Ground Water Quality Technical Report No. 5

# Ground Water and Soils Reconnaissanceof the Lower Payette area, Payette County, Idaho

Prepared for the Payette Soil and Water Conservation District

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# Abstract

Ground-water and soils sampling was conducted in the lower Payette area, Idaho to evaluate agrichemical impacts to ground water. Much of the study area is intensively farmed with crops such as sugar beets, onions, corn, mint and specialty seed crops being grown. The depth to water is less than 25 feet over much of the area, and most crops are furrow irrigated. The size of the study area is 32,871 acres.

During an initial inventory of the area, 82 domestic wells were sampled for nitrate, major ions, and field parameters. Selected wells were sampled for pesticides. Thirty domestic wells were selected for quarterly monitoring over a year-long period. Quarterly wells were sampled for nitrate, pesticides, and field parameters. Depth to water measurements were collected where possible. Soil samples were collected from eight fields to evaluate the potential for storage and transport of agrichemicals below the root zone to the water table.

Surface drains were sampled during the non-irrigation season to document ground-water quality.

Three areas of elevated nitrate (> 3 mg/L) in ground water were delineated. These areas coincided with areas where intensive agricultural practices occur. Nitrate concentrations in these areas ranged from below detection limits (< 0.005 mg/L) to 37 mg/L. Seventeen percent of 82 wells had nitrate concentration between 5 and 10 mg/L, and 5 percent exceeded the Idaho Drinking Water standard of 10 mg/L.

The herbicide Dacthal was detected in 12 of 20 quarterly monitoring wells sampled. Dacthal was generally detected in wells where nitrate also was detected. Average soil nitrate concentrations below the root zone ranged from 6.4 mg/kg to 11.4 mg/kg and showed no correlation with crop type. Soil samples from one sugar beet field (4 fields were sampled for pesticides) had detections for the pesticides DDT and DDE.

# Introduction

The Lower Payette area, below Black Canyon dam, constitutes a major portion of the intensively farmed cropland which drains the Payette River basin. The primary agricultural crops grown in the area include row crops such as sugar beets, onions, corn, potatoes, beans, mint, and specialty seed crops. Small grains, alfalfa, and pasture are also grown as rotation crops.

Agrichemical use is intensive, furrow irrigation is typical, and fertilizer use efficiency is low for shallow-rooted crops such as onions and mint. When combined with the shallow depth to ground water found over much of the area, the potential vulnerability of ground-water resources to contamination is high (Rupert, et al, 1991).

In adjacent eastern Malhuer County, Oregon, where agricultural practices are similar, surface water and ground-water impacts from agrichemicals have been documented. These impacts include nitrate-nitrogen (hereafter referred to as nitrate) concentrations above drinking water standards, and concentrations of selected pesticides at levels approaching U.S. Environmental Protection Agency (EPA) health advisory levels (Smyth and Istok, 1989).

In the Lower Payette area surface water monitoring was conducted by the U.S. Bureau of Reclamation during the 1985-86 irrigation season. Two stations on the Payette River, located above and below the Lower Payette agricultural area were sampled for sediment, nutrients, and bacteria. The sampling indicted significant surface water quality deterioration between the two stations, which are located 23 miles apart. Irrigation return flow from the project area empties into the river along this stretch and has been identified as a major source of water quality deterioration.

Concern over these water quality problems in the basin have resulted in activities by state and federal agencies, in cooperation with local farmers, directed towards the development of management strategies which will improve water quality conditions.

The U.S. Soil Conservation Service (SCS) was awarded a grant which establishes the Idaho Snake-Payette Rivers Hydrologic Unit Area. Under this grant resource conditions will be defined, best management practices will be developed and evaluated through demonstration programs, and the resulting technology will be transferred to operators throughout the basin.

In September 1989, the Division of Environmental Quality (DEQ) awarded the Payette Soil and Water Conservation District planning grant funding, through the State Agricultural Water Quality Program (SAWQP), for the Lower Payette planning project study. Two of the tasks of this planning effort are 1) to determine the natural resource conditions in the study area and 2) to determine the major contributors to water quality problems in the project area.

In order to support these planning efforts, the Idaho Soil Conservation Commission in 1990 awarded DEQ a grant to evaluate existing surface water, ground-water and soils conditions in the project area. This report describes ground-water and soils data collected from April 1991 through March 1992. A draft report describing an initial surface water quality survey conducted in the project area has been prepared by Ingham (1991).

## Purpose

The purpose of this study is to present information to the Payette SWCD on ground-water and soil conditions in the Lower Payette project area, and the effects of ground-water contributions on surface water quality. This information will be used to develop best management practices for solving water quality problems in the project area.

## Objectives And Scope

The objectives of this study are to evaluate the status of ground-water quality with respect to contamination from agrichemical sources and to determine the potential for storage and transport of these chemicals in the vadose zone.

The scope of work included area-wide ground-water sampling of 80 wells to determine general water quality within the project area. A subset of 30 wells was selected for quarterly sampling over a one year period to examine seasonal variations in water quality parameters.

Soil sampling consisted of coring and compositing samples from the shallow vadose zone (feet) in eight fields under different crop types. The soil samples were analyzed for nutrients and pesticides.

### Previous Studies

Limited ground-water quality investigations have been conducted in parts of the project area. Some of these are described below.

Personnel from DEQ collected ground-water samples from 15 wells in the vicinity of Fruitland, Idaho, in July 1986 (DEQ, 1986). The samples were analyzed for nitrate and pesticides. Analytical results showed that nitrate concentrations ranged from 0.003 to 12.9 milligrams per liter (mg/L) and averaged 5.2 mg/L. Nearly half the wells sampled had concentrations between 5 and 10 mg/L. The pre-emergent herbicide Dacthal was detected in 12 of 15 wells, with concentrations ranging from 0.03 to 10 micrograms per liter (ug/L).

Personnel from DEQ collected ground-water and soil samples from areas north and south of Weiser, Idaho in 1989 (DEQ, 1989). These areas have similar agricultural practices, depth to water, and soil conditions as the Lower Payette area. Sixteen wells were sampled for nitrate, and a pesticide scan was run on all samples. Laboratory sample results indicated nitrate concentrations ranged from below detection limits (0.005 mg/L) to 22.3 mg/L, with a median nitrate concentration of 10.1 mg/L. Fifty percent of all wells sampled exceeded the drinking water standard for nitrate (10 mg/L).

Pesticides were detected in 12 of the 16 wells and included dacthal, chlorpyrifos (trade name Lorsban), and metribuzin (trade name Sencor). Dacthal concentrations ranged from below detection limits to 73 ug/L. Chlorpyrifos was detected in trace amounts in one well; metribuzin was detected in trace amounts in a second well. Pentachlorophenol was also detected in 8 of the water samples, with concentrations ranging from below detection limits to 0.42 ug/L.

The Idaho Farm Bureau Federation (IFBF) sponsored a well sampling day in Payette and Gem Counties in April 1991. Residents of the two counties were invited to collect water samples from their private wells and submit the samples to the University of Idaho Analytical Laboratory for analysis. All samples were analyzed for nitrate and selected sites for metals (lead, arsenic, selenium, chromium, cadmium, and beryllium). Results for nitrate from 317 sample analyses indicated a bimodal distribution with two peaks, one near the detection limit and another around 3 mg/L. Nitrate concentrations for 28 wells sampled in the Lower Payette project area ranged from below detection limits to 14.0 mg/L; the distribution was also bimodal with peaks at concentrations of 0.1 and 5 mg/L. Nearly half the wells sampled had concentrations at or below the detection limit (0.1 mg/L).

## Description Of Study Area

The study area is located in west-central Idaho, near the confluence of the Payette and Snake Rivers (Figure 1). The area is bounded on the south by the Black Canyon A-Line Canal, on the north by the Payette River, on the west by Highway 95-30, and on the east by Elgin Road.

### System for Numbering Wells and Springs

The numbering system for identifying locations of wells and springs in this report is based on the common subdivision of lands into townships, ranges, and sections (Figure 2). The location based on the township-range system is referenced to the Boise base line and meridian. The first segment represents the township north of the Boise baseline, the second segment represents the range west of the Boise meridian, and the third the section number. The three letters following the section number indicate the 1/4-1/4-1/4 section (40-acre tract) within the section. Quarter sections are labeled A,B,C, and D in counterclockwise order starting with the NE 1/4 of the section. A numeral following the letters indicates the order in which wells within the 40-acre tract were inventoried.

### Climate

The climate of the project area is semiarid, with warm, dry summers and cool, moist winters. The average daily maximum and minimum temperatures during July are 91° and 55° Fahrenheit; comparable temperatures during January are 36° and 20 °Fahrenheit. The average annual precipitation at Payette during the 30-year period of record from 1945-1975 was 11.41 inches; annual precipitation during the period ranged from about 5 inches to about 16 inches. The average frost-free growing season for the area is 147 days (SCS, 1976).

Figure 1. Location of Lower Payette project area.

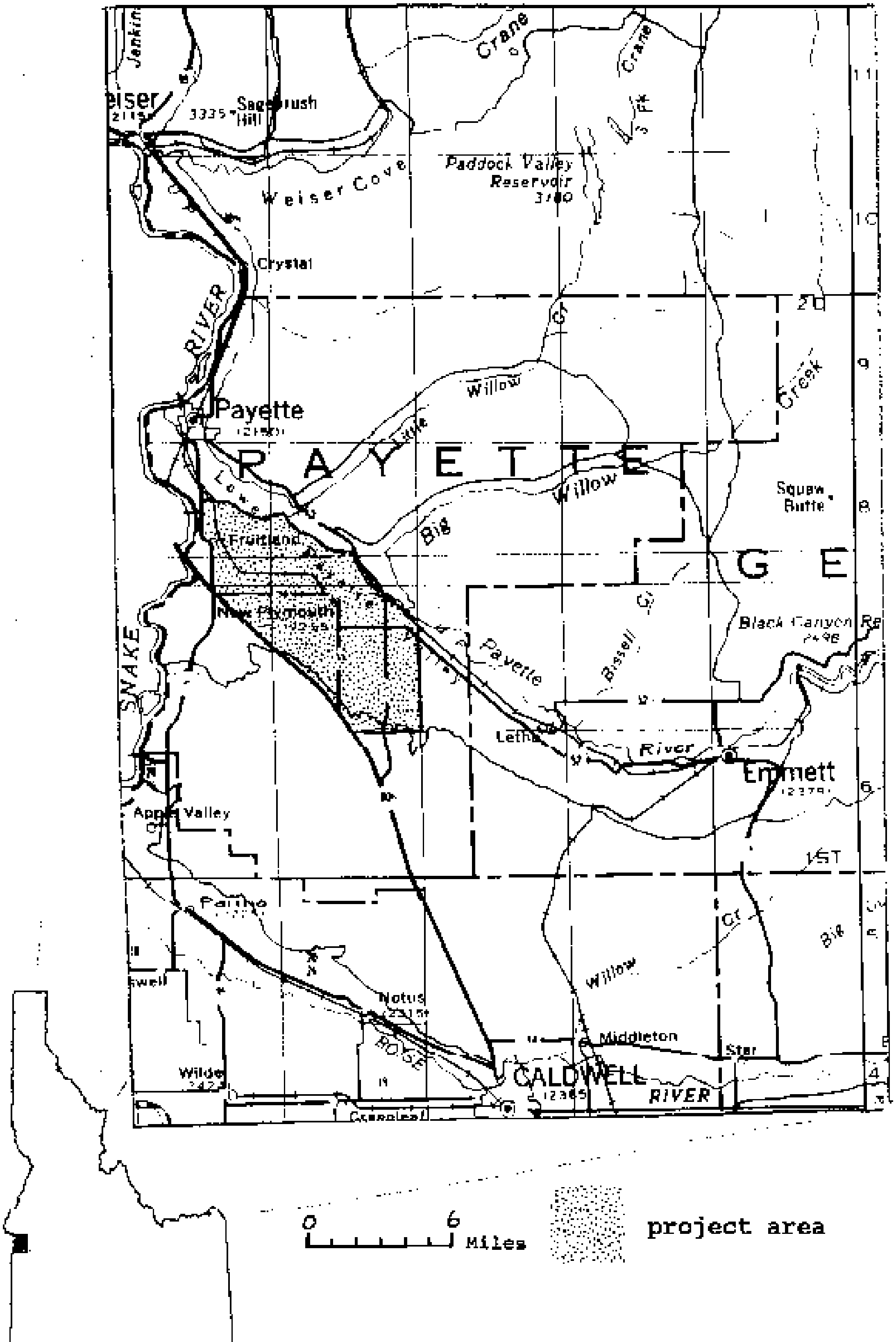
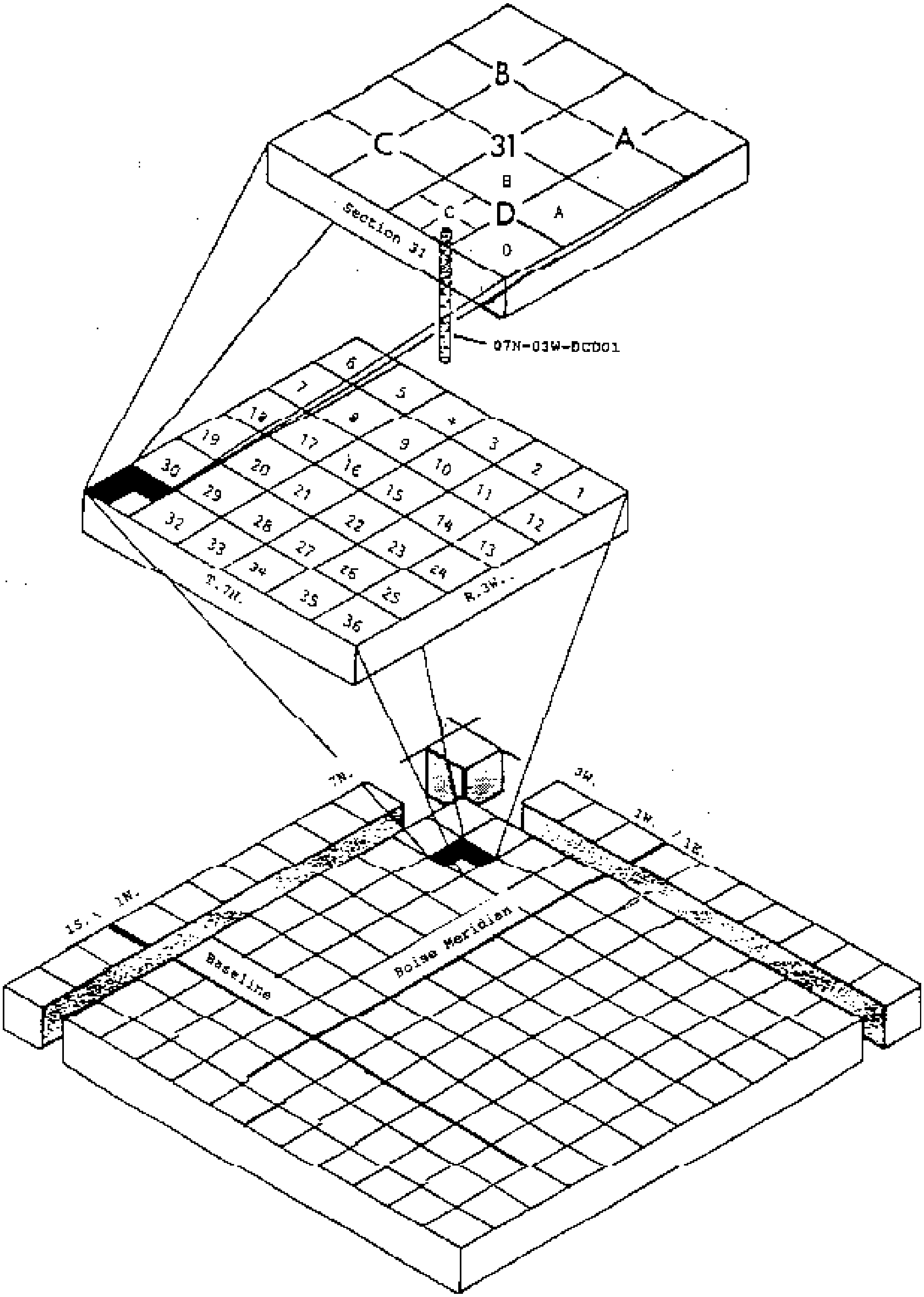


Figure 2. Well numbering system.



## Soils

The soils found in the study area have been described in the Soil Survey of Payette County (SCS, 1976). This reference is the basis for much of the discussion below.

A series of three increasingly older terraces is encountered as one travels south and west from the Payette River. The soils found on these terraces reflect the varying age, landscape position, and stability of the terrace surfaces as well as the variability in parent material between terraces. Generally, the soils found in the study area developed in sediments of lacustrine, fluvial, and eolian origin. The fluvial sediments represent both reworked lacustrine material and younger alluvial material of other sources. Soils developed in these materials are the youngest in the study area and are found on the lowest terraces and present floodplain adjacent to the Payette River. These soils tend to be more weakly developed, are coarser in texture (loams and sandy loams), are more poorly drained than soils on the higher terraces, and may possess a shallow water table. Typical soils in these areas include the Moulton, Letha, Notus, and Baldock series.

The next higher, intermediate terrace is dominated by silty and clayey lacustrine sediments covered with a veneer of silty or sandy loess. The soils developed in these materials are well drained and typically have a thick zone of clay accumulation (silty clay loam). This horizon may be absent in unstable landscape positions subject to erosion. The dominant soils are the Greenleaf, Nyssaton, and Owyhee series. These soils occupy the largest portion of the study area and are described in more detail in the soil monitoring section.

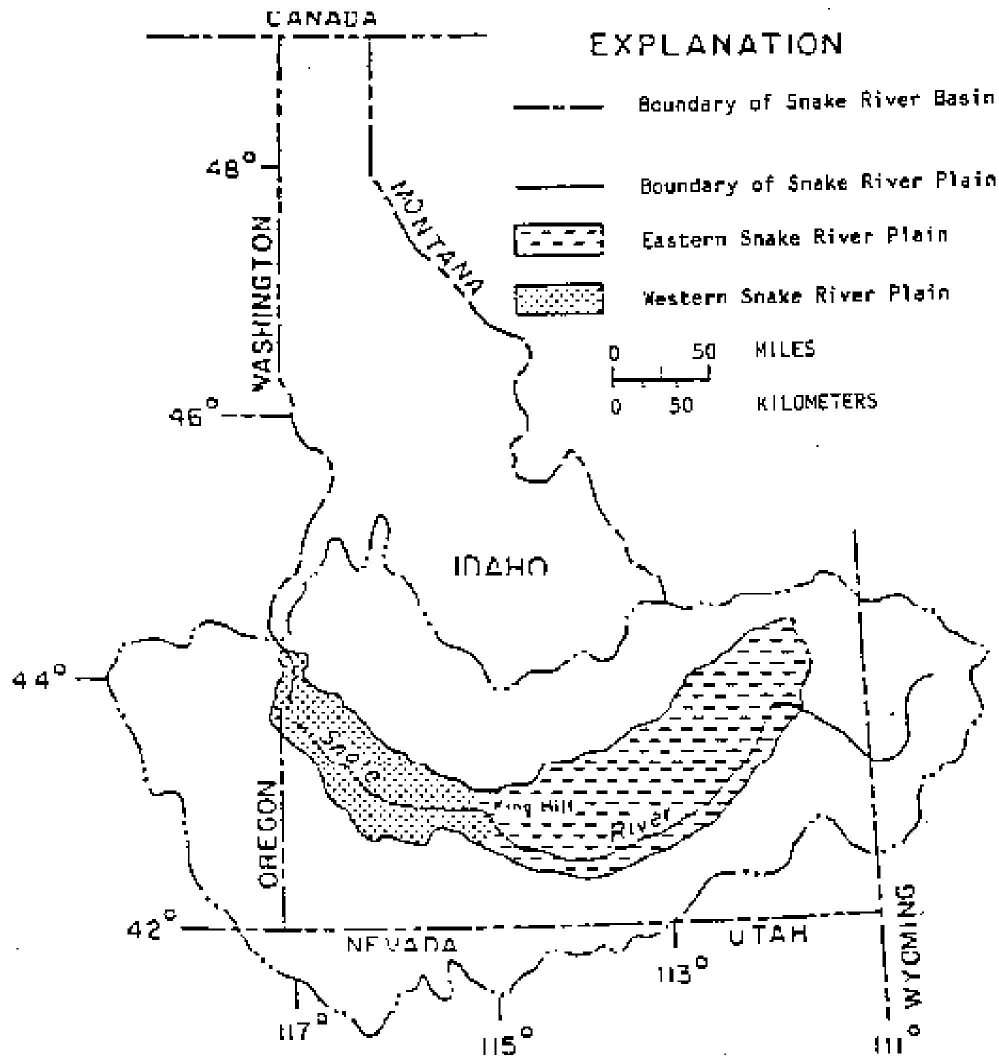
The soils found on the highest, oldest terrace formed in coarse-textured sediments of the Idaho Group (described in more detail in Geology below) and also contain a thin veneer of silty or sandy loess. These soils typically have a thin, well developed horizon of clay accumulation (silty clay loam) that is underlain, at a shallow depth (20-40 inches) by a hardpan of calcium carbonate and silica. This hardpan ranges from weakly cemented to indurated. The Elijah and Purdam series are typically found on this terrace.

## *Geology*

The geology of the lower Payette region has been described in several reports. These include Lindgren (1898a and 1898b), Kirkham (1930, 1931a, 1931b, 1931c, and 1935), Savage (1961), and Deick and Ralston (1986). The geological discussion of the lower Payette project area which follows is summarized from Deick and Ralston (1986). Well logs obtained from the Idaho Department of Water Resources were used to confirm subsurface geology in the project area.

The project area is located within the western Snake River Plain, an elongate feature that stretches from King Hill on the east to the Idaho-Oregon border on the west (Figure 3). The Snake River is the major regional surface water drainage for the western Snake River Plain. This feature has been described as a large sediment-filled trough formed by a graben. The sediments in the trough came from erosion of the adjacent uplands (Savage, 1961).

Figure 3. Location of the Snake Plain. (Bigelow, Goodell, and Newton, 1984).



Based on data from the Ore-Ida Foods No. 1 well in Ontario, Oregon (Wood and Anderson, 1981), the thickness of sediments in the trough exceeds 5,000 feet. Only the upper part of these sediments is of interest in this study.

The sedimentary rocks of interest in the project area have been divided into the following units: 1) Idaho Group, 2) Tenmile Gravel, 3) Caldwell and Nampa sediments, and 4) fluviatile and eolian deposits. Table 1 (modified from Deick and Ralston, 1986) shows the near-surface rock units.

The Glenns Ferry Formation of the Idaho Group underlies the project area. The formation is composed of interlayered clay, shale, ash, silt, sandstone, oolitic limestone, impure diatomite, and fine gravel. The sediments were probably deposited in lakes which existed in the region. The lakes alternated between stable deep lakes and shallow lakes with fluctuating water levels.

The different depositional environments resulted in coarse-grained sediments accumulating along beaches and deltas, while fine-grained sediments accumulated in the deeper quiet-water environments. The Glenns Ferry Formation is exposed in the bluffs along the north side of the Payette River, southeast of Payette.

A feature of the Glenns Ferry Formation in the subsurface is the occurrence of "blue" sediments, especially "blue clay" noted in drillers logs. The blue color may have resulted from deposition under reducing conditions; these conditions could have been present in a lake with limited circulation and abundant organic material. Elevations on the top of the blue clay range from about 2300 feet above sea level in the southern part of the study area to about 2150 feet in the northwestern corner of the study area. Three general areas with similar elevations have been delineated. These areas may represent different erosional terraces of the ancient Payette River.

The Tenmile gravel and the Nampa and Caldwell sediments are composed of unconsolidated silt, sand, and gravel. The Tenmile Gravel is believed to exist mainly along the southern part of the study area, near Interstate 80N. The Ten Mile Gravel was deposited from glacial meltwater that flowed from mountainous areas to the north.

The Caldwell and Nampa sediments are treated as a single unit due to their similar lithologies (Deick and Ralston, 1986). The sediments occur over much of the project area and are overlain by either a soil mantle or recent fluviatile and eolian deposits. The sediments were deposited following the end of glaciation in the region.

Recent deposits, of fluviatile and eolian origin, mostly are derived from older reworked deposits. These deposits form the lower terraces and the floodplain of the Payette River. The deposits are probably represented by landforms in the project area below about 2240 feet.

Drillers logs from wells in the project area indicate a persistent layer of clay or sandy clay from 10 to 20 feet thick that occurs in the first 20 feet below land surface. Othburg (1991, personal communication) noted that slackwater deposits from the Bonneville Flood are found in the Lower Payette River valley, with the

**Table 1. Near-surface geologic units in the Lower Payette project area (modified from Savage, 1961 and Smith, 1981).**

| Geologic Age | | | | Formation or Unit (with estimated thickness in feet) | Brief Description |
|---|---|---|---|---|---|
| Quaternary | Recent | | | Late and Early fluviatile and eolian deposits 0-30± Qa | Clay, silt, sand and gravel; generally non-consolidated. Some caliche in early deposits. Occupies modern flood plains and low strata deposits. |
| Quaternary | Pleistocene | Late | Snake River Group | Caldwell and Nampa sediments (undifferentiated) 0-50 Qpa | "Terrace gravels", clay, silt, sand and gravel; generally nonconsolidated. Some caliche. Generally below 2,500 feet elevation; "Provo and Bonneville floods." |
| | | | | ---- unconformity ------ | |
| Quaternary | Pleistocene | Early | Snake River Group | Tenmile Gravel 500± Qpo | "Terrace gravels", clay, silt, sand, gravel and cobbles; nonconsolidated to poorly consolidated, some caliche. Fluviatile with some crossbedding, channeling and stratification. Generally good imbrication--current flowing southwest or west. Piedmont alluvial fill, chiefly crystalline rock with some disintegrated pebbles. Aggrading Pleistocene stream deposit. |
| Tertiary to Quaternary | Pliocene to Pleistocene | | Idaho Group | Glenns Ferry Formation Chalk Hills Formation Banbury Basalt (Grassy Mt. Basalt) Poison Ck. Formation Tpd | Clay, ash, silt, sand and fine gravel; unconsolidated. Diatomite (impure) limestone, shale and sandstone. A fluviatile deposit with local lacusterine beds. Generally below 3,000 feet elevation. |

maximum height of the water occurring at about 2430 feet above sea level. This clay layer may represent material that was partly derived from the slackwater deposits.

## Hydrogeology

The project area lies in the western part of the Western Snake River Plain (Figure 3). Wood and Anderson (1981) described the regional hydrogeology of this part of the Snake River Plain and proposed three general hydrogeologic units for the region. The three units include: 1) a shallow cold water aquifer system, 2) an intermediate warm water system that occurs within a thick blue clay zone, and 3) a deep hydrogeologic unit which has been identified from oil and gas wells drilled in the area. Wood and Anderson (1981) divided the shallow hydrogeologic system into an upper sand and gravel unit that includes 1) the surficial deposits and terrace gravels, 2) basalts of the Snake River Group, and 3) the upper part of the Glenns Ferry Formation. Basalts of the Snake River Group either were not deposited or were removed by erosion in the project area. Because of this, the surficial deposits directly overlie the upper part of the Glenns Ferry Formation.

The distinction between the surficial deposits and terrace gravels and the upper part of the Glenns Ferry Formation is difficult to make in drillers logs, but generally shallow wells located along the northern part of the project area are probably completed in saturated surficial and terrace gravel deposits. Deep wells located along the southern and eastern parts of the project area are probably completed in the upper part of the Glenns Ferry Formation. The first blue clay unit noted in drillers logs probably indicates the upper part of the Glenns Ferry Formation.

The warm water hydrogeologic unit described by Wood and Anderson (1981) probably is within the middle part of the Glenns Ferry Formation. A blue clay zone is a distinctive characteristic of this unit. Squires and others (1992, page 28) note the occurrence of blue sediments of the Glenns Ferry Formation in the Boise valley area.

Drillers logs for many domestic wells in the project area have indicated blue clay in the lower part of the well. This first clay zone often is 20-40 feet thick and shallow wells are usually completed in saturated units above the blue clay. Wells completed in deeper zones of the middle Glenns Ferry Formation can have high yields.

Recharge to aquifers in the project area is from precipitation, from underflow from areas adjacent to the project area, and from irrigation water. Recharge from irrigation water probably accounts for much of the water that reaches ground water under existing conditions. This recharge occurs both from percolation below the root zone in fields, and from seepage losses from canals, laterals and ditches in the area. Precipitation in the area is small and evapotranspiration is large resulting in little net recharge from precipitation.

