WATER QUALITY STATUS REPORT NO. 116

LOWER PAYETTE RIVER AGRICULTURE IRRIGATION WATER RETURN STUDY AND GROUND WATER EVALUATION

Payette County, Idaho
1992 – 1993

Prepared by
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This report is dedicated in the memory of Dr. Richard Timothy Litke.

Dr. Richard Timothy Litke:
Husband, Father and Scientist
1954-1994

TABLE OF CONTENTS

Page

Page

Page

LIST OF TABLES

Page

Page

LIST OF FIGURES

Page

ACKNOWLEDGEMENT

I would like to acknowledge Mark Van Kleek, Kurt Braun, Phedra Harris and Brad Koenig who offered their valuable time in assisting with the monitoring of the drains. Also, Tony Bennett and Donna Rodman for coming through when no one else was available. Also very special thanks again to Phedra for her hard work in compiling the data tables.

A very special thanks to Jim Dodd's staff at the State Bureau of Laboratories for completing all analysis in a timely manner. Also, to the Bureau of Laboratories, a special thanks to Sandy Radwin and Bob Chehey.

The following professionals set aside their valuable time to review the draft report: Dave Zimmer, USBOR; Walton Low, USGS; Michael Raymond, NRCS (Payette SWCD); Bill Clark, DEQ-CO; Barry Burnell, DEQ-CO; Don Lee, DEQ-SWIRO; John Cardwell, DEQ-NCIRO; Tim Stieber U of I (Snake-Payette Rivers HUA); and Tim Stack NRCS (Snake-Payette Rivers HUA). All comments were greatly appreciated.

I would like to extend special thanks to the participants who allowed us to enter their private property to conduct surface and/or ground water monitoring. Also special thanks to the Payette Soil and Water Conservation District's Chairman and Associates for their understanding in the delay in getting this report to press.

While the final revision of this report was delayed by my illness, my supervisors showed support by knowing that it would be completed, although not in a timely manner as expected. A special thanks to Joy Palmer, Regional Administrator of SWIRO, and Craig Shepard, Supervisor of Monitoring and Technical Support, SWIRO, for their understanding and support. Also to the clerical support at SWIRO; Carol Mueler, Dorthy Boggs, Kathy Hansen, Renee Atkinson and A.J. Cude for their patience while I tied up the copier and printer.

And, to anyone one else, whom I may left out, who may have assisted in monitoring and/or development of this report.

ABSTRACT

The Payette River is a large river with a total drainage area of over 2,000,000 acres originating in the Central Idaho batholith. The Lower Payette River is classified as from Black Canyon Dam to the confluence of the Snake River (River mile 365). The area of concern, is the final seventeen miles of the river, and 32,000 acres of irrigated cropland referred to as the Lower Payette State Agriculture Water Quality Project.

An indepth surface and ground water monitoring effort was initiated by the State of Idaho Department of Health and Welfare, Division of Environmental Quality, and the Payette Soil and Water Conservation District in June 1992. The study was completed in September 1993.

The project area consists of fifteen known surface agricultural wastewater return drains. Of those, six received extensive monitoring for sediments, nutrients, physical characteristics, pesticides, and bacteria. Two Payette River stations were evaluated to assist in determining impacts from the project to the river. Twenty domestic wells were chosen to receive intensive evaluation for pesticides, physical characteristics, nutrients, and common ions.

Data indicates that the Lower Payette River irrigated row crop areas contribute excessive amounts of nutrients, bacteria and sediments to the Payette River. Suspended sediment loads to the river are estimated to exceed 105 tons/day, and an estimated 490 lbs/day total phosphorus during irrigation season. Fecal Coliform and Fecal Streptococcus bacteria often exceeded 20,000/100 mℓ and on some dates, counts over 100,000/100 mℓ were noted. The pesticide Dacthal, or it's metabolite, was detected in all drains during the non-irrigation season. High concentrations of nitrates as nitrogen in surface drains indicate that ground water base-flow is contributing to surface water nitrogen problems.

Ground water monitoring data showed that a majority of the shallow aquifer is contaminated with nitrates. The pesticide Dacthal was detected in fourteen of the twenty wells tested, although none exceeded criteria for safe drinking water. Also, 2-4D was detected in one well. Two wells exceeded recommended drinking water standards for arsenic.

Total Water Year 1993 suspended sediment loads for the Payette River showed an overall increase of 25,500 tons from the up river site to the down river site. An estimated 40,000 lbs of total phosphorus was contributed to the Lower Payette River during June, July, August, and September 1993. At the up river station total inorganic nitrogen exceeded the recommended criteria of 0.3 mg/ℓ on 45% of the monitoring dates, while at the down river sites the criteria was exceeded on 64% of the monitoring dates. Bacteria densities counts showed an increase during irrigation season from the up river site to the down river site. Fecal Streptococcus, a known pathogen, had counts as high as 440/ 100 mℓ at the down river site, but at the same time, counts of 910/ 100 mℓ were detected at the up river site.

Overall conclusions are that continued implementation of best management practices for both surface water and ground water protection should be implemented. Monitoring of best management practices effectiveness will be an important tool to determine if overall goals and objectives can be achieved. Further evaluation and a more indepth river monitoring effort should be initiated to assist in determining current status of designated beneficial uses.

INTRODUCTION

The Payette River originates in Central Idaho and generally flows south before entering the Snake River near Payette, Idaho. The Payette River drainage encompasses 2,073,600 acres of mostly forested mountains, wet meadows, and adjacent rangelands. There are four major man-made impoundments: Cascade Reservoir on the North Fork of the Payette River, Deadwood Reservoir on the Deadwood River, Black Canyon Reservoir on the Main Payette River near Emmett, Idaho, and Paddock Reservoir on Little Willow creek near Payette, Idaho. The remainder of the Payette River is mostly free-flowing except for minor diversions of irrigation water.

The Lower Payette River is classified as the portion of the river from Black Canyon Reservoir to the confluence with the Snake River, river mile 365 (United States Geological Survey USGS), 1974). Total river length from Black Canyon Reservoir is approximately 38 miles and the general area is situated approximately 50 miles from Boise, Idaho (Figure 1). The project area that received intensive monitoring for this report is shown in Figure 2, and is located in the final seventeen mile section of the Lower Payette River. The project area stretches from the Payette County line to Highway 95, which is approximately three miles upstream from the confluence with the Snake River.

The dominant land use in the Lower Payette River is irrigated cropland and pasture. Irrigated crops include dry beans, onions, mint, corn, sugar beets, potatoes, alfalfa, small grains, and seed production. Numerous small and large Confined Animal Feeding Operations (CAFOs) and Confined Feeding Operations (CFOs) are scattered throughout the Lower Payette River Valley.

In October 1988, the Payette Soil and Water Conservation District (SWCD) submitted a pre-application for a planning grant to the State Agriculture Water Quality Program (SAWQP). On June 21, 1989, the Idaho Board of Health and Welfare approved the planning grant, scheduling it to cease in June 1992, and later giving it an extension to January 1993. The final effort of the planning project was the publication of the "Lower Payette River Water Quality Planning Project, Final Report" (Payette Soil and Water Conservation District, 1993). The purpose of this final report was to determine overall goals and objectives for a pollution abatement strategy, and to determine if there was adequate public participation to implement such goals in the Lower Payette River project area. In April 1993, the SWCD submitted an application to the State Board of Health and Welfare for a grant to implement Best Management Practices (BMP's) on agricultural lands within the Lower Payette River SAWQP area. In October 1993, the Idaho Board of Health and Welfare approved the implementation grant.

This report is intended to assist land management agencies in determining areas of concerns and critical areas where BMPs should be applied. This is also the document used for the development of a Total Maximum Daily Load (TMDL) allocation for the Lower Payette River.

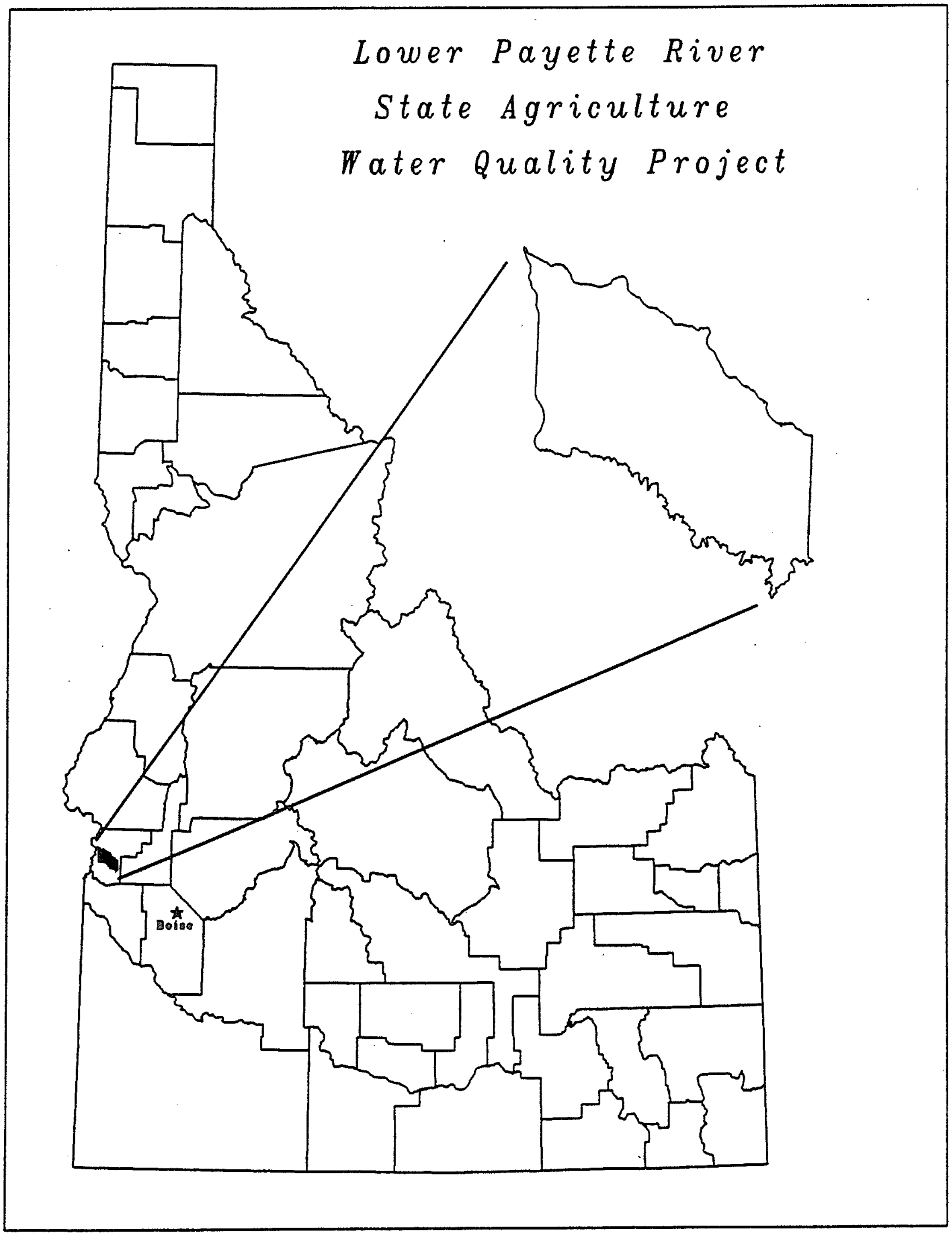


Figure 1. Lower Payette River SAWQP Project Area.

BACKGROUND

The 1983 Idaho Agricultural Pollution Abatement Plan or "Ag Plan" ranked the Lower Payette River, from Black Canyon Dam to the confluence with the Snake River, as a second priority stream segment, SWB-340 (Idaho Department of Health and welfare (IDHW), U.S. EPA, ISCC, 1983). The Ag Plan identified the Lower Payette River as impacted by sediment from agricultural activity. Studies by the Bureau of Reclamation (Williams, 1975) also indicated sediment, along with increased phosphorus levels and elevated bacterial counts, as water quality problems associated with the Lower Payette River.

Part of the planning process was to determine water quality impacts, so as to define the critical or prioritized areas that would receive BMPs. These practices are designed to reduce or abate water quality problems associated with agricultural practices.

The Idaho Ground Water Quality Vulnerability Project rated this area as having very vulnerable ground water (Rupert, 1991). This rating was based on parameters such as depth to ground water, soil type, recharge, and land use. To address ground water quality, the existing Payette SWCD Planning Grant was amended to include an evaluation of the ground water quality with respect to contamination from agri-chemical sources.

In 1991, the United States Department of Agriculture (USDA) established a Hydrologic Unit Area (HUA) Project in southwestern Idaho encompassing parts of Payette, Washington, Gem, and Canyon Counties. The HUA project will assist in the success of the Payette SAWQP project by augmenting limited state financial resources used to install BMPs. The Payette SAWQP project would in turn contribute an essential resource component to the HUA project by providing the water quality monitoring activities required to verify the effectiveness of any BMPs installed.

The Payette SWCD and the Snake/Payette Rivers HUA Project Steering Committee believe a coordinated approach to the monitoring of both projects would maximize the limited resources available and provide valuable information to the HUA and the SAWQP. Moreover, this combined effort would further strengthen the water quality commitment among local, state, and federal agencies in Payette County and the State of Idaho.

Surface Water

A 1975 study of the Lower Payette River (Tangarone, D.R. and B. Bogue. 1976) indicated a 54% increase of total phosphorus from the Letha Bridge to the USGS gaging station at Highway 95. Approximately 50% of this phosphorus loading was associated with drains in the project area. The 1975 survey also examined bacterial parameters and determined that livestock contribution was the primary source for bacterial contamination in the Lower Payette River.

Drains monitored in August 1975 also indicated violation of primary contact recreation for the one-time sampling period.

Dissolved oxygen supersaturation was noted at the lower station of the Payette River during August 1975 (Tangarone, D.R. and B. Bogue. 1976). It was found that an increased concentration of algae was causing the supersaturation. The added algal presence could be associated with increased concentrations of available nutrients, as well as other favorable climatic and physical conditions. This data indicates during this study, cold water biota was threatened in the lower portions of the Payette River.

The 1988 pre-application (Payette SWCD, 1988) determined the major pollution source to the Lower Payette River could be attributed to extensive irrigation return flows from agricultural lands. Bureau of Reclamation (Williams, 1975) data also indicated increasing levels of bacteria, nutrients, and sediment moving downstream from the Payette River gaging station in Emmett, Idaho, to the United States Geological Survey (USGS) gaging station on the Payette River near Payette, Idaho.

The Lower Payette River SAWQP area is a maze of irrigation canals and irrigation return drains. In 1991, a one event monitoring plan (Ingham, 1991) was developed to help determine a more intensive baseline monitoring plan. This one time monitoring event established the station and drain identification scheme identified in Figures 2. According to this one time study completed in August 1991, the study area contributed approximately 109 tons of suspended sediment per day to the Payette River, and each drain carried an average sediment load of 7 tons/day. The most critical area appeared to be the western portion of the area where stations S-9 through S-14 (refer to Figure 2) discharge into the Payette River. The average sediment load of the six western drains was 12 tons/day. The western drains represented 60% of the total suspended sediment input for the project area, but only contributed 50% of the total inflow.

This study also demonstrated a strong correlation between suspended sediment and total phosphorus levels. Total phosphorus levels ranged from 0.16 mg/ℓ to 0.93 mg/ℓ, with a mean concentration of 0.41 mg/ℓ. Total phosphorus loading was approximately 542 lb/day, whereas the average loading for the project area was 35 lb/day per drain. The western portion (drains S-9 through S-14) exhibited higher concentrations of phosphorus, with a mean level of 0.57 mg/ℓ and an average loading of 47 lb/day per drain. Stations S-9 through S-14 contributed approximately 53% or 280 lb/day of the total phosphorus loading.

In 1991, fifteen drains in the project area were monitored for bacteria levels of Fecal Coliform and Fecal Streptococcus. Thirteen of the drains indicated a violation of primary contact recreation limits and eight drains had levels that exceeded secondary contact recreation limits; levels are designated by the State Water Quality Standards (Idaho Department of Health and Welfare, 1992). There was not an obvious pattern of increased bacterial contamination in one area versus another. The Fecal Coliform counts ranged from 160 per 100 mℓ at Station S-5, to a count of 40,000 per 100 mℓ at Station S-4. All samples were a one time sampling and do not represent a geometric mean for bacteria levels.

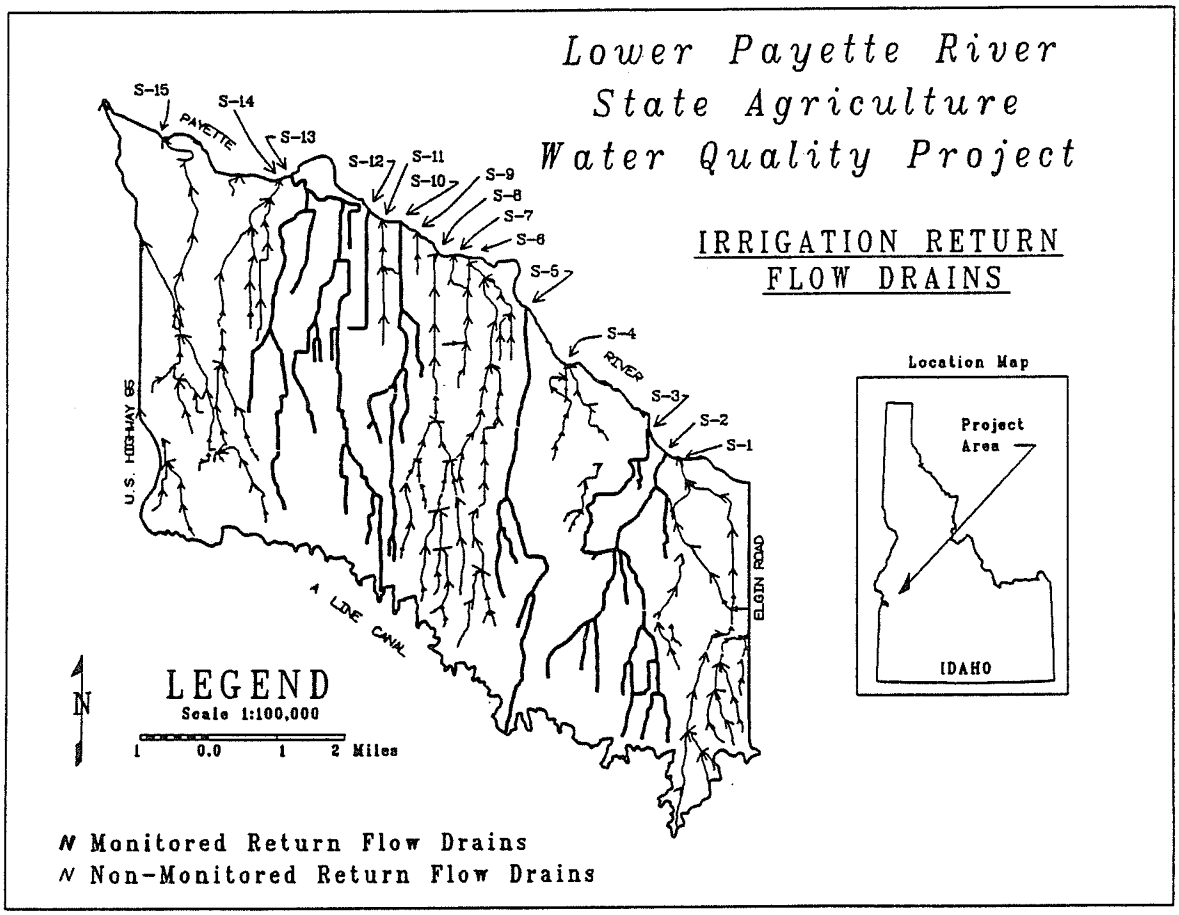


Figure 2. Irrigation Return Drains and Station Identification. Lower Payette River SAWQP, 1992-93.

Using the Fecal Coliform/Fecal Strep ratio as an indicator, the majority of bacterial contamination in the project area was due to animal waste products. Of the fifteen drains monitored, eleven had a Fecal Coliform/Fecal Strep ratio of less than 0.7, which implied the presence of animals and animal waste problems in the majority of the drains. Clausen et al. (1977) found that a ratio less than 0.7 usually indicated animal contamination, while a ratio greater than 2.0 or 3.0 can be attributed to human influences. Ratios between 0.7 and 2.0 are ambiguous and cannot be used to determine the exact source of contamination. One-time instantaneous temperatures were recorded at each drain. The average temperature was 19.9°C, which may be indicative that cold water biota is threatened in the majority of drains.

Ground Water

Several ground water quality studies conducted in the area have indicated the occurrence of nitrate (NO_3) concentrations above the generally accepted naturally-occurring levels of 1-2 mg/ℓ (DEQ, 1986; DEQ, 1989; and Steed et al., 1993). The pre-emergent herbicide Dacthal was also detected in the ground water of the project area, as were the pesticides 2,4-D and PCP.

The Weiser-Lower Payette Water Quality Surveys (Tangarone, D.R. and B. Bogue. 1976) documented an increase in nutrient loading to the Payette River from irrigation drains during non-irrigation periods. This suggests that ground water has been contributing to the poor condition of the area's surface water quality.

Data generated during 1991/1992 by the Ground Water and Soils Reconnaissance of the Lower Payette Area (Baldwin and Wicherski, 1992) indicated that nitrate impacts to ground water from man-related activities had occurred over the entire project area. The most severe of these impacts appears to have occurred in the northwestern portion of the Lower Payette River SAWQP area. The average laboratory nitrate concentration of ground water taken from 22 wells located east of Butte Road was 2.45 mg/ℓ. The average laboratory nitrate concentration of the 13 wells located west of Butte Road was 8.0 mg/ℓ. Dacthal, a pre-emergent herbicide used primarily in this area for onion production, was found in 12 out of 20 wells, principally in the area west of Butte Road. Laboratory results are referenced since other results were obtained through field measurements.

DESCRIPTION OF PROJECT AREA

Land Use and Ownership

The entire project area covers 32,871 acres. Of this total, 30,225 acres are under some form of irrigation; either furrowed crops, orchards, or pastures. Private ownership accounts for 98% of the overall acreage, with the remainder being under federal or state management. The Payette River forms the northern boundary of the project area, and the Black Canyon A-Line canal forms the southern boundary. The eastern boundary is delineated by Elgin Road (near the Payette-Gem County lines), and U.S. Highway 95 constitutes the western boundary.

Other land use in the area consists of warm-water fish rearing, wildlife habitat, urbanization, open rangeland, and recreation. Portions of the Payette River and its river islands are managed by the Idaho Department of Fish and Game (IDF&G). These areas are used extensively by migratory waterfowl. However, as shown in Figure 3, a majority of landuse is in some form of irrigated cropland.

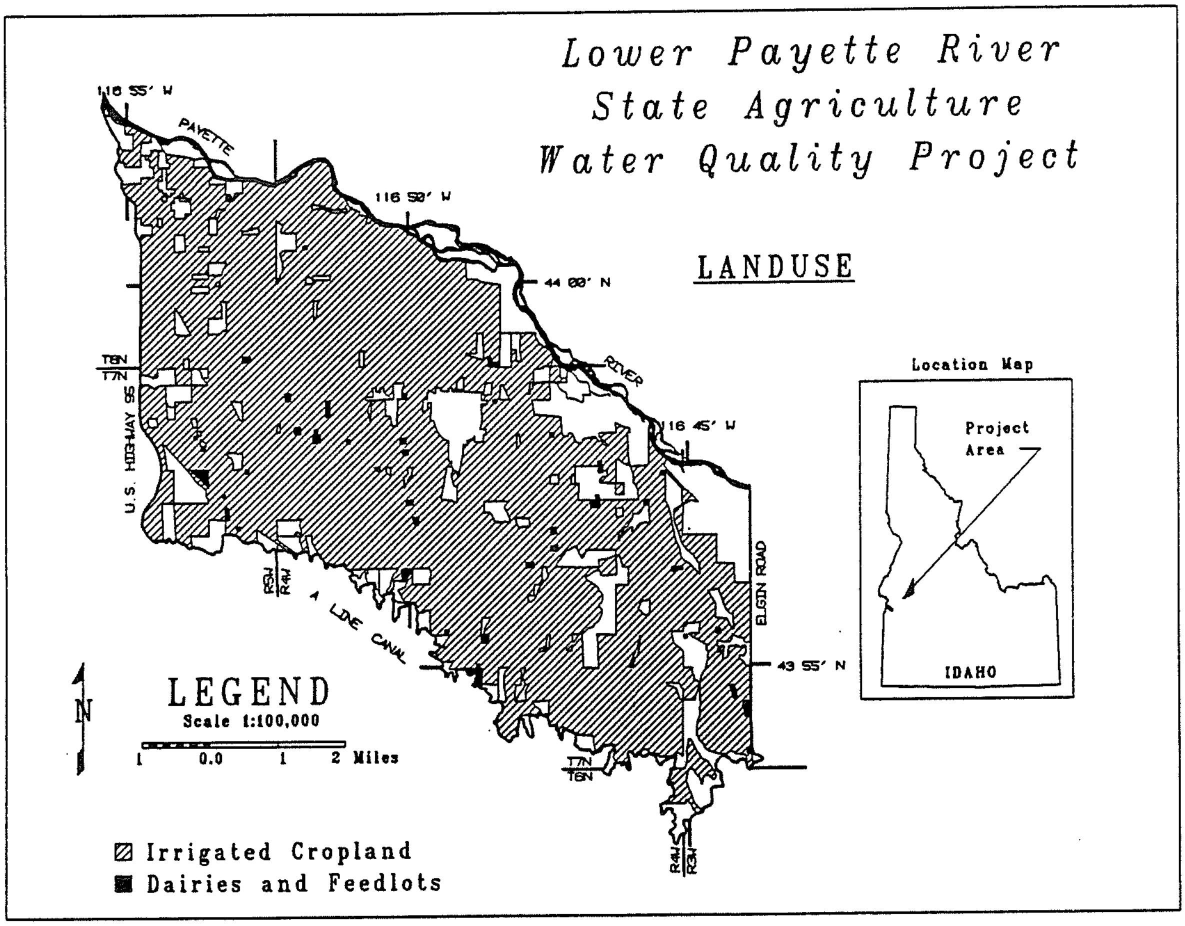


Figure 3. Land Use. Lower Payette River SAWQP, 1992-93.

Geology

In general, the valley is formed by alluvial action and laustrine influences due to past basalt dams and volcanic depositions. An underlying layer of "Blue Clay" within the Idaho Formation sediments can be found at depths ranging from 100 feet, to 400 feet. Blue Clays usually indicate the presence of past lake sediment deposits. For the most part, the slope faces north in an upward gradient away from the Lower Payette River. The Soil Survey of Payette County, Idaho (Rasmussen, 1976) classified the area as within the Greenleaf-Nyssaton Association. The survey described this association as a flat to moderately steep area, with well-drained silt loams on intermediate terraces. The terraces were developed through lake-laid silt deposits. This area is well-suited to the crops grown in the region. The area includes Elijah-Purdam Associations (upper terrace) and Baldock-Greenleaf Varient Association (lower terrace).

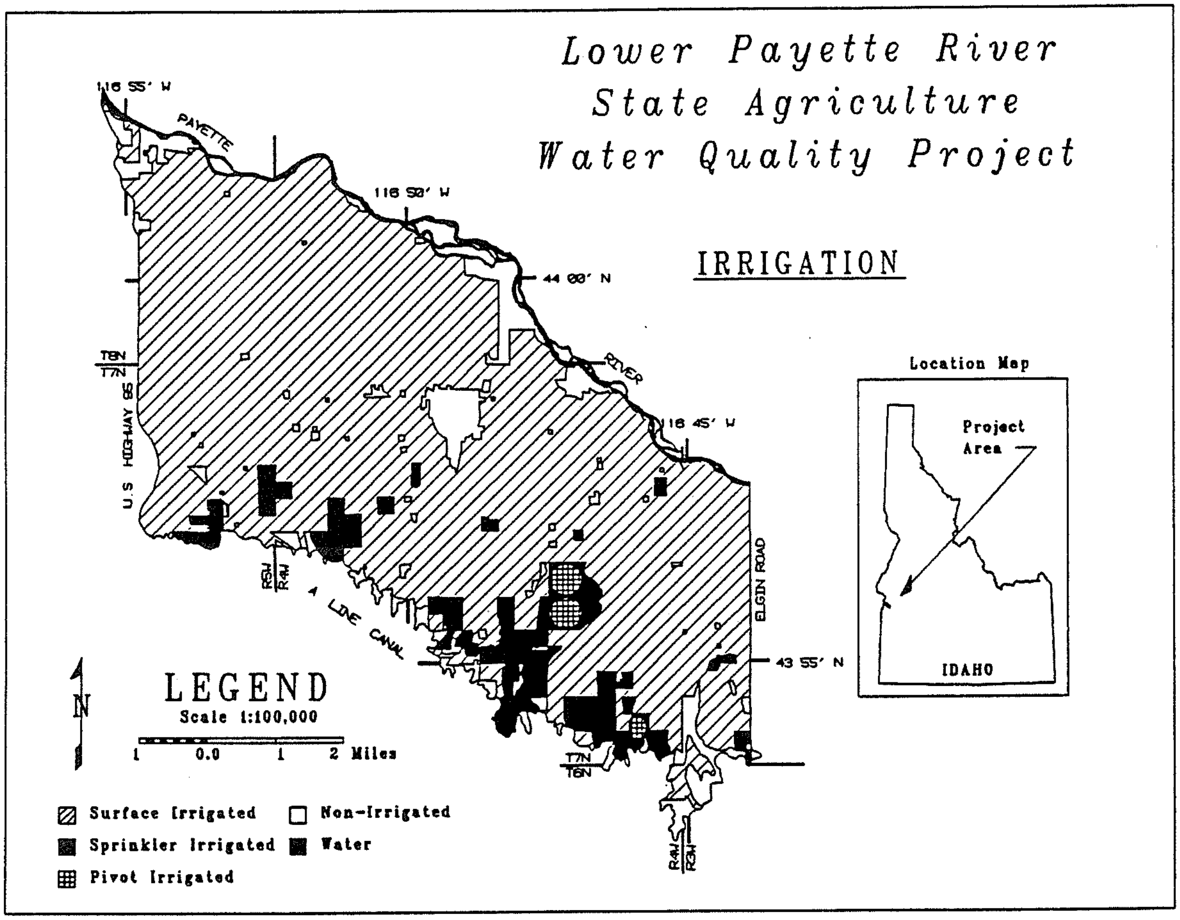


Figure 4. Prominent Irrigation Type. Lower Payette SAWQP, 1992-93.

Climate

The Lower Payette River Valley has a semiarid climate, with very little precipitation in most summer months. Overall average precipitation for Payette, Idaho is 11 inches per year; whereas the average growing-season precipitation amounts to 3.5 inches per year. Winter months account for up to 60% of all recorded precipitation. During the 1993 monitoring period, spring rain and winter snow events were well above normal. In contrast, precipitation levels were well below average during the 1992 monitoring period. Frost-free periods can be expected from early June to late September.

Hydrology

Payette River

Human activity has greatly altered the overall hydrology of the Lower Payette River with the construction of the following: irrigation water storage reservoirs, flood control structures, and constructed drains. Water release is governed by snowmelt and irrigation water demand. Out of bank floods are still common despite upstream flood control measures and river channelization.

Irrigation Water

Irrigation water is delivered to the project area from either the Black Canyon Dam (located approximately twenty miles upstream from the project area) or by direct diversion from the Payette River. Three major feeder canals dissect across the project area (refer to Figure 5). The Black Canyon C-Line Canal originates from Black Canyon Reservoir, a majority of the canal is diverted and pumped over to the Lower Boise River watershed. The remainder of the Black Canyon C-Line that stays in the Lower Payette River watershed forms the Black Canyon A-Line which forms the southern boundary of the project area. It supplies water to the upper terraces before it leaves the region. The Farmers Cooperative Canal originates from the A-Line near the City of Emmett, Idaho, and flows northwesterly supplying water to the central portion of the project area. The majority of this irrigation water is utilized, however some excess water does leave the project area, flowing into the Payette River near the Highway 95 Bridge. Nobel Canal (the third feeder canal) is diverted from the Payette River approximately five miles upstream from the project area, near the town of Letha, Idaho. The Nobel Canal supplies water to lower elevations in the project area.

Many irrigation laterals and pipelines, along with extensive land-leveling, have complicated the hydrology of the area by crossing over from one sub-watershed to another. Also, the re-use of irrigation water, especially near the river, has diverted water into other sub-watersheds.

Return Flow Drains

Irrigation water return flows are carried back to the Payette River via fifteen established drains that are shown in Figure 3. In the southeastern portion of the project area, most of the drains follow natural water courses; whereas in the western portion, most drains have been constructed to assist in removing sub-surface water. All drains showed high discharges during the irrigation season, but also exhibited good flows during the non-irrigation season. Non-irrigation season flows are attributed to ground water contribution to surface water drains. Of the six drains that received eighteen months of monitoring, none iced over enough to prevent monitoring or obtaining flow data.

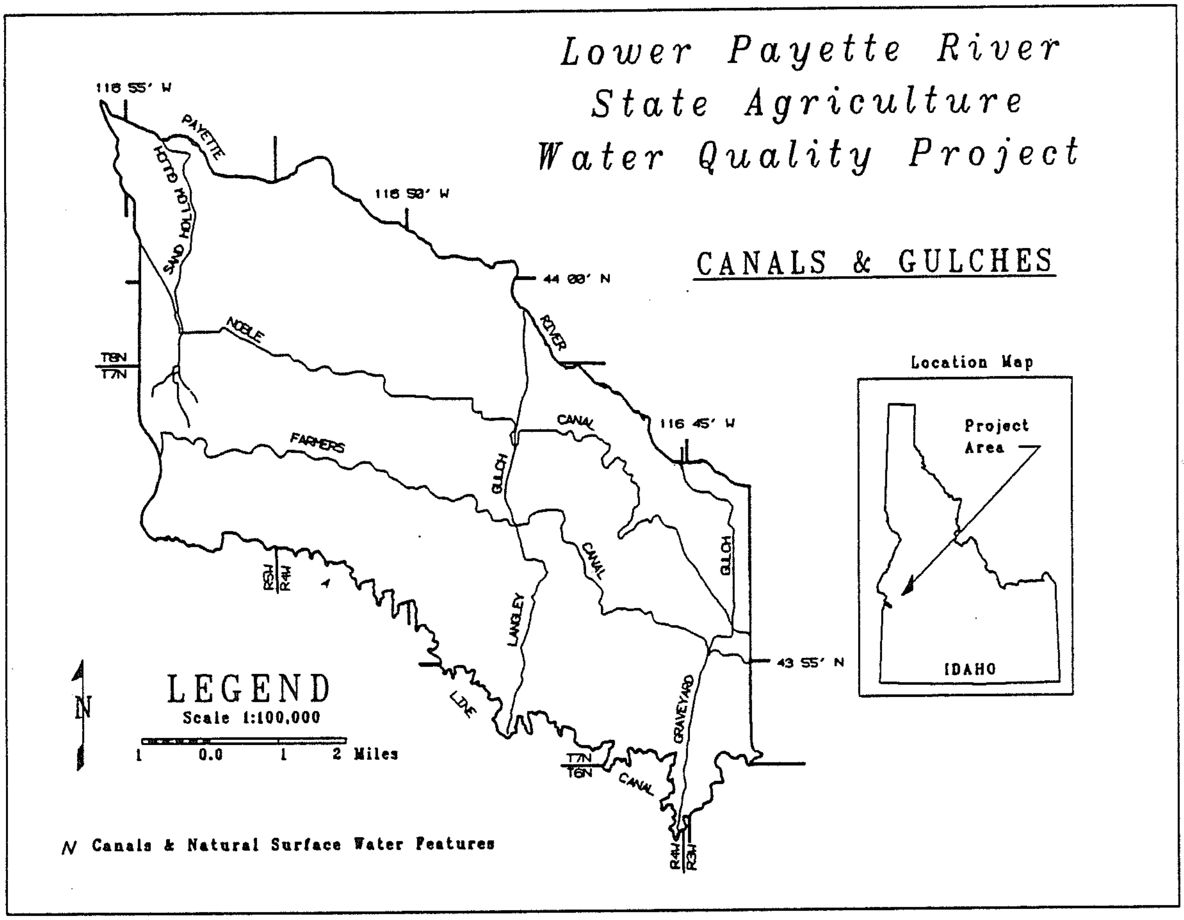


Figure 5. General Hydrology and Canals. Lower Payette River SAWQP, 1992-93.

Water is diverted from many return flow drains and reused for irrigation before returning to the drains, sometimes not in the same drain it was recovered from. Some water may be used as much as four times before discharging to the Lower Payette River.

The principal characteristic of all the drains is a sand-silt substrate, with little to no gravels or cobbles present. One of the drains, Langley Gulch (Kidd Creek), did demonstrate good scouring capability during the spring snowmelt period, but quickly resilted during more normal irrigation season flows.

Ground Water Hydrology

Most of the ground water in the project area is associated with four distinctive subsurface areas: the Miocene basalt rocks, the overlying sediments, the Tertiary sediments, and the Quaternary sediments. The majority of domestic water is obtained from the overlying sediments, which in some areas are 200 feet thick (Steed et al., 1993). Ground water movement is generally in the northern direction, towards the Payette River.

A study of ground water discharge to surface waters in the Western Snake River Plain (Newton, 1989) concluded that almost no water leaves the western plain as under flow. Ground water discharge to the Payette River between Emmett, Idaho and Payette, Idaho was estimated by subtracting flow of the Payette River near Emmett and inflow from Big and Little Willow Creeks from flows in the river near Payette. Estimated ground water discharge to the Lower Payette River from November 1, 1979 to January 31, 1980 was 217,000 acre feet.

Near the Payette River, ground water recharge is usually associated with flooding of the river itself. In some places, the flood plain near the river bottom is a half mile wide. In other areas however, extensive flood control measures have reduced the flood-prone area to the river channel. The lower terraces in the project area usually have ground water within fifty feet of the surface. Further to the south, ground water levels are greater than fifty feet.

Ground water use is mainly confined to the domestic water supply. With the abundance of surface irrigation water in the area, no large scale ground water source is needed for agriculture.

PURPOSE OF STUDY

Objectives

1. Conduct pollution source and transport (PST) monitoring.

   Rationale: The project area encompasses 32,871 acres, of which 30,225 acres are used for croplands or other agricultural activities. To drain the extensive croplands, a series of drainage ditches were built. Fifteen ditches discharge directly into the Lower Payette River. In an effort to limit the time and expense involved in sampling all fifteen return flow drainages, information obtained from August 1991 monitoring was used to select representative drains for further baseline monitoring of the SAWQP area. Six drains were selected for this monitoring, and the data collected for these drains will be assumed to represent the entire SAWQP watershed.

2. Assess beneficial use status and impacts from agricultural activity.

   Rationale: The beneficial use status of selected drains in the Lower Payette River project area needs to be determined prior to the implementation of BMPs. Since the numerous drains in the project area discharge directly into the Lower Payette River, the beneficial use status of the river will also need to be determined.

   Beneficial uses for selected drains and the Payette River are:

   Cold Water Biota
   Warm Water Biota
   Salmonid Spawning
   Primary Contact Recreation
   Secondary Contact Recreation
   Agricultural Water Supply

3. Establish a ground water quality monitoring network, conduct sampling to obtain baseline data, and identify seasonal fluctuations as well as long term trends.

   Rational: Analysis of ground water quality baseline conditions must incorporate the recognition of seasonal fluctuations, so that long-term trends can be correctly evaluated. Baseline conditions need to be documented to provide a point of reference for relative determinations of water quality improvements resulting from this project.

4. Obtain additional ground water quality data to determine the nature and extent of contamination.

   Rational: Additional information is needed to fully describe the contaminants of concern, and to demarcate the extent of the contamination identified.

MATERIALS AND METHODS

PARAMETER SELECTION AND RATIONALE

Surface Water

The Lower Payette River SAWQP water quality parameters selected for the surface water monitoring are listed in Table 1, along with their respective STORET numbers and units.

Suspended Sediment

Suspended sediment consists of solid material, either mineral or organic, that is suspended and is being transported by water. Suspended sediment has been selected as the prime indicator of BMP effectiveness for the Lower Payette project, and is of leading importance to land managing agencies in this area (Natural Resource Conservation Service and Soil Conservation District). Many other pollutants are associated with suspended sediment such as bacteria, nutrients and pesticides. If sediment is successfully kept from leaving irrigated croplands, then it will provide cleaner water for the receiving waters (i.e. Payette River and Snake River).

The general formula for the calculation of interval pollutant loads is as follows:

LOAD (tons) = DISCHARGE (cfs) x CONCENTRATION (mg/ℓ) X 0.0027 X TIME (days)

In these calculations, each sample is weighted by using the number of days between sampling as the time period. (Example: The sample collected at Station S-13 on August 16, 1993 had a daily suspended sediment load of 12 tons/day, with the previous sampling date occurring on August 2, 1993. Therefore, the interval suspended sediment load for August 2 through August 16 would be: 11.88 tons/day x 14 days = 166.32 tons.) It is expected that the delivery rate would remain constant.

Nutrients

Nutrients are a major concern when examining agricultural return flows. These flows may contain excessive nutrients that may impact water quality in receiving waters by creating an over-abundance of aquatic plants and animal biomass, particularly undesirable species and communities. The two major nutrient, nitrogen and phosphorus, components will now be discussed.

Phosphorus

Total Phosphorus

Total phosphorus is a measurement of both dissolved ortho-phosphates and forms of phosphorus associated with suspended sediment. To prevent the development of biological nuisances and to control accelerated or cultural eutrophication, total phosphorus as phosphorus (P) should not exceed 0.05 mg/ℓ in streams where it enters a lake or reservoir (U.S. Environmental Protection Agency, 1988). The agricultural return drains in the project area discharge into the Payette River, then into the Snake River, and eventually into reservoirs further downstream. This criteria should have an important role in future studies on the Lower Snake River. For streams that do not discharge directly into a lake or reservoir, a maximum of 0.10 mg/ℓ is recommended to prevent plant nuisance growth (MacKenthun, 1973). Since in-stream criterion is not easily obtained or may not apply to certain surface water situations (particularly lotic situations), a range of 0.05 mg/ℓ to 0.10 mg/ℓ may be an appropriate indicator of excessive concentrations of total phosphorus in agricultural return drains.

Dissolved Ortho-Phosphates

The ortho-phosphate parameter is a measure of those forms of phosphorus that are in solution within the water-column. These forms of phosphates are believed to be the most biological significant.

Nitrogen

Nitrite-Nitrate as Nitrogen

Nitrogen is another important nutrient that can cause water quality problems when found in excess. Total inorganic nitrogen (nitrite, nitrate, and ammonia) in concentrations of 0.3 mg/ℓ is considered the limit for controlling biological nuisances and the acceleration of cultural eutrophication (Idaho Department of Health and Welfare, 1980). In this study, Nitrite-Nitrate as Nitrogen (NO_2+NO_3) is used to determine if this criterion has been exceeded. It should be noted that in oxygenated waters, inorganic ammonia and nitrite are readily oxidized to nitrate.

Ammonia

Un-ionized ammonia (NH_3) is the principal toxic form of ammonia. Concentrations (uncorrected for pH) ranging from 0.53 to 22.8 mg/ℓ have been shown to be acutely toxic to a variety of freshwater organisms. Several factors such as dissolved oxygen concentrations, temperature, and pH effect ammonia toxicity.

Total Kjeldahl Nitrogen

Total Kjeldahl Nitrogen measures the amount of ammonia in the organic form. There appears to be a correlation between suspended sediment and organic forms of ammonia (Clark and Litke, 1992).

Bacteria

Fecal Coliform bacteria are found in the intestine of warm-blooded animals, and are indicators of contamination by waste products. Although not a pathogen itself, it may indicate the presence of other disease-causing organisms. Fecal Streptococci (Fecal Strep) bacteria are pathogens, and are indicators of contamination from livestock or wildlife. The Lower Payette River is protected and designated for primary and secondary contact recreation as beneficial uses (Idaho Department of Health and Welfare, 1992). The resulting bacteria counts from this study will be compared with the State Water Quality Standards to determine if the monitored agricultural return drains exceed the standards for these uses.

The Idaho standard for primary contact recreation (Idaho Department of Health and Welfare, 1992) states that Fecal Coliform densities are not to exceed:

a. 500/100 mℓ at any time

b. 200/100 mℓ in more than ten percent (10%) of the total samples taken over a thirty (30) day period

c. A geometric mean of 50/100 mℓ based on a minimum of five (5) samples taken over a thirty (30) day period.

The Idaho standard for secondary contact recreation (Idaho Department of Health and Welfare, 1992) requires Fecal Coliform concentrations of no more than :

a. 800/100 mℓ at any time

b. 400/100 mℓ in more than ten percent (10%) of the total samples taken over a thirty (30) day period

c. A geometric mean of 200/100 mℓ based on a minimum of five (5) samples taken over a thirty (30) day period

Using the Fecal Coliform/Fecal Strep ratio, a determination of the possible source of contamination can be made. Clausen et al. (1977) determined that a Fecal Coli/Fecal Strep ratio of less than 0.7 indicated the presence of a livestock contamination source. The most recent Standard Methods (APHA, 1992) suggests that this ratio needs to be used with caution due to variable survival rates and a high false-positive for Fecal Streptococci.

Physical Parameters

Flow

Flow or discharge is a direct measurement of the volume of water passing a given point at a given time. Sediment and nutrient concentrations combined with flow measurements describe loadings.

Temperature

Temperature is used primarily to determine the beneficial use status of cold water biota and salmonid spawning. The State Water Quality Standards (Idaho Department of Health and Welfare, 1992) for cold water biota require a water temperature of 22°C or less for a one-time measurement, and a maximum daily average of no more than 19°C. For salmonid spawning, temperature standards pertain to times when spawning activity is occurring, as well as during incubation periods. The state temperature standards for salmonid spawning (Idaho Department of Health and Welfare, 1992) require an instantaneous water temperature of 13°C or less, and a maximum daily average of no greater than 9°C.

Dissolved Oxygen

Dissolved Oxygen (DO) concentrations are also used to determine the beneficial use status of cold water biota and salmonid spawning. The State Water Quality Standards state that Dissolved Oxygen concentrations must exceed 6 mg/ℓ at all times to support these beneficial uses (Idaho Department of Health and Welfare, 1992).

pH

pH values are used to measure the hydrogen ion concentration in water and soil. State Water Quality Standards (Idaho Department of Health and Welfare, 1992) designate a pH range from 6.5 su to 9.0 su for cold water biota and salmonid spawning.

Specific Conductivity

Specific conductivity is a reliable field measurement of dissolved solid concentrations within a water column. The specific conductance of some waters may change because of chemical and physical reactions such as precipitation, absorption, ion exchange, oxidation, and reduction. For surface waters, specific conductivity is often a good indicator of dissolved salts associated with irrigation return flows.

Turbidity

Turbidity is an indirect measure of the amount of suspended solids in water. Turbidity and the amount of light penetration through a water column have an inverse relationship. Studies by Sigler et al. (1984) determined that turbidity levels as low as 25 NTU's caused a reduction in fish growth, and turbidity levels between 100-300 NTU's caused fish to either die or forced them to leave the channel. Lloyd et al. (1987) found that increased levels in turbidity caused a reduction in light penetration, therefore resulting in decreased production of plant material (primary production), decreased abundance of food organisms (secondary production), and decreased production and abundance of fish. Lloyd also determined that even slight increases in turbidity (5-10 NTU's) caused decreases in plant abundance.

Dacthal

Dacthal and its corresponding di-acid metabolites have been found in surface water return drains in the Mahleur County area of eastern Oregon. Specific measurements for detection of Dacthal will be taken to further characterize its presence in return flows drainages and loadings to the Lower Payette River. There are no current Dacthal ambient water quality standards, even though certain impurities found in the acid metabolites have toxic characteristics that affect aquatic organisms.

Dacthal is actually a trade name for the pesticide. Its' common (generic) name is DCPA, and chemical name is dimethyl tetrachloroterphthalate. DCPA is used for selective weed control in strawberries, vegetable crops, corn, and others. The main use or application crop in the Lower Payette River SAWQP area is onions.

Table 1. Parameters for the Lower Payette River SAWQP Water Quality Status Report, 1992-93.

PARAMETERS	STORET #	UNIT OF MEASUREMENT
TEMPERATURE	00010	°C
pH	00400	su*
SPECIFIC CONDUCTIVITY	00095	µmhos/cm
DISSOLVED OXYGEN	00300	mg/ℓ
SUSPENDED SEDIMENT	80154	mg/ℓ
TURBIDITY	00076	NTU's
FLOW	00060	cfs
TOTAL PHOSPHORUS	00665	mg/ℓ
DISSOLVED o-PHOSPHATES	00671	mg/ℓ
NITRITE-NITRATE AS NITROGEN	00630	mg/ℓ
AMMONIA	00610	mg/ℓ
TOTAL KJELDAHL NITROGEN	00625	mg/ℓ
FECAL COLIFORM	31616	count/100 mℓ
FECAL STREPTOCOCCUS	31697	count/100 mℓ
DACTHAL		µg/ℓ

*Standard Units

Ground Water

Physical Parameters

Temperature

Temperature is often a characteristic of a particular ground water body. Temperature data was used to assist in identification of the ground water system. Some of the wells did demonstrate some geothermal activity within a few of the monitored water bodies. Temperature was also a major indicator of whether the casing had been purged of any stagnant water, and an adequate volume had been removed.

Specific Conductivity

Specific conductivity is an indirect field measurement of the total dissolved solids or inorganic salts within a water column. Specific Conductivity is another parameter that aids in determining whether the casing had been purged of any stagnant water, and an adequate volume had been removed.

As stated previously, the specific conductance of some waters may change because of chemical and physical reactions such as precipitation, absorption, ion exchange, oxidation, and reduction. For ground water, it can be a good indicator of similar water body characteristics and also as an indicator of ground water pollution.

pH

pH is a measurement of the hydrogen ion concentrations within a solution. Low pH (lower than 7) indicates an acidic solution, and high pH (greater than 7) indicates a basic solution. pH is controlled mainly by the hydrolysis of salts of strong bases and strong acids. Interactions with dissolved gases, as well as other chemical, physical, and biological reactions, can dramatically alter pH values. Most ground water demonstrates similar pH values when collected from an identified water body, and therefore pH is a good indicator of similar characteristics. pH is also another major indicator of whether the casing had been purged of any stagnant water, and an adequate volume had been removed.

Chemical Parameters

Common Ions

Calcium, sodium, magnesium, chlorides, and sulfates are common ions found in most natural waters. These ions and their respective STORET numbers are listed in Table 2. As water flows through an aquifer, it interacts with the geologic characteristics, and therefore assumes a distinct chemical composition. This becomes useful for water body identification by analytically comparing the results to common ions found in a particular area. Sodium and chloride ions are particularly useful in identifying whether there are surface or subsurface contamination sources. There are currently no State Drinking Water Standards that address common ions and their potential health risks.

