CHERRY CREEK RESERVOIR

2001 ANNUAL AQUATIC BIOLOGICAL

AND NUTRIENT MONITORING STUDY

MARCH 2002

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Submitted To:

Cherry Creek Basin Water Quality Authority
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TABLE OF CONTENTS

INTRODUCTION

An inter-governmental agreement was executed in 1985 by several local governmental entities within the Cherry Creek basin to form the Cherry Creek Basin Water Quality Authority (CCBWQA). This Authority was created for the purpose of coordinating and implementing the investigations necessary to maintain the quality of water resources of the Cherry Creek basin while allowing for further economic development. Based on a clean lakes water study (Denver Regional Council of Governments [DRCOG] 1984), the Colorado Water Quality Control Commission (CWQCC) set standards for phosphorus, and a TMDL for phosphorus. An in-lake phosphorus standard of 35 µg/L was adopted to maintain a seasonal mean chlorophyll goal of 15 µg/L. Subsequently, a phosphorus TMDL was prepared for the reservoir allocating loads among point sources, background, and nonpoint sources within a net annual load of 14,270 lbs total phosphorus.

The Cherry Creek Basin Master Plan (DRCOG 1985), approved by the CWQCC in 1985, was adopted in part as the "Regulations for Control of Water Quality in Cherry Creek Reservoir" (Section 4.2.0, 5C.C.R.3.8.11). An annual monitoring program (In-Situ, Inc. 1986, as amended, ASI 1994 a and b) was implemented at the end of April 1987 to assist in the assessment of several aspects of the Master Plan. These monitoring studies have included long-term monitoring of 1) nutrient levels within the reservoir and from tributary streams during base flows and stormwaters, 2) nutrient levels in precipitation, and 3) chlorophyll levels within the reservoir. In addition, a number of incidental studies have been conducted using such methods as benthic respirometers and limnocorrals.

In September 2000, following a hearing before the CWQCC, the standard for Cherry Creek Reservoir was changed to a July - September value of 15 µg/L of chlorophyll to be met nine out of ten years, with an underlying total phosphorus goal of 40 µg/L, also as a July - September mean. In May 2001 at the CWQCC hearing, a new control regulation was adopted for the Cherry Creek Reservoir which maintained the annual allowable total phosphorus load (TMAL) of 14,270 lbs/year as part of a “phased-TMDL” for the reservoir.

In 1994, Chadwick Ecological Consultants, Inc. (CEC) was retained by the CCBWQA to conduct annual aquatic biological and nutrient analyses on Cherry Creek Reservoir and selected tributaries. Results have been summarized in annual monitoring reports (CEC 1995 - 2001). Additionally, these data have been reviewed by Dr. John Jones of the University of Missouri-Columbia and presented to the Authority in his annual reports (Jones 1994 - 1999, 2001). The present study was designed to continue the characterization of the potential relationships between nutrient loading (both in-lake and external) and reservoir productivity. The specific objectives of this annual monitoring study include the following:

- Determine the concentrations of selected nutrients, primarily nitrogen and phosphorus species, in Cherry Creek Reservoir and various streams flowing into the reservoir, and the reservoir outflow.

- Determine the pounds of phosphorus entering Cherry Creek Reservoir from streams and precipitation and leaving the reservoir through its outlet.

- Determine biological productivity in Cherry Creek Reservoir, as measured by algal biomass (chlorophyll concentrations) and algal densities. In addition, determine species composition of the algal community along with the composition and abundance of zooplankton, the primary consumers of algae.

- Determine potential relationships between the nutrient levels and biological productivity in Cherry Creek Reservoir through correlation of the various measurements made during the study.

STUDY AREA

Cherry Creek Reservoir was impounded in 1950 by the U.S. Army Corps of Engineers (COE) to protect the City of Denver from flash floods that may originate in the reservoir's 995 km^2 drainage basin. The reservoir has maintained a surface area of approximately 350 ha (approximately 850 acres) since 1959. The reservoir and surrounding state park have also become an important recreational site, providing opportunities for activities which include fishing, boating, swimming, bicycling, bird watching, and hiking.

Sampling Sites

Sampling in 2001 was conducted at nine sites, including three sites in Cherry Creek Reservoir, five sites on tributary streams, and one site on Cherry Creek downstream of the reservoir (Fig. 1). The sampling sites are summarized below:

Cherry Creek Reservoir

CCR-1 This site is also called the Dam site, and was established in 1987. CCR-1 corresponds to the northwest trident within the lake (Knowlton and Jones 1993). Sampling was discontinued at this site in 1996 following determination that this site exhibited similar characteristics to the other two sites in this well-mixed reservoir. Sampling recommenced in July 1998 at the request of consultants for Greenwood Village.