The relative contribution of irrigation recharge to the ground-water system can be seen from water-level changes measured in wells during 1991 and 1992. Water level changes as much as 13.15 feet were recorded at well 07N-04W-

28AAA01 from April 1991 to March 3, 1992. The water level rise begins shortly after irrigation starts in the spring and continues until late fall when irrigation stops. Figure 4 shows hydrographs for 10 quarterly monitoring wells in the study area. Under pre-irrigation conditions the water table was deeper over much of the area. Within a few years after irrigation began recharge caused water levels to rise, creating saturated soils in low-lying areas. Surface drains were constructed to lower the water table (Figure 5); many of the drains flow year around. The surface drains, which run from south to north, intercept ground water which would otherwise discharge to the river.

Ground water in the project area generally moves from south to north, toward the Payette River. A potentiometric map was constructed from water levels measured in April and May of 1991 (Figure 6). The water table slopes toward the Payette River; ground water moves from higher to lower elevations and discharges to the river. Ground-water also discharges to surface drains in the project area. Ground-water discharge to the drains would be indicated by contours "veeing" upstream along the drains; however a sufficient number of wells could not be measured in the project area to get this level of detail for the potentiometric map.

Some ground water also may move upward from aquifers in the middle Glenns Ferry Formation to the shallow aquifer. The Payette River serves as a regional discharge area for ground-water flow systems in the area. Ground water levels probably increase with well depth, indicating the potential for upward movement from deep to shallow aquifers.

Depth to water in the project area ranges from 10 to 20 feet below land surface near the Payette River to 90 to 100 feet below land surface in the southeastern part of the study area (Figure 7). This range in depth to water occurs because the slope on the land surface is greater than the slope on the water table from north to south across the project area.

## Land Use

Land use in the study area is dominated by agriculture. Historically, orchards and fruit production, along with the raising of cattle and sheep, were the primary agricultural activities. In recent years, however, row crop production has dramatically increased while fruit production has declined. The row crops commonly grown include sugar beets, onions, corn, potatoes, beans, mint, small grains, and specialty seed crops. These crops are typically flood irrigated using water supplied by three canals: Noble, Farmers Cooperative, and the Black Canyon.

In those portions of the study area that do not have soil conditions conducive to row crop production, alfalfa, small grains and pasture are often grown. Both surface and sprinkler irrigation is used for these areas and water is supplied from canals. Portions of the study area too steep for irrigation or which are not supplied by canal water are left in rangeland. These areas are concentrated in the higher terrace areas in the south and southeast portions of the study area.

Figure 4. Hydrographs for selected quarterly monitoring wells.

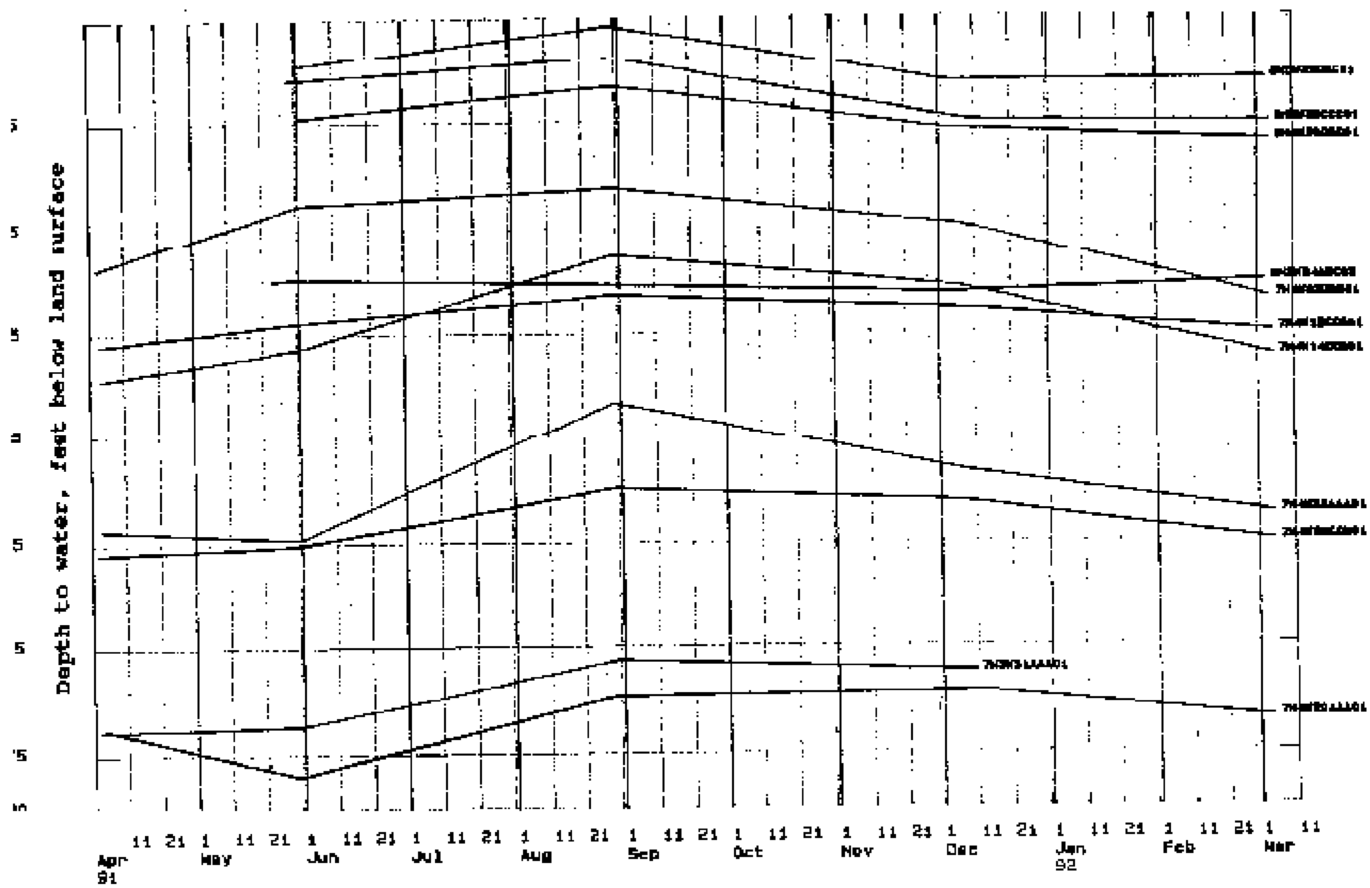


Figure 5. Location of surface drains sampled during January 1992.

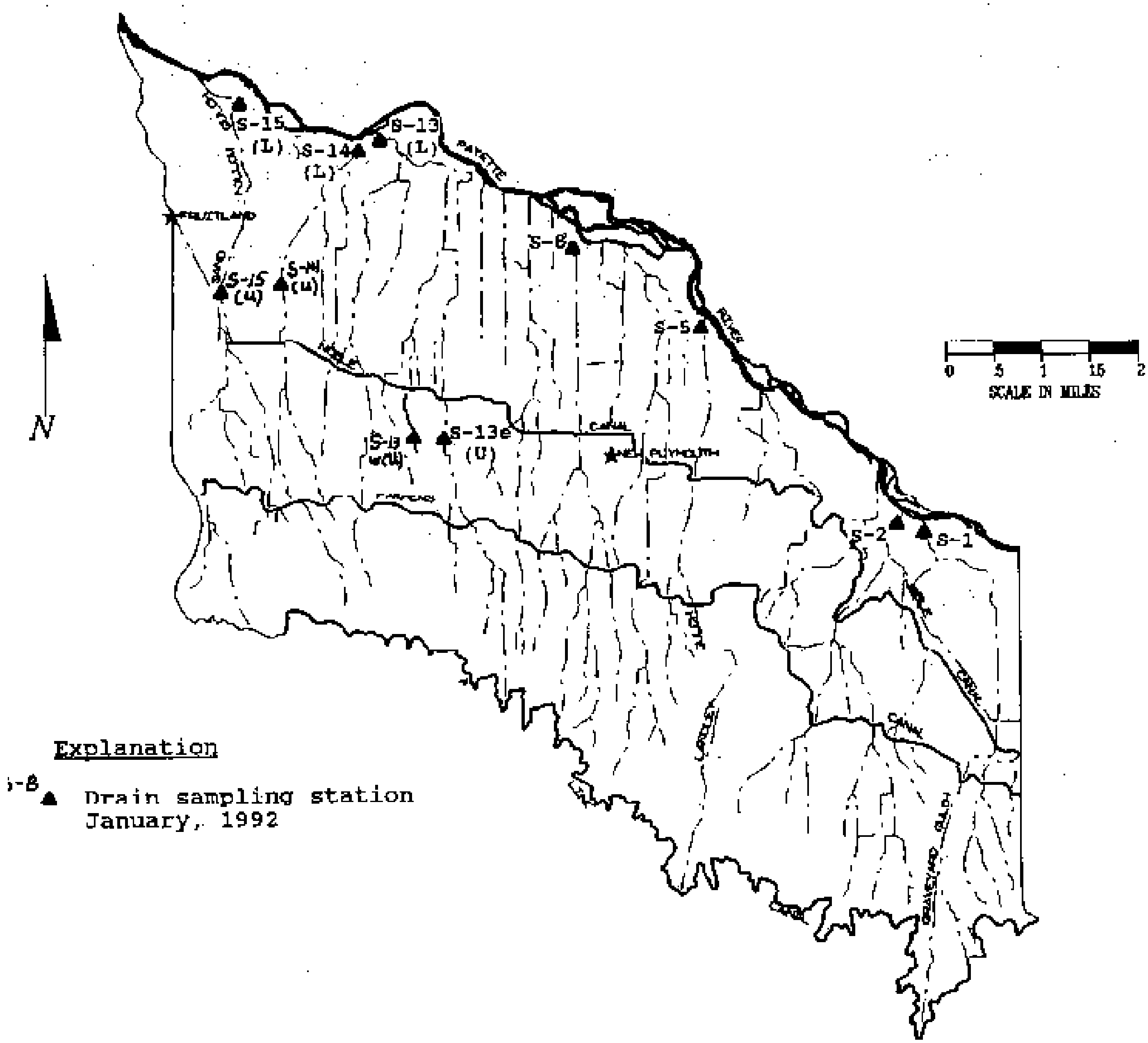


Figure 6. Potentiometric map of the Lower Payette study area.

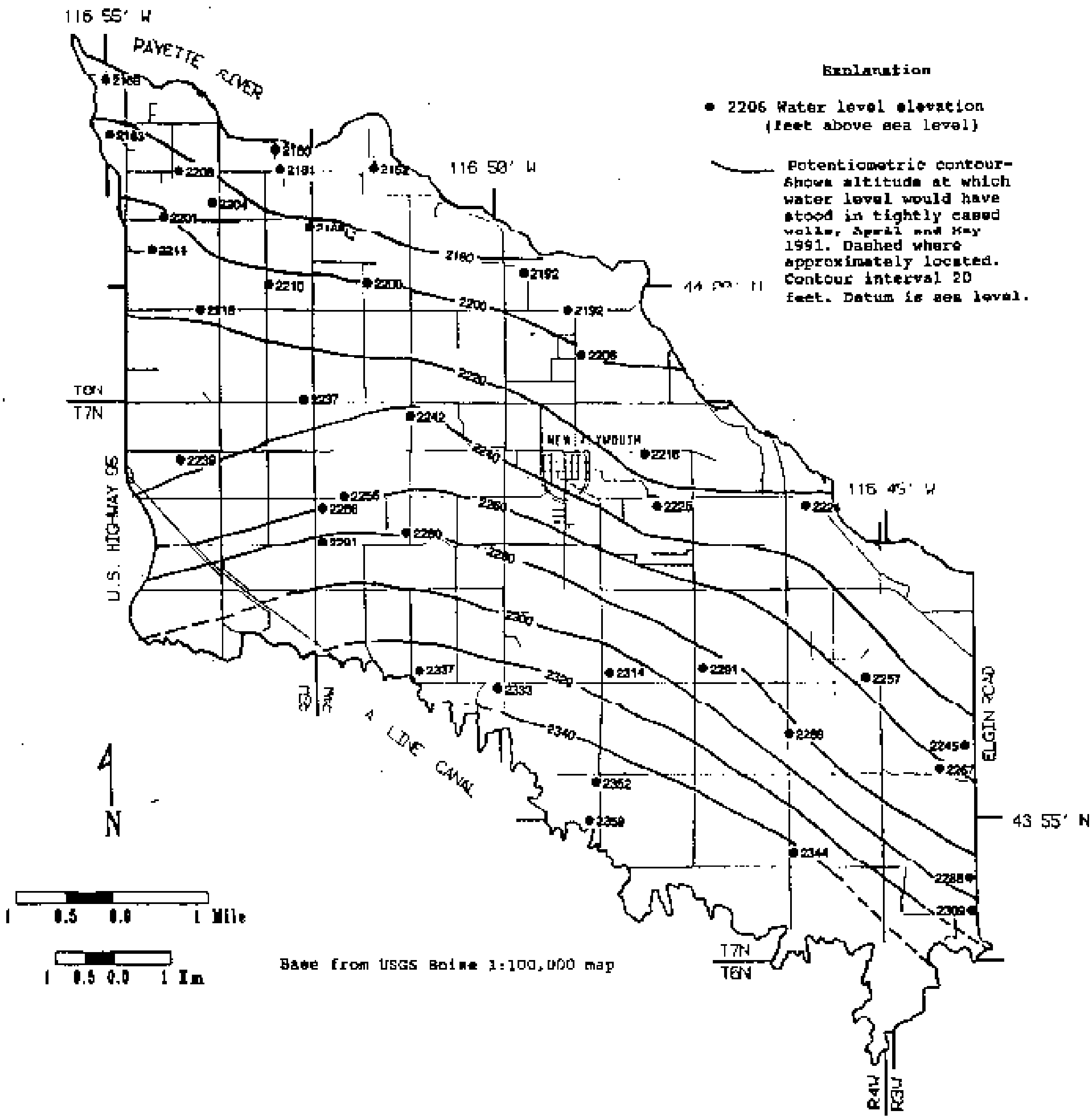
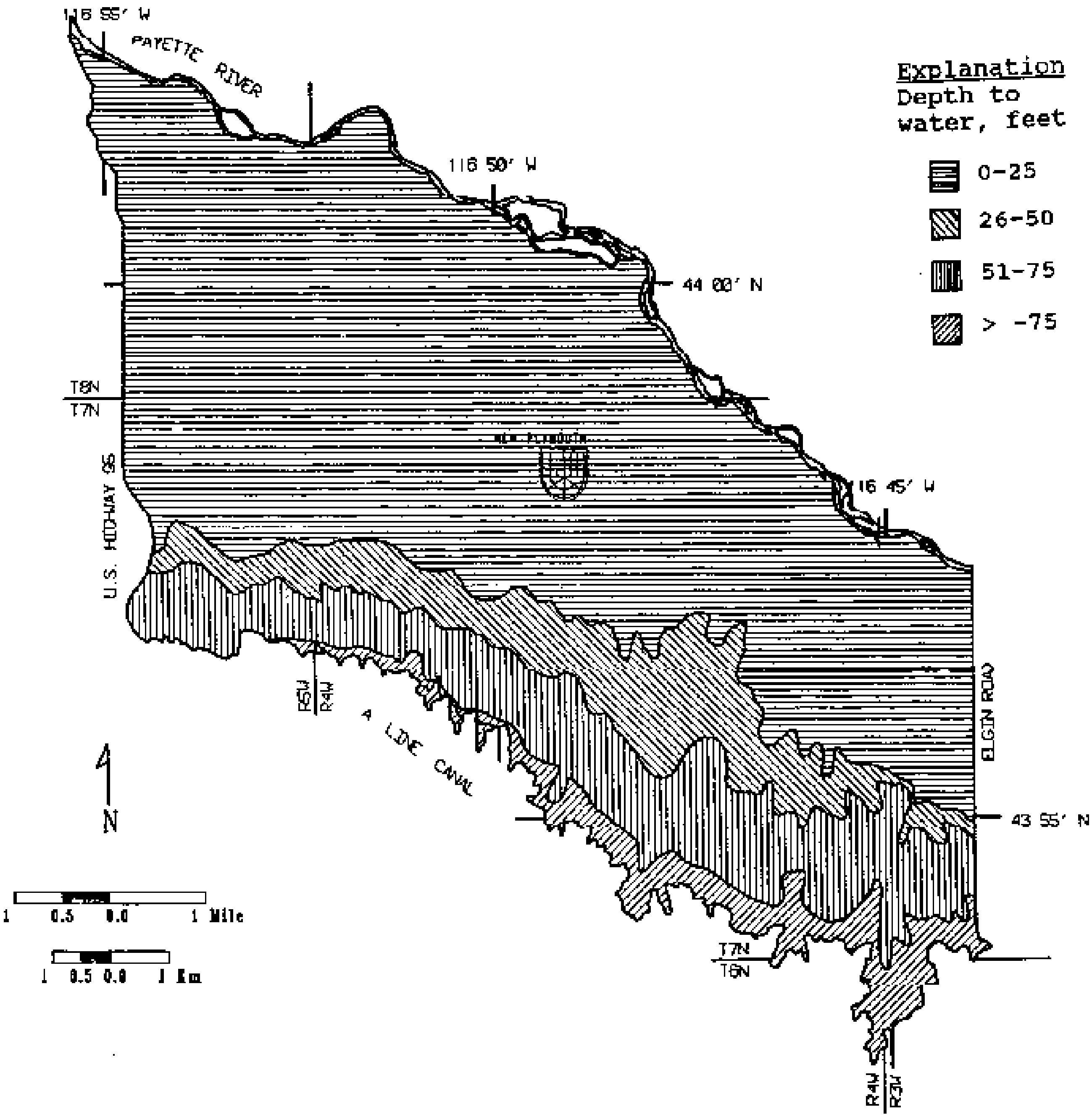


Figure 7. Depth of first ground water.



Feedlot and dairy operations, scattered throughout the study area, do not constitute a large percentage of the total agricultural acreage. However, depending on their proximity to surface drains and the management practices employed, their impact on surface water and ground-water quality can be significant. Small areas of land adjacent to the Payette River which are too wet to farm are in pasture or supply wildlife habitat.

# Materials and Methods

The initial phase of the study, conducted in April and May of 1991 consisted of an area-wide ground-water survey of 84 wells within the project area. The wells were selected to get an even distribution over the area. Well owners were interviewed to obtain information on well construction and completion depth and other pertinent information. Information for wells inventoried in the study area is presented in Table 2 (Table 2 is located in Appendix A).

Water levels were measured with a steel tape. Measurements were taken to the nearest hundredth of a foot. Well depth was measured to the nearest one to two feet with the steel tape. It was not always possible to obtain a water level and a depth from a well, but if a well was determined to be in an area where information was needed, water chemistry information was gathered. Land surface elevation was determined from U.S. Geological Survey 1:24000 topographic quadrangles.

In addition to collecting well information and water levels, field water quality parameters were measured. The parameters included temperature, specific conductance, pH, nitrate, and chloride. Temperature, specific conductance, and pH were measured over a ten minute period while the well was pumping. When results were within 15 percent of the preceding measurement, water samples were collected for nitrate and chloride analysis.

Field nitrate analysis on the first 10-15 wells was done using a HACH colorimetric field nitrate test kit, with a range of 0 to 50 mg/L nitrate. The color disc used with this kit is incremented in units of 1 mg/L and nitrate values can be estimated to the nearest 0.5 mg/L. The remainder of the field nitrate values were determined using a HACH DR2000 field spectrophotometer. For the nitrate test the detection limit is 0.1 mg/L. Several checks on the accuracy of the DR2000 were performed during the initial field screening. Daily measurements were made of lab-prepared standards. Thirty-nine samples were submitted for lab analysis. Lab nitrate values were compared to field values. Field nitrate values below about 4 mg/L tended to overestimate the true value by about 30 percent while field values greater than 4 mg/L were underestimated by about 36 percent. A linear regression of lab versus field nitrate values had an r-squared of 0.94. These data suggest that the field screening nitrate values were of sufficient accuracy to present a representative picture of area-wide nitrate in ground water. Field chloride concentrations were determined at 28 wells by titration with mercuric nitrate solution, using a digital titrator. Water samples were collected from 53 wells for laboratory chloride analysis. Comparison of laboratory and field results indicated that the field results were typically within 20 percent of lab results. Field bicarbonate concentrations were determined by titration using sulfuric acid in a digital titrator.

Water quality information from the initial area-wide survey was used to select 30 wells for a year-long quarterly sampling effort. Quarterly samples were collected in May, August, and December 1991 and March 1992.

Locations of quarterly wells were based on results from the area-wide survey. A greater density of wells was selected for sampling in the northwestern part of the project area because ground-water impacts appeared to be greater there. Water samples from quarterly wells were analyzed in the Idaho Bureau of Laboratories for chloride, nitrate, pH, specific conductance, total Kjeldahl nitrogen (TKN), and total phosphorus. Water samples for pesticide analysis were collected from 20 of the 30 wells each quarter. All wells selected for quarterly sampling were sampled once for major ions (calcium, magnesium, sodium, potassium, chloride, sulfate, and bicarbonate). Twelve additional wells in the project area were sampled for major ions. Laboratory analysis for arsenic was done on 30 wells from the project area.

Soil sampling of the vadose zone took place during the week of June 10-14, 1991. Procedures employed for field selection, sampling procedures, and analytical procedures are described below.

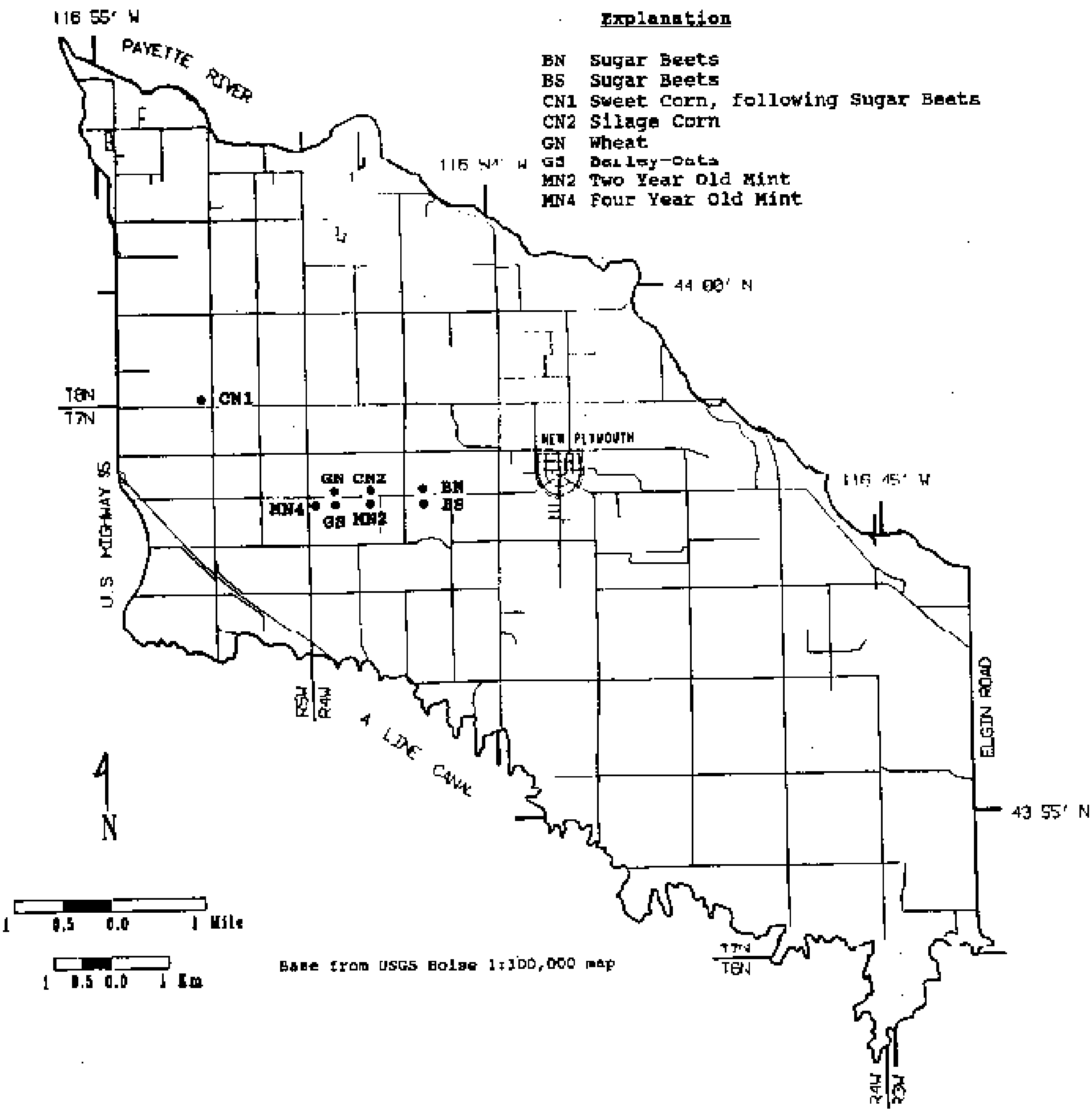
Fields utilized in this monitoring study were chosen in cooperation with the Payette SCS field office and the Payette Soil and Water Conservation District. The locations of the eight fields sampled are shown on Figure 8. Four general crop types were chosen for sampling, with two fields sampled within each crop type. The crop types sampled (along with sample designations) were: corn (one field of sweet-CN1 and one of silage-CN2), sugar beets (BN and BS), mint (a 2 yr. old-MN2 and a 4 yr. old-MN4 stand), and small grains (a wheat field-GN and a barley/oats field-GS).

All the fields sampled were mapped by the Soil Conservation Service as being located within delineations of the Greenleaf silt loam mapping units GeA or GeB (SCS, 1976). These mapping units contain dominantly the Greenleaf soil series with smaller amounts of Greenleaf (wet variant), Nyssaton, and Owyhee soil series. The type location for the Greenleaf soil series is located within a quarter-mile of several of the study fields. A typical profile of the Greenleaf series contains textures of silt loam from 0-26 inches, silty clay loam from 26-33 inches, and silt from 33-60+ inches. The silt layer is hard and platy. The soils typically are calcareous below 26 inches. The Nyssaton and Owyhee soils are not as strongly developed as the Greenleaf and lack the accumulations of clay in the subsoil.

The soils found during sampling generally fit the typical description for Greenleaf noted above, at least in the upper five feet. Below this depth there was significant variability from field to field, particularly in these characteristics: depth to some type of cemented layer, the strength of cementation, the occurrence of lenses of sand, and the depth to water.

At each field selected a square, five acre parcel was chosen for sampling. Through the use of a random number table, five random locations were selected for sampling. The only constraint placed on this random selection process was that there be at least one location in each quadrant. Soils were sampled by hand using a 3-1/4" bucket auger. Samples were taken from each location at depths of 0 1, 3 4, 6 7, and 9 10 feet. In certain fields, samples were taken at one foot intervals for moisture content analysis. At each of the indicated depths, samples from all five locations within a field were combined, mixed, and several subsamples

Figure 8. Location of soil sampling sites in the Lower Payette study area.



taken for analysis. The composited samples were placed on ice in coolers and shipped to the University of Idaho Analytical Laboratory for analysis.

Samples were analyzed for a range of inorganic and organic parameters. Inorganic parameters included pH (using a pH electrode in a soil:water slurry), percent organic matter (Walkley-Black titrimetric method), nitrate-N ($CaSO_4$ extraction and FIA), ammonium-N (FIA), organic N (combustion), and electrical conductivity (EC electrode).

Organic analyses were done for selected classes of pesticides. Based on discussions with the participating farmers as to what chemicals had been applied to their fields, different classes were analyzed for the fields in each crop type. The four classes of pesticides analyzed were: chlorinated compounds and PCB's (EPA Method 8080 for analysis and EPA Method 3540 for extraction), chlorinated acids (EPA Method 8150/3540), organophosphorus and organonitrogen compounds (EPA Methods 3540/8140), and carbamate compounds (EPA Method 531.1 for analysis and a USGS (1987) technique for extraction). The individual compounds within a given class of pesticides which are detected by the analytical methods used are shown in Table 3. Also included in this Table are the classes of pesticides chosen for analysis for each crop type.

Inorganic analyses were conducted on samples from all four depths and all eight fields while, because of cost constraints, pesticide analyses were only done on four fields (one from each crop type) and at three depths in each field.

## Quality Assurance and Quality Control

### Water

All water samples for major ion, nitrate, and metal analysis were collected in clean polyethylene 500 milliliter (ml) containers, and chilled to 4$ Celsius. Samples collected for nitrate analysis were preserved in the field with 2 ml sulfuric acid ($H_2SO_4$). Samples collected for arsenic analysis were preserved in the field with 2 ml nitric acid ($HNO_3$). Pesticide samples were collected in 1 liter amber glass jugs and cooled to 4$ Celsius. All samples were transported to the Idaho Bureau of Laboratories on the same day of collection. Travel and transfer blanks were analyzed in the Idaho Bureau of Laboratories to check on field sample collection techniques.