Arsenic

Arsenic at one time was a widely utilized pesticide for orchard treatments. It can also be found in natural sources, with some areas demonstrating high background concentrations. The State Drinking Water Quality Standard for arsenic is 0.05 mg/ℓ (50 μg/ℓ)(Idaho Department of Health and Welfare, 1992). Ambient surface water quality criterion also exist (EPA, 1985), but will not be discussed here.

Pesticides

In addition to the common ions, Table 2 shows the pesticide parameters that were monitored. Most of the pesticides shown have an EPA Health Advisory limit or an Idaho Drinking Water Standard (Idaho Department of Health and Welfare, 1992).

Table 2. Pesticides and Ions of Concern as Parameters for Ground Water Only. Lower Payette River SAWQP Report, 1992-1993.

COMMON IONS	STORET #	UNIT	METHODS
Ca	00915	mg/ℓ	Standard Methods*
Na	00930	mg/ℓ	" "
Cl	00940	mg/ℓ	" "
SO4	00945	mg/ℓ	" "
As	01002	mg/ℓ	" "
Mg	00927	mg/ℓ	" "

Common Name	Trade Name	Analytical Procedure
2,4-D	2,4-D**	515.1
Aldicarb	Temik	531.1
Alachlor	Lasso	507
Atrazine	Atrizine**	507
Carbonfuran	Furdan**	531.1
Chloropicrin	Telone	GC/MS
Chlordane	Chlorodane**	508
hlorpyrifos	Lorsban	507
*DBCP	Nemafume**	508
DCPA	Dacthal	508
Diazinon		507
Dicamba	Banvel	515.1
Dinoseb	**	515.1
Endosulfan	Thiodan	508
EPTC	Eptan	507
HCH	Lindane	508
*Methoxychlor	**	508
Metribuzin	Sencor	507
Pendimethalin	Prowl	GC/MS
Pentachlorophenol	PCP**	515.1
Picloram	Tordon**	515.1
Pronamide	Kerb	507
Propiconazole	Tilt	GC/MS
*2,4,5-TP	Silvex**	507
Simazine	Simazine**	507
Terbacil	Sinbar	507
Terbufos	Counter	507
*Toxaphene	**	508
Tribluralin	Treflan	508

*Methods Described in APHA 1985

**Denotes Safe Drinking Water Act (SDWA) regulated pesticides for which there are established MCL's.

SURFACE WATER STUDY DESIGN

Sampling/Collection Methods

Suspended sediment and nutrient (phosphorus and nitrogen) constituents were collected as cross-composite depth-integrated samples using a DH-48 Suspended Sediment Sampler. Samples were combined into an eight-liter churn splitter and then dispensed into one-quart cubitainers. Samples collected for total phosphorus and nitrogen analysis were preserved with 2 mℓ of H_2SO_4. Dissolved orth-phosphate samples were collected by first extracting the sample from the churn splitter by using a 50 cc syringe, and then by filtering the sample through a .45 micron filter into a 20 mℓ vile.

Bacteria samples were obtained by the grab method. The samples were collected as close to the main stream flow as possible, with a sterile 250 mℓ Nalgene bottles. A one-half (1/2) inch air gap was left between the water surface and the neck of the bottle.

Stream velocity and depth were measured in feet per second with a Marsh-McBirney Model 201D Portable Water Current Meter at equal intervals. The overall discharge was calculated in cubic feet per second (cfs) by multiplying velocity, depth, and interval width, and then by adding the measurements over the total width of the stream.

Dissolved oxygen (mg/ℓ) and temperature (°C) were determined with the use a Yellow Springs Instrument Model 50 Dissolved Oxygen Meter. pH was determined in standard units (su) with the use of a Orion Model 231 pH/mv/Temperature Meter. Conductivity was measured by using a Yellow Springs Instrument Model 33 Salinity-Conductivity-Temperature Meter, and the results were recorded in μmhos.

Sample collection followed methods described by Ralston and Browne (1976).

Frequency

The 1992-93 survey began in June 1992. Twice monthly samples were collected during irrigation season, which occurred from June 6, 1992 to September 30, 1992, and again from April 15, 1993 to September 30, 1993. Normal irrigation season would be classified from April 15th through September 30th. Monthly samples were collected from October 1, 1992 through March 31, 1993, to characterize the non-irrigation season water quality. There are twenty-seven sets of samples (n=27) for nutrients, suspended sediment, and bacteria. Twenty-one (n=21) of these sample dates occurred during the irrigation season, and six (n=6) sample dates took place during the non-irrigation season.

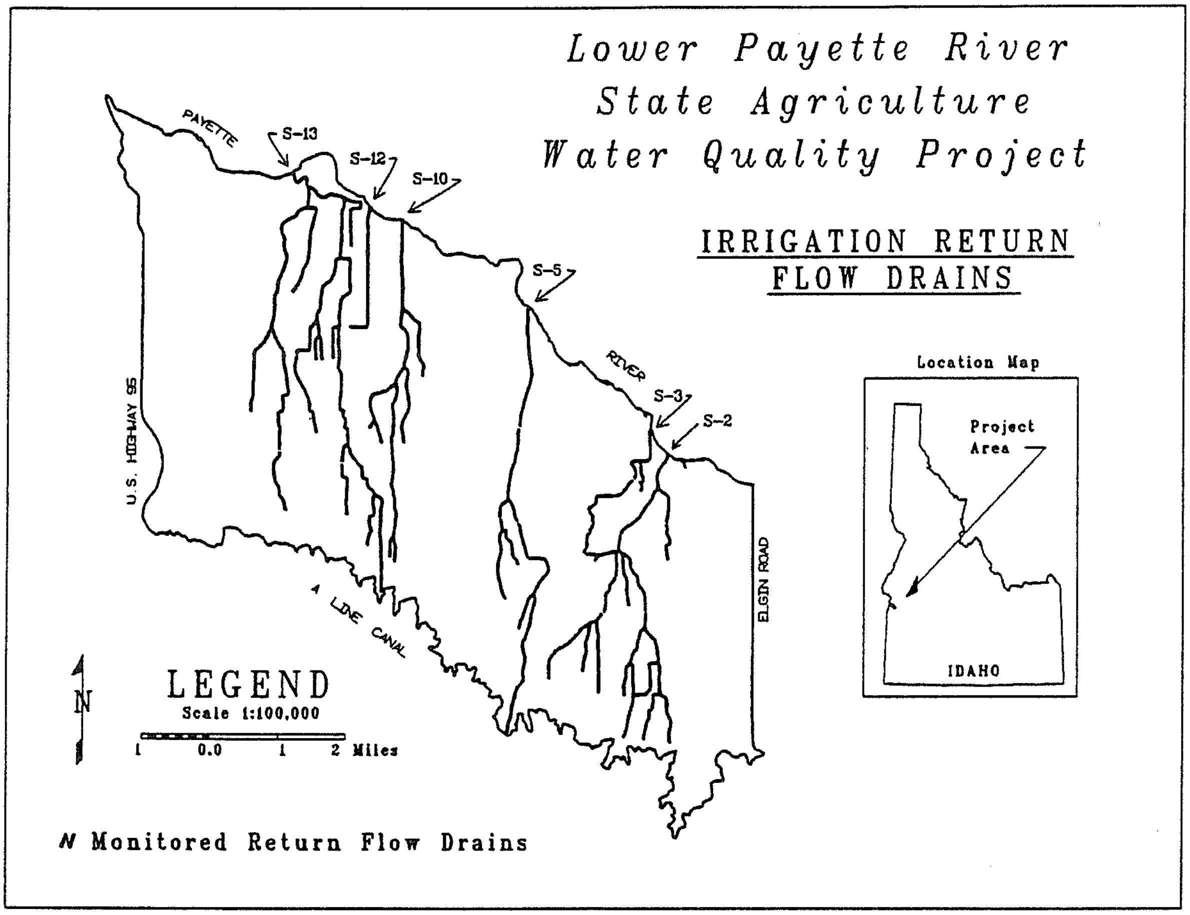


Figure 6. Monitoring Stations, Lower Payette River SAWQP, 1992-93.

Stations

Six stations were selected for intensive baseline monitoring. Table 3 shows the assigned station numbers, station locations, and STORET Numbers; Table 4 displays each station's latitude, longitude, and elevation. A map of the stations is displayed in Figure 6. Stations were selected based on past monitoring data (Ingham, 1992), land use, available ground water data, and flow patterns.

Two of the stations are located on the Payette River. Station R-2 is the USGS triennially trend monitoring site at the U.S. Highway 95 Bridge, approximately 2 miles upstream from the confluence with the Snake River. Station R-1 is a Bureau of Reclamation monitoring site located on the Payette River at the Letha Bridge near the town of Letha, Idaho. This site is located approximately 25 miles upstream from the confluence of the Payette and Snake Rivers. Since the project area is located between these two stations, they will help determine what impacts the project area is having on the Payette River. Two other stations were established to determine outside impacts other than those attributable to the agricultural return drains. Station C-3, at the Black Canyon "A" Line Canal, was established to help determine the water quality of the irrigation water as it enters into the project area. Station C-7, at Willow Creek, was situated to determine what impacts, if any, could be associated with the areas to the north of the project area. These monitoring sites are not shown on any Figures.

Table 3. Monitoring Stations for the Lower Payette River SAWQP Surface Water Quality Study, 1992-1993.

STATION	STATION DESCRIPTION	STORET # or Agency Codes
S-2	@ Payette River, River Mile 15.75	2040488
S-3	@ Payette River, River Mile 15.25	2040489
S-5	.25 miles downstream Willow Ck. Road	2040491
S-10	.2 miles north of River Road	2040496
S-12	Payette River @ River Road	2040498
S-13	.5 miles north of River Road	2040499
C-3	Black Canyon "A" Line @ County Line	2040482
R-1	Payette River at U.S. Highway 95 Bridge	132551000
R-2	Payette River at Letha Bridge	EM 103
C-7	Willow Creek at Idaho Highway 52 Bridge	2040486

Table 4. Station Locations: Latitude, Longitude, and Elevation.

STATION	LATITUDE	LONGITUDE	ELEVATION (Feet)
S-2	44° 00' 36"	116° 49' 57"	2180
S-3	43° 57' 52"	116° 45' 42"	2220
S-5	43° 59' 39"	116° 50' 11"	2200
S-10	44° 00' 24"	116° 50' 11"	2180
S-12	44° 01' 46"	116° 50' 44"	2180
S-13	44° 01' 21"	116° 52' 08"	2175
R-1	43° 53' 48"	116° 37' 35"	2295
R-2	42° 02' 33"	116° 55' 32"	2140
C-3	43° 53' 40"	116° 43' 57"	2500
C-7	43° 52' 36"	116° 42" 12"	2188

GROUND WATER STUDY DESIGN

Sampling/Collection Methods

For ground water samples, the well being sampled was first purged of any possible stagnant water by removing three to five well volumes of water, or until pH, specific conductivity, and temperature were stabilized. Ground water quality samples obtained from the well were collected from the nearest access port to the well, excluding any water treatment devices or water storage tanks. Samples were collected directly from the sampling port; garden hoses or any other conveyance devices were disconnected.

pH (su) and temperature (°C) were determined with the use of an Orion Model 231 pH/mv/Temperature Meter. Conductivity was measured by using a Yellow Springs Instrument S-C-T Meter, and the results were recorded in μmhos.

Samples for nutrients, common ions, and arsenic were collected directly into individual one quart cubitainers. Samples collected for nutrient analysis were preserved with 2 mℓ of H_2SO_4.

Pesticides samples were collected into one gallon amber glass containers, with one exception. Samples designated for carbonfuran analysis were collected in 100 mℓ amber glass bottles, and they were preserved with 4 mℓ of monochloroacetic acid buffer solution and 4.8 mg of sodium thiosulfate.

Frequency

Three monitoring events were conducted: Fall 1992, Spring 1993, and again in the Fall of 1993. It was anticipated that seasonal fluctuations in ground water levels would occur due to irrigation practices in the area. The spring monitoring events occurred over a one week period, whereas the fall monitoring was completed in three days.

Stations

A network of twenty wells was established to receive the intensive seasonal monitoring. Selection of the wells was based on past monitoring efforts (Baldwin and Wicherski, 1992), availability of well logs, willingness of property owners to allow monitoring, and proximity to the Lower Payette SAWQP area. All wells are within irrigated tracts and demonstrate seasonal fluctuations due to irrigation practices in the area.

Each well's identification number, elevation, well depth, and STORET number are given in Table 5. Most well owners asked for anonymity, so no well locations will be given. General overviews of contamination are provided in the results portion of this document.

Table 5. Ground Water Monitoring Stations. Lower Payette River SAWQP, 1992-1993.

GROUND WATER	ELEVATION in feet	WELL DEPTH in feet	STORET #
W-7	2385	160	2040558
W-9	2246	60	2040551
W-10	2248	110	2040547
W-11	2285	53	2040542
W-25	2330	75	2040550
W-26	2350	75	2040644
W-27	2231	136	2040643
W-37	2406	75	2040543
W-38	2420	110	
W-55	2210	44	2040561
W-56	2190	56	2040529
W-58	2358	NA	2040531
W-64	2195	NA	2040530
W-65	2210	45	2040536
W-69	2230	41	
W-71	2350	36	2040549
W-72	2226	NA	
W-76	2232	55	2040562
W-77	2215	60	2040537
W-82	2190	300	2040533
W-84	2245	35	2040646
W-101	NA	NA	2040645

NA, Not Available

Climatic Conditions

During this study, over a eighteen month period, climatic conditions varied greatly. During the winter of 1992-93 precipitation was 126% of normal, with snowfall amounts of 212%. The 1993 growing season was dominated with wet and cool conditions. Precipitation for June was 188%; for July precipitation was 231%; and for August 161%. Temperatures for June and July were 4°F below normal, while in July temperatures were 11°F below normal. In contrast, 1992 was a dry year with below precipitation during the growing season. Temperatures were near to above normal. Held over irrigation water for the 1992 irrigation season was limited. Climatic conditions are based on personal communications (Payette Soil and Water Conservation District, 1995).

RESULTS

SURFACE WATER

Physical Parameters

Appendix A contains all surface water data from drains receiving monitoring.

Flow

Flow rate has a major influence on stream bank erosion and sediment transport. Flow rates greatly effect both pollutant delivery rates and pollutant sources, as is demonstrated in the suspended sediment section of this report.

To show flow rate fluctuations, a breakdown of the non-irrigation season and the 1992-1993 irrigation seasons are examined in Table 6. All drains showed dramatic decreases in flows when comparing irrigation to non-irrigation seasons, with most drains having a decreased discharge of approximately 50%. None of the drains completely dried up during the non-irrigation season, thus indicating baseline flow from ground water discharge.

Station S-3 appears to be the most influenced by irrigation return flows and/or waste-water return flows from canals. During the 1992 irrigation season, S-3 had a mean flow of 10.4 cfs, whereas the mean flow for the 1993 irrigation season doubled to 21.6 cfs. The mean flow for the combined irrigation seasons was 16.8 cfs, while for the non-irrigation season it was 5.9 cfs. The remainder of the drains showed only slight differences in flows between the two irrigation seasons: S-2: (1992) 30.2 cfs, (1993) 27.9 cfs; S-5: 29.6 cfs, 33.8 cfs; S-10: 12.8 cfs, 16.2 cfs; S-12: 6.2 cfs, 4.8 cfs; S-13: 38.4 cfs, 38.2 cfs.

Even though the 1992 irrigation season occurred during a limited water year, the information indicates that there was not a large difference in the flows of the two irrigation seasons. More than likely, the greatest influence on flow variation is associated with the size of the drain and who was irrigating what crop and when the irrigation was occurring.

Table 6. Mean Flows for Overall, Irrigation Seasons (combined), Non-Irrigation Season, Irrigation Season 1992, and Irrigation Season 1993. Stations S-2, S-3, S-5, S-10, S-12, and S-13. Lower Payette River SAWQP, 1992-93.

Monitoring Stations	S-2	S-3	S-5	S-10	S-12	S-13
Flow (cfs)						
Overall	25.8	14.4	28.6	12.8	4.7	32.4
Irrigation Seasons	28.9	16.8	32.0	14.7	5.4	38.2
Non-Irrigation Season	14.8	5.9	17.6	6.2	2.2	11.8
Irrigation Season 1992	30.2	10.4	29.6	12.8	6.2	38.4
Irrigation Season 1993	27.9	21.6	33.8	16.2	4.8	38.2

Turbidity

Turbidity is the measurement of the inability of light to pass through water, or the indirect measurement of the amount of suspended solids. Narrative criteria established for aesthetic quality sets a maximum NTU level of 25 (Idaho Department of Health and Welfare, 1980).

Since most of the drains that received monitoring already have a designated beneficial use for agriculture and secondary contact recreation, only those drains that have demonstrated an ability to support cold water biota will be discussed. It was determined through best professional judgement, as well as discussion with the local community, that Drains S-2 and S-5 supported cold water biota either presently or in the recent past. Station S-2 had an overall turbidity of 4.1 NTU's, and met the criteria for cold water biota. Drain S-5 also met this criteria, but had three instances in which the designated level was exceeded. On one particular monitoring date, a turbidity level of 44 NTU's was recorded.

Turbidity does not appear to be a problem for the drains that may support cold water biota. There were two other drains in the area that did not receive monitoring, but may also support cold water biota: Station S-1 at Graveyard Gulch, and Station S-15 at Sand Hollow Creek. Further evaluation of these two drains is needed to determine if cold water biota are affected by turbidity.

Temperature

Since temperature is used to determine the status of cold water biota and salmonid spawning, only the two drains (S-2 and S-5) that are believed to be attainable in supporting these beneficial uses will be examined.

Station S-2 had an overall mean temperature of 14.0°C, with a maximum and minimum temperature of 17.0°C and 9.0°C, respectively. The combined irrigation seasons had a mean temperature of 14.7°C, and the non-irrigation season had a mean temperature of 11.7°C. It is suspected that S-2 is influenced by ground water, and the small change in water temperature from the irrigation seasons to the non-irrigation season supports this theory. The other drains had temperature differences of at least 5.5°C between the combined irrigation season and the non-irrigation season mean values. Drain S-2 met the Idaho temperature standards for supporting cold water biota; however, S-2 could be temperature-limited in supporting salmonid spawning, depending on when the spawning period occurs.

Station S-5 had an overall mean temperature of 15.8°C, and a maximum and minimum temperatures of 21.0°C and 8.5°C, respectively. The combined irrigation seasons had a mean temperature of 17.5°C, whereas the non-irrigation season had a mean temperature of 10.9°C; a 6.6°C difference. It is expected that Station S-5 could support cold water biota, but salmonid spawning may be limited to winter months or early spring when flows allow for better water temperature mixing.

Dissolved Oxygen

Dissolved oxygen (DO) is also an indicator of the status of cold water biota and salmonid spawning. Only drains S-2 and S-5 will be discussed since they are believed to be attainable in supporting these beneficial uses. It should be noted that DO data is limited to ten sampling dates, with most of the results from the 1992 irrigation season and two dates available from the non-irrigation season.

Station S-2 had an overall mean DO concentration of 7.1 mg/ℓ, a 1992 irrigation season mean of 6.9 mg/ℓ, and a non-irrigation season mean of 8.3 mg/ℓ. The DO concentration fell below the Idaho Water Quality Standard of 6.0 mg/ℓ on two occasions during the 1992 irrigation season. Since the site appeared to be well agitated and temperature levels were low enough so as not to effect DO concentrations. It seems that Drain S-2 did not meet the state standard for dissolved oxygen. Other factors such as materials causing a biological and/or chemical oxygen demand may have influenced the DO levels.

Station S-5 had an overall mean concentration level of 8.7 mg/ℓ. The mean DO concentrations for the 1992 irrigation season and the non-irrigation season were 8.3 mg/ℓ and 9.6 mg/ℓ, respectively. All of the monitoring dates met the state DO standard, and therefore Drain S-5 was not DO-limiting for cold water biota or salmonid spawning.

pH

pH is another indicator of the cold water biota and salmonid spawning status, as with other parameters, only Drains S-2 and S-5 will be analyzed.

At Station S-2, the pH level exceeded the designated range of 6.5 to 9.0 su (Idaho Water Quality

Standards, 1992) on one monitoring date. A pH value of 9.32 su was recorded during the non-irrigation season, but the remainder of the monitoring dates were within the state standards. Similarly, the pH standard was exceeded once at Station S-5 during the non-irrigation season, with a value of 9.05 su. The drain had no additional violations of the standard during the irrigation seasons.

Specific Conductivity

Specific conductivity is a field measurement of the dissolved solids within a water column. The Lower Payette River SAWQP area is heavily irrigated, which greatly impacts the specific conductivity or salinity of surface water returns. One purpose of the constructed drains is to drain shallow ground waters; which if not removed, would tend to rise to the surface, pool, and then evaporate leaving alkaline soils.

During the 1992 monitoring period, limited water quality monitoring of the irrigation water in Black Canyon Canal (C-3) was implemented. The monitoring of the incoming canal water was designed to assist in determining the water quality as it enters the project area. On July 20, 1992, the specific conductivity of Canal C-3 was 30 μmhos. On August 17, 1992, the specific conductivity was 60 μmhos. Specific conductivity readings of these values were expected. The Black Canyon Canal originates from the Black Canyon Dam on the Payette River, and specific conductivity values in waters originating from the Idaho Batholith are usually low in specific conductivity. Appendix B contains data from Black Canyon Canal and from Willow Creek.

As the irrigation water is used, and sometimes reused, it picks up dissolved solids and transport them to receiving waters. The Lower Payette SAWQP Area is a prime example of the source and transport of dissolved solids. Higher values were recorded during the non-irrigation season reflecting the base-flow support by contaminated ground water in the surface water system. As surface water is leached through the soils it will pick up dissolved solids and transport them into the local aquifer or shallow ground water, which is then discharged back to surface waters during periods of base-flows.

Each monitoring station had a higher specific conductivity during the non-irrigation season than during the irrigation seasons, with the exception of Station C-7 (which is not in the project area). The following is a list of each drain, and their mean specific conductivity values for the non-irrigation season and the combined irrigation seasons, in that order: S-2, 384 μmhos, 326 μmhos; S-3, 293 μmhos, 202 μmhos; S-5, 395 μmhos, 266 μmhos; S-10, 428 μmhos, 296 μmhos; S-12, 582 μmhos, 369 μmhos; S-13, 435 μmhos, 372 μmhos; and C-7, 160 μmhos, 207 μmhos. The specific conductivity measurements from the 1992 and 1993 irrigation seasons were not significantly different.

The specific conductivity data indicates that as irrigation water is used in the Lower Payette River SAWQP area it acquires dissolved solids, either through the surface irrigation return flows or the leaching of salts into ground water, before entering the Payette River.

Suspended Sediment

Suspended sediment is a major pollutant of concern from irrigated cropland. Sediment impacts aquatic life by increasing turbidity, covering spawning gravels, and by filling in habitat and interstitial space needed for food production. It also carries with it other pollutants of concern such as nutrients, pesticides, and bacteria. The soil types in the Lower Payette River SAWQP area are highly susceptible to irrigation-induced erosion, but streambank erosion may also be a significant source of sediment within the project area.

Suspended sediment concentrations and suspended sediment loadings furnish different, but equally valuable information. Sediment concentrations are an indication of the degree of erosion and sediment transported. Suspended sediment loadings are a measurement of the total volume of sediments carried by a watershed; a product of both flow rates and concentrations.

Concentrations

The upstream stations (S-2, S-3, and S-5) had much lower overall suspended sediment concentrations as compared to the downstream stations (S-10, S-12, and S-13). Even though there were some dramatic differences in concentrations, most of the stations drained similar amounts of overall acreage. For example, S-2 services 4608 acres and had an overall average concentration of 27.7 mg/ℓ, whereas S-13 drained 5274 acres and had an average concentration of 153.4 mg/ℓ. These two particular drains also differed in terms of the land use of the areas they serviced. Irrigated pastures, alfalfa, and some small grains were the dominant land uses for the upper drain of S-2. In contrast, S-13 drained an area with many more acres of intensively cultivated row-crops such as sugar beets, onions, and corn.

It would be expected that the higher concentrations for suspended sediment would occur during the earlier potions of irrigation season. This would be the period of first irrigations when most fields lie furrowed with little protection from erosion. The drains did not show similar mean concentrations either during a combination of both irrigation seasons, the separate irrigation seasons, or during the non-irrigation season. The results for stations S-2, S-3, and S-12 indicate that the highest mean concentrations of suspended sediment occurred during the non-irrigation season. S-5, S-10, and S-13 showed their highest mean concentrations during the irrigation seasons. These concentrations contradict conclusions from a similar study on Jump Creek, Owyhee County, during the same time period (Bauer, 1994). That study showed higher suspended sediment concentrations associated with irrigation practices, especially during the earlier part of the irrigation season.

Each station showed wide-ranging variability of suspended sediment concentrations for all of the seasons in question. Only S-2 showed fairly consistent suspended sediment concentrations, with an overall concentration standard deviation of 18.2 mg/ℓ. In comparison, station S-3 had an overall concentration standard deviation of 78 mg/ℓ. Land use involving the two drains was very similar, with primarily irrigated pastures. Station S-3, however, was also influenced by wastewater from an irrigation canal further up in the watershed.

Station S-10 exhibited the highest suspended sediment concentrations, with an overall mean concentration of 221.7 mg/ℓ. For the combined irrigation seasons of 1992 and 1993, there was a mean concentration of 224 mg/ℓ. Separately, the 1992 irrigation season had a mean concentration of 326.1 mg/ℓ, and the 1993 irrigation season mean was 182.4 mg/ℓ. The non-irrigation season, stretching from October 1992 to April 1993, exhibited a mean suspended sediment concentration of 160.2 mg/ℓ.

Station S-12 is the smallest watershed that received monitoring, draining only 499 acres. During the non-irrigation season, S-12 exhibited the highest mean concentration of all the stations, with a value of 339 mg/ℓ. A one-time spike of 843 mg/ℓ was collected on March 16, 1993, and it accounted for much of this mean concentration. However, January and February also had high suspended sediment concentrations, with values well over 400 mg/ℓ for both dates.

The recommended guideline for suspended sediment concentrations in streams impacted by agricultural return flows has been established at 50 mg/ℓ (Clark and Litke, 1991). Station S-2 exceeded this guideline on only 11% of the monitoring dates; S-3 exceeded it on 15% of all monitoring dates; S-5 on 18% of all monitoring dates; S-10 on 96% of all monitoring dates; S-12 on 89% of all monitoring dates; and S-13 on 81% of all monitoring dates.

It should be noted that there was no spacial variability in the monitoring dates, and that sampling of each site occurred on the same date within a couple hours of each other. Table 7 displays the mean suspended sediment concentrations, and Appendix A shows the suspended sediment concentration results for each monitoring date within the study.

Loadings

Daily suspended sediment loads were calculated for five periods: overall, irrigation seasons (combined), non-irrigation season, irrigation season 1992, and irrigation season 1993. The mean suspended sediment daily loads are also shown in Table 7, and the loadings for the individual monitoring dates are given in Appendix A. The results indicate that Station S-13 had the highest daily load of all the stations, with an overall mean value of 17 tons/day. Although similar flows were recorded at Stations S-2 and S-5, loads were at a much higher magnitude at S-13. During the 1992 irrigation season, S-13 had a mean daily load of 27 tons/day with a mean flow rate of 38.4 cfs. This station had a nearly identical mean flow of 38.2 cfs during the 1993 irrigation season, but experienced a lower mean daily load of 16 tons/day. This would indicate that there may be some variability in land use from year to year along with seasonal effects, and therefore some variability in the suspended sediment loads in the area serviced by S-13. It should be noted that 1992 was a low precipitation year, and the lack of available irrigation water may have influenced cropping patterns for that year. 1993 was just the opposite, where there was more than adequate water supplies.

Table 7. Mean Flows, Mean Suspended Sediment Concentrations, and Mean Suspended Sediment Daily Loads for Overall, Irrigation Seasons (combined), Non-Irrigation Season, Irrigation Season 1992, and Irrigation Season 1993. Stations S-2, S-3, S-5, S-10, S-12, and S-13. Lower Payette River SAWQP, 1992-93.

Monitoring Stations	S-2	S-3	S-5	S-10	S-12	S-13
Flows (cfs)						
Overall	25.8	14.4	28.6	12.8	4.7	32.4
Irrigation Seasons	28.9	16.8	32.0	14.7	5.4	38.2
Non-Irrigation Season	14.8	5.9	17.6	6.2	2.2	11.8
Irrigation Season 1992	30.2	10.4	29.6	12.8	6.2	38.4
Irrigation Season 1993	27.9	21.6	33.8	16.2	4.8	38.2
Suspended Sediment (mg/ℓ)						
Overall	27.7	57.7	35.2	221.7	172.3	159.3
Irrigation Seasons	23.8	48.5	40.4	244.0	124.6	174.6
Non-Irrigation Season	41.7	90.2	18.5	160.2	339.0	106.0
Irrigation Season 1992	34.1	72.0	56.5	326.1	84.7	209.9
Irrigation Season 1993	16.0	30.8	28.7	182.4	154.6	148.1
Daily Loads (tons/day)						
Overall	2	3	3	8	2	17
Irrigation Seasons	2	3	3	10	2	21
Non-Irrigation Season	1	1	2	3	3	4
Irrigation Season 1992	3	4	4	11	2	28
Irrigation Season 1993	1	2	3	9	2	16

Interval Loads/Delivery Rates

All of the drains that were monitored discharge directly into the Lower Payette River. The suspended sediment loads to the river from each drain, as well as from the entire project area, will be compared and statistically evaluated in the Payette River section of this report. For this discussion, we will compare the suspended sediment delivery rate (the total loadings in tons divided by the number of acres serviced for each drain) in order to determine the most critical areas of concern. Drain S-2 had a total suspended sediment load of 477 tons for Water Year

1993, and serviced approximately 4600 acres; therefore, the calculated delivery rate would be 0.10 tons suspended sediment/acre. The following is a list of the delivery rates for the remaining drains: S-3 had a rate of 0.76 tons/acre, S-5 had a rate of 0.27 tons/acre, S-10 had a rate of 1.36 tons/acre, S-12 had a rate of 1.48 tons/acre, and S-13 had a rate of 0.61 tons/acre.

As shown in Table 8, Stations S-10, S-12, and S-13 are probably the higher priority areas. Drain S-3 should not be designated as high priority because of the wide variation of flows, as well as impacts from irrigation canal wastewater.

Table 8. Suspended Sediment Interval Loads. Stations S-2, S-3, S-5, S-10, S-12, and S-13. Lower Payette River SAWQP Area. Water Year 1993: October 1992 through September 1993. Lower Payette River SAWQP, 1992-93.

Station	S-2	S-3	S-5	S-10	S-12	S-13
Non-Irrigation Season Interval Load (tons)	250.8	131.9	189.1	401.5	423.9	637.3
Irrigation Season 1993 Interval Load (tons)	226.7	464.9	527.0	1776.5	316.5	2586.1
Water Year 1993 Total Interval Load (tons)	477.5	596.8	716.1	2178.0	740.4	3223.4

Nutrients

The nutrients examined during this study are the following: Ammonia, Nitrite-Nitrate as Nitrogen (NO_2+NO_3), Total Kjeldahl Nitrogen (organic nitrogen), total phosphorus, and Dissolved ortho-Phosphates. These selected nutrients will be discussed separately, and the results for all of the chemical parameters are located in Appendix A.

Phosphorus

The mean values for the total phosphorus concentrations, dissolved ortho-phosphates, and total phosphorus loads are listed in Table 9. Much like the suspended sediment results, the total phosphorus concentrations increased from the up-river site S-2, to the down-river site at Station S-13. As discussed previously, the more intensive irrigation areas are further down river. It is believed that more soil and streambank erosion takes place in this area, and therefore more phosphorus remains attached to these sediment particles.

Simple correlations of suspended sediment and total phosphorus concentrations were calculated for all the drains. At Station S-2, the correlation had a r^2 value of 0.006, meaning little to no correlation occurred between suspended sediment and total phosphorus. This is also reflected in the mean dissolved ortho-phosphate results for this station. By comparing the total phosphorus values with the dissolved ortho-phosphate results, it can be determined whether the majority was dissolved, or whether there was a good chance the phosphorus were attached to sediments. The mean concentration of dissolved ortho-phosphates at Station S-2 for the entire monitoring period was 0.154 mg/ℓ, for the combined irrigation seasons it was 0.153 mg/ℓ, and for the non-irrigation season it was 0.158 mg/ℓ. The mean total phosphorus concentrations for the overall study at S-2 was 0.19 mg/ℓ, for the combined irrigation seasons it was also 0.19 mg/ℓ, and for the non-irrigation season it was 0.17 mg/ℓ. The observation that can be drawn from this comparison is that at Drain S-2, a large percentage of the total phosphorus was in the dissolved form.

Table 9. Mean Total Phosphorus Concentrations, Mean Dissolved Ortho-Phosphate Concentrations, and Mean Daily Total Phosphorus Loads for Overall, Irrigation Seasons (combined), Non- Irrigation Season, Irrigation Season 1992, and Irrigation Season 1993. Stations S-2, S-3, S-5. S-10, S-12, and S-13. Lower Payette River SAWQP, 1992-93.

Monitoring Stations	S-2	S-3	S-5	S-10	S-12	S-13
Total Phosphorus (mg/ℓ)						
Overall	0.19	0.20	0.19	0.47	0.43	0.41
Irrigation Seasons	0.19	0.21	0.20	0.50	0.39	0.43
Non-Irrigation Season	0.17	0.17	0.17	0.35	0.56	0.35
Irrigation Season 1992	0.17	0.22	0.18	0.53	0.30	0.43
Irrigation Season 1993	0.21	0.20	0.21	0.48	0.46	0.44
Dissolved Ortho-Phosphate (mg/ℓ)						
Overall	0.154	0.125	0.136	0.180	0.211	0.199
Irrigation Seasons	0.153	0.124	0.131	0.182	0.191	0.190
Non-Irrigation Season	0.158	0.129	0.153	0.173	0.277	0.229
Irrigation Season 1992	0.164	0.170	0.165	0.206	0.199	0.215
Irrigation Season 1993	0.145	0.086	0.110	0.165	0.185	0.170
Daily Loads (lbs/day)						
Overall	27.2	14.8	29.1	33.5	10.1	79.5
Irrigation Seasons	31.0	17.8	34.6	40.1	11.0	95.5
Non-Irrigation Season	13.8	4.3	11.9	10.3	7.1	23.5
Irrigation Season 1992	28.1	10.9	26.3	33.9	10.7	99.4
Irrigation Season 1993	33.2	22.9	44.3	44.7	11.2	92.6

In contrast, Station S-12 had a correlation r^2 value of 0.72, thereby indicating a strong correlation between suspended sediment and total phosphorus. Mean dissolved ortho-phosphate results for Station S-12 were 0.211 mg/ℓ for overall, 0.191 mg/ℓ for the combined irrigation seasons, 0.277 mg/ℓ for the non-irrigation season, 0.199 mg/ℓ for the 1992 irrigation season, and 0.185 mg/ℓ for the 1993 irrigation season. Mean total phosphorus concentrations for S-12 were 0.43 mg/ℓ for overall, 0.39 mg/ℓ for the combined irrigation seasons, 0.56 mg/ℓ for the non-irrigation season, 0.30 mg/ℓ for the 1992 irrigation season, and 0.46 mg/ℓ for the 1993 irrigation season. All of these results indicate that Station S-12 had a fairly large proportion of its total phosphorus attached to sediments.

Station S-2 showed very little change in the dissolved ortho-phosphate and total phosphorus concentrations when comparing the irrigation seasons versus the non-irrigation season. However, Station S-12 did show a significant difference in the phosphorus results between the irrigation seasons and non-irrigation season. This drain demonstrated a much higher mean concentration of dissolved ortho-phosphates during the non-irrigation season. Total phosphorus loads are a good indicator of pollutant sources within the project area. Station S-13 had the largest daily total phosphorus loading of all the drains. An overall mean daily total phosphorus load was determined to be 79.5 lbs/day. This site also demonstrated a much higher mean daily total phosphorus load during the irrigation seasons, than during the non-irrigation season. The mean daily load for the combined irrigation season was calculated to be 95.5 lbs/day, whereas the non-irrigation season had a mean daily load was 23.5 lbs/day. Station S-12 had a slightly higher mean daily total phosphorus load for the combined irrigation season of 11.0 lbs/day, with a non-irrigation season load of 7.1 lbs/day.

The six monitored drains combined to deliver a sum of 27.8 tons (55,534.2 lbs) of total phosphorus during the Water Year of 1993. This overall loading was calculated by multiplying the mean daily load of both the non-irrigation season and the 1993 irrigation season, by the number of days in each season respectively. The non-irrigation season consisted of 197 days (October 1st to April 14th), and the 1993 irrigation season included 167 days (April 15th to September 30th).

Nitrogen

Most nitrogen can be found in either the organic form (Kjeldahl Nitrogen) or the inorganic form (Nitrite, Nitrate, and unionized Ammonia). Organic forms are usually associated with suspended sediment particles and can be used as an indicator of BMP effectiveness in reducing suspended sediment in receiving waters (Clark and Litke, 1991). Total inorganic nitrogen is easily soluble and is found in concentrations of approximately 9.32 mg/ℓ in the ground water of the area (refer to ground water data results). The organic nitrogen will not be discussed in this section.

Total Inorganic Nitrogen

The resulting ammonia (as nitrogen) mean concentrations are listed in Table 10. The concentrations ranged from an overall value of 0.029 mg/ℓ at Station S-2, to an overall figure of 0.127 mg/ℓ at Station S-13.

Of all the drains, stations S-10, S-12, and S-13 showed the greatest differences of ammonia between the irrigation seasons and the non-irrigation season. Station S-13 had the greatest overall mean concentration of ammonia with a value of 0.127 mg/ℓ. The combined irrigation seasons at this site had a mean concentration of 0.077 mg/ℓ, whereas the non-irrigation season had a mean value of 0.303 mg/ℓ. However, the mean concentration at Station S-13 was higher during the 1992 irrigation season (0.119 mg/ℓ), than during the 1993 irrigation season (0.045 mg/ℓ). At this time there is no explanation for this large difference, since flows at this station remained at about 38 cfs for both the 1992 and 1993 irrigation seasons. Similar results were obtained from the other drains that received monitoring; they all had higher mean concentrations of ammonia in 1992 as compared to 1993.

Ammonia toxicity to aquatic life varies with pH and temperature. All of the drains that received monitoring had ammonia concentrations that remained below EPA toxic concentrations. These are estimated by taking both pH and temperature into account. For example, at a pH of 9.0 su and a temperature of 15°C, the standard concentration for acute toxicity is 0.86 mg/ℓ (U.S. EPA, 1986).

Table 10. Ammonia as Nitrogen Mean Concentrations for Overall, Irrigation Seasons (combined), Non-Irrigation Season, Irrigation Season 1992, and Irrigation Season 1993. Stations S-2, S-3, S-5, S-10, S-12, and S-13. Lower Payette River SAWQP, 1992-93.

Monitoring Stations	S-2	S-3	S-5	S-10	S-12	S-13
Ammonia as Nitrogen (mg/ℓ)						
Overall	0.029	0.038	0.040	0.053	0.043	0.127
Irrigation Seasons	0.029	0.039	0.041	0.042	0.039	0.077
Non-Irrigation Season	0.027	0.036	0.039	0.091	0.058	0.303
Irrigation Season 1992	0.041	0.056	0.052	0.046	0.043	0.119
Irrigation Season 1993	0.020	0.026	0.032	0.040	0.026	0.045

Nitrite-Nitrates as Nitrogen (also referred to as nitrates) is the primary component of inorganic nitrogen. This parameter was used to determine whether the criterion for the prevention of eutrophication was exceeded in receiving waters. The resulting mean concentrations shown in Table 11 were all well above the designated level of 0.3 mg/ℓ for each of the drains, and for all five of the specified time periods (Idaho Department of Health and Welfare, 1980). Station S-3 had the lowest mean concentrations of all the stations. This drain had an overall mean concentration of 0.59 mg/ℓ, a combined irrigation season mean of 0.37 mg/ℓ, a non-irrigation season mean 1.37 mg/ℓ, a 1992 irrigation season mean of 0.40 mg/ℓ, and a 1993 irrigation season mean of 0.34 mg/ℓ. In contrast, Station S-12 had the greatest mean concentrations of nitrates from all of the monitored sites: the overall mean was 5.44 mg/ℓ, the combined irrigation season mean was 4.40 mg/ℓ, the non-irrigation season mean was 9.10 mg/ℓ, the 1992 irrigation season mean was 3.97 mg/ℓ, and the 1993 irrigation season mean was 4.72 mg/ℓ. Drain S-12 drains an area with a natural occurring high water table in an intensively farmed area. The drainage area for drain S-12 is small (499 acres) with much of the water table is within ten feet of the surface.

All stations showed higher mean concentrations of nitrates during the non-irrigation season, as compared to the mean value of the combined irrigation seasons. For example, Station S-12 had an irrigation season (combined) mean of 4.4 mg/ℓ, with a mean flow of 5.4 cfs; whereas the non-irrigation season had a higher mean concentration of 9.1 mg/ℓ, with a flow of 2.2 cfs. This would indicate that contaminated ground water discharge to surface waters as base-flows support is directly effecting the quality of the receiving surface waters. Station S-12 is a small drain that services an area of 499 acres, and sources of nitrite-nitrate can be associated with this agricultural activity. The predominant land use is intensively irrigated row-crops. Sugar beets, onions, and mint are the main crops, and all are highly demanding of water and nutrients. However, it should be noted that septic systems may also be source of nutrients to ground water.

Table 11. Nitrite-Nitrate as Nitrogen Mean Concentrations for Overall, Irrigation Seasons (combined), Non-Irrigation Season, Irrigation Season 1992, and Irrigation Season 1993. Stations S-2, S-3, S-5, S-10, S-12, and S-13. Lower Payette River SAWQP, 1992-93.

Monitoring Stations	S-2	S-3	S-5	S-10	S-12	S-13
Nitrite-Nitrate as Nitrogen (mg/ℓ)						
Overall	1.66	0.59	2.01	3.29	5.44	4.32
Irrigation Seasons	1.50	0.37	1.61	2.79	4.40	3.69
Non-Irrigation Season	2.22	1.37	3.30	5.04	9.10	6.52
Irrigation Season 1992	1.51	0.40	1.83	2.73	3.97	3.78
Irrigation Season 1993	1.49	0.34	1.45	2.84	4.72	3.63

Bacteria

There does not appear to be any obvious pattern to determine which area had the greatest bacterial contamination, or which drain to concentrate BMP efforts on. All drains at one time or another violated primary and secondary contact recreation standards (Idaho Department of Health and Welfare, 1992). Table 12 shows the Fecal Coliform percent exceedence of these recreation standards for each site.

At Station S-2, Fecal Coliform densities ranged from a count of 36/100 mℓ to 3800/100 mℓ, and Fecal Streptococci counts ranged from 60/100 mℓ to 5000/100 mℓ. Station S-3 had Fecal Coli counts that ranged from 16/100 mℓ to 28,000/100 mℓ, and Fecal Strep counts from 20/100 mℓ to 28,000/100 mℓ. Drain S-5 had a Fecal Coli range from less than 10/100 mℓ to 2300/100 mℓ, and a Fecal Strep range from 10/100 mℓ to 2500/100 mℓ. At Station S-10, Fecal Coli densities ranged from 8/100 mℓ to 6900/100 mℓ, and Fecal Strep densities ranged from 40/100 mℓ to 38,000/100 mℓ. Station S-12 had Fecal Coli counts from less than 10/100 mℓ to 5400/100 mℓ, and Fecal Strep counts from 20/100 mℓ to 100,000/100 mℓ. The last site, Station S-13, had a Fecal Coli range from 140/100 mℓ to 23,000/100 mℓ, and a Fecal Strep range from 80/100 mℓ to 28,000/100 mℓ.

The Fecal Coli/Fecal Strep ratio may be the most appropriate means of determining bacterial sources, as well as areas in which BMPs should be focused to reduce or abate bacterial contamination. The following is a list of each drain and the percentage of the 27 sampling dates that had a Fecal Coli/Fecal Strep ratio less than 0.7: S-2, 44.4%; S-3, 51.9%; S-5, 42.3%; S-10, 59.3%; S-12, 77.8%; and S-13, 44.4%.

By looking at the bacterial results, it is apparent that the Lower Payette River project area is a major source of bacteria to the Lower Payette River. Further examination on the effects to the Lower Payette River will be discussed in another section of this report.

Since there are many Confined Animal Feeding Operations (CAFOs) and Confined Feeding Operations (CFOs) scattered throughout the project area, each operation should be examined separately so as to determine which BMP activities need implementation. Also, further evaluation is needed to determine the current status of the septic systems in the area.

Table 12. Fecal Coliform Percent (%) Exceedence of Primary and Secondary Contact Recreation Standards (IDHW, 1992) and Percentage (%) of Samples with Fecal Coli/Fecal Strep Ratio less than 0.7. Lower Payette River SAWQP, 1992-93.

Monitoring Stations	S-2	S-3	S-5	S-10	S-12	S-13
Bacteria Densities						
Number of Total Samples	27	27	26	27	27	27
% Exceedence of Primary Contact Standard	51.8%	48.1%	46.2%	66.7%	55.6%	85.2%
% Exceedence of Secondary Contact Standard	29.6%	40.7%	26.9%	51.9%	33.3%	77.8%
% Fecal Coli/Fecal Strep Ratio Less than 0.7	44.4%	51.9%	42.3%	59.3%	77.8%	44.4%

Dacthal

During the October 1993 ground water monitoring of pesticides, the surface water sites also underwent sampling for the herbicide Dacthal. Table 13 shows the concentrations of the Dacthal, or its metoblite Dacthal di-acid, found at six of the drains; the results for Drain S-10 were unavailable due to a problem at the Bureau of Laboratories. The Dacthal di-acid laboratory analysis was done according to EPA methods 515.1/8150 and 508/8080. All surface water stations had quantifiable hits of Dacthal di-acid. As was expected, the drains that serviced the more intensively irrigated areas had the higher readings.

Dacthal di-acid is a leachable agent that can easily contaminate ground water. The herbicide was found in the ground water throughout the project area, especially in areas of intensive row crops such as onion production. The ground water contamination will be elaborated on in another section of this report. It is very likely that surface water contamination of Dacthal di-acid can be attributed to the ground water impacts. During this monitoring effort, all surface irrigation watering had ceased and no rain events had occurred for a long period of time. Therefore, the surface water detection of Dacthal di-acid was probably associated with contaminated ground water discharging to the surface water system.

Table 13. Dacthal di-acid Results from Stations S-2, S-3, S-5, S-12, and S-13. October 1993. Lower Payette River SAWQP, 1992-93.

Monitoring Stations	S-2	S-3	S-5	S-12	S-13
Dacthal µg/ℓ					
October 1993	1.0	1.0	3.0	23.3	18.4

PAYETTE RIVER

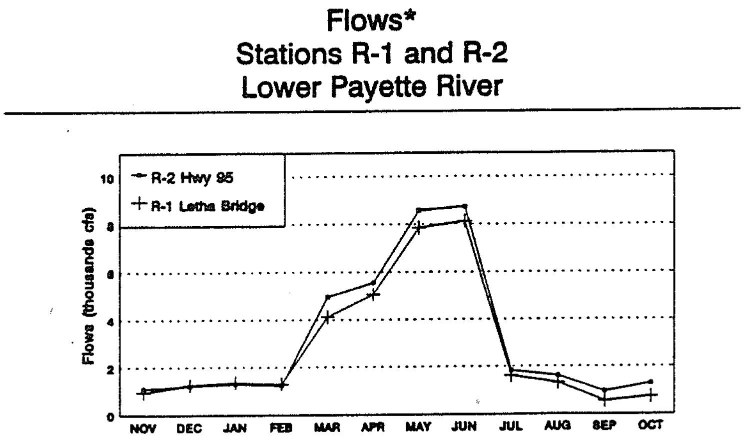
As mentioned earlier, two additional monitoring stations were established on the Payette River. Station R-1 is located on the Payette River approximately five miles upstream from the project boundary, near the town of Letha, Idaho. This site is representative of the water quality prior to impacts from the Lower Payette SAWQP Area. It is also an established water quality monitoring site for the Bureau of Reclamation (BOR), with a formal STORET number of EMM025. Flow measurements were not taken at the site by BOR personnel, but they were obtained by the Idaho Department of Water Resources (IDWR) (Personal Communications, 1994). The second station, R-2, is located on the Payette River at the Highway 95 Bridge, and is the western boundary of the project area. This station is located approximately two miles upstream of the confluence with the Snake River. Station R-2 is an established USGS trend monitoring station that receives triennial monitoring. It is hoped that Station R-2 is representative of the Payette River water quality as it leaves the project area. As with Station R-1, 1993 flows measurements for R-2 were obtained from the USGS (USGS, 1994).

Since there were several agencies involved with the monitoring of the Payette River, the resulting data of the two stations do not coincide on the same dates. Data for the Payette River monitoring is located in Appendix C.

Flow

Flow variation created a problem in trying to determine the loadings for total phosphorus. This will be discussed later on in the Payette River Nutrients section. Two types of flow data obtained from the USGS were looked at: the mean monthly discharge, and the actual flow recorded at the time of monitoring (USGS, 1994). To determine interval loads, the measured flow values at the time of monitoring were used in the calculation, as they should be. However, flows change from day to day, and if the monitoring of the two stations did not occur on the same day, wide variations in loadings can occur. For example, on May 18, 1993, the BOR conducted their monitoring effort at R-1 and through simulated flow estimates by IDWR (Personal Communication, 1994) it was determined that the discharge for that day was 10,467 cfs. On May 20, 1993, the USGS monitored R-2, determining the discharge to be 9,486 cfs. The flow values decreased by 981 cfs. However, when examining mean monthly flows, Station R-1 (the Payette River at Letha) had a mean discharge of 7,858 cfs, whereas Station R-2 (the Payette River at Highway 95) had a mean discharge of 8582 cfs. These mean flow rates increased from the up-river station to the down-river station by 724 cfs. This increase is expected, even though it is not evident when examining data obtained at the time of monitoring (refer to Figures 8 and 9). To maintain a level of consistency, all loadings will be calculated using the flow rates determined at the time of monitoring.

It is difficult to determine the effects of withdrawal from the river will have on the overall picture of nutrient, flow and sediment parameters. Currently withdrawal by local irrigation districts are estimated, with no known available records for the period of the monitoring effort. There appears to be only two withdrawal points on the Lower Payette River, Noble Canal near Station R-1, and the Lower Payette Canal.



