	**Selkirk Mountains Woodland Caribou**	**Southern Idaho Ground Squirrel**	**North American Wolverine**	**Bull Trout**	**Kootenai River White Sturgeon**	**Banbury Springs Lanx**	**Bliss Rapids Snail**	**Bruneau Hot Springsnail**	**Snake River Physa**	**Goose Creek Milkvetch**	**MacFarlane's Four-O'Clock**	**Packard's Milkvetch**	**Slickspot Peppergrass**	**Spalding's Catchfly**	**Ute Ladies'-Tresses**	**Water Howellia**	**Whitebark Pine**
Scientific Name	*Rana luteiventris*	*Centrocercus urophasianus*	*Coccyzus americanus*	*Lynx canadensis*	*Ursus arctos horribilis*	*Spermophilus brunneus brunneus*	*Rangifer tarandus caribou*	*Spermophilus brunneus endemicus*	*Gulo gulo luscus*	*Salvelinus confluentus*	*Acipenser transmontanus*	*Lanx* sp.	*Taylorconcha serpenticola*	*Pyrgulopsis bruneauensis*	*Haitia (Physa) natricina*	*Astragalus anserinus*	*Mirabilis macfarlanei*	*Astragalus cusickii var. parkardiae*	*Lepidium papilliferum*	*Silene spaldingii*	*Spiranthes diluvialis*	*Howellia aquatilis*	*Pinus albicaulis*
Gooding		C										E	T		E								
Idaho			C	T					P	T-DCH							T			T			C
Jefferson		C	C	T					P												T		
Jerome		C											T		E								
Kootenai			C	T					P	T-DCH										T		T	
Latah			C	T					P											T		T	
Lemhi		C	C	T					P	T-DCH													
Lewis			C							T-DCH										T			
Lincoln		C																					
Madison		C	C	T					P												T		
Minidoka		C	C												E								
Nez Perce				T						T-DCH										T			
Oneida		C	C																				
Owyhee	C	C	C							T-DCH				E	E				P-PCH				
Payette		C						C		T					E			C	P-PCH				
Power		C																					
Shoshone				T					P	T-DCH										T		T	C
Teton				T	T				P														C
Twin Falls	C	C	C										T		E								
Valley				T		T			P	T-DCH													C
Washington		C				T		C	P	T-DCH					E								C

Table Key: C = Candidate Species P= Proposed Species T=Threatened Species E=Endangered Species PCH= Proposed Critical Habitat DCH=Designated Critical Habitat



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(toll free) 877-815-5672
(fax) 208-664-5946

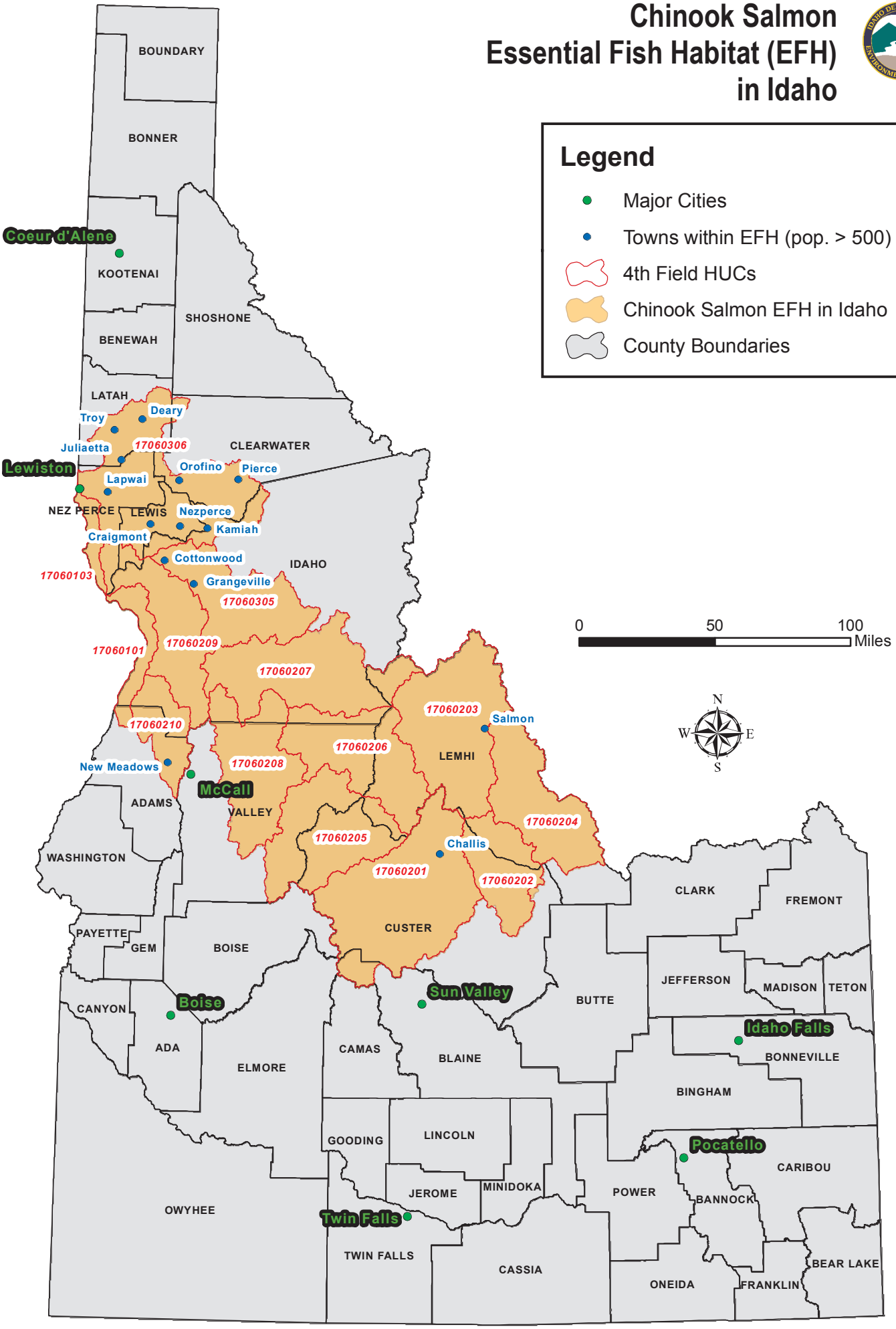
Rose Lake Water Association

Critical Habitat

Sources:
Kootenai County GIS Department
US Fish and Wildlife, Critical Habitat 2012

PROJECT NO.....41113
DRAWN BY.....AW
FILENAME.....CriticalHabitat
DATE.....9/23/13

Chinook Salmon Essential Fish Habitat (EFH) in Idaho



APPENDIX H4:

LAND USE, ZONING, AND HISTORIC PLACES INFORMATION

WELCH-COMER
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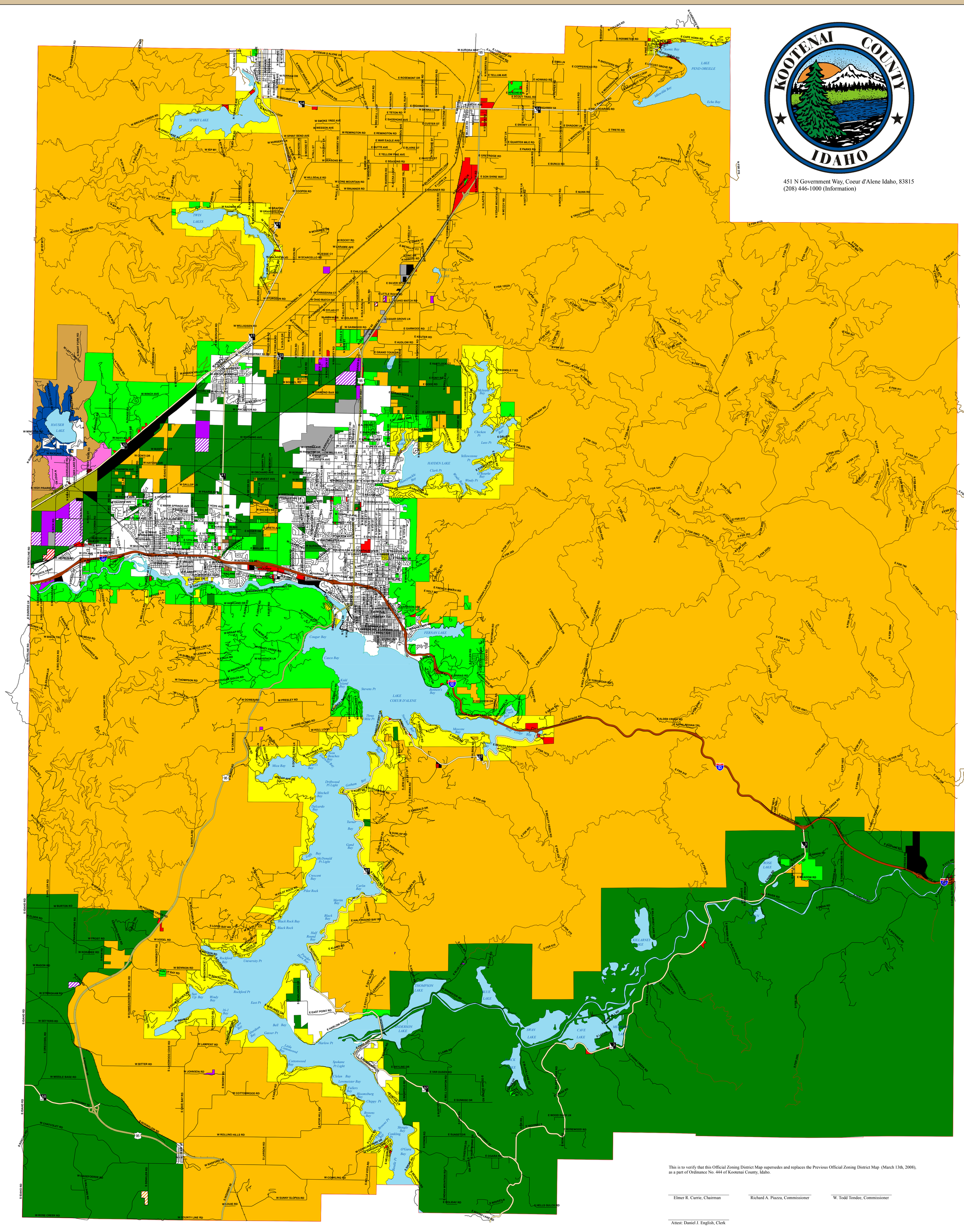
Kootenai County Zoning District Map

June 24th, 2010



KOOTENAI COUNTY IDAHO

451 N Government Way, Coeur d'Alene Idaho, 83815
(208) 446-1000 (Information)

This is to verify that this Official Zoning District Map supersedes and replaces the Previous Official Zoning District Map (March 13th, 2008), as a part of Ordinance No. 444 of Kootenai County, Idaho.