Duplicate nitrate samples were collected from ten percent of the quarterly wells and during the area-wide screening. Laboratory spikes for nitrate analysis were added to water samples during the first quarterly sampling event to test for laboratory recovery accuracy. Duplicate samples were collected for ten percent of the pesticide samples collected during quarterly sampling.

Statistical indicators of laboratory accuracy and precision were calculated and are presented in Table 4. Results are presented for nitrate and the pesticide Dacthal for each sampling date of the study. For nitrate, reproducibility of duplicate sample analyses was poor during the area-wide April 1991 sampling event but steadily improved and were within accepTable limits during all quarterly sampling events. Accuracy of nitrate analyses, as determined through the use of field

Table 3. Compounds analyzed by the University of Idaho analytical lab for different pesticide classes.

| Organo N and P | Chlorinated | Carbamates | Chlorinated Acids |
|---|---|---|---|
| Alachlor | Aldrin | Aldicarb Sulfoxide | 2,4-DB |
| Ametryne | BHC-alpha | Aldicarb Sulfone | 2,4-D |
| Ametraton | BHC-beta | Oxamyl | 2,4,5-T |
| Atrazine | BHC-delta | Methomyl | 2,4,5-TP (Silvex) |
| Bromacil | BHC-gamma (Lindane) | 3-Hydroxycarbofuran | Dalapon |
| Butachlor | Chlordane (technical) | Aldicarb | Dicamba |
| Butylate | 4,4'-DDD | Baygon (Propoxpur) | Dichloroprop |
| Carboxin | 4,4'-DDE | Carbofuran | Dinoseb |
| Chloropropham | 4,4'-DDT | Carbaryl | MCPA |
| Cycloate | Dieldrin | 1-Napthol | MCPP |
| Diazinon | Endosulfan I | Methiocarb | DCPA |
| Dichlorvos | Endosulfan II | | |
| Diphenamid | Endosulfan sulfate | | |
| Disulfoton | Endrin | | |
| Disulfoton sulfone | Endrin aldehyde | | |
| Disulfoton sulfoxide | Heptachlor | | |
| EPTC | Heptachlor epoxide | | |
| Ethoprop | Methoxychlor | | |
| Fenamiphos | Toxaphene | | |
| Fenarimol | | | |
| Fluridone | | | |
| Hexazinone | | | |
| Merphos | | | |
| Methyl paraoxon | | | |
| Metolachlor | | | |
| Metribuzin | | | |
| Mevinphos | | | |
| MGK 264 | | | |
| Molinate | | | |
| Napropamide | | | |
| Norflurazon | | | |
| Pebulate | | | |
| Prometon | | | |
| Prometryne | | | |
| Pronamide | | | |
| Propazine | | | |
| Simazine | | | |
| Simetryne | | | |
| Stirofos | | | |
| Tebuthiuron | | | |
| Terbacil | | | |
| Terbufos | | | |
| Terbutryne | | | |
| Triadimefon | | | |
| Tricyclazole | | | |
| Vernolate | | | |

Table 4. QA/QC statistics for ground water sampling events in the Lower Payette study area.

| Analyte | 4/91 | 5/91 | 8/91 | 12/91 | 3/92 | Overall |
|---|---|---|---|---|---|---|
| **Nitrate** | | | | | | |
| Mean RPD(%) | 86(5) | 15(2) | 13(2) | 2(4) | 5(1) | 35(14) |
| SD(%) | 92 | 2 | 18 | 1 | -- | 65 |
| | | | | | | |
| Mean Recovery(%) | 83(3) | 214(1) | 88(1) | -- | -- | 92(5) |
| SD(%) | 88 | -- | -- | | | 76 |
| | | | | | | |
| Transfer Blank | ND | ND | | | | |
| **Dachthal** | | | | | | |
| Mean RPD(%) | 81(2) | 103(2) | 62(2) | 108(2) | 88(2) | 88(10) |
| SD(%) | 99 | 136 | 88 | 128 | 47 | 80 |
| | | | | | | |
| Mean Recovery(%) | -- | -- | -- | -- | 129(2) | |
| SD(%) | | | | | 11 | |

Note: in the printed table, the date columns appear under the heading "Sample Date".

Value in parentheses represents number of samples
RPD= Relative Percent Difference
SD= Standard Deviation
ND= Not Detected

spiked samples, were erratic and indicated possible difficulties in the field procedures used to introduce the spikes in the field. Another indication of accuracy, resubmission of samples of standard nitrate solutions for analysis, produced more acceptable recoveries that ranged from 83-106 percent with a mean recovery of 93 percent.

Results for Dacthal, the most commonly detected pesticide, were more problematic. Reproducibility during all sampling events was erratic and outside acceptable limits. Variability of duplicate sample analyses was often as high or higher than that observed at the same well over multiple sampling dates. Two duplicate samples were submitted during each sampling event. Typically, one duplicate would have an acceptably low relative percent difference (RPD) and the other would be very high. The majority of those duplicate samples with unacceptably high RPD values had concentrations significantly above the detection limit. Use of the RPD statistic is typically restricted to samples with concentrations at least five times the detection limit. This tends to confirm the validity of the conclusions reached regarding analytical reproducibility during the study.

As a result of the above evaluation of quality assurance and control during the sampling and analysis for pesticides the results presented should be considered qualitative. The detection of pesticides will therefore be evaluated on a presence/absence basis only.

### Soil

QA/QC procedures employed during the soil sampling event included sampling equipment decontamination at each location in each field, prior to taking a sample at a given depth for pesticide analysis. Decontamination consisted of removing large soil particles with a scrub brush and a TSP detergent solution, rinsing with hexane and finally rinsing with distilled water. On one occasion a sample of rinsate was collected and analyzed for two classes of pesticides (chlorinated and organo N and P) as a check on the adequacy of the decontamination procedures. None were detected.

Additional quality control procedures included duplicate analysis of four samples for inorganic parameters and one sample for pesticide analysis. Of the four inorganic duplicates, three consisted of separate samples collected after the compositing procedure had been completed while one was a subsample, taken by the laboratory from the same sample container. The three former samples provided a check on the compositing procedure as well as the lab precision. QA/QC results are presented in Table 5.

For pesticide analyses the University of Idaho Analytical Laboratory performs routine fortification analyses as a check on the accuracy of the methods employed. Known levels of compounds which are considered to act similarly to the class of compounds being analyzed are added to samples and the percent recovered is calculated. The spike compounds used for each class of pesticides are as follows:

1,3 dimethyl,2-dinitrobenzene for organo N and P, dichlorobenzene for organochlorine, and dichloroacetic acid for chlorinated acids. For the carbamate class, each compound in the class is spiked and the average recovery of the group is reported. The average recovery for each class was as follows: carbamate (81%), organo N and P (88%, range of 70-118%), organochlorine (89%), and chlorinated acids (89%). These values are within the range typically required for data acceptability and support the accuracy of the data as reported.

Table 5. QA/QC statistics for soil sampling in the Lower Payette study area.

| | Relative Percent Difference (%) | | | | |
|---|---|---|---|---|---|
| Sample # | $NO_3$ | $NH_4$ | O.M. | E.C. | Pesticide |
| BN-1-2 | 1.9 | 14.3 | 6.9 | 143 | |
| MN4-1-3 | 2.8 | 13 | 4.9 | 12.2 | |
| MN4-1-2 | | | | | 0 |
| GN-1-2 | 0 | 26 | 4.9 | 4.9 | |
| GN-1-1 | | | | | 0 |
| CN-1-1 | 1.3 | 16.9 | 0.9 | 7.2 | |
| Average | 1.5 | 17 | 4.4 | 41.8 | 0 |

Relative percent difference (%)=(ABS(X1-X2)/(X1+X2))X 200
O.M. = organic matter
E.C. = electrical conductivity

# Results and Discussion

## Ground Water

Nitrate in ground water can originate from natural and human-related sources. Natural sources include atmospheric nitrogen, decaying organic material, and soluble compounds or minerals in soils and rocks. These sources can contribute significant amounts of nitrate to the ground-water system.

Human-related sources of nitrate include septic tank effluent, fertilizers, and leachate from feedlots. Water from some wells in the project area have nitrate concentrations below the laboratory detection limit (0.005 mg/L). This indicates that contributions from natural sources at these wells are very low. Since no geologic conditions in the study area were identified that could contribute nitrate to ground water prior to human activities, it is assumed that all ground water in the study area contained very little nitrate prior to man's activities. For the purposes of this study, ground water with nitrate concentrations exceeding 0.005 mg/L is considered to be impacted by man's activities.

Figure 9 shows the location of wells visited in the area-wide survey; Figure 10 shows the location of wells selected for quarterly sampling. Tables 6 and 7 (located in Appendix A) list laboratory and field water quality data from all wells inventoried in the project area. Table 2 lists well construction and completion information for wells inventoried during the study.

### Area-wide ground-water survey

Data from the initial area-wide well survey indicated that nitrate concentrations above background levels occurred over much of the project area. Twenty seven of 82 wells in the project area had nitrate concentrations at or near the method detection level. A histogram illustrating the frequency distribution of nitrate concentrations measured during the initial area-wide screening is presented in Figure 11. It can be seen that the distribution is strongly skewed toward low nitrate concentrations with nearly half the 82 wells containing concentrations less than 1 mg/L.

The lack of a normal distribution causes typical statistical measures such as the mean to be misleading. This is indicated by the large disparity between the mean value, 3.1 mg/L, and the median, 1.2 mg/L. When the nitrate data are transformed in an attempt to "normalize" the data, using a log conversion, the resulting mean nitrate concentration, 1.0 mg/L, is much closer to the median concentration and thus more representative of "average" nitrate concentrations found in the study area.

Nitrate concentrations from the initial area-wide survey were contoured using the EPA geostatistical software GEO-EAS (EPA, 1988). Three general areas with elevated (3 mg/L) nitrate concentrations were identified; an area south-southeast of New Plymouth, an area west of New Plymouth, and an area in the northwestern part of the study area (Figure 12).

Figure 9. Location of wells inventoried during the area-wide ground water survey.

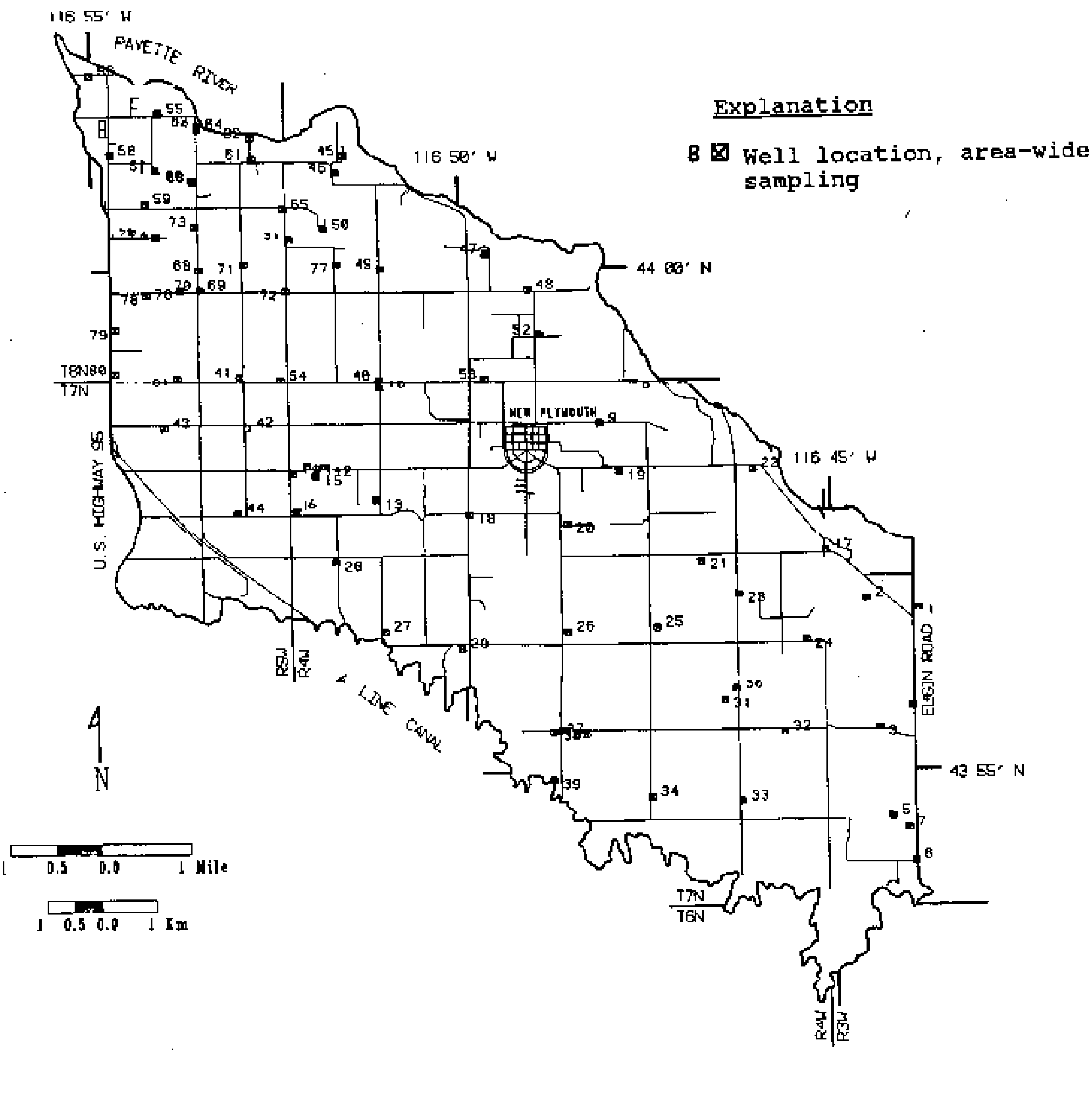


Figure 10. Location of wells selected for quarterly monitoring.

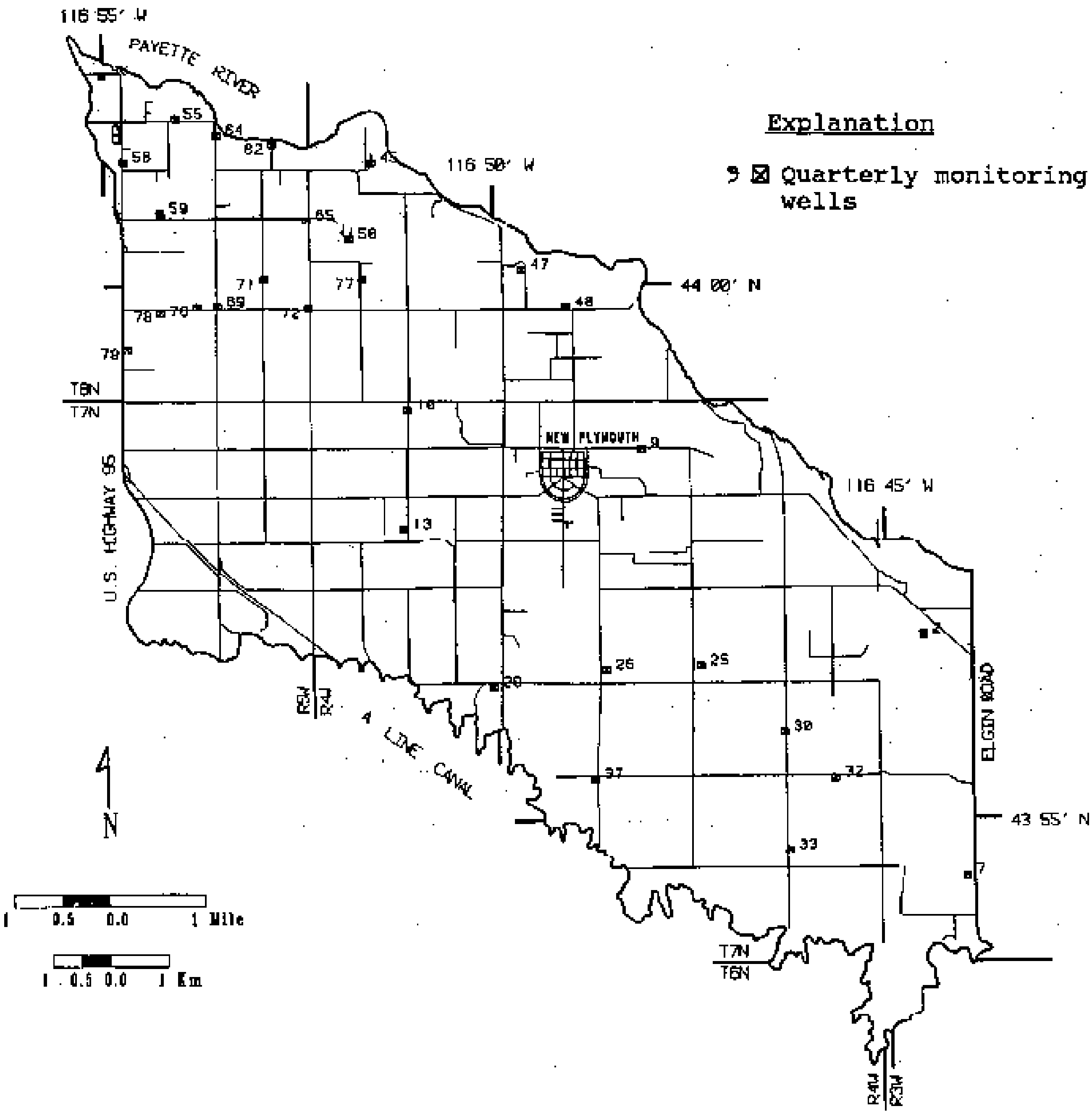


Figure 11. Nitrate frequency distribution for wells in the Lower Payette study area, April 1991 field season.

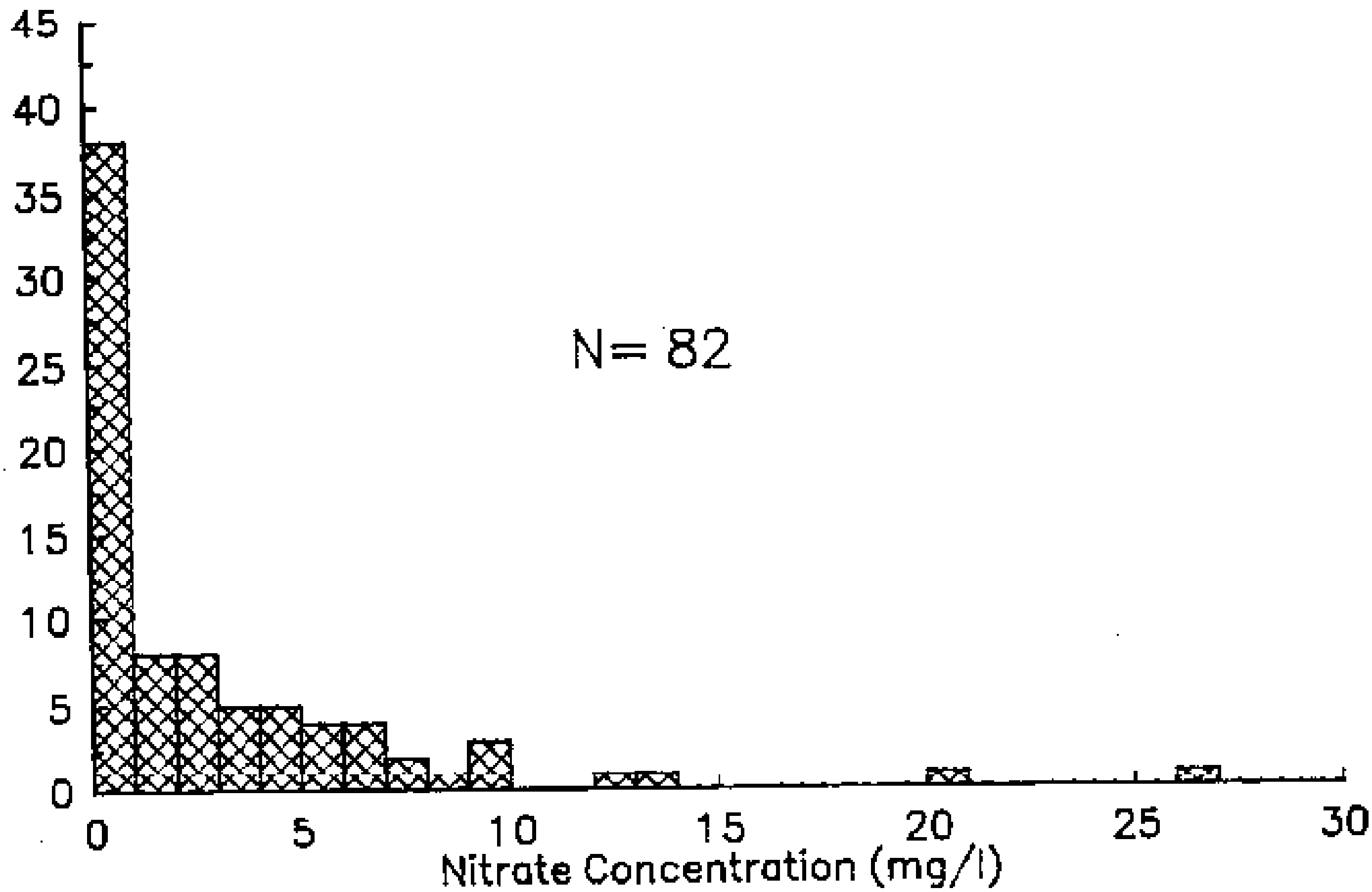
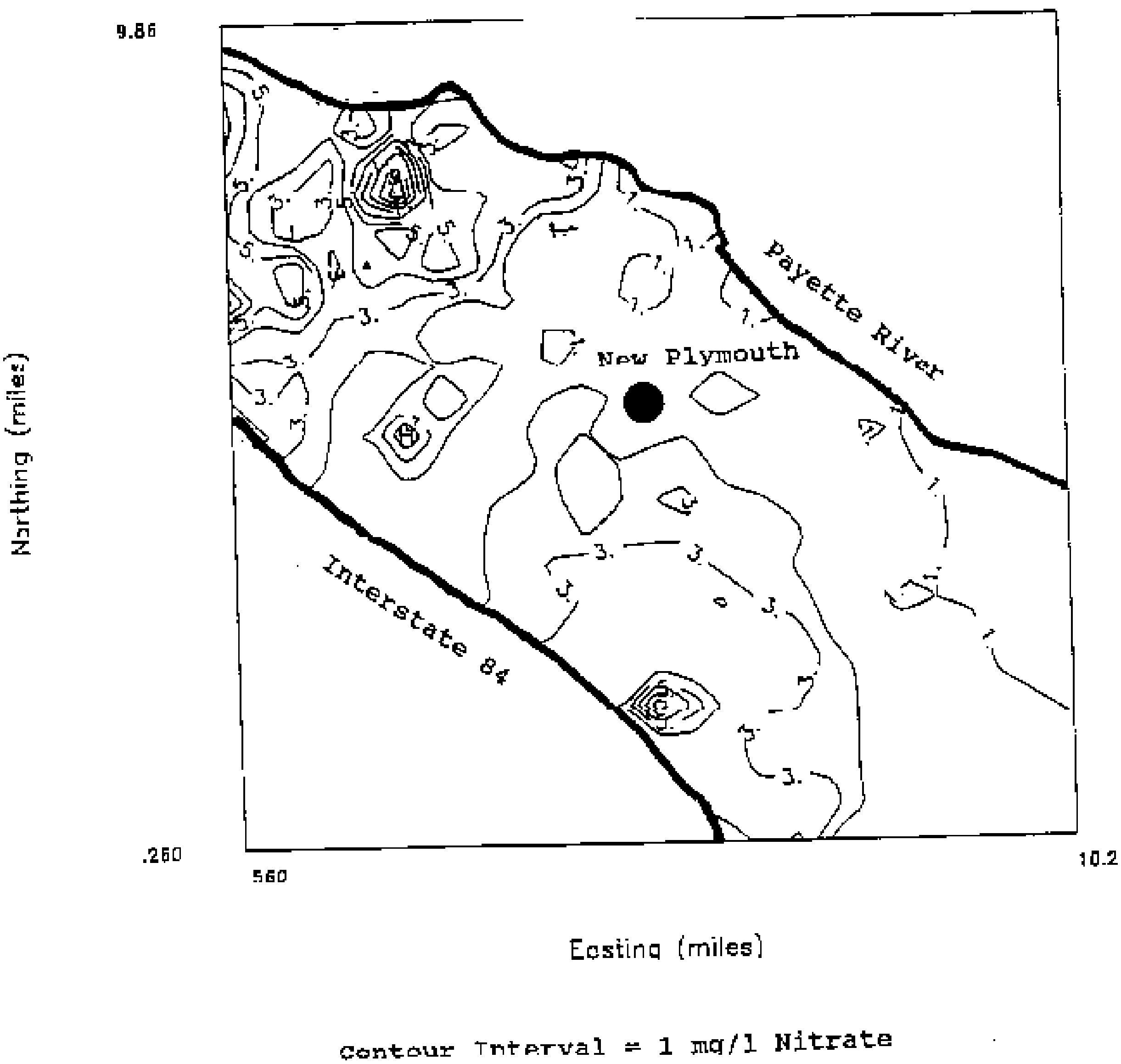


Figure 12. Contoured nitrate concentrations (kriged) using laboratory data.



The distribution of nitrate concentration in the study area was compared to the zones of relative potential vulnerability to ground water contamination delineated by DEQ as part of the Ground Water Vulnerability Mapping Project (Rupert, et. al., 1991). Much of the study area had been delineated as possessing high or very high vulnerability, based on the three factors of depth to ground water, soils, and land use/recharge that were used in the evaluation and rating process.

The correlation between vulnerability delineations and measured nitrate concentrations was poor. There are several reasons for this poor correlation. Most are the result of the methods used and the stated objectives of the ground water vulnerability project. One of the objectives was to use the maps produced for large scale (statewide) planning purposes, such as for distributing scarce resources available for monitoring. Use of the maps on a site-specific basis was never intended.

Other reasons that limit the utility of site-specific analysis involve the way specific factors were utilized in the vulnerability assessment procedure. For example, land use/recharge evaluations only focused on the type of irrigation (flood vs. sprinkler) employed and not the type of crops grown. Soils data represented area-wide statistical averages and not what occurs on a specific piece of ground. Finally, depth to ground water evaluations looked at first encountered water without taking into account the specific hydrogeology of an area.

Chloride ion was also analyzed for during the initial area-wide well survey. A histogram of chloride ion concentration (Figure 13) shows that these data also are strongly skewed toward low chloride concentrations. About half of the 62 wells contained less than 10 mg/L chloride and seventy percent of the wells had less than 20 mg/L chloride ion. When the data are transformed using a log conversion, the mean value is 13 mg/L with a standard deviation of about 3 mg/L. This indicates that there is a background chloride concentration in ground water in the study area in the range of 10 to 15 mg/L. Ground water with chloride concentrations greater than this range most likely has been impacted by human activities.

A plot of dissolved nitrate and chloride concentrations versus well depth was prepared to illustrate the distribution of these ions with depth (Figure 14). Wells with known or measured depths were used, and the wells were grouped into three depth ranges. The Figure shows that elevated dissolved nitrate generally occurs in wells up to 99 feet deep, but for deep wells (greater than 100 feet deep) nitrate concentrations are generally less than 4 mg/L. Elevated dissolved chloride (greater than 15 mg/L chloride) occurs at all depths, but the largest concentrations occur in deeper wells.

### Quarterly ground-water monitoring

Thirty wells in the project area were selected for quarterly ground-water monitoring, based on the results of the area-wide survey (Figure 10). Water samples from these wells were analyzed at the Idaho Bureau of Laboratories for chloride, nitrate, pH, and specific conductance. The purpose of the quarterly sampling events was to confirm initial sample results, determine seasonal water quality

Figure 13. Chloride frequency distribution for wells in the Lower Payette study area, April 1991 field season.