	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT
R-2 Hwy 95	1.096	1.217	1.303	1.248	4.964	5.58	8.582	8.736	1.838	1.617	0.953	1.294
R-1 Letha Bridge	0.943	1.284	1.366	1.3	4.13	5.059	7.868	8.138	1.62	1.324	0.56	0.738

Monitoring Dates (months)

*Flows are Monthly Average Taken from IDWR

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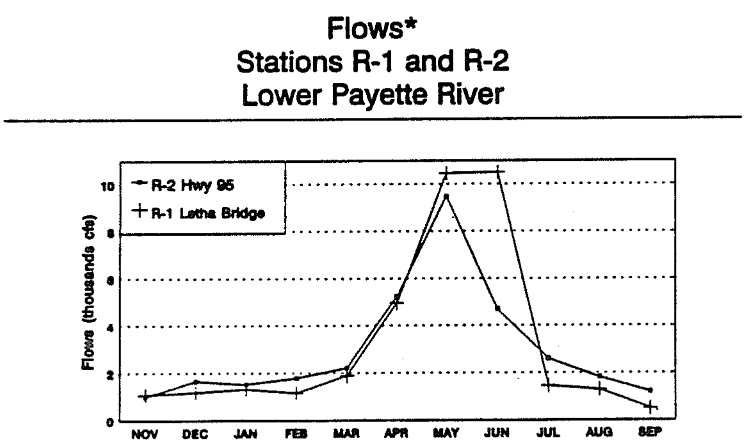
Figure 7. Lower Payette River Average Monthly Flows (IDWR).



	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
R-2 Hwy 95	1.01	1.67	1.537	1.79	2.226	5.25	9.486	4.71	2.61	1.93	1.22
R-1 Letha Bridge	1.079	1.194	1.33	1.173	1.895	4.996	10.487	10.513	1.498	1.309	0.52

Monitoring Dates (months)

*Flows Measurements Taken at Time of Monitoring

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Figure 8. Lower Payette River Flow Measurements at Time of Monitoring.

Flow variations in the Lower Payette River could have been caused by a variety of situations like the following: snowmelt period, irrigation water demand, reservoir storage demand, conditions, minimal pool requirements, flood control, and fish flushing. During the last six water years (1988 through 1993), monthly mean flow rates have varied from a low of 367 cfs in June 1988, to a high of 8,736 cfs in June 1993. Overall, 1993 had greater flows than any of the five previous years. The water years of 1988 and 1991 experienced the lowest discharges, with mean monthly flow rates never exceeding 2000 cfs.

Water quality conditions were probably very poor in the Lower Payette River from 1988 to 1991. When low flows occur, as they did during this period, dilution factors for nutrients and bacteria become low, and water temperatures tend to be high. Without good data for this period, it is difficult to determine how the low flow conditions affected the beneficial uses in the Lower Payette River. However, it is speculated that the conditions during these years were unfavorable for cold water biota, salmonid spawning, primary contact recreation, and secondary contact recreation.

Suspended Sediment

For the 1993 Water Year, suspended sediment concentrations at Station R-1 ranged from 7 mg/ℓ to 22 mg/ℓ. The overall mean concentration was 13.4 mg/ℓ (n=11) and the standard deviation was 4.9 mg/ℓ. Site R-1 had six monitoring dates (n=6) during the irrigation season (April 12, 1993 through September 8, 1993. Although the April 12th does not coincide with the overall irrigation season for the Lower Payette SAWQP area, it is felt that the water quality at the time of monitoring indicates some impacts of irrigation practices.), resulting in a suspended sediment mean concentration of 12.3 mg/ℓ and a standard deviation of 5.9 mg/ℓ. The down-river station, R-2, had an overall 1993 mean concentration of 35.0 mg/ℓ, with a standard deviation of 26.1 mg/ℓ for 9 available data points (n=9). The suspended sediment mean concentration for the R-2 irrigation season was 30.6 mg/ℓ (n=5), and the standard deviation was 11.0 mg/ℓ.

The total suspended sediment interval load for the 1993 Water Year increased by 25,552 tons from the upper site on the Payette River (R-1) to the lower site (R-2). Stations R-1 and R-2 had total suspended sediment loads of 45,576 tons/year and 75,128 tons/year, respectively. During the irrigation season alone, the interval loads were 35,051 tons at R-1 and 47,256 tons at R-2; a net increase of 12,205 tons.

Nutrients

Phosphorus

Total Phosphorus

As mentioned previously, total phosphorus loadings were skewed by the variation in USGS and IDWR flow data, particularly by the May 1993 monitoring results. The BOR monitored Station R-1 for chemical and physical parameters on May 18th, obtaining a total phosphorus concentration of 0.076 mg/ℓ and a discharge of 10,467 cfs. Using these values, the daily total phosphorus load was calculated to be 4,281 lbs. On May 20th, the USGS monitored Station R-2, and found the total phosphorus concentration to be 0.05 mg/ℓ and the flow to be 9,486 cfs. The daily load of phosphorus was then calculated to be 2,551 lbs. With this data, the total phosphorus interval loadings were calculated: R-1 had a total load of 154,116 lbs, and R-2 had a load of 64,998 lbs. The decrease in load indicates that the area between R-1 and R-2 acted as a sink for total phosphorus (refer to Figure 9).

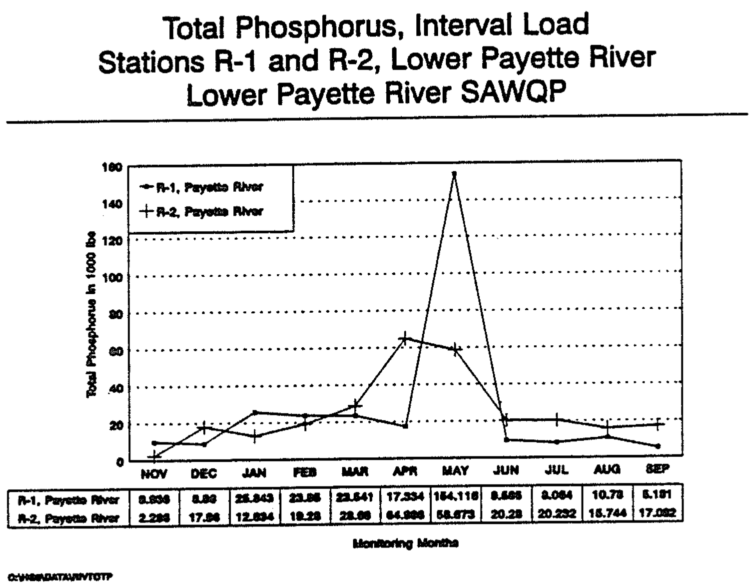


Figure 9. Lower Payette River Total Phosphorus Interval Loads.

Since the validity of the data obtained in May is questionable, an analysis of the June, July, August, and September loadings is appropriate. June 1993 had total phosphorus interval loadings of 9,595 lbs for R-1, and 20,280 lbs for R-2. This is a total phosphorus increase of 10,685 lbs (or 111%) from the up-river station to the down-river station. During July, R-1 had an total interval loading of 8,064 lbs, and R-2 had a load of 20,232 lbs; an increase of 12,168 lbs (151%). In August, the total interval load at R-1 was 10,780 lbs, and at R-2 it was 15,744 lbs. The difference was an increase of 4,964 lbs (46%). The results for the September monitoring date were calculated to have total phosphorus loads of 5,191 lbs at R-1, and 17,082 lbs at R-2; a rise of 11,891 lbs (229%). It is evident that the total phosphorus loads increased from Stations R-1 to R-2 for the months of June through September, with an overall mean increase of 134%.

Even though the total phosphorus interval loads may not be accurate for May, the data obtained for June through August is believed to be valid and representable of the water quality in the Payette River.

Dissolved Ortho-Phosphates

The most readily available forms of phosphorus for plant utilization are the dissolved ortho-phosphates. At Station R-1, dissolved ortho-phosphates made up 36% to 76% of the total phosphorus, with an average of 54%. The irrigation season (April through September) had dissolved ortho-phosphate percentages ranging from 36% to 65%, and the non-irrigation season had a percentage range of 53% to 74%.

Site R-2 had dissolved ortho-phosphate concentrations that composed 20% to 100% of the total phosphorus, averaging 44%. The irrigation season of R-2 also had a dissolved ortho-phosphate range of 20% to 100%, with the highest values recorded in June, July, and August. The R-2 non-irrigation season had a dissolved ortho-phosphate range of 20% to 43%.

The analysis of dissolved ortho-phosphates as phosphorus, in relation to total phosphorus is important in determining the pollution source and transport. The data indicates that the phosphorus in the Payette River near Letha (R-1) occurred mostly in the dissolved form. Just the opposite was the case down-river at the Highway 95 Bridge site (R-2), where it appeared to be primarily bound to sediments.

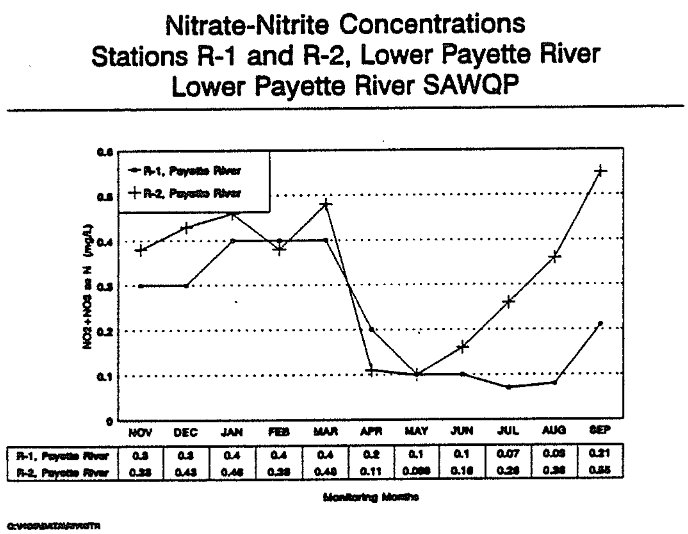
Nitrogen

Nitrite-Nitrate (NO_2+NO_3)

At Station R-1, concentrations of NO_2+NO_3 as N (dissolved) ranged from 0.07 mg/ℓ to 0.40 mg/ℓ. The highest concentrations were measured during both the irrigation and the non-irrigation seasons. During the months of November through March in the non-irrigation season, the mean was 0.36 mg/ℓ and the standard deviation was 0.05 mg/ℓ. The R-1 irrigation season had a mean concentration of 0.13 mg/ℓ, with a standard deviation of 0.06 mg/ℓ. The recommended criterion of 0.3 mg/ℓ for NO_2+NO_3 was equaled or exceeded 45% of the monitoring dates at Station R-1.

Station R-2 had a NO_2+NO_3 as N (dissolved) range from 0.099 mg/ℓ to 0.550 mg/ℓ. The mean concentration for the non-irrigation season was 0.43 mg/ℓ, where the standard deviation was 0.04 mg/ℓ. The irrigation season had a mean concentration of 0.255 mg/ℓ, with a standard deviation of 0.16 mg/ℓ. Sixty-four percent (64%) of the monitoring dates at R-2 had nitrate results that equaled or exceeded the criterion of 0.3 mg/ℓ.

It would appear that concentrations of NO_2+NO_3 as N increased from the upper Payette River station at Letha to the down-river station at Highway 95 (refer to Figure 9). During the period of June through September, the NO_2+NO_3 increase was very noticeable from R-1 to R-2. A variety of conditions could be associated with this increase: impacts from agricultural return flows, microbial activity, and greater ground water discharge to the river from irrigated lands. Since flow increased from R-1 to R-2 as well, it appears that the expected dilution of the nitrate concentrations did not take place.



	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
R-1, Payette River	0.3	0.3	0.4	0.4	0.4	0.2	0.1	0.1	0.07	0.08	0.21
R-2, Payette River	0.38	0.43	0.46	0.38	0.48	0.11	0.098	0.16	0.28	0.38	0.55

Figure 10. Lower Payette River Nitrite-Nitrate Concentrations.

Ammonia

Total ammonia (dissolved) concentrations appeared to be low enough that an evaluation comparison to the Idaho Water Quality Standards (Idaho Department of Health and Welfare, 1992) was not needed. Total ammonia concentrations ranged from < 0.010 mg/ℓ to 0.070 mg/ℓ at Station R-1. Station R-2 had total ammonia results that ranged from < 0.010 mg/ℓ to 0.050 mg/ℓ. Ammonia concentrations remained below the EPA toxic concentrations, which are estimated by taking pH and temperature levels into account. The example given previously to demonstrate this is as follows: at a pH of 9.0 su and a temperature of 15°C, the standard acute toxicity concentration is 0.86 mg/ℓ (U.S. EPA, 1986).

Bacteria

Determining bacterial densities in the surface water can be difficult since wide variations in counts can occur. Often a lack of resources and funding allow for only one-time monthly measurements to determine bacterial violations of primary and secondary contact recreation. Station R-1 has five sampling dates (n=5); however, only four of these have valid data points (n=4) to determine primary contact recreation violations. Site R-2 has eleven sampling dates (n=11), and only nine (n=9) are valid for determining secondary contact recreation violations.

The maximum, minimum, and mean Fecal Coliform and Fecal Streptococci counts for Stations R-1 and R-2 are given in Tables 14 and 15, respectively. Both stations showed increasing counts of Fecal Coliform and Fecal Streptococci from the non-irrigation season to the irrigation season. During July and August, Station R-2 Fecal Strep counts exceeded 700/100mℓ. Fecal Coli counts at R-2 decreased over the same period. This pattern was not as evident at the upriver station, R-1, where Fecal Strep counts never exceeded 450/100mℓ.

At Station R-1, the Fecal Coli/Fecal Strep ratio was less than 0.7 on two occasions; Station R-2 had a ratio less than 0.7 on five occasions. Station R-2 did have high Fecal Strep counts in comparison to Station R-1, probably indicating high amounts of waste material from livestock throughout the project area.

At no time did Fecal Coliform violations occur for primary or secondary contact recreation in the Lower Payette River. However, if Fecal Strep densities are taken into account, there would be numerous violations. Fecal Strep is a potential pathogen, and therefore it would be expected that primary contact recreation would not be supported. Also, as reported earlier, the flows recorded during Water Year 1993 were much higher than those recorded in previous years. These lower flows will increase the counts that may have been present.

Table 14. Fecal Coliform at Stations R-1 and R-2, Lower Payette River SAWQP, 1992-93.

STATION	MAXIMUM (count/100mℓ)	MINIMUM (count/100mℓ)	MEAN FECAL COLI/ FECAL STREP RATIO	GEOMETRIC MEAN (count/100mℓ)
R-1	440	50	1.23	167
R-2	380	< 7	0.88	129

Table 15. Fecal Streptococci at Stations R-1 and R-2, Lower Payette River SAWQP, 1992-93.

STATION	MAXIMUM (count/100mℓ)	MINIMUM (count/100mℓ)	MEAN FECAL COLI/ FECAL STREP RATIO	GEOMETRIC MEAN (count/100mℓ)
R-1	440	32	1.23	176
R-2	910	< 6	0.88	176

GROUND WATER

Nutrients

Nitrates-Nitrites (NO_2 + NO_3) as N

High concentrations of NO_2 + NO_3 can greatly affect the quality of domestic water supplies. Concentrations greater than 10 mg/ℓ can be associated with methemoglobin, also known as "Blue Baby Syndrome." This condition can effect young children and infants. State of Idaho Drinking Water Standards (Idaho Department of Health and Welfare, 1992) sets a limit of 10 mg/ℓ for public water supplies. Although this standard is not enforced on private domestic water supplies, it is used as an indicator for public health.

During the period October 1992 through October 1993, 59 samples were collected. Of those 59 samples, 17 samples exceed the 10 mg/ℓ standard. The range for samples were <0.005 mg/ℓ to 66.6 mg/ℓ. There was an overall mean of 9.32 mg/ℓ with a standard deviation of 12.4 mg/ℓ.

At Well # 37, the NO_2 + NO_3 concentration for October 1992 was 57.3 mg/ℓ. In April 1993 the concentration was 66.6 mg/ℓ. In October 1993 the concentration was 41.9 mg/ℓ. This well is approximately 100 feet deep and was constructed in the 1950's. No well log was available to determine the characteristics of this well, such as casing depth. The only distinguishing characteristics of this well is it's proximity to a confined animal feeding operation located up gradient about 1/4 mile. Well head protection appears adequate.

Overall, six wells had overall mean concentrations exceeding 10 mg/ℓ. Five wells had mean concentrations between 5-10 mg/ℓ. Six wells had mean concentrations between 2-5 mg/ℓ. Three wells had mean concentrations below 2 mg/ℓ. Table 16 shows the break down of wells that fall into the chosen ranges.

Table 16. Ground Water Nitrates-Nitrites (NO_2 + NO_3) as N concentrations. Lower Payette River SAWQP, 1992-1993.

Results mg/ℓ	<2.0	2.0-5.0	5.0-10.0	>10.0
Number of Wells	3	6	5	6

Refer to Figure 11 for well locations. Appendix D contains ground water information data.

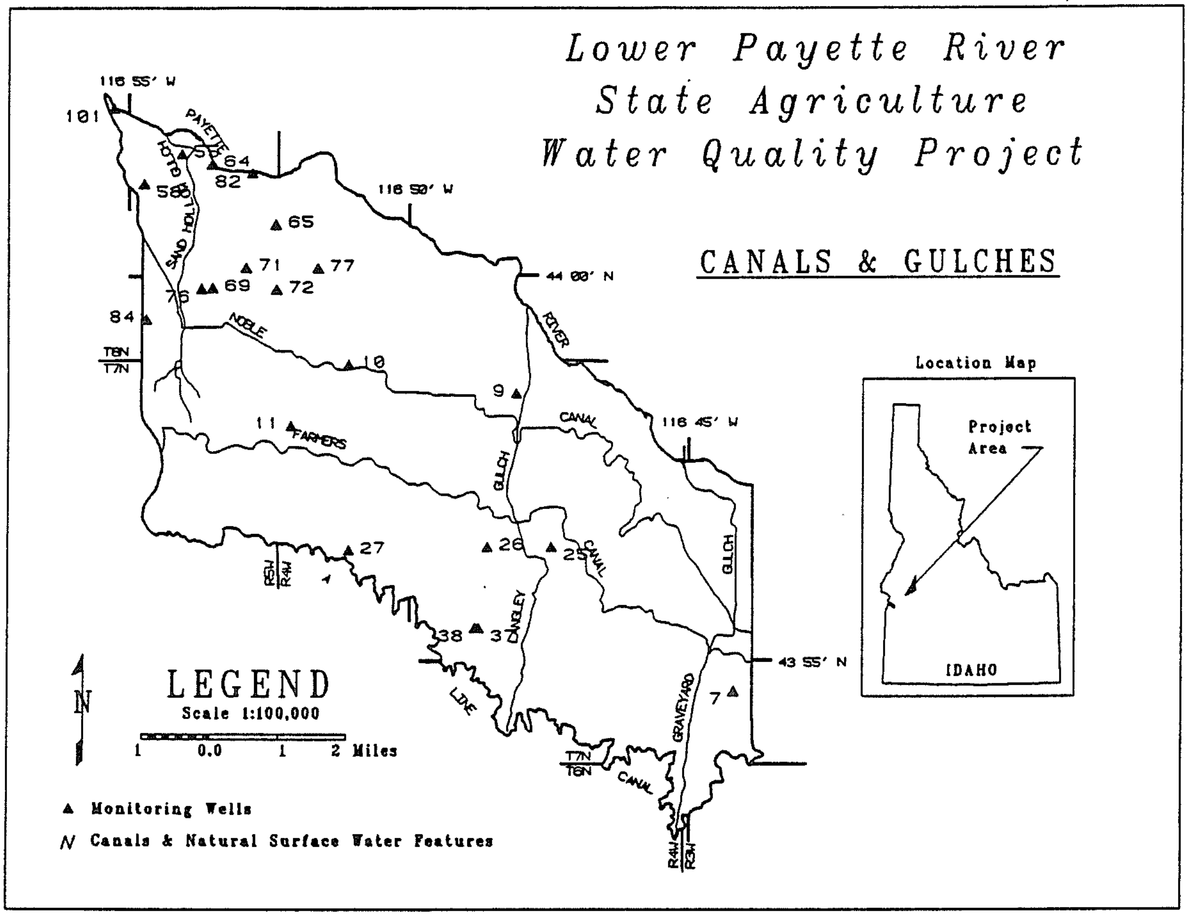


Figure 11. Ground Water Monitoring Stations. Lower Payette River SAWQP, 1992-93.

With the wide ranging values obtained from the monitoring effort, it is not clear where the greatest concentrations can be found. Most of the monitoring effort focused on the area north of the Noble Canal, east of Highway 95 and west of New Plymouth, Idaho. Concentrations > 10 mg/ℓ were found throughout the area. Concentrations < 2.0 mg/ℓ were found in three wells, all in different locations within the project area. At Well #82, ammonia had a mean concentration of 5.38 mg/ℓ, total Kjeldahl Nitrogen had a mean concentration of 4.97 mg/ℓ. This was the only well that had ammonia and/or total Kjeldahl Nitrogen that exceeds 0.5 mg/ℓ. Appendix D contains all data from ground water monitoring.

Arsenic

Arsenic is also considered to be a parameter of concern. Before the advancement of organic pesticides, arsenic was widely used for both insect and vegetation control. There is also areas in southwest Idaho where background concentrations of arsenic exceed State Drinking Water Standards. Currently there is a Idaho Drinking Water Standard of 0.05 mg/ℓ (50 μg/ℓ) for community systems (Idaho Health and Welfare, 1992). There were two wells that exceed this standard. Twelve wells had a range between 10 μg/ℓ to 50 μg/ℓ.

Arsenic was found throughout the project area. There does appear to be a tendency for higher concentrations in the north western portion of the project area.

Pesticides

Of the 38 pesticides receiving analysis, Dacthal di-acid and 2-4-D were detected in the project area. Of the twenty wells, fourteen tested positive for Dacthal di-acid. Only one well tested positive for 2-4-D. The 2-4-D was detected in Well #58 at a concentration of 0.19 μg/ℓ.

Dacthal di-acid was found mainly in the northwest portion of the project area, south of the Noble Canal, east of Highway 95 and west of New Plymouth, Idaho. Concentrations ranged from 0.04 μg/ℓ to 105 μg/ℓ. Well #65 had an overall mean concentration of 64.5 μg/ℓ.

PROJECTION MODELING FOR CUMULATIVE IMPACTS

FLOW

As mentioned earlier, a lack of resources prevented monitoring of all drains within the lower Payette River SAWQP area. Objective #1 was implemented in the hope of extrapolating impacts from monitored drains to those with no monitoring.

The first objective was to determine the discharge from each watershed. Watershed discharge can be affected by agricultural return flows, flow regimes can change due to irrigation practices, availability of irrigation water, cropping sequences, and unused irrigation water wasted from "feeder" canals. Table 17 displays mean flow rates for drains S-2, S-3, S-5, S-10, S-12, and S-13.

Table 17. Mean Flow Measurements at Stations S-2, S-3, S-5, S-10, S-12, and S-13. Lower Payette River SAWQP, 1992-93.

SEASON	S-2 (cfs)	S-3 (cfs)	S-5 (cfs)	S-10 (cfs)	S-12 (cfs)	S-13 (cfs)
OVERALL	25.8	14.4	28.6	12.8	4.7	32.4
COMBINED IRRIGATION SEASONS	28.9	16.8	32.0	14.8	5.4	38.2
NON-IRRIGATION SEASON	14.8	5.9	17.6	6.2	2.20	11.8

A simple correlation was run to determine if there was any relationship between area drained and flows recorded. Using combined irrigation season mean flow measurements and acres in each watershed an r^2 value of 0.64 (r=0.80) was obtained. This value indicated a correlation between area drained and flows recorded. The variability of flows recorded at Station S-3, caused by the wasting of irrigation water in 1993, greatly altered the difference of flows recorded during the 1992 and 1993 irrigation seasons. Flows of 10.4 cfs were recorded in 1992 compared to 21.6 cfs in 1993. Further inspection of the S-3 watershed determined that a structure exist on the Noble Canal that allows excess canal water to be wasted into the S-3 Drain. Another correlation was run without flow measurements from Station S-3. The r^2 value was 0.81 (r=0.90). Further evaluation of the inferences of the linear correlation coefficient determined that there is a dependency of the variables at a 98% Confidence Interval (p=0.02) (Johnson, 1988).

Table 18. Correlation Model Results for Estimating Flows in Drains Not Receiving Monitoring, Results From Drains Monitored in 1991, and Results For Flows Obtained in the 1992-93 Combined Irrigation Season. Lower Payette River SAWQP, 1992-93.

STATIONS	ACRES	ESTIMATED FLOWS MODELED (cfs)	MEASURED FLOWS 1991 (cfs)	MEAN FLOW 1992-93 IRRIGATION SEASONS (cfs)
S-1	5318	38	59.8	NA
S-2	4608	34	31.9	28.9
S-3	781	11	8.8	16.8
S-4	1171	13	32.4	NA
S-5	2637	22	25.4	32.0
S-6	2667	22	4.0	NA
S-7	160	7	1.2	NA
S-8	2381	20.5	14.1	NA
S-9	128	7	3.8	NA
S-10	1600	16	6.9	14.7
S-11	200	7	10.8	NA
S-12	499	9	8.1	5.4
S-13	5274	38	37.4	38.2
S-14	1773	17	32.9	NA
S-15	3245	26	22	NA

This correlation value indicated a strong correlation between area drained and flow measurements obtained. With the information obtained from the acres drained and the value from the correlation, a model was developed to help determine flows from drains that did not receive monitoring. Table 18 depicts the results from the model, along with flows obtained in 1991 and mean irrigation season flows form 1992-93.

Based on the estimated flows acquired using the mentioned flow model, further evaluation concerning suspended sediment and total phosphorus loads may be made. Concentrations for suspended sediment and total phosphorus for stations that did not receive the intensive monitoring in 1992 and 1993 were evaluated using results from the one-time monitoring effort in 1991. Tables 18 and 19 show the estimated loads for suspended sediment and total phosphorus.

SUSPENDED SEDIMENTS ESTIMATED LOADINGS

The overall project area contributes 106 tons of suspended sediment per day to the Lower Payette River (Table 19). The measured loading for the Payette River at Letha, Station R-1, was approximately 26 tons per day during the period of June through September 1993. At the Payette River at Highway 95, Station R-2, the measured suspended sediment loading is approximately 197 tons per day during the same period. Overall there is a 171 tons per day increase between Station R-1 and Station R-2. Using the modeled loadings for the Lower Payette River SAWQP area, the project area contributes approximately 62% of the total suspended sediment load for R-1 to R-2. Results for the Payette River monitoring are located in Appendix C.

Table 19. Estimated Suspended Sediment Loadings for Cumulative Impacts from the Lower Payette River SAWQP area. Lower Payette River SAWQP 1992-93.

STATIONS	SUSPENDED SEDIMENT AVERAGE CONCENTRATION (mg/ℓ)	ESTIMATED FLOW (cfs)	ESTIMATED DAILY SUSPENDED SEDIMENT LOAD (tons/day)
S-1*	26	38	3
S-2	24	34	2
S-3	48.5	11	1
S-4*	28	13	1
S-5	40	22	2
S-6*	331	22	20
S-7*	37	7	1
S-8*	322	20.5	18
S-9*	138	7	3
S-10	242	16	10
S-11*	588	7	11
S-12	123	9	3
S-13	167	38	17
S-14*	187	17	9
S-15*	82	26	6
TOTAL			106.49

*Concentrations for Suspended Sediment and Total Phosphorus taken from the 1991 monitoring event.

Further statistical evaluation of the suspended sediment loadings showed no significant difference between means. The estimated loadings and the actual measured mean loadings were compared using a F-distribution between two dependent samples. At a 95% Confidence Interval ($p=0.05$) the difference between the modeled loadings and actual measured mean loadings is between -2.6 and 1.6 tons/day.

TOTAL PHOSPHORUS ESTIMATED LOADINGS

The Lower Payette River SAWQP area contributes approximately 493 lbs/day total phosphorus to the Lower Payette River (Table 20). At Station R-1, Payette River at Letha, the measured daily load between June and September 1993 was 258 lbs/day. At station R-2, Payette River at Highway 95, the measured daily load was 664 lbs/day. This represents an overall increase of 406 lbs/day, or a 61% increase between R-1 and R-2. However, if there is already 258 lbs/day in the system and the project area contributes 493 lbs/day, there is an overall net loss of 86 lbs/day. Results for Payette River monitoring are located in Appendix C.

Table 20. Estimated Total Phosphorus Loadings for Cumulative Impacts from the Lower Payette River SAWQP area. Lower Payette River SAWQP 1992-93.

STATIONS	TOTAL PHOSPHORUS AVERAGE CONCENTRATION (mg/ℓ)	ESTIMATED FLOW (cfs)	ESTIMATED DAILY TOTAL PHOSPHORUS (lbs/day)
S-1*	0.19	38	38.9
S-2	0.19	34	34.8
S-3	0.19	11	11.3
S-4*	0.18	13	12.6
S-5	0.18	22	21.3
S-6*	0.49	22	58.0
S-7*	0.32	7	12.1
S-8*	0.49	20.5	54.1
S-9*	0.26	7	9.8
S-10	0.50	16	43.1
S-11*	0.76	7	28.6
S-12	0.39	9	18.9
S-13	0.43	38	88.0
S-14*	0.38	17	34.8
S-15*	0.19	26	26.6
TOTAL			492.9

*Concentrations for Suspended Sediment and Total Phosphorus taken from the 1991 monitoring event.

Further statistical evaluation of the total phosphorus loadings showed no significant difference between means. The modeled loadings and the actual mean loadings were compared using a F-distribution between two dependent samples. At a 95% Confidence Interval ($p=0.05$) the difference between the modeled loadings and actual measured mean loadings is between -7.9 to 5.84 lbs/day.

The net loss in the river can be contributed to many factors, such as bio-assimilation by aquatic bio-mass (phytoplankton, zooplankton, macroinvertibrates, macrophytes, and microbial activity), dewatering activity, and time of monitoring effort. Since phosphorus is an essential element for all life, the utilization can vary depending on amount of bio-mass along with chemical and physical conditions. As mentioned earlier, the most prominent form of phosphorus in the upriver portion of the project area is in the form of dissolved ortho-phosphate. This form of phosphorus is more readily available for utilization by aquatic plants in the Lower Payette River.

Since the amount of total phosphorus entering the system, including input from the project area, does not equal with the amount leaving the system, it may be difficult to determine the overall contribution in a percentage form. However, the amount of contribution associated with agricultural activity would indicate that BMPs implemented to control nutrient would be beneficial in reducing phosphorus and deterring aquatic plant growth.

NITRITES-NITRATES (NO_2 + NO_3) AS NITROGEN

Due to lack of available NO_2 + NO_3 concentrations for those drains that did not receive monitoring, it will not be possible to determine NO_2 + NO_3 impacts from the entire Lower Payette River SAWQP area. As discussed in earlier sections, NO_2 + NO_3 is impacting the Lower Payette River.

An average daily load for NO_2 +NO_3 at Station R-1 was 2862 lbs/day for Water Year 1993. At Station R-2, the average daily load for the same period was 3618 lbs/day. The monitored drains, S-2, S-3, S-5, S-10, S-12, and S-13, had a combined average NO_2 + NO_3 daily load of 2060 lbs/day. With a total of 2862 lbs/day already in the system and another 2060 lbs/day input from the monitored drains, there is an overall measured net loss of 1404 lbs/day.

As with total phosphorus, the net loss can be attributed to many factors, such as bio-assimilation by aquatic bio-mass (phytoplankton, zooplankton, macroinvertibrates, macrophytes, and microbial activity), dewatering activity, and time of monitoring effort. Since nitrogen is an essential element for all life, the utilization can vary depending on amount of bio-mass along with chemical and physical conditions. Since NO_2 +NO_3 is so readily available for plant utilization, it may be expected that some of the total load would be loss. However, the amount of loss would be affected by the amount of bio-mass and associated physical and chemical conditions.

As a non-point pollution source ground water contamination to surface waters, $NO_2 + NO_3$ should be addressed as a pollutant of concern. BMPs to address $NO_2 + NO_3$ loadings should be implemented.

BACTERIA

As demonstrated in Tables 14 and 15, page 57, there does not appear to be any difference between density counts at R-1 and R-2 for either Fecal Coliform or Fecal Streptococci. However, as demonstrated in Appendix A, fecal bacteria is a pollutant of concern for the Lower Payette River SAWQP area. Although not well documented from the results of the Payette River monitoring, the source of the bacteria should be addressed in the project area.

As mentioned in the discussion focused on water quality issues in the Payette River, 1993 was a good water year when comparing the previous five years. It is not expected that the sources of the bacteria had any difference in the contribution during the periods of less flow than what occurred in 1992-93.

The variability in the bacteria densities monitored would prohibit determining a practical estimate. Bacteria density varied from less than 10/100 mℓ to as high as 100,000/100 mℓ in the drains that received monitoring.

QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

An elaborate QA\QC program was initiated for the Lower Payette River SAWQP water quality monitoring. The initial monitoring plan (Ingham and Cardwell, 1992) described QA\QC procedures to address sample handling, sample collection, sampling location, field parameters documentation, media variability and data management.

Field measurements were documented in a three ring spiral notebook that contained the monitoring plan, aerial photos and maps to display sampling stations. This field notebook accompanied all monitoring personnel into the field on every monitoring date. Field documentation followed a strict plan that incorporated calibration of equipment and documentation of calibration methods.

Global Positioning System (GPS) data points were recorded at each monitoring site, and well locations. The recorded GPS data was later downloaded and corrected to produce some of the Geographic Information System (GIS) figures located within this report. Surface water Station S-5 was relocated after the local drainage district removed a series of beaver dams. The sampling location was moved approximately 100 yards upstream from the original site. The moving of the sampling location is not expect to affect the data gathered for this drain.

With the large number of samples being collected on each sampling date, it was determined that samples to calculate precision and accuracy collection of samples would be implemented on each sampling date. Replicate samples were collected at Station S-2 for the surface water monitoring effort. For ground water, replicate sampling were collected at wells W-71, W-26, W-9, and W-38. Spiked samples were collected at surface water Station S-13 and at wells W-10, W-7, W-27, W-26, W-38, and W-82. Since there was a number of different wells in the replication and spiking efforts, some wells received more than a one time QA/QC effort.

For surface water monitoring, average relative range was excellent for nitrite-nitrates as N (NO_2 + NO_3 as N), suspended sediment and turbidity. All these parameters had a relative range of less than 6%. Total phosphorus and dissolved ortho-phosphate were both less than 10%. Total Kjeldahl Nitrogen had a relative range of 15.4%, and ammonia 18.1%. The higher relative ranges are to be expected when low concentrations are detected. Table 21 shows the average relative range for those parameters receiving a replication sampling effort.

For ground water duplicate analysis, all inorganic compounds including Ammonia, NO_2 + NO_3 as N., Kjeldahl Nitrogen, Calcium, Sodium, Magnesium, Chloride, Sulfates, and Arsenic were incorporated into the replicate sampling. Table 22 depicts results for duplicate analysis for ground water parameters.

Table 21. Surface Water Monitoring Relative Range for Duplicated Samples. Lower Payette River SAWQP, 1992-93.

PARAMETER	NUMBER Of SAMPLES	SUM OF RELATIVE RANGE (%)	AVERAGE RELATIVE RANGE (%)
T. Kjeldahl Nitrogen	26	399.2	15.4
T. Phosphorus as P.	26	252.1	9.7
Dissolved o-phosphate	24	148.5	6.2
T.Ammonia	26	470.9	18.1
Total NO_2 + NO_3	26	31.9	1.2
Suspended Sediment	26	113.7	4.4
Turbidity	26	131.7	5.27

Table 22. Ground Water Monitoring Relative Range for Duplicated Samples. Lower Payette River SAWQP, 1992-93.

PARAMETER	NUMBER Of SAMPLES	SUM OF RELATIVE RANGE (%)	AVERAGE RELATIVE RANGE (%)
Ammonia	5	0.052	28.8
NO_2 + NO_3	5	0.61	2.5
T. Kjeldahl	4	0.05	9.0
Calcium	5	4.00	1.65
Sodium	5	6.0	1.4
Magnesium	5	1.4	0.3
Chloride	5	3.0	8.5
Sulphate	5	6.0	2.6
Arsenic	5	17.0	5.0

Surface water "spike" analysis are presented in Table 23. Results were good to excellent for Ammonia, NO_2 + NO_3 as N, Dissolved o-phosphates and suspended sediment. For Kjeldahl Nitrogen and total phosphorus the spiked results were greater than 10% but less than 12% and would be classified as good.

Ground water spiked analysis for inorganic compounds are displayed in Table 24. Poor to good percent recovery results were obtained for Chloride and Arsenic. The poor results can probably be contributed to the number of samples submitted (n=2). The other parameters showed good to excellent percent recovered.

Results for organic compounds fell within acceptable limits as outlined by the U.S. Environmental Protection Agency. Further evaluation will not be discussed.

Table 23. Surface Water Monitoring Percent Recovery for "Spiked" Samples. Lower Payette River SAWQP, 1992-93.

PARAMETER	NUMBER Of SAMPLES	AVERAGE % RECOVERED (%)	95% Confidence Interval (%) (+ or -)
Ammonia	14	93.8	8.6
NO_2 + NO_3	14	108.7	8.1
T. Kjeldahl	14	95.8	10.2
Total Phosphorus	14	105.6	11.3
Diss. o-phosphates	14	90.2	8.5
Suspended Sediment	15	94.8	3.6

Table 24. Ground Water Monitoring Percent Recovery for "Spiked" Samples. Lower Payette River SAWQP, 1992-93.

PARAMETER	NUMBER Of SAMPLES	AVERAGE % RECOVERED (%)	95% Confidence Interval (%) (+ or -)
Ammonia	7	97.5	1.9
NO_2 + NO_3	7	98.9	1.9
T. Kjeldahl	6	98.4	7.3
Magnesium	4	99.9	2.2
Sodium	4	109.1	4.9
Chloride	2	101.4	14.8
Arsenic	2	99.8	15.0

In June 1994, a memorandum from the State of Idaho Bureau of Laboratories was received concerning problems associated with Dissolved ortho-phosphate analyses complete since 1989. It was determined that there was a high bias for Dissolved ortho-phosphate results on all studies with low total phosphorus concentrations since 1989. Through laboratory QA/QC analysis it was discovered that when the automated method was used compared to the manual method, higher Dissolved ortho-phosphate concentrations were the results.

However, it is felt that the samples collected during the Lower Payette River SAWQP study had high enough concentrations of total phosphorus that the bias detected for Dissolved ortho-phosphates will not greatly alter the results. For example, at Station S-2, of the 26 samples submitted for analysis for Dissolved ortho-phosphate, 11 were greater than the results received for total phosphorus. The total phosphorus concentrations ranged from 0.11 mg/ℓ to 0.55 mg/ℓ while Dissolved Ortho-phosphates ranged from 0.094 mg/ℓ to 0.211 mg/ℓ. At

Station S-13 at no time did the Dissolved Ortho-phosphate results exceed the results for total phosphorus. The range for total phosphorus was 0.22 mg/ℓ to 0.79 mg/ℓ, while Dissolved Ortho-phosphates ranged from 0.110 mg/ℓ to 0.430 my/ℓ.

In conclusion, it is expected that at stations that recorded low total phosphorus concentrations, mainly Stations S-2 and S-3, that the Dissolved Ortho-phosphate concentrations will be somewhat high. It is not expected that the laboratory error will effect the results of this study.

Appendix E contains all data collected and data analyses for the QA/QC procedures. All QA/QC procedures followed established DEQ protocols (Bauer, 1988)

DISCUSSION AND CONCLUSION

SURFACE WATER

As was demonstrated through this monitoring effort, surface water from the Lower Payette River SAWQP area is impacting the Lower Payette River. The amount of sediments, nutrients and bacteria that may be attributed from the area, are impacting the designated beneficial uses of the Lower Payette River.

Nutrient contribution exceed criteria to prevent eutrophication of receiving waters (US. Environmental Protection Agency, 1986 and Idaho Department of Health and Welfare, 1980). Bacteria densities exceed Idaho Water Quality Standards (Idaho Department of Health and Welfare, 1992) for both primary and secondary recreational contact. Bacteria sources in the project area can presumable be contributed to animal waste products and to some extent, human waste from faulty septic systems or direct input.

Sediment delivery rates exceeded 1.5 tons/year in some of the Lower Payette River SAWQP area. To the same extent, measurable total phosphorus in selected drains can contribute up to 100 lbs/day to the river. The lose of top soil and fertilizer to receiving waters can contribute to additional cost of farming.

Nitrogen loads to the wastewater return drains can be attributed to both ground water base-flow and to some magnitude, surface run-off from agriculture lands. Further evaluation of water quality, mainly nitrates-nitrites, in the Payette River would assist in determining the severity of the pollutant.

GROUND WATER

High concentrations of nitrite-nitrate as N, are impacting domestic water supplies and surface waters in the Lower Payette SAWQP area. Some domestic water users have installed treatment systems to remove nutrients and pesticides from their drinking water. High concentrations of nitrite-nitrate as N are found throughout the entire project area. However, neighboring wells in the immediate area may have had low concentration, which may indicate that wellhead protection is needed.

Pesticide contamination appears to be located in one area. Concentrations of Dacthal averages ranged from 1.08 $\mu g/\ell$ to 64.5 $\mu g/\ell$. Most contamination is confined north of Highway 30 and to the east of Highway 95 in the Butte Road area.

RECOMMENDATIONS

1. The current activity by the Payette Soil and Water Conservation District has focused the attention on Sub-watershed 2B (Drain S-13). Monitoring data would indicate this area is the greatest area of concern when examining both surface and ground water data. The implementation of BMPs in this area will enhance both surface and ground water quality.

2. Bacteria contamination appears to be wide spread. An in-depth inventory of confined animal feeding operations along with an in-depth examination of waste management will provide additional information on bacterial sources.

3. Further evaluation of nutrient and pesticide management in the area will intensify the knowledge of how these products are stored, handled and applied. Further vadose zone monitoring will provide useful information on how these products interact with the environment.

4. Future surface and ground water monitoring will be essential to determine the effectiveness of BMPs.

5. As the development of the TMDL proceeds, further indepth monitoring of the Payette River will be needed. Along with river monitoring, studies of point source effluent and other urban sources should be initiated to assist in determine contribution from all sources.

6. Additional resources and funding should be acquired for addition monitoring of pollutant sources (drains and creeks) outside the project area. Although the Lower Payette River SAWQP area is the largest contributor of non-point pollution to the river, water quality up river of the area is also degraded.

LITERATURE CITED

American Public Health Association. 1985. Standard methods for the examination of water and waste water; American Water Works Association, Water Pollution Control Federation, Washington, D.C., 16th Edition.

Baldwin, J.A., Wicherski, B., 1992. **DRAFT.** Ground Water and Soils Reconnaissance of the Lower Payette Area, Payette County, Idaho. Idaho Department of Health and Welfare, Division of Environmental Quality. Boise, Idaho.

Bauer, S.B. 1994. Jump Creek Water Quality Status Report. State Agriculture Water Quality Program. Owyhee Soil Conservation District. Marsing, Idaho.

Bauer, S.B. 1986. Pilot study of quality assurance sample procedures 1986. Water Quality Report, Idaho Department of Health and Welfare, Division of Environmental Quality, Boise, Idaho.

Clark, W.H, T. Litke. 1991. Cedar Draw, Water Quality Status Report No. 100. Idaho Department of Health and Welfare, Division of Environmental Quality, Boise, Idaho.

Clausen, E.M., B.L. Green, and W. Litsky. 1977. Fecal streptococci: indicators of pollution IN: A. W. Hoadley and B. J. Dutka, Eds. Bacteria indicators/health hazards associated with water. American Society Testing Materials No. 635:247-264.

Idaho Department of Health and Welfare. 1980. Idaho Water Quality Status Report. Idaho Department of Health and Welfare. Division of Environmental Quality, Boise, Idaho.

_____, U.S. EPA, Idaho Soil Conservation Commission. 1983. Idaho Agricultural Abatement Plan. Idaho Department of Health and Welfare, Division of Environmental Quality, Boise, Idaho.

_____. Division of Environmental Quality. 1986. Fruitland Area Ground Water Monitoring Study. Unpublished Data. Idaho Department of Health and Welfare, Division of Environmental Quality, Boise, Idaho.

_____. Division of Environmental Quality. 1989. Idaho Water Quality Status Report and Nonpoint Source Assessment 1988. Idaho Department of Health and Welfare, Division of Environmental Quality, Boise, Idaho.

_____. Division of Environmental Quality. 1989. Weiser Area Ground Water and Soils Monitoring Study. Unpublished Data. Idaho Department of Health and Welfare, Division of Environmental Quality, Boise, Idaho.

_____. Division of Environmental Quality. 1991. Ground Water And Soils Reconnaissance Of The Lower Payette Area, Payette County, Idaho. Interim Report, Publication Pending. Idaho Department of Health and Welfare, Division of Environmental Quality, Boise, Idaho.

_____. 1992. Idaho water quality standards and wastewater treatment requirements. Idaho Department of Health and Welfare, Division of Environmental Quality. Boise, Idaho.

Idaho Department of Water Resources. 1994. Personal Communications.

Ingham, M.J., and J. Cardwell. 1992. Pre-Implementation Water Quality Monitoring Plan for the Lower Payette River Project State Agricultural Water Quality Program. Idaho Department of Health and Welfare, Division of Environmental Quality. Boise, Idaho.

Ingham, M.J. 1991. **Unpublished Data.** Summary report for August 1991,monitoring activity of drains in the Lower Payette River Water Quality Project Area. Idaho Department of Health and Welfare, Division of Environmental Quality. Boise, Idaho.

Johnson, Robert. 1988. Elementary Statistics, Fifth Edition. PWS-Kent Publishing Company. Boston, Massachusetts

Newton, G.D., 1989. Geohydrology of the regional aquifer system, Western Snake River Plain, Southwestern Idaho. United States Geological Survey. Open File Report #88-317. Boise, Idaho

Lloyd, D.S., J.P. Koenings, and J.D. Laperriere. 1987. Effects of Turbidity in Fresh Waters of Alaska. North American Journal of Fisheries Management. 7:18-33

Mackenthun, K.M. 1973. Towards a cleaner environment. U.S. Environmental Protection Agency, Washington D.C.

Payette Soil and Water Conservation District 1988. Pre-application for planning grant to the Idaho agricultural water quality program. Payette SWCD Board of Supervisors. Payette, Idaho.

Payette Soil and Water Conservation District. 1993. Lower Payette River State Agricultural Water Quality Program, Final Report. Payette SWCD Board of Supervisors.

Payette Soil and Water Conservation District. 1995. Personal Communications

Ralston, G., and M. Browne. 1976. Technical procedures manual for water quality monitoring. Idaho Department of Health and Welfare, Division of Environmental Quality. Boise, Idaho.

Rasmussen, L.M. 1976. Soil Survey of Payette County, Idaho. U.S. Department of Agriculture, Soil Conservation Service in Cooperation with University of Idaho , College of Agriculture, Idaho Agricultural Research Station.

Rupert, M. 1991. The Idaho Ground Water Vulnerability Project. Idaho Department of Health and Welfare, Division of Environmental Quality. Boise, Idaho.

Sigler, J.W., T.C. Bjorn, F.H. Everrest. 1984. Effects of chronic turbidity on density and growth of Steelhead and Coho Salmon. Transcription of the American Fisheries Society. vol. 113:142-150

Steed, R., G. Winter, J. Cardwell. 1993. Idaho Snake-Payette Rivers Hydrological Unit Ground Water Quality Assessment, Ground Water Technical Report No. 3. Idaho Department of Health and Welfare, Division of Environmental Quality. Boise, Idaho.

Tangarone, D.R., and B. Bogue. 1976. Weiser-Lower Payette Water Quality Surveys. Working Paper #EPA910/8-76-098. Region X. Seattle, Washington.

U.S. Environmental Protection Agency. 1986 Quality criteria for water, (The Gold Book). U.S. Environmental Protection Agency 440/585-001. Washington D.C.

United States Geological Survey, 1974. Payette Quadrangle, Idaho-Oregon. 7.5 Minute Series (Topographic). Scale 1:24,000

United States Geological Survey, 1994. Water Resource Data, Idaho. Water Year 1993. Volume 2. United States Geological Survey Water Data Report ID-93-2. Boise, Idaho

Williams, E.C. 1975. Cascade Reservoir and Lower Payette River Basin Water Quality Study. Bureau of Reclamation. Boise, Idaho.

APPENDIX A

Appendix A. Table of Content

Table 1. Lower Payette River SAWQP, Station S-2, Suspended Sediment-Total Phosphorus Loads, 1992-93.

DATE	Flows (cfs)	Total Phosphorus (mg/ℓ)	Total Phosphorus (lbs/day)	Suspended Sediment (mg/ℓ)	Daily Suspended Sediment (Tons/day)	Interval Suspended Sediment (Tons)
92/06/01	NA	NA	NA	NA	NA	NA
92/06/08	32.38	0.14	24.39	10	0.87	6.09
92/06/23	26.66	0.14	20.09	12	0.86	12.90
92/07/06	30.13	0.16	25.94	26	2.11	27.43
92/07/20	30.46	0.24	39.34	35	2.88	40.32
92/08/03	31.22	0.21	35.24	59	4.97	69.58
92/08/17	25.98	0.20	27.96	70	4.91	68.74
92/08/31	42.56	0.19	43.52	40	4.60	64.40
92/09/15	26.35	0.14	19.85	26	1.85	29.60
92/09/28	25.96	0.12	16.77	29	2.03	24.36
92/10/13	21.62	0.14	16.29	30	1.75	26.25
92/11/12	16.84	0.23	20.85	25	1.14	34.20
92/12/15	14.92	0.20	16.06	36	1.45	47.85
93/01/27	11.54	0.17	10.56	41	1.28	55.04
93/02/16	12.29	0.13	8.60	83	2.75	57.75
93/03/16	11.68	0.17	10.69	35	1.10	29.70
93/04/13	11.42	0.11	6.76	15	0.46	12.88
93/05/10	10.36	0.21	11.71	12	0.34	9.18
93/05/24	22.51	0.17	20.59	17	1.03	14.42
93/06/14	16.69	0.14	12.58	2	0.09	1.80
93/06/23	23.26	0.23	28.79	11	0.69	6.90
93/07/06	30.77	0.18	29.81	14	1.16	15.08
93/07/19	36.11	0.18	34.98	20	1.95	25.35
93/08/02	34.04	0.20	36.64	15	1.38	19.32
93/08/16	39.29	0.14	29.60	22	2.33	32.62
93/08/30	41.21	0.26	57.67	20	2.23	31.22
93/09/13	37.00	0.19	37.83	24	2.40	33.60
93/09/27	32.16	0.53	91.73	20	1.74	24.36

Table 1A. Statistical Analysis of S-2 Suspended Sediment-Total Phosphorus Loads. Lower Payette SAWQP, 1992-93.