Elmer R. Currie, Chairman

Richard A. Piazza, Commissioner

W. Todd Tondee, Commissioner

Attest: Daniel J. English, Clerk

Kootenai County Planning & Zoning Office

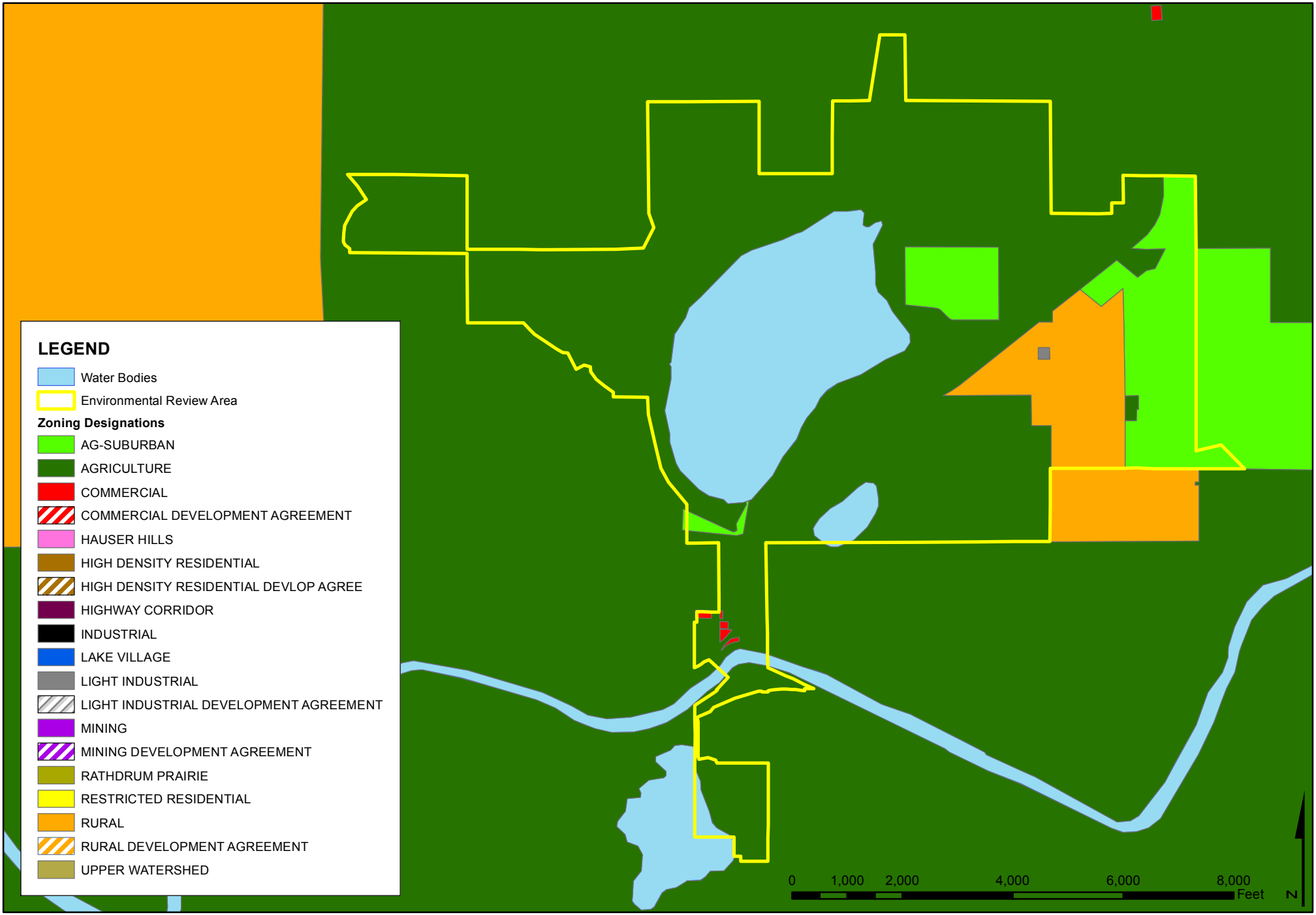
PO Box 9000
451 N Government Way
Coeur d' Alene, ID 83814-9000
email: kcmap@co.kootenai.id.us
www.co.kootenai.id.us

Prepared for: Community Development
Prepared by: KCGIS
Issue Date: 01-22-2013
Project Filename: Zoning.mxd
Plot File: Zoning.pdf

0 1.25 2.5 5 7.5 10 Miles

This map is to be used for reference purposes only.
Kootenai County is not responsible for an inaccuracies contained herin.

- AG-SUBURBAN
- AGRICULTURE
- COMMERCIAL
- COMMERCIAL DEVELOPMENT AGREEMENT
- HAUSER HILLS
- HIGH DENSITY RESIDENTIAL
- HIGH DENSITY RESIDENTIAL DEVLOP AGREE
- HIGHWAY CORRIDOR
- INDUSTRIAL
- LAKE VILLAGE
- LIGHT INDUSTRIAL
- LIGHT INDUSTRIAL DEVELOPMENT AGREEMENT
- MINING
- MINING DEVELOPMENT AGREEMENT
- RATHDRUM PRAIRIE
- RESTRICTED RESIDENTIAL
- RURAL
- RURAL DEVELOPMENT AGREEMENT
- UPPER WATERSHED



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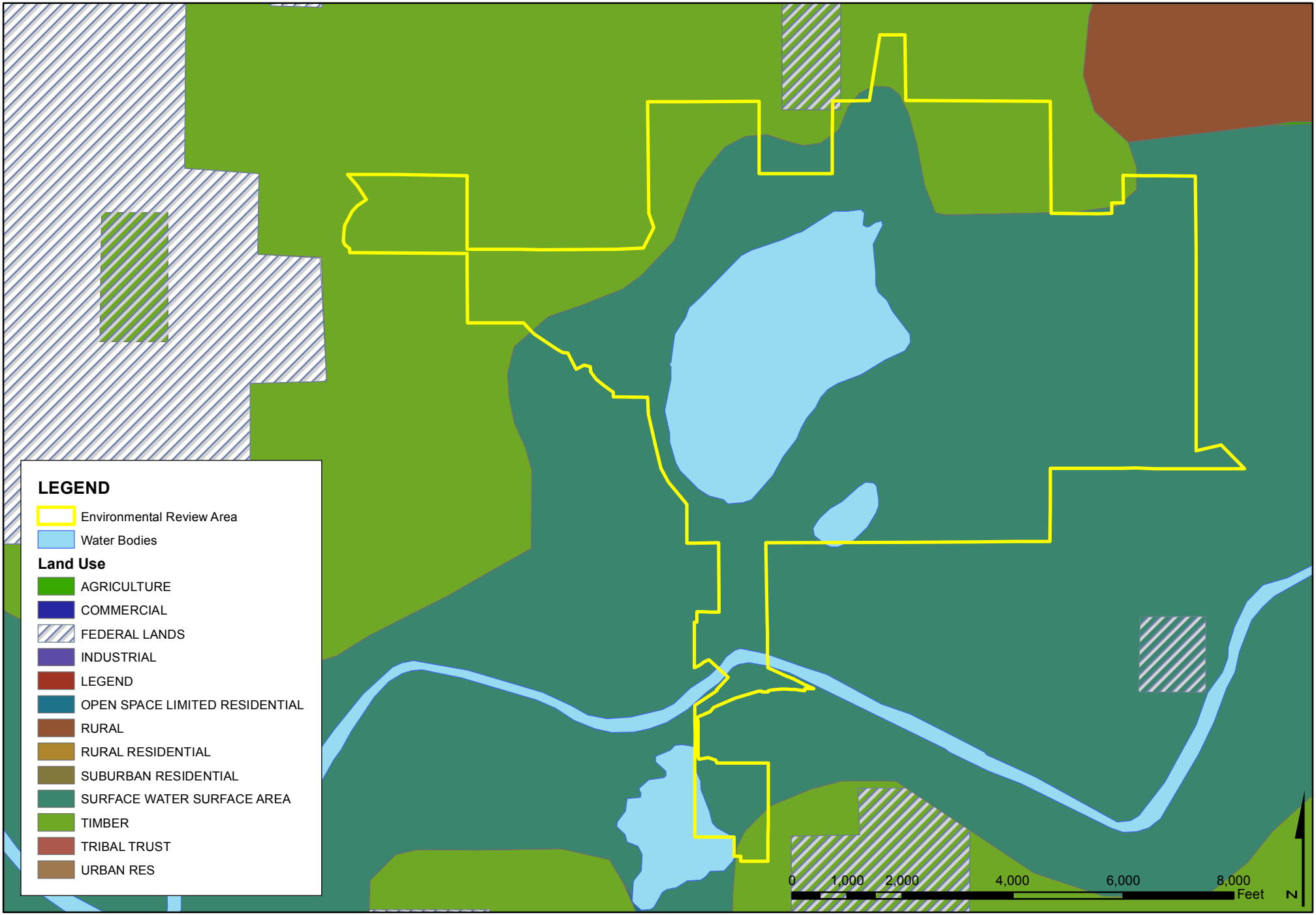
(toll free) 877-815-5672
(fax) 208-664-5946

Rose Lake Water Association

Zoning

Sources:
Kootenai County GIS Department
Dept. of Interior, Imagery (Spokane, WA 2009)

PROJECT NO.....41113
DRAWN BY.....AW
FILENAME.....Zoning
DATE.....9/23/13



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(toll free) 877-815-5672
(fax) 208-664-5946