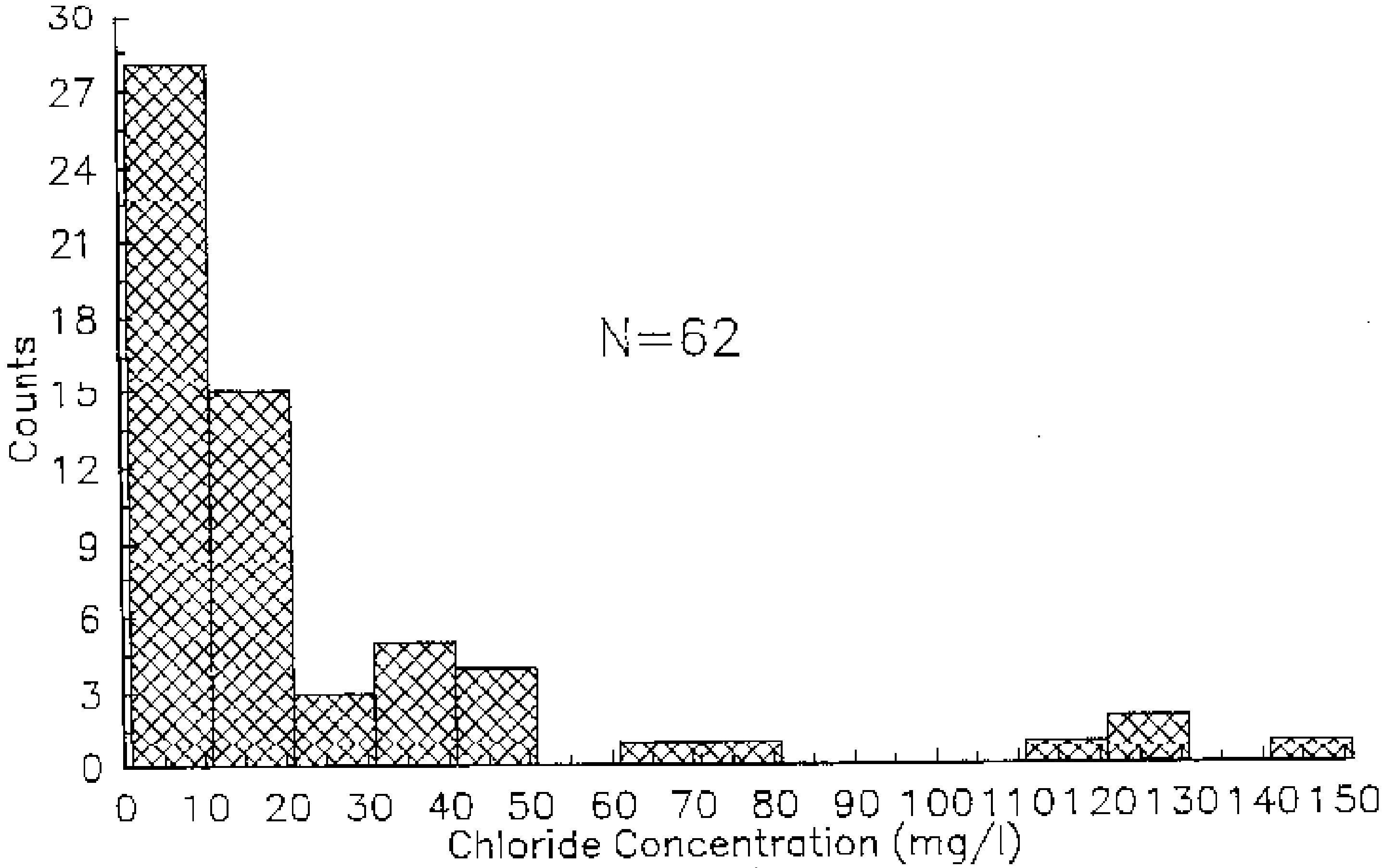
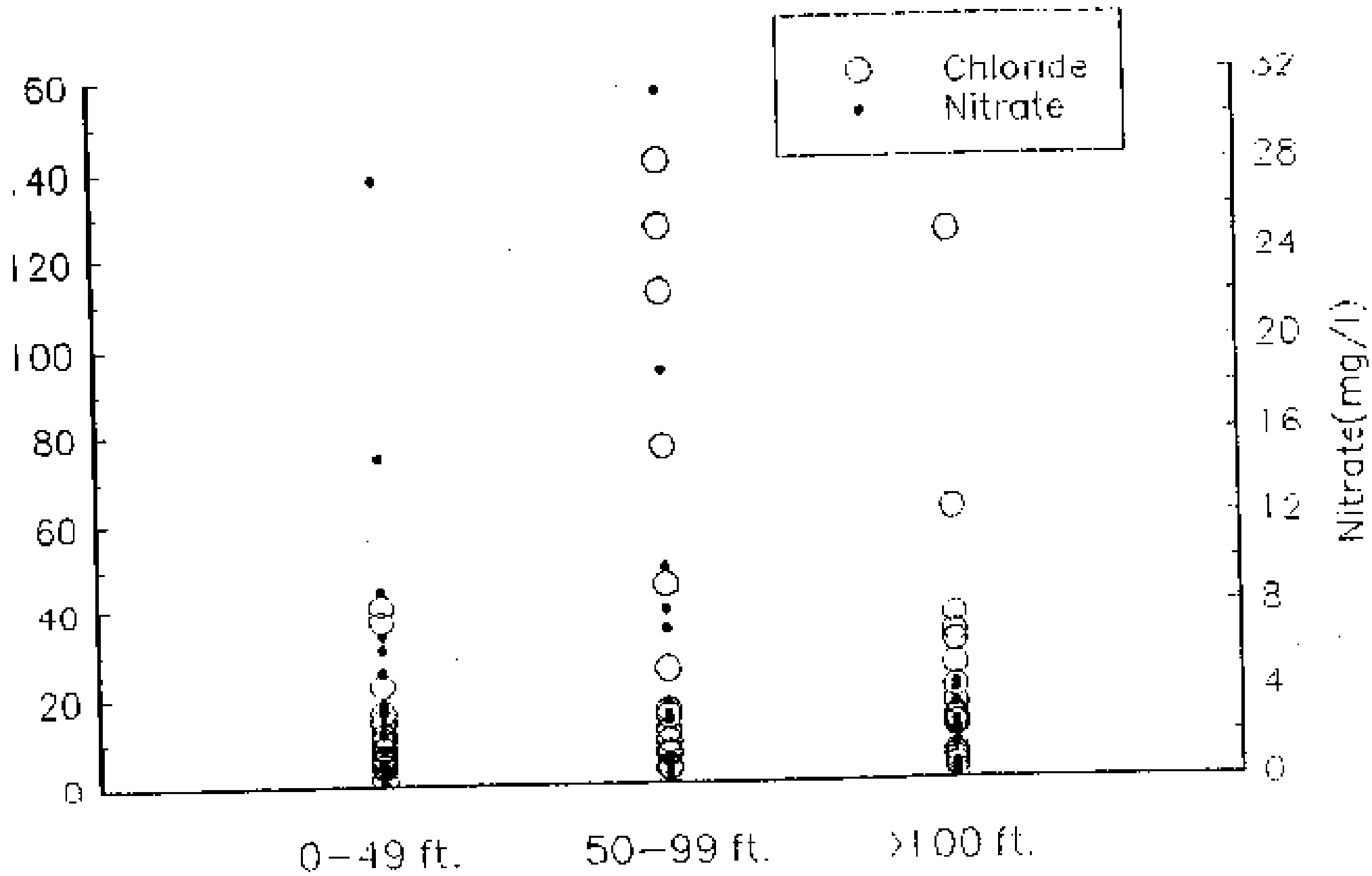


**Figure 14. Well depth versus chloride/nitrate concentrations in the Lower Payette study area.**



trends, and determine the magnitude of seasonal water level trends in the study area.

Using the year-long mean nitrate value for each site (i.e. averaging all quarterly sampling events at a given site) the overall mean nitrate concentration for the quarterly wells was 6.1 mg/L. Mean values for individual wells ranged from below the detection limit to 31.3 mg/L.

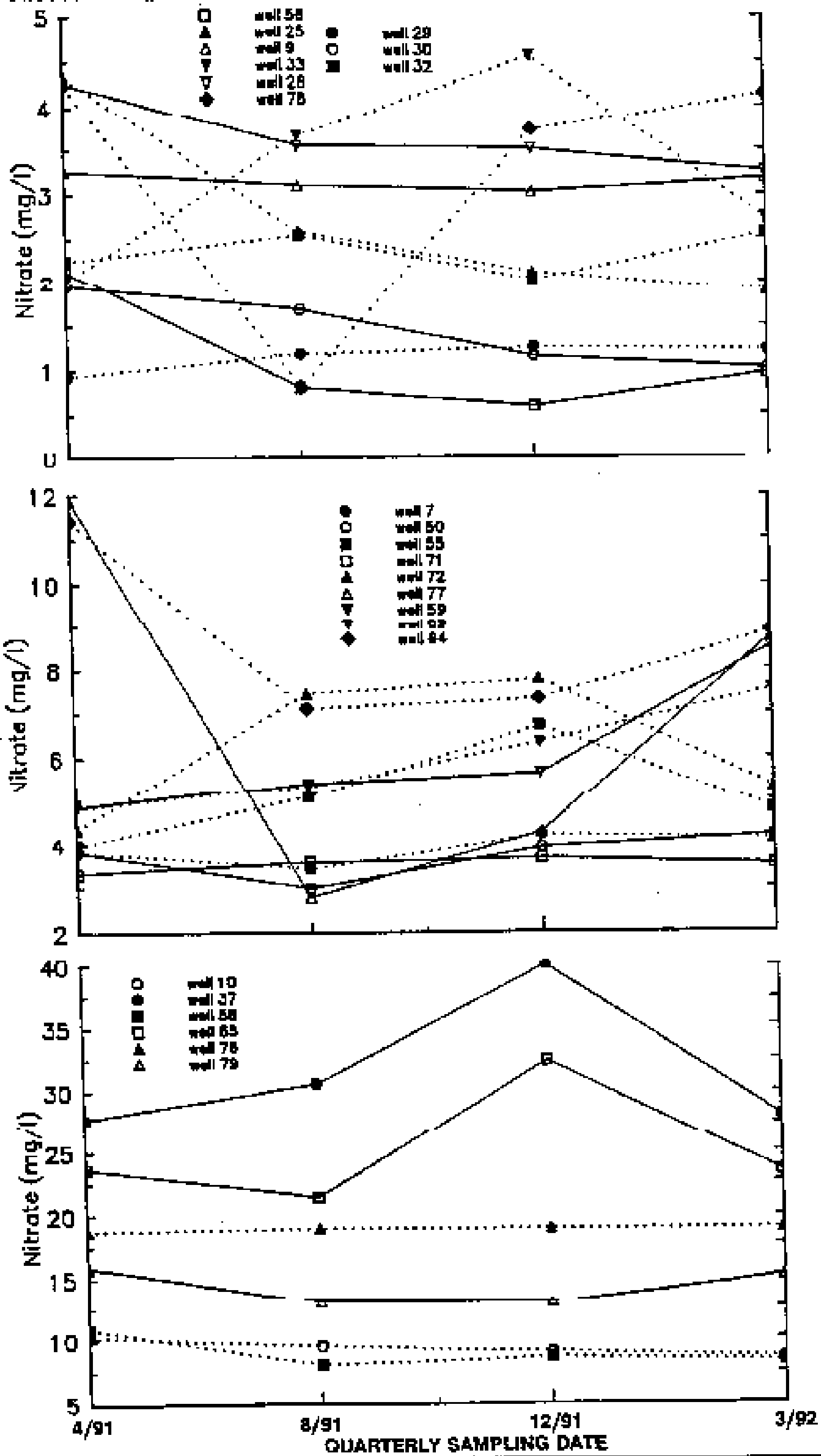
Seasonal trends over the course of the four quarterly sampling events were not apparent. Figure 15 shows the seasonal variation in nitrate concentrations for a selected group of wells. Some wells increased in concentration between the irrigation and non-irrigation seasons while other wells declined or remained the same. Variation in nitrate concentrations at a given well during the yearlong sampling period were typically low. The mean coefficient of variation (CV, standard deviation/mean) for all quarterly wells was 23 percent. The most widespread impacts appear to occur in the northwestern part of the study area. Nitrate concentrations in this area were as high as 37 mg/L. The Idaho Drinking Water standard of 10 mg/L nitrate as nitrogen was exceeded at 6 wells in this area during the year-long sampling period. At well 82, in the northwestern area, nitrate concentrations consistently were below detection limits. However, TKN concentrations ranged from 3.4 to 5.9 mg/L during the quarterly sampling period.

One other well in the study area (well 45) had a maximum TKN concentration of 2.0 mg/L; all other wells in the study area had TKN concentrations below 1.0 mg/L. TKN is a measure of organic and ammonia forms of nitrogen. It is believed that water contaminated with ammonia from feedlots adjacent to wells 45 and 82 may be traveling to the water table. This ammonia contributes to the elevated TKN concentrations seen in water samples from the wells.

Wells in an area south-southeast of New Plymouth generally have nitrate concentrations that range from 2 to 4 mg/L (Figure 13). One well in this area (well #37) had nitrate concentrations that ranged from 27.8 to 40.0 mg/L. The measured well depth was 75 feet. A large dairy operation 400 to 500 feet east and hydraulically upgradient of well #37 is supplied by two wells (#35 and #36). A domestic well (#38) is located downgradient of well #37. Field nitrate samples were run on wells 35, 36, and 38; nitrate concentrations ranged from 2.6 to 4.3 mg/L. Well depths for these wells ranged from 100 to 120 feet. It is believed that the intake zone for the three wells is from 40 to 90 feet below the water table, while the intake zone for well #37 is about 20 feet below the water table.

Nitrate contamination from the septic tank and drain field associated with well #37 seems unlikely since drainfield effluent reaching the water table would be diluted by ground-water underflow. Chloride concentrations at the four wells (35, 36, 37, and 38) range from 38 to 137 mg/L, while chloride at an upgradient well (well 39) was 3 mg/L. The most likely explanation for the elevated nitrate and chloride values is migration of leachate from the dairy operation to the water table. Well #37 produces water from the upper 10 to 20 feet of the aquifer where impacts would be largest.

Figure 15. Seasonal nitrate trends from selected quarterly monitoring wells in the Lower Payette study area.



### Pesticide sampling

Twenty samples for pesticide analysis were collected quarterly from wells in the study area and an additional 7 pesticide samples were collected during the area-wide sampling period. Figure 16 shows the location of wells sampled for pesticides. Of the 81 pesticide analyses 72 were collected from the 3 most impacted areas.

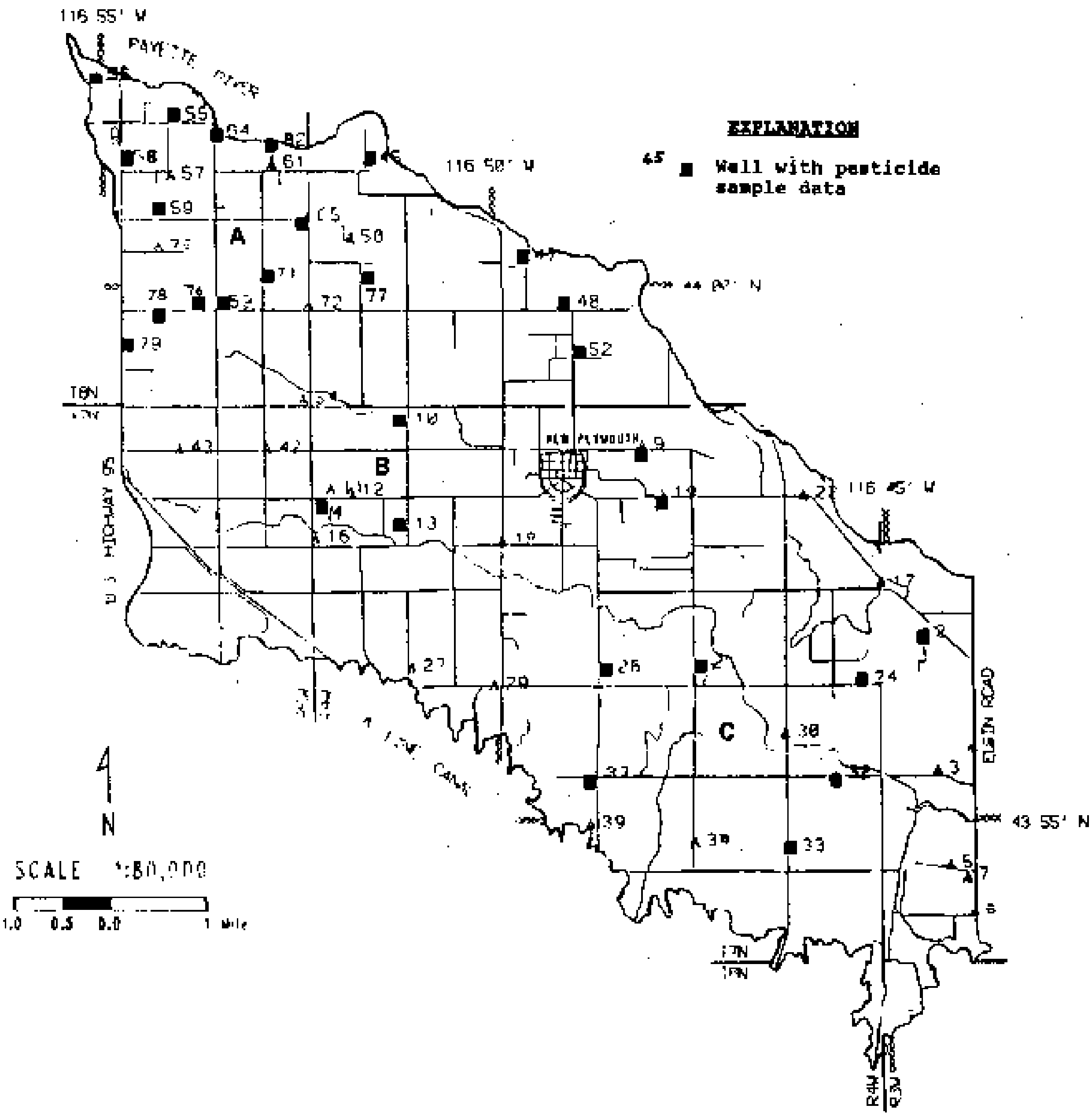
Table 8 lists the impacted areas, number of pesticide samples collected from each area, and the number of detections. As discussed in the QA/QC section these data should be used mostly as an indicator of the presence or absence of pesticides in groundwater.

Table 8. Impacted areas, number of pesticide samples collected from each area, and number of detections

| Area | Number of wells sampled | Number of pesticide samples | Number of wells with detections | Number of detections |
|---|---|---|---|---|
| A | 14 | 47 | 13 | 34 |
| B | 3 | 5 | 3 | 5 |
| C | 7 | 10 | 2 | 2 |
| * | 9 | 27 | 2 | 12 |

A = northwest part of study area
B = west of New Plymouth
C = south - southeast of New Plymouth
* = other wells

Figure 16. Locations of wells sampled for pesticides.



Dacthal was the most commonly detected pesticide. Concentrations ranged from below detection limits to 432 ug/L. All Dacthal concentrations are well below the EPA Lifetime Adult Health Advisory level of 4,000 ug/L. The herbicide 2,4-D was detected at a concentration of 0.38 ug/L at well #47. In general, Dacthal was detected in wells where nitrate was also detected. At well #82, Dacthal was detected but nitrate was not (nitrate - BDL; Dacthal -0.82 ug/L).

### Arsenic Sample Collection

Fruit orchards have been important agricultural crops in parts of the Lower Payette project area in the past. Arsenic-based pesticides were commonly used on fruit crops up to the mid-1940s. There has been concern that arsenic from orchard operations may migrate to ground water. The EPA drinking water standard for arsenic is 50 ug/L.

As part of the sampling program, water samples from 30 wells were submitted for arsenic analysis. Arsenic concentrations ranged from below detection limit (1 ug/L) to 85 ug/L, with an average of 20 ug/L. Wells #28, #59, and #79 with arsenic concentrations of 85, 60, and 65 ug/L, respectively, exceeded the EPA drinking water limit. The extent and source of elevated arsenic in these wells was not determined from this sampling. Naturally occurring arsenic in ground water has been documented over wide areas of the western Snake River Plain, mostly along the Snake River (Parliman, 1982, 1983).

### Major Ion sample Analysis

Major ions (calcium, magnesium, sodium, potassium, bicarbonate, chloride, and sulfate) were analyzed for water samples from 48 wells in the study area. These data are useful for characterizing ground-water chemistry and to help determine whether ground-water impacts at wells are from point source or non-point source activities.

Trilinear diagrams (Piper, 1944) are used to display major-ion water chemistry data from the study area. These diagrams show concentrations, in percent milliequivalent, of the major cations (calcium, magnesium, sodium, and potassium) and anions (carbonate, bicarbonate, chloride, and sulfate) in a water sample. For each water sample, cations are plotted on the left triangle and anions are plotted on the right triangle. The plotting points for each sample in the cation and anion triangles can also be projected up into the diamond-shaped area to show cation and anion groups as a percentage of the sample. Wells with similar water chemistry plot in the same area on the diagram.

Under natural conditions major ion composition in ground water is controlled by soluble minerals in the aquifer and the residence time of water in the aquifer. The longer the water is in the aquifer the more time it will have to come in contact with and dissolve minerals from the aquifer framework. Natural water chemistry differences between shallow and deep water zones often occurs because water in deeper zones is older.

Point and non-point contaminant sources can impact the chemical composition of ground water. Point source impacts such as failed drain fields produce small waste water volumes and impacts from these sources should occur locally around a well. Trilinear diagrams which display water chemistry can help to distinguish contaminant different sources.

Wells with total depths from 0-49 feet and greater than 100 feet were plotted on trilinear diagrams (Figures 17 and 18) to illustrate water chemistry differences between shallow and deeper water-bearing zones. Only wells with drillers logs or measured well depths were used for this analysis. The diagrams for the shallow and deep wells indicate a similar anion composition for most wells. This indicates that there is little or no hydraulic separation between shallow and deep water bearing units in the study area.

Bicarbonate is the dominant anion for both shallow and deep wells, accounting for 80 to 90 percent of the anions. Chloride generally ranges from about 5 to 10 percent of the anions, and sulfate ranges from 10 to 20 percent. The main source of bicarbonate ion is dissolution of atmospheric carbon dioxide ($CO_2$) in water which recharges the aquifer.

For shallow wells, the cations plot in two general areas, wells with less than 40 percent sodium and wells with greater than 50 percent sodium (Figure 17). Water containing greater than 50 percent sodium may be impacted from various sources. Deep wells 7, 27, and 82 contain greater than 50 percent sodium (Figure 18). Wells 7 and 82 are most likely impacted by feedlot operations. There are no obvious contaminant sources near well 27. This well also contained elevated arsenic; the source of the arsenic is unknown.

Dissolved chloride exceeding 20 mg/L was noted in 18 wells. Dissolved chloride and sulfate values were plotted for wells where data were available (Figure 19). Most elevated chlorides and sulfates occur in an area west of New Plymouth. A land use inventory of the Lower Payette area conducted by the SCS included locations of feedlots and dairies (Payette SWCO, 1993). Many of these operations are coincident with the area of elevated ground-water chloride occurrence.

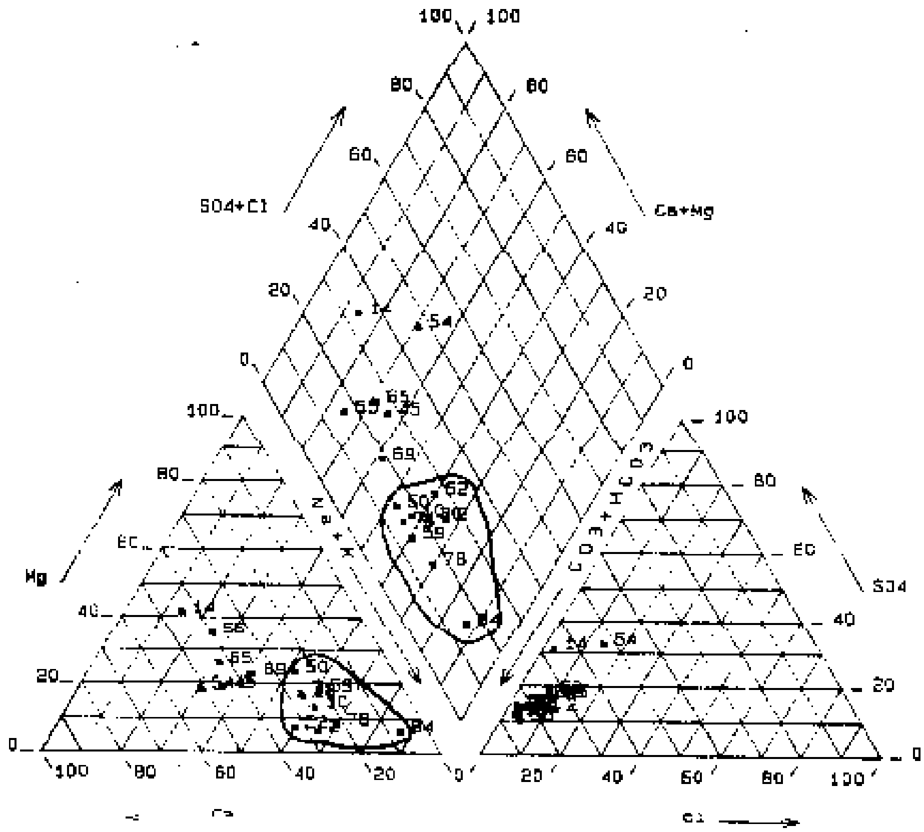
Overcash and others (1983) present micronutrient data that shows chloride to be a major constituent of dairy and beef manure . Land application of manure in the area west of New Plymouth could account for elevated chloride for ground water. Leachate from septic tank drainfields could be another possible source of elevated chloride in ground water. However, the small volumes of water associated with these systems is not sufficient to account for the wide spread occurrence of elevated chloride. (Analytical results from agricultural surface drains, presented below, confirm that elevated chloride occurs over a wide area).

Well 84 which had about 85 percent sodium, also had an $NO_3$ concentration of 14.9 mg/L. Well 79 is adjacent to this well. The well depth is unknown, but the well had nitrate concentrations that ranged from 11.2 to 15.9 mg/L, and also had similar major ion chemistry. This indicates that well 79 is producing water from the same zone as well 84.

## Agricultural Drain Sampling

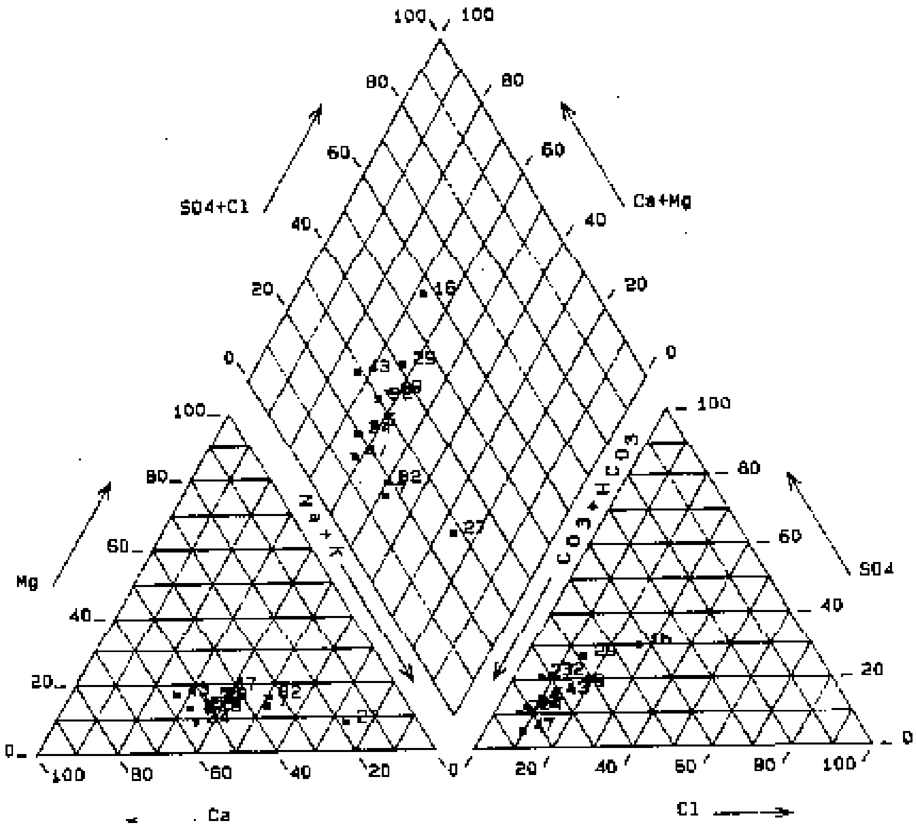
In an effort to more clearly define the connection between agricultural activity and ground water quality, seven of the numerous drains throughout the study

Figure 17. Piper diagram of selected chemical analysis of water from wells with completion depths from 0 to 50 feet below the land surface.



