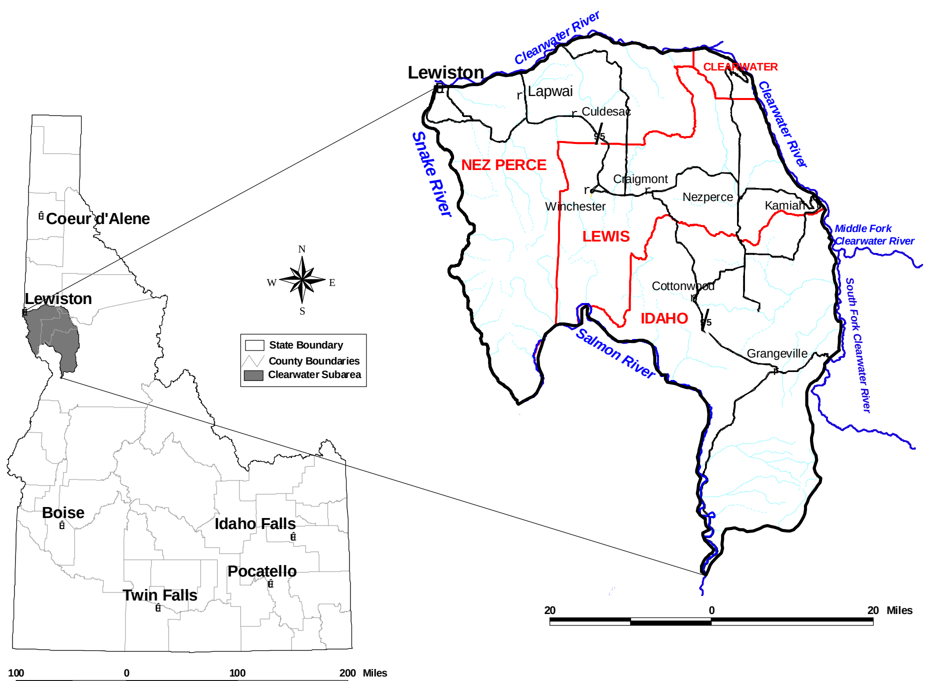
# SUMMARY OF STATEWIDE AMBIENT GROUND WATER QUALITY MONITORING PROGRAM DATA CLEARWATER PLATEAU HYDROGEOLOGIC SUBAREA, 1990-2002




Idaho Department of Water Resources

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***July 2003***

*Prepared by:* Edward F. Hagan

# SUMMARY OF STATEWIDE AMBIENT GROUND WATER QUALITY MONITORING PROGRAM DATA, CLEARWATER PLATEAU HYDROGEOLOGIC SUBAREA, 1990-2002


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Idaho Department of Water Resources

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## Acknowledgements

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# 1. EXECUTIVE SUMMARY

This report summarizes the ground water quality in the Clearwater Plateau Hydrogeologic Subarea (Clearwater Subarea) as determined from data collected through the Statewide Ambient Ground Water Quality Monitoring Program (Statewide Program). The Idaho Department of Water Resources administers the Statewide Program in cooperation with the U.S. Geological Survey, Water Resources Division. The Statewide Program monitoring network currently consists of over 1,600 sites (wells and springs) in 20 hydrogeologic subareas.

The results from the 61 Statewide Program Clearwater Subarea monitoring sites sampled from 1990 through 2002 are included in this report. Data collected from 1991 through 1994 are referred to as First Round data. Second Round sampling took place from 1995 through 1998. During this period most of the First Round sites were resampled. Third Round sampling, initiated in 1999, extends through 2003 due to the addition/replacement of 300 wells. Since 1995, two of the 61 sites have been sampled annually.

The major source of ground water in the Clearwater Subarea occurs in aquifers within the Columbia River Basalt. Older granite and metamorphic rocks yield small volumes of ground water suitable for domestic use. Shallow alluvial aquifers of limited extent also serve as sources of water. All but five of the Statewide Program wells in the Clearwater Subarea are completed in the Columbia River Basalt. Three of the wells are completed in granite, one well is completed in sandstone, and one well is completed in shale.

The ground water quality data indicate over 60 percent of the ground water samples are classified as calcium–bicarbonate type water, 30 percent are a combination of calcium/magnesium/sodium-bicarbonate type water, five percent are sodium-sulfate dominant type water, and five percent are mixed waters. Clearwater Subarea sites generally have good quality, soft or moderately soft water, with the exception of a few sites containing constituents above a primary drinking water standard [also know as Maximum Contaminant Level (MCL)].

The ground water at nine of the 61 Statewide Program monitoring sites in the Clearwater subarea (15 percent) contained one or more constituents in concentrations above an MCL. Ground water from five sites exceeded the MCL for fecal coliform; three sites had ground water containing nitrate above the MCL of 10 milligrams per liter (mg/L), and one site had ground water with arsenic above the MCL of 10 micrograms per liter (µg/L). Ground water samples from another eight sites contained nitrate concentrations between 5 mg/L and 10 mg/L.

One or more pesticides were detected in ground water samples from 13 of the 59 sites analyzed by either immunoassay methods or gas chromatography methods. Pesticides were detected during multiple sampling events at two sites. Volatile organic compounds were detected in samples from three sites. All pesticide and VOC concentrations were below MCLs or health advisories. In cases where an MCL does not exist, health advisories are used to evaluate the potential risk to human health.

A comparison of nitrate data from the first round with the nitrate data from the most recent round indicates 15 sites experienced a nitrate increase of more than 0.3 mg/L. Nitrate concentrations decreased by 0.3 mg/l or more at two sites. Based on this observation it appears nitrate levels are increasing. However, a statistical comparison of median nitrate values from the sites with three complete rounds indicates, that regionally, a statistically significant trend does not exist at the 95 percent confidence level.

# 2. INTRODUCTION

## 2.1. Statewide Ambient Ground Water Quality Monitoring Program

The Ground Water Quality Protection Act (Senate Bill #1269), passed by the Idaho State Legislature in 1989, authorized a comprehensive approach for maintaining and improving Idaho's ground water quality. The Act resulted in the formation of the Ground Water Quality Council, which developed the Idaho Ground Water Quality Plan in 1992. The monitoring component of the plan outlined the need for statewide, regional, and local ground water quality monitoring. The Idaho Department of Water Resources (IDWR) was tasked with designing and maintaining a statewide ambient ground water quality monitoring network. Responsibilities for regional and local monitoring were designated to the Idaho Department of Environmental Quality (IDEQ) and the Idaho State Department of Agriculture (ISDA). The three parts of the plan are designed to complement each other by allowing different degrees of data resolution (Ground Water Quality Council, 1996).

The Statewide Ambient Ground Water Quality Monitoring Program (Statewide Program) began in 1990 with a limited prototype network of 97 monitoring sites (Idaho Department of Water Resources, 1991). The IDWR developed a joint funding agreement with the U.S. Geological Survey (USGS) in 1990, and since 1991, the USGS has contributed annually through federal cooperative funding. The combined State and Federal funds enabled the addition of about 400 sites to the network each year from 1991 through 1994. By the fall of 1994, the Statewide Program network included over 1,500 monitoring sites. Statewide Program sites are sampled during the summer months and thus do not address seasonal variability in ground water quality. The ISDA contributed funding to the Statewide Program for pesticide analyses from 1993 through 2001.

The IDWR is responsible for the overall administration of the Statewide Program. The IDWR, with assistance from the USGS and the Monitoring Subcommittee of the Ground Water Quality Council, developed the network design and selected the monitoring sites. The IDWR is responsible for analyzing the data and writing interpretative reports. The USGS provides logistical support by: 1) purchasing and distributing field supplies, 2) conducting the field work which includes inspecting potential monitoring sites, acquiring permission from the site owners, collecting and preserving the ground water samples and shipping the samples to the appropriate laboratories, 3) managing the data received from the USGS National Water Quality Laboratory (NWQL), and 4) transferring the data received from NWQL to the IDWR. USGS staff at the District and National levels provided consultation during the development of the network. Both the USGS and the IDWR have responsibilities for ensuring that appropriate Quality Assurance and Quality Control practices are followed.

Samples were analyzed according to the constituent types at either the USGS National Water Quality Laboratory in Arvada, Colorado, the Idaho State Health Laboratory in Boise, Idaho, Alpha Analytical Laboratory in Sparks, Nevada, or the University of Illinois in Urbana-Champaign, Illinois.

## 2.2. Program Objectives, Purpose of Report, and Data Availability

The objectives of the Statewide Program are:

1. Characterize the ground water quality of the major aquifers in Idaho,
2. Identify trends and changes in ground water quality within the major aquifers, and
3. Identify potential ground water quality problem areas.

Initial data collected for the Statewide Program from 1991 to 1994 (First Round) are being used to address the first objective (characterization) and, to some extent, the third objective (potential problem areas). Data collected in later rounds are being used for trend analyses and additional characterization. More detailed information regarding the "rounds" of data collection is presented later in this report.

The purposes of this report are:

- Characterize the ground water quality data collected for the Clearwater Subarea,
- Evaluate potential ground water quality trends,
- Discuss ground water quality concerns identified through Statewide Program monitoring, and
- Provide recommendations for future efforts related to understanding and protecting the ground water quality in the Clearwater Subarea.

This report is one in a series of technical reports planned for the 20 hydrogeologic subareas of the Statewide Program. Previous reports described the ground water quality for the Treasure Valley Shallow and Deep subareas (Neely and Crockett, 1998) and the Twin Falls Subarea (Neely, 2001). Additional technical reports and Statewide Program data can be found on the IDWR website (Idaho Department of Water Resources, 2003).

The ground water quality data presented in this report can be obtained by contacting the author: ehagan@idwr.state.id.us or 208.327.5445. Some of the data can be obtained through the USGS either by contacting Ivalou O'Dell: ioodell@usgs.gov or 208.387.1325, or by accessing the USGS Idaho water quality data website (U.S. Geological Survey, 2003).

## 2.3. Network Development

Limited sampling was conducted in 1990 to develop protocols for network design and to evaluate sample collection and quality assurance procedures. Ideally, it would have been desirable to select and sample all network sites in one year. However, this approach was not economically or logistically possible. Therefore, the network development occurred over a four-year period from 1991 through 1994; this period is called the First Round. The second round of sampling occurred from 1995 through 1998. The third round of sampling runs from 1999 through 2003. This third round was extended to five years because an additional 300 wells were added to the network during this round.

The number and location of monitoring sites for the Statewide Program were determined using a stratified random selection technique (Neely, 1994). The following steps describe the site selection process.

1) The state was subdivided into 22 hydrogeologic subareas based primarily on aquifer descriptions by Graham and Campbell (1981).
2) The number of sites for 20 of the 22 subareas was estimated using the Neyman Maximum Allocation Method which incorporated weighting factors for population, aquifer area and water quality variability (Nelson and Ward, 1981; Spruill, 1990); two subareas were not sampled because they do not have major aquifers and have very small populations.
3) Potential monitoring areas were randomly selected from Public Land Survey System sections.
4) Monitoring sites were picked for each selected sections using existing well and spring databases maintained by the USGS and the IDWR. Potential sites were required to have well construction and lithologic information, water temperatures equal to or less than 29.4° C (85° F), and to be representative of the aquifer system in the area (which was determined by inspecting the lithologic records on the well driller's reports).
5) The Network was expanded by approximately 300 wells during the years 2001 and 2002, to bring the total number of network wells up to 1,600. The wells were located based on the following considerations: 1) replacements for wells dropped from the Network, 2) characterize aquifers with new development, and 3) fill in data gaps. To accommodate the new wells into the Network, the 4-year cycle was lengthened to a 5-year cycle. The wells sampled in 1993 and

1997, were sampled over a two-year period during 2001 and 2002. The 2001 sampling event consisted of approximately 150 new wells, 150 wells sampled in 1997, and 100 annual wells. The 2002 sampling event was conducted similarly, consisting of 150 new wells, 100 annual wells, and the remaining wells sampled in 1997, which were not sampled in 2001. The wells sampled in 1994 and 1998, plus the annual sites, are to be sampled in 2003.

6) Global positioning system (GPS) measurements are used to identify the locations of new wells and update the locations of existing wells located prior to use of GPS technology.

7) Permission was received from all well owners prior to sampling.

## 2.4. Site Numbering System

The numbering system used in this report for monitoring sites (wells and springs) is identical to the system used by the USGS in Idaho (Figure 1). The system indicates the location of wells within the official rectangular subdivision of the Public Land Survey System (PLSS) with reference to the Idaho baseline and meridian originating at Initial Point in Ada County. The first two segments of the number designate the township and range. The third segment gives the section number followed by three or four letters and a number. The letters indicate the ¼ section (160 acre tract), ¼-¼ section (40 acre tract), ¼-¼-¼ section (10 acre tract), ¼-¼-¼-¼ section (2.5 acre tract), and the serial number of the well within the tract. Quarter sections are lettered A, B, C, and D in counterclockwise order beginning in the northeast quarter of the section. Successively smaller tracts are lettered in the same manner. For example, well 05N 01W 34ACD1 corresponds to the PLSS location: SE¼, SW¼, NE¼, Section 34, Township 5 North, Range 1 West, and the "1" indicates that it was the first well inventoried by the USGS in that tract.

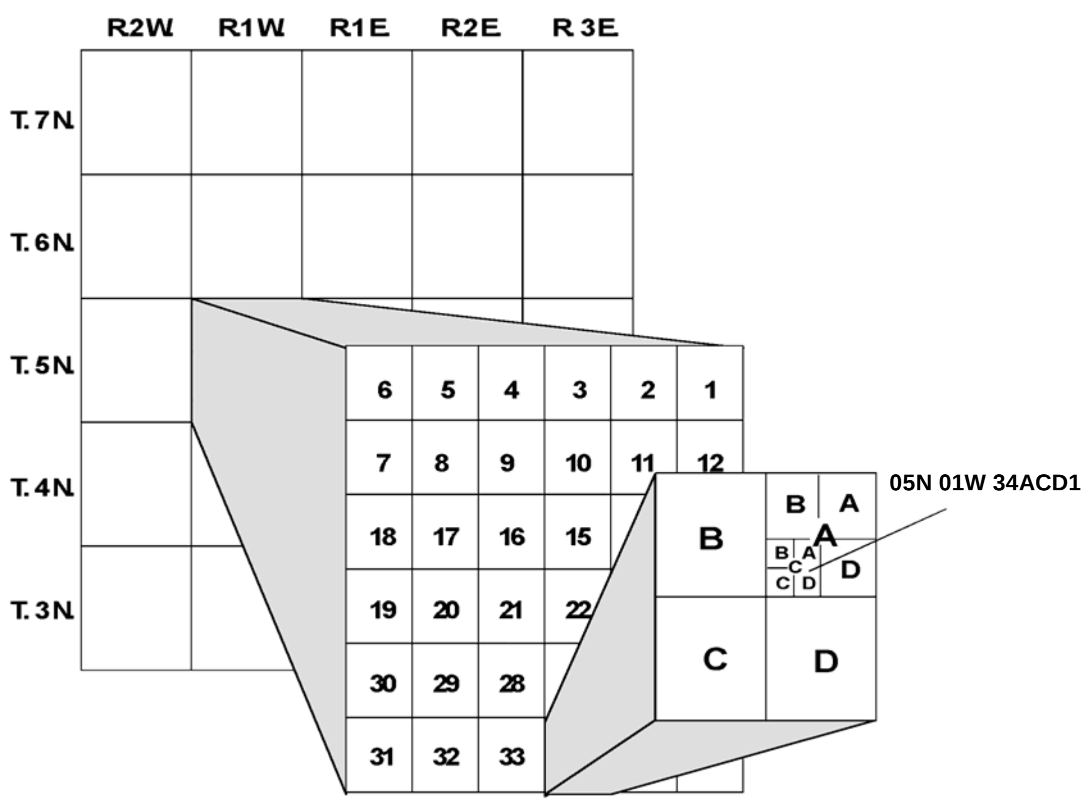


**Figure 1. Site Numbering System**

# 3. CLEARWATER PLATEAU HYDROGEOLOGIC SUBAREA

## 3.1. Location

The Clearwater Subarea is located in north-central Idaho (Graham and Campbell, 1981) and encompasses approximately 1.2 million acres. Lewis County, as well as portions of Idaho County, Nez Perce County, and a small portion of Clearwater County (Figure 2) are contained within the boundaries of the Subarea. The Clearwater Subarea is bounded on the north, northeast, and east by the Clearwater River, on the southeast by the South Fork Clearwater River. The southern boundary is not clearly defined, but is approximated by Slate Creek. The southwestern boundary of the Clearwater Subarea is the Salmon River, while the western boundary is the Snake River.

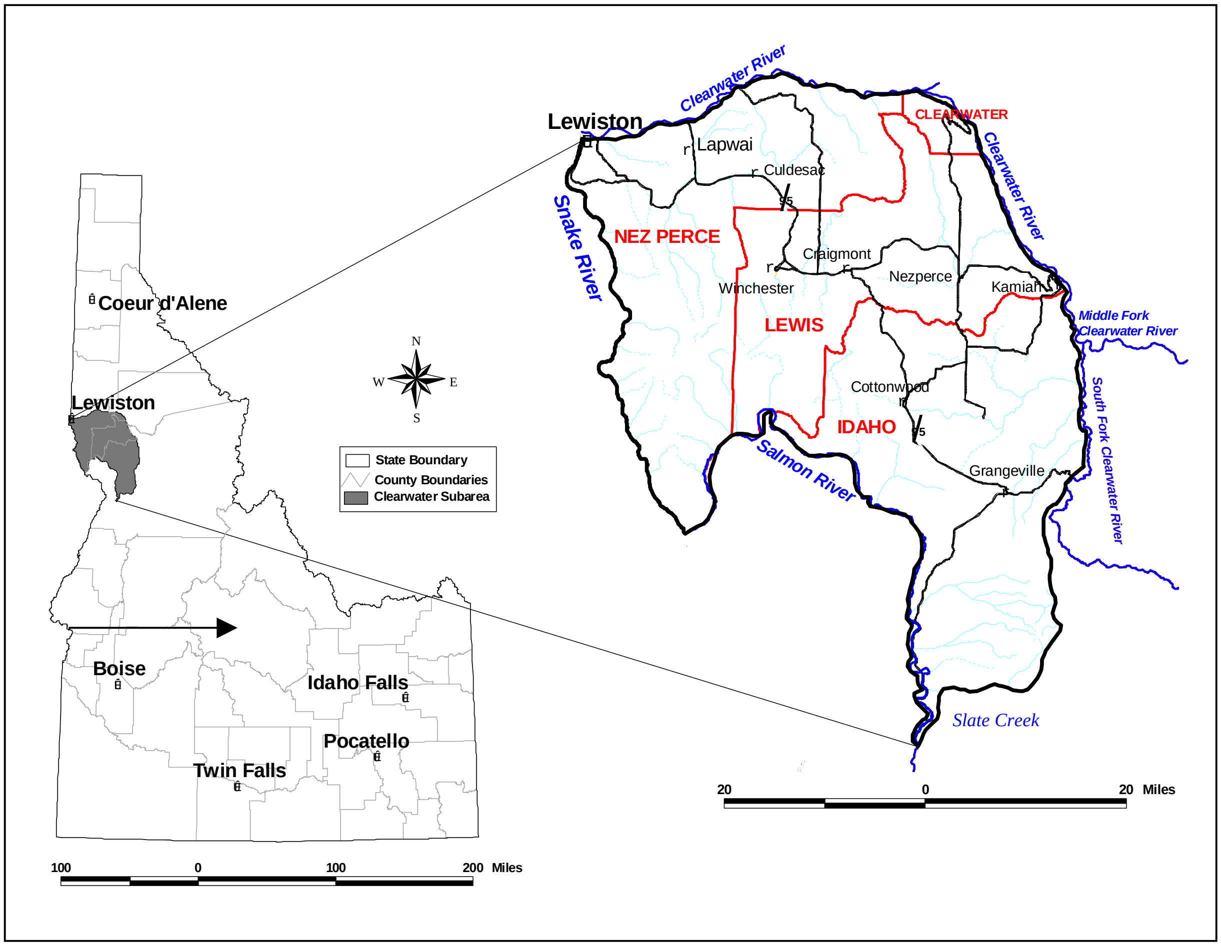


**Figure 2. Location of Clearwater Plateau Hydrogeologic Subarea.**

### 3.2. Climate

The climate in the Subarea is arid to semi-arid with hot dry summers and moderately cold winters (Castelin, 1976). Winters are dominated by cool air masses from the Gulf of Alaska and summers by a stationary high-pressure zone over the Pacific Northwest coast. Temperature and precipitation vary significantly across the Subarea due to differences in elevation and topography. Average annual precipitation, based on precipitation records from the years 1971 through 2000, ranges from just less than 13 inches in the Lewiston area to more than 50 inches along the Mount Idaho Escarpment south of the City of Grangeville (Western Regional Climate Center, 2003). On the Plateau, the average annual precipitation is approximately 24 inches, with almost one-half the precipitation occurring during March through June. The 30-year average (1971-2000) annual temperature for the Lewiston area is 52.7°F. By comparison, the 30-year average annual temperature for Grangeville is 46.7° F. The following table illustrates the climatic variability of the Subarea. The climate of the low valleys is characterized by the Lewiston weather station. The climate of the Plateau is similar to the Grangeville area and the climate of the higher elevation forestland is similar to the Winchester readings.

**Table 1. Selected Climatic Variables for Stations within the Clearwater Subarea**

| Station | Lewiston | Winchester | Grangeville |
|---|---|---|---|
| Elevation of Station (feet above sea level) | 1437 | 3950 | 3310 |
| Average Max. Temp. (°F) | 63.3 | 54.3 | 58.2 |
| Average Min. Temp. (°F) | 42.5 | 31.9 | 35.2 |
| Average Annual precipitation (inches) | 12.78 | 24.63 | 24.07 |
| Frost Free Days | 200 | 70 | 120 |

(Based on data from years 1971-2000, Western Regional Climate Center, 2003)

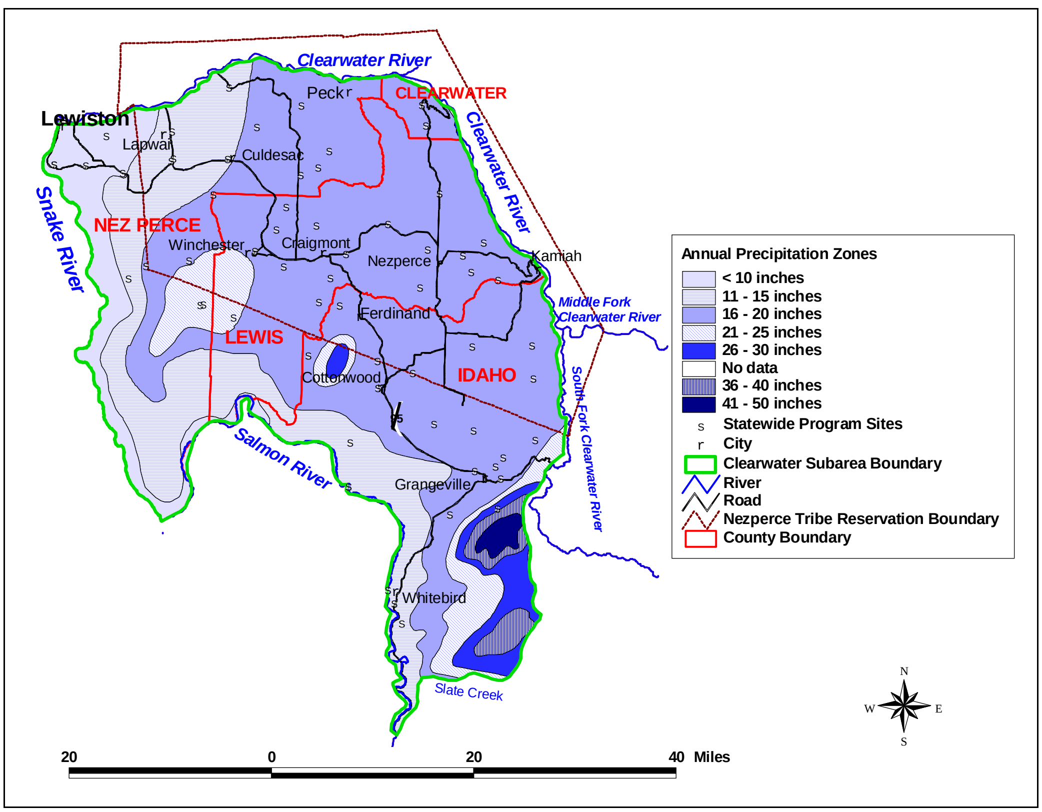


**Figure 3. Annual Precipitation Contour Map**

## 3.3. Geography

The Clearwater Subarea is characterized by rolling basalt plateaus dissected by deep canyons. Forested mountainous terrain, primarily south of Grangeville and in the Craig Mountain area, comprises about 30 percent of the Subarea. Elevations within the Clearwater Subarea extend from about 700 feet above mean sea level (amsl) near the confluence of the Snake River and the Clearwater River at Lewiston, to an elevation of more 5000 feet amsl on Craig Mountain and the Mount Idaho area to the south of Grangeville.

The Clearwater Subarea is divided into six physiographic features (Bond, 1963) - the Lewiston Basin; the Soldiers Meadow Slope, the Nezperce Plateau, the Camas Prairie, Whitebird Basin, and Dairy Mountain Slope (Figure 4). The triangular-shaped Lewiston Basin is bounded on the west by the Snake River; the north by the Clearwater River; and the Southeast by the Waha Escarpment. The Soldiers Meadow Slope is located between the Lewiston Basin and the Salmon River. It extends from the Craig Mountain area toward the northeast, merging into the Nez Perce Plateau near the City of Winchester. The Nez Perce Plateau and Camas Prairie occupy the basalt plateau that stretches from the Waha Escarpment to the Mount Idaho Escarpment south of Grangeville. For this report, the Nezperce Plateau and the Camas Prairie are combined into a single unit, referred to as the Clearwater Plateau. The elevation of the Clearwater Plateau is relatively constant, with elevations ranging from 3000 feet to 3500 feet amsl. The Whitebird Basin and Dairy Mountain Slope are located in the terrain to the south of Grangeville.

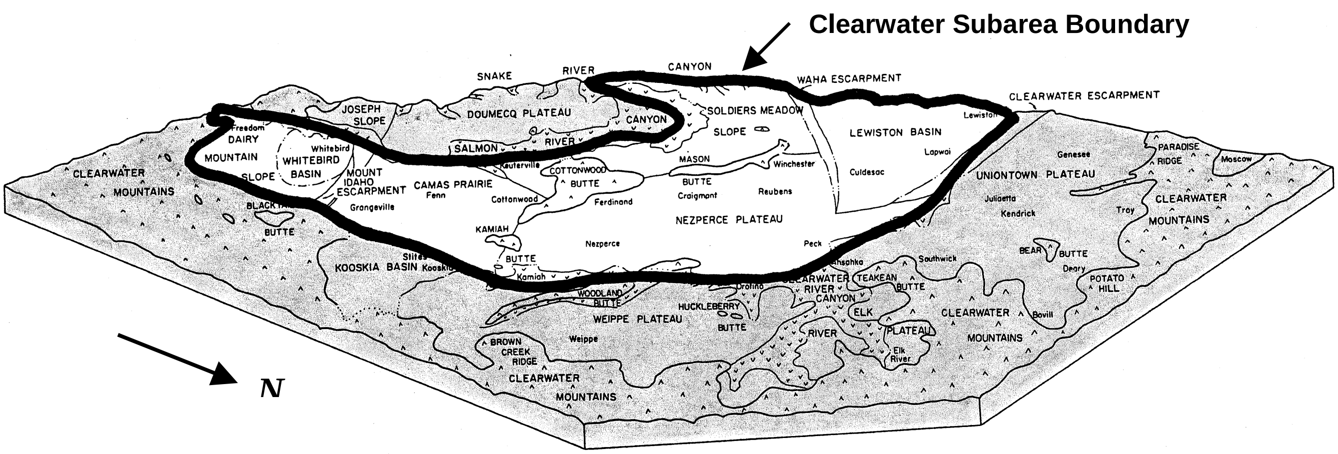


**Figure 4. Major Physiographic Features of Clearwater Subarea (Bond 1963).**

The Subarea encompasses portions of the watersheds for the Salmon River, Clearwater River, South Fork Clearwater River, and Snake River. About 60 percent of the Subarea (720,000 acres) drains to the north and east into the Clearwater River or southeast into the South Fork Clearwater River. The westernmost portions of the Subarea drain west into the Snake River, while the southern and southwestern portions drain into the Salmon River.

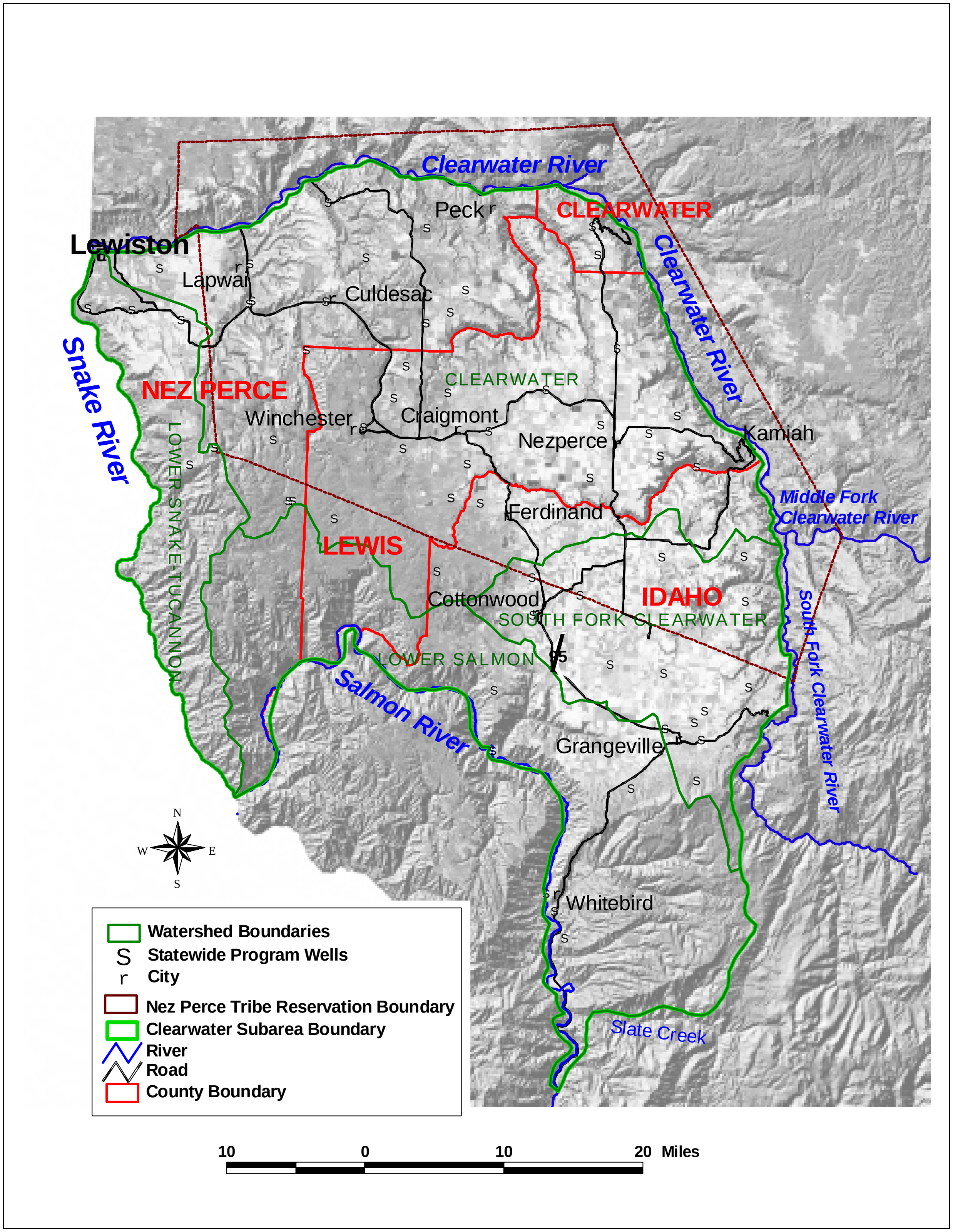


**Figure 5. Relief Map Showing Watershed Boundaries**

## 3.4. Soils

The predominant soils in the Subarea consist of loess (fine-grained material deposited by wind). Because the Clearwater Plateau is higher in elevation than other portions of the Columbia River Plateau, the loess is generally quite thin, often measuring only a few feet in thickness. The combination of thin loess and high spring precipitation causes intense weathering of the loess into clay (Barker, 1982).

The USDA separates the soils within the Subarea into three groups: 1) soils on dissected alluvial terraces; 2) soils on plateaus; and 3) soils on canyonsides and mountains (Hahn, 2001). Soils on dissected alluvial terraces are limited to the valleys near Lewiston. They are nearly level to very steep, very deep, well-drained sandy soils that formed in alluvium. The soils on the Plateau generally range in depth from 30 to 60 inches and are gently sloping to moderately sloping loam. The soil horizon typically consists of well drained, dark gray to dark brown loam with a clayey subsoil formed in loess and material weathered from basalt or granite. These soils support the bulk of the dry-land farming in the Subarea. Soils on the canyonsides and mountains are moderately deep to very deep, well drained and somewhat excessively drained loamy to coarse-grained soils with rock outcrops (Barker, 1982). Comprehensive discussions of the soils in the Subarea are available in USDA Soil Survey reports (Barker, 1982 and Hahn, 2001). General soil map units are shown on Figure 6.

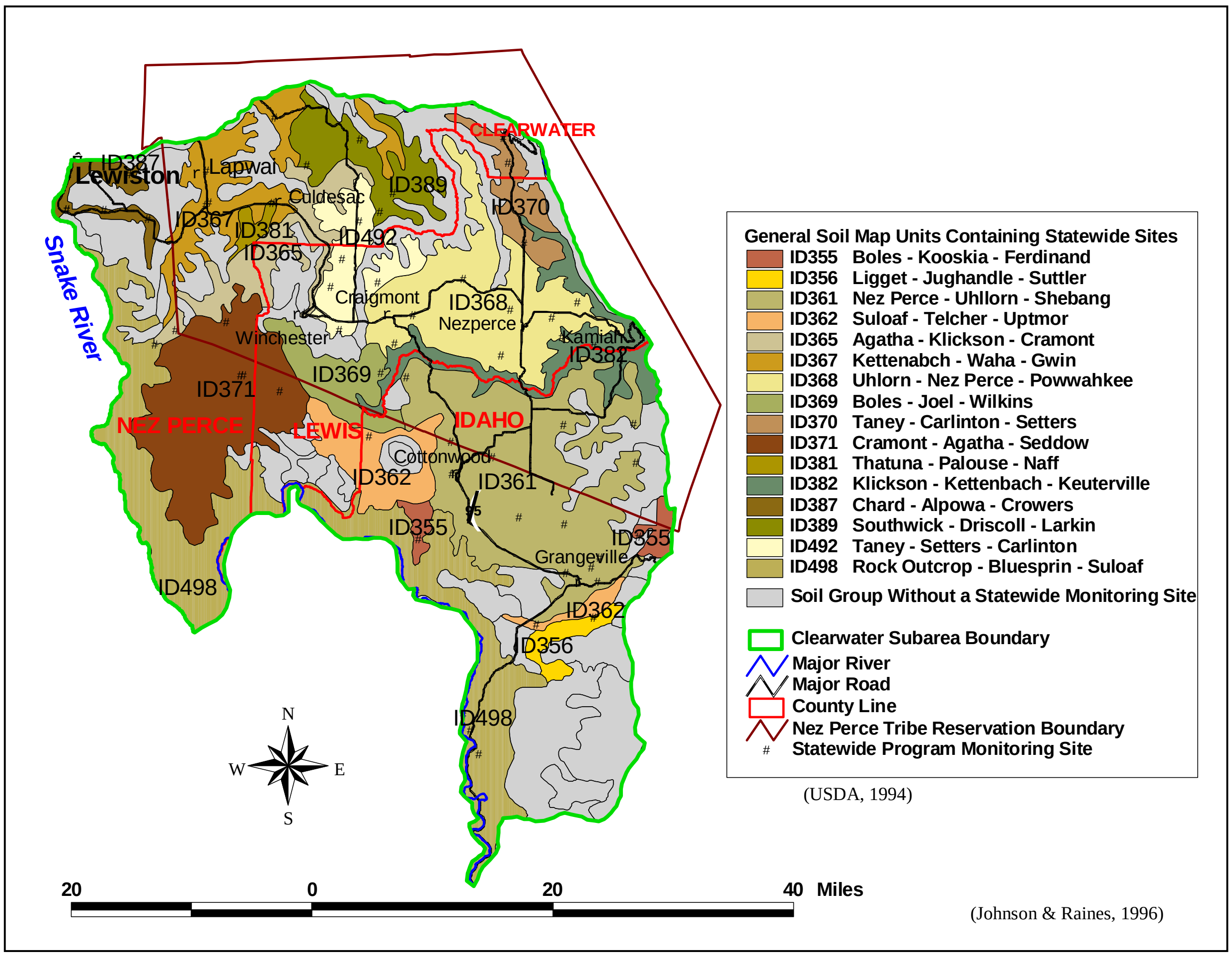


**Figure 6. Clearwater Subarea Soils**

## 3.5. Hydrogeology

3.5.1. Geologic Setting

The predominant hydrogeologic feature of the Clearwater Subarea is the Columbia River Basalts. The Subarea lies within the Clearwater Embayment, which is the easternmost portion of the Columbia River Basalt flows. Within the Clearwater Subarea, the basalts flowed across the Permian to Triassic sedimentary and volcanic rocks of the Seven Devils Complex and the Cretaceous granite of the Idaho Batholith (Alt and Hyndman, 1989). These older basement rocks, which are the remnants of ancient mountains that were not buried beneath basalt, extend above the basalt flows near the center of the Subarea just north of the city of Cottonwood and along the margins of the Subarea (Figure 7). Exposures of the Precambrian belt series metasedimentary complex can be seen in the canyon walls of the Clearwater River west of Orofino and in the South Fork of the Clearwater River Canyon east of Grangeville. Several reports by the Idaho Water Resources Research Institute (Stevens et al, 2003a,b,c) provide excellent descriptions of the hydrogeologic characteristics affecting the ground water resources of three small communities on the Clearwater Plateau. The geology of the Clearwater Subarea is shown on Figure 7 (Johnson & Raines, 1996).

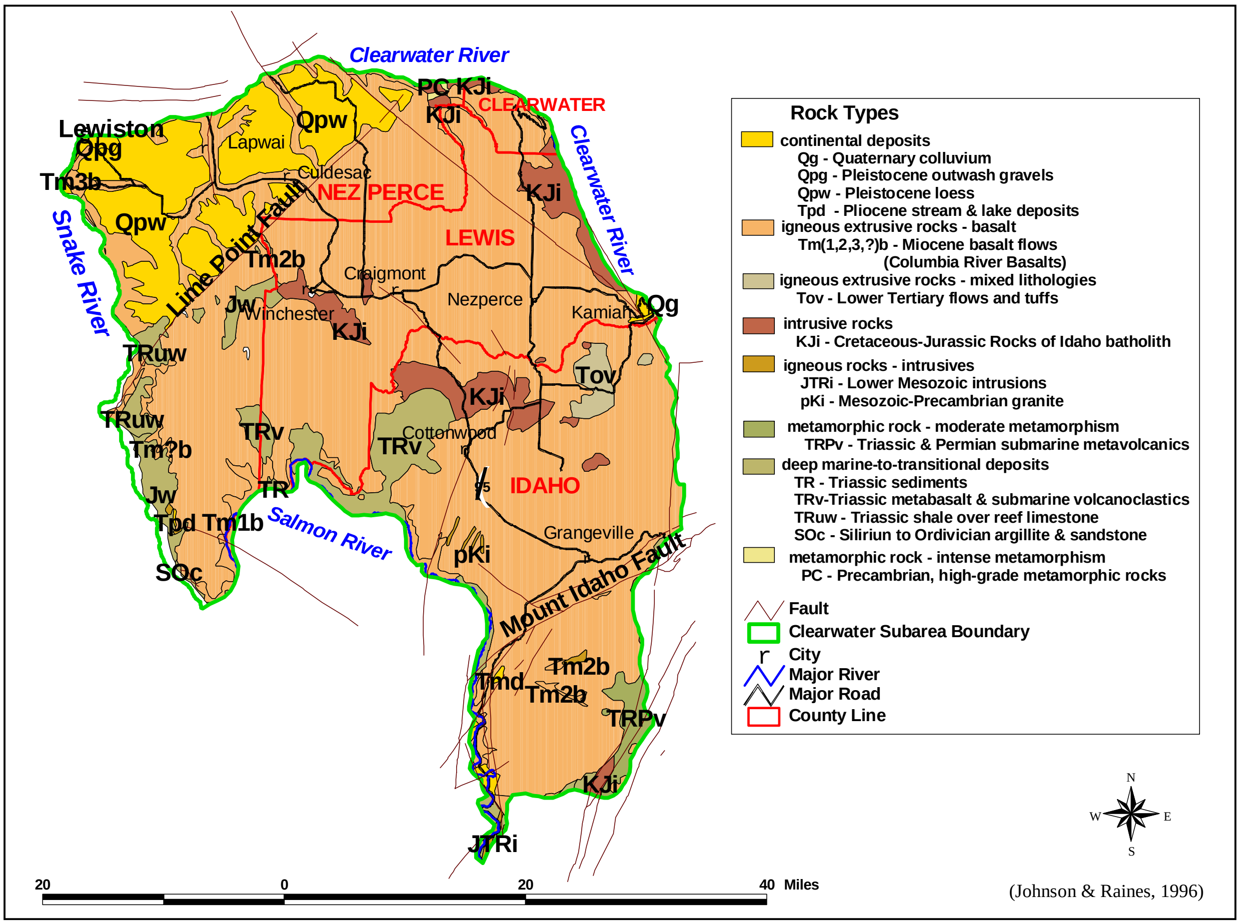


**Figure 7. Geologic Map of Clearwater Subarea**

3.5.2. Columbia River Basalt

The Columbia River Basalt Group in Central Washington and Northern Oregon has been intensively studied. By comparison, the Columbia River Basalts forming the Clearwater Plateau have been neglected. Few publications describing the hydrogeology of the Clearwater Plateau are available. The research by Bond (1963) remains the preeminent geologic reference for the Subarea as a whole. Cohen and Ralston (1980) provide a summary of the Russell Aquifer in the Lewiston Basin. Castelin (1976) and Morrison-Maierle (1976) address the ground water conditions in the subarea.

Between 17.5 and 6 million years ago, as measured by K-Ar and 40Ar-39Ar ages, magma extruded from vents in Idaho, Oregon, and Washington (Swanson et al, 1989). As the molten rock came to the surface, the earth's crust gradually sank into the space left by the rising lava. The subsidence of the crust produced a large, slightly depressed lava plain now known as the Columbia Basin Plateau. These basalt flows spread for hundreds of miles forming the Columbia Plateau of eastern and central Washington, northern and eastern Oregon, and western Idaho. Over 300 high-volume individual flows have been identified along with countless smaller flows (Swanson et al, 1989). The Columbia River Basalt Group is formally divided into five formations, which in turn are subdivided into formal and informal members. These basalt formations contain many separate basalt flows that are characterized by layered internal structures of porous, rubbly flow-tops, variably jointed columnar basalt, and variably fractured flow bases. The five formations include Imnaha, Grande Ronde, Picture Gorge, Wanapum, and Saddle Mountains Basalts.

Early eruptions (17.5-17 million years ago) fed the Imnaha Basalt, which is confined to the southeast part of the Columbia River Plateau. About 87% of the group was formed during a 1.5-million-year period between about 17 and 15.5 million years ago, resulting in the Grande Ronde Basalt and the subordinate and geographically limited Picture Gorge Basalt (Swanson et al, 1989). Later eruptions formed the Wanapum Basalt (about 15.5-14.5 million years ago) and the Saddle Mountains Basalt (about 14-6 million years ago). The aquifers underlying the Lewiston Basin are composed of Saddle Mountains, Wanapum, and Grande Ronde Basalts (Cohen and Ralston, 1980). The Clearwater Plateau consists of the three formations underlying the Lewiston Basin as well as the older Picture Gorge Basalt. The mineral composition of the Columbia River Basalts consists mostly of plagioclase, pyroxene, and glass (Bond, 1963).

In some areas relatively little erosion took place between flows, owing to the rapid rate of accumulation, except during Saddle Mountains time. However, a regionally extensive saprolite (fossil soil) or a sedimentary interbed separates the Grande Ronde and Wanapum in most places. Flows just below and above the contact typically are normally magnetized, so that the time represented by the break is probably less than a few hundred thousand years, most likely less than 100,000 years. However, in Saddle Mountains time, interflow erosion was significant, and most contacts are erosional unconformities (Swanson et al, 1989).

Initial flows of the basalt were limited to low lying areas, valleys, and deep canyons with relief exceeding 4000 feet. Eventually these landscapes were filled with lava until the terrain was relatively level, allowing succeeding flows to spread unimpeded over the relatively flat landscape. Between flow events weathering processes modified the exposed surface of the basalt. Streams draining the Plateau cut downward through the basalt until a new lava flow cut off the stream, altering the drainage pattern and often forming a lake. Deposits of sediments accumulated in these lakebeds until another lava flow engulfed the lake, creating the interbedded sediments found between the basalt flows. The thickness of the Columbia River Basalt is dependent on the topography of the pre-existing basement rocks. The thickest sequence of basalt in the Subarea, more than 4,000 feet, is near the confluence of the Salmon River and the Snake River (Bond, 1963).

During late Pliocene or early Pleistocene time, approximately 2 million years ago, the Plateau began a major cycle of structural deformation (Bond, 1963). Tilting and faulting shaped the Clearwater Subarea following the deposition of the Columbia River Basalt. The foremost structural features of note within the Subarea are the east trending Lewiston syncline located below the City of Lewiston, and the northeast trending Craig Mountain anticline, the crest of which is essentially dissected by the Limekiln or Lime Point Fault (Cohen and Ralston, 1980). The structural relief from the axis of the Lewiston syncline to the crest of the Craig Mountain anticline is more than 4,000 feet at the western end of the structures along the Snake River with the folds dying out to the east near Jacks Creek (Bond, 1963).

The Limekiln fault, on the north limb of the Craig Mountain anticline, is topographically expressed as the Waha Escarpment.

Extensive faulting has occurred on the Plateau since the cessation of the Columbia River Basalt eruptions. The Limekiln Fault, with vertical displacement of approximately 1,000 feet, functions as the northwestern edge of the Clearwater Plateau. The Mount Idaho fault, a northeast trending feature, located to the south of Grangeville, forms the southern boundary of the Clearwater Plateau. The Mount Idaho Fault is part of the Grangeville Mountain Fault block group that has a vertical displacement exceeding 1,500 feet (Bond, 1963). Other faults, of varying orientation and with less vertical displacement are scattered throughout the subarea (Figure 7).

### 3.5.3. Hydrogeology

Ground water within the Clearwater Subarea occurs in both regional and local flow systems under confined or unconfined conditions. The basalt aquifers are by far the most significant source of ground water in the Subarea. Other locally important sources of water are found in the highly productive, but areally limited, alluvial valley aquifers, and the widespread but low yield basement rocks.

The major water producing zones within the basalt occur in the sedimentary interbeds, through the porous rubble zones at the bottom and top of basalt flows, and in fractures. Basalt flows are characterized by a number of features controlling ground water movement through the formation. The uppermost section of a basalt flow consists of vesicular or brecciated zones with high porosity and high permeability. The interior of the basalt flow is usually quite dense with low permeability. However, vertical joints or columns, occurring in the basalt because of stress from differential cooling, provide possible pathways for vertical movement of ground water. A zone of low permeability with variable fracturing, associated with rapid cooling, often occurs at the base of the lava flow (Swanson et al, 1989).

#### 3.5.3.1. Depth to Water

Within the Subarea ground water is first encountered at depths ranging from 5 feet above land surface to 530 feet below land surface (bls) in Statewide Program wells. The median and mean depth to ground water are 81 feet bls and 124 feet bls, respectively. The deepest water levels (between 400 feet bls and 530 feet bls) were measured in wells east and northeast of Culdesac. Shallow water is present at depths of less than 30 feet throughout the Subarea. With the exception of the wells near Culdesac, depth to water measurements varied throughout the Subareas with no discernable spatial patterns. The only flowing artesian Statewide Program well in the Subarea is a 154 feet deep well completed in Columbia River Basalt, located between the cities of Craigmont and Nezperce. The most recent depth to water measurements are summarized in Figure 8.

On a regional scale, water levels appear to be relatively stable since Statewide Program monitoring began in 1990. However, depth to water measurements in Statewide Program wells suggest local water levels are declining in a couple areas. Two sites have three or more consecutive higher depth to water measurements (Figure 8). The depth to water at 31N 03E 36BCA1, a 184-foot deep well near the City of Grangeville, has increased from 136 feet in 1985 (USGS measurement prior to Statewide Program) to 160 feet in 2002. The depth to water at 34N 03W 04ABD1, a 400-foot deep well, has increased about the same amount, from 260 feet in 1985 to 287 feet in 2000. Both these wells draw water from confined basalt aquifers.