CCR-2 This site is also called the Swim Beach site, and was established in 1987. Site CCR-2 corresponds to the northeast trident within the lake (Knowlton and Jones 1993).

CCR-3 This site is also called the Inlet site and was established in 1987, corresponding to the south trident within the lake (Knowlton and Jones 1993).

Shop Creek

SC-1 This site was established in 1987 immediately east of Parker Road on Shop Creek. Originally, Site SC-1 monitored phosphorus levels prior to its confluence with Cherry Creek. Since 1990, this site has monitored water quality upstream of the Shop Creek detention pond/wetland pollutant reduction facility (PRF).

SC-3 This site was established on Shop Creek in 1990 upstream of the Perimeter Road and downstream of the new Shop Creek detention pond and most of the wetland system. This site was moved just downstream of the Perimeter Road in 1994 and again further downstream to a location just upstream of its confluence with Cherry Creek in 1997. This site serves to monitor the effectiveness of the pond/wetland PRF and the water quality of Shop Creek as it joins Cherry Creek.

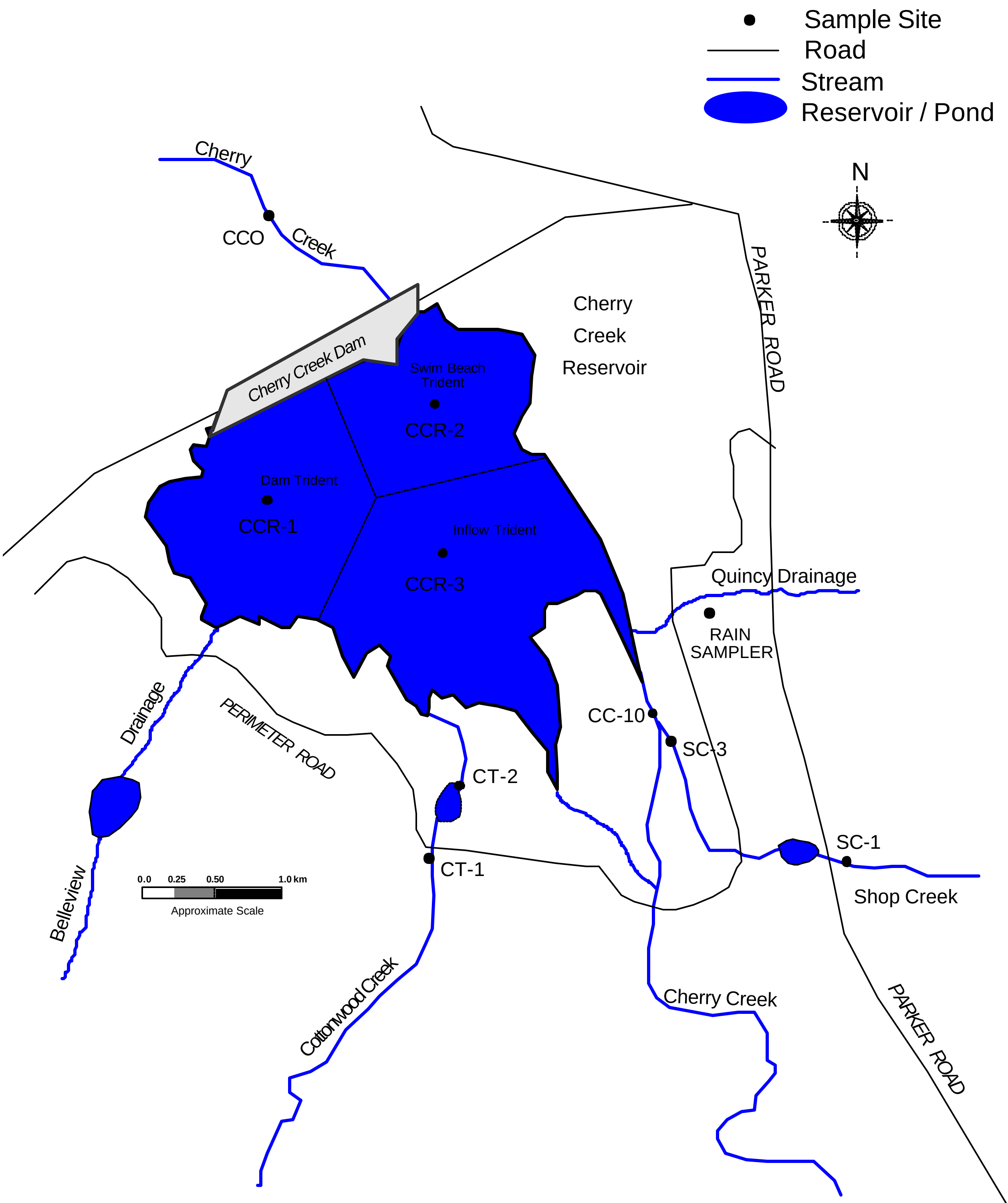

FIGURE 1: Sampling sites on Cherry Creek Reservoir and selected streams, 2001.