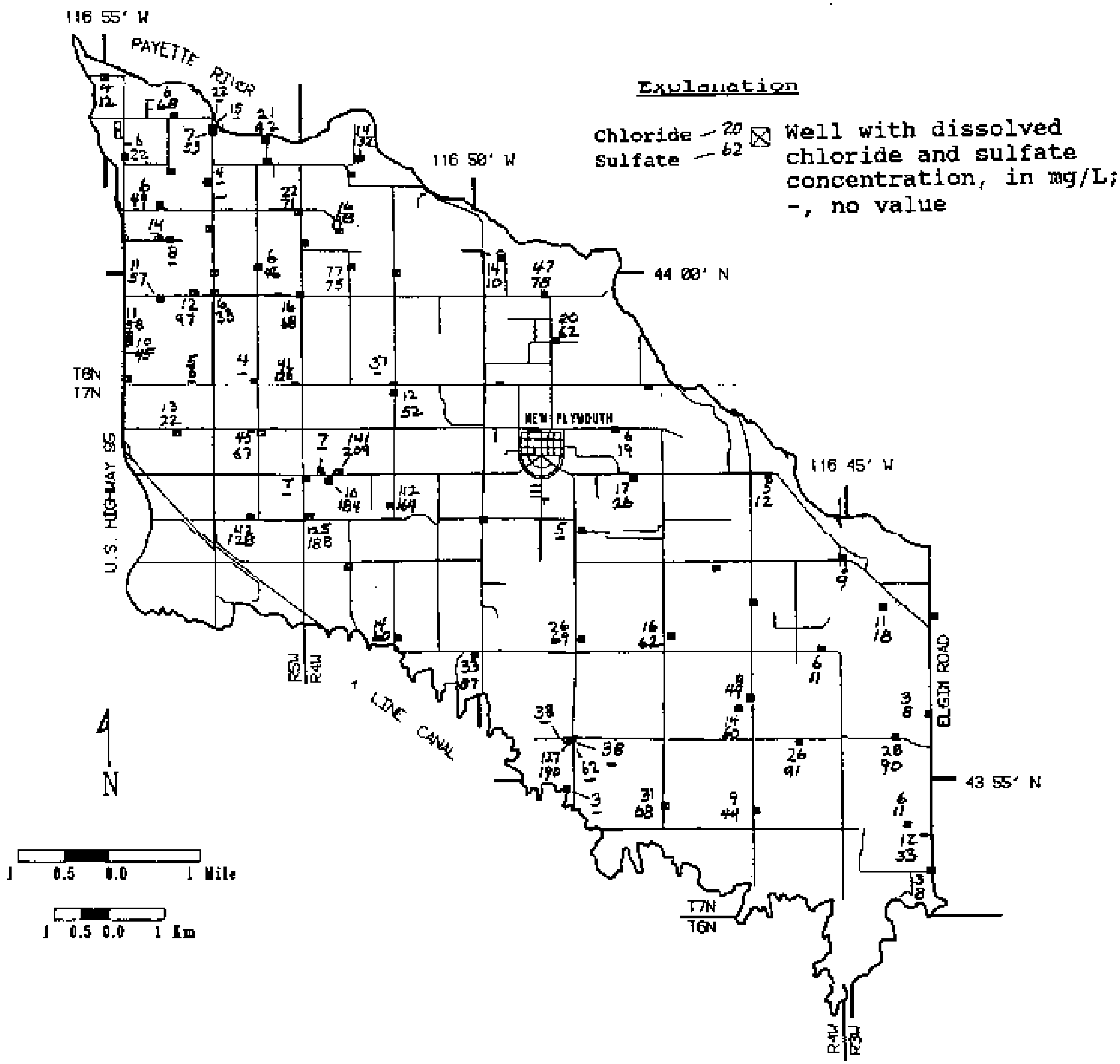

| Well # | Date (YYMMDD) | Well I.D. | Well Depth (ft) |
|---|---|---|---|
| 55 | 910605 | 8N5W14DCD01 | 44 |
| 69 | 910528 | 8N5W25CCC01 | 41 |
| 71 | 910828 | 8N5W25DBC01 | 36 |
| 50 | 910828 | 8N4W30BAA01 | 48 |
| 78 | 910528 | 8N5W35BAA01 | 35 |
| 2 | 911209 | 7N3W18CAA01 | 27 |
| 84 | 920302 | 8N5W35BCC02 | 35 |
| 52 | 910403 | 8N4W33ADC01 | 33 |
| 30 | 910411 | 7N4W23DAC01 | 45 |
| 10 | 910410 | 7N4W06AAA01 | 42 |
| 59 | 910411 | 8N5W23CDD01 | 33 |
| 65 | 910411 | 8N5W25AAA01 | 45 |
| 45 | 910409 | 8N4W19ACC01 | 32 |
| 54 | 910415 | 8N5W36DDD01 | 47 |
| 14 | 910807 | 7N4W07BBB01 | 11 |

Figure 18. Piper diagram of selected chemical analysis of water from wells with completion depths greater than 100 feet below the land surface.




| Well # | Date (YYMMDD) | Well I.D. | Depth (ft) |
|---|---|---|---|
| 29 | 910403 | 7N4W20AAA01 | 160 |
| 82 | 910827 | 8N5W24ABC02 | 100 |
| 7 | 910402 | 7N3W31AAA01 | 280 |
| 5 | 910402 | 7N3W30DCD01 | 270 |
| 32 | 910829 | 7N4W25ABB01 | 140 |
| 19 | 910403 | 7N4W10ABA01 | 106 |
| 24 | 910401 | 7N4W13DDC01 | 127 |
| 47 | 910410 | 8N4W28CBA01 | 115 |
| 16 | 910415 | 7N4W07BCC01 | 134 |
| 27 | 910410 | 7N4W17CCB01 | 138 |
| 49 | 910419 | 7N5W02DBB01 | 100 |

Figure 19. Dissolved chloride and sulfate concentrations from wells. Data are from laboratory and field analyses. Averages are used for wells with multiple analyses).



area were sampled and discharge measurements were collected. Sampling took place on January 21, 1992, the middle of the non-irrigation season, when presumably all water flowing into the drains was derived from shallow ground water. There had been minimal snow cover and snow melt/run off up to the time the samples were collected. The seven drains that were sampled were part of an eighteen drain sampling network established during the surface water portion of this study (Ingham, 1991).

Stations S-1, S-2, S-5, S-8, S-13(Lower), S-14(Lower), and S-15(Lower) are located just upstream of the confluence of the drain with the Payette River (Figure 5). Water quality samples from each of these stations represent an integrated water sample from the entire contributing drainage area of each drain. Stations S-13east(Upper), S-13west(Upper), S-14(Upper), and S-15(Upper) were sampled to give an indication water quality in different parts of the contributing areas.

Discharge ranged from 1.7 cubic feet per second ($ft^3/s$) at S-15 to 50.7 $ft^3/s$ at S-1 (Table 9). With the exception of S-1, these discharge quantities are substantially less than during the irrigation period (Ingham, 1991).

Nitrate concentrations ranged from about 1 to 3.4 mg/L for stations S-1 through S-8, while stations S-13(Lower), S-14(Lower), and S-15(Lower) had nitrate concentrations of 5.73, 4.25, 4.62 mg/L, respectively. Major ion concentrations, including chloride, had similar trends, with highest values occurring at Stations S-13(Lower) and S-14(Lower). Chloride concentrations from drains serving the eastern part of the study area range from 7 to 14 mg/L, which is similar to the predicted background ground-water chloride concentration range.

Major ion data plotted on a trilinear diagram (Figure 20) shows that water at stations S-8, S-13(Lower), and S-14(Lower) contains a higher percentage of dissolved sodium than water from other drains. These water quality data substantiate the ground water data and indicate that water quality impacts seen in wells are the result of non-point source activities, rather than point source impacts at an individual well.

## Soils

One of the primary objectives in examining the distribution of agricultural chemicals in the vadose zone (that area between ground surface and the water table) is to evaluate the potential for their storage below the root zone and subsequent transport to ground water. The methods employed in this study only provide a snapshot in time of the distribution of chemicals which can be quite dynamic in their movement. For example, the distribution of nitrate in the soil can be affected by numerous factors, some of which include: current and prior years fertilizer application amount, timing, and type; current and prior year crop type, precipitation amount, type, and pattern, irrigation practices, and soil characteristics such as texture, permeability, percent organic matter, and horizonation.

During the course of the soil sampling, a static water table was encountered at depths ranging from six to greater than ten feet. In some cases boreholes were dry until a particular hardpan-like layer was penetrated and then ground water rose in the borehole, possibly indicating semi-confined conditions for this shal-

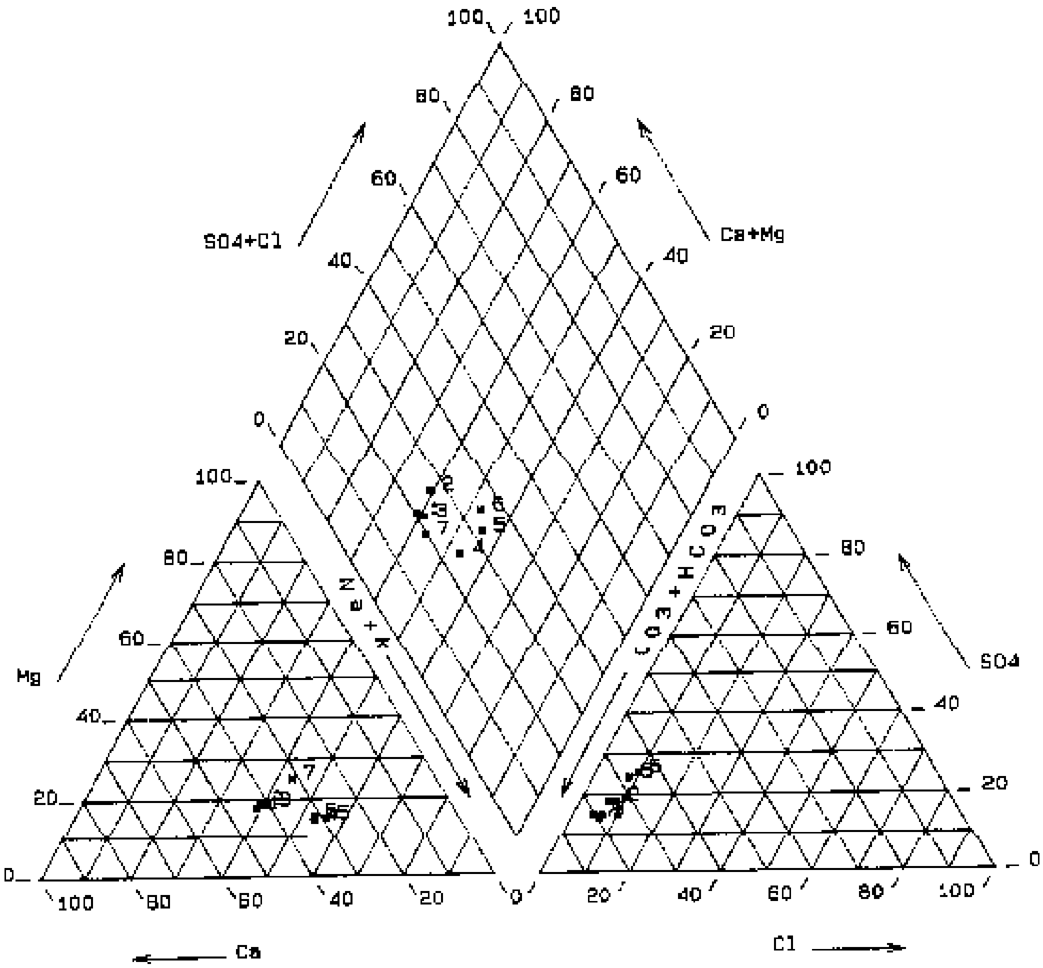
## Table 9. Discharge and chemical concentrations of selected drains in the Lower Payette study area.

| STATION | DISCHARGE (CFS) | NO3 | CA | MG | NA | K | HCO3 | CL | SO4 | SPEC. COND.* |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Concentrations in MG/L | | | | | | | | |
| S-1 | 50.7 | 1.07 | 33 | 8.5 | 33 | 2.6 | 153 | 7 | 22 | 396 |
| S-1(DUPLICATE) | | 1.14 | | | | | | | | |
| S-2 | 11.7 | 2.17 | 48 | 13.5 | 51 | 2.5 | 215 | 14 | 43 | 530 |
| S-5 | 6.7 | 3.44 | 66 | 16 | 64 | 2.9 | 276 | 14 | 42 | 606 |
| S-8 | 3 | 3.4 | 48 | 13.5 | 90 | 3.2 | 275 | 14 | 63 | 662 |
| S-13(LOWER) | 5.3 | 5.73 | 64 | 17 | 116 | 4.5 | 311 | 22 | 89 | 815 |
| S-13-east(UPPER) | | 4.85 | | | | | | | | |
| S-13-west(UPPER) | | 6.03 | | | | | | | | |
| S-14(LOWER) | | 4.25 | 54 | 16.5 | 102 | 3.9 | 259 | 23 | 84 | 767 |
| S-14(UPPER) | | 3.36 | | | | | | | | |
| S-15(LOWER) | 1.7 | [illegible] | [illegible] | [illegible] | 74 | 4.6 | [illegible] | 19 | 44 | [illegible] |
| S-15(UPPER) | | 2.68 | | | | | | | | |
| BLANK | | <.005 | | | | | | | | |

*µMHOS/CM

Sampling Date. January 21, 1992

Figure 20. Trilinear diagram of water from selected drains.




| Plotting Number | Station Number | Specific Conductance |
|---|---|---|
| 1 | S-1 | 336 |
| 2 | S-2 | 530 |
| 3 | S-5 | 606 |
| 4 | S-8 | 662 |
| 5 | S-13-L | 815 |
| 6 | S-14-L | 757 |
| 7 | S-15-L | 662 |

lowest aquifer. Given these observations, the depth of sampling (a maximum of ten feet) can be considered representative of the majority of the vadose zone in the fields sampled.

Analytical results of the soil sampling are presented in Table 10. Sample results for nitrate can be converted to pounds N/acre by multiplying the mg/kg value by 4. The highest values for nitrate (132 mg/kg) occurred in MN2. It was subsequently discovered that the portion of field MN2 that was sampled had received an extremely large application of nitrogen fertilizer (200-300 lbs. N/acre) in February and an additional 100 lbs. N/acre in April/May. This was later confirmed by resampling the surface six inches of the field originally sampled as well as a portion of the same field, adjacent to it, which presumably had not received the heavy application. The former field contained 87.7 mg/kg nitrates and the latter field 24.4 mg/kg. The practices used and nitrate values observed at MN2 are not considered representative of typical agricultural practices of the area.

Nitrate storage and the profile distributions found in these fields can be evaluated by looking at average nitrate concentrations from those depths sampled below the major rooting zone. This includes the 3-4, 6-7, and 9-10 foot intervals. The average nitrate values (mg/kg) for the various crop types were as follows: corn-6.4, beets-7.5, grains-6.4, and mint-11.4. For individual fields the average values (in mg/kg) were BN-4.9, BS-10, MN2-18.7, MN4-4.1, GN-4.0, GS-8.7, CN1-4.3, and CN2-8.5. With the exception of the mint fields there appears to be little correlation with respect to crop type. This may be attributable to the wide variety of row crops grown in the area, the changes in crop type in response to market conditions, and the typical rotations employed where one crop type (with the exception of mint) may not be grown more than two years consecutively.

In order to put the nitrate values obtained in this study into perspective, a comparison with results obtained in other studies under similar conditions is appropriate. Idaho DEQ has conducted soil monitoring studies in two other areas of the state with one (near Weiser) under similar soil types (DEQ, 1989). In that study an onion field was sampled and the average nitrate concentration below the root zone was 18.5 mg/kg. This value can be correlated with average values of nitrate in ground water sampled from wells in the same area (dominantly devoted to onion production) of 14.1 mg/L.

A similar study in Franklin County of four crop types yielded average nitrate values (in mg/kg) under: barley (0.9), alfalfa (0.5), dryland grain (3.7), and corn (5.1) (DEQ, 1990). In this vicinity the intensity of agricultural production and the use of agrichemicals is much lower than in the Lower Payette area and row crops such as corn occupy a much smaller percentage of the total mix of crops grown. It is interesting, however, to note the similarity in nitrate concentrations under corn between these two agricultural areas.

A study conducted in Nebraska measured nitrate in deep soil cores in silty clay loam soils under furrow irrigation conditions (Spalding and Kitchen, 1988). Two types of plots were cored: 1) controlled fertility plots which received from 0-400 lbs. N/acre/year and 2) independent producer's fields under corn. In the controlled plots average soil nitrate concentrations below the root zone of 3.1 and 6.7

Table 10. Soil sampling results (June 10-14, 1991) in the Lower Payette study area.

| CROP | DEPTH | pH | (PCT.) O.M. | (MG/KG) TKN | NH4 | NO3 | (MMHOS/CM) E.C. | PCT.(WT.) M.C. | (MG/KG) PESTICIDE | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| SUGAR | 0-12" | 7.1 | 1.17 | 2100 | 1.16 | 32.5 | 1.76 | 9.9 | NA | | |
| BEETS | 36-48" | 8.2 | 0.42 | 1200 | 0.6 | 5.1 | 0.59 | 26.9 | NA | | |
| NORTH | 72-84" | 8.2 | 0.38 | 1100 | 0.72 | 4.8 | 0.53 | 26.2 | NA | | |
| (BN) | 108-120" | 8.1 | 0.6 | 1200 | 0.48 | 4.8 | 0.6 | 13.6 | NA | | |
| | 36-48" duplicate | 8.2 | 0.45 | 1200 | 0.52 | 5.2 | 3.53 | | NA | | |
| SUGAR | 0-12" | 7.8 | 1.87 | 2200 | 1.08 | 39.6 | 1.88 | 20.3 | DDE,DDT | 3.14 | 1.4 |
| BEETS | 36-48" | 8.3 | 0.6 | 1500 | 0.88 | 14.6 | 0.76 | 25.1 | DDE,DDT | 0.079 | 0.014 |
| SOUTH | 72-84" | 8.1 | 0.38 | 1000 | 0.8 | 9 | 0.64 | 23.4 | NA | | |
| (BS) | 108-120" | 8 | 0.44 | 1100 | 0.44 | 6.6 | 1.01 | 23.5 | DDE,DDT | 0.028 | 0.045 |
| MINT-4YR | 0-12" | 7.8 | 1.29 | 1900 | 1.68 | 8.4 | 1.08 | 22 | BRL | | |
| (MN4) | 36-48" | 8 | 0.57 | 1200 | 0.88 | 4.8 | 0.67 | 13.5 | BRL | | |
| | 72-84" | 8.3 | 0.42 | 900 | 0.28 | 3.6 | 0.54 | 17.4 | BRL | | |
| | 108-120" | 8.3 | 0.34 | 800 | 0.58 | 4.1 | 0.78 | 16.8 | NA | | |
| | 72-84" duplicate | 8.2 | 0.4 | 1100 | 0.32 | 3.6 | 0.61 | | NA | | |
| MINT-2YR | 0-12" | [illegible] | 1.63 | 1500 | 0.84 | 135 | [illegible] | 11.7 | NA | | |
| (MN2) | 36-48" | 8.1 | 0.45 | 1000 | 0.44 | 23.1 | 0.91 | 11.7 | NA | | |
| | 72-84" | 8 | 0.52 | 500 | 0.58 | 17.2 | 0.98 | 13.3 | NA | | |
| | 108-120" | 8 | 0.5 | 600 | 0.57 | 16.8 | 0.94 | 14.5 | NA | | |
| WHEAT | 0-12" | 7.7 | 1.34 | 1600 | 1.48 | 3.2 | 0.73 | 16.7 | BRL | | |
| (GN) | 36-48" | 8.1 | 0.42 | 700 | 0.52 | 2 | 0.4 | 17.6 | BRL | | |
| | 72-84" | 8.2 | 0.38 | 400 | 0.68 | 6 | 0.51 | 8.6 | NA | | |
| | 36-48" duplicate | 8.1 | 0.4 | 400 | 0.4 | 2 | 0.42 | | BRL | | |
| BARLEY | 0-12" | 7.8 | 1.59 | 1800 | 1.24 | 21.9 | 2.02 | 12.1 | NA | | |
| (GS) | 36-48" | 8.1 | 0.44 | 1100 | 0.64 | 11.8 | 1.01 | 18.4 | NA | | |
| | 72-84" | 8 | 0.39 | 800 | 0.32 | 7.2 | 0.88 | 20.4 | NA | | |
| | 108-120" | 8.2 | 0.43 | 1000 | 0.4 | 7.3 | 0.88 | 24.4 | NA | | |
| CORN | 0-12" | 7.7 | 1.17 | 1700 | 1.28 | 61.6 | 2.02 | 17.6 | NA | | |
| (CN1) | 36-48" | 8.2 | 0.39 | 1100 | 0.72 | 4.2 | 0.62 | 12 | NA | | |
| | 72-84" | 8.7 | 0.45 | 1000 | 0.4 | 4 | 0.72 | 16.9 | NA | | |
| | 108-120" | 8.5 | 0.39 | 900 | 0.52 | 4.8 | 0.88 | 16.8 | NA | | |
| | 0-12" duplicate | 7.6 | 1.15 | 1200 | 1.08 | 60.8 | 1.89 | | NA | | |
| CORN | 0-12" | 7.8 | 2.17 | 2900 | 2.08 | 51 | 1.49 | 21.4 | BRL | | |
| (CN2) | 36-48" | 8.1 | 0.4 | 1400 | 0.4 | 10.7 | 0.67 | 18.3 | BRL | | |
| | 72-84" | 8.1 | 0.57 | 1000 | 0.48 | 11.6 | 0.83 | 24.5 | BRL | | |
| | 108-120" | 8.1 | [illegible] | 700 | 0.4 | 3.2 | [illegible] | [illegible] | BRL | | |

Mg/Kg=parts per million NA=not analyzed BRL=below reporting limits E.C.=electrical conductivity M.C.=moisture content mg/kg were found on plots receiving 300 and 400 lbs. N/acre/year, respectively. The five independent producers fields that were sampled were located in the vicinity of a municipal well field where half of the wells have nitrate concentrations at or above 10 mg/L. The average soil nitrate concentrations below the rooting zone of these fields was 8.9 mg/kg.

In the current study, as a result of the shallow depth to water encountered in many of the fields, temporary monitoring wells were installed in two of the fields sampled (MN4 and CN1) in order to correlate soil nitrate distributions with first encountered ground water nitrate values. Only the mint field well was sampled. Water samples were collected on two dates, 7/1/91 and 8/7/91, and yielded nitrate values of 8.2 and 2.9 mg/L, respectively. This mint field had soil nitrate concentrations among the lowest found in the study, indicating the large potential for transport through the unsaturated zone.

Only one field of four sampled for pesticides had detectable concentrations of pesticides. In the sugar beet field BS, all three soil samples analyzed detected the no longer registered, chlorinated pesticide DDT and it's breakdown product DDE (Table 10). Concentrations were greatest at the surface and decreased with depth. The detections of these compounds confirms their well-known properties of persistence and slow breakdown, low mobility, and low water solubility.

# Summary

The Lower Payette area, located in western Idaho, constitutes a major portion of the intensively farmed cropland which drains the Payette River Basin. Row crops and specialty seed crops are grown along with small grains, alfalfa, and pasture. Agrichemical use is intensive, furrow irrigation is typical and fertilizer use efficiency is low for shallow rooted crops such as onions and mint. Fruit orchards were also common to the area in the past. When combined with the shallow depth to water found over much of the area, the potential for ground-water contamination is significant.

The study area is located in the western Snake River Plain. The geology of the area consists of up to 5000 feet of fluviatile deposits of the Glenns Ferry Formation overlain by Recent alluvial deposits of the Payette River. A blue clay zone noted in drillers logs marks the top of the Glenns Ferry Formation.

The aquifer in the area is composed of the uppermost part of the Glenns Ferry Formation and the Recent alluvial deposits. The depth to first ground water ranges from about 100 feet below land surface along the southwestern part of the area to about 10 feet along the northern part. The direction of ground-water flow is from south to north, toward the Payette River. Most recharge to the aquifer is from seepage from irrigation canals and laterals, and from deep percolation of irrigation water. A series of surface drains constructed throughout the area to lower the water table intercept ground water. These drains also carry irrigation runoff during the summer months. The drains discharge to the Payette River; some flow throughout the year. Drain flow during the winter months mostly is from ground-water discharge.

An initial area-wide well survey, conducted in April and May 1991 indicated that nitrate concentration above background levels occurred over much of the area. (A background nitrate concentration of 0.005 milligrams per liter (mg/L) was established, based on nitrate concentrations at or near the laboratory detection limit for 27 of 82 wells sampled. The laboratory detection limit was 0.005 mg/L.) Nitrate concentrations from the initial survey ranged from below the detection limit (0.005 mg/L) to 37.0 mg/L.

Nitrate data from the initial survey were strongly skewed toward low nitrate concentrations. The arithmetic mean for 82 wells was 3.1 mg/L; a log transform of the data gave a mean of 1.0 mg/L, close to the median value of 1.2 mg/L. Dissolved chloride concentrations from the initial well survey also were strongly skewed toward low concentrations. A background chloride concentration in the range of 10 to 15 mg/L was estimated for the area. Wells exceeding this range are considered to be impacted by human activities.

Three general areas of elevated nitrate (> 3 mg/L nitrate) were established by contouring nitrate data:

- An area south-southeast of New Plymouth,
- An area west of New Plymouth,

- An area in the northwestern part of the study area.

Water level fluctuations up to 15 feet were measured in wells in response to irrigation recharge over the year-long monitoring period.

Analysis of major ion data indicated that impacts to ground water could be attributed to non-point source activities such as agricultural and dairy and feedlot operations. Surface drain sampling further substantiated that impacts to ground water were occurring over wide spread areas.

Pesticide samples collected from 32 wells indicated that the herbicide Dacthal was the most commonly detected pesticide, with concentrations ranging from below detection limits to 432 micrograms per liter (ug/L). Reproducibility of the pesticide data was outside acceptable limits, and these results should be considered qualitative.

Arsenic samples collected from 30 wells showed three wells exceeded the EPA drinking water standard of 50 ug/L. Arsenic in these wells ranged from 60 to 85 ug/L.

Soil samples were collected from eight fields representing four crop types to evaluate the potential for transport of agrichemicals below the root zone to the water table. Average nitrate values (mg/kg) for the various crop types were: corn-6.4, beets-7.5, grains-6.4, and mint-11.4. A monitoring well installed in the mint field yielded 8.2 and 2.9 mg/L nitrate on two sampling dates. These data indicate the large potential for transport of agrichemicals through the root zone to the water table.

# Conclusions

Conclusions which can be drawn from the results of this study include:

1. Ground-water impacts from nitrates have been detected over the entire study area, based on comparison to an assumed background concentrations of 0.005 mg/L. Seventeen percent of 82 wells sampled had nitrate concentrations between 5 and 10 mg/L and 5 percent exceeded the State Drinking Water standard.

2. Area-wide and quarterly ground water sampling identified three areas where ground-water impacts are more severe: south-southeast, west, and northwest of New Plymouth. Impacts to the area northwest of New Plymouth most likely are from intensive agricultural operations. Ground-water impacts in the areas west and south-southeast of New Plymouth probably are from feedlot and dairy operations, in addition to agricultural activities.

3. Water quality samples from surface drains corroborate ground-water sample results. Drains in the eastern part of the study area have nitrate concentrations ranging from 1 to 3.4 mg/L. Drains in the central and western part of the study area have nitrate concentrations ranging from 4.8 to 6 mg/L. Major ion concentrations in drains from the central and western part of the study area also are elevated compared to major ions in drain samples from the eastern part of the study area.

4. Seasonal water level changes due to irrigation water recharge occur throughout the study area. The greatest depth to water generally occurred during late winter or early spring while the shallowest depth to water occurred during late summer to early fall. Water level fluctuations up to about 13 feet were recorded in quarterly wells.

5. Seasonal trends in nitrate concentration were not apparent in wells monitored quarterly. Nitrate concentration in some wells increased during the irrigation season while concentrations decreased in other wells during the same period.

6. The herbicide Dacthal was detected in 12 of 20 quarterly wells sampled. In general it was detected in wells where nitrate was also detected and more commonly in the area northwest of New Plymouth.

7. Three of 30 wells sampled for arsenic had concentrations exceeding the EPA maximum contaminant level of 50 ug/L. Additional work would be required to determine the source and extent of arsenic in ground water.

8. Concentrations of soil nitrate measured below the root zone show low variability and little correlation with crop type. When compared with results obtained from controlled fertility plots in similar soil types, these concentrations correlate with application rates of 300-400+ lbs. N/acre/year.

9. The soil nitrate and ground water concentrations measured in one field, when combined with comparable data from an adjacent agricultural area indicates the

potential for storage and transport of nitrates below the rooting zone and contamination of ground water from agricultural activities in this study area.