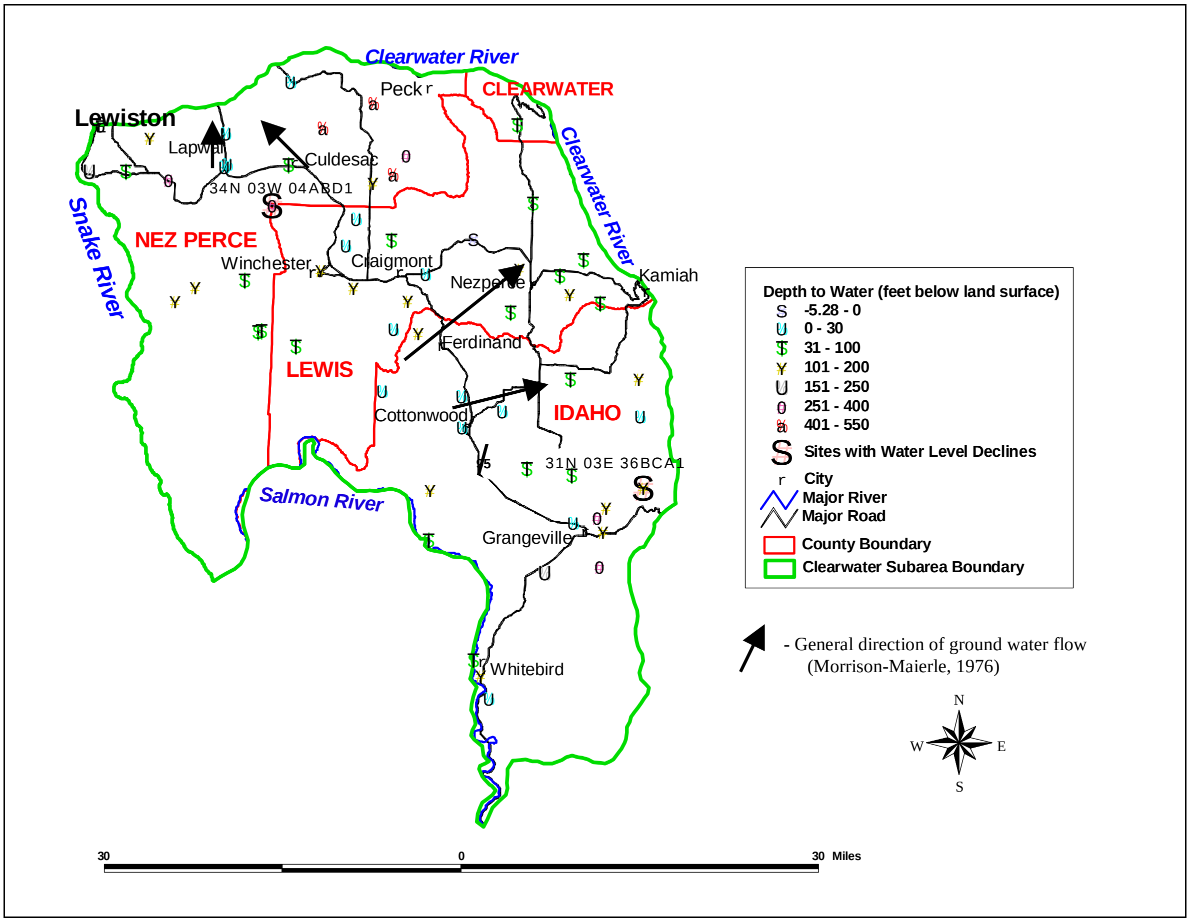


**Figure 8. Depth to Water/Water Level Declines – Clearwater Subarea**

3.5.3.2. Ground Water Flow Direction

The regional direction of ground water flow within the Subarea is generally approximated by the topography of the Subarea. Recharge to the ground water systems occurs through precipitation in the uplands to the south, by infiltration from precipitation across the Plateau, and seepage from surface water features. Ground water flows from higher elevations in the southern and southeastern portions of the Subarea toward the north; where it discharges into the Clearwater River or its tributary streams (Figure 8) (Morrison-Maierle, 1976). A contour map of the Lawyer Creek Interbed created by Bond (1963) corresponds to the regional ground water flow direction estimated by Morrison-Maierle (1976), suggesting ground water flow is strongly influenced by the subsurface lithology.

Local flow systems exist in the upper portions of the basalts and overburden units. Ground water flow directions in these local systems vary due to geological factors such as faults, fractures, and buried stream channels. Ground water flow modeling conducted by the University of Idaho, to delineate source water protection areas for communities on the Clearwater Plateau, indicates surface water bodies can strongly influence the local ground water flow regime (Williams et al, 2001a).

Ground water recharge rates vary across the Subarea due to multiple factors, including precipitation, elevation, soil type, and topographic slope. A recharge estimate of 1 inch per year was used by the University of Idaho to calibrate the ground water flow model for the City of Nezperce (Williams et al, 2001a).

3.5.3.3. <u>Well Depth</u>

The well depths of Statewide Program wells range from 58 to 630 feet bls. The median well depth and mean well depth are 192 feet bls and 246 feet bls, respectively. Well depths vary throughout the subarea but, in general, the deepest wells are located in the north-central portion of the Clearwater Plateau (Figure 9). The three deepest wells (605-630 feet bls) are located to the east/northeast of Culdesac. The shallowest Statewide Program well (58 feet bls) is located east of Cottonwood. Numerous shallow wells are located throughout the Subarea (Bentz, 1998), however, well logs are not available for these wells, and therefore are not included in the Statewide Program.

Casing lengths ranged from 15 feet to 600 feet with the median value being 92 feet. Based on median well lengths and median well casing depths, casings extend approximately one-half the well depth. Partially cased wells or wells with multiple screened or slotted zones may allow mixing of ground water from different aquifers. Ground water from a shallow contaminated aquifer may enter a well and move down into an uncontaminated aquifer if a well is open to both water bearing zones.

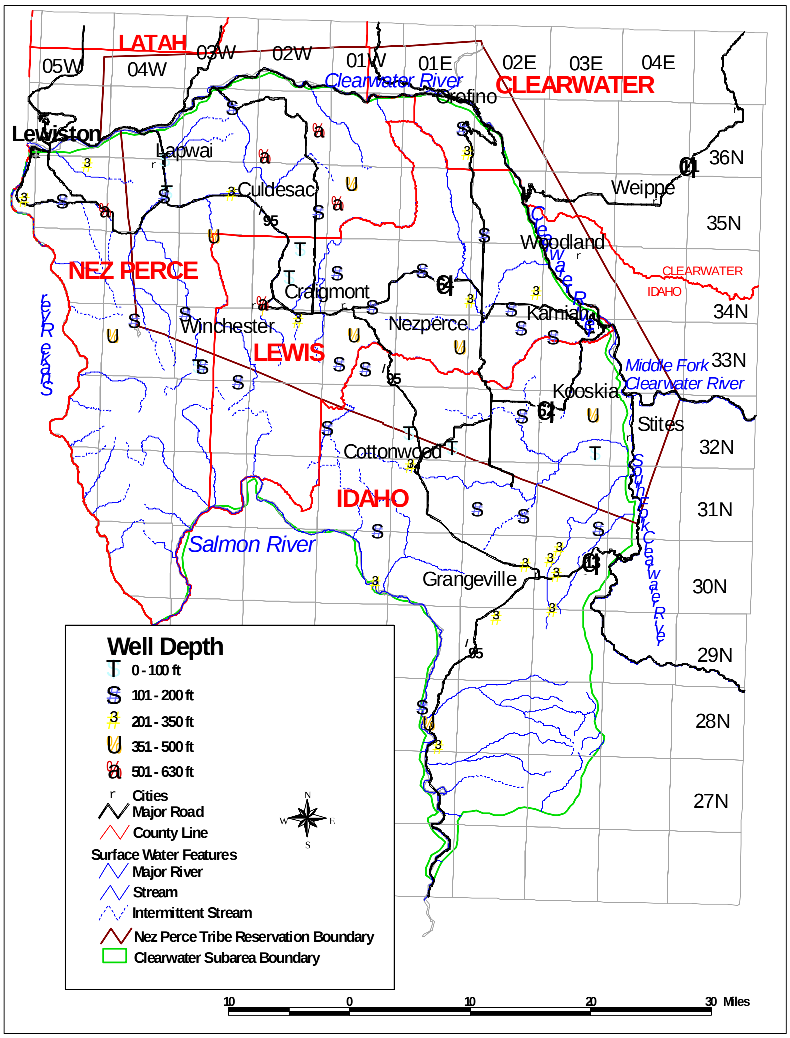


**Figure 9. Well Depths – Clearwater Subarea**

A linear regression was performed on the well depths and depth to water data to evaluate the relationship between well depth and depth to water (Figure 10). The result yields a correlation coefficient ($R^2$) of 0.685, suggesting well depth for Statewide Program wells is an indicator of depth to ground water. A similar relationship between well depth and depth to ground water was reported by the Idaho Water Resources Research Institute (Stevens et al 2003a, b, c). The positive correlation indicates the ground water gradient is generally downward over much of the Subarea (Stevens et al 2003a, b, c). The Pearson's product moment correlation coefficient is 0.828; the Spearman's rho–rank order correlation coefficient is 0.793. These methods are described in Section 4.1.1.

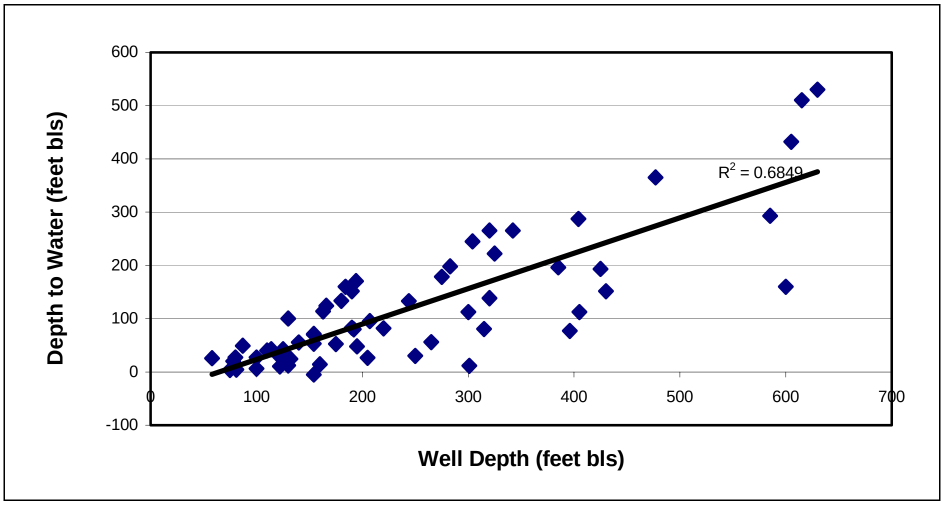


**Figure 10. Correlation Test Results – Well Depth vs. Depth to Water**

3.5.3.4. Well Yields

Based on information from well driller's logs, pumping rates of Statewide Program wells within the Subareas range from 1 or 2 gallons per minute (gpm) from a domestic well completed in granite to 650 gpm from a municipal well completed in basalt. Well capacities within the Nez Perce Tribe Reservation Boundary range from 2.6 gallons per minute (gpm) to 400 gpm (Morrison-Maierle, 1976). Well yields from City of Nezperce wells are about 300 gpm (Williams et al, 2001a), while City of Winchester wells yield from 50 gpm to 150 gpm (Williams et al, 2001b). Wells drawing from the basalt aquifer below the City of Lewiston produce over 2,000 gpm (Cohen and Ralston, 1980). Aquifer tests conducted on City of Clarkston municipal wells indicate the aquifer is highly productive with aquifer coefficients of transmissivity of 1.1 x $10^5$ to 1.7 x $10^6$ gallons per day per ft (gpd/ft) (1,400 to 21,000 $m^2$/day) (Cohen and Ralston, 1980).

## 3.6. Land Cover

Major land cover categories in the Clearwater Subarea include agriculture and pasture, forestland, and rangeland (Table 2), with agriculture and pasture constituting 49 percent of the total land use in the subarea. The native vegetation is bunchgrass prairie at the lower elevations and coniferous forest in the cooler, moister higher elevations (Barker, 1982). Figure 11 illustrates how the central portion of the Plateau has been developed into agricultural lands while the higher elevations of the subarea remain forested. Shrub steppe and grassland cover the canyon walls along the Salmon River and Snake River.

**Table 2. Land Cover – Clearwater Subarea**

| Categories | Percent of Subarea |
|---|---|
| Agricultural crop and pastureland | 49.0% |
| Urban and Industrial | 0.6% |
| Shrub Steppe and Grasslands | 17.3% |
| Recent timber harvest areas | 0.8% |
| Montane Forests | 25.1% |
| Montane Forest-Steppe Transitions | 7.1% |

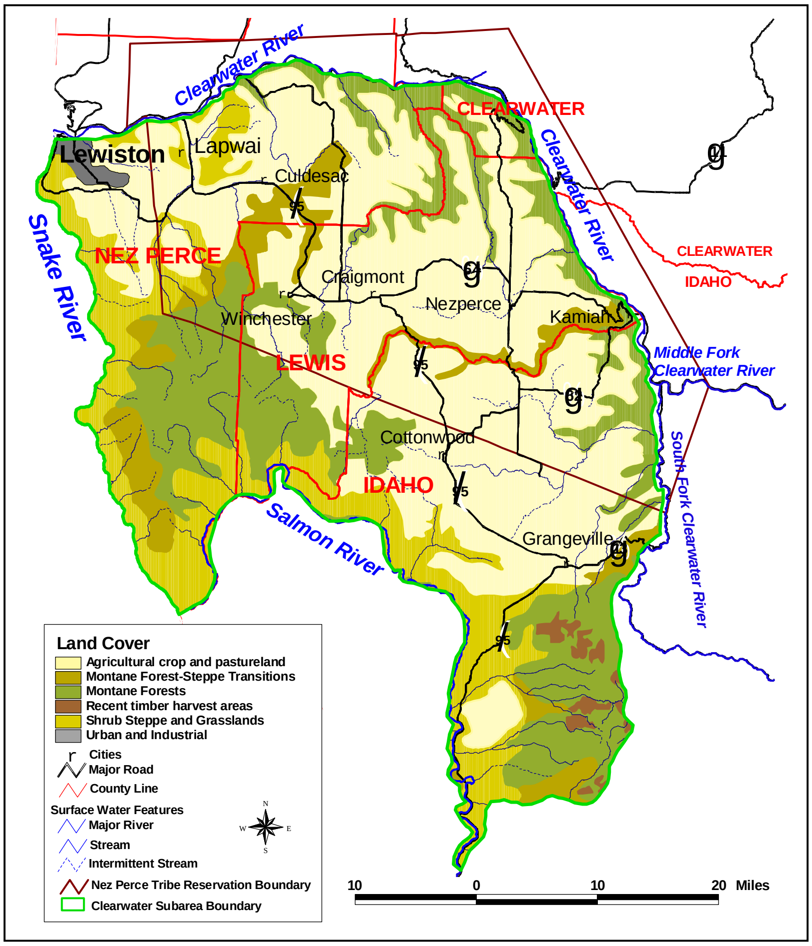


**Figure 11. Land Cover – Clearwater Subarea**

3.6.1. Agricultural Production

Dry-land farming is the primary form of agricultural production. However, a very small amount of land near the City of Lewiston is irrigated. The Lewiston Orchards Irrigation District, operated by the Bureau of Reclamation, delivers a full irrigation water supply to over 3,900 acres (U.S. Bureau of

Reclamation, 2003) in the Lewiston Orchards area southeast of Lewiston. Winter wheat, barley, spring wheat, oats, alfalfa hay, and dry beans are the major commodities produced in the Subarea (U.S. Department of Agriculture, 2003). The top commodities for the years 1980, 1990, and 2000, are summarized in Table 3. The acreage dedicated to these crops in Lewis County and Idaho County has remained relatively constant for the last two decades. However, harvested acreage in Nez Perce County increased from approximately 200,000 acres in 1980 to almost 247,000 acres in 2000.

**Table 3. Top Agricultural Commodities (acres harvested)**

| Commodity | Lewis County | | | Nez Perce County | | | Idaho County* | | |
|---|---|---|---|---|---|---|---|---|---|
| Year | 1980 | 1990 | 2000 | 1980 | 1990 | 2000 | 1980 | 1990 | 2000 |
| Beans, All Dry Edible | NR | NR | 0 | NR | NR | 17100 | NR | NR | 0 |
| Hay, Alfalfa (dry) | NR | 3500 | 7000 | NR | 11800 | 6300 | NR | 18200 | 22600 |
| Barley; all | 31000 | 30900 | 17800 | 19000 | 17900 | 18400 | 31500 | 30200 | 22300 |
| Oats | 1800 | 1100 | 500 | 1200 | 700 | 400 | 1700 | 900 | 1800 |
| Wheat: all | 56700 | 72700 | 72400 | 90200 | 89500 | 102200 | 67600 | 59800 | 63600 |
| Wheat; other spring | 5700 | 4800 | 20400 | 6800 | 2900 | 25200 | 4500 | 2800 | 14600 |
| Wheat; winter all | 51000 | 67900 | 52000 | 83400 | 86600 | 77000 | 63100 | 57000 | 49000 |
| Total Acreage | 146200 | 180900 | 170100 | 200600 | 209400 | 246600 | 168400 | 168900 | 173900 |

*- not all harvested acreage in Idaho County lies within the Clearwater Subarea

3.6.2. Livestock

Rangeland is a significant portion of the Subarea. About 183,000 acres of shrub steppe and grassland are located within Nez Perce and Lewis County alone (Hahn, 2001). About 86,000 acres of shrub steppe and grassland are located in the Idaho portion of the Subarea. Cattle grazing operations represent a significant, albeit diminishing source of income in the Subarea. The number of livestock, including sheep, dairy cows, and beef cattle, within the three counties decreased from 98,000 head in 1980 to 61,000 head in 2000 (U.S. Department of Agriculture, 2003). Seven dairies are located within the Subarea: six dairies are located in Idaho County near the City of Cottonwood and one dairy is located in Nez Perce County, to the south of Culdesac (Ewart and Young, 1999).

## 3.7. Demographics

An estimated 48,000 people reside within the Clearwater Subarea (Idaho Department of Commerce, 2002). The cities of Lewiston, Idaho (31,000) and Clarkston, Washington (7,345) (Washington State Office of Financial Management, 2002) serve as the regional center of economic, medical, and educational activity. Smaller communities include Grangeville (3,228), Kamiah (1,160), Lapwai (1,134), Cottonwood (944), Craigmont (556), and Nezperce (528) (Idaho Department of Commerce, 2002). About 3,000 members of the Nez Perce Tribe are estimated to reside within the Nez Perce Tribe Reservation Boundary (Nez Perce Tribe, 2003).

The service industry and retail trade provide the largest number of employment opportunities in the area (Idaho Department of Commerce, 2002). These numbers reflect the large impact of the City of Lewiston on the employment statistics. However, in the more rural areas on the Plateau, agriculture is the foundation of the economy. The per capita income of the rural areas is well below state and national averages. The largest employment sectors in the counties comprising the Clearwater Subarea, as of 1999, are shown below on Table 4.

**Table 4. Employment Sector (number of persons employed) and Income Statistics**

| LARGEST EMPLOYMENT SECTORS | Nez Perce County | Lewis County | Idaho County | Total |
|---|---|---|---|---|
| Manufacturing | 4045 | 187 | 982 | 5214 |
| Retail Trade | 4905 | 350 | 1099 | 6354 |
| Services | 7566 | 343 | 1511 | 9420 |
| State and Local Government | 2871 | 366 | 930 | 4167 |
| Finance, Insur. & Real Estate | 2072 | 128 | 458 | 2658 |
| Construction | 1351 | Not reported | 566 | 1917 |
| Transportation, Comm.& Pub. Utils. | 1660 | 115 | 338 | 2113 |
| Farm | 591 | 252 | 961 | 1804 |
| INCOME | | | | |
| Per capita Income | $24,519 | $19,074 | $17,690 | |
| Percent of State/National Average | 107.2% / 85.9% | 66.8% / 83.4% | 62.0% / 77.4% | |

### 3.7.1. Land Ownership

More than 85 percent of the land within the Subarea is owned by individuals or corporations. Federally owned lands managed by the Bureau of Land Management, the U.S. Forest Service, and the National Park Service comprise nine percent of the Subarea (Figure 12). The State of Idaho owns about four percent of the land. Although a large part of the Subarea lies within the Nez Perce Tribe reservation boundary only about two percent of the land is actually owned by the Nez Perce Tribe. The Tribal lands are widely scattered within the reservation boundary.

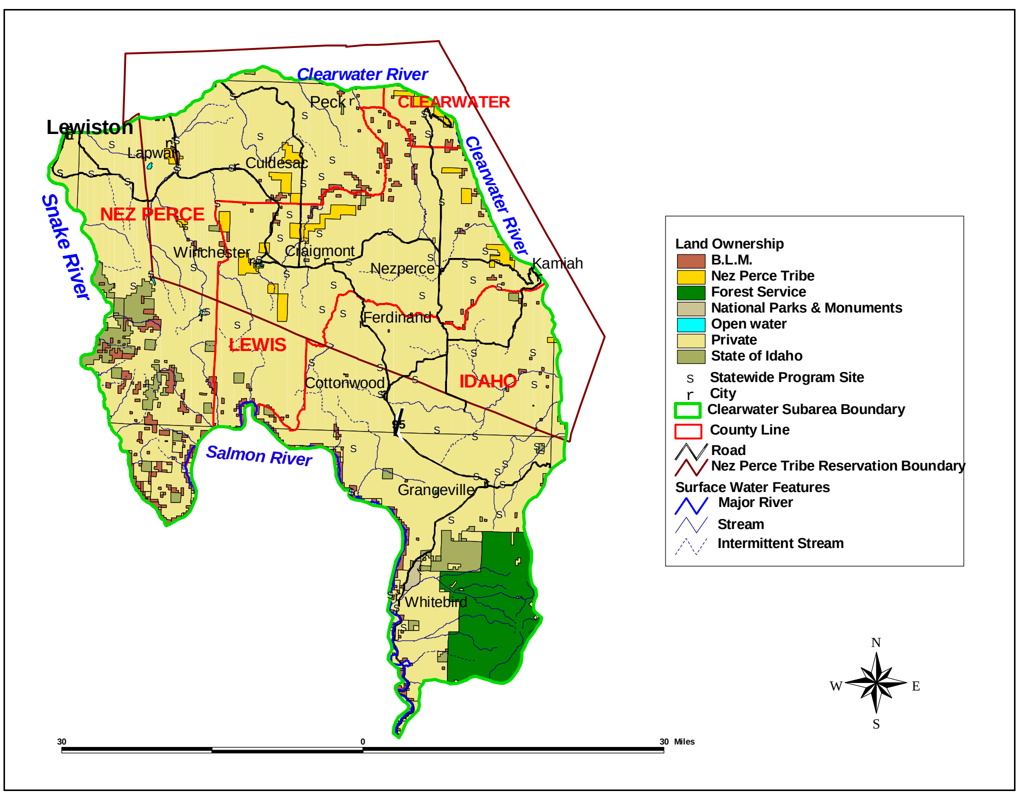


**Figure 12. Land Ownership in the Clearwater Subarea**

## 3.8. Statewide Program Monitoring Sites

Data are available for 61 Statewide Program sites within the Clearwater Subarea (Figure 14). Nine sites have been dropped from the network for a variety of reasons; the most common reasons being - well no longer in use, or owner request to be removed from the program. Six sites were added in 2001 and five sites were added in 2002 to replace sites dropped or to characterize areas without data. Therefore, 52 sites are currently on the "active" monitoring list. Although clustering of monitoring sites has occurred in some areas due to the nature of the selection process, the original spatial distribution provided coverage of most areas with ground water usage. Data gaps (no sites in some areas) do exist primarily because there were no viable monitoring sites, or permission to sample could not be obtained from well owners.

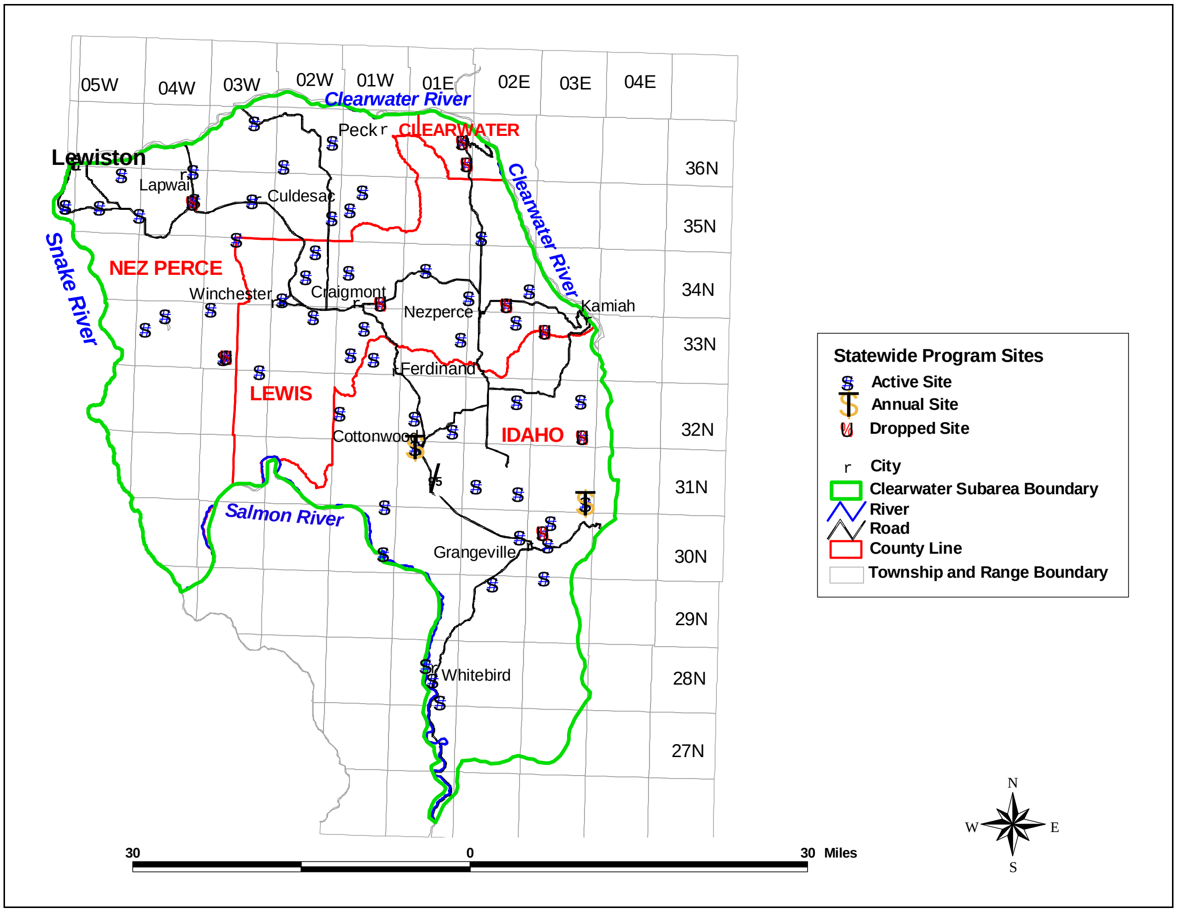


**Figure 13. Statewide Program Monitoring Sites - Clearwater Subarea.**

# 4. METHODS

The Statewide Program uses consistent sample collection methods and standardized laboratory analyses to facilitate comparisons of data from year to year. For some analyses, such as the stable nitrogen isotope ratio analyses, standard laboratory methods do not exist. Quality assurance and quality control management processes are maintained to ensure the resulting data are indicative of the water quality in the aquifers of Idaho and unaffected by sampling or analysis techniques. Quality assurance procedures are used to control those immeasurable components of a project, such as sampling at the right place with the correct equipment and using the appropriate techniques (U.S. Geological Survey, 2002). Quality control is the information generated to estimate the magnitude of any bias and variability in the processes for obtaining water quality data (U.S. Geological Survey, 2002).

## 4.1. Field Methods

All samples are collected in accordance with standard operating procedures (SOPs) (Idaho Department of Water Resources and U.S. Geological Survey, 2001). These SOPs are derived from the USGS Field Manual (U.S. Geological Survey, 1997), with modifications made as necessary. Use of SOPS and the same field crews from year to year is the principal non-laboratory quality assurance mechanism utilized by the Statewide Program. SOPs are available for the following topics:

SOP # 1.00 Field Inventories;

SOP # 2.00 Field Substitution of Monitoring Sites;

SOP #3.00 Purging a Well

SOP # 4.00 Decontaminating Field Equipment

SOP # 4.50 Measuring Alkalinity in the Field

SOP # 5.00 Ground Water Quality Sample Collection

SOP # 5.50 Fecal Coliform Media Kit Preparation and Field Analysis

SOP # 6.00 Shipping Ground Water Quality Samples

SOP # 7.00 Mailing Field Forms

SOP # 8.00 Bottle Labeling and Lab Forms

SOP # 9.00 Collecting and Labeling QC Samples

SOP # 10.0 Preparing VOC Transfer Blanks

SOP # 11.0 Instructions for Collecting Pesticide Samples

Sampling issues not specifically addressed by a SOP are performed in accordance with the USGS Field Manual (1997) when possible or after consultation between USGS, IDWR, and the laboratory, if necessary.

## 4.2. Analytical Methods

The number of variables potentially affecting results are reduced by limiting the number of laboratories used in the Statewide Program. Common ions, nutrients, metals, and trace element analyses have always been performed by the USGS National Water Quality Laboratory in Arvada, Colorado. Volatile organic compounds (VOCs) were analyzed by the Idaho State Health Laboratory in 1990 and 1991 using EPA Method 502.2 and by the USGS laboratory in 1992 using a USGS method equivalent to EPA Method 524.2. Since then, Alpha Analytical Laboratory, a USGS certified laboratory in Nevada has conducted the VOC analyses using EPA Method 524.2. The Idaho State Health Lab in Boise, Idaho has performed the radiological analyses for gross alpha and gross beta. Stable nitrogen isotope ratios were determined by the University of Illinois at Urbana-Champaign. Water samples are analyzed for pesticides using both immunoassay and gas chromatography (GC) methods. Immunoassay testing is performed by the Idaho State Health Lab using test kits manufactured by Strategic Diagnostics, Incorporated or Abraxis, Incorporated. Pesticide analyses using GC methods were performed by the USGS NWQL.

The three primary laboratories used by the Statewide Program have quality assurance and quality control practices in place to minimize bias and variability in the analytical results. To monitor for potential contamination introduced through the sampling process, ambient blanks, equipment blanks, and trip blanks are collected. Replicate samples are collected to monitor variability. Spike samples are occasionally sent to evaluate laboratory detection and measurement capability. Periodically, split samples are submitted to multiple laboratories to corroborate the results.

Results from individual wells from each sampling round are contained in Appendix A to illustrate the maximum number of analytes evaluated during each of the rounds.

# 5. GROUND WATER QUALITY CHARACTERIZATION

This report uses Statewide Program data collected from 1990 through 2002 and includes general statements about constituent concentration distributions as well as basic descriptive and non-parametric statistical test results. Primary drinking water standards or Maximum Contaminant Levels (MCLs) and secondary drinking water standards established by the U.S. Environmental Protection Agency (EPA) are used as benchmarks to assess the ground water quality (U.S. Environmental Protection Agency, 2003a). MCLs are enforceable standards that apply to constituents with potential human health concerns. Secondary standards are non-mandatory water quality standards for 15 contaminants. These guidelines assist public water systems in managing their drinking water for aesthetic considerations, such as taste, color, and odor. The Idaho Ground Water Quality Rule of 1996 (IDAPA 58.01.11) adopted the MCLs and secondary standards as ground water quality standards.

Characterization results are discussed in the following sections: 1) Field Measurements; 2) Major Ions; 3) Nutrients; 4) Trace Elements; 5) Radioactivity; 6) Volatile Organic Compounds; 7) Pesticides; 8) Bacteria; 9) Secondary Standards; and 10) Characterization Summary. All ground water quality data except pesticide and VOC results are contained in Appendix B.

## 5.1. Field Measurements

On-site field measurements recorded as part of the Statewide Program include depth to water, water temperature, pH, specific conductance, alkalinity, and since 1999, dissolved oxygen. The most recent ground water temperatures for the 61 Clearwater Subarea sites ranged from 7.2 °C to 19.7 °C with the median and average values being 12.0 °C and 12.6 °C, respectively. Higher ground water temperatures 15 °C to 19.7 °C) occurred in two areas – near Lewiston and along the Salmon River in the southern portion of the Subarea (Figure 14). Wells with moderately warm water (11.5 °C to 15 °C) are dispersed across the northern and eastern portions of the Subarea.

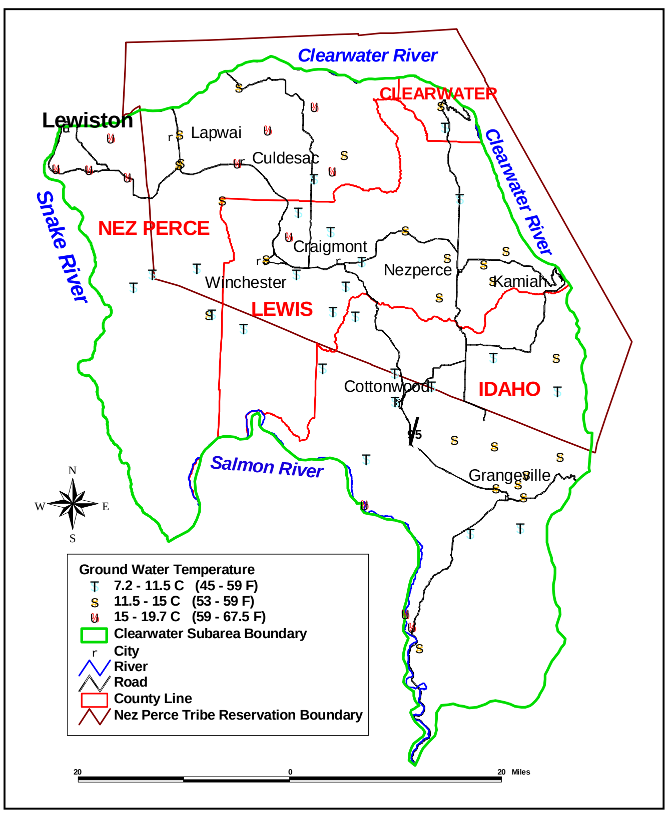


**Figure 14. Ground Water Temperature – Clearwater Plateau**

Specific Conductance (SC) is "a measure of the electrical conductance of a substance normalized to unit length and unit cross section at a specified temperature" (Radke et al, 1998). Within the Clearwater Subarea SC values from Statewide Program wells roughly correspond to 140 percent of the total dissolved solids (TDS) values. SC for the Clearwater Subarea ranged from 4 to 1,330 microsiemens per centimeter (µS/cm) with the median and mean values 308 µS/cm and 353 µS/cm, respectively. A well located to the west of Kamiah contained the highest SC value for the Subarea. Wells along the Salmon River, with relatively high water temperatures, contained the next highest SC values. Wells containing the lowest SC values are generally located along the southwestern boundary, where water temperatures are typically low. These wells tend to be located in areas that are not agricultural. (Figure 15).

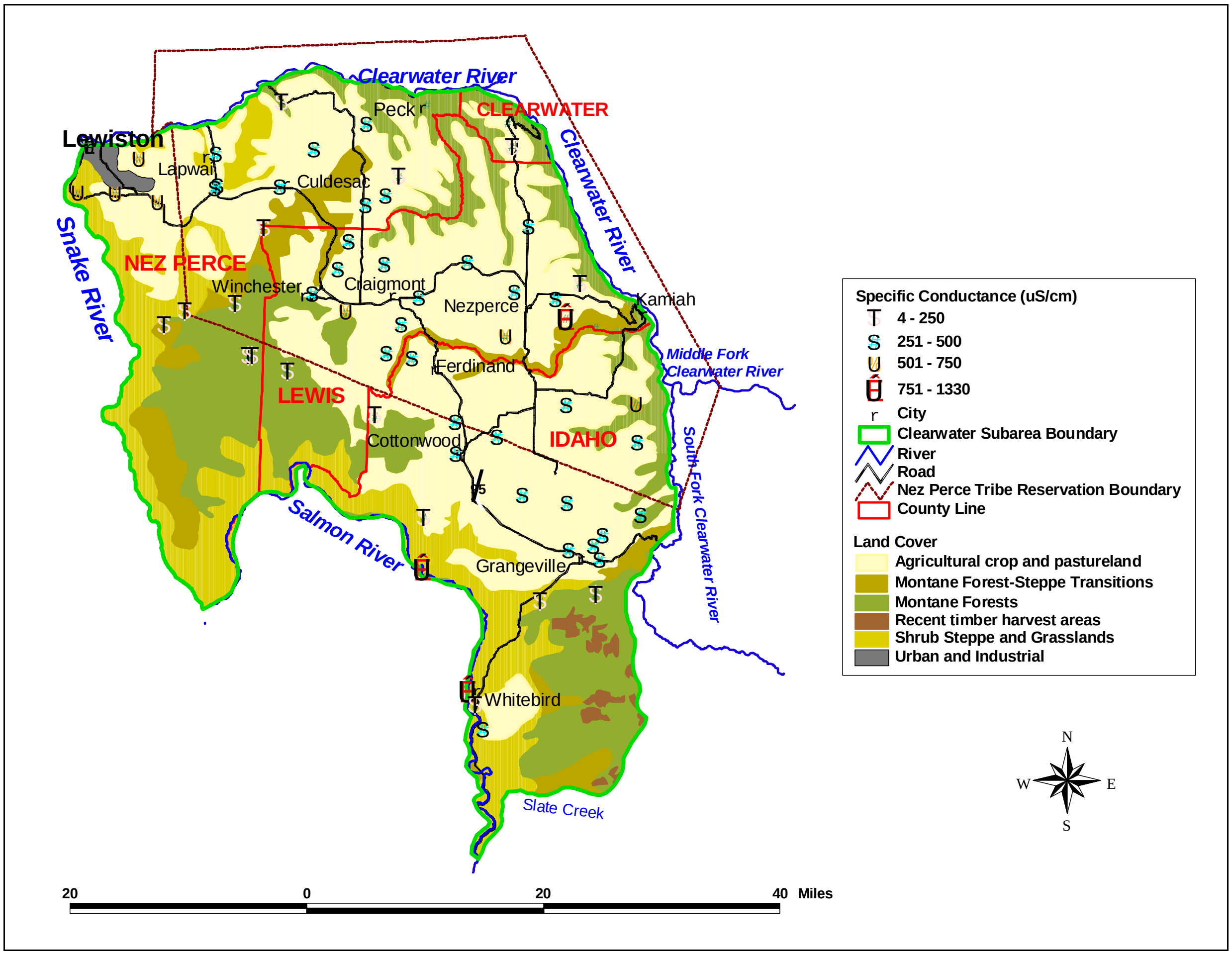


**Figure 15. Specific Conductance Values - Clearwater Subarea**

PH is the measure of acidity or alkalinity in a water sample. PH values less than 7 pH units indicate that the water is acidic; pH values greater than 7 pH units indicate that the water is alkaline. The secondary standard for pH applies to waters with pH values less than 6.5 pH units or greater than 8.5 pH units. Acidic pH waters can cause corrosion of plumbing, and may cause a bitter taste and discoloration of water (U.S. Environmental Protection Agency, 2003b).

In Clearwater Subarea wells, pH levels ranged from 6.31 pH units to 9.6 pH units with the median and mean values being 7.5 pH units and 7.52 pH units, respectively. One site had pH value less than 6.5 pH units – the lower limit of the secondary standard for pH. Three sites had pH values greater than or equal to 8.5 pH units - the upper limit of the secondary standard for pH (Figure 16).

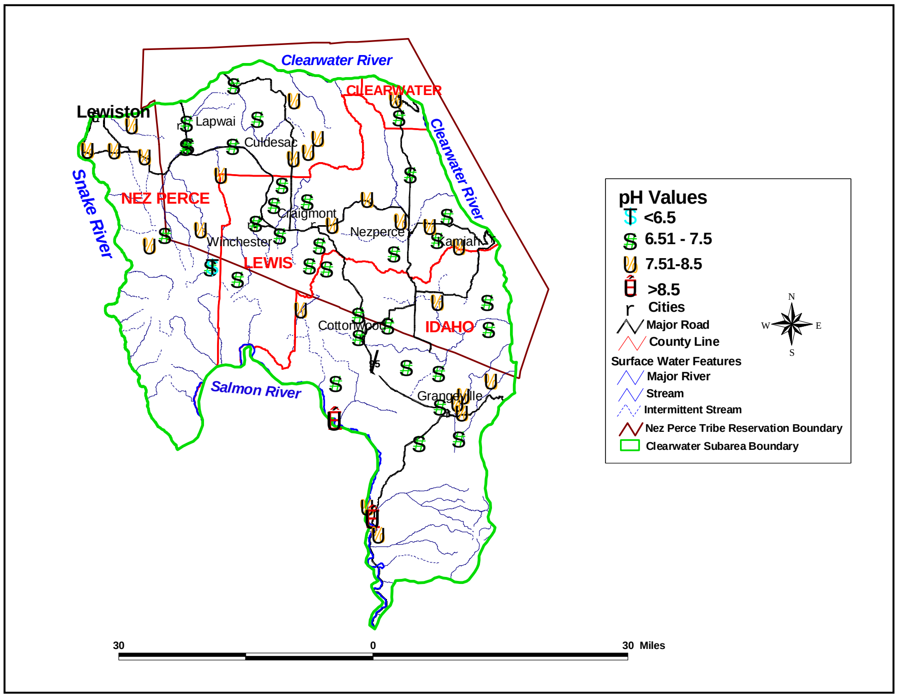


**Figure 16. pH Values - Clearwater Subarea**

Alkalinity is the capacity of solutes in an aqueous system to neutralize acid (Hem, 1985). Alkalinity ranged from 32 to 261 milligrams per liter (mg/L) with the median and mean values being 139 mg/L and 170 mg/L, respectively. Distinct patterns of alkalinity concentrations occurred in the Clearwater Subarea. More than 90 percent (10 of 11) of the sites with alkalinity levels below 100 mg/l are located in non-agricultural areas. Lower concentrations were most frequent in the south/southwestern part of the Subarea. Higher concentrations were more common in the northern and western parts of the subarea (Figure 17).

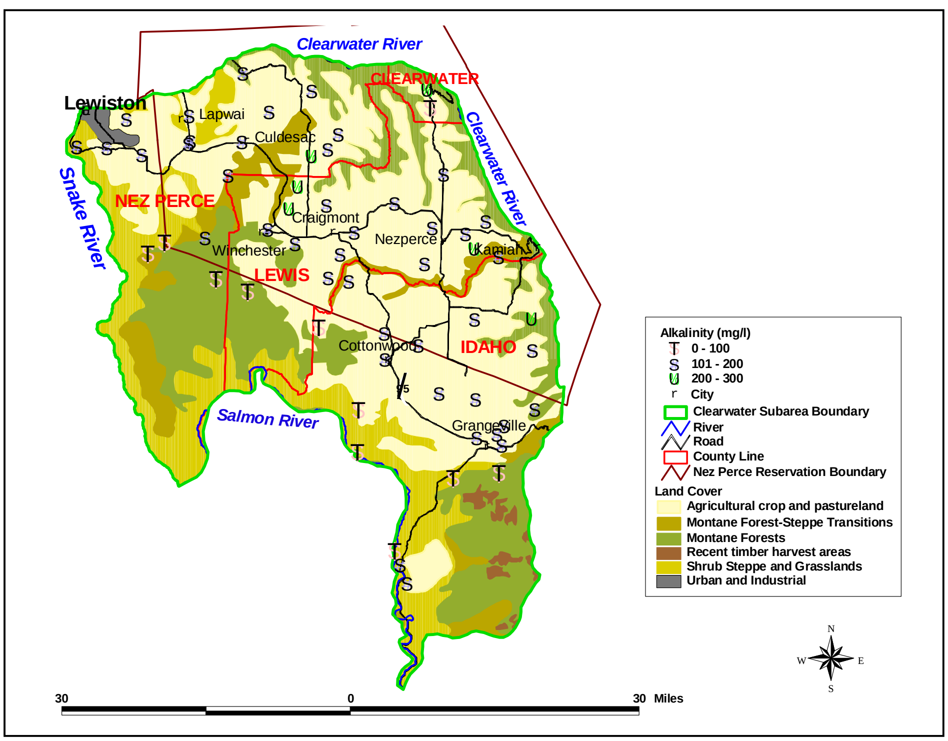


**Figure 17. Alkalinity Values – Clearwater Subarea**

Boxplots of the field measurements were created using Minitab Statistical Software (Minitab, 2000) to evaluate the distribution of the data (Figure 18). This provides information useful in determining appropriate methods for evaluating the data.

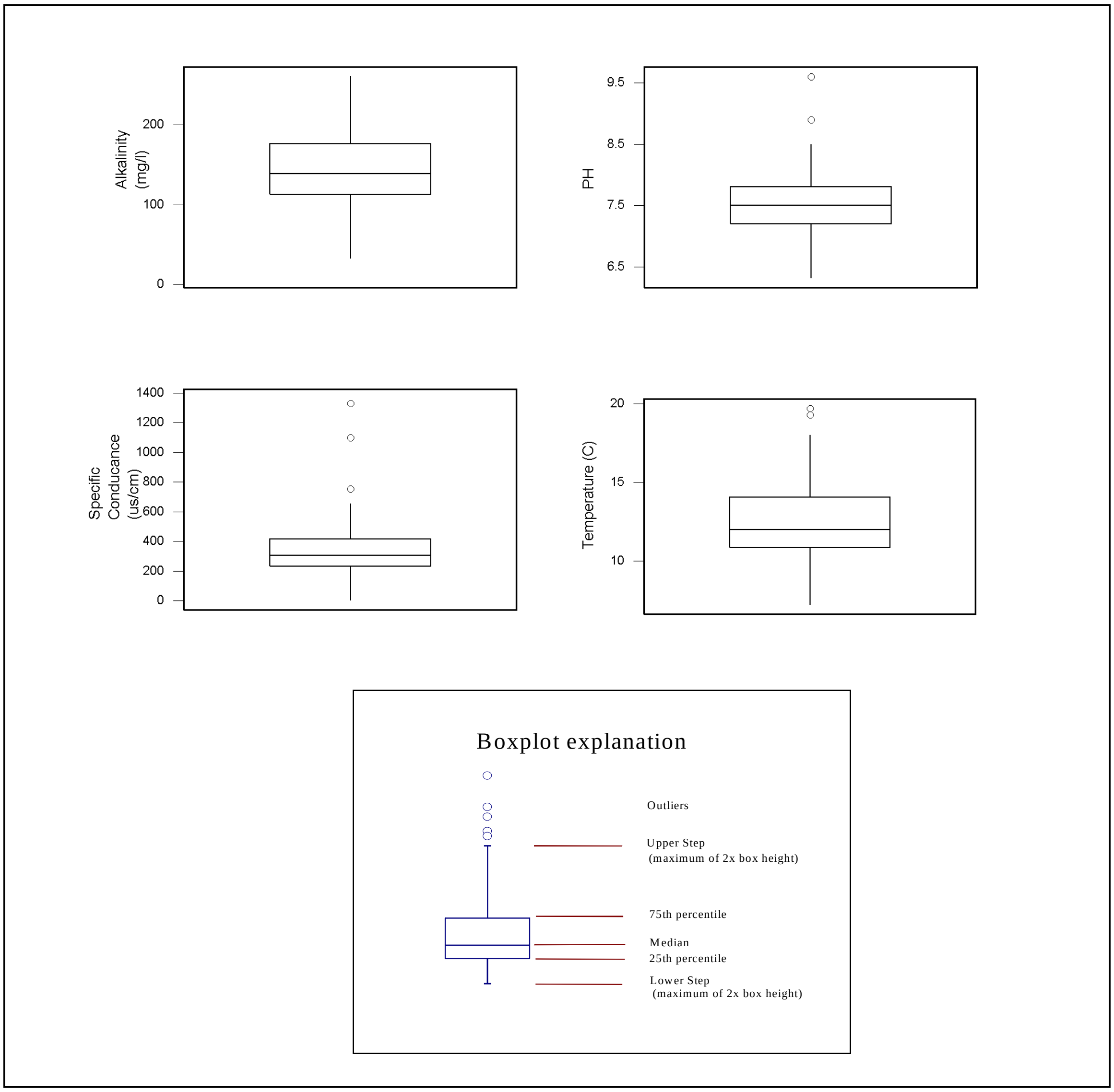


**Figure 18. Field Parameter Boxplots - Clearwater Subarea**

### 5.1.1. Correlations Between On-Site Measurements and Well Depths

On-site measurements and well depths were examined using scatterplots for any apparent correlations to evaluate potential variability in ground water chemistry with depth. Consistent ground water chemistry with depth indicates hydrogeochemical conditions are relatively uniform throughout the aquifer. Ground water chemistry was not correlated with other parameters such as land use, and screened interval due to incomplete or poor quality data. Correlation coefficients measure the degree to which two variables are linearly related. Correlation coefficients range from –1 to +1, with values near zero indicating no correlation between the two variables tested. Positive correlation coefficients indicate one variable increases as the other variable increases. Negative correlation coefficients indicate that as one variable increases, the other variable decreases.

Three correlation analysis methods – linear regression, Pearson's product moment correlation coefficient, and Spearman's rho rank-order correlation coefficient - were applied to the data. The results of all methods are included on the following figures to illustrate the variability between correlation methods. However, in general the three methods agreed. Linear regression and the Pearson product moment correlation coefficient make the implicit assumption that the two variables are both normally distributed (U.S. Department of Defense, 2000). The Spearman's rho rank-order nonparametric test, which measures the correlation coefficient (i.e., the strength of the association) between two variables when the relationship is non-linear (Helsel and Hirsch, 1992), is more appropriate when the data are skewed. A probability (p) also was calculated for each correlation coefficient. When p is less than 0.05, the relationship between the two variables is significant at the 95 percent confidence level (Minitab Inc., 2000).

Correlations between well depth and four field parameters (temperature, pH, specific conductance and alkalinity) are shown in Figures 19 through 22. Correlations were significant at the 95 percent confidence level for temperature versus well depth. No correlations existed with well depth and the other field parameters (specific conductance, alkalinity, and pH).