Rose Lake Water Association

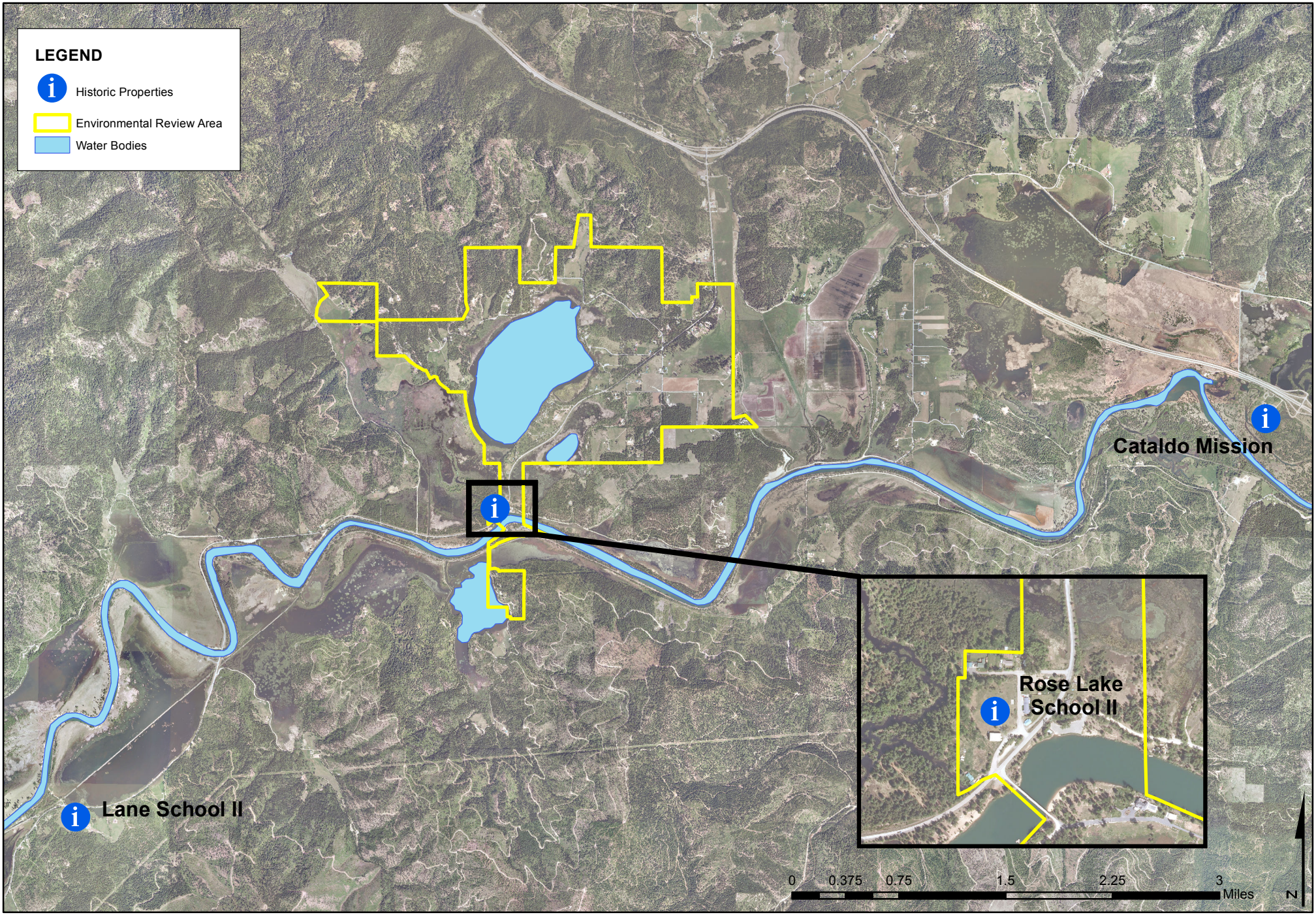
Land Use

Sources:
Kootenai County GIS Department
Dept. of Interior, Imagery (Spokane, WA 2009)

PROJECT NO.....41113
DRAWN BY.....AW
FILENAME.....LandUse
DATE.....9/25/13

National Register of Historic Places: Listed Properties as of October 1, 2011

85002090	IDAHO	Kootenai	Bayview	Bayview School II	Careywood Rd.	19850912	BUILDING	Kootenai County Rural Schools TR
85002091	IDAHO	Kootenai	Rockford Bay	Bellgrove School II	Hamaker Rd.	19850912	BUILDING	Kootenai County Rural Schools TR
66000312	IDAHO	Kootenai	Cataldo	Cataldo Mission	Off U.S. 10	19661015	BUILDING	
85002092	IDAHO	Kootenai	Medimont	Cave Lake School	ID 3	19850912	BUILDING	Kootenai County Rural Schools TR
85002093	IDAHO	Kootenai	Athol	Cedar Mountain School	Parks and Lewellyn Creek Rd.	19850912	BUILDING	Kootenai County Rural Schools TR
78001070	IDAHO	Kootenai	Clarksville	Clark House	On Hayden Lake	19781212	BUILDING	
79000792	IDAHO	Kootenai	Coeur d'Alene	Coeur d'Alene City Hall	5th and Sherman Sts.	19790803	BUILDING	
77000461	IDAHO	Kootenai	Coeur d'Alene	Coeur d'Alene Federal Building	4th and Lakeside	19771216	BUILDING	
78001071	IDAHO	Kootenai	Coeur d'Alene	Coeur d'Alene Masonic Temple	525 Sherman Ave.	19780522	BUILDING	
85002094	IDAHO	Kootenai	Post Falls	Cougar Gulch School III	Cougar Gulch Rd.	19850912	BUILDING	Kootenai County Rural Schools TR
99001476	IDAHO	Kootenai	Harrison	Crane, Silas W., and Elizabeth, House	201 S. Coeur d'Alene Ave.	19991209	BUILDING	
85001126	IDAHO	Kootenai	Coeur d'Alene	Davey, Harvey M., House	315 Wallace Ave.	19850523	BUILDING	
85002095	IDAHO	Kootenai	Camp Mivoden	East Hayden Lake School II	Hayden Lake Rd.	19850912	BUILDING	Kootenai County Rural Schools TR
87001562	IDAHO	Kootenai	Hayden Lake	Finch, John A., Caretaker's House	2160 Finch Rd.	19870914	BUILDING	
79000793	IDAHO	Kootenai	Coeur d'Alene	First United Methodist Church	618 Wallace Ave.	19790618	BUILDING	
79000794	IDAHO	Kootenai	Coeur d'Alene	Fort Sherman Buildings	North Idaho Junior College campus	19791025	DISTRICT	
88000272	IDAHO	Kootenai	Coeur d'Alene	Gray, John P. and Stella, House	521 S. Thirteenth St.	19880331	BUILDING	
96001505	IDAHO	Kootenai	Harrison	Harrison Commercial Historic District	Roughly bounded by N. Lake Ave., W. Harrison St., N. Coeur d'Alene., and Pi	19961220	DISTRICT	
85002096	IDAHO	Kootenai	Medimont	Indian Springs School II	ID 3	19850912	BUILDING	Kootenai County Rural Schools TR
75000633	IDAHO	Kootenai	Coeur d'Alene	Inland Empire Electric Railway Substation	Mullan Rd. and Northwest Blvd.	19750627	BUILDING	
77000462	IDAHO	Kootenai	Coeur d'Alene	Kootenai County Courthouse	501 Government Way	19771223	BUILDING	
01000834	IDAHO	Kootenai	Rathdrum	Kootenai County Jail	802 Second St.	20010810	BUILDING	
85002097	IDAHO	Kootenai	Lane	Lane School II	Lanz Rd.	19850912	BUILDING	Kootenai County Rural Schools TR
85002098	IDAHO	Kootenai	McGuire	McGuires School	Corbin Rd. and Old Hwy. 10	19850912	BUILDING	Kootenai County Rural Schools TR
09001163	IDAHO	Kootenai	Coeur d'Alene	Mooney-Dahlberg Farmstead	5803 Riverview Dr.	20091230	BUILDING	
90000548	IDAHO	Kootenai	Coeur d'Alene	Mullan Road	3 segments:1)between Aldar Creek and Cedar Creek;2)Fourth of July Pass b	19900405	SITE	
85002099	IDAHO	Kootenai	Pleasant View	Pleasant View School II	Pleasant View Rd.	19850912	BUILDING	Kootenai County Rural Schools TR
84003851	IDAHO	Kootenai	Post Falls	Post Falls Community United Presbyterian Church	4th and William Sts.	19840907	BUILDING	
85002100	IDAHO	Kootenai	Coeur d'Alene	Prairie School II	Prairie Ave.	19850912	BUILDING	Kootenai County Rural Schools TR
74000742	IDAHO	Kootenai	Rathdrum	Rathdrum State Bank	1st and Mills Sts.	19741108	BUILDING	
76000676	IDAHO	Kootenai	Coeur d'Alene	Roosevelt School	1st and Wallace Sts.	19760730	BUILDING	
85002101	IDAHO	Kootenai	Rose Lake	Rose Lake School II	Queen St. and ID 3	19850912	BUILDING	Kootenai County Rural Schools TR
92000418	IDAHO	Kootenai	Coeur d'Alene	Sherman Park Addition	Bounded by Garden Ave., Hubbard St., Lakeshore Dr. and Park Dr.	19920427	DISTRICT	
79000795	IDAHO	Kootenai	Spirit Lake	Spirit Lake Historic District	Maine St.	19790208	DISTRICT	
03000124	IDAHO	Kootenai	Post Falls	Spokane Valley Land and Water Company Canal	Diverts in Falls Park, Fourth St.	20030320	STRUCTURE	
77000464	IDAHO	Kootenai	Rathdrum	St. Stanislaus Kostka Mission	McCartney and 3rd Sts.	19771117	BUILDING	
77000463	IDAHO	Kootenai	Coeur d'Alene	St. Thomas Catholic Church	919 Indiana Ave.	19771005	BUILDING	
85002156	IDAHO	Kootenai	Hayden Lake	Thunborg, Jacob and Cristina, House	Chicken Point	19850912	BUILDING	
92000420	IDAHO	Kootenai	Post Falls	Treaty Rock	N of I-90, NE of Spokane R. falls	19920430	SITE	
85002102	IDAHO	Kootenai	Silver Sands Beach	Upper Twin Lakes School	Twin Lakes Rd.	19850912	BUILDING	Kootenai County Rural Schools TR
96001507	IDAHO	Kootenai	Post Falls	Washington Water Power Bridges	.5 mi. W of jct. of Spokane and 4th Sts.	19961220	STRUCTURE	
97000765	IDAHO	Kootenai	Post Falls	Young, Samuel and Ann, House	120 4th Ave.	19970709	BUILDING	



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(fax) 208-664-5946

Rose Lake Water Association

Historic Properties

Sources:
Kootenai County GIS Department
National Register of Historic Places, NPS

PROJECT NO.....41113
DRAWN BY.....AW
FILENAME.....HistoricProp
DATE.....9/23/13

APPENDIX H5:

FLOODPLAINS, WETLANDS, AND WILD SCENIC INFORMATION

WELCH-COMER
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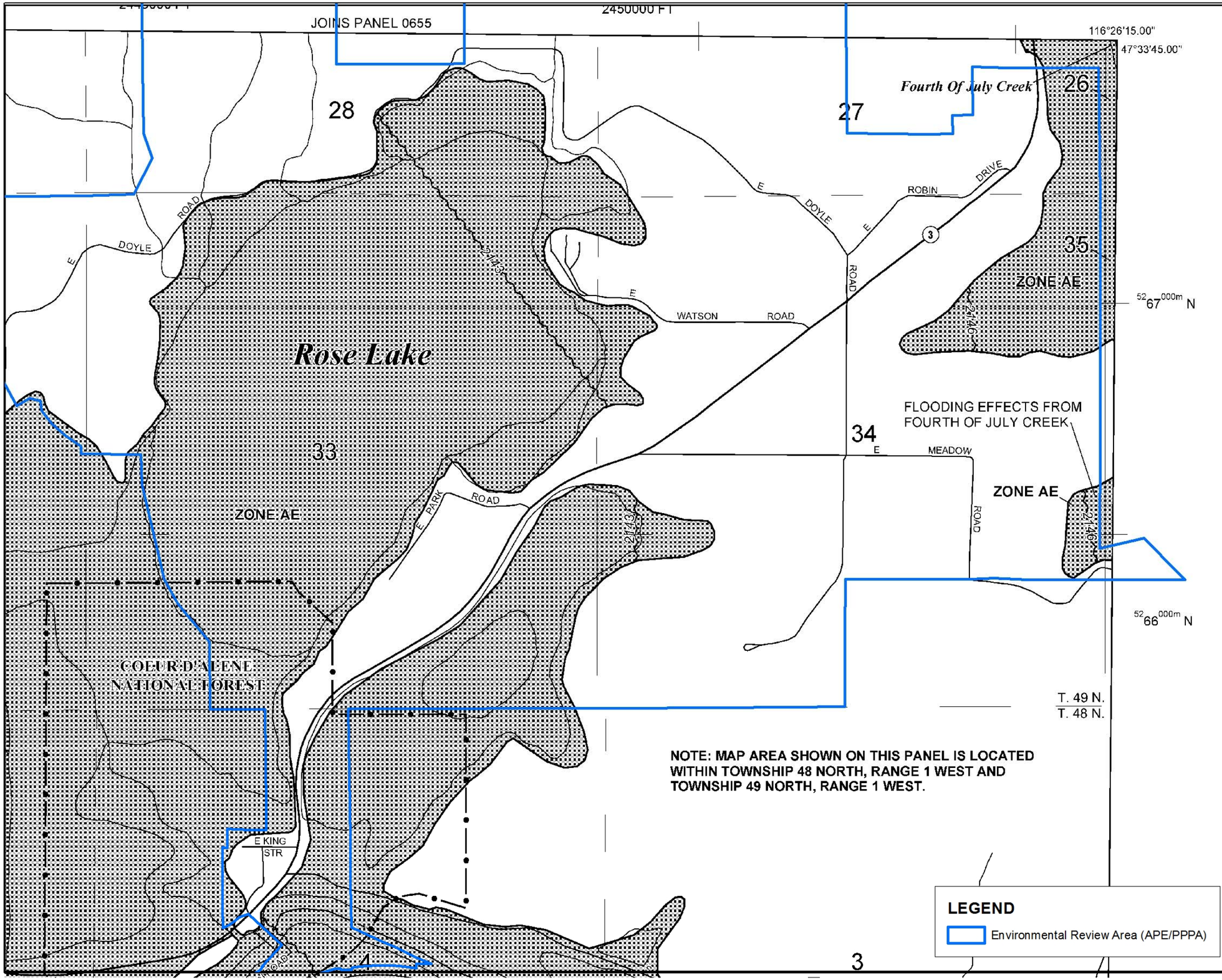


MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

METE

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0665E

FIRM

FLOOD INSURANCE RATE MAP

KOOTENAI COUNTY, IDAHO

AND INCORPORATED AREAS

PANEL 665 OF 975

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
KOOTENAI COUNTY	160076	0665	E

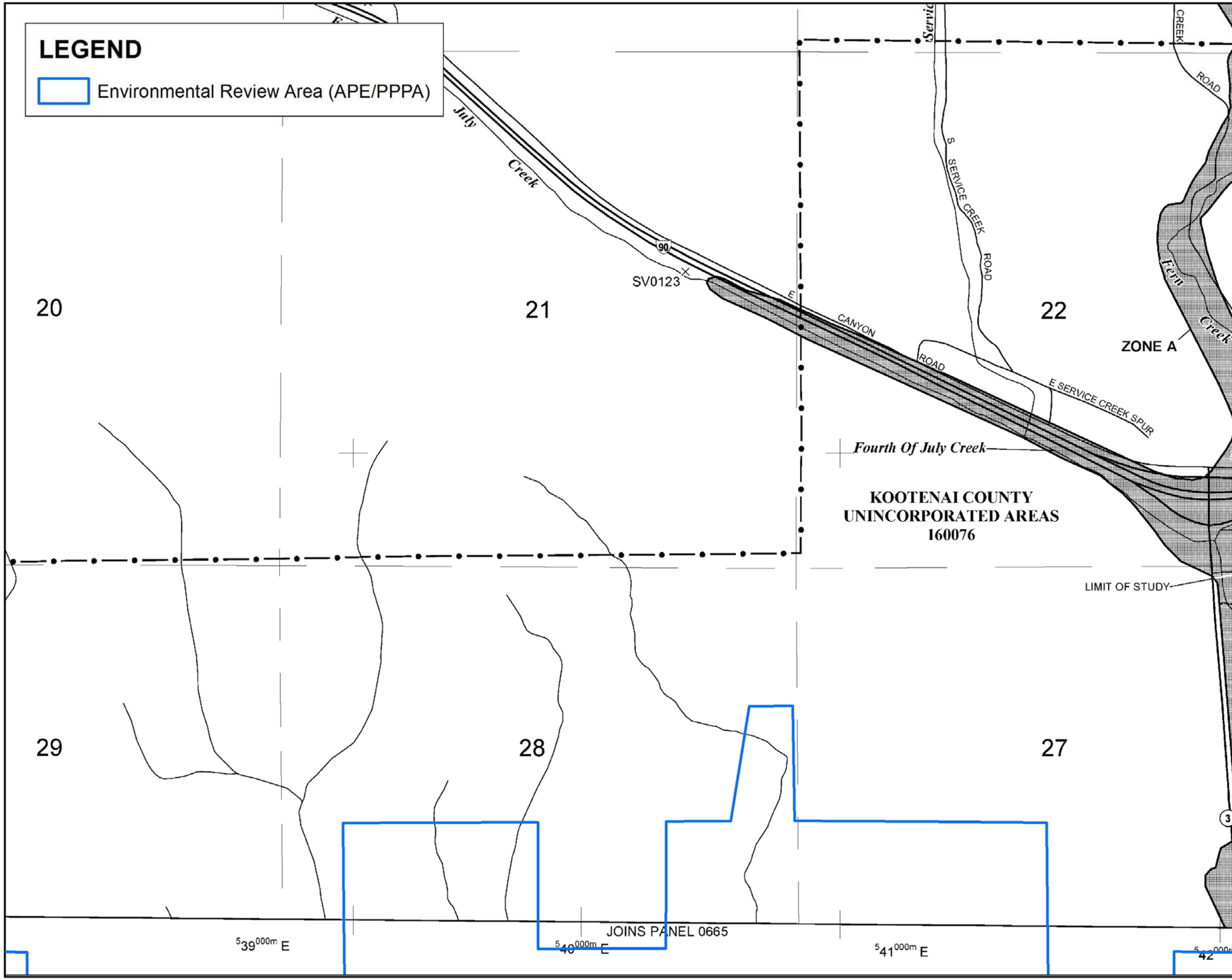
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
16055C0665E

EFFECTIVE DATE
MAY 3, 2010

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

METE

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0655E

FIRM

FLOOD INSURANCE RATE MAP

KOOTENAI COUNTY, IDAHO

AND INCORPORATED AREAS

PANEL 655 OF 975

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
KOOTENAI COUNTY	160076	0655	E

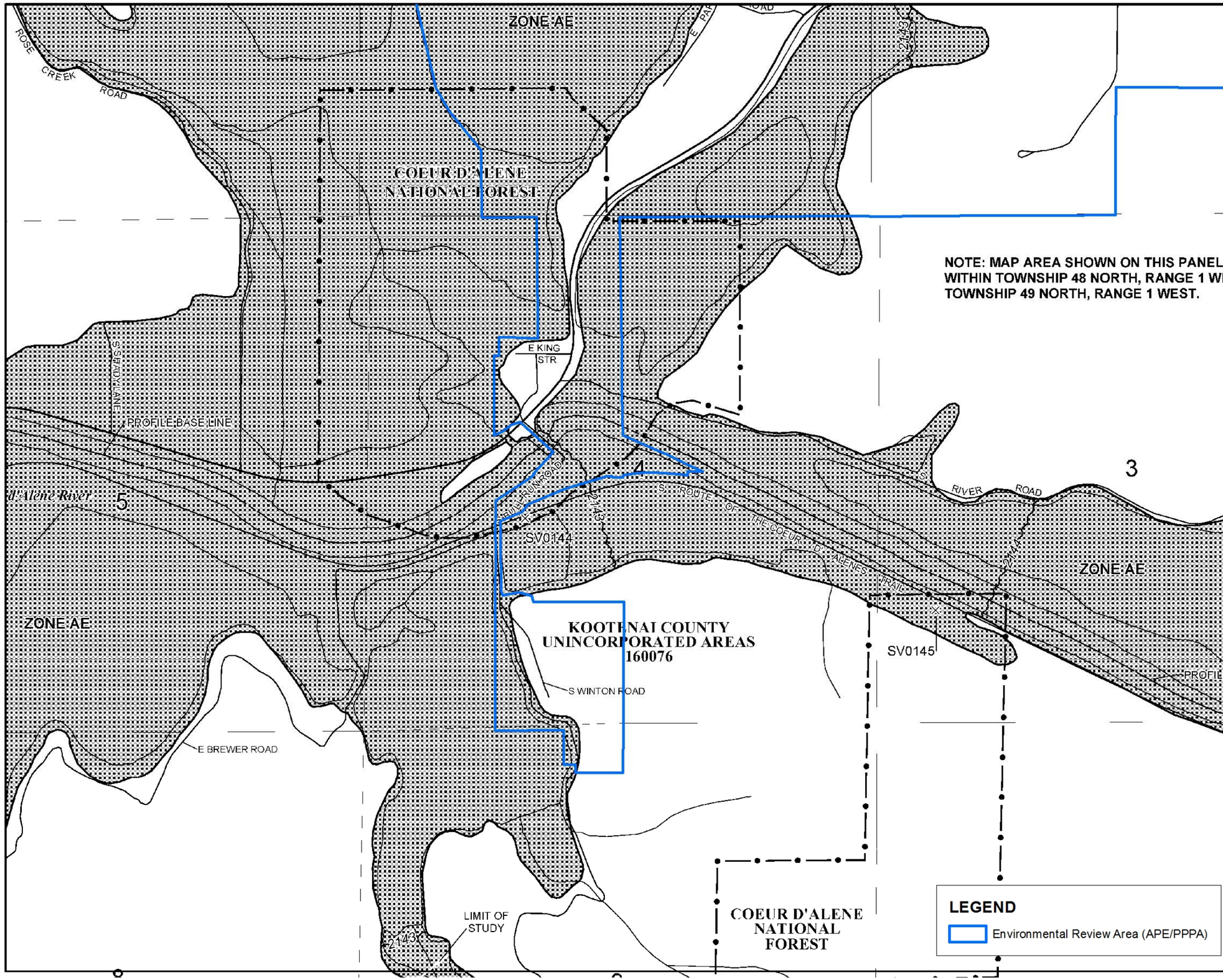
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
16055C0655E

EFFECTIVE DATE
MAY 3, 2010

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



NOTE: MAP AREA SHOWN ON THIS PANEL I
WITHIN TOWNSHIP 48 NORTH, RANGE 1 WE
TOWNSHIP 49 NORTH, RANGE 1 WEST.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

METE

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0665E

FIRM

FLOOD INSURANCE RATE MAP

KOOTENAI COUNTY, IDAHO

AND INCORPORATED AREAS

PANEL 665 OF 975

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
KOOTENAI COUNTY	160076	0665	E

