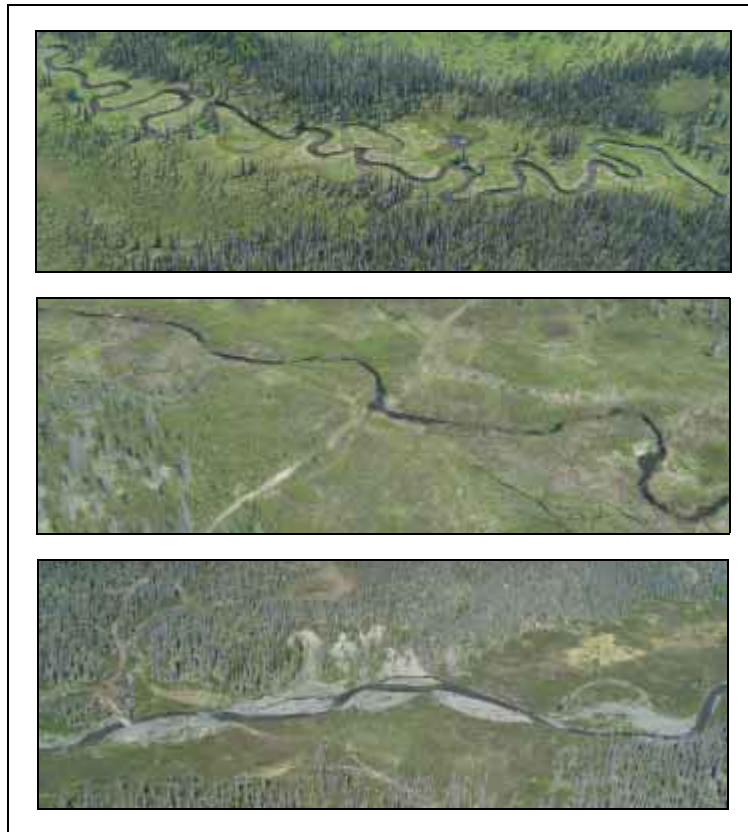


**HOMER SOIL AND WATER CONSERVATION DISTRICT
&
COOK INLET KEEPER**

**A Preliminary Water Quality Assessment
of Lower Kenai Peninsula
Salmon-bearing Streams**



August 1998 - June 2004



COVER PHOTOS: Chakok River, tributary to Anchor River (top); Beaver Creek at Watermelon Trail crossing (middle); north fork of Deep Creek at Waterhole Trail crossing (bottom)

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Salmon-bearing Streams

August 1998 – June 2004

Prepared in November 2004 by:

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ACKNOWLEDGEMENTS

Cook Inlet Keeper thanks the U.S. Environmental Protection Agency (EPA) for invaluable advice and support; Alaska Department of Environmental Conservation (ADEC) for input and guidance on this and other Keeper documents; personnel at the U.S. Geological Survey (USGS) for sharing previously collected data as well as sampling methods and field time; and the Environment and Natural Resources Institute, University of Alaska Anchorage for providing bioassessment training and data. Thanks are also due to the Technical Advisory Committee for reviewing and commenting on a draft of this report, although any mistakes are strictly Keeper's responsibility.

Special thanks to Shirley Schollenberg, Lindsay Winkler, Al Poindexter, and the Homer Soil and Water Conservation District for helping to make this project possible. Thanks to Joel Cooper and Brad van Appel at Keeper for designing and starting this project. Many thanks go to Beth Lambert, Keeper's previous Stream Ecologist, who refined techniques in the field and lab and produced the first two editions of this preliminary assessment. Laboratory facilities for the first five years of this project were graciously provided by Campus Director Carol Swartz of the Kachemak Bay Campus of the Kenai Peninsula College, a unit of the University of Alaska Anchorage. And Keeper greatly appreciates the private landowners, Ninilchik Traditional Council, and Cook Inlet Region, Inc. for allowing access to sampling sites in this project.

Keeper's interns over the years: Josh Brann, Jake Fugazzotto, Jessica Lambert, Bob Forrest, Jeremy Kobor, Ami Riscassi, Wendy Kroll, Melissa Roberts, Tracy Parsons, Heather Sirotnak, and Jeff Jasperson and past and present staff: Tom Wallace, Dale Banks, Edan Badajos, Bob Shavelson, Marla McPherson, Brad van Appel, Joel Cooper, Mike Gracz, Miranda Weiss, Jaime Gable, Steve Baird, Will Schlein, Kathy Peel and Yvonne Prucha provided field, office, and technical assistance.

Finally, Keeper extends its sincere appreciation to all the volunteers who braved the elements to provide field assistance to Keeper's stream ecologists over the last five years. Many thanks to: Andrew McLeod, Andy Anderson, Angela Middleton, Antony Blaikie, Bob DeCino, Bob Keller, Bridget Paule, Cameron Forbes, Carl Schoch, Carol Charat, Carmen Field, Chris Rainwater, Chuck Cover, Chuck Lokey, Coowe Walker, Crystal Poindexter, Elizabeth Wasserman, Emilie Otis, Erin Kaufman, Geoff Coble, Hailey Smith, Heloise Chenecot, Jennifer Poindexter, Jim Ingram, Jim Levine, John Cannell, Karin Sonnen, Karyn Noyes, Kathy Urffer, Kenton Bloom, Kim Baker, L.A. Holmes, Mark Schollenberger, Mark Wipfli, Marta Meengs, Mckibben Jackinski, Mike Byerly, Mike Miller, Molly Dutton, Nancy Mauger, Nicky Szarzi, Nina Faust, Rod Jackson, Pat Kepner, Sara Gilk, Spencer Wood, Ted Otis, and Thomas McDonough.

This project was made possible by an EPA Regional Geographic Initiative grant and Section 319 Clean Water Act grant from ADEC, funding from ACF, George H. and Jane A. Mifflin Memorial Fund, True North Foundation, EPA Wetlands Development Program, Bullitt Foundation, *Exxon Valdez* Oil Spill Trustee Council, Norcross Wildlife Foundation, Inc., Skaggs Foundation, and Kachemak Bay Conservation Society. Generous support was also provided by Keeper's members and business supporters.

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A PRELIMINARY WATER QUALITY ASSESSMENT OF LOWER KENAI PENINSULA SALMON-BEARING STREAMS

INTRODUCTION

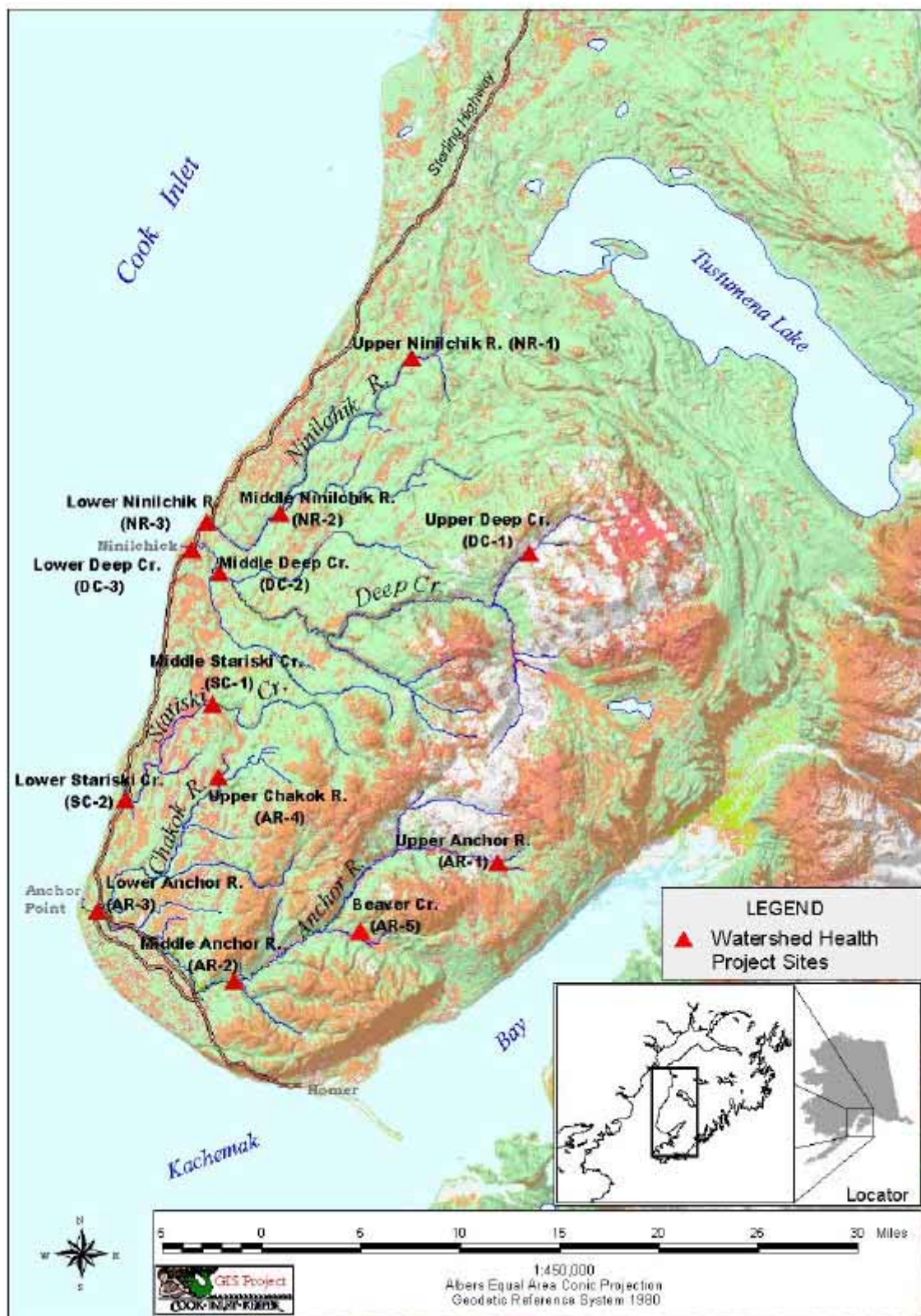
Background

Through the Lower Kenai Peninsula Watershed Health Project, Cook Inlet Keeper (Keeper) and the Homer Soil and Water Conservation District (HSWCD) are jointly collecting reliable baseline water quality data on the Ninilchik River, Deep Creek, Stariski Creek, and Anchor River and educating local citizens about water quality issues. This report is the sixth published by the two partners and presents water quality data collected from August 1998 through June 2004. The report offers a preliminary water quality assessment of the four rivers and is produced to partially fulfill the requirements of a Section 319 Clean Water Act grant from the Alaska Department of Environmental Conservation and a Regional Geographic Initiative grant from the Environmental Protection Agency.

The streams of the lower Kenai Peninsula support healthy sport and commercial fisheries, and provide important subsistence resources for Alaska Natives and other groups. However, current and potential changes in land use and natural resource management within the watersheds may degrade water quality. In the Pacific Northwest, many wild salmon runs have vanished because of habitat degradation or loss from dam construction, timber harvesting, mining, and urbanization. State and federal agencies lack the resources to conduct thorough water quality investigations on these rivers. Nonetheless, citizens, industry, and resource managers need a comprehensive and ongoing inventory of water quality in order to track changes and understand impacts. Only with this kind of information can we make economically and environmentally sound decisions.

The Lower Kenai Peninsula Watershed Health Project

Cook Inlet Keeper began water quality monitoring in 1998 on four salmon-bearing streams: Ninilchik River, Deep Creek, Stariski Creek, and Anchor River. Using EPA-approved or Standard Methods, Keeper monitors twelve sites for discharge, temperature, dissolved oxygen, pH, conductivity, nitrate-nitrogen, ammonia-nitrogen, orthophosphate, total phosphorus, apparent color, turbidity, settleable solids, total suspended solids and bacteria. Keeper monitors four sites on the Anchor River, three on both Ninilchik River and Deep Creek, and two on Stariski Creek (Figure 1). Monitoring goals are to 1) collect baseline data and determine natural variability over time for each parameter, 2) compare data with state water quality standards and federal recommendations, 3) identify water quality patterns within and between watersheds, and 4) educate local citizens about water quality issues. This report summarizes data collected from August 1998 through June 2004.



STUDY AREA

The Ninilchik River, Deep Creek, Stariski Creek, and Anchor River watersheds lie in the southern part of the Kenai Peninsula. The region is bounded on the west by Cook Inlet and on the east by the Caribou Hills. The topography is gently rolling, with wide river valleys and extensive wetlands. Elevations range from sea level to around 2800 feet.

The climate of the study area is considered to be transitional between continental and maritime (Brabets, 1999). Temperatures in Homer, just south of the study area, range from an average temperature of -5.2 °C/22.7 °F in January to 11.9 °C/53.4 °F in July. Temperatures are generally colder in the central and northern parts of the study area than in the southern portion. Average annual precipitation is 24.84 inches in Homer. Most of the rain falls during August, September, October, and November (National Weather Service, 2003). High stream flows also occur in April and May when air temperatures increase, resulting in snowmelt and ice breakup.

The four watersheds are home to many species of wildlife. A wide variety of seabirds, shorebirds, raptors, waterfowl, and songbirds live in the watersheds. Moose, black and brown bear, fox, lynx, coyote, and many small mammals are found here. Finally, the streams host a variety of fish, including chinook salmon *Oncorhynchus tshawytscha*, coho salmon *O. kisutch*, pink salmon *O. gorbuscha*, Dolly Varden char *Salvelinus malma*, and steelhead (anadromous) and rainbow (resident) trout *O. mykiss*.



The towns of Anchor Point and Ninilchik, as well as the smaller communities of Happy Valley and Nikolaevsk, are located in the study area. The economic base of Anchor Point and Ninilchik is commercial fishing, sport fishing, and tourism. The recreational fishery for Dolly Varden in Anchor River is one of the largest in Alaska (Larson, 1995).

Land ownership within the four watersheds is complex, with varying proportions of Federal, Native Corporation, State, Borough, and private ownership (Figures 2-5; Table 1). Anchor River watershed has the highest proportion of privately owned land (28%) while Deep Creek has the lowest proportion (5%).

Land use has changed dramatically over the last ten years in the study area with increased road building, logging, and gravel mining. Prior to 1990, much of the study area was relatively remote wilderness. Access was provided only by trails along seismic lines (Figures 2-5). In 1990, logging began in the four watersheds, and accelerated rapidly (Table 1). In the Ninilchik River watershed, for example, less than one percent of the watershed was slated for timber sales in 1990. By 1999, 44% of the watershed had been included in timber sales.



Logging activity in the Deep Creek watershed (6/04)



Gravel mining in the Anchor River watershed (6/04)



Off-road vehicle trail crossing at Beaver Creek (7/04)



Sediment-laden flood waters of Deep Creek (10/02)

The increase in logging activity relates to concerns about fire danger due to large fuel loads from downed or standing beetle killed trees. Spruce beetle (*Dendroctonus rufipennis*) infestations during the 1990's have resulted in extensive areas of dead spruce trees in Alaska. On the Kenai Peninsula approximately 1.1 million acres of forested land have been infested by the bark beetle. Increased water yields may result because of reduced transpiration from dead and dying trees (Holsten et al., 1999).

Road building, logging, and gravel mining may affect stream water quality by changing the natural hydrograph of these systems as well as introducing sediments to the stream channel. Sediment pollution, particularly turbidity, is the most prevalent form of pollution in Alaska (Lloyd et al., 1987).

Off-road vehicle (ORV) trail stream crossings may also be contributing to increasing rates of sedimentation. In 1999, the Alaska Department of Fish and Game looked at ORV trail stream crossings in the upper Anchor River and Deep Creek drainages. ORV use appears to be increasing in the study area with the increase in backcountry and logging roads. In this survey, ATV stream crossings exhibited exposed soils, bank alterations, riparian zone degradation, and increased bank widths (Weidmer, 2002).

In October and November 2002, the lower Kenai Peninsula experienced flood events not seen in the last 50-100 years. Channel scour, bank erosion and major habitat alteration reshaped salmon stream channels and riparian habitat. Poorly-placed and inadequately-sized culverts on private, Borough and State roads failed resulting in pulses of debris torrents, which caused extensive damage to roads, bridges and property downstream.

A recent USGS report suggests that streams within the Cook Inlet Basin, which includes the Kenai Peninsula, may experience a water temperature change of 3°C in coming years. This is based on a model that uses air temperature to predict water temperature due to climate warming. Ninilchik River was one of the 15 sites predicted to see a 3°C change, a magnitude of change that is considered significant for the incidence of disease in fish populations (Kyle and Brabets, 2001).

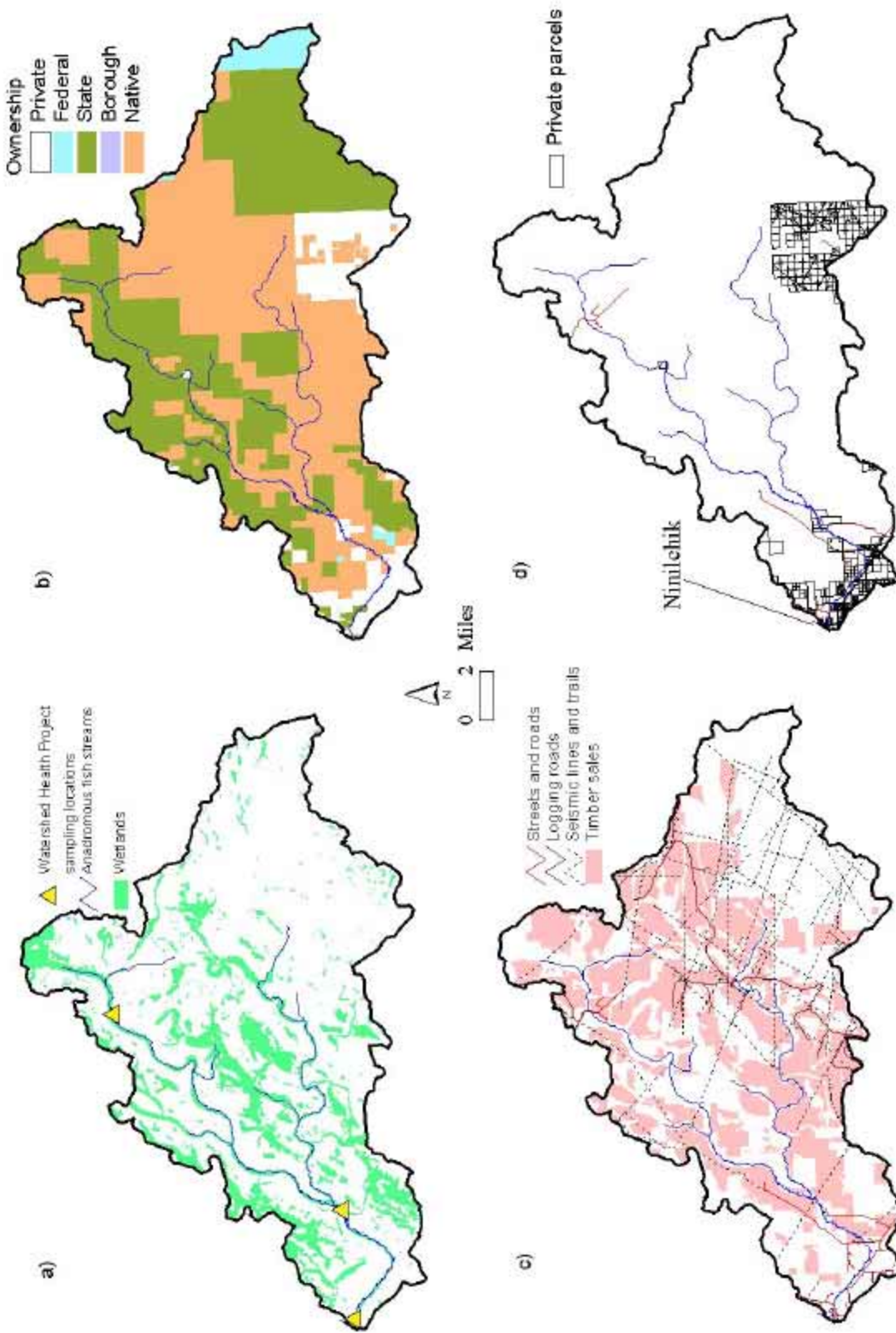


Figure 2. Ninilchik River watershed: a) wetlands and anadromous fish streams; b) land ownership; c) roads, trails, and timber sales; and d) communities and private parcels. Anadromous streams mapped by Alaska Department of Fish & Game; wetlands mapped by US Fish and Wildlife Service National Wetlands Inventory; and ownership, timber sales, trails and roads from Kenai Peninsula Borough data.

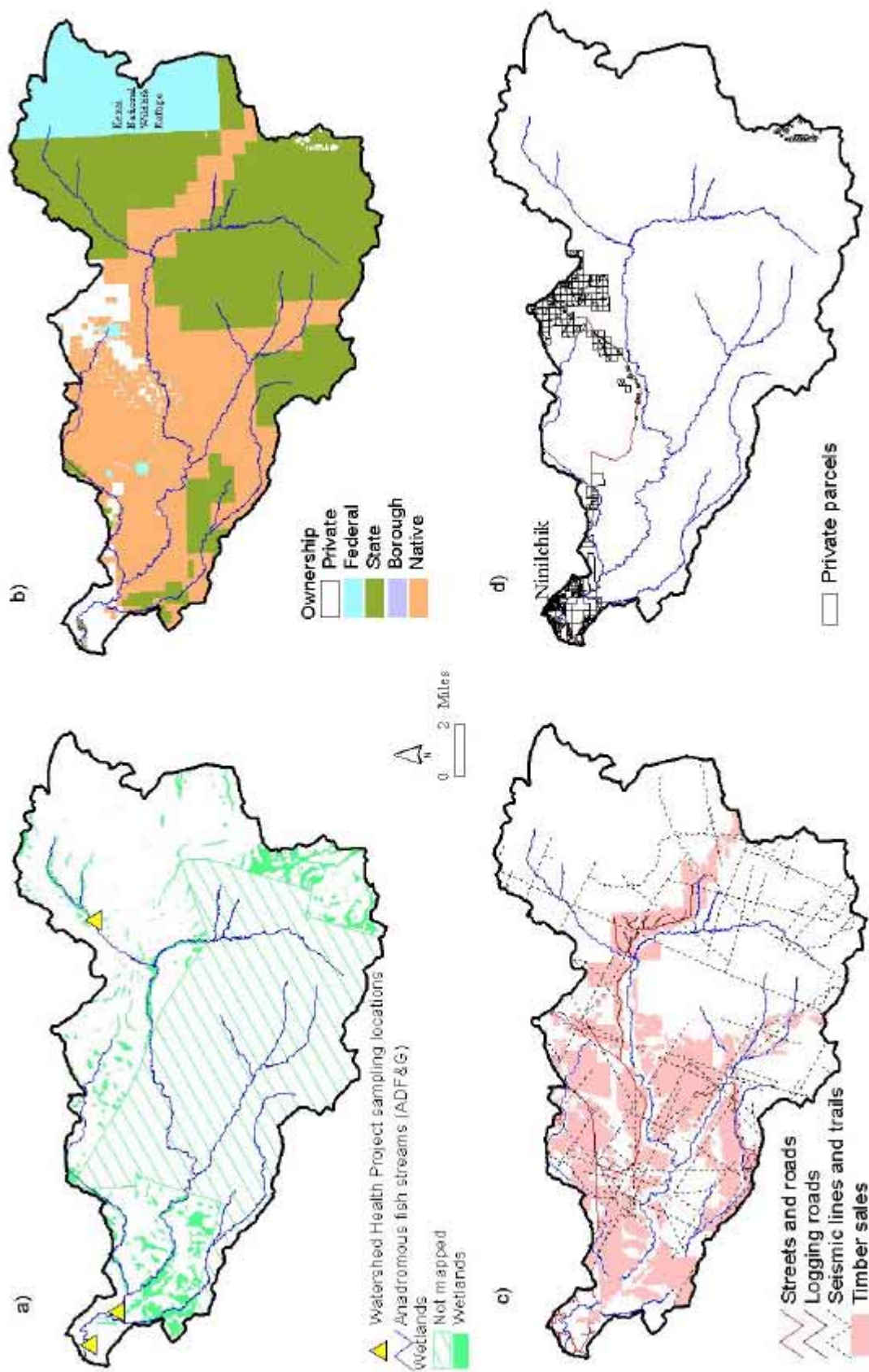


Figure 3. Deep Creek watershed: a) wetlands and anadromous fish streams; b) land ownership; c) roads, trails, and timber sales; and d) communities and private parcels. Anadromous streams mapped by Alaska Department of Fish & Game; wetlands mapped by US Fish and Wildlife Service National Wetlands Inventory; and ownership, timber sales, trails and roads from Kenai Peninsula Borough data.

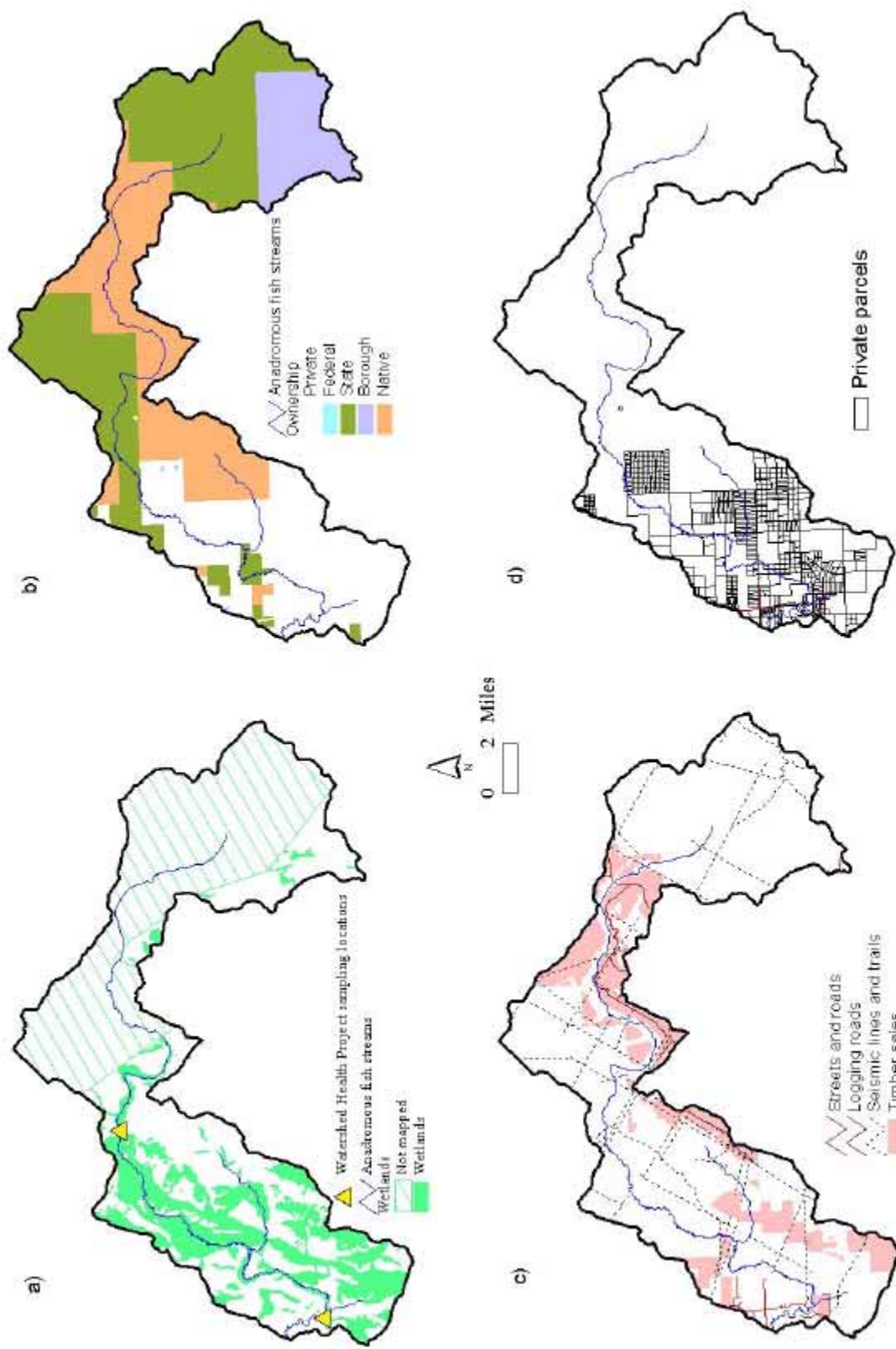


Figure 4. Stariski Creek watershed: a) wetlands and anadromous fish streams; b) land ownership; c) roads, trails, and timber sales; and d) communities and private parcels. Anadromous streams mapped by Alaska Department of Fish & Game; wetlands mapped by US Fish and Wildlife Service National Wetlands Inventory; and ownership, timber sales, trails and roads from Kenai Peninsula Borough data.