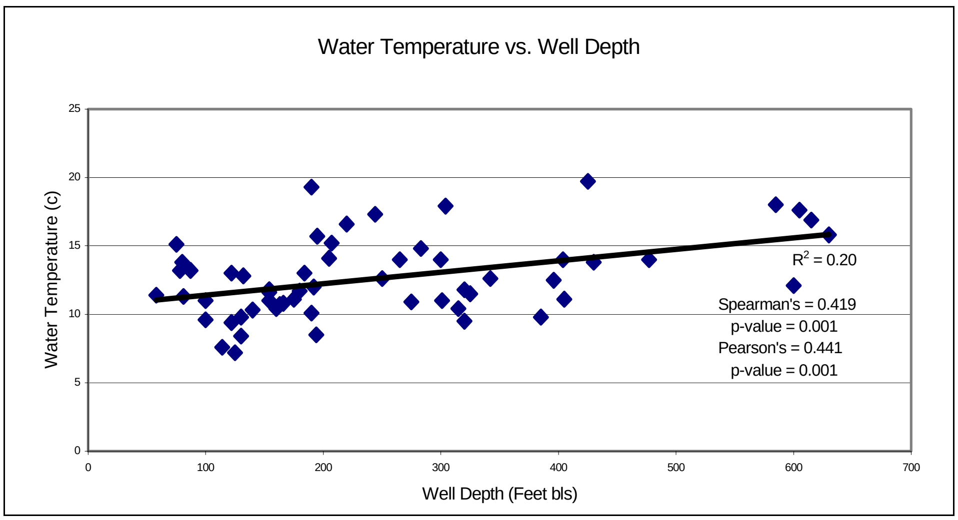


**Figure 19. Correlation Test Results - Water Temperature vs. Well Depth**

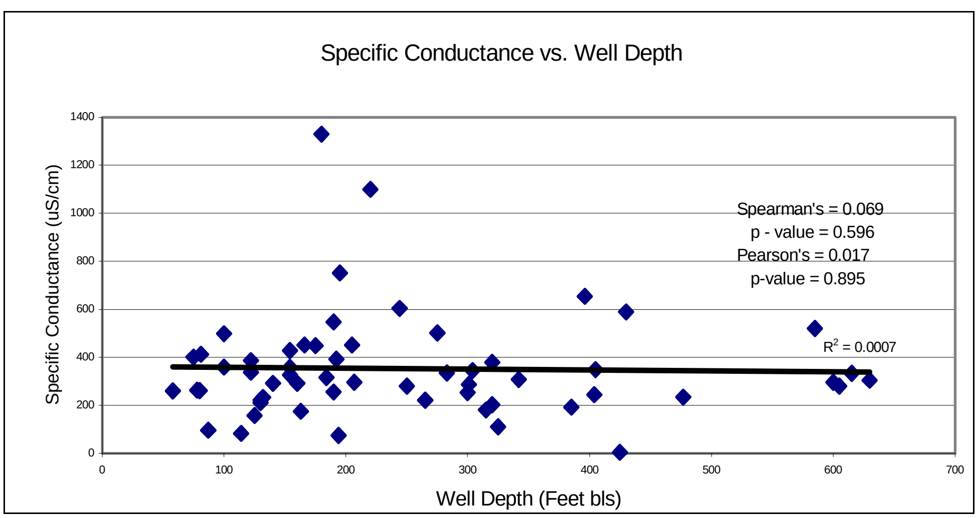


**Figure 20. Correlation Test Results - specific conductance vs. well depth**

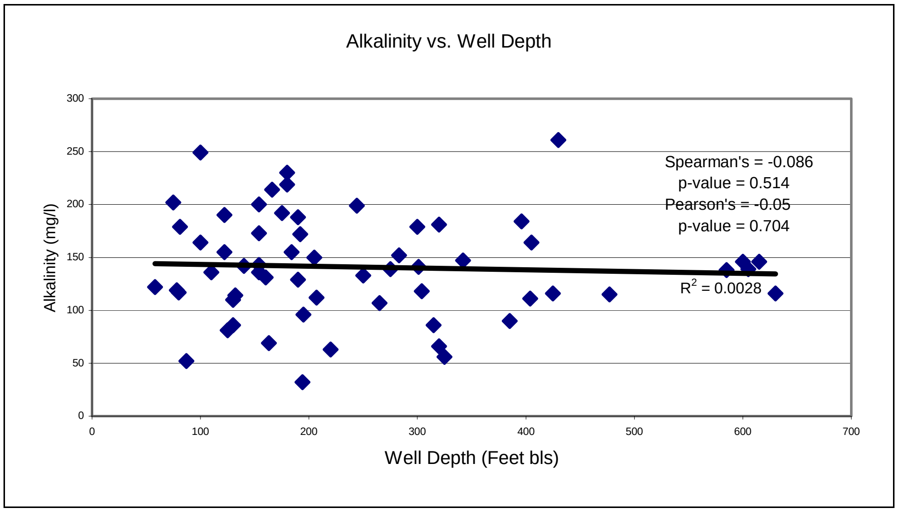


**Figure 21. Correlation Test Results - Alkalinity vs. Well Depth**

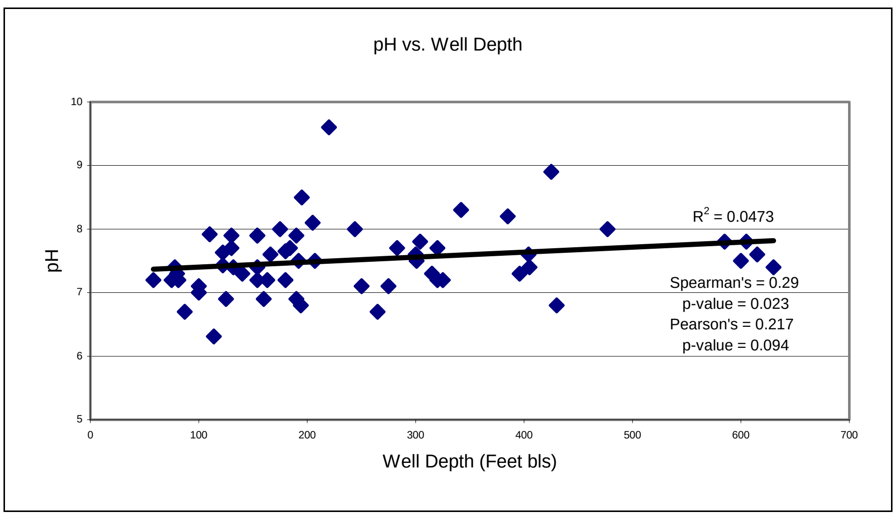


**Figure 22. Correlation Test Results - pH vs. Well Depth**

Water temperature was the only field parameter that displayed statistically significant (95% confidence interval) correlation with well depth using both the Spearman's and Pearson's correlation methods. The correlation between well depth and pH was significant using the Spearman's rho method, but not significant using the Pearson's product moment correlation coefficient  No statistically significant correlation existed between well depth and specific conductance or well depth and alkalinity.

Statistically significant correlations between the other field parameters (pH, specific conductivity, alkalinity, and temperature) existed for four of the six combinations. The strongest correlations exist between conductivity and alkalinity, and temperature and pH. The linear correlation between alkalinity and specific conductance was low ($R^2$ = 0.21) when viewed across all the data. The correlation improved dramatically when the highest and very lowest conductivity values (outliers) were removed from the data ($R^2$ = 0.85). Correlations are presented in Table 5. Scatter plots are contained in Appendix C.

The lack of correlation between field parameters illustrates the variability that exists between sites within the Subarea. This lack of correlation increases the uncertainty when interpolating data between wells or extrapolating data from one well to another.

**Table 5. Field Parameter Correlations**

| Field Parameter Combinations | $R^2$ | Pearson's | p-value | Spearman's | p-value |
|---|---|---|---|---|---|
| Conductivity vs. Alkalinity | 0.21 | 0.379 | 0.003 | 0.626 | 0.000 |
| Conductivity (<500) vs Alkalinity. | 0.85 | NA | NA | NA | NA |
| Conductivity vs. Temperature | 0.06 | 0.326 | 0.01 | 0.344 | 0.006 |
| Conductivity vs. pH | 0.11 | 0.287 | 0.024 | 0.221 | 0.084 |
| Alkalinity vs. Temperature | 0.01 | 0.075 | 0.565 | 0.089 | 0.494 |
| Alkalinity vs. pH | 0.001 | -0.027 | 0.834 | 0.112 | 0.388 |
| Temperature vs. pH | 0.26 | 0.389 | 0.002 | 0.398 | 0.001 |

## 5.2. Major Ions, Water Types, Total Dissolved Solids and Hardness

### 5.2.1. Major Ions

Major ions analyzed were calcium, magnesium, sodium, potassium, bicarbonate, sulfate, and chloride. Boxplots show that the common ions typically have non-normal right-skewed distributions (Figure 23). The exceptions are the bicarbonate ($HCO_3$) and magnesium (Mg) values, which appear to be normally distributed.

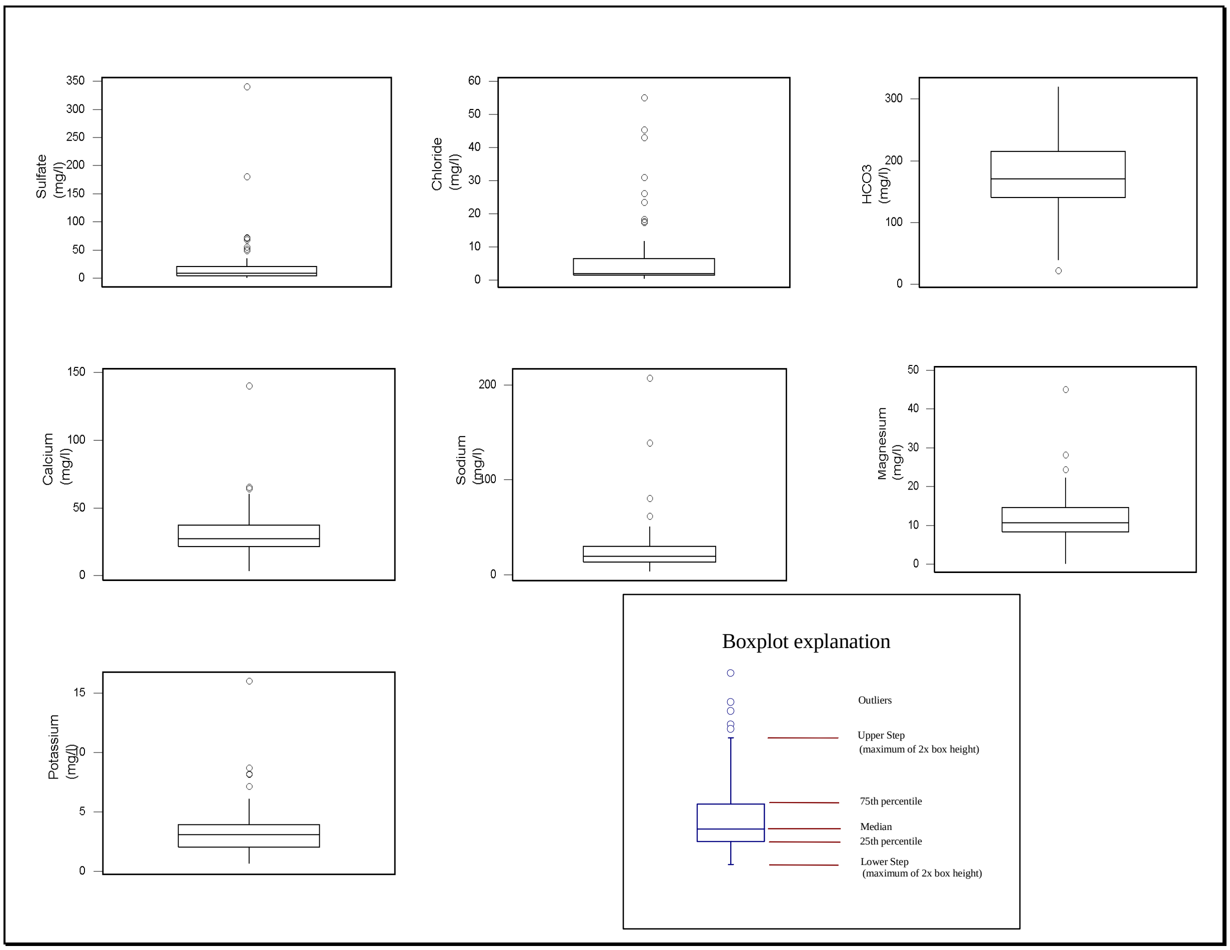


**Figure 23. Major Ion Boxplots - Clearwater Subarea**

Major ions with a secondary standard include chloride (250 mg/L) and sulfate (250 mg/L). The maximum chloride concentration measured in water samples collected from the sites was 55 mg/l. One site (30N 01W 26ADD1), with a sulfate concentration of 340 mg/L, exceeded the secondary standard for sulfate. Ground water from this site also had a pH of 9.6 and high sodium (207 mg/L).

### 5.2.2. Water Types

The major ion chemistry data were evaluated using the Piper trilinear diagram graphical technique. This method is useful for comparing water chemistry of large numbers of water samples because the major ion composition of each water sample can be viewed on a single plot. Water samples with similar chemistry plot in the same area on the diagram. The major cations [calcium (Ca), magnesium (Mg), and sodium (Na) + potassium (K)] are plotted on the left triangle. The major anions [chloride (Cl), bicarbonate ($HCO_3$), and sulfate ($SO_4$)] plotted on the right triangle. The plotted points for each water sample are then projected to the upper diamond-shaped area that shows cation and anion groups as a percentage of total milliequivalents per liter (meq/l) of sample.

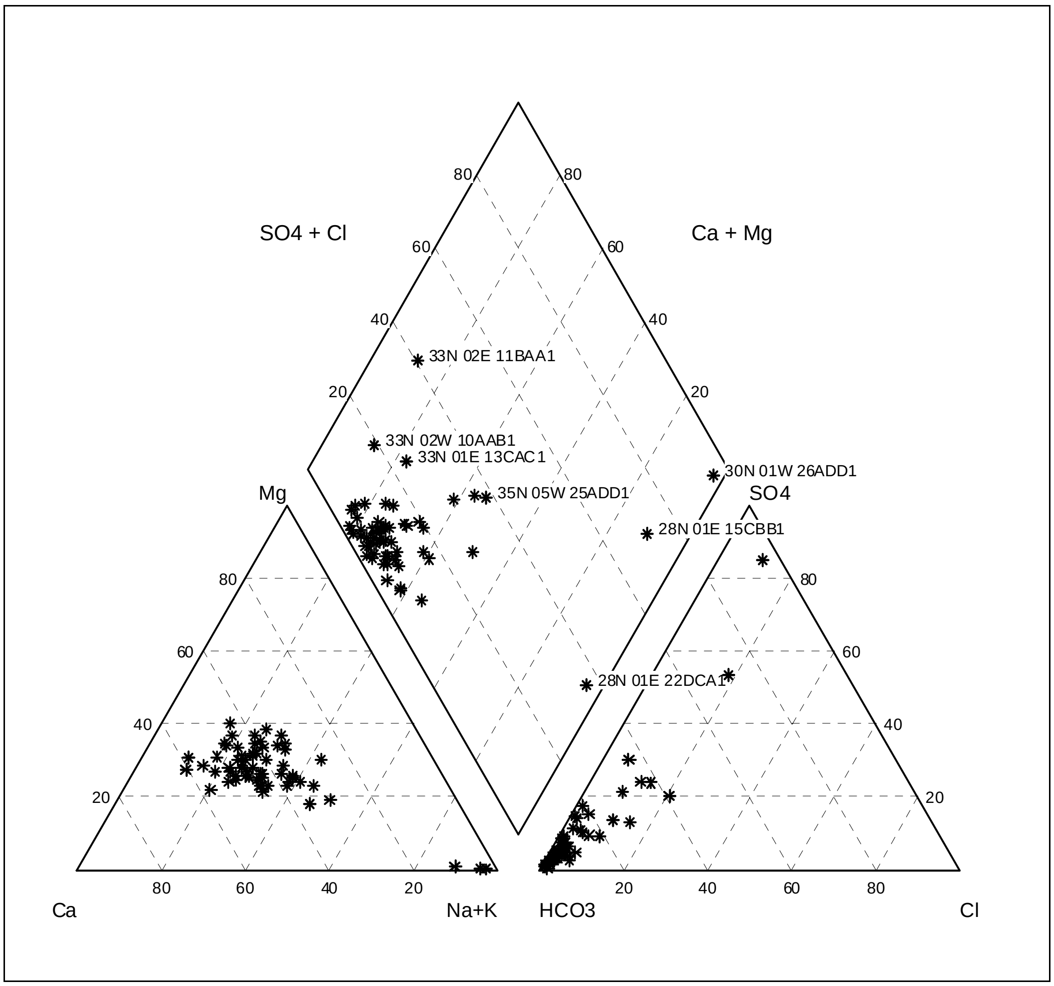


**Figure 24. Ground Water Types – Clearwater Subarea (anomalous sites labeled)**

Trilinear plotting of the data indicates that 55 of the 61 samples have bicarbonate as the dominant anion with calcium or magnesium or sodium as the dominant cations. These water types plot in the west/southwest quadrant of the diamond-shaped diagram. Three sites deviate considerably from the other samples because sodium is the dominant cation. These sites are located on the right side of the diamond-shaped area. The remaining three sites contain mixed waters with more equal levels of anions and cations. The water types are summarized in Table 6.

**Table 6. Summary of Ground Water Types**

| **Water Type** | **Number of Wells** | **Representative Well** |
|---|---|---|
| Bicarbonate dominant | | |
| Ca- Mg-$HCO_3$ | 12 | 32N 03W 01BBC1 |
| Ca-Mg-Na-$HCO_3$ or Ca-Na-Mg-$HCO_3$ | 37 | 31N 01E 08ABB3 |
| Mg-Ca-Na-$HCO_3$ or Na-Ca-Mg-$HCO_3$ | 5 | 32N 03E 11DCC1 |
| Na-Ca-$HCO_3$ | 1 | 35N 06W 24CCA2 |
| Sodium dominant | | |
| Na-SO4 | 1 | 30N 01W 26ADD1 |
| Na-SO4-HCO3 or Na-HCO3-SO4 | 2 | 28N 01E 15CBB1 |
| Mixed Waters | | |
| Ca-Na-Mg-$HCO_3$-$SO_4$ or Na-Mg-Ca-$HCO_3$-$SO_4$ | 2 | 35N 05W 21CDB1 |
| Na-Ca-HCO3-SO4 | 1 | 35N 05W 25ADD1 |

The calcium-bicarbonate dominated waters, which are predominant across the subarea, are typical of aquifers in the Columbia River Basalts (Castelin, 1976, Morrison-Maierle, 1976, Hagan and Bentz, 2000). The water type is a function of the minerals in the soil and underlying basalt that dissolve into water as it moves through the subsurface.

The anomalous sodium dominated waters were collected from wells completed in basalt located near the Salmon River. Two of the wells (28N 01E 15CBB1 and 28N 01E 22DCA1) are located near the City of Whitebird. The other well (30N 01W 26ADD1) is located adjacent to the Salmon River about 15 miles downstream from Whitebird. The well driller's logs from all three wells indicate the wells are completed in basalt. No unusual geologic conditions were noted on the logs. However, the wells are adjacent to faults, have warm water temperatures that rank in the top quartile of measured temperatures, and have the highest fluoride levels (1.7 to 2.3 mg/L). Sodium sulfate dominated waters may be associated with dissolution from shale deposits (Hem, 1985).

5.2.3. Total Dissolved Solids

The total dissolved solids (TDS) concentrations determined by the Statewide Program are the sum of the major dissolved constituents. This differs from true TDS, which is determined by measuring the weight of solids remaining after a known volume of water is evaporated to dryness (Drever, 1988). The secondary standard for TDS is 500 mg/L (U.S. Environmental Protection Agency, 2003b). TDS concentrations for the Clearwater Subarea ranged from 70 to 816 mg/L with the median and mean concentrations being 212 and 245 mg/L, respectively. TDS exceeded the secondary standard of 500 mg/L at two sites [30N 01W 26ADD1 (666 mg/L) and 33N 02E 11BAA1 (816 mg/L)] (Figure 25).

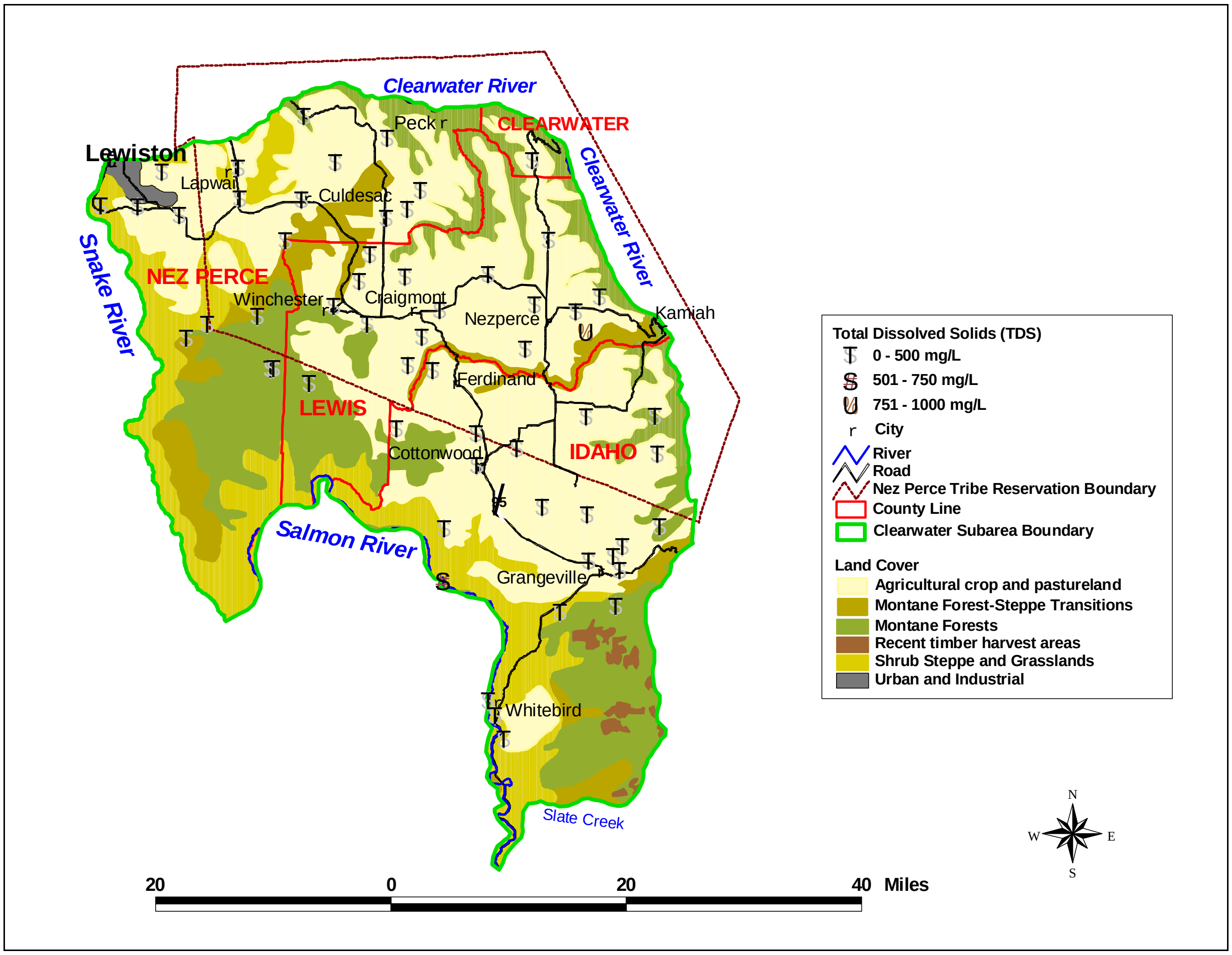


**Figure 25. TDS Concentrations – Clearwater Subarea.**

5.2.4. Hardness

Hardness is calculated from the calcium and magnesium concentrations of a water sample (Drever, 1988). Hardness values ranged from 8 to 540 mg/L with the median and mean values being 110 and 123 mg/L, respectively. Based on the hardness classification scale used by the American Water Works Association (Sawyer and McCarty, 1967) eleven sites have soft water (<75 mg/l); 34 sites have moderately hard water (75 – 150 mg/l); 15 sites have hard water (151-300 mg/l); and one well has very hard water (>300 mg/l). All the wells with soft water, but one, are limited to the southwestern portion of the Subarea. Every well with soft water also contained low levels of alkalinity. These measurements typically show good correlation because they both are a measure of the calcium in a water sample. The well with the highest TDS concentration also contains the hardest water. However, the well with the second highest TDS concentration contains soft water because the water from this well contains low levels of calcium and magnesium but high levels of sodium.

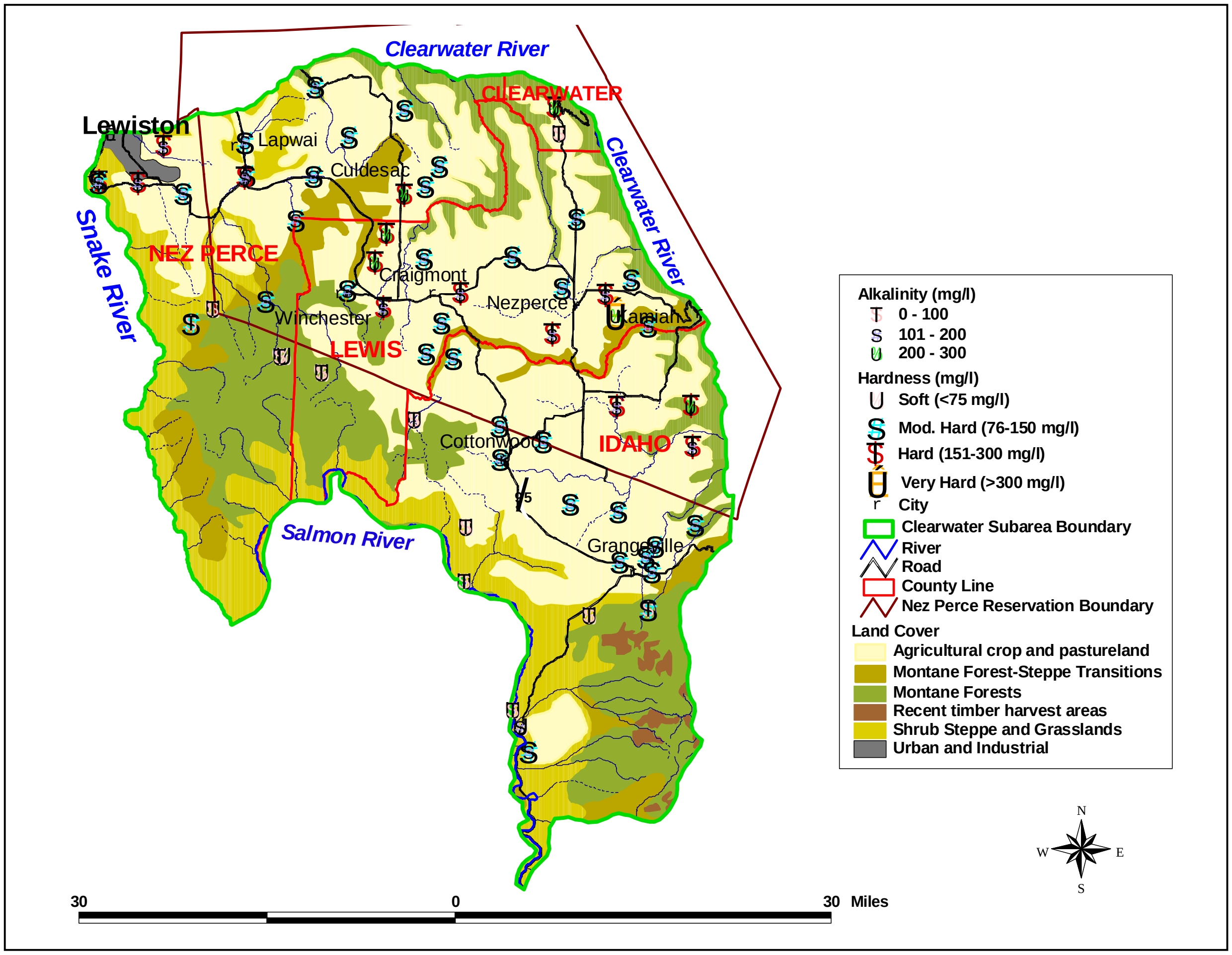


**Figure 26. Hardness and Alkalinity Values - Clearwater Subarea**

## 5.3. Nutrients

### 5.3.1. Nitrate

Nitrate is an oxidized form of nitrogen that typically comes from inorganic fertilizers, decaying organic matter, wastewater from commercial operations, animal manure, and human sewage (U.S. Environmental Protection Agency, 2002a). Nitrate can cause a potentially fatal blood condition known as methemoglobinemia in infants age six months and younger (University of Nebraska, 1998a). Nitrate may: 1) cause miscarriages (Mortality and Morbidity Weekly Report, 1996), 2) be passed on to infants through the milk of nursing mothers (University of Nebraska, 1998b), and 3) contribute to the risk of non-Hodgkin's lymphoma (Ward et al., 1996). The elderly who are infirmed also may be affected by high levels of nitrate.

Nitrate concentrations ($N0_2$+$N0_3$ as nitrogen) for the Clearwater Subarea ranged from less than the minimum laboratory reporting limit of 0.05 mg/L at five sites to 79.5 mg/L with the median and mean values being 0.4 mg/l and 3.0 mg/l, respectively.

Three of the 61 sites (five percent) contained a nitrate concentration greater than 10 mg/L. Approximately 87 percent of the sites had a nitrate concentration equal to or greater than 2 mg/L; the concentration considered to be an indication that the ground water quality has been impacted by land-use activities (Crockett, 1995). Nitrate concentrations greater than 5 mg/l are indicative of more severe impacts. Only two areas within the Clearwater Subarea appear to display any clustering of sites with nitrate values greater that 2 mg/l. The area between Craigmont and Kamiah contains the three sites with nitrate concentrations above 10 mg/l and three sites with nitrate concentrations between 2 and 5 mg/l. The other area with consistently elevated levels of nitrate stretches from Culdesac through Lewiston. Nitrate levels in wells in this area range from 2 to 10 mg/l. Wells along the southern and southwestern part of the Subarea generally have low levels of nitrate. Other recent ground water quality investigations on the Plateau (Bentz, 1998 and Bahr and Carlson, 2002) reported similar percentages of wells with nitrate levels above the drinking water standard.

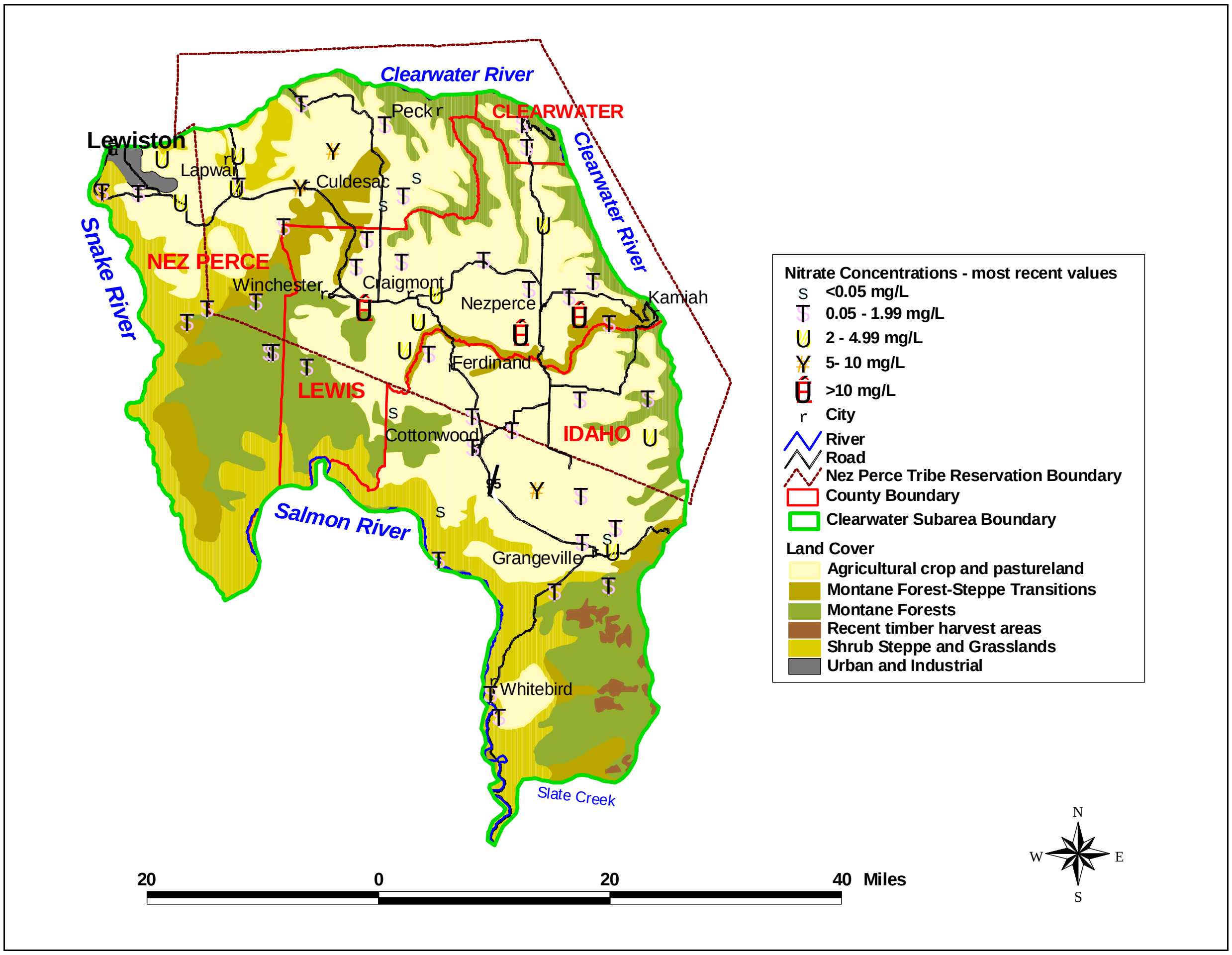


**Figure 27. Nitrate Results - Clearwater Subarea.**

**Table 7. Most Recent Nitrate Results - Clearwater Subarea.**

| Nitrate concentration ranges | Number of Sites | Percentage of Sites |
|---|---|---|
| < 0.05 mg/l | 8 | 13.1% |
| > detection< 2 mg/L | 37 | 60.6% |
| 2-5 mg/L | 10 | 16.4% |
| 5.01-10 mg/L | 3 | 4.9% |
| > 10 mg/L | 3 | 4.9% |

Correlation test results indicate no correlation exists between nitrate concentrations and well depth at the 95% confidence level. Figure 28 is a scatterplot of the nitrate values versus well depth (the highest nitrate value (79.5 mg/l) is not included in the scatterplot to improve the scale). Typically, one would expect nitrate levels to be lower in deeper wells than in shallow wells due to increased opportunity for physical and chemical interactions in the subsurface. However, in the Clearwater Subarea, a couple of deep wells had nitrate levels between 4 and 6 mg/L. Other studies in the Clearwater Subarea (Bentz, 1998 and Idaho Department of Environmental Quality, 2001a) suggest that nitrate levels decrease with increasing well depth. However, no statistical evaluations were conducted in these studies. Studies in the Twin Falls Subarea (Neely, 2001) and on the Eastern Snake River Plain (Rupert, 1997) indicate nitrate concentrations decrease with increasing well depth.

Nitrate impacts in the deeper wells suggest preferential pathways in the basalt are allowing the nitrate to move through the subsurface into the deeper ground water. Because most of the Statewide Program wells in the Subarea are not under confined conditions, deep, poorly sealed wells could act as conduits, allowing water from a contaminated shallow aquifer to flow down into a deeper aquifer.

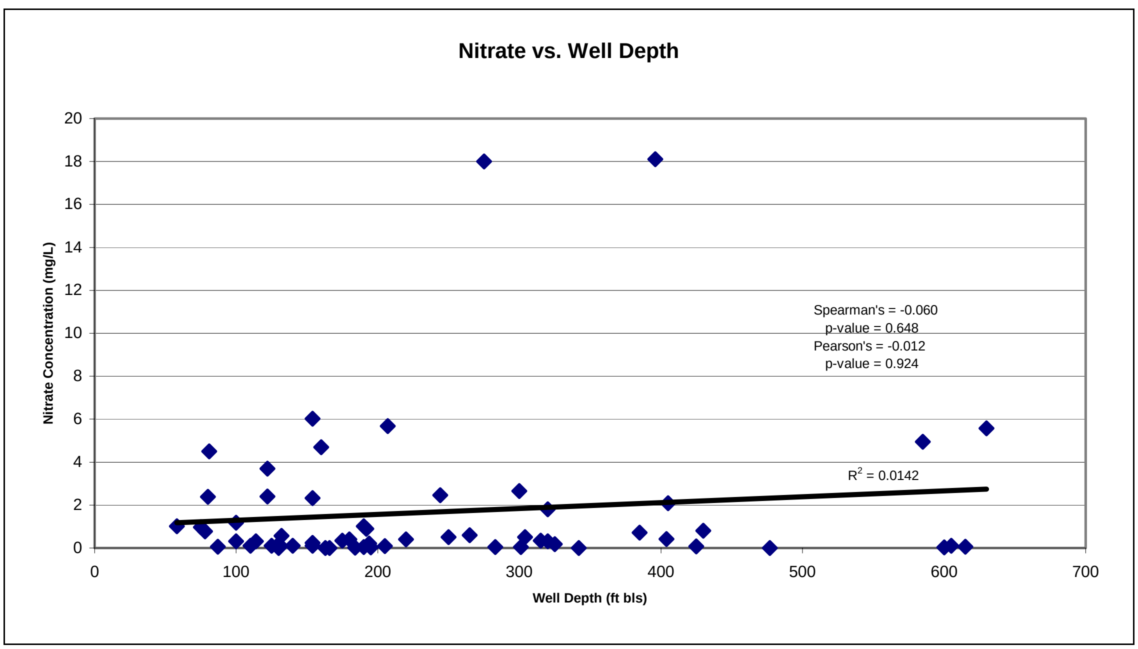


**Figure 28. Correlation Test Results - Nitrate vs. Well Depth**

Correlations between nitrate and other constituents were determined to evaluate potential indicators of nitrate concentrations. Positive correlations between nitrate and specific conductance, TDS, calcium, chloride, and magnesium were significant at the 95 percent confidence level. The best correlation was with calcium.

In most cases, the Pearson's and Spearman's methods yielded equivalent results at the 95 percent confidence level. However, three constituents (pH, iron, and orthophosphate) were determined to have significant correlations with the Spearman's method but not with the Pearson's method. Iron and pH have significant negative correlations with nitrate, while orthophosphate has a positive correlation with nitrate.

**Table 8. Nitrate – Constituent Correlations**

| CONSTITUENT | Pearson's | p-value | Spearman's | p-value |
|---|---|---|---|---|
| Field Parameters | | | | |
| pH | -0.124 | 0.337 | -0.310 | 0.014 |
| Specific Conductance | 0.620 | 0.001 | 0.341 | 0.007 |
| Alkalinity | 0.242 | 0.060 | 0.232 | 0.072 |
| Water Temperature | -0.014 | 0.911 | 0.053 | 0.0684 |
| Laboratory Measured Values | | | | |
| Bicarbonate | 0.244 | 0.058 | 0.242 | 0.060 |
| Calcium | 0.829 | 0.001 | 0.484 | 0.001 |
| Chloride | 0.586 | 0.001 | 0.347 | 0.001 |
| Iron | -0.090 | 0.490 | -0.582 | 0.000 |
| Magnesium | 0.650 | 0.001 | 0.252 | 0.047 |
| Orthophosphate | -0.026 | 0.841 | 0.270 | 0.034 |
| Sodium | -0.011 | 0.931 | 0.049 | 0.0704 |
| Sulfate | 0.119 | 0.356 | 0.062 | 0.634 |
| TDS | 0.657 | 0.001 | 0.352 | 0.006 |

5.3.2. Nitrogen Isotopes

During 2000, 2001, and 2002 ground water samples were analyzed for stable nitrogen isotope ratios in an effort to identify the source of nitrate in the ground water. This test provides a measurement of the ratio of the two most abundant isotopes of nitrogen, $^{14}N$ and $^{15}N$. The ratio of these two isotopes can be a useful indicator of sources of contamination because certain $^{15}N/^{14}N$ ratios are associated with different sources of nitrogen contamination (Kendall, 1998)

The nitrogen isotopes $^{15}N$ and $^{14}N$ constitute an isotope pair. The lighter isotope $^{14}N$ is significantly more abundant in the environment than $^{15}N$. In the atmosphere, there is one atom of $^{15}N$ per 273 atoms of $^{14}N$ (Drever, 1988). The ratio of the heavier isotope to that of the lighter isotope in a substance can provide useful information because the slight differences in the mass of the isotopes cause slight differences in their behavior. Stable isotopes are measured as the ratio of the two most abundant isotopes of a given element. Isotope values for nitrogen and other elements are presented in the delta notation format defined in the following equation:

$$\delta^{15}N = \{[(^{15}N/^{14}N)_{sample}\ )\ (^{15}N/^{14}N)_{air}\ ] - 1\} \times 1000$$

The δ-value is expressed as parts per thousand or per mil ($^{0}/_{00}$) difference from the reference. For example, a $\delta^{15}N$ value of +10 per mil has 10 parts per thousand (one percent) more $^{15}N$ than the reference. A positive δ-value is said to be "enriched" or "heavy", while a negative δ-value is said to be "depleted" or "light". The reference standard for the stable isotopes of nitrogen ($^{15}N/^{14}N$) is atmospheric nitrogen (Clark and Fritz, 1997).

Interpreting the data can be complicated because several steps in the nitrogen cycle can modify the stable-isotope composition of a nitrogen-containing chemical. These changes, called fractionation, occur because of physical and chemical reactions. Isotopic effects, caused by slight differences in the mass of two isotopes, tend to cause the heavier isotope to remain in the starting material of a chemical reaction. Denitrification, for example, causes the nitrate of the starting material to become isotopically heavier. Volatilization of ammonia results in the lighter isotope preferentially being lost to the atmosphere, and the ammonia that remains behind becomes isotopically heavier (Howarth, 1999).

These isotopic effects mean that, depending on its origin, the same compound may have different isotopic compositions. For stable isotopes to provide a useful tool in identifying sources of nitrogen contamination, the isotopic composition of the potential source materials must be distinguishable. The major potential sources of nitrogen contamination in the environment commonly have characteristic $^{15}N/^{14}N$ ratios. Typical $\delta^{15}N$ values for important sources of nitrogen contamination are presented in Table 6 (Seiler, 1996).

**Table 9. Nitrogen Sources with Associated $^{15}N$ Isotope Ratios. (Seiler, 1996).**

| **Nitrogen Source** | **$\delta^{15}N$ ($^{0}/_{00}$)** |
|---|---|
| Commercial fertilizer | -4 to +4 |
| Precipitation | -3 |
| Organic nitrogen in soil | +4 to +9 |
| Human or animal waste | +10 |

Nitrogen isotope analyses are available for only seven Statewide Program sites in the Clearwater Subarea (Figure 29). Sites with historical nitrate concentrations greater than 2 mg/L were selected for nitrogen isotope analysis during the sampling events in 2000 and 2001. Additionally, one site with low nitrate levels was submitted to the laboratory. In 2002, only sites with historical nitrate concentrations above 5 mg/L were analyzed. Nitrogen isotope values ranged from 2.84 per mil to 18.37 per mil (Table 10).

**Table 10. Nitrogen Isotope Results**

| Site | Sample Date | Nitrate Concentration (mg/L) | $\delta^{15}N$ ($^{0}/_{00}$) | Nitrogen Source |
|---|---|---|---|---|
| 31N 01E 08ABB3 | 8/1/2000 | 0.071 | 2.84 | Commercial Fertilizer |
| 33N 01E 13CAC1 | 7/26/2000 | 18.1 | 15.43 | Human or Animal Waste |
| 33N 02W 10AAB1 | 8/8/2002 | 18.0 | 18.37 | Human or Animal Waste |
| 34N 02W 10ACA1 | 9/24/2001 | 1.18 | 5.74 | Natural or mixed sources |
| 35N 05W 02CCA1 | 8/26/2001 | 2.46 | 4.77 | Natural or mixed sources |
| 35N 05W 25ADD1 | 7/26/2000 | 4.95 | 8.46 | Natural or mixed sources |
| 36N 02W 31DBA1 | 8/27/2001 | 5.57 | 6.95 | Natural or mixed sources |

The nitrogen sources based on the nitrogen isotope data for the Clearwater Subarea are summarized as follows: commercial fertilizer - one site; human or animal waste - two sites; natural organic nitrogen in soil or mixed sources - four sites. Nitrogen isotope results from six wells sampled in 1999 near the City of Ferdinand indicate commercial fertilizer was the predominant source of nitrate in ground water samples at that time (Hagan and Bentz, 2000). Existing data are insufficient to accurately characterize the nitrate sources contributing to ground water degradation.

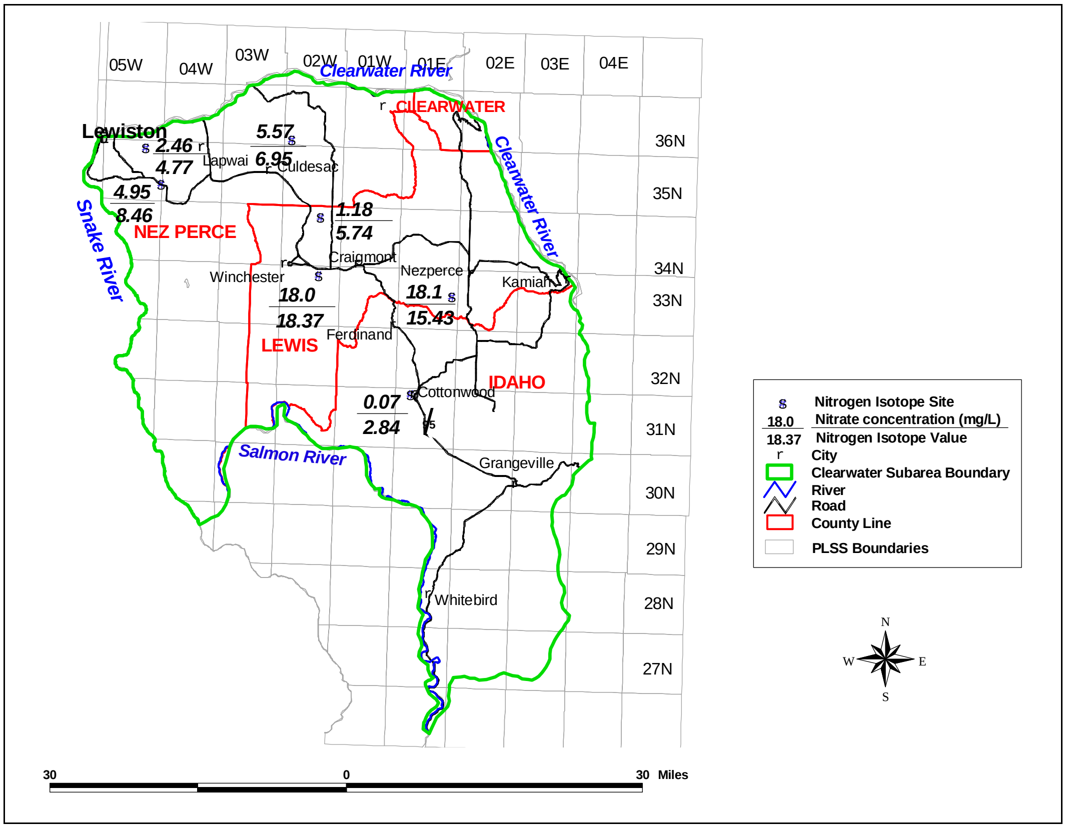


**Figure 29. Nitrogen Isotope Ratios - Clearwater Subarea.**

5.3.3. Ammonia and Orthophosphate

Dissolved ammonia concentrations for the Clearwater Subarea ranged from less than the detection limit of 0.01 mg/L at 22 sites to 0.16 mg/L, with the median and mean values being 0.04 and 0.031 mg/L, respectively. Dissolved orthophosphate concentrations ranged from less than the detection limit of 0.01 mg/L at one site to 0.17 mg/L, with the median and mean values being 0.05 and 0.053 mg/L, respectively. Drinking water standards do not exist for these constituents. However, the ammonia concentrations are well below the health advisory for ammonia in drinking water of 30 mg/L. EPA has not developed a drinking water health advisory for orthophosphate.

## 5.4. Trace Elements and Fluoride

Arsenic, iron, selenium, manganese, zinc, copper, and fluoride are the elements discussed for the Clearwater Subarea. Results for other trace elements - cadmium, chromium, copper, cyanide, and lead are included the water quality results in Appendix A. These elements are not discussed in this report because the data contained high percentages of non-detections.

5.4.1. Arsenic

Arsenic is a trace element that occurs commonly in Idaho's ground water, probably as the result of natural conditions. Detectable dissolved arsenic concentrations for the Clearwater Subarea range from 0.1 to 22.0 micrograms per Liter (µg/L). Thirty-one sites did not contain detectable concentrations of arsenic. The MCL for arsenic in drinking water was reduced to 10 µg/L from 50 µg/L in February 2002 (U.S. Environmental Protection Agency, 2003c). However, the compliance date is not until January 2006. Only one site (28N 01E 15CBB1) has an arsenic concentration greater than 10 µg/L.

5.4.2. Iron

Dissolved iron in ground water is typically the result of natural sources (University of Nebraska, 1996). Dissolved iron concentrations ranged from less than the detection limit of 3 µg/L or 10 µg/L at 28 sites to 1,480 µg/L. The median and mean values are 9.5 µg/L and 76.2 µg/L, respectively. The secondary standard of 300 µg/L was exceeded at four sites (U.S. Environmental Protection Agency, 2003b).

5.4.3. Manganese

Dissolved manganese in ground water is typically the result of natural sources (University of Nebraska, 1996). Manganese can produce undesirable staining and bacterial problems when the concentration exceeds the secondary standard of 50 µg/l (U.S. Environmental Protection Agency, 2003b). Dissolved manganese concentrations ranged from less than the detection limit of 1 µg/L at 23 sites to 110 µg/L. The median and mean values are 2.0 µg/L and 11.3 µg/L, respectively. The secondary standard of 50 µg/L was exceeded at four sites.

5.4.4. Selenium

Selenium can occur in ground water naturally and usually in low concentrations (U.S. Environmental Protection Agency, 2003a). The maximum dissolved selenium concentration for the Clearwater Subarea was 2.8 µg/L. The primary MCL for selenium is 50 µg/L.