OVERALL	Flows cfs	Total Phosphorus mg/ℓ	Total Phosphorus lbs/day	Suspended Sediment mg/ℓ	Daily Suspended Sediment Tons/day	Suspended Sediment Loads Tons
Number of Samples	27	27	27	27	27	820.94
Average Value	25.76	0.19	27.22	27.7	1.87	
Standard Deviation	9.67	0.08	17.39	18.2	1.26	
Maximum Value	42.56	0.53	91.73	83	4.97	
Minimum Value	10.36	0.11	6.76	2	0.09	

IRRIGATION SEASON						
Number of Samples	21	21	21	21	21	570.15
Average Value	28.88	0.19	31.04	23.8	1.95	
Standard Deviation	8.52	0.08	17.83	15.8	1.38	
Maximum Value	42.56	0.53	91.73	70	4.97	
Minimum Value	10.36	0.11	6.76	2	0.09	

NON-IRRIGATION SEASON						
Number of Samples	6	6	6	6	6	250.79
Average Value	14.81	0.17	13.83	41.7	1.58	
Standard Deviation	3.59	0.03	4.25	19.2	0.57	
Maximum Value	21.62	0.23	20.84	83	2.75	
Minimum Value	11.54	0.13	8.60	25	1.10	

Table 1B. Statistical Analysis of S-2 Suspended Sediment-Total Phosphorus Loads. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Flows cfs	Total Phosphorus mg/ℓ	Total Phosphorus lbs/day	Suspended Sediment mg/ℓ	Daily Suspended Sediment Tons/day	Suspended Sediment Loads Tons
Number of Samples	9	9	9	9	9	343.42
Average Value	30.19	0.17	28.12	34.1	2.79	
Standard Deviation	5.27	0.04	9.31	19.9	1.65	
Maximum Value	42.56	0.24	43.52	70	4.97	
Minimum Value	25.96	0.12	16.77	10	0.86	

1993 IRRIGATION SEASON						
Number of Samples	12	12	12	12	12	226.73
Average Value	27.90	0.21	33.22	16.0	1.32	
Standard Deviation	10.77	0.11	23.06	6.0	0.82	
Maximum Value	41.21	0.53	91.73	24	2.40	
Minimum Value	10.36	0.11	6.76	2	0.09	

Table 2. Lower Payette River SAWQP, Station S-3, Suspended Sediment-Total Phosphorus Loads, 1992-93.

DATE	Flows (cfs)	Total Phosphorus (mg/ℓ)	Total Phosphorus (lbs/day)	Suspended Sediment (mg/ℓ)	Daily Suspended Sediment (Tons/day)	Interval Suspended Sediment (Tons)
92/06/01	NA	NA	NA	NA	NA	NA
92/06/08	6.95	0.17	6.36	19	0.36	2.52
92/06/23	6.73	0.37	13.41	19	0.35	5.25
92/07/06	4.87	0.16	4.20	21	0.28	3.64
92/07/20	6.18	0.20	6.65	15	0.25	3.50
92/08/03	4.04	0.31	6.74	59	0.64	8.96
92/08/17	6.12	0.36	11.86	130	2.15	30.10
92/08/31	33.56	0.18	32.51	344	31.17	436.38
92/09/15	18.85	0.13	13.19	21	1.07	17.12
92/09/28	5.96	0.11	3.53	20	0.32	3.84
92/10/13	21.32	0.10	11.47	24	1.38	20.70
92/11/12	1.75	0.18	1.70	17	0.08	2.40
92/12/15	~ 3.5	0.17	3.20	31	0.29	9.57
93/01/27	~ 3.0	0.20	3.23	40	0.32	13.76
93/02/16	~ 3.0	0.27	4.36	175	1.42	29.82
93/03/16	~ 3.0	0.11	1.78	254	2.06	55.62
93/04/13	~ 2.0	0.13	1.40	13	0.07	1.96
93/05/10	46.24	0.19	47.28	52	6.49	175.23
93/05/24	11.71	0.23	14.50	55	1.74	24.36
93/06/14	36.93	0.12	23.85	30	2.99	59.80
93/06/23	3.14	0.16	2.70	17	0.14	1.40
93/07/06	3.24	0.24	4.19	10	0.09	1.17
93/07/19	19.35	0.19	19.79	30	1.57	20.41
93/08/02	37.72	0.22	44.66	60	6.11	85.54
93/08/16	17.76	0.18	17.20	20	0.96	13.44
93/08/30	22.61	0.27	32.85	40	2.44	34.16
93/09/13	29.01	0.15	23.42	25	1.96	27.44
93/09/27	29.38	0.27	42.69	18	1.43	20.02

Table 2A. Statistical Analysis of S-3 Suspended Sediment-Total Phosphorus Loads. Lower Payette SAWQP, 1992-93.

OVERALL	Flows cfs	Total Phosphorus mg/ℓ	Total Phosphorus lbs/day	Suspended Sediment mg/ℓ	Daily Suspended Sediment Tons/day	Suspended Sediment Loads Tons
Number of Samples	27	27	27	27	27	1108.11
Average Value	14.37	0.20	14.77	57.7	2.52	
Standard Deviation	13.11	0.07	13.84	78.0	5.84	
Maximum Value	46.24	0.37	47.28	344	31.17	
Minimum Value	1.75	0.10	1.40	10	0.07	
IRRIGATION SEASON						
Number of Samples	21	21	21	21	21	976.24
Average Value	16.78	0.21	17.76	48.5	2.98	
Standard Deviation	13.46	0.07	14.24	71.1	6.54	
Maximum Value	46.24	0.37	47.28	344	31.17	
Minimum Value	~ 2.0	0.11	1.40	10	0.07	
NON-IRRIGATION SEASON						
Number of Samples	6	6	6	6	6	131.87
Average Value	5.93	0.17	4.29	90.2	0.93	
Standard Deviation	6.90	0.06	3.34	91.1	0.73	
Maximum Value	21.32	0.27	11.47	254	2.06	
Minimum Value	1.75	0.10	1.70	17	0.08	

Table 2B. Statistical Analysis of S-3 Suspended Sediment-Total Phosphorus Loads. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Flows cfs	Total Phosphorus mg/ℓ	Total Phosphorus lbs/day	Suspended Sediment mg/ℓ	Daily Suspended Sediment Tons/day	Suspended Sediment Loads Tons
Number of Samples	9	9	9	9	9	511.31
Average Value	10.36	0.22	10.94	72.0	4.07	
Standard Deviation	9.75	0.10	8.91	108.6	10.18	
Maximum Value	33.56	0.37	32.51	344	31.17	
Minimum Value	4.04	0.11	3.53	15	0.25	

1993 IRRIGATION SEASON						
Number of Samples	12	12	12	12	12	464.93
Average Value	21.59	0.20	22.88	30.8	2.17	
Standard Deviation	14.77	0.05	16.22	17.1	2.14	
Maximum Value	46.24	0.27	47.28	60	0.07	
Minimum Value	~ 2.0	0.12	1.40	13	6.49	

Table 3. Lower Payette River SAWQP, Station S-5, Suspended Sediment-Total Phosphorus Loads, 1992-93.

DATE	Flows (cfs)	Total Phosphorus (mg/ℓ)	Total Phosphorus (lbs/day)	Suspended Sediment (mg/ℓ)	Daily Suspended Sediment (Tons/day)	Interval Suspended Sediment (Tons)
92/06/01	NA	NA	NA	NA	NA	NA
92/06/23	24.66	0.13	17.25	16	1.07	23.54
92/07/06	26.95	0.18	26.11	101	7.35	95.55
92/07/20	23.43	0.34	42.87	142	8.98	125.72
92/08/03	4.50	0.22	5.33	34	0.41	5.74
92/08/17	26.26	0.20	28.27	60	4.25	59.50
92/08/31	31.33	0.13	21.92	23	1.95	27.30
92/09/15	38.03	0.14	28.65	18	1.85	29.60
92/09/28	61.84	0.12	39.94	58	9.68	116.16
92/10/13	72.95	0.10	39.26	56	11.03	165.45
92/11/12	~ 6.8	0.17	6.22	4	0.07	2.10
92/12/15	9.69	0.16	8.34	6	0.16	5.28
93/01/27	6.38	0.15	5.15	6	0.10	4.30
93/02/16	5.28	0.29	8.24	30	0.43	9.03
93/03/16	4.69	0.17	4.29	9	0.11	2.97
93/04/13	5.36	0.15	4.33	24	0.35	9.80
93/05/10	30.48	0.25	41.01	65	5.35	144.45
93/05/24	33.65	0.23	41.65	79	7.18	100.52
93/06/23	32.64	0.20	35.13	37	3.26	97.80
93/07/06	21.03	0.19	21.50	19	1.08	14.04
93/07/19	36.69	0.22	43.44	6	0.59	7.67
93/08/02	23.73	0.23	29.38	9	0.58	8.12
92/08/16	42.14	0.14	31.75	27	3.07	42.98
93/08/30	33.54	0.19	34.30	10	0.91	12.74
93/09/13	43.55	0.21	49.22	16	1.88	26.32
93/09/27	68.95	0.31	155.03	24	4.47	62.58

Table 3A. Statistical Analysis of S-5 Suspended Sediment-Total Phosphorus Loads. Lower Payette SAWQP, 1992-93.

OVERALL	Flows cfs	Total Phosphorus mg/ℓ	Total Phosphorus lbs/day	Suspended Sediment mg/ℓ	Daily Suspended Sediment Tons/day	Suspended Sediment Loads Tons
Number of Samples	25	25	25	25	25	1199.26
Average Value	28.58	0.19	29.14	35.2	3.05	
Standard Deviation	19.01	0.06	22.62	33.8	3.36	
Maximum Value	72.95	0.34	155.03	142	11.03	
Minimum Value	4.50	0.10	4.29	4	0.07	

IRRIGATION SEASON						
Number of Samples	19	19	19	19	19	1010.13
Average Value	32.04	0.20	34.58	40.4	3.38	
Standard Deviation	15.22	0.06	22.41	34.9	2.94	
Maximum Value	68.95	0.34	155.03	142	9.68	
Minimum Value	4.50	0.12	4.33	6	0.35	

NON-IRRIGATION SEASON						
Number of Samples	6	6	6	6	6	189.13
Average Value	17.63	0.17	11.92	18.5	1.98	
Standard Deviation	24.79	0.06	12.32	20.7	4.43	
Maximum Value	72.95	0.29	39.26	56	11.03	
Minimum Value	4.69	0.10	4.29	4	0.07	

Table 3B. Statistical Analysis of S-5 Suspended Sediment-Total Phosphorus Loads. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Flows cfs	Total Phosphorus mg/ℓ	Total Phosphorus lbs/day	Suspended Sediment mg/ℓ	Daily Suspended Sediment Tons/day	Suspended Sediment Loads Tons
Number of Samples	8	8	8	8	8	483.11
Average Value	29.63	0.18	26.29	56.5	4.44	
Standard Deviation	16.14	0.07	12.02	44.8	3.72	
Maximum Value	61.84	0.34	42.87	142	9.68	
Minimum Value	4.50	0.12	5.33	16	0.41	

1993 IRRIGATION SEASON						
Number of Samples	11	11	11	11	11	527.02
Average Value	33.80	0.21	44.25	28.7	2.61	
Standard Deviation	15.79	0.05	38.71	23.4	2.27	
Maximum Value	68.95	0.31	155.03	79	7.18	
Minimum Value	5.36	0.14	4.33	6	0.35	

Table 4. Lower Payette River SAWQP, Station S-10, Suspended Sediment-Total Phosphorus Loads, 1992-93.

DATE	Flows (cfs)	Total Phosphorus (mg/ℓ)	Total Phosphorus (lbs/day)	Suspended Sediment (mg/ℓ)	Daily Suspended Sediment (Tons/day)	Interval Suspended Sediment (Tons)
92/06/01	NA	NA	NA	NA	NA	NA
92/06/08	4.22	0.47	10.67	219	2.49	17.43
92/06/23	7.00	0.90	33.92	863	16.32	244.80
92/07/06	16.95	0.40	36.49	288	13.18	171.34
92/07/20	10.36	0.43	23.98	230	6.43	90.02
92/08/03	9.44	0.84	42.68	268	6.83	95.62
92/08/17	18.18	0.70	68.49	452	22.19	310.66
92/08/31	19.20	0.49	50.63	351	18.20	254.80
92/09/15	10.60	0.28	15.97	116	3.32	53.12
92/09/28	18.95	0.22	22.44	148	7.57	98.44
92/10/13	19.90	0.23	24.63	182	9.78	146.70
92/11/12	2.85	0.27	4.14	66	0.51	15.30
92/12/15	3.18	0.23	3.94	30	0.26	8.58
93/01/27	~ 5.0	0.36	9.69	177	2.39	102.77
93/02/16	~ 2.0	0.29	3.12	152	0.82	17.22
93/03/16	4.30	0.70	16.20	354	4.11	110.97
93/04/13	4.74	0.44	11.22	237	3.03	84.84
93/05/10	27.71	0.43	64.13	236	17.66	476.82
93/05/24	~ 25.0	1.03	138.58	624	42.12	589.68
93/06/14	13.17	0.32	22.68	119	4.23	84.60
93/06/23	16.00	0.78	67.16	259	11.19	111.90
93/07/06	13.69	0.49	36.09	122	4.51	58.63
93/07/19	3.93	0.34	7.19	66	0.70	9.10
93/08/02	9.38	0.51	25.73	118	2.99	41.86
93/08/16	14.03	0.27	20.38	128	4.85	67.90
93/08/30	14.93	0.34	27.31	70	2.82	39.48
93/09/13	28.65	0.43	66.30	132	10.21	142.94
93/09/27	23.30	0.40	50.16	78	4.91	68.74

Table 4A. Statistical Analysis of S-10 Suspended Sediment-Total Phosphorus Loads. Lower Payette SAWQP, 1992-93.

OVERALL	Flows cfs	Total Phosphorus mg/ℓ	Total Phosphorus lbs/day	Suspended Sediment mg/ℓ	Daily Suspended Sediment Tons/day	Suspended Sediment Loads Tons
Number of Samples	27	27	27	27	27	3514.26
Average Value	12.84	0.47	33.48	221.7	8.28	
Standard Deviation	7.82	0.22	28.74	186.2	9.03	
Maximum Value	28.65	1.03	138.58	863	42.12	
Minimum Value	~ 2.0	0.22	3.12	30	0.26	
IRRIGATION SEASON						
Number of Samples	21	21	21	21	21	3112.72
Average Value	14.73	0.50	40.10	244.0	9.80	
Standard Deviation	7.17	0.22	29.10	196.7	9.59	
Maximum Value	28.65	1.03	138.58	863	42.12	
Minimum Value	3.93	0.22	7.19	66	0.70	
NON-IRRIGATION SEASON						
Number of Samples	6	6	6	6	6	401.54
Average Value	6.21	0.35	10.29	160.2	2.98	
Standard Deviation	6.20	0.16	7.86	103.5	3.32	
Maximum Value	19.90	0.70	24.63	354	9.78	
Minimum Value	~ 2.0	0.23	3.12	30	0.26	

Table 4B. Statistical Analysis of S-10 Suspended Sediment-Total Phosphorus Loads. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Flows cfs	Total Phosphorus mg/ℓ	Total Phosphorus lbs/day	Suspended Sediment mg/ℓ	Daily Suspended Sediment Tons/day	Suspended Sediment Loads Tons
Number of Samples	9	9	9	9	9	1336.23
Average Value	12.77	0.53	33.92	326.1	10.73	
Standard Deviation	5.64	0.24	18.20	225.3	6.99	
Maximum Value	19.20	0.90	68.49	863	22.19	
Minimum Value	4.22	0.22	10.67	116	2.49	

1993 IRRIGATION SEASON						
Number of Samples	12	12	12	12	12	1776.49
Average Value	16.21	0.48	44.74	182.4	9.10	
Standard Deviation	8.34	0.22	36.35	154.1	11.42	
Maximum Value	28.65	1.03	138.58	624	42.12	
Minimum Value	3.93	0.27	7.19	66	0.70	

Table 5. Lower Payette River SAWQP, Station S-12, Suspended Sediment-Total Phosphorus Loads, 1992-93.

DATE	Flows (cfs)	Total Phosphorus (mg/ℓ)	Total Phosphorus (lbs/day)	Suspended Sediment (mg/ℓ)	Daily Suspended Sediment (Tons/day)	Interval Suspended Sediment (Tons)
92/06/01	NA	NA	NA	NA	NA	NA
92/06/08	3.93	0.23	4.86	66	0.70	4.90
92/06/23	2.00	0.17	1.83	23	0.12	1.80
92/07/06	7.83	0.23	9.69	65	1.37	17.81
92/07/20	9.32	0.46	23.07	175	4.40	61.60
92/08/03	6.70	0.46	16.59	68	1.23	17.22
92/08/17	5.33	0.36	10.33	114	1.64	22.96
92/08/31	6.93	0.23	8.58	71	1.33	18.62
92/09/15	8.20	0.31	13.67	73	1.62	25.92
92/09/28	5.46	0.27	7.93	107	1.58	18.96
92/10/13	1.89	0.22	2.24	61	0.31	4.65
92/11/12	~ 1.5	0.34	2.75	53	0.21	6.30
92/12/15	~ 3.0	0.44	7.10	136	1.10	36.30
93/01/27	~ 1.0	0.86	4.63	489	1.32	56.76
93/02/16	~ 1.0	0.62	3.34	452	1.22	25.62
93/03/16	4.79	0.87	22.43	843	10.90	294.30
93/04/13	~ 1.0	0.66	3.55	372	1.00	28.00
93/05/10	< 1.0	0.41	2.21	51	0.14	3.72
93/05/24	~ 5.0	1.10	29.60	485	6.55	91.70
93/06/14	6.90	0.26	9.66	117	2.18	43.60
93/06/23	6.15	0.49	16.22	113	1.88	18.80
93/07/06	4.01	0.47	10.14	227	2.46	31.98
93/07/19	4.85	0.36	9.40	125	1.64	21.32
93/08/02	2.30	0.36	4.45	74	0.46	6.44
93/08/16	6.17	0.31	10.29	146	2.43	34.02
93/08/30	8.16	0.23	10.10	32	0.71	9.94
93/09/13	4.05	0.28	6.10	42	0.46	6.44
93/09/27	7.65	0.55	22.64	71	1.47	20.58

Table 5A. Statistical Analysis of S-12 Suspended Sediment-Total Phosphorus Loads. Lower Payette SAWQP, 1992-93.

OVERALL	Flows cfs	Total Phosphorus mg/ℓ	Total Phosphorus lbs/day	Suspended Sediment mg/ℓ	Daily Suspended Sediment Tons/day	Suspended Sediment Loads Tons
Number of Samples	27	27	27	27	27	930.26
Average Value	4.67	0.43	10.13	172.3	1.88	
Standard Deviation	2.58	0.22	7.22	192.3	2.25	
Maximum Value	9.32	1.10	29.60	843	10.90	
Minimum Value	< 1.0	0.17	1.83	23	0.12	
IRRIGATION SEASON						
Number of Samples	21	21	21	21	21	506.33
Average Value	5.38	0.39	11.00	124.6	1.68	
Standard Deviation	2.40	0.20	7.03	113.5	1.47	
Maximum Value	9.32	1.10	29.60	485	6.55	
Minimum Value	< 1.0	0.17	1.83	23	0.12	
NON-IRRIGATION SEASON						
Number of Samples	6	6	6	6	6	423.93
Average Value	2.20	0.56	7.08	339.0	2.51	
Standard Deviation	1.34	0.25	7.05	285.7	3.78	
Maximum Value	4.79	0.87	22.43	843	10.90	
Minimum Value	~ 1.0	0.22	2.24	53	0.21	

Table 5B. Statistical Analysis of S-12 Suspended Sediment-Total Phosphorus Loads. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Flows cfs	Total Phosphorus mg/ℓ	Total Phosphorus lbs/day	Suspended Sediment mg/ℓ	Daily Suspended Sediment Tons/day	Suspended Sediment Loads Tons
Number of Samples	9	9	9	9	9	189.79
Average Value	6.19	0.30	10.73	84.7	1.55	
Standard Deviation	2.27	0.10	6.35	42.8	1.18	
Maximum Value	9.32	0.46	23.07	175	4.40	
Minimum Value	2.00	0.17	1.83	23	0.12	

1993 IRRIGATION SEASON						
Number of Samples	12	12	12	12	12	316.54
Average Value	4.77	0.46	11.20	154.6	1.78	
Standard Deviation	2.41	0.24	8.06	140.7	1.70	
Maximum Value	8.16	1.10	29.60	485	6.55	
Minimum Value	< 1.0	0.23	2.21	32	0.14	

Table 6. Lower Payette River SAWQP, Station S-13, Suspended Sediment-Total Phosphorus Loads, 1992-93.

DATE	Flows (cfs)	Total Phosphorus (mg/ℓ)	Total Phosphorus (lbs/day)	Suspended Sediment (mg/ℓ)	Daily Suspended Sediment (Tons/day)	Interval Suspended Sediment (Tons)
92/06/01	NA	NA	NA	NA	NA	NA
92/06/08	89.84	0.79	381.96	550	133.41	933.87
92/06/23	35.67	0.34	65.27	207	19.94	299.10
92/07/06	51.74	0.37	103.03	193	26.96	350.48
92/07/20	38.62	0.43	89.37	218	22.73	318.22
92/08/03	34.50	0.50	92.84	150	13.97	195.58
92/08/17	17.27	0.69	64.13	402	18.74	262.36
92/08/31	34.55	0.22	40.91	43	4.01	56.14
92/09/15	18.75	0.24	24.22	30	1.52	24.32
92/09/28	24.17	0.25	32.52	96	6.26	75.12
92/10/13	22.17	0.30	35.79	48	2.87	43.05
92/11/12	~ 8.3	0.28	12.51	17	0.38	11.40
92/12/15	7.02	0.24	9.07	25	0.47	15.51
93/01/27	7.39	0.37	14.72	115	2.30	98.90
93/02/16	9.66	0.32	16.64	76	1.98	41.58
93/03/16	16.49	0.59	52.36	355	15.81	426.87
93/04/13	10.48	0.29	16.36	73	2.07	57.96
93/05/10	7.20	0.30	11.63	82	1.59	42.93
93/05/24	~ 40.0	0.65	139.93	325	35.10	491.40
93/06/14	~ 35.0	0.25	47.09	69	6.52	130.40
93/06/23	33.93	0.44	80.35	253	23.18	231.80
93/07/06	42.80	0.47	108.25	210	24.27	315.51
93/07/19	42.15	0.76	172.40	188	21.40	278.20
93/08/02	55.74	0.45	135.00	144	21.67	303.38
93/08/16	52.39	0.30	84.58	84	11.88	166.32
93/08/30	55.33	0.31	92.30	81	12.10	169.40
93/09/13	45.12	0.36	87.42	62	7.55	105.70
93/09/27	37.64	0.67	135.72	206	20.94	293.10

Table 6A. Statistical Analysis of S-13 Suspended Sediment-Total Phosphorus Loads. Lower Payette SAWQP, 1992-93.

OVERALL	Flows cfs	Total Phosphorus mg/ℓ	Total Phosphorus lbs/day	Suspended Sediment mg/ℓ	Daily Suspended Sediment Tons/day	Suspended Sediment Loads Tons
Number of Samples	27	27	27	27	27	5738.60
Average Value	32.37	0.41	79.49	159.3	17.02	
Standard Deviation	19.23	0.17	74.29	129.4	25.27	
Maximum Value	89.84	0.79	381.96	550	133.41	
Minimum Value	7.02	0.22	9.07	17	0.38	

IRRIGATION SEASON						
Number of Samples	21	21	21	21	21	5101.29
Average Value	38.23	0.43	95.49	174.6	20.75	
Standard Deviation	17.65	0.18	76.65	129.0	27.49	
Maximum Value	89.84	0.79	381.96	550	133.41	
Minimum Value	7.20	0.22	11.63	30	1.52	

NON-IRRIGATION SEASON						
Number of Samples	6	6	6	6	6	637.31
Average Value	11.84	0.35	23.51	106.0	3.97	
Standard Deviation	5.61	0.11	15.48	116.1	5.37	
Maximum Value	22.17	0.59	52.36	355	15.81	
Minimum Value	7.02	0.24	9.07	17	0.38	

Table 6B. Statistical Analysis of S-13 Suspended Sediment-Total Phosphorus Loads. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Flows cfs	Total Phosphorus mg/ℓ	Total Phosphorus lbs/day	Suspended Sediment mg/ℓ	Daily Suspended Sediment Tons/day	Suspended Sediment Loads Tons
Number of Samples	9	9	9	9	9	2515.19
Average Value	38.35	0.43	99.36	209.9	27.50	
Standard Deviation	22.07	0.20	109.52	169.5	40.67	
Maximum Value	89.84	0.79	381.96	550	133.41	
Minimum Value	17.27	0.22	24.22	30	1.52	

1993 IRRIGATION SEASON						
Number of Samples	12	12	12	12	12	2586.10
Average Value	38.15	0.44	92.59	148.1	15.69	
Standard Deviation	15.52	0.17	49.72	87.1	10.29	
Maximum Value	55.74	0.76	172.40	325	35.10	
Minimum Value	7.20	0.25	11.63	62	1.59	

Table 7. Lower Payette River SAWQP, Station S-2, Chemical Parameters 1992-93.

DATES	Ammonia as N mg/ℓ	Total NO_2+NO_3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. Ortho in Total Phoshorus (x 100)
92/06/08	< 0.005	1.19	0.71	0.14	0.170	1.21
92/06/23	0.035	1.32	0.17	0.14	0.172	1.23
92/07/06	0.034	1.21	0.38	0.16	0.180	1.13
92/07/20	0.028	1.23	0.81	0.24	0.153	0.64
92/08/03	0.031	1.73	0.32	0.21	0.170	0.81
92/08/17	0.047	1.54	0.44	0.20	0.150	0.75
92/08/31	0.036	1.44	0.44	0.19	0.130	0.68
92/09/15	0.125	1.94	0.24	0.14	0.190	1.36
92/09/28	0.030	2.01	0.20	0.12	0.161	1.34
92/10/13	< 0.005	1.89	0.40	0.14	0.163	1.16
92/11/12	0.006	2.11	0.29	0.23	0.163	0.71
92/12/15	0.057	2.35	0.12	0.20	0.177	0.89
93/01/27	0.016	2.48	0.14	0.17	0.122	0.72
93/02/16	0.023	2.35	0.59	0.13	0.142	1.09
93/03/16	0.055	2.11	0.31	0.17	0.178	1.05
93/04/13	0.028	2.29	0.26	0.11	0.129	1.17
93/05/10	0.016	2.33	0.20	0.21	0.132	0.63
93/05/24	0.044	1.19	0.16	0.17	0.094	0.55
93/06/14	0.007	1.64	0.12	0.14	0.128	0.91
93/06/23	< 0.005	1.34	0.24	0.23	0.211	0.92
93/07/06	0.010	1.22	0.06	0.18	NA	NA
93/07/19	0.035	1.16	0.19	0.18	0.114	0.63
93/08/02	< 0.005	1.20	0.13	0.20	0.109	0.55
93/08/16	0.020	1.13	0.20	0.14	0.147	1.05
93/08/30	0.034	1.38	0.42	0.26	0.147	0.57
93/09/13	< 0.005	1.38	0.31	0.19	0.177	0.93
93/09/27	0.030	1.63	0.08	0.53	0.205	0.39

Table 7A. Statistical Analysis of S-2 Chemical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Ammonia as N mg/ℓ	Total NO2 + NO3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. o-Phosphates in Total Phosphorus
Number of Samples	27	27	27	27	26	26
Average Value	0.029	1.66	0.29	0.19	0.154	0.89
Standard Deviation	0.025	0.45	0.19	0.08	0.029	0.27
Maximum Value	0.125	2.48	0.81	0.53	0.211	1.36
Minimum Value	< 0.005	1.13	0.06	0.11	0.094	0.39

IRRIGATION SEASON						
Number of Samples	21	21	21	21	20	20
Average Value	0.029	1.50	0.29	0.19	0.153	0.87
Standard Deviation	0.026	0.37	0.19	0.09	0.032	0.29
Maximum Value	0.125	2.33	0.81	0.53	0.211	1.36
Minimum Value	< 0.005	1.13	0.06	0.11	0.094	0.39

NON-IRRIGATION SEASON						
Number of Samples	6	6	6	6	6	6
Average Value	0.027	2.22	0.31	0.17	0.158	0.94
Standard Deviation	0.023	0.22	0.17	0.04	0.022	0.19
Maximum Value	0.057	2.48	0.59	0.23	0.178	1.16
Minimum Value	< 0.005	1.89	0.12	0.13	0.122	0.71

Table 7B. Statistical Analysis of S-2 Chemical Parameters. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Ammonia as N mg/ℓ	Total NO2 + NO3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. o-Phosphates in Total Phosphorus
Number of Samples	9	9	9	9	9	9
Average Value	0.041	1.51	0.41	0.17	0.164	1.01
Standard Deviation	0.033	0.32	0.22	0.04	0.018	0.29
Maximum Value	0.125	2.01	0.81	0.24	0.190	1.36
Minimum Value	< 0.005	1.19	0.20	0.12	0.150	0.64

1993 IRRIGATION SEASON						
Number of Samples	12	12	12	12	11	11
Average Value	0.020	1.49	0.20	0.21	0.145	0.75
Standard Deviation	0.014	0.42	0.10	0.11	0.038	0.25
Maximum Value	0.044	2.33	0.42	0.53	0.211	1.17
Minimum Value	< 0.005	1.13	0.06	0.11	0.094	0.55

Table 8. Lower Payette River SAWQP, Station S-3, Chemical Parameters 1992-93.

DATES	Ammonia as N mg/ℓ	Total NO_2+NO_3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. Ortho in Total Phoshorus
92/06/08	0.033	0.177	0.97	0.17	0.121	0.71
92/06/23	0.071	0.545	0.54	0.37	0.152	0.41
92/07/06	0.043	0.376	0.34	0.16	0.175	1.09
92/07/20	0.024	0.319	0.29	0.20	0.176	0.88
92/08/03	0.051	0.671	0.44	0.31	0.350	1.13
92/08/17	0.084	0.560	0.50	0.36	0.184	0.51
92/08/31	0.078	0.251	0.62	0.18	0.129	0.72
92/09/15	0.041	0.345	0.37	0.13	0.141	1.08
92/09/28	0.083	0.372	0.28	0.11	0.104	0.95
92/10/13	< 0.005	0.276	0.39	0.10	0.077	0.77
92/11/12	0.025	1.880	0.18	0.18	0.140	0.78
92/12/15	0.060	1.830	0.27	0.17	0.139	0.82
93/01/27	0.024	1.760	0.26	0.20	0.121	0.61
93/02/16	0.033	1.240	0.63	0.27	0.141	0.52
93/03/16	0.067	1.240	0.16	0.11	0.155	1.41
93/04/13	0.018	1.030	0.21	0.13	0.131	1.01
93/05/10	0.017	0.063	0.51	0.19	0.038	0.20
93/05/24	0.088	0.280	0.41	0.23	0.091	0.40
93/06/14	0.014	0.118	0.40	0.12	0.054	0.45
93/06/23	0.007	0.725	0.20	0.16	0.135	0.84
93/07/06	0.005	0.520	0.14	0.24	NA	NA
93/07/19	0.052	0.280	0.36	0.19	0.073	0.38
93/08/02	0.021	0.136	0.35	0.22	0.045	0.20
93/08/16	0.021	0.248	0.35	0.18	0.118	0.66
93/08/30	0.035	0.215	0.55	0.27	0.111	0.41
93/09/13	0.007	0.265	0.19	0.15	0.073	0.49
93/09/27	0.031	0.246	0.15	0.27	0.074	0.2

Table 8A. Statistical Analysis of S-3 Chemical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Ammonia as N mg/ℓ	Total NO2 + NO3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. o-Phosphates in Total Phosphorus
Number of Samples	27	27	27	27	26	26
Average Value	0.038	0.591	0.37	0.20	0.125	0.68
Standard Deviation	0.026	0.542	0.19	0.07	0.061	0.31
Maximum Value	0.088	1.880	0.97	0.37	0.350	1.41
Minimum Value	< 0.005	0.063	0.14	0.10	0.038	0.20
IRRIGATION SEASON						
Number of Samples	21	21	21	21	20	20
Average Value	0.039	0.369	0.39	0.21	0.124	0.64
Standard Deviation	0.027	0.233	0.19	0.07	0.069	0.31
Maximum Value	0.088	1.030	0.97	0.37	0.350	1.13
Minimum Value	0.005	0.063	0.14	0.11	0.038	0.20
NON-IRRIGATION SEASON						
Number of Samples	6	6	6	6	6	6
Average Value	0.036	1.371	0.32	0.17	0.129	0.82
Standard Deviation	0.024	0.609	0.17	0.06	0.028	0.31
Maximum Value	0.067	1.880	0.63	0.27	0.155	1.41
Minimum Value	< 0.005	0.276	0.16	0.10	0.077	0.52

Table 8B. Statistical Analysis of S-3 Chemical Parameters. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Ammonia as N mg/ℓ	Total NO2 + NO3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. o-Phosphates in Total Phosphorus
Number of Samples	9	9	9	9	9	9
Average Value	0.056	0.401	0.48	0.22	0.170	0.83
Standard Deviation	0.023	0.159	0.22	0.10	0.073	0.26
Maximum Value	0.084	0.671	0.97	0.37	0.350	1.13
Minimum Value	0.024	0.177	0.28	0.11	0.104	0.41

1993 IRRIGATION SEASON						
Number of Samples	12	12	12	12	11	11
Average Value	0.026	0.344	0.39	0.20	0.086	0.48
Standard Deviation	0.024	0.281	0.14	0.05	0.340	0.26
Maximum Value	0.088	1.030	0.55	0.27	0.135	1.01
Minimum Value	0.005	0.063	0.14	0.12	0.038	0.20

Table 9. Lower Payette River SAWQP, Station S-5, Chemical Parameters 1992-93.

DATES	Ammonia as N mg/ℓ	Total NO_2+NO_3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. Ortho in Total Phosphorus (x 100)
92/06/23	0.051	1.89	0.31	0.13	0.159	1.22
92/07/06	0.047	1.15	0.48	0.18	0.127	0.71
92/07/20	0.040	1.88	0.60	0.34	0.165	0.49
92/08/03	0.097	3.38	0.33	0.22	0.380	1.73
92/08/17	0.045	2.33	0.48	0.20	0.161	0.81
92/08/31	0.082	1.69	0.47	0.13	0.134	1.03
92/09/15	0.026	1.52	0.39	0.14	0.128	0.91
92/09/28	0.030	0.772	0.39	0.12	0.066	0.55
92/10/13	< 0.005	0.716	0.38	0.10	0.078	0.78
92/11/12	0.019	3.85	0.22	0.17	0.160	0.94
92/12/15	0.042	4.08	0.16	0.16	0.163	1.02
93/01/27	0.010	4.07	0.31	0.15	0.144	0.96
93/02/16	0.134	3.50	0.23	0.29	0.173	0.60
93/03/16	0.025	3.58	0.34	0.17	0.198	1.16
93/04/13	0.046	4.00	0.39	0.15	0.126	0.84
93/05/10	0.017	0.319	0.47	0.25	0.060	0.24
93/05/24	0.137	0.723	0.26	0.23	NA	NA
93/06/23	0.011	0.282	0.37	0.20	0.100	0.50
93/07/06	0.005	2.01	0.44	0.19	NA	NA
93/07/19	0.048	1.34	0.27	0.22	0.087	0.40
93/08/02	< 0.005	2.08	0.24	0.23	0.108	0.47
93/08/16	0.020	1.15	0.06	0.14	0.092	0.66
93/08/30	0.030	1.64	0.46	0.19	0.121	0.64
93/09/13	0.008	1.53	0.07	0.21	0.124	0.59
93/09/27	0.027	0.875	0.14	0.31	0.085	0.27

Table 9A. Statistical Analysis of S-5 Chemical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Ammonia as N mg/ℓ	Total NO2 + NO3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. o-Phosphates in Total Phosphorus
Number of Samples	25	25	25	25	23	23
Average Value	0.040	2.01	0.33	0.19	0.136	0.76
Standard Deviation	0.037	1.25	0.14	0.06	0.065	0.34
Maximum Value	0.137	4.08	0.60	0.34	0.380	1.73
Minimum Value	< 0.005	0.282	0.06	0.10	0.060	0.24
IRRIGATION SEASON						
Number of Samples	19	19	19	19	17	17
Average Value	0.041	1.61	0.35	0.20	0.131	0.71
Standard Deviation	0.034	0.939	0.15	0.06	0.071	0.37
Maximum Value	0.137	4.00	0.60	0.34	0.380	1.73
Minimum Value	< 0.005	0.282	0.06	0.12	0.060	0.24
NON-IRRIGATION SEASON						
Number of Samples	6	6	6	6	6	6
Average Value	0.039	3.30	0.27	0.17	0.153	0.91
Standard Deviation	0.048	1.29	0.08	0.06	0.041	0.20
Maximum Value	0.134	4.08	0.38	0.29	0.198	1.16
Minimum Value	< 0.005	0.716	0.16	0.10	0.078	0.60

Table 9B. Statistical Analysis of S-5 Chemical Parameters. Lower Payette SAWQP, 1992-93

1992 IRRIGATION SEASON	Ammonia as N mg/ℓ	Total NO2 + NO3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. o-Phosphates in Total Phosphorus
Number of Samples	8	8	8	8	8	8
Average Value	0.052	1.83	0.43	0.18	0.165	0.93
Standard Deviation	0.025	0.79	0.09	0.07	0.092	0.40
Maximum Value	0.097	3.38	0.60	0.34	0.380	1.73
Minimum Value	0.026	0.77	0.31	0.12	0.066	0.49

1993 IRRIGATION SEASON						
Number of Samples	11	11	11	11	8	8
Average Value	0.032	1.45	0.29	0.21	0.110	0.51
Standard Deviation	0.038	1.04	0.15	0.05	0.037	0.19
Maximum Value	0.137	4.00	0.47	0.31	0.198	0.84
Minimum Value	< 0.005	0.282	0.06	0.14	0.060	0.24

Table 10. Lower Payette River SAWQP, Station S-10, Chemical Parameters 1992-93.

DATES	Ammonia as N mg/ℓ	Total NO_2+NO_3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. Ortho in Total Phosphorus
92/06/08	0.022	2.56	1.03	0.47	0.225	0.48
92/06/23	0.072	1.81	1.19	0.90	0.161	0.18
92/07/06	0.046	1.85	0.55	0.40	0.175	0.44
92/07/20	0.040	2.41	0.60	0.43	0.207	0.48
92/08/03	0.048	4.10	1.16	0.84	0.380	0.45
92/08/17	0.052	3.36	1.14	0.70	0.190	0.27
92/08/31	0.055	2.81	1.81	0.49	0.160	0.33
92/09/15	0.052	3.14	0.64	0.28	0.194	0.69
92/09/28	0.026	2.56	0.53	0.22	0.136	0.62
92/10/13	0.029	1.64	0.66	0.23	0.103	0.45
92/11/12	0.020	5.15	0.46	0.27	0.174	0.64
92/12/15	0.030	6.40	0.28	0.23	0.173	0.75
93/01/27	0.043	6.05	0.60	0.36	0.155	0.43
93/02/16	0.149	5.37	0.74	0.29	0.189	0.65
93/03/16	0.276	5.62	1.25	0.70	0.242	0.35
93/04/13	0.086	6.15	0.66	0.44	0.209	0.48
93/05/10	0.017	0.606	0.46	0.43	0.074	0.17
93/05/24	0.039	1.68	1.05	1.03	0.122	0.12
93/06/14	0.046	3.52	0.58	0.32	0.176	0.55
93/06/23	0.029	2.27	0.94	0.78	0.209	0.27
93/07/06	0.047	3.02	0.45	0.49	NA	NA
93/07/19	0.023	3.78	0.46	0.34	0.197	0.58
93/08/02	0.027	3.01	0.48	0.51	0.172	0.34
93/08/16	0.048	3.82	0.30	0.27	0.192	0.71
93/08/30	0.043	2.46	0.52	0.34	0.185	0.54
93/09/13	0.034	1.69	0.40	0.43	0.128	0.30
93/09/27	0.037	2.02	0.10	0.40	0.148	0.37

Table 10A. Statistical Analysis of S-10 Chemical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Ammonia as N mg/ℓ	Total NO2 + NO3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. o-Phosphates in Total Phosphorus
Number of Samples	27	27	27	27	26	26
Average Value	0.053	3.29	0.71	0.47	0.180	0.45
Standard Deviation	0 052	1.58	0.38	0.22	0.055	0.17
Maximum Value	0.276	6.40	1.81	1.03	0.380	0.75
Minimum Value	0.017	0.606	0.10	0.22	0.074	0.12

IRRIGATION SEASON						
Number of Samples	21	21	21	21	20	20
Average Value	0.042	2.79	0.72	0.50	0.182	0.42
Standard Deviation	0.017	1.15	0.39	0.22	0.059	0.17
Maximum Value	0.086	6.15	1.81	1.03	0.380	0.71
Minimum Value	0.017	0.606	0.10	0.22	0.074	0.12

NON-IRRIGATION SEASON						
Number of Samples	6	6	6	6	6	6
Average Value	0.091	5.04	0.67	0.35	0.173	0.55
Standard Deviation	0.102	1.73	0.33	0.18	0.045	0.16
Maximum Value	0.276	6.40	1.25	0.70	0.242	0.75
Minimum Value	0.020	1.64	0.28	0.23	0.103	0.35

Table 10B. Statistical Analysis of S-10 Chemical Parameters. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Ammonia as N mg/ℓ	Total NO2 + NO3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. o-Phosphates in Total Phosphorus
Number of Samples	9	9	9	9	9	9
Average Value	0.046	2.73	0.96	0.53	0.206	0.44
Standard Deviation	0.015	0.73	0.42	0.24	0.073	0.16
Maximum Value	0.072	4.10	1.81	0.90	0.380	0.69
Minimum Value	0.022	1.81	0.53	0.22	0.136	0.18

1993 IRRIGATION SEASON						
Number of Samples	12	12	12	12	11	11
Average Value	0.040	2.84	0.53	0.48	0.165	0.40
Standard Deviation	0.017	1.42	0.26	0.22	0.042	0.18
Maximum Value	0.086	6.15	1.05	1.03	0.209	0.71
Minimum Value	0.017	0.61	0.10	0.27	0.122	0.17

Table 11. Lower Payette River SAWQP, Station S-12, Chemical Parameters 1992-93.

DATES	Ammonia as N mg/ℓ	Total NO_3+NO_2 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. Ortho in Total Phosphorus
92/06/08	0.012	3.64	0.77	0.23	0.215	0.93
92/06/23	0.033	4.35	0.48	0.17	0.187	1.10
92/07/06	0.038	2.69	0.48	0.23	0.171	0.74
92/07/20	0.058	2.92	0.86	0.46	0.209	0.45
92/08/03	0.044	7.28	0.89	0.46	0.290	0.63
92/08/17	0.101	4.58	0.92	0.36	0.200	0.56
92/08/31	0.039	2.36	0.92	0.23	0.124	0.54
92/09/15	0.021	4.18	0.79	0.31	0.236	0.76
92/09/28	0.038	3.77	0.68	0.27	0.159	0.59
92/10/13	0.022	5.73	0.60	0.22	0.189	0.86
92/11/12	0.031	9.25	0.55	0.34	0.288	0.85
92/12/15	0.089	10.60	0.72	0.44	0.296	0.67
93/01/27	0.036	11.30	1.11	0.86	0.251	0.29
93/02/16	0.078	8.65	1.05	0.62	0.293	0.47
93/03/16	0.089	9.08	0.076	0.87	0.346	0.40
93/04/13	0.052	10.50	0.98	0.66	0.255	0.39
93/05/10	0.021	10.30	0.52	0.41	0.255	0.62
93/05/24	0.122	3.30	1.51	1.10	0.182	0.17
93/06/14	0.017	2.15	0.44	0.26	0.089	0.34
93/06/23	0.040	3.49	0.74	0.49	0.193	0.39
93/07/06	0.011	3.68	0.53	0.47	NA	NA
93/07/19	0.030	3.08	0.69	0.36	0.145	0.40
93/08/02	< 0.005	4.93	0.49	0.36	0.186	0.52
93/08/16	0.040	2.97	0.45	0.31	0.153	0.49
93/08/30	0.043	4.34	0.50	0.23	0.174	0.76
93/09/13	0.016	4.02	0.47	0.28	0.201	0.72
93/09/27	0.030	3.82	0.36	0.55	0.197	0.36

Table 11A. Statistical Analysis of S-12 Chemical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Ammonia as N mg/ℓ	Total NO2 + NO3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. o-Phosphates in Total Phosphorus
Number of Samples	27	27	27	27	26	26
Average Value	0.043	5.44	0.69	0.43	0.211	0.58
Standard Deviation	0.029	2.94	0.29	0.23	0.060	0.22
Maximum Value	0.122	11.30	1.51	1.10	0.346	1.10
Minimum Value	< 0.005	2.15	0.076	0.17	0.089	0.17

IRRIGATION SEASON						
Number of Samples	21	21	21	21	20	20
Average Value	0.039	4.40	0.69	0.39	0.191	0.57
Standard Deviation	0.028	2.27	0.27	0.20	0.047	0.22
Maximum Value	0.122	10.50	1.51	1.10	0.290	1.10
Minimum Value	< 0.005	2.15	0.36	0.17	0.089	0.17

NON-IRRIGATION SEASON						
Number of Samples	6	6	6	6	6	6
Average Value	0.058	9.10	0.68	0.56	0.277	0.59
Standard Deviation	0.031	1.93	0.38	0.27	0.053	0.24
Maximum Value	0.089	11.30	1.11	0.87	0.346	0.86
Minimum Value	0.022	5.73	0.076	0.22	0.189	0.29

Table 11B. Statistical Analysis of S-12 Chemical Parameters. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Ammonia as N mg/ℓ	Total NO2 + NO3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. o-Phosphates in Total Phosphorus
Number of Samples	9	9	9	9	9	9
Average Value	0.043	3.97	0.75	0.30	0.199	0.70
Standard Deviation	0.025	1.46	0.17	0.10	0.048	0.21
Maximum Value	0.101	7.28	0.92	0.46	0.290	1.10
Minimum Value	0.012	2.36	0.48	0.17	0.124	0.45

1993 IRRIGATION SEASON						
Number of Samples	12	12	12	12	11	11
Average Value	0.026	4.72	0.64	0.46	0.185	0.47
Standard Deviation	0.015	2.75	0.32	0.24	0.047	0.18
Maximum Value	0.122	10.5	1.51	1.10	0.255	0.76
Minimum Value	< 0.005	2.15	0.36	0.23	0.089	0.17

Table 12. Lower Payette River SAWQP, Station S-13, Chemical Parameters 1992-93.

DATES	Ammonia as N mg/ℓ	Total NO_2+NO_3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. Ortho in Total Phosphorus
92/06/08	0.041	2.94	0.99	0.79	0.190	0.24
92/06/23	0.058	2.68	0.91	0.34	0.171	0.50
92/07/06	0.043	2.35	0.71	0.37	0.199	0.54
92/07/20	0.050	3.46	0.66	0.43	0.180	0.42
92/08/03	0.678	5.68	1.21	0.50	0.430	0.86
92/08/17	0.057	3.70	1.19	0.69	0.235	0.34
92/08/31	0.092	4.19	0.76	0.22	0.165	0.75
92/09/15	< 0.005	3.96	0.56	0.24	0.211	0.88
92/09/28	0.049	5.08	0.53	0.25	0.156	0.62
92/10/13	0.477	3.74	1.21	0.30	0.242	0.81
92/11/12	0.474	6.75	1.50	0.28	0.219	0.78
92/12/15	0.095	7.38	0.44	0.24	0.215	0.90
93/01/27	0.070	7.83	0.83	0.37	0.188	0.51
93/02/16	0.223	6.39	0.85	0.32	0.204	0.64
93/03/16	0.476	7.05	2.99	0.59	0.303	0.51
93/04/13	0.097	7.58	0.65	0.29	0.196	0.68
93/05/10	0.038	6.13	0.62	0.30	0.179	0.60
93/05/24	0.033	1.99	1.08	0.65	0.110	0.17
93/06/15	0.019	2.42	0.47	0.25	0.135	0.54
93/06/23	0.021	2.63	0.78	0.44	0.168	0.38
93/07/06	0.042	3.11	0.79	0.47	NA	NA
93/07/19	0.049	4.04	0.78	0.76	0.214	0.28
93/08/02	0.050	2.80	0.93	0.45	0.150	0.33
93/08/16	0.057	2.92	0.47	0.30	0.193	0.64
93/08/30	0.065	3.49	0.53	0.31	0.163	0.53
93/09/13	0.022	3.16	0.55	0.36	0.188	0.52
93/09/27	0.050	3.28	0.87	0.67	0.171	0.26

Table 12A. Statistical Analysis of S-13 Chemical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Ammonia as N mg/ℓ	Total NO2 + NO3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. o-Phosphates in Total Phosphorus
Number of Samples	27	27	27	27	26	26
Average Value	0.127	4.32	0.88	0.41	0.199	0.55
Standard Deviation	0.178	1.82	0.50	0.17	0.060	0.21
Maximum Value	0.678	7.83	2.99	0.79	0.430	0.90
Minimum Value	< 0.005	1.99	0.44	0.22	0.110	0.17

IRRIGATION SEASON						
Number of Samples	21	21	21	21	20	20
Average Value	0.077	3.69	0.76	0.43	0.190	0.50
Standard Deviation	0.139	1.39	0.22	0.18	0.063	0.20
Maximum Value	0.678	7.58	1.21	0.79	0.430	0.88
Minimum Value	< 0.005	1.99	0.47	0.22	0.110	0.17

NON-IRRIGATION SEASON						
Number of Samples	6	6	6	6	6	6
Average Value	0.303	6.52	1.30	0.35	0.229	0.69
Standard Deviation	0.197	1.45	0.90	0.13	0.041	0.16
Maximum Value	0.477	7.83	2.99	0.59	0.303	0.90
Minimum Value	0.070	3.74	0.44	0.24	0.188	0.51

Table 12B. Statistical Analysis of S-13 Chemical Parameters. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Ammonia as N mg/ℓ	Total NO2 + NO3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. o-Phosphates in Total Phosphorus
Number of Samples	9	9	9	9	9	9
Average Value	0.119	3.78	0.84	0.43	0.215	0.57
Standard Deviation	0.211	1.09	0.25	0.20	0.084	0.23
Maximum Value	0.678	5.68	1.21	0.79	0.430	0.88
Minimum Value	< 0.005	2.35	0.53	0.22	0.156	0.24

1993 IRRIGATION SEASON						
Number of Samples	12	12	12	12	11	11
Average Value	0.045	3.63	0.71	0.44	0.170	0.45
Standard Deviation	0.022	1.62	0.19	0.17	0.030	0.17
Maximum Value	0.097	7.58	1.08	0.76	0.214	0.68
Minimum Value	0.019	1.99	0.47	0.25	0.110	0.17

Table 13. Lower Payette River SAWQP, Station S-2, Physical Parameters 1992-93.