Cherry Creek

CC-10 This site was originally established in 1987 on Cherry Creek near the historic USGS "Melvin" gage (roughly due west of the intersection of Parker Road and Orchard Road). This location is in an area of Cherry Creek that frequently becomes dry during summer months as a result of the natural geomorphology and alluvial pumping for domestic water supply (Halepaska & Associates, Inc. 1999, 2000).

In 1995, this site was relocated further downstream between the Perimeter Road and the reservoir, approximately ½ km upstream of the reservoir. This site was moved still further downstream in 1996, just upstream of the confluence with Shop Creek and closer to the reservoir. In 1999, it was moved below the confluence with Shop Creek to eliminate the effect of a stream crossing on the CC-10 hydrograph. Since 1995, Cherry Creek has been monitored in a reach with perennial flow, allowing a more accurate monitoring of water quality and surface flows in Cherry Creek before it enters the reservoir.

This site was previously called CC-I, but was renamed CC-10 to place it in context with concurrent monitoring in Cherry Creek upstream (Halepaska & Associates, Inc. 1999 - 2001). Since 1994, monthly surface flow and water quality data have been collected at ten sites on Cherry Creek upstream of the Perimeter Road (Halepaska & Associates, Inc. 1999 - 2001). These ten sites extend from the Castlewood Site in Castlewood Canyon downstream to Site CC-9 at the Perimeter Road.

CC-O This site was established in 1987 on Cherry Creek downstream of Cherry Creek Reservoir and upstream of the Hampden Avenue-Havana Street junction in the Kennedy Golf Course (near the USGS gage). Site CC-O monitors the water quality of Cherry Creek downstream of the reservoir outlet.

Cottonwood Creek

CT-1 This site on Cottonwood Creek was established in 1987 where the Cherry Creek Park Perimeter Road crosses the stream to monitor the water quality of Cottonwood Creek before it enters the reservoir. During the fall/winter of 1996, a PRF, consisting of a water quality/detention pond and wetland system, was constructed downstream of this site. As a result of the back-flow from this pond, this site was relocated further upstream near Belleview Avenue in 1997.

CT-2 This site was established in 1996 and is located downstream from the PRF on Cottonwood Creek. This site monitors the effectiveness of this structure on water quality and monitors the quality of Cottonwood Creek before it enters the reservoir.

METHODS

Sampling Methodologies

Reservoir Sampling

The general sampling schedule included regular sampling trips to the reservoir at varying frequencies over the annual sampling period, as outlined below. Sampling was not conducted in February 2001 due to unsafe ice conditions on the reservoir.

Sampling Trips per Sampling Period

Sampling Period	Frequency	Trips/Period
Nov - Apr	Monthly	5
Oct and May	Bi-Monthly	4
June - Sept	Weekly	17
	Total	26

During each sampling episode on the reservoir, three main tasks were conducted, including 1) determining water clarity, 2) taking depth profile measurements for temperature, dissolved oxygen, pH, conductivity, and oxygen reduction potential, and 3) collecting water samples for chemical and biological analyses.

Water Clarity

First, transparency was determined at each reservoir site using a Secchi disk. The Secchi reading was taken from the shaded side of the boat or, if this was not possible, sunglasses or other shading was used to reduce glare. The disk was lowered slowly until the white quadrants disappeared, at which point the depth was recorded to the nearest 3 cm. The disk was then lowered approximately 0.5 m further and slowly brought back up until the white quadrants reappeared and again the depth was recorded. The Secchi disk depth was recorded as the average of these two readings. The final Secchi depth is often considered to be roughly half the euphotic zone, i.e. the zone where ambient light allows photosynthetic activity (Cole 1979). In this report, however, Secchi depth is simply used as a measure of transparency and all discussion is based on Secchi depth alone without the transformation to a photic zone depth.