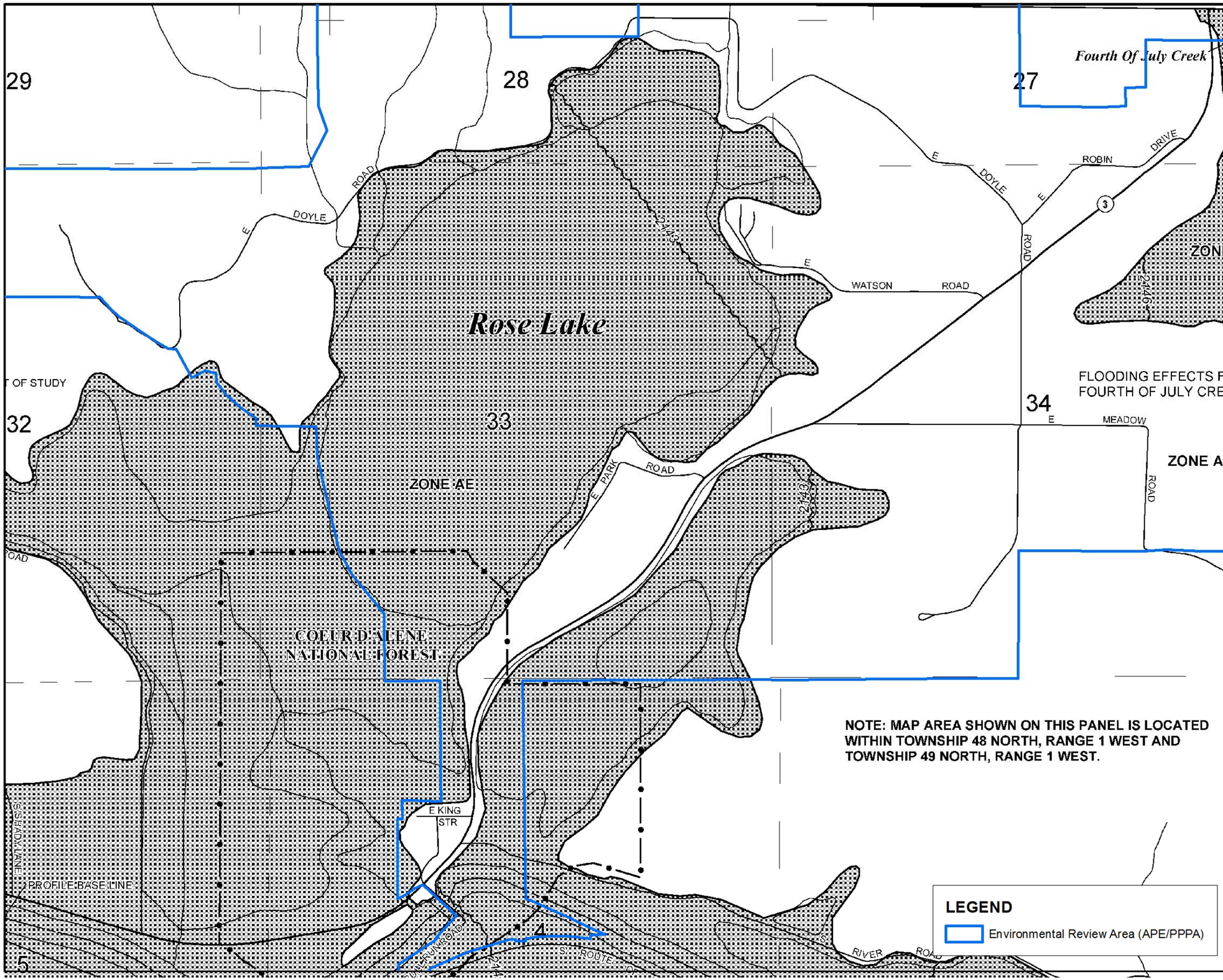
Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
16055C0665E

EFFECTIVE DATE
MAY 3, 2010

Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

METE

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0665E

FIRM

FLOOD INSURANCE RATE MAP

KOOTENAI COUNTY, IDAHO

AND INCORPORATED AREAS

PANEL 665 OF 975

(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
KOOTENAI COUNTY	160076	0665	E

Notice to User: The **Map Number** shown below should be used when placing map orders; the **Community Number** shown above should be used on insurance applications for the subject community.

MAP NUMBER
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EFFECTIVE DATE
MAY 3, 2010

Federal Emergency Management Agency

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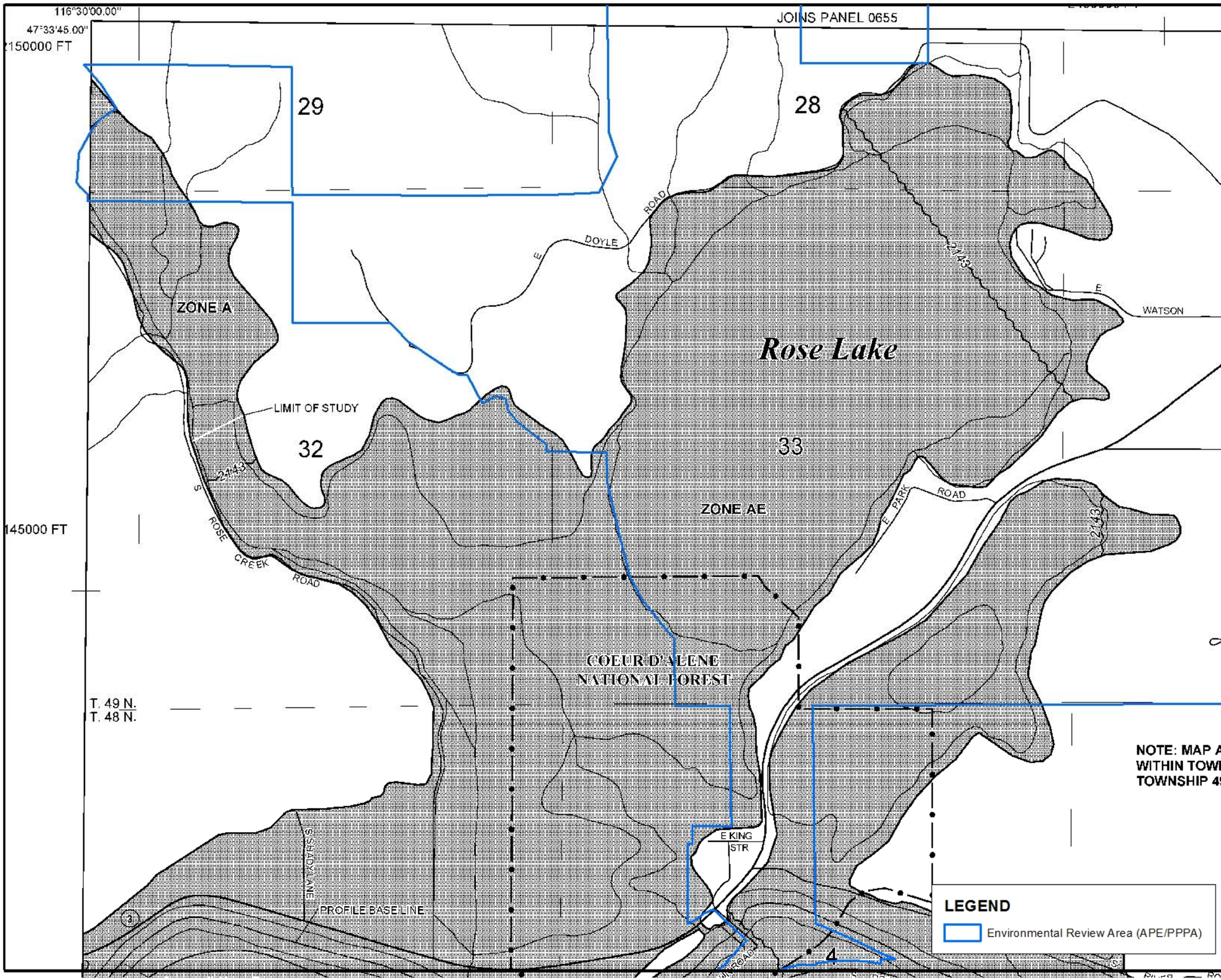

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

METE

NFIP

NATIONAL FLOOD INSURANCE PROGRAM

PANEL 0665E

FIRM

FLOOD INSURANCE RATE MAP

KOOTENAI COUNTY, IDAHO

AND INCORPORATED AREAS

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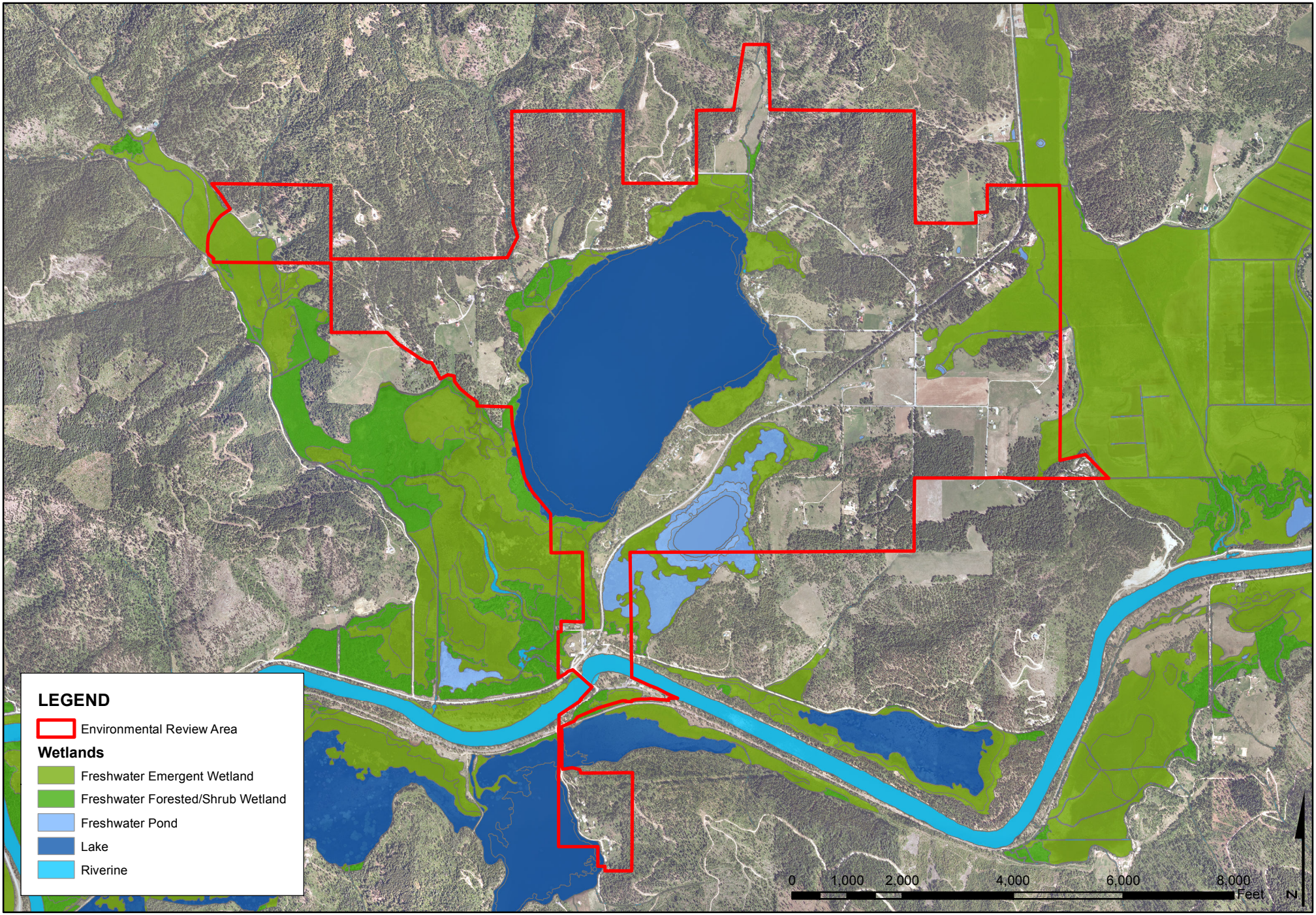