10. Severe impacts to deeper ground water from vadose zone storage and transport of nitrates resulting from agricultural activities may be mitigated to some degree by soil characteristics such as low permeability and routing of shallow ground water to surface drains.

11. Of 4 fields sampled for pesticides, soils from only one field of sugar beets had any detections. The compounds detected were DDT and DDE, which are no longer registered and which are extremely persistent in the environment.

Two local farmers agreed to sampling of their fields. The assistance and cooperation of all these individuals is greatly appreciated.

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*The Rathdrum Prairie Aquifer Technical Report*, August 1988.

*Ground Water Contamination and Monitoring Activities on the Rathdrum Prairie Aquifer*, April 1991.

*Ground Water Vulnerability Assessment Snake River Plain, Southern Idaho*, April 1991.

*Annual Ground Water Contamination Report*, State Fiscal Year 1991.

*Appendixes to the Annual Ground Water Contamination Report*, State Fiscal Year 1991.

*Black Cliffs Ground Water Quality Study: Nitrate Impact*, October 1994.

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# Appendix

Table 2. Inventory of selected wells in the Lower Payette study area, Idaho.

| # | WELL_ID | Well Depth(ft.) | Casing Diam.(in.) | Date Drilled | Elevation(ft.) | Depth to Water(ft) | Date | Comments |
|---|---|---|---|---|---|---|---|---|
| 1 | 7N 3W 17CBC01 | | | | | | | |
| 2 | 7N 3W 18CAA01 | 27 | | 01-Jan-17 | 2238 | 3.70 | 31-May-91 | |
| 3 | 7N 3W 19CDD01 | 84 | 6.30 | 31-Jul-84 | 2330 | 53.44 | 11-Apr-91 | L |
| 4 | 7N 3W 19DAD01 | 90 | | | 2252 | 8.59 | 11-Apr-91 | |
| 5 | 7N 3W 30DCD01 | 270 | 6.30 | 21-Oct-76 | 2355 | | | L |
| 7 | 7N 3W 31AAA01 | 160 | 6.30 | | 2385 | 72.20 | 02-Apr-91 | |
| | 7N 3W 31AAA01 | | | | | 72.13 | 31-May-91 | |
| | 7N 3W 31AAA01 | | | | | 66.22 | 29-Aug-91 | |
| | 7N 3W 31AAA01 | | | | | 67.45 | 09-Dec-91 | |
| 6 | 7N 3W 31ADD01 | 280 | 6.30 | 22-May-68 | 2435 | 128.57 | 01-Apr-91 | L |
| 8 | 7N 4W 03AAB01 | | 4.00 | | 2214 | | | |
| 9 | 7N 4W 03DBB01 | 60 | 6.30 | 07-May-88 | 2246 | 28.90 | 02-Apr-91 | L |
| | 7N 4W 03DBB01 | | | | | 22.51 | 31-May-91 | |
| | 7N 4W 03DBB01 | | | | | 21.00 | 28-Aug-91 | |
| | 7N 4W 03DBB01 | | | | | 24.72 | 06-Dec-91 | |
| | 7N 4W 03DBB01 | | | | | 32.00 | 03-Mar-92 | |
| 10 | 7N 4W 06AAA01 | 42 | 6.30 | 01-Jan-76 | 2248 | 7.97 | 10-Apr-91 | M |
| | 7N 4W 06AAA01 | | | | | 4.84 | 30-May-91 | |
| | 7N 4W 06AAA01 | | | | | 2.71 | 28-Aug-91 | |
| | 7N 4W 06AAA01 | | | | | 8.42 | 06-Dec-91 | |
| 11 | 7N 4W 06CCD01 | 53 | 6.30 | 02-Nov-72 | 2285 | 9.50 | 12-Jun-91 | L |
| 12 | 7N 4W 06DCC01 | 80 | | | 2281 | | | |
| 13 | 7N 4W 07ADA01 | 74 | 4.00 | | 2290 | 20.14 | 09-Apr-91 | |
| 14 | 7N 4W 07BBB01 | 11 | 1.00 | 14-Jun-91 | 2290 | 9.04 | 14-Jun-91 | |
| 15 | 7N 4W 07BBB02 | 55 | 6.30 | | 2280 | 14.00 | 12-Jun-91 | |
| 16 | 7N 4W 07BCC01 | 134 | 6.30 | | 2313 | 22.08 | 15-Apr-91 | |
| 17 | 7N 4W 07CCC01 | 47 | | | 2231 | | | |

L=driller's log available  M=welldepth measured

Table 2. Inventory of selected wells in the Lower Payette study area, Idaho.

| # | WELL_ID | Well Depth(ft.) | Casng Diam.(in.) | Date Drilled | Elevation(ft.) | Depth to Water(ft.) | Date | Comments |
|---|---|---|---|---|---|---|---|---|
| 18 | 7N 4W 09CBB01 | | | | 2281 | | | |
| 19 | 7N 4W 10ABA01 | 106 | 3.00 | 01-Jan-23 | 2257 | 24.82 | 03-Apr-91 | |
| 20 | 7N 4W 10CBC01 | | | | 2285 | | | |
| 21 | 7N 4W 11DBB01 | | 6.30 | | 2260 | | | |
| 22 | 7N 4W 12BBA01 | 110 | 4.00 | | 2232 | 10.99 | 02-Apr-91 | |
| 23 | 7N 4W 13BCC01 | 80 | | | 2280 | | | |
| 24 | 7N 4W 13DDC01 | 127 | 4.00 | 01-Jan-40 | | 33.02 | 01-Apr-91 | |
| 25 | 7N 4W 14CCB01 | 74 | 6.30 | | 2330 | 39.23 | 03-Apr-91 | M |
| | 7N 4W 14CCB01 | | | | | 36.37 | 30-May-91 | |
| | 7N 4W 14CCB01 | | | | | 27.66 | 29-Aug-91 | |
| | 7N 4W 14CCB01 | | | | | 30.76 | 06-Dec-91 | |
| | 7N 4W 14CCB01 | | | | | 37.35 | 05-Mar-92 | |
| 26 | 7N 4W 15CCB01 | 75 | 6.30 | 01-Jan-80 | 2350 | 35.97 | 03-Apr-91 | L |
| | 7N 4W 15CCB01 | | | | | 33.90 | 30-May-91 | |
| | 7N 4W 15CCB01 | | | | | 31.40 | 29-Aug-91 | |
| | 7N 4W 15CCB01 | | | | | 32.84 | 09-Dec-91 | |
| | 7N 4W 15CCB01 | | | | | 35.15 | 05-Mar-92 | |
| 27 | 7N 4W 17CCB01 | 136 | 6.30 | | 2231 | 87.83 | 10-Apr-91 | |
| 28 | 7N 4W 18BAA01 | | | | 2358 | | | |
| 29 | 7N 4W 20AAA01 | 160 | 4.00 | | 2405 | 72.38 | 03-Apr-91 | M |
| | 7N 4W 20AAA01 | | | | | 76.98 | 30-May-91 | |
| | 7N 4W 20AAA01 | | | | | 69.63 | 28-Aug-91 | |
| | 7N 4W 20AAA01 | | | | | 69.18 | 09-Dec-91 | |
| | 7N 4W 20AAA01 | | | | | 71.85 | 03-Mar-92 | |

L=driller's log available M=well depth measured

Table 2. Inventory of selected wells in the Lower Payette study area, Idaho.

| # | WELL_ID | Well Depth(ft.) | Casing Diam.(in.) | Date Drilled | Elevation(ft.) | Depth to Water(ft.) | Date | Comments |
|---|---|---|---|---|---|---|---|---|
| 30 | 7N 4W 23DAC01 | 45 | 6.30 | 10-Mar-81 | 2305 | 19.57 | 11-Apr-91 | L |
| | 7N 4W 23DAC01 | | | | | 12.31 | 31-May-91 | |
| | 7N 4W 23DAC01 | | | | | 9.11 | 29-Aug-91 | |
| | 7N 4W 23DAC01 | | | | | 15.17 | 09-Dec-91 | |
| | 7N 4W 23DAC01 | | | | | 17.38 | 05-Mar-92 | |
| 31 | 7N 4W 23DAC02 | | | | | | | |
| 32 | 7N 4W 25ABB01 | 140 | 4.00 | | 2342 | | | R |
| 33 | 7N 4W 25CCB01 | 96 | 6.30 | | 2395 | 56.08 | 02-Apr-91 | L |
| | 7N 4W 25CCB01 | | | | | 55.20 | 31-May-91 | |
| | 7N 4W 25CCB01 | | | | | 50.01 | 29-Aug-91 | |
| | 7N 4W 25CCB01 | | | | | 51.34 | 06-Dec-91 | |
| | 7N 4W 25CCB01 | | | | | 55.01 | 05-Mar-92 | |
| 34 | 7N 4W 26CBC01 | 100 | 4.00 | | 2380 | | | |
| 35 | 7N 4W 27BBB01 | 100 | 6.00 | 24-May-57 | 2380 | | | |
| 36 | 7N 4W 27BBB02 | 120 | 4.00 | 01-Jan-45 | 2380 | | | |
| 37 | 7N 4W 28AAA01 | 75 | 6.30 | | 2406 | 53.70 | 03-Apr-91 | L |
| | 7N 4W 28AAA01 | | | | | 54.74 | 30-May-91 | |
| | 7N 4W 28AAA01 | | | | | 41.59 | 29-Aug-91 | |
| | 7N 4W 28AAA01 | | | | | 46.50 | 09-Dec-91 | |
| | 7N 4W 28AAA01 | | | | | 52.54 | 04-Mar-92 | |
| 38 | 7N 4W 28AAA02 | 110 | 6.30 | 01-Jan-81 | 2420 | | | |
| 39 | 7N 4W 28DAA01 | 208 | 16.00 | 16-Sep-78 | 2450 | 91.27 | 06-Jun-91 | L |
| 40 | 7N 4W 31DDD01 | 25 | 4.00 | | 2243 | | | |
| 41 | 7N 5W 01BAA01 | 100 | 5.00 | 23-Dec-86 | 2262 | 25.00 | 23-Dec-88 | L |
| 42 | 7N 5W 01DBB01 | | 6.30 | | 2260 | | | |
| 43 | 7N 5W 02DBB01 | 100 | 6.30 | | 2265 | 21.29 | 19-Apr-91 | |
| 44 | 7N 5W 12BDD01 | | | | 2307 | | | |

L=driller's log available M=well depth measurec

Table 2. Inventory of selected vells in the Lower Fayette study area, daho.

| # | WELL_ID | Well Depth(ft.) | Casing Diam.(in.) | Date Drilled | Elevation(ft.) | Depth to Water(ft.) | Date | Comments |
|---|---|---|---|---|---|---|---|---|
| 45 | 8N 4W19ACC01 | 32 | 6.30 | | 2175 | 7.89 | 09-Apr-91 | |
| 46 | 8N 4W19DBC01 | | 4.00 | | 2182 | | | |
| 47 | 8N 4W28CBA01 | 115 | 6.30 | 09-Mar-91 | 2193 | 6.11 | 10-Apr-91 | L |
| | 8N 4W28CBA01 | | | | | 6.67 | 30-May-91 | |
| | 8N 4W28CBA01 | | | | | 7.37 | 28-Aug-91 | |
| | 8N 4W28CBA01 | | | | | 7.58 | 05-Dec-91 | |
| | 8N 4W28CBA01 | | | | | 7.78 | 03-Mar-92 | |
| 48 | 8N 4W28DCD01 | 51 | 4.00 | | 2208 | 16.49 | 09-Apr-91 | |
| | 8N 4W28DCD01 | | | | | 15.69 | 30-May-91 | |
| | 8N 4W28DCD01 | | | | | 14.44 | 28-Aug-91 | |
| | 8N 4W28DCD01 | | | | | 16.24 | 05-Dec-91 | |
| | 8N 4W28DCD01 | | | | | 15.98 | 03-Mar-92 | |
| 49 | 8N 4W29CBC01 | 170 | | | 2205 | | | |
| 50 | 8N 4W30BAD01 | 48 | 6.30 | 20-Sep-79 | 2210 | | | L |
| 51 | 8N 4W30BCC01 | | 4.00 | | 2210 | | | |
| 52 | 8N 4W33ADC01 | 33 | 6.30 | 11-Aug-84 | 2215 | 8.68 | 03-Apr-91 | L |
| 53 | 8N 4W33CCD01 | | | | 2237 | | | |
| 55 | 8N 5W14DCD01 | 44 | 6.00 | 18-Mar-63 | 2210 | 25.00 | 18-Mar-63 | L |
| 56 | 8N 5W15DAB01 | | | | | | | |
| ~~56~~ | ~~8N 5W15DAB01~~ | 56 | 6.63 | 01-Jan-85 | 2190 | 21.40 | 23-May-91 | L |
| | | | | | | 21.03 | 27-Aug-91 | |
| | ~~8N 5W 15DAB01~~ | | | | | 21.42 | 03-Dec-91 | |
| | ~~8N 5W 15DAB01~~ | | | | | 23.63 | 02-Mar-92 | |
| 57 | 8N 5W23ACC01 | 42 | 6.30 | 01-Jan-74 | 2220 | 12.27 | 12-Jun-91 | |
| 58 | 8N 5W23BCC01 | 32 | 4.00 | 01-Jan-26 | 2220 | | | |

L=driller's log available  M=well depth measurec

Table 2. Inventory of selected wells in the Lower Payette study area, Idaho.

| # | WELL_ID | Well Depth(ft.) | Casing Diam.(in.) | Date Drilled | Elevation(ft.) | Depth to Water(ft.) | Date | Comments |
|---|---|---|---|---|---|---|---|---|
| 59 | 8N 5W 23CDD01 | 33 | 6.30 | 26-Nov-74 | 2250 | 19.10 | 11-Apr-91 | L |
| | 8N 5W 23CDD01 | | | | | 13.14 | 28-May-91 | |
| | 8N 5W 23CDD01 | | | | | 7.36 | 27-Aug-91 | |
| | 8N 5W 23CDD01 | | | | | 14.86 | 03-Dec-91 | |
| | 8N 5W 23CDD01 | | | | | 17.35 | 02-Mar-92 | |
| 60 | 8N 5W 23DAD01 | 22 | 4.00 | 01-Jan-61 | 2213 | 16.41 | 12-Jun-91 | |
| 83 | 8N 5W 23DAD02 | 30 | 6.30 | 01-Jan-65 | 2213 | | | |
| 82 | 8N 5W 24ABC02 | 100 | 6.63 | | 2190 | 30.09 | 23-May-91 | L |
| | 8N 5W 24ABC02 | | | | | 29.82 | 28-May-91 | |
| | 8N 5W 24ABC02 | | | | | 30.45 | 27-Aug-91 | |
| | 8N 5W 24ABC02 | | | | | 31.39 | 03-Dec-91 | |
| | 8N 5W 24ABC02 | | | | | 30.46 | 02-Mar-92 | |
| 61 | 8N 5W 24ACD01 | 300 | 6.62 | | 2200 | 28.14 | 23-May-91 | L |
| 62 | 8N 5W 24BBB01 | | 4.00 | 01-Jan-67 | 2195 | | | |
| 63 | 8N 5W 24BBB02 | | 6.30 | | 2195 | | | |
| 64 | 8N 5W 24BBC01 | | | | 2195 | | | |
| 65 | 8N 5W 25AAA01 | 45 | 6.30 | | 2210 | 21.88 | 11-Apr-91 | L |
| | 8N 5W 25AAA01 | | | | | 17.52 | 28-May-91 | |
| | 8N 5W 25AAA01 | | | | | 14.52 | 28-Aug-91 | |
| | 8N 5W 25AAA01 | | | | | 18.41 | 05-Dec-91 | |
| | 8N 5W 25AAA01 | | | | | 20.46 | 02-Mar-92 | |
| 67 | 8N 5W 25ABB01 | 129 | 4.00 | | 2210 | | | |
| 68 | 8N 5W 25CBC01 | | | | 2227 | | | |
| 69 | 8N 5W 25CCC01 | 41 | 6.30 | 02-May-79 | 2230 | 10.87 | 28-May-91 | L |
| | 8N 5W 25CCC01 | | | | | 8.78 | 27-Aug-91 | |
| | 8N 5W 25CCC01 | | | | | 15.16 | 09-Dec-91 | |

L=driller's log available  M=well depth measured

Table 2. Inventory of selected wells in the Lower Payette study area, Idaho.

| # | WELL_ID | Well Depth(ft.) | Casing Diam.(in.) | Date Drilled | Elevation(ft.) | Depth to Water(ft.) | Date | Comments |
|---|---|---|---|---|---|---|---|---|
| | 8N 5W 25CCC01 | | | | | 15.34 | 03-Mar-92 | |
| 70 | 8N 5W 25CCC02 | 80 | | 01-Jan-16 | 2230 | | | |
| 71 | 8N 5W 25DBC01 | 36 | 6.30 | 06-Apr-73 | 2220 | 9.64 | 30-May-91 | L |
| | 8N 5W 25DBC01 | | | | | 5.78 | 28-Aug-91 | |
| | 8N 5W 25DBC01 | | | | | 11.34 | 03-Dec-91 | |
| | 8N 5W 25DBC01 | | | | | 11.13 | 02-Mar-92 | |
| 72 | 8N 5W 25DDD01 | | | | 2226 | | | |
| 73 | 8N 5W 26AAD01 | 115 | 4.00 | 01-Jan-20 | 2220 | | | |
| 74 | 8N 5W 26ACB01 | 41 | 3.00 | | 2225 | | | |
| 75 | 8N 5W 26BDA01 | 61 | 4.00 | | 2225 | 13.70 | 12-Jun-91 | |
| 76 | 8N 5W 26DDC01 | 55 | 6.30 | | 2232 | 15.15 | 11-Apr-91 | L |
| | 8N 5W 26DDC01 | | | | | 8.37 | 29-May-91 | |
| | 8N 5W 26DDC01 | | | | | 7.26 | 27-Aug-91 | |
| | 8N 5W 26DDC01 | | | | | 13.52 | 05-Dec-91 | |
| | 8N 5W 26DDC01 | | | | | 13.66 | 02-Mar-92 | |
| 77 | 8N 5W 34DBC01 | 60 | | 01-Jan-88 | 2215 | 14.55 | 30-May-91 | L |
| | 8N 5W 34DBC01 | | | | | 11.59 | 28-Aug-91 | |
| | 8N 5W 34DBC01 | | | | | 15.92 | 03-Dec-91 | |
| | 8N 5W 34DBC01 | | | | | 17.07 | 03-Mar-92 | |
| 78 | 8N 5W 35BAA01 | 35 | 6.30 | 01-Jan-12 | 2230 | | | |
| 79 | 8N 5W 35BCC01 | | 6.00 | | 2246 | | | |
| 84 | 8N 5W 35BCC02 | 35 | 6.30 | | 2245 | 14.70 | 02-Mar-92 | |
| 80 | 8N 5W 35CCC01 | 100 | 4.00 | 01-Jan-20 | 2268 | | | |
| 81 | 8N 5W 35DDC01 | 110 | 4.00 | | 2270 | | | |
| 54 | 8N 5W 36DDD01 | 47 | 4.00 | | 2252 | 20.19 | 15-Apr-91 | |

L=driller's log available  M=well depth measured

Table 6. Field Chemical Concentrations of Ground Water from Selected Wells in the Lower Payette Study Area

| # | WELLID | Latitude | Longitude | Date | pH | ond.(umhos/cm) | Temp.(deg.C) | NO3 (mg/l) | Cl (mg/l) | HCO3 (mg/l) | SO4 (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 07N-03W-17CBC01 | 43.94222222 | 116.7222222 | 910401 | | 567 | 10.7 | 0.0 | | | |
| 2 | 07N-03W-18CAA01 | 43.94527778 | 116.7419444 | 910401 | 7.77 | 523 | 14.1 | 1.5 | | | |
| 2 | 07N-03W-18CAA01 | 43.94527778 | 116.7419444 | 910531 | 8.05 | 250 | 13.6 | | | | |
| 2 | 07N-03W-18CAA01 | 43.94527778 | 116.7419444 | 910629 | 8.38 | 217 | 20.6 | | | 89 | |
| 2 | 07N-03W-18CAA01 | 43.94527778 | 116.7419444 | 920304 | 8.11 | 390 | 13.0 | | | | |
| 3 | 07N-03W-19CDD01 | 43.92388889 | 116.7394444 | 910411 | 7.45 | 687 | 14.7 | 2.0 | | | |
| 4 | 07N-03W-19DAD01 | 43.92750000 | 116.7319444 | 910411 | 8.11 | 466 | 14.2 | 0.5 | | | |
| 5 | 07N-03W-30DCD01 | 43.90972222 | 116.7369444 | 910402 | 7.71 | 163 | 19.3 | 0.0 | | | |
| 6 | 07N-03W-31ADD01 | 43.90194444 | 116.7319444 | 910401 | 7.35 | 170 | 16.6 | 0.0 | | | |
| 7 | 07N-03W-31AAA01 | 43.90777778 | 116.7333333 | 910402 | 7.63 | 565 | 14.1 | 6.0 | | | |
| 7 | 07N-03W-31AAA01 | 43.90777778 | 116.7333333 | 910531 | 7.59 | 650 | 14.6 | | | | |
| 7 | 07N-03W-31AAA01 | 43.90777778 | 116.7333333 | 911209 | 7.48 | 580 | 15.4 | | | 328 | 35 |
| 7 | 07N-03W-31AAA01 | 43.90777778 | 116.7333333 | 920304 | 7.74 | 635 | 14.4 | | | | |
| 8 | 07N-04W-03AAB01 | 43.90777778 | 116.7333333 | 910402 | 8.20 | 319 | 13.3 | 0.0 | | | |
| 9 | 07N-04W-03DBB01 | 43.97444444 | 116.8019444 | 910402 | 7.44 | 650 | 13.4 | 4.0 | | | |
| 9 | 07N-04W-03DBB01 | 43.97444444 | 116.8019444 | 910531 | 7.41 | 653 | 13.7 | | | | |
| 9 | 07N-04W-03DBB01 | 43.97444444 | 116.8019444 | 911208 | 7.49 | 664 | | 2.9 | | 411 | |
| 9 | 07N-04W-03DBB01 | 43.97444444 | 116.8019444 | 920303 | 7.59 | 626 | 12.9 | | | | |
| 10 | 07N-04W-06AAA01 | 43.96055556 | 116.8519444 | 910410 | 7.67 | 636 | 11.1 | 5.2 | | | |
| 10 | 07N-04W-06AAA01 | 43.96055556 | 116.8519444 | 910530 | 7.74 | 720 | 13.7 | | | | |
| 10 | 07N-04W-06AAA01 | 43.96055556 | 116.8519444 | 911206 | | 773 | | | | 364 | 27 |
| 10 | 07N-04W-06AAA01 | 43.96055556 | 116.8519444 | 920303 | 7.58 | 701 | 12.8 | | | | |
| 11 | 07N-04W-06CCD01 | 43.96805556 | 116.8688111 | 910612 | 7.30 | 523 | 15.1 | 7.7 | 65 | | |
| 12 | 07N-04W-06DCC01 | 43.96777778 | 116.8644444 | 910403 | 7.67 | 1385 | 14.3 | 0.0 | | | |
| 13 | 07N-04W-07ADA01 | 43.94250000 | 116.8530556 | 910409 | 7.17 | 1106 | 13.5 | 0.5 | | | |
| 13 | 07N-04W-07ADA01 | 43.94250000 | 116.8530556 | 910530 | 7.15 | 1126 | 16.0 | | | | |
| 13 | 07N-04W-07ADA01 | 43.94250000 | 116.8530556 | 911206 | 7.35 | 509 | 12.6 | | | 191 | 38 |
| 13 | 07N-04W-07ADA01 | 43.94250000 | 116.8530556 | 920303 | 7.94 | 684 | 14.7 | | | | |
| 14 | 07N-04W-07BBB01 | 43.94666670 | 116.8719444 | 910710 | 7.45 | 745 | 12.7 | 12.9 | 72 | | |
| 14 | 07N-04W-07BBB01 | 43.94666670 | 116.8719444 | 910807 | 7.79 | 820 | 15.4 | 6.9 | 80 | 366 | |
| 15 | 07N-04W-07BBB02 | 43.94638889 | 116.8666667 | 910612 | 7.49 | 703 | 13.3 | 9.9 | 72 | | |

Table 6. Field Chemical Concentrations of Ground Water from Selected Wells in the Lower Payette Study Area

| # | WELLID | Latitude | Longitude | Date | pH | Cond.(umhos/cm) | Temp.(deg.C) | NO3 (mg/l) | Cl (mg/l) | HCO3 (mg/l) | SO4 (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | 07N-04W-07BCC01 | 43.99055556 | 116.6719444 | 910415 | 7.49 | 1226 | 15.8 | 0.4 | | | |
| 17 | 07N-04W-07CCC01 | 43.95333333 | 116.7511111 | 910402 | 9.10 | 220 | 14.2 | 1.5 | | | |
| 18 | 07N-04W-09CBB01 | 43.98000000 | 116.8319444 | 910409 | 823 | 386 | 14.1 | 0.5 | | | |
| 19 | 07N-04W-10ABA01 | 43.98666667 | 116.7977778 | 910403 | 780 | 330 | 13.9 | 0.0 | | | |
| 20 | 07N-04W-10CBC01 | 43.95833333 | 116.8097222 | 910606 | 765 | 560 | 14.8 | 4.6 | 4.8 | | |
| 21 | 07N-04W-11DBB01 | 43.96694444 | 116.7808333 | 910403 | 633 | 345 | 16.0 | 0.0 | | | |
| 22 | 07N-04W-12BBA01 | 43.98694444 | 116.7675000 | 910402 | 802 | 245 | 13.2 | 1.0 | | | |
| 23 | 07N-04W-13BCC01 | 43.94811111 | 116.7711111 | 910409 | 738 | 445 | 14.8 | 0.0 | | | |
| 24 | 07N-04W-13DDC01 | 43.63833333 | 116.7552778 | 910401 | 795 | 197 | 15.9 | 0.0 | | | |
| 25 | 07N-04W-14CCB01 | 43.14083333 | 116.7897222 | 910403 | 775 | 864 | 15.1 | 3.0 | | | |
| 26 | 07N-04W-14CCB01 | 43.14083333 | 116.7897222 | 910530 | 765 | 886 | 14.9 | | | 386 | |
| 25 | 07N-04W-14CCB01 | 43.14083333 | 116.7897222 | 911206 | 750 | 849 | | | | | |
| 25 | 07N-04W-14CCB01 | 43.14083333 | 116.7897222 | 920304 | 7.76 | 442 | 12.8 | | | | |
| 26 | 07N-04W-15CCB01 | 43.14027778 | 116.8100000 | 910403 | 7.62 | 810 | 14.5 | 0.0 | | | |
| 26 | 07N-04W-15CCB01 | 43.14027778 | 116.8100000 | 910530 | 7.60 | 706 | 14.5 | | | 433 | |
| 26 | 07N-04W-15CCB01 | 43.14027778 | 116.8100000 | 911209 | 7.42 | 773 | 13.4 | | | | |
| 26 | 07N-04W-15CCB01 | 43.14027778 | 116.8100000 | 920304 | 7.71 | | 13.7 | | | | |
| 27 | 07N-04W-17CCB01 | 43.94055556 | 116.8516667 | 910410 | 8.10 | 468 | 14.5 | 1.1 | | | |
| 28 | 07N-04W-18BAA01 | 43.95194444 | 116.8625000 | 919410 | 8.28 | 182 | 16.0 | 0.4 | | | |
| 29 | 07N-04W-20AAA01 | 43.93777778 | 116.8341667 | 910403 | 7.47 | 639 | 16.1 | 3.0 | | | |
| 29 | 07N-04W-20AAA01 | 43.93777778 | 116.8341667 | 910530 | 7.43 | 623 | 17.4 | | | 242 | 70 |
| 29 | 07N-04W-20AAA01 | 43.93777778 | 116.8341667 | 911209 | 7.31 | 608 | 16.5 | | | | |
| 29 | 07N-04W-20AAA01 | 43.93777778 | 116.8341667 | 920303 | 7.85 | 601 | 16.4 | | | | |
| 30 | 07N-04W-23DAC01 | 43.93027778 | 116.7719444 | 910411 | 7.72 | 618 | 13.9 | 2.3 | | | |
| 30 | 07N-04W-23DAC01 | 43.93027778 | 116.7719444 | 910531 | 7.76 | 638 | 14.7 | | | | |
| 30 | 07N-04W-23DAC01 | 43.93027778 | 116.7719444 | 920304 | 7.97 | 513 | 13.0 | | | | |
| 31 | 07N-04W-23DAC02 | 43.92861111 | 116.7747222 | 910411 | 7.88 | 639 | 13.9 | 2.1 | | | |
| 32 | 07N-04W-25ABB01 | 43.92333333 | 116.7611111 | 910402 | 7.52 | 734 | 14.2 | | | | |
| 32 | 07N-04W-25ABB01 | 43.92333333 | 116.7611111 | 910531 | 7.52 | 733 | 9.1 | 3.0 | | | |
| 32 | 07N-04W-25ABB01 | 43.92333333 | 116.7611111 | 910829 | 7.73 | 745 | 18.9 | | | 349 | |
| 32 | 07N-04W-25ABB01 | 43.92333333 | 116.7611111 | 920304 | 7.89 | 685 | 7.0 | | | | |