5.4.5. Zinc

Dissolved zinc can occur in water naturally, can leach from pipes, or can originate from paints and dyes (U.S. Environmental Protection Agency, 2003b). (The secondary standard for zinc is 5,000 µg/L. The maximum zinc concentration was 600 µg/L, with the median and mean values, being 44 and 98 µg/L, respectively.

5.4.6. Copper

High concentrations of copper in water can cause gastrointestinal distress (short term exposure) and kidney or liver damage (long term exposure). Copper has a primary MCL of 1,300 µg/L and a secondary standard of 1,000 µg/L (U.S. Environmental Protection Agency, 2003a). Copper concentrations ranged from less than the laboratory reporting limit of 1 µg/L to 38 µg/L.

5.4.7. Fluoride

In children, excessive fluoride may cause mottled (discolored) teeth and weakened enamel in the teeth; in adults, long-term intake of excessive fluoride may cause bone disease such as osteosclerosis (U.S. Environmental Protection Agency, 2003a). Fluoride has a primary MCL of 4 mg/L and a secondary standard of 2 mg/L. One site in the Clearwater Subarea with a concentration of 2.3 mg/L exceeded the secondary standard of 2 mg/L.

### 5.5. Secondary Standard Exceedance Summary

The following constituents that were analyzed through the Statewide Program have secondary standards as established by the EPA (U.S. Environmental Protection Agency, 2003b): fluoride, iron, manganese, pH, sulfate, total dissolved solids (TDS), and zinc. Secondary standards may affect the color, odor, or taste of the water, or may cause skin or teeth discoloration. Secondary standards for one or more constituents were exceeded at 12 of the 61 sites (Figure 30). Only two sites contained multiple constituents above secondary standards. The constituents detected most frequently above secondary standards included iron (four sites) and manganese (four sites).

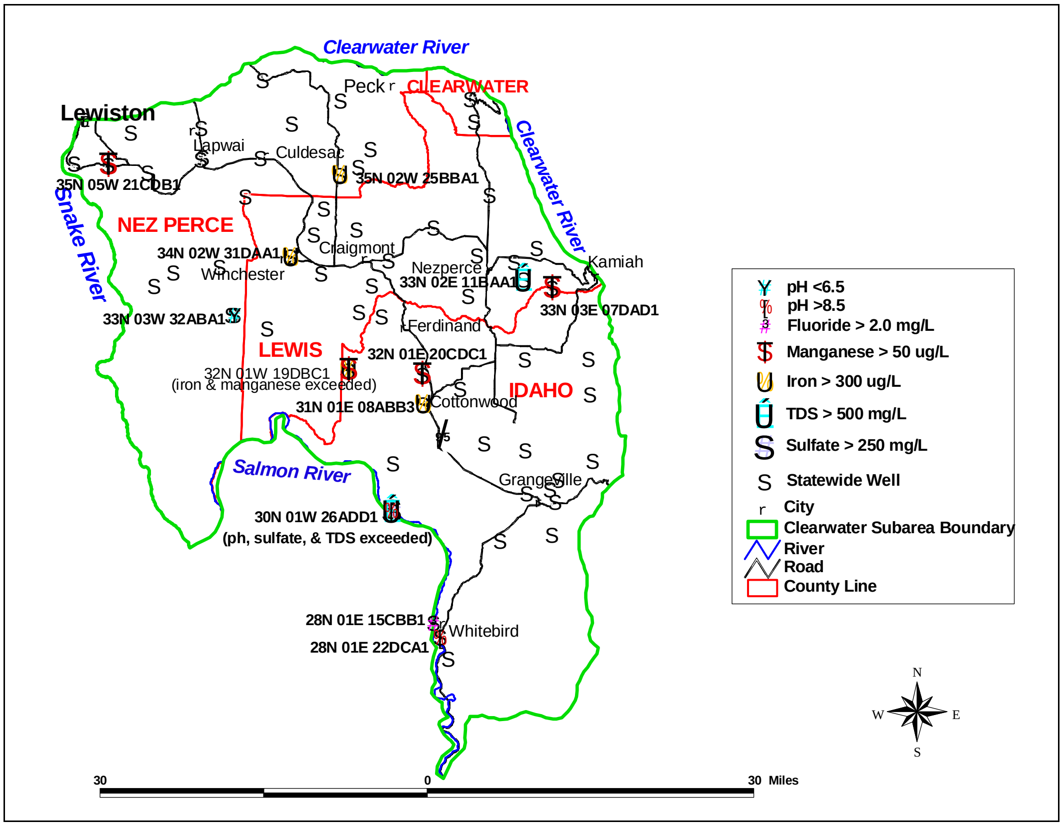


**Figure 30. Secondary Standard Violations – Clearwater Subarea**

### 5.6. Radioactivity

Testing for radionuclides was conducted to evaluate aquifer conditions and evaluate potential health threats. Radionuclides emit "ionizing radiation", a known human carcinogen, when they radioactively decay. Analyses by the EPA (U.S. Environmental Protection Agency, 2002b) indicate that long-term exposure to radionuclides in drinking water may cause cancer. Certain rock types have naturally occurring trace amounts of "mildly radioactive" elements (radioactive elements with very long half-lives). Water flowing though these types of rocks may accumulate unsafe levels of radionuclides. Additionally, in some areas of Idaho, drinking water contamination may occur through accidental releases of radioactivity or through improper disposal practices of man-made radioactive contamination from facilities that use, manufacture, or dispose of radioactive substances.

Radioactivity testing included total gross alpha, total gross beta, and radon. Total gross alpha and total gross beta data are available for 58 of the 61 sites. Samples collected from the three sites sampled only in 1990 were not analyzed for radioactive constituents. Radon samples are available for 46 sites.

In this report, radioactivity results for total gross alpha, total gross beta, and radon are presented in terms of activity levels (i.e., picoCuries per liter (pCi/L)) since human health risks for these constituents are based on activity levels. A picoCurie (pCi) is the quantity of radioactive material producing 2.22 nuclear transformations per minute (U.S. Environmental Protection Agency, 1991).

### 5.6.1. Total Gross Alpha Concentrations

The gross alpha concentration reported by the Statewide Program is total gross alpha. While the primary MCL of 15 pCi/L for alpha particle radiation is the *adjusted* gross alpha concentration (U.S. Environmental Protection Agency, 2002b). Adjusted gross alpha activity is defined as the total gross alpha activity minus the alpha activities in the sample from uranium and radon. Total gross alpha concentrations ranged from –0.8 to 14 pCi/L with the median being 1.2 pCi/l. None of the samples would exceed the MCL since adjusted values are lower than total values. It is assumed that the gross alpha activities in the ground water in the Clearwater Subarea are due to natural conditions.

### 5.6.2. Total Gross Beta

The primary MCL for gross beta activities is described as follows: "The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year" (U.S. Environmental Protection Agency, 2002c). A public water system is considered to be in compliance if gross beta activity does not exceed 50 pCi/L, and if the concentrations of tritium or strontium-90 do not exceed 20,000 pCi/L and 8 pCi/L, respectively (U.S. Environmental Protection Agency, 2002). Gross beta concentrations ranged from 0.5 to 17 pCi/L. The median gross beta concentration for the Clearwater Subarea was 3.3 pCi/L. It is assumed that the gross beta activities in the ground water in the Clearwater Subarea are due to natural conditions.

### 5.6.3. Radon

Radon is a tasteless, odorless, and colorless gas that originates from the radioactive breakdown of uranium in rock, soil, or water (U.S. Environmental Protection Agency, 1999). Breathing radon can cause lung cancer; drinking water with radon may cause stomach and other internal cancers; however, the risk of health problems is lower than breathing radon (U.S. Environmental Protection Agency, 1999).

Radon concentrations for the 46 sites tested for radon ranged from less than the laboratory reporting limit of 80 pCi/L to 1,300 pCi/L. Radon was detected in 19 of the 46 sites analyzed. All but one of the 19 sites contained radon concentrations greater than 300 pCi/L, which is the primary MCL for Option 2 under the proposed radon standard[1]. Clustering of sites with radon concentrations greater than 300 pCi/L occurred in some places (Figure 32).

[1] The proposed EPA standard for radon in public drinking water supplies allows for two options with different MCLs for ground water (U.S. Environmental Protection Agency, 2000). Option 1 is focused on multimedia mitigation that allows public water suppliers to develop programs that will reduce airborne radon. For public water suppliers that select this option, the primary MCL for radon is proposed to be 4,000 pCi/L. Option 2 is for systems that do not choose to develop a multimedia mitigation approach. The primary MCL for option 2 is proposed to be 300 pCi/L.

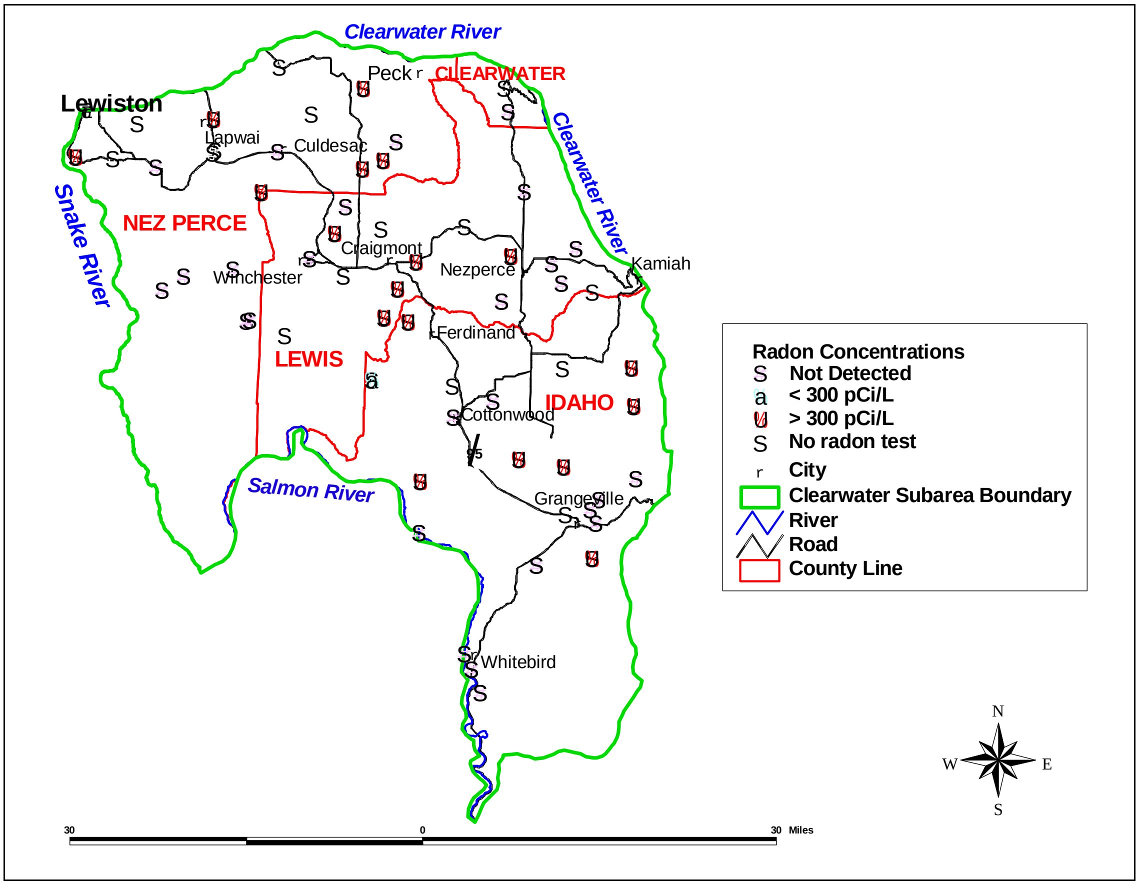


**Figure 31. Radon Values – Clearwater Subarea.**

## 5.7. Volatile Organic Compounds

Volatile organic compounds (VOCs) are a group of commonly used chemicals that evaporate, or volatilize, when exposed to air. VOCs are widely used as cleaning and liquefying agents in fuels, degreasers, solvents, polishes, cosmetics, drugs, and dry cleaning solutions. The health effects are associated with VOCs are variable depending upon the VOC. Some VOCs are known or suspected carcinogens (U.S. Environmental Protection Agency, 1995). Because VOCs do not occur naturally (except a few in oil and natural gas) their presence in ground water indicates human activities have impacted the water quality.

Ground water samples were analyzed for a wide spectrum of VOCs using EPA methods 502.2 and 524.2. No VOCs were detected in the most recent ground water samples collected at each site. Three VOCs, in concentrations below MCLs, were detected at three sites (one VOC at each site) in previous rounds of sampling. However, these results were not confirmed during more recent sampling events.

## 5.8. Pesticides

A pesticide is any substance or mixture of substances intended for preventing, destroying, repelling, or mitigating pests. Pesticide is a general term that includes such things as insecticides, herbicides, fungicides, rodenticides, fumigants, disinfectants, and plant growth regulators (U.S. Environmental Protection Agency, 2003d)

Two different analytical techniques (immunoassay and gas chromatography (GC)) were employed to identify pesticides in ground water samples. Immunoassay tests were performed on 58 of the 61 Clearwater Subarea sites. The only GC pesticide analyses conducted on sites in the Clearwater Subarea were performed in 1994 on eight samples. Data from 1992 through 2002 are summarized in this report (data from 1991 were not used because of laboratory quality control problems.).

Immunoassays (enzyme-linked immunosorbent assays or ELISA) are enzyme-specific tests developed originally for the medical field and now being used for environmental monitoring (Vanderlaan and others, 1988). (U.S. Geological Survey, 2002). Immunoassay tests were selected for use in the Statewide Program because they are inexpensive, relatively easy to perform, unlikely to produce false negatives and have minimum laboratory reporting limits as low as, or lower than, some GC analyses. Each test is designed for a specific pesticide family. For example, the atrazine test will detect atrazine as well as some other members in the triazine family. This results in a limitation of immunoassay analyses in that results are not analyte-specific for individual compounds within each family tested because of the cross-reactivity attributes of the method.

Immunoassay tests have been used in the Statewide Program since its inception. The number of individual tests performed on each ground water sample ranged from three to ten from 1992 through 2002 depending on available funding and on recommendations from the Idaho State Department of Agriculture (Table 11). Alachlor, atrazine, and metolachlor are the only pesticides included as tested analytes every year. No pesticides were detected in samples collected in years 1996, 1999, 2000, 2001, 2002.

**Table 11. Immunoassay Constituents Annual Summary – Clearwater Subarea**

| Constituent | 1993/ Detect | 1993/ Detect | 1994/ Detect | 1995/ Detect | 1996/ Detect | 1997/ Detect | 1998/ Detect | 1999/ Detect | 2000/ Detect | 2001/ Detect | 2002/ Detect |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 2,4-D | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | NA | NA | NA |
| Alachlor | 0 | 3 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Aldicarb | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | NA | NA |
| Atrazine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Carbofuran | 0 | 0 | 0 | 4 | 0 | 0 | 1 | 0 | NA | NA | NA |
| Chloropyrifos | NA | NA | NA | NA | NA | NA | 1 | 0 | NA | NA | NA |
| Cyanazine | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | NA | NA | NA |
| Metrobuzin | NA | NA | NA | NA | 0 | 0 | 2 | 0 | NA | NA | NA |
| Metolachlor | 0 | 0 | 1 | 2 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Simazine | NA | NA | NA | NA | 0 | 0 | 0 | NA | NA | NA | NA |
| Total Detects | 1 | 3 | 1 | 6 | 0 | 1 | 4 | 0 | 0 | 0 | 0 |

NA= Not Analyzed

Immunoassay results for the Clearwater Subarea indicate 13 of the 59 sites (22 percent) contain ground water with at least one detection of a pesticide compound (Figure 32). Carbofuran, alachlor, and metolachlor are the most frequently detected pesticides. None of the pesticide detections exceeded any existing or proposed MCL, or any Health Advisory levels (U.S. Environmental Protection Agency, 2002d). Ground water samples collected from the northwest portion of the Subarea did not contain pesticides. A cluster of sites with pesticide impacted ground water is located to the north of Grangeville.

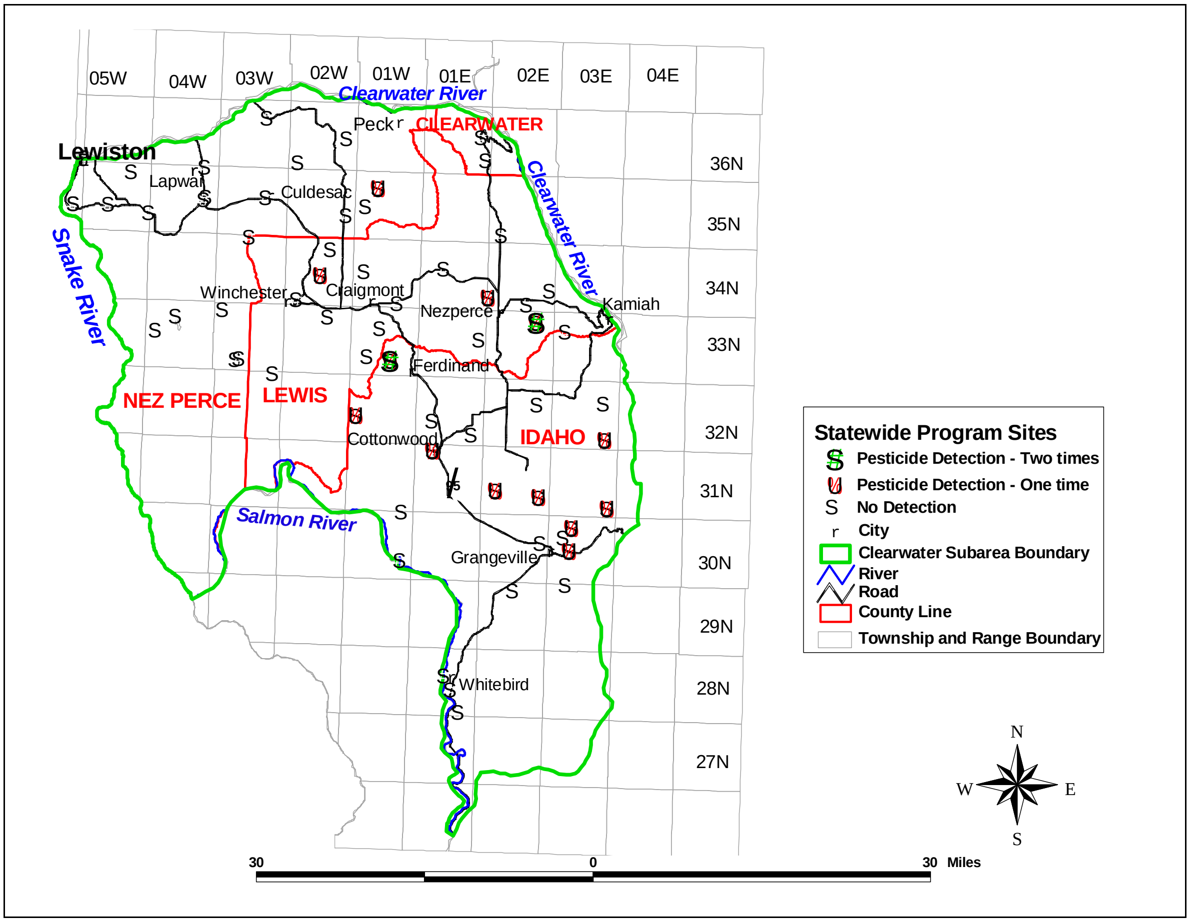


**Figure 32. Pesticide Results – Clearwater Subarea.**

Gas chromatography (GC) analyses were conducted on the eight Clearwater Subarea Statewide Program sites sampled in 1994. The samples were analyzed for 46 compounds using USGS method 2001 which is a solid-phase extraction method that has minimum laboratory reporting limits in the parts per trillion range. One site had a detection of a pesticide compound over the minimum laboratory reporting limit. The pesticide DDE was detected at a concentration of 0.002 µg/L. DDE (dichlorodiphenyldichloroethylene) is a chemical similar to DDT that was a contaminant in commercial DDT preparations. DDE has no commercial use. A federal drinking water health advisory for DDT/DDE/DDD has not been developed. However, the World Health Organization drinking water guideline for DDT and metabolites is 2.0 µg/L (Agency for Toxic Substances and Disease Registry, 2002).

**Table 12. Pesticide Detections – Clearwater Subarea**

| Pesticide detected | Testing Method | Number of Detections | Concentration range of detections | MCL or *Health Advisory* |
|---|---|---|---|---|
| Alachlor | ELISA | 4 | 0.05 – 0.15 µg/L | 2 µg/L |
| Aldicarb | ELISA | 1 | 0.42 µg/L | 3 µg/L |
| Carbofuran | ELISA | 5 | 0.13 – 0.29 µg/L | 40 µg/L |
| Chloropyrifos | ELISA | 1 | 0.11 µg/L | 20 µg/L [HA] |
| DDE | GC | 1 | 0.002 µg/L | 2.0 µg/L [WHO] |
| Metolachlor | ELISA | 3 | 0.06 – 0.19 µg/L | 100 µg/L [HA] |
| Metribuzin | ELISA | 2 | 0.04 µg/L | 200 µg/L [HA] |

[HA] –Health Advisory lifetime exposure, [WHO] – World Health Organization drinking water guideline

Pesticide results from the ISDA Southern Clearwater Plateau Volcanic Aquifer Regional ground water quality monitoring project in 2001 indicate that six of the 72 wells sampled contained detectable concentrations of pesticides (Bahr and Carlson, 2002). No pesticides were detected at levels above existing MCLs. However, one site contained two similar compounds (atrazine and atrazine desethyl) the sum of which exceeds the MCL for atrazine of 3.0 µg/L (Bahr and Carlson, 2002).

### 5.8.1. Pesticides and nitrate correlations

Nitrate concentrations at the sites with pesticides were reviewed to explore potential correlations with nitrate. Nitrate and pesticide detections do not appear to be related based on a brief assessment of the data. Nine of the 13 sites containing pesticides had nitrate concentrations below 2 mg/L. Ground water samples from two of the pesticide sites contained nitrate levels below the detection limit: seven pesticide sites had ground water with nitrate levels less than 2 mg/L. Of the four sites with nitrate concentrations above 2 mg/L, two pesticide sites had ground water with nitrate levels between 2 and 5 mg/L; one site had ground water with a nitrate concentration between 5 and 10 mg/L; and one site had ground water with a nitrate concentration above 10 mg/L.

## 5.9. Bacteria

Ground water samples were tested for fecal coliform bacteria primarily as a courtesy to the site owner. Samples were filtered, incubated, and analyzed in the field. Fecal coliform bacteria originate from the waste products of humans and warm-blooded animals (National Ground Water Association, 2003). The presence of one or more fecal coliform bacteria colonies in the ground water is a violation of the MCL and indicates the ground water quality has been impacted by surface or near-surface activities. From 1990 through 2002, five of the 61 Clearwater Subarea sites had at least one sampling event with a detection of fecal coliform bacteria. Only one site has experienced multiple fecal coliform detections. Samples from one site have not contained fecal coliform during the two most recent sampling events. Three of the sites are no longer in use.

## 5.10. Characterization Summary

The major source of ground water in the Clearwater Subarea primarily occurs in aquifers within the Columbia River Basalt. Older granite and metamorphic rocks yield small volumes of ground water suitable for domestic use. Shallow alluvial aquifers of limited extent also serve as sources of water. All but five of the Statewide Program wells in the Clearwater Subarea are completed in the Columbia River Basalts. Three of the wells are completed in granite, one well is completed in sandstone, and one well is completed in shale.

The ground water quality data indicate calcium is the dominant cation, with bicarbonate the dominant anion. About 90 percent of the ground water samples are classified as calcium and/or magnesium and/or sodium-bicarbonate type water. Ground water from the Clearwater Subarea sites is generally of good quality with the exception of a few sites containing constituents above a primary drinking water standard.

The ground water at nine of the 61 Statewide Program monitoring sites in the Clearwater subarea (15 percent) had one or more constituents that exceeded a primary drinking water standard [also know as Maximum Contaminant Level (MCL)] as established by the U.S. Environmental Protection Agency for public drinking water supplies. Ground water from five sites exceeded the MCL for fecal coliform; three sites had ground water containing nitrate above the MCL of 10 milligrams per liter (mg/L), and one site had ground water with arsenic above the MCL of 10 micrograms per liter (µg/L). On one occasion, a site with nitrate above the MCL also contained nitrite above the MCL for nitrite of 1 mg/L. However, follow up sampling indicated the nitrite level was below the MCL.

One or more pesticides were detected in ground water samples from 12 of the 59 sites analyzed by either immunoassay methods or gas chromatography methods with minimum laboratory reporting limits in parts per billion. Pesticides were detected during multiple sampling events at two sites. Volatile organic compounds were detected in samples from three sites. All pesticide and VOC concentrations were below MCLs or health advisories. In cases where an MCL does not exist, health advisories are used to evaluate the potential risk to human health.

The occurrences of nitrate, fecal coliform bacteria, pesticides, and VOCs in the ground water indicate impacts from land uses have occurred.

Secondary standards for one or more constituents were exceeded at 12 of the 61 sites. Only two sites contained multiple constituents above a secondary standard. The constituents detected most frequently above secondary standards included iron (four sites) and manganese (four sites). Other constituents detected in concentrations above a secondary standard include pH (three sites), TDS (two sites), fluoride (one site), and sulfate (one site). For the most part, the secondary standard exceedances appear to be due to natural conditions. However, the TDS concentrations at one site may be associated with land use impacts. In addition to the high TDS, water samples from this site also contained nitrates over 10 mg/L and had detectable levels of pesticides.

# 6. TREND MONITORING

## 6.1. Program Approach

The trend monitoring objective of the Statewide Program is being accomplished in two ways. First, about 1,500 monitoring sites called **Rotational** sites are sampled once every five years. Prior to 2001 Rotational sites were sampled every four years. This approach allows for wide area coverage at a sampling frequency adequate for determining long-term changes in overall ground water quality. Second, about 100 sites called **Annual** sites are sampled once every year to provide data for short-term trend analyses. The collection frequency at Annual sites may be useful for determining whether concentration changes are associated with long-term trends or are being affected by unique events or conditions such as precipitation extremes or patterns.

The network of monitoring sites was developed from 1991 through 1994 when about 400 new sites were added during each of these four years. The sample collection that occurred during these years is called **First Round** sampling. The majority of sites were sampled only once; however, a few sites were sampled a second time during the first round. Prior to the 1995 field season, sites were not designated as either Rotational or Annual sites. Most of the Rotational sites sampled in 1991 through 1994 were re-sampled in 1995 through 1998, respectively (i.e., 1991 sites were re-sampled in 1995, etc.). The data collected from 1995 through 1998 at Rotational sites are called **Second Round** sampling. Only six of the 46 sites sampled in the First Round could not be sampled during the Second Round. **Third Round** sampling, which began in 1999, extends through 2003. Third round sampling extends over a 5-year period to accommodate an additional 300 wells. Thus, only two rounds of data are available for the 14 wells sampled in 1994 and 1998. Wells added to the program in 2001 and 2002 replace dropped sites and improve the coverage in poorly characterized areas. The Statewide Program now consists of 1,500 rotational sites to be sampled every 5 years and 100 annual sites.

## 6.2. Summary of Yearly Nitrate Concentrations

A plot of the median and mean nitrate concentrations indicates that median nitrate levels vary annually in a consistent pattern over the 13-year sampling period (Figure 34). One of the most noticeable features of the plot is the median nitrate concentration peaks during years 1991, 1995, and 1999, while the median concentrations during the other years are stable near 0.5 mg/L. A significant amount of variability, most likely caused by one or two very high nitrate concentrations, is evident in the mean nitrate values. Overall, no conspicuous trends are apparent.

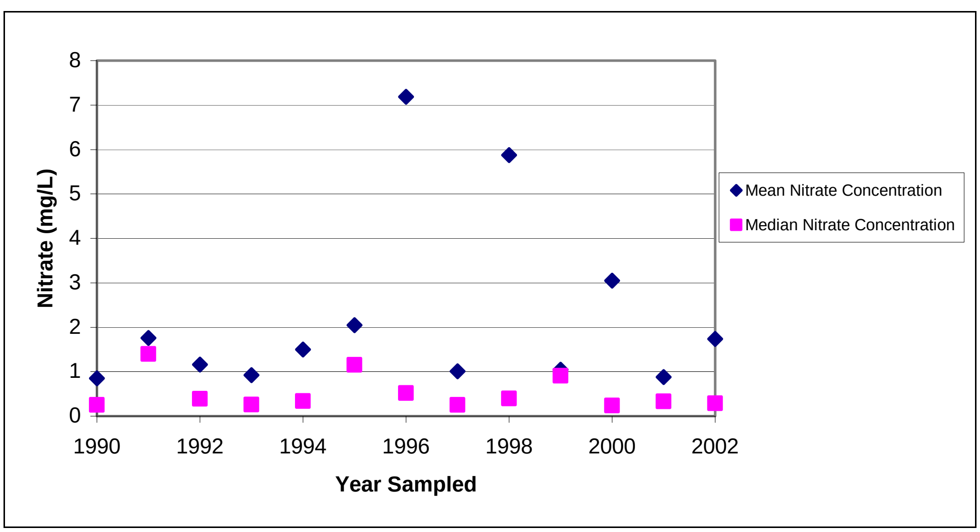


**Figure 33. Mean and Median Nitrate Concentrations – Clearwater Subarea**

## 6.3. Round to Round Comparisons

Three or more rounds of data are available for 25 of the 61 sites sampled in the Clearwater Subarea. First and Second Round data are available for 40 sites. One other site, sampled in 1990 and 2002, has two rounds of data but is not included in the comparison between First Round and Second Round results. Only one round of data are available for 20 sites. Nine of the sites with only one round of data are dropped sites, while 11 of these sites are new sites added in 2001 or 2002. Sites sampled in 1998 are to be sampled for a third time in 2003.

The Mann-Whitney Test was used to compare paired data from the First Round (91-94) and the Second Round (95-98). The test compares the equality of two population medians. The differences will be approximately symmetrical (i.e., about half of the differences will be above zero and about half of the differences will be below zero) if the two groups are from the same, or from an unchanged, population (Helsel and Hirsch, 1992). The test also compares the magnitude of the differences to see if variability and skewness between the two groups is significantly different. Results of the Mann-Whitney test are expressed as p-values, the significance level attained by the data (Parliman, 2002). P-values less than or equal to 0.05 indicate there is a 95 percent or greater level of confidence the data from the two rounds are different.

The Mann-Whitney test was performed on nitrate and 17 other constituents (alkalinity, bicarbonate, calcium, chloride, fluoride, hardness, magnesium, manganese, nitrate, pH, phosphorus, potassium, sodium, specific conductance, sulfate, temperature, and zinc) with similar results – no statistically significant difference exists between the data sets.

### 6.3.1. Nitrate Changes - First Round to Second Round

Nitrate concentrations increased by more than 0.1 mg/L at 24 of the 40 Clearwater Subarea sites (60 percent) sampled in both the First and Second Rounds. Nitrate increases ranged from 0.1 mg/L to 71 mg/L. Nitrate concentrations decreased by more than 0.1 mg/L at only one site. Six sites had increases greater than 1.0 mg/L. No sites had decreases greater than 1.0 mg/L. No ground water samples from the First Round contained nitrate concentrations above the MCL. Ground water samples from two sites had nitrate concentrations exceeding the MCL in the Second Round. The number of sites with nitrate concentrations exceeding 5 mg/L increased from four in the First Round to seven in the Second Round. The median nitrate value for the 40 paired Clearwater Subarea sites increased from 0.39 mg/L (First Round) to 0.54 mg/L (Second Round). However, the change in the median nitrate values from the First to Second Round was not significantly different at the 95 percent confidence level according to the Mann-Whitney Test.

### 6.3.2. Nitrate Changes First Measurement to Most Recent Measurement

Gross changes in nitrate concentrations for the 41 sites with two rounds or more of data are evaluated by comparing the First Round results with the most recent results (Figure 34). Nitrate decreased by 0.1 mg/L or more at three sites and increased by 0.1 mg/L or more at 20 sites. The median and mean nitrate concentration increases were 0.40 mg/L and 4.77 mg/L, respectively. The greatest nitrate concentration change was 8.5 mg/L in 1994 to 79.5 mg/L in 1998.

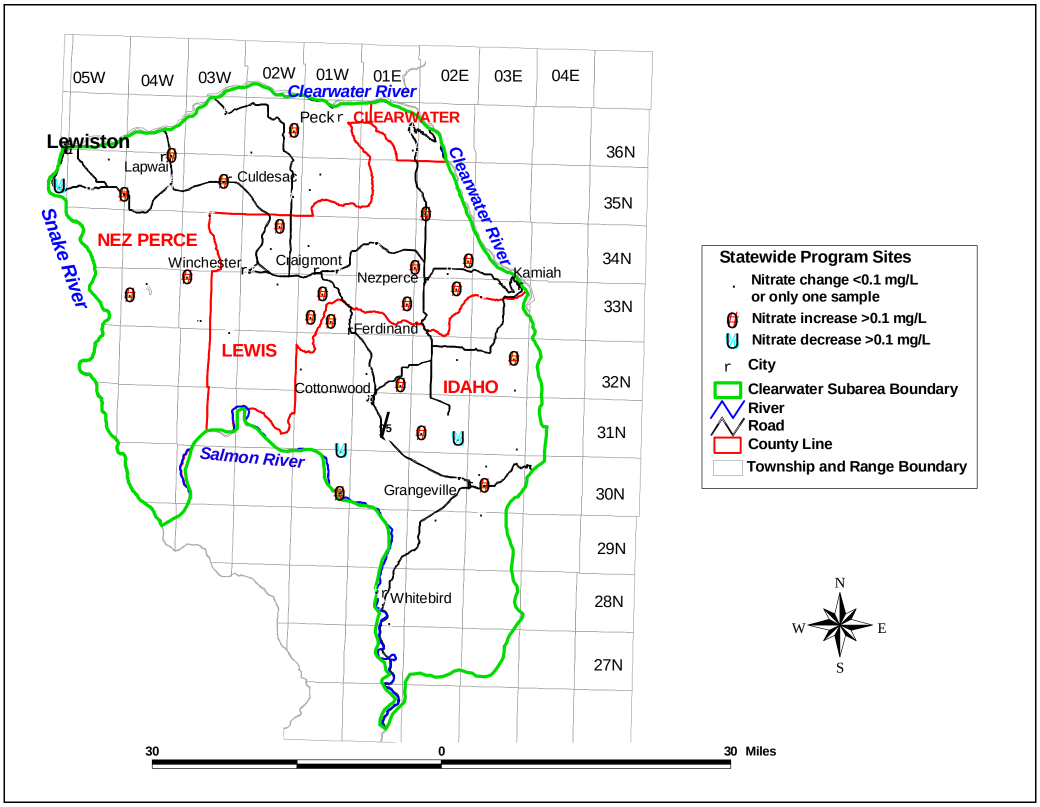


**Figure 34. Nitrate Changes - First Measurement to Most Recent Measurement**

### 6.3.3. Nitrate Changes - Three Rounds Modified

To facilitate comparison of sites with three rounds of data, the first three years of each round are compared. First Round Modified includes years 1991-1993; Second Round Modified includes years 1995-1997; Third Round Modified includes years 1999-2002 (new sites are excluded). Sites sampled in 1993 and 1997 were sampled over a two-year period in 2001 and 2002, with one-half the sites sampled each year. Results from sites sampled in years 1994, 1998 are not included in these analyses because only two rounds of data are available. Three or more rounds of data are available for 25 of the 61 sites sampled in the Clearwater Subarea.

The median and mean nitrate values from the three rounds are provided in Table 13. Mann-Whitney Test results indicate the median nitrate concentrations for the three rounds of paired data are not statistically different at the 95% confidence level.

**Table 13. Nitrate Value Comparison – Three Rounds (modified)**

| Round | First Round (1991-1993) | Second Round (1995-1997) | Third Round (1999-2002) |
|---|---|---|---|
| Median Nitrate Value | 0.39 mg/L | 0.47 mg/L | 0.21 mg/L |
| Mean Nitrate Value | 1.03 mg/L | 2.92 mg/L | 1.41 mg/L |

#### 6.3.3.1. First Round Modified to Second Round Modified

Nitrate concentrations increased by more than 0.1 mg/L at 14 of the 25 Clearwater Subarea sites with three rounds of data (Table 14). Nitrate concentrations decreased by more than 0.1 mg/L at only one site. Six sites had increases greater than 1.0 mg/L. No sites had decreases greater than 1.0 mg/L.

6.3.3.2. Second Round Modified to Third Round Modified

Nitrate concentrations from the 25 sites with results from the Second Round and the Third Round were compared (Table 14). Nitrate concentrations increased by more than 0.1 mg/L at five of the 25 Clearwater Subarea sites with three rounds of data when comparing Second Round results to Third Round results. One of the five sites had a nitrate increase of more than 1.0 mg/L between the Second Round and Third Round. Eight sites had nitrate concentrations decrease by more than 0.1 mg/L, with six of the sites having decreases of 1.0 mg/L or more. Nitrate concentrations changed by less than 0.1 mg/L at 12 sites.

Eight of the 14 sites exhibiting nitrate increases of 0.1 mg/L from the First Round to Second Round decreased from the Second Round to the Third Round. The six sites with nitrate increases above 1.0 mg/L, later had nitrate decreases greater than 1.0 mg/L from the Second Round to the Third Round.

Five of the 25 sites with three rounds of data exhibit three rounds of data with consistently increasing or decreasing nitrate concentrations that vary by 0.1 mg/L or more per round. The five sites with increasing nitrate levels for all three rounds have nitrate concentrations below 5 mg/L. The greatest magnitude change is an increase from 3.4 mg/L to 4.7 mg/L. No sites had nitrate concentrations that decrease by more than of 0.1 mg/L or more per round.

**Table 14. Nitrate Comparisons - Modified Rounds**

| Round | 1st – 2nd Round | 2nd – 3rd Third Round | 1st-2nd –3rd Rounds |
|---|---|---|---|
| $NO_3$ increase > 0.1 mg/L | 14 sites | 5 sites | 5 sites |
| $NO_3$ increase > 1.0 mg/L | 6 sites | 1 sites | 2 sites |
| $NO_3$ decrease > 0.1 mg/L | 3 sites | 8 sites | 0 sites |
| $NO_3$ decrease > 1.0 mg/L | 0 sites | 6 sites | 0 sites |
| $NO_3$ change < 0.1 mg/L | 8 sites | 12 sites | 20 sites |

6.3.4. Results from Annual Sites

There are two annual Statewide Program sites in the Clearwater Subarea (Figure 14). Nitrate levels in the wells have never exceeded 1 mg/L during the nine rounds of sampling at each site. Nitrate concentrations at Site 31N 01E 08ABB3 have varied from a high of 0.9 mg/L in 1999 to the detection limit of 0.05 mg/L in 2002. Nitrate levels remain near the detection limit at Site 31N 03E 36BCA1 (Figure 35).

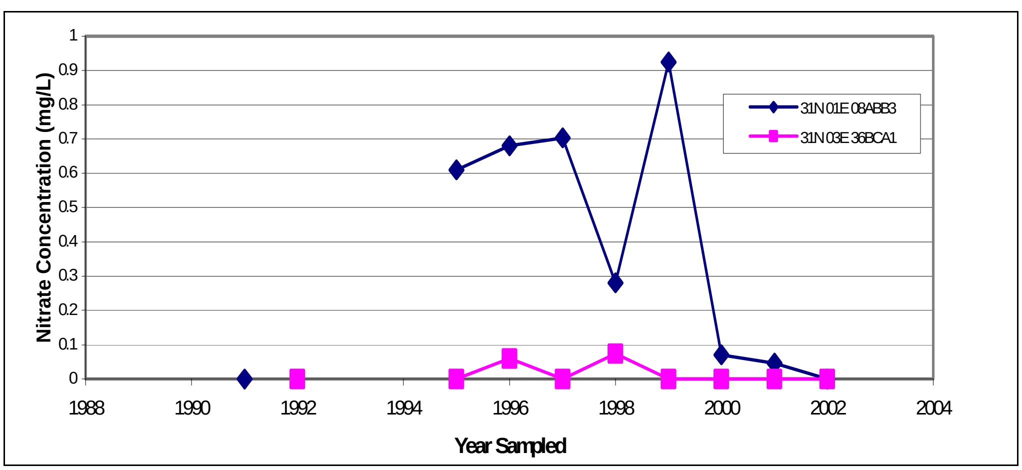


**Figure 35. Nitrate Concentrations vs. Time – Clearwater Subarea Annual Sites**

## 6.4. Nitrate Trend Summary

Nitrate trends in ground water in the Clearwater Subarea are not easily characterized. In fact, contradictory interpretations can be made depending on how the data are evaluated. Non-parametric statistical analysis methods indicate a statistically significant trend in nitrate concentrations does not exist at the 95% confidence level between the three rounds of sampling completed to date. However, comparisons of nitrate levels from round to round indicate many more sites have increasing nitrate levels than have decreasing nitrate levels. A comparison of the nitrate changes from the first measurement to the most recent measurement indicates the number of sites with increasing nitrate levels (20) is almost seven times greater than the number of sites with decreasing nitrate levels (3).

Additionally, data at sites with three rounds of sampling show nitrate concentrations are consistently increasing in ground water at five sites, while only one site contains ground water with consistently decreasing nitrate levels of 0.1 mg/L or more per round.

Nitrate concentrations in ground water samples from the two annual sites indicate nitrate levels are unchanged or decreasing. Nitrate concentrations in one annual site decreased each of the last three years. Nitrate levels at the other annual site remain near detection limits

### 6.4.1. USGS Nitrate Trend Study

Trend analysis of nitrate concentrations in the Camas Prairie by the USGS (Parliman, 2002) indicate a statistically significant increase in nitrate levels occurred between the time periods 1991-1994 and 1995-1998. These results conflict with Statewide Program Results showing no statistically significant difference at the 95% confidence level. The discrepancy appears to be the result of the USGS combining data from other studies (e.g., Bentz, 1998) with the Statewide Program data for the period 1995-1998. The USGS comparison of data between the periods 1991-1994 and 1999-2000 indicates the data sets are not statistically different at the 95% confidence level.

# 7. AREAS OF GROUND WATER QUALITY CONCERNS

The third objective of the Statewide Program is to identify areas where ground water quality problems exist or may be emerging. The Statewide Program monitoring network was designed primarily to address overall ambient ground water quality and, consequently, the density of sites is not adequate to define and delineate regional ground water quality problems, or to screen for all possible areas of local contamination. However, the data can be used to indicate where there are sites and/or areas of concern requiring follow-up investigations.

## 7.1. MCL Exceedances

Based solely on Statewide Program data, it does not appear ground water quality problems are widespread across the Clearwater Subarea. Ground water samples from nine of the 61 Statewide Program sites in the Clearwater Subarea contained a constituent above a primary MCL (Figure 36). Five of the sites exceeded the MCL for fecal coliform bacteria. Fecal coliform contamination is typically a site-specific problem of very limited areal extent. One site exceeded the MCL for arsenic. Arsenic is a naturally occurring element that may occur in concentrations above the MCL. Three sites contained nitrate concentrations above the MCL for nitrate of 10 mg/L. Ground water samples from the site with the highest nitrate concentration (79.5 mg/L) also contained pesticides and TDS above the secondary standard of 500 mg/L. The other two sites with nitrate above the MCL had no other water quality issues.

The frequency of nitrate detections above the MCL (5 percent) is similar to the percent of total Statewide Program sites that exceed the MCL for nitrate. All three sites with nitrate MCL exceedances are limited to the central portion of the Clearwater Subarea. Other ground water quality studies conducted by IDEQ (Bentz, 1998) and ISDA (Bahr and Carlson, 2002) confirm nitrate is a ground water quality concern within certain areas of the Clearwater Subarea.

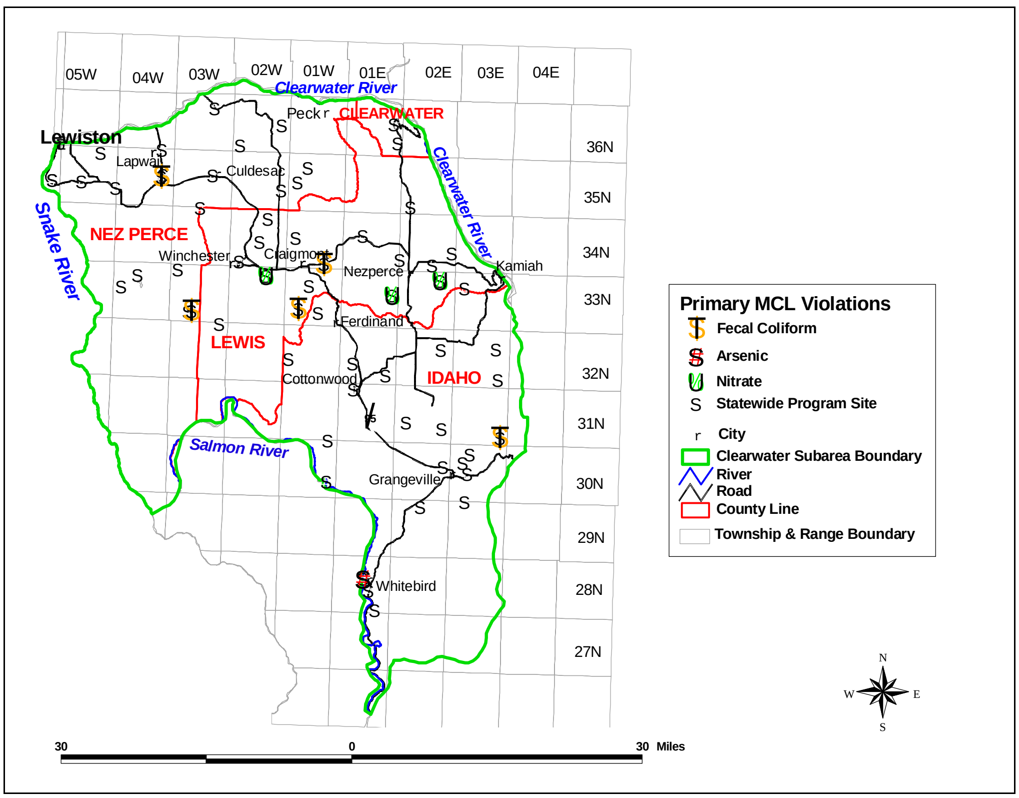


**Figure 36. Primary MCL Violations – Clearwater Subarea**

## 7.2. Nitrate Priority Areas

Significant portions of the Clearwater Subarea are identified by IDEQ as areas of degraded ground water quality due to elevated levels of nitrate (Idaho Department of Environmental Quality, 2001b). Within these areas, designated as “Nitrate Priority Areas”, more than 25 percent of the sampled wells contain nitrate concentrations greater than 5 mg/L. IDEQ has delineated two Nitrate Priority Areas - Lapwai Creek and Camas Prairie - within the Clearwater Subarea (Figure 37). The Nitrate Priority Areas in the Clearwater Subarea are primarily based on ground water quality data from three sources - Statewide Program sites, public water system wells, and IDEQ ground water quality studies.

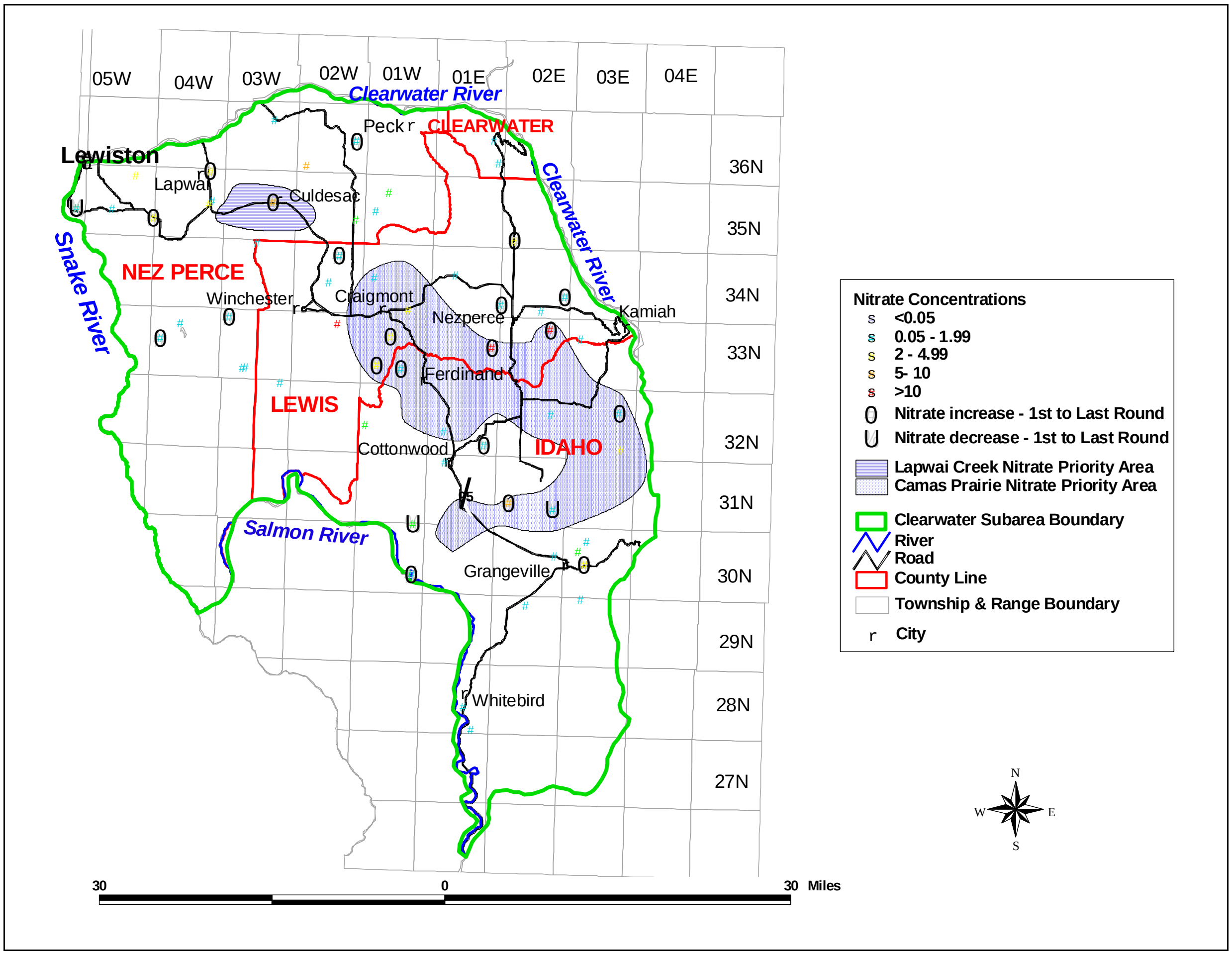


**Figure 37. Nitrate Priority Areas and Statewide Program Nitrate Results**

The Statewide Program results closely approximate the Nitrate Priority Area criteria. Ground water samples from three of the 13 (23 percent) Statewide Program sites within the Camas Prairie Nitrate Priority Area contain nitrate above 5 mg/L, with two of the sites containing nitrate above the MCL of 10 mg/L. One site, adjacent to the western boundary of the Camas Prairie Nitrate Priority Area, exceeds nitrate above 10 mg/L. The single Statewide Program site located within the Lapwai Creek Nitrate priority Area contained a nitrate concentration of 5.7 mg/L. Nitrate concentrations in ground water samples from seven of the 13 Statewide Program sites have increased between the First Round and the most recent round. Nitrate concentrations decreased at one site between the First Round and the most recent round.