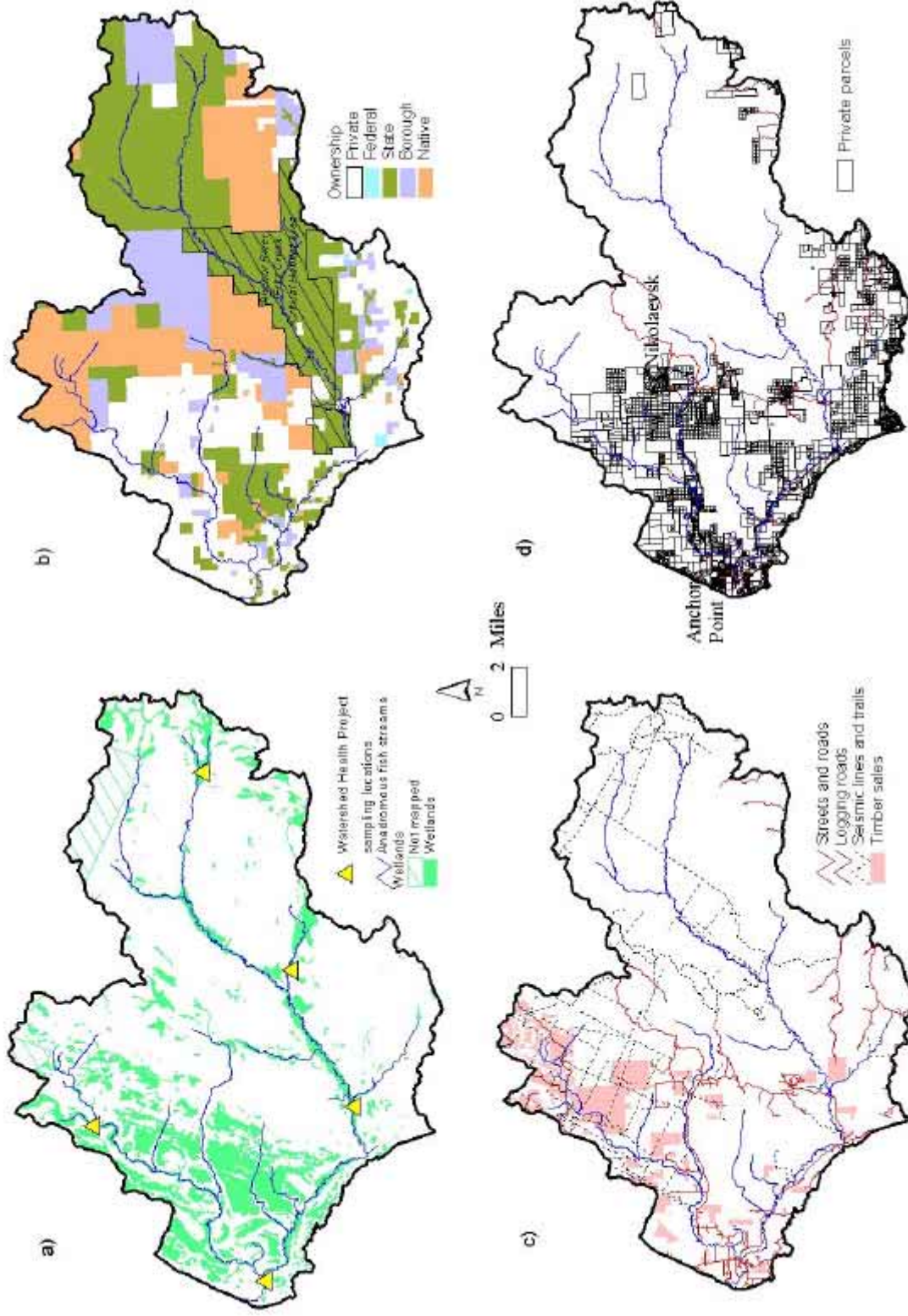


Figure 5. Anchor River watershed: a) wetlands and anadromous fish streams; b) land ownership; c) roads, trails, and timber sales; and d) communities and private parcels. Anadromous streams mapped by Alaska Department of Fish & Game; wetlands mapped by US Fish and Wildlife Service National Wetlands Inventory; and ownership, timber sales, trails and roads from Kenai Peninsula Borough data.

Table 1. Physical and political characteristics of the Ninilchik River, Deep Creek, Stariski Creek, and Anchor River watersheds.

Characteristic	Ninilchik River Watershed	Deep Creek Watershed	Stariski Creek Watershed	Anchor River Watershed
Drainage area	135 miles ²	211 miles ²	49 miles ²	225 miles ²
Miles of anadromous fish streams	52 miles	106 miles	28 miles	114 miles
Miles of Road	59 miles	52 miles	19 miles	146 miles
Wetlands:				
Percentage of watershed mapped for wetlands	~100%	54%	58%	97%
Percentage of wetlands in mapped area	20%	12%	22%	19%
Land ownership:				
Native Corporation	46 %	38%	25%	21%
Federal	3 %	12%	0%	< 1%
State	42 %	44%	37%	36%
Borough	< 1%	< 1%	10%	13%
Private	8%	5%	27%	28%
Other	<1%	<1%	1%	1%
Timber Sales, Cumulative area:				
Pre-1990	< 1%	3%	<1%	<1%
1990-1993	6%	4%	4%	<1%
1994-2000	44%	25%	15%	11%

METHODS

Study Design

The Lower Kenai Peninsula Watershed Health Project was developed to inventory water quality and characterize the health of the Ninilchik River, Deep Creek, Stariski Creek, and Anchor River watersheds. The study was designed under the direction of a Technical Advisory Committee (TAC) of scientists from federal, state and local agencies as well as Tribal associations, community groups, and the University of Alaska (Appendix III).

Sample Site Selection

A total of twelve sampling sites were chosen to represent water quality conditions throughout each watershed. Sites were chosen on the upper reaches of the watershed, middle portion of the watershed, and near the mouth of the river, where the cumulative impacts of human use are expected to be the strongest. Three sites were chosen on Ninilchik River and Deep Creek, two on Stariski Creek, and four were located in the Anchor River watershed. When determining the exact location of each monitoring station, the following criteria were used: private property access, historical data available from the site, parameters previously measured, representative-ness, and logistical access. One sampling location on the upper Anchor River (AR-1) was changed after access was deemed too difficult. The Technical Advisory Committee approved a new location on Beaver Creek (AR-5) in March 2000 (see Figure 1). In August 2002, access to the middle Deep Creek site (DC-2) was denied by the landowners as they embarked on a tree replanting project. In July 2003, the upper Ninilchik River site was dropped from the regular sampling rotation to increase effort at other sites.

Parameter Selection

Keeper chose monitoring parameters that are part of Alaska's water quality standards and federal water quality criteria and that provide useful indicators of watershed health. Keeper has refined its list of monitoring parameters over time. In August 1998, Keeper began monitoring the following parameters: water temperature, streamflow, pH, oxidation-reduction potential, conductivity, salinity, total dissolved solids, dissolved oxygen, nitrite-nitrogen, nitrate-nitrogen, ammonia-nitrogen, orthophosphate, total phosphorus, color, turbidity, suspended solids, and bacteria. In 1999, under direction of the TAC, Keeper eliminated oxidation-reduction potential, which is more appropriate for groundwater than for surface water. Keeper also eliminated nitrite-nitrogen and salinity because the values for these parameters were too low to measure accurately. Keeper incorporated an additional parameter, settleable solids.

Monitoring Frequency

From August 1998 to May 2000, Keeper monitored all twelve sites monthly during the summer months of May through October. During the winter months of November through April, at least six sites were visited each month. Sites were visited in order of priority, with the lower, most accessible sites first, the middle sites second, and the least accessible upper sites last.

Starting in May 2000, the monitoring schedule has targeted high flow events such as spring break-up and the annual fall storms. With this approach, all sites are visited every six weeks during the summer months. And, each site is visited at least one additional time during snowmelt or storms. This schedule results in the same number of site visits during the summer months as the previous schedule, but the time of each visit is chosen so that each site is visited over a range of flow conditions.



Middle Anchor River during spring break-up (5/02)



Middle Anchor River during summer low flow (7/02)

Stream systems are dynamic, and a year's worth of field visits may capture only some of the natural variability. Water chemistry may be expected to vary from day to day, times of high flow to low flow, from season to season, and from year to year. Results indicate the water quality at the moment of that particular sample. Therefore, it is important to continue monitoring to develop a complete picture of variability for each water quality parameter. The more samples that are collected, the more this variability will be revealed.

Measurement and Analysis Techniques

Sampling and analysis methods were chosen so that data could be compared with data from other studies both in Alaska and around the United States. For most parameters, Keeper selected sampling methods from *Standard Methods for the Examination of Water and Wastewater, 19th Edition* (American Public Health Association, 1995), and/or methods that have been approved or accepted by the United States Environmental Protection Agency (EPA). Standard methods, EPA-approved tests and standard operating procedures (SOPs) were used wherever possible so that results could be compared with other studies and accepted by other scientists. A more detailed discussion of both the project design and the sampling and analysis methods can be found in the Quality Assurance Project Plan (Cook Inlet Keeper, 2000).

Data Management

All water quality data are recorded in notebooks and on field data sheets and are entered into Keeper's Microsoft Access database. Data are screened for data entry errors; data that are suspected to be inaccurate due to instrument calibration concerns or that fall outside of the normal expected range for each parameter are not included in data analysis and presentation.

Data Presentation

The data are summarized using box plots, which illustrate mean, median, and other percentiles (Figure 6), to document natural variability over time for each site. For certain parameters, longitudinal trends and relationships to stream discharge have been highlighted. Differences between watersheds are explored using analysis of variance.

Keeper also compares data to state water quality standards and/or federal water quality criteria, and historical water quality data. State water quality standards were taken from *Water Quality Standards as Amended Through May 27, 1999* (ADEC, 1999). Federal water quality criteria were taken from *Quality Criteria for Water 1986* (EPA, 1986) and *1998 Update of Ambient Water Quality Criteria for Ammonia* (EPA, 1998).

Quality Assurance

Keeper has quality checks on all aspects of the Lower Kenai Peninsula Watershed Health Project (Figure 7). First, the monitoring plan was developed under the direction of a Technical Advisory Committee (TAC) of scientists from federal and state agencies as well as industry (Appendix III). The TAC chose sampling sites, determined the sampling frequency, and reviewed the chosen methods. Next, Keeper and the TAC chose standard field and lab methods so that data collected by Keeper could be easily compared with data from other studies. Third, Keeper incorporates quality assurance steps into the data collection process. For example, Keeper splits samples with another professional lab annually to compare results. Keeper also uses a standard solution of known concentration with each laboratory analysis to estimate precision and accuracy. The results of the sample splits are found in Appendix I. Finally, all quality assurance methods are described in detail in Keeper's Lower Kenai Peninsula Watershed Health Project Quality Assurance Project Plan (QAPP). The QAPP in turn was reviewed by the TAC and approved by both Alaska Department of Environmental Conservation and the U.S. Environmental Protection Agency.

The QAPP is available upon request from Cook Inlet Keeper.

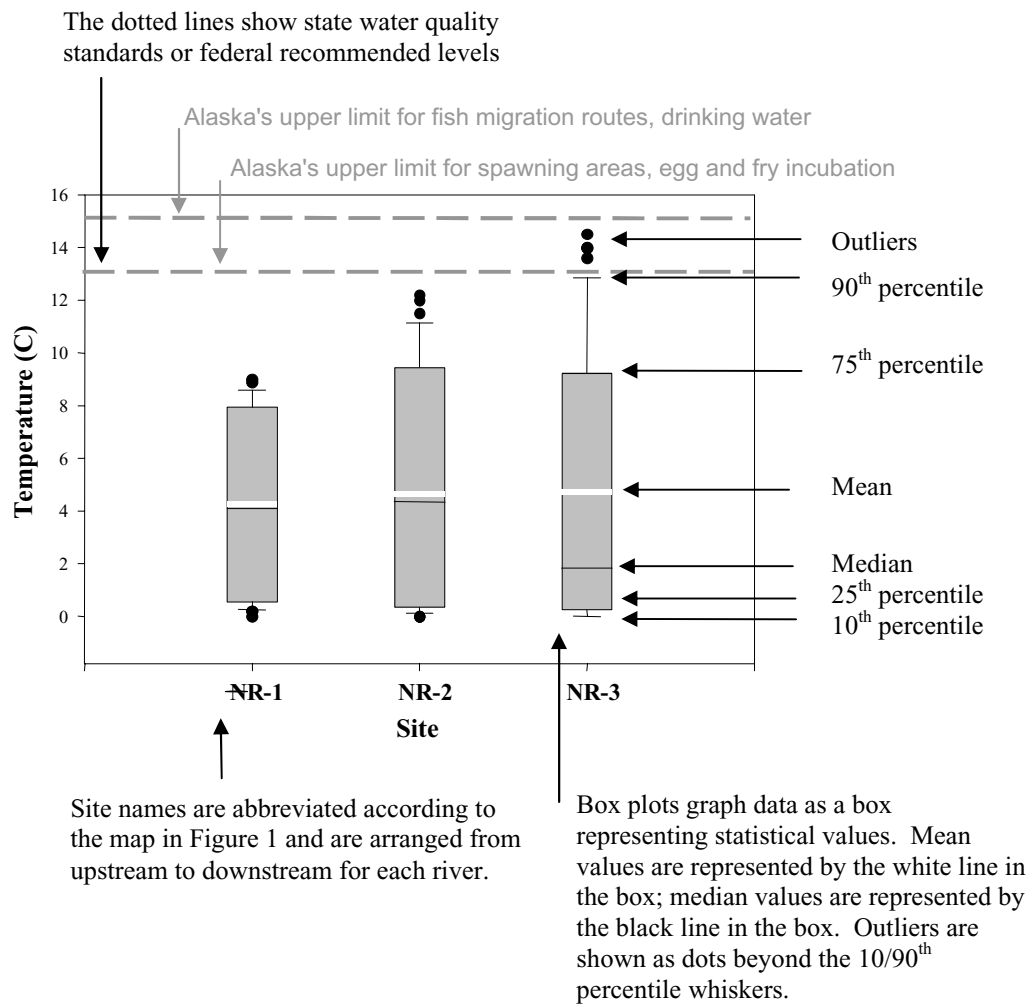


Figure 12. Water temperature measured by Cook Inlet Keeper on Ninilchik River sites, 8/98-6/04.

The figure caption explains the parameters presented in the chart.

Figure 6. Data presentation method used in this report.

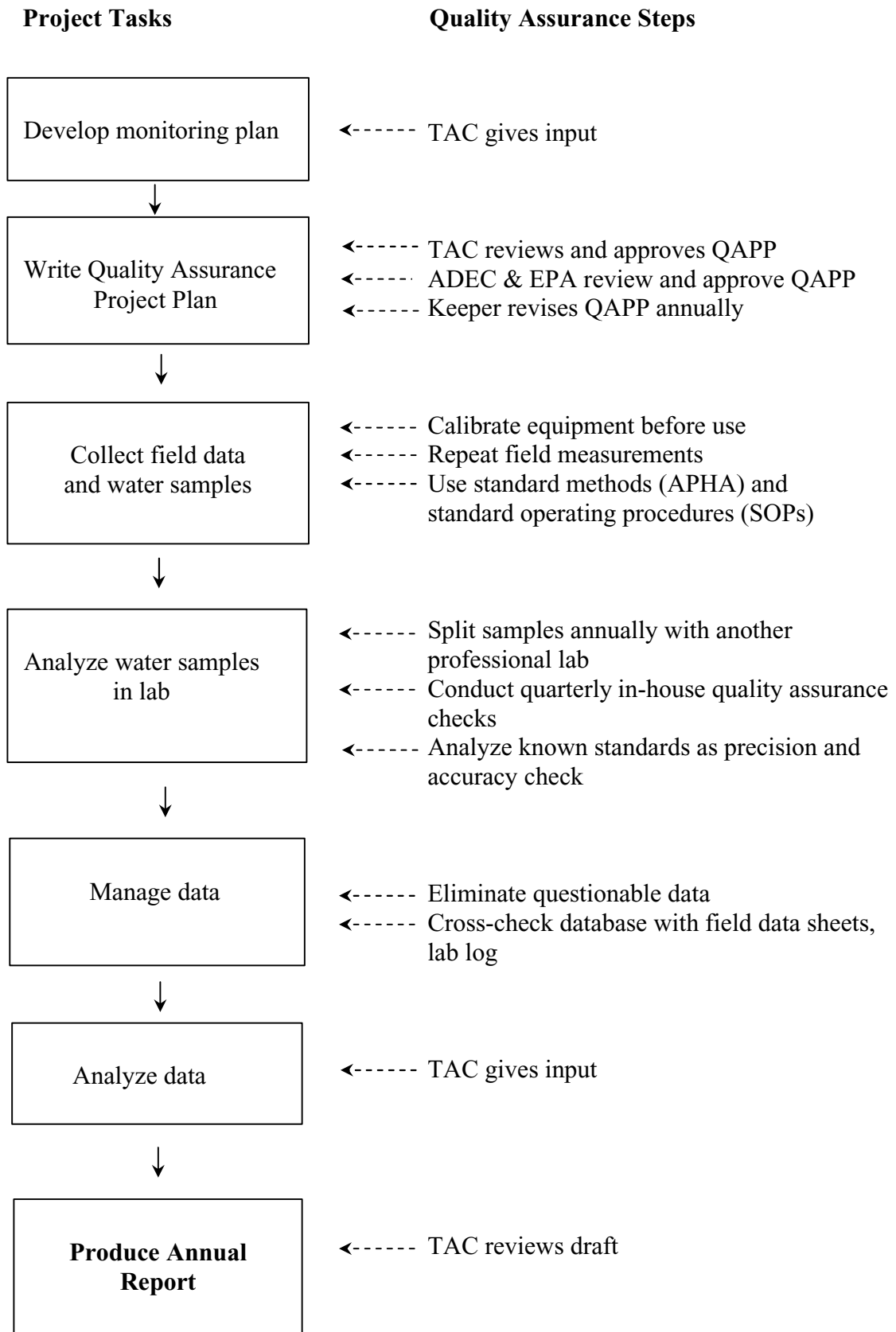


Figure 7. Lower Kenai Peninsula Watershed Health Project tasks and associated quality assurance steps.

WATER QUALITY PARAMETERS

Parameters

Streamflow (discharge) is the volume of water moving through a stream at any given point in time. Streamflow is often expressed in cubic feet per second (cfs). The discharge of a stream can vary on a daily basis in response to precipitation, snowmelt, dry periods, and withdrawals of water by people. Streamflow affects water chemistry; thus, water quality measurements should always be looked at in relation to streamflow.

Water Temperature is a crucial aspect of aquatic habitat. Aquatic organisms are adapted to live within a certain temperature range. As the upper and lower limits of the range are approached, organisms become more susceptible to disease. Also, fish that spend extra energy searching for cool areas may be at a disadvantage when competing for food. Stream temperature results from inputs of solar radiation as well as air temperature (EPA, 1991).

Dissolved Oxygen is needed by fish and other stream organisms to live. In natural small streams, dissolved oxygen levels are usually 100% of the holding capacity of the water. As plant and animal material decays, it consumes dissolved oxygen, particularly in slow-moving areas of the stream. Turbulence, interaction with the air, and photosynthesis replenish oxygen to the water (Table 2). Colder water can hold more dissolved oxygen than warmer water. Dissolved oxygen measurements can be expressed as a concentration in milligrams per liter (mg/L), or as percent saturation: the amount of oxygen the water holds compared to what it could absorb at that temperature.

pH is a measure of the level of activity of hydrogen ions in a solution, resulting in the acidic or basic quality of the solution. The pH range is from 0 (acidic) to 14 (basic), with 7 being neutral (Figure 8). Stream organisms are adapted to certain pH ranges. Humans can impact pH through mining activities (which make water more acidic) and by increasing nutrients, which increase plant growth and pH (Table 2). Most natural rivers range from 6.5 pH units to 8 pH units.

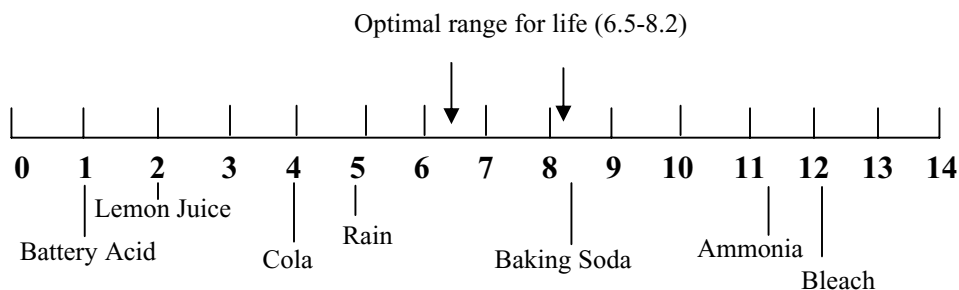


Figure 8. pH levels of some common substances.

Total Dissolved Solids is a measure, in milligrams per liter (mg/L), of the amount of dissolved materials in the stream. Ions such as potassium, sodium, and chloride all contribute to a dissolved solids measurement. Measuring total dissolved solids is a way of estimating the suitability of water for irrigation and drinking water. Groundwater has higher levels of dissolved solids from increased contact with rock and more time to dissolve rock and mineral materials. Thus, when stream flows are high from rain or snow melt, dissolved solids measurements are expected to be low. When stream flow is low, most of the source water is from groundwater and dissolved solids levels are higher (Hem, 1992).

Conductivity is the ability of a substance to conduct an electrical current, measured in microsiemens per centimeter ($\mu\text{S}/\text{cm}$). The presence of ions in a sample of water gives it its ability to conduct electricity; thus conductivity is an indicator of the amount of dissolved solids in the stream. Conductivity is often used to estimate the amounts of dissolved solids rather than measuring each dissolved constituent individually.

Nutrients are chemical elements that are essential to plant and animal life and growth. Nitrogen and phosphorus are nutrients that are important to aquatic life, but at high levels they are considered contaminants. Keeper measures nitrate-nitrogen, ammonia-nitrogen, orthophosphate, and total phosphorus. Both nitrogen and phosphorus are affected by chemical and biological processes that change their form and transfer them to or from water, soil, biological organisms, and the atmosphere (Mueller and Helsel, 1999). High levels of nutrients can cause increased growth of algae beyond what is normal and impact the quality of the water. Decaying algae mats can cause foul odors and tastes and remove dissolved oxygen from the water. In nature, both nitrogen and phosphorus come from the soil and decaying plants and animals (Table 2).

Turbidity is an optical property of water that refers to the amount of light scattered or absorbed by the water (American Public Health Association, 1995). In this project, turbidity is measured in nephelometric turbidity units (NTUs). Increasing turbidity is described visually as increasing cloudiness. Silt, clay, organic material, and colored organic compounds can all contribute to turbidity. Although turbidity may be a sign of suspended sediment, it cannot be correlated with a weight concentration of suspended material. Turbidity is an important parameter of drinking water for both aesthetic and practical reasons (EPA, 1991).

Suspended Solids can cause problems both as it travels through the water and after it is deposited on the stream bed. Suspended sediment can reduce visibility, making it hard for fish to find prey. It can clog the gills of fish and suffocate macroinvertebrates. Once suspended sediment is deposited, it can fill the spaces between gravel pieces in the bed of the stream. This reduces the permeability of the bed material, meaning that water cannot filter through, bringing dissolved oxygen and nutrients to stream insects, fish eggs and fry. High levels of suspended solids make treatment of water for drinking difficult.

Settleable Solids are the volume of solids that settles out of a sample of water compared to the total volume of the sample. This is another way of measuring the amount of sediment in a water sample. The State of Alaska uses the amount of settleable solids as the parameter of importance for meeting the state water quality standard for sediment to protect swimming.

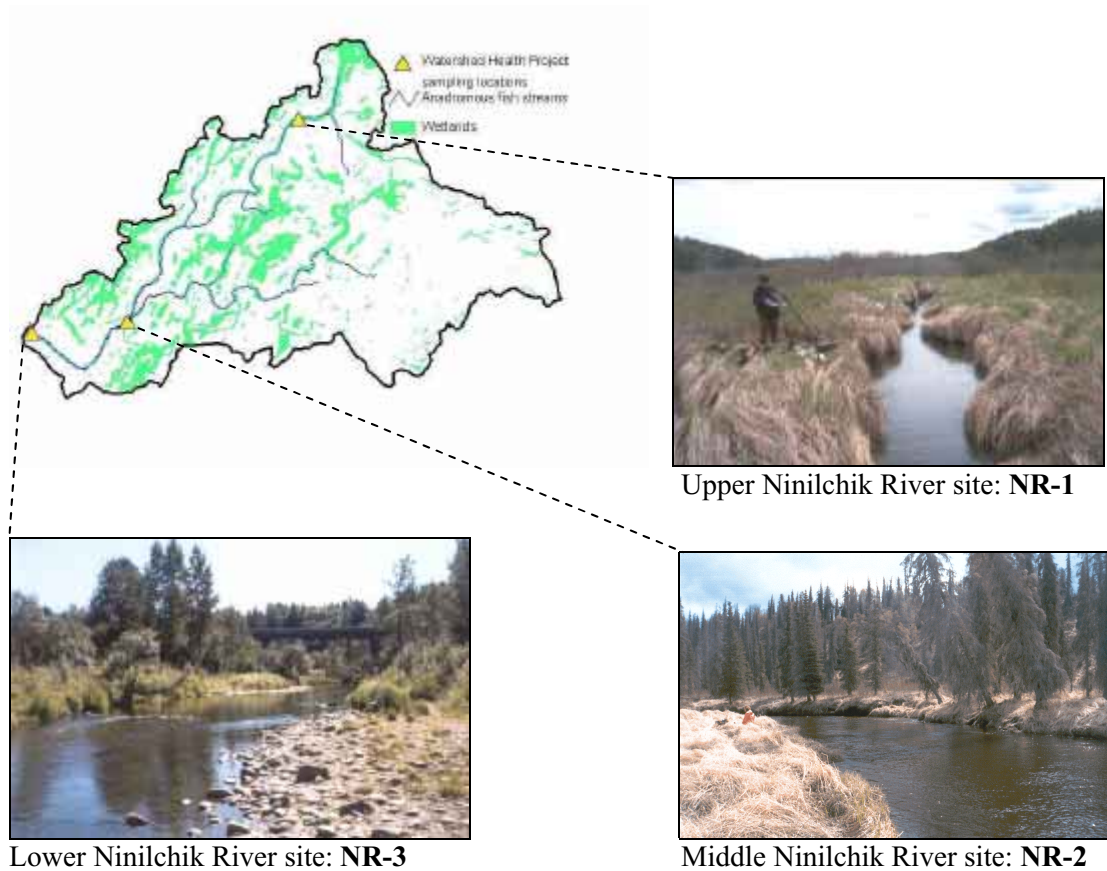
Apparent Color The color of water comes from the leaching of organic debris (dead plants) in wetlands. The color of water is not directly related to any chemical properties of the water. However, it is an important aesthetic quality of drinking water.

Table 2. Water quality parameters and common natural and human impact sources.

Parameter	Common Natural Contributions	Common Human Impact Sources
Discharge	Precipitation, snowmelt, groundwater	Withdrawals of stream or groundwater, dams, impermeable surfaces
Temperature	Solar radiation, shade, groundwater contributions	Removal of riparian vegetation, inputs from treatment plants
Dissolved Oxygen	Turbulence, interaction with air	Decaying plant and animal material, sewage, effluent
pH	Decaying wetland plants, geology	Mine tailings leaching, agricultural runoff, algae blooms
Total Dissolved Solids	Geology, discharge	Road and fertilizer runoff
Conductivity	Geology, discharge	Pollution, road and fertilizer runoff
Nitrogen: Ammonia and Nitrate	Decaying plant and animal material	Sewage, wastewater treatment plant effluent, fertilizers, logging and lawn debris, deposition from the atmosphere
Phosphorus: Orthophosphate and Total Phosphorus	Decaying plant material, soils, underlying geology	Detergents, fertilizers, sediment
Turbidity	Discharge, natural erosion	Road building and erosion, forest harvest, mining, grazing, wastewater discharges
Suspended Solids	Discharge, natural erosion	Road building and erosion, forest harvest, mining, grazing, wastewater discharges
Settleable Solids	Discharge, natural erosion	Road building and erosion, forest harvest, mining, grazing, wastewater discharges
Color	Chemical compounds from decaying plants	Chemical contaminants

WATER QUALITY DATA

Ninilchik River Watershed



Streamflow (discharge)

Collecting stream flow data during ice cover, snow melt periods, and high flow events (>300 cfs) has proven to be a challenge using methods for wadeable streams. In April and August 2001, U.S. Geological Survey (USGS) personnel worked with Keeper staff to collect high flow data using a variety of methods. Keeper's measurements on the middle and lower Ninilchik River sites (NR-2, NR-3) are comparable to continuous data collected from the USGS gauge on the lower Ninilchik River (Figure 9). Peak flows (>1,000 cfs) from the USGS gauge (station # 15241600) for the Fall floods of 2002 were: (USGS measurements are provisional and subject to change.)

October 24, 2002	5,800 cfs	November 24, 2002	1,610 cfs
October 25, 2002	2,000 cfs	November 25, 2002	1,190 cfs
October 26, 2002	1,050 cfs		

Due to a lack of funding, the USGS Ninilchik River gauge went off line in October 2003.

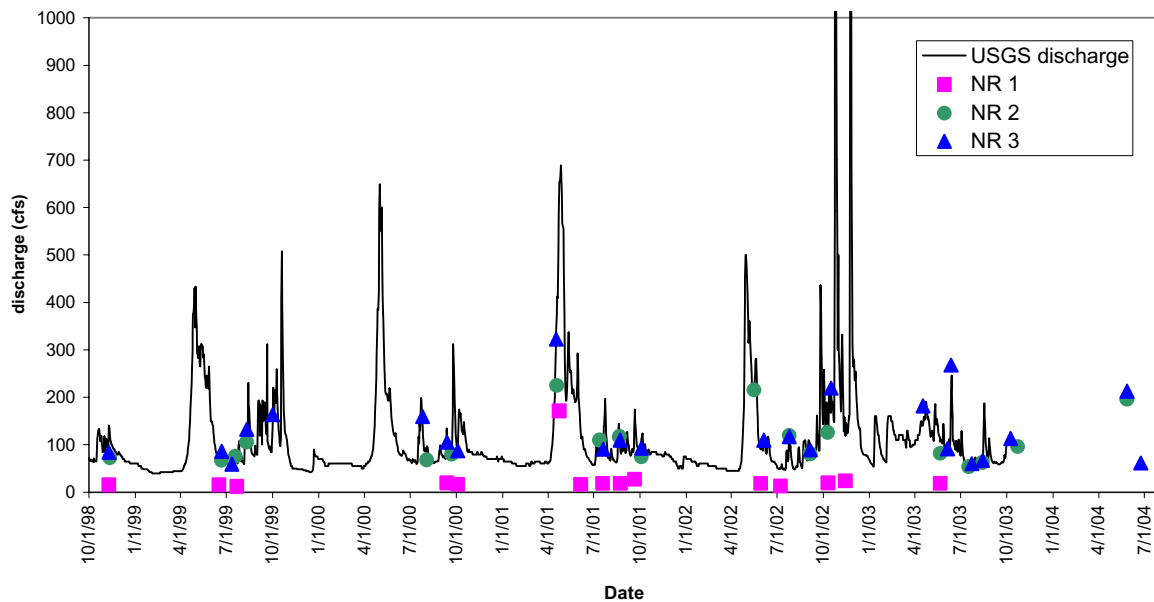


Figure 9. Discharge data for sites measured by Cook Inlet Keeper on the Ninilchik River and discharge measurements from USGS stream gauge (station number 15241600).