Beginning in 1998, a second method to measure the depth of the euphotic zone was used by determining the depth at which 1% of the light penetrates the water column. This is considered the point at which, on average, light no longer can sustain photosynthesis in excess of oxygen consumption from respiration (Goldman and Horne 1983). This was accomplished by using a double-deck photometer. One photocell remained on the surface, and the other was lowered into the water on the sunny side of the boat. Both photocells were attached to a data logger, which records the amount of light in micromoles per second per square meter. The underwater photocell is lowered until the value displayed on the data logger is 1% of the value of the surface photocell, and then the depth is recorded. This method was employed until mid-August at which point the data logger and photocells appeared to be malfunctioning. The equipment is currently being serviced and recalibrated. The determination of 1% transmittance values is expected to resume early in 2002.

Profile Measurements

The second task involved measuring dissolved oxygen, temperature, conductivity, pH, and oxidation reduction potential from the surface to near the bottom every meter to develop depth profiles for each site during each sampling episode. Readings were taken with a YSI meter, Model #600 XL multi-probe meter. This meter was calibrated monthly to ensure accurate measurements.

Water Sampling

Water samples for nutrient, phytoplankton, and chlorophyll analyses were collected with a vertical Van Dorn water sampler, which has a sample volume of approximately 3 liters. To sample, the open Van Dorn sampler was lowered to the appropriate depth. A "messenger" was sent to "trip" the sampler closed and the water was brought to the surface and transferred to a clean plastic bucket for splitting into aliquots as described below. The sampler was rinsed thoroughly, with lake water, between samples and between sites.

At each reservoir site, a photic composite sample was taken, which was composed of at least three equally contributed samples collected with the Van Dorn water sampler at equally spaced increments beginning at the surface and continuing to the photic depth (based on the 1% transmissivity). Composites from each site were combined to form a whole-lake photic composite. These photic samples were used in the determination of chlorophyll concentrations (two 1 L bottles). Additionally, one 250 mL bottle (preserved with 2.5 mL of 25% gluteraldehyde solution) was prepared by Chadwick &Associates, Inc. (C&A) and sent overnight to PhycoTech in St. Joseph, Michigan, for determination of algal species and counts.

A second surface composite sample was also taken from each reservoir site for nutrient analysis. The samples were comprised of an equal volume of water collected from depths of 0, 1, 2, and 3 m at each site. Once delivered to the laboratory of C&A, the three samples were combined to form a whole-lake composite used to measure chemical parameters in the reservoir.

Zooplankton were sampled at each site with a Schindler-Patalas plankton trap. This sampler encloses 10 L of water and filters it through a bucket with a 63 mm mesh netting. The sample collected was a lake-wide composite of three samples taken from each of the three reservoir sites (nine samples total). Ten L of water were sampled at each site from the surface, half the photic depth, and the total photic depth, for a total of 90 L of water collected and filtered on each sample date. Samples were placed in a 250 mL bottle provided by C&A (preserved with a 70% denatured alcohol solution).

Following the collection of the photic and surface composite samples, individual depth profile samples for nutrient analysis were collected at Site CCR-2 during every sampling trip in 2001. Samples were collected every meter beginning at five meters, the lower depth of the well-mixed main reservoir pool according to the dynamic lake model (LaZerte and Nürnberg 2000), and progressing down to just above the bottom (approximately 7 m) representing the smaller, less frequently mixed bottom reservoir pool (LaZerte and Nürnberg 2000) (i.e., samples at 5 m, 6 m, and 7m). The Van Dorn sampler was lowered to the appropriate depth and "tripped" to take the sample. As before, the van Dorn sampler was rinsed thoroughly with lake water before each sample was taken. Once collected, the sample was transferred to a 1 L container and delivered to C&A. Additionally, 16 oz bottles provided by Severn-Trent Laboratories (STL) were filled and transferred to the Arvada, Colorado-based laboratory for analysis.

All samples were immediately placed on ice in a cooler and kept in the dark. Nutrient, chlorophyll, algal, and zooplankton samples were returned to C&A, and split samples for nutrients and chlorophyll were sent to MU via overnight mail.

In the laboratory, nutrient samples were transferred to polyethylene bottles and stored at 4EC (±1EC). Dissolved nutrient samples were filtered through Gelman A/E glass fiber filters prior to storage. Nutrient samples were analyzed using flow injection analysis methods developed by Zellweger Analytics (1999), which are similar to the proposed nutrient methods described in APHA (1998). The chlorophyll samples were filtered through Gelman A/E glass fiber filters and analyzed using the spectrophotometric method following a hot-ethanol extraction (APHA 1998). Algal samples were analyzed according to the methods described in APHA (1998).

Lastly, samples were collected at each reservoir site for coliform analysis. Sterile containers were placed in the reservoir, opened, allowed to fill, and sealed. The three individual samples were combined at C&A laboratories to form a whole-lake composite. Coliform analysis occurred June to October in 2001 (19 samples total).