7.2.1. Other Ground Water Quality Monitoring Projects

After the establishment of the Camas Prairie Nitrate Priority Area, the ISDA initiated a ground water quality monitoring program consisting of approximately 70 wells to characterize degradation of ground water quality due to agricultural sources (Figure 38). In 2001 ISDA began the Southern Clearwater Plateau Volcanic Aquifer regional ground water quality monitoring project. Results from the first year of sampling in 2001 indicate 12 of the 72 wells (16 percent) sampled contained nitrate concentrations above 5 mg/L with six of the wells containing nitrate concentrations above 10 mg/L (Bahr and Carlson, 2002). In addition to nitrates, ISDA also is monitoring ground water samples for pesticides (mentioned earlier in Section 5.8), nitrogen isotopes, oxygen isotopes, nutrients, and common ions. ISDA monitoring is projected to continue for a number of years into the future. ISDA also conducts annual ground water quality monitoring at dairies for a limited number of constituents.

In addition to monitoring by state and federal government agencies, ground water quality in the Clearwater Subarea is tested on a regular basis by public water systems as required by the Federal Safe Drinking Water Act. However, public water system data are collected at the point of use after storage and possibly treatment have occurred. Thus, samples from public water systems can be a blend of waters from multiple wells and may not identify site-specific ground water quality problems. On the other hand, contamination in the storage and/or distribution system may mistakenly suggest ground water problems exist in the aquifer.

IDEQ and the Nez Perce Tribe also conduct local and regional ground water quality investigations on an irregular basis, based on the availability of funding. Ground water quality data are sometimes collected during site-specific investigations to characterize contaminated sites.

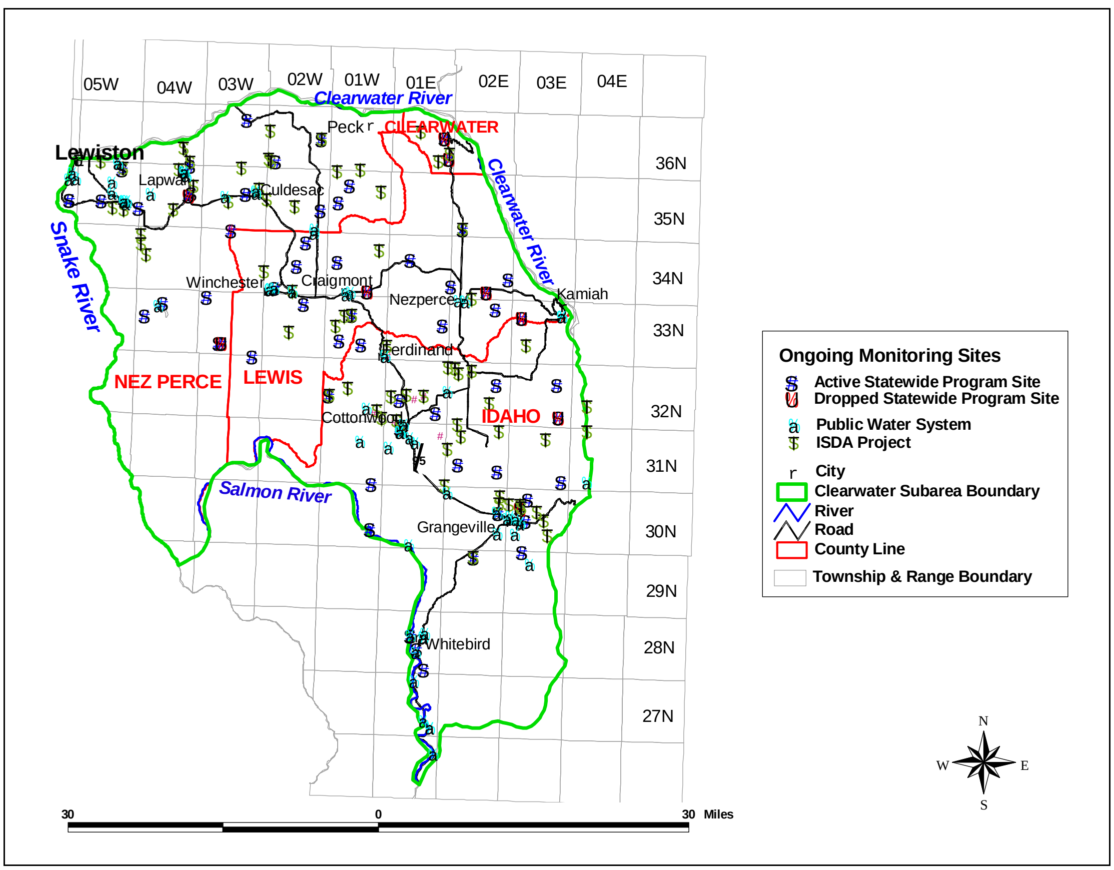


**Figure 38. Ongoing Ground Water Quality Monitoring Sites**

# 8. SUMMARY AND CONCLUSIONS

The Clearwater Subarea, located in north-central Idaho, is one of 20 hydrogeologic subareas in the Statewide Ambient Ground Water Quality Monitoring Program. Ground water quality samples were collected at 61 monitoring sites in the Clearwater Subarea from 1990 through 2002. From 1995 through 1998, most First Round sites were re-sampled as the Second Round of the Statewide Program was completed. The Third Round, which began in 1999, will be completed in 2003.

Ground water in the Clearwater Subarea occurs primarily in aquifers within the Columbia River Basalt. Older granite and metamorphic rocks yield small volumes of ground water suitable for domestic use. Shallow alluvial aquifers of limited extent also serve as sources of water. All but five of the Statewide Program wells in the Clearwater Subarea are completed in the Columbia River Basalts. Three of the wells are completed in granite, one well is completed in sandstone, and one well is completed in shale.

Most of the ground water from the Statewide Program had soft or moderately soft water hardness values. The ground water quality data indicate over 60 percent of the ground water samples are classified as calcium–bicarbonate type water, 30 percent are a combination of calcium/magnesium/sodium-bicarbonate type water, 5 percent are sodium-sulfate dominant type water, and 5 percent are mixed waters.

The Statewide Program data indicate the ground water at most of the Clearwater Subarea sites is suitable for human consumption and other beneficial uses. However, 9 of the 61 sites (15 percent) had one or more constituents with concentrations that exceeded their respective MCL. The contaminants detected above primary MCLs were nitrate (three sites), fecal coliform bacteria (five sites), and arsenic (one site). Radon is also present in the ground water at levels above a proposed MCL for radon of 300 pCi/L.

Ground water quality data indicate the ground water in the Clearwater Subarea is impacted by human activity with respect to nitrates and to lesser degree, pesticides. Ground water samples from five of the sites contained nitrate concentrations greater than the MCL of 10 mg/L. Another eight sites contained ground water with nitrate concentrations between 5 mg/L and 10 mg/L. The median and mean nitrate concentrations are 0.4 mg/L and 3.0 mg/L, respectively (based on the most recent nitrate data available for each well).

One or more pesticides were detected in ground water samples from 13 of the 59 sites analyzed by either immunoassay methods or gas chromatography methods. Pesticides were detected during multiple sampling events at two sites. Volatile organic compounds were detected in samples from three sites. All pesticide and VOC concentrations are below MCLs or health advisories. In cases where an MCL does not exist, health advisories are used to evaluate the potential risk to human health.

A comparison of nitrate data from the first round with the nitrate data from the most recent round indicates that 15 sites have experienced a nitrate increase of more than 0.3 mg/L. Nitrate concentrations have decreased by 0.3 mg/l or more at two sites. Based on this observation it appears nitrate levels are increasing. However, a statistical comparison of median nitrate values from the sites with three complete rounds indicates, that regionally, a statistically significant trend does exist at the 95 percent confidence interval.

# 9. RECOMMENDATIONS

Continued ground water quality monitoring for the Clearwater Subarea is necessary to observe trends in nitrate concentrations and to evaluate relationships between land use practice changes and nitrate levels in ground water. Agencies or organizations that could potentially assist with the recommendations are contained in parentheses.

The following actions are recommended to better characterize the ground water quality.

1. Continue sampling Rotational and Annual sites according to their specific schedules (IDWR and USGS).

2. Replace dropped sites within same sampling event if possible, to ensure adequate coverage and reduce data gaps (IDWR and USGS).

3. Assess ground water quality for emerging contaminants of concern, such as pharmaceuticals (IDWR, USGS, ISDA, and IDEQ).

4. Evaluate the current ground water monitoring efforts of all entities to identify poorly characterized areas, improve coordination, and eliminate nonessential sampling (all entities performing ground water monitoring).

5. Conduct quarterly ground water quality monitoring at sites with the highest nitrate and/or pesticide levels to evaluate seasonal variability in nitrate and pesticide concentrations (possibly a cooperative effort of state agencies, the Nez Perce Tribe, and the federal government).

6. Prepare annual report summarizing ground water quality results from all sampling activities conducted within the Clearwater Subarea (IDEQ).

7. Develop ground water elevation contour maps to better characterize ground water movement in the Clearwater Subarea (possibly a cooperative effort of state agencies, the Nez Perce Tribe, and the federal government).

8. Use well construction methods that prevent unwanted ground water movement from shallow aquifers containing contaminants to deeper aquifers.

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# 11. APPENDICES

11.1 Appendix A. Individual Well Results Showing Analytes for Years 1990 - 2002

11.2 Appendix B. Clearwater Subarea Ground Water Quality Results - Statewide Program 1990 – 2002

11.3 Appendix C. Scatter Plots

## 11.1. Appendix A. Individual Well Results Showing Analytes for Years 1990 - 2002

# APPENDIX A

## 1990 Result Example

## *Idaho Department of Water Resources Sample Results*
## *Statewide Ground Water Quality Monitoring Program*

| Site ID | Station Name | Sample Date && Time | Sample ID |
|---|---|---|---|
| **462206116475001** | **35N 04W 23ABA1** | **August 7, 1990 10:50 AM** | **GWQM-1990-025** |

### Well Data

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| County | Nez Perce | Latitude | 46.36833333 | Longitude | -116.797222 | Altitude | 1125 ft |
| Water Use | H | | | Well Depth | 122 ft | Casing Depth | 47 ft |

### Inorganics and Field Analysis

| | | | | | |
|---|---|---|---|---|---|
| 155 mg/L | Alkalinity | 0.020 mg/L | Ammonia | <1 ug/L | Arsenic |
| 189 mg/L | Bicarbonate | 1.0 ug/L | Cadmium | 38 mg/L | Calcium |
| 0 mg/L | Carbonate | 6.2 mg/L | Chloride | 2 ug/L | Chromium |
| 1 ug/L | Copper | <0.01 mg/L | Cyanide | 75 col/100 ml | Fecal Coliform<br>**MCL 0 col/100 ml EXCEEDED** |
| 0.20 mg/L | Fluoride | 153 mg/L | Hardness | 9 ug/L | Iron |
| <1 ug/L | Lead | 14 mg/L | Magnesium | 2 ug/L | Manganese |
| 0.1 ug/L | Mercury | 2.4 mg/L | Nitrate | 7.43 pH | pH |
| 0.090 mg/L | Phosphorus | 3.8 mg/L | Potassium | <1 ug/L | Selenium |
| 50 mg/L | Silica | 13 mg/L | Sodium | 338 uS/cm | Specific Conductance |
| 5.7 mg/L | Sulfate | 13 °C | Water Temperature | 100 ug/L | Zinc |

# APPENDIX A

## 1991 Result Example

## *Idaho Department of Water ResourcesSample Results*
## *Statewide Ground Water Quality Monitoring Program*

| Site ID | Station Name | Sample Date && Time | Sample ID |
|---|---|---|---|
| **460314116212501** | **31N 01E 08ABB3** | **September 4, 1991 12:00** | **GWQM-1991-213** |

### Well Data

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| County | Idaho | Latitude | 46.05388888 | Longitude | -116.356944 | Altitude | 3560 ft |
| Water Use | P | | | Well Depth | 301 ft | Casing Depth | 270 ft |

### Inorganics and Field Analysis

| | | | | | |
|---|---|---|---|---|---|
| 153 mg/L | Alkalinity | <0.010 mg/L | Ammonia | <1 ug/L | Arsenic |
| 187 mg/L | Bicarbonate | <1.0 ug/L | Cadmium | 29 mg/L | Calcium |
| 0 mg/L | Carbonate | 1.4 mg/L | Chloride | <1 ug/L | Chromium |
| <1 ug/L | Copper | <0.01 mg/L | Cyanide | <1 col/100 ml | Fecal Coliform |
| 0.50 mg/L | Fluoride | 122 mg/L | Hardness | 380 ug/L | Iron |
| <1 ug/L | Lead | 12 mg/L | Magnesium | 22 ug/L | Manganese |
| <0.1 ug/L | Mercury | <0.05 mg/L | Nitrate | <0.010 mg/L | Nitrite |
| 7.60 pH | pH | 0.050 mg/L | Phosphorus | 2.1 mg/L | Potassium |
| - pCi/L | Radon-222 | - pCi/L | Radon-222 | <1 ug/L | Selenium |
| 53 mg/L | Silica | 18 mg/L | Sodium | 216 mg/L | Solids |
| 293 uS/cm | Specific Conductance | 8.5 mg/L | Sulfate | 13 °C | Water Temperature |
| 29 ug/L | Zinc | | | | |

### Radiochemistry

| | | | | | |
|---|---|---|---|---|---|
| -0.3 pCi/L | Alpha, Gross | 1.3 pCi/L | Alpha, Gross 2S | -0.4416626 | Alpha, Thorium pCi/L |
| 1.9 pCi/L | Beta, Gross | 1.6 pCi/L | Beta, Gross 2S | | |

### Volatile Organic Compounds

| | | | | | |
|---|---|---|---|---|---|
| <0.10 ug/L | Benzene | <0.14 ug/L | Bromobenzene | <0.01 ug/L | Bromochloromethane |
| <0.20 ug/L | Bromoform | <0.19 ug/L | Bromomethane | <0.14 ug/L | Butylbenzene, n- |
| <0.16 ug/L | Butylbenzene, -sec | <0.17 ug/L | Carbon Tetrachloride | <0.09 ug/L | Chlorobenzene |
| <0.13 ug/L | Chloroethane | <0.10 ug/L | Chloroform | <0.04 ug/L | Chlorotoluene,-o |
| <0.07 ug/L | Chlorotoluene-p | <0.11 ug/L | Dibromochloromethane | <0.2 ug/L | Dibromochloropropane (DBCP) |
| <0.17 ug/L | Dibromoethane,1,2- (EDB) | <0.07 ug/L | Dibromomethane | <0.17 ug/L | Dichlorobenzene,1,2- |
| <0.19 ug/L | Dichlorobenzene,1,3- | <0.21 ug/L | Dichlorobenzene,1,4- | <0.16 ug/L | Dichlorobromomethane |
| <0.29 ug/L | Dichlorodifluoromethane | <0.12 ug/L | Dichloroethane,1,1- | <0.12 ug/L | Dichloroethane,1,2- |
| <0.26 ug/L | Dichloroethene,1,1- | <0.05 ug/L | Dichloroethene,1,2,cis- | <0.17 ug/L | Dichloroethene,1,2,trans- |
| <0.12 ug/L | Dichloropropane,1,2- | <0.02 ug/L | Dichloropropane,1,3- | ND ug/L | Dichloropropane,2,2- |
| <0.05 ug/L | Dichloropropene,1,1- | <0.15 ug/L | Dichloropropene,1,3 cis- | <0.20 ug/L | Dichloropropene,1,3 trans- |
| <0.09 ug/L | Ethylbenzene | <0.11 ug/L | Ethylbenzene, 2,3-Dimethyl- | - ug/L | Freon 113 |
| <0.09 ug/L | Hexachlorobutadiene | <0.15 ug/L | Isodurene | <0.14 ug/L | Isopropylbenzene |
| <0.14 ug/L | Methylene chloride | <0.05 ug/L | Naphthalene | <0.16 ug/L | Paraldehyde |
| <0.08 ug/L | Styrene | ND ug/L | Tetrachloroethane,1,1,1,2- | <0.28 ug/L | Tetrachloroethane,1,1,2,2- |
| <0.31 ug/L | Tetrachloroethylene | <0.1 ug/L | Tetralin | <0.05 ug/L | Toluene |
| <0.13 ug/L | Toluene, 2-Isopropyl- | <0.06 ug/L | Trichlorobenzene,1,2,3- | <0.08 ug/L | Trichlorobenzene,1,2,4- |
| <0.12 ug/L | Trichloroethane,1,1,1- | <0.04 ug/L | Trichloroethane,1,1,2- | <0.16 ug/L | Trichloroethylene |
| <0.34 ug/L | Trichlorofluoromethane | <0.02 ug/L | Trichloropropane | <0.10 ug/L | Trimethylbenzene,1,2,4- |
| <0.11 ug/L | TRIMETHYLBENZENE,1,3 | <0.52 ug/L | Vinyl chloride | <0.22 ug/L | Xylenes |

# APPENDIX A

## 1992 Result Example

## *Idaho Department of Water Resources Sample Results*
## *Statewide Ground Water Quality Monitoring Program*

| Site ID | Station Name | Sample Date && Time | Sample ID |
|---|---|---|---|
| **461155116163701** | **33N 01E 13CAC1** | **September 18, 1992 12:00** | **GWQM-1992-402** |

### Well Data

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| County | Lewis | Latitude | 46.19861111 | Longitude | -116.276944 | Altitude | 3460 ft |
| Water Use | H | | | Well Depth | 396 ft | Casing Depth | 20 ft |

### Inorganics and Field Analysis

| | | | | | |
|---|---|---|---|---|---|
| 222 mg/L | Alkalinity | 0.020 mg/L | Ammonia | <1 ug/L | Arsenic |
| 271 mg/L | Bicarbonate | <1.0 ug/L | Cadmium | 31 mg/L | Calcium |
| 0 mg/L | Carbonate | 11 mg/L | Chloride | <1 ug/L | Chromium |
| 1 ug/L | Copper | <0.01 mg/L | Cyanide | <1 col/100 ml | Fecal Coliform |
| 0.60 mg/L | Fluoride | 168 mg/L | Hardness | 4 ug/L | Iron |
| <1 ug/L | Lead | 22 mg/L | Magnesium | <1 ug/L | Manganese |
| <0.1 ug/L | Mercury | 6.00 mg/L | Nitrate | <0.010 mg/L | Nitrite |
| 7.72 pH | pH | 0.020 mg/L | Phosphorus | 6.7 mg/L | Potassium |
| - pCi/L | Radon-222 | - pCi/L | Radon-222 | 2 ug/L | Selenium |
| 47 mg/L | Silica | 34 mg/L | Sodium | 333 mg/L | Solids |
| 476 uS/cm | Specific Conductance | 21 mg/L | Sulfate | 14.3 °C | Water Temperature |
| 250 ug/L | Zinc | | | | |

### Pesticides by Immunoassay

| | | | | | |
|---|---|---|---|---|---|
| ND ug/L | 2,4-D | - ug/L | Alachlor | ND ug/L | Aldicarb |
| ND ug/L | Atrazine | - ug/L | Carbofuran | - ug/L | Cyanazine |
| - ug/L | Metolachlor | | | | |

### Radiochemistry

| | | | | | |
|---|---|---|---|---|---|
| 1.9 pCi/L | Alpha, Gross | 2.5 pCi/L | Alpha, Gross 2S | 2.7233498 | Alpha, Thorium pCi/L |
| 7.3 pCi/L | Beta, Gross | 2.4 pCi/L | Beta, Gross 2S | | |

### Volatile Organic Compounds

| | | | | | |
|---|---|---|---|---|---|
| <0.2 ug/L | Benzene | - ug/L | Bromobenzene | - ug/L | Bromochloromethane |
| <0.2 ug/L | Bromoform | - ug/L | Bromomethane | - ug/L | Butylbenzene, n- |
| - ug/L | Butylbenzene, -sec | <0.2 ug/L | Carbon Tetrachloride | <0.2 ug/L | Chlorobenzene |
| - ug/L | Chloroethane | <0.2 ug/L | Chloroform | - ug/L | Chlorotoluene,-o |
| - ug/L | Chlorotoluene-p | <0.2 ug/L | Dibromochloromethane | - ug/L | Dibromochloropropane (DBCP) |
| - ug/L | Dibromoethane,1,2- (EDB) | - ug/L | Dibromomethane | <0.2 ug/L | Dichlorobenzene,1,2- |
| <0.2 ug/L | Dichlorobenzene,1,3- | <0.2 ug/L | Dichlorobenzene,1,4- | <0.2 ug/L | Dichlorobromomethane |
| <0.2 ug/L | Dichlorodifluoromethane | <0.2 ug/L | Dichloroethane,1,1- | <0.2 ug/L | Dichloroethane,1,2- |
| <0.2 ug/L | Dichloroethene,1,1- | <0.2 ug/L | Dichloroethene,1,2,cis- | <0.2 ug/L | Dichloroethene,1,2,trans- |
| <0.2 ug/L | Dichloropropane,1,2- | - ug/L | Dichloropropane,1,3- | - ug/L | Dichloropropane,2,2- |
| - ug/L | Dichloropropene,1,1- | - ug/L | Dichloropropene,1,3 cis- | - ug/L | Dichloropropene,1,3 trans- |
| <0.2 ug/L | Ethylbenzene | - ug/L | Ethylbenzene, 2,3-Dimethyl- | <0.5 ug/L | Freon 113 |
| - ug/L | Hexachlorobutadiene | - ug/L | Isodurene | - ug/L | Isopropylbenzene |
| <0.2 ug/L | Methylene chloride | - ug/L | Naphthalene | - ug/L | Paraldehyde |
| <0.2 ug/L | Styrene | - ug/L | Tetrachloroethane,1,1,1,2- | - ug/L | Tetrachloroethane,1,1,2,2- |
| <0.2 ug/L | Tetrachloroethylene | - ug/L | Tetralin | <0.2 ug/L | Toluene |
| - ug/L | Toluene, 2-Isopropyl- | - ug/L | Trichlorobenzene,1,2,3- | - ug/L | Trichlorobenzene,1,2,4- |
| <0.2 ug/L | Trichloroethane,1,1,1- | - ug/L | Trichloroethane,1,1,2- | <0.2 ug/L | Trichloroethylene |
| <0.2 ug/L | Trichlorofluoromethane | - ug/L | Trichloropropane | - ug/L | Trimethylbenzene,1,2,4- |
| - ug/L | TRIMETHYLBENZENE,1,3 | <0.2 ug/L | Vinyl chloride | <0.2 ug/L | Xylenes |

## APPENDIX A

### 1993 Result Example

### *Idaho Department of Water Resources Sample Results*
### *Statewide Ground Water Quality Monitoring Program*

| Site ID | Station Name | Sample Date && Time | Sample ID |
|---|---|---|---|
| **461025116290401** | **33N 01W 29BDD1** | **August 11, 1993 11:20 AM** | **GWQM-1993-155** |

#### Well Data

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| County | Lewis | Latitude | 46.17361111 | Longitude | -116.484444 | Altitude | 3980 ft |
| Water Use | H | | | Well Depth | 160 ft | Casing Depth | 150 ft |

#### Inorganics and Field Analysis

| | | | | | |
|---|---|---|---|---|---|
| 125 mg/L | Alkalinity | 0.010 mg/L | Ammonia | <1 ug/L | Arsenic |
| 152 mg/L | Bicarbonate | <1.0 ug/L | Cadmium | 28 mg/L | Calcium |
| 0 mg/L | Carbonate | 1.0 mg/L | Chloride | 1 ug/L | Chromium |
| <1 ug/L | Copper | <0.01 mg/L | Cyanide | 2 col/100 ml | Fecal Coliform **MCL 0 col/100 ml EXCEEDED** |
| 0.40 mg/L | Fluoride | 105 mg/L | Hardness | <3 ug/L | Iron |
| <1 ug/L | Lead | 8.4 mg/L | Magnesium | <1 ug/L | Manganese |
| <0.1 ug/L | Mercury | 3.40 mg/L | Nitrate | <0.010 mg/L | Nitrite |
| 7.9 pH | pH | 0.070 mg/L | Phosphorus | 2.2 mg/L | Potassium |
| 1000 pCi/L | Radon-222 | 52 pCi/L | Radon-222 | <1 ug/L | Selenium |
| 54 mg/L | Silica | 16 mg/L | Sodium | 206 mg/L | Solids |
| 286 uS/cm | Specific Conductance | 5.7 mg/L | Sulfate | 12.2 °C | Water Temperature |
| 39 ug/L | Zinc | | | | |

#### Pesticides by Immunoassay

| | | | | | |
|---|---|---|---|---|---|
| ND ug/L | 2,4-D | ND ug/L | Alachlor | ND ug/L | Aldicarb |
| ND ug/L | Atrazine | ND ug/L | Carbofuran | - ug/L | Cyanazine |
| ND ug/L | Metolachlor | | | | |

#### Radiochemistry

| | | | | | |
|---|---|---|---|---|---|
| 1.5 pCi/L | Alpha, Gross | 1.7 pCi/L | Alpha, Gross 2S | 2.147893 | Alpha, Thorium |
| 1.9 pCi/L | Beta, Gross | 1.4 pCi/L | Beta, Gross 2S | | |

#### Volatile Organic Compounds

| | | | | | |
|---|---|---|---|---|---|
| <0.5 ug/L | Benzene | <0.5 ug/L | Bromobenzene | <0.5 ug/L | Bromochloromethane |
| <0.5 ug/L | Bromoform | <0.5 ug/L | Bromomethane | <0.5 ug/L | Butylbenzene, n- |
| <0.5 ug/L | Butylbenzene, -sec | <0.5 ug/L | Carbon Tetrachloride | <0.5 ug/L | Chlorobenzene |
| <0.5 ug/L | Chloroethane | <0.5 ug/L | Chloroform | <0.5 ug/L | Chlorotoluene,-o |
| <0.5 ug/L | Chlorotoluene-p | <0.5 ug/L | Dibromochloromethane | <0.5 ug/L | Dibromochloropropane (DBCP) |
| <0.2 ug/L | Dibromoethane,1,2- (EDB) | <0.5 ug/L | Dibromomethane | <0.5 ug/L | Dichlorobenzene,1,2- |
| <0.5 ug/L | Dichlorobenzene,1,3- | <0.5 ug/L | Dichlorobenzene,1,4- | <0.5 ug/L | Dichlorobromomethane |
| <0.5 ug/L | Dichlorodifluoromethane | <0.5 ug/L | Dichloroethane,1,1- | <0.5 ug/L | Dichloroethane,1,2- |
| <0.5 ug/L | Dichloroethene,1,1- | <0.5 ug/L | Dichloroethene,1,2,cis- | <0.5 ug/L | Dichloroethene,1,2,trans- |
| <0.5 ug/L | Dichloropropane,1,2- | <0.5 ug/L | Dichloropropane,1,3- | <0.5 ug/L | Dichloropropane,2,2- |
| <0.5 ug/L | Dichloropropene,1,1- | <0.5 ug/L | Dichloropropene,1,3 cis- | <0.5 ug/L | Dichloropropene,1,3 trans- |
| <0.5 ug/L | Ethylbenzene | <0.5 ug/L | Hexachlorobutadiene | <0.5 ug/L | Isodurene |
| <0.5 ug/L | Isopropylbenzene | <0.5 ug/L | Methylene chloride | <0.5 ug/L | Naphthalene |
| <0.5 ug/L | Paraldehyde | <0.5 ug/L | Styrene | <0.5 ug/L | Tetrachloroethane,1,1,1,2- |
| <0.5 ug/L | Tetrachloroethane,1,1,2,2- | <0.5 ug/L | Tetrachloroethylene | <0.5 ug/L | Tetralin |
| <0.5 ug/L | Toluene | <0.5 ug/L | Toluene, 2-Isopropyl- | <0.5 ug/L | Trichlorobenzene,1,2,3- |
| <0.5 ug/L | Trichlorobenzene,1,2,4- | <0.5 ug/L | Trichloroethane,1,1,1- | <0.5 ug/L | Trichloroethane,1,1,2- |
| <0.5 ug/L | Trichloroethylene | <0.5 ug/L | Trichlorofluoromethane | <0.5 ug/L | Trichloropropane |
| <0.5 ug/L | Trimethylbenzene,1,2,4- | <0.5 ug/L | TRIMETHYLBENZENE,1,3 | <0.5 ug/L | Vinyl chloride |
| <0.5 ug/L | Xylenes | | | | |

# APPENDIX A

## 1994 Result Example

## *Idaho Department of Water Resources Sample Results*
## *Statewide Ground Water Quality Monitoring Program*

| Site ID | Station Name | Sample Date && Time | Sample ID |
|---|---|---|---|
| **461233116274101** | **33N 01W 09DCC1** | **August 9, 1994 8:15 AM** | **GWQM-1994-170** |

### Well Data

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| County | Lewis | Latitude | 46.20916666 | Longitude | -116.461388 | Altitude | 3830 ft |
| Water Use | H | | | Well Depth | 405 ft | Casing Depth | 19 ft |

### Inorganics and Field Analysis

| | | | | | |
|---|---|---|---|---|---|
| 14.0 °C | Air Temperature | 150 mg/L | Alkalinity | 0.020 mg/L | Ammonia |
| <1 ug/L | Arsenic | 183 mg/L | Bicarbonate | <1.0 ug/L | Cadmium |
| 30 mg/L | Calcium | 0 mg/L | Carbonate | 2.7 mg/L | Chloride |
| <1 ug/L | Chromium | 2 ug/L | Copper | <0.01 mg/L | Cyanide |
| <1 col/100 ml | Fecal Coliform | 0.60 mg/L | Fluoride | 116 mg/L | Hardness |
| 5 ug/L | Iron | <1 ug/L | Lead | 10 mg/L | Magnesium |
| <1 ug/L | Manganese | - ug/L | Mercury | 1.20 mg/L | Nitrate |
| <0.010 mg/L | Nitrite | 7.7 pH | pH | 0.110 mg/L | Phosphorus |
| 3.6 mg/L | Potassium | 1000 pCi/L | Radon-222 | 32 pCi/L | Radon-222 |
| <1 ug/L | Selenium | 56 mg/L | Silica | 24 mg/L | Sodium |
| 228 mg/L | Solids | 329 uS/cm | Specific Conductance | 4.7 mg/L | Sulfate |
| 11 °C | Water Temperature | 630 ug/L | Zinc | | |

### Pesticides

| | | | | | |
|---|---|---|---|---|---|
| <0.009 ug/L | Alachlor | <0.017 ug/L | Atrazine | <0.005 ug/L | Atrazine, desethyl |
| <0.013 ug/L | Benefin | <0.007 ug/L | BHC, alpha- | <0.011 ug/L | BHC, gamma- (Lindane) |
| <0.013 ug/L | Carbofuran | <0.008 ug/L | Chloropyrifos | <0.013 ug/L | Cyanazine |
| <0.004 ug/L | Dacthal (DCPA) | <0.010 ug/L | DDE,4,4'- | <0.008 ug/L | Diazinon |
| <0.008 ug/L | Dieldrin | <0.006 ug/L | Diethylaniline,2,6- | <0.024 ug/L | Dimethoate |
| <0.005 ug/L | Dipropylthiocarbamate, S-Ethyl (EPTC) | <0.060 ug/L | Disulfoton | <0.008 ug/L | Dyfonate |
| <0.013 ug/L | Ethalfluralin | <0.012 ug/L | Ethoprop | <0.050 ug/L | Guthion |
| <0.039 ug/L | Linuron | <0.014 ug/L | Malathion | <0.009 ug/L | Metolachlor |
| <0.012 ug/L | Metribuzin | <0.007 ug/L | Molinate | <0.010 ug/L | Napropamide |
| <0.022 ug/L | Parathion | <0.035 ug/L | Parathion-methyl | <0.009 ug/L | Pebulate |
| <0.018 ug/L | Penoxalin | <0.016 ug/L | Permethrins | <0.011 ug/L | Phorate |
| <0.009 ug/L | Pronamide | <0.015 ug/L | Propachlor | <0.016 ug/L | Propanil |
| <0.008 ug/L | Propargite | <0.046 ug/L | Sevin | <0.008 ug/L | Simazine |
| <0.015 ug/L | Tebuthiuron | <0.030 ug/L | Terbacil | <0.012 ug/L | Terbufos |
| <0.008 ug/L | Thiobencarb | <0.008 ug/L | Triallate | <0.012 ug/L | Trifluralin |

### Pesticides by Immunoassay

| | | | | | |
|---|---|---|---|---|---|
| ND ug/L | 2,4-D | ND ug/L | Alachlor | ND ug/L | Aldicarb |
| ND ug/L | Atrazine | ND ug/L | Carbofuran | ND ug/L | Cyanazine |
| ND ug/L | Metolachlor | ND mg/L | Nitrate | | |

### Radiochemistry

| | | | | | |
|---|---|---|---|---|---|
| 0.6 pCi/L | Alpha, Gross | 1.9 pCi/L | Alpha, Gross 2S | 0.8531152 | Alpha, Thorium pCi/L |
| 3.3 pCi/L | Beta, Gross | 1.7 pCi/L | Beta, Gross 2S | | |

# APPENDIX A

## Volatile Organic Compounds

| | | |
|---|---|---|
| <0.5 ug/L Benzene | <0.5 ug/L Bromobenzene | <0.5 ug/L Bromochloromethane |
| <0.5 ug/L Bromoform | <0.5 ug/L Bromomethane | <0.5 ug/L Butylbenzene, n- |
| <0.5 ug/L Butylbenzene, -sec | <0.5 ug/L Carbon Tetrachloride | <0.5 ug/L Chlorobenzene |
| <0.5 ug/L Chloroethane | <0.5 ug/L Chloroform | <0.5 ug/L Chlorotoluene,-o |
| <0.5 ug/L Chlorotoluene-p | <0.5 ug/L Dibromochloromethane | <0.5 ug/L Dibromochloropropane (DBCP) |
| <0.2 ug/L Dibromoethane,1,2- (EDB) | <0.5 ug/L Dibromomethane | <0.5 ug/L Dichlorobenzene,1,2- |
| <0.5 ug/L Dichlorobenzene,1,3- | <0.5 ug/L Dichlorobenzene,1,4- | <0.5 ug/L Dichlorobromomethane |
| <0.5 ug/L Dichlorodifluoromethane | <0.5 ug/L Dichloroethane,1,1- | <0.5 ug/L Dichloroethane,1,2- |
| <0.5 ug/L Dichloroethene,1,1- | <0.5 ug/L Dichloroethene,1,2,cis- | <0.5 ug/L Dichloroethene,1,2,trans- |
| <0.5 ug/L Dichloropropane,1,2- | <0.5 ug/L Dichloropropane,1,3- | <0.5 ug/L Dichloropropane,2,2- |
| <0.5 ug/L Dichloropropene,1,1- | <0.5 ug/L Dichloropropene,1,3 cis- | <0.5 ug/L Ethylbenzene |
| <0.5 ug/L Hexachlorobutadiene | <0.5 ug/L Isodurene | <0.5 ug/L Isopropylbenzene |
| <0.5 ug/L Methylene chloride | <0.5 ug/L Naphthalene | <0.5 ug/L Paraldehyde |
| <0.5 ug/L Styrene | <0.5 ug/L Tetrachloroethane,1,1,1,2- | <0.5 ug/L Tetrachloroethane,1,1,2,2- |
| <0.5 ug/L Tetrachloroethylene | <0.5 ug/L Tetralin | <0.5 ug/L Toluene |
| <0.5 ug/L Toluene, 2-Isopropyl- | <0.5 ug/L Trichlorobenzene,1,2,3- | <0.5 ug/L Trichlorobenzene,1,2,4- |
| <0.5 ug/L Trichloroethane,1,1,1- | <0.5 ug/L Trichloroethane,1,1,2- | <0.5 ug/L Trichloroethylene |
| <0.5 ug/L Trichlorofluoromethane | <0.5 ug/L Trichloropropane | <0.5 ug/L Trimethylbenzene,1,2,4- |
| <0.5 ug/L TRIMETHYLBENZENE,1,3 ,5- | <0.5 ug/L Vinyl chloride | <0.5 ug/L Xylenes |

# APPENDIX A

## 1995 Result Example

### *Idaho Department of Water Resources Sample Results*
### *Statewide Ground Water Quality Monitoring Program*

| Site ID | Station Name | Sample Date && Time | Sample ID |
|---|---|---|---|
| **455906116015301** | **31N 03E 36BCA1** | **July 20, 1995 1:25 PM** | **GWQM-1995-081** |

### Well Data

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| County | Idaho | Latitude | 45.985 | Longitude | -116.031388 | Altitude | 2845 ft |
| Water Use | H | | | Well Depth | 184 ft | Casing Depth | 144 ft |

### Inorganics and Field Analysis

| | | | | | |
|---|---|---|---|---|---|
| 31.0 °C | Air Temperature | 164 mg/L | Alkalinity | 0.050 mg/L | Ammonia |
| <1 ug/L | Arsenic | 200 mg/L | Bicarbonate | <1.0 ug/L | Cadmium |
| 26 mg/L | Calcium | 0 mg/L | Carbonate | 1.8 mg/L | Chloride |
| <1 ug/L | Chromium | <1 ug/L | Copper | 2 col/100 ml | Fecal Coliform<br>**MCL 0 col/100 ml EXCEEDED** |
| 0.50 mg/L | Fluoride | 131 mg/L | Hardness | 340 ug/L | Iron |
| <1 ug/L | Lead | 16 mg/L | Magnesium | 31 ug/L | Manganese |
| <0.050 mg/L | Nitrate | <0.010 mg/L | Nitrite | 8.58 pH | pH |
| 0.030 mg/L | Phosphorus | 3.1 mg/L | Potassium | - pCi/L | Radon-222 |
| - pCi/L | Radon-222 | <1 ug/L | Selenium | 54 mg/L | Silica |
| 19 mg/L | Sodium | 230 mg/L | Solids | 329 uS/cm | Specific Conductance |
| 11 mg/L | Sulfate | 13.6 °C | Water Temperature | 24 ug/L | Zinc |

### Pesticides by Immunoassay

| | | | | | |
|---|---|---|---|---|---|
| ND ug/L | 2,4-D | ND ug/L | Alachlor | ND ug/L | Aldicarb |
| ND ug/L | Atrazine | 0.29 ug/L | Carbofuran | ND ug/L | Cyanazine |
| ND ug/L | Metolachlor | | | | |

### Radiochemistry

| | | | | | |
|---|---|---|---|---|---|
| 1.3 pCi/L | Alpha, Gross | 1.8 pCi/L | Alpha, Gross 2S | 1.8601646 pCi/L | Alpha, Thorium |
| 3.8 pCi/L | Beta, Gross | 1.7 pCi/L | Beta, Gross 2S | | |

### Volatile Organic Compounds

| | | | | | |
|---|---|---|---|---|---|
| <0.5 ug/L | Benzene | <0.5 ug/L | Bromobenzene | <0.5 ug/L | Bromochloromethane |
| <0.5 ug/L | Bromoform | <0.5 ug/L | Bromomethane | <0.5 ug/L | Butylbenzene, n- |
| <0.5 ug/L | Butylbenzene, -sec | <0.5 ug/L | Carbon Tetrachloride | <0.5 ug/L | Chlorobenzene |
| <0.5 ug/L | Chloroethane | <0.5 ug/L | Chloroform | <0.5 ug/L | Chlorotoluene,-o |
| <0.5 ug/L | Chlorotoluene-p | <0.5 ug/L | Dibromochloromethane | <0.5 ug/L | Dibromochloropropane (DBCP) |
| <0.2 ug/L | Dibromoethane,1,2- (EDB) | <0.5 ug/L | Dibromomethane | <0.5 ug/L | Dichlorobenzene,1,2- |
| <0.5 ug/L | Dichlorobenzene,1,3- | <0.5 ug/L | Dichlorobenzene,1,4- | <0.5 ug/L | Dichlorobromomethane |
| <0.5 ug/L | Dichlorodifluoromethane | <0.5 ug/L | Dichloroethane,1,1- | <0.5 ug/L | Dichloroethane,1,2- |
| <0.5 ug/L | Dichloroethene,1,1- | <0.5 ug/L | Dichloroethene,1,2,cis- | <0.5 ug/L | Dichloroethene,1,2,trans- |
| <0.5 ug/L | Dichloropropane,1,2- | <0.5 ug/L | Dichloropropane,1,3- | <0.5 ug/L | Dichloropropane,2,2- |
| <0.5 ug/L | Dichloropropene,1,1- | <0.5 ug/L | Dichloropropene,1,3 cis- | <0.5 ug/L | Ethylbenzene |
| <0.5 ug/L | Hexachlorobutadiene | <0.5 ug/L | Isodurene | <0.5 ug/L | Isopropylbenzene |
| <0.5 ug/L | Methyl tertiary butyl ether (MTBE) | <0.5 ug/L | Methylene chloride | <0.5 ug/L | Naphthalene |
| <0.5 ug/L | Paraldehyde | <0.5 ug/L | Styrene | <0.5 ug/L | Tetrachloroethane,1,1,1,2- |
| <0.5 ug/L | Tetrachloroethane,1,1,2,2- | <0.5 ug/L | Tetrachloroethylene | <0.5 ug/L | Tetralin |
| <0.5 ug/L | Toluene | <0.5 ug/L | Toluene, 2-Isopropyl- | <0.5 ug/L | Trichlorobenzene,1,2,3- |
| <0.5 ug/L | Trichlorobenzene,1,2,4- | <0.5 ug/L | Trichloroethane,1,1,1- | <0.5 ug/L | Trichloroethane,1,1,2- |
| <0.5 ug/L | Trichloroethylene | <0.5 ug/L | Trichlorofluoromethane | <0.5 ug/L | Trichloropropane |
| <0.5 ug/L | Trimethylbenzene,1,2,4- | <0.5 ug/L | TRIMETHYLBENZENE,1,3 | <0.5 ug/L | Vinyl chloride |
| <0.5 ug/L | Xylenes | | | | |

# APPENDIX A

## 1996 Result Example

### *Idaho Department of Water Resources Sample Results*
### *Statewide Ground Water Quality Monitoring Program*

| Site ID | Station Name | Sample Date && Time | Sample ID |
|---|---|---|---|
| **460714116023801** | **32N 03E 11DCC1** | **July 17, 1996 4:05 PM** | **GWQM-1996-143** |

### Well Data

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| County | Idaho | Latitude | 46.12055555 | Longitude | -116.043888 | Altitude | 2875 ft |
| Water Use | H | | | Well Depth | 430 ft | Casing Depth | 19 ft |

### Inorganics and Field Analysis

| | | | | | |
|---|---|---|---|---|---|
| 33 °C | Air Temperature | 291 mg/L | Alkalinity | 0.03 mg/L | Ammonia |
| <1 ug/L | Arsenic | 356 mg/L | Bicarbonate | <1.0 ug/L | Cadmium |
| 50 mg/L | Calcium | 0 mg/L | Carbonate | 12 mg/L | Chloride |
| <1 ug/L | Chromium | 4 ug/L | Copper | <1 col/100 ml | Fecal Coliform |
| 0.4 mg/L | Fluoride | 253 mg/L | Hardness | 12 ug/L | Iron |
| <1 ug/L | Lead | 31 mg/L | Magnesium | 16 ug/L | Manganese |
| 3.7 mg/L | Nitrate | <0.010 mg/L | Nitrite | 7.7 pH | pH |
| 0.06 mg/L | Phosphorus | 5.2 mg/L | Potassium | <1 ug/L | Selenium |
| 41 mg/L | Silica | 53 mg/L | Sodium | 433 mg/L | Solids |
| 697 uS/cm | Specific Conductance | 48 mg/L | Sulfate | 14.6 °C | Water Temperature |
| 570 ug/L | Zinc | | | | |

### Pesticides by Immunoassay

| | | | | | |
|---|---|---|---|---|---|
| ND ug/L | 2,4-D | ND ug/L | Alachlor | ND ug/L | Aldicarb |
| ND ug/L | Atrazine | ND ug/L | Carbofuran | ND ug/L | Cyanazine |
| ND ug/L | Metolachlor | ND ug/L | Metribuzin | ND ug/L | Simazine |

### Radiochemistry

| | | | | | |
|---|---|---|---|---|---|
| 1.3 pCi/L | Alpha, Gross | 3 pCi/L | Alpha, Gross 2S | 1.8601646 | Alpha, Thorium pCi/L |
| 7.7 pCi/L | Beta, Gross | 3 pCi/L | Beta, Gross 2S | | |

### Volatile Organic Compounds

| | | | | | |
|---|---|---|---|---|---|
| <0.5 ug/L | Benzene | <0.5 ug/L | Bromobenzene | <0.5 ug/L | Bromochloromethane |
| <0.5 ug/L | Bromoform | <0.5 ug/L | Bromomethane | <0.5 ug/L | Butylbenzene, n- |
| <0.5 ug/L | Butylbenzene, -sec | <0.5 ug/L | Carbon Tetrachloride | <0.5 ug/L | Chlorobenzene |
| <0.5 ug/L | Chloroethane | <0.5 ug/L | Chloroform | <0.5 ug/L | Chlorotoluene,-o |
| <0.5 ug/L | Chlorotoluene-p | <0.5 ug/L | Dibromochloromethane | <0.5 ug/L | Dibromochloropropane (DBCP) |
| <0.2 ug/L | Dibromoethane,1,2- (EDB) | <0.5 ug/L | Dibromomethane | <0.5 ug/L | Dichlorobenzene,1,2- |
| <0.5 ug/L | Dichlorobenzene,1,3- | <0.5 ug/L | Dichlorobenzene,1,4- | <0.5 ug/L | Dichlorobromomethane |
| <0.5 ug/L | Dichlorodifluoromethane | <0.5 ug/L | Dichloroethane,1,1- | <0.5 ug/L | Dichloroethane,1,2- |
| <0.5 ug/L | Dichloroethene,1,1- | <0.5 ug/L | Dichloroethene,1,2,cis- | <0.5 ug/L | Dichloroethene,1,2,trans- |
| <0.5 ug/L | Dichloropropane,1,2- | <0.5 ug/L | Dichloropropane,1,3- | <0.5 ug/L | Dichloropropane,2,2- |
| <0.5 ug/L | Dichloropropene,1,1- | <0.5 ug/L | Dichloropropene,1,3 cis- | <0.5 ug/L | Ethylbenzene |
| <0.5 ug/L | Hexachlorobutadiene | <0.5 ug/L | Isodurene | <0.5 ug/L | Isopropylbenzene |
| <0.5 ug/L | Methyl tertiary butyl ether (MTBE) | <0.5 ug/L | Methylene chloride | <0.5 ug/L | Naphthalene |
| <0.5 ug/L | Paraldehyde | <0.5 ug/L | Styrene | <0.5 ug/L | Tetrachloroethane,1,1,1,2- |
| <0.5 ug/L | Tetrachloroethane,1,1,2,2- | <0.5 ug/L | Tetrachloroethylene | <0.5 ug/L | Tetralin |
| <0.5 ug/L | Toluene | <0.5 ug/L | Toluene, 2-Isopropyl- | <0.5 ug/L | Trichlorobenzene,1,2,3- |
| <0.5 ug/L | Trichlorobenzene,1,2,4- | <0.5 ug/L | Trichloroethane,1,1,1- | <0.5 ug/L | Trichloroethane,1,1,2- |
| <0.5 ug/L | Trichloroethylene | <0.5 ug/L | Trichlorofluoromethane | <0.5 ug/L | Trichloropropane |
| <0.5 ug/L | Trimethylbenzene,1,2,4- | <0.5 ug/L | TRIMETHYLBENZENE,1,3 | <0.5 ug/L | Vinyl chloride |
| <0.5 ug/L | Xylenes | | | | |

# APPENDIX A

## 1997 Result Example

### *Idaho Department of Water Resources Sample Results*
### *Statewide Ground Water Quality Monitoring Program*

| Site ID | Station Name | Sample Date && Time | Sample ID |
|---|---|---|---|
| **471301116503001** | **33N 04W 09DBB1** | **July 16, 1997 7:45 AM** | **GWQM-1997-107** |

### Well Data

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| County | Nez Perce | Latitude | 46.21694444 | Longitude | -116.841666 | Altitude | 3480 ft |
| Water Use | H | | | Well Depth | 194 ft | Casing Depth | 192 ft |

### Inorganics and Field Analysis

| | | | | | |
|---|---|---|---|---|---|
| 11.5 °C | Air Temperature | 33 mg/L | Alkalinity | <0.015 mg/L | Ammonia |
| <1 ug/L | Arsenic | 40 mg/L | Bicarbonate | <1.0 ug/L | Cadmium |
| 6.8 mg/L | Calcium | 0 mg/L | Carbonate | 0.79 mg/L | Chloride |
| <1.0 ug/L | Chromium | 2.0 ug/L | Copper | - ft | Depth to Water |
| <1 col/100 ml | Fecal Coliform | <0.10 mg/L | Fluoride | 28 mg/L | Hardness |
| 1400 ug/L | Iron | <1.0 ug/L | Lead | 2.6 mg/L | Magnesium |
| 5.2 ug/L | Manganese | 0.253 mg/L | Nitrate | <0.010 mg/L | Nitrite |
| 6.9 pH | pH | 0.036 mg/L | Phosphorus | 1.4 mg/L | Potassium |
| <1 ug/L | Selenium | 31 mg/L | Silica | 3.3 mg/L | Sodium |
| 70 mg/L | Solids | 73 uS/cm | Specific Conductance | 1.2 mg/L | Sulfate |
| 9.2 °C | Water Temperature | 106 ug/L | Zinc | | |