Water Temperature

Water temperature is one of the most significant factors in the health of stream ecosystems. Temperature affects salmon egg and fry incubation, fish metabolism, organisms' resistance to disease, the availability of oxygen and nutrients to fish and wildlife, and other factors. Researchers have determined that adult cold-water fish species may cease to migrate or die un-spawned if exposed to long periods of warmer than usual temperatures (Bell, 1973). Starting in August 1999, water temperature measurements taken during regular site visits in summer months were exceeding 13°C, Alaska's water quality standards to protect cold-water fish habitat, at the lower Ninilchik River site (Figure 10). Because these streams support runs of salmon and other fish which are extremely important to the economic and ecologic health of the region, Keeper deployed continuous temperature loggers in the summers of 2002 and 2003 to thoroughly assess stream temperature variation and how it might affect habitat and water quality. Data collected in 2003 at 15-minute intervals from a temperature logger show the frequency of elevated temperatures at the lower Ninilchik River (Figure 11). A comparison of data collected in the summers of 2002 and 2003 show that both the frequency and the magnitude of the temperature exceedances increased in 2003 (Table 3).

In May 2004, five temperature loggers were deployed in the Ninilchik River to determine how far upstream temperatures are exceeding water quality standards. The lower Ninilchik River site is a fish migration route and thus temperatures above 15°C are of concern to salmon health and mortality. Four loggers have been placed higher up in the watershed in spawning areas to record the extent of temperatures exceeding 13°C. These data will be presented in the 2005 annual water quality status report.

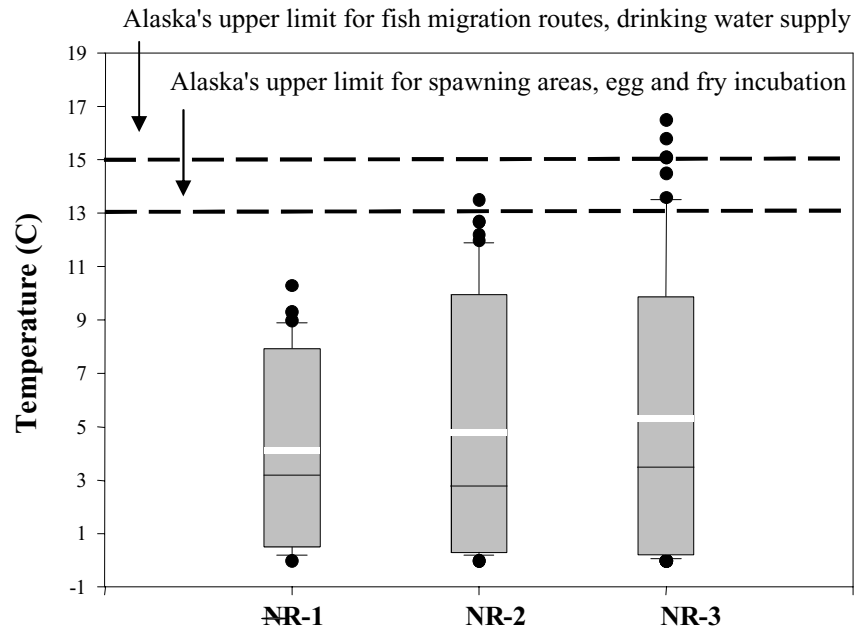


Figure 10. Water temperature measured during regular site visits on the Ninilchik River, 8/98-6/04.

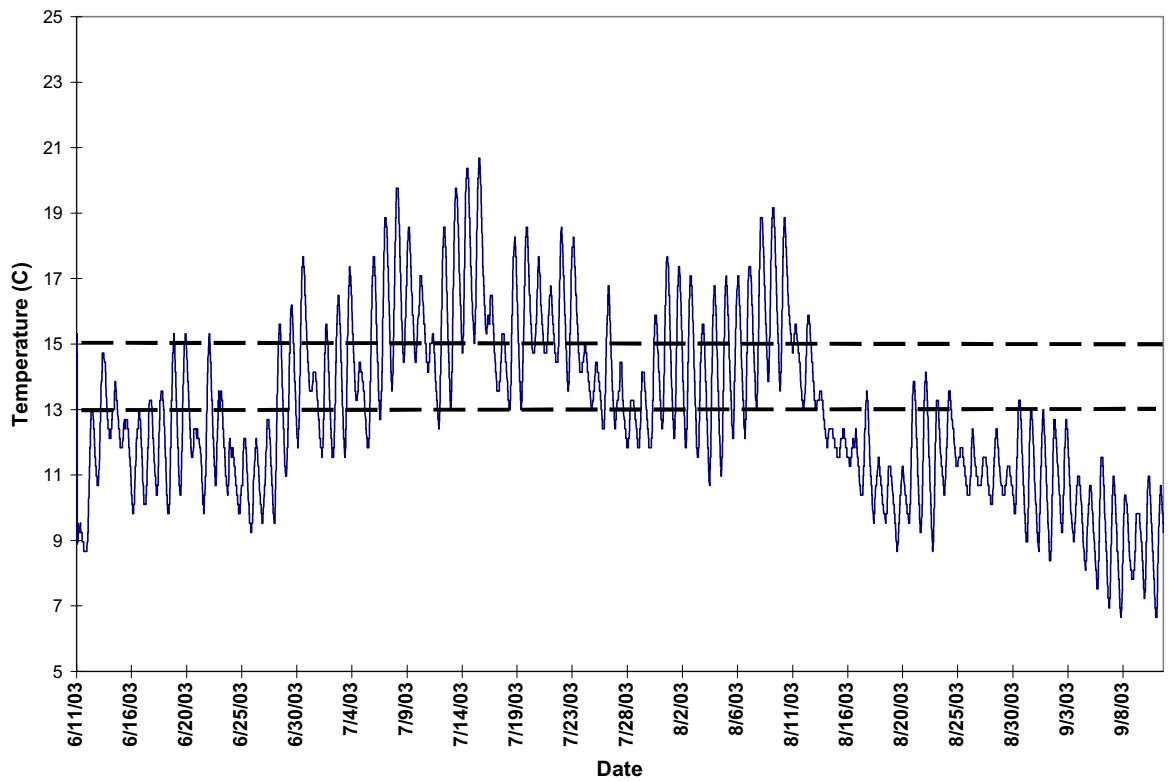


Figure 11. Continuous temperature logger data collected from 6/03 – 9/03 at the lower Ninilchik River site.

Table 3: Summary of elevated water temperatures from temperature logger data on the lower Ninilchik River site in the summers of 2002 and 2003.

Year	Above 13°C	Above 15°C	Maximum temp (date)
2002	56 days 13.6 hours/day on average 3 full days 2 consecutive days	35 days 9.7 hours/day on average 0 full days	19.2°C (6/30, 7/17)
2003	64 days 15.9 hours/day on average 18 full days 5 consecutive days	47 days 11.8 hours/day on average 2 full days 2 consecutive days	20.7°C (7/15)

Descriptive statistics of water quality parameters measured from 8/98 to 6/04 are summarized in Table 4. No exceedances of Alaska's water quality criteria for dissolved oxygen, pH, total dissolved solids, or nitrate-nitrogen were observed from 7/03 through 6/04. Data for turbidity (Figure 12), total suspended solids, and apparent color are difficult to relate to state standards because they are described in relation to natural conditions rather than as a specific value. No state standards exist for conductivity, orthophosphate-phosphorus, total phosphorus, ammonia-nitrogen, and settleable solids. Ammonia- nitrogen levels were well below EPA's criteria to protect aquatic life. Thirty-five percent (NR-1), fifty-five percent (NR-2), and forty-eight percent (NR-3) of total phosphorus measurements were above EPA's recommended level of 0.10 mg/L as phosphorus (Figure 13).

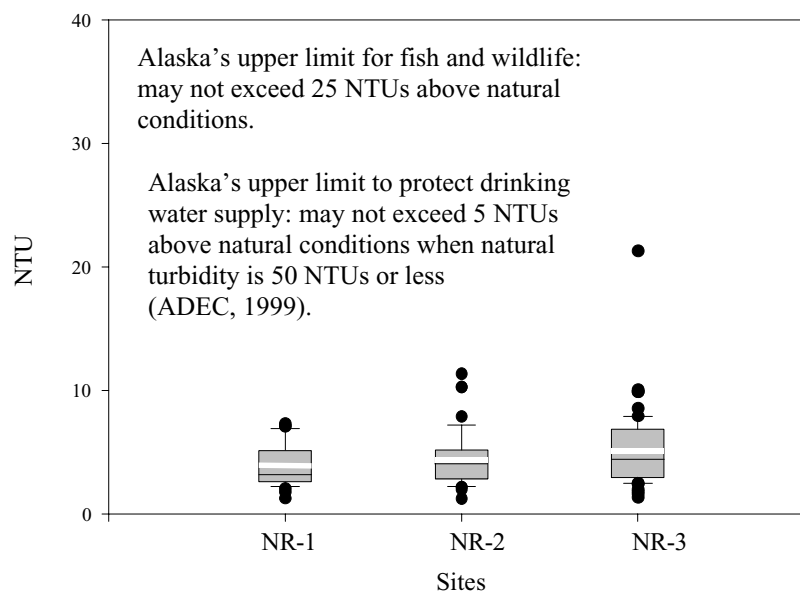


Figure 12. Turbidity measured by Cook Inlet Keeper on Ninilchik River sites, 8/98-6/04.

Table 4: Descriptive statistics of water quality parameters measured from 8/98 to 6/04 for Ninilchik River sites.

	Water Temp (C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Sat.)	pH	Conductivity (uS/cm)	TDS (mg/L)	Turbidity (NTUs)	App. Color (PtCo units)	Ortho-Phosph. (mg/L)	Total Phosph. (mg/L)	Ammonia-Nitrogen (mg/L)	Nitrate-Nitrogen (mg/L)	TSS (mg/L)	Settleable Solids (mg/L)
NR-1														
N	35	33	33	29	35	34	35	35	34	34	34	30	34	24
Mean	4.12	10.97	82.91	7.12	80.92	36.85	3.91	67.54	.08	.10	.18	.02	9.71	.10
Median	3.20	11.14	83.00	7.20	82.40	38.00	3.21	63.00	.08	.10	.16	.00	6.50	.10
Std. Deviation	3.66	1.12	7.00	.31	14.63	6.39	1.70	23.52	.02	.03	.09	.05	17.20	.00
Range	10.30	5.73	31	1.20	62.40	26	6.05	104	.11	.16	.39	.26	104	.00
Minimum	.00	7.42	65	6.31	45.90	20	1.29	40	.04	.01	.00	.00	2	.10
Maximum	10.30	13.15	96	7.51	108.30	46	7.34	144	.15	.17	.39	.26	106	.10
NR-2														
N	47	45	45	39	44	44	42	45	43	44	44	38	43	34
Mean	4.80	11.60	90.51	7.33	86.50	39.20	4.37	69.11	.09	.12	.20	.03	8.07	.11
Median	2.80	11.70	93.00	7.34	88.45	40.50	4.05	69.00	.08	.11	.20	.03	6.00	.10
Std. Deviation	4.78	1.36	9.07	.34	15.71	7.36	2.14	22.14	.02	.05	.06	.04	5.89	.03
Range	13.50	5.84	38	1.57	69.90	35	10.09	97	.11	.30	.31	.12	30	.10
Minimum	.00	9.06	67	6.46	49.70	22	1.26	34	.05	.01	.02	.00	2	.10
Maximum	13.50	14.90	105	8.03	119.60	57	11.35	131	.16	.31	.33	.12	32	.20
NR-3														
N	58	54	53	50	58	58	56	58	54	54	55	53	53	43
Mean	5.32	11.62	92.19	7.26	86.85	39.93	5.10	71.74	.09	.11	.20	.04	9.02	.11
Median	3.50	11.64	95.00	7.19	91.40	42.00	4.44	69.50	.09	.10	.19	.02	7.00	.10
Std. Deviation	5.41	1.30	10.70	.43	19.85	9.39	3.08	24.12	.03	.04	.09	.04	6.91	.04
Range	16.50	5.61	49	2.04	84.00	41	19.94	103	.13	.24	.38	.15	43	.20
Minimum	.00	8.66	67	6.11	36.30	16	1.36	36	.03	.03	.03	.00	2	.10
Maximum	16.50	14.27	116	8.15	120.30	57	21.30	139	.16	.27	.41	.15	45	.30

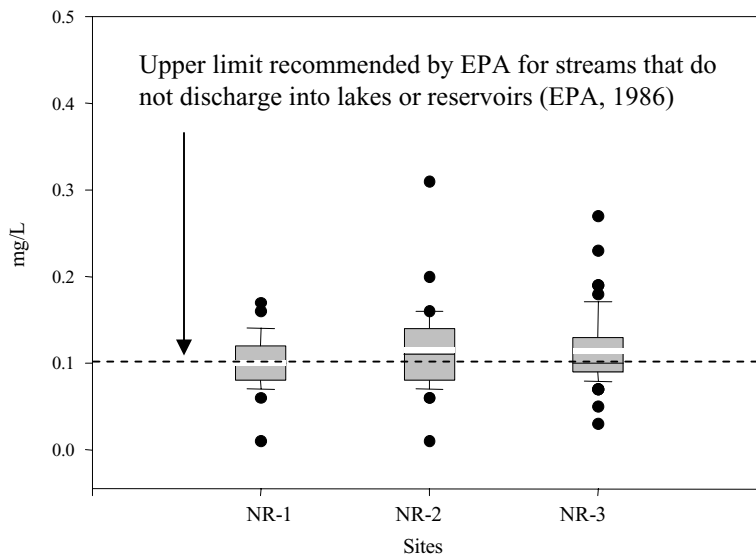


Figure 13. Total phosphorus measured by Cook Inlet Keeper on Ninilchik River sites, 8/98-6/04.

Comparison of Water Quality Parameters to Discharge

Discharge is an important stream variable because of its impact on water quality and on the living organisms and habitats in the stream. Discharge, or stream flow, is a function of water volume and velocity. Water volume is affected by weather, snow melt, evapo-transpiration, topography, geology, and human withdrawals. Velocity changes with channel width and depth and can affect the organisms living in the water, rate of sediment delivery, and dissolved oxygen concentrations. Changes in climate, impervious surfaces, vegetation composition and abundance can alter discharge patterns in a watershed.

Having water quality data collected alongside a stream gauging station makes the discharge and water quality data much more valuable than if these data are collected separately. Understanding the relationship between discharge and water quality will allow us to quantify natural variability and how our activities in the watershed might be changing the quality and quantity of water in our salmon-bearing streams.

With data from the Ninilchik River stream gauge, the following patterns are apparent: 1) low stream flows deliver higher conductivity and total dissolved solids, and 2) high stream flows deliver higher concentrations of ammonia-nitrogen, turbidity (Figure 14) total phosphorus (Figure 15), suspended solids, and color. For turbidity, the R-squared value (0.34) suggests that stream discharge explains some, but not all, of the variation in turbidity. The R-squared value (0.08) for total phosphorus suggests that there is not a strong relationship between total phosphorus values and discharge and, thus, other variables must be driving phosphorus levels. Values associated with baseflow and the rising and falling limbs of the hydrograph have been identified to determine if rising stream levels caused by rain and snow-melt events deliver more turbidity and phosphorus than falling stream levels; no clear relationship is evident.

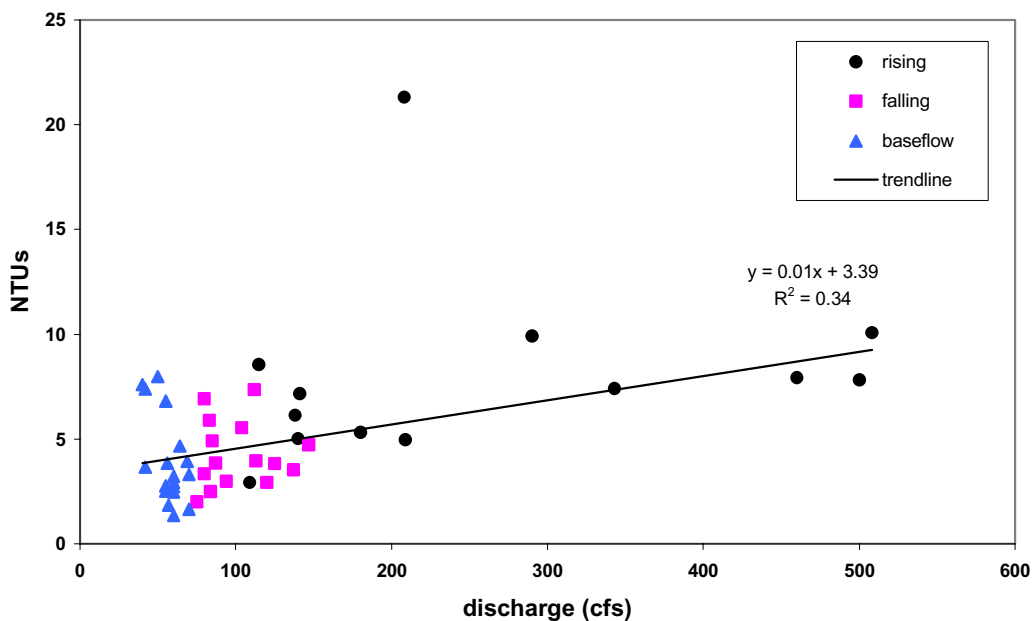


Figure 14. Relationship between discharge and turbidity at the lower Ninilchik River site.

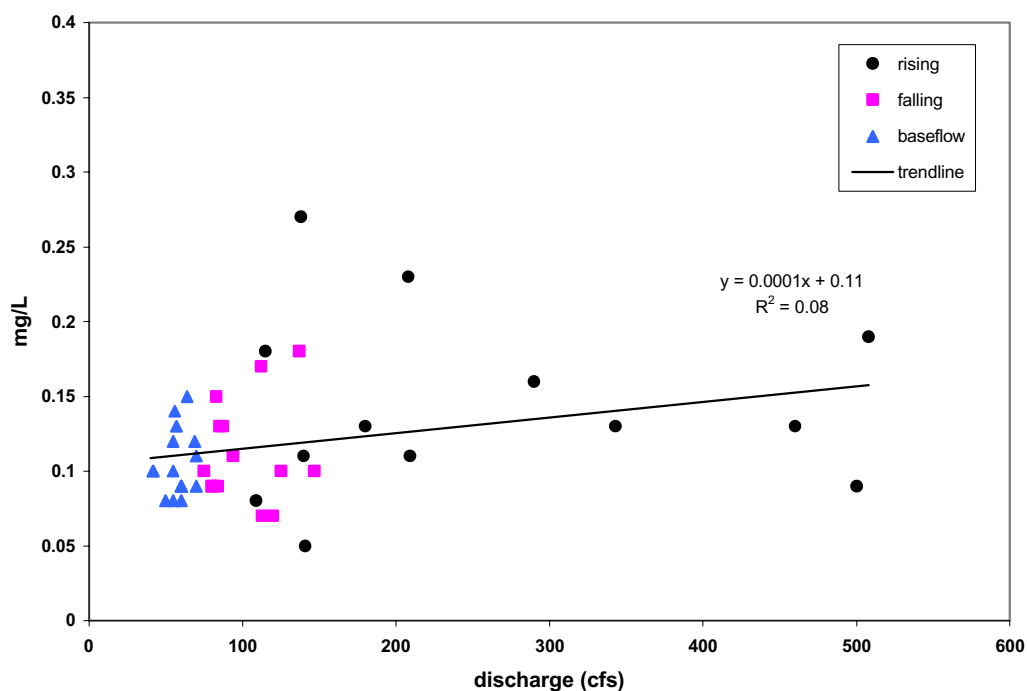
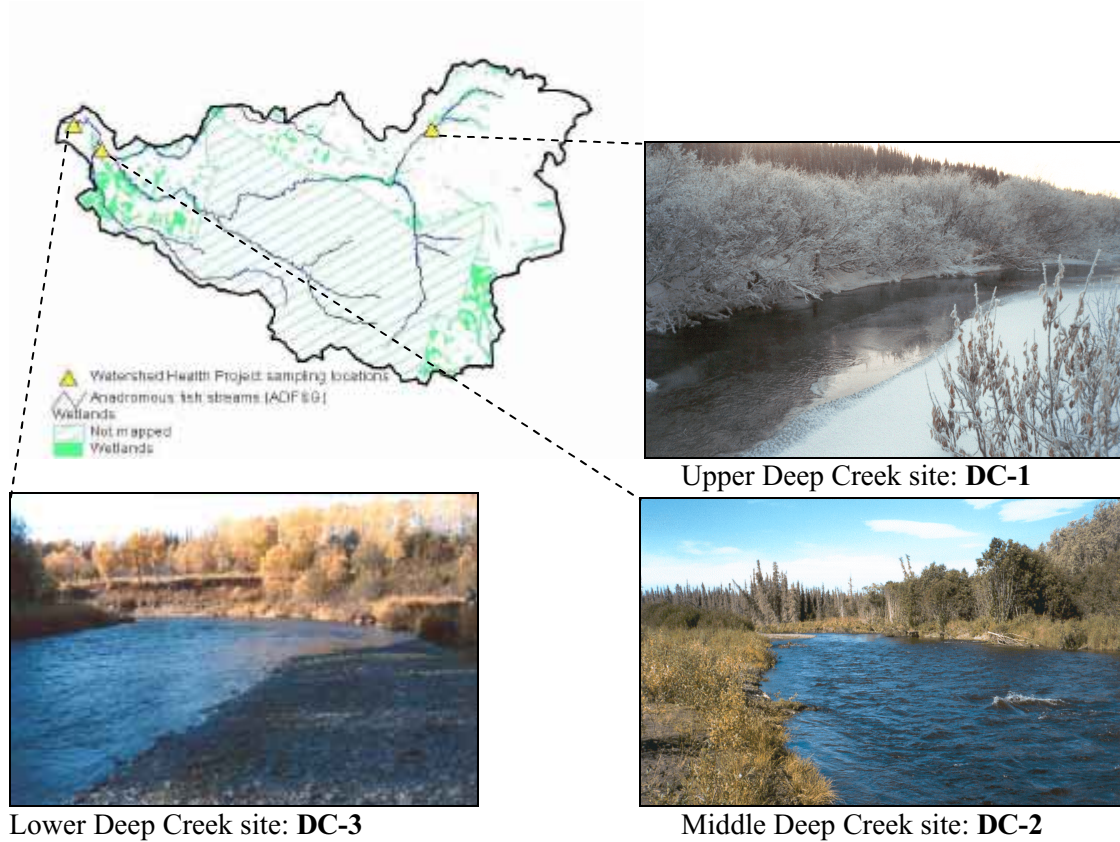


Figure 15. Relationship between discharge and total phosphorus at the lower Ninilchik River site.

Deep Creek Watershed



Streamflow (discharge)

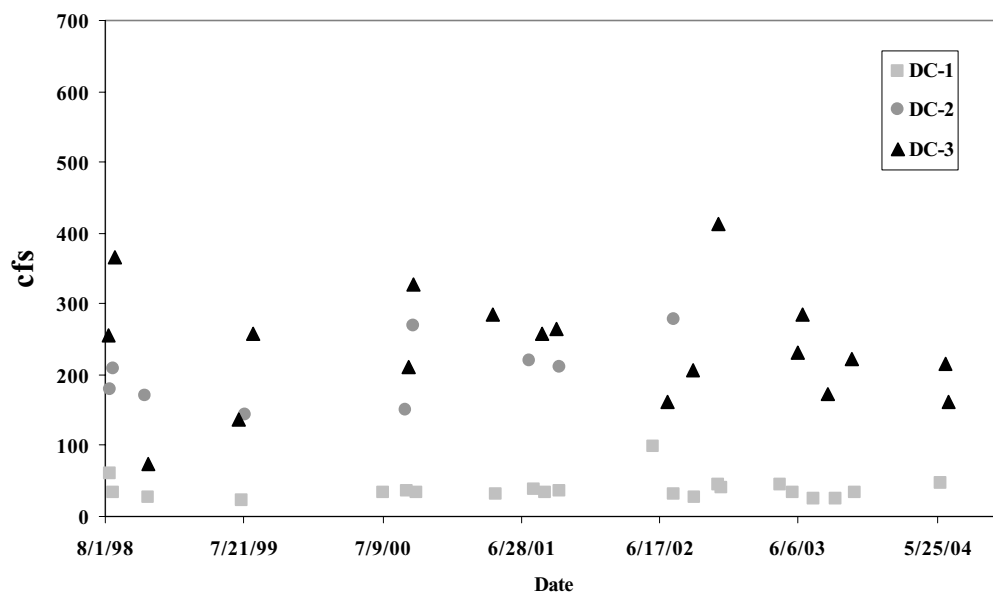


Figure 16. Discharge measurements for sites measured by Cook Inlet Keeper on Deep Creek.

Water Temperature

Water temperature measurements taken during regular site visits exceeded Alaska's water quality standards to protect cold-water fish habitat at the lower site in July 1999, 2002, and 2004; the middle site in July 1999; and at the upper site in July 2003 (Figure 17). Data collected in 2003 at 15-minute intervals from a temperature logger show the frequency of elevated temperatures at the lower Deep Creek site (Figure 18). A comparison of data collected in the summers of 2002 and 2003 show that both the frequency and magnitude of the temperature exceedances increased in 2003 (Table 5).

In 2004, six temperature loggers were deployed in Deep Creek to determine how far upstream temperatures are exceeding water quality standards. The lower Deep Creek site is a fish migration route and thus temperatures above 15°C are of concern to salmon health and mortality. Five loggers have been placed higher up in the watershed in spawning areas to record the extent of temperatures exceeding 13°C. These data will be presented in the 2005 annual water quality status report.

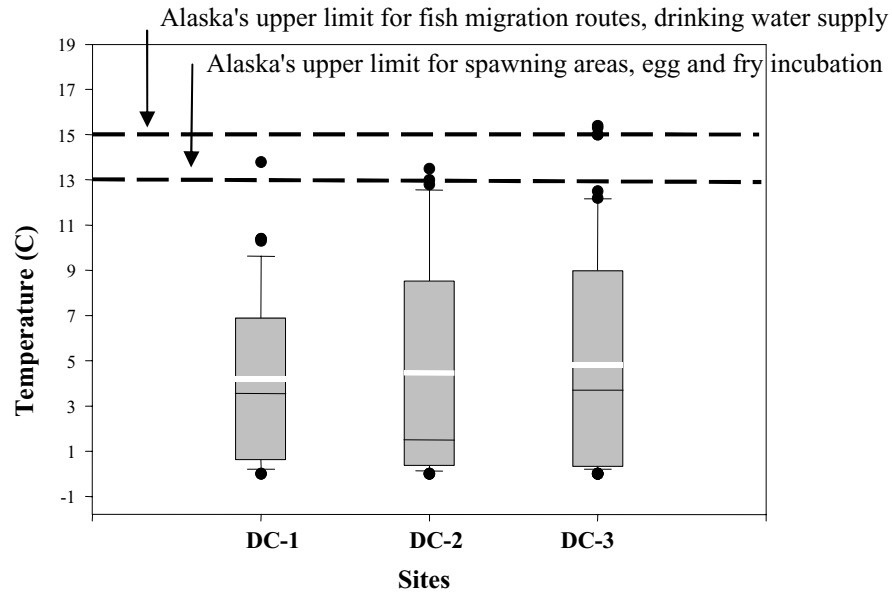


Figure 17. Water temperature measured during site visits on Deep Creek, 8/98-6/04.

Table 5: Summary of elevated water temperatures from temperature logger data on the lower Deep Creek site in the summers of 2002 and 2003.

Year	Above 13°C	Above 15°C	Maximum temp (date)
2002	50 days 11.4 hours/day on average 0 full days	28 days 7.7 hours/day on average 0 full days	18.5°C (7/17)
2003	56 days 17.0 hours/day on average 17 full days 5 consecutive days	42 days 12.1 hours/day on average 0 full days	21.2°C (7/14)

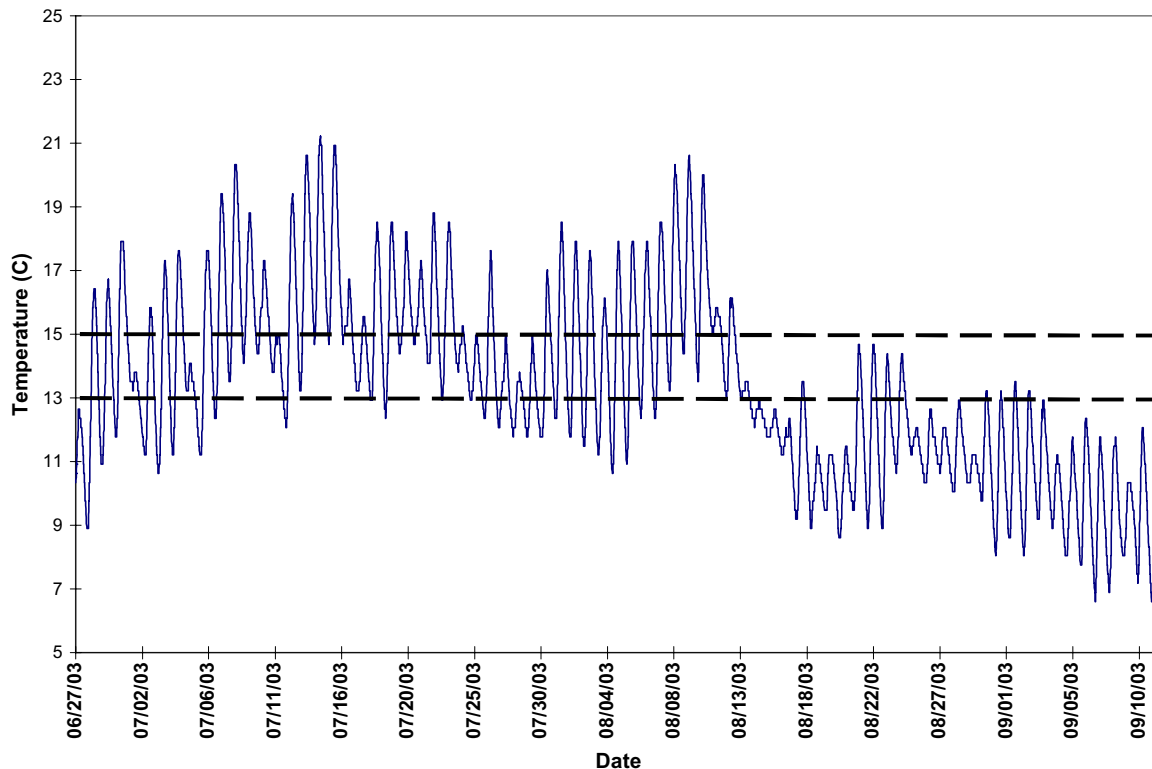


Figure 18. Continuous temperature logger data collected from 6/03-9/03 at the lower Deep Creek site.