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350 E. Kathleen Ave.
Coeur d'Alene, ID 83815

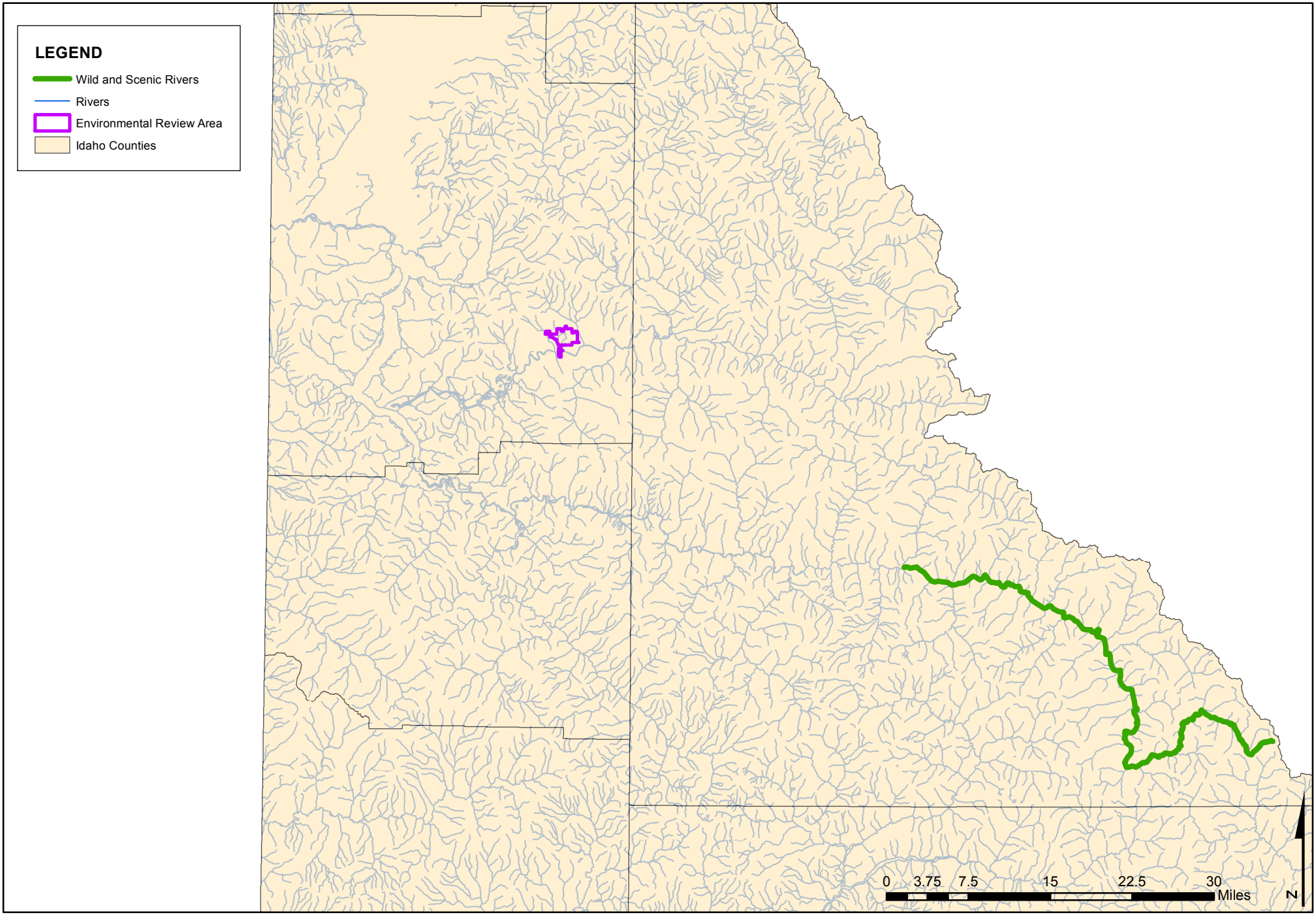
208-664-9382
(toll free) 877-815-5672
(fax) 208-664-5946

Rose Lake Water Association

Wetland

Sources:
Kootenai County GIS Department
US Fish and Wildlife Wetlands Map, 2013

PROJECT NO.....41113
DRAWN BY.....AW
FILENAME.....Wetland
DATE.....9/25/13



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(toll free) 877-815-5672
(fax) 208-664-5946

Rose Lake Water Association

Wild and Scenic Rivers

Sources:
Kootenai County GIS Department
Wild and Scenic Rivers, 2009

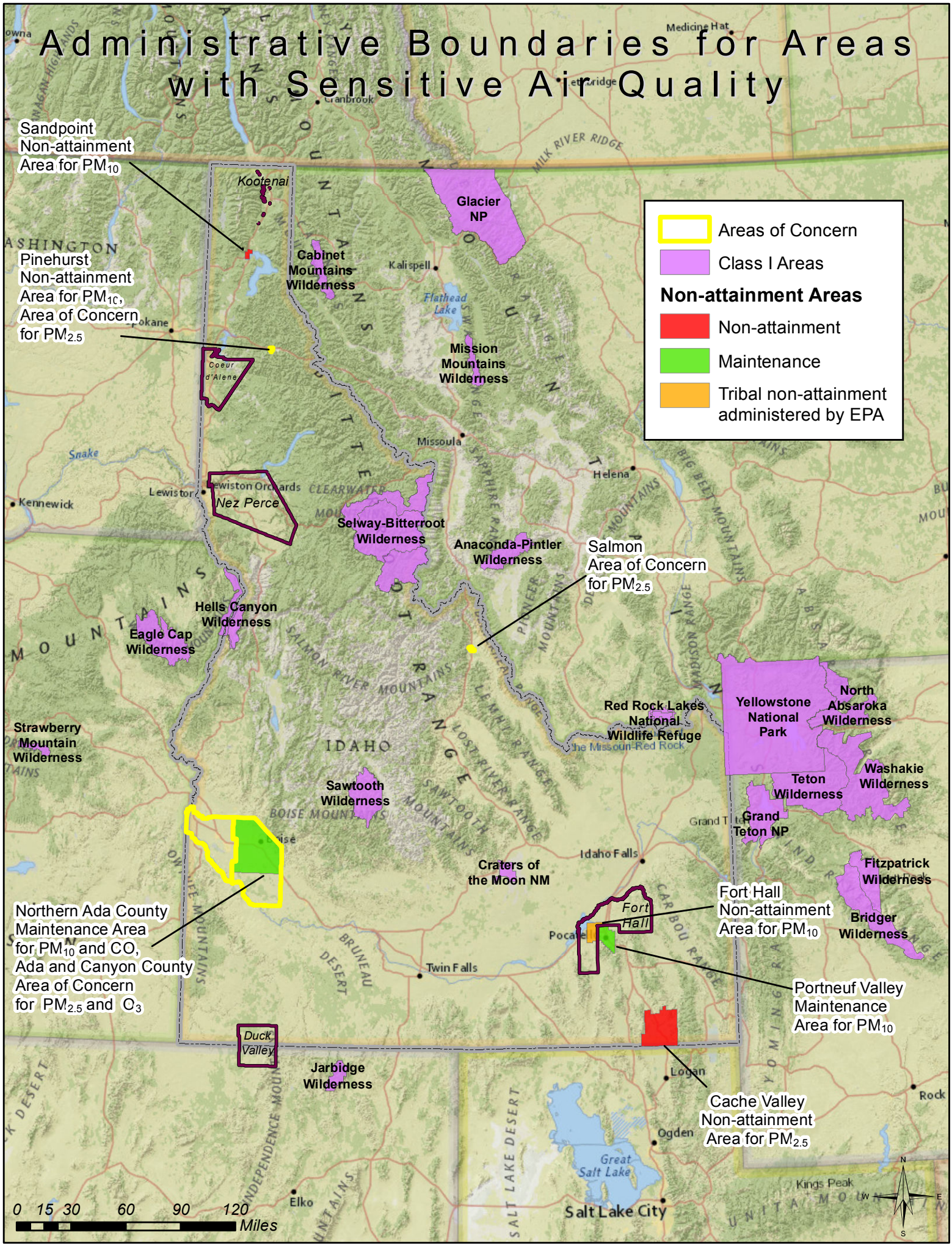
PROJECT NO.....41113
DRAWN BY.....AW
FILENAME.....WildnScenic
DATE.....9/23/13

APPENDIX H6:

AIR QUALITY INFORMATION

WELCH-COMER
ENGINEERS | SURVEYORS

Administrative Boundaries for Areas with Sensitive Air Quality



APPENDIX H7:

ALTERNATIVE COMPARISON TABLES

WELCH-COMER
ENGINEERS | SURVEYORS

SOURCE OPTIONS

Environmental Criteria	No Action (Option C)	Option A: Drill New Well	Option B: Add Capacity to Well No. 3
Climate and Physical Aspects (Topography, Geology, and Soils)	No Impact	Excavation for New Well and Well House (Minor Long-Term Impact, Short-Term Impact)	Excavation for Add'l Well Depth (Minor Long-Term Impact, Short-Term Impact)
Population, Economic, and Social Profile	No Potential for Growth or Expansion	Increased User Rates, Allow for Growth, Improved Service	Increased User Rates, Allow for Growth, Improved Service
Land Use	No Impact	No Impact	No Impact
Floodplain Development	No Impact	No Impact	No Impact
Wetlands and Water Quality	No Impact	Site Disturbance (Short-Term Impact to Water Quality)	Site Disturbance (Short-Term Impact to Water Quality)
Wild and Scenic Rivers	No Impact	No Impact	No Impact
Cultural Resources	No Impact	Potential Impact (Excavation in New Area)	No Adverse Impact
Flora and Fauna	No Impact	Site Disturbance (Short-Term Impact)	Site Disturbance (Short-Term Impact)
Recreation and Open Space	No Impact	No Impact	No Impact
Agricultural Lands	No Impact	Potential Impact (Excavation in New Area)	No Impact
Air Quality	No Impact	Construction Emissions (Short-Term Impact)	Construction Emissions (Short-Term Impact)
Energy	No Impact	Improved Overall System Efficiency	Improved Overall System Efficiency
Public Health	Continue Deficiencies in Service and Reliability	Improved Service and Reliability	Improved Service and Reliability
Option Cost	$0	$284,000	$158,350