Table 6. Field Chemical Concentrations of Ground Water from Selected Wells in the Lower Payette Study Area

| # | WELLID | Latitude | Longitude | Date | pH | Cond.(umhos/cm) | Temp.(deg.C) | NO3 (mg/l) | Cl (mg/l) | HCO3 (mg/l) | SO4 (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 33 | 07N-04W-25CCB01 | 4391222222 | 116.771111 | 910402 | 7.93 | 638 | 14.3 | 2.5 | | | |
| 33 | 07N-04W-25CCB01 | 4391222222 | 116.771111 | 910531 | 7.62 | 638 | 14.1 | | | | |
| 33 | 07N-04W-25CCB01 | 4391222222 | 116.771111 | 910829 | 7.88 | 60 | 20.2 | | | 311 | |
| 33 | 07N-04W-25CCB01 | 4391222222 | 116.771111 | 920304 | 8.16 | 549 | 14.8 | | | | |
| 34 | 07N-04W-26CBC01 | 4391305556 | 116.7916667 | 910402 | 7.54 | 512 | 11.6 | 0.0 | | | |
| 35 | 07N-04W-27BBB01 | 4392388889 | 116.8116667 | 910606 | 7.68 | 825 | 16.0 | 4.3 | 27.6 | | |
| 36 | 07N-04W-27BBB02 | 4392388889 | 116.811111 | 910606 | 7.48 | 768 | 15.5 | 2.6 | 62.0 | | |
| 37 | 07N-04W-28AAA01 | 43.92333333 | 116.8127778 | 910403 | 7.07 | 1815 | 14.9 | 20.0 | | | |
| 37 | 07N-04W-28AAA01 | 4392333333 | 116.8127778 | 910530 | 6.99 | 1833 | 14.8 | | | | |
| 37 | 07N-04W-28AAA01 | 4392333333 | 116.8127778 | 920304 | 6.96 | 1060 | 14.0 | | | | |
| 38 | 07N-04W-28AAA02 | 43.92361111 | 116.8138111 | 910606 | 7.83 | 637 | 15.3 | 3.4 | 37.6 | | |
| 39 | 07N-04W-28DAA01 | 43.91583333 | 116.8138889 | 910606 | 7.46 | 184 | 16.0 | 0.7 | 2.8 | | |
| 40 | 07N-04W-31DDD01 | 43.86222222 | 116.8516444 | 910606 | 7.86 | 427 | 15.1 | 0.4 | 37.2 | | |
| 41 | 07N-05W-01BAA01 | 43.38166667 | 116.8747222 | 910606 | 7.89 | 207 | 14.7 | 0.3 | 1.0 | | |
| 42 | 07N-05W-01DBB01 | 43.37416667 | 116.8819444 | 910419 | 7.61 | 533 | 14.4 | 0.6 | | | |
| 43 | 07N-05W-02DBB01 | 43.37416667 | 116.9008333 | 910419 | 7.47 | 328 | 12.9 | 0.0 | | | |
| 44 | 07N-05W-12BDD01 | 43.36055556 | 116.8644444 | 910415 | 7.29 | 870 | 14.6 | 1.6 | | | |
| 45 | 08N-04W-19ACC01 | 44.41916667 | 116.8597667 | 910409 | 8.05 | 350 | 13.5 | 0.5 | | | |
| 45 | 08N-04W-19ACC01 | 44.41916667 | 116.8591667 | 910530 | 7.93 | 356 | 14.9 | | | | |
| 45 | 08N-04W-19ACC01 | 44.41916667 | 116.8591667 | 911203 | 7.66 | | | | | 171 | |
| 45 | 08N-04W-19ACC01 | 44.41916667 | 116.8591667 | 920302 | 8.15 | 303 | 13.3 | | | | |
| 46 | 08N-04W-19DBC01 | 44.41611111 | 116.9111111 | 910409 | 7.83 | 458 | 14.1 | 0.2 | | | |
| 47 | 08N-04W-28CBA01 | 44.40361111 | 116.8269444 | 910410 | 7.85 | 367 | 11.5 | 0.0 | | | |
| 47 | 08N-04W-28CBA01 | 44.40361111 | 116.8269444 | 910530 | 7.75 | 363 | 13.6 | | | | |
| 47 | 08N-04W-28CBA01 | 44.40361111 | 116.8269444 | 911205 | 7.41 | 338 | 9.9 | | | 200 | |
| 47 | 08N-04W-28CBA01 | 44.40361111 | 116.8269444 | 920303 | 8.07 | 366 | 12.7 | | | | |
| 48 | 08N-04W-28DCD01 | 43.19666667 | 116.8177778 | 910409 | 7.75 | 665 | 12.4 | 0.4 | | | |
| 48 | 08N-04W-28DCD01 | 43.19666667 | 116.8177778 | 910530 | 7.65 | 684 | 14.6 | | | | |
| 48 | 08N-04W-28DCD01 | 43.19666667 | 116.8177778 | 911205 | 7.31 | 632 | 11.5 | | | 278 | |
| 48 | 08N-04W-28DCD01 | 43.19666667 | 116.8177778 | 920303 | 7.77 | 635 | 13.0 | | | | |
| 49 | 08N-04W-29CBC01 | 44.40027778 | 116.8511111 | 910409 | 7.75 | 622 | 13.5 | 1.2 | | | |

Table 6 Field Chemical Concentrations of Ground Water from Selected Wells in the Lower Payette Study Area

| # | WELLID | Latitude | Longitude | Date | pH | Cond.(umhos/cm) | Temp.(deg.C) | NO3 (mg/l) | Cl (mg/l) | HCO3 (mg/l) | SO4(mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | 08N-04W-30BAA01 | 44.00722222 | 116.8638889 | 910523 | 7.59 | 1194 | 14.5 | 3.3 | | | |
| 50 | 08N-04W-30BAA01 | 44.00722222 | 116.8638889 | 910530 | 7.46 | 1154 | 13.2 | | | | |
| 50 | 08N-04W-30BAA01 | 44.00722222 | 116.8638889 | 910828 | 7.43 | 1028 | 17.6 | | | 610 | |
| 50 | 08N-04W-30BAA01 | 44.00722222 | 116.8638889 | 920303 | 7.61 | 1079 | 12.9 | | | | |
| 51 | 08N-04W-30BCC01 | 44.00500000 | 116.8716667 | 910524 | 7.68 | 567 | 16.7 | 0.0 | | | |
| 52 | 08N-04W-33ADC01 | 43.98944444 | 116.8152778 | 910403 | 7.72 | 734 | 13.5 | 0.5 | | | |
| 53 | 08N-04W-33CCD01 | 43.98222222 | 116.8277778 | 910409 | 7.73 | 894 | 14.8 | 0.4 | | | |
| 54 | 08N-05W-36DDD01 | 43.98222222 | 116.8741667 | 910415 | 7.59 | 840 | 13.8 | 1.5 | | | |
| 55 | 08N-05W-14DCD01 | 44.02583333 | 116.9011111 | 910524 | 7.35 | 809 | 15.3 | 4.0 | | | |
| 55 | 08N-05W-14DCD01 | 44.02583333 | 116.9011111 | 910529 | 7.53 | 803 | 15.2 | 4.4 | 5.[illegible] | | |
| 55 | 08N-05W-14DCD01 | 44.02583333 | 116.9011111 | 911203 | 7.39 | 799 | 13.0 | | | 483 | |
| 55 | 08N-05W-14DCD01 | 44.02583333 | 116.9011111 | 920302 | 7.37 | 764 | 13.8 | | | | |
| 56 | 08N-05W-15DAB01 | 44.03150000 | 116.9166667 | 910523 | 7.55 | 534 | 17.8 | 2.6 | | | |
| 56 | 08N-05W-15DAB01 | 44.03150000 | 116.9166667 | 910529 | 7.61 | 529 | 16.4 | 2.4 | 4.[illegible] | | |
| 56 | 08N-05W-15DAB01 | 44.03150000 | 116.9166667 | 910827 | 7.55 | 447 | 16.1 | | | 264 | |
| 56 | 08N-05W-15DAB01 | 44.03150000 | 116.9166667 | 920302 | 6.89 | 345 | 14.8 | | | | |
| 57 | 08N-05W-23ACC01 | 44.01194444 | 116.9019444 | 910612 | 6.7[illegible] | 594 | 14.3 | 2.3 | 5.[illegible] | | |
| 58 | 08N-05W-23BCC01 | 44.01444444 | 116.9122222 | 910524 | 7.4[illegible] | 708 | 16.3 | 6.9 | | | |
| 58 | 08N-05W-23BCC01 | 44.01444444 | 116.9122222 | 910528 | 7.53 | 705 | 14.5 | | 6.[illegible] | | |
| 58 | 08N-05W-23BCC01 | 44.01444444 | 116.9122222 | 911203 | 7.85 | 628 | 11.1 | | 6.[illegible] | 363 | |
| 58 | 08N-05W-23BCC01 | 44.01444444 | 116.9122222 | 920302 | 7.81 | 683 | 13.5 | | | | |
| 59 | 08N-05W-23CDD01 | 44.01166667 | 116.9044444 | 910411 | 7.83 | 844 | 12.3 | 5.1 | | | |
| 59 | 08N-05W-23CDD01 | 44.01166667 | 116.9044444 | 910528 | 7.65 | 807 | 14.1 | | | | |
| 59 | 08N-05W-23CDD01 | 44.01166667 | 116.9044444 | 911203 | | 736 | | | | 442 | |
| 59 | 08N-05W-23CDD01 | 44.01166667 | 116.9044444 | 920302 | 8.0[illegible] | 751 | 13.7 | | | | |
| 60 | 08N-05W-23DAD01 | 44.01000000 | 116.8930556 | 910612 | 7.73 | 547 | 15.0 | 6.9 | | | |
| 61 | 08N-05W-24ACD01 | 44.01161111 | 116.8802778 | 910523 | 7.61 | 822 | 17.6 | 0.6 | | 338 | |
| 62 | 08N-05W-24BBB01 | 44.02388889 | 116.8922222 | 910528 | 7.71 | 687 | 14.7 | 1.4 | 22.[illegible] | | |
| 63 | 08N-05W-24BBB02 | 44.02388889 | 116.8922222 | 910529 | 7.9 | 583 | 16.1 | 0.8 | 15.[illegible] | | |
| 64 | 08N-05W-24BBC02 | 44.02133333 | 116.8922222 | 910411 | 7.61 | 803 | 13.3 | 7.3 | | | |
| 64 | 08N-05W-24BBC02 | 44.02133333 | 116.8922222 | 910528 | 7.7[illegible] | 790 | 15.5 | 9.8 | 9.[illegible] | | |
| 64 | 08N-05W-24BBC02 | 44.02133333 | 116.8922222 | 911203 | 7.8[illegible] | 765 | | | | 478 | |
| 64 | 08N-05W-24BBC02 | 44.02133333 | 116.8922222 | 920302 | 7.7[illegible] | 767 | 12.4 | | | | |

Table 6. Field Chemical Concentrations of Ground Water from Selected Wells in the Lower Payette Study Area

| # | WELLID | Latitude | Longitude | Date | pH | Cond.(umhos/cm) | Temp.(deg.C) | NO3 (mg/l) | Cl (mg/l) | HCO3 (mg/l) | SO4 (mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 65 | 08N-05W-25AAA01 | 44.01055556 | 116.8730556 | 910411 | 7.35 | 897 | 13.9 | 26.4 | | | |
| 65 | 08N-05W-25AAA01 | 44.01055556 | 116.8730556 | 910529 | 7.57 | 930 | 14.1 | | 244 | | |
| 65 | 08N-05W-25AAA02 | 44.01055556 | 116.8730556 | 911205 | 7.73 | 958 | 10.3 | | | 356 | 95 |
| 65 | 08N-05W-25AAA01 | 44.01055556 | 116.8730556 | 920302 | 7.72 | 866 | 13.7 | | | | |
| | | | | | | | | | | | |
| 67 | 08N-05W-25ABB01 | 44.01055556 | 116.8822222 | 910523 | 7.75 | 455 | 16.4 | 0.4 | | | |
| 68 | 08N-05W-25CBC01 | 44.01027778 | 116.8922222 | 910411 | 7.68 | 310 | 15.6 | 0.6 | | | |
| | | | | | | | | | | | |
| 69 | 08N-05W-25CCC01 | 43.99694444 | 116.8819444 | 910524 | 7.40 | 507 | 16.5 | 8.4 | | | |
| 69 | 08N-05W-25CCC01 | 43.99694444 | 116.8819444 | 910528 | 7.41 | 558 | 16.4 | | 64 | | |
| 69 | 08N-05W-25CCC01 | 43.99694444 | 116.8819444 | 911208 | 7.35 | 446 | 9.5 | | | 236 | |
| 69 | 08N-05W-25CCC01 | 43.99694444 | 116.8819444 | 920303 | 8.00 | 548 | 15.3 | | | | |
| | | | | | | | | | | | |
| 70 | 08N-05W-25CCC02 | 43.99694444 | 116.8819444 | 910524 | 7.15 | 600 | 16.9 | 0.6 | | | |
| 70 | 08N-05W-25CCC02 | 43.99694444 | 116.8819444 | 910528 | 7.24 | 594 | 17.6 | | 236 | | |
| | | | | | | | | | | | |
| 71 | 08N-05W-25DBC01 | 44.01111111 | 116.8822222 | 910524 | 7.10 | 774 | 16.0 | 4.5 | | | |
| 71 | 08N-05W-25DBC01 | 44.01111111 | 116.8822222 | 910530 | 7.00 | 704 | 13.7 | | | | |
| 71 | 08N-05W-25DBC01 | 44.01111111 | 116.8822222 | 910828 | 7.74 | 663 | 16.3 | | | 403 | |
| 71 | 08N-05W-25DBC01 | 44.01111111 | 116.8822222 | 920302 | 7.16 | 722 | 13.6 | | | | |
| | | | | | | | | | | | |
| 72 | 08N-05W-25DDD01 | 43.99666667 | 116.8727778 | 910415 | 7.40 | 563 | 14.6 | 6.8 | | | |
| 72 | 08N-05W-25DDD01 | 43.99666667 | 116.8727778 | 910528 | 7.48 | 588 | 14.4 | 5.6 | 110 | | |
| 72 | 08N-05W-25DDD01 | 43.99666667 | 116.8727778 | 911205 | 7.15 | 740 | | | | 332 | |
| 72 | 08N-05W-25DDD01 | 43.99666667 | 116.8727778 | 920303 | 7.43 | 743 | 14.6 | | | | |
| | | | | | | | | | | | |
| 73 | 08N-05W-26AAD01 | 44.00750000 | 116.8847222 | 910524 | 7.45 | 291 | 18.2 | 0.8 | | | |
| 74 | 08N-05W-26ACB01 | 44.00555556 | 116.9022222 | 910606 | 7.88 | 248 | 16.0 | 0.6 | 78 | | |
| 75 | 08N-05W-26BDA01 | 44.00583333 | 116.9047222 | 910612 | 7.43 | 474 | 14.8 | 0.5 | 148 | | |
| | | | | | | | | | | | |
| 76 | 08N-05W-26DDC01 | 43.99694444 | 116.8955556 | 910411 | 7.70 | 908 | 12.8 | 13.9 | | | |
| 76 | 08N-05W-26DDC01 | 43.99694444 | 116.8955556 | 910529 | 7.72 | 938 | 14.5 | 15.2 | 62 | | |
| 76 | 08N-05W-26DDC01 | 43.99694444 | 116.8955556 | 911205 | 7.14 | 877 | 13.0 | | | 299 | 80 |
| 76 | 08N-05W-26DDC01 | 43.99694444 | 116.8955556 | 920302 | 7.48 | 858 | 13.5 | | | | |
| | | | | | | | | | | | |
| 77 | 08N-04W-30DBC01 | 44.01111111 | 116.8638889 | 910524 | 7.45 | 1103 | 18.8 | 9.2 | | | |
| 77 | 08N-04W-30DBC01 | 44.01111111 | 116.8638889 | 910530 | 7.54 | 1132 | 12.9 | | | | |
| 77 | 08N-04W-30DBC01 | 44.01111111 | 116.8638889 | 910828 | | | | | | 326 | |
| 77 | 08N-04W-30DBC01 | 44.01111111 | 116.8638889 | 920303 | 7.56 | 1138 | 13.8 | | | | |

Table 6. Field Chemical Concentrations of Ground Water from Selected Wells in the Lower Payette Study Area

| # | WELLID | Latitude | Longitude | Date | pH | Cond.(umhos/cm) | Temp.(deg.C) | NO3 (mg/l) | Cl (mg/l) | HCO3 (mg/l) | SO4(mg/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 78 | 08N-05W-35BAA01 | 43.96811111 | 116.9044444 | 910524 | 7.81 | 744 | 15.1 | 5.3 | | | |
| 78 | 08N-05W-35BAA01 | 43.96811111 | 116.9044444 | 910528 | 7.59 | 735 | 16.0 | | 10.4 | | |
| 78 | 08N-05W-35BAA01 | 43.96811111 | 116.9044444 | 911206 | | 740 | 12.2 | | | 499 | |
| 78 | 08N-05W-35BAA01 | 43.96811111 | 116.9044444 | 920302 | 8.68 | 731 | 13.3 | | | | |
| 79 | 08N-05W-35BCC01 | 43.96055556 | 116.9116667 | 910419 | 7.74 | 1000 | 12.6 | 9.6 | | | |
| 79 | 08N-05W-35BCC01 | 43.96055556 | 116.9116667 | 910529 | 8.00 | 959 | 13.0 | 8.6 | 12.4 | | |
| 79 | 08N-05W-35BCC01 | 43.96055556 | 116.9116667 | 921206 | 8.05 | 979 | | | | 536 | |
| 79 | 08N-05W-35BCC01 | 43.96055556 | 116.9116667 | 920302 | | 928 | 13.0 | | | | |
| 80 | 08N-05W-35CCC01 | 43.91333333 | 116.9119444 | 910524 | 7.72 | 256 | 16.4 | 0.6 | | | |
| 81 | 08N-05W-35DDC01 | 43.94250000 | 116.8975000 | 910419 | 7.87 | 205 | 14.2 | 0.9 | | | |
| 82 | 08N-05W-24ABC02 | 44.0 861111 | 116.8800000 | 910523 | 7.49 | 709 | 17.1 | 2.4 | | | |
| 82 | 08N-05W-24ABC02 | 44.0 861111 | 116.8800000 | 910529 | 7.74 | 680 | 14.7 | 1.9 | 18.0 | | |
| 82 | 08N-05W-24ABC02 | 44.0 861111 | 116.8800000 | 910827 | 7.72 | 705 | | | | 362 | |
| 82 | 08N-05W-24ABC02 | 44.01861111 | 116.8800000 | 920302 | 8.49 | 616 | 14.5 | | | | |
| 83 | 08N-05W-23DAD02 | 44.01000000 | 116.8930556 | 910612 | 7.80 | 491 | 15.3 | 5.0 | 44 | | |
| 84 | 08N-05W-35BCC02 | 43.91999998 | 116.9116667 | 920302 | | 903 | | | | | |

Table 7. Laboratory Chemical Concentrations of Ground Water from Selected Wells in Lower Payette Study Area

| # | Well ID | Latitude | Longitude | Date | Ca(mg/l) | Mg(mg/l) | Na(mg/l) | K(mg/l) | HCO3(mg/l) | Cl(mg/l) | SO4(mg/l) | NO3(mg/l) | pH | Cond(umhos/cm) | TKN(mg/l) | TotP(mg/l) | As(mg/l) | Fe(mg/l) | Dacthal(ug/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 2 | 07N-03W-18CAA01 | 43.94527778 | 116.741444 | 910401 | 39 | | 63 | | 183 | 16 | 21 | 0.060 | 7.38 | 387 | 0.41 | | 0.008 | | 0.02 |
| 2 | 07N-03W-18CAA01 | 43.94527778 | 116.741444 | 910531 | | | | | | 6 | | 0.003 | 7.60 | 187 | 0.19 | 0.05 | | | 0.02 |
| 2 | 07N-03W-18CAA01 | 43.94527778 | 116.741444 | 910828 | 12 | 1.5 | 37 | 1.0 | 91 | 8 | 12 | 0.008 | 7.40 | 212 | 0.21 | 0.08 | 0.008 | | |
| 2 | 07N-03W-18CAA01 | 43.94527778 | 116.741444 | 911209 | 21 | 29.0 | 57 | 1.4 | 144 | 14 | 21 | 0.003 | 7.60 | 337 | 0.45 | 0.02 | | | 0.02 |
| 2 | 07N-03W-18CAA01 | 43.94527778 | 116.741444 | 920304 | | | | | | 15 | | 0.007 | 7.70 | 316 | 0.34 | 0.02 | | | 0.03 |
| 3 | 07N-03W-18CDD01 | 43.92388889 | 116.739444 | 910417 | 58 | 14.0 | 77 | 2.6 | 240 | 28 | 90 | | 7.48 | 662 | | | | | |
| 4 | 07N-03W-19DAD01 | 43.92750000 | 116.731444 | 910411 | 12 | 1.4 | 23 | 1.4 | 77 | 3 | 8 | 0.360 | 7.33 | 171 | 0.02 | | 0.006 | 2.520 | |
| 6 | 07N-03W-30CCD01 | 43.90972222 | 116.736444 | 910402 | 19 | 3.0 | 18 | 1.6 | 74 | 6 | 11 | 0.340 | 7.00 | 187 | 0.15 | | | | |
| 6 | 07N-03W-31ADD01 | 43.90194444 | 116.731444 | 910401 | 14 | | 13 | | 63 | 3 | 6 | 0.035 | 7.18 | 134 | 0.02 | | | | |
| 7 | 07N-03W-31AAA01 | 43.90777778 | 116.730033 | 910402 | 45 | 10.5 | 74 | 3.0 | 238 | 14 | 33 | 4.840 | 7.33 | 880 | 0.22 | | | | |
| 7 | 07N-03W-31AAA01 | 43.90777778 | 116.733333 | 910531 | | | | | | 13 | | 3.810 | 7.40 | 486 | 0.35 | 0.06 | | | |
| 7 | 07N-03W-31AAA01 | 43.90777778 | 116.733333 | 910828 | | | | | | 9 | | 3.420 | 7.70 | 588 | 0.38 | 0.08 | | | |
| 7 | 07N-03W-31AAA01 | 43.90777778 | 116.733333 | 911209 | | | | | | 12 | | 4.200 | 7.60 | 538 | 0.05 | 0.06 | | | |
| 7 | 07N-03W-31AAA01 | 43.90777778 | 116.733333 | 920304 | | | | | | 13 | | 4.100 | 7.65 | 561 | 0.02 | 0.02 | | | |
| 9 | 07N-04W-03CBB01 | 43.97444444 | 116.801444 | 910402 | 56 | 14.0 | 63 | 1.9 | 307 | 7 | 16 | 2.080 | 7.66 | 618 | 0.07 | | | | 0.02 |
| 9 | 07N-04W-03CBB01 | 43.97444444 | 116.801444 | 910531 | | | | | | 6 | | 3.270 | 7.20 | 550 | 0.13 | 0.12 | | | |
| 9 | 07N-04W-03CBB01 | 43.97444444 | 116.801444 | 910828 | | | | | | 6 | | 3.110 | 7.60 | 608 | 0.15 | 0.16 | | | |
| 9 | 07N-04W-03CBB01 | 43.97444444 | 116.801444 | 911206 | | | | | | 6 | | 0.850 | 7.50 | 634 | 0.11 | 0.09 | | | |
| 9 | 07N-04W-03CBB01 | 43.97444444 | 116.851444 | 920303 | | | | | | 7 | | 3.180 | 7.60 | 636 | 0.22 | 0.10 | | | |
| 10 | 07N-04W-06AAA01 | 43.98055556 | 116.851444 | 910410 | 36 | 14.9 | 90 | 3.1 | 261 | 11 | 82 | 7.400 | 7.78 | 824 | 0.13 | | 0.020 | | |
| 10 | 07N-04W-06AAA01 | 43.98055556 | 116.851444 | 910530 | | | | | | 11 | | 10.200 | | | 0.51 | 0.10 | | | 0.14 |
| 10 | 07N-04W-06AAA01 | 43.98055556 | 116.851444 | 910828 | | | | | | 12 | | 8.900 | 7.60 | 708 | 0.18 | 0.10 | | | 0.04 |
| 10 | 07N-04W-06AAA01 | 43.98055556 | 116.868111 | 911206 | | | | | | 13 | | 8.080 | 7.70 | 747 | 0.02 | 0.13 | | | 1.36 |
| 10 | 07N-04W-06AAA01 | 43.98055556 | 116.868111 | 920303 | | | | | | 12 | | 8.590 | 7.60 | 697 | 0.16 | 0.12 | | | 0.06 |
| 12 | 07N-04W-06DCC01 | 43.96777778 | 116.864144 | 910403 | 146 | 27.5 | 97 | 6.4 | 283 | 141 | 208 | 0.003 | 7.25 | 1307 | 0.02 | | 0.008 | | |
| 13 | 07N-04W-07ADA01 | 43.96250000 | 116.853658 | 910408 | 124 | 17.5 | 90 | 4.9 | 252 | 106 | 184 | 0.003 | 7.61 | 1104 | 0.41 | | 0.011 | | 0.80 |
| 13 | 07N-04W-07ADA01 | 43.96250000 | 116.853658 | 910530 | | | | | | 113 | | 0.003 | | | 0.48 | 0.02 | | | 0.02 |
| 13 | 07N-04W-07ADA01 | 43.96250000 | 116.853658 | 910828 | | | | | | | | 0.003 | 7.70 | 1070 | 0.58 | 0.05 | | | 0.02 |
| 13 | 07N-04W-07ADA01 | 43.96250000 | 116.853658 | 911206 | | | | | | 115 | | 0.120 | 7.60 | 1067 | 0.65 | 0.02 | | | 0.02 |
| 13 | 07N-04W-07ADA01 | 43.96250000 | 116.853658 | 920303 | | | | | | 112 | | 0.009 | 7.70 | 990 | 0.36 | 0.02 | | | 0.06 |
| 14 | 07N-04W-07BBB01 | 43.96666670 | 116.871444 | 910710 | 94 | 41.5 | 25 | 2.3 | 475 | 10 | 104 | 6.240 | 7.60 | 711 | | | | | |
| 16 | 07N-04W-07BCC01 | 43.96666666 | 116.871444 | 910418 | 144 | 21.0 | 94 | 5.2 | 341 | 129 | 186 | 0.040 | 7.48 | 1169 | 0.60 | | 0.006 | 0.040 | |
| 17 | 07N-04W-07CCC01 | 43.95333333 | 116.758111 | 910402 | 7 | | 30 | | 78 | 1 | 8 | 0.008 | 7.52 | 158 | 0.22 | | 0.008 | | |
| 18 | 07N-04W-10BAA01 | 43.98666667 | 116.797778 | 910405 | 33 | 4.8 | 27 | 1.8 | 122 | 17 | 26 | 0.003 | 7.21 | 298 | 0.07 | | 0.069 | | 0.02 |
| 22 | 07N-04W-12BBA01 | 43.96694444 | 116.787000 | 910402 | 12 | | 60 | | 94 | 5 | 12 | 0.060 | 8.15 | 209 | 0.03 | | | | |
| 24 | 07N-04W-13DDC01 | 43.93833333 | 116.759778 | 910401 | 30 | 2.6 | 18 | 1.3 | 97 | 8 | 11 | 0.003 | 7.53 | 174 | 0.17 | | 0.068 | | 0.02 |
| 25 | 07N-04W-14CCB01 | 43.94083333 | 116.789222 | 910408 | 97 | 13.0 | 138 | 2.1 | 378 | 17 | 62 | 3.220 | 7.38 | 890 | 0.37 | | 0.014 | | 0.02 |
| 25 | 07N-04W-14CCB01 | 43.94083333 | 116.789222 | 910530 | | | | | | 21 | | 4.340 | | | 0.35 | 0.11 | | | |
| 25 | 07N-04W-14CCB01 | 43.94083333 | 116.789222 | 910829 | | | | | | 18 | | 2.980 | 7.70 | 787 | 0.31 | 0.14 | | | |
| 25 | 07N-04W-14CCB01 | 43.94083333 | 116.789222 | 911206 | | | | | | 13 | | 2.110 | 7.70 | 664 | 0.02 | 0.13 | | | |
| 25 | 07N-04W-14CCB01 | 43.94083333 | 116.789222 | 920304 | | | | | | 14 | | 1.860 | 7.80 | 680 | 0.47 | 0.10 | | | 0.02 |
| 26 | 07N-04W-15CCB01 | 43.94027778 | 116.810000 | 910405 | 96 | 17.8 | 108 | 3.7 | 367 | 28 | 69 | 3.810 | 7.32 | 843 | 0.30 | | 0.018 | | 0.02 |
| 26 | 07N-04W-15CCB01 | 43.94027778 | 116.810000 | 910530 | | | | | | 31 | | 4.370 | | | 0.17 | 0.11 | | | |
| 26 | 07N-04W-15CCB01 | 43.94027778 | 116.810000 | 910828 | | | | | | 29 | | 3.840 | 7.80 | | 0.08 | 0.10 | | | |
| 26 | 07N-04W-15CCB01 | 43.94027778 | 116.810000 | 911209 | | | | | | 28 | | 3.500 | 7.80 | 804 | 0.06 | 0.16 | | | |