Descriptive statistics of water quality parameters measured from 8/98 to 6/04 are summarized in Table 6. The flood events in the Fall of 2002 resulted in some extreme water quality measurements on Deep Creek. In October 2002, Deep Creek samples showed elevated levels of ammonia-nitrogen, orthophosphate-phosphorus, total phosphorus, turbidity, total suspended solids, settleable solids, and color. On October 30, 2002, values for ammonia-nitrogen, total suspended solids, and color were over range at the lower Deep Creek site and thus are not included in the statistics.

No exceedances of Alaska's water quality criteria for dissolved oxygen, pH, total dissolved solids, or nitrate-nitrogen were observed from 7/03 through 6/04. Data for turbidity (Figure 19), total suspended solids, and apparent color are difficult to relate to state standards because they are described in relation to natural conditions rather than as a specific value. No state standards exist for conductivity, orthophosphate-phosphorus, total phosphorus, ammonia-nitrogen, and settleable solids. Ammonia-nitrogen levels were well below EPA's criteria to protect aquatic life. Zero percent (DC-1), fourteen percent (DC-2), and twenty-nine percent (DC-3) of total phosphorus measurements were above EPA's recommended level of 0.10 mg/L as phosphorus (Figure 20).

Table 6: Descriptive statistics of water quality parameters measured from 8/98 to 6/04 for Deep Creek sites.

	Water Temp (C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Sat.)	pH	Conductivity (uS/cm)	TDS (mg/L)	Turbidity (NTUs)	App. Color (PtCo units)	Ortho-Phosph. (mg/L)	Total Phosph. (mg/L)	Ammonia-Nitrogen (mg/L)	Nitrate-Nitrogen (mg/L)	TSS (mg/L)	Settleable Solids (mg/L)
DC-1														
N	42	41	41	35	40	40	38	42	41	41	41	35	41	34
Mean	4.19	12.56	96.39	7.58	61.82	28.05	2.60	26.60	.03	.04	.05	.01	6.83	.10
Median	3.55	12.66	97.00	7.63	64.90	30.00	.67	17.00	.03	.03	.04	.01	3.00	.10
Std.	3.76	1.22	4.27	.29	11.50	5.07	4.96	26.85	.02	.01	.04	.01	11.60	.00
Deviation														
Range	13.80	5.84	18	1.37	54.50	26	21.47	133	.10	.06	.15	.05	58	.00
Minimum	.00	9.24	87	6.86	22.30	10	.13	5	.00	.02	.00	.00	0	.10
Maximum	13.80	15.08	105	8.23	76.80	36	21.60	138	.10	.08	.15	.05	58	.10
DC-2														
N	31	29	29	30	31	31	30	30	27	29	29	25	30	18
Mean	4.48	12.28	93.72	7.36	66.32	30.19	6.42	55.50	.05	.09	.12	.05	13.07	.13
Median	1.50	12.75	96.00	7.35	68.00	31.00	4.27	36.50	.05	.07	.09	.05	5.00	.10
Std.	4.81	1.49	6.85	.35	12.61	6.08	7.51	46.45	.02	.06	.08	.04	19.06	.08
Deviation														
Range	13.50	4.91	33	1.46	56.20	27	33.61	217	.08	.31	.33	.15	87	.30
Minimum	.00	9.49	70	6.46	28.50	13	.89	15	.02	.05	.04	.00	2	.10
Maximum	13.50	14.40	103	7.92	84.70	40	34.50	232	.10	.36	.37	.15	89	.40
DC-3														
N	58	54	54	46	57	57	55	55	56	56	54	50	51	44
Mean	4.84	12.32	95.83	7.37	65.32	29.58	27.45	59.56	.063	.11	.15	.05	21.78	.17
Median	3.70	12.55	97.50	7.37	67.90	31.00	4.63	43.00	.050	.07	.13	.04	7.00	.10
Std.	4.89	1.40	6.07	.34	14.09	6.70	125.74	41.16	.045	.12	.14	.05	53.09	.32
Deviation														
Range	15.40	5.77	27	1.67	57.90	29	913.96	203	.30	.68	.94	.18	375	2.10
Minimum	.00	9.33	78	6.50	26.20	11	1.04	19	.02	.04	.00	.00	1	.00
Maximum	15.40	15.10	105	8.17	84.10	40	915.00	222	.32	.72	.94	.18	376	2.10

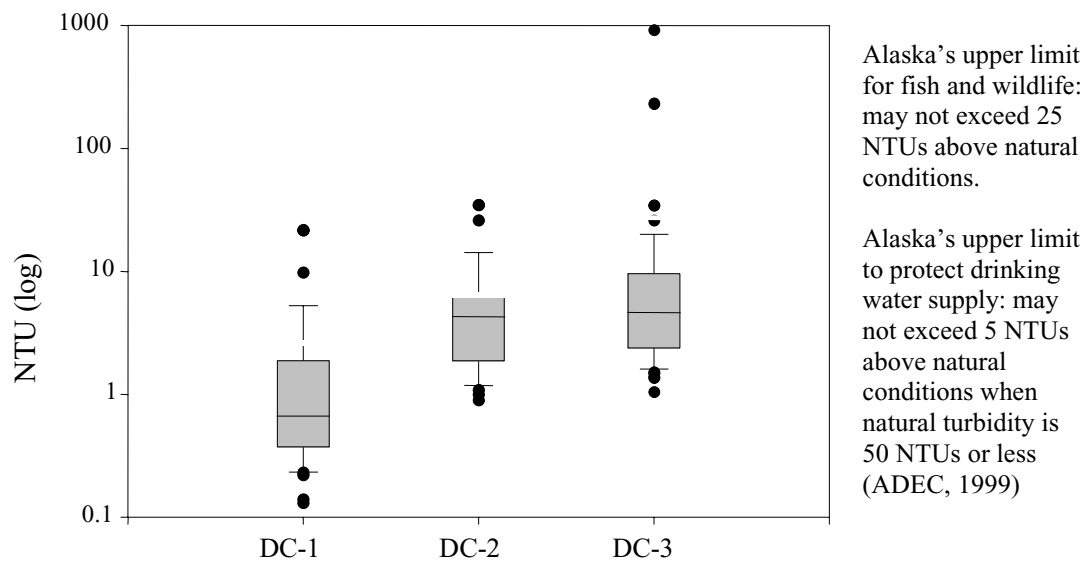


Figure 19. Turbidity (note log scale) measured by Cook Inlet Keeper on Deep Creek sites, 8/98-6/04.

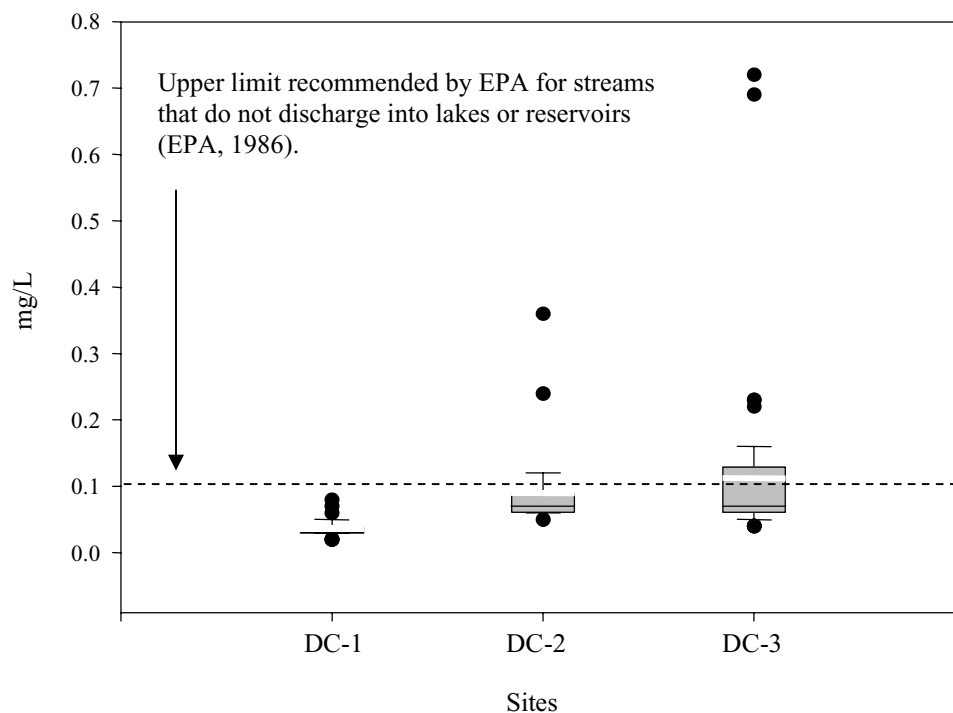
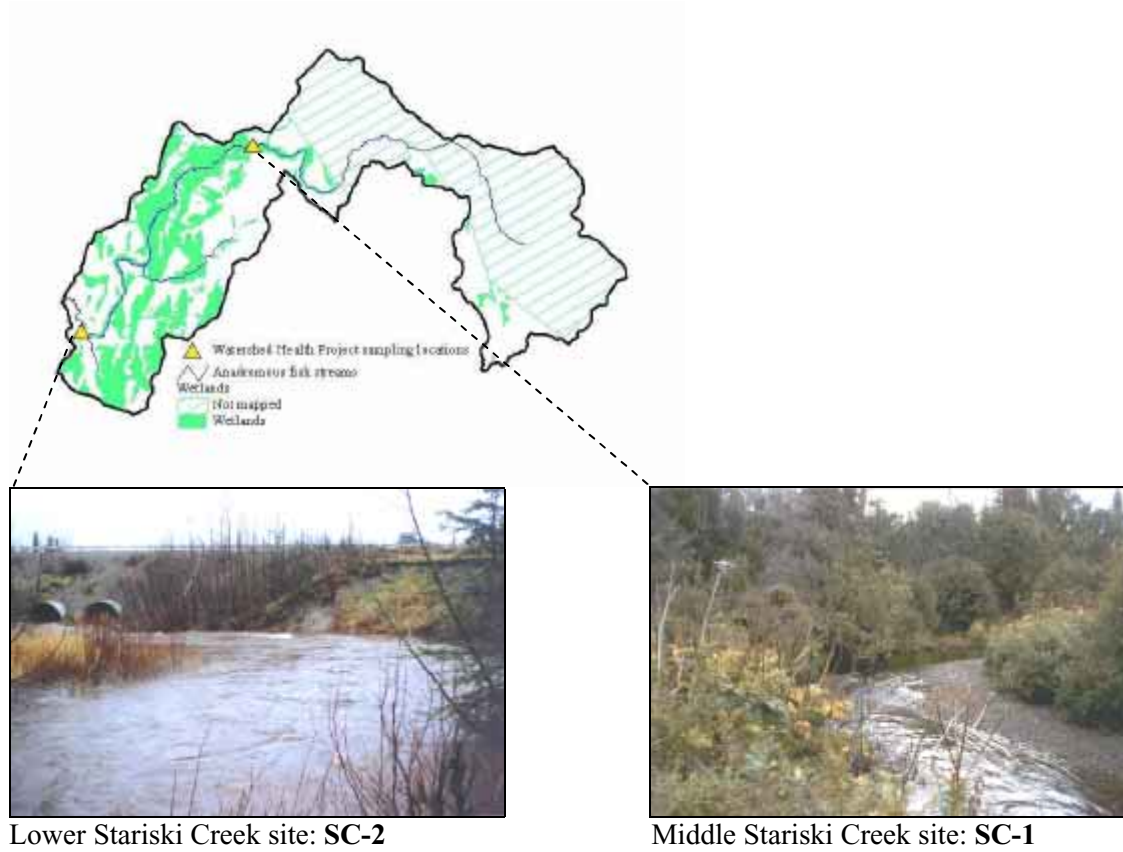


Figure 20. Total phosphorus measured by Cook Inlet Keeper on Deep Creek, 8/98-6/04.

Stariski Creek Watershed



Streamflow (discharge)

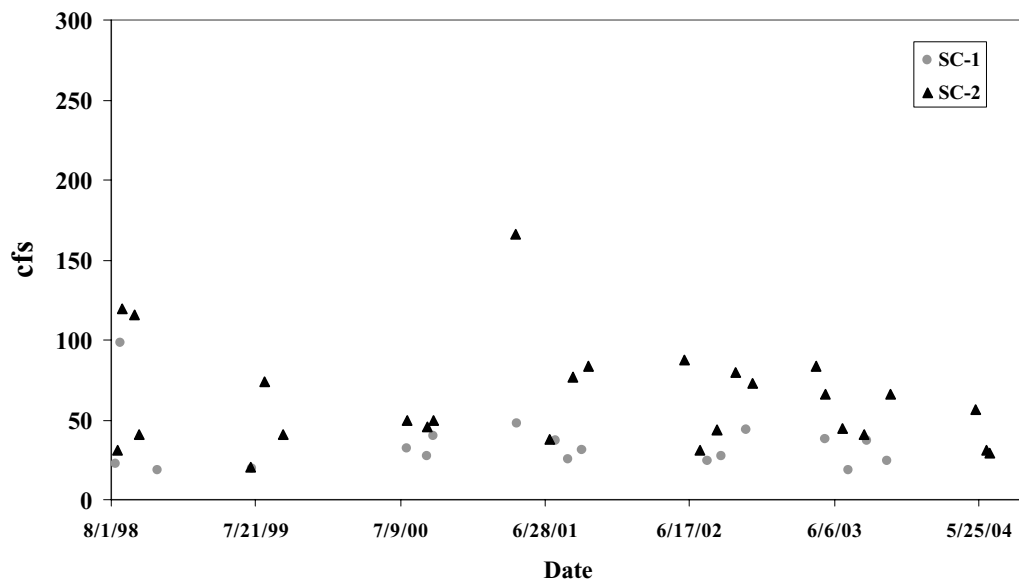


Figure 21. Discharge for sites measured by Cook Inlet Keeper on Stariski Creek.

Water Temperature

Starting in June 1999, water temperature measurements taken during regular site visits in summer months were exceeding 13°C, Alaska's water quality standards to protect cold-water fish habitat, at the lower Stariski River site (Figure 22). Data collected in 2003 at 15-minute intervals from a temperature logger show the frequency of elevated temperatures at the lower Stariski Creek site (Table 7, Figure 23).

In May 2004, three temperature loggers were deployed in Stariski Creek to determine how far upstream temperatures are exceeding water quality standards. The lower Stariski Creek site is a fish migration route and spawning area thus temperatures above 15°C and 13°C are of concern to salmon health and mortality. Two loggers have been placed higher up in the watershed in spawning areas to record the extent of temperatures exceeding 13°C. These data will be presented in the 2005 annual water quality status report.

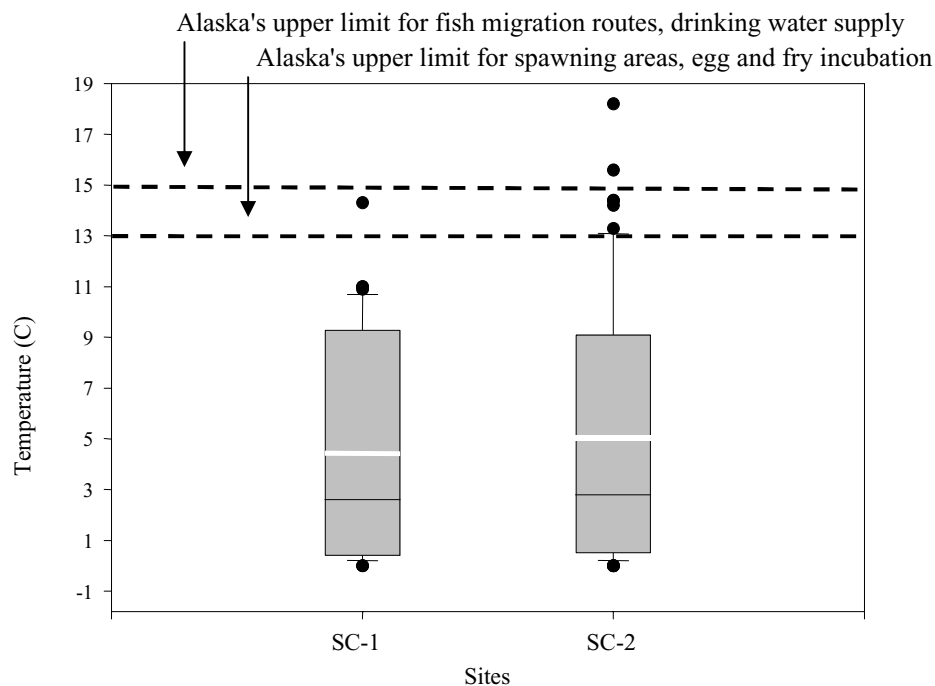


Figure 22. Water temperature measured during site visits on Stariski Creek, 8/98-6/04.

Table 7: Summary of elevated water temperatures from temperature logger data on the lower Stariski Creek site in the summer of 2003.

Year	Above 13°C	Above 15°C	Maximum temp (date)
2003	51 days 18.8 hours/day on average 21 full days 6 consecutive days	39 days 11.9 hours/day on average 1 full day	20.0°C (7/15)

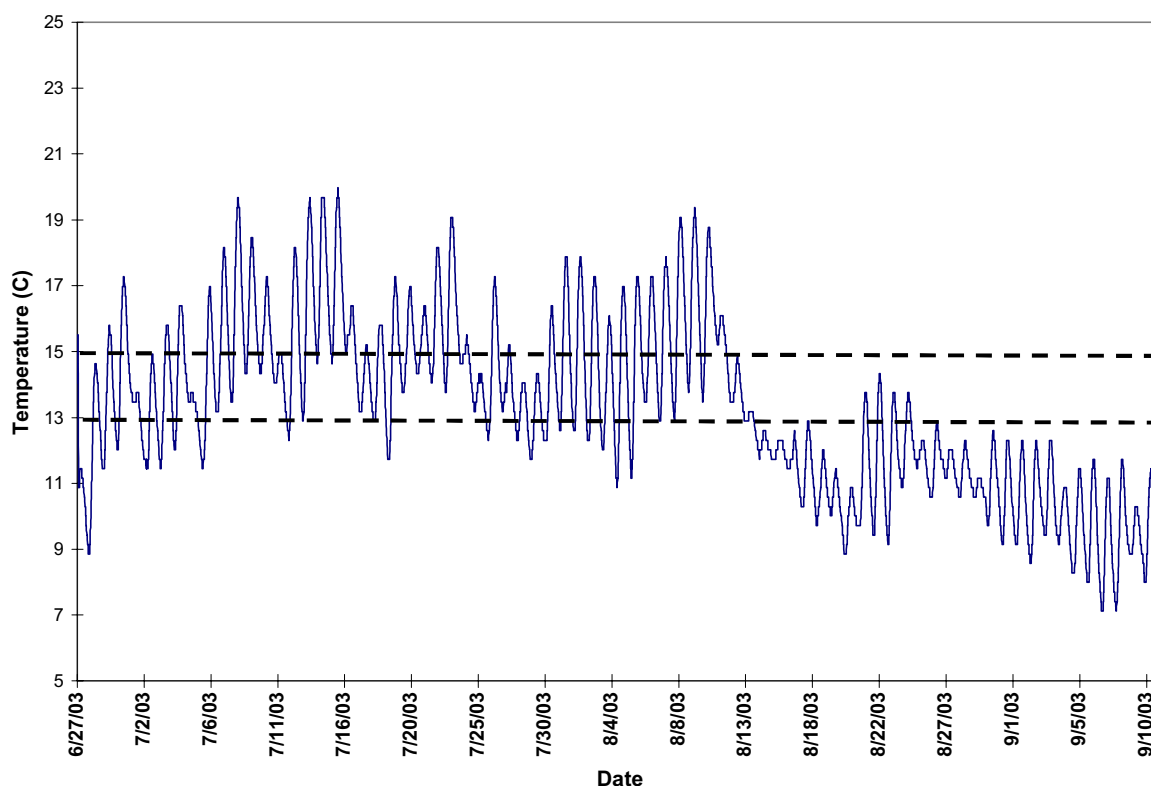


Figure 23. Continuous temperature logger data collected from 6/03 – 9/03 at the lower Stariski Creek site.

Descriptive statistics of water quality parameters measured from 8/98 to 6/04 are summarized in Table 8. No exceedances of Alaska's water quality criteria for dissolved oxygen, pH, total dissolved solids, or nitrate-nitrogen were observed from 7/03 through 6/04. Data for turbidity (Figure 24), total suspended solids, and apparent color are difficult to relate to state standards because they are described in relation to natural conditions rather than as a specific value. No state standards exist for conductivity, orthophosphate-phosphorus, total phosphorus, ammonia-nitrogen, and settleable solids. Ammonia-nitrogen levels were well below EPA's criteria to protect aquatic life. Forty-five percent (SC-1) and thirty-six percent (SC-2) of total phosphorus measurements were above EPA's recommended level of 0.10 mg/L as phosphorus (Figure 25).

Table 8: Descriptive statistics of water quality parameters measured from 8/98 to 6/04 for Stariski Creek sites.

	Water Temp (C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Sat.)	pH	Conduc- tivity (uS/cm)	TDS (mg/L)	Turbidity (NTUs)	App. Color (PtCo units)	Ortho- Phosph. (mg/L)	Total Phosph. (mg/L)	Ammonia- Nitrogen (mg/L)	Nitrate- Nitrogen (mg/L)	TSS (mg/L)	Settle- able Solids (mg/L)
SC-1														
N	42	39	39	40	42	42	41	42	42	40	41	35	40	30
Mean	4.43	12.19	93.49	7.28	70.03	31.26	6.19	69.48	.08	.12	.18	.13	12.10	.11
Median	2.60	12.60	95.00	7.30	71.60	32.00	3.35	57.50	.08	.10	.16	.14	5.50	.10
Std. Deviation	4.40	1.49	7.07	.27	14.54	6.19	7.97	56.34	.03	.06	.11	.09	19.47	.04
Range	14.30	5.86	32	1.14	82.60	28	46.45	351	.18	.22	.54	.38	112	.20
Minimum	.00	8.64	71	6.61	32.80	15	1.45	26	.02	.06	.07	.00	1	.10
Maximum	14.30	14.50	103	7.75	115.40	43	47.90	377	.20	.28	.61	.38	113	.30
SC-2														
N	60	59	59	55	61	61	57	61	59	60	60	54	57	47
Mean	4.91	11.87	92.76	7.25	70.13	32.21	7.81	84.28	.06	.12	.18	.06	14.60	.12
Median	2.35	11.70	95.00	7.25	73.60	34.00	4.78	72.00	.06	.09	.15	.04	7.00	.10
Std. Deviation	5.23	1.38	9.48	.38	16.05	7.67	9.45	48.87	.02	.07	.12	.06	21.39	.08
Range	18.20	6.05	40	2.06	73.20	35	58.79	301	.12	.37	.62	.24	129	.40
Minimum	.00	8.92	67	6.19	30.30	13	1.01	14	.03	.06	.02	.00	1	.10
Maximum	18.20	14.97	107	8.25	103.50	48	59.80	315	.15	.43	.64	.24	130	.50

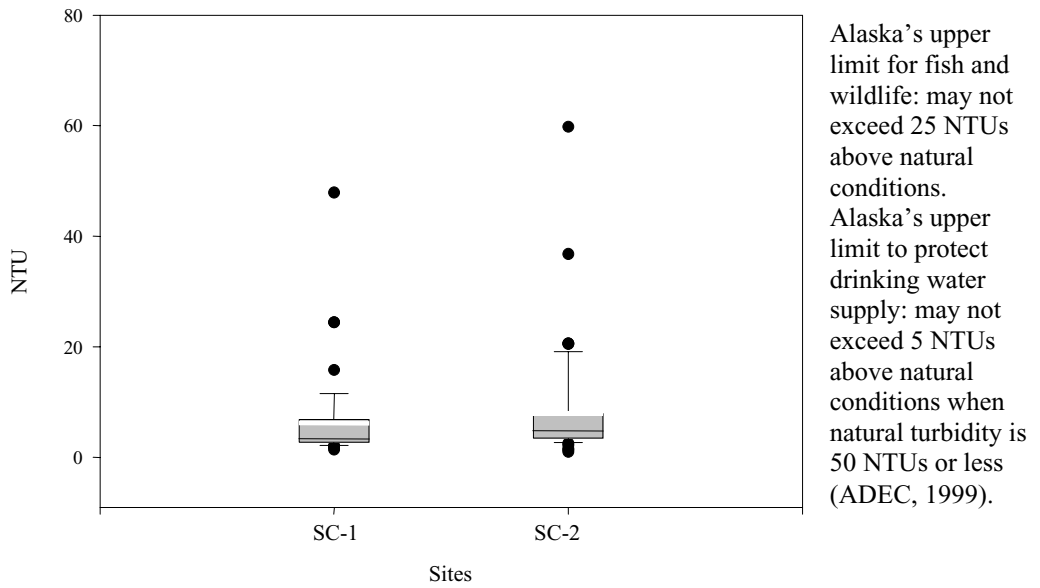


Figure 24. Turbidity measured by Cook Inlet Keeper on Stariski Creek sites, 8/98-6/04.

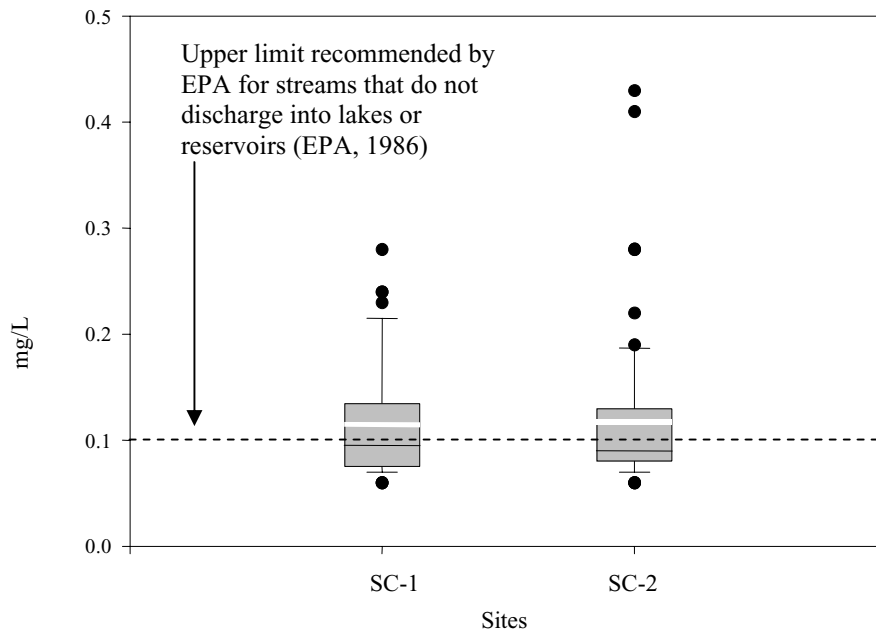
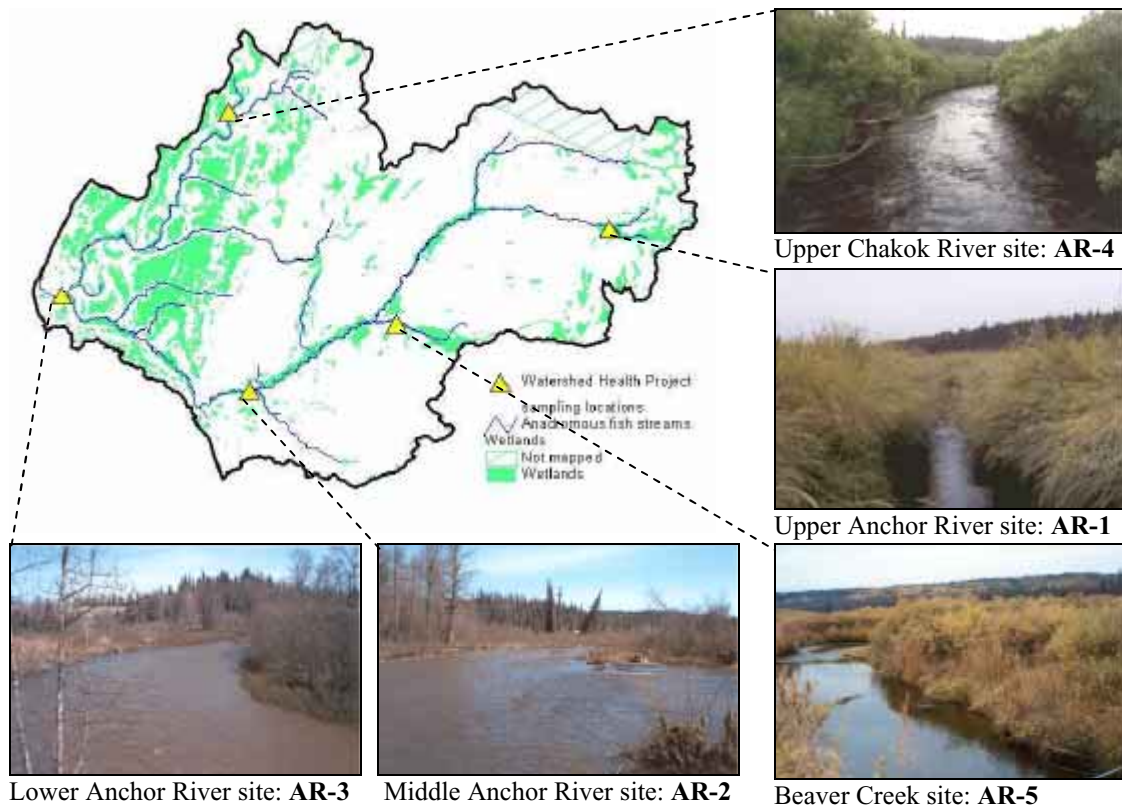


Figure 25. Total phosphorus measured by Cook Inlet Keeper on Stariski Creek sites, 8/98-6/04.