DATES	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
92/06/08	NA	NA	NA	32.4	NA	NA
92/06/23	16.4	7.47	7.2	26.7	2	320
92/07/06	15.5	7.48	7.73	30.1	3	280
92/07/20	16.8	7.09	4.84	30.5	4	180
92/08/03	16.2	7.49	6.58	31.2	6	350
92/08/17	16.7	7.60	5.38	26.0	7	360
92/08/31	15.3	7.01	7.60	42.6	5	340
92/09/15	14.2	7.90	6.81	26.4	4	360
92/09/28	13.6	7.34	8.64	26.0	3	370
92/10/13	14.3	9.32	8.15	21.6	4	370
92/11/12	13.1	7.46	8.36	16.8	4	360
92/12/15	11.4	8.99	NA	14.9	7	390
93/01/27	11.0	NA	NA	11.5	3	385
93/02/16	9.0	NA	NA	12.3	12	390
93/03/16	11.5	NA	NA	11.7	4	410
93/04/13	11.0	NA	NA	11.4	1	410
93/05/10	13.3	8.25	NA	10.4	1	500
93/05/24	13.6	7.95	NA	22.5	4	295
93/06/14	17.0	8.33	NA	16.7	NA	350
93/06/23	14.0	8.5	NA	23.3	3	300
93/07/06	14.5	7.9	NA	30.8	4.1	280
93/07/19	NA	8.0	NA	36.1	4	283
93/08/02	16.0	NA	NA	34.0	4	310
93/08/16	14.0	7.57	NA	39.3	3	300
93/08/30	14.0	NA	NA	41.2	3	300
93/09/13	14.0	NA	NA	37.0	4	280
93/09/27	14.0	8.12	NA	32.2	3	350

Table 13A. Statistical Analysis of S-2 Physical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
Number of Samples	25	19	10	27	25	26
Average Value	14.0	7.88	7.13	25.8	4.1	339.3
Standard Deviation	2.1	0.61	1.25	9.9	2.2	61.2
Maximum Value	17.0	9.32	8.64	42.6	12	500
Minimum Value	9.0	7.01	4.84	10.4	1	180
IRRIGATION SEASON						
Number of Samples	19	16	8	21	19	20
Average Value	14.7	7.75	6.85	28.9	3.6	325.9
Standard Deviation	1.5	0.44	1.25	8.7	1.5	63.4
Maximum Value	17.0	8.5	8.64	42.6	7	500
Minimum Value	11.0	7.01	4.84	10.4	1	180
NON-IRRIGATION SEASON						
Number of Samples	6	3	2	6	6	6
Average Value	11.7	8.59	8.26	14.8	5.7	384.2
Standard Deviation	1.8	0.99	0.15	3.9	3.4	17.4
Maximum Value	14.3	9.32	8.36	21.6	12	410
Minimum Value	9.0	7.46	8.15	11.5	3	360

Table 13B. Statistical Analysis of S-2 Physical Parameters. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity μmhos
Number of Samples	8	8	8	9	8	8
Average Value	15.6	7.42	6.85	30.2	4.3	320.0
Standard Deviation	1.2	0.28	1.25	5.3	1.7	63.5
Maximum Value	16.8	7.90	8.64	42.6	7	370
Minimum Value	13.6	7.01	4.84	26.0	2	180

1993 IRRIGATION SEASON						
Number of Samples	11	8	NA	12	11	12
Average Value	14.1	8.08	NA	27.9	3.1	329.8
Standard Deviation	1.5	0.29	NA	10.8	1.1	65.8
Maximum Value	17.0	8.5	NA	41.2	4.1	500
Minimum Value	11.0	7.57	NA	10.4	1	280

Table 14. Lower Payette River SAWQP, Station S-3, Physical Parameters 1992-93.

DATES	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
92/06/08	NA	NA	NA	7.0	NA	NA
92/06/23	19.0	7.47	7.45	6.7	4	220
92/07/06	15.5	7.48	8.04	4.9	12	200
92/07/20	18.0	7.23	5.25	6.2	3	110
92/08/03	16.5	7.23	5.62	4.0	7	285
92/08/17	18.0	7.46	4.35	6.1	33	250
92/08/31	18.0	7.11	7.77	33.6	13	150
92/09/15	14.8	7.57	7.12	18.9	4	160
92/09/28	13.9	7.32	9.12	6.0	5	170
92/10/13	14.2	9.25	8.19	21.3	5	160
92/11/12	9.7	7.33	8.48	1.8	3	320
92/12/15	6.6	NA	9.0	~ 3.5	8	315
93/01/27	6.0	NA	NA	~ 3.0	9	310
93/02/16	8.0	NA	NA	~ 3.0	31	300
93/03/16	10.0	NA	NA	~ 3.0	30	350
93/04/13	11.0	NA	NA	~ 2.0	2	350
93/05/10	11.2	7.8	NA	46.2	13	70
93/05/24	13.6	7.38	NA	11.7	19	110
93/06/14	14.0	7.83	10.2	36.9	NA	700
93/06/23	15.5	8.6	NA	3.1	5	245
93/07/06	15.5	8.3	NA	3.2	6.2	260
93/07/19	NA	7.77	NA	19.4	7	121
93/08/02	19.5	NA	NA	37.7	15	100
93/08/16	16.5	7.66	NA	17.8	6	NA
93/08/30	15.0	NA	NA	22.6	7	120
93/09/13	15.0	NA	NA	29.0	6	100
93/09/27	14.0	7.98	NA	29.4	3	110

Table 14A. Statistical Analysis of S-3 Physical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity μmhos
Number of Samples	25	18	12	27	25	25
Average Value	14.0	7.71	7.55	14.4	10.2	223.4
Standard Deviation	3.7	0.54	1.72	13.4	9.0	133.4
Maximum Value	19.5	9.25	10.2	46.2	33	700
Minimum Value	6.0	7.11	4.35	1.8	2	70

IRRIGATION SEASON						
Number of Samples	20	16	9	21	19	20
Average Value	15.5	7.64	7.21	16.8	9.0	201.6
Standard Deviation	2.3	0.40	1.88	13.8	7.4	142.8
Maximum Value	19.5	8.6	10.2	46.2	33	700
Minimum Value	11.0	7.11	4.35	2.0	2	70

NON-IRRIGATION SEASON						
Number of Samples	6	2	3	6	6	6
Average Value	9.1	8.29	8.56	5.9	14.3	292.5
Standard Deviation	3.0	1.36	0.41	7.5	12.7	67.1
Maximum Value	14.2	9.25	9.0	21.3	31	350
Minimum Value	6.0	7.33	8.19	1.8	3	160

Table 14B. Statistical Analysis of S-3 Physical Parameters. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
Number of Samples	8	8	8	9	8	8
Average Value	16.7	7.36	6.84	10.4	10.1	193.1
Standard Deviation	1.8	0.16	1.61	9.8	10.0	57.1
Maximum Value	19.0	7.57	9.12	33.6	33	285
Minimum Value	13.9	7.11	4.35	4.0	3	110

1993 IRRIGATION SEASON						
Number of Samples	11	8	1	12	11	11
Average Value	14.6	7.92	10.2	21.6	8.1	207.8
Standard Deviation	2.4	0.38	0	14.8	5.3	185.3
Maximum Value	19.5	8.6	10.2	46.2	19	700
Minimum Value	11.0	7.38	10.2	2.0	2	70

Table 15. Lower Payette River SAWQP, Station S-5, Physical Parameters 1992-93.

DATES	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
92/06/08	NA	NA	NA	NA	NA	NA
92/06/23	20.4	8.5	NA	24.7	4	345
92/07/06	19.3	8.23	8.21	27.0	33	220
92/07/20	18.4	7.24	7.26	23.4	44	345
92/08/03	18.2	7.82	8.71	4.5	8	360
92/08/17	19.3	7.91	6.53	26.3	16	380
92/08/31	18.2	7.63	9.37	31.3	5	295
92/09/15	15.6	8.18	8.30	38.0	4	248
92/09/28	15.7	7.02	9.74	61.8	12	170
92/10/13	15.0	9.05	8.38	73.0	8	170
92/11/12	11.2	8.08	9.99	~ 6.8	1	400
92/12/15	8.5	NA	10.34	9.7	1	430
93/01/27	9.0	NA	NA	6.4	2	420
93/02/16	10.0	NA	NA	5.3	5	480
93/03/16	11.5	NA	NA	4.7	2	470
93/04/13	14.0	NA	NA	5.4	3	500
93/05/10	15.3	7.82	NA	30.5	18	90
93/05/24	18.5	8.5	NA	33.7	23	140
93/06/23	17.0	8.6	NA	32.6	8	225
93/07/06	NA	8.3	NA	21.0	5	NA
93/07/19	NA	8.14	NA	36.7	92	240
93/08/02	21.0	NA	NA	23.7	4.3	340
93/08/16	17.0	7.85	NA	42.1	6	220
93/08/30	16.0	NA	NA	33.5	4	270
93/09/13	17.5	NA	NA	43.6	6	240
93/09/27	16.5	8.28	NA	69.0	5	160

Table 15A. Statistical Analysis of S-5 Physical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
Number of Samples	23	17	10	25	25	24
Average Value	15.8	8.07	8.68	28.6	12.8	298.3
Standard Deviation	3.6	0.50	1.21	19.4	19.5	116.2
Maximum Value	21.0	9.05	10.34	73.0	92	500
Minimum Value	8.5	7.02	6.53	4.5	1	90

IRRIGATION SEASON						
Number of Samples	17	15	7	19	19	18
Average Value	17.5	8.00	8.30	32.0	15.8	266.0
Standard Deviation	1.9	0.46	1.13	15.6	21.5	100.1
Maximum Value	21.0	8.6	9.74	69.0	92	500
Minimum Value	14.0	7.02	6.53	4.5	3	90

NON-IRRIGATION SEASON						
Number of Samples	6	2	3	6	6	6
Average Value	10.9	8.57	9.57	17.7	3.2	395.0
Standard Deviation	2.3	0.69	1.05	27.2	2.8	114.3
Maximum Value	15.0	9.05	10.34	73.0	8	480
Minimum Value	8.5	8.08	8.38	4.7	1	170

Table 15B. Statistical Analysis of S-5 Physical Parameters. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
Number of Samples	8	8	7	8	8	8
Average Value	18.1	7.82	8.30	29.6	15.8	295.4
Standard Deviation	1.7	0.50	1.13	16.1	14.9	75.5
Maximum Value	20.4	8.5	9.74	61.8	44	380
Minimum Value	15.6	7.02	6.53	4.5	4	170

1993 IRRIGATION SEASON						
Number of Samples	9	7	NA	11	11	10
Average Value	17.0	8.21	NA	33.8	15.8	242.5
Standard Deviation	2.0	0.30	NA	15.8	26.0	114.5
Maximum Value	21.0	8.6	NA	69.0	92	500
Minimum Value	14.0	7.82	NA	5.4	3	90

Table 16. Lower Payette River SAWQP, Station S-10, Physical Parameters 1992-93.

DATES	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
92/06/08	NA	NA	NA	4.2	NA	NA
92/06/23	18.1	8.14	7.46	7.0	123	320
92/07/06	16.3	7.96	8.5	17.0	93	260
92/07/20	17.6	7.56	7.54	10.4	60	130
92/08/03	17.5	7.85	7.37	9.4	81	350
92/08/17	17.7	7.99	5.85	18.2	86	360
92/08/31	15.8	7.01	8.84	19.2	40	350
92/09/15	13.8	7.61	8.09	10.6	30	310
92/09/28	13.0	7.45	9.80	19.0	35	290
92/10/13	13.9	9.33	8.41	19.9	32	250
92/11/12	9.6	7.93	9.53	2.9	12	420
92/12/15	7.5	NA	12.21	3.2	5	445
93/01/27	3.0	NA	NA	~ 5.0	37	410
93/02/16	8.0	NA	NA	~ 2.0	26	440
93/03/16	10.0	NA	NA	4.3	46	600
93/04/13	10.0	NA	NA	4.7	30	440
93/05/10	13.9	7.85	NA	27.7	35	125
93/05/24	18.0	7.65	NA	~ 25.0	155	240
93/06/14	14.7	8.27	10.8	13.2	NA	370
93/06/23	15.0	8.6	NA	16.0	50	285
93/07/06	17.5	8.1	NA	13.7	36	330
93/07/19	NA	8.24	NA	3.9	24	416
93/08/02	21.0	NA	NA	9.4	44	370
93/08/16	14.0	8.02	NA	14.0	37	360
93/08/30	14.0	NA	NA	14.9	26	210
93/09/13	15.5	NA	NA	28.7	16	160
93/09/27	13.0	8.18	NA	23.3	20	245

Table 16A. Statistical Analysis of S-10 Physical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
Number of Samples	25	18	12	27	25	26
Average Value	13.9	7.99	8.7	12.8	47.2	326.4
Standard Deviation	4.1	0.49	1.7	8.0	35.3	108.4
Maximum Value	21.0	9.33	12.21	28.7	155	600
Minimum Value	3.0	7.01	5.85	2.0	5	125

IRRIGATION SEASON						
Number of Samples	19	16	9	21	19	20
Average Value	15.6	7.91	8.25	14.7	53.7	296.1
Standard Deviation	2.5	0.38	1.46	7.4	37.5	89.4
Maximum Value	21.0	8.6	10.8	28.7	155	440
Minimum Value	10.0	7.01	5.85	3.9	16	125

NON-IRRIGATION SEASON						
Number of Samples	6	2	3	6	6	6
Average Value	8.7	8.63	10.05	6.2	26.3	427.5
Standard Deviation	3.6	0.99	1.95	6.8	15.4	111.4
Maximum Value	13.9	9.33	12.21	19.9	46	600
Minimum Value	3.0	7.93	8.41	2.0	5	250

Table 16B. Statistical Analysis of S-10 Physical Parameters. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
Number of Samples	8	8	8	9	8	8
Average Value	16.2	7.70	7.93	12.8	68.5	296.3
Standard Deviation	1.9	0.37	1.18	5.7	32.8	75.2
Maximum Value	18.1	8.14	9.80	19.2	123	360
Minimum Value	13.0	7.01	5.85	4.2	30	130

1993 IRRIGATION SEASON						
Number of Samples	11	8	1	12	11	12
Average Value	15.1	8.11	10.8	16.2	43.0	295.9
Standard Deviation	2.9	0.29	0	8.4	38.5	101.1
Maximum Value	21.0	8.6	10.8	28.7	155	440
Minimum Value	10.0	7.65	10.8	3.9	16	125

Table 17. Lower Payette River SAWQP, Station S-12, Physical Parameters 1992-93.

DATES	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
92/06/08	NA	NA	NA	3.9	NA	NA
92/06/23	18.5	8.22	8.69	2.0	NA	450
92/07/06	17.0	6.87	8.32	7.8	28	285
92/07/20	19.1	7.18	6.43	9.3	57	130
92/08/03	17.7	7.10	6.27	6.7	26	500
92/08/17	18.9	8.06	5.58	5.3	25	450
92/08/31	17.1	7.60	8.17	6.9	19	310
92/09/15	14.1	7.80	7.89	8.2	27	390
92/09/28	12.4	7.26	9.86	5.5	29	330
92/10/13	15.6	9.27	9.67	1.9	21	480
92/11/12	8.8	7.83	9.68	~ 1.5	20	550
92/12/15	6.8	NA	10.9	~ 3.0	54	600
93/01/27	6.0	NA	NA	~ 1.0	128	600
93/02/16	8.5	NA	NA	~ 1.0	82	560
93/03/16	9.0	NA	NA	4.8	117	700
93/04/13	10.0	NA	NA	NA	54	500
93/05/10	15.7	8.34	NA	< 1.0	14	550
93/05/24	18.5	7.9	NA	~ 5.0	100	370
93/06/14	17.0	8.44	10.2	6.9	NA	230
93/06/23	16.0	8.7	NA	6.2	38	300
93/07/06	17.0	8.1	NA	4.0	70	360
93/07/19	NA	8.01	NA	4.9	46	298
93/08/02	20.5	NA	NA	2.3	29	500
93/08/16	15.0	8.13	NA	6.2	38	330
93/08/30	15.0	NA	NA	8.2	19	380
93/09/13	15.0	NA	NA	4.1	7	370
93/09/27	12.0	8.21	NA	7.7	23	350

Table 17A. Statistical Analysis of S-12 Physical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
Number of Samples	25	18	12	26	24	26
Average Value	14.4	7.95	8.47	4.8	44.6	406.1
Standard Deviation	4.1	0.60	1.69	2.5	32.9	151.2
Maximum Value	20.5	9.27	10.9	9.3	128	700
Minimum Value	6.0	6.87	5.58	< 1.0	7	130

IRRIGATION SEASON						
Number of Samples	19	16	9	20	18	20
Average Value	16.1	7.87	7.93	5.6	36.1	369.2
Standard Deviation	2.7	0.53	1.59	2.2	22.6	102.1
Maximum Value	20.5	8.7	10.2	9.3	100	550
Minimum Value	10.0	6.87	5.58	< 1.0	7	130

NON-IRRIGATION SEASON						
Number of Samples	6	2	3	6	6	6
Average Value	9.1	8.55	10.08	2.2	70.3	581.7
Standard Deviation	3.4	1.02	0.71	1.5	46.6	72.8
Maximum Value	15.6	9.27	10.9	4.8	128	700
Minimum Value	6.0	7.83	9.67	1.0	20	480

Table 17B. Statistical Analysis of S-12 Physical Parameters. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
Number of Samples	8	8	8	9	7	8
Average Value	16.9	7.51	7.65	6.2	30.1	355.6
Standard Deviation	2.4	0.49	1.44	2.3	12.3	118.6
Maximum Value	19.1	8.22	9.86	9.3	57	500
Minimum Value	12.4	6.87	5.58	2.0	19	130

1993 IRRIGATION SEASON						
Number of Samples	11	8	1	11	11	12
Average Value	15.6	8.23	10.2	5.1	39.8	378.2
Standard Deviation	2.9	0.26	0	2.2	27.1	94.0
Maximum Value	20.5	8.7	10.2	8.2	100	550
Minimum Value	10.0	7.9	10.2	< 1.0	7	230

Table 18. Lower Payette River SAWQP, Station S-13, Physical Parameters 1992-93.

DATES	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
92/06/08	NA	NA	NA	89.8	NA	NA
92/06/23	19.2	8.02	7.41	35.7	48	340
92/07/06	17.1	7.88	8.04	51.7	48	290
92/07/20	18.3	7.22	6.82	38.6	46	160
92/08/03	17.8	7.29	6.02	34.5	40	450
92/08/17	18.6	7.91	5.26	17.3	40	440
92/08/31	15.9	7.40	8.73	34.6	12	430
92/09/15	15.4	7.70	7.84	18.8	9	410
92/09/28	14.5	7.32	9.69	24.2	30	430
92/10/13	14.6	8.84	8.54	22.2	16	410
92/11/12	9.5	7.94	10.21	~ 8.3	4	500
92/12/15	6.7	NA	12.24	7.0	9	495
93/01/27	6.0	NA	NA	7.4	35	50
93/02/16	12.5	NA	NA	9.7	23	555
93/03/16	10.0	NA	NA	16.5	60	600
93/04/13	10.0	NA	NA	10.5	18	550
93/05/10	13.4	7.99	NA	7.2	18	580
93/05/24	18.0	7.73	NA	~ 40.0	85	280
93/06/14	17.5	8.08	7.1	~ 35.0	NA	300
93/06/23	17.0	8.6	NA	33.9	74	330
93/07/06	17.0	8.0	NA	42.8	56	355
93/07/19	NA	8.2	NA	42.2	54	408
93/08/02	20.0	NA	NA	55.7	50	338
93/08/16	15.0	7.91	NA	52.4	27	340
93/08/30	15.0	NA	NA	55.3	24	340
93/09/13	14.0	NA	NA	45.1	16	340
93/09/27	13.0	8.18	NA	37.6	46	320

Table 18A. Statistical Analysis of S-13 Physical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
Number of Samples	25	18	12	27	25	26
Average Value	14.6	7.90	8.16	32.4	35.5	386.2
Standard Deviation	3.8	0.43	1.91	19.6	21.2	124.5
Maximum Value	20.0	8.84	12.24	89.8	85	600
Minimum Value	6.0	7.22	5.26	7.0	4	50

IRRIGATION SEASON						
Number of Samples	19	16	9	21	19	20
Average Value	16.1	7.84	7.43	38.2	39.0	371.6
Standard Deviation	2.5	0.38	1.35	18.1	20.7	94.7
Maximum Value	20.0	8.6	9.69	89.8	85	580
Minimum Value	10.0	7.22	5.26	7.2	9	160

NON-IRRIGATION SEASON						
Number of Samples	6	2	3	6	6	6
Average Value	9.9	8.39	10.33	11.9	24.5	435.0
Standard Deviation	3.3	0.64	1.85	6.2	20.5	199.1
Maximum Value	14.6	8.84	12.24	22.2	60	600
Minimum Value	6.0	7.94	8.54	7.0	4	50

Table 18B. Statistical Analysis of S-13 Physical Parameters. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
Number of Samples	8	8	8	9	8	8
Average Value	17.1	7.59	7.48	38.4	34.1	368.8
Standard Deviation	1.7	0.32	1.43	22.0	15.7	101.1
Maximum Value	19.2	8.02	9.69	89.8	48	450
Minimum Value	14.5	7.22	5.26	17.3	9	160

1993 IRRIGATION SEASON						
Number of Samples	11	8	1	12	11	12
Average Value	15.4	8.09	7.1	38.1	42.5	373.4
Standard Deviation	2.8	0.26	0	15.5	23.8	94.8
Maximum Value	20.0	8.6	7.1	55.7	85	580
Minimum Value	10.0	7.73	7.1	7.2	16	280

Table 19. Bacteria Density, Station S-2. Lower Payette SAWQP 1992-93

DATE	Fecal Coliform (#/100 ml)	Fecal Strep. (#/100 ml)	Fecal Coli.-Fecal Strep. Ratio
92/06/08	490	190	2.58
92/06/23	1100	550	2.00
92/07/06	840	770	1.09
92/07/20	580	470	1.23
92/08/03	1200	900	1.33
92/08/17	1100	680	1.62
92/08/31	500	600	0.83
92/09/16	170	100	1.70
92/09/28	140	890	0.16
92/10/13	250	800	0.31
92/11/12	100	2000	0.05
92/12/15	170	350	0.49
93/01/27	36	130	0.28
93/02/17	50	76	0.66
93/03/16	210	1300	0.16
93/04/13	510	160	3.19
93/05/10	380	60	6.33
93/05/24	1100	760	1.45
93/06/07	100	500	0.20
93/06/23	800	740	1.08
93/07/06	1600	5000	0.32
93/07/19	3800	2700	1.41
93/08/02	550	480	1.15
93/08/16	800	2100	0.38
93/08/30	140	1100	0.13
93/09/13	3000	2000	1.50
93/09/27	< 100	1700	0.06

Table 20. Bacteria Density, Station S-3. Lower Payette SAWQP 1992-93

DATE	Fecal Coliform (#/100 ml)	Fecal Strep. (#/100 ml)	Fecal Coli.-Fecal Strep. Ratio
92/06/08	260	760	0.34
92/06/23	320	740	0.43
92/07/06	2200	2100	1.05
92/07/20	4100	6000	0.68
92/08/03	3500	6200	0.57
92/08/17	28000	26000	1.08
92/08/31	3100	2700	1.15
92/09/16	1500	28000	0.05
92/09/28	250	300	0.83
92/10/13	110	630	0.18
92/11/12	160	2300	0.07
92/12/15	41	220	0.19
93/01/27	23	20	1.15
93/02/17	70	440	0.16
93/03/16	16	480	0.03
93/04/13	60	30	2.00
93/05/10	200	40	5.00
93/05/24	2100	1160	1.81
93/06/07	900	1400	0.64
93/06/23	160	230	0.70
93/07/06	600	600	1.00
93/07/19	960	2900	0.33
93/08/02	620	520	1.19
93/08/16	5500	5300	1.04
93/08/30	2400	7500	0.32
93/09/13	360	270	1.33
93/09/27	360	670	0.54

Table 21. Bacteria Density, Station S-5. Lower Payette SAWQP 1992-93

DATE	Fecal Coliform (#/100 ml)	Fecal Strep. (#/100 ml)	Fecal Coli.-Fecal Strep. Ratio
92/06/23	550	580	0.95
92/07/06	550	1800	0.31
92/07/20	1300	1700	0.77
92/08/03	500	1200	0.42
92/08/17	1200	710	1.69
92/08/31	800	100	8.00
92/09/16	900	1300	0.69
92/09/28	90	420	0.21
92/10/13	70	360	0.19
92/11/12	74	440	0.17
92/12/15	74	66	1.12
93/01/27	150	16	9.38
93/02/17	140	240	0.58
93/03/16	41	46	0.89
93/04/13	< 10	10	1.00
93/05/10	480	470	1.02
93/05/24	1600	820	1.95
93/06/07	800	2500	0.32
93/06/23	390	510	0.77
93/07/06	1600	1000	1.60
93/07/19	1000	2500	0.40
93/08/02	710	300	2.37
93/08/16	2300	1600	1.44
93/08/30	210	1100	0.19
93/09/13	120	2200	0.06
93/09/27	270	300	0.90

Table 22. Bacteria Density, Station S-10. Lower Payette SAWQP 1992-93

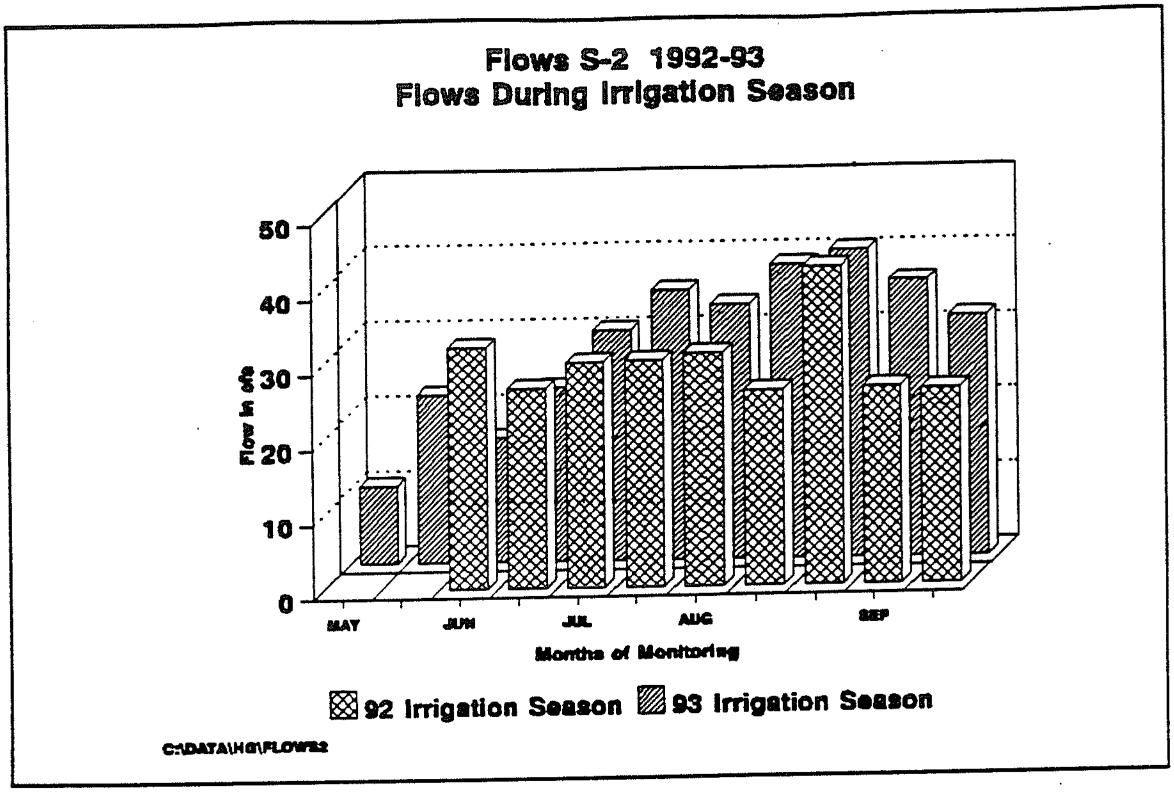
DATE	Fecal Coliform (#/100 ml)	Fecal Strep. (#/100 ml)	Fecal Coli.-Fecal Strep. Ratio
92/06/08	1400	890	1.57
92/06/23	1100	1300	0.85
92/07/06	890	1700	0.52
92/07/20	5700	5200	1.10
92/08/03	1000	3300	0.30
92/08/17	1200	20000	0.06
92/08/31	600	9200	0.07
92/09/16	540	38000	0.01
92/09/28	2000	1500	1.33
92/10/13	220	530	0.42
92/11/12	36	2600	0.01
92/12/15	70	330	0.21
93/01/27	240	50	4.80
93/02/17	8	49	0.16
93/03/16	200	300	0.67
93/04/13	70	40	1.75
93/05/10	150	270	0.56
93/05/24	6900	220	31.36
93/06/07	6300	7400	0.85
93/06/23	720	1500	0.48
93/07/06	600	1400	0.43
93/07/19	390	610	0.64
93/08/02	1100	1200	0.92
93/08/16	2000	4700	0.43
93/08/30	1100	2600	0.42
93/09/13	2500	1510	1.66
93/09/27	2000	550	3.64

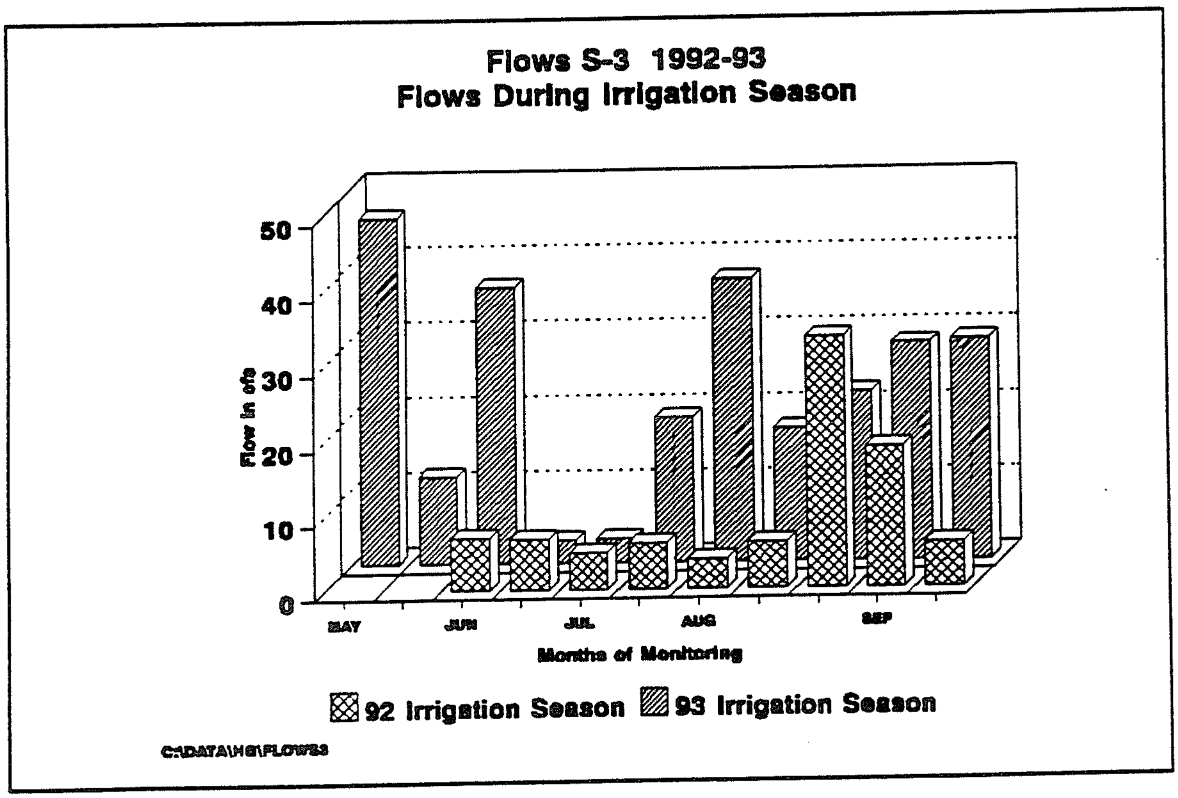
Table 23. Bacteria Density, Station S-12. Lower Payette SAWQP 1992-93

DATE	Fecal Coliform (#/100 ml)	Fecal Strep. (#/100 ml)	Fecal Coli.-Fecal Strep. Ratio
92/06/08	350	470	0.75
92/06/23	520	170	3.06
92/07/06	1000	24000	0.04
92/07/20	5400	5000	1.08
92/08/03	800	7300	0.11
92/08/17	3300	> 20000	0.17
92/08/31	< 10	700	0.01
92/09/16	550	100000	0.006
92/09/28	370	810	0.46
92/10/13	80	70	1.14
92/11/12	120	1400	0.09
92/12/15	140	640	0.22
93/01/27	1350	80	16.88
93/02/17	40	570	0.07
93/03/16	20	2400	0.008
93/04/13	40	20	2.00
93/05/10	30	100	0.30
93/05/24	1200	2000	0.60
93/06/07	300	2100	0.14
93/06/23	800	2200	0.36
93/07/06	1600	2600	0.62
93/07/19	630	1900	0.33
93/08/02	590	880	0.67
93/08/16	1500	5900	0.25
93/08/30	810	18000	0.05
93/09/13	1290	11200	0.12
93/09/27	300	69000	0.004

Table 24. Bacteria Density, Station S-13. Lower Payette SAWQP 1992-92

DATE	Fecal Coliform (#/100 ml)	Fecal Strep. (#/100 ml)	Fecal Coli.-Fecal Strep. Ratio
92/06/08	540	900	0.60
92/06/23	2800	1200	2.33
92/07/06	7100	4100	1.73
92/07/20	2000	3800	0.53
92/08/03	5500	5200	1.06
92/08/17	17000	1700	10.00
92/08/31	1100	3900	0.28
92/09/16	500	7100	0.07
92/09/28	1000	1100	0.91
92/10/13	7300	1000	7.30
92/11/12	> 2000	> 2000	1.00
92/12/15	400	980	0.41
93/01/27	940	260	3.62
93/02/17	140	420	0.33
93/03/16	> 2000	2600	0.77
93/04/13	580	80	7.25
93/05/10	150	340	0.44
93/05/24	1900	1330	1.43
93/06/07	8300	4900	1.69
93/06/23	1000	1700	0.59
93/07/06	2000	500	4.00
93/07/19	1600	1700	0.94
93/08/02	23000	28000	0.82
93/08/16	1800	14000	0.13
93/08/30	3100	4500	0.69
93/09/13	1370	5600	0.25
93/09/27	1400	7100	0.20


Flows S-2 1992-93
Flows During Irrigation Season
50
40
30
20
10
0
Flow in cfs
MAY
JUN
JUL
AUG
SEP
Months of Monitoring
92 Irrigation Season
93 Irrigation Season
C:\DATA\HG\FLOWS2


Flows S-3 1992-93
Flows During Irrigation Season
50
40
30
20
10
0
Flow in cfs
MAY
JUN
JUL
AUG
SEP
Months of Monitoring
92 Irrigation Season
93 Irrigation Season
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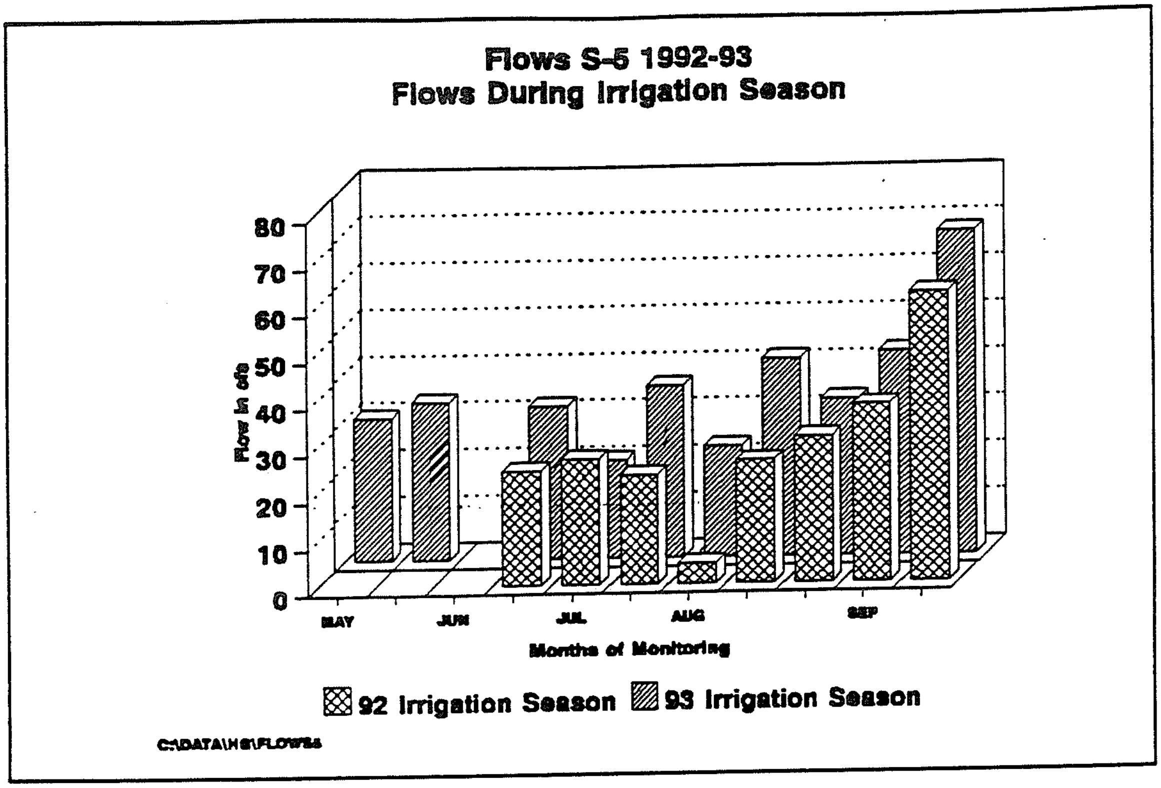
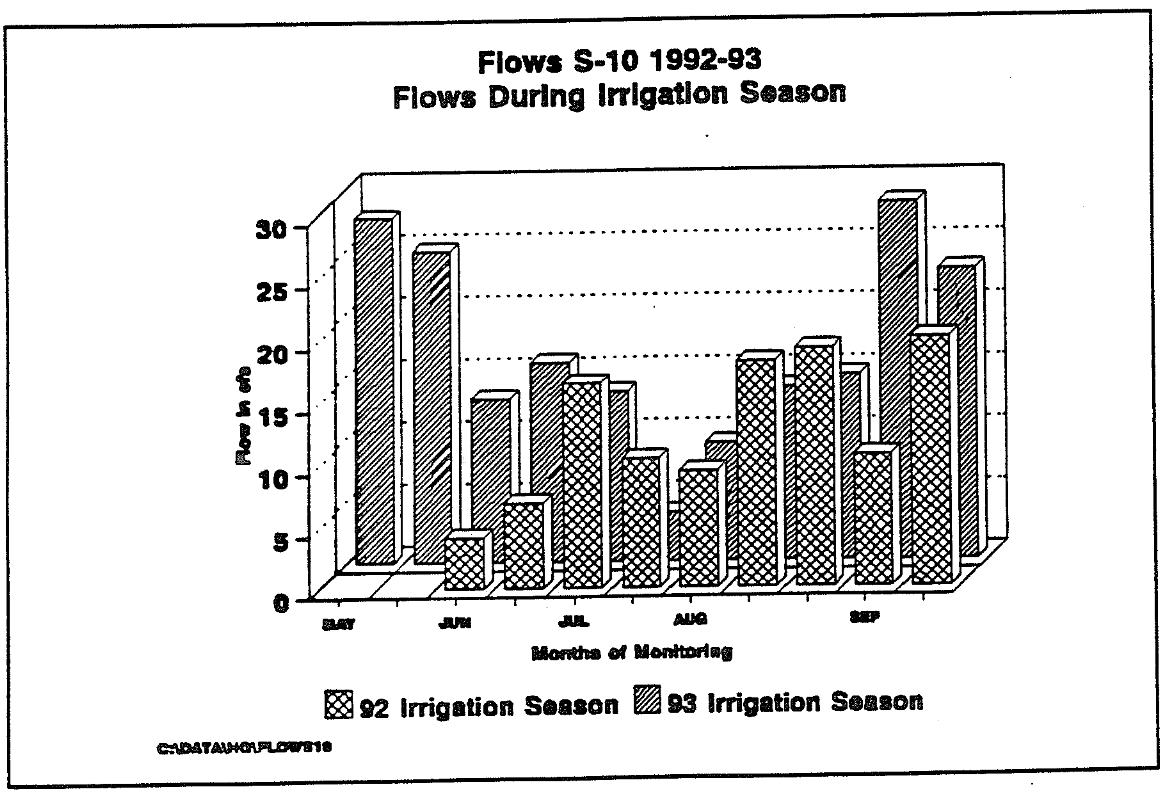
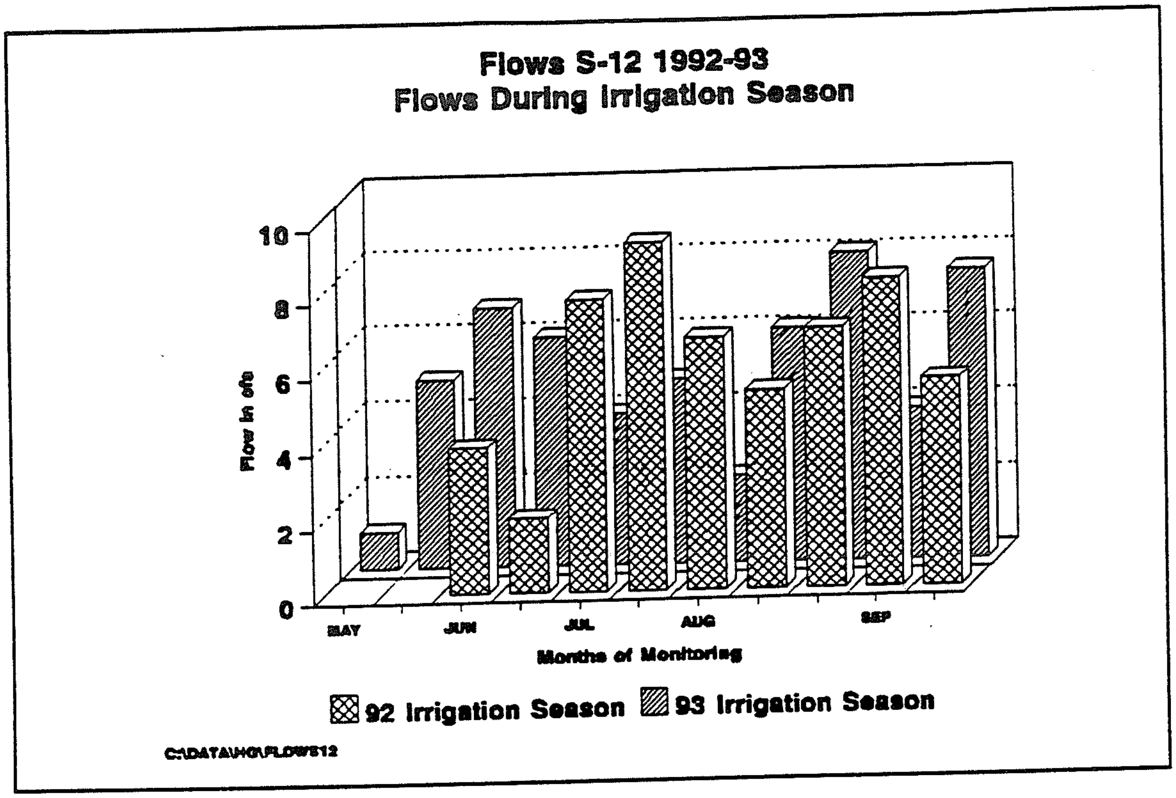

Flows S-5 1992-93
Flows During Irrigation Season
80
70
60
50
40
30
20
10
0
Flow in cfs
MAY
JUN
JUL
AUG
SEP
Months of Monitoring
92 Irrigation Season
93 Irrigation Season


Flows S-10 1992-93
Flows During Irrigation Season
30
25
20
15
10
5
0
Flow in cfs
MAY
JUN
JUL
AUG
SEP
Months of Monitoring
92 Irrigation Season
93 Irrigation Season


Flows S-12 1992-93
Flows During Irrigation Season
10
8
6
4
2
0
Flow in cfs
MAY
JUN
JUL
AUG
SEP
Months of Monitoring
92 Irrigation Season
93 Irrigation Season
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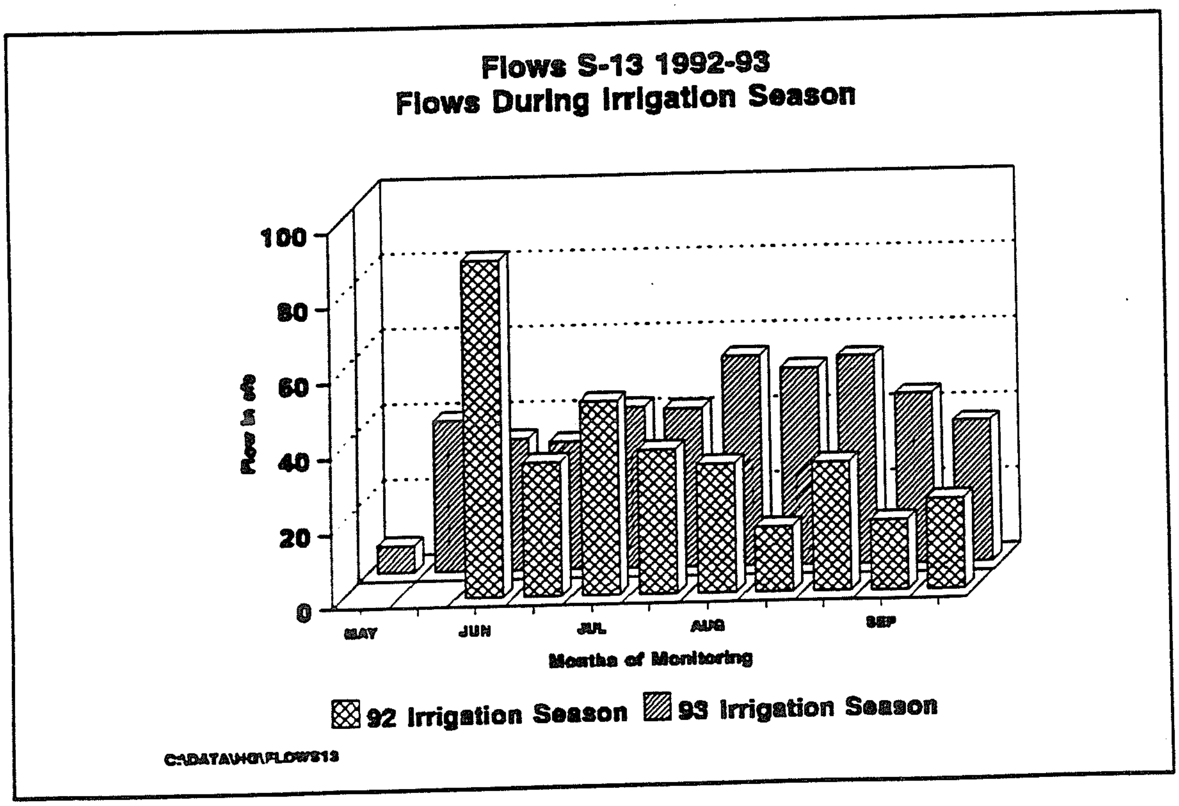
Flows S-13 1992-93
Flows During Irrigation Season
100
80
60
40
20
0
Flow in cfs
MAY
JUN
JUL
AUG
SEP
Months of Monitoring
92 Irrigation Season
93 Irrigation Season
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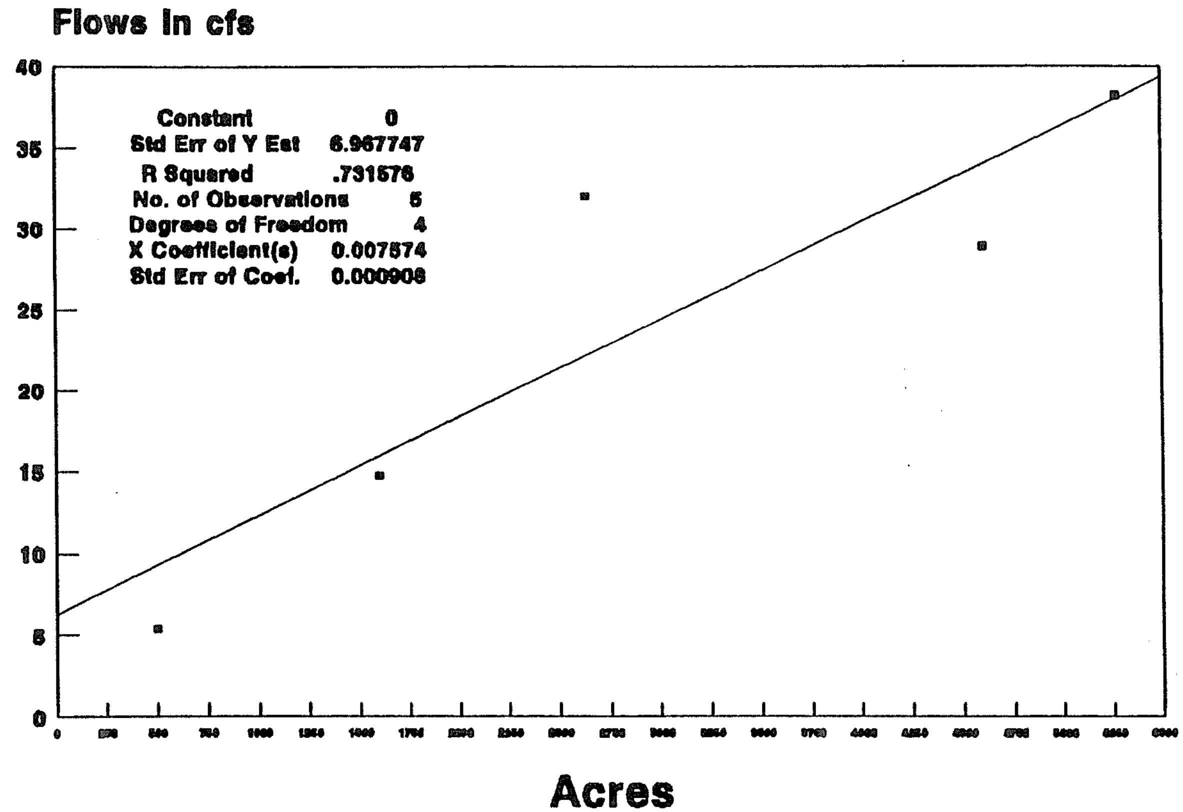
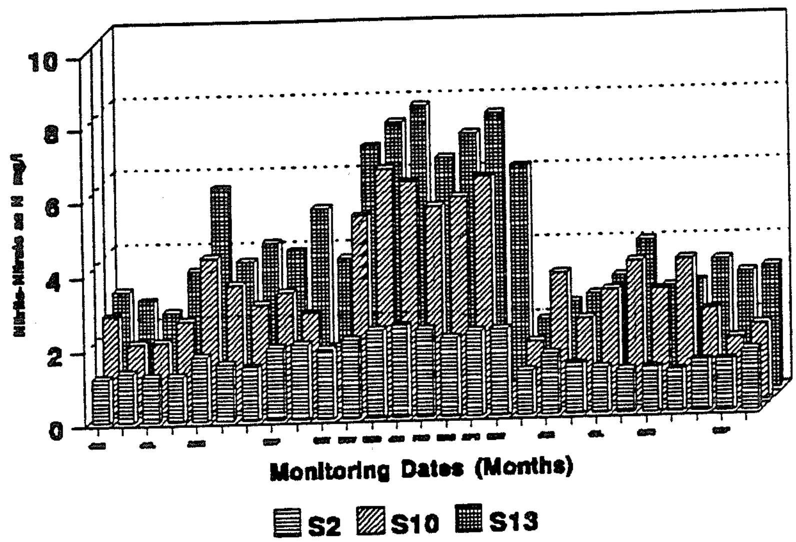
Lower Payette River SAWQP
Regression Model S2, S5, S10, S12,& S-13
Flows Monitored Jun 92 through Sep. 93