Fish Population Data

As in the past, this monitoring study has also reviewed fish stocking and population data collected by the Colorado Division of Wildlife (CDOW). As part of their sampling schedule to reduce mortality to a walleye brood-stock population in Cherry Creek Reservoir, CDOW has begun sampling fish populations every two to three years (Dave Nesler, CDOW, pers. comm.). Sampling was tentatively set for 2001, but did not occur.

Stream Sampling

Low-Flow/Ambient Sampling. Standard sampling was conducted according to the schedule below during the regular reservoir sampling trips to Cherry Creek Reservoir. This sampling was performed in order to provide information during non-storm event periods, corresponding to the low-flow ambient samples collected in past studies.

Sampling Trips per Sampling Period

Sampling Period	Frequency	Trips/Period
Jan - Dec	Monthly	12

During these sampling episodes, water was collected from each of the 6 stream sampling sites (sites on tributary streams and on Cherry Creek downstream of the reservoir) and analyzed for nutrients. Flows were sufficient at each site through the year to obtain all scheduled samples. One sample for chemical analysis was collected from each of the stream sampling sites and consisted of a mid-stream, mid-column grab sample using one 1 L bottle. Additionally, at Sites CC-10 and CT-2, a sample was collected for coliform analysis by placing a sterile container into the stream, opening it, allowing it to fill with water, and sealing the container. Samples were collected June - October during regularly scheduled sampling trips and during storm events. In 2001, eight samples were collected at Site CC-10 and ten samples were collected at Site CT-2.

Storm Sampling. Storm events were sampled at Site CC-10 on Cherry Creek, Sites CT-1 and CT-2 on Cottonwood Creek, and Sites SC-1 and SC-3 on Shop Creek during the 2001 sampling season (Table 1).

Storm samples were collected with ISCO automatic samplers, which collect samples when the water level reaches a pre-set level. Once the pre-set level is reached, the ISCO collects a sample every 15 minutes for approximately 2.5 hours (timed composite) at Sites CC-10, CT-2, and SC-3. Site SC-1 has a faster response time to precipitation events. Therefore, it takes samples every 15 minutes for approximately 1.5 hours (timed composite). Personnel from CEC retrieved the samples collected by the automatic samplers, transferred them to water bottles, and immediately delivered the samples to the C&A laboratory for nutrient analysis. Peak storm flows generally occurred in the evening (often between 10:00 p.m. and midnight). Thus, sample retrieval was made the following morning (usually between 8:00 a.m. and 9:00 a.m.).

TABLE 1: Number of storm samples taken from tributary streams to Cherry Creek Reservoir, 2001.

	Site					
	SC-1	SC-3	CC-10	CC-O	CT-1	CT-2
Number of Storm Samples	3	3	3	0	4	4

An alternative to using timed composites would be to collect stream water samples using flow-weighted composites, which are composed of subsamples collected every five minutes for two hours. The volume of each of these subsamples depends on the volume of streamflow, with larger subsamples taken during higher flows, and smaller subsamples taken during lower flows. To compare the differences between timed and flow-weighted composites in 2001, both methods were to be used to collect storm samples at Site CT-1, the only sampler currently with a multiple-bottle (24 bottles) sampling cage. However, due to ISCO malfunctions and lack of significant storm events following repairs, flow-weighted composites were not collected in 2001.

Precipitation Sampling

Precipitation samples were collected during three storm events in 2001. The precipitation sampler consisted of a clean, inverted plastic trash can lid used to funnel rain into a 1-gallon container. This sampler was located at adjacent to the Quincy Drainage within the State Park boundary (Fig. 1). The sampler was checked weekly to assure that any small precipitation events would not contaminate a sample collected at a later date. Between precipitation events, dryfall also accumulates in the sampler. Subsequently, it would be washed into the sample and combined with the precipitation sample. As such, precipitation samples include both wet and dry fall material. After each storm, the sample bottle was removed from the sampler and taken directly to the C&A laboratory for analysis of total phosphorus, total nitrogen, and nitrite- nitrate. Sufficient volume remained in all three samples to measure alkalinity, water hardness, pH, and suspended solids.

Surface Hydrology

Pressure transducers attached to ISCO Series 4200 or 6700 flowmeters measured and recorded water levels (stage) at five sites on three tributaries to Cherry Creek Reservoir (Fig. 1). These flow meters recorded water depth in 10-minute intervals year round. Streamflow (discharge) was estimated at these five sites using stage-discharge relationships developed for each stream site. Discharge measurements were taken using a Marsh McBirney Model 2000 flowmeter. For a complete description of streamflow determination, see Appendix C.