Anchor River Watershed



Streamflow (discharge)

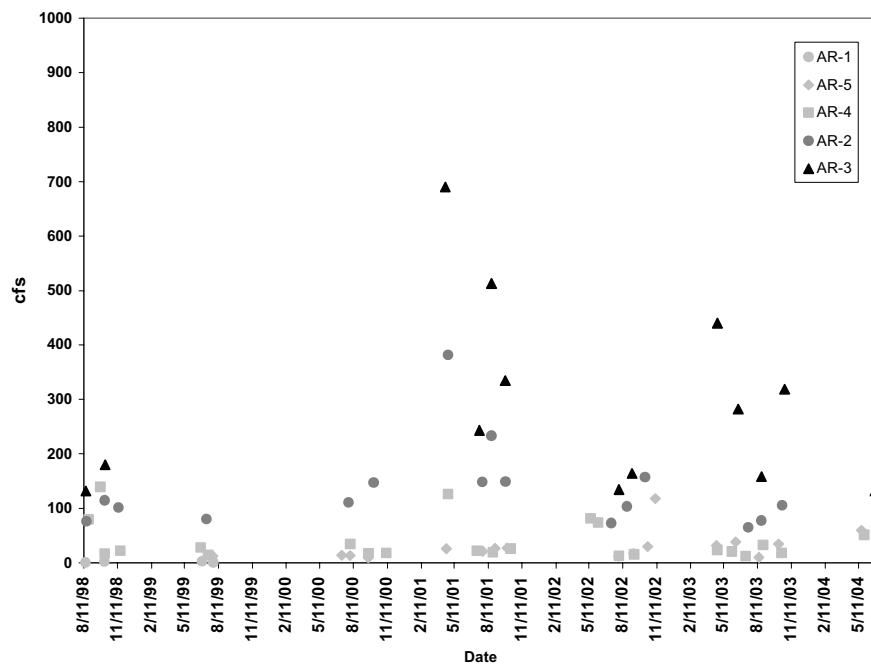


Figure 26. Discharge measurements taken by Cook Inlet Keeper on Anchor River sites.

Water Temperature

Starting in August 1998, water temperature measurements taken during regular site visits in summer months were exceeding 13°C, Alaska's water quality standards to protect cold-water fish habitat and drinking water supply, at the lower Anchor River site (Figure 27). Data collected in 2003 at 15-minute intervals from a temperature logger show the frequency of elevated temperatures at the lower Anchor River site (Figure 28). A comparison of data collected in the summers of 2002 and 2003 show that both the frequency and magnitude of temperature exceedances increased in 2003 (Table 9).

In May 2004, six temperature loggers were deployed in the Anchor River to determine how far upstream temperatures are exceeding water quality standards. The lower Anchor River site is a fish migration route and thus temperatures above 15°C are of concern to salmon health and mortality. Five loggers have been placed higher up in the watershed in spawning areas to record the extent of temperatures exceeding 13°C. These data will be presented in the 2005 annual water quality status report.

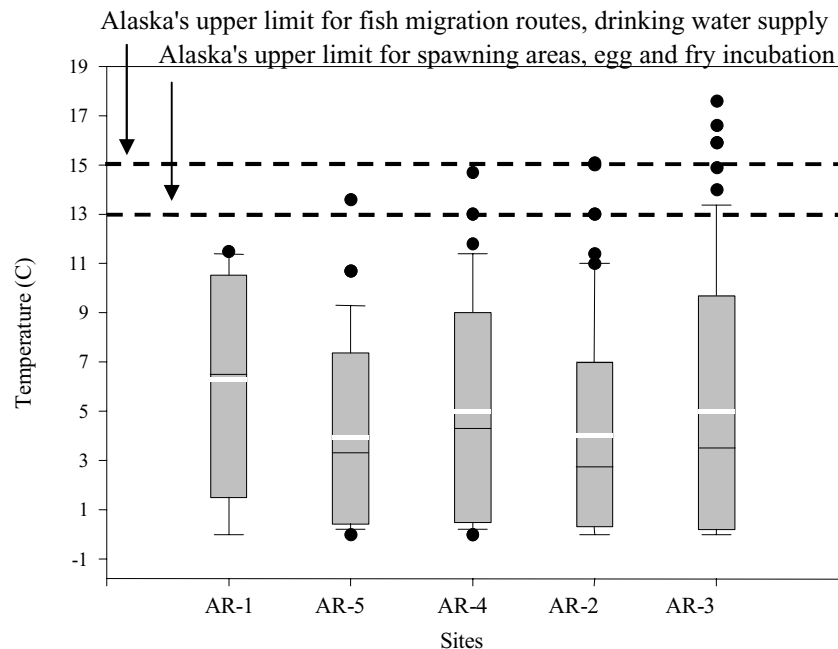


Figure 27. Water temperature measured during site visits on Anchor River, 8/98-6/04.

Table 9: Summary of elevated water temperatures from temperature logger data on the lower Anchor River site in the summers of 2002 and 2003.

Year	Above 13°C	Above 15°C	Maximum temp (date)
2002	54 days 11.0 hours/day on average 0 full days	32 days 8.4 hours/day on average 0 full days	19.2°C (6/30)
2003	60 days 17.7 hours/day on average 24 full days 11 consecutive days	50 days 12.3 hours/day on average 4 full days 3 consecutive days	20.7°C (7/13, 7/14, 7/15)

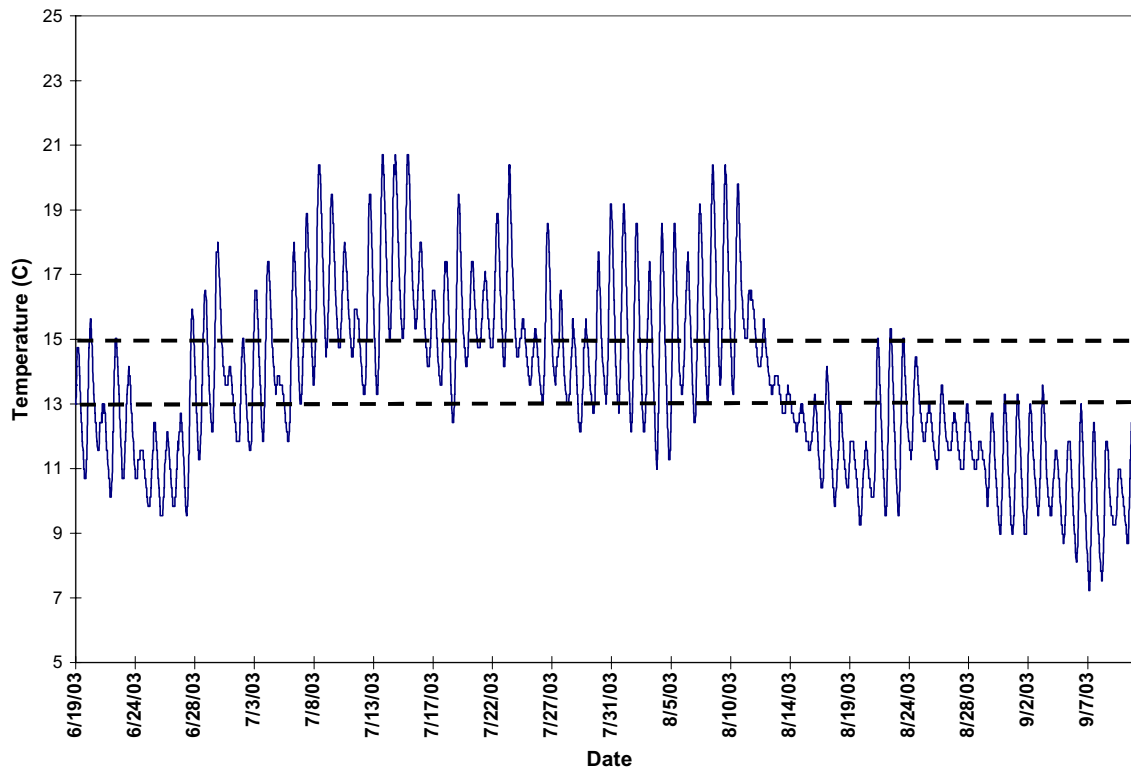


Figure 28. Continuous temperature logger data collected from 6/03 – 9/03 at the lower Anchor River site.

Descriptive statistics of water quality parameters measured from 8/98 to 6/04 are summarized in Table 10. No exceedances of Alaska’s water quality criteria for dissolved oxygen, total dissolved solids, pH, or nitrate-nitrogen were observed from 7/03 through 6/04. However, two nitrate-nitrogen measurements (11/20/03, 1/2/04) on Beaver Creek (AR-5) were over range (>0.40 mg/L).

Data for turbidity (Figure 29), total suspended solids, and apparent color are difficult to relate to state standards because they are described in relation to natural conditions rather than as a specific value. No state standards exist for conductivity, orthophosphate-phosphorus, total phosphorus, ammonia-nitrogen, and settleable solids. Ammonia-nitrogen levels were well below EPA’s criteria to protect aquatic life. Seventeen percent (AR-1), nine percent (AR-5), fourteen percent (AR-4), thirty-five percent (AR-2), and twenty-six percent (AR-3) of total phosphorus measurements were above EPA’s recommended level of 0.10 mg/L as phosphorus (Figure 30).

Table 10. Descriptive statistics of water quality parameters measured from 8/98 to 6/04 for Anchor River sites.

	Water Temp (C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Sat.)	pH	Conduc-tivity (uS/cm)	TDS (mg/L)	Turbidity (NTUs)	App. Color (PtCo units)	Ortho- Phosph. (mg/L)	Total Phosph. (mg/L)	Ammonia- Nitrogen (mg/L)	Nitrate- Nitrogen (mg/L)	TSS (mg/L)	Settle- able Solids (mg/L)
AR-1														
N	7	7	7	7	7	7	6	7	5	6	7	2	7	7
Mean	6.34	11.66	94.86	7.25	48.93	24.43	3.53	77.43	.06	.08	.21	.01	4.29	
Median	6.50	11.86	97.00	7.19	51.30	25.00	3.20	80.00	.07	.08	.18	.01	4.00	
Std. Deviation	4.79	1.33	6.72	.18	9.02	2.88	1.73	16.40	.02	.02	.06	.01	1.98	
Range	11.50	3.83	18	.49	26.20	8	4.92	40	.05	.06	.16	.02	6	
Minimum	.00	9.37	86	7.04	32.80	20	1.69	55	.03	.05	.16	.00	1	
Maximum	11.50	13.20	104	7.53	59.00	28	6.61	95	.08	.11	.32	.02	7	
AR-2														
N	56	53	53	48	55	55	53	56	54	55	56	53	52	42
Mean	4.01	12.47	95.21	7.36	71.48	32.60	6.63	62.09	.07	.10	.16	.15	10.75	.11
Median	2.75	12.71	97.00	7.36	74.30	34.00	4.51	47.50	.07	.09	.15	.15	6.00	.10
Std. Deviation	4.47	1.30	7.40	.41	15.84	7.85	5.97	42.40	.02	.03	.08	.10	12.94	.02
Range	15.10	6.45	36	1.93	61.80	32	25.06	272	.10	.20	.40	.38	66	.10
Minimum	.00	8.45	76	6.43	36.20	16	1.34	8	.03	.01	.00	.00	2	.10
Maximum	15.10	14.90	112	8.36	98.00	48	26.40	280	.13	.21	.40	.38	68	.20
AR-3														
N	59	58	58	48	58	58	57	59	60	57	58	54	55	44
Mean	5.03	12.29	95.95	7.28	72.09	32.78	10.29	83.08	.06	.10	.17	.10	16.76	.13
Median	3.50	12.58	98.00	7.27	74.25	33.50	5.12	59.00	.06	.08	.12	.10	7.00	.10
Std. Deviation	5.31	1.50	7.33	.44	17.76	8.42	16.55	65.75	.03	.07	.13	.09	30.56	.11
Range	17.60	5.73	36	2.02	84.40	39	79.57	339	.12	.35	.74	.40	166	.50
Minimum	.00	9.07	73	6.20	34.10	15	1.73	35	.00	.04	.00	.00	2	.10
Maximum	17.60	14.80	109	8.22	118.50	54	81.30	374	.12	.39	.74	.40	168	.60

Table 10. (Cont.)

	Water Temp (C)	Dissolved Oxygen (mg/L)	Dissolved Oxygen (% Sat.)	pH	Conductivity (uS/cm)	TDS (mg/L)	Turbidity (NTUs)	App. Color (PtCo units)	Ortho-Phosph. (mg/L)	Total Phosph. (mg/L)	Ammonia-Nitrogen (mg/L)	Nitrate-Nitrogen (mg/L)	TSS (mg/L)	Settle-able Solids (mg/L)
AR-4														
N	45	41	41	36	45	45	44	46	46	44	45	39	44	31
Mean	5.00	12.20	94.98	7.25	64.90	29.80	4.38	74.17	.06	.09	.19	.12	7.27	.10
Median	4.30	12.30	95.00	7.27	68.80	31.00	3.52	68.50	.06	.08	.17	.10	5.00	.10
Std. Deviation	4.47	1.38	5.57	.37	13.89	6.74	2.32	22.72	.02	.03	.09	.08	5.37	.00
Range	14.70	5.81	22	1.68	54.50	28	12.84	125	.10	.17	.44	.37	25	.00
Minimum	.00	9.26	85	6.27	33.50	15	1.46	37	.02	.06	.00	.00	2	.10
Maximum	14.70	15.07	107	7.95	88.00	43	14.30	162	.12	.23	.44	.37	27	.10
AR-5														
N	35	35	35	29	35	35	35	35	35	35	35	33	34	34
Mean	3.92	12.44	94.51	7.28	63.09	28.00	4.45	64.86	.06	.08	.17	.19	9.56	.10
Median	3.30	12.62	95.00	7.35	64.60	30.00	3.53	60.00	.05	.08	.15	.15	7.00	.10
Std. Deviation	3.92	1.32	5.37	.35	12.99	5.85	3.62	21.86	.02	.02	.07	.09	8.04	.00
Range	13.60	5.53	20	1.65	45.50	21	19.32	97	.07	.12	.34	.36	40	.00
Minimum	.00	9.35	83	6.45	37.30	16	.28	32	.02	.04	.03	.03	3	.10
Maximum	13.60	14.88	103	8.10	82.80	37	19.60	129	.09	.16	.37	.39	43	.10

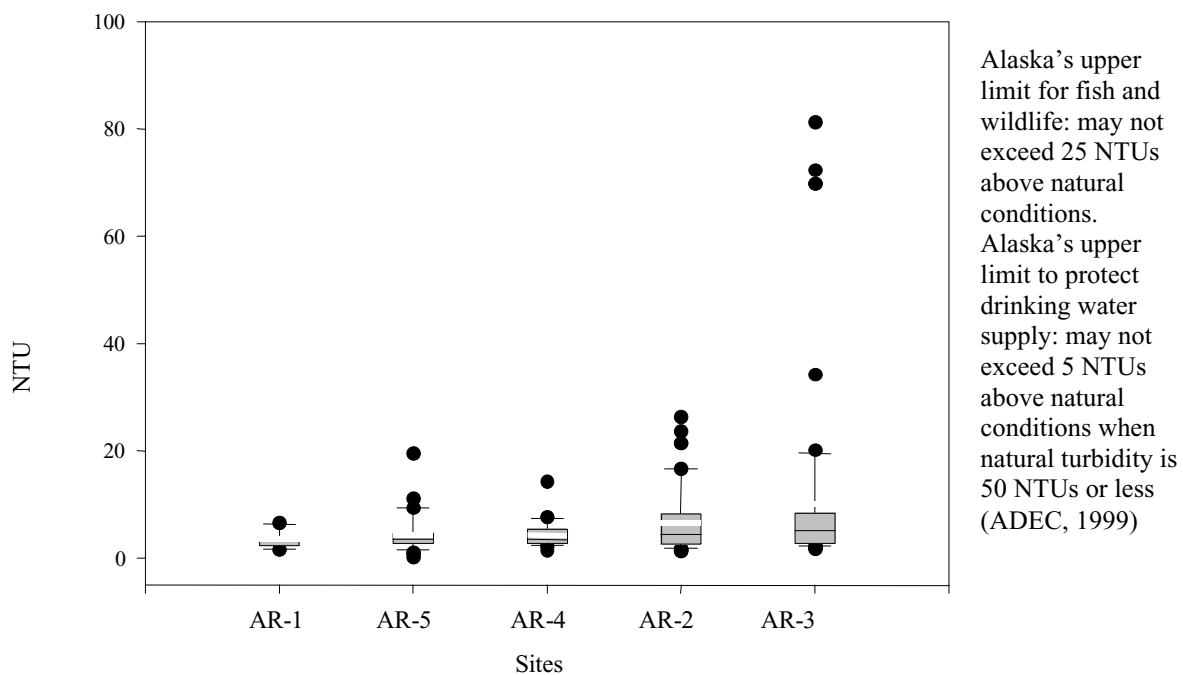


Figure 29. Turbidity measured by Cook Inlet Keeper on Anchor River sites, 8/98-6/04.

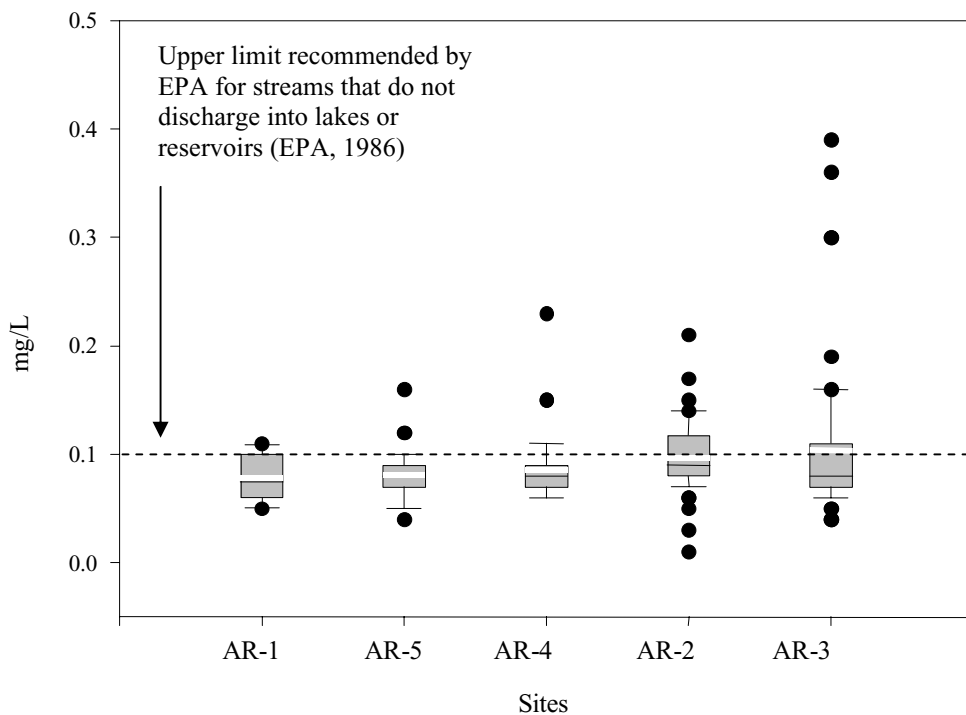


Figure 30. Total phosphorus measured by Cook Inlet Keeper on Anchor River sites, 8/98-6/04.

WATER QUALITY DATA SUMMARY

AUGUST 1998 - JUNE 2004

Summary

Cook Inlet Keeper and the Homer Soil and Water Conservation District have been monitoring water quality on Ninilchik River, Deep Creek, Stariski Creek, and Anchor River since August 1998 to document current water quality conditions and compare current conditions with the water quality standards that the State of Alaska has developed. Based on these data the water quality of the four rivers is high. However, temperature exceedances are increasing and may pose a risk to migrating salmon as well as egg and fry survival. Some pH measurements fall below the range set by the State of Alaska to protect its waters. Thirty percent of the total phosphorus measurements are above the level suggested by EPA for streams and rivers.

On the Ninilchik River:

- Temperatures exceeded 13°C on 56 days and 15°C on 35 days in summer 2002.
- Temperatures exceeded 13°C on 64 days and 15°C on 47 days in summer 2003.
- Five pH measurements were below Alaska's lower limit to protect aquatic life.
- 47% of the total phosphorus measurements were above EPA's suggested level.

On the Deep Creek:

- Temperatures exceeded 13°C on 50 days and 15°C on 28 days in summer 2002.
- Temperatures exceeded 13°C on 56 days and 15°C on 42 days in summer 2003.
- One pH measurement was below Alaska's lower limit to protect aquatic life.
- 16% of the total phosphorus measurements were above EPA's suggested level.
- Elevated levels of ammonia-nitrogen, orthophosphate-phosphorus, total phosphorus, turbidity, total suspended solids, settleable solids and color occurred on October 30, 2002 (after severe flooding) and June 11, 2003 (after steady rainfall).

On the Stariski Creek:

- Temperatures exceeded 13°C on 51 days and 15°C on 39 days in summer 2003.
- Two pH measurements were below Alaska's lower limit to protect aquatic life.
- 40% of the total phosphorus measurements were above EPA's suggested level.

On the Anchor River:

- Temperatures exceeded 13°C on 54 days and 15°C on 32 days in summer 2002.
- Temperatures exceeded 13°C on 60 days and 15°C on 50 days in summer 2003.
- Five pH measurements were below Alaska's lower limit to protect aquatic life.
- 22% of the total phosphorus measurements were above EPA's suggested level.

Data for turbidity, total suspended solids, and apparent color are difficult to relate to state standards because they are described in relation to natural conditions rather than as a specific value. Keeper's data should be valuable in determining what the natural conditions are for these streams, although some land-use changes may have already occurred that affect these water quality parameters.

With data from the Ninilchik River stream gauge, the following patterns are apparent:

- high stream flows deliver higher concentrations of ammonia-nitrogen, total phosphorus, turbidity, suspended solids, and color.
- low stream flows deliver higher conductivity and total dissolved solids.

Differences in water quality parameters between watersheds were apparent (See Cook Inlet Keeper, 2001 for analysis):

- significant differences were found between the watersheds for conductivity, total dissolved solids, nitrate-nitrogen, and orthophosphate.

COMPARISONS WITH HISTORICAL DATA

Keeper compared current water quality data from the Lower Kenai Peninsula Watershed Health Project with historical data collected by the USGS between 1950 and 1970 (See Cook Inlet Keeper, 2001 for analysis). Keeper compared temperature, conductivity, total dissolved solids, nitrate-nitrogen, total suspended solids, and apparent color data collected by the two organizations at four sites.

Differences between past and present data can best be explained by differences in methods rather than by changes in water quality. Keeper and USGS used different methods for total dissolved solids, nitrate-nitrogen, suspended solids, and apparent color. USGS's methods for total dissolved solids and nitrate-nitrogen may be incorporated into Keeper's protocols in the future when funds for new laboratory equipment become available. Differences in sampling time and frequency may also account for different results. In particular, the USGS captured a greater range of total suspended solids concentrations than Keeper by sampling a greater range of flow conditions.

Comparisons between USGS data from 1950 - 1970 and Lower Kenai Peninsula Watershed Health Project data from August 1998 - June 2001 showed the following:

- temperature measurements were similar between the two time periods;
- conductivity measurements were similar between the two time periods;
- total dissolved solids measured by the USGS were higher than values measured by Keeper;
- nitrate-nitrogen concentrations measured by the USGS were higher than measured by Keeper;
- total suspended solids concentrations measured by the USGS showed greater variability than Keeper data; and
- apparent color levels measured by the USGS were generally lower than those measured by Keeper.

DIRECTIONS FOR FUTURE MONITORING

Based on findings from baseline data collection and analysis, monitoring needs to continue on the lower Kenai Peninsula's salmon streams to investigate concerns about high water temperatures, elevated phosphorus levels, increasing sedimentation, and post-flood habitat recovery. Monitoring is imperative to track changes in these watersheds, which are experiencing dramatic increases in land-use activity, to ensure they do not become impaired waterbodies.

Temperature Concerns

Monitoring has revealed that summer temperatures consistently exceed Alaska's standards and may pose risks to these important salmon streams. Water temperature is one of the most significant factors in the health of stream ecosystems. Temperature affects salmon egg and fry incubation, fish metabolism, organisms' resistance to disease, and availability of oxygen and nutrients to fish and wildlife. To determine the frequency and duration of elevated temperatures, Keeper deployed temperature loggers in the lower reaches of the Ninilchik River, Deep Creek, and Anchor River in the summers of 2002 and 2003. Data from these loggers suggest that water temperatures exceeded 13°C more than 50 days during 2002 and more than 56 days in 2003. On the Anchor and Ninilchik Rivers, the number of consecutive days with temperatures consistently above 15°C is increasing and may influence timing of migration to spawning grounds.

Extensive historical temperature data are not available so there is no way to be certain if these elevated temperatures are typical of these systems. However, a recent USGS report suggests that streams within the Cook Inlet Basin may experience a water temperature change of 3°C in the coming years. This is based on a model that uses air temperature to predict water temperature and simulates future trends in water temperature based on increased air temperature due to climate warming. Ninilchik River was one of the 15 sites predicted to see a 3°C change, a magnitude of change that is considered significant for the incidence of disease in fish populations (Kyle and Brabets, 2001).

In 2004, twenty temperature loggers were deployed across the four watersheds and were programmed to collect data at 15-minute intervals to quantify how many hours per day and how many days per season salmon stream temperatures exceed state standards. Sites were selected at major confluences to provide information about the relative contribution each major tributary makes to overall stream temperature. These data will be assessed to identify potential causes of elevated temperatures using GIS coverages of land use activity. Temperature logger deployment in the summer of 2005 will focus on sub-watersheds of concern based on the 2004 data.

Elevated Phosphorus Levels

Throughout the past five years of the salmon stream monitoring program, thirty percent of the total phosphorus measurements exceeded 0.1 mg/L (100 µg/L), the level recommended by EPA for streams and rivers that do not drain into lakes and reservoirs

(EPA, 1986). This level is only recommended, however, and EPA is currently developing better ways to estimate appropriate levels of phosphorus. A more recent report developed for the Western Forested Mountains (Nutrient Ecoregion II) cites 0.01 mg/L (10 µg/L) as the recommended level for streams and rivers (EPA, 2000). Nutrient Ecoregion II includes all or parts of the States of Washington, Oregon, California, Idaho, Montana, Wyoming, Utah, South Dakota, New Mexico, and Arizona. EPA has not yet developed nutrient criteria for Alaska.

The elevated phosphorus levels on the lower Kenai Peninsula streams may be due, in part, to the volcanic origin and sedimentary geology of the region. Nutrient studies from Ontario streams reported greater phosphorus export from streams draining watersheds of sedimentary origin compared with those of igneous origin (Dillon and Kirchner, 1975). However, other studies have shown that phosphate levels are unrelated to geology but related to land use (Likens and Bormann, 1974). Phosphate binds easily to sediments so it is possible that land uses that increase sediment inputs, such as urban development, logging, mining, road construction, all-terrain vehicle use, and wetlands development, play a role in increasing phosphorus levels in these salmon streams. And while phosphorus is a nutrient crucial to aquatic life, it is considered a contaminant at high levels. At high concentrations, phosphorus can cause algal blooms resulting in dramatic decreases in dissolved oxygen concentrations.

Many measurements of orthophosphate (or total reactive phosphorus) also were above the EPA recommended level for total phosphorus. There are no federal or state standards for orthophosphate levels. A new method to measure dissolved orthophosphate has been incorporated into the Quality Assurance Project Plan. This method involves filtering a sample which removes the phosphorus bound to sediments and leaves the dissolved component. Comparing results from filtered and unfiltered samples will provide additional information to determine whether the observed phosphorus levels are naturally occurring from geological sources and whether increased sedimentation from land-use activities may degrade the water quality in these watersheds.

Starting in August 2004, the frequency of phosphorus, turbidity and discharge data collection has increased to better represent the change in levels across the hydrograph. Two sites on the Ninilchik River, two sites on Deep Creek, two sites on Stariski Creek, and four sites on the Anchor River will be sampled at least twice a month during ice-free periods. Winter sampling will be less frequent but will provide information on base flow levels. Based on the relationship developed between phosphorus/turbidity and discharge, sampling in 2005 will be focused on non-flow related patterns of phosphorus and turbidity.

Increasing Sedimentation

Alaska's standards for turbidity and total suspended solids are difficult to use as they require an understanding of natural conditions which is generally lacking in the State. The data included in this report should be valuable in determining what the natural conditions are for these streams; however, these may be the parameters that change most

rapidly as land-use activities increase and that may have the greatest affect on lower Kenai Peninsula communities and economies. A 2001 report from the Alaska Department of Fish and Game states “Deep Creek was not fishable for the first three weekends it was open to fishing because the water was high and muddy” and “Anchor River anglers also suffered from high muddy water during the first three weekends the fishery was open” (ADF&G, 2001). Monitoring turbidity in these rivers and educating citizens about activities that contribute to muddy waters is critical.