### Pesticides by Immunoassay

| | | | | | |
|---|---|---|---|---|---|
| ND ug/L | 2,4-D | ND ug/L | Alachlor | ND ug/L | Aldicarb |
| ND ug/L | Atrazine | ND ug/L | Carbofuran | ND ug/L | Cyanazine |
| ND ug/L | Metolachlor | ND ug/L | Metribuzin | ND ug/L | Simazine |

### Radiochemistry

| | | | | | |
|---|---|---|---|---|---|
| 1.0698495683 9283 pCi/L | Alpha, Gross 2S | 1.0034152180 1555 pCi/L | Alpha, Thorium | 2.1178623180 4728 pCi/L | Beta, Gross |
| 0.7022613442 | Beta, Gross 2S 83418 pCi/L | | | | |

### Volatile Organic Compounds

| | | | | | |
|---|---|---|---|---|---|
| <0.5 ug/L | Benzene | <0.5 ug/L | Bromobenzene | <0.5 ug/L | Bromochloromethane |
| <0.5 ug/L | Bromoform | <0.5 ug/L | Bromomethane | <0.5 ug/L | Butylbenzene, n- |
| <0.5 ug/L | Butylbenzene, -sec | <0.5 ug/L | Carbon Tetrachloride | <0.5 ug/L | Chlorobenzene |
| <0.5 ug/L | Chloroethane | <0.5 ug/L | Chloroform | <0.5 ug/L | Chlorotoluene,-o |
| <0.5 ug/L | Chlorotoluene-p | <0.5 ug/L | Dibromochloromethane | <0.5 ug/L | Dibromochloropropane (DBCP) |
| <0.2 ug/L | Dibromoethane,1,2- (EDB) | <0.5 ug/L | Dibromomethane | <0.5 ug/L | Dichlorobenzene,1,2- |
| <0.5 ug/L | Dichlorobenzene,1,3- | <0.5 ug/L | Dichlorobenzene,1,4- | <0.5 ug/L | Dichlorobromomethane |
| <0.5 ug/L | Dichlorodifluoromethane | <0.5 ug/L | Dichloroethane,1,1- | <0.5 ug/L | Dichloroethane,1,2- |
| <0.5 ug/L | Dichloroethene,1,1- | <0.5 ug/L | Dichloroethene,1,2,cis- | <0.5 ug/L | Dichloroethene,1,2,trans- |
| <0.5 ug/L | Dichloropropane,1,2- | <0.5 ug/L | Dichloropropane,1,3- | <0.5 ug/L | Dichloropropane,2,2- |
| <0.5 ug/L | Dichloropropene,1,1- | <0.5 ug/L | Dichloropropene,1,3 cis- | <0.5 ug/L | Ethylbenzene |
| <0.5 ug/L | Hexachlorobutadiene | <0.5 ug/L | Isodurene | <0.5 ug/L | Isopropylbenzene |
| <0.5 ug/L | Methyl tertiary butyl ether (MTBE) | <0.5 ug/L | Methylene chloride | <0.5 ug/L | Naphthalene |
| <0.5 ug/L | Paraldehyde | <0.5 ug/L | Styrene | <0.5 ug/L | Tetrachloroethane,1,1,1,2- |
| <0.5 ug/L | Tetrachloroethane,1,1,2,2- | <0.5 ug/L | Tetrachloroethylene | <0.5 ug/L | Tetralin |
| <0.5 ug/L | Toluene | <0.5 ug/L | Toluene, 2-Isopropyl- | <0.5 ug/L | Trichlorobenzene,1,2,3- |
| <0.5 ug/L | Trichlorobenzene,1,2,4- | <0.5 ug/L | Trichloroethane,1,1,1- | <0.5 ug/L | Trichloroethane,1,1,2- |
| <0.5 ug/L | Trichloroethylene | <0.5 ug/L | Trichlorofluoromethane | <0.5 ug/L | Trichloropropane |
| <0.5 ug/L | Trimethylbenzene,1,2,4- | <0.5 ug/L | TRIMETHYLBENZENE,1,3 | <0.5 ug/L | Vinyl chloride |
| <0.5 ug/L | Xylenes | | | | |

## APPENDIX A

### 1998 Result Example

### *Idaho Department of Water Resources Sample Results*
### *Statewide Ground Water Quality Monitoring Program*

| Site ID | Station Name | Sample Date && Time | Sample ID |
|---|---|---|---|
| **461340116451501** | **33N 03W 06DBD1** | **August 13, 1998 1:20 PM** | **GWQM-1998-299** |

### Well Data

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| County | Nez Perce | Latitude | 46.22777777 | Longitude | -116.754166 | Altitude | 4250 ft |
| Water Use | H | | | Well Depth | 130 ft | Casing Depth | 130 ft |

### Inorganics and Field Analysis

| | | | | | |
|---|---|---|---|---|---|
| 30.0 °C | Air Temperature | 110 mg/L | Alkalinity | .075 mg/L | Ammonia |
| <1 ug/L | Arsenic | 130 mg/L | Bicarbonate | <1.0 ug/L | Cadmium |
| 22 mg/L | Calcium | 0 mg/L | Carbonate | .52 mg/L | Chloride |
| <1.0 ug/L | Chromium | 1.4 ug/L | Copper | - ft | Depth to Water |
| - mg/L | Dissolved Oxygen | <1 col/100 ml | Fecal Coliform | .25 mg/L | Fluoride |
| 94 mg/L | Hardness | <10 ug/L | Iron | <1.0 ug/L | Lead |
| 9.7 mg/L | Magnesium | <4.0 ug/L | Manganese | .177 mg/L | Nitrate |
| <0.010 mg/L | Nitrite | 7.9 pH | pH | .058 mg/L | Phosphorus |
| 2.7 mg/L | Potassium | <1 ug/L | Selenium | 46 mg/L | Silica |
| 7.8 mg/L | Sodium | 157 mg/L | Solids | 222 uS/cm | Specific Conductance |
| 1.4 mg/L | Sulfate | 8.4 °C | Water Temperature | 53 ug/L | Zinc |

### Pesticides by Immunoassay

| | | | | | |
|---|---|---|---|---|---|
| ND ug/L | 2,4-D | ND ug/L | Alachlor | ND ug/L | Aldicarb |
| ND ug/L | Atrazine | ND ug/L | Carbofuran | ND ug/L | Chloropyrifos |
| ND ug/L | Cyanazine | ND ug/L | Metolachlor | ND ug/L | Metribuzin |
| ND ug/L | Simazine | | | | |

### Radiochemistry

| | | | | | |
|---|---|---|---|---|---|
| 1.5781679190 | Alpha, Gross 2S | 0.8932755656 | Alpha, Thorium | 1.3821100599 | Beta, Gross |
| 0.9384028594 | Beta, Gross 2S | 37174 pCi/L | | | |

### Volatile Organic Compounds

| | | | | | |
|---|---|---|---|---|---|
| <0.5 ug/L | Benzene | <0.5 ug/L | Bromobenzene | <0.5 ug/L | Bromochloromethane |
| <0.5 ug/L | Bromoform | <0.5 ug/L | Bromomethane | <0.5 ug/L | Butylbenzene, n- |
| <0.5 ug/L | Butylbenzene, -sec | <0.5 ug/L | Carbon Tetrachloride | <0.5 ug/L | Chlorobenzene |
| <0.5 ug/L | Chloroethane | <0.5 ug/L | Chloroform | <0.5 ug/L | Chlorotoluene,-o |
| <0.5 ug/L | Chlorotoluene-p | <0.5 ug/L | Dibromochloromethane | <0.5 ug/L | Dibromochloropropane (DBCP) |
| <0.2 ug/L | Dibromoethane,1,2- (EDB) | <0.5 ug/L | Dibromomethane | <0.5 ug/L | Dichlorobenzene,1,2- |
| <0.5 ug/L | Dichlorobenzene,1,3- | <0.5 ug/L | Dichlorobenzene,1,4- | <0.5 ug/L | Dichlorobromomethane |
| <0.5 ug/L | Dichlorodifluoromethane | <0.5 ug/L | Dichloroethane,1,1- | <0.5 ug/L | Dichloroethane,1,2- |
| <0.5 ug/L | Dichloroethene,1,1- | <0.5 ug/L | Dichloroethene,1,2,cis- | <0.5 ug/L | Dichloroethene,1,2,trans- |
| <0.5 ug/L | Dichloropropane,1,2- | <0.5 ug/L | Dichloropropane,1,3- | <0.5 ug/L | Dichloropropane,1,3- |
| <0.5 ug/L | Dichloropropane,2,2- | <0.5 ug/L | Dichloropropene,1,1- | <0.5 ug/L | Ethylbenzene |
| <0.5 ug/L | Hexachlorobutadiene | <0.5 ug/L | Isodurene | <0.5 ug/L | Isopropylbenzene |
| <0.5 ug/L | Methyl tertiary butyl ether (MTBE) | <0.5 ug/L | Methylene chloride | <0.5 ug/L | Naphthalene |
| <0.5 ug/L | Paraldehyde | <0.5 ug/L | Styrene | <0.5 ug/L | Tetrachloroethane,1,1,1,2- |
| <0.5 ug/L | Tetrachloroethane,1,1,2,2- | <0.5 ug/L | Tetrachloroethylene | <0.5 ug/L | Tetralin |
| <0.5 ug/L | Toluene | <0.5 ug/L | Toluene, 2-Isopropyl- | <0.5 ug/L | Trichlorobenzene,1,2,3- |
| <0.5 ug/L | Trichlorobenzene,1,2,4- | <0.5 ug/L | Trichloroethane,1,1,1- | <0.5 ug/L | Trichloroethane,1,1,2- |
| <0.5 ug/L | Trichloroethylene | <0.5 ug/L | Trichlorofluoromethane | <0.5 ug/L | Trichloropropane |
| <0.5 ug/L | Trimethylbenzene,1,2,4- | <0.5 ug/L | TRIMETHYLBENZENE,1,3 | <0.5 ug/L | Vinyl chloride |
| <0.5 ug/L | Xylenes | | | | |

# APPENDIX A

## 1999 Result Example

***Idaho Department of Water Resources Sample Results***
***Statewide Ground Water Quality Monitoring Program***

| Site ID | Station Name | Sample Date && Time | Sample ID |
|---|---|---|---|
| **461512116154601** | **34N 01E 25DDD1** | **July 14, 1999 2:15 PM** | **GWQM-1999-152** |

### Well Data

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| County | Lewis | Latitude | 46.25333333 | Longitude | -116.262777 | Altitude | 3200 ft |
| Water Use | H | | | Well Depth | 320 ft | Casing Depth | 320 ft |

### Inorganics and Field Analysis

| | | | | | |
|---|---|---|---|---|---|
| 22.0 °C | Air Temperature | 181 mg/L | Alkalinity | <.020 mg/L | Ammonia |
| <1 ug/L | Arsenic | 11 ug/L | Barium | 220 mg/L | Bicarbonate |
| <1.0 ug/L | Cadmium | 35 mg/L | Calcium | 0 mg/L | Carbonate |
| 3.5 mg/L | Chloride | <1.0 ug/L | Copper | 137.59 ft | Depth to Water |
| 7.0 mg/L | Dissolved Oxygen | <1 col/100 ml | Fecal Coliform | .46 mg/L | Fluoride |
| 130 mg/L | Hardness | <10 ug/L | Iron | 1.0 ug/L | Lead |
| 11 mg/L | Magnesium | <3.0 ug/L | Manganese | 1.80 mg/L | Nitrate |
| <.010 mg/L | Nitrite | 7.7 pH | pH | .087 mg/L | Phosphorus |
| 1.9 mg/L | Potassium | <1 ug/L | Selenium | 46 mg/L | Silica |
| 28 mg/L | Sodium | 256 mg/L | Solids | 379 uS/cm | Specific Conductance |
| 14 mg/L | Sulfate | 11.8 °C | Water Temperature | 180 ug/L | Zinc |

### Pesticides by Immunoassay

| | | | | | |
|---|---|---|---|---|---|
| ND ug/L | Alachlor | ND ug/L | Aldicarb | ND ug/L | Atrazine |
| ND ug/L | Carbofuran | ND ug/L | Chloropyrifos | ND ug/L | Cyanazine |
| ND ug/L | Metolachlor | ND ug/L | Metribuzin | | |

### Volatile Organic Compounds

| | | | | | |
|---|---|---|---|---|---|
| <0.50 ug/L | Benzene | <0.50 ug/L | Bromobenzene | <0.50 ug/L | Bromochloromethane |
| <0.50 ug/L | Bromoform | <0.50 ug/L | Bromomethane | <0.50 ug/L | Butylbenzene, n- |
| <0.50 ug/L | Butylbenzene, -sec | <0.50 ug/L | Carbon Tetrachloride | <0.50 ug/L | Chlorobenzene |
| <0.50 ug/L | Chloroethane | <0.50 ug/L | Chloroform | <0.50 ug/L | Chlorotoluene,-o |
| <0.50 ug/L | Chlorotoluene-p | <0.50 ug/L | Dibromochloromethane | <0.50 ug/L | Dibromochloropropane (DBCP) |
| <0.20 ug/L | Dibromoethane,1,2- (EDB) | <0.50 ug/L | Dibromomethane | <0.50 ug/L | Dichlorobenzene,1,2- |
| <0.50 ug/L | Dichlorobenzene,1,3- | <0.50 ug/L | Dichlorobenzene,1,4- | <0.50 ug/L | Dichlorobromomethane |
| <0.50 ug/L | Dichlorodifluoromethane | <0.50 ug/L | Dichloroethane,1,1- | <0.50 ug/L | Dichloroethane,1,2- |
| <0.50 ug/L | Dichloroethene,1,1- | <0.50 ug/L | Dichloroethene,1,2,cis- | <0.50 ug/L | Dichloroethene,1,2,trans- |
| <0.50 ug/L | Dichloropropane,1,2- | <0.50 ug/L | Dichloropropane,1,3- | <0.50 ug/L | Dichloropropane,1,3- |
| <0.50 ug/L | Dichloropropane,2,2- | <0.50 ug/L | Dichloropropene,1,1- | <0.50 ug/L | Ethylbenzene |
| <0.50 ug/L | Hexachlorobutadiene | <0.50 ug/L | Isodurene | <0.50 ug/L | Isopropylbenzene |
| <0.50 ug/L | Methyl tertiary butyl ether (MTBE) | <0.50 ug/L | Methylene chloride | <0.50 ug/L | Naphthalene |
| <0.50 ug/L | Paraldehyde | <0.50 ug/L | Styrene | <0.50 ug/L | Tetrachloroethane,1,1,1,2- |
| <0.50 ug/L | Tetrachloroethane,1,1,2,2- | <0.50 ug/L | Tetrachloroethylene | <0.50 ug/L | Tetralin |
| <0.50 ug/L | Toluene | <0.50 ug/L | Toluene, 2-Isopropyl- | <0.50 ug/L | Trichlorobenzene,1,2,3- |
| <0.50 ug/L | Trichlorobenzene,1,2,4- | <0.50 ug/L | Trichloroethane,1,1,1- | <0.50 ug/L | Trichloroethane,1,1,2- |
| <0.50 ug/L | Trichloroethylene | <0.50 ug/L | Trichlorofluoromethane | <0.50 ug/L | Trichloropropane |
| <0.50 ug/L | Trimethylbenzene,1,2,4- | <0.50 ug/L | TRIMETHYLBENZENE,1,3 | <0.50 ug/L | Vinyl chloride |
| <0.50 ug/L | Xylenes | | | | |

# APPENDIX A

## 2000 Result Example

### *Idaho Department of Water Resources Sample Results*
### *Statewide Ground Water Quality Monitoring Program*

| Site ID | Station Name | Sample Date && Time | Sample ID |
|---|---|---|---|
| **462056116535201** | **35N 05W 25ADD1** | **July 26, 2000 10:50 AM** | **GWQM-2000-184** |

### Well Data

County Nez Perce | Latitude 46.34888888 | Longitude -116.897777 | Altitude 1530 ft

Water Use H | Well Depth 585 ft | Casing Depth 333 ft

### Inorganics and Field Analysis

| | | | | | |
|---|---|---|---|---|---|
| 25.0 °C | Air Temperature | 138 mg/L | Alkalinity | <0.020 mg/L | Ammonia |
| 1.8 ug/L | Arsenic | 63 ug/L | Barium | 170 mg/L | Bicarbonate |
| <1.0 ug/L | Cadmium | 36.5 mg/L | Calcium | 0 mg/L | Carbonate |
| 23.5 mg/L | Chloride | 292.96 ft | Depth to Water | <1 col/100 ml | Fecal Coliform |
| 0.9 mg/L | Fluoride | 140 mg/L | Hardness | <10 ug/L | Iron |
| 11.2 mg/L | Magnesium | E1 ug/L | Manganese | 4.95 mg/L | Nitrate |
| <0.010 mg/L | Nitrite | 7.8 pH | pH | 0.020 mg/L | Phosphorus |
| 6.0 mg/L | Potassium | 1.1 ug/L | Selenium | 53.3 mg/L | Silica |
| 50.7 mg/L | Sodium | 338 mg/l | Solids | 520 uS/cm | Specific Conductance |
| 51.9 mg/L | Sulfate | 18.0 °C | Water Temperature | | |

### Nitrogen Isotope Ratio

| | |
|---|---|
| 8.46 ‰ | 15N Enrichment |

### Pesticides by Immunoassay

| | | | | | |
|---|---|---|---|---|---|
| ND ug/L | Acetochlor | ND ug/L | Alachlor | ND ug/L | Atrazine |
| ND ug/L | Metolachlor | | | | |

### Volatile Organic Compounds

| | | | | | |
|---|---|---|---|---|---|
| <0.5 ug/L | Benzene | <0.5 ug/L | Bromobenzene | <0.5 ug/L | Bromochloromethane |
| <0.5 ug/L | Bromoform | <0.5 ug/L | Bromomethane | <0.5 ug/L | Carbon Tetrachloride |
| <0.5 ug/L | Chlorobenzene | <0.5 ug/L | Chloroethane | <0.5 ug/L | Chloroform |
| <0.5 ug/L | Chloromethane | <0.5 ug/L | Chlorotoluene,-o | <0.5 ug/L | Chlorotoluene-p |
| <0.5 ug/L | Dibromochloromethane | <0.5 ug/L | Dibromochloropropane (DBCP) | <0.2 ug/L | Dibromoethane,1,2- (EDB) |
| <0.5 ug/L | Dibromomethane | <0.5 ug/L | Dichlorobenzene,1,2- | <0.5 ug/L | Dichlorobenzene,1,3- |
| <0.5 ug/L | Dichlorobenzene,1,4- | <0.5 ug/L | Dichlorobromomethane | <0.5 ug/L | Dichlorodifluoromethane |
| <0.5 ug/L | Dichloroethane,1,1- | <0.5 ug/L | Dichloroethane,1,2- | <0.5 ug/L | Dichloroethene,1,1- |
| <0.5 ug/L | Dichloroethene,1,2,cis- | <0.5 ug/L | Dichloroethene,1,2,trans- | <0.5 ug/L | Dichloropropane,1,2- |
| <0.5 ug/L | Dichloropropane,1,3- | <0.5 ug/L | Dichloropropane,2,2- | <0.5 ug/L | Dichloropropene,1,1- |
| <0.5 ug/L | Dichloropropene,e,z-1,3- | <0.5 ug/L | Ethylbenzene | <0.5 ug/L | Hexachlorobutadiene |
| <0.5 ug/L | Isopropylbenzene | <0.5 ug/L | Methyl tertiary butyl ether (MTBE) | <0.5 ug/L | Methylene chloride |
| <0.5 ug/L | Naphthalene | <0.5 ug/L | n-Butylbenzene | <0.5 ug/L | sec-Butylbenzene |
| <0.5 ug/L | Styrene | <0.5 ug/L | tert-Butylbenzene | <0.5 ug/L | Tetrachloroethane,1,1,1,2- |
| <0.5 ug/L | Tetrachloroethane,1,1,2,2- | <0.5 ug/L | Tetrachloroethylene | <0.5 ug/L | Toluene |
| <0.5 ug/L | Toluene, 4-Isopropyl- | <0.5 ug/L | Trichlorobenzene,1,2,3- | <0.5 ug/L | Trichlorobenzene,1,2,4- |
| <0.5 ug/L | Trichloroethane,1,1,1- | <0.5 ug/L | Trichloroethane,1,1,2- | <0.5 ug/L | Trichloroethylene |
| <0.5 ug/L | Trichlorofluoromethane | <0.5 ug/L | Trichloropropane,1,2,3- | <0.5 ug/L | Trimethylbenzene,1,2,4- |
| <0.5 ug/L | Trimethylbenzene,1,3,5- | <0.5 ug/L | Vinyl chloride | <0.5 ug/L | Xylenes |

# APPENDIX A

## 2001 Result Example

### *Idaho Department of Water Resources Sample Results*
### *Statewide Ground Water Quality Monitoring Program*

| Site ID | Station Name | Sample Date && Time | Sample ID |
|---|---|---|---|
| **462405116560001** | **35N 05W 02CCA1** | **August 26, 2001 8:30 PM** | **GWQM-2001-324** |

### Well Data

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| County | Nez Perce | Latitude | 46.40138888 | Longitude | -116.933333 | Altitude | 1400 ft |
| Water Use | U | | | Well Depth | 244 ft | Casing Depth | 244 ft |

### Inorganics and Field Analysis

| | | | | | |
|---|---|---|---|---|---|
| 33 °C | Air Temperature | 199 mg/L | Alkalinity | <0.04 mg/L | Ammonia |
| 4.1 ug/L | Arsenic | 35.1 ug/L | Barium | 240 mg/L | Bicarbonate |
| E0.03 ug/L | Cadmium | 35.5 mg/L | Calcium | 0 mg/L | Carbonate |
| 26.2 mg/L | Chloride | 1.4 ug/L | Copper | 4.7 mg/L | Dissolved Oxygen |
| <1 col/100 ml | Fecal Coliform | 0.7 mg/L | Fluoride | 190 mg/L | Hardness |
| 10 ug/L | Iron | 0.17 ug/L | Lead | 24.4 mg/L | Magnesium |
| E2 ug/L | Manganese | 2.46 mg/L | Nitrate | <0.006 mg/L | Nitrite |
| 8 pH | pH | E0.015 mg/L | Phosphorus | 7.14 mg/L | Potassium |
| 2.1 ug/L | Selenium | 46.7 mg/L | Silica | 61.5 mg/L | Sodium |
| 404 mg/l | Solids | 603 uS/cm | Specific Conductance | 70.7 mg/L | Sulfate |
| 17.3 °C | Water Temperature | 285 ug/L | Zinc | | |

### Nitrogen Isotope Ratio

| | |
|---|---|
| 4.77 ‰ | 15N Enrichment |

### Pesticides by Immunoassay

| | | | | | |
|---|---|---|---|---|---|
| ND ug/L | Alachlor | ND ug/L | Atrazine | ND ug/L | Metolachlor |

### Radiochemistry

| | | | | | |
|---|---|---|---|---|---|
| 2.2 pCi/L | Alpha, Gross | ±3.5 pCi/L | Alpha, Gross 2S | 9.3 pCi/L | Beta, Gross |
| ±2 pCi/L | Beta, Gross 2S | | | | |

### Volatile Organic Compounds

| | | | | | |
|---|---|---|---|---|---|
| <0.5 ug/L | Benzene | <0.5 ug/L | Bromobenzene | <0.5 ug/L | Bromochloromethane |
| <0.5 ug/L | Bromoform | <0.5 ug/L | Bromomethane | <0.5 ug/L | Carbon Tetrachloride |
| <0.5 ug/L | Chlorobenzene | <0.5 ug/L | Chloroethane | <0.5 ug/L | Chloroform |
| <0.5 ug/L | Chloromethane | <0.5 ug/L | Chlorotoluene,-o | <0.5 ug/L | Chlorotoluene-p |
| <0.5 ug/L | Dibromochloromethane | <0.5 ug/L | Dibromochloropropane (DBCP) | <0.2 ug/L | Dibromoethane,1,2- (EDB) |
| <0.5 ug/L | Dibromomethane | <0.5 ug/L | Dichlorobenzene,1,2- | <0.5 ug/L | Dichlorobenzene,1,3- |
| <0.5 ug/L | Dichlorobenzene,1,4- | <0.5 ug/L | Dichlorobromomethane | <0.5 ug/L | Dichlorodifluoromethane |
| <0.5 ug/L | Dichloroethane,1,1- | <0.5 ug/L | Dichloroethane,1,2- | <0.5 ug/L | Dichloroethene,1,1- |
| <0.5 ug/L | Dichloroethene,1,2,cis- | <0.5 ug/L | Dichloroethene,1,2,trans- | <0.5 ug/L | Dichloropropane,1,2- |
| <0.5 ug/L | Dichloropropane,1,3- | <0.5 ug/L | Dichloropropane,2,2- | <0.5 ug/L | Dichloropropene,1,1- |
| <0.5 ug/L | Dichloropropene,e,z-1,3- | <0.5 ug/L | Ethylbenzene | <0.5 ug/L | Hexachlorobutadiene |
| <0.5 ug/L | Isopropylbenzene | <0.5 ug/L | Methyl tertiary butyl ether (MTBE) | <0.5 ug/L | Methylene chloride |
| <0.5 ug/L | Naphthalene | <0.5 ug/L | n-Butylbenzene | <0.5 ug/L | n-Propylbenzene |
| <0.5 ug/L | sec-Butylbenzene | <0.5 ug/L | Styrene | <0.5 ug/L | tert-Butylbenzene |
| <0.5 ug/L | Tetrachloroethane,1,1,1,2- | <0.5 ug/L | Tetrachloroethane,1,1,2,2- | <0.5 ug/L | Tetrachloroethylene |
| <0.5 ug/L | Toluene | <0.5 ug/L | Toluene, 4-Isopropyl- | <0.5 ug/L | Trichlorobenzene,1,2,3- |
| <0.5 ug/L | Trichlorobenzene,1,2,4- | <0.5 ug/L | Trichloroethane,1,1,1- | <0.5 ug/L | Trichloroethane,1,1,2- |
| <0.5 ug/L | Trichloroethylene | <0.5 ug/L | Trichlorofluoromethane | <0.5 ug/L | Trichloropropane,1,2,3- |
| <0.5 ug/L | Trimethylbenzene,1,2,4- | <0.5 ug/L | Trimethylbenzene,1,3,5- | <0.5 ug/L | Vinyl chloride |
| <0.5 ug/L | Xylenes | | | | |

## APPENDIX A

### 2002 Result Example

***Idaho Department of Water Resources Sample Results***
***Statewide Ground Water Quality Monitoring Program***

| Site ID | Station Name | Sample Date && Time | Sample ID |
|---|---|---|---|
| **460533116213601** | **32N 01E 20CDC1** | **July 31, 2002 10:30 AM** | **GWQM-2002-236** |

### Well Data

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| County | Idaho | Latitude | 46.09263888 | Longitude | -116.36 | Altitude | 3664 ft |
| Water Use | H | | | Well Depth | 100 ft | Casing Depth | |

### Hormones by Immunoassay

| | |
|---|---|
| ND ug/L | Estradiol |

### Inorganics and Field Analysis

| | | | | | |
|---|---|---|---|---|---|
| 22 °C | Air Temperature | 164 mg/L | Alkalinity | <0.04 mg/L | Ammonia |
| 0.3 ug/L | Arsenic | 9.2 ug/L | Barium | 200 mg/L | Bicarbonate |
| 0.05 ug/L | Cadmium | 35.7 mg/L | Calcium | 0 mg/L | Carbonate |
| 1.65 mg/L | Chloride | 1.9 ug/l | Copper | 0.2 mg/L | Dissolved Oxygen |
| <1 col/100 ml | Fecal Coliform | 0.5 mg/L | Fluoride | 140 mg/L | Hardness |
| 20 ug/L | Iron | <0.08 ug/l | Lead | 12.6 mg/L | Magnesium |
| 50.4 ug/L | Manganese | 0.32 mg/L | Nitrate | <0.008 mg/L | Nitrite |
| 7 ph | pH | 0.02 mg/L | Phosphorus | 0.64 mg/L | Potassium |
| 2.8 ug/L | Selenium | 34.6 mg/L | Silica | 29.1 mg/L | Sodium |
| 243 mg/l | Solids | 359 uS/cm | Specific Conductance | 27.3 mg/L | Sulfate |
| 11 °C | Water Temperature | 15 ug/l | Zinc | | |

### Pesticides by Immunoassay

| | | | |
|---|---|---|---|
| ND ug/L | Atrazine | ND ug/L | Metolachlor |

\

### Volatile Organic Compounds

| | | | | | |
|---|---|---|---|---|---|
| <0.5 ug/L | Benzene | <0.5 ug/L | Bromobenzene | <0.5 ug/L | Bromochloromethane |
| <0.5 ug/L | Bromoform | <0.5 ug/L | Bromomethane | <0.5 ug/L | Carbon Tetrachloride |
| <0.5 ug/L | Chlorobenzene | <0.5 ug/L | Chloroethane | <0.5 ug/L | Chloroform |
| <0.5 ug/L | Chloromethane | <0.5 ug/L | Chlorotoluene,-o | <0.5 ug/L | Chlorotoluene-p |
| <0.5 ug/L | Dibromochloromethane | <0.5 ug/L | Dibromochloropropane (DBCP) | <0.2 ug/L | Dibromoethane,1,2- (EDB) |
| <0.5 ug/L | Dibromomethane | <0.5 ug/L | Dichlorobenzene,1,2- | <0.5 ug/L | Dichlorobenzene,1,3- |
| <0.5 ug/L | Dichlorobenzene,1,4- | <0.5 ug/L | Dichlorobromomethane | <0.5 ug/L | Dichlorodifluoromethane |
| <0.5 ug/L | Dichloroethane,1,1- | <0.5 ug/L | Dichloroethane,1,2- | <0.5 ug/L | Dichloroethene,1,1- |
| <0.5 ug/L | Dichloroethene,1,2,cis- | <0.5 ug/L | Dichloroethene,1,2,trans- | <0.5 ug/L | Dichloropropane,1,2- |
| <0.5 ug/L | Dichloropropane,1,3- | <0.5 ug/L | Dichloropropane,2,2- | <0.5 ug/L | Dichloropropene,1,1- |
| <0.5 ug/L | Dichloropropene,e,z-1,3- | <0.5 ug/L | Ethylbenzene | <0.5 ug/L | Hexachlorobutadiene |
| <0.5 ug/L | Isopropylbenzene | <0.5 ug/L | Methyl tertiary butyl ether (MTBE) | <0.5 ug/L | Methylene chloride |
| <0.5 ug/L | Naphthalene | <0.5 ug/L | n-Butylbenzene | <0.5 ug/L | n-Propylbenzene |
| <0.5 ug/L | sec-Butylbenzene | <0.5 ug/L | Styrene | <0.5 ug/L | tert-Butylbenzene |
| <0.5 ug/L | Tetrachloroethane,1,1,1,2- | <0.5 ug/L | Tetrachloroethane,1,1,2,2- | <0.5 ug/L | Tetrachloroethylene |
| <0.5 ug/L | Toluene | <0.5 ug/L | Toluene, 4-Isopropyl- | <0.5 ug/L | Trichlorobenzene,1,2,3- |
| <0.5 ug/L | Trichlorobenzene,1,2,4- | <0.5 ug/L | Trichloroethane,1,1,1- | <0.5 ug/L | Trichloroethane,1,1,2- |
| <0.5 ug/L | Trichloroethylene | <0.5 ug/L | Trichlorofluoromethane | <0.5 ug/L | Trichloropropane,1,2,3- |
| <0.5 ug/L | Trimethylbenzene,1,2,4- | <0.5 ug/L | Trimethylbenzene,1,3,5- | <0.5 ug/L | Vinyl chloride |
| <0.5 ug/L | Xylenes | | | | |

## 11.2. Appendix B. Clearwater Subarea Ground Water Quality Results - Statewide Program 1990 – 2002

| Station | Sampling Date | County | Alkalinity (mg/l) | NH3 (mg/l) | As (ug/l) | Ba (ug/l) | HCO3 (mg/l) | Cd (ug/l) | Ca (mg/l) | CO3 (mg/l) | Cl (mg/l) | Cr (ug/l) | Cu (ug/l) | DO (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28N 01E 15CBB1 | 9/1/1993 | Idaho | 120 | 0.02 | 25 | | 137 | 0 | 12 | 5 | 29 | 0 | 0 | |
| 28N 01E 15CBB1 | 8/20/1997 | Idaho | 128 | 0 | 26 | | 150 | 0 | 10 | 5 | 26 | 0 | 0 | |
| 28N 01E 15CBB1 | 8/30/2001 | Idaho | 96 | 0 | 22 | 4 | 120 | 0 | 13.2 | 5 | 45.3 | | | 0.3 |
| 28N 01E 22DCA1 | 9/1/1993 | Idaho | 119 | 0.01 | 0 | | 122 | 0 | 3 | 11 | 5.9 | 0 | 4 | |
| 28N 01E 22DCA1 | 8/20/1997 | Idaho | 144 | 0.026 | 0 | | 160 | 0 | 3.2 | 8 | 3.3 | 0 | 0 | |
| 28N 01E 22DCA1 | 7/30/2002 | Idaho | 116 | 0.04 | 0.1 | 1.9 | 130 | 0.04 | 3.05 | 6 | 7.31 | | | 3.4 |
| 28N 01E 35CAD1 | 8/10/1994 | Idaho | 194 | 0.02 | 0 | | 236 | 0 | 29 | 0 | 8 | 0 | 0 | |
| 28N 01E 35CAD1 | 7/22/1998 | Idaho | 150 | 0.049 | 0 | | 180 | 0 | 33 | 0 | 8.9 | 0 | 0 | 0 |
| 29N 02E 04DDA1 | 9/1/1993 | Idaho | 56 | 0.02 | 0 | | 69 | 0 | 9.1 | 0 | 0.5 | 0 | 40 | |
| 29N 02E 04DDA1 | 8/18/1997 | Idaho | 58 | 0 | 0 | | 70 | 0 | 9.1 | 0 | 0.32 | 0 | 38 | |
| 29N 02E 04DDA1 | 7/30/2002 | Idaho | 56 | 0.02 | 0.2 | 0.5 | 68 | 0.03 | 10.1 | 0 | 0.65 | | | 9.5 |
| 29N 03E 05ABD1 | 8/11/1994 | Idaho | 94 | 0.02 | 0 | | 114 | 0 | 18 | 0 | 0.9 | 0 | 0 | |
| 29N 03E 05ABD1 | 7/22/1998 | Idaho | 66 | 0.03 | 1 | | 81 | 0 | 18 | 0 | 1 | 0 | 0 | 0 |
| 30N 01W 02AAA1 | 9/5/1991 | Idaho | 84 | 0.01 | 0 | | 102 | 0 | 15 | 0 | 0.3 | 0 | 2 | |
| 30N 01W 02AAA1 | 8/8/1995 | Idaho | 72 | 0 | 0 | | 88 | 0 | 15 | 0 | 1.2 | 0 | 2 | |
| 30N 01W 02AAA1 | 7/13/1999 | Idaho | 69 | 0 | 0 | 3 | 84 | 0 | 15 | 0 | 1.7 | | 1.3 | 20 |
| 30N 01W 26ADD1 | 8/10/1994 | Idaho | 74 | 0.19 | 0 | | 36 | 0 | 4.7 | 27 | 28 | 0 | 0 | |
| 30N 01W 26ADD1 | 7/24/1998 | Idaho | 63 | 0.161 | 1 | | 22 | 0 | 4.9 | 27 | 31 | 0 | 0 | 0 |
| 30N 02E 13CBA1 | 8/29/2001 | Idaho | 133 | 0 | 0.1 | 9.9 | 160 | 0 | 25.6 | 0 | 1.9 | | 0.7 | 3.9 |
| 30N 03E 09BBC1 | 8/9/1990 | Idaho | 155 | 0.04 | 0 | | 189 | 1 | 26 | 0 | 3.1 | 0 | 0 | |
| 30N 03E 09BBC1 | 9/11/1993 | Idaho | 154 | 0.05 | 0 | | 188 | 0 | 25 | 0 | 2.6 | 0 | 0 | |
| 30N 03E 09BBC1 | 8/19/1997 | Idaho | 150 | 0.043 | 0 | | 180 | 0 | 29 | 0 | 1.4 | 0 | 0 | |
| 30N 03E 09BBC1 | 7/30/2002 | Idaho | 152 | 0.04 | 0.2 | 49.9 | 185 | 0.04 | 28.3 | 0 | 2.41 | | | 0.5 |
| 30N 03E 17BAB1 | 9/11/1993 | Idaho | 147 | 0.04 | 0 | | 180 | 0 | 22 | 0 | 1.4 | 0 | 0 | |
| 30N 03E 20AAC1 | 9/4/1991 | Idaho | 123 | 0 | 0 | | 151 | 0 | 21 | 0 | 5.8 | 0 | 64 | |
| 30N 03E 20AAC1 | 7/20/1995 | Idaho | 124 | 0.02 | 0 | | 152 | 0 | 22 | 0 | 3.3 | 0 | 6 | |
| 30N 03E 20AAC1 | 7/12/1999 | Idaho | 179 | 0 | 0 | 70 | 220 | 0 | 19 | 0 | 1.6 | | 27 | 2.2 |
| 31N 01E 02AAA1 | 8/11/1994 | Idaho | 121 | 0.02 | 0 | | 148 | 0 | 24 | 0 | 2 | 0 | 1 | |
| 31N 01E 02AAA1 | 8/19/1998 | Idaho | 122 | 0.076 | 0 | | 150 | 0 | 23 | 0 | 1.9 | 0 | 0 | 0 |
| 31N 01E 08ABB3 | 9/4/1991 | Idaho | 153 | 0 | 0 | | 187 | 0 | 29 | 0 | 1.4 | 0 | 0 | |
| 31N 01E 08ABB3 | 8/8/1995 | Idaho | 153 | 0 | 0 | | 186 | 0 | 30 | 0 | 4.4 | 0 | 0 | |
| 31N 01E 08ABB3 | 8/6/1996 | Idaho | 153 | 0.03 | 0 | | 186 | 0 | 29 | 0 | 3.7 | 0 | 0 | |
| 31N 01E 08ABB3 | 8/19/1997 | Idaho | 150 | 0.017 | 0 | | 180 | 0 | 29 | 0 | 3.7 | 0 | 1.3 | |

| Station | Sampling Date | County | Alkalinity (mg/l) | NH3 (mg/l) | As (ug/l) | Ba (ug/l) | HCO3 (mg/l) | Cd (ug/l) | Ca (mg/l) | CO3 (mg/l) | Cl (mg/l) | Cr (ug/l) | Cu (ug/l) | DO (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31N 01E 08ABB3 | 8/19/1998 | Idaho | 146 | 0.086 | 0 | | 180 | 0 | 26 | 0 | 2.5 | 0 | 0 | 0 |
| 31N 01E 08ABB3 | 7/13/1999 | Idaho | 99 | 0 | 0 | 5.6 | 120 | 0 | 16 | 0 | 1.7 | | 0 | 5.4 |
| 31N 01E 08ABB3 | 8/1/2000 | Idaho | 153 | 0 | 0 | 15 | 190 | 0 | 27.7 | 0 | 2.9 | | | 0.4 |
| 31N 01E 08ABB3 | 8/29/2001 | Idaho | 122 | 0 | 0.3 | 9.6 | 150 | 0.02 | 25.4 | 0 | 2.2 | | | 1.6 |
| 31N 01E 08ABB3 | 7/31/2002 | Idaho | 141 | 0.04 | 0.2 | 15.1 | 172 | 0.04 | 26.8 | 0 | 4.12 | | | 0.5 |
| 31N 02E 29BBA1 | 8/10/1994 | Idaho | 137 | 0.02 | 0 | | 168 | 0 | 33 | 0 | 7.1 | 0 | 2 | |
| 31N 02E 29BBA1 | 8/19/1998 | Idaho | 143 | 0.074 | 0 | | 180 | 0 | 33 | 0 | 7.3 | 0 | 1.8 | 0 |
| 31N 02E 35ADB1 | 9/5/1991 | Idaho | 152 | 0 | 0 | | 185 | 0 | 39 | 0 | 6.2 | 0 | 6 | |
| 31N 02E 35ADB1 | 7/21/1995 | Idaho | 153 | 0.02 | 0 | | 186 | 0 | 40 | 0 | 5.6 | 0 | 4 | |
| 31N 02E 35ADB1 | 7/12/1999 | Idaho | 172 | 0 | 0 | 32 | 210 | 0 | 39 | 0 | 6.1 | | 2.1 | 2.1 |
| 31N 03E 36BCA1 | 9/18/1992 | Idaho | 172 | 0.04 | 0 | | 210 | 0 | 27 | 0 | 0.1 | 0 | 0 | |
| 31N 03E 36BCA1 | 7/20/1995 | Idaho | 164 | 0.05 | 0 | | 200 | 0 | 26 | 0 | 1.8 | 0 | 0 | |
| 31N 03E 36BCA1 | 8/7/1996 | Idaho | 160 | 0.05 | 0 | | 195 | 0 | 24 | 0 | 1.8 | 0 | 0 | |
| 31N 03E 36BCA1 | 8/19/1997 | Idaho | 147 | 0.034 | 0 | | 180 | 0 | 25 | 0 | 1.9 | 0 | 0 | |
| 31N 03E 36BCA1 | 7/23/1998 | Idaho | 107 | 0 | 0 | | 130 | 0 | 23 | 0 | 1.9 | 0 | 0 | 0 |
| 31N 03E 36BCA1 | 7/12/1999 | Idaho | 152 | 0 | 0 | 65 | 180 | 0 | 24 | 0 | 2.7 | | 0 | 0.2 |
| 31N 03E 36BCA1 | 8/2/2000 | Idaho | 150 | 0.025 | 0 | 62 | 180 | 0 | 23.5 | 0 | 2.2 | | | 2.2 |
| 31N 03E 36BCA1 | 8/29/2001 | Idaho | 153 | 0 | 0.2 | 68.6 | 190 | 0 | 25.2 | 0 | 2.3 | | | 0.5 |
| 31N 03E 36BCA1 | 8/1/2002 | Idaho | 155 | 0.04 | 0.2 | 72.5 | 189 | 0.04 | 24.8 | 0 | 2.61 | | | 3.6 |
| 32N 01E 20CDC1 | 7/31/2002 | Idaho | 164 | 0.04 | 0.3 | 9.2 | 200 | 0.05 | 35.7 | 0 | 1.65 | | 1.9 | 0.2 |
| 32N 01W 19DBC1 | 9/14/1992 | Idaho | 93 | 0.04 | 0 | | 114 | 0 | 21 | 0 | 2.5 | 0 | 0 | |
| 32N 01W 19DBC1 | 8/6/1996 | Idaho | 92 | 0.04 | 0 | | 112 | 0 | 20 | 0 | 1 | 0 | 0 | |
| 32N 01W 19DBC1 | 8/1/2000 | Idaho | 86 | 0 | 0 | 28 | 100 | 0 | 18.7 | 0 | 1 | | | 0.4 |
| 32N 02E 14ACA1 | 7/31/2002 | Idaho | 192 | 0.04 | 0.2 | 51.7 | 235 | 0.03 | 38.3 | 0 | 7.03 | | 0.3 | 0.4 |
| 32N 03E 11DCC1 | 9/23/1992 | Idaho | 311 | 0 | 0 | | 380 | 0 | 50 | 0 | 21 | 0 | 3 | |
| 32N 03E 11DCC1 | 7/17/1996 | Idaho | 291 | 0.03 | 0 | | 356 | 0 | 50 | 0 | 12 | 0 | 4 | |
| 32N 03E 11DCC1 | 8/2/2000 | Idaho | 261 | 0 | 0 | 76 | 320 | 0 | 41.4 | 0 | 10.8 | | | 1.4 |
| 32N 03E 35AAC1 | 9/9/1993 | Idaho | 179 | 0.01 | 0 | | 219 | 0 | 39 | 0 | 2 | 0 | 5 | |
| 32N 03W 01BBC1 | 8/21/2002 | Lewis | 81 | 0.04 | 0.2 | 2.8 | 98 | 0.04 | 15.9 | 0 | 0.45 | | 0.3 | 6.7 |
| 33N 01E 13CAC1 | 9/18/1992 | Lewis | 222 | 0.02 | 0 | | 271 | 0 | 31 | 0 | 11 | 0 | 1 | |
| 33N 01E 13CAC1 | 8/6/1996 | Lewis | 233 | 0.02 | 0 | | 284 | 0 | 100 | 0 | 40 | 0 | 3 | |
| 33N 01E 13CAC1 | 7/26/2000 | Lewis | 184 | 0 | 0 | 12 | 220 | 0 | 65.4 | 0 | 18.3 | | | |
| 33N 01W 09DCC1 | 8/9/1994 | Lewis | 150 | 0.02 | 0 | | 183 | 0 | 30 | 0 | 2.7 | 0 | 2 | |

| Station | Sampling Date | County | Alkalinity (mg/l) | NH3 (mg/l) | As (ug/l) | Ba (ug/l) | HCO3 (mg/l) | Cd (ug/l) | Ca (mg/l) | CO3 (mg/l) | Cl (mg/l) | Cr (ug/l) | Cu (ug/l) | DO (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33N 01W 09DCC1 | 8/19/1998 | Lewis | 164 | 0.071 | 0 | | 200 | 0 | 32 | 0 | 3.3 | 0 | 1.6 | 0 |
| 33N 01W 27DBC1 | 8/11/1993 | Idaho | 119 | 0.01 | 0 | | 145 | 0 | 23 | 0 | 0.8 | 0 | 0 | |
| 33N 01W 27DBC1 | 8/19/1997 | Idaho | 129 | 0 | 0 | | 160 | 0 | 24 | 0 | 0.6 | 0 | 1.7 | |
| 33N 01W 27DBC1 | 8/29/2001 | Idaho | 129 | 0 | 0.5 | 53.7 | 160 | 0 | 24.3 | 0 | 1 | | | 5.3 |
| 33N 01W 29BDD1 | 8/11/1993 | Lewis | 125 | 0.01 | 0 | | 152 | 0 | 28 | 0 | 1 | 1 | 0 | |
| 33N 01W 29BDD1 | 7/16/1997 | Lewis | 124 | 0 | 0 | | 150 | 0 | 29 | 0 | 0.95 | 0 | 0 | |
| 33N 01W 29BDD1 | 8/21/2002 | Lewis | 131 | 0.04 | 0.2 | 5.1 | 160 | 0.04 | 30.6 | 0 | 1.77 | | | 7.9 |
| 33N 02E 11BAA1 | 8/23/1994 | Lewis | 164 | 0 | 0 | | 200 | 0 | 54 | 0 | 28 | 0 | 2 | |
| 33N 02E 11BAA1 | 7/23/1998 | Lewis | 219 | 0 | 0 | | 270 | 0 | 140 | 0 | 55 | 0 | 3.1 | 0 |
| 33N 02E 11BAA1 | 8/19/1998 | Lewis | 0 | 0.079 | 0 | | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| 33N 02W 10AAB1 | 8/8/2002 | Lewis | 139 | 0.04 | 0.3 | 112 | 170 | 0.04 | 60.4 | 0 | 11.8 | | 1.2 | 6.6 |
| 33N 03E 07DAD1 | 10/15/1990 | Lewis | 136 | 0.09 | 0 | | 165 | 0 | 24 | 0 | 1.5 | 0 | 2 | |
| 33N 03W 06DBD1 | 8/12/1994 | Nez Perce | 140 | 0.05 | 0 | | 149 | 0 | 22 | 11 | 0.6 | 0 | 2 | |
| 33N 03W 06DBD1 | 8/13/1998 | Nez Perce | 110 | 0.075 | 0 | | 130 | 0 | 22 | 0 | 0.52 | 0 | 1.4 | 0 |
| 33N 03W 32ABA1 | 8/12/1993 | Nez Perce | 55 | 0 | 0 | | 67 | 0 | 10 | 0 | 0.6 | 0 | 0 | |
| 33N 03W 32ABA1 | 7/16/1997 | Nez Perce | 49 | 0 | 0 | | 60 | 0 | 9.5 | 0 | 0.41 | 0 | 0 | |
| 33N 03W 32ABA1 | 8/27/2001 | Nez Perce | 52 | 0 | 0 | 3.6 | 64 | 0 | 10 | 0 | 0.7 | | | 3.3 |
| 33N 03W 33BBB1 | 9/3/1991 | Nez Perce | 0 | 0 | 0 | | 0 | 0 | 8.5 | 0 | 1.7 | 0 | 2 | |
| 33N 04W 09DBB1 | 8/12/1993 | Nez Perce | 37 | 0.01 | 0 | | 45 | 0 | 7 | 0 | 0.8 | 0 | 5 | |
| 33N 04W 09DBB1 | 7/16/1997 | Nez Perce | 33 | 0 | 0 | | 40 | 0 | 6.8 | 0 | 0.79 | 0 | 2 | |
| 33N 04W 09DBB1 | 8/27/2001 | Nez Perce | 32 | 0.021 | 0.1 | 4.8 | 39 | 0 | 7.04 | 0 | 0.8 | | | 3.2 |
| 33N 04W 18DDB1 | 8/11/1994 | Nez Perce | 86 | 0.02 | 1 | | 105 | 0 | 23 | 0 | 0.9 | 1 | 0 | |
| 33N 04W 18DDB1 | 8/13/1998 | Nez Perce | 90 | 0.077 | 1 | | 110 | 0 | 24 | 0 | 0.85 | 2.4 | 0 | 0 |
| 34N 01E 16CBB1 | 9/25/2001 | Lewis | 173 | 0 | 0.4 | 9.9 | 210 | 0 | 26.6 | 0 | 3.7 | | 3 | 0.1 |
| 34N 01E 25DDD1 | 8/14/1991 | Lewis | 188 | 0 | 0 | | 229 | 0 | 38 | 0 | 4.7 | 0 | 0 | |
| 34N 01E 25DDD1 | 7/19/1995 | Lewis | 180 | 0.03 | 0 | | 220 | 0 | 38 | 0 | 2.1 | 0 | 0 | |
| 34N 01E 25DDD1 | 7/14/1999 | Lewis | 181 | 0 | 0 | 11 | 220 | 0 | 35 | 0 | 3.5 | | 0 | 7 |
| 34N 01W 18DDD1 | 9/25/2001 | Lewis | 142 | 0.038 | 0.1 | 22.7 | 170 | 0 | 33 | 0 | 1 | | 1.6 | 11 |
| 34N 01W 34DAD1 | 8/14/1991 | Lewis | 190 | 0 | 0 | | 232 | 0 | 42 | 0 | 4.5 | 0 | 1 | |
| 34N 02E 25ABB1 | 8/12/1993 | Lewis | 110 | 0.01 | 0 | | 134 | 0 | 19 | 0 | 0.6 | 0 | 7 | |
| 34N 02E 25ABB1 | 7/17/1997 | Lewis | 103 | 0 | 0 | | 130 | 0 | 20 | 0 | 0.74 | 0 | 1.2 | |
| 34N 02E 25ABB1 | 8/19/2002 | Lewis | 107 | 0.04 | 0.2 | 5.2 | 130 | 0.04 | 20.7 | 0 | 1.44 | | | 7.1 |
| 34N 02E 34BDD1 | 8/10/1994 | Lewis | 200 | 0.05 | 0 | | 244 | 0 | 37 | 0 | 2 | 0 | 2 | |