Table 7. Laboratory Chemical Concentrations of Ground Water from Selected Wells in Lower Payette Study Area

| # | Well ID | Latitude | Longitude | Date | Ca(mg/l) | Mg(mg/l) | Na(mg/l) | K(mg/l) | HCO3(mg/l) | Cl(mg/l) | SO4(mg/l) | NO3(mg/l) | pH | Cond(umhos/cm) | TKN(mg/l) | TotP(mg/l) | As(mg/l) | Fe(mg/l) | Dacthal(ug/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 26 | 07N-04W-15CCB01 | 43.94027778 | 116.810000 | 920304 | | | | | | 24 | | 3.290 | 7.54 | 757 | 0.02 | 0.16 | | | |
| 27 | 07N-04W-17CCB01 | 43.94083333 | 116.951667 | 910410 | 17 | 6.8 | 41 | 1.5 | 262 | 14 | 40 | 0.480 | 7.86 | 441 | 0.10 | | 0.006 | 3.69 | |
| 28 | 07N-04W-20AAA01 | 43.93777778 | 116.834167 | 910403 | 45 | 13.0 | 54 | 1.0 | 191 | 35 | 57 | 3.650 | 7.06 | 597 | 0.22 | | | | |
| 28 | 07N-04W-20AAA01 | 43.93777778 | 116.834167 | 910530 | | | | | | 33 | | 0.932 | | | 0.06 | 0.05 | | | |
| 28 | 07N-04W-20AAA01 | 43.93777778 | 116.834167 | 910829 | | | | | | 32 | | 1.160 | 7.50 | 580 | 0.02 | 0.06 | | | |
| 28 | 07N-04W-20AAA01 | 43.93777778 | 116.834167 | 911209 | | | | | | 34 | | 1.250 | 7.50 | 541 | 0.08 | 0.04 | | | |
| 28 | 07N-04W-20AAA01 | 43.93777778 | 116.834167 | 920305 | | | | | | 33 | | 1.210 | 7.80 | 603 | 0.29 | 0.07 | | | |
| 30 | 07N-04W-23DAC01 | 43.93027778 | 116.771944 | 910411 | 56 | 11.6 | 54 | 12.0 | 290 | 9 | 49 | 1.830 | 7.84 | 590 | 0.09 | | | | |
| 30 | 07N-04W-23DAC01 | 43.93027778 | 116.771944 | 910531 | | | | | | 10 | | 1.958 | 7.30 | 550 | 0.14 | 0.10 | | | |
| 30 | 07N-04W-23DAC01 | 43.93027778 | 116.771944 | 910829 | | | | | | 7 | | 1.660 | 7.69 | 556 | 0.25 | 0.12 | | | |
| 30 | 07N-04W-23DAC01 | 43.93027778 | 116.771944 | 911209 | | | | | | 7 | | 1.190 | 7.79 | 418 | 0.03 | 0.10 | | | |
| 30 | 07N-04W-23DAC01 | 43.93027778 | 116.771944 | 920304 | | | | | | 8 | | 1.010 | 7.68 | 441 | 0.02 | 0.11 | | | |
| 31 | 07N-04W-23DAC02 | 43.92861111 | 116.774722 | 910411 | 44 | 15.5 | 80 | 1.3 | 260 | 14 | 80 | | 7.48 | 599 | | | | | |
| 32 | 07N-04W-25ABB01 | 43.92333333 | 116.761111 | 910402 | 80 | | 84 | | 253 | 26 | 57 | 1.940 | 7.95 | 687 | 0.02 | | 0.005 | | 0.02 |
| 32 | 07N-04W-25ABB01 | 43.92333333 | 116.761111 | 910531 | | | | | | 27 | | 2.250 | 7.59 | 834 | 0.06 | 0.09 | | | |
| 32 | 07N-04W-25ABB01 | 43.92333333 | 116.761111 | 910826 | 61 | 15.4 | 66 | 3.2 | 275 | 26 | 65 | 2.540 | 7.69 | 757 | 0.30 | 0.09 | 0.006 | | 0.02 |
| 32 | 07N-04W-25ABB01 | 43.92333333 | 116.761111 | 920304 | | | | | | 23 | | 2.020 | 7.52 | 648 | 0.02 | 0.07 | | | |
| 32 | 07N-04W-25ABB01 | 43.92333333 | 116.761111 | 911209 | | | | | | 25 | | 2.580 | 7.60 | 697 | 0.02 | 0.08 | | | |
| 33 | 07N-04W-25CCB01 | 43.91222222 | 116.771111 | 910402 | 24 | | 90 | | 300 | 9 | 44 | 1.980 | 7.25 | 486 | 0.08 | | 0.050 | | 0.02 |
| 33 | 07N-04W-25CCB01 | 43.91222222 | 116.771111 | 910531 | | | | | | 9 | | 2.030 | 7.50 | 456 | 0.11 | 0.02 | | | |
| 33 | 07N-04W-25CCB01 | 43.91222222 | 116.771111 | 910829 | 29 | 8.5 | 96 | 2.3 | 242 | 8 | 44 | 8.660 | 8.00 | 589 | 0.29 | 0.02 | 0.030 | | |
| 33 | 07N-04W-25CCB01 | 43.91222222 | 116.771111 | 911206 | | | | | | 9 | | 4.660 | 7.80 | 616 | 0.02 | 0.08 | | | |
| 33 | 07N-04W-25CCB01 | 43.91222222 | 116.771111 | 920304 | | | | | | 11 | | 2.730 | 7.82 | 501 | 0.41 | 0.02 | | | |
| 34 | 07N-04W-26CDC01 | 43.91305556 | 116.791667 | 910402 | 80 | | 24 | | 142 | 31 | 86 | 0.040 | 7.15 | 485 | 0.25 | | | | |
| 37 | 07N-04W-28AAA01 | 43.92333333 | 116.812778 | 910403 | 190 | 47.0 | 114 | 3.2 | 433 | 114 | 190 | 30.200 | 6.70 | 1909 | 0.94 | | | | 0.02 |
| 37 | 07N-04W-28AAA01 | 43.90833333 | 116.812778 | 910530 | | | | | | 144 | | 27.800 | | | 0.89 | 0.02 | | | |
| 37 | 07N-04W-28AAA01 | 43.92361111 | 116.813611 | 910828 | | | | | | 143 | | 36.600 | 7.30 | 1962 | 0.64 | 0.02 | | | 0.02 |
| 37 | 07N-04W-28AAA01 | 43.91805556 | 116.813889 | 911209 | | | | | | 91 | | 40.000 | 7.20 | 1819 | 0.61 | 0.02 | | | 0.09 |
| 37 | 07N-04W-28AAA01 | 43.90222222 | 116.851944 | 920304 | | | | | | 102 | | 26.000 | 7.25 | 1521 | 0.40 | 0.02 | | | 0.04 |
| 42 | 07N-05W-01DDB01 | 43.87416667 | 116.881944 | 910410 | 64 | 8.6 | 43 | 4.8 | 170 | 45 | 47 | 0.273 | 7.39 | 482 | 0.34 | | | | |
| 43 | 07N-05W-02DBB01 | 43.87416667 | 116.900833 | 910418 | 37 | 7.8 | 16 | 3.6 | 128 | 13 | 32 | 0.086 | 7.24 | 294 | 0.17 | | 0.010 | .840 | |
| 44 | 07N-05W-12BBD01 | 43.86055556 | 116.904444 | 910415 | 12 | 16.5 | 61 | 5.4 | 204 | 42 | 128 | 0.980 | 7.56 | 850 | 0.82 | | 0.005 | 1.010 | |
| 45 | 08N-04W-18ACC01 | 44.01916667 | 116.859167 | 910409 | 31 | 8.0 | 26 | 4.3 | 129 | 14 | 32 | 0.059 | 7.44 | 343 | 2.00 | | 0.006 | 1.170 | 0.00 |
| 45 | 08N-04W-18ACC01 | 44.01916667 | 116.859167 | 910530 | | | | | | 14 | | 0.003 | | | 1.38 | 0.13 | | | 0.02 |
| 45 | 08N-04W-18ACC01 | 44.01916667 | 116.859167 | 910829 | | | | | | 18 | | 3.800 | 7.50 | 363 | 1.47 | 0.14 | | | 0.02 |
| 45 | 08N-04W-18ACC01 | 44.01916667 | 116.859167 | 911203 | | | | | | 16 | | 0.050 | 7.70 | 337 | 1.24 | 0.11 | | | 0.27 |
| 45 | 08N-04W-18ACC01 | 44.01916667 | 116.859167 | 920302 | | | | | | 13 | | 0.109 | 7.70 | 319 | 1.06 | 0.09 | | | 0.33 |
| 47 | 08N-04W-29CBA01 | 44.00361111 | 116.829444 | 910410 | 35 | 8.0 | 33 | 4.1 | 168 | 13 | 10 | 0.083 | 7.44 | 383 | 1.33 | | 0.005 | 2.440 | 0.11 |
| 47 | 08N-04W-29CBA01 | 44.00361111 | 116.829444 | 910530 | | | | | | 23 | | 0.015 | | | 0.91 | 0.07 | | | 0.49 |
| 47 | 08N-04W-29CBA01 | 44.00361111 | 116.829444 | 910829 | | | | | | 17 | | 0.008 | 7.59 | 408 | 1.02 | 0.08 | | | 0.09 |
| 47 | 08N-04W-29CBA01 | 44.00361111 | 116.829444 | 911205 | | | | | | 8 | | 0.007 | 7.69 | 317 | 0.86 | 0.06 | | | 0.18 |
| 47 | 08N-04W-29CBA01 | 44.00361111 | 116.829444 | 920303 | | | | | | 7 | | 0.008 | 7.79 | 319 | 0.75 | 0.07 | | | 0.07 |

Table 7 Laboratory Chemical Concentrations in Ground Water from Selected Wells in Lower Payette Study Area

| # | Well ID | Latitude | Longitude | Date | Ca(mg/l) | Mg(mg/l) | Na(mg/l) | K(mg/l) | HCO3(mg/l) | Cl(mg/l) | SO4(mg/l) | NO3(mg/l) | pH | Conductance(umhos/cm) | TKN(mg/l) | TotP(mg/l) | As(mg/l) | Fe(mg/l) | Dacthal(ug/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 48 | 08N-04W-28DCD01 | 43.99666667 | 116.1177778 | 910409 | 60 | 18.9 | 62 | 1.1 | 217 | 47 | 78 | 0.030 | 7.6 | 662 | 1.09 | | 0.008 | | 0.07 |
| 48 | 08N-04W-28DCD01 | 43.99666667 | 116.1177778 | 910530 | | | | | | 47 | | 0.010 | | | 1.73 | 0.09 | | | |
| 48 | 08N-04W-28DCD01 | 43.99666667 | 116.1177778 | 910829 | | | | | | 48 | | 0.013 | 7.7 | 706 | 1.07 | 0.11 | | | 0.02 |
| 48 | 08N-04W-28DCD01 | 44.00027778 | 116.1511111 | 911206 | | | | | | 45 | | 0.041 | 7.6 | 654 | 1.09 | 0.09 | | | 0.02 |
| 48 | 08N-04W-28DCD01 | 44.00027778 | 116.1511111 | 920305 | | | | | | 43 | | 0.007 | 7.5 | 667 | 1.55 | 0.07 | | | 0.04 |
| 50 | 08N-04W-30BAD01 | 44.00722222 | 116.1638889 | 910530 | | | | | | 14 | | 3.810 | | | 1.22 | 0.22 | | | |
| 50 | 08N-04W-30BAD01 | 44.00722222 | 116.1638889 | 910829 | 58 | 24.5 | 136 | 8.8 | 472 | 21 | 58 | 2.090 | 7.7 | 757 | 1.12 | 0.15 | 0.010 | | |
| 50 | 08N-04W-30BAD01 | 44.00722222 | 116.1638889 | 911205 | | | | | | 18 | | 3.820 | 7.9 | 1067 | 1.13 | 0.24 | | | |
| 50 | 08N-04W-30BAD01 | 44.00722222 | 116.1638889 | 920305 | | | | | | 14 | | 4.200 | 7.7 | 1116 | 1.19 | 0.18 | | | |
| 52 | 08N-04W-33ADC01 | 43.98944444 | 116.1152778 | 910405 | 53 | 7.5 | 110 | 5.1 | 310 | 20 | 42 | 0.006 | 7.5 | 675 | 1.14 | | 0.005 | | 0.02 |
| 53 | 08N-04W-33CCD01 | 43.97222222 | 116.1277778 | 910409 | | | | | | | | 0.008 | | | | | | | |
| 54 | 08N-05W-36DDC01 | 43.98722222 | 116.1741667 | 910415 | 91 | 26.0 | 60 | 4.0 | 257 | 41 | 128 | 0.990 | 7.2 | 804 | 1.02 | | 0.015 | 2.930 | |
| 55 | 08N-05W-14DCD01 | 44.02583333 | 116.2011111 | 910529 | 74 | 38.5 | 48 | 8.8 | 388 | 7 | 68 | 3.960 | 7.9 | 718 | 1.12 | 0.21 | | | |
| 55 | 08N-05W-14DCD01 | 44.02583333 | 116.2011111 | 910827 | | | | | | 8 | | 6.080 | 7.8 | 787 | 1.11 | 0.21 | | | 0.03 |
| 55 | 08N-05W-14DCD01 | 44.02583333 | 116.2011111 | 911205 | | | | | | 7 | | 6.720 | 7.8 | 804 | 1.02 | 0.26 | | | |
| 55 | 08N-05W-14DCD01 | 44.02583333 | 116.2011111 | 920302 | | | | | | 8 | | 4.780 | 7.5 | 787 | 1.14 | 0.19 | | | 0.03 |
| 56 | 08N-05W-15DAB01 | 44.03250000 | 116.2166667 | 910529 | | | | | 283 | 4 | 18 | 2.120 | 7.9 | 473 | 1.33 | 0.78 | | | 0.00 |
| 56 | 08N-05W-15DAB01 | 44.03250000 | 116.2166667 | 910827 | 41 | 19.9 | 18 | 4.8 | 208 | 3 | 9 | 0.795 | 7.9 | 413 | 1.24 | 0.18 | 0.014 | | 0.02 |
| 56 | 08N-05W-15DAB01 | 44.03250000 | 116.2166667 | 911203 | | | | | | 3 | | 0.897 | 7.9 | 337 | 1.02 | 0.15 | | | 0.02 |
| 56 | 08N-05W-15DAB01 | 44.03250000 | 116.2166667 | 920302 | | | | | | 4 | | 0.855 | 7.8 | 334 | 1.12 | 0.13 | | | |
| 58 | 08N-05W-23BCC01 | 44.01944444 | 116.3122222 | 910529 | 68 | 41.0 | 33 | 8.4 | 428 | 5 | 22 | 10.900 | 7.8 | 815 | 1.24 | 0.10 | | | 0.02 |
| 58 | 08N-05W-23BCC01 | 44.01944444 | 116.3122222 | 910827 | | | | | | 6 | | 8.060 | 7.8 | 716 | 1.21 | 0.10 | | | 0.05 |
| 58 | 08N-05W-23BCC01 | 44.01944444 | 116.3122222 | 911203 | | | | | | 6 | | 8.690 | 7.8 | 681 | 1.02 | 0.13 | | | 0.04 |
| 58 | 08N-05W-23BCC01 | 44.01944444 | 116.3122222 | 920302 | | | | | | 6 | | 8.330 | 7.8 | 640 | 1.20 | 0.10 | | | 0.09 |
| 59 | 08N-05W-23CDD01 | 44.01166667 | 116.3044444 | 910411 | 42 | 21.5 | 134 | 5.7 | 400 | 8 | 49 | 8.550 | 7.7 | 841 | 1.17 | | 0.060 | 0.020 | |
| 59 | 08N-05W-23CDD01 | 44.01166667 | 116.3044444 | 910528 | | | | | | 7 | | 4.920 | | | 1.37 | 0.16 | | | 17.80 |
| 59 | 08N-05W-23CDD01 | 44.01166667 | 116.3044444 | 910827 | | | | | | 8 | | 5.330 | 7.8 | 787 | 1.13 | 0.23 | | | 18.20 |
| 59 | 08N-05W-23CDD01 | 44.01166667 | 116.3044444 | 911203 | | | | | | 6 | | 6.940 | 7.9 | 747 | 1.02 | 0.28 | | | |
| 59 | 08N-05W-23CDD01 | 44.01166667 | 116.3044444 | 920302 | | | | | | 5 | | 7.530 | 7.8 | 780 | 1.28 | 0.21 | | | 18.80 |
| 64 | 08N-05W-24BBC02 | 44.02333333 | 116.2922222 | 910411 | 55 | 43.0 | 54 | 1.8 | 355 | 8 | 53 | 9.250 | 7.8 | 778 | 1.11 | | 0.026 | | 0.08 |
| 64 | 08N-05W-24BBC02 | 44.02333333 | 116.2922222 | 910528 | | | | | | 7 | | 11.400 | | | 1.08 | 0.14 | | | 0.14 |
| 64 | 08N-05W-24BBC02 | 44.02333333 | 116.2922222 | 910827 | | | | | | 7 | | 7.100 | 7.9 | 820 | 1.16 | 0.17 | | | 0.02 |
| 64 | 08N-05W-24BBC02 | 44.02333333 | 116.2922222 | 911203 | | | | | | 8 | | 7.320 | 7.9 | 747 | 1.02 | 0.18 | | | 0.02 |
| 64 | 08N-05W-24BBC02 | 44.02333333 | 116.2922222 | 920302 | | | | | | 7 | | 8.850 | 7.9 | 787 | 1.18 | 0.13 | | | |
| 65 | 08N-05W-25AAA01 | 44.01055556 | 116.2730556 | 910411 | 82 | 54.5 | 76 | 3.1 | 295 | 27 | 71 | 37.000 | 7.7 | 863 | 1.22 | | 0.018 | 0.830 | 119.00 |
| 65 | 08N-05W-25AAA01 | 44.01055556 | 116.2730556 | 910528 | | | | | | 21 | | 25.700 | | | 1.28 | 0.12 | | | 55.70 |
| 65 | 08N-05W-25AAA01 | 44.01055556 | 116.2730556 | 910828 | | | | | | 15 | | 21.900 | 7.8 | 818 | 1.32 | 0.08 | | | 34.80 |
| 65 | 08N-05W-25AAA02 | 44.01055556 | 116.2730556 | 911205 | | | | | | 30 | | 32.400 | 7.8 | 1048 | 1.23 | 0.13 | | | 84.70 |
| 65 | 08N-05W-25AAA01 | 44.01055556 | 116.2730556 | 920302 | | | | | | 19 | | 33.400 | 7.8 | 910 | 1.39 | 0.12 | | | 432.00 |
| 69 | 08N-05W-25CCC01 | 43.99694444 | 116.2819444 | 910529 | 42 | 16.0 | 43 | 5.1 | 219 | 7 | 33 | 4.640 | | 496 | 1.13 | 0.07 | | | 11.80 |
| 69 | 08N-05W-25CCC01 | 43.99694444 | 116.2819444 | 910827 | | | | | | 8 | | 5.400 | 800 | 384 | 1.43 | 0.11 | | | 22.40 |
| 69 | 08N-05W-25CCC01 | 43.99694444 | 116.2819444 | 911209 | | | | | | 8 | | 8.650 | 770 | 410 | 1.02 | 0.07 | | | 0.02 |
| 69 | 08N-05W-25CCC01 | 43.99694444 | 116.2819444 | 920303 | | | | | | 7 | | 8.500 | 780 | 568 | 1.17 | 0.08 | | | 0.17 |
| 70 | 08N-05W-25CCC02 | 43.99694444 | 116.2819444 | 910529 | | | | | | 0 | | 0.003 | | | | | | | |

Table 7. Laboratory Chemical Concentrations of Ground Water from Selected Wells in Lower Payette Study Area

| # | Well ID | Latitude | Longitude | Date | Ca(mg/l) | Mg(mg/l) | Na(mg/l) | K(mg/l) | HCO3(mg/l) | Cl(mg/l) | SO4(mg/l) | NO3(mg/l) | pH | Conductance(us) | TKN(mg/l) | TotP(mg/l) | As(mg/l) | Fe(mg/l) | Dacthal(ug/l) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 71 | 08N-05W-25DBC01 | 44.00111111 | 116.9822222 | 910530 | | | | | | 7 | | 3.330 | | | 0.11 | 0.15 | | | 0.02 |
| 71 | 08N-05W-25DBC01 | 44.00111111 | 116.9822222 | 910628 | 41 | 10.8 | 100 | 3.7 | 321 | 7 | 46 | 3.560 | 7.80 | [illegible] | 0.40 | 0.14 | 0.005 | | 0.08 |
| 71 | 08N-05W-25DBC01 | 44.00111111 | 116.9822222 | 911203 | | | | | | 8 | | 3.470 | 8.00 | 810 | 0.02 | 0.16 | | | 0.02 |
| 71 | 08N-05W-25DBC01 | 44.00111111 | 116.9822222 | 920302 | | | | | | 8 | | 3.510 | 7.70 | 711 | 0.03 | 0.11 | | | [illegible] |
| 72 | 08N-05W-25DDB01 | 43.99666667 | 116.8727778 | 910415 | 30 | 7.0 | 94 | 1.8 | 190 | 14 | 48 | 2.030 | 7.55 | [illegible] | 0.00 | | 0.008 | | |
| 72 | 08N-05W-25DDB01 | 43.99666667 | 116.8727778 | 910529 | | | | | | 13 | | 4.340 | 7.30 | [illegible] | 0.16 | 0.14 | | | |
| 72 | 08N-05W-25DDB01 | 43.99666667 | 116.8727778 | 910628 | | | | | | 10 | | 7.430 | 7.70 | 731 | 0.16 | 0.16 | | | |
| 72 | 08N-05W-25DDB01 | 43.99666667 | 116.8727778 | 911205 | | | | | | 10 | | 7.770 | 7.70 | 804 | 0.02 | 0.12 | | | |
| 72 | 08N-05W-25DDB01 | 43.99666667 | 116.8727778 | 920303 | | | | | | 17 | | 5.330 | 7.70 | 887 | 0.27 | 0.12 | | | |
| 76 | 08N-05W-26DDC01 | 43.99444444 | 116.8000000 | 910411 | 45 | 12.5 | 180 | 4.0 | 334 | 11 | 87 | 19.000 | 7.83 | 914 | 0.15 | | 0.040 | 0220 | 70.70 |
| 76 | 08N-05W-26DDC01 | 43.99444443 | 116.8000000 | 910529 | | | | | | 11 | | 16.700 | 7.40 | 845 | 0.00 | 0.19 | | | 8.09 |
| 76 | 08N-05W-26DDC01 | 43.99444444 | 116.8000000 | 910627 | | | | | | 14 | | 16.800 | 7.80 | 1074 | 0.41 | 0.18 | | | 34.00 |
| 76 | 08N-05W-26DDC01 | 43.99444444 | 116.8000000 | 911205 | | | | | | 12 | | 18.900 | 7.70 | 851 | 0.10 | 0.19 | | | 84.00 |
| 76 | 08N-05W-26DDC01 | 43.99444444 | 116.8000000 | 920302 | | | | | | 11 | | 18.900 | 7.80 | [illegible] | 0.35 | 0.15 | | | 4.20 |
| 77 | 08N-04W-30CBC01 | 44.00111111 | 116.8630000 | 910530 | | | | | | 86 | | 11.900 | | | 0.30 | 0.10 | | | |
| 77 | 08N-04W-30CBC01 | 44.00111111 | 116.8630000 | 910628 | 40 | 20.0 | 86 | 6.2 | 261 | 90 | 15 | 8.780 | 7.60 | 786 | 0.37 | 0.10 | 0.000 | | 80.50 |
| 77 | 08N-04W-30CBC01 | 44.00111111 | 116.8630000 | 911205 | | | | | | 79 | | 4.280 | 7.50 | 890 | 0.40 | 0.24 | | | 0.37 |
| 77 | 08N-04W-30CBC01 | 44.00111111 | 116.8630000 | 920303 | | | | | | 100 | | 8.730 | 7.80 | 1110 | 0.20 | 0.16 | | | 5.40 |
| 78 | 08N-05W-36BAA01 | 43.98611111 | 116.9044444 | 910530 | 34 | 8.5 | 130 | 4.2 | 311 | 8 | 57 | 8.240 | 7.80 | 816 | 0.10 | 0.16 | | | 0.40 |
| 78 | 08N-05W-36BAA01 | 43.98611111 | 116.9044444 | 910627 | | | | | | 12 | | 6.007 | 7.70 | 767 | 0.07 | 0.10 | | | 4.70 |
| 78 | 08N-05W-36BAA01 | 43.98611111 | 116.9044444 | 911204 | | | | | | 13 | | 6.720 | 7.80 | 778 | 0.15 | 0.14 | | | 2.80 |
| 78 | 08N-05W-36BAA01 | 43.98611111 | 116.9044444 | 920302 | | | | | | 11 | | 4.150 | 7.70 | 798 | 0.25 | 0.16 | | | 0.10 |
| 79 | 08N-05W-36BCC01 | 43.98000000 | 116.9116667 | 910416 | 16 | 7.8 | 222 | 2.4 | 425 | 13 | 86 | 11.200 | 7.72 | | 0.81 | | 0.000 | 0.010 | |
| 79 | 08N-05W-36BCC01 | 43.98000000 | 116.9116667 | 910529 | | | | | | 9 | | 15.800 | 7.80 | 871 | 0.25 | 0.13 | | | 0.80 |
| 79 | 08N-05W-36BCC01 | 43.98000000 | 116.9116667 | 910627 | | | | | | 10 | | 12.100 | 8.00 | 876 | 0.45 | 0.15 | | | 0.80 |
| 79 | 08N-05W-36BCC01 | 43.98000000 | 116.9116667 | 911206 | | | | | | 14 | | 13.100 | 8.00 | 866 | 0.10 | 0.15 | | | 0.09 |
| 79 | 08N-05W-36BCC01 | 43.98000000 | 116.9116667 | 920302 | | | | | | 12 | | 18.800 | 7.80 | 816 | 0.25 | 0.17 | | | [illegible] |
| 81 | 08N-05W-36DDC01 | 43.97500000 | 116.8975000 | 910416 | 17 | 1.8 | 16 | 2.8 | 185 | 5 | 9 | 0.836 | 7.46 | 177 | 0.06 | | | | |
| 82 | 08N-05W-24ABC02 | 44.01861111 | 116.8800000 | 910529 | | | | | 250 | 20 | 40 | 6.003 | 7.80 | 561 | 3.41 | 0.14 | | | |
| 82 | 08N-05W-24ABC02 | 44.01861111 | 116.8800000 | 910627 | 47 | 13.6 | 76 | 7.4 | 269 | 18 | 48 | 6.003 | 7.80 | 474 | 5.82 | 0.00 | 0.006 | | 0.82 |
| 82 | 08N-05W-24ABC02 | 44.01861111 | 116.8800000 | 911203 | | | | | | 21 | | 6.003 | 7.80 | 637 | 4.87 | 0.12 | | | |
| 82 | 08N-05W-24ABC02 | 44.01861111 | 116.8800000 | 920303 | | | | | | 23 | | 6.003 | 7.80 | 640 | 4.30 | 0.11 | | | |
| 84 | 08N-05W-36BCD02 | 43.98000000 | 116.9116667 | 920302 | 14 | 5.5 | 205 | 2.8 | 290 | 10 | 45 | 14.000 | 8.00 | 892 | 0.52 | 0.16 | | | |

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