The Homer Soil and Water Conservation District, Cook Inlet Keeper and the U.S. Geological Survey have collected a great deal of water quality and habitat data on the Ninilchik River, Deep Creek, Stariski Creek and Anchor River watersheds; however, there are large gaps in our understanding of natural conditions for turbidity and suspended solids along the hydrologic gradient. Little information has been collected at flows exceeding 300 cfs when the highest turbidity levels would be expected. This is mostly the result of safety and logistical issues of using wadeable sampling methods when the stream is no longer wadeable.

The Homer District and Keeper have relied on a stream gauge on the Ninilchik River, which was established and maintained by the U.S. Geological Survey, to understand the relationship between high flow conditions and in stream sediment levels. Unfortunately, funding for maintenance of the Ninilchik River gauge has been lacking since October 2003. Loss of this dataset means we loose a valuable tool to detect changes in the relationship between water quality and water quantity. And this relationship is likely to change in the coming years as global climate change alters Kenai Peninsula watersheds by affecting flooding frequencies, stream temperature, precipitation levels, surface and ground water volumes, soil nutrient dynamics, and other hydrologic characteristics. In addition, climate change may impact geographic distribution of wetlands. The U.S. Fish and Wildlife Service’s National Wetlands Inventory program has mapped more than 220 square miles of wetlands on the lower Kenai Peninsula. Wetlands regulate climate and hydrologic regimes and act as sources and sinks of greenhouse gases. Wetlands also provide specific functional roles, like extensive water storage and sediment retention. The forest recovery from the Spruce Bark Beetle infestation on the lower Kenai Peninsula may also result in significant changes in hydrologic patterns.

Community Rivers Planning Coalition’s project entitled “Online Water Quality Monitoring in the Anchor River Watershed” will further investigate turbidity pollution and provide important data needed to understand the link between turbidity and discharge levels in this high priority watershed. The extensive dataset generated by these turbidity data loggers will help describe levels of turbidity along the entire hydrologic gradient.

This project will continue to describe natural variation in turbidity on all lower Kenai Peninsula’s salmon streams by increasing sampling frequency and collaborating with other agencies and organizations to establish staff and stage gauges on more streams and by employing non-wadeable sampling methods, such as sampling from bridges, when possible. Suspended solids data will continue to be collect as there is historic information to compare for assessing long term trends.

Post-Flood Habitat Recovery

In Fall 2002, the lower Kenai Peninsula experienced two, 100-year flood events. Major habitat alteration reshaped salmon stream channels and riparian habitat especially in the lower reaches of the Anchor River and Deep Creek. Keeper's five years of baseline habitat and water quality data are invaluable in assessing conditions before and after the floods. In order to track the biological communities in these streams and to understand flood affects on stream productivity, Keeper expanded its bioassessment program in the summer of 2003 and 2004 to include sampling on all four salmon streams using University of Alaska Anchorage, Environment and Natural Resources Institute's (ENRI) technical-level methods. These data will be available when sample processing and identification is completed and compared with ENRI's bioassessment data prior to October 2002.

Concerns about temperature, phosphorus, turbidity, and flood recovery are really concerns about the habitat quality for the biological communities living in our streams. Monitoring is an essential component of a comprehensive and effective strategy to maintain stream health and protect watersheds that support important public resources, as well as local economic and social opportunities. This report illustrates the challenges of interpreting data for the purpose of applying it to State Water Quality Standards. As data gaps are filled and a more complete picture of natural conditions emerges, the State Standards will need to be evaluated to be sure they are useful tools for managing our valuable aquatic resources.



Looking down Deep Creek toward Cook Inlet (6/04)

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APPENDIX I.

Results of Quality Assurance Checks

Keeper estimates the precision and accuracy of its laboratory analysis in four ways:

- Splitting samples annually with another professional lab, using the same procedures.
- Splitting samples quarterly with the Project's QA Officer during Keeper's laboratory analysis.
- Analyzing a known standard solution for each parameter during each laboratory analysis session.
- Participating in USGS Standard Reference Sample Program.

In August 1998, Keeper split ten samples with a professional lab: CTE, Inc., in Anchorage, Alaska. CTE analyzed samples for ammonia-nitrogen, orthophosphate-phosphorus, total phosphorus, apparent color, and total suspended solids. CTE used different methods for apparent color so these results are not included in Table 11. The greatest difference between the split samples was for ammonia-nitrogen concentrations: CTE's measurements were an average of 0.11 mg/L lower than Keeper's measurements.

In May 2000, Keeper split six samples with another professional lab: Northern Testing Laboratories, Inc. (NTL), in Anchorage, Alaska. NTL analyzed samples for nitrate-nitrogen, ammonia-nitrogen, orthophosphate-phosphorus, total phosphorus, total suspended solids, conductance, and turbidity. NTL's minimum method reporting level for ammonia-nitrogen was 1.00 mg/L, which was above Keeper's ammonia-nitrogen values so no comparison could be made. Keeper's nitrate-nitrogen values for four of the six samples were below NTL's minimum method reporting level of 0.10 mg/L.

In May/June 2001, Keeper split ten samples with NTL. Samples were analyzed for nitrate-nitrogen, orthophosphate-phosphorus, total phosphorus, total suspended solids, conductance, and turbidity. NTL's minimum method reporting limit for orthophosphate-phosphorus was 0.04 mg/L, which was above Keeper's orthophosphate values for eight samples. Keeper's nitrate-nitrogen values for five samples were below NTL's minimum method reporting level of 0.10 mg/L. The nitrate-nitrogen value for one sample was above Keeper's detection limit of 0.40 mg/L. The greatest difference between the split samples was for total suspended solids; NTL's measurements were an average of 42.3 mg/L higher than Keeper's measurements.

In both June 2002 and June 2003, Keeper split six samples with NTL. Samples were analyzed for nitrate-nitrogen, orthophosphate-phosphorus, total phosphorus, total suspended solids, conductance, and turbidity. Keeper's nitrate-nitrogen values for three samples in 2002 and five samples in 2003 were below NTL's minimum method reporting level of 0.10 mg/L. In 2002, the greatest difference between the split samples was for total suspended solids; NTL's measurements were an average of 14.2 mg/L higher than Keeper's measurements. This difference in suspended solids data was not seen in 2003.

In 2003, Keeper's lab: *Cook Inlet Community-based Water Quality Laboratory*, enrolled in the USGS Standard Reference Sample Program. Participating labs are evaluated by using performance evaluation samples, called Standard Reference Samples (SRSs). SRSs are submitted to laboratories semi-annually for round-robin laboratory performance comparison purposes. Currently, approximately 100 laboratories are evaluated for their analytical performance. Keeper participated in the Fall 2003 and Spring 2004 round robin studies and analyzed SRSs for orthophosphate-phosphorus, total phosphorus, conductivity, and pH.

Keeper also split samples during laboratory quality assurance sessions to test how results can differ between two people using the same methods at the Keeper lab. The results of the sample split showed negligible differences between people using the same method.

Table 11. Results of Keeper's quality assurance checks. The table shows the average difference between the sample splits and Keeper's data. The number of samples analyzed are identified in parentheses.

	Nitrate-Nitrogen	Ammonia-Nitrogen	Orthophosphate-Phosphorus	Total Phosphorus	Color	Suspended Solids	Conductivity	Turbidity	pH
1998 professional sample split (CTE)		-0.11 mg/L (5)	0.02 mg/L (5)	-0.02 mg/L (10)		-7 mg/L (10)			
2000 professional sample split (NTL)	0.06 mg/L (2)		-0.01 mg/L (6)	-0.01 mg/L (6)		4 mg/L (6)	-7.4 µS/cm (6)	-5.1 NTU (6)	
2001 professional sample split (NTL)	0.09 mg/L (4)		-0.02 mg/L (2)	0.03 mg/L (10)		42.3 mg/L (10)	-0.3 µS/cm (10)	-12.4 NTU (10)	
2002 professional sample split (NTL)	0.06 mg/L (3)		-0.02 mg/L (6)	0.00 mg/L (6)		14.2 mg/L (6)	7.7 µS/cm (6)	-3.2 NTU (6)	
2003 professional sample split (NTL)	0.02 mg/L (1)		0.01 mg/L (6)	-0.01 mg/L (6)		0 mg/L (6)	-1.3 µS/cm (6)	-1.8 NTU (6)	
2003/2004 Standard Reference Sample (USGS)			0.0 mg/L (1)	-0.02 (2)			-3.1 µS/cm (2)		-0.13 (1)
1998-2004 split with QA Officer	0.01 mg/L (4)	0.01 mg/L (6)	-0.01 mg/L (4)	0.01 mg/L (5)	0.7 Unit (7)	0.3 mg/L (6)			

APPENDIX II.

All Water Quality Data Collected by Cook Inlet Keeper, 8/98-6/04.

Values that exceed federal recommendations or state standards are in **bold**.

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
AR-1	8/15/98	11.5	9.37	86	7.46	59.0	28	4.09	94	0.07	0.11	0.18		4		0.84
AR-1	8/31/98	6.5	11.86	97	7.04	47.4	23	3.62	87	0.03	0.09	0.32		4		
AR-1	9/23/98	6.0	11.00	88	7.23	53.8	25	2.41	80		0.05	0.24		3		
AR-1	10/6/98	0.0	13.20	97	7.15	32.8	27		57	0.08	0.06	0.17		7		1.73
AR-1	11/12/98	0.0	13.15	91	7.19	51.3	22	6.61	55			0.16	0.00	1		
AR-1	6/28/99	9.4	11.86	104	7.53	42.2	20	1.69	74	0.06	0.06	0.18		5		2.50
AR-1	7/28/99	10.9	11.21	101	7.18	56.0	26	2.77	95	0.08	0.10	0.24	0.02	6		0.90
AR-2	8/18/98	8.2	10.84	92	7.57	89.3	42		56	0.12	0.14	0.18		2		76.32
AR-2	8/25/98	8.7	11.60	100	7.44			4.92	75	0.10	0.08	0.18		8		
AR-2	9/4/98					66.3	31	2.64	61	0.11	0.10	0.26		6		
AR-2	9/24/98	4.6	13.90	110	7.43	74.1	34	3.84	72	0.08	0.10	0.21		9		
AR-2	10/7/98	3.1	12.92	96	7.52	58.5	48		41	0.11	0.08	0.12	0.13	6		114.90
AR-2	11/13/98	0.4	13.49	93	7.00	79.1	34	6.49	42		0.01	0.13	0.16	2		101.60
AR-2	12/3/98	0.3	12.71	88	7.00	78.3	34	6.36	31	0.08	0.08	0.14	0.17	2		
AR-2	1/14/99	0.0	12.20	84	7.17	86.5	40	8.36	8	0.13	0.11	0.10	0.24	7		
AR-2	2/24/99	1.0			6.89	93.3	44		37		0.08	0.12	0.26	3		
AR-2	3/8/99	0.0	14.10	97	7.16	92.6	44	7.82	41	0.08	0.09	0.10	0.25	5		
AR-2	4/12/99	0.5	13.70	97	8.00	98.0	46	9.10	50	0.11	0.11	0.11	0.24	6		
AR-2	5/18/99	3.0	13.92	102	6.80	83.1	37	21.50	280	0.03	0.21	0.40	0.19	68		
AR-2	6/24/99	10.9	11.12	101	7.65	63.2	30	1.34	46	0.13	0.08	0.18	0.11	4		
AR-2	7/9/99	11.0	11.38	105		77.5	36	1.76	41	0.09	0.08	0.00	0.00	4		80.17
AR-2	8/13/99	10.2	10.42	93	7.39	54.2	25	12.70	135	0.09	0.17	0.37	0.02		0.2	
AR-2	10/4/99	4.7	12.86	100	6.98	64.6	29	4.25	65	0.07	0.08	0.19	0.06		0.1	
AR-2	10/19/99	2.7	13.31	98	6.51	44.0	19	16.70		0.05	0.14	0.35	0.03		0.2	
AR-2	11/17/99	0.0	14.30	98	7.11			2.07	33	0.06	0.07	0.09	0.19		0.1	
AR-2	12/15/99	0.0	13.60	93	6.84	75.8	35	3.14	35	0.07	0.09	0.14	0.16			

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
AR-2	1/24/00	0.0	13.20	90		83.3	39		36	0.06	0.08	0.04	0.16	5	0.1	
AR-2	2/1/00	0.0				88.4	42	10.80	39	0.07	0.03	0.10	0.27	4	0.1	
AR-2	3/21/00	0.0	13.70	94		89.3	42	4.51	46	0.09	0.13	0.11	0.18	9	0.1	
AR-2	4/10/00	0.0	14.90	102		92.1	44	4.74	48	0.08			0.16	14	0.1	
AR-2	5/24/00	2.2	13.04	95	7.06	49.6	22	7.19	96	0.05	0.11	0.17	0.07	20	0.1	
AR-2	7/28/00	10.5	11.30	100	6.43	79.0	34	2.73	62		0.12	0.19	0.05	7	0.1	110.80
AR-2	9/13/00	6.3	12.28	99	7.80	86.6	40	1.97	55	0.10	0.11	0.15	0.05	6	0.1	
AR-2	10/4/00	3.7	12.87	97	7.55	85.2	38	6.37	60	0.09	0.13	0.15	0.08	10	0.1	147.20
AR-2	12/13/00	1.0	13.30	94	7.23	73.3	31	1.94	38	0.05	0.06	0.13	0.16	4	0.1	
AR-2	1/19/01	1.0	13.50	95	7.41	43.1	18	16.60	125	0.06	0.13	0.22	0.08	32	0.1	
AR-2	2/22/01	0.5	13.30	92	6.93	80.5	34	1.43	33	0.06	0.06	0.09	0.17	3	0.1	
AR-2	4/24/01	3.2			7.84	59.4	26	14.85	101	0.06	0.14	0.21	0.09	29	0.1	382.00
AR-2	6/6/01	5.0	12.77	100	7.32	36.4	16	13.80	91	0.03	0.08	0.15	0.11	25	0.1	
AR-2	7/26/01	13.0	10.37	98	7.70	68.9	32	4.58	63	0.07	0.09	0.19	0.03	7	0.1	148.30
AR-2	8/20/01	9.8	11.25	98	7.61	64.6	30	8.37	83	0.07		0.19	0.01	10	0.1	233.00
AR-2	9/27/01	4.9	13.00	101	7.69	72.5	33	3.04	62	0.08	0.10	0.18	0.07	6	0.1	149.30
AR-2	12/5/01	0.2	11.00	76	7.32	75.5	32	3.93	35	0.08	0.08	0.15	0.25	4	0.1	
AR-2	1/3/02	0.4	12.40	86	7.29	55.8	24	1.54	56	0.07	0.07	0.20	0.08	3	0.1	
AR-2	3/6/02	0.3	12.30	85	7.21	84.9	36	2.65	30	0.05	0.07	0.08	0.21	5	0.1	
AR-2	4/18/02	0.3	12.60	87	7.40	86.3	37	4.59	44	0.10	0.09	0.07	0.18	5	0.1	
AR-2	5/24/02	3.2	13.92	103	6.84	36.2	16	23.70	150	0.05	0.14	0.21	0.07	42	0.1	
AR-2	6/3/02	6.1	12.08	96		48.8	22	5.89	77	0.06	0.08	0.12	0.08	12	0.1	
AR-2	7/11/02	15.0	10.02	98	7.86	74.3	35	1.66	40	0.09	0.09	0.06	0.00	5	0.1	72.63
AR-2	8/22/02	11.3	10.85	98		78.1	37	3.33	52	0.10	0.12	0.17	0.09	4	0.1	103.30
AR-2	10/10/02	2.8	12.91	95	7.16	66.4	29	2.47	49	0.07	0.10	0.16	0.15	6	0.1	156.80
AR-2	10/31/02	3.9	12.79	96	7.22	40.9	18	16.70	123	0.06	0.11	0.22	0.12	37	0.1	
AR-2	1/9/03	0.3	11.80	81	6.96	64.6	28	2.35	31	0.05	0.05	0.03	0.24	3	0.1	
AR-2	2/20/03	0.3	12.70	88	7.42	63.6	27	2.00	36	0.08	0.07	0.18	0.37	4	0.1	
AR-2	3/26/03	0.4	14.64	101		73.7	32	4.43	38	0.05	0.09	0.06	0.34	10	0.1	
AR-2	6/3/03	9.6	12.98	112	8.28	65.5	30	2.80	44	0.05	0.08	0.09	0.05	4	0.1	
AR-2	7/17/03	15.1	8.45	88	8.36	83.3	39	2.98	44	0.09	0.12	0.16	0.20	3	0.1	64.69
AR-2	8/21/03	11.4	10.24	98	7.86	79.8	37	2.43	47	0.09	0.12	0.24	0.11	4	0.1	77.40

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
AR-2	10/16/03	2.9	12.63	99	7.65	74.2	33	2.53	49	0.07	0.10	0.17	0.17	5	0.1	105.50
AR-2	12/8/03	0.2	11.80	81	7.41	81.2	35	4.62	35	0.05	0.09	0.15	0.37	7	0.1	
AR-2	1/29/04	0.2	12.60	87	7.26	85.9	37	4.68	41	0.08	0.09	0.12	0.38	6	0.1	
AR-2	2/23/04	0.2	11.80	81	7.21	82.9	35	4.28	47	0.04	0.09	0.13	0.21	7	0.1	
AR-2	4/21/04	2.6	13.57	106	7.41	56.0	25	26.40	146	0.04	0.15	0.33	0.15	44	0.1	
AR-2	5/19/04	7.7	11.47	102	7.99	43.1	20	9.45	76	0.04	0.08	0.20	0.13	16	0.1	
AR-3	8/16/98	14.0	9.07	87	7.09			4.36	53	0.12	0.13	0.18		5		132.10
AR-3	8/25/98	9.7	11.23	99	7.38	57.4	27	8.74	120	0.07	0.14	0.35		15		
AR-3	9/4/98	8.0	11.46	98	7.58	63.8	30	3.63	72	0.08	0.09	0.28		7		
AR-3	9/30/98	6.7	11.36	92	7.27	84.4	40	7.13	57	0.06	0.07	0.17		4		
AR-3	10/8/98	2.5	13.47	99	7.12	95.8	43	7.06	55	0.09	0.09	0.06	0.14	8		180.30
AR-3	11/19/98	0.4	13.70	95		83.3	36	7.02	46	0.07	0.07	0.09	0.12	3		
AR-3	12/15/98	0.2	11.79	82	7.19	76.3	36		40	0.06		0.12	0.17	9		
AR-3	1/11/99	0.5	13.20	93	7.30	84.2	40	8.50	56	0.11	0.08	0.06	0.17	6		
AR-3	2/24/99	0.0			7.27	94.4	44		44	0.09	0.07	0.08	0.19	3		
AR-3	3/8/99	1.0	13.90	98	6.74	96.5	46	8.11	59	0.10	0.07	0.08	0.17	4		
AR-3	4/12/99	0.0	13.90	95	7.37	118.5	54	9.30	71	0.08	0.09	0.08	0.20	7		
AR-3	5/18/99	3.5	14.46	109	6.55	70.2	31	15.10	267	0.04	0.16	0.38	0.08	57		
AR-3	6/15/99	8.6	11.64	99	7.51	68.4	32	2.52	62	0.07	0.09		0.10	5		
AR-3	7/12/99	15.9	10.22	103		82.1	39	4.01	47	0.07	0.08	0.08		5		
AR-3	8/13/99	10.3	10.34	93		47.6	22	17.20	177	0.06	0.19	0.39	0.00		0.3	
AR-3	9/27/99	4.7	12.81	100	7.48	74.0	33	2.53	64	0.08	0.09	0.11	0.05		0.1	
AR-3	10/18/99	2.0	14.05	101	6.40	40.3	18	69.80		0.08	0.30	0.74	0.02		0.6	
AR-3	11/17/99	0.0	14.10	97	6.67			2.70	46	0.06	0.07	0.07	0.20		0.1	
AR-3	12/15/99	0.0	13.80	95	6.34	71.5	34	3.99	45	0.06	0.07	0.10	0.18			
AR-3	1/24/00	0.0	13.20	90		86.3	40		39	0.04	0.07	0.00	0.13	4	0.1	
AR-3	2/1/00				7.17	90.2	42	3.62	47	0.05	0.07	0.08	0.17	5	0.1	
AR-3	3/21/00	0.0	14.30	98		91.0	43	5.13	73	0.07	0.08	0.10	0.09	10	0.1	
AR-3	4/10/00	0.0	14.80	101		94.5	45	5.12	72	0.07			0.04	13	0.1	
AR-3	5/24/00	4.4	12.80	99	6.98	57.9	26	8.88	102	0.04	0.10	0.17	0.08	16	0.1	
AR-3	7/6/00	11.8	10.41	95	6.90	81.8	39	2.32	58	0.07	0.10	0.00	0.00	10		
AR-3	7/24/00	12.4	10.50	98		65.3	31	5.54	97	0.07	0.13	0.30	0.00	13	0.1	

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
AR-3	9/13/00	7.5	12.45	103	8.01	90.9	42	2.77	62	0.10	0.10	0.12	0.01	5	0.1	
AR-3	10/4/00	4.2	12.77	98	7.63	86.9	39	7.22	68	0.07	0.12	0.11	0.06	14	0.1	
AR-3	12/13/00	0.5	13.70	95	7.27	74.4	32	1.73	41	0.05	0.05	0.12	0.14	3	0.1	
AR-3	1/12/01	1.0	12.80	90	7.51	80.8	34	1.85	36	0.06	0.05	0.08	0.16	2	0.1	
AR-3	2/9/01	0.5	13.70	95	7.06	81.5	35	2.03	35	0.05	0.04	0.09	0.14	2	0.1	
AR-3	4/16/01	1.9	14.09	101		59.7	26	8.71	115	0.03	0.09	0.23	0.00	17	0.1	690.00
AR-3	5/24/01	4.3	13.27	102	7.35	40.2	18	29.60	156	0.03	0.14	0.19	0.14	54	0.1	
AR-3	7/18/01	14.0	10.74	104	8.21	74.1	35	2.98	65	0.06	0.08	0.16	0.00	4	0.1	243.00
AR-3	8/20/01	9.7	11.21	98	7.46	67.3	31	13.50	109	0.06		0.23	0.00	20	0.1	513.00
AR-3	9/26/01	7.0	12.71	104	7.69	68.9	32	5.60	75	0.10	0.10	0.22	0.03	7	0.1	334.40
AR-3	12/12/01	0.2	10.60	73	7.09	88.9	38	6.15	47	0.11	0.09	0.11	0.23	9	0.1	
AR-3	1/9/02	0.2	12.40	85	7.21	54.1	23	2.10	52	0.03	0.04	0.13	0.02	3	0.1	
AR-3	3/6/02	0.2	12.90	89	7.05	83.2	36	2.69	44	0.05	0.07	0.10	0.13	4	0.1	
AR-3	4/24/02	0.4	12.10	84	7.21	56.9	24	5.11	72	0.02	0.08	0.16	0.00	10	0.1	
AR-3	4/29/02	0.4	12.20	85	7.43	41.0	17	72.40	283	0.00	0.39	0.52	0.00	168	0.5	
AR-3	5/20/02	5.0	13.39	103	7.13	34.1	15	81.30	374	0.00	0.36	0.42	0.04	140	0.4	
AR-3	6/5/02	10.3	11.78	103		50.7	24	6.54	74	0.06	0.08	0.15		15	0.1	
AR-3	7/31/02	17.6	9.30	97	6.20	81.9	39	2.86	48	0.12	0.11	0.12	0.13	4	0.1	134.70
AR-3	9/5/02	11.6	11.33	103		80.4	38	2.88	52	0.11	0.11	0.12	0.07	3	0.1	164.30
AR-3	10/16/02	5.3	11.84	98	7.39	59.8	27	5.63	80	0.05	0.09	0.25	0.09	10	0.1	
AR-3	10/31/02	4.4	13.27	101	7.09	42.4	19	34.30	208	0.05	0.18	0.38	0.11	74	0.1	
AR-3	1/3/03	0.2	11.60	80	6.86	74.4	32	2.14	39	0.04	0.04	0.02	0.25	2	0.1	
AR-3	3/6/03	0.2	14.04	96	7.56	61.4	26	4.99	73	0.06	0.07	0.16	0.14	10	0.1	
AR-3	4/24/03	4.6	12.71	97	7.98	50.8	23	20.20	203	0.06	0.16	0.28	0.11	45	0.1	440.30
AR-3	6/3/03	10.5	11.40	101	8.22	69.6	33	2.40	49	0.03	0.06	0.17	0.00	5	0.1	
AR-3	6/19/03	14.9	9.53	99	7.56	62.6	29	2.28	67	0.02	0.07	0.09	0.01	6	0.1	282.40
AR-3	8/21/03	11.9	9.51	93	7.81	82.4	39	2.73	49	0.07	0.10	0.11	0.09	4	0.1	158.10
AR-3	10/23/03	2.7	13.31	104		69.3	31	4.16	58	0.06	0.08	0.17	0.15	6	0.1	319.00
AR-3	12/8/03	0.2	12.20	84	7.26	82.7	35	2.40	39	0.04	0.06	0.07	0.36	5	0.1	
AR-3	1/21/04	0.2	11.90	82	7.25	91.4	39	5.40	46	0.04	0.08	0.04	0.40	8	0.1	
AR-3	2/26/04	0.2	13.20	91	84.7	84.7	36	3.69	46	0.05	0.06	0.08	0.19	4	0.1	
AR-3	4/21/04	2.1	14.20	109	7.87	41.3	18	14.90	128	0.02	0.12	0.32	0.01	27	0.1	

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
AR-3	5/26/04	9.8	10.92	101	7.30	51.1	24	7.63	92	0.03	0.08	0.23	0.06	17	0.1	
AR-3	6/25/04	16.6	9.26	101	7.66	85.7	41	3.29	48	0.07	0.08	0.10	0.00	6	0.1	131.90
AR-4	8/13/98	11.8	10.44	96	7.46	71.1	33	3.88	74	0.12	0.23	0.22		5		
AR-4	8/24/98	9.7	9.85	87	7.45	52.7	25	14.30	162	0.07	0.15	0.44		27		79.61
AR-4	9/4/98	7.0				58.4	28	2.79	68	0.08	0.06	0.30		7		
AR-4	9/25/98	6.7	10.53	88	7.21	64.9	30	7.55	89	0.06	0.10	0.34		13		139.00
AR-4	10/7/98	2.0	12.54	91	7.25	50.1	43	6.99	53	0.09	0.07	0.13	0.10	3		16.29
AR-4	11/18/98	0.4	12.25	85	6.88	70.4	30	6.85	52	0.07	0.06	0.09	0.17	3		21.72
AR-4	12/9/98	0.5	12.50	86	7.25	68.8	32	7.69	59	0.07	0.08	0.17	0.16	6		
AR-4	1/21/99				6.83	79.9	38		37	0.08	0.08	0.14	0.19	4		
AR-4	2/25/99	0.0	13.60	93	7.39	88.0	42	7.69	60	0.11	0.08	0.13	0.22	3		
AR-4	4/22/99	1.0	13.50	95	7.17	64.8	31	7.42	103	0.07	0.09	0.25	0.05	5		
AR-4	5/27/99	4.0	13.72	104	6.91	37.5	17		83	0.03			0.14	15		
AR-4	6/24/99	10.1	11.27	100	7.42	57.4	27	1.46	62	0.06	0.07	0.18	0.05	3		27.72
AR-4	7/14/99	11.4	10.87	102		77.4	36	2.77	64	0.07	0.08	0.14	0.04	3		14.70
AR-4	10/4/99	5.0	12.22	95	6.68	53.9	24	5.15	87	0.03	0.07	0.23	0.03		0.1	
AR-4	2/15/00	0.0				82.9	38	3.57	60	0.08	0.08	0.13	0.09			
AR-4	5/31/00	5.8	12.23	98	6.87	64.8	30	2.31	66	0.05	0.07	0.12	0.18	5	0.1	
AR-4	7/6/00	10.5	11.62	103	6.92	78.6	37	2.43	66	0.08	0.10	0.02	0.07	10		
AR-4	8/2/00	10.1	10.06	89	7.28			5.64	102	0.08	0.15	0.30	0.06	22	0.1	34.47
AR-4	9/21/00	7.6	11.44	95	7.68	83.8	39	3.47	69	0.09	0.09	0.13	0.04	6	0.1	17.32
AR-4	11/8/00	0.5	13.90	97	7.26	72.7	31	2.59	55	0.05	0.06	0.11	0.15	3	0.1	18.10
AR-4	1/18/01	1.0	12.40	87	7.32	50.7	21	2.55	72	0.04	0.06	0.16	0.09	6	0.1	
AR-4	3/2/01	0.4	13.52	93	7.17	84.6	36	4.06	66	0.06	0.07	0.15		5	0.1	
AR-4	4/24/01	1.1			7.42	50.4	22	6.69	98	0.03	0.09	0.26	0.00	14	0.1	126.00
AR-4	5/29/01	5.4	12.78	100	7.67	50.5	23	4.34	67	0.03	0.08	0.14		10	0.1	
AR-4	7/11/01	10.3	10.66	95	7.89	74.6	35	3.17	74	0.11	0.08	0.12	0.07	5	0.1	21.70
AR-4	8/23/01	11.8	10.12	93	7.62	73.2	34	3.34	86	0.07		0.23	0.05	4	0.1	19.34
AR-4	10/11/01	2.3	13.14	96		60.1	26	2.72	69	0.06	0.07	0.21	0.07	5	0.1	25.73
AR-4	12/13/01	0.2	12.30	85	7.24	74.4	32	4.89	59	0.09	0.08	0.11	0.21	5	0.1	
AR-4	2/20/02	0.2	13.60	94	7.15	73.8	32	2.87	60	0.04	0.07	0.09	0.12	6	0.1	
AR-4	3/13/02	0.3	13.10	90	7.57	80.3	34	3.71	56	0.07	0.07	0.13	0.14	4	0.1	