Nitrite-Nitrate as N Concentrations
Stations S2, S10 & S13
June 1992 through Sept. 1993



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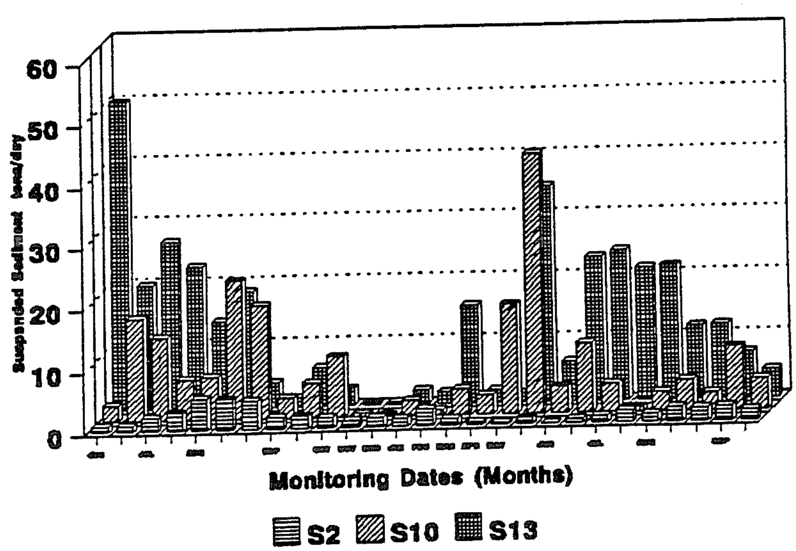
Suspended Sediment Loads
Stations S2, S10 & S13
June 1992 through Sept. 1993



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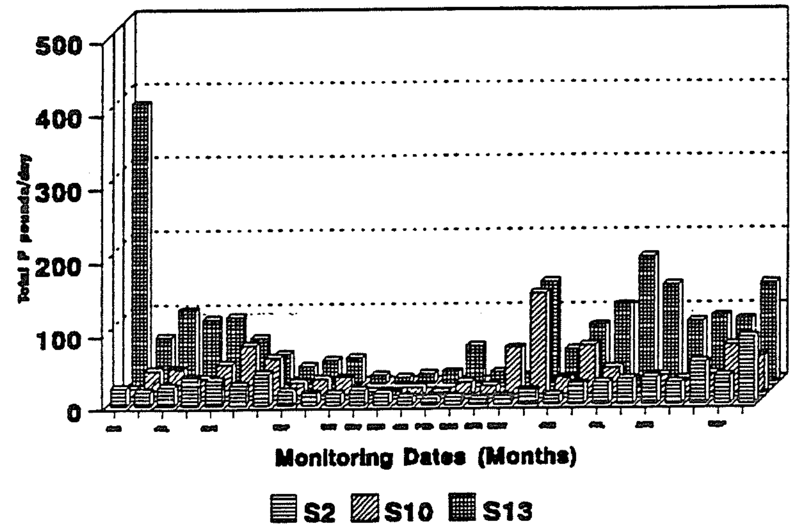
Total Phosphorus Loads
Stations S2, S10 & S13
June 1992 through Sept. 1993



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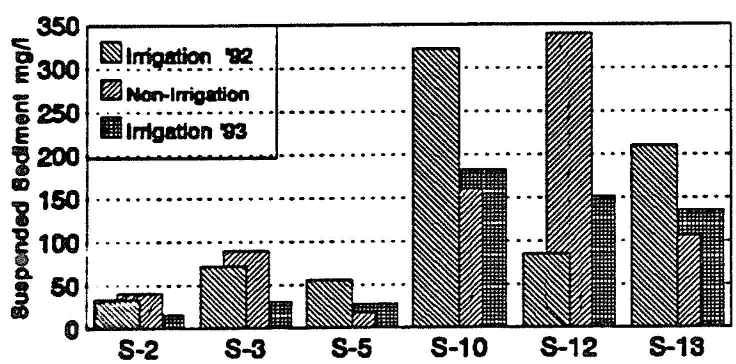
Average Suspended Sediment Concentrations

Stations: S-2, S-3, S-5, S-10, S-12, & S-13
Irrigation Season '92, Non-Irrigation Season, & Irrigation Season '93



	S-2	S-3	S-5	S-10	S-12	S-13
Irrigation '92	34.1	72	56.5	321.9	84.7	209.9
Non-Irrigation	41.7	90.2	17.8	160.2	339	106
Irrigation '93	16	30.8	28.7	182.4	151.6	134.8

STATIONS

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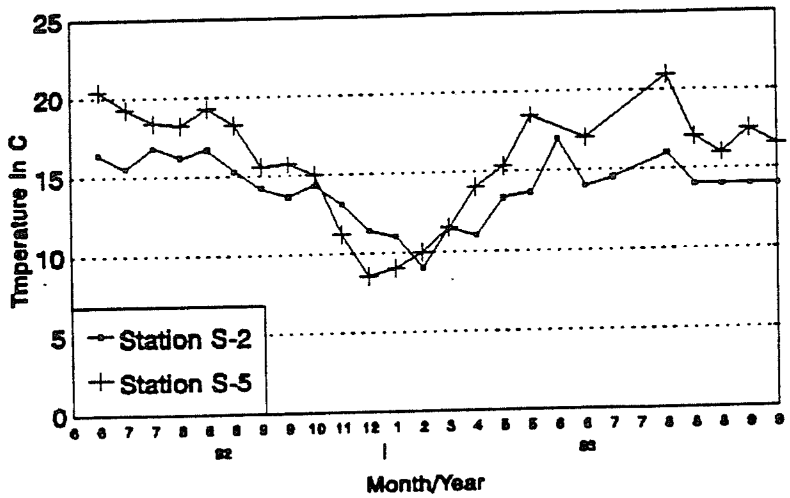
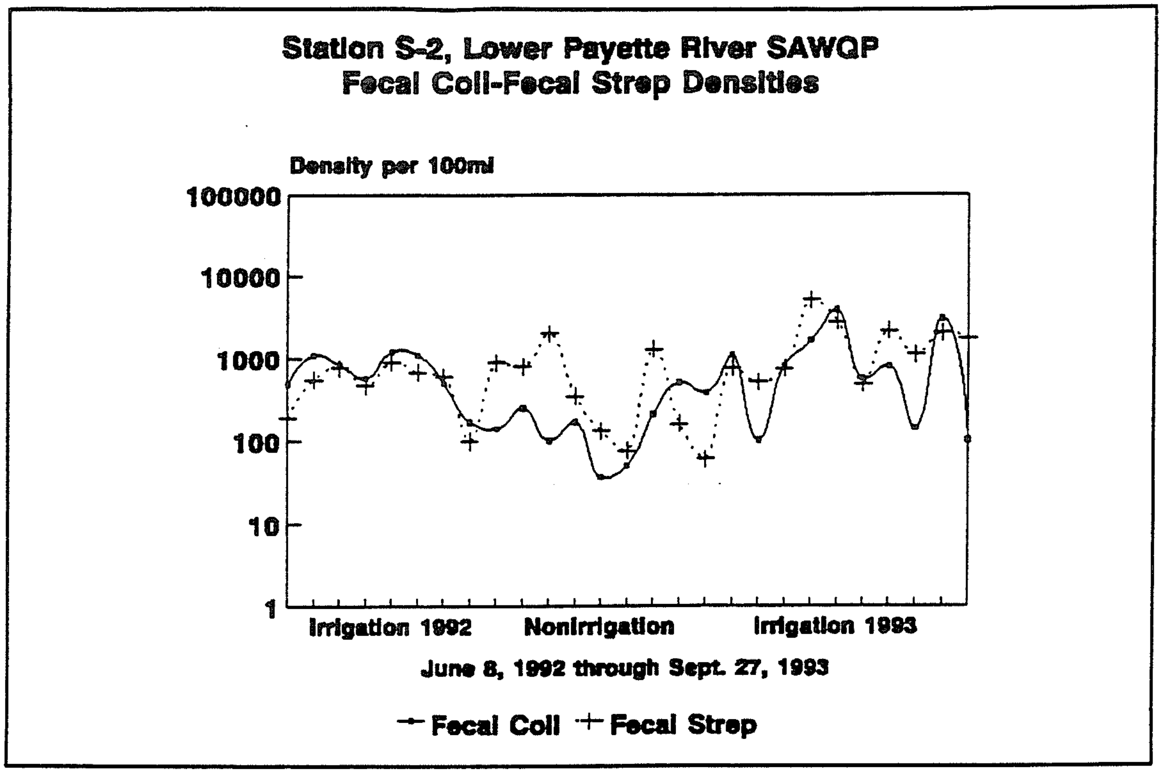
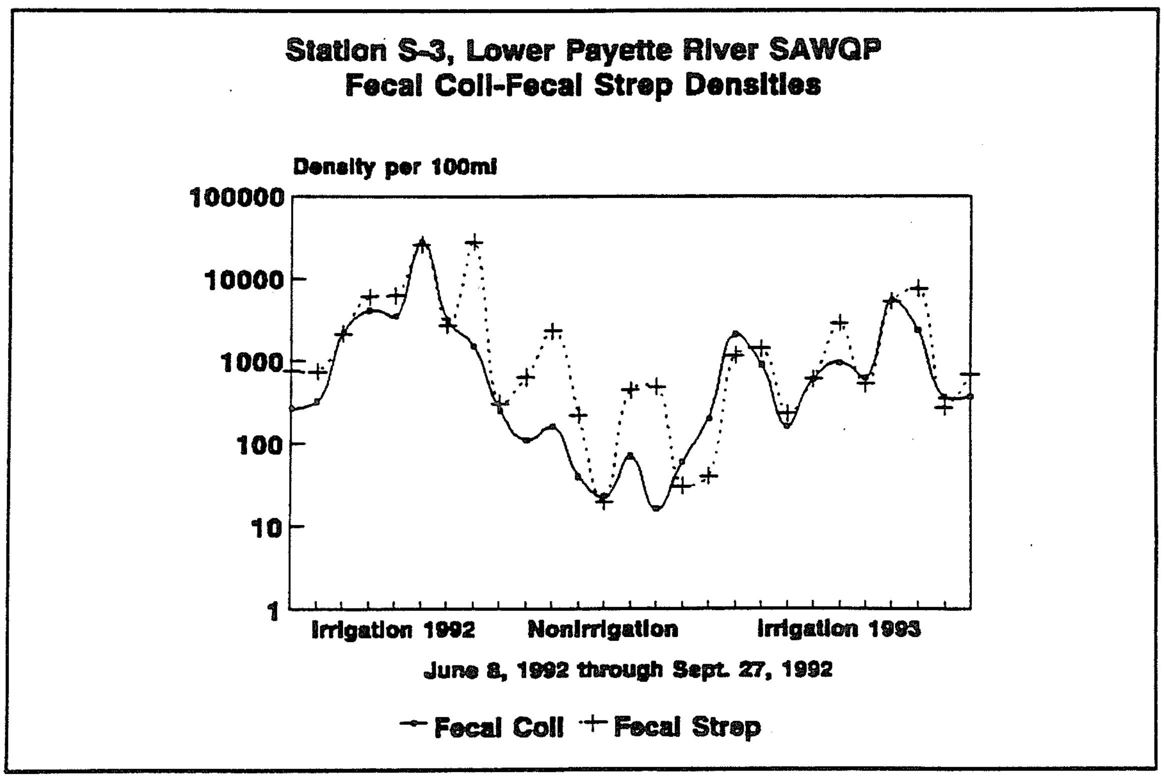
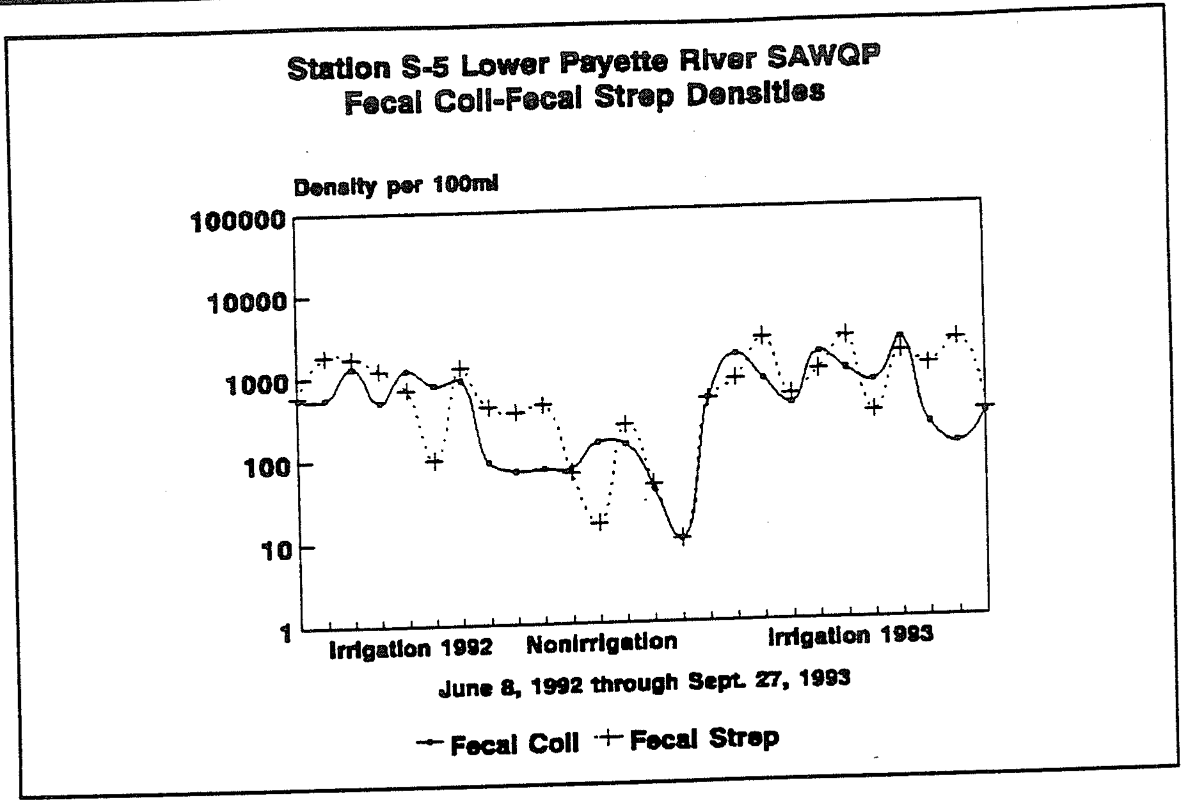
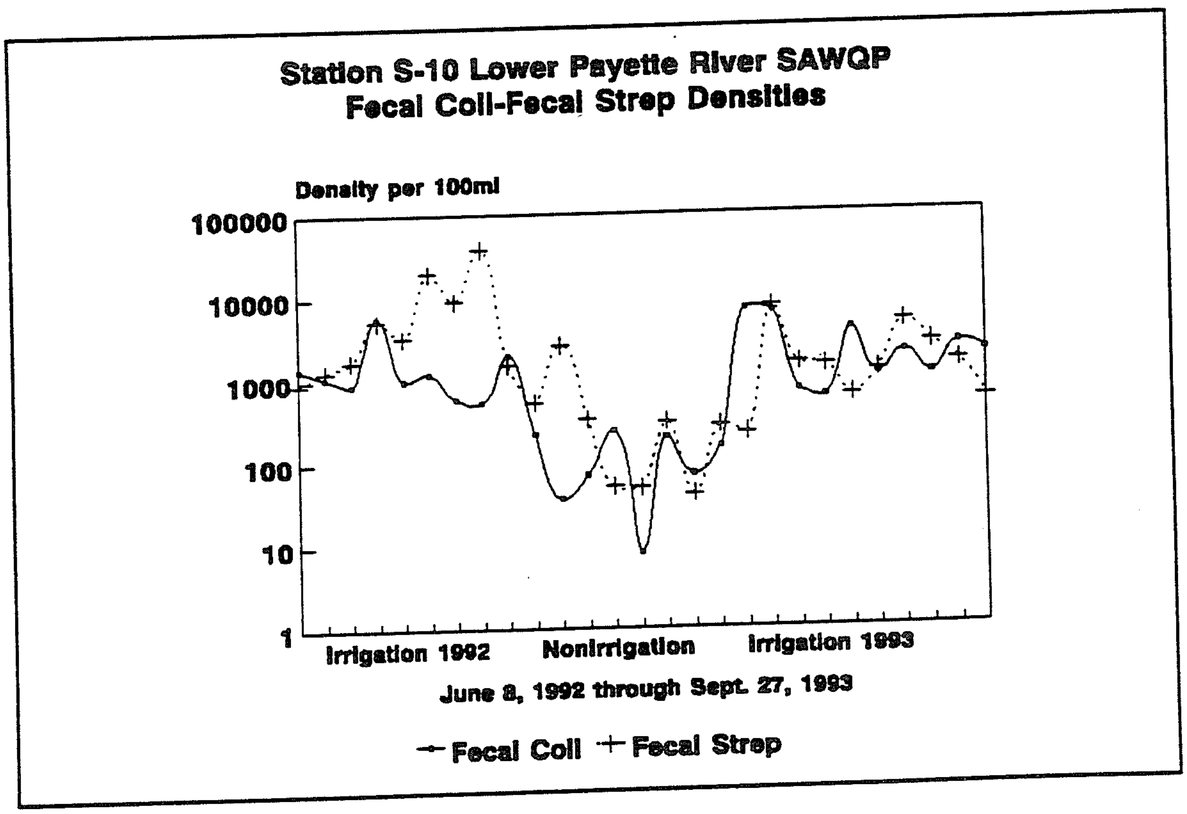
Station S-2 and S-5, Temperatures
June 1992 through September 1993
Lower Payette SAWQP

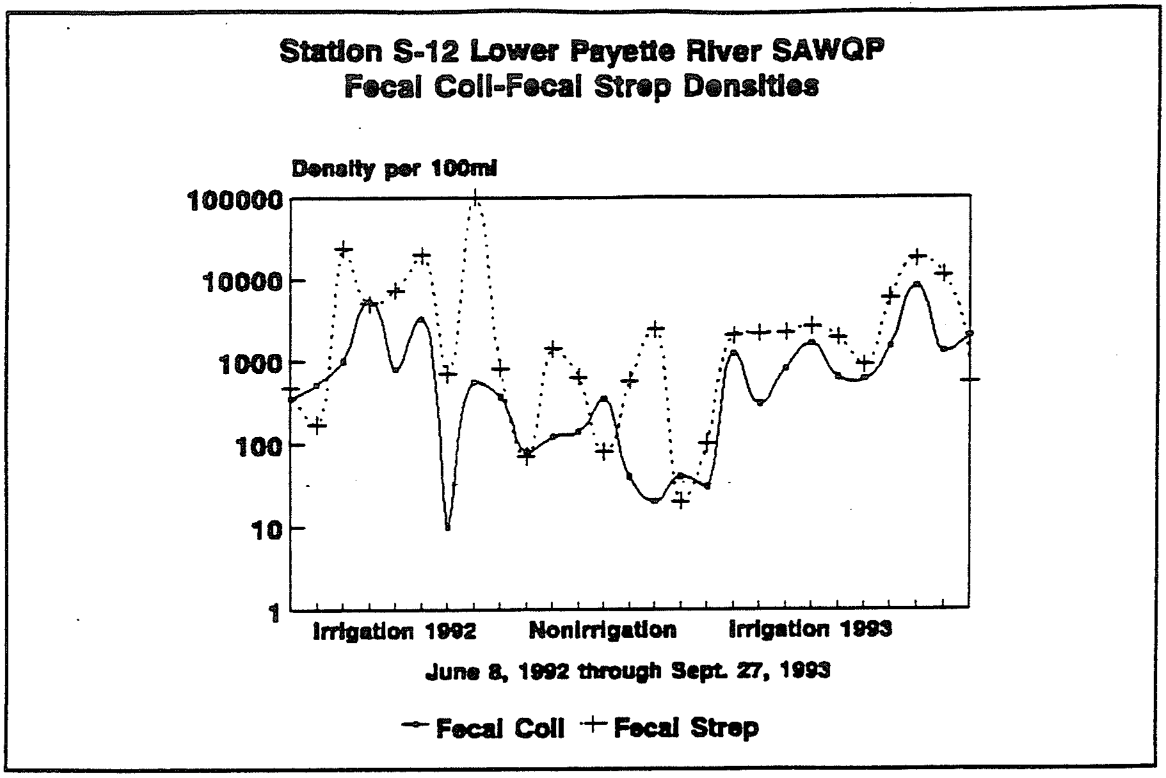


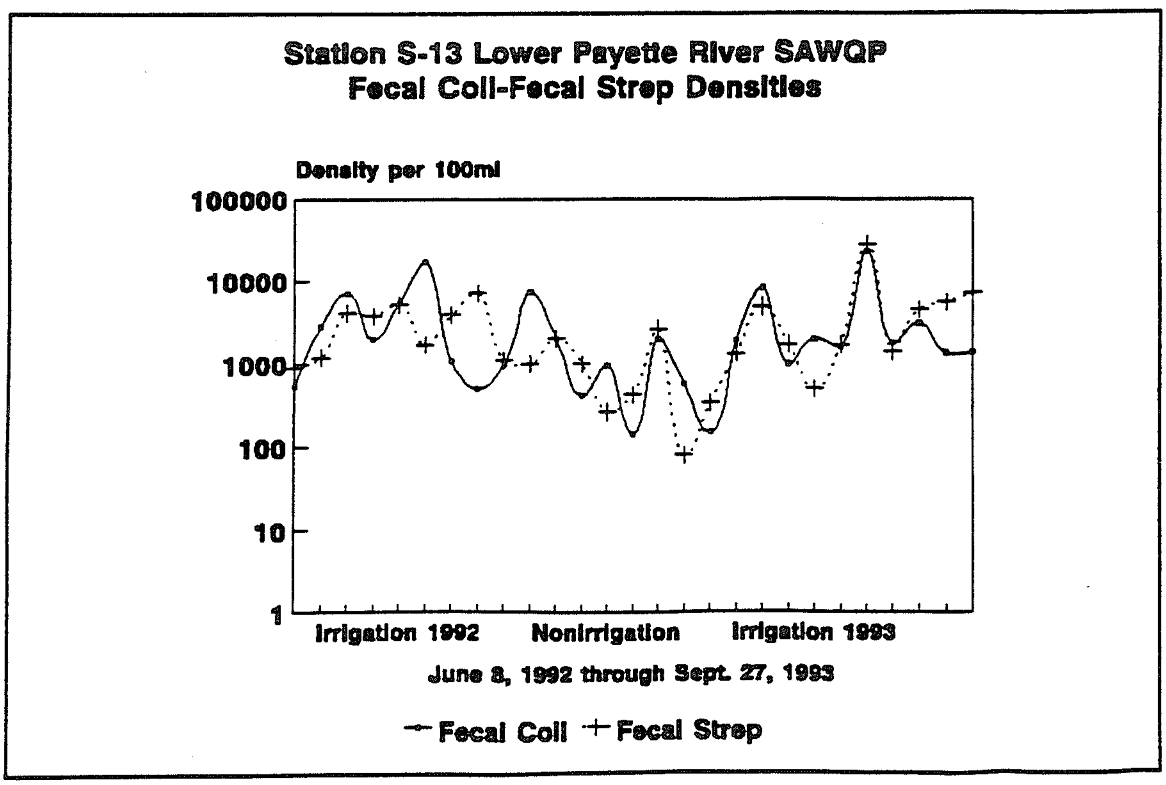

Station S-2, Lower Payette River SAWQP
Fecal Coli-Fecal Strep Densities
Density per 100ml
100000
10000
1000
100
10
1
Irrigation 1992
Nonirrigation
Irrigation 1993
June 8, 1992 through Sept. 27, 1993
Fecal Coli
Fecal Strep


Station S-3, Lower Payette River SAWQP
Fecal Coli-Fecal Strep Densities
Density per 100ml
100000
10000
1000
100
10
1
Irrigation 1992
Nonirrigation
Irrigation 1993
June 8, 1992 through Sept. 27, 1992
Fecal Coli
Fecal Strep

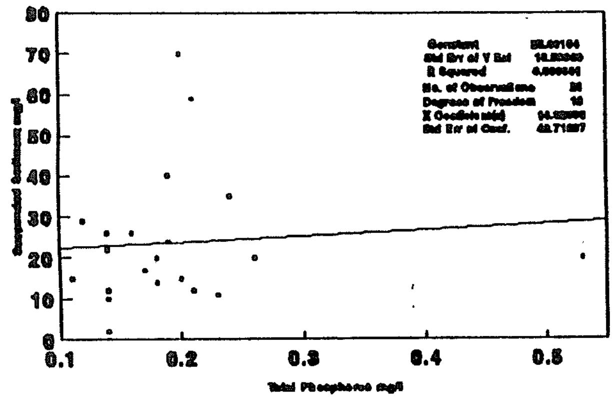

Station S-5 Lower Payette River SAWQP
Fecal Coli-Fecal Strep Densities
Density per 100ml
100000
10000
1000
100
10
1
Irrigation 1992
Nonirrigation
Irrigation 1993
June 8, 1992 through Sept. 27, 1993
Fecal Coli
Fecal Strep


Station S-10 Lower Payette River SAWQP
Fecal Coli-Fecal Strep Densities
Density per 100ml
100000
10000
1000
100
10
1
Irrigation 1992
Nonirrigation
Irrigation 1993
June 8, 1992 through Sept. 27, 1993
Fecal Coli
Fecal Strep


Station S-12 Lower Payette River SAWQP
Fecal Coli-Fecal Strep Densities
Density per 100ml
100000
10000
1000
100
10
1
Irrigation 1992
Nonirrigation
Irrigation 1993
June 8, 1992 through Sept. 27, 1993
Fecal Coli
Fecal Strep


Station S-13 Lower Payette River SAWQP
Fecal Coli-Fecal Strep Densities
Density per 100ml
100000
10000
1000
100
10
1
Irrigation 1992
Nonirrigation
Irrigation 1993
June 8, 1992 through Sept. 27, 1993
Fecal Coli
Fecal Strep

Lower Payette River SAWQP, Station S-2
Suspended Sediment-Total Phosphorus
Linear Regression* June 92 thru Sept 93



Lower Payette River SAWQP, Station S-3
Suspended Sediment-Total Phosphorus
Linear Regression* June 92 thru Sept 93

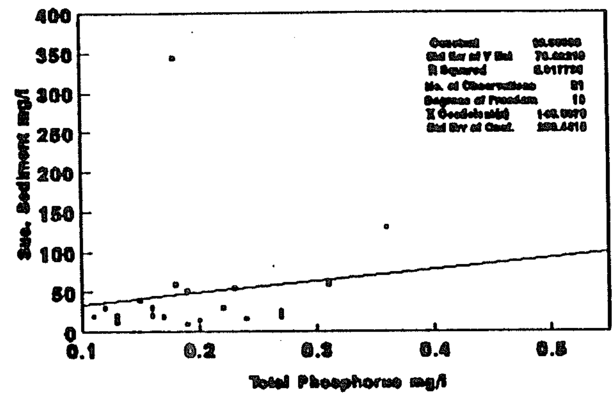


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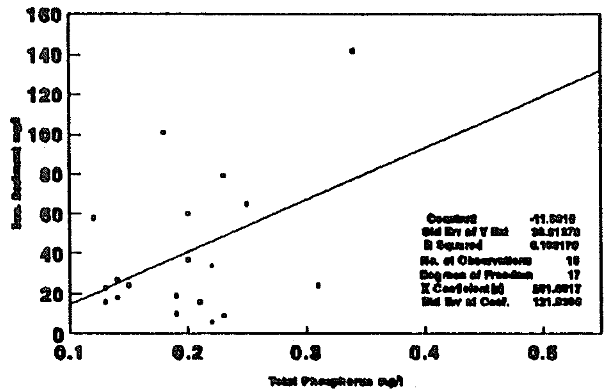
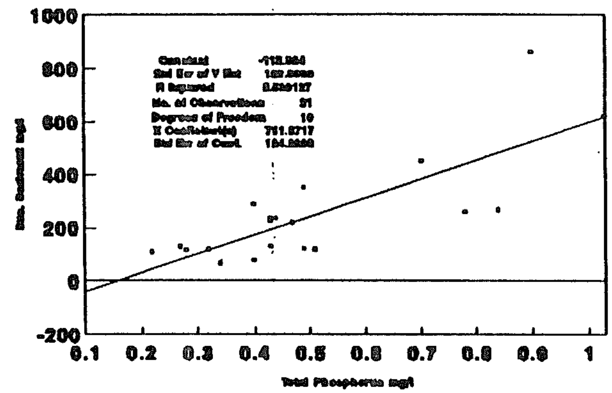
Figure 19

Lower Payette River SAWQP, Station S-5
Suspended Sediment-Total Phosphorus
Linear Regression* June 92 thru Sept 93



*Line of Best Fit

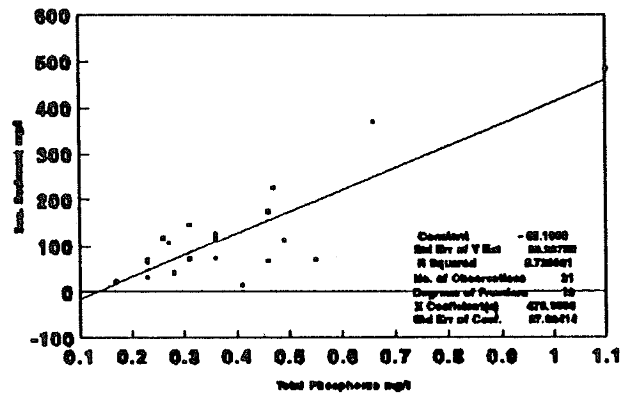
Lower Payette River SAWQP, Station S-10
Suspended Sediment-Total Phosphorus
Linear Regression* June 92 thru Sept 93



*Line of Best Fit

C:\DATA\HG\S-5-10REGR

Lower Payette River SAWQP, Station S-12
Suspended Sediment-Total Phosphorus
Linear Regression* June 92 thru Sept 93



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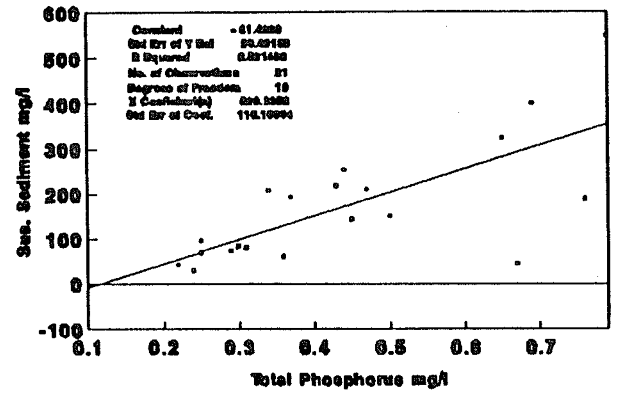
*Line of Best Fit

Lower Payette River SAWQP, Station S-13
Suspended Sediment-Total Phosphorus
Linear Regression* June 92 thru Sept 93



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*Line of Best Fit

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APPENDIX B

APPENDIX B. Table of Content

Table 1. Lower Payette River SAWQP, Station C-3, Suspended Sediment-Total Phosphorus Loads, 1992-93.

DATE	Flows (cfs)	Total Phosphorus (mg/ℓ)	Total Phosphorus (lbs/day)	Suspended Sediment (mg/ℓ)	Daily Suspended Sediment (Tons/day)	Interval Suspended Sediment (Tons)
92/06/01	NA	NA	NA	NA	NA	NA
92/06/08	NA	NA	NA	NA	NA	NA
92/06/23	NA	NA	NA	NA	NA	NA
92/07/06	NA	NA	NA	NA	NA	NA
92/07/20	NA	0.10	NA	14	NA	NA
92/08/03	NA	NA	NA	NA	NA	NA
92/08/17	NA	0.07	NA	7	NA	NA
92/08/31	NA	NA	NA	NA	NA	NA
92/09/15	NA	NA	NA	NA	NA	NA
92/09/28	NA	NA	NA	NA	NA	NA
92/10/13	NA	NA	NA	NA	NA	NA
92/11/12	NA	NA	NA	NA	NA	NA
92/12/15	NA	NA	NA	NA	NA	NA
93/02/16	NA	NA	NA	NA	NA	NA
93/03/16	NA	NA	NA	NA	NA	NA
93/04/13	NA	NA	NA	NA	NA	NA
93/05/10	NA	NA	NA	NA	NA	NA
93/05/24	NA	NA	NA	NA	NA	NA
93/06/14	NA	NA	NA	NA	NA	NA
93/06/23	NA	NA	NA	NA	NA	NA
93/07/06	NA	NA	NA	NA	NA	NA
93/07/19	NA	NA	NA	NA	NA	NA
93/08/02	NA	NA	NA	NA	NA	NA
93/08/16	NA	NA	NA	NA	NA	NA
93/08/30	NA	NA	NA	NA	NA	NA
93/09/14	NA	NA	NA	NA	NA	NA
93/09/27	NA	NA	NA	NA	NA	NA

Table 1A. Statistical Analysis of C-3 Suspended Sediment-Total Phosphorus Loads. Lower Payette SAWQP, 1992-93.

OVERALL	Flows cfs	Total Phosphorus mg/ℓ	Total Phosphorus lbs/day	Suspended Sediment mg/ℓ	Daily Suspended Sediment Tons/day	Suspended Sediment Loads Tons
Number of Samples	NA	2	NA	2	NA	NA
Average Value	NA	0.09	NA	10.5	NA	
Standard Deviation	NA	0.02	NA	4.9	NA	
Maximum Value	NA	0.10	NA	14	NA	
Minimum Value	NA	0.07	NA	7	NA	

IRRIGATION SEASON						
Number of Samples	NA	2	NA	2	NA	NA
Average Value	NA	0.09	NA	10.5	NA	
Standard Deviation	NA	0.02	NA	4.9	NA	
Maximum Value	NA	0.10	NA	14	NA	
Minimum Value	NA	0.07	NA	7	NA	

NON-IRRIGATION SEASON						
Number of Samples	NA	NA	NA	NA	NA	NA
Average Value	NA	NA	NA	NA	NA	
Standard Deviation	NA	NA	NA	NA	NA	
Maximum Value	NA	NA	NA	NA	NA	
Minimum Value	NA	NA	NA	NA	NA	

Table 1B. Statistical Analysis of C-3 Suspended Sediment-Total Phosphorus Loads. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Flows cfs	Total Phosphorus mg/ℓ	Total Phosphorus lbs/day	Suspended Sediment mg/ℓ	Daily Suspended Sediment Tons/day	Suspended Sediment Loads Tons
Number of Samples	NA	2	NA	2	NA	NA
Average Value	NA	0.09	NA	10.5	NA	
Standard Deviation	NA	0.02	NA	4.9	NA	
Maximum Value	NA	0.10	NA	14	NA	
Minimum Value	NA	0.07	NA	7	NA	

1993 IRRIGATION SEASON						
Number of Samples	NA	NA	NA	NA	NA	NA
Average Value	NA	NA	NA	NA	NA	
Standard Deviation	NA	NA	NA	NA	NA	
Maximum Value	NA	NA	NA	NA	NA	
Minimum Value	NA	NA	NA	NA	NA	

Table 2. Lower Payette River SAWQP, Station C-7, Suspended Sediment-Total Phosphorus Loads, 1992-93.

DATE	Flows (cfs)	Total Phosphorus (mg/ℓ)	Total Phosphorus (lbs/day)	Suspended Sediment (mg/ℓ)	Daily Suspended Sediment (Tons/day)	Interval Suspended Sediment (Tons)
92/06/01	NA	NA	NA	NA	NA	NA
92/06/08	61.44	0.15	49.60	26	4.31	30.17
92/06/23	9.53	0.10	5.13	9	0.23	3.45
92/07/06	102.20	0.14	77.00	31	8.55	111.15
92/07/20	9.15	0.13	6.40	11	0.27	3.78
92/08/03	61.42	0.15	49.58	30	4.98	69.72
92/08/17	46.56	0.19	47.61	50	6.29	88.06
92/08/31	75.48	0.10	40.62	10	2.04	28.56
92/09/15	126.14	0.10	67.89	17	5.79	92.64
92/09/28	152.42	0.15	123.04	19	7.82	93.84
92/10/13	88.16	0.08	37.96	16	3.81	57.15
92/11/12	14.59	0.30	23.56	26	1.02	30.60
92/12/15	N/A	0.20	NA	43	NA	NA
93/02/16	223.20	0.13	156.16	34	20.49	1987.53
93/03/16	N/A (flooding)	NA	NA	NA	NA	NA
93/04/13	~ 120.0	0.32	206.66	56	18.14	997.70
93/05/10	45.04	0.11	26.66	54	6.57	177.39
93/05/24	76.73	0.25	103.24	68	14.09	197.26
93/06/14	125.76	0.13	87.99	39	13.24	264.80
93/06/23	88.28	0.16	76.02	38	9.06	90.60
93/07/06	17.51	0.09	8.48	14	0.66	8.58
93/07/19	30.25	0.30	48.84	44	3.59	46.67
93/08/02	15.38	0.15	12.42	17	0.71	9.94
93/08/16	38.49	0.18	37.29	20	2.08	29.12
93/08/30	14.87	0.09	7.20	11	0.44	6.16
93/09/14	73.86	0.15	59.62	9	1.79	25.06
93/09/27	57.45	0.35	108.21	7	1.09	15.26

Table 2A. Statistical Analysis of C-7 Suspended Sediment-Total Phosphorus Loads. Lower Payette SAWQP, 1992-93.

OVERALL	Flows cfs	Total Phosphorus mg/ℓ	Total Phosphorus lbs/day	Suspended Sediment mg/ℓ	Daily Suspended Sediment Tons/day	Suspended Sediment Loads Tons
Number of Samples	24	25	24	25	24	4465.19
Average Value	69.75	0.17	61.13	28.0	5.71	
Standard Deviation	52.78	0.08	50.30	17.2	5.74	
Maximum Value	223.20	0.35	206.66	68	20.49	
Minimum Value	9.15	0.08	5.13	7	0.23	
IRRIGATION SEASON						
Number of Samples	21	21	21	21	21	2389.91
Average Value	64.19	0.17	59.50	27.8	5.33	
Standard Deviation	41.69	0.08	48.55	17.8	4.93	
Maximum Value	152.42	0.35	206.66	68	18.14	
Minimum Value	9.15	0.09	5.13	7	0.23	
NON-IRRIGATION SEASON						
Number of Samples	3	4	3	4	3	2075.28
Average Value	108.65	0.18	72.56	29.8	8.44	
Standard Deviation	105.80	0.10	72.76	11.5	10.53	
Maximum Value	223.20	0.30	156.16	43	20.49	
Minimum Value	14.59	0.08	23.56	16	1.02	

Table 2B. Statistical Analysis of C-7 Suspended Sediment-Total Phosphorus Loads. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Flows cfs	Total Phosphorus mg/ℓ	Total Phosphorus lbs/day	Suspended Sediment mg/ℓ	Daily Suspended Sediment Tons/day	Suspended Sediment Loads Tons
Number of Samples	9	9	9	9	9	521.37
Average Value	71.59	0.13	51.87	22.6	4.48	
Standard Deviation	48.79	0.03	35.99	13.3	3.06	
Maximum Value	152.42	0.19	123.04	50	8.55	
Minimum Value	9.15	0.10	5.13	9	0.23	

1993 IRRIGATION SEASON						
Number of Samples	12	12	12	12	12	1868.54
Average Value	58.64	0.19	65.22	31.4	5.96	
Standard Deviation	38.83	0.09	57.10	21.0	6.22	
Maximum Value	125.76	0.35	206.66	68	18.14	
Minimum Value	14.87	0.09	7.20	7	0.44	

Table 3. Lower Payette River SAWQP, Station C-3, Chemical Parameters 1992-93.

DATES	Ammonia as N mg/ℓ	Total NO_3+NO_2 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phoshates mg/ℓ	% Diss. Ortho in Total Phosphorus
92/06/08	NA	NA	NA	NA	NA	NA
92/06/23	NA	NA	NA	NA	NA	NA
92/07/06	NA	NA	NA	NA	NA	NA
92/07/20	0.032	0.033	0.58	0.10	0.014	0.14
92/08/03	NA	NA	NA	NA	NA	NA
92/08/17	0.078	0.043	0.68	0.07	0.012	0.17
92/08/31	NA	NA	NA	NA	NA	NA
92/09/15	NA	NA	NA	NA	NA	NA
92/09/28	NA	NA	NA	NA	NA	NA
92/10/13	NA	NA	NA	NA	NA	NA
92/11/12	NA	NA	NA	NA	NA	NA
93/02/16	NA	NA	NA	NA	NA	NA
93/04/13	NA	NA	NA	NA	NA	NA
93/05/10	NA	NA	NA	NA	NA	NA
93/05/24	NA	NA	NA	NA	NA	NA
93/06/14	NA	NA	NA	NA	NA	NA
93/06/23	NA	NA	NA	NA	NA	NA
93/07/06	NA	NA	NA	NA	NA	NA
93/07/19	NA	NA	NA	NA	NA	NA
93/08/02	NA	NA	NA	NA	NA	NA
93/08/16	NA	NA	NA	NA	NA	NA
93/08/30	NA	NA	NA	NA	NA	NA
93/09/14	NA	NA	NA	NA	NA	NA
93/09/27	NA	NA	NA	NA	NA	NA

Table 3A. Statistical Analysis of C-3 Chemical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Ammonia as N mg/ℓ	Total NO2 + NO3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. o-Phosphates in Total Phosphorus
Number of Samples	2	2	2	2	2	2
Average Value	0.055	0.038	0.63	0.09	0.013	0.16
Standard Deviation	0.033	0.007	0.07	0.02	0.001	0.02
Maximum Value	0.078	0.043	0.68	0.10	0.014	0.17
Minimum Value	0.032	0.033	0.58	0.07	0.012	0.14

IRRIGATION						
Number of Samples	2	2	2	2	2	2
Average Value	0.055	0.038	0.63	0.09	0.013	0.16
Standard Deviation	0.033	0.007	0.07	0.02	0.001	0.02
Maximum Value	0.078	0.043	0.68	0.10	0.014	0.17
Minimum Value	0.032	0.033	0.58	0.07	0.012	0.14

NON-IRRIGATION SEASON						
Number of Samples	NA	NA	NA	NA	NA	NA
Average Value	NA	NA	NA	NA	NA	NA
Standard Deviation	NA	NA	NA	NA	NA	NA
Maximum Value	NA	NA	NA	NA	NA	NA
Minimum Value	NA	NA	NA	NA	NA	NA

Table 4. Lower Payette River SAWQP, Station C-7, Chemical Parameters 1992-93.

DATES	Ammonia as N mg/ℓ	Total NO_2+NO_3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. Ortho in Total Phosphorus
92/06/08	0.020	0.140	0.75	0.15	0.099	0.66
92/06/23	0.047	0.175	0.75	0.10	0.113	1.13
92/07/06	0 027	0.084	0.47	0.14	0.087	0.62
92/07/20	0 046	0.161	0.46	0.13	0.090	0.69
92/08/03	0 597	0.195	0.56	0.15	0.085	0.57
92/08/17	0.094	0.300	0.56	0.19	0.091	0.48
92/08/31	0.062	0.167	0.47	0.10	0.069	0.69
92/09/15	< 0.005	0.151	0.50	0.10	0.083	0.83
92/09/28	0.026	0.176	0.39	0.15	0.069	0.46
92/10/13	< 0.005	0.153	0.44	0.08	0.032	0.40
92/11/12	0.025	0.152	0.32	0.30	0.043	0.14
93/02/16	0.071	0.637	0.41	0.13	0.060	0.46
93/04/13	0.050	0.430	0.42	0.32	0.099	0.31
93/05/10	0.032	0.059	0.51	0.11	0.058	0.53
93/05/24	0.111	0.110	0.35	0.25	0.026	0.10
93/06/14	0.022	0.092	0.37	0.13	0.037	0.28
93/06/23	0.022	0.065	0.39	0.16	0.030	0.19
93/07/06	0.012	0.134	0.29	0.09	NA	NA
93/07/19	0.057	0.120	0.32	0.30	0.037	0.12
93/08/02	< 0.005	0.049	0.36	0.15	0.031	0.21
93/08/16	0.019	0.100	0.33	0.18	0.047	0.26
93/08/30	0.047	0.081	0.30	0.09	0.042	0.47
93/09/14	0.008	0.115	< 0.05	0.15	0.080	0.53
93/09/27	0.032	0.154	0.08	0.35	0.056	0.16

Table 4A. Statistical Analysis of C-7 Chemical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Ammonia as N mg/ℓ	Total NO2 + NO3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. o-Phosphates in Total Phosphorus
Number of Samples	24	24	24	24	23	23
Average Value	0.060	0.167	0.41	0.17	0.064	0.45
Standard Deviation	0.118	0.129	0.16	0.08	0.026	0.26
Maximum Value	0.597	0.637	0.75	0.35	0.113	1.13
Minimum Value	< 0.005	0.049	< 0.05	0.08	0.026	0.10
IRRIGATION SEASON						
Number of Samples	21	21	21	21	20	20
Average Value	0.064	0.146	0.41	0.17	0.066	0.46
Standard Deviation	0.125	0.086	0.17	0.08	0.027	0.27
Maximum Value	0.597	0.430	0.75	0.35	0.113	1.13
Minimum Value	< 0.005	0.049	< 0.05	0.09	0.026	0.10
NON-IRRIGATION SEASON						
Number of Samples	3	3	3	3	3	3
Average Value	0.034	0.314	0.39	0.17	0.045	0.33
Standard Deviation	0.034	0.280	0.06	0.12	0.014	0.17
Maximum Value	0.071	0.637	0.44	0.30	0.060	0.46
Minimum Value	< 0.005	0.152	0.32	0.08	0.032	0.14

Table 4B. Statistical Analysis of C-7 Chemical Parameters. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Ammonia as N mg/ℓ	Total NO2 + NO3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. o-Phosphates in Total Phosphorus
Number of Samples	9	9	9	9	9	9
Average Value	0.103	0.172	0.55	0.13	0.087	0.68
Standard Deviation	0.187	0.057	0.13	0.03	0.014	0.20
Maximum Value	0.597	0.300	0.75	0.19	0.113	1.13
Minimum Value	< 0.005	0.084	0.39	0.10	0.069	0.46

1993 IRRIGATION SEASON						
Number of Samples	12	12	12	12	11	11
Average Value	0.035	0.126	0.31	0.19	0.049	0.29
Standard Deviation	0.029	0.101	0.13	0.09	0.023	0.16
Maximum Value	0.111	0.430	0.51	0.35	0.099	0.53
Minimum Value	< 0.005	0.049	< 0.05	0.09	0.026	0.10

Table 4A. Statistical Analysis of C-7 Chemical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Ammonia as N mg/ℓ	Total NO2 + NO3 mg/ℓ	Total Kjeldahl Nitrogen mg/ℓ	Total Phosphorus mg/ℓ	Dissolved o-Phosphates mg/ℓ	% Diss. o-Phosphates in Total Phosphorus
Number of Samples	24	24	24	24	23	23
Average Value	0.060	0.167	0.41	0.17	0.064	0.45
Standard Deviation	0.118	0.129	0.16	0.08	0.026	0.26
Maximum Value	0.597	0.637	0.75	0.35	0.113	1.13
Minimum Value	< 0.005	0.049	< 0.05	0.08	0.026	0.10
IRRIGATION SEASON						
Number of Samples	21	21	21	21	20	20
Average Value	0.064	0.146	0.41	0.17	0.066	0.46
Standard Deviation	0.125	0.086	0.17	0.08	0.027	0.27
Maximum Value	0.597	0.430	0.75	0.35	0.113	1.13
Minimum Value	< 0.005	0.049	< 0.05	0.09	0.026	0.10
NON-IRRIGATION SEASON						
Number of Samples	3	3	3	3	3	3
Average Value	0.034	0.314	0.39	0.17	0.045	0.33
Standard Deviation	0.034	0.280	0.06	0.12	0.014	0.17
Maximum Value	0.071	0.637	0.44	0.30	0.060	0.46
Minimum Value	< 0.005	0.152	0.32	0.08	0.032	0.14

Table 5A. Statistical Analysis of C-3 Physical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
Number of Samples	2	2	2	NA	NA	2
Average Value	21.9	7.12	5.31	NA	NA	45
Standard Deviation	0.6	0.37	0.40	NA	NA	21.2
Maximum Value	22.3	7.38	5.60	NA	NA	60
Minimum Value	21.5	6.86	5.03	NA	NA	30

IRRIGATION SEASON						
Number of Samples	2	2	2	NA	NA	2
Average Value	21.9	7.12	5.31	NA	NA	45
Standard Deviation	0.6	0.37	0.40	NA	NA	21.2
Maximum Value	22.3	7.38	5.60	NA	NA	60
Minimum Value	21.5	6.86	5.03	NA	NA	30

NON-IRRIGATION SEASON						
Number of Samples	NA	NA	NA	NA	NA	NA
Average Value	NA	NA	NA	NA	NA	NA
Standard Deviation	NA	NA	NA	NA	NA	NA
Maximum Value	NA	NA	NA	NA	NA	NA
Minimum Value	NA	NA	NA	NA	NA	NA

Table 5B. Statistical Analysis of C-3 Physical Parameters. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
Number of Samples	2	2	2	NA	NA	2
Average Value	21.9	7.12	5.31	NA	NA	45
Standard Deviation	0.6	0.37	0.40	NA	NA	21.2
Maximum Value	22.3	7.38	5.60	NA	NA	60
Minimum Value	21.5	6.86	5.03	NA	NA	30

1993 IRRIGATION SEASON						
Number of Samples	NA	NA	NA	NA	NA	NA
Average Value	NA	NA	NA	NA	NA	NA
Standard Deviation	NA	NA	NA	NA	NA	NA
Maximum Value	NA	NA	NA	NA	NA	NA
Minimum Value	NA	NA	NA	NA	NA	NA

Table 6. Lower Payette River SAWQP, Station C-7, Physical Parameters 1992-93.