Laboratory Procedures

Nutrient Laboratory Analysis

Nutrient analyses for the water collected in the study, as described above, were conducted by the C&A laboratory in Littleton, Colorado. Split water samples of the photic whole-lake composite were sent to Dr. Jones, MU, for chemical and biological (chlorophyll) analyses as a quality assurance check. Table 2 lists the parameters analyzed and the methods that were used. Detailed methodologies are available from C&A.

Biological Laboratory Analysis

Biological analyses of the samples collected in the study were conducted by MU, C&A, and PhycoTech, Inc. (St. Joseph, MI). These analyses included species identifications and counts for the zooplankton and phytoplankton, and analysis of chlorophyll. The methods for these analyses, with appropriate

QA/QC procedures, are available from C&A. These analyses provided cell or organism counts per unit volume (cells/mL or organisms/m^3) and chlorophyll concentrations in µg/L.

TABLE 2: Parameter list, laboratory, method number, and detection limits for chemical analyses of water collected from Cherry Creek Reservoir and tributaries, 2001.

Parameter	Lab	Method	Detection Limit
Alkalinity	C&A	APHA 2320B	2 mg/L
Hardness	"	HACH 8266	2 mg/L
Total Phosphorus	"	QC 10-115-01-1-U	2 µg/L
Total Dissolved Phosphorus	"	QC 10-115-01-1-U	2 µg/L
Orthophosphorus	"	QC 10-115-01-1-T	3 µg/L
Total Nitrogen	"	APHA 4500-N B (modified)	4 µg/L
Total Dissolved Nitrogen	"	APHA 4500-N B (modified)	4 µg/L
Ammonia	"	QC 10-107-06-3-D	3 µg/L
Nitrate and Nitrite	"	QC 10-107-04-1-B	5 µg/L
TSS	"	APHA 2540D	4 mg/L
TVSS	"	APHA 2540E	4 mg/L
Chlorophyll	"	APHA 10200 H (modified)	1 µg/L
Coliform	"	APHA 9221B	2/100 mL
Fecal Coliform	"	APHA 9221E	2/100 mL
E. coli	"	APHA 9221F	2/100 mL
Total Suspended Solids	STL	MCAWW 160.2	4 mg/L
Total Volatile Suspended Solids	"	SM 18 2540E	10 mg/L
Total Aluminum	"	SW-846 6010 B	0.10 mg/L
Total Calcium	"	SW-846 6010 B	0.20 mg/L

Quality Assurance/Quality Control

To ensure data quality, a number of quality assurance checks were used. During each reservoir sampling episode, a photic water sample split/duplicate was taken from each reservoir site. Additionally, during each tributary sampling episode, a split/duplicate sample was taken at Sites CC-10 and CT-2, resulting in approximately 30% of the samples having a QA split/duplicate. These samples were shipped to Dr. Jones for analysis at his laboratory at MU. This provided an independent assessment of the lake water analyses conducted by C&A and STL.

In addition, field sampling quality control included the use of a field blank. This field blank contained laboratory grade deionized water in a sample container identical to those used in the field collections that was carried through the entire sampling episode. The cap of this container was removed at a particular site and left open during the regular sampling effort at that site. Upon completion of sampling at that site, the cap was replaced. One field blank was used for every sampling trip. The field blanks and duplicate samples were analyzed for all the parameters, identical to a routine sample. Chain of custody procedures were observed during the field sampling and delivery of samples to C&A and STL, and for samples shipped to Dr. Jones.

Results of QA/QC checks performed on the water quality data from the reservoir for 2001, with comparison between labs, are located in Appendix E. This analysis showed that results from the analytical labs were quite similar. As such, values reported herein are based on all results from both laboratories, unless otherwise noted.

Calculation of Phosphorus Loading

Phosphorus loading to Cherry Creek Reservoir from streams and precipitation was estimated for the 2001 calendar year using data on streamflow and precipitation, and their respective concentrations of phosphorus. Detailed discussion of the streamflow measurements and derivation of loads can be found in Appendix C.

Calculation of Long-Term Trends in Cherry Creek Reservoir

Long-term analyses for Secchi depth, total phosphorus, and chlorophyll levels were determined by averaging yearly seasonal (July to September) values from each reservoir site between 1987 and 2001. Yearly values were compared using linear regression analysis (described below). Additionally, annual results were analyzed using a 95% confidence interval. These analyses were used to determine if there were any significant increasing or decreasing trends in Secchi depth, total phosphorus, and chlorophyll levels over time.