| Station | Sampling Date | County | Alkalinity (mg/l) | NH3 (mg/l) | As (ug/l) | Ba (ug/l) | HCO3 (mg/l) | Cd (ug/l) | Ca (mg/l) | CO3 (mg/l) | Cl (mg/l) | Cr (ug/l) | Cu (ug/l) | DO (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 34N 02W 10ACA1 | 8/25/1993 | Lewis | 253 | 0.01 | 0 | | 308 | 0 | 58 | 0 | 0.2 | 0 | 0 | |
| 34N 02W 10ACA1 | 7/17/1997 | Lewis | 248 | 0 | 0 | | 300 | 0 | 55 | 0 | 2.3 | 0 | 1.1 | |
| 34N 02W 10ACA1 | 9/24/2001 | Lewis | 249 | 0 | 0.1 | 6.6 | 300 | 0 | 64 | 0 | 3.8 | | | 8.2 |
| 34N 02W 22BCC1 | 8/9/1994 | Lewis | 192 | 0.02 | 0 | | 234 | 0 | 38 | 0 | 1 | 0 | 3 | |
| 34N 02W 22BCC1 | 8/13/1998 | Lewis | 202 | 0.045 | 0 | | 250 | 0 | 46 | 0 | 0.86 | 0 | 3.3 | 0 |
| 34N 02W 31DAA1 | 8/11/1993 | Lewis | 143 | 0.02 | 0 | | 174 | 0 | 26 | 0 | 1.4 | 0 | 0 | |
| 34N 02W 31DAA1 | 7/16/1997 | Lewis | 150 | 0.015 | 0 | | 180 | 0 | 27 | 0 | 1.8 | 0 | 0 | |
| 34N 02W 31DAA1 | 9/25/2001 | Lewis | 146 | 0 | 0 | 9.5 | 180 | 0 | 27.5 | 0 | 2 | | | |
| 34N 03W 04ABD1 | 9/14/1992 | Lewis | 124 | 0.01 | 0 | | 152 | 0 | 22 | 0 | 1.3 | 0 | 1 | |
| 34N 03W 04ABD1 | 8/7/1996 | Lewis | 125 | 0.02 | 0 | | 152 | 0 | 23 | 0 | 1.2 | 0 | 1 | |
| 34N 03W 04ABD1 | 7/27/2000 | Lewis | 111 | 0 | 0 | 4 | 140 | 0 | 23.2 | 0 | 1.5 | | | |
| 35N 01W 08DAA1 | 8/24/1994 | Nez Perce | 116 | 0 | 0 | | 142 | 0 | 17 | 0 | 1 | 0 | 0 | |
| 35N 01W 08DAA1 | 8/19/1998 | Nez Perce | 115 | 0.084 | 0 | | 140 | 0 | 17 | 0 | 1 | 0 | 0 | 0 |
| 35N 01W 19AADC1 | 9/15/1992 | Nez Perce | 164 | 0.05 | 2 | | 200 | 0 | 25 | 0 | 1.8 | 0 | 0 | |
| 35N 01W 19AADC1 | 8/7/1996 | Nez Perce | 164 | 0.02 | 1 | | 200 | 0 | 24 | 0 | 1.6 | 0 | 0 | |
| 35N 01W 19AADC1 | 7/27/2000 | Nez Perce | 146 | 0 | 1.6 | 38 | 180 | 0 | 25.5 | 0 | 2.3 | | | |
| 35N 02E 32BCC1 | 8/25/1993 | Lewis | 163 | 0.01 | 0 | | 199 | 0 | 29 | 0 | 0.9 | 0 | 10 | |
| 35N 02E 32BCC1 | 7/17/1997 | Lewis | 158 | 0 | 0 | | 190 | 0 | 30 | 0 | 0.92 | 0 | 1 | |
| 35N 02E 32BCC1 | 8/19/2002 | Lewis | 136 | 0.04 | 0.3 | 3.4 | 166 | 0.04 | 30 | 0 | 1.94 | | | 10.6 |
| 35N 02W 25BBA1 | 8/9/1994 | Nez Perce | 204 | 0.03 | 0 | | 249 | 0 | 39 | 0 | 2 | 0 | 0 | |
| 35N 02W 25BBA1 | 8/13/1998 | Nez Perce | 214 | 0.066 | 0 | | 260 | 0 | 38 | 0 | 1.9 | 0 | 0 | 0 |
| 35N 03W 15DAD1 | 8/9/1994 | Nez Perce | 112 | 0.02 | 0 | | 137 | 0 | 29 | 0 | 3.6 | 0 | 0 | |
| 35N 03W 15DAD1 | 8/13/1998 | Nez Perce | 112 | 0.062 | 0 | | 140 | 0 | 27 | 0 | 3.3 | 0 | 0 | 0 |
| 35N 04W 02ABD1 | 8/8/1994 | Nez Perce | 116 | 0.02 | 0 | | 142 | 0 | 25 | 0 | 1.5 | 0 | 0 | |
| 35N 04W 02ABD1 | 8/18/1998 | Nez Perce | 117 | 0.027 | 0 | | 140 | 0 | 24 | 0 | 1.5 | 0 | 0 | 0 |
| 35N 04W 14DDD1 | 8/8/2002 | Nez Perce | 119 | 0.04 | 0.5 | 35.4 | 145 | 0.02 | 25.1 | 0 | 2.65 | | 0.4 | 3.5 |
| 35N 04W 23ABA1 | 8/7/1990 | Nez Perce | 155 | 0.02 | 0 | | 189 | 1 | 38 | 0 | 6.2 | 2 | 1 | |
| 35N 05W 02CCA1 | 8/26/2001 | Nez Perce | 199 | 0 | 4.1 | 35.1 | 240 | 0.03 | 35.5 | 0 | 26.2 | | 1.4 | 4.7 |
| 35N 05W 21CDB1 | 8/8/1990 | Nez Perce | 189 | 0.05 | 0 | | 230 | 1 | 41 | 0 | 17 | 0 | 0 | |
| 35N 05W 21CDB1 | 8/8/2002 | Nez Perce | 188 | 0.04 | 0.2 | 29.7 | 230 | 0.04 | 40.4 | 0 | 17.7 | | 1.5 | 0.5 |
| 35N 05W 25ADD1 | 10/17/1990 | Nez Perce | 161 | 0.01 | 2 | | 197 | 0 | 37 | 0 | 20 | 0 | 1 | |
| 35N 05W 25ADD1 | 9/15/1992 | Nez Perce | 145 | 0.02 | 2 | | 177 | 0 | 24 | 0 | 15 | 0 | 0 | |
| 35N 05W 25ADD1 | 8/9/1996 | Nez Perce | 199 | 0.02 | 2 | | 243 | 0 | 46 | 0 | 22 | 0 | 0 | |

| Station | Sampling Date | County | Alkalinity (mg/l) | NH3 (mg/l) | As (ug/l) | Ba (ug/l) | HCO3 (mg/l) | Cd (ug/l) | Ca (mg/l) | CO3 (mg/l) | Cl (mg/l) | Cr (ug/l) | Cu (ug/l) | DO (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35N 05W 25ADD1 | 7/26/2000 | Nez Perce | 138 | 0 | 1.8 | 63 | 170 | 0 | 36.5 | 0 | 23.5 | | | |
| 35N 06W 24CCA2 | 8/10/1993 | Nez Perce | 167 | 0 | 2 | | 203 | 0 | 56 | 0 | 52 | 0 | 0 | |
| 35N 06W 24CCA2 | 7/15/1997 | Nez Perce | 142 | 0.026 | 2 | | 170 | 0 | 41 | 0 | 32 | 0 | 0 | |
| 35N 06W 24CCA2 | 8/15/1997 | Nez Perce | 0 | 0 | 2 | | 0 | 0 | 44 | 0 | 43 | 0 | 0 | |
| 35N 06W 24CCA2 | 8/8/2002 | Nez Perce | 118 | 0.04 | 1.7 | 15.9 | 144 | 0.04 | 21.4 | 0 | 17.4 | | | 0.5 |
| 36N 01E 13CCB1 | 10/16/1990 | Clearwater | 230 | 0.01 | 0 | | 281 | 0 | 40 | 0 | 1.4 | 0 | 1 | |
| 36N 01E 25CDA1 | 8/10/1994 | Clearwater | 86 | 0.01 | 0 | | 105 | 0 | 13 | 0 | 2.1 | 0 | 2 | |
| 36N 02W 24BBC1 | 8/24/1994 | Nez Perce | 139 | 0.02 | 0 | | 169 | 0 | 24 | 0 | 0.9 | 0 | 0 | |
| 36N 02W 24BBC1 | 8/13/1998 | Nez Perce | 139 | 0.054 | 0 | | 170 | 0 | 28 | 0 | 0.91 | 0 | 1.3 | 0 |
| 36N 02W 31DBA1 | 8/27/2001 | Nez Perce | 116 | 0 | 0.2 | 28.7 | 140 | 0 | 31.8 | 0 | 2.3 | | 0.8 | 7.2 |
| 36N 03W 10DAD1 | 8/27/2001 | Nez Perce | 114 | 0 | 0.7 | 4.9 | 140 | 0.02 | 21.8 | 0 | 2 | | 1.2 | 4.9 |

| Station | Sampling Date | Fecal Coli (cols/100 ml) | F (mg/l) | G_ALPHA (pCi/l) | G_ALPHA_Thor (pCi/l) | G_BETA (pCi/l) | Hardness (mg/l) | Fe (ug/l) | Pb (ug/l) | Mg (mg/l) | Mn (ug/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 28N 01E 15CBB1 | 9/1/1993 | 0 | 2 | 1.2 | 1.7163004 | 5.4 | 33 | 6 | 0 | 0.85 | 2 |
| 28N 01E 15CBB1 | 8/20/1997 | 0 | 2.2 | | -1.368646045 | 2.199161975 | 28 | 3.2 | 0 | 0.69 | 2.4 |
| 28N 01E 15CBB1 | 8/30/2001 | | 2.3 | | | | 36 | 0 | | 0.826 | 1.6 |
| 28N 01E 22DCA1 | 9/1/1993 | 0 | 1.5 | 1.1 | 1.5724362 | 2.4 | 8 | 4 | 0 | 0.09 | 0 |
| 28N 01E 22DCA1 | 8/20/1997 | 0 | 1.3 | | 0.574407467 | 2.236511213 | 8 | 4.4 | 0 | 0.097 | 1.2 |
| 28N 01E 22DCA1 | 7/30/2002 | 0 | 1.5 | | | | 8 | 10 | | 0.09 | 2 |
| 28N 01E 35CAD1 | 8/10/1994 | 0 | 0.5 | 1.2 | 1.7163004 | 2.1 | 122 | 24 | 0 | 12 | 14 |
| 28N 01E 35CAD1 | 7/22/1998 | 0 | 0.59 | | 0.487818694 | 4.187183939 | 140 | 19 | 0 | 14 | 15 |
| 29N 02E 04DDA1 | 9/1/1993 | 0 | 0.3 | 3.4 | 4.8813128 | 1.4 | 45 | 0 | 0 | 5.4 | 0 |
| 29N 02E 04DDA1 | 8/18/1997 | 0 | 0.34 | | -0.189170858 | 1.518724612 | 44 | 0 | 0 | 5.2 | 0 |
| 29N 02E 04DDA1 | 7/30/2002 | 0 | 0.3 | | | | 47 | 10 | | 5.22 | 2 |
| 29N 03E 05ABD1 | 8/11/1994 | 0 | 0.2 | 1.5 | 2.147893 | 3.4 | 86 | 4 | 0 | 9.9 | 0 |
| 29N 03E 05ABD1 | 7/22/1998 | 0 | 0.22 | | 0.996339843 | 3.822418456 | 85 | 0 | 0 | 10 | 0 |
| 30N 01W 02AAA1 | 9/5/1991 | 0 | 0.4 | 0.8 | 1.1408436 | 3.1 | 61 | 3 | 0 | 5.8 | 0 |
| 30N 01W 02AAA1 | 8/8/1995 | 0 | 0.4 | 0.2 | 0.2776584 | 2.6 | 61 | 0 | 0 | 5.7 | 0 |
| 30N 01W 02AAA1 | 7/13/1999 | 0 | 0.43 | | | | 62 | 0 | 0 | 5.8 | 0 |
| 30N 01W 26ADD1 | 8/10/1994 | 0 | 1.7 | 1.7 | 2.4356214 | -0.5 | 12 | 30 | 0 | 0.13 | 0 |
| 30N 01W 26ADD1 | 7/24/1998 | 0 | 1.8 | | 1.156361036 | 1.917045848 | 13 | 19 | 0 | 0.072 | 0 |
| 30N 02E 13CBA1 | 8/29/2001 | | 0.6 | | | | 100 | 0 | 0.23 | 9.35 | 0 |

| Station | Sampling Date | Fecal Coli (cols/100 ml) | F (mg/l) | G_ALPHA (pCi/l) | G_ALPHA_Thor (pCi/l) | G_BETA (pCi/l) | Hardness (mg/l) | Fe (ug/l) | Pb (ug/l) | Mg (mg/l) | Mn (ug/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 30N 03E 09BBC1 | 8/9/1990 | 0 | 0.5 | | | | 102 | 180 | 0 | 9.1 | 31 |
| 30N 03E 09BBC1 | 9/11/1993 | 0 | 0.6 | -0.4 | -0.5855268 | 2.4 | 100 | 92 | 0 | 9.2 | 27 |
| 30N 03E 09BBC1 | 8/19/1997 | 0 | 0.5 | | 0.360992869 | 3.897896586 | 110 | 98 | 0 | 10 | 32.3 |
| 30N 03E 09BBC1 | 7/30/2002 | 0 | 0.5 | | | | 110 | 55 | | 10.3 | 35.9 |
| 30N 03E 17BAB1 | 9/11/1993 | 0 | 0.3 | 0.7 | 0.9969794 | 3.9 | 94 | 86 | 0 | 9.6 | 26 |
| 30N 03E 20AAC1 | 9/4/1991 | 0 | 0.5 | 3.2 | 4.5935844 | 6.9 | 89 | 8 | 0 | 8.9 | 8 |
| 30N 03E 20AAC1 | 7/20/1995 | 0 | 0.6 | -0.8 | -1.1609836 | 3.5 | 92 | 5 | 0 | 8.9 | 9 |
| 30N 03E 20AAC1 | 7/12/1999 | 0 | 0.58 | | | | 81 | 0 | 0 | 8.4 | 8.3 |
| 31N 01E 02AAA1 | 8/11/1994 | 0 | 0.6 | -0.6 | -0.8732552 | 0.6 | 97 | 3 | 0 | 8.9 | 0 |
| 31N 01E 02AAA1 | 8/19/1998 | 0 | 0.62 | | 1.80324177 | 1.672099455 | 93 | 0 | 0 | 8.6 | 0 |
| 31N 01E 08ABB3 | 9/4/1991 | 0 | 0.5 | -0.3 | -0.4416626 | 1.9 | 122 | 380 | 0 | 12 | 22 |
| 31N 01E 08ABB3 | 8/8/1995 | 0 | 0.6 | 0 | -0.01007 | 2.6 | 116 | 39 | 0 | 10 | 18 |
| 31N 01E 08ABB3 | 8/6/1996 | 0 | 0.6 | 0.4 | 0.5653868 | 2.6 | 118 | 200 | 0 | 11 | 24 |
| 31N 01E 08ABB3 | 8/19/1997 | 0 | 0.62 | | -0.359868593 | 1.4857316 | 120 | 140 | 0 | 11 | 43.4 |
| 31N 01E 08ABB3 | 8/19/1998 | 0 | 0.64 | | -0.179290372 | 2.527522853 | 110 | 450 | 0 | 10 | 34 |
| 31N 01E 08ABB3 | 7/13/1999 | 0 | 0.54 | | | | 72 | 0 | 0 | 7.6 | 0 |
| 31N 01E 08ABB3 | 8/1/2000 | | 0.6 | | | | 120 | 380 | | 11.5 | 44 |
| 31N 01E 08ABB3 | 8/29/2001 | | 0.6 | | | | 100 | 200 | | 9.72 | 24.2 |
| 31N 01E 08ABB3 | 7/31/2002 | 0 | 0.7 | | | | 120 | 411 | | 12.2 | 26.2 |
| 31N 02E 29BBA1 | 8/10/1994 | 0 | 0.5 | 1.2 | 1.7163004 | 2.7 | 128 | 0 | 0 | 11 | 0 |
| 31N 02E 29BBA1 | 8/19/1998 | 0 | 0.49 | | 3.679974009 | 3.060671172 | 130 | 0 | 0 | 11 | 0 |
| 31N 02E 35ADB1 | 9/5/1991 | 0 | 0.6 | 1.8 | 2.5794856 | 4 | 147 | 0 | 0 | 12 | 0 |
| 31N 02E 35ADB1 | 7/21/1995 | 0 | 0.7 | 1.1 | 1.5724362 | 2 | 153 | 0 | 0 | 13 | 0 |
| 31N 02E 35ADB1 | 7/12/1999 | 0 | 0.69 | | | | 150 | 0 | 0 | 14 | 0 |
| 31N 03E 36BCA1 | 9/18/1992 | 0 | 0.5 | -0.7 | -1.0171194 | 2 | 133 | 410 | 0 | 16 | 29 |
| 31N 03E 36BCA1 | 7/20/1995 | 2 | 0.5 | 1.3 | 1.8601646 | 3.8 | 131 | 340 | 0 | 16 | 31 |
| 31N 03E 36BCA1 | 8/7/1996 | 0 | 0.5 | 0 | -0.01007 | 2.8 | 126 | 300 | 0 | 16 | 29 |
| 31N 03E 36BCA1 | 8/19/1997 | 0 | 0.54 | | -0.172448599 | 3.987575551 | 120 | 360 | 0 | 15 | 29.4 |
| 31N 03E 36BCA1 | 7/23/1998 | 4 | 0.54 | | -0.324181778 | 2.972171966 | 120 | 110 | 0 | 14 | 27 |
| 31N 03E 36BCA1 | 7/12/1999 | 0 | 0.55 | | | | 120 | 310 | 0 | 15 | 30 |
| 31N 03E 36BCA1 | 8/2/2000 | | 0.5 | | | | 120 | 260 | | 14.4 | 28 |
| 31N 03E 36BCA1 | 8/29/2001 | | 0.5 | | | | 130 | 370 | | 15.7 | 30.9 |
| 31N 03E 36BCA1 | 8/1/2002 | 0 | 0.5 | | | | 130 | 275 | | 16.1 | 30.1 |
| 32N 01E 20CDC1 | 7/31/2002 | 0 | 0.5 | 1.8 | | 2.0 | 140 | 20 | 0.08 | 12.6 | 50.4 |

| Station | Sampling Date | Fecal Coli (cols/100 ml) | F (mg/l) | G_ALPHA (pCi/l) | G_ALPHA_Thor (pCi/l) | G_BETA (pCi/l) | Hardness (mg/l) | Fe (ug/l) | Pb (ug/l) | Mg (mg/l) | Mn (ug/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 32N 01W 19DBC1 | 9/14/1992 | 0 | 0.2 | -0.6 | -0.8732552 | 2 | 76 | 1000 | 0 | 5.9 | 89 |
| 32N 01W 19DBC1 | 8/6/1996 | 0 | 0.2 | -0.3 | -0.4416626 | 1.8 | 74 | 800 | 0 | 5.8 | 88 |
| 32N 01W 19DBC1 | 8/1/2000 | 0 | 0.2 | | | | 69 | 950 | | 5.43 | 85 |
| 32N 02E 14ACA1 | 7/31/2002 | 0 | 0.7 | 0.4 | | 4.1 | 160 | 47 | 0.42 | 16.1 | 34.8 |
| 32N 03E 11DCC1 | 9/23/1992 | 0 | 0 | 1.5 | 2.147893 | 6.3 | 260 | 19 | 0 | 33 | 140 |
| 32N 03E 11DCC1 | 7/17/1996 | 0 | 0.4 | 1.3 | 1.8601646 | 7.7 | 253 | 12 | 0 | 31 | 16 |
| 32N 03E 11DCC1 | 8/2/2000 | 0 | 0.2 | | | | 220 | 20 | | 28.1 | 13 |
| 32N 03E 35AAC1 | 9/9/1993 | 0 | 0.8 | 4.1 | 5.8883622 | 3.5 | 151 | 0 | 0 | 13 | 0 |
| 32N 03W 01BBC1 | 8/21/2002 | 0 | 0.1 | 0.7 | | 1.9 | 68 | 10 | 0.27 | 6.94 | 2 |
| 33N 01E 13CAC1 | 9/18/1992 | 0 | 0.6 | 1.9 | 2.7233498 | 7.3 | 168 | 4 | 0 | 22 | 0 |
| 33N 01E 13CAC1 | 8/6/1996 | 0 | 0.6 | 5.6 | 8.0463252 | 8.7 | 386 | 6 | 0 | 33 | 1 |
| 33N 01E 13CAC1 | 7/26/2000 | 0 | 0.7 | | | | 260 | 0 | | 22.3 | 0 |
| 33N 01W 09DCC1 | 8/9/1994 | 0 | 0.6 | 0.6 | 0.8531152 | 3.3 | 116 | 5 | 0 | 10 | 0 |
| 33N 01W 09DCC1 | 8/19/1998 | 0 | 0.57 | | 1.566472202 | 4.70924732 | 120 | 0 | 0 | 10 | 0 |
| 33N 01W 27DBC1 | 8/11/1993 | 0 | 0.2 | 2.6 | 3.7303992 | 2.5 | 88 | 5 | 0 | 7.4 | 0 |
| 33N 01W 27DBC1 | 8/19/1997 | 0 | 0.19 | | 0.72593327 | 2.370958564 | 91 | 0 | 0 | 7.5 | 0 |
| 33N 01W 27DBC1 | 8/29/2001 | | 0.2 | | | | 93 | 0 | | 7.87 | 0 |
| 33N 01W 29BDD1 | 8/11/1993 | 2 | 0.4 | 1.5 | 2.147893 | 1.9 | 105 | 0 | 0 | 8.4 | 0 |
| 33N 01W 29BDD1 | 7/16/1997 | 0 | 0.42 | | 0.771919524 | 2.233033305 | 110 | 4.7 | 0 | 8.5 | 0 |
| 33N 01W 29BDD1 | 8/21/2002 | 0 | 0.4 | | | | 110 | 10 | | 9.2 | 2 |
| 33N 02E 11BAA1 | 8/23/1994 | 0 | 0.6 | 4.3 | 6.1760906 | 3 | 213 | 0 | 0 | 19 | 4 |
| 33N 02E 11BAA1 | 7/23/1998 | 0 | 0.62 | | 7.520043823 | 5.484281697 | 540 | 0 | 0 | 45 | 4.5 |
| 33N 02E 11BAA1 | 8/19/1998 | 0 | 0 | | 7.520043823 | 5.484281697 | 0 | 0 | 0 | 0 | 0 |
| 33N 02W 10AAB1 | 8/8/2002 | 0 | 0.4 | 14.0 | | 9.3 | 220 | 10 | 0.05 | 16.5 | 2 |
| 33N 03E 07DAD1 | 10/15/1990 | 0 | 0.4 | | | | 98 | 80 | 1 | 9.3 | 110 |
| 33N 03W 06DBD1 | 8/12/1994 | 0 | 0.3 | 0.9 | 1.2847078 | 2.3 | 96 | 0 | 0 | 9.9 | 0 |
| 33N 03W 06DBD1 | 8/13/1998 | 0 | 0.25 | | 0.893275566 | 1.38211006 | 94 | 0 | 0 | 9.7 | 0 |
| 33N 03W 32ABA1 | 8/12/1993 | 0 | 0.2 | 0.8 | 1.1408436 | 1.8 | 42 | 33 | 0 | 4.2 | 1 |
| 33N 03W 32ABA1 | 7/16/1997 | 0 | 0.15 | | 0.553558946 | 2.04959356 | 40 | 83 | 0 | 4 | 0 |
| 33N 03W 32ABA1 | 8/27/2001 | | 0.2 | | | | 44 | 20 | | 4.56 | 2 |
| 33N 03W 33BBB1 | 9/3/1991 | 69 | 0 | 0.4 | 0.5653868 | 0.9 | 32 | 190 | 0 | 2.7 | 2 |
| 33N 04W 09DBB1 | 8/12/1993 | 0 | 0 | 0 | -0.01007 | 2.2 | 29 | 190 | 1 | 2.8 | 3 |
| 33N 04W 09DBB1 | 7/16/1997 | 0 | 0 | | 1.003415218 | 2.117862318 | 28 | 1400 | 0 | 2.6 | 5.2 |
| 33N 04W 09DBB1 | 8/27/2001 | | 0 | | | | 30 | 200 | | 2.92 | 1.7 |

| Station | Sampling Date | Fecal Coli (cols/100 ml) | F (mg/l) | G_ALPHA (pCi/l) | G_ALPHA_Thor (pCi/l) | G_BETA (pCi/l) | Hardness (mg/l) | Fe (ug/l) | Pb (ug/l) | Mg (mg/l) | Mn (ug/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 33N 04W 18DDB1 | 8/11/1994 | 0 | 0.2 | 0.3 | 0.4215226 | 0.4 | 78 | 36 | 0 | 5.1 | 1 |
| 33N 04W 18DDB1 | 8/13/1998 | 0 | 0.14 | | 1.18531903 | 0.523726528 | 81 | 0 | 0 | 5.5 | 0 |
| 34N 01E 16CBB1 | 9/25/2001 | | 0.5 | | | | 130 | | 0.1 | 16.6 | |
| 34N 01E 25DDD1 | 8/14/1991 | 0 | 0.4 | 0.6 | 0.8531152 | 1.8 | 144 | 8 | 0 | 12 | 0 |
| 34N 01E 25DDD1 | 7/19/1995 | 0 | 0.4 | 0 | -0.01007 | 2.6 | 144 | 0 | 1 | 12 | 0 |
| 34N 01E 25DDD1 | 7/14/1999 | 0 | 0.46 | | | | 130 | 0 | 1 | 11 | 0 |
| 34N 01W 18DDD1 | 9/25/2001 | | 0.6 | | | | 120 | 0 | 0.19 | 9.26 | 0 |
| 34N 01W 34DAD1 | 8/14/1991 | 1 | 0.4 | 1.5 | 2.147893 | 2.7 | 163 | 0 | 0 | 14 | 2 |
| 34N 02E 25ABB1 | 8/12/1993 | 0 | 0.5 | 0.6 | 0.8531152 | 1.4 | 75 | 7 | 1 | 6.6 | 0 |
| 34N 02E 25ABB1 | 7/17/1997 | 0 | 0.55 | | 0.149232444 | 2.256889083 | 77 | 0 | 0 | 6.8 | 0 |
| 34N 02E 25ABB1 | 8/19/2002 | 0 | 0.5 | | | | 82 | 10 | | 7.32 | 2 |
| 34N 02E 34BDD1 | 8/10/1994 | 0 | 0.6 | 1.5 | 2.147893 | 3.7 | 162 | 0 | 0 | 17 | 10 |
| 34N 02W 10ACA1 | 8/25/1993 | 0 | 0.5 | 3.8 | 5.4567696 | 5.4 | 219 | 81 | 0 | 18 | 4 |
| 34N 02W 10ACA1 | 7/17/1997 | 0 | 0.56 | | 9.506774262 | 6.430349771 | 210 | 51 | 0 | 18 | 3.7 |
| 34N 02W 10ACA1 | 9/24/2001 | | 0.5 | | | | 240 | 0 | | 19.7 | 0 |
| 34N 02W 22BCC1 | 8/9/1994 | 0 | 0.5 | 2.9 | 4.1619918 | 3.3 | 144 | 5 | 0 | 12 | 0 |
| 34N 02W 22BCC1 | 8/13/1998 | 0 | 0.58 | | 3.907486269 | 1.774996159 | 170 | 0 | 0 | 14 | 0 |
| 34N 02W 31DAA1 | 8/11/1993 | 0 | 0.3 | 1.4 | 2.0040288 | 3.5 | 114 | 640 | 0 | 12 | 31 |
| 34N 02W 31DAA1 | 7/16/1997 | 0 | 0.37 | | 0.998279053 | 2.202800012 | 120 | 1200 | 0 | 13 | 41.1 |
| 34N 02W 31DAA1 | 9/25/2001 | | 0.4 | | | | 120 | 1480 | | 13 | 43.8 |
| 34N 03W 04ABD1 | 9/14/1992 | 0 | 0.2 | 1.1 | 1.5724362 | 2.7 | 100 | 0 | 0 | 11 | 0 |
| 34N 03W 04ABD1 | 8/7/1996 | 0 | 0.2 | 0 | -0.01007 | 3.5 | 103 | 7 | 0 | 11 | 0 |
| 34N 03W 04ABD1 | 7/27/2000 | 0 | 0.3 | | | | 110 | 0 | | 11.5 | 0 |
| 35N 01W 08DAA1 | 8/24/1994 | 0 | 0.3 | 1 | 1.428572 | 1.5 | 84 | 16 | 0 | 10 | 33 |
| 35N 01W 08DAA1 | 8/19/1998 | 0 | 0.34 | | 0.120710168 | 2.113103978 | 83 | 20 | 0 | 10 | 30 |
| 35N 01W 19AADC1 | 9/15/1992 | 0 | 0.4 | 1.9 | 2.7233498 | 9.5 | 107 | 5 | 0 | 11 | 24 |
| 35N 01W 19AADC1 | 8/7/1996 | 0 | 0.4 | 0.3 | 0.4215226 | 9.6 | 109 | 7 | 0 | 12 | 21 |
| 35N 01W 19AADC1 | 7/27/2000 | 0 | 0.5 | | | | 110 | 0 | | 12 | 24 |
| 35N 02E 32BCC1 | 8/25/1993 | 0 | 0.5 | 3.6 | 5.1690412 | 4.4 | 122 | 5 | 0 | 12 | 10 |
| 35N 02E 32BCC1 | 7/17/1997 | 0 | 0.56 | | 0.625560029 | 4.430314095 | 130 | 0 | 0 | 13 | 0 |
| 35N 02E 32BCC1 | 8/19/2002 | 0 | 0.6 | | | | 130 | 10 | | 12.2 | 2 |
| 35N 02W 25BBA1 | 8/9/1994 | 0 | 0.6 | 0.4 | 0.5653868 | 4.1 | 180 | 720 | 0 | 20 | 42 |
| 35N 02W 25BBA1 | 8/13/1998 | 0 | 0.61 | | 3.155309807 | 4.231113238 | 180 | 480 | 0 | 21 | 41 |

| Station | Sampling Date | Fecal Coli (cols/100 ml) | F (mg/l) | G_ALPHA (pCi/l) | G_ALPHA_Thor (pCi/l) | G_BETA (pCi/l) | Hardness (mg/l) | Fe (ug/l) | Pb (ug/l) | Mg (mg/l) | Mn (ug/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 35N 03W 15DAD1 | 8/9/1994 | 0 | 0.3 | 0.8 | 1.1408436 | 3.8 | 122 | 0 | 0 | 12 | 0 |
| 35N 03W 15DAD1 | 8/13/1998 | 0 | 0.28 | | 0.490187456 | 3.434654383 | 110 | 0 | 0 | 11 | 0 |
| 35N 04W 02ABD1 | 8/8/1994 | 0 | 0.3 | 1.2 | 1.7163004 | 2.9 | 102 | 0 | 0 | 9.7 | 0 |
| 35N 04W 02ABD1 | 8/18/1998 | 0 | 0.41 | | 0.663425987 | 3.439418319 | 99 | 0 | 0 | 9.5 | 0 |
| 35N 04W 14DDD1 | 8/8/2002 | 0 | 0.3 | 0.1 | | 4.9 | 100 | 10 | 0.07 | 9.72 | 2 |
| 35N 04W 23ABA1 | 8/7/1990 | 75 | 0.2 | | | | 153 | 9 | 0 | 14 | 2 |
| 35N 05W 02CCA1 | 8/26/2001 | | 0.7 | | | | 190 | 10 | 0.17 | 24.4 | 2 |
| 35N 05W 21CDB1 | 8/8/1990 | 0 | 0.2 | | | | 177 | 59 | 0 | 18 | 94 |
| 35N 05W 21CDB1 | 8/8/2002 | 0 | 0.3 | 0 | | 17.4 | 170 | 28 | 0.08 | 17.3 | 51.2 |
| 35N 05W 25ADD1 | 10/17/1990 | 0 | 0.3 | | | | 134 | 0 | 0 | 10 | 0 |
| 35N 05W 25ADD1 | 9/15/1992 | 0 | 0.6 | 2.7 | 3.8742634 | 8.3 | 85 | 4 | 1 | 6.1 | 0 |
| 35N 05W 25ADD1 | 8/9/1996 | 0 | 0.6 | 1.9 | 2.7233498 | 10.3 | 173 | 5 | 0 | 14 | 0 |
| 35N 05W 25ADD1 | 7/26/2000 | 0 | 0.9 | | | | 140 | 0 | | 11.2 | 0 |
| 35N 06W 24CCA2 | 8/10/1993 | 0 | 0.5 | 6.9 | 9.9165598 | 10.6 | 226 | 0 | 1 | 21 | 0 |
| 35N 06W 24CCA2 | 7/15/1997 | 0 | 0.7 | | 5.744551697 | 8.591248973 | 160 | 0 | 0 | 15 | 0 |
| 35N 06W 24CCA2 | 8/15/1997 | 0 | 0.64 | | | | 170 | 0 | 0 | 16 | 0 |
| 35N 06W 24CCA2 | 8/8/2002 | 0 | 0.9 | | | | 87 | 10 | | 8.12 | 2 |
| 36N 01E 13CCB1 | 10/16/1990 | 0 | 0.4 | | | | 186 | 3 | 1 | 21 | 1 |
| 36N 01E 25CDA1 | 8/10/1994 | 0 | 0.3 | 0.3 | 0.4215226 | 2.6 | 64 | 25 | 0 | 7.7 | 3 |
| 36N 02W 24BBC1 | 8/24/1994 | 0 | 0.3 | 1.3 | 1.8601646 | 3.4 | 113 | 34 | 0 | 13 | 17 |
| 36N 02W 24BBC1 | 8/13/1998 | 0 | 0.32 | | 0.438187263 | 3.344885382 | 130 | 34 | 0 | 16 | 4.3 |
| 36N 02W 31DBA1 | 8/27/2001 | | 0.3 | | | | 120 | 0 | 0.4 | 10.3 | 0 |
| 36N 03W 10DAD1 | 8/27/2001 | | 0.4 | | | | 94 | 0 | 0.09 | 9.71 | 0 |

| Station | Sampling Date | N15 per mil | Nitrate (mg/L) | Nitrite (mg/L) | pH | OrthoP (mg/l) | K (mg/l) | Radon (pCi/l) | Spec. Cond (uS/cm) | Se (ug/l) | Silica (mg/l) | Na (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 28N 01E 15CBB1 | 9/1/1993 | | 0 | 0 | 8.7 | 0 | 1.2 | 0 | 692 | 0 | 33 | 130 |
| 28N 01E 15CBB1 | 8/20/1997 | | 0.154 | 0 | 8.6 | 0 | 2.3 | | 610 | 0 | 34 | 117 |
| 28N 01E 15CBB1 | 8/30/2001 | | 0.032 | 0 | 8.5 | 0 | 2.6 | | 752 | 0 | 34.3 | 139 |
| 28N 01E 22DCA1 | 9/1/1993 | | 0.072 | 0 | 9 | 0.02 | 1.8 | 0 | 352 | 0 | 48 | 75 |
| 28N 01E 22DCA1 | 8/20/1997 | | 0 | 0 | 8.9 | 0.01 | 2.5 | | 347 | 0 | 45 | 76.4 |
| 28N 01E 22DCA1 | 7/30/2002 | | 0.08 | 0.008 | 8.9 | 0.02 | 2.83 | | 4 | 0.3 | 44.4 | 80.5 |
| 28N 01E 35CAD1 | 8/10/1994 | | 0 | 0 | 8.2 | 0 | 3 | 0 | 422 | 0 | 40 | 44 |
| 28N 01E 35CAD1 | 7/22/1998 | | 0.088 | 0 | 8.1 | 0.017 | 3.3 | | 452 | 0 | 36 | 43 |

| Station | Sampling Date | N15 per mil | Nitrate (mg/L) | Nitrite (mg/L) | pH | OrthoP (mg/l) | K (mg/l) | Radon (pCi/l) | Spec. Cond (uS/cm) | Se (ug/l) | Silica (mg/l) | Na (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 29N 02E 04DDA1 | 9/1/1993 | | 0.21 | 0 | 7.3 | 0.15 | 2.6 | 0 | 114 | 0 | 71 | 6.1 |
| 29N 02E 04DDA1 | 8/18/1997 | | 0.225 | 0 | 7.1 | 0.148 | 1.7 | | 117 | 0 | 70 | 6 |
| 29N 02E 04DDA1 | 7/30/2002 | | 0.18 | 0.008 | 7.2 | 0.15 | 2.08 | | 111 | 0.4 | 66.1 | 5.87 |
| 29N 03E 05ABD1 | 8/11/1994 | | 0.24 | 0 | 7.1 | 0.17 | 3.3 | 470 | 196 | 0 | 56 | 5.5 |
| 29N 03E 05ABD1 | 7/22/1998 | | 0.309 | 0 | 7.2 | 0.167 | 3.7 | | 203 | 0 | 54 | 5.5 |
| 30N 01W 02AAA1 | 9/5/1991 | | 2 | 0 | 6.6 | 0.11 | 2.3 | 550 | 162 | 0 | 58 | 9.2 |
| 30N 01W 02AAA1 | 8/8/1995 | | 3 | 0 | 7.73 | 0.1 | 2.3 | 0 | 171 | 0 | 59 | 9.1 |
| 30N 01W 02AAA1 | 7/13/1999 | | 0 | 0 | 7.2 | 0.049 | 2.4 | | 175 | 0 | 55 | 9.5 |
| 30N 01W 26ADD1 | 8/10/1994 | | 0.08 | 0 | 9.6 | 0.02 | 2.1 | 0 | 989 | 0 | 44 | 190 |
| 30N 01W 26ADD1 | 7/24/1998 | | 0.396 | 0.039 | 9.6 | 0.041 | 1.9 | | 1100 | 0 | 42 | 207 |
| 30N 02E 13CBA1 | 8/29/2001 | | 0.506 | 0 | 7.1 | 0.063 | 2.12 | | 280 | 0.9 | 44.8 | 19.3 |
| 30N 03E 09BBC1 | 8/9/1990 | | 0 | | 8.06 | 0.03 | 3.5 | | 298 | 0 | 47 | 29 |
| 30N 03E 09BBC1 | 9/11/1993 | | 0 | 0 | 8 | 0.03 | 3.9 | 0 | 319 | 0 | 48 | 28 |
| 30N 03E 09BBC1 | 8/19/1997 | | 0 | 0 | 7.7 | 0.031 | 3.7 | | 346 | 0 | 53 | 29.1 |
| 30N 03E 09BBC1 | 7/30/2002 | | 0.05 | 0.008 | 7.7 | 0.01 | 4.49 | | 335 | 0.3 | 46.3 | 29.9 |
| 30N 03E 17BAB1 | 9/11/1993 | | 0 | 0 | 8.3 | 0.03 | 3.5 | 0 | 308 | 0 | 44 | 33 |
| 30N 03E 20AAC1 | 9/4/1991 | | 0.57 | 0 | 7.47 | 0.07 | 3.6 | 0 | 262 | 0 | 46 | 21 |
| 30N 03E 20AAC1 | 7/20/1995 | | 0.47 | 0 | 7.41 | 0.05 | 3.2 | 0 | 269 | 0 | 55 | 21 |
| 30N 03E 20AAC1 | 7/12/1999 | | 2.65 | 0 | 7.6 | 0.013 | 4 | | 253 | 0 | 46 | 21 |
| 31N 01E 02AAA1 | 8/11/1994 | | 0.65 | 0 | 7.5 | 0.07 | 1.7 | 0 | 266 | 0 | 57 | 18 |
| 31N 01E 02AAA1 | 8/19/1998 | | 1.01 | 0 | 7.2 | 0.087 | 1.7 | | 260 | 0 | 59 | 18 |
| 31N 01E 08ABB3 | 9/4/1991 | | 0 | 0 | 7.6 | 0.05 | 2.1 | 0 | 293 | 0 | 53 | 18 |
| 31N 01E 08ABB3 | 8/8/1995 | | 0.61 | 0 | 7.59 | 0.03 | 1.5 | 0 | 328 | 0 | 55 | 22 |
| 31N 01E 08ABB3 | 8/6/1996 | | 0.68 | 0 | 7.8 | 0.04 | 1.7 | | 325 | 0 | 55 | 22 |
| 31N 01E 08ABB3 | 8/19/1997 | | 0.704 | 0.01 | 7.3 | 0.04 | 1.7 | | 318 | 0 | 60 | 20.9 |
| 31N 01E 08ABB3 | 8/19/1998 | | 0.281 | 0 | 7.6 | 0.064 | 1.8 | | 302 | 0 | 56 | 18 |
| 31N 01E 08ABB3 | 7/13/1999 | | 0.925 | 0 | 7.9 | 0.033 | 1.8 | | 208 | 0 | 49 | 16 |
| 31N 01E 08ABB3 | 8/1/2000 | 2.84 | 0.071 | 0 | 7.4 | 0.044 | 2 | | 315 | 0 | 56 | 18.7 |
| 31N 01E 08ABB3 | 8/29/2001 | | 0.458 | 0 | 7.3 | 0.027 | 1.96 | | 272 | 0 | 48.8 | 16.6 |
| 31N 01E 08ABB3 | 7/31/2002 | | 0.05 | 0.008 | 7.5 | 0.05 | 2.46 | | 288 | 0.3 | 54.4 | 17.3 |
| 31N 02E 29BBA1 | 8/10/1994 | | 5.4 | 0 | 7.8 | 0.05 | 3 | 990 | 341 | 0 | 53 | 20 |
| 31N 02E 29BBA1 | 8/19/1998 | | 6.02 | 0 | 7.4 | 0.07 | 3 | | 358 | 0 | 54 | 20 |
| 31N 02E 35ADB1 | 9/5/1991 | | 4.3 | 0 | 7.53 | 0.05 | 2.9 | 720 | 355 | 0 | 44 | 20 |
| 31N 02E 35ADB1 | 7/21/1995 | | 6.5 | 0 | 7.65 | 0.04 | 2.7 | 0 | 393 | 0 | 51 | 22 |

| Station | Sampling Date | N15 per mil | Nitrate (mg/L) | Nitrite (mg/L) | pH | OrthoP (mg/l) | K (mg/l) | Radon (pCi/l) | Spec. Cond (uS/cm) | Se (ug/l) | Silica (mg/l) | Na (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 31N 02E 35ADB1 | 7/12/1999 | | 0.894 | 0 | 7.5 | 0.027 | 3.3 | | 393 | 0 | 39 | 22 |
| 31N 03E 36BCA1 | 9/18/1992 | | 0 | 0 | 7.78 | 0.03 | 3.2 | 0 | 333 | 0 | 0.2 | 19 |
| 31N 03E 36BCA1 | 7/20/1995 | | 0 | 0 | 8.58 | 0.03 | 3.1 | 0 | 329 | 0 | 54 | 19 |
| 31N 03E 36BCA1 | 8/7/1996 | | 0.06 | 0 | 7.8 | 0.03 | 3.4 | | 326 | 0 | 52 | 19 |
| 31N 03E 36BCA1 | 8/19/1997 | | 0 | 0 | 7.6 | 0.04 | 3.1 | | 319 | 0 | 58 | 18.6 |
| 31N 03E 36BCA1 | 7/23/1998 | | 0.074 | 0 | 7.5 | 0.035 | 3.2 | | 316 | 0 | 51 | 18 |
| 31N 03E 36BCA1 | 7/12/1999 | | 0 | 0 | 7.7 | 0.034 | 3.3 | | 312 | 0 | 50 | 19 |
| 31N 03E 36BCA1 | 8/2/2000 | | 0 | 0 | 7.3 | 0.025 | 3.2 | | 314 | 0 | 52.8 | 18.4 |
| 31N 03E 36BCA1 | 8/29/2001 | | 0 | 0 | 7.3 | 0.009 | 3.07 | | 320 | 0 | 47.6 | 19.8 |
| 31N 03E 36BCA1 | 8/1/2002 | | 0.02 | 0.008 | 7.7 | 0.03 | 3.48 | | 316 | 0.3 | 51.2 | 18.4 |
| 32N 01E 20CDC1 | 7/31/2002 | | 0.32 | 0.008 | 7 | 0.02 | 0.64 | | 359 | 2.8 | 34.6 | 29.1 |
| 32N 01W 19DBC1 | 9/14/1992 | | 0 | 0 | 7.62 | 0.04 | 1.6 | 280 | 219 | 0 | 47 | 15 |
| 32N 01W 19DBC1 | 8/6/1996 | | 0.08 | 0 | 8.5 | 0.04 | 1.5 | | 221 | 0 | 46 | 15 |
| 32N 01W 19DBC1 | 8/1/2000 | | 0 | 0 | 7.7 | 0.049 | 1.5 | | 212 | 0 | 46.9 | 15.1 |
| 32N 02E 14ACA1 | 7/31/2002 | | 0.35 | 0.008 | 8 | 0.01 | 3.75 | | 448 | 0.3 | 43.5 | 38.8 |
| 32N 03E 11DCC1 | 9/23/1992 | | 0.39 | 0 | 7.39 | 0.04 | 5.3 | 803 | 693 | 0 | 37 | 49 |
| 32N 03E 11DCC1 | 7/17/1996 | | 3.7 | 0 | 7.7 | 0.06 | 5.2 | | 697 | 0 | 41 | 53 |
| 32N 03E 11DCC1 | 8/2/2000 | | 0.802 | 0 | 6.8 | 0.034 | 4.8 | | 589 | 0 | 35.6 | 41.1 |
| 32N 03E 35AAC1 | 9/9/1993 | | 4.5 | 0 | 7.2 | 0.05 | 2.7 | 340 | 412 | 0 | 53 | 29 |
| 32N 03W 01BBC1 | 8/21/2002 | | 0.11 | 0.008 | 6.9 | 0.06 | 1.92 | | 158 | 0.3 | 41.8 | 5.95 |
| 33N 01E 13CAC1 | 9/18/1992 | | 6 | 0 | 7.72 | 0.02 | 6.7 | 0 | 476 | 2 | 47 | 34 |
| 33N 01E 13CAC1 | 8/6/1996 | | 45 | 0 | 7.5 | 0.03 | 3.7 | | 1013 | 0 | 53 | 39 |
| 33N 01E 13CAC1 | 7/26/2000 | 15.43 | 18.1 | 0 | 7.3 | 0.038 | 3.3 | | 654 | 1.9 | 57.5 | 31.5 |
| 33N 01W 09DCC1 | 8/9/1994 | | 1.2 | 0 | 7.7 | 0.11 | 3.6 | 1000 | 329 | 0 | 56 | 24 |
| 33N 01W 09DCC1 | 8/19/1998 | | 2.09 | 0 | 7.4 | 0.131 | 3.4 | | 349 | 0 | 56 | 24 |
| 33N 01W 27DBC1 | 8/11/1993 | | 0.71 | 0 | 7.6 | 0.07 | 2.1 | 1300 | 254 | 0 | 43 | 19 |
| 33N 01W 27DBC1 | 8/19/1997 | | 1.03 | 0 | 7.1 | 0.074 | 2 | | 257 | 0 | 48 | 18.7 |
| 33N 01W 27DBC1 | 8/29/2001 | | 1.01 | 0 | 6.9 | 0.071 | 2.05 | | 256 | 0.3 | 41 | 20.7 |
| 33N 01W 29BDD1 | 8/11/1993 | | 3.4 | 0 | 7.9 | 0.07 | 2.2 | 1000 | 286 | 0 | 54 | 16 |
| 33N 01W 29BDD1 | 7/16/1997 | | 3.94 | 0 | 7.2 | 0.066 | 2.1 | | 291 | 0 | 57 | 17 |
| 33N 01W 29BDD1 | 8/21/2002 | | 4.7 | 0.008 | 6.9 | 0.06 | 2.16 | | 292 | 0.4 | 51.5 | 16.7 |
| 33N 02E 11BAA1 | 8/23/1994 | | 61.6 | 0.85 | 7.9 | 0 | 3.5 | 0 | 550 | 0 | 39 | 24 |
| 33N 02E 11BAA1 | 7/23/1998 | | 65.3 | 1.75 | 7.3 | 0.034 | 3.9 | | 1260 | 0 | 48 | 28 |
| 33N 02E 11BAA1 | 8/19/1998 | | 79.5 | 0.051 | 7.2 | 0.041 | 0 | | 1330 | 0 | 0 | 0 |
| 33N 02W 10AAB1 | 8/8/2002 | | 18 | 0.008 | 7.1 | 0.07 | 2.1 | | 502 | 0.3 | 50.1 | 12.8 |