STORAGE AND BOOSTER OPTIONS

Environmental Criteria	No Action (Option E)	Option A: Add Booster Pump Station*	Option B: Add Dedicated Transmission Main and Booster**	Option C: Add New Storage***	Option D: Individual Booster Pumps
Climate and Physical Aspects (Topography, Geology, and Soils)	No Impact	Excavation for Piping and Pump Installation (Minor Long-Term Impact, Short-Term Impact)	Excavation for Waterline Installation (Minor Long-Term Impact, Short-Term Impact)	Excavation for Reservoir and Site Piping (Minor Long-Term Impact, Short-Term Impact)	Minor Excavation for Piping and Pump Installation (Minor Long-Term and Short-Term Impact)
Population, Economic, and Social Profile	No Potential for Growth or Expansion	Increased User Rates, Allow for Growth, Improved Service and Pressure	Increased User Rates, Allow for Growth, Improved Service	Increased User Rates, Allow for Growth, Improved Service	Minor Increased User Rates, Allow for Growth, Improved Service and Pressure for Services Modified
Land Use	No Impact	No Impact	No Impact	No Impact	No Impact
Floodplain Development	No Impact	No Impact	Line Installation in Floodplain (Minor Short-Term Impact)	No Impact	No Impact
Wetlands and Water Quality	No Impact	Site Disturbance (Short-Term Impact to Water Quality)	Line Installation in Wetland, and General Disturbance for Line Installation (Short-Term Impact)	Site Disturbance (Short-Term Impact to Water Quality)	Installation in Wetland, and Minor General Disturbance for Line Installation (Short-Term Impact)
Wild and Scenic Rivers	No Impact	No Impact	No Impact	No Impact	No Impact
Cultural Resources	No Impact	Potential Impact (Excavation in New Area)	Potential Impact (Excavation in New Area)	Potential Impact (Excavation in New Area)	Potential Impact (Excavation in New Area)
Flora and Fauna	No Impact	Site Disturbance (Short-Term Impact)	Site Disturbance (Short-Term Impact)	Site Disturbance (Short-Term Impact)	Site Disturbance (Short-Term Impact)

Recreation and Open Space	No Impact	No Impact	No Impact	No Impact	No Impact
Agricultural Lands	No Impact	Potential Impact (Excavation in New Area)	Potential Impact (Excavation in New Area)	Potential Impact (Excavation in New Area)	Potential Impact (Excavation in New Area)
Air Quality	No Impact	Construction Emissions and Intermittent Use of Standby Generator (Short-Term and Long-Term Impact, respectively)	Construction Emissions (Short-Term Impact)	Construction Emissions (Short-Term Impact)	Construction Emissions (Short-Term Impact)
Energy	No Impact	Improved Overall System Efficiency, Additional Pumping (Negligible Impact)	No Impact	No Impact	Minor Additional Consumption
Public Health	Continue Deficiencies in Service and Reliability	Improved Service and Reliability	Improved Service and Reliability	Improved Service and Reliability	Improved Service for Services Modified
Option Cost	$0	$194,400	$2,105,190	$409,050	$24,990

*Requires either Source Option A or B (add these impacts to this option)
**Combined with Storage and Booster Option A (add these impacts to this option)
***Requires modification to Well No. 3, a version of Source Option B (add these impacts to this option)

DISTRIBUTION OPTIONS

Environmental Criteria	No Action (Option C)	Option A: Meter Replacement	Option B: Leak Detection
Climate and Physical Aspects (Topography, Geology, and Soils)	No Impact	Minor Excavation for Piping and Meter Installation (Minor Long-Term and Short-Term Impact)	No Impact
Population, Economic, and Social Profile	No Potential for Growth or Expansion	Minor Increased User Rates, Allow for Growth, More Accurate Estimate of Use	No Impact
Land Use	No Impact	No Impact	No Impact
Floodplain Development	No Impact	No Impact	No Impact
Wetlands and Water Quality	No Impact	Installation in Wetland (depending on location), and Minor General Disturbance for Line Installation (Short-Term Impact)	No Impact
Wild and Scenic Rivers	No Impact	No Impact	No Impact
Cultural Resources	No Impact	Potential Impact (Excavation in New Area)	No Impact
Flora and Fauna	No Impact	Site Disturbance (Short-Term Impact)	No Impact
Recreation and Open Space	No Impact	No Impact	No Impact
Agricultural Lands	No Impact	Potential Impact (Excavation in New Area)	No Impact
Air Quality	No Impact	Construction Emissions (Short-Term Impact)	No Impact
Energy	No Impact	Accurate Estimate of Usage, Leading to Change in Pumping/Energy Requirements	No Impact
Public Health	Continue Deficiencies in Service and Reliability, Potentially Leading to Contamination	No Impact	No Impact
Option Cost	$0	$79,240	$4,125

TREATMENT OPTIONS

Environmental Criteria	No Action (Option E)	Option A: Precipitative Oxidation Filtration System	Option B: Adsorption System	Option D: Precipitative Oxidation Filtration System (for Arsenic) and POU (for Radium)
Climate and Physical Aspects (Topography, Geology, and Soils)	No Impact	Minor Excavation for Well House Expansion (Minor Long-Term and Short-Term Impact)	Minor Excavation for Well House Expansion (Minor Long-Term and Short-Term Impact)	Minor Excavation for Well House Expansion (Minor Long-Term and Short-Term Impact)
Population, Economic, and Social Profile	No Impact	Increased User Rates, Allow Improved Service	Increased User Rates, Allow Improved Service	Increased User Rates, Allow Improved Service
Land Use	No Impact	No Impact	No Impact	No Impact
Floodplain Development	No Impact	No Impact	No Impact	No Impact
Wetlands and Water Quality	Continued High Level of Arsenic and Radium in Raw Well Water; Continued Aesthetically Dis-Pleasing Level of Iron in Raw Well Water	Site Disturbance and Backwash Storage in Drainfield (if used in lieu of recycle) (Short-Term and Long-Term Impact to Water Quality); Addressing Water Quality Issues in Raw Well Water (Positive Long-Term Impact)	Site Disturbance (Short-Term Impact to Water Quality); Addressing Water Quality Issues in Raw Well Water (Positive Long-Term Impact)	Site Disturbance and Backwash Storage in Drainfield (if used in lieu of recycle) (Short-Term and Long-Term Impact to Water Quality); Addressing Water Quality Issues in Raw Well Water (Positive Long-Term Impact)
Wild and Scenic Rivers	No Impact	No Impact	No Impact	No Impact
Cultural Resources	No Impact	Potential Impact (Excavation in New Area)	Potential Impact (Excavation in New Area)	Potential Impact (Excavation in New Area)
Flora and Fauna	No Impact	Site Disturbance (Short-Term Impact)	Site Disturbance (Short-Term Impact)	Site Disturbance (Short-Term Impact)
Recreation and Open Space	No Impact	No Impact	No Impact	No Impact
Agricultural Lands	No Impact	Potential Impact (Excavation in New Area)	Potential Impact (Excavation in New Area)	Potential Impact (Excavation in New Area)
Air Quality	No Impact	Construction Emissions (Short-Term Impact)	Construction Emissions (Short-Term Impact)	Construction Emissions (Short-Term Impact)

Energy	No Impact	Minor Additional Pumping (Minor Long-Term Impact)	No Impact	Minor Additional Pumping (Minor Long-Term Impact)
Public Health	Continued High Level of Arsenic in Raw Well Water	Improved Water Quality and Service	Improved Water Quality and Service	Improved Water Quality and Service
Option Cost	$0	$452,650	$635,980	$305,290

APPENDIX I:

SYSTEM CLASSIFICATION WORKSHEETS

WELCH-COMER
ENGINEERS | SURVEYORS

Option A

IDAHO DRINKING WATER TREATMENT PLANT CLASSIFICATION WORKSHEET

OFFICE USE ONLY
DO NOT WRITE HERE
System Class _____
Notes:
_____
_____

Approved by _____

Date_____

DEQ will use this information to classify your system.

Public Water Service No. ID1280161

Name of System: Rose Lake Water Association Water System

System Address: PO Box 178

City: Cataldo State: ID Zip Code: 83810

Contact Person: Deborah Carroll Title: President

Business Phone Number: (208)682-2788 Email: yellowzoonie@hotmail.com

Instructions: Evaluate each item listed in the table below and place the specified point value next to each item selected. Add the total number of points selected to determine the class of the treatment system. Definitions describing all configurations, names, and/or reasons why rating points are or are not assigned to a particular item are provided for those items with a small D-number behind the item, i.e D-1. Check the definition if unsure whether a particular treatment plant process qualifies for the point value shown. Mail the completed, signed form to your regional Department of Environmental Quality or Health District drinking water contact. Keep a photocopy of the original form for your files.

Item	Points	Your System
System Size (2 to 20 points)		
Maximum Population served, peak day (1 point minimum to 10 point maximum)	1 point/10,000 or part	1
Design flow (average/day) or peak month's (average/day) Whichever is larger (1 point min to 10 point max)	1 point/MGD or part	1
Water Supply Source (3 to 8 points)		
Groundwater	3 points	3
Surface Water	5 points	
Average Raw Water Quality (0 to 10 points)		
Little or no variation	0 points	0
Raw water quality (other than turbidity) varies enough to require treatment changes approximately 10% of the time	2 points	
Raw water quality (turbidity) varies severely enough to require pronounced or very frequent treatment changes	5 points	
Raw water quality subject to periodic serious industrial waste pollution	10 points	
Treatment Process		
Aeration	2 points	
Packed tower aeration	6 points	
PH adjustment	4 points	
Stability or corrosion control	4 points	
Taste and odor control	8 points	
Color control	4 points	
Iron or iron/manganese removal	10 points	10

Item	Points	Your System
Ion exchange softening	10 points	
Chemical precipitation softening	20 points	
Coagulant addition	4 points	
Flocculation	5 points	
Sedimentation	14 points	
Upflow clarification	14 points	
Filtration	10 points	
Fluoridation	5 points	
Special processes such as reverse osmosis, electrodialysis	15 points	
Disinfection (0 to 10 points) For disinfectants, such as ozone, chlorine dioxide, or chloramines, assign 5 points for chlorination or comparable and 5 points for on-site generation of disinfectant.		
No disinfection	0 points	
Chlorination or comparable	5 points	5
On-site generation of disinfectant	5 points	
Sludge/Backwash Water Disposal (0 to 5 points)		
No disposal to raw water source (example to sewer or off watershed)	0 points	
No disposal to raw water source (example supernatant discharge to reservoir)	2 points	
Any disposal to plant raw water	5 points	5
Bacteriological/Biological Laboratory Control (0 to 10 points)		
Lab work done outside plant	2 points	2
Membrane filter procedures	3 points	
Use of fermentation tubes or any dilution method: fecal coliform determination	7 points	
Biological identification	7 points	
Viral studies or similarly complex work conducted on-site	10 points	
Chemical/Physical Laboratory Control (0 to 10 points)		
Lab work done outside plant	0 points	
Push button or colorimetric methods for simple tests, such as chlorine residual, pH	3 points	3
Additional procedures such as titration, jar test, alkalinity, hardness	5 points	
More advanced determinations, such as numerous inorganics	7 points	
Highly sophisticated instrumentations, such as atomic absorption & gas chromatography	10 points	
TOTAL POINTS FOR YOUR SYSTEM		30

System Classification Key			
Class I	*30 points or fewer*	*Class III*	*56 to 75 points*
Class II	*31 to 55 points*	*Class IV*	*76 points or greater*

YOUR SYSTEM CLASSIFICATION	**I, II, III, IV** **(Circle one)**

_____/_____

Signature Date

Option B

IDAHO DRINKING WATER TREATMENT PLANT CLASSIFICATION WORKSHEET

OFFICE USE ONLY
DO NOT WRITE HERE
System Class _____
Notes:
_____
_____

Approved by _____

Date_____

DEQ will use this information to classify your system.