The statistical analyses to determine the relationship between total phosphorus concentration and flow, stage discharge relationship, QA/QC between labs, and comparisons of biological and physical parameters for each site were conducted using NCSS 2000 statistical software. In order to decrease the relationship between the variance and the mean of the data, natural log transformations were performed prior to linear regression analysis, as appropriate. In some cases, the natural log transformation did not improve the relationship and, therefore, the non-transformed values were used in the linear regression. A value of P # 0.05 was used to indicate statistical significance.

RESULTS AND DISCUSSION

Reservoir Water Quality

Alkalinity and pH

The alkalinity in Cherry Creek Reservoir was slightly lower in 2001 as compared to 2000. In 2001, the whole-reservoir photic zone mean alkalinity value ranged from 135 to 171 mg/L as $CaCO_3$ (Fig. 2), versus a range of 150 to 185 mg/L as $CaCO_3$ in 2000. Values observed in 2001 are similar to those observed in the Reservoir between 1994 and 2000 and continue to indicate a well-buffered system. The mean whole-reservoir photic pH value ranged between 7.51 and 8.65 (Fig. 2).

Suspended Solids

The mean whole-lake concentration of total suspended solids (TSS) in the photic zone of Cherry Creek Reservoir ranged from a high of 23.8 mg/L to a low of 6.8 mg/L (Fig. 3). The annual mean concentration of TSS was 14.4 mg/L with a standard deviation of 4.1 mg/L, higher than the value observed in 2000 (10.6 mg/L). The relationship between whole reservoir mean photic concentration of TSS and total inflow to the reservoir was not statistically significant ($p > 0.05$).

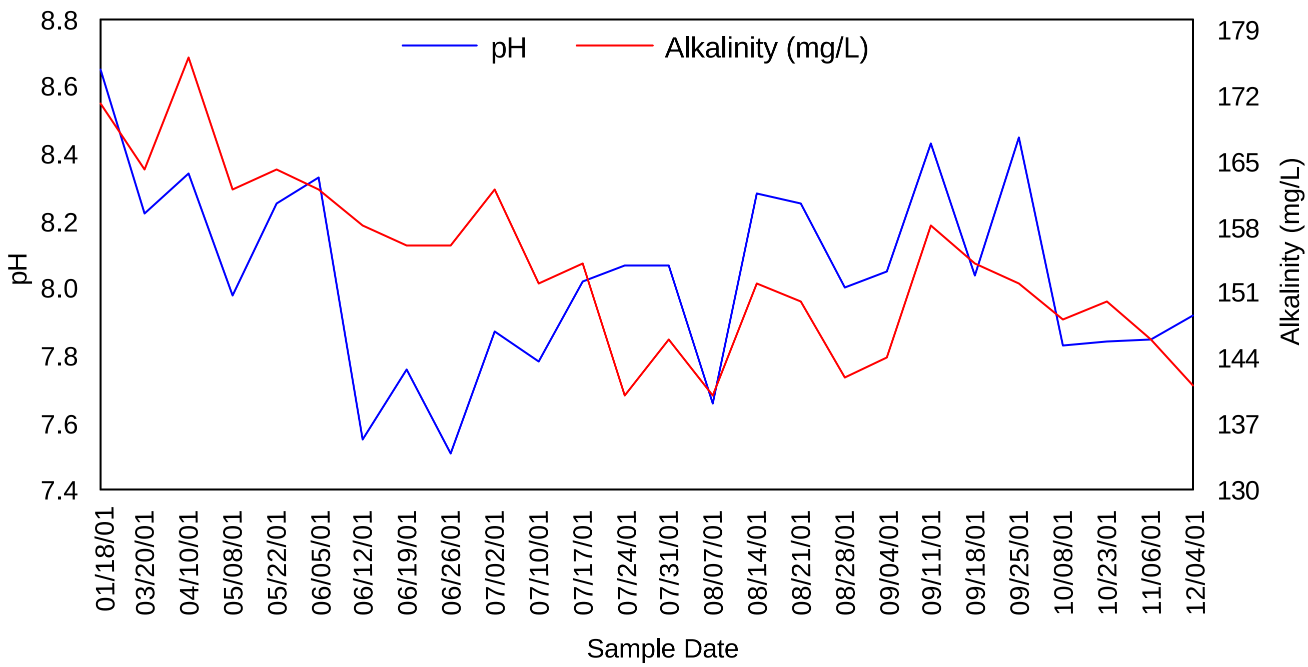

FIGURE 2: Mean whole-reservoir photic pH and alkalinity (mg/L as $CaCO_3$) concentrations in Cherry Creek Reservoir, 2001.