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge Cfs
AR-4	5/15/02	3.4	13.23	99	7.28	43.1	19	5.83	77	0.05	0.08	0.18	0.27	14	0.1	81.43
AR-4	6/5/02	8.8	11.51	97		43.9	20	4.85	94	0.05	0.08	0.31		13	0.1	73.46
AR-4	7/31/02	13.0	9.59	90	6.60	77.2	36	4.22	72	0.10	0.11	0.21	0.15	7	0.1	12.82
AR-4	9/11/02	6.9	11.67	95		71.1	33	3.37	79	0.08	0.09	0.15	0.08	5	0.1	15.44
AR-4	11/6/02	5.3	11.86	92		33.5	15	5.19	137	0.03	0.11	0.36	0.00	14	0.1	
AR-4	1/30/03	0.3	14.05	97	6.27	70.8	30	3.36	55	0.07	0.08	0.19	0.27	3	0.1	
AR-4	3/5/03	0.2	15.07	104		56.2	24	2.50	80	0.05	0.06	0.20	0.10	3	0.1	
AR-4	4/24/03	3.7	13.14	98	7.61	58.9	26	2.94	87	0.10	0.08	0.22	0.15	5	0.1	23.20
AR-4	6/3/03	7.3	13.11	107	7.95	61.7	28	2.29	59	0.04	0.06	0.15	0.14	5	0.1	20.42
AR-4	7/10/03	14.7	9.26	96	7.64	69.1	33	2.37	65	0.06	0.09	0.13	0.19	4	0.1	11.87
AR-4	8/26/03	11.0				69.7	33	5.38	103	0.06	0.11	0.23	0.09	10	0.1	32.72
AR-4	10/15/03	4.3	12.08	98	7.57	65.5	29	2.51	64	0.04	0.07	0.21	0.14	4	0.1	17.70
AR-4	1/21/04	0.2	12.90	89		81.4	35	3.07	43	0.05	0.07	0.00	0.37	2	0.1	
AR-4	2/26/04	0.2	13.40	92	7.44	78.7	34	2.98	49	0.05	0.08	0.10	0.19	3	0.1	
AR-4	4/21/04	1.2	13.55	102	6.79	40.0	17	6.15	89	0.02	0.10	0.31	0.01	14	0.1	
AR-4	5/26/04	7.4	11.53	101	6.81	49.2	23	2.79	81	0.03	0.06	0.32	0.08	7	0.1	50.99
AR-5	11/9/99	0.3	14.88	103	6.50	59.1	25	1.55	32	0.04	0.06	0.23	0.21		0.1	
AR-5	2/16/00	0.0	14.60	100	7.53	77.2	36	3.72	41	0.09	0.08	0.11	0.12	7		
AR-5	6/1/00	4.7	12.84	100		48.2	22	6.01	60	0.04	0.09	0.13	0.15	9	0.1	
AR-5	7/10/00	9.2	11.23	98	8.10	70.8	33	0.28	61	0.08	0.08	0.15	0.08	10	0.1	14.21
AR-5	8/1/00	8.2	10.30	88	6.45	70.8	33	2.96	77	0.08	0.08	0.23	0.09	7	0.1	13.26
AR-5	9/20/00	4.4	12.65	98		81.9	37	2.02	55	0.08	0.09	0.12	0.10	5	0.1	9.38
AR-5	11/9/00	1.0	13.20	93	7.35	72.4	31	4.52	57	0.07	0.12	0.13	0.19	13	0.1	
AR-5	1/11/01	1.0	12.80	90	7.13	60.1	26	0.96	44	0.03	0.05	0.12	0.21	3	0.1	
AR-5	2/21/01	0.5	13.40	94	6.76	70.8	30	2.56	42	0.04	0.09	0.12	0.23	5	0.1	
AR-5	4/19/01	1.6	13.87	99		68.3	30	4.00	77	0.05	0.07	0.20	0.10	8	0.1	26.10
AR-5	6/7/01	4.8	13.07	101	7.49	41.9	19	9.41	75	0.02	0.08	0.11	0.26	22	0.1	
AR-5	7/27/01	9.2	10.92	94	7.48	63.4	30	3.02	65	0.06	0.07	0.20	0.11	6	0.1	21.09
AR-5	8/29/01	7.8	11.33	95	7.38	66.3	31	5.32	112	0.04	0.09	0.35	0.03	8	0.1	26.39
AR-5	10/10/01	3.9	12.62	96	7.26	64.6	29	4.11	84	0.05	0.08	0.20	0.09	9	0.1	27.31
AR-5	11/8/01	0.3	12.30	85	6.99	77.8	33	3.39	50	0.06	0.08	0.15	0.25	4	0.1	
AR-5	1/16/02	0.3	12.50	86		54.2	23	1.04	62	0.04	0.04	0.15	0.14	3	0.1	

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
AR-5	2/27/02	0.5	13.10	91	7.38	79.3	34	3.59	49	0.09	0.07	0.11	0.30	5	0.1	
AR-5	3/21/02	0.6	13.70	95		82.8	36	4.04	49	0.02	0.08	0.08	0.26	5	0.1	
AR-5	5/23/02	4.4	12.29	93	6.93	41.8	19	19.60	129	0.02	0.16	0.23	0.22	43	0.1	
AR-5	7/30/02	10.7	10.49	92	7.39	68.3	32	4.77	75	0.06	0.10	0.19	0.13	9	0.1	12.13
AR-5	9/9/02	7.6	12.32	101	7.30	63.9	29	2.74	72	0.07	0.08	0.10	0.10	5	0.1	16.92
AR-5	10/17/02	3.4	13.02	97	7.31	54.7	24	2.79	57	0.07	0.06	0.17	0.15	4	0.1	29.76
AR-5	11/7/02	3.3	13.54	101	7.13	37.3	16	9.17	100	0.05	0.09	0.23	0.15	20	0.1	118.10
AR-5	1/28/03	0.7	11.90	83	7.56	61.0	26	3.32	39	0.05	0.07	0.10	0.38	6	0.1	
AR-5	2/19/03	0.4	14.27	98	7.41	56.0	24	1.56	47	0.05	0.05	0.15	0.39	4	0.1	
AR-5	4/21/03	1.9	14.35	103	7.32	45.3	20	4.79	71	0.07	0.07	0.19	0.14	11	0.1	31.49
AR-5	6/12/03	9.3	10.99	94	7.57	46.0	21	3.52	76	0.04	0.08	0.25	0.13	10	0.1	38.33
AR-5	7/9/03	13.6	9.35	94	7.55	68.7	32	3.53	60	0.06	0.10	0.03	0.32	8	0.1	
AR-5	8/14/03	10.7	10.06	95	7.60	75.2	35	2.73	58	0.08	0.10	0.13	0.30	7	0.1	10.08
AR-5	10/7/03	6.7	11.40	98	7.28	55.6	25	5.08	80	0.03	0.09	0.37	0.07	12	0.1	34.44
AR-5	11/20/03	0.2	11.72	86	7.19	71.5	30	1.79	37	0.04	0.05	0.12	>0.40	4	0.1	
AR-5	1/22/04	0.2	13.00	90	7.57	79.6	34	4.27	47	0.06	0.07	0.10	>0.40	4	0.1	
AR-5	2/18/04	0.2	12.30	85	7.39	78.6	34	2.97	50	0.06	0.07	0.15	0.28	5	0.1	
AR-5	4/16/04	0.4	13.15	97		51.8	22	9.40	98	0.02	0.12	0.31	0.17	21	0.1	
AR-5	5/18/04	5.3	12.00	95	6.82	42.8	19	11.15	82	0.04	0.09	0.16	0.30	23	0.1	59.52
DC-1	8/12/98	9.0	11.00	97	7.69	66.2	31	1.20	16	0.03	0.08	0.07		2		60.54
DC-1	8/23/98	7.0	11.08	91	7.79	65.3	31	1.89	24	0.04	0.03	0.05		5		33.24
DC-1	9/6/98	6.0	11.37	93	7.48	62.6	30	1.19	11	0.10	0.05	0.09		2		
DC-1	9/27/98	5.5	12.45	97	7.70	40.2	31	1.21	17	0.04	0.03	0.05		3		
DC-1	11/20/98	0.4	15.08	105	7.08	62.7	27	5.26	5	0.05	0.04	0.00	0.02	1		26.34
DC-1	3/22/99	1.0	13.90	98	7.80	76.8	36	5.28	9		0.03	0.00	0.01	2		
DC-1	5/24/99	3.4	13.40	102		52.4	23		84	0.01				58		
DC-1	7/15/99	9.5	11.42	100		67.3	31	0.14	12	0.05	0.03	0.02		1		22.76
DC-1	11/11/99	0.0	14.00	96					38	0.04	0.04	0.06	0.02		0.1	
DC-1	3/7/00	0.0	13.90	95	7.40	75.9	36	0.63	9	0.05	0.05	0.01	0.02	5	0.1	
DC-1	5/8/00	2.7	13.40	99	6.86	59.6	26	0.68	33	0.03	0.07	0.07	0.00	4	0.1	
DC-1	7/11/00	10.3	11.07	99		63.1	30	0.26	26	0.03	0.03	0.06	0.00	8	0.1	34.29
DC-1	9/11/00	6.6	12.29	100	7.55	66.1	30	0.35	24	0.04	0.04	0.09	0.00	2	0.1	35.41

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
DC-1	10/5/00	3.7	13.19	100	7.62	67.0	30	0.46	19	0.02	0.03	0.04	0.00	3	0.1	34.53
DC-1	12/1/00	0.5			7.08			0.28	14	0.04	0.03	0.04	0.01	2	0.1	
DC-1	1/24/01	1.0	12.70	89		69.7	30	0.48	13	0.04	0.04	0.02	0.02	3	0.1	
DC-1	3/8/01	0.6	14.08	98	7.89	75.2	32	0.98	7	0.02	0.04	0.01		2	0.1	
DC-1	4/25/01	3.0	12.40	92	7.88	72.2	32	0.66	13	0.03	0.03	0.04	0.01	3	0.1	31.80
DC-1	6/4/01	4.3	12.66	97		22.3	10	5.06	66	0.01	0.05	0.15	0.02	13	0.1	
DC-1	7/31/01	9.9	11.02	97	7.73	59.4	28	0.24	18	0.02	0.02	0.05	0.00	2	0.1	37.57
DC-1	8/30/01	7.7	12.02	100	7.69	68.1	31	0.13	17	0.05	0.02	0.07	0.00	2	0.1	34.26
DC-1	10/4/01	6.0	12.55	100	7.65	64.5	29	0.37	13	0.04	0.03	0.02	0.00	0	0.1	35.35
DC-1	11/14/01	0.2	12.60	87	7.36	67.5	29	0.44	14	0.02	0.03	0.01	0.02	2	0.1	
DC-1	1/30/02	0.4	13.50	94	7.30	69.4	30	0.67	10	0.03	0.03	0.01	0.03	3	0.1	
DC-1	3/14/02	0.3	13.50	93	7.50	68.9	29	0.22	11	0.03	0.04	0.02	0.01	2	0.1	
DC-1	4/5/02	0.4	12.90	89	7.26	68.7	29		13	0.04	0.05	0.02	0.00	4	0.1	
DC-1	5/30/02	5.4	12.56	98	7.96	29.8	13		43	0.01	0.02	0.05	0.00	5	0.1	99.28
DC-1	7/22/02	10.4	10.88	96	8.23	64.5	30	0.32	17	0.04	0.03	0.00	0.00	2	0.1	31.20
DC-1	9/12/02	6.6	12.83	103	7.84	63.8	29	0.43	10	0.04	0.03	0.00	0.00	1	0.1	27.76
DC-1	11/14/02	1.6	13.97	98	7.66	47.4	21	1.42	23	0.05	0.03	0.01	0.04	4	0.1	43.90
DC-1	11/21/02	0.7	14.07	98	7.54	53.9	23	0.94	13	0.07	0.03	0.01	0.04	2	0.1	41.19
DC-1	1/8/03	0.2	12.90	89	7.36	58.1	25	2.31	14	0.04	0.03	0.02	0.04	6	0.1	
DC-1	2/27/03	1.5	14.14	100	7.76	61.1	27	9.74	75	0.03	0.05	0.04	0.00	17	0.1	
DC-1	4/23/03	4.0	13.38	101	7.60	54.7	24	21.40	89	0.00	0.06	0.14	0.00	42	0.1	44.13
DC-1	5/22/03	9.2	10.96	93	8.06	53.2	25	4.35	29	0.01	0.03	0.01	0.00	8	0.1	33.92
DC-1	7/16/03	13.8	9.24	94	7.69	68.7	32	0.64	18	0.03	0.04	0.01	0.01	2	0.1	25.17
DC-1	9/12/03	6.9	11.45	99	7.81	69.4	32	0.23	10	0.02	0.04	0.04	0.01	3	0.1	24.29
DC-1	10/27/03	2.4	11.90	99	7.63	59.5	26	0.58	20	0.02	0.03	0.12	0.01	2	0.1	32.75
DC-1	1/28/04	0.2	13.40	92	7.40	70.4	30	0.51	10	0.03	0.03	0.00	0.05	3	0.1	
DC-1	3/3/04	1.1	12.90	91		71.3	31	21.60	138	0.02	0.05	0.12	0.00	34	0.1	
DC-1	4/22/04	3.8	12.00	92	7.18	67.0	30	4.76	43	0.03	0.04	0.08	0.00	11	0.1	
DC-1	6/2/04	8.8	11.06	101	7.41	49.0	23	1.62	29	0.02	0.03	0.11	0.00	4	0.1	47.55
DC-2	8/12/98	13.0	9.54	91	7.59	68.0	32	3.07		0.06	0.09	0.15		4		179.00
DC-2	8/23/98	9.0	10.36	90	7.91	72.1	34	3.78	41	0.06	0.08	0.13		4		209.60
DC-2	9/1/98	8.0	11.99	101	7.40	52.7	25	16.50	232	0.07	0.24	0.37		51		

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
DC-2	9/22/98	7.5	11.45	95	7.63	70.3	33	2.21	37	0.07	0.09	0.13		3		
DC-2	11/11/98	0.5	13.47	93	7.22	71.5	30	6.79	34			0.06	0.06	3		171.50
DC-2	12/16/98	0.5	14.00	99	7.00	74.0	35	5.84	15		0.05	0.09	0.08	5		
DC-2	1/25/99	0.5	13.00	92	6.94	74.0	34	6.57	24	0.05	0.06	0.06	0.10	4		
DC-2	2/25/99	0.5	9.90	70	7.12	77.7	36	6.19	21	0.09	0.07	0.04	0.08	2		
DC-2	3/17/99	0.5	13.80	97	7.08	84.7	40	7.48	35	0.07	0.07	0.06	0.09	5		
DC-2	4/8/99	0.0	14.40	99	7.33	84.5	39	6.59	39		0.08	0.04	0.15	6		
DC-2	5/5/99	2.8			6.90	66.5	30	8.52	80	0.10	0.10	0.21	0.01	10		
DC-2	6/17/99	10.0			7.57	51.3	24	2.65	46	0.03	0.09		0.01	11		
DC-2	7/22/99	13.5	10.64	103	7.70	74.1	35	1.08	31		0.06	0.04		5		142.80
DC-2	2/23/00	0.0	14.20	97	7.20	78.7	37	2.81	32	0.07	0.06	0.06	0.07		0.1	
DC-2	4/18/00	0.0	14.10	97	6.46	72.2	35		103	0.06			0.06	30	0.3	
DC-2	9/7/00	8.8	11.33	97		79.2	37	1.27	27	0.06	0.07	0.06	0.00	4	0.1	149.20
DC-2	9/26/00	8.6	10.94	93	7.61	67.3	31	1.85	53	0.05	0.07	0.13	0.01	9	0.1	269.30
DC-2	11/30/00	0.5	14.20	99	7.21	59.9	26	1.48	35	0.05	0.06	0.10	0.05	5	0.1	
DC-2	1/4/01	0.5	13.10	91	7.53	68.6	29	0.89	23	0.06	0.06	0.07	0.07	4	0.1	
DC-2	3/1/01	0.3	13.89	96	7.28	76.5	33	1.50	26	0.04	0.06	0.05		3	0.1	
DC-2	4/26/01	1.5	12.90	92	7.38	56.5	24	11.90	92	0.04	0.12	0.22	0.01	25	0.1	
DC-2	6/6/01	5.0	12.75	99	7.69	28.5	13	25.90	136	0.02	0.12	0.19	0.00	47	0.1	
DC-2	7/19/01	12.4	10.56	98	7.73	63.5	30	1.96	36	0.03	0.06	0.13	0.00	2	0.1	219.70
DC-2	9/5/01	8.1	12.00	101	7.75	63.4	29	5.25	56	0.04	0.08	0.16	0.00	10	0.1	
DC-2	10/3/01	4.6	13.02	100	7.92	67.7	31	1.69	33	0.05	0.06	0.09	0.01	2	0.1	210.20
DC-2	12/12/01	0.3	12.20	84	7.22	72.6	31	2.46	23	0.05	0.06	0.07	0.08	5	0.1	
DC-2	1/17/02	0.2	12.77	88	7.00	66.0	28	0.99	32	0.05	0.06	0.06	0.05	2	0.1	
DC-2	2/28/02	0.2	12.80	88	7.36	66.7	28	5.41	47	0.07	0.07	0.06	0.06	8	0.1	
DC-2	4/29/02	0.3	12.00	83	6.93	49.5	21	34.50	144	0.04	0.36	0.32	0.08	89	0.4	
DC-2	5/29/02	8.4	11.46	96	7.26	36.1	17	10.60	76	0.02	0.09	0.12	0.00	23	0.1	
DC-2	7/25/02	12.8	9.49	89	7.81	61.7	29	4.75	56	0.05	0.08	0.08	0.00	11	0.1	277.60
DC-3	8/11/98	12.5	9.33	87	7.71	63.8	30	2.90	119	0.12	0.13	0.23		7		255.20
DC-3	8/26/98	8.0	12.06	103	7.47	65.7	31	8.03	54		0.06	0.21		7		366.50
DC-3	9/1/98	8.0	12.00	102	7.33	52.0	25	11.30	135	0.08	0.23	0.30		54		
DC-3	9/22/98	7.5	11.06	92	7.60	69.3	32	2.24	50	0.07	0.09	0.22		2		

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
DC-3	10/5/98	6	12.18	96		84.1	38	2.55	38		0.06	0.04		3		
DC-3	11/19/98	0.3	13.88	96	7.02	79.6	34	6.18	25	0.07	0.06	0.06	0.07	2		74.05
DC-3	12/3/98	0.5	13.44	93	7.09	83.9	36	5.99	21	0.06	0.04	0.15	0.14	1		
DC-3	1/14/99	0.5	13.30	94	7.06	76.1	40	6.48	28	0.09	0.06	0.04	0.11	5		
DC-3	2/11/99	0.5														
DC-3	3/10/99	1.0			7.14	82.7	39	7.08	28	0.06	0.07	0.18	0.10	5		
DC-3	5/27/99	4.0	14.02	103	6.90	31.1	14		222	0.03	0.15	0.41		58		
DC-3	6/17/99	10.0			7.59	51.8	24	1.92	46	0.04	0.08		0.01	8		
DC-3	7/8/99	15.0	10.36	101		72.6	34	3.29	32	0.06	0.19			6		137.70
DC-3	8/12/99	10.7	11.01	100		75.0	35	3.37	51	0.08	0.09	0.04	0.01		0	257.30
DC-3	10/1/99	6.2	12.61	102	7.02	67.9	31	7.00	61	0.06	0.12	0.15	0.00		0.2	
DC-3	10/19/99	2.5	12.74	93	6.67	37.5	16	25.80		0.05	0.16	0.41	0.02		0.3	
DC-3	11/10/99				6.95				25	0.06	0.05	0.06	0.07			
DC-3	12/13/99	0.0	14.30	98	6.50	74.2	35	1.98	25	0.04	0.06	0.08	0.09		0.1	
DC-3	1/20/00	0.0	13.60	93		73.9	34	2.23	29	0.04	0.06	0.00	0.15	4	0.1	
DC-3	2/15/00	0.0			6.92	78.4	36	2.72	29	0.07	0.06	0.06	0.03			
DC-3	3/8/00	0.0	14.10	97	7.14	80.8	39	3.52	32	0.06	0.10	0.04	0.06	8	0.1	
DC-3	4/11/00	0.0	15.10	103	7.23	83.5	40		38	0.06			0.02	16	0.1	
DC-3	5/25/00	3.6	13.30	100	7.12	46.4	21	8.25	93	0.02	0.07	0.15	0.00	19	0.1	
DC-3	7/25/00	11.8	9.77	90	7.26	56.9	27	2.69	67	0.07	0.08	0.18	0.00	10	0.1	
DC-3	9/14/00	6.9	12.21	100	7.33	75.9	35	1.50	38	0.08	0.07	0.09	0.00	5	0.1	210.70
DC-3	9/26/00	9.2	11.26	97	7.51	66.9	31	2.54	62	0.06	0.13	0.13	0.00	7	0.1	327.40
DC-3	11/14/00	1.0	14.10	100	7.37	50.5	22	12.70	88	0.04	0.16	0.23	0.04	22	0.2	
DC-3	1/3/01	0.5	12.90	90	7.29	64.1	27	1.04	29	0.04	0.05	0.08	0.07	3	0.1	
DC-3	3/7/01	0.3	14.29	99	7.54	80.4	35	3.16	28	0.04	0.07	0.05		6	0.1	
DC-3	4/18/01	2.6	14.11	103	7.71	68.2	30	18.65	101	0.05	0.22	0.21	0.00	44	0.2	285.00
DC-3	5/23/01	3.9	13.08	99	7.45	38.6	17	21.10	106	0.03	0.13	0.20	0.06	43	0.1	
DC-3	7/12/01	10.6	11.06	99	7.80	59.7	28	2.41	43	0.06	0.05	0.06	0.00	3	0.1	
DC-3	8/21/01	12.1	10.78	100	7.85	64.6	30	2.94	52	0.05		0.14	0.00	3	0.1	258.00
DC-3	9/26/01	5.2	12.75	100	7.45	64.3	29	7.20	73	0.04	0.07	0.15	0.00	15	0.1	264.40
DC-3	12/6/01	0.2	11.30	78	7.33	52.2	22	1.38	19	0.03	0.04	0.08	0.05	2	0.1	
DC-3	1/9/02	0.2	12.00	83	7.07	60.7	26	1.36	32	0.04	0.05	0.09	0.04	3	0.1	

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
DC-3	2/21/02	0.2	13.30	92	7.33	72.9	31	2.35	31	0.05	0.06	0.02	0.07	5	0.1	
DC-3	4/25/02	0.3	12.50	86	7.37	69.1	30	10.14	71	0.09	0.14	0.13	0.05	27	0.1	
DC-3	5/16/02	5.8	12.72	100		37.1	17	17.60	106	0.03	0.14	0.19	0.04	48	0.1	
DC-3	6/4/02	8.7	11.31	95		44.0	20	6.05	60	0.05	0.07	0.15	0.00	14	0.1	
DC-3	7/8/02	15.4	10.56	105	7.92	70.2	33	1.48	37	0.11	0.07	0.04	0.00	4	0.1	160.60
DC-3	9/11/02	7.0	12.62	102	7.52	66.3	30	1.86	41	0.05	0.07	0.06	0.00	4	0.1	207.50
DC-3	10/16/02	4.5	12.68	98		55.1	25	4.63	63	0.05	0.08	0.23	0.01	10	0.1	
DC-3	10/30/02	3.5	11.86	88		26.2	11	915.00	>500	0.32	0.72	>2.50	0.00	>750	2.1	
DC-3	11/13/02	0.2	14.21	98		52.9	22	19.95	113	0.04	0.14	0.21	0.04	39	0.1	413.10
DC-3	1/3/03	0.3	12.60	87	7.18	65.0	28	1.94	27	0.05	0.04	0.01	0.11	3	0.1	
DC-3	3/6/03	0.3	14.13	97	7.63	67.1	29	8.28	73	0.05	0.06	0.13	0.10	14	0.1	
DC-3	3/27/03	0.3	13.61	94		72.7	31	16.20	90	0.07	0.10	0.12	0.11	31	0.1	
DC-3	6/4/03	9.3	11.39	98	7.91	66.4	31	11.50	113	0.05	0.09	0.18	0.00	26	0.1	230.40
DC-3	6/11/03	9.0	11.11	95		49.7	23	230.00	>500	0.19	0.69	0.94	0.07	376	0.9	
DC-3	6/16/03	12.2	9.82	96	7.73	64.3	30	11.50	86	0.03	0.08	0.11	0.02	24	0.1	286.00
DC-3	8/20/03	10.0	10.81	100	7.71	79.5	37	4.80	53	0.14	0.10	0.13	0.07	10	0.1	172.80
DC-3	10/22/03	3.8	12.56	101	7.67	73.5	33	3.31	39	0.05	0.07	0.08	0.09	5	0.1	221.80
DC-3	12/4/03	0.2	12.10	83		76.9	33	2.52	20	0.03	0.04	0.04	0.18	8	0.1	
DC-3	1/29/04	0.2	12.90	89	7.48	77.7	33	6.45	39	0.04	0.07	0.04	0.15	13	0.1	
DC-3	2/19/04	0.2	12.50	86	7.38	80.1	34	4.92	39	0.05	0.07	0.11	0.11	7	0.1	
DC-3	4/7/04	0.2	12.53	92	7.11	73.9	32	34.10	187	0.03	0.16	0.24	0.06	63	0.1	
DC-3	6/14/04	12.3	10.23	101	7.37	71.3	33	1.79	34	0.04	0.06	0.04	0.00	5	0.1	215.30
DC-3	6/24/04	15.3	9.35	101	8.17	77.9	37	1.60	35	0.07	0.07	0.11	0.00	4	0.1	160.50
NR-1	8/10/98	8.0			6.97	69.1	36	2.70	96	0.08	0.10	0.33		106		
NR-1	8/27/98	6.0	11.54	93	7.25	86.5	41	3.21	114	0.08	0.08	0.24		4		
NR-1	9/3/98															
NR-1	9/6/98	5.5	11.02	89	7.17	78.8	38	3.30	63	0.09	0.10	0.22		8		
NR-1	9/28/98	4.1	11.59	87	7.25	55.8	45	7.15	72	0.09	0.08	0.22		7		17.35
NR-1	11/9/98	0.0	11.96	83	7.12	93.8	40	7.34	40		0.01	0.10	0.04	3		14.82
NR-1	12/2/98	0.5	11.75	82	6.68	97.9	42	6.92	42	0.08	0.09	0.12	0.26	2		
NR-1	4/28/99	1.0	11.00	69	6.70	71.8	34	7.09	92	0.09	0.12	0.28		4		
NR-1	5/17/99	9.0	9.16	77	6.99	87.8		6.77	144	0.06	0.08	0.39	0.01	6		

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
NR-1	6/16/99	8.6	10.42	89	7.46	82.4	38	2.42	66	0.11	0.09		0.01	8		14.68
NR-1	7/22/99	8.0	11.37	96	7.20	95.7	44	4.79	61	0.12	0.12	0.10	0.00	9		12.24
NR-1	10/21/99	1.3	13.15	94	6.38	52.1	23	2.71	75	0.06	0.07	0.24	0.02		0.1	
NR-1	5/9/00	3.2	11.72	87	6.31	48.7	22	2.25	80	0.08	0.10	0.22	0.03	6	0.1	
NR-1	7/7/00	8.6	10.43	89		90.6	42	2.58	60	0.10	0.13	0.00	0.00	11		
NR-1	9/12/00	5.7	11.13	88	7.33	91.0	42	2.23	59	0.08	0.16	0.20	0.00	6	0.1	19.01
NR-1	10/3/00	2.4	12.24	89	7.43	85.5	38	2.08	50	0.07	0.09	0.14	0.01	6	0.1	16.09
NR-1	11/30/00	0.5	12.00	83		72.1	31	1.29	40	0.04	0.06	0.13	0.02	4	0.1	
NR-1	1/3/01	0.5	11.50	80	6.84	94.3	40	2.41	44	0.05	0.08	0.11	0.04	5	0.1	
NR-1	2/8/01	1.0	11.60	82	6.95	108.3	46	3.89	53	0.06	0.08	0.11	0.01	6	0.1	
NR-1	4/23/01	0.5	11.14	77	7.27	45.9	20	3.80	109	0.08	0.10	0.28	0.00	7	0.1	171.00
NR-1	6/5/01	7.7	9.75	81		80.2	37	4.73	67	0.08	0.12	0.17	0.00	11	0.1	16.43
NR-1	7/18/01	8.9	10.26	88	7.41	91.5	43	4.87	73	0.08	0.12	0.21	0.00	7	0.1	17.83
NR-1	8/23/01	7.8	9.95	83	7.45	92.0	43	5.27	81	0.10		0.27	0.00	10	0.1	18.10
NR-1	9/20/01	7.5	8.98	75	7.21	87.8	41	3.37	78	0.08	0.12	0.28	0.00	9	0.1	27.06
NR-1	1/21/02	0.2			6.87	82.4	35	2.56	47	0.05	0.07	0.15	0.01	4	0.1	
NR-1	3/7/02	0.2	12.30	85	7.18	95.0	41	4.62	66	0.15	0.11	0.10	0.00	9	0.1	
NR-1	3/27/02	0.7	12.10	85	7.23	96.6	42	5.41	67	0.08	0.11	0.03	0.00	8	0.1	
NR-1	5/29/02	8.5	10.14	85		74.1	34	5.72	69	0.09	0.14	0.17	0.00	14	0.1	18.15
NR-1	7/8/02	9.3	10.45	89	7.49	77.9	36	3.07	53	0.07	0.14	0.06	0.00	6	0.1	13.41
NR-1	8/22/02	10.3	7.42	65		79.2	37	5.25	100	0.09	0.17	0.36	0.00	9	0.1	
NR-1	10/10/02	1.5	11.27	80	7.19	71.3	31	1.80	58	0.07	0.10	0.16	0.00	5	0.1	19.80
NR-1	11/13/02	0.4	11.78	81	7.01	64.6	28	2.78	59	0.06	0.09	0.14	0.00	7	0.1	23.97
NR-1	1/29/03	0.5	11.17	77	7.29	84.4	36	3.09	45	0.09	0.08	0.11	0.02	5	0.1	
NR-1	2/26/03	0.5	10.76	74	7.22	81.7	35	3.06	53	0.06	0.10	0.16	0.02	7	0.1	
NR-1	3/27/03	0.2	10.65	73		92.3	39	3.21	43	0.06	0.08	0.11	0.04	5	0.1	
NR-1	5/21/03	5.7	10.39	81	7.51	73.0	33	3.18	45	0.06	0.10	0.10	0.00	6	0.1	18.25
NR-2	8/10/98	12.0	9.77	89	7.37	65.7	35	7.91	114	0.09	0.15	0.33		32		
NR-2	8/27/98	9.0	11.59	98	7.49	87.3	41	4.14	85	0.11	0.11	0.30		5		
NR-2	9/3/98	8.0	11.54	98	7.34	90.2	43	4.50	84	0.08	0.14	0.29		6		85.07
NR-2	9/22/98	7.5	10.27	84	7.46	92.1	44	3.71	81	0.10	0.10	0.27		8		
NR-2	11/11/98	0.4	13.40	93	7.08	99.8	43	7.39	34		0.01	0.17	0.08	3		71.81