APPENDIX B

| Station | Sampling Date | N15 per mil | Nitrate (mg/L) | Nitrite (mg/L) | pH | OrthoP (mg/l) | K (mg/l) | Radon (pCi/l) | Spec. Cond (uS/cm) | Se (ug/l) | Silica (mg/l) | Na (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 33N 03E 07DAD1 | 10/15/1990 | | 0.1 | | 7.92 | 0.04 | 5.3 | | 0 | 0 | 45 | 25 |
| 33N 03W 06DBD1 | 8/12/1994 | | 0 | 0 | 8.8 | 0 | 2.6 | 0 | 222 | 0 | 47 | 7.6 |
| 33N 03W 06DBD1 | 8/13/1998 | | 0.177 | 0 | 7.9 | 0.058 | 2.7 | | 222 | 0 | 46 | 7.8 |
| 33N 03W 32ABA1 | 8/12/1993 | | 0.12 | 0 | 7.2 | 0.07 | 0.1 | 0 | 110 | 0 | 45 | 4.7 |
| 33N 03W 32ABA1 | 7/16/1997 | | 0.103 | 0 | 6.6 | 0.06 | 1.5 | | 103 | 0 | 44 | 4.5 |
| 33N 03W 32ABA1 | 8/27/2001 | | 0.06 | 0 | 6.7 | 0.041 | 1.54 | | 96 | 0 | 43.3 | 4.6 |
| 33N 03W 33BBB1 | 9/3/1991 | | 0.32 | 0 | 6.31 | 0.06 | 1.3 | 0 | 84 | 0 | 33 | 4.1 |
| 33N 04W 09DBB1 | 8/12/1993 | | 0.26 | 0 | 7.3 | 0.03 | 1.6 | 0 | 78 | 0 | 32 | 3.4 |
| 33N 04W 09DBB1 | 7/16/1997 | | 0.253 | 0 | 6.9 | 0.036 | 1.4 | | 73 | 0 | 31 | 3.3 |
| 33N 04W 09DBB1 | 8/27/2001 | | 0.206 | 0 | 6.8 | 0.03 | 1.49 | | 75 | 0 | 31.3 | 3.3 |
| 33N 04W 18DDB1 | 8/11/1994 | | 0.6 | 0 | 8 | 0 | 1.2 | 0 | 181 | 0 | 36 | 6.6 |
| 33N 04W 18DDB1 | 8/13/1998 | | 0.718 | 0 | 8.2 | 0.017 | 6.1 | | 193 | 0 | 35 | 6.4 |
| 34N 01E 16CBB1 | 9/25/2001 | | 0.107 | 0 | 7.9 | 0.029 | 4.6 | | 358 | | 47.4 | 26.7 |
| 34N 01E 25DDD1 | 8/14/1991 | | 1.4 | 0 | 7.7 | 0.09 | 1.9 | 660 | 351 | 0 | 46 | 27 |
| 34N 01E 25DDD1 | 7/19/1995 | | 1.7 | 0 | 7.99 | 0.07 | 1.9 | 0 | 381 | 0 | 51 | 25 |
| 34N 01E 25DDD1 | 7/14/1999 | | 1.8 | 0 | 7.7 | 0.087 | 1.9 | | 379 | 0 | 46 | 28 |
| 34N 01W 18DDD1 | 9/25/2001 | | 0.099 | 0 | 7.3 | 0.026 | 0.91 | | 292 | 0 | 49.3 | 17.1 |
| 34N 01W 34DAD1 | 8/14/1991 | | 3.7 | 0.02 | 7.63 | 0.07 | 1.9 | 310 | 387 | 0 | 42 | 28 |
| 34N 02E 25ABB1 | 8/12/1993 | | 0.27 | 0 | 7.5 | 0.12 | 2 | 0 | 208 | 0 | 55 | 13 |
| 34N 02E 25ABB1 | 7/17/1997 | | 0.452 | 0 | 7.1 | 0.129 | 2.1 | | 224 | 0 | 60 | 13.6 |
| 34N 02E 25ABB1 | 8/19/2002 | | 0.6 | 0.008 | 6.7 | 0.12 | 1.94 | | 221 | 0.6 | 52 | 12.9 |
| 34N 02E 34BDD1 | 8/10/1994 | | 0.24 | 0 | 7.9 | 0.01 | 2.9 | 0 | 428 | 0 | 39 | 30 |
| 34N 02W 10ACA1 | 8/25/1993 | | 0.94 | 0 | 7.4 | 0.06 | 3.2 | 0 | 478 | 0 | 51 | 17 |
| 34N 02W 10ACA1 | 7/17/1997 | | 1.09 | 0 | 7.3 | 0.064 | 3.4 | | 480 | 0 | 53 | 18 |
| 34N 02W 10ACA1 | 9/24/2001 | 5.74 | 1.18 | 0 | 7.1 | 0.066 | 3.16 | | 499 | 0.8 | 52.9 | 18.8 |
| 34N 02W 22BCC1 | 8/9/1994 | | 0.87 | 0 | 7.4 | 0.07 | 1.8 | 720 | 391 | 0 | 56 | 16 |
| 34N 02W 22BCC1 | 8/13/1998 | | 0.965 | 0 | 7.2 | 0.077 | 1.6 | | 401 | 0 | 57 | 18 |
| 34N 02W 31DAA1 | 8/11/1993 | | 0 | 0 | 7.7 | 0.07 | 2.4 | 0 | 291 | 0 | 60 | 16 |
| 34N 02W 31DAA1 | 7/16/1997 | | 0 | 0 | 7.2 | 0.08 | 2.8 | | 315 | 0 | 65 | 17.9 |
| 34N 02W 31DAA1 | 9/25/2001 | | 0.026 | 0 | 7.5 | 0.05 | 2.66 | | 296 | 0 | 59.9 | 18.8 |
| 34N 03W 04ABD1 | 9/14/1992 | | 0.44 | 0 | 7.5 | 0.04 | 3.2 | 511 | 238 | 0 | 57 | 9.4 |
| 34N 03W 04ABD1 | 8/7/1996 | | 0.36 | 0 | 7.93 | 0.04 | 3.5 | | 244 | 0 | 51 | 8.4 |
| 34N 03W 04ABD1 | 7/27/2000 | | 0.41 | 0 | 7.6 | 0.039 | 3.2 | | 245 | 0 | 54.6 | 9.1 |
| 35N 01W 08DAA1 | 8/24/1994 | | 0 | 0 | 8.2 | 0.01 | 1.9 | 0 | 234 | 0 | 50 | 16 |

| Station | Sampling Date | N15 per mil | Nitrate (mg/L) | Nitrite (mg/L) | pH | OrthoP (mg/l) | K (mg/l) | Radon (pCi/l) | Spec. Cond (uS/cm) | Se (ug/l) | Silica (mg/l) | Na (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 35N 01W 08DAA1 | 8/19/1998 | | 0 | 0 | 8 | 0.033 | 1.8 | | 234 | 0 | 51 | 16 |
| 35N 01W 19AADC1 | 9/15/1992 | | 0 | 0 | 7.52 | 0.09 | 8.9 | 976 | 332 | 0 | 52 | 23 |
| 35N 01W 19AADC1 | 8/7/1996 | | 0.08 | 0 | 7.94 | 0.07 | 9.6 | | 333 | 0 | 49 | 23 |
| 35N 01W 19AADC1 | 7/27/2000 | | 0.055 | 0 | 7.6 | 0.085 | 8.7 | | 333 | 0 | 50.6 | 22.6 |
| 35N 02E 32BCC1 | 8/25/1993 | | 1.2 | 0 | 7.7 | 0.08 | 3.5 | 0 | 314 | 0 | 54 | 18 |
| 35N 02E 32BCC1 | 7/17/1997 | | 1.79 | 0 | 7.3 | 0.078 | 3.8 | | 332 | 0 | 58 | 18.9 |
| 35N 02E 32BCC1 | 8/19/2002 | | 2.32 | 0.008 | 7.2 | 0.09 | 3.37 | | 327 | 0.9 | 53.8 | 17.2 |
| 35N 02W 25BBA1 | 8/9/1994 | | 0 | 0 | 7.8 | 0.04 | 5.8 | 530 | 451 | 0 | 62 | 26 |
| 35N 02W 25BBA1 | 8/13/1998 | | 0 | 0 | 7.6 | 0.057 | 5.6 | | 452 | 0 | 0 | 26 |
| 35N 03W 15DAD1 | 8/9/1994 | | 5.5 | 0 | 7.6 | 0.05 | 3.6 | 0 | 302 | 0 | 53 | 13 |
| 35N 03W 15DAD1 | 8/13/1998 | | 5.68 | 0 | 7.5 | 0.06 | 3.5 | | 296 | 0 | 57 | 13 |
| 35N 04W 02ABD1 | 8/8/1994 | | 1.9 | 0 | 7.7 | 0.05 | 3.2 | 490 | 256 | 0 | 53 | 12 |
| 35N 04W 02ABD1 | 8/18/1998 | | 2.39 | 0 | 7.3 | 0.054 | 3.1 | | 261 | 0 | 54 | 12 |
| 35N 04W 14DDD1 | 8/8/2002 | | 0.77 | 0.008 | 7.4 | 0.06 | 4.44 | | 263 | 0.5 | 52.9 | 12.7 |
| 35N 04W 23ABA1 | 8/7/1990 | | 2.4 | | 7.43 | 0.09 | 3.8 | | 338 | 0 | 50 | 13 |
| 35N 05W 02CCA1 | 8/26/2001 | 4.77 | 2.46 | 0 | 8 | 0.015 | 7.14 | | 603 | 2.1 | 46.7 | 61.5 |
| 35N 05W 21CDB1 | 8/8/1990 | | 0 | | 8.03 | 0.01 | 0 | | 0 | 0 | 49 | 40 |
| 35N 05W 21CDB1 | 8/8/2002 | | 0.05 | 0.008 | 7.9 | 0.01 | 16 | | 548 | 0.2 | 45.8 | 40.6 |
| 35N 05W 25ADD1 | 10/17/1990 | | 2.2 | | 8.23 | 0.01 | 0 | | 0 | 0 | 45 | 53 |
| 35N 05W 25ADD1 | 9/15/1992 | | 1.3 | 0 | 7.94 | 0.02 | 7.4 | 0 | 652 | 0 | 52 | 46 |
| 35N 05W 25ADD1 | 8/9/1996 | | 7.5 | 0 | 8 | 0.04 | 7.1 | | 637 | 2 | 46 | 54 |
| 35N 05W 25ADD1 | 7/26/2000 | 8.46 | 4.95 | 0 | 7.8 | 0.02 | 6 | | 520 | 1.1 | 53.3 | 50.7 |
| 35N 06W 24CCA2 | 8/10/1993 | | 2.1 | 0 | 7.9 | 0 | 8.7 | 330 | 710 | 1 | 50 | 50 |
| 35N 06W 24CCA2 | 7/15/1997 | | 5.44 | 0 | 7.8 | 0.015 | 7.5 | | 555 | 0 | 61 | 42.5 |
| 35N 06W 24CCA2 | 8/15/1997 | | 0 | 0 | 7.7 | 0 | 8.2 | | 591 | 2 | 64 | 44.5 |
| 35N 06W 24CCA2 | 8/8/2002 | | 0.5 | 0.008 | 7.8 | 0.02 | 8.16 | | 345 | 0.4 | 60.3 | 36.1 |
| 36N 01E 13CCB1 | 10/16/1990 | | 0.4 | | 7.65 | 0.05 | 2.3 | | 0 | 0 | 46 | 31 |
| 36N 01E 25CDA1 | 8/10/1994 | | 0.34 | 0 | 7.3 | 0.12 | 2.6 | 0 | 181 | 0 | 53 | 13 |
| 36N 02W 24BBC1 | 8/24/1994 | | 0 | 0 | 8 | 0.03 | 3.6 | 620 | 340 | 0 | 58 | 17 |
| 36N 02W 24BBC1 | 8/13/1998 | | 0.104 | 0 | 7.8 | 0.046 | 4.4 | | 280 | 1 | 57 | 17 |
| 36N 02W 31DBA1 | 8/27/2001 | 6.95 | 5.57 | 0 | 7.4 | 0.064 | 1.17 | | 305 | 0.3 | 60.6 | 15.9 |
| 36N 03W 10DAD1 | 8/27/2001 | | 0.572 | 0 | 7.4 | 0.056 | 3.45 | | 233 | 0.2 | 60.2 | 13.4 |

| Station | Sampling Date | SO4 (mg/l) | TDS (mg/l) | TONS_AFT | H2O Temp © | Zn (ug/l) | Depth to Water (ft) |
|---|---|---|---|---|---|---|---|
| 28N 01E 15CBB1 | 9/1/1993 | 140 | 420 | 0.57 | 15.6 | 22 | |
| 28N 01E 15CBB1 | 8/20/1997 | 110 | 383 | 0.52 | 15.5 | 9.3 | 0 |
| 28N 01E 15CBB1 | 8/30/2001 | 180 | | 0.65 | 15.7 | | |
| 28N 01E 22DCA1 | 9/1/1993 | 39 | 246 | 0.34 | 20 | 86 | |
| 28N 01E 22DCA1 | 8/20/1997 | 25 | 244 | 0.33 | 20.2 | 9.5 | 193.04 |
| 28N 01E 22DCA1 | 7/30/2002 | 48.7 | 257.95 | 0.35 | 19.7 | | |
| 28N 01E 35CAD1 | 8/10/1994 | 15 | 268 | 0.36 | 13.7 | 21 | |
| 28N 01E 35CAD1 | 7/22/1998 | 16 | 246 | 0.33 | 14.1 | | 34 |
| 29N 02E 04DDA1 | 9/1/1993 | 1.2 | 132 | 0.18 | 11.8 | 450 | |
| 29N 02E 04DDA1 | 8/18/1997 | 1.2 | 130 | 0.18 | 11.8 | 290 | 222.25 |
| 29N 02E 04DDA1 | 7/30/2002 | 1.2 | 125.29 | 0.17 | 11.5 | | |
| 29N 03E 05ABD1 | 8/11/1994 | 3.4 | 155 | 0.21 | 8.3 | 360 | |
| 29N 03E 05ABD1 | 7/22/1998 | 2.8 | 137 | 0.19 | 9.5 | 314 | 0 |
| 30N 01W 02AAA1 | 9/5/1991 | 2.5 | 152 | 0.208 | 12 | 160 | |
| 30N 01W 02AAA1 | 8/8/1995 | 2.7 | 152 | 0.207 | 11.1 | 28 | |
| 30N 01W 02AAA1 | 7/13/1999 | 3.8 | 136 | 0.18 | 10.7 | 25 | 114.99 |
| 30N 01W 26ADD1 | 8/10/1994 | 310 | 626 | 0.85 | 16.3 | 11 | |
| 30N 01W 26ADD1 | 7/24/1998 | 340 | 666 | 0.91 | 16.6 | | 0 |
| 30N 02E 13CBA1 | 8/29/2001 | 6.2 | | 0.26 | 12.6 | 432 | |
| 30N 03E 09BBC1 | 8/9/1990 | 9.8 | | | 15 | 18 | |
| 30N 03E 09BBC1 | 9/11/1993 | 11 | 221 | 0.3 | 14.2 | 26 | |
| 30N 03E 09BBC1 | 8/19/1997 | 22 | 240 | 0.33 | 14.2 | 20.7 | 0 |
| 30N 03E 09BBC1 | 7/30/2002 | 24.6 | 235.84 | 0.32 | 14.8 | | |
| 30N 03E 17BAB1 | 9/11/1993 | 12 | 215 | 0.29 | 12.6 | 53 | |
| 30N 03E 20AAC1 | 9/4/1991 | 11 | 195 | 0.265 | 16.6 | 260 | |
| 30N 03E 20AAC1 | 7/20/1995 | 8.9 | 200 | 0.272 | 14.4 | 350 | |
| 30N 03E 20AAC1 | 7/12/1999 | 8 | 227 | 0.31 | 14 | 91 | 112.63 |
| 31N 01E 02AAA1 | 8/11/1994 | 5.1 | 193 | 0.26 | 11.3 | 13 | |
| 31N 01E 02AAA1 | 8/19/1998 | 6.4 | 197 | 0.27 | 11.4 | | 0 |
| 31N 01E 08ABB3 | 9/4/1991 | 8.5 | 216 | 0.295 | 13 | 29 | |
| 31N 01E 08ABB3 | 8/8/1995 | 9.9 | 228 | 0.31 | 11.1 | 18 | |
| 31N 01E 08ABB3 | 8/6/1996 | 9.7 | 228 | 0.31 | 11.8 | 38 | |
| 31N 01E 08ABB3 | 8/19/1997 | 9.1 | 229 | 0.31 | 11.4 | 34.7 | 0 |

| Station | Sampling Date | SO4 (mg/l) | TDS (mg/l) | TONS_AFT | H2O Temp © | Zn (ug/l) | Depth to Water (ft) |
|---|---|---|---|---|---|---|---|
| 31N 01E 08ABB3 | 8/19/1998 | 7.1 | 212 | 0.29 | 12.2 | 23 | 0 |
| 31N 01E 08ABB3 | 7/13/1999 | 4.1 | 160 | 0.22 | 14.5 | | 0 |
| 31N 01E 08ABB3 | 8/1/2000 | 9 | | 0.3 | 12.3 | | |
| 31N 01E 08ABB3 | 8/29/2001 | 7.1 | | 0.25 | 12.1 | | |
| 31N 01E 08ABB3 | 7/31/2002 | 9.4 | 213.73 | 0.29 | 11 | | |
| 31N 02E 29BBA1 | 8/10/1994 | 7.9 | 242 | 0.33 | 11.3 | 56 | |
| 31N 02E 29BBA1 | 8/19/1998 | 7.8 | 249 | 0.34 | 11.8 | | 0 |
| 31N 02E 35ADB1 | 9/5/1991 | 13 | 247 | 0.337 | 12.6 | 9 | |
| 31N 02E 35ADB1 | 7/21/1995 | 15 | 270 | 0.368 | 11.6 | | |
| 31N 02E 35ADB1 | 7/12/1999 | 21 | 251 | 0.34 | 12 | | 0 |
| 31N 03E 36BCA1 | 9/18/1992 | 13 | 183 | 0.25 | 12.6 | 36 | |
| 31N 03E 36BCA1 | 7/20/1995 | 11 | 230 | 0.313 | 13.6 | 24 | |
| 31N 03E 36BCA1 | 8/7/1996 | 12 | 225 | 0.3 | 12 | 21 | |
| 31N 03E 36BCA1 | 8/19/1997 | 11 | 223 | 0.3 | 12.8 | 14.6 | 151.42 |
| 31N 03E 36BCA1 | 7/23/1998 | 11 | 187 | 0.25 | 12.9 | | 152.05 |
| 31N 03E 36BCA1 | 7/12/1999 | 9.8 | 215 | 0.29 | 13.2 | 17 | 156.64 |
| 31N 03E 36BCA1 | 8/2/2000 | 10.5 | | 0.29 | 13.5 | | 160.02 |
| 31N 03E 36BCA1 | 8/29/2001 | 11.7 | | 0.3 | 12.9 | | |
| 31N 03E 36BCA1 | 8/1/2002 | 11.2 | 221.1 | 0.3 | 13 | | |
| 32N 01E 20CDC1 | 7/31/2002 | 27.3 | 243.21 | 0.33 | 11 | 15 | |
| 32N 01W 19DBC1 | 9/14/1992 | 28 | 179 | 0.24 | 9.3 | 13 | |
| 32N 01W 19DBC1 | 8/6/1996 | 20 | 166 | 0.22 | 10.5 | 5 | |
| 32N 01W 19DBC1 | 8/1/2000 | 17.2 | | 0.22 | 9.8 | | 12.2 |
| 32N 02E 14ACA1 | 7/31/2002 | 35 | 302.17 | 0.41 | 11.1 | 16 | |
| 32N 03E 11DCC1 | 9/23/1992 | 48 | 433 | 0.59 | 13.6 | 660 | |
| 32N 03E 11DCC1 | 7/17/1996 | 48 | 433 | 0.58 | 14.6 | 570 | |
| 32N 03E 11DCC1 | 8/2/2000 | 30.7 | | 0.48 | 13.8 | | 151.45 |
| 32N 03E 35AAC1 | 9/9/1993 | 10 | 277 | 0.38 | 11.3 | 15 | |
| 32N 03W 01BBC1 | 8/21/2002 | 0.8 | 125.29 | 0.17 | 7.2 | 7 | |
| 33N 01E 13CAC1 | 9/18/1992 | 21 | 333 | 0.45 | 14.3 | 250 | |
| 33N 01E 13CAC1 | 8/6/1996 | 39 | 648 | 0.88 | 12.3 | 290 | |
| 33N 01E 13CAC1 | 7/26/2000 | 30.8 | | 0.57 | 12.5 | | 80.63 |
| 33N 01W 09DCC1 | 8/9/1994 | 4.7 | 228 | 0.31 | 11 | 630 | |
| 33N 01W 09DCC1 | 8/19/1998 | 5.4 | 243 | 0.33 | 11.1 | 317 | 0 |

| Station | Sampling Date | SO4 (mg/l) | TDS (mg/l) | TONS_AFT | H2O Temp © | Zn (ug/l) | Depth to Water (ft) |
|---|---|---|---|---|---|---|---|
| 33N 01W 27DBC1 | 8/11/1993 | 2.3 | 173 | 0.24 | 9.8 | 73 | |
| 33N 01W 27DBC1 | 8/19/1997 | 2.9 | 186 | 0.25 | 10.5 | 53.8 | 0 |
| 33N 01W 27DBC1 | 8/29/2001 | 3.1 | | 0.24 | 10.1 | | |
| 33N 01W 29BDD1 | 8/11/1993 | 5.7 | 206 | 0.28 | 12.2 | 39 | |
| 33N 01W 29BDD1 | 7/16/1997 | 5.9 | 213 | 0.29 | 10.7 | 58.1 | 13.73 |
| 33N 01W 29BDD1 | 8/21/2002 | 0.1 | 213.73 | 0.29 | 10.4 | | |
| 33N 02E 11BAA1 | 8/23/1994 | 36 | 340 | 0.46 | 11.5 | | |
| 33N 02E 11BAA1 | 7/23/1998 | 72 | 816 | 1.11 | 11.3 | | 0 |
| 33N 02E 11BAA1 | 8/19/1998 | 0 | 0 | 0 | 11.7 | | 0 |
| 33N 02W 10AAB1 | 8/8/2002 | 15.4 | 339.02 | 0.46 | 10.9 | 44 | |
| 33N 03E 07DAD1 | 10/15/1990 | 5 | | | | 52 | |
| 33N 03W 06DBD1 | 8/12/1994 | 1.5 | 176 | 0.24 | 9.1 | 93 | |
| 33N 03W 06DBD1 | 8/13/1998 | 1.4 | 157 | 0.21 | 8.4 | 53 | 0 |
| 33N 03W 32ABA1 | 8/12/1993 | 0.1 | 99 | 0.13 | 8.8 | 210 | |
| 33N 03W 32ABA1 | 7/16/1997 | 0.8 | 96 | 0.13 | 8.6 | 153 | 46.54 |
| 33N 03W 32ABA1 | 8/27/2001 | 0.8 | | 0.13 | 13.2 | | |
| 33N 03W 33BBB1 | 9/3/1991 | 1 | 79 | 0.108 | 7.6 | 600 | |
| 33N 04W 09DBB1 | 8/12/1993 | 1.4 | 73 | 0.1 | 9.1 | 290 | |
| 33N 04W 09DBB1 | 7/16/1997 | 1.2 | 70 | 0.095 | 9.2 | 106 | 0 |
| 33N 04W 09DBB1 | 8/27/2001 | 1.3 | | 0.09 | 8.5 | | |
| 33N 04W 18DDB1 | 8/11/1994 | 2.3 | 130 | 0.18 | 11.2 | 87 | |
| 33N 04W 18DDB1 | 8/13/1998 | 2.5 | 137 | 0.19 | 9.8 | 56 | 195.78 |
| 34N 01E 16CBB1 | 9/25/2001 | 10.6 | | 0.33 | 11.8 | 13 | |
| 34N 01E 25DDD1 | 8/14/1991 | 14 | 263 | 0.358 | 12 | 210 | |
| 34N 01E 25DDD1 | 7/19/1995 | 15 | 262 | 0.356 | 12.7 | 210 | |
| 34N 01E 25DDD1 | 7/14/1999 | 14 | 256 | 0.35 | 11.8 | 180 | 137.59 |
| 34N 01W 18DDD1 | 9/25/2001 | 3 | | 0.27 | 10.3 | 11 | |
| 34N 01W 34DAD1 | 8/14/1991 | 10 | 273 | 0.372 | 9.4 | 5 | |
| 34N 02E 25ABB1 | 8/12/1993 | 1.6 | 166 | 0.23 | 13.2 | 22 | |
| 34N 02E 25ABB1 | 7/17/1997 | 1.9 | 169 | 0.23 | 12.7 | 8 | 0 |
| 34N 02E 25ABB1 | 8/19/2002 | 2.5 | 169.51 | 0.23 | 14 | | |
| 34N 02E 34BDD1 | 8/10/1994 | 18 | 268 | 0.36 | 11.6 | 12 | |
| 34N 02W 10ACA1 | 8/25/1993 | 6.1 | 310 | 0.42 | 9.4 | 12 | |

| Station | Sampling Date | SO4 (mg/l) | TDS (mg/l) | TONS_AFT | H2O Temp © | Zn (ug/l) | Depth to Water (ft) |
|---|---|---|---|---|---|---|---|
| 34N 02W 10ACA1 | 7/17/1997 | 4.5 | 309 | 0.42 | 10.2 | 10.2 | 26.82 |
| 34N 02W 10ACA1 | 9/24/2001 | 6.1 | | 0.44 | 9.6 | | |
| 34N 02W 22BCC1 | 8/9/1994 | 2.4 | 247 | 0.34 | 15.8 | 41 | |
| 34N 02W 22BCC1 | 8/13/1998 | 2.5 | 266 | 0.36 | 15.1 | | 3.62 |
| 34N 02W 31DAA1 | 8/11/1993 | 7.1 | 212 | 0.29 | 10.8 | 45 | |
| 34N 02W 31DAA1 | 7/16/1997 | 7.7 | 227 | 0.31 | 11.1 | 16.5 | 0 |
| 34N 02W 31DAA1 | 9/25/2001 | 8.1 | | 0.3 | 12.1 | | |
| 34N 03W 04ABD1 | 9/14/1992 | 3.5 | 184 | 0.25 | 13.7 | 68 | |
| 34N 03W 04ABD1 | 8/7/1996 | 3.4 | 178 | 0.24 | 13.7 | 61 | |
| 34N 03W 04ABD1 | 7/27/2000 | 3.8 | | 0.24 | 14 | | 287.1 |
| 35N 01W 08DAA1 | 8/24/1994 | 4.5 | 171 | 0.23 | 13.9 | 220 | |
| 35N 01W 08DAA1 | 8/19/1998 | 4.4 | 172 | 0.23 | 14 | 89 | 0 |
| 35N 01W 19AADC1 | 9/15/1992 | 9.5 | 230 | 0.31 | 15.6 | 99 | |
| 35N 01W 19AADC1 | 8/7/1996 | 9.6 | 228 | 0.31 | 15.5 | 230 | |
| 35N 01W 19AADC1 | 7/27/2000 | 9.9 | | 0.3 | 16.9 | | |
| 35N 02E 32BCC1 | 8/25/1993 | 3.4 | 225 | 0.31 | 10.7 | 210 | |
| 35N 02E 32BCC1 | 7/17/1997 | 4.9 | 233 | 0.32 | 11.3 | 118 | 45.48 |
| 35N 02E 32BCC1 | 8/19/2002 | 6.2 | 228.47 | 0.31 | 11 | | |
| 35N 02W 25BBA1 | 8/9/1994 | 23 | 302 | 0.41 | 11 | 130 | |
| 35N 02W 25BBA1 | 8/13/1998 | 21 | 243 | 0.33 | 10.8 | 119 | 124.39 |
| 35N 03W 15DAD1 | 8/9/1994 | 7.2 | 214 | 0.29 | 15.2 | 79 | |
| 35N 03W 15DAD1 | 8/13/1998 | 6.8 | 214 | 0.29 | 15.2 | 97 | 95.25 |
| 35N 04W 02ABD1 | 8/8/1994 | 3.3 | 186 | 0.25 | 14.2 | 39 | |
| 35N 04W 02ABD1 | 8/18/1998 | 3.2 | 189 | 0.26 | 13.8 | | 0 |
| 35N 04W 14DDD1 | 8/8/2002 | 5.5 | 191.62 | 0.26 | 13.2 | 17 | |
| 35N 04W 23ABA1 | 8/7/1990 | 5.7 | | | 13 | 100 | |
| 35N 05W 02CCA1 | 8/26/2001 | 70.7 | | 0.55 | 17.3 | 285 | |
| 35N 05W 21CDB1 | 8/8/1990 | 57 | | | 8 | 9 | |
| 35N 05W 21CDB1 | 8/8/2002 | 55 | 353.76 | 0.48 | 19.3 | 4 | |
| 35N 05W 25ADD1 | 10/17/1990 | 46 | | | 16 | 69 | |
| 35N 05W 25ADD1 | 9/15/1992 | 34 | 278 | 0.38 | 17 | 200 | |
| 35N 05W 25ADD1 | 8/9/1996 | 50 | 393 | 0.53 | 16.5 | 120 | |
| 35N 05W 25ADD1 | 7/26/2000 | 51.9 | | 0.46 | 18 | | 292.96 |

| Station | Sampling Date | SO4 (mg/l) | TDS (mg/l) | TONS_AFT | H2O Temp © | Zn (ug/l) | Depth to Water (ft) |
|---|---|---|---|---|---|---|---|
| 35N 06W 24CCA2 | 8/10/1993 | 87 | 434 | 0.59 | 17.4 | 44 | |
| 35N 06W 24CCA2 | 7/15/1997 | 45 | 353 | 0.48 | 18.3 | 27.6 | 244.81 |
| 35N 06W 24CCA2 | 8/15/1997 | 68 | 366 | 0.5 | 17.5 | 13.1 | 0 |
| 35N 06W 24CCA2 | 8/8/2002 | 20.2 | 250.58 | 0.34 | 17.9 | | |
| 36N 01E 13CCB1 | 10/16/1990 | 5.4 | | | 12 | 260 | |
| 36N 01E 25CDA1 | 8/10/1994 | 4.3 | 150 | 0.2 | 10.4 | 130 | |
| 36N 02W 24BBC1 | 8/24/1994 | 10 | 210 | 0.29 | 17.5 | 68 | |
| 36N 02W 24BBC1 | 8/13/1998 | 13 | 221 | 0.3 | 17.6 | 169 | 0 |
| 36N 02W 31DBA1 | 8/27/2001 | 14.2 | | 0.28 | 15.8 | 122 | |
| 36N 03W 10DAD1 | 8/27/2001 | 3.9 | | 0.25 | 12.8 | 27 | |

**Abbreviations**

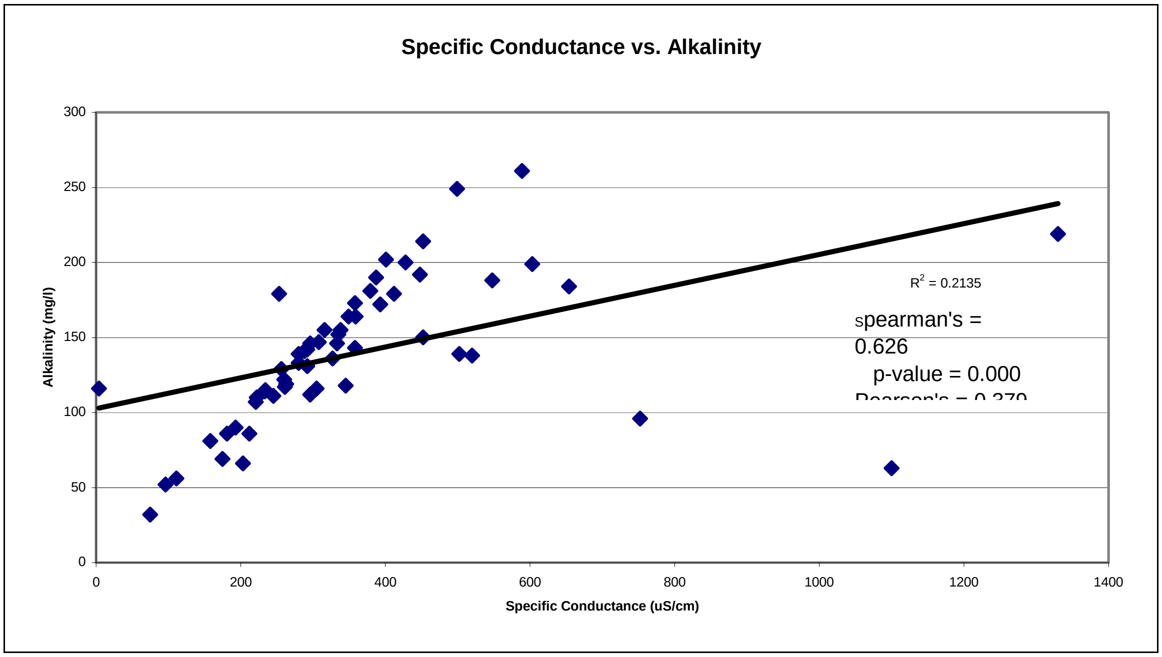
mg/L = milligrams per liter
ug/L = micrograms per liter
pCi/l = picocuries per liter
uS/cm = microsiemens per centimeter

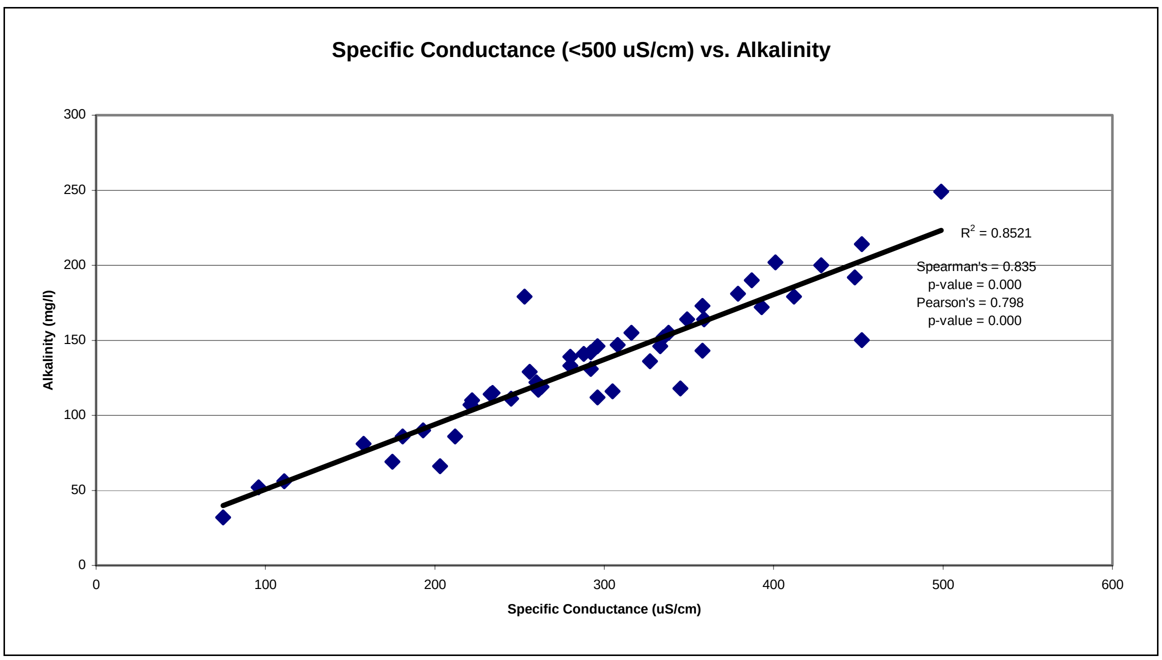
As = arsenic
Ba = barium
Ca = calcium
Cd = cadmium
Cl -= chloride
CO3 = carbonate
Cr = chromium
Cu = copper
DO = dissolved oxygen
F = fluoride
Fe = iron
G Alpha = gross alpha total
G Alpha Thor = gross alpha Thorium
G Beta = gross beta
H2O Temp = ground water temperature

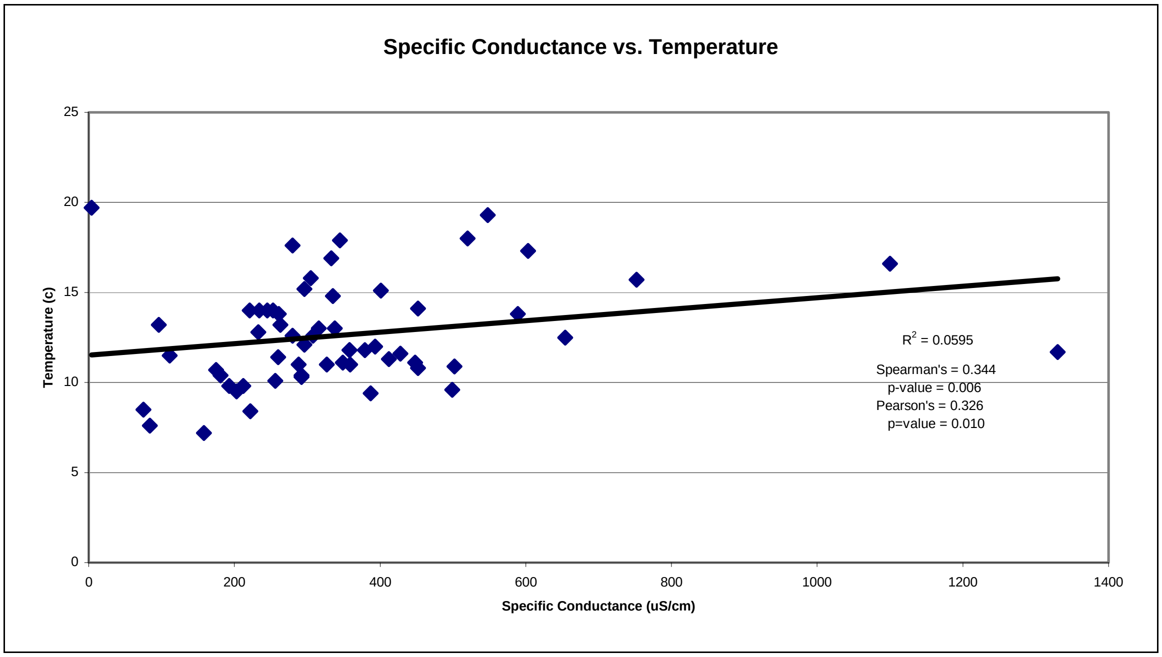
HCO3 = bicarbonate
K = potassium
Mg = magnesium
Mn = manganese
Na = sodium
NH3 = ammonia
N15 = nitrogen isotope ratio of N15 to N14
OrthoP = orthophosphate
Se = selenium
SO4 = sulfate
Spec. Cond = specific conductance
TDS = total dissolved solids
Tons AFT = total dissolved solids reported as tons per acre foot of water
Zn = zinc

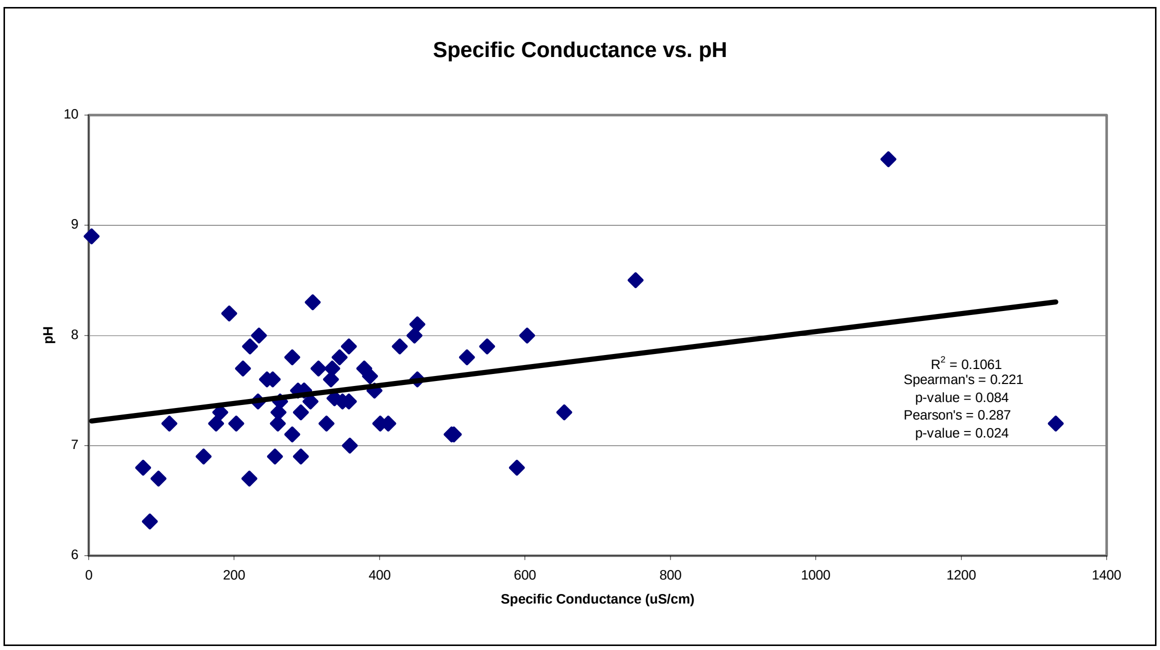
## 11.3. Appendix C. Scatter Plots

APPENDIX C
FIELD MEASUREMENT SCATTER PLOTS

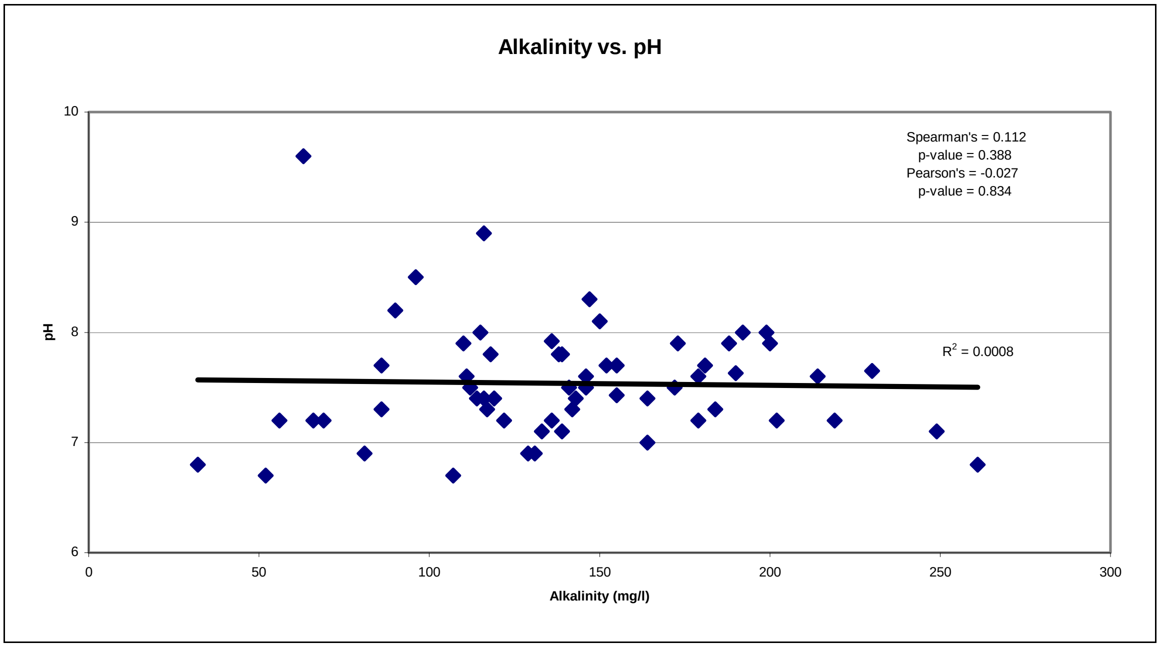


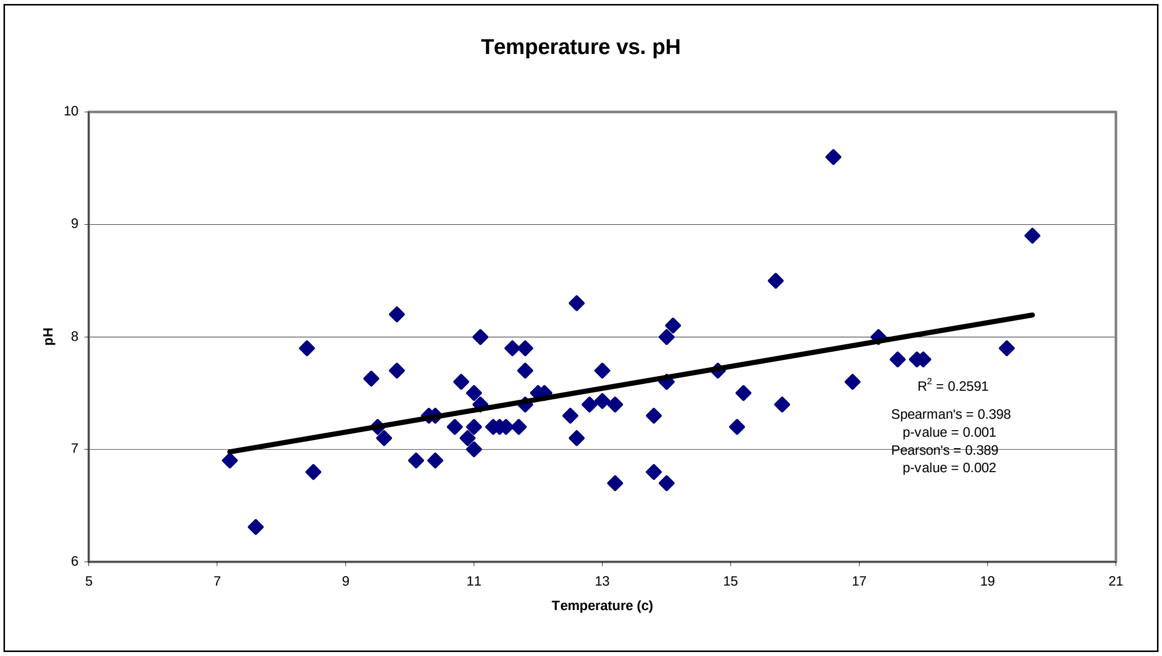



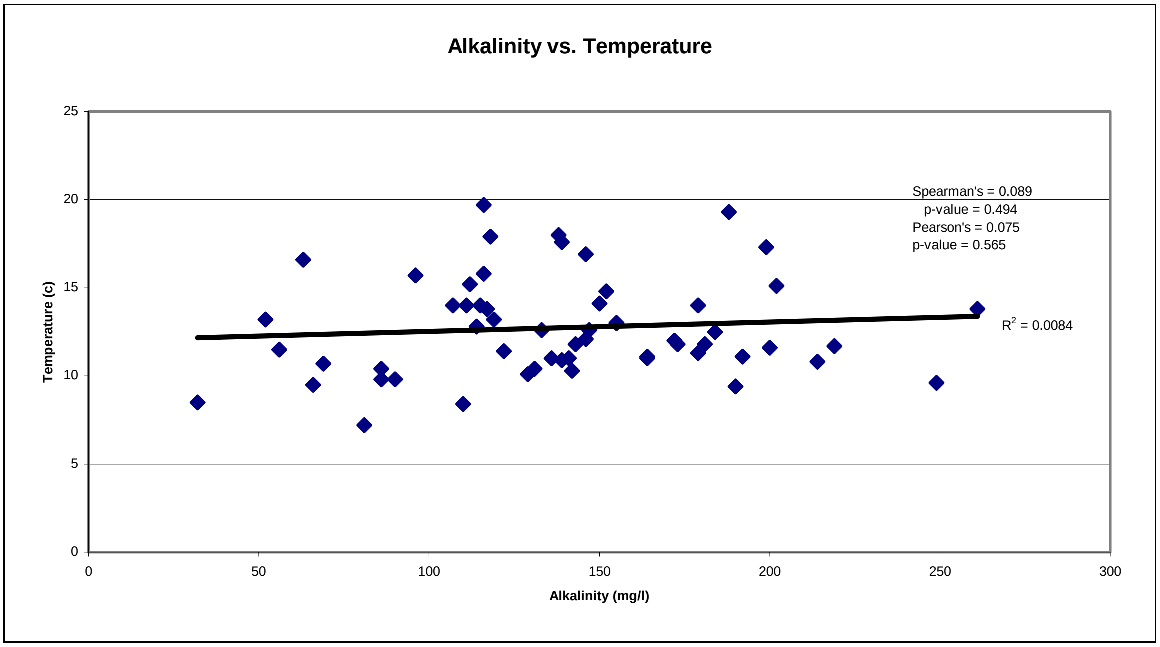

Specific Conductance vs. Temperature
25
20
15
10
5
0
Temperature (c)
0
200
400
600
800
1000
1200
1400
Specific Conductance (uS/cm)
$R^2$ = 0.0595
Spearman's = 0.344
p-value = 0.006
Pearson's = 0.326
p=value = 0.010


Specific Conductance vs. pH
10
9
8
7
6
pH
0
200
400
600
800
1000
1200
1400
Specific Conductance (uS/cm)
$R^2$ = 0.1061
Spearman's = 0.221
p-value = 0.084
Pearson's = 0.287
p-value = 0.024

APPENDIX C
FIELD MEASUREMENT SCATTER PLOTS




Alkalinity vs. Temperature
25
20
15
10
5
0
Temperature (c)
0
50
100
150
200
250
300
Alkalinity (mg/l)
Spearman's = 0.089
p-value = 0.494
Pearson's = 0.075
p-value = 0.565
R2 = 0.0084