Public Water Service No. ID1280161

Name of System: Rose Lake Water Association Water System

System Address: PO Box 178

City: Cataldo State: ID Zip Code: 83810

Contact Person: Deborah Carroll Title: President

Business Phone Number: (208)682-2788 Email: yellowzoonie@hotmail.com

Instructions: Evaluate each item listed in the table below and place the specified point value next to each item selected. Add the total number of points selected to determine the class of the treatment system. Definitions describing all configurations, names, and/or reasons why rating points are or are not assigned to a particular item are provided for those items with a small D-number behind the item, i.e D-1. Check the definition if unsure whether a particular treatment plant process qualifies for the point value shown. Mail the completed, signed form to your regional Department of Environmental Quality or Health District drinking water contact. Keep a photocopy of the original form for your files.

Item	Points	Your System
System Size (2 to 20 points)		
Maximum Population served, peak day (1 point minimum to 10 point maximum)	1 point/10,000 or part	1
Design flow (average/day) or peak month's (average/day) Whichever is larger (1 point min to 10 point max)	1 point/MGD or part	1
Water Supply Source (3 to 8 points)		
Groundwater	3 points	3
Surface Water	5 points	
Average Raw Water Quality (0 to 10 points)		
Little or no variation	0 points	0
Raw water quality (other than turbidity) varies enough to require treatment changes approximately 10% of the time	2 points	
Raw water quality (turbidity) varies severely enough to require pronounced or very frequent treatment changes	5 points	
Raw water quality subject to periodic serious industrial waste pollution	10 points	
Treatment Process		
Aeration	2 points	
Packed tower aeration	6 points	
PH adjustment	4 points	
Stability or corrosion control	4 points	
Taste and odor control	8 points	
Color control	4 points	
Iron or iron/manganese removal	10 points	10

Item	Points	Your System
Ion exchange softening	10 points	
Chemical precipitation softening	20 points	
Coagulant addition	4 points	
Flocculation	5 points	
Sedimentation	14 points	
Upflow clarification	14 points	
Filtration	10 points	
Fluoridation	5 points	
Special processes such as reverse osmosis, electrodialysis	15 points	
Disinfection (0 to 10 points) For disinfectants, such as ozone, chlorine dioxide, or chloramines, assign 5 points for chlorination or comparable and 5 points for on-site generation of disinfectant.		
No disinfection	0 points	
Chlorination or comparable	5 points	5
On-site generation of disinfectant	5 points	
Sludge/Backwash Water Disposal (0 to 5 points)		
No disposal to raw water source (example to sewer or off watershed)	0 points	
No disposal to raw water source (example supernatant discharge to reservoir)	2 points	
Any disposal to plant raw water	5 points	5
Bacteriological/Biological Laboratory Control (0 to 10 points)		
Lab work done outside plant	2 points	2
Membrane filter procedures	3 points	
Use of fermentation tubes or any dilution method: fecal coliform determination	7 points	
Biological identification	7 points	
Viral studies or similarly complex work conducted on-site	10 points	
Chemical/Physical Laboratory Control (0 to 10 points)		
Lab work done outside plant	0 points	
Push button or colorimetric methods for simple tests, such as chlorine residual, pH	3 points	3
Additional procedures such as titration, jar test, alkalinity, hardness	5 points	
More advanced determinations, such as numerous inorganics	7 points	
Highly sophisticated instrumentations, such as atomic absorption & gas chromatography	10 points	
TOTAL POINTS FOR YOUR SYSTEM		30

System Classification Key			
Class I	*30 points or fewer*	*Class III*	*56 to 75 points*
Class II	*31 to 55 points*	*Class IV*	*76 points or greater*

YOUR SYSTEM CLASSIFICATION	**I, II, III, IV** **(Circle one)**

_____/_____

Signature Date

IDAHO DISTRIBUTION SYSTEM CLASSIFICATION WORKSHEET

OFFICE USE ONLY
DO NOT WRITE HERE
System Class _____

Notes:

Approved by _____
Date _____

DEQ will use this information to classify your system.

PWS System No. ID1280161
(Example: ID1234567)

Name of Public Water System: Rose Lake Water Association Water System

System Address: PO Box 178

City: Cataldo State: ID Zip Code: 83810

Contact Person: Deborah Carroll Title: President

Business Phone Number: (208) 682-2788 Email: yellowzoonie@hotmail.com

Population served by this distribution system: 294
(The number of people, not the number of connections)

Name of Water Source(s): Well No. 3 and Well No. 4
(Example: Well #16, Johnson Well or East Fork of Miller Creek, etc.)

_____ _____
Signature Date

***Please note*: Your PWS may also be a treatment facility* as defined here:**
*** Treatment Facility** - Any place(s) where a public drinking water system or non-transient noncommunity water system alters the physical or chemical characteristics of the drinking water. Chlorination may be considered as a function of a distribution system. (IDAPA 58.01.08.003.74)

If your PWS is also a treatment facility, submit a treatment facility worksheet which can be found at http://www.deq.idaho.gov/media/758669-dw-treatment-plant-classification-worksheet.pdf**.**

Mail the completed, signed form to your regional Department of Environmental Quality or Health District drinking water contact.

Distribution system classification is based on complexity and population served as follows:

Very Small Public Drinking Water System (* see definition below)	
Class I	**1,500 or less**
Class II	**1,501 to 15,000**
Class III	**15,001 to 50,000**
Class IV	**50,001 and greater**

*** Very Small Public Drinking Water System –** A Community or Non-transient Non-community Public Water System that serves five hundred (500) persons or less and has no treatment other than disinfection** or has only treatment which does not require any chemical treatment, process adjustment, backwashing or media regeneration by an operator (e.g. calcium carbonate filters, granular activated carbon filters, cartridge filters, ion exchangers.) (IDAPA 58.01.08.003.79)

**** Disinfection –** Introduction of chlorine or other agent or process approved by the Department of Environmental Quality, in sufficient concentration and for the time required to kill or inactivate pathogenic and indicator organisms. (IDAPA 58.01.08.003.22)

APPENDIX J:

RADIUM AND ARSENIC WASTE STREAM CALCULATION WORKSHEETS

WELCH-COMER
ENGINEERS | SURVEYORS

41113 Rose Lake
Radium Removal
Casey Walton, E.I.T.; updated by Ashley Williams, P.E.

Source Water

Radium Concentration (Average):	4.8	pCi/L	ATEC Test
Arsenic Concentration (Average):	0.01	mg/L	ATEC Test (2013)

Product Water

Radium Concentration (Average):	0.3	pCi/L	ATEC Test

0.9375

Backwash Water

Arsenic Concentration:	0.0123	mg/L	ATEC Test (2013)

Time interval between backwashes:	12	hours			
# of backwashes per year:	730				
Well Production:	150	gpm			
Total Production (2012 through October 2013):	9,669,600	gallons	1	gallon equals	3.78541 liters
			1	liter equals	1000 g
			1	lb equals	453.59237 g
Volume per backwash:	5,480	gallons	ATEC Test		
Total Volume of backwash per year:	4,000,400	gallons			
	15,143,154	liters			
	15143154164	grams			
	33,384,940	lbs			

Radium Precipitate (per Year)			Arsenic Precipitate (per Year)		
Percent Removed	Total pCi	Total g	Percent Removed	Total mg	Total kg
100%	72,687,140	2.66E-07	100%	151,432	0.15
90%	65,418,426	2.40E-07	90%	136,288	0.14
80%	58,149,712	2.13E-07	80%	121,145	0.12
70%	50,880,998	1.87E-07	70%	106,002	0.11
60%	43,612,284	1.60E-07	60%	90,859	0.09
50%	36,343,570	1.33E-07	50%	75,716	0.08
40%	29,074,856	1.07E-07	40%	60,573	0.06
30%	21,806,142	7.99E-08	30%	45,429	0.05
20%	14,537,428	5.33E-08	20%	30,286	0.03
10%	7,268,714	2.66E-08	10%	15,143	0.02
0%	0	0.00E+00	0%	0	0.00

Notes:

1 picocurie is approximately 10^{-12} curies

~~1 curie is approximately 1 gram of Radium~~

1 curie	3.67E-03	g
Mass in g	6.50E-14	g
Atomic Mass (R-228)	228	
Moles	2.85088E-16	
Avogadro's Number	6.022E+23	
Number of Atoms	171679824.6	
Half-Life	181332000	s
Decay Constant	3.82172E-09	
Decays per Sec	0.656112095	
Curies	1.77328E-11	
Picocuries	17.73275933	

41113 Rose Lake
Radium Removal
Casey Walton, E.I.T.; updated by Ashley Williams, P.E.

Source Water

Radium Concentration (Average):	4.8	pCi/L	ATEC Test

Product Water

Radium Concentration (Average):	0.3	pCi/L	ATEC Test

0.9375

Time interval between backwashes:	12	hours			
Well Production:	150	gpm			
Total Production (2012 through October 2013):	1	Gallons	1 gallon equals	3.78541	liters
	3.78541	liters	1 liter equals	1000	g

Precipitate per Gallon

Percent Removed	Concentration of Sludge (pCi/L)	Concentration of Sludge (µCi/mL)	Concentration of Sludge (pCi/g)	Concentration of Sludge (g/L)	Concentration of Sludge (g/g)	
100%	18	1.82E-08	0.018	6.66E-14	6.66E-17	0.0000000000000067%
90%	16	1.64E-08	0.016	5.99E-14	5.99E-17	0.0000000000000060%
80%	15	1.45E-08	0.015	5.33E-14	5.33E-17	0.0000000000000053%
70%	13	1.27E-08	0.013	4.66E-14	4.66E-17	0.0000000000000047%
60%	11	1.09E-08	0.011	4.00E-14	4.00E-17	0.0000000000000040%
50%	9	9.08E-09	0.009	3.33E-14	3.33E-17	0.0000000000000033%
40%	7	7.27E-09	0.007	2.66E-14	2.66E-17	0.0000000000000027%
30%	5	5.45E-09	0.005	2.00E-14	2.00E-17	0.0000000000000020%
20%	4	3.63E-09	0.004	1.33E-14	1.33E-17	0.0000000000000013%
10%	2	1.82E-09	0.002	6.66E-15	6.66E-18	0.0000000000000007%
0%	0	0.00E+00	0.000	0.00E+00	0.00E+00	0.0000000000000000%

Notes:
1 picocurie is approximately 10^{-12} curies
~~1 curie is approximately 1 gram of Radium~~

1 curie	3.67E-03	g
Mass in g	6.50E-14	g
Atomic Mass (R-228)	228	
Moles	2.85088E-16	
Avogadro's Number	6.022E+23	
Number of Atoms	171679824.6	
Half-Life	181332000	s
Decay Constant	3.82172E-09	
Decays per Sec	0.656112095	
Curies	1.77328E-11	
Picocuries	17.73275933	