DATES	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
92/06/08	NA	NA	NA	61.4	NA	NA
92/06/23	26.7	7.55	0.17 ?	9.5	3	210
92/07/06	22.0	8.01	8.08	102.2	5	330
92/07/20	23.0	7.33	6.20	9.2	3	240
92/08/03	24.5	7.39	6.32	61.4	5	240
92/08/17	23.4	7.41	4.96	46.6	5	280
92/08/31	21.0	7.29	8.72	75.5	3	260
92/09/15	16.5	7.48	7.58	126.1	3	228
92/09/28	15.5	7.12	9.23	152.4	4	200
92/10/13	15.5	8.75	7.66	88.2	5	210
92/11/12	6.4	7.02	10.59	14.6	4	150
93/02/16	4.0	NA	NA	223.2	8	120
93/03/16	NA	NA	NA	NA (flooding)	NA	NA
93/04/13	12.0	NA	NA	~ 120.0	13	280
93/05/10	15.3	7.71	NA	45.0	10	100
93/05/24	18.0	7.49	NA	76.7	21	65
93/06/14	16.8	7.75	10.6	125.8	NA	800
93/06/23	20.2	NA	NA	88.3	10	75
93/07/06	22.0	7.7	NA	17.5	3	120
93/07/19	NA	7.79	NA	30.3	4	93
93/08/02	30.0	NA	NA	15.4	3.5	120
93/08/16	19.0	7.96	NA	38.5	5	100
93/08/30	19.0	NA	NA	14.9	2	130
93/09/13	18.0	NA	NA	73.9	2	120
93/09/27	15.5	7.91	NA	57.5	3	150

Table 6A. Statistical Analysis of C-7 Physical Parameters. Lower Payette SAWQP, 1992-93.

OVERALL	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity µmhos
Number of Samples	22	17	11	24	22	23
Average Value	18.4	7.63	7.28	69.8	5.7	200.9
Standard Deviation	6.0	0.41	2.95	52.8	4.5	150.5
Maximum Value	30.0	8.75	10.6	223.2	21	800
Minimum Value	4.0	7.02	0.17 ?	9.2	2	65

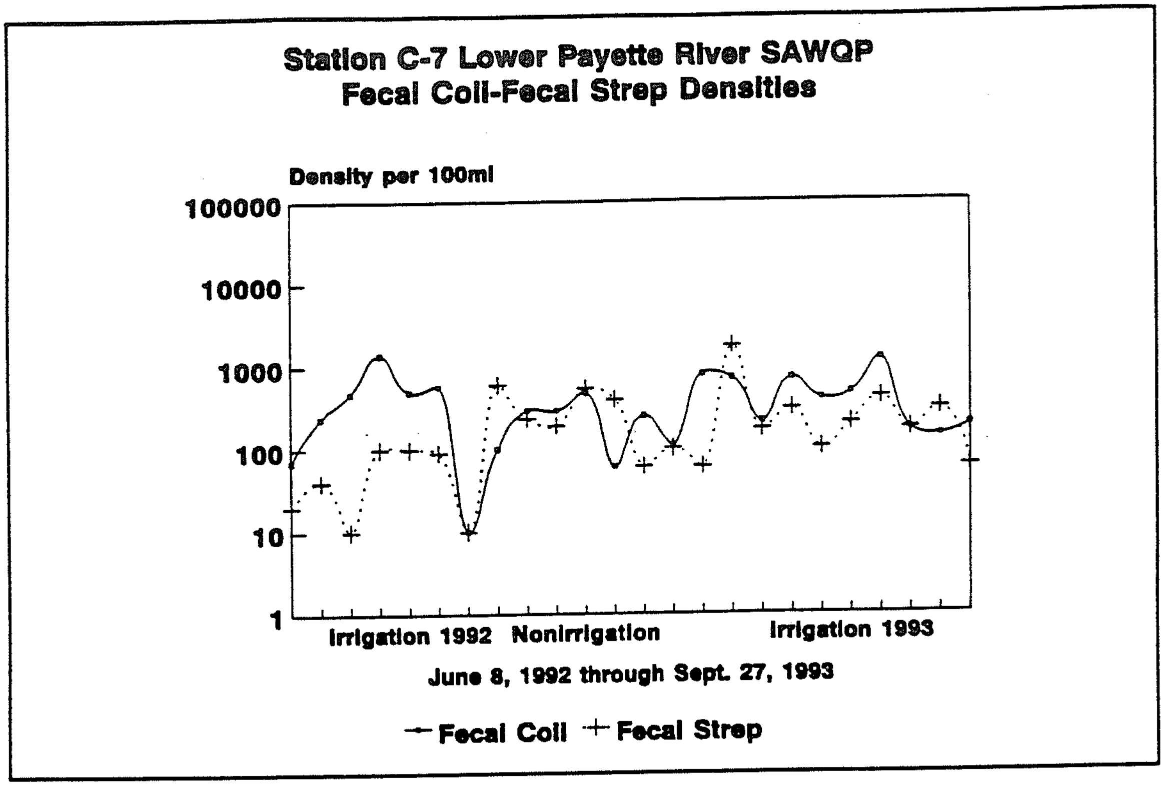
IRRIGATION SEASON						
Number of Samples	19	15	9	21	19	20
Average Value	19.9	7.59	6.87	64.2	5.7	207.1
Standard Deviation	4.4	0.26	3.04	42.7	4.8	160.3
Maximum Value	30.0	8.01	10.6	152.4	21	800
Minimum Value	12.0	7.12	0.17 ?	9.2	2	65

NON-IRRIGATION SEASON						
Number of Samples	3	2	2	3	3	3
Average Value	8.6	7.89	9.13	108.7	5.7	160.0
Standard Deviation	6.1	1.22	2.07	105.8	2.1	45.8
Maximum Value	15.5	8.75	10.59	223.2	8	210
Minimum Value	4.0	7.02	7.66	14.6	4	120

Table 6B. Statistical Analysis of C-7 Physical Parameters. Lower Payette SAWQP, 1992-93.

1992 IRRIGATION SEASON	Temp in °C	pH su	DO mg/ℓ	Flow cfs	Turbidity NTU	Conductivity μmhos
Number of Samples	8	8	8	9	8	8
Average Value	21.6	7.45	6.41	71.6	3.9	248.5
Standard Deviation	3.8	0.26	2.89	48.8	1.0	41.7
Maximum Value	26.7	8.01	9.23	152.4	5	330
Minimum Value	15.5	7.12	0.17 ?	9.2	3	200

1993 IRRIGATION SEASON						
Number of Samples	11	7	1	12	11	12
Average Value	18.7	7.76	10.6	58.7	7.0	179.4
Standard Deviation	4.6	0.15	0	38.8	6.0	203.0
Maximum Value	30.0	7.96	10.6	125.8	21	800
Minimum Value	12.0	7.49	10.6	14.9	2	65


Station C-7 Lower Payette River SAWQP
Fecal Coli-Fecal Strep Densities
Density per 100ml
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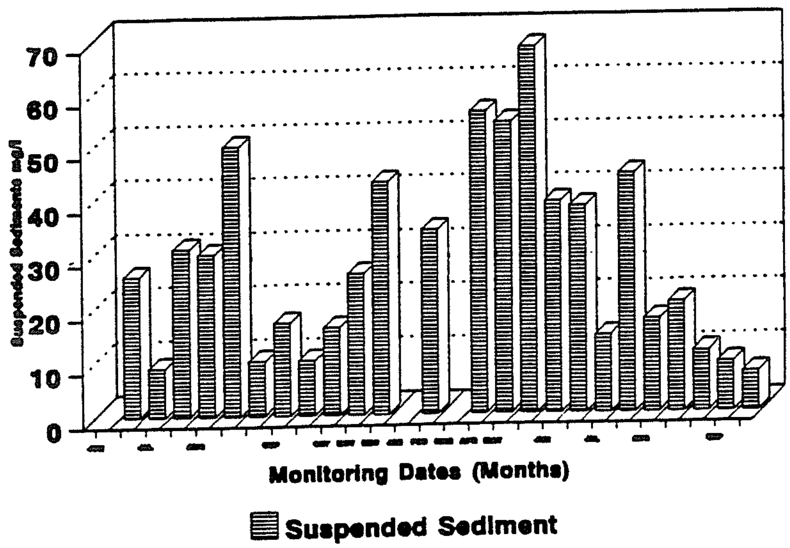
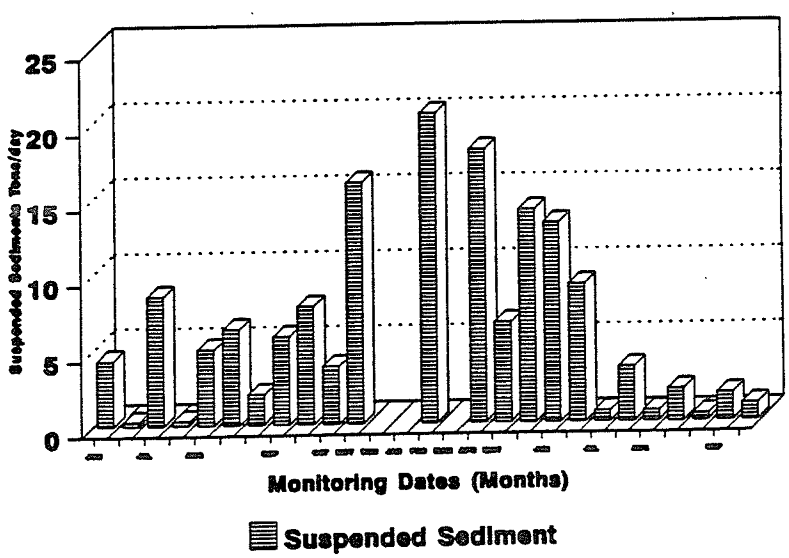
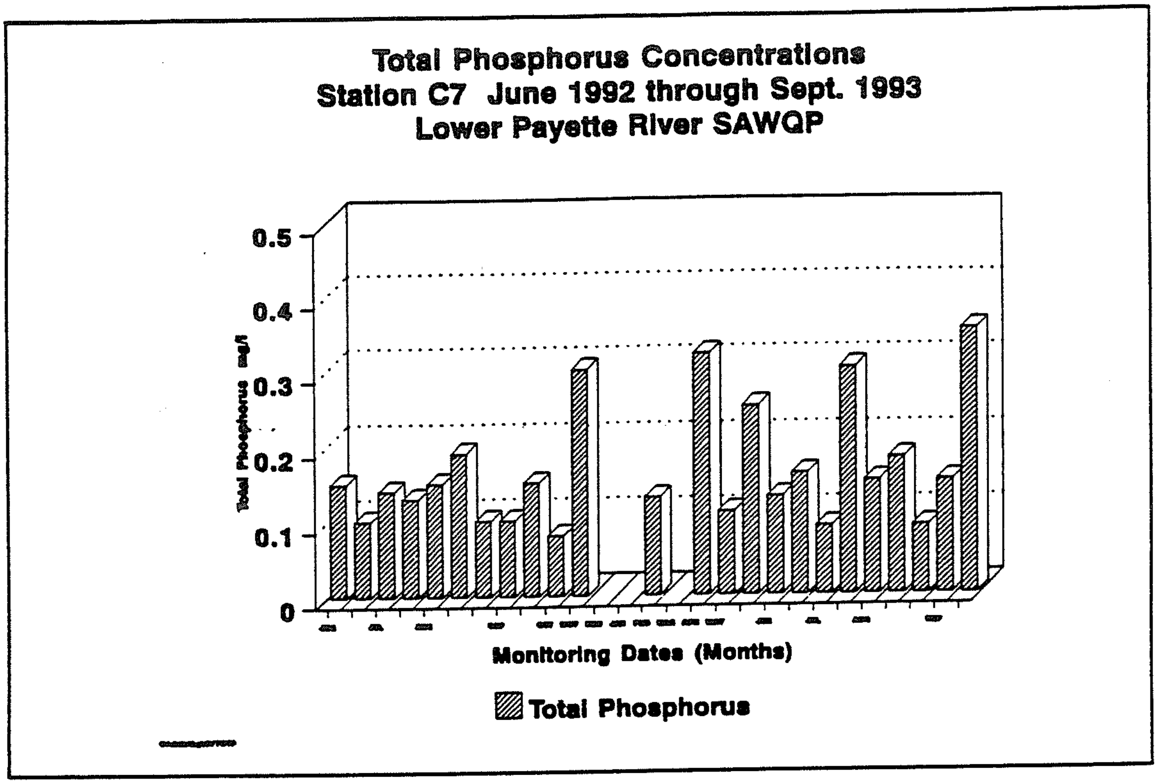
10000
1000
100
10
1
Irrigation 1992
Nonirrigation
Irrigation 1993
June 8, 1992 through Sept. 27, 1993
Fecal Coli
Fecal Strep

Suspended Sediment Concentrations
Station C7 June 1992 through Sept. 1993
Lower Payette River SAWQP



Suspended Sediment Daily Loadings
Station C7 June 1992 through Sept. 1993
Lower Payette River SAWQP




Total Phosphorus Concentrations
Station C7 June 1992 through Sept. 1993
Lower Payette River SAWQP
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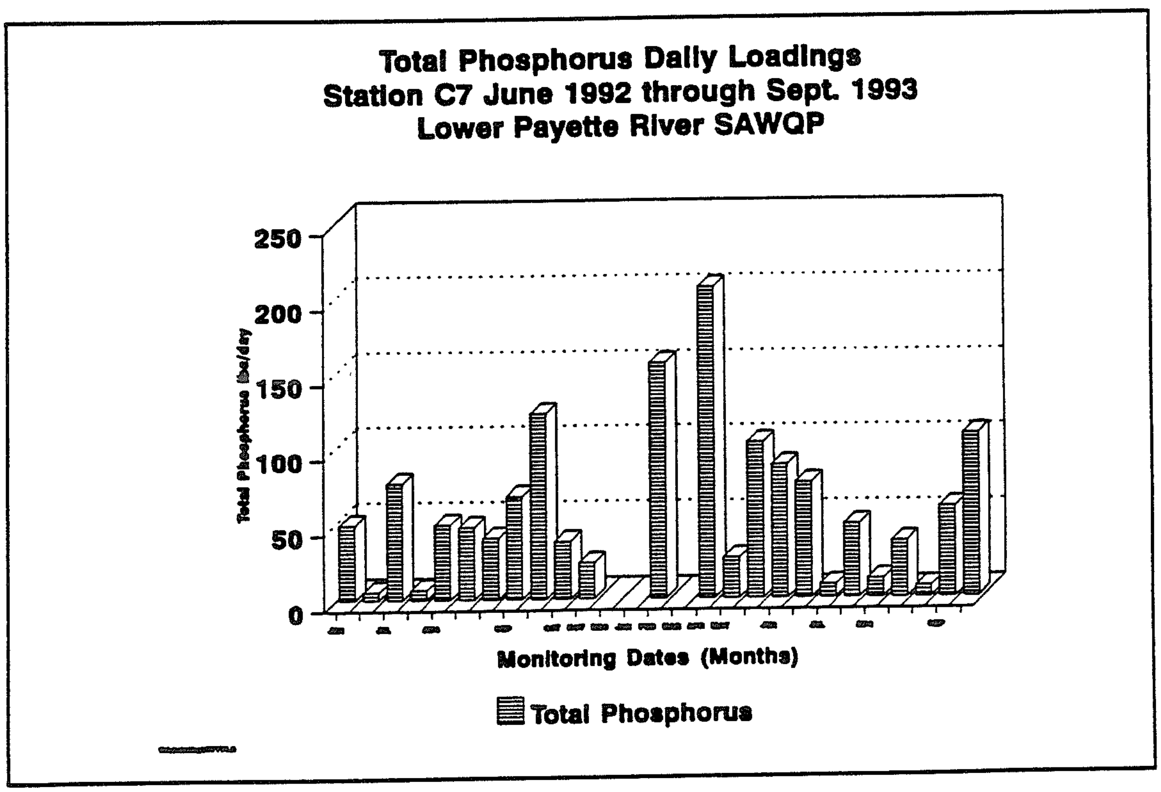
0.4
0.3
0.2
0.1
0
Total Phosphorus mg/l
Monitoring Dates (Months)
Total Phosphorus


Total Phosphorus Daily Loadings
Station C7 June 1992 through Sept. 1993
Lower Payette River SAWQP
250
200
150
100
50
0
Total Phosphorus lbs/day
Monitoring Dates (Months)
Total Phosphorus

APPENDIX C

APPENDIX C. Table of Content

Table 1. Total Phosphorus Loads at Station R-1, Payette River at Letha, Idaho.

DATE	Discharge (cfs)	Total Phosphorus (mg/ℓ)	Daily Total Phosphorus Load (lbs)	Interval (days)	Interval Loads (lbs)
11/01/92	NA	NA	NA	NA	NA
11/18/92	1079	0.095	552	18	9936
12/08/92	1194	0.069	443	20	8860
01/19/93	1330	0.084	601	43	25843
02/23/93	1173	0.088	530	45	23850
03/16/93	1895	0.110	1121	21	23541
04/12/93	4966	0.024	642	27	17334
05/18/93	10467	0.076	4281	36	154116
06/08/93	10513	0.074	505	19	9595
07/06/93	1468	0.064	288	28	8064
08/10/93	1309	0.041	307	35	10780
09/08/93	520	0.110	179	29	5191
TOTAL					297,110 lbs

Table 2. Total Phosphorus Loads at Station R-2, Payette River at Hwy 95, Payette, Idaho.

DATE	Discharge (cfs)	Total Phosphorus (mg/ℓ)	Daily Total Phosphorus Load (lbs)	Interval (days)	Interval Loads (lbs)
11/01/92	NA	NA	NA	NA	NA
11/06/92	1010	0.07	381	6	2286
12/16/92	1670	0.05	449	40	17960
01/08/93	1537	0.07	558	23	12834
02/17/93	1790	0.05	482	40	19280
03/12/93	2226	0.10	1195	24	28680
04/27/93	5250	0.05	1413	46	64998
05/20/93	9486	0.05	2551	23	58673
06/29/93	4710	0.02	507	40	20280
07/23/93	2610	0.06	843	24	20232
08/25/93	1830	0.05	492	32	15744
09/20/93	1220	0.10	657	26	17082
TOTAL					278,049 lbs

Table 3. Susp̄ended S̄ediment Loads at Station R-1, Payette River at Letha, Idaho.

DATE	Discharge (cfs)	Suspended Sediment (mg/ℓ)	Daily Suspended Sediment Load (tons)	Interval (days)	Interval Loads (tons)
11/01/92	NA	NA	NA	NA	NA
11/18/92	1079	10	29	18	522
12/08/92	1194	18	58	20	1160.0
01/19/93	1330	14	50	43	2150
02/23/93	1173	14	44	45	1980
03/16/93	1895	17	87	21	1827
04/12/93	4966	8	107	27	2889
05/18/93	10467	22	622	36	22392
06/08/93	10513	19	539	19	10241
07/06/93	1468	9	36	28	1008
08/10/93	1309	9	32	35	1120
09/08/93	520	7	10	29	290
TOTAL					45576 tons

Table 4. Suspended Sediment Loads at Station R-2, Payette River at Hwy 95, Payette, Idaho.

DATE	Discharge (cfs)	Suspended Sediment (mg/ℓ)	Daily Suspended Sediment Load (tons)	Interval (days)	Interval Loads (tons)
11/01/92	NA	NA	NA	NA	NA
11/06/92	1010	13	35	6	210
12/16/92	1670	13	59	40	1960
01/08/93	1537	NA	NA	NA	NA
02/17/93	1790	20	97	63	6111
03/12/93	2226	45	270	24	6480
04/27/93	5250	14	198	46	9108
05/20/93	9486	40	1020	23	23460
06/29/93	4710	21	267	40	10680
07/23/93	2610	NA	NA	NA	NA
08/25/93	1830	41	203	49	9947
09/20/93	1220	37	122	26	3172
TOTAL					71128 tons

Table 5. Chemical Parameters at Station R-1, Payette River at Letha, Idaho.

DATE	Nitrogen NO_2+NO_3 (Dissolved) (mg/ℓ)	Total Ammonia (Dissolved) (mg/ℓ)	Total Phosphorus as P (mg/ℓ)	Dissolved Ortho-Phosphates (mg/ℓ)	Suspended Sediment (mg/ℓ)
11/18/92	0.30	< 0.010	0.095	0.070	10
12/08/92	0.30	0.070	0.069	0.037	18
01/19/93	0.40	0.060	0.084	0.056	14
02/23/93	0.40	0.030	0.088	0.067	14
03/16/93	0.40	0.030	0.110	0.059	17
04/12/93	0.20	0.020	0.074	0.034	8
05/18/93	0.10	0.020	0.076	0.027	22
06/08/93	0.10	0.010	0.074	0.029	19
07/06/93	0.07	0.030	0.064	0.033	9
08/10/93	0.08	0.020	0.041	0.015	9
09/08/93	0.21	< 0.010	0.110	0.072	7

Table 6. Chemical Parameters at Station R-2, Payette River at Hwy 95.

DATE	Nitrogen NO_3+NO_3 (Dissolved) (mg/ℓ)	Total Ammonia (Dissolved) (mg/ℓ)	Total Phosphorus as P (mg/ℓ)	Dissolved Ortho-Phosphates (mg/ℓ)	Suspended Sediment (mg/ℓ)
11/06/92	0.380	< 0.010	0.070	0.030	13
12/16/92	0.043	0.020	0.050	0.010	13
01/08/93	0.460	0.050	0.07	0.020	NA
02/17/93	0.380	0.020	0.05	0.020	20
03/12/93	0.480	0.030	0.10	0.040	45
04/27/93	0.1100	0.020	0.05	0.010	14
05/20/93	0.099	< 0.010	0.05	0.020	40
06/29/93	0.160	0.020	0.02	0.020	21
07/23/93	0.260	0.020	0.06	0.030	NA
08/25/93	0.360	0.020	0.05	0.030	3
09/20/93	0.550	0.020	0.10	0.030	NA

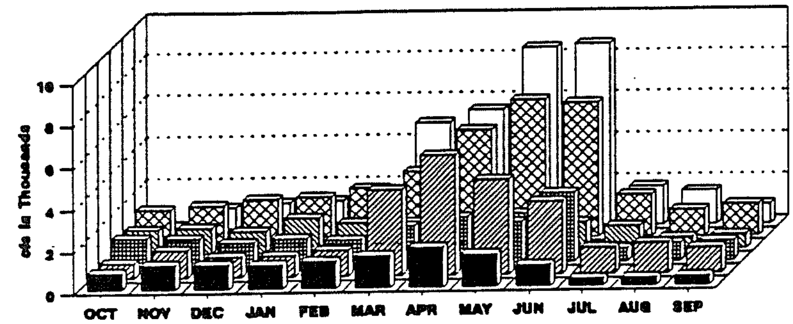
Table 7. Physical Parameters at Station R-1, Payette River at Letha, Idaho.

DATE	Temperature (°C)	Specific Conductivity (us/cm)	Dissolved Oxygen (mg/ℓ)	Fecal Coliform (Colonies/100mℓ)	Fecal Streptococci (Colonies/100mℓ)
11/06/92	9.5	212	10.6	86	200
12/16/92	1.0	155	9.9	25	180
01/08/93	0.5	161	9.6	< 30	110
02/17/93	2.5	157	13.9	< 7	< 6
03/12/93	5.5	170	12.3	NA	190
04/27/93	10.0	97	11.0	55	150
05/20/93	14.0	59	11.5	260	88
06/29/93	16.5	85	9.4	380	220
07/23/93	10.5	134	9.2	290	910
08/25/93	18.0	158	10.9	180	790
09/20/93	16.5	207	10.5	> 300	> 600

Table 8. Physical Parameters at Station R-1, Payette River at Hwy 95.

DATE	Temperature (°C)	Specific Conductivity (μmhos)	Dissolved Oxygen (mg/ℓ)	Fecal Coliform (Colonies/100mℓ)	Fecal Streptococci (Colonies/100mℓ)
11/18/92	9.3	220	10.6	56	80
12/08/92	3.7	170	12.0	100	160
01/19/93	2.7	184	12.3	50	56
02/23/93	4.0	221	11.2	120	160
03/16/93	7.4	200	11.4	140	70
04/12/93	7.3	101	11.0	58	32
05/18/93	13.2	69	11.3	320	120
06/08/93	13.2	74	11.0	238	315
07/06/93	19.0	NA	NA	440	200
08/10/93	17.5	NA	NA	315	280
09/08/93	18.0	NA	NA	35	440

LOWER PAYETTE RIVER FLOWS
Payette River @ Payette, Id.
Water Years 88, 89, 90, 91, 92, & 93



	OCT	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
WY 1993		1.029	1.217	1.303	1.243	4.964	5.56	8.582	8.736	1.838	1.617	0.963
WY 1992	1.523	1.684	1.968	2.071	2.473	3.228	5.169	6.587	6.421	2.027	1.302	1.531
WY 1991	1.133	1.213	1.023	1.642	1.402	1.386	1.034	1.759	1.294	1.101	0.528	0.661
WY 1990	1.306	1.284	1.061	1.224	1.139	1.801	2.191	1.909	3.277	0.613	0.84	0.932
WY 1989	0.704	1.297	0.967	0.994	1.246	4.117	5.732	4.556	3.468	1.257	1.466	1.2
WY 1988	0.828	1.19	1.191	1.154	1.306	1.642	1.931	1.572	1.036	0.367	0.401	0.447

Monthly Means WY 88, 89, 90, 91, 92, 93

WY 1988 WY 1989 WY 1990 WY 1991 WY 1992 WY 1993

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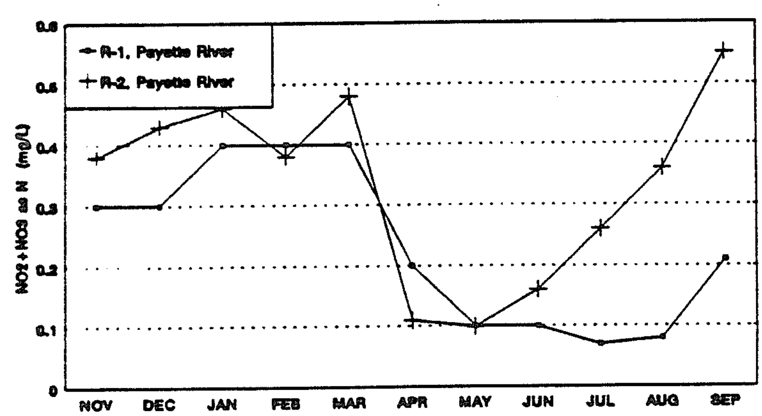
Nitrate-Nitrite Concentrations
Stations R-1 and R-2, Lower Payette River
Lower Payette River SAWQP



	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP
R-1, Payette River	0.3	0.3	0.4	0.4	0.4	0.2	0.1	0.1	0.07	0.08	0.21
R-2, Payette River	0.38	0.43	0.48	0.38	0.48	0.11	0.099	0.16	0.26	0.36	0.56

Monitoring Months

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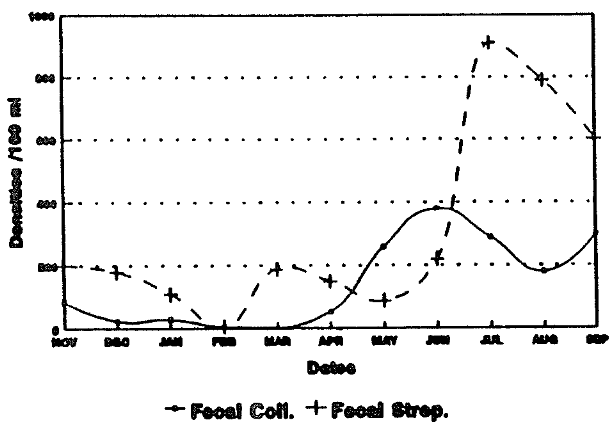
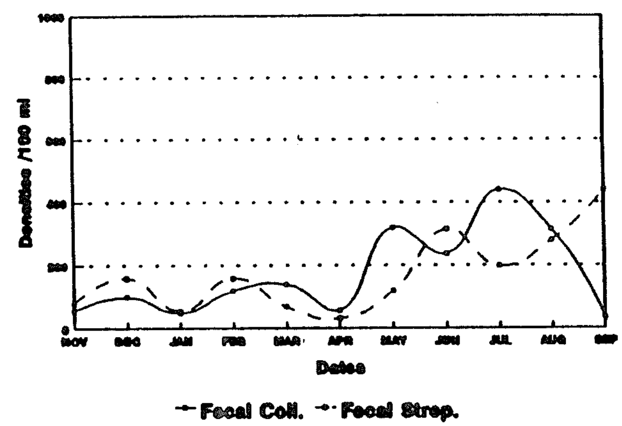
Lower Payette River SAWQP
Bacteria Densities, Hwy 95
November 1992 through Sept. 1993



Lower Payette River SAWQP
Bacteria Densities, Letha
November 1992 through Sept. 1993



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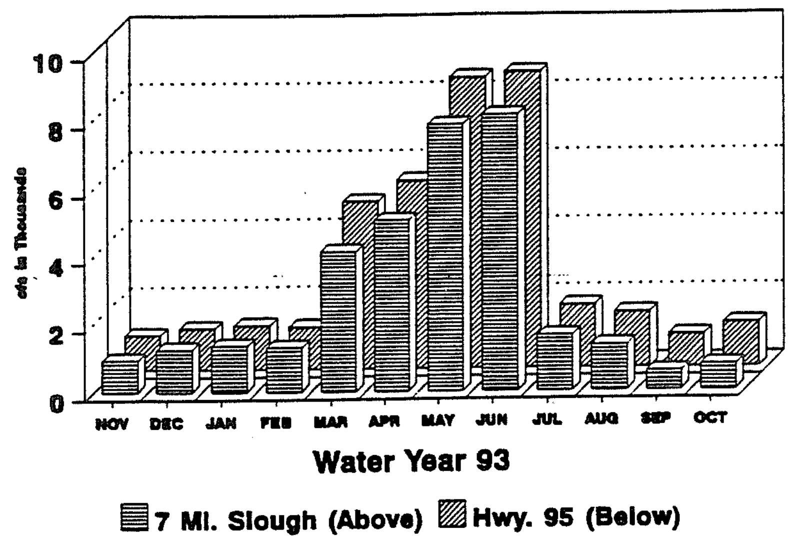
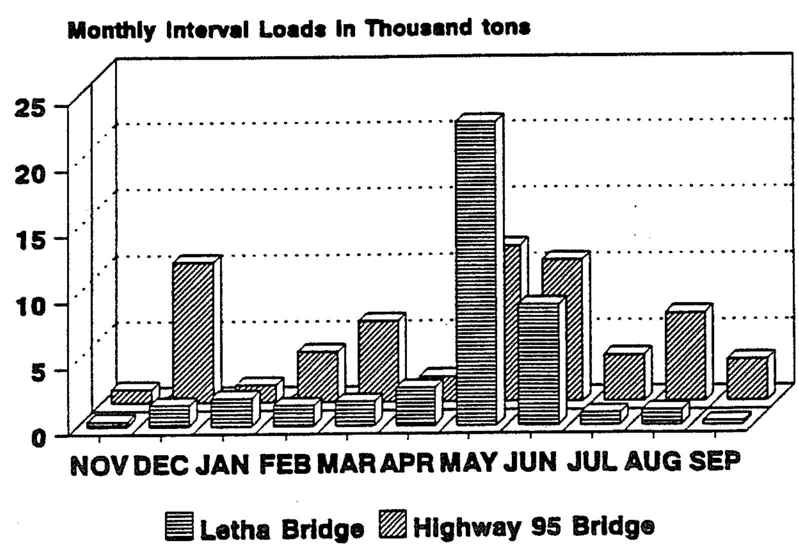
LOWER PAYETTE RIVER FLOWS
ABOVE AND BELOW PROJECT AREA
Water Year 1993



Below is estimated Flow (IDWR 1993)
C:\DATA\HG\FLOW1993

Lower Payette River SAWQP
Susp. Sediment Loads, Water Year 1993
Letha Bridge (above) Hwy 95 (below)



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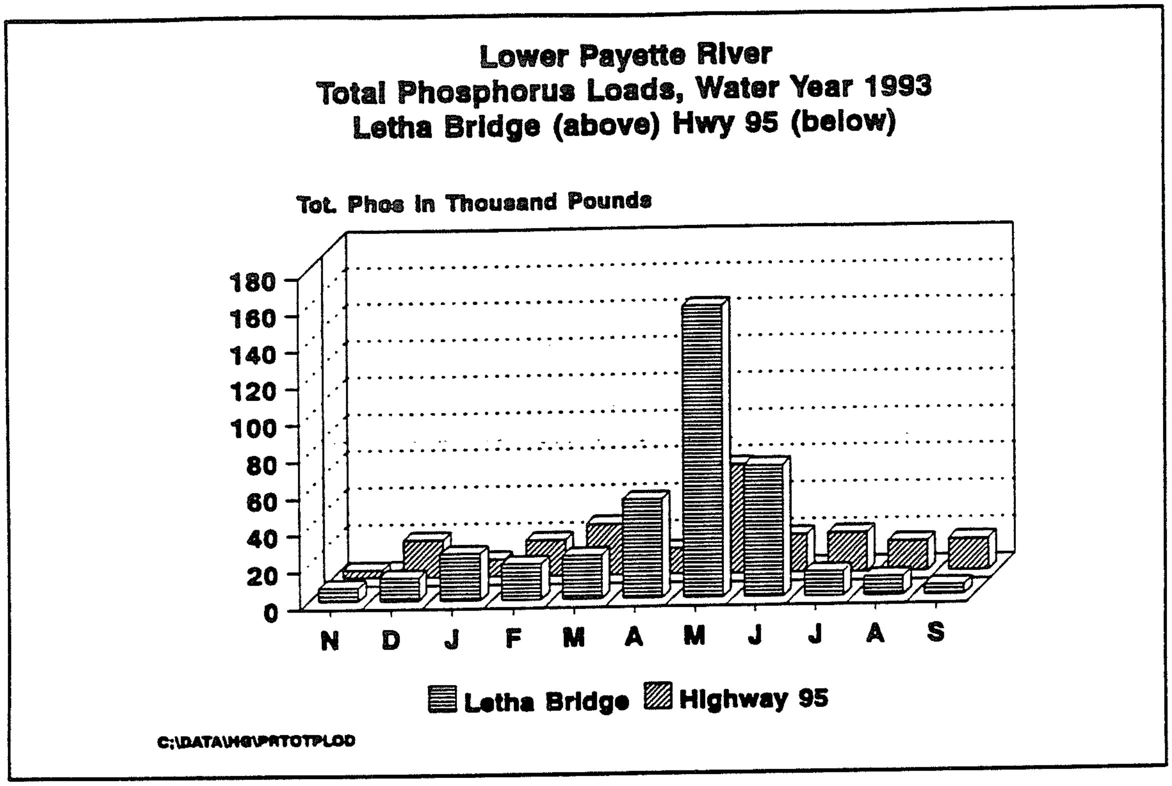

Lower Payette River
Total Phosphorus Loads, Water Year 1993
Letha Bridge (above) Hwy 95 (below)
Tot. Phos in Thousand Pounds
180
160
140
120
100
80
60
40
20
0
N D J F M A M J J A S
Letha Bridge
Highway 95
C:\DATA\HG\PRTOTPLOD

APPENDIX D

APPENDIX D. Table of Content

Table 1. Ground Water Data for Wells 101 and 9. Lower Payette River SAWQP 1992-94.

Parameter	Well#101					Well #9				
	10/92	4/93	10/93	MEAN	STD	10/92	4/93	10/93	MEAN	STD
Temperature (°C)	16	16.2	15	15.3	0.5	14.2	13.3	14	13.8	0.4
pH (su)	6	7.07	7.51	6.86	0.63	6.78	7.12	6.78	6.89	2.06
Conductivity (umhos/cm)	295	490	345	377	82.7	500	500	500	500	0
Ammonia (mg/ℓ)	0.092	0.192	<0.005	0.095	0.08	0.034	0.054	0.008	0.032	0.019
NO2 + NO3 as N (mg/ℓ)	1.25	3.19	1.67	2.03	0.83	5.95	7.38	5.9	6.39	0.66
T. Kjel Nitrogen (mg/ℓ)	<0.05	0.13	<0.005	0.05	0.06	0.07	0.12	0.09	0.09	0.020
Calcium (mg/ℓ)	43	87	51	60	19.1	62	72	61	65	4.9
Magnesium (mg/ℓ)	16	26	17.8	20	4.4	15	15	14.2	14.7	0.38
Sodium (mg/ℓ)	12	26	17	18	5.8	72	86	70	76	7.1
Chlorides (mg/ℓ)	3	8	2	5	2.2	5	7	7	6.3	0.94
Sulphate (mg/ℓ)	2	26	212	13	9.8	22	26	22	23	1.9
Arsenic (mg/ℓ)	12	<10	16	11.6	5.9	<10	10	8	9	4.3
2, 4-D (ug/ℓ)	u	u	u	NA	NA	u	u	u	NA	NA
Dacthal (ug/ℓ)	0.19	u	u	NA	NA	u	u	u	NA	NA

Table 2. Ground Water Data for Wells 7 and 10. Lower Payette River SAWQP 1992-93.

Parameter	Well #7					Well #10				
	10/92	4/93	10/93	MEAN	STD	10/92	4/93	10/93	MEAN	STD
Temperature (°C)	19.5	19.6	19.2	19.4	0.17	13.5	13.6	13.3	13.5	0.1
pH (su)	7.62	7.44	7.53	7.53	0.07	6.75	7.33	8.08	7.38	0.54
Conductivity (umhos/cm)	180	175	170	175	4.0	625	595	500	573	53.3
Ammonia (mg/L)	0.076	0.028	0.01	0.038	0.027	0.028	0.209	0.006	0.081	0.090
NO2 + NO3 as N (mg/ℓ)	0.109	0.179	0.119	0.135	0.031	11.9	12.7	9.88	11.49	1.19
T. Kjel Nitrogen (mg/ℓ)	<0.05	<0.05	NA	NA	NA	<0.05	0.1	0.16	0.086	0.065
Calcium (mg/ℓ)	20	23	19	20.7	1.7	46	53	42	47	4.5
Magnesium (mg/ℓ)	3.4	4	3.5	3.6	0.262	18	19	18	18.3	.5
Sodium (mg/ℓ)	18	23	18	19.7	2.4	112	140	108	120	14.2
Chlorides (mg/ℓ)	6	5	6	5.7	0.5	13	12	11	12	0.82
Sulphate (mg/ℓ)	15	14	16	15	0.8	61	62	57	60	2.16
Arsenic (mg/ℓ)	<10	<10	<10	NA	NA	16	15	19	16.67	1.7
2, 4-D (ug/ℓ)	u	u	u	NA	NA	u	u	u	NA	NA
Dacthal (ug/ℓ)	0.06	u	u	NA	NA	0.8	0.4	u	0.6	0.2

Table 3. Ground Water Data for Wells 11 and 25. Lower Payette River SAWQP 1992-93.

Parameter	Well#11					Well #25				
	10/92	4/93	10/93	MEAN	STD	10/92	4/93	10/93	MEAN	STD
Temperature (°C)	14.5	14.2	14	14.2	0.2	15.1	14.5	14.6	14.7	0.26
pH (su)	6.55	7.47	8.00	7.34	0.60	NA	7.51	7.67	7.59	0.08
Conductivity (umhos/cm)	450	475	440	455	14.7	610	650	600	620	21.6
Ammonia (mg/ℓ)	0.059	0.184	<0.005	0.081	0.077	0.017	0.01	<0.005	0.0135	0.004
NO2 + NO3 as N (mg/ℓ)	10.5	11.9	8.65	10.35	1.33	2.28	2.9	2.04	2.41	0.36
T. Kjel Nitrogen (mg/ℓ)	0.12	0.10	0.07	0.10	0.020	<0.05	0.09	NA	NA	NA
Calcium (mg/ℓ)	29	38	29	32	4.2	0.3	6	0.2	2.2	2.7
Magnesium (mg/ℓ)	9.5	9	9.2	9.2	0.2	<0.1	1	0.1	0.55	0.45
Sodium (mg/ℓ)	90	106	84	93.3	9.3	210	270	192	224	33.3
Chlorides (mg/ℓ)	8	7	5	6.7	1.2	16	12	13	13.7	1.7
Sulphate (mg/ℓ)	54	54	46	51.3	3.78	69	53	64	62	6.7
Arsenic (mg/ℓ)	35	34	38	35.7	1.7	<10	<10	10	NA	NA
2, 4-D (ug/ℓ)	u	u	u	NA	NA	u	u	u	NA	NA
Dacthal (ug/ℓ)	u	u	u	NA	NA	0.24	u	u	NA	NA

Table 4. Ground Water Data for Wells 26 and 27. Lower Payette River SAWQP 1992-93.

Parameter	Well#26					Well #27				
	10/92	4/93	10/93	MEAN	STD	10/92	4/93	10/93	MEAN	STD
Temperature (°C)	15.1	14.2	14.9	14.7	0.4	16.2	15.2	15.4	15.6	0.4
pH (su)	7.43	7.36	7.48	7.42	0.05	NA	8.05	8.28	8.16	0.12
Conductivity (umhos/cm)	650	680	660	663	12.5	370	370	360	367	4.7
Ammonia (mg/ℓ)	0.017	0.01	<0.005	0.014	0.003	0.049	0.014	<0.005	0.032	0.018
NO2 + NO3 as N (mg/ℓ)	4.44	4.40	3.81	4.22	0.29	0.45	0.80	0.74	0.66	0.15
T. Kjel Nitrogen (mg/ℓ)	0.11	0.05	NA	0.053	0.045	<0.05	0.07	0.09	0.08	0.01
Calcium (mg/ℓ)	83	94	81	86	5.7	18	20	18	18.7	0.9
Magnesium (mg/ℓ)	18.5	18	18	18.2	0.2	5.5	5	5.2	5.2	0.20
Sodium (mg/ℓ)	97	126	110	111	11.9	84	96	83	87.7	5.9
Chlorides (mg/ℓ)	26	24	28	26	1.6	13	19	21	17.7	3.4
Sulphate (mg/ℓ)	88	72	96	85.3	10.0	55	59	68	60.7	5.4
Arsenic (mg/ℓ)	10	<10	11	10.5	1	60	59	55	58	2.2
2, 4-D (ug/ℓ)	u	u	u	NA	NA	u	u	u	NA	NA
Dacthal (ug/ℓ)	u	u	u	NA	NA	u	u	u	NA	NA

Table 6. Ground Water Data for Wells 55 and 58. Lower Payette River SAWQP 1992-93.

Parameter	Well#55					Well #58				
	10/92	4/93	10/93	MEAN	STD	10/92	4/93	10/93	MEAN	STD
Temperature (°C)	14.8	14.8	14.0	14.5	0.4	13.7	13.3	13.1	13.4	0.25
pH (su)	6.78	6.96	7.6	7.11	0.4	6.38	7.07	7.87	7.11	0.60
Conductivity (umhos/cm)	260	600	600	486.7	160.3	610	600	550	586.7	26.2
Ammonia (mg/ℓ)	0.057	<0.05	<0.05	NA	NA	0.055	<0.005	0.011	0.033	0.022
NO2 + NO3 as N as N (mg/ℓ)	0.685	4.71	3.34	2.91	1.67	5.5	8.33	6.58	6.80	1.17
T. Kjel Nitrogen (mg/ℓ)	<0.05	0.06	<0.05	NA	NA	<0.05	0.10	<0.05	NA	NA
Calcium (mg/ℓ)	29	91	75	65	26.3	59	65	58	60.7	3.1
Magnesium (mg/ℓ)	20	43	16.6	26.5	11.7	44.5	41	40.5	42	1.8
Sodium (mg/ℓ)	29	60	57	48.7	13.9	59	74	58	63.7	7.3
Chlorides (mg/ℓ)	3	5	5	4.3	0.9	6	5	6	5.7	0.5
Sulphate (mg/ℓ)	10	48	53	37	19.2	36	42	37	38.3	2.6
Arsenic (mg/ℓ)	24	17	20	20.3	2.9	23	31	28	27.3	3.3
2, 4-D (ug/ℓ)	u	u	u	NA	NA	u	u	u	NA	NA
Dacthal (ug/ℓ)	0.15	u	u	NA	NA	u	u	u	NA	NA

Table 5. Ground Water Data for Wells 37 and 38. Lower Payette River SAWQP 1992-93.

Parameter	Well #37					Well #38				
	10/92	4/93	10/93	MEAN	STD	10/92	4/93	10/93	MEAN	STD
Temperature (°C)	14.6	14.7	14.1	14.7	0.3		14.8	14.3	14.5	0.3
pH (su)	7.44	6.77	7.18	7.13	0.27		7.74	7.80	7.77	0.03
Conductivity (umhos/cm)	1400	1850	1290	1513.3	242.3		420	455	438	17.50
Ammonia (mg/ℓ)	0.07	0.021	<0.005	0.045	0.025		0.008	<0.005	NA	NA
NO2 + NO3 as N (mg/ℓ)	57.30	66.60	41.90	55.30	10.19		1.83	2.51	2.17	0.34
T. Kjel Nitrogen (mg/ℓ)	0.57	0.08	NA	0.33	0.25		<0.05	NA	NA	NA
Calcium (mg/ℓ)	210	260	180	216.7	33.0		28	25	26.5	1.5
Magnesium (mg/ℓ)	66	87	225	126	70.5		8	7.8	7.9	0.1
Sodium (mg/ℓ)	116	156	115	129	19		111	94	102.5	8.5
Chlorides (mg/ℓ)	112	181	100	131	35.7		21	27	24	3
Sulphate (mg/ℓ)	219	244	228	230.3	10.3		27	30	28.5	1.5
Arsenic (mg/ℓ)	<10	<10	<10	NA	NA		44	40	42	2
2, 4-D (ug/ℓ)	NA	u	u	NA	NA		u	u	NA	NA
Dacthal (ug/ℓ)	u	0.12	u	NA	NA		0.04	u	NA	NA

Table 7. Ground Water Data for Wells 65 and 71. Lower Payette River SAWQP 1992-93.

Parameter	Well#65					Well #71				
	10/92	4/93	10/93	MEAN	STD	10/92	4/93	10/93	MEAN	STD
Temperature (°C)	14.3	13.6	14	13.9	0.3	13.9	14.1	14.2	14.1	0.1
pH (su)	NA	7.38	7.82	7.60	0.22	7.42	7.44	8.00	7.62	0.27
Conductivity (umhos/cm)	650	590	510	583.3	57.3	NA	550	500	525	25
Ammonia (mg/ℓ)	0.032	0.131	<0.005	0.082	0.050	0.031	0.011	0.019	0.020	0.008
NO2 + NO3 as N (mg/ℓ)	21.1	16.5	13.0	16.87	3.32	5.28	3.92	4.03	4.41	0.61
T. Kjel Nitrogen (mg/ℓ)	0.13	0.13	<0.05	0.13	0.0	0.18	0.13	<0.05	0.155	0.025
Calcium (mg/ℓ)	78	82	68	76	5.9	40	51	40	43.7	5.2
Magnesium (mg/ℓ)	29.5	28	25.5	27.7	1.6	15.5	16	15.8	15.8	0.21
Sodium (mg/ℓ)	73	80	69	74	4.5	108	134	112	118	11.4
Chlorides (mg/ℓ)	22	11	13	15.3	4.8	6	5	5	5.3	0.5
Sulphate (mg/ℓ)	72	61	52	61.7	8.2	34	39	38	37.0	2.2
Arsenic (mg/ℓ)	19	20	20	19.7	0.5	38	44	34	38.7	4.1
2, 4-D (ug/ℓ)	u	u	u	NA	NA	u	u	u	NA	NA
Dacthal (ug/ℓ)	37.4	51	105	64.5	29.2	u	0.10	u	NA	NA

Table 8. Ground Water Data for Wells 72 and 76. Lower Payette River SAWQP 1992-93.

Parameter	Well#72					Well #76				
	10/92	4/93	10/93	MEAN	STD	10/92	4/93	10/93	MEAN	STD
Temperature (°C)	14.5	15	14.1	14.5	0.4	13.5	13.7	13.6	13.6	0.1
pH (su)	7.19	7.35	7.99	7.51	0.35	6.50	7.36	7.89	7.25	0.6
Conductivity (umhos/cm)	575	485	600	553	49.4	NA	700	700	700	0
Ammonia (mg/ℓ)	0.017	0.212	0.015	0.081	0.092	0.028	<0.005	0.018	0.023	0.005
NO2 + NO3 as N (mg/ℓ)	7.1	5.6	7.8	6.83	0.92	23.1	20.5	21.3	21.6	1.09
T. Kjel Nitrogen (mg/ℓ)	<0.05	0.07	<0.05	NA	NA	0.06	0.19	<0.05	0.125	.065
Calcium (mg/ℓ)	40	29	46	38.3	7.0	44	59	27	43.3	13.1
Magnesium (mg/ℓ)	11.5	7	12.6	10.4	2.4	13.5	14	14.2	13.9	0.3
Sodium (mg/ℓ)	124	130	144	132.7	8.4	158	200	164	174	18.5
Chlorides (mg/ℓ)	19	13	17	16.3	2.5	11	11	12	11.3	0.5
Sulphate (mg/ℓ)	81	67	92	80	10.2	81	76	85	80.1	3.7
Arsenic (mg/ℓ)	19	21	19	19.7	0.9	38	32	36	35.3	2.5
2, 4-D (ug/ℓ)	u	u	u	NA	NA	u	u	u	NA	NA
Dacthal (ug/ℓ)	21.6	23	61.5	35.4	18.5	29.6	24.8	10.5	21.6	8.1

Table 9. Ground Water Data for Wells 77 and 82. Lower Payette River SAWQP 1992-93.