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
NR-2	12/7/98	0.0	11.76	82	7.11	101.9	45		52	0.09	0.10	0.22	0.09	3		
NR-2	1/18/99	0.5	14.90	105	6.67	77.5	38	7.11	45	0.07	0.10	0.17	0.07	5		
NR-2	3/3/99	1.0														
NR-2	4/7/99	0.0														
NR-2	5/5/99	2.0	13.76	101	6.76			10.30	109	0.11	0.16	0.30		15		
NR-2	6/21/99	9.9	11.22	99	7.81	84.6	40	3.10	65	0.08	0.14		0.01	7		66.38
NR-2	7/19/99	11.5	10.55	95		97.6	46	4.79	82		0.14	0.18		10		75.44
NR-2	8/10/99	10.8	10.55	95		83.1	39	5.19	96	0.12	0.16	0.21	0.00		0.2	105.70
NR-2	10/6/99	4.3	12.43	96	6.86	66.6	30		99	0.06	0.12	0.30	0.00		0.2	
NR-2	3/28/00	0.0	12.60	86		119.6	57		69	0.08	0.11	0.21	0.05	6	0.1	
NR-2	5/25/00	4.6	12.59	98	6.81	69.2	31	3.69	81	0.07	0.11	0.20	0.00	16	0.1	
NR-2	7/7/00	12.2	10.36	96		100.0	47	3.30	61	0.11	0.15	0.02	0.00	9		
NR-2	8/2/00	11.0	10.10	92	7.10	100.5	47	4.28	83	0.12	0.15	0.24	0.00	9	0.1	68.05
NR-2	9/21/00	5.7	12.09	96	7.75	103.6	47	2.48	59	0.13	0.12	0.17	0.00	6	0.1	79.56
NR-2	11/8/00	0.5	12.80	89	7.30	93.2	40	2.00	45	0.07	0.08	0.14	0.03	5	0.1	
NR-2	1/4/01	0.5	11.70	81	7.21	95.0	45	2.18	45	0.07	0.08	0.17	0.06	10	0.1	
NR-2	3/7/01	0.3	12.73	88	7.58	119.0	51	4.20	48	0.07	0.08	0.15		3	0.1	
NR-2	4/18/01	0.7	13.09	91	7.47	74.2	32	11.35	131	0.08	0.20	0.28	0.00	25	0.2	225.00
NR-2	5/23/01	5.9	12.36	99	7.49	56.8	26	4.58	70	0.06	0.08	0.19	0.03	8	0.1	
NR-2	7/12/01	10.5	10.37	93	7.78	90.4	42	5.99	72	0.16	0.14	0.16	0.00	8	0.1	109.30
NR-2	8/21/01	10.1	9.72	86	7.63	87.9	41	6.28	88	0.10		0.22	0.00	11	0.1	117.10
NR-2	10/3/01	4.4	12.39	95	7.68	95.3	43	4.72	66	0.08	0.13	0.20	0.00	6	0.1	73.95
NR-2	12/6/01	0.2	9.90	68	7.12	95.5	41	3.06	38	0.08	0.08	0.15	0.04	2	0.1	
NR-2	1/17/02	0.3	9.77	67	6.95	82.9	35	1.26	47	0.08	0.06	0.13	0.04	2	0.1	
NR-2	2/21/02	0.2	11.80	81	7.21	94.8	41	3.12	55	0.07	0.08	0.10	0.04	6	0.1	
NR-2	4/25/02	0.2	11.70	80	7.21	73.6	31	3.96	85	0.09	0.12	0.20	0.00	6	0.1	
NR-2	5/16/02	5.6	12.08	94		49.7	22	6.58	93	0.06	0.11	0.22	0.02	15	0.1	214.60
NR-2	7/25/02	12.0	9.75	89	7.31	85.5	41	6.10	78	0.10	0.31	0.20	0.00	16	0.1	119.10
NR-2	9/4/02	10.0	11.65	101	7.68	84.8	40	3.37	67	0.10	0.12	0.24	0.00	6	0.1	80.96
NR-2	10/9/02	2.8	13.67	100	7.34	71.9	32	3.00	76	0.08	0.10	0.26	0.00	8	0.1	125.80
NR-2	1/29/03	0.2	11.88	82	6.46	89.0	38	2.69	43	0.08	0.08	0.19	0.07	4	0.1	
NR-2	2/26/03	0.3	13.53	93	7.57	84.4	36	2.83	50	0.08	0.06	0.15	0.06	4	0.1	

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
NR-2	4/17/03	2.0	12.96	93	7.34	59.5	26	4.75	84	0.07	0.14	0.24	0.00	11	0.1	
NR-2	5/21/03	10.3	11.74	103	8.03	76.7	36	2.25	52	0.06	0.10	0.12	0.01	3	0.1	81.29
NR-2	7/17/03	13.5	9.06	92	7.69	100.1	47	3.56	66	0.11	0.15	0.21	0.07	6	0.1	53.26
NR-2	8/13/03	12.7	9.10	90	7.57	108.0	51	4.20	71	0.11	0.16	0.23	0.06	9	0.1	62.61
NR-2	10/22/03	1.9	13.24	102	78.7	78.7	34	2.73	52	0.07	0.09	0.12	0.07	4	0.1	95.81
NR-2	12/10/03	0.2	10.90	75	7.25	89.9	38	2.21	40	0.07	0.07	0.17	0.10	3	0.1	
NR-2	1/29/04	0.2	11.70	81	7.34	97.2	42	2.76	40	0.07	0.07	0.09	0.12	3	0.1	
NR-2	2/19/04	0.2	10.80	74	7.49	98.8	42	2.40	45	0.08	0.08	0.15	0.08	8	0.1	
NR-2	4/8/04	0.2	11.41	84	7.21	78.1	33	4.32	78	0.08	0.12	0.22	0.05	6	0.1	
NR-2	5/27/04	9.1	10.84	99	7.44	55.7	26	5.35	86	0.05	0.09	0.28	0.00	9	0.1	195.90
NR-3	8/11/98	12.0			7.67	76.7	36		119					23		179.20
NR-3	8/26/98	9.0	11.62	100	7.53	89.0	42	4.94	91	0.08	0.15	0.30		8		165.70
NR-3	9/3/98	8.0	11.65	101	7.45	91.3	43	5.33	78		0.03	0.25		7		
NR-3	9/28/98	7.0	11.86	95	7.20	60.6	46	7.36	76	0.10	0.07	0.28		10		
NR-3	10/5/98	5.0	12.46	95	7.45	112.5	51	3.93	68	0.13	0.12	0.14	0.03	6		
NR-3	11/9/98	0.4	12.93	89	7.20	99.1	43	7.17	50		0.05	0.17	0.06	2		84.17
NR-3	12/2/98	0.5	11.17	77	7.30	106.6	46	6.92	42	0.08	0.09	0.16	0.06	3		
NR-3	1/13/99	0.5	11.60	82	7.41	101.3	48	7.99	53			0.14	0.10	5		
NR-3	2/11/99	0.0			7.10	114.3	54	7.59	54	0.13			0.12	5		
NR-3	3/10/99	1.0	11.80		7.01	114.9	54	7.39	55		0.10	0.05		4		
NR-3	4/7/99	1.0			7.87	117.4	54	6.82	62	0.15	0.12	0.13	0.14	4		
NR-3	5/17/99	9.5	12.39	108	7.75	96.6	45	9.90	133	0.08	0.16	0.35	0.04	18		
NR-3	6/21/99	14.5	11.40	110	8.02	81.6	39	2.02	56	0.08	0.10	0.10	0.01	4		85.76
NR-3	7/12/99	14.0	10.30	100		104.1	49	1.84	70	0.11	0.13		0.02	10		58.62
NR-3	8/10/99	13.6	9.59	93		83.5	40	7.35	104	0.11	0.17	0.22	0.00		0.2	132.70
NR-3	10/1/99	5.8	12.16	97	7.09	93.3	43	6.14	80	0.09	0.27	0.20	0.00		0.2	163.10
NR-3	10/19/99	2.1	13.76	100	6.34	42.8	19	10.07		0.09	0.19	0.38	0.02		0.2	
NR-3	11/10/99	0.0	14.00	96	6.80				47	0.08	0.08	0.05	0.04			
NR-3	12/13/99	0.0	12.30	87	6.94	73.4	34	3.67	46	0.08	0.10	0.09	0.09		0.1	
NR-3	1/20/00	0.0	12.10	86		99.5	47	2.46	43	0.07	0.09	0.06	0.08	4	0.1	
NR-3	2/15/00				6.81	108.9	51	2.73	46	0.09	0.09	0.17	0.02			
NR-3	3/8/00	0.0	13.10	89	6.85	112.5	53	2.77	51	0.11	0.10	0.15	0.08	6	0.1	

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
NR-3	4/11/00	0.0	14.00	96	6.93	120.3	57		64	0.09			0.04	12	0.1	
NR-3	5/25/00	5.2	12.66	100	7.08	68.6	31	4.72	85	0.07	0.10	0.20	0.00	10	0.1	
NR-3	7/25/00	13.2	9.80	94	6.87	77.8	37	3.53	102	0.10	0.18	0.32	0.00	22	0.1	158.60
NR-3	9/12/00	8.3	11.66	99	8.15	97.9	49	3.95	68	0.11	0.07	0.20	0.00	9	0.1	105.30
NR-3	10/3/00	3.5	12.93	97	7.76	92.2	41	2.98	51	0.09	0.11	0.15	0.01	6	0.1	87.46
NR-3	11/14/00	1.0			7.09	58.8	25	3.35	74	0.06	0.09	0.21	0.01	9	0.1	
NR-3	1/19/01	1.0	12.20	86	7.32	93.4	40	3.24	66	0.11	0.08	0.13	0.04	4	0.1	
NR-3	3/1/01	0.3	11.40	79	6.90	109.9	47	2.94	53	0.07	0.09	0.14		6	0.1	
NR-3	4/17/01	0.6	14.27	99	7.47	71.4	31	7.42	123	0.07	0.13	0.24	0.00	14	0.1	323.00
NR-3	6/5/01	11.3	10.77	98	7.76	67.9	32	3.82	70	0.06	0.10	0.18	0.00	9	0.1	
NR-3	7/19/01	12.5	10.07	94	7.71	95.8	45	5.90	76	0.14	0.15	0.26	0.01	10	0.1	90.73
NR-3	8/22/01	10.7	10.58	95	7.69	95.2	45	5.55	86	0.09		0.27	0.00	12	0.1	109.50
NR-3	10/3/01	5.6	12.62	99	7.81	94.3	43	4.91	65	0.09	0.13	0.20	0.00	5	0.1	92.25
NR-3	12/5/01	0.2	9.80	67	7.10	98.8	42	3.30	42	0.05	0.09	0.14	0.08	5	0.1	
NR-3	1/3/02	0.2	10.90	75	7.04	72.3	31	1.66	71	0.09	0.11	0.20	0.01	4	0.1	
NR-3	2/28/02	0.2	10.50	72	6.86	99.8	43	2.52	47	0.09	0.08	0.13	0.06	3	0.1	
NR-3	4/25/02	0.2	11.70	81	7.09	70.3	30	5.32	87	0.10	0.13	0.19	0.00	12	0.1	
NR-3	5/2/02	1.6	11.80	85	7.11	36.3	16	7.93	125	0.05	0.13	0.33	0.00	15	0.1	
NR-3	6/4/02	9.9	12.94	112		74.2	35	2.92	69	0.07	0.08	0.17	0.00	13	0.1	109.70
NR-3	7/25/02	15.1	9.12	90	6.11	88.8	42	8.55	78	0.16	0.18	0.21	0.00	16	0.1	117.60
NR-3	9/4/02	11.3	11.20	101		87.0	41	3.86	73	0.08	0.13	0.20	0.00	6	0.1	89.59
NR-3	10/16/02	4.6	12.75	97	7.35	64.0	29	4.96	89	0.09	0.11	0.32	0.00	10	0.1	219.70
NR-3	10/30/02	3.3	11.98	89	6.90	39.9	18	7.81	139	0.04	0.09	0.41	0.00	15	0.1	
NR-3	1/3/03	0.3	10.00	69	6.80	83.7	36	1.36	36	0.05	0.09	0.03	0.07	3	0.1	
NR-3	3/6/03	0.2	13.62	94	6.75	68.8	29	2.94	77	0.06	0.07	0.22	0.03	4	0.1	
NR-3	4/17/03	3.5	13.58	101		59.7	27	5.02	83	0.06	0.11	0.24	0.00	11	0.1	181.60
NR-3	6/4/03	10.1	11.48	100	7.88	78.7	37	2.49	62	0.07	0.09	0.18	0.01	4	0.1	90.85
NR-3	6/11/03	9.2	10.75	93		65.2	30	21.30	103	0.09	0.23	0.35	0.02	45	0.3	267.50
NR-3	7/23/03	15.8	8.66	92	7.59	101.8	48	3.86	68	0.09	0.14	0.18	0.09	8	0.1	60.40
NR-3	8/13/03	13.3	9.40	95	7.28	108.4	51	4.68	71	0.11	0.15	0.15	0.08	7	0.1	67.06
NR-3	10/8/03	5.4	11.47	96	7.62	80.1	36	4.19	70	0.07	0.11	0.30	0.05	8	0.1	113.00
NR-3	12/10/03	0.2	10.60	73		90.4	39	3.06	42	0.06	0.08	0.25	0.12	6	0.1	

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
NR-3	1/19/04	0.2	11.40	79	7.01	100.7	43	2.67	41	0.06	0.08	0.10	0.15	4	0.1	
NR-3	2/23/04	0.2	11.20	77	7.17	99.2	42	2.77	47	0.03	0.09	0.14	0.10	4	0.1	
NR-3	4/7/04	0.2	12.23	90	7.10	91.5	39	5.93	81	0.10	0.14	0.18	0.06	11	0.1	
NR-3	5/27/04	9.9	10.81	101		56.2	26	5.63	90	0.07	0.10	0.29	0.00	10	0.1	212.80
NR-3	6/23/04	16.5	10.67	116	7.84	97.8	46	3.94	63	0.07	0.11	0.13	0.00	7	0.1	61.33
SC-1	8/13/98	10.5	8.64	77	7.49	82.2	34	3.37	63	0.12	0.20	0.27		6		22.04
SC-1	8/24/98	9.0	10.79	94	7.45	59.5	29	11.20	153	0.10	0.23			35		97.81
SC-1	9/2/98	6.5	12.42	103	7.38	60.5	28	4.66	79	0.06	0.12	0.26		11		
SC-1	9/25/98	5.9	10.80	88	7.26	69.8	32	7.64	84	0.15	0.15	0.29		16		
SC-1	11/23/98	0.5			7.23	74.4	32	6.92	41	0.17		0.09	0.15	5		18.51
SC-1	12/10/98	0.5			7.23	72.0	34	7.71	42	0.09	0.23	0.16	0.14	9		
SC-1	1/20/99				7.17	79.8	38	7.84	45	0.08	0.07	0.11	0.20	4		
SC-1	3/4/99	1.0	13.50	95		115.4	43		44	0.09	0.09	0.09	0.20	1		
SC-1	4/15/99	1.0	14.20	100	7.02	90.5	43	7.90	55	0.09	0.11	0.14	0.26	6		
SC-1	5/13/99	2.6	14.09	103	7.21	43.5	19	15.80	153	0.06	0.18	0.46		35		
SC-1	6/23/99	10.3	10.98	98	7.71	59.9	28	1.45	58	0.08	0.09	0.12	0.06	5		
SC-1	7/14/99	10.6	10.82	97		82.3	39	2.77	51	0.08						19.14
SC-1	11/18/99	0.0	13.60	93	6.74			3.80	58	0.08	0.07	0.10	0.11			
SC-1	2/22/00	0.0	14.50	100	7.07	85.1	40	3.25	43	0.08	0.09	0.11	0.15		0.1	
SC-1	6/5/00	9.3	11.59	101	6.73	64.4	30				0.08	0.13		5	0.1	
SC-1	7/27/00	10.9	10.27	93	6.99	70.7	33	2.46	78	0.09	0.11	0.25	0.04	8	0.1	31.93
SC-1	9/14/00	7.5	12.25	102	7.53	77.9	36	2.04	57	0.10	0.10	0.14	0.01	7	0.1	27.59
SC-1	9/27/00	4.9	12.20	95	7.43	71.2	32	3.33	67	0.10	0.08	0.19	0.03	8	0.1	40.23
SC-1	12/14/00	0.5	13.00	90	7.11	67.7	29	2.30	38	0.04	0.06	0.09	0.14	5	0.1	
SC-1	1/12/01	1.0	12.20	86	7.25	73.9	32	1.81	31	0.05	0.07	0.09	0.15	3	0.1	
SC-1	3/2/01	0.4	12.87	89	6.94	79.3	34	2.87	43	0.08	0.08	0.12		3	0.1	
SC-1	4/20/01	1.6	13.96	100	7.51	71.3	31	6.54	81	0.05	0.11	0.20	0.02	14	0.1	47.60
SC-1	5/24/01	2.6	13.13	96	7.65	39.4	17	12.10	86	0.04	0.12	0.20	0.09	24	0.1	
SC-1	7/26/01	11.0	10.23	93	7.52	62.9	29	5.41	76	0.08	0.10	0.26	0.07	8	0.1	36.65
SC-1	8/24/01	9.7	10.82	95	7.51	76.8	36	3.69	61	0.05		0.17	0.05	3	0.1	25.05
SC-1	9/27/01	3.7	12.97	98	7.42	71.7	32	2.86	60	0.08	0.14	0.20	0.05	5	0.1	31.26
SC-1	12/13/01	0.2	10.30	71	6.61	76.3	33	2.99	43	0.08	0.07	0.12	0.17	4	0.1	

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
SC-1	1/31/02	0.2	12.60	87	7.08	75.6	32	3.22	48	0.13	0.08	0.11	0.12	6	0.1	
SC-1	3/13/02	0.2	13.00	90	7.15	80.8	35	3.35	46	0.08	0.08	0.10	0.18	4	0.1	
SC-1	4/24/02	0.3	11.80	82	7.16	71.5	31	6.94	62	0.05	0.14	0.16	0.07	15	0.1	
SC-1	5/20/02	4.0	13.72	103	7.02	37.8	17	24.40	141	0.02	0.24	0.27	0.13	54	0.2	
SC-1	7/31/02	10.9	10.38	93	7.75	74.9	35	3.67	51	0.10	0.13	0.20	0.14	5	0.1	24.50
SC-1	9/5/02	9.5	11.04	95	7.54	71.0	33	2.80	60	0.09	0.11	0.17	0.11	3	0.1	26.85
SC-1	11/6/02	5.0	12.68	98	7.19	32.8	15	47.90	377	0.20	0.28	0.61	0.00	113	0.3	
SC-1	11/20/02	0.6	14.43	100	7.42	56.3	24	2.62	52	0.06	0.07	0.14	0.16	4	0.1	43.82
SC-1	1/30/03	0.3	13.86	95	7.51	69.5	30	2.26	36	0.06	0.06	0.17	0.26	3	0.1	
SC-1	2/20/03	0.2	12.70	88		66.5	28	2.25	42	0.07	0.07	0.27	0.24	4	0.1	
SC-1	3/26/03	0.3	12.72	87	7.30	75.8	32	2.53	26	0.08	0.06	0.07	0.38	4	0.1	
SC-1	5/15/03	5.7	12.60	99	7.73	52.9	24	2.95	61	0.03	0.07	0.10	0.00	6	0.1	37.95
SC-1	7/10/03	14.3	8.73	89	7.31	73.3	35	3.93	64	0.07	0.11	0.10	0.18	9	0.1	18.93
SC-1	8/26/03	10.1			7.32	72.5	34	6.96	76	0.06	0.16	0.29	0.03	16	0.1	36.58
SC-1	10/16/03	2.4	12.26	95	7.39	71.3	31	2.05	44	0.06	0.09	0.19	0.18	3	0.1	24.44
SC-1	3/4/04	0.2	12.70	88	7.32	80.5	34	3.19	42	0.06	0.09	0.09	0.20	5	0.1	
SC-2	8/15/98	12.0	9.60	89	7.40	70.3	33	5.95	91	0.15	0.13	0.24		11		31.34
SC-2	8/26/98	8.0	11.75	100	7.40	89.0	29	3.10	14	0.07	0.14	0.34		20		119.80
SC-2	9/2/98	9.0	11.54	104	7.32	60.1	28	6.74	103	0.05	0.12	0.31		13		
SC-2	9/28/98	7.0	11.42	92	7.30	45.8	35		76	0.08	0.08	0.26		10		115.40
SC-2	10/7/98	3.0	12.81	95	7.42	58.2	48	7.35	72		0.11	0.12		6		40.61
SC-2	11/23/98				7.25	103.5	48	7.40	52	0.07	0.07	0.08	0.09	3		
SC-2	12/15/98	0.5	11.59	80	7.05	77.6	37		57	0.08	0.08	0.15	0.12	10		
SC-2	1/11/99	0.5	11.30	80	7.20	82.9	39	8.64	62		0.08	0.08	0.14	7		
SC-2	2/24/99	1.0			6.84	91.5	43		51	0.09	0.08	0.08	0.15	3		
SC-2	3/4/99	1.0	11.70	82		94.7	45		56		0.09	0.09	0.13	1		
SC-2	4/20/99	0.5	13.40	94	7.78	73.6	35	8.19	99	0.08	0.10	0.14		9		
SC-2	5/13/99	5.0	12.80	100	6.98	40.1	18	19.60	199	0.09	0.28	0.49		56		
SC-2	6/23/99	14.2	10.36	101	7.81	64.7	31	3.26	71	0.08	0.11	0.15	0.01	10		
SC-2	7/8/99	15.6	9.87	99		80.1	38	1.01	63	0.09				6		19.92
SC-2	8/12/99	10.8	10.51	98	7.33	77.6	36	14.30	134	0.11	0.22	0.17	0.02		0.4	73.96
SC-2	9/27/99	3.8	13.51	103	7.17	71.4	32	3.37	75	0.08	0.10	0.13	0.05		0.1	41.09

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
SC-2	10/8/99	1.7	14.97	107	6.58	40.4	18	20.60		0.05	0.20	0.45	0.02		0.3	
SC-2	11/18/99	0.0	12.90	88	6.67			1.58	40	0.08	0.08	0.08	0.18		0.1	
SC-2	12/15/99	0.0	12.70	87	6.40	69.2	33	4.88	54	0.06	0.10	0.10	0.13			
SC-2	2/1/00				6.19	86.1	41	3.80	57	0.06	0.07	0.09	0.12	6	0.1	
SC-2	3/8/00	0.0	13.90	95	7.15	87.9	41	5.22	56	0.07	0.09	0.10	0.10	6	0.1	
SC-2	4/11/00	0.0	14.10	97	7.21	88.0	42		81	0.08			0.02	14	0.1	
SC-2	5/24/00	5.2	12.64	100	6.74	58.9	27	12.20	117	0.06	0.16	0.23	0.03	34	0.2	
SC-2	7/27/00	14.4	9.74	95	7.39	75.3	36	3.78	103	0.10	0.13	0.27	0.00	13	0.1	49.73
SC-2	9/14/00	8.9	11.22	99	7.84	83.3	39	3.24	70	0.08	0.09	0.14	0.00	6	0.1	46.06
SC-2	9/29/00	2.6	13.32	98	7.39	78.8	35	3.58	76	0.06	0.11	0.18	0.00	8	0.1	49.94
SC-2	12/14/00	0.5	12.70	88	7.20	74.2	32	2.22	42	0.04	0.06	0.09	0.09	4	0.1	
SC-2	1/18/01	1.0	12.50	88	6.93	57.9	25	3.11	67	0.03	0.07	0.15	0.03	7	0.1	
SC-2	2/22/01	0.5	11.70	81	6.88	86.3	37	3.95	51	0.05	0.07	0.11	0.04	5	0.1	
SC-2	2/22/01	0.5	12.30	85	6.96	86.1	37	3.66	49	0.06	0.07	0.12	0.04	5	0.1	
SC-2	2/22/01	0.5	11.70	81	6.95	86.0	37	3.87	51	0.05	0.08	0.11	0.04	6	0.1	
SC-2	4/17/01	2.0	12.39	89	7.50	54.0	24	11.45	132	0.04	0.17	0.26	0.00	30	0.1	166.00
SC-2	5/29/01	6.3	12.18	98	7.25	37.5	17	59.80	234	0.09	0.43	0.38	0.00	130	0.5	
SC-2	7/11/01	11.6	10.66	97	7.91	78.7	37	3.45	76	0.04	0.09	0.08	0.00	6	0.1	37.63
SC-2	9/5/01	9.9	11.14	98	7.69	72.0	34	11.90	102	0.05	0.18	0.26	0.00	22	0.1	76.44
SC-2	10/11/01	1.9	13.60	98	7.17	59.7	26	5.67	87	0.04	0.09	0.24	0.00	12	0.1	83.92
SC-2	12/5/01	0.2	9.70	67	7.05	87.1	37	4.81	61	0.04	0.07	0.08	0.12	5	0.1	
SC-2	1/3/02	0.2	10.00	69	7.21	52.4	22	1.38	72	0.06	0.06	0.21	0.00	2	0.1	
SC-2	2/28/02	0.2	12.30	85	7.19	81.3	35	4.08	53	0.06	0.07	0.10	0.08	5	0.1	
SC-2	4/18/02	0.2	12.80	88	7.04	83.9	36	5.53	66	0.05	0.10	0.08	0.07	6	0.1	
SC-2	5/2/02	1.3	11.70	83	7.53	30.3	13	19.10	181	0.03	0.15	0.36	0.00	38	0.1	
SC-2	6/3/02	8.6	11.33	96	7.08	54.7	25	20.50	133	0.05	0.19	0.16	0.04	42	0.2	87.81
SC-2	7/11/02	14.0	10.20	98	7.68	74.0	35	2.88	61	0.06	0.10	0.08	0.00	5	0.1	31.08
SC-2	8/22/02	12.6	10.46	97		78.2	37	4.78	78	0.09	0.14	0.25	0.04	5	0.1	43.72
SC-2	10/9/02	3.7	14.15	106	7.27	61.2	27	4.86	88	0.05	0.09	0.25	0.01	9	0.1	79.77
SC-2	10/30/02	3.6	12.65	94		31.5	14	36.80	315	0.06	0.41	0.64	0.00	85	0.1	
SC-2	11/20/02	0.7	13.56	95		58.3	25	4.67	67	0.04	0.07	0.15	0.10	8	0.1	72.63
SC-2	1/9/03	0.3	10.60	73	6.76	71.3	30	3.54	48	0.07	0.08	0.03	0.19	5	0.1	

Site ID	Date	Water Temp °C	DO mg/L	DO % sat	pH	Cond. uS/cm	TDS mg/L	Turb. NTU	Color PtCo units	Ortho Phos. mg/L	Total Phos. mg/L	Ammonia Nitrogen mg/L	Nitrate N mg/L	TSS mg/L	*Settleable S mg/L	Discharge cfs
SC-2	3/5/03	0.2	14.56	100	7.22	50.9	22	3.72	83	0.03	0.06	0.20	0.03	7	0.1	
SC-2	4/24/03	4.4	12.79	97	7.42	56.8	25	17.30	161	0.07	0.16	0.26	0.06	38	0.1	83.13
SC-2	5/15/03	8.7	12.57	106	7.71	54.3	25	4.95	74	0.04	0.08	0.17	0.00	10	0.1	66.20
SC-2	6/4/03	10.9	10.84	96	8.25	66.5	31	2.56	65	0.04	0.08	0.16	0.00	6	0.1	
SC-2	6/27/03	11.2	9.85	94	7.46	66.2	31	3.18	80	0.04	0.08	0.11	0.00	5	0.1	44.67
SC-2	8/20/03	10.4	10.54	99	7.77	74.4	35	3.98	95	0.08	0.12	0.19	0.04	9	0.1	40.74
SC-2	10/23/03	2.1	13.25	102	7.40	62.1	27	4.09	72	0.06	0.08	0.21	0.08	6	0.1	66.09
SC-2	12/4/03	0.2	10.80	74	6.96	80.2	34	5.51	43	0.05	0.09	0.09	0.19	8	0.1	
SC-2	1/19/04	0.2	11.60	80	7.38	82.0	35	4.87	57	0.05	0.07	0.02	0.24	5	0.1	
SC-2	2/26/04	0.2	12.30	85	7.06	86.8	37	4.10	54	0.05	0.08	0.08	0.16	6	0.1	
SC-2	4/8/04	0.2	12.47	92		72.3	31	8.27	104	0.06	0.10	0.30	0.07	15	0.1	
SC-2	5/19/04	9.1	11.70	107	7.26	63.3	29	6.99	72	0.05	0.11	0.10	0.11	14	0.1	56.20
SC-2	6/14/04	13.3	10.35	104	7.57	76.1	36	2.73	66	0.06	0.09	0.09	0.00	4	0.1	31.53
SC-2	6/21/04	18.2	8.92	100		80.4	38	2.99	72	0.05	0.10	0.12	0.00	5	0.1	28.87

* Detection limit for settleable solids data is 0.1mg/L so values recorded as 0.1 mg/L are more accurately described as less than or equal to 0.1 mg/L.

Note: Temperature logger datasets are available upon request from Cook Inlet Keeper.

APPENDIX III.

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