Parameter	Well#77					Well #82				
	10/92	4/93	10/93	MEAN	STD	10/92	4/93	10/93	MEAN	STD
Temperature (°C)	13.6	13.7	13.1	13.5	0.3	14.0	13.9	14.2	14.0	0.1
pH (su)	7.42	7.27	7.9	7.53	0.27	7.64	7.46	8.16	7.75	0.30
Conductivity (umhos/cm)	600	700	600	633.3	47.1	NA	500	450	475	25
Ammonia (mg/ℓ)	0.055	0.125	0.101	0.094	0.029	5.35	5.52	5.26	5.38	0.11
NO2 + NO3 as N (mg/ℓ)	4.06	8.05	8.88	7.00	2.10	0.015	<0.05	<0.05	NA	NA
T. Kjel Nitrogen (mg/ℓ)	0.11	0.21	0.30	0.20	0.08	5.33	5.07	4.51	4.97	0.34
Calcium (mg/ℓ)	72	88	52	70.7	14.7	46	55	45	48.7	4.5
Magnesium (mg/ℓ)	20.5	24	22.5	22.3	1.4	14.5	14	13.4	13.9	0.4
Sodium (mg/ℓ)	70	126	112	102.7	23.8	79	96	76	83.6	8.8
Chlorides (mg/ℓ)	38	53	21	37.3	13.1	17	16	18	17	0.8
Sulphate (mg/ℓ)	72	59	53	61.3	7.9	42	41	39	40.7	1.2
Arsenic (mg/ℓ)	14	15	19	16	2.2	<10	<10	<10	NA	NA
2, 4-D (ug/ℓ)	u	u	u	NA	NA	u	u	u	NA	NA
Dacthal (ug/ℓ)	1.1	8.0	4.2	4.3	2.8	0.6	0.9	1.74	1.08	0.48

Table 10. Ground Water Data for Wells 84 and 64. Lower Payette River SAWQP 1992-94.

Parameter	Well #84					Well #64				
	10/92	4/93	10/93	MEAN	STD	10/92	4/93	10/93	MEAN	STD
Temperature (°C)	12.6	12.2	12.8	12.5	0.2	13.7	13.3	13.1	13.4	0.25
pH (su)	7.74	7.67	8.27	7.89	0.27	6.38	7.07	7.87	7.10	0.60
Conductivity (umhos/cm)	NA	620	600	610	10	610	600	550	586	26.2
Ammonia (mg/ℓ)	0.07	0.37	0.005	0.15	0.16	0.055	<0.005	0.011	0.033	0.022
NO2 + NO3 as N (mg/ℓ)	14.7	18.5	13.4	15.53	2.16	5.50	8.33	6.58	6.80	1.17
T. Kjel Nitrogen (mg/ℓ)	0.20	0.15	0.24	0.20	0.04	<0.05	0.10	<0.05	NA	NA
Calcium (mg/ℓ)	17	20	18	18.3	1.2	59	65	58	60	3.1
Magnesium (mg/ℓ)	8.5	7.5	8.2	8.1	0.4	44.5	41	40.5	42	1.8
Sodium (mg/ℓ)	200	235	195	210	17.8	59	74	58	63.7	7.3
Chlorides (mg/ℓ)	10	9	8	9	0.8	6	5	6	5.7	0.5
Sulphate (mg/ℓ)	46	43	39	42.7	2.9	36	42	37	38.3	2.6
Arsenic (mg/ℓ)	65	80	80	75	7.1	23	31	28	27.3	3.3
2, 4-D (ug/ℓ)	u	u	u	NA	NA	u	u	u	NA	NA
Dacthal (ug/ℓ)	4.74	1.94	u	3.34	1.4	u	u	u	NA	NA

APPENDIX E

APPENDIX E. Table of Content

Table 1. Calculation of Average Relative Range (Precision) for Total Kjeldahl Nitrogen. Lower Payette SAWQP Project. Drain S-13. 1992-1993

DATE	X1	X2	MEAN	RANGE	RELATIVE RANGE (%)
92/06/23	1.09	0.91	1.00	0.18	18.00
92/07/06	0.61	0.71	0.66	0.10	15.15
92/07/20	0.72	0.66	0.69	0.06	8.70
92/08/03	1.37	1.21	1.29	0.16	12.40
92/08/17	1.31	1.19	1.25	0.12	9.60
92/08/31	0.71	0.76	0.735	0.05	6.80
92/09/16	0.65	0.56	0.605	0.09	14.88
92/09/28	0.57	0.53	0.55	0.04	7.27
92/10/13	1.27	1.21	1.24	0.06	4.84
92/11/12	1.45	1.50	1.475	0.05	3.39
92/12/15	0.35	0.44	0.395	0.09	22.78
93/01/27	0.90	0.83	0.865	0.07	8.09
93/02/17	1.09	0.85	0.97	0.24	24.74
93/03/16	2.13	2.99	2.56	0.86	33.59
93/04/13	0.56	0.65	0.605	0.09	14.88
93/05/10	0.45	0.62	0.535	0.17	31.78
93/05/24	1.17	1.08	1.125	0.09	8.00
93/06/13	0.40	0.47	0.435	0.07	16.09
93/06/23	0.52	0.78	0.65	0.26	40.00
93/07/06	0.80	0.79	0.795	0.01	1.26
93/07/19	0.72	0.78	0.75	0.06	8.00
93/08/02	0.86	0.93	0.895	0.07	7.82
93/08/16	0.45	0.47	0.46	0.02	4.35
93/08/30	0.66	0.53	0.595	0.13	21.85
93/09/13	0.43	0.55	0.49	0.12	24.49
93/09/27	0.64	0.87	0.755	0.23	30.46

SUM OF RELATIVE RANGE	399.21 %
AVERAGE RELATIVE RANGE	15.35 %

Table 2. Calculation of Average Relative Range (Precision) for Total Phosphorus as P. Lower Payette SAWQP Project. Drain S-13. 1992-1993

DATE	X1	X2	MEAN	RANGE	RELATIVE RANGE (%)
92/06/23	0.37	0.34	0.355	0.03	8.45
92/07/06	0.37	0.37	0.37	0.00	0.00
92/07/20	0.42	0.43	0.425	0.01	2.35
92/08/03	0.57	0.50	0.535	0.07	13.08
92/08/17	0.73	0.69	0.71	0.04	5.63
92/08/31	0.24	0.22	0.23	0.02	8.70
92/09/16	0.20	0.24	0.22	0.04	18.18
92/09/28	0.22	0.25	0.235	0.03	12.77
92/10/13	0.29	0.30	0.295	0.01	3.39
92/11/12	0.28	0.28	0.28	0.00	0.00
92/12/15	0.28	0.24	0.26	0.04	15.38
93/01/27	0.35	0.37	0.36	0.02	5.56
93/02/17	0.30	0.32	0.31	0.02	6.45
93/03/16	0.46	0.59	0.525	0.13	24.76
93/04/13	0.27	0.29	0.28	0.02	7.14
93/05/10	0.30	0.30	0.30	0.00	0.00
93/05/24	0.75	0.65	0.70	0.10	14.29
93/06/13	0.24	0.25	0.245	0.01	4.08
93/06/23	0.45	0.44	0.445	0.01	2.25
93/07/06	0.52	0.47	0.495	0.05	10.10
93/07/19	0.67	0.76	0.715	0.09	12.59
93/08/02	0.38	0.45	0.415	0.07	16.87
93/08/16	0.33	0.30	0.315	0.03	9.52
93/08/30	0.31	0.31	0.31	0.00	0.00
93/09/13	0.29	0.36	0.325	0.07	21.54
93/09/27	0.50	0.67	0.585	0.17	29.06

SUM OF RELATIVE RANGE	252.14 %

AVERAGE RELATIVE RANGE	9.70 %

Table 3. Calculation of Average Relative Range (Precision) for Dissolved o-Phosphates P. Lower Payette SAWQP Project. Drain S-13. 1992-1993

DATE	X1	X2	MEAN	RANGE	RELATIVE RANGE (%)
92/06/23	0.169	0.171	0.170	0.002	1.18
92/07/06	0.199	0.199	0.199	0.000	0.00
92/07/20	0.177	0.180	0.1785	0.003	1.68
92/08/03	0.595	0.430	0.5125	0.165	32.20
92/08/17	0.235	0.235	0.235	0.000	0.00
92/08/31	0.195	0.165	0.180	0.030	16.67
92/09/16	0.208	0.211	0.2095	0.003	1.43
92/09/28	0.145	0.156	0.1505	0.011	7.31
92/10/13	0.213	0.242	0.2275	0.029	12.75
92/11/12	0.230	0.219	0.2245	0.011	4.90
92/12/15	0.199	0.215	0.207	0.016	7.73
93/01/27	0.185	0.188	0.1865	0.003	1.61
93/02/17	0.215	0.204	0.2095	0.011	5.25
93/03/16	0.309	NA	NA	NA	NA
93/04/13	0.195	0.196	0.1955	0.001	0.51
93/05/10	0.186	0.179	0.1825	0.007	3.84
93/05/24	0.104	0.110	0.107	0.006	5.61
93/06/13	0.128	0.135	0.1315	0.007	5.32
93/06/23	0.152	0.168	0.160	0.016	10.00
93/07/06	NA	NA	NA	NA	NA
93/07/19	0.211	0.214	0.2125	0.003	1.41
93/08/02	0.153	0.150	0.1515	0.003	1.98
93/08/16	0.187	0.193	0.190	0.006	3.16
93/08/30	0.165	0.163	0.164	0.002	1.22
93/09/13	0.232	0.188	0.210	0.044	20.95
93/09/27	0.168	0.171	0.1695	0.003	1.77

SUM OF RELATIVE RANGE	148.48 %
AVERAGE RELATIVE RANGE	6.19 %

Table 4. Calculation of Average Relative Range (Precision) for Total Ammonia as N. Lower Payette SAWQP Project. Drain S-13. 1992-1993

DATE	X1	X2	MEAN	RANGE	RELATIVE RANGE (%)
92/06/23	0.060	0.058	0.059	0.002	3.39
92/07/06	0.053	0.043	0.048	0.010	20.83
92/07/20	0.038	0.050	0.044	0.012	27.27
92/08/03	0.704	0.678	0.691	0.026	3.76
92/08/17	0.114	0.057	0.0855	0.057	66.67
92/08/31	0.077	0.092	0.0845	0.015	17.75
92/09/16	≤ 0.005	≤ 0.005	≤ 0.005	0.000	0.00
92/09/28	0.061	0.049	0.055	0.012	21.82
92/10/13	0.473	0.477	0.475	0.004	0.84
92/11/12	0.502	0.474	0.488	0.028	5.74
92/12/15	0.087	0.095	0.091	0.008	8.79
93/01/27	0.061	0.070	0.0655	0.009	13.74
93/02/17	0.235	0.223	0.229	0.012	5.24
93/03/16	0.465	0.476	0.4705	0.011	2.34
93/04/13	0.083	0.097	0.090	0.014	15.56
93/05/10	0.033	0.038	0.0355	0.005	14.08
93/05/24	0.117	0.033	0.075	0.084	112.00
93/06/13	0.016	0.019	0.0175	0.003	17.14
93/06/23	0.013	0.021	0.017	0.008	47.06
93/07/06	0.044	0.042	0.043	0.002	4.65
93/07/19	0.036	0.049	0.0425	0.013	30.59
93/08/02	0.043	0.050	0.0465	0.007	15.05
93/08/16	0.059	0.057	0.058	0.002	3.45
93/08/30	0.057	0.065	0.061	0.008	13.11
93/09/13	0.022	0.022	0.022	0.000	0.00
93/09/27	0.050	0.050	0.050	0.000	0.00

SUM OF RELATIVE RANGE	470.87 %
AVERAGE RELATIVE RANGE	18.11 %

Table 5. Calculation of Average Relative Range (Precision) for Total NO2 + NO3 as N. Lower Payette SAWQP Project. Drain S-13. 1992-1993

DATE	XI	X2	MEAN	RANGE	RELATIVE RANGE (%)
92/06/23	2.68	2.68	2.68	0.00	0.00
92/07/06	2.33	2.35	2.34	0.02	0.85
92/07/20	3.43	3.46	3.445	0.03	0.87
92/08/03	5.63	5.68	5.655	0.05	0.88
92/08/17	3.61	3.70	3.655	0.09	2.46
92/08/31	4.30	4.19	4.245	0.11	2.59
92/09/16	3.95	3.96	3.955	0.01	0.25
92/09/28	5.00	5.08	5.04	0.08	1.59
92/10/13	3.83	3.74	3.785	0.09	2.38
92/11/12	6.70	6.75	6.725	0.05	0.74
92/12/15	7.38	7.38	7.38	0.00	0.00
93/01/27	7.93	7.83	7.88	0.10	1.27
93/02/17	6.47	6.39	6.43	0.08	1.24
93/03/16	6.95	7.05	7.00	0.10	1.43
93/04/13	7.58	7.58	7.58	0.00	0.00
93/05/10	6.58	6.13	6.355	0.45	7.08
93/05/24	1.98	1.99	1.985	0.01	0.50
93/06/13	2.44	2.42	2.43	0.02	0.82
93/06/23	2.65	2.63	2.64	0.02	0.76
93/07/06	3.08	3.11	3.095	0.03	0.97
93/07/19	4.04	4.04	4.04	0.00	0.00
93/08/02	2.75	2.80	2.775	0.05	1.80
93/08/16	2.95	2.92	2.935	0.03	1.02
93/08/30	3.49	3.49	3.49	0.00	0.00
93/09/13	3.18	3.16	3.17	0.02	0.63
93/09/27	3.34	3.28	3.31	0.06	1.81

SUM OF RELATIVE RANGE	31.94 %

AVERAGE RELATIVE RANGE	1.23 %

Table 6. Calculation of Average Relative Range (Precision) for Suspended Sediment. Lower Payette SAWQP Project. Drain S-13. 1992-1993

DATE	X1	X2	MEAN	RANGE	RELATIVE RANGE (%)
92/06/23	202	207	204.5	5	2.44
92/07/06	182	193	187.5	11	5.87
92/07/20	216	218	217	2	0.92
92/08/03	156	150	153	6	3.92
92/08/17	432	402	417	30	7.19
92/08/31	42	43	42.5	1	2.35
92/09/16	33	30	31.5	3	9.52
92/09/28	101	96	98.5	5	5.08
92/10/13	49	48	48.5	1	2.06
92/11/12	16	17	16.5	1	6.06
92/12/15	28	25	26.5	3	11.32
93/01/27	114	115	114.5	1	0.87
93/02/17	77	76	76.5	1	1.31
93/03/16	342	355	348.5	13	3.73
93/04/13	71	73	72	2	2.78
93/05/10	78	82	80	4	5.00
93/05/24	342	325	333.5	17	5.10
93/06/13	69	69	69	0	0.00
93/06/23	244	253	248.5	9	3.62
93/07/06	218	210	214	8	3.74
93/07/19	180	188	184	8	4.35
93/08/02	140	144	142	4	2.82
93/08/16	83	84	83.5	1	1.20
93/08/30	92	81	86.5	11	12.72
93/09/13	64	62	63	2	3.17
93/09/27	220	206	213	14	6.57

SUM OF RELATIVE RANGE	113.71 %

AVERAGE RELATIVE RANGE	4.37 %

Table 7. Calculation of Average Relative Range (Precision) for Turbidity. Lower Payette SAWQP Project. Drain S-13. 1992-1993

DATE	X1	X2	MEAN	RANGE	RELATIVE RANGE (%)
92/06/23	48	48	48	0	0.00
92/07/06	48	48	48	0	0.00
92/07/20	50	46	48	4	8.33
92/08/03	39	40	39.5	1	2.53
92/08/17	54	40	47	14	29.79
92/08/31	10	12	11	2	18.18
92/09/16	10	9	9.5	1	10.53
92/09/28	26	30	28	4	14.29
92/10/13	16	16	16	0	0.00
92/11/12	4	4	4	0	0.00
92/12/15	9	9	9	0	0.00
93/01/27	35	35	35	0	0.00
93/02/17	22	23	22.5	1	4.44
93/03/16	58	60	59	2	3.39
93/04/13	17	18	17.5	1	5.71
93/05/10	17	18	17.5	1	5.71
93/05/24	85	85	85	0	0.00
93/06/13	NA	NA	NA	NA	NA
93/06/23	76	74	75	2	2.67
93/07/06	58	56	57	2	3.51
93/07/19	52	54	53	2	3.77
93/08/02	48	50	49	2	4.08
93/08/16	27	27	27	0	0.00
93/08/30	25	24	24.5	1	4.08
93/09/13	15	16	15.5	1	6.45
93/09/27	48	46	47	2	4.26

SUM OF RELATIVE RANGE	131.72 %

AVERAGE RELATIVE RANGE	5.27 %

Table 8. Calculation of Percent Recovery (Accuracy) for Total Kjeldahl Nitrogen. Lower Payette SAWQP Project. Drain S-5. 1992-93

DATE	BACKGROUND "B"	RESULT "A"	RECOVERY "A"-"B"	PERCENT RECOVERY
11/12/92	0.22	4.60	4.38	87.6
12/16/92	0.16	4.77	4.61	92.2
1/28/93	0.31	4.88	4.57	91.4
2/16/93	0.23	3.46	3.23	64.6
3/16/93	0.34	4.31	3.97	79.4
4/14/93	0.39	4.78	4.39	87.8
5/10/93	0.47	5.90	5.43	108.6
5/24/93	0.26	4.05	3.79	75.8
6/24/93	0.37	6.59	6.22	124.4
7/06/93	0.44	5.46	5.02	100.4
7/19/93	0.27	6.42	6.15	123.0
8/02/93	0.24	5.42	5.18	103.6
8/16/93	0.06	5.88	5.82	116.4
8/31/93	0.46	4.75	4.29	85.8

NUMBER OF SAMPLES	14
TOTAL % RECOVERY	1341
AVERAGE % RECOVERY	95.79
STANDARD DEVIATION	17.83
CONFIDENCE INTERVAL	2.145

95% CONFIDENCE INTERVAL ± 10.2%

Table 9. Calculation of Percent Recovery (Accuracy) for Total Phosphorus as P. Lower Payette SAWQP Project. Drain S-5. 1992-93

DATE	BACKGROUND "B"	RESULT "A"	RECOVERY "A"-"B"	PERCENT RECOVERY
11/12/92	0.17	1.13	0.96	96.0
12/16/92	0.16	1.33	1.17	117.0
1/28/93	0.15	1.14	0.99	99.0
2/16/93	0.29	0.83	0.54	54.0
3/16/93	0.17	1.11	0.94	94.0
4/14/93	0.15	1.14	0.99	99.0
5/10/93	0.25	1.47	1.22	122.0
5/24/93	0.23	1.31	1.08	108.0
6/24/93	0.20	1.28	1.08	108.0
7/06/93	0.19	1.56	1.37	137.0
7/19/93	0.22	1.34	1.12	112.0
8/02/93	0.23	1.47	1.24	124.0
8/16/93	0.14	1.31	1.17	117.0
8/31/93	0.19	1.11	0.92	92.0

NUMBER OF SAMPLES	14
TOTAL % RECOVERY	1479
AVERAGE % RECOVERY	105.64
STANDARD DEVIATION	19.74
CONFIDENCE INTERVAL	2.145

95% CONFIDENCE INTERVAL ± 11.3%

Table 10. Calculation of Percent Recovery (Accuracy) for Dissolved o-Phosphate as P. Lower Payette SAWQP Project. Drain S-5. 1992-93

DATE	BACKGROUND "B"	RESULT "A"	RECOVERY "A"-"B"	PERCENT RECOVERY
11/12/92	0.160	1.09	0.93	93.0
12/16/92	0.163	0.921	0.758	75.8
1/28/93	0.144	0.920	0.776	77.6
2/16/93	0.173	1.15	0.977	97.7
3/16/93	0.198	1.11	0.912	91.2
4/14/93	0.126	0.659	0.533	53.3
5/10/93	0.060	0.974	0.914	91.4
5/24/93	NA	NA	NA	NA
6/24/93	0.100	1.16	1.06	106.0
7/06/93	NA	NA	NA	NA
7/19/93	0.087	1.02	0.933	93.3
8/02/93	0.108	1.05	0.942	94.2
8/16/93	0.092	1.16	1.068	106.8
8/31/93	0.121	1.07	0.949	94.9
9/13/93	0.124	1.10	0.976	97.6

NUMBER OF SAMPLES	13
TOTAL % RECOVERY	1172.8
AVERAGE % RECOVERY	90.22
STANDARD DEVIATION	14.21
CONFIDENCE INTERVAL	2.160

95% CONFIDENCE INTERVAL ± 8.5%

Table 11. Calculation of Percent Recovery (Accuracy) for T. Ammonia as N. Lower Payette SAWQP Project. Drain S-5. 1992-93

DATE	BACKGROUND "B"	RESULT "A"	RECOVERY "A"-"B"	PERCENT RECOVERY
11/12/92	0.019	0.962	0.943	94.3
12/16/92	0.042	0.555	0.513	51.3
1/28/93	0.010	1.03	1.02	102.0
2/16/93	0.134	1.16	1.026	102.6
3/16/93	0.025	0.958	0.933	93.3
4/14/93	0.046	1.16	1.114	111.4
5/10/93	0.017	1.06	1.043	104.3
5/24/93	0.137	1.26	1.123	112.3
6/24/93	0.011	0.947	0.936	93.6
7/06/93	0.005	0.938	0.933	93.3
7/19/93	0.048	0.881	0.833	83.3
8/02/93	< 0.005	0.840	0.835	83.5
8/16/93	0.020	0.944	0.924	92.4
8/31/93	0.030	0.991	0.961	96.1

NUMBER OF SAMPLES	14
TOTAL % RECOVERY	1313.7
AVERAGE % RECOVERY	93.84
STANDARD DEVIATION	15.03
CONFIDENCE INTERVAL	2.145

95% CONFIDENCE INTERVAL ± 8.6%

Table 12. Calculation of Percent Recovery (Accuracy) for T. NO2 + NO3 as N. Lower Payette SAWQP Project. Drain S-5. 1992-93

DATE	BACKGROUND "B"	RESULT "A"	RECOVERY "A"-"B"	PERCENT RECOVERY
11/12/92	3.85	11.8	7.95	106.0
12/16/92	4.08	13.2	9.12	121.6
1/28/93	4.07	14.05	9.98	133.1
2/16/93	3.50	13.8	10.3	137.3
3/16/93	3.58	11.7	8.12	108.3
4/14/93	4.00	12.0	8.0	106.7
5/10/93	0.319	7.95	7.631	101.8
5/24/93	0.723	7.60	6.877	91.7
6/24/93	0.282	8.63	8.348	111.3
7/06/93	2.01	9.13	7.12	94.9
7/19/93	1.34	8.33	6.99	93.2
8/02/93	2.08	9.8	7.72	102.9
8/16/93	1.15	8.34	7.19	95.9
8/31/93	1.64	10.5	8.86	118.1

NUMBER OF SAMPLES	14
TOTAL % RECOVERY	1522.8
AVERAGE % RECOVERY	108.7
STANDARD DEVIATION	14.2
CONFIDENCE INTERVAL	2.145

95% CONFIDENCE INTERVAL ± 8.1%

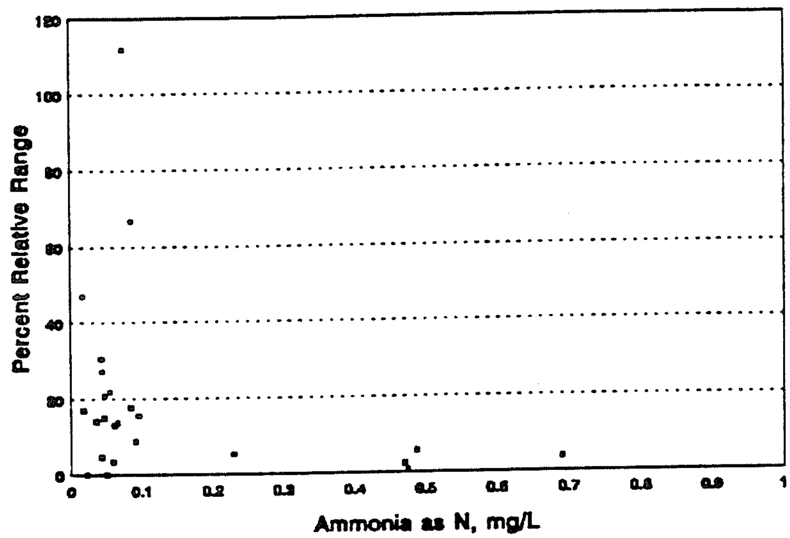
Table 13. Calculation of Percent Recovery (Accuracy) for Suspended Sediment. Lower Payette SAWQP Project. Drain S-5. 1992-93

DATE	BACKGROUND "B"	RESULT "A"	RECOVERY "A"-"B"	PERCENT RECOVERY
11/12/92	4	1533	1529	100.7
12/16/92	6	1302	1296	96.1
1/28/93	6	986	980	94.9
2/16/93	30	1327	1297	98.9
3/16/93	9	1144	1135	94.3
4/14/93	24	1292	1268	95.7
5/10/93	65	1036	971	94.6
5/24/93	79	1135	1056	97.6
6/24/93	37	1340	1303	97.8
7/06/93	19	1766	1747	111.2
7/19/93	6	1245	1239	88.4
8/02/93	9	1088	1079	89.8
8/16/93	27	1271	1244	90.7
8/31/93	10	944	934	83.2
9/13/93	16	1260	1244	88.7

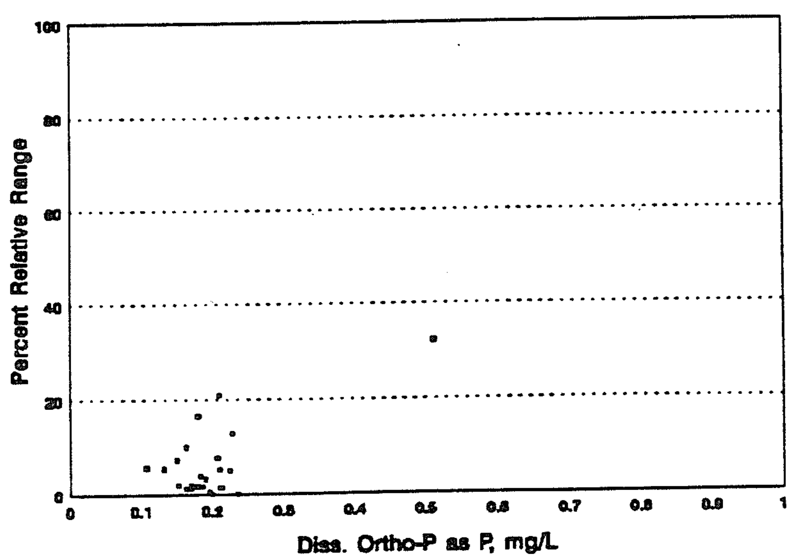
NUMBER OF SAMPLES	15
TOTAL % RECOVERY	1422.6
AVERAGE % RECOVERY	94.84
STANDARD DEVIATION	6.52
CONFIDENCE INTERVAL	2.131

95% CONFIDENCE INTERVAL ± 3.6%

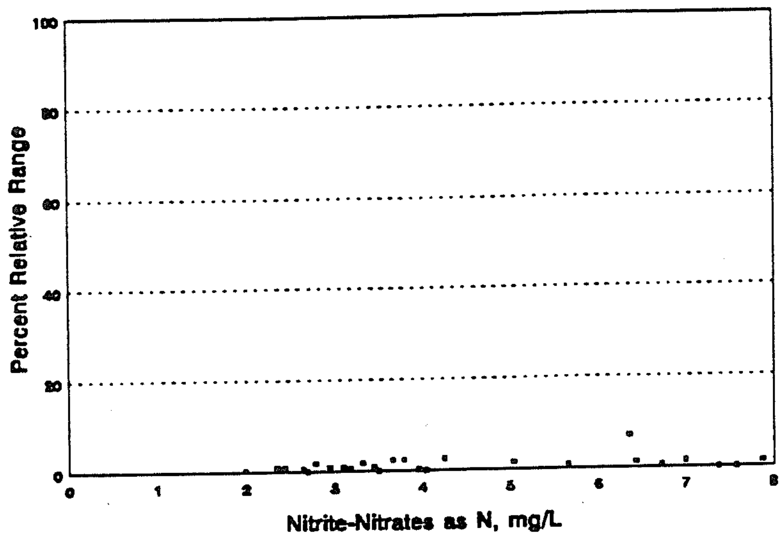
Relative Range of Duplicate Samples Versus Mean Concentrations, Ammonia as N



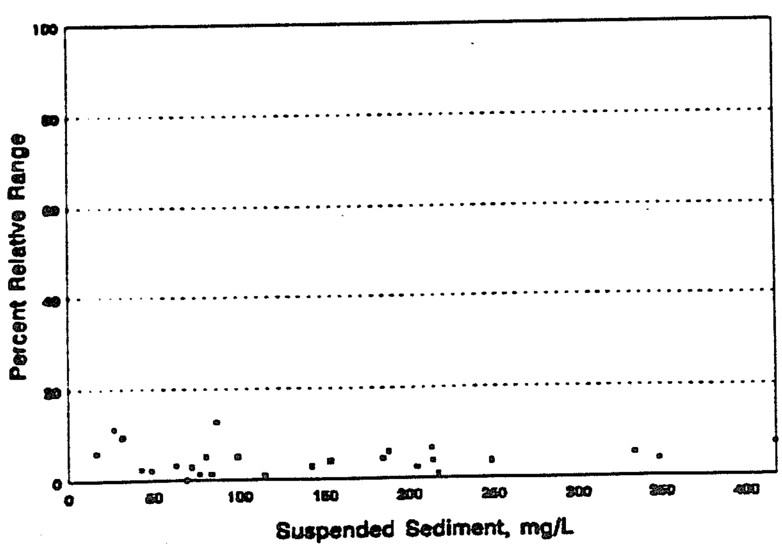
Relative Range of Duplicate Samples Versus Mean Concentrations, Dissolved Ortho Phosphate as P



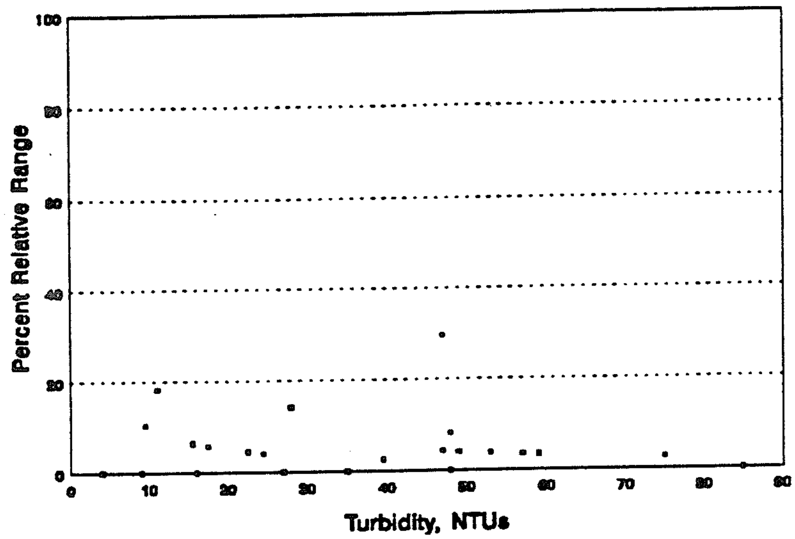
Relative Range of Duplicate Samples Versus Mean Concentrations, Nitrite-Nitrate as N



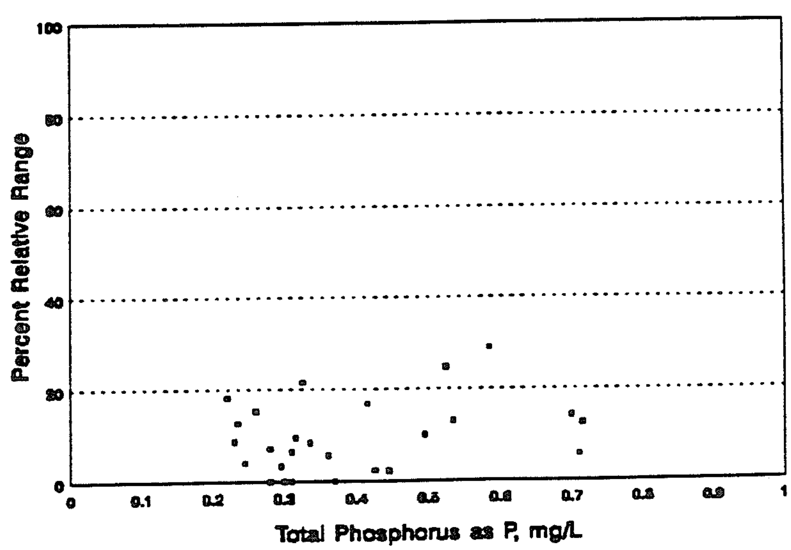
Relative Range of Duplicate Samples Versus Mean Concentrations, Suspended Sediment



Relative Range of Duplicate Samples Versus Mean Concentrations, Turbidity



Relative Range of Duplicate Samples Versus Mean Concentrations, Total Phosphorus as P



Relative Range of Duplicate Samples Versus Mean Concentrations, Total Kjeldahl Nitrogen

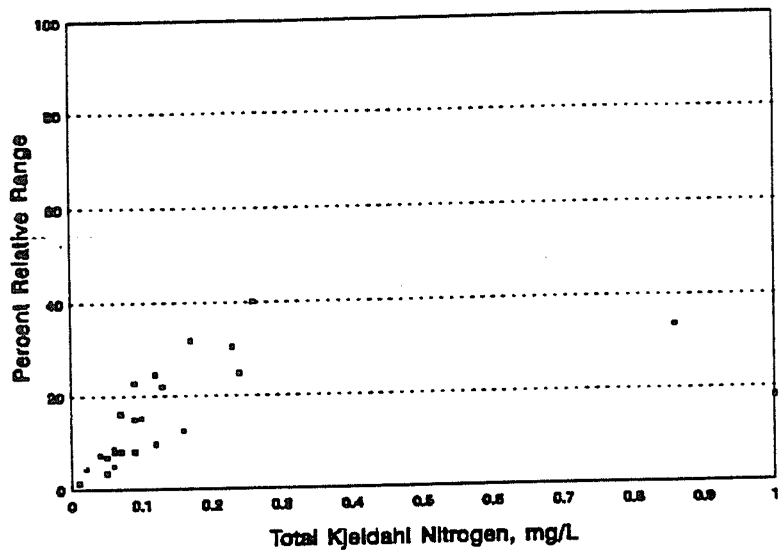


Table 14. Calculation of Average Relative Range (Precision) for Ammonia. Lower Payette SAWQP Project. Ground Water. 1992-1993.

DATE	X1	X2	MEAN	RANGE	RELATIVE RANGE (%)
10/18/93	0.019	0.018	0.0185	0.001	5.4
10/22/93	0.005	0.005	0.005	0	0
10/19/93	0.008	0.008	0.008	0	0
4/20/93	0.054	0.093	0.0735	0.039	53.0
4/21/93	0.008	0.020	0.014	0.012	85.7
Sum of Relative Range (%)			144.2		
Average Relative Range (%)			28.8		

Table 15. Calculation of Average Relative Range (Precision) for NO^2 + NO^3 as N. Lower Payette SAWQP Project. Ground Water. 1992-1993.

DATE	X1	X2	MEAN	RANGE	RELATIVE RANGE (%)
10/18/93	4.03	4.04	4.035	0.01	0.25
10/22/93	3.81	3.73	3.77	0.08	2.1
10/19/93	6.05	5.9	5.98	0.15	2.5
4/20/93	7.33	7.03	7.18	0.3	4.2
4/21/93	1.83	1.9	1.87	0.07	3.7
Sum of Relative Range (%)			12.8		
Average Relative Range (%)			2.6		

Table 16. Calculation of Average Relative Range (Precision) for Chloride Lower Payette SAWQP Project. Ground Water. 1992-1993.

DATE	X1	X2	MEAN	RANGE	RELATIVE RANGE (%)
10/18/93	5	4	4.5	1	22.2
10/22/93	28	28	28	0	0
10/19/93	7	6	6.5	1	15.4
4/20/93	7	7	7	0	0
4/21/93	21	22	21.5	1	4.7
Sum of Relative Range (%)			42.3		
Average Relative Range (%)			8.5		

Table 17. Calculation of Average Relative Range (Precision) for Sulfate. Lower Payette SAWQP Project. Ground Water. 1992-1993.

DATE	X1	X2	MEAN	RANGE	RELATIVE RANGE (%)
10/18/93	38	38	38	0	0
10/22/93	96	100	98	4	4.1
10/19/93	22	24	23	2	8.7
4/20/93	26	26	26	0	0
4/21/93	27	27	27	0	0

Sum of Relative Range (%)	12.8
Average Relative Range (%)	2.6

Table 18. Calculation of Average Relative Range (Precision) for Arensic. Lower Payette SAWQP Project. Ground Water. 1992-1993.

DATE	X1	X2	MEAN	RANGE	RELATIVE RANGE (%)
10/18/93	34	36	35	2	5.7
10/22/93	11	10	10.5	1	9.5
10/19/93	8	8	8	0	0
4/20/93	10	na			
4/21/93	44	40	42	4	9.5

Sum of Relative Range (%)	24.8
Average Relative Range (%)	6.2

Table 19. Calculation of Average Relative Range (Precision) for Total Kjel. Nitrogen. Lower Payette SAWQP Project. Ground Water. 1992-1993.

DATE	X1	X2	MEAN	RANGE	RELATIVE RANGE (%)
10/18/93	0.05	0.05	0.05	0	0
10/22/93	na	na	na	na	na
10/19/93	0.09	0.13	0.11	0.04	36.4
4/20/93	0.12	0.11	0.115	0.01	8.7
4/21/93	0.05	0.05	0.05	0	0

Sum of Relative Range (%)	45.4
Average Relative Range (%)	11.4

Table 20. Calculation of Average Relative Range (Precision) for Calcium. Lower Payette SAWQP Project. Ground Water. 1992-1993.

DATE	X1	X2	MEAN	RANGE	RELATIVE RANGE (%)
10/18/93	40	40	40	0	0
10/22/93	81	81	81	0	0
10/19/93	61	63	62	2	3.2
4/20/93	72	73	72.5	1	1.4
4/21/93	28	27	27.5	1	3.6
Sum of Relative Range (%)	8.2				
Average Relative Range (%)	1.6				

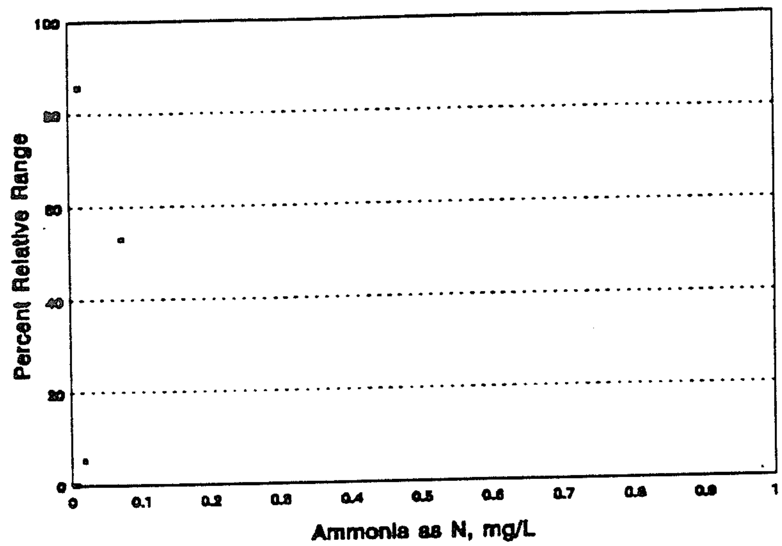
Table 21. Calculation of Average Relative Range (Precision) for Magnesium. Lower Payette SAWQP Project. Ground Water. 1992-1993.

DATE	X1	X2	MEAN	RANGE	RELATIVE RANGE (%)
10/18/93	15.8	15.8	15.8	0	0
10/22/93	18	18	18	0	0
10/19/93	14.2	14.4	14.3	0.2	1.4
4/20/93	15	15	15	0	0
4/21/93	8	8	8	0	0
Sum of Relative Range (%)	1.4				
Average Relative Range (%)	.3				

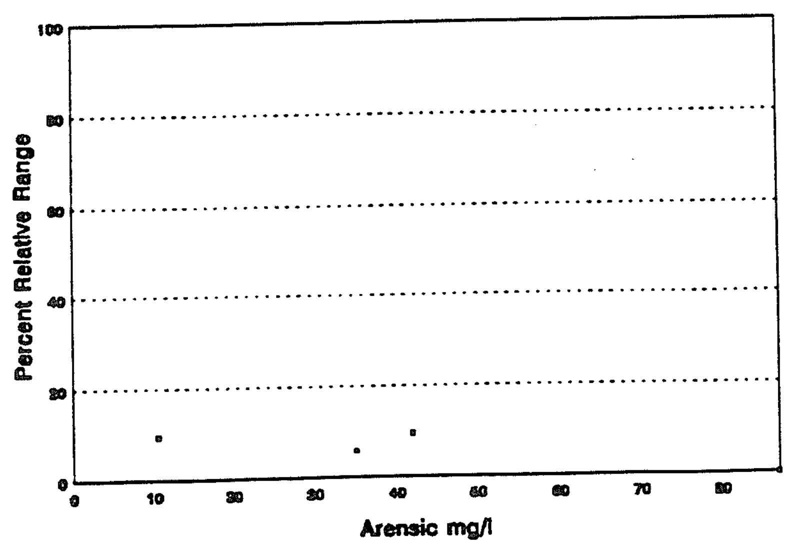
Table 22. Calculation of Average Relative Range (Precision) for Sodium. Lower Payette SAWQP Project. Ground Water. 1992-1993.

DATE	X1	X2	MEAN	RANGE	RELATIVE RANGE (%)
10/18/93	110	110	110	0	0
10/22/93	110	110	110	0	0
10/19/93	70	71	70.5	1	1.4
4/20/93	86	83	84.5	3	3.6
4/21/93	111	113	112	2	1.8
Sum of Relative Range (%)	6.8				
Average Relative Range (%)	1.4				

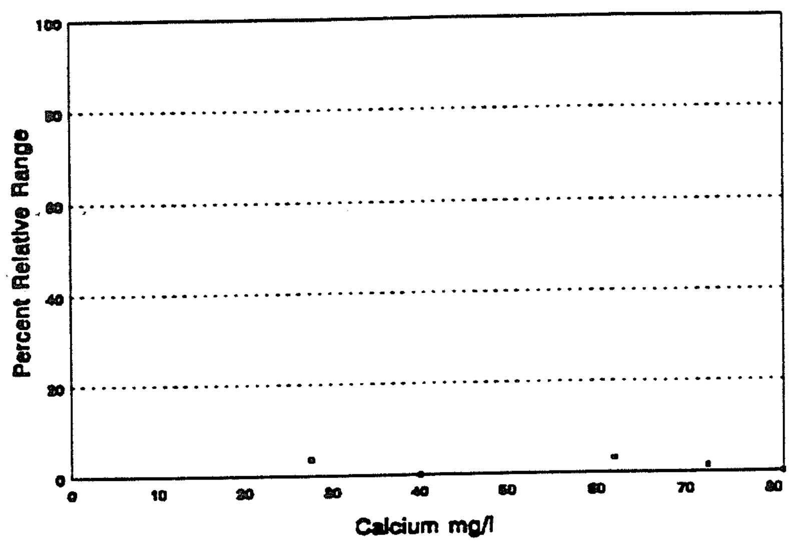
Relative Range of Duplicate Samples
Versus Mean Concentrations, Ammonia as N, Ground Water



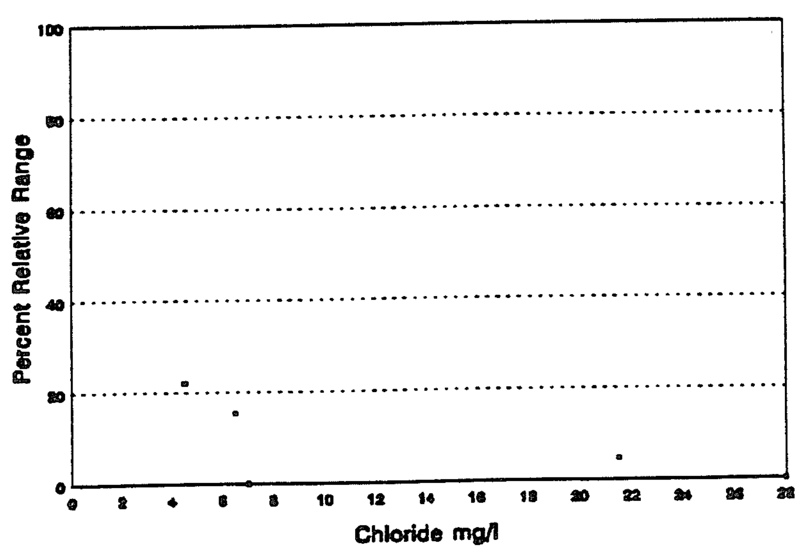
Relative Range of Duplicate Samples
Versus Mean Concentrations, Aresnic, Ground Water



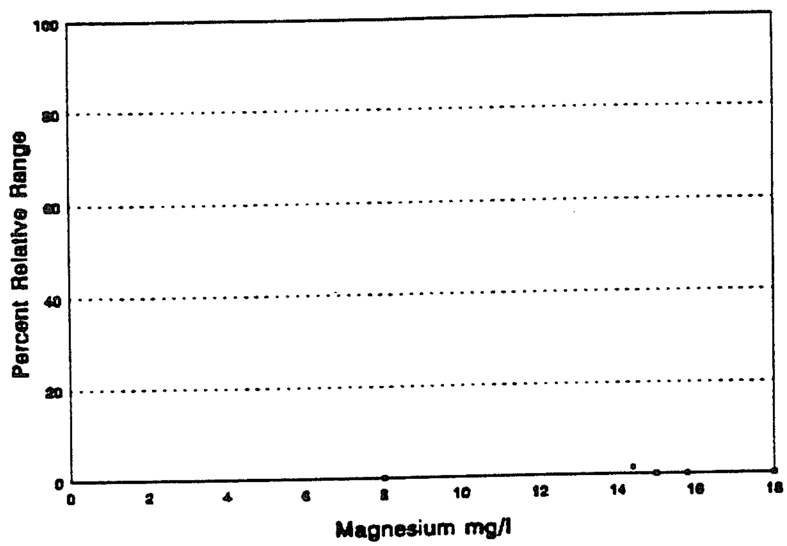
Relative Range of Duplicate Samples Versus Mean Concentrations, Calcium, Ground Water



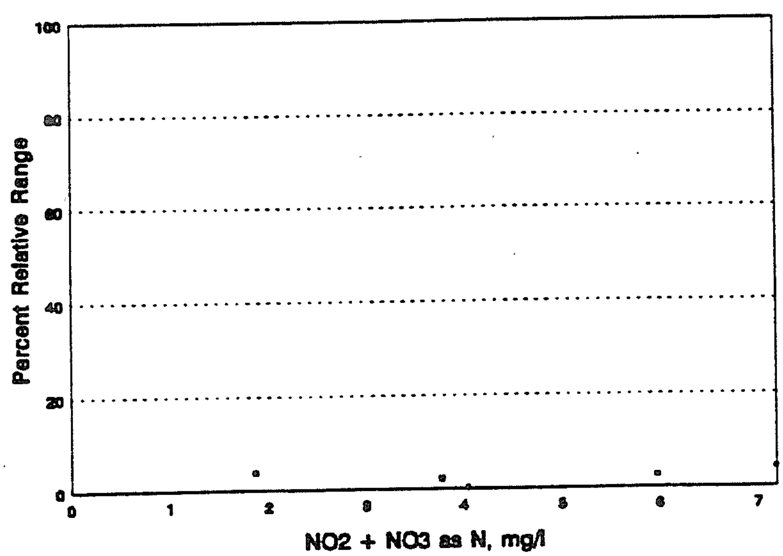
Relative Range of Duplicate Samples Versus Mean Concentrations, Chloride, Ground Water



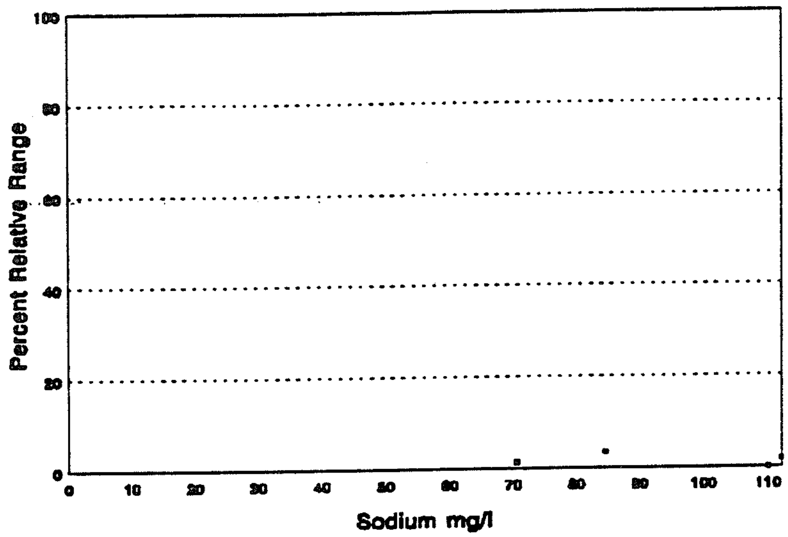
Relative Range of Duplicate Samples Versus Mean Concentrations, Magnesium, Ground Water



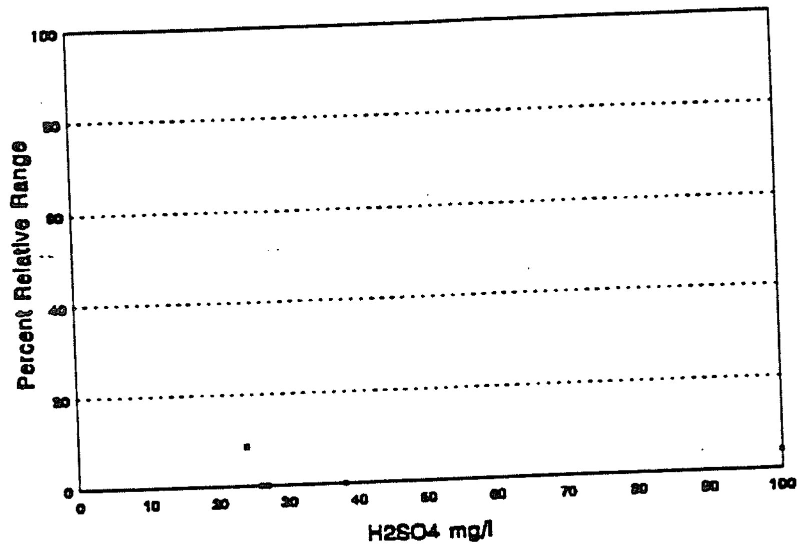
Relative Range of Duplicate Samples Versus Mean Concentrations, NO2 + NO3 as N, Ground Water



Relative Range of Duplicate Samples Versus Mean Concentrations, Sodium, Ground Water



Relative Range of Duplicate Samples Versus Mean Concentrations, Sulfate, Ground Water



Relative Range of Duplicate Samples Versus Mean Concentrations, T. Kjel Nit., Ground Water