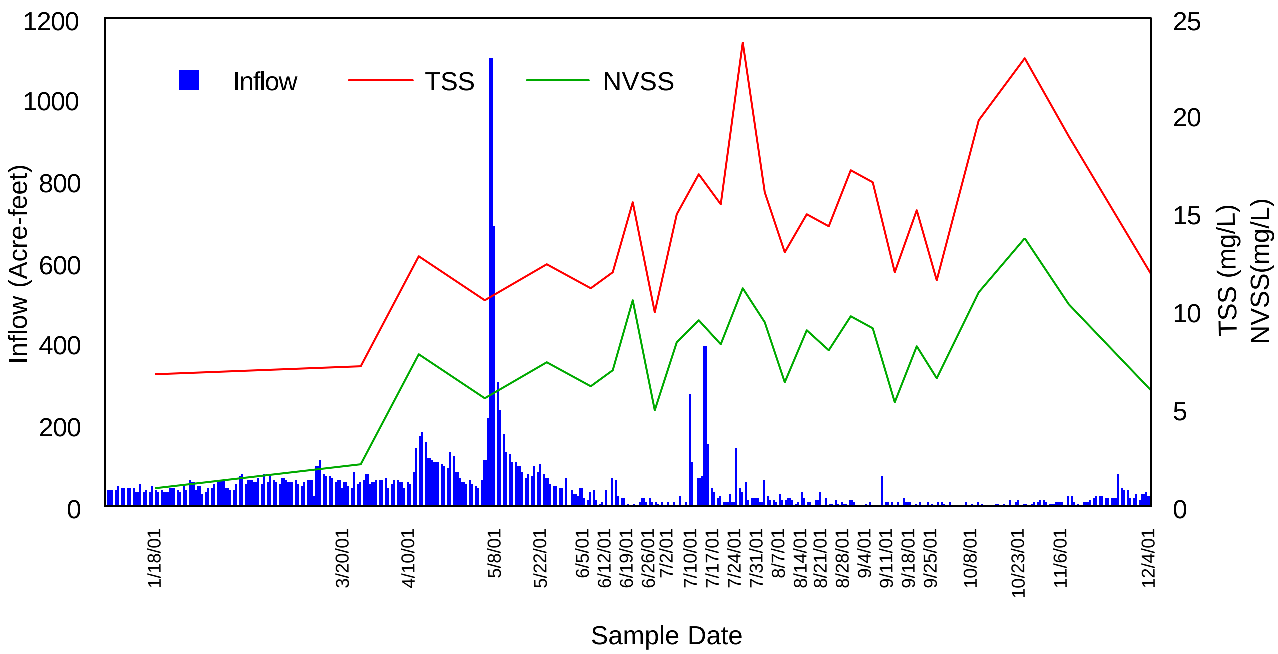

FIGURE 3: Relationship between TSS (mg/L), inflow (acre feet [AF]), and NVSS (mg/L) in Cherry Creek Reservoir, 2001.

Transparency

The whole-reservoir mean Secchi depth varied from a low of 0.50 m in late July to a high of 1.2 m in mid-June. The whole-reservoir mean was 0.75 m (standard deviation of 0.15 m) between July and September 2001. This value is lower than those observed in the reservoir recently (Fig. 4). The whole-reservoir mean maximum depth of 1% light transmittance ranged from a high of 3.23 m in mid-May to a low of 0.70 m in mid-January. Deepest recorded 1% transmittance values were observed March - July (mean = 2.56 m, median = 2.68 m).

Analysis of 2001 data indicated that Secchi depth was not significantly ($p > 0.05$) related to TSS. Conversely, 1% transmittance was significantly and negatively influenced by TSS ($p = 0.004$, $R^2 = 0.487$). Although the above relationships are differing, TSS did account for roughly 50% of the variation in annual measurements of Secchi depth and 1% transmittance. TSS did not have a significant influence on July to September Secchi depth and 1% transmittance ($p > 0.05$). Additionally, no significant relationship could be determined between Secchi depth and chlorophyll *a* concentrations and phytoplankton densities (Fig. 5).

Long-Term Secchi Transparency Trends in Cherry Creek Reservoir

Routine monitoring data collected since 1987 suggest a trend of increasing water clarity through 1996, followed by a decreasing trend in seasonal Secchi depth since 1997. There is not, however, a statistically significant long-term upward or downward trend ($p > 0.05$, $R^2 = 0.015$) over the period of record (Fig. 4).

Dissolved Oxygen and Temperature

Analysis of past Cherry Creek Reservoir temperature profiles indicates that stratification occurs when there is a >2EC difference between surface and bottom temperatures (Jones 1998). Differences of approximately 1EC suggest a recent mixing event (Jones 1998). Using the above criteria, Cherry Creek Reservoir was investigated for periods of potential stratification and anoxic levels (Figs. 6 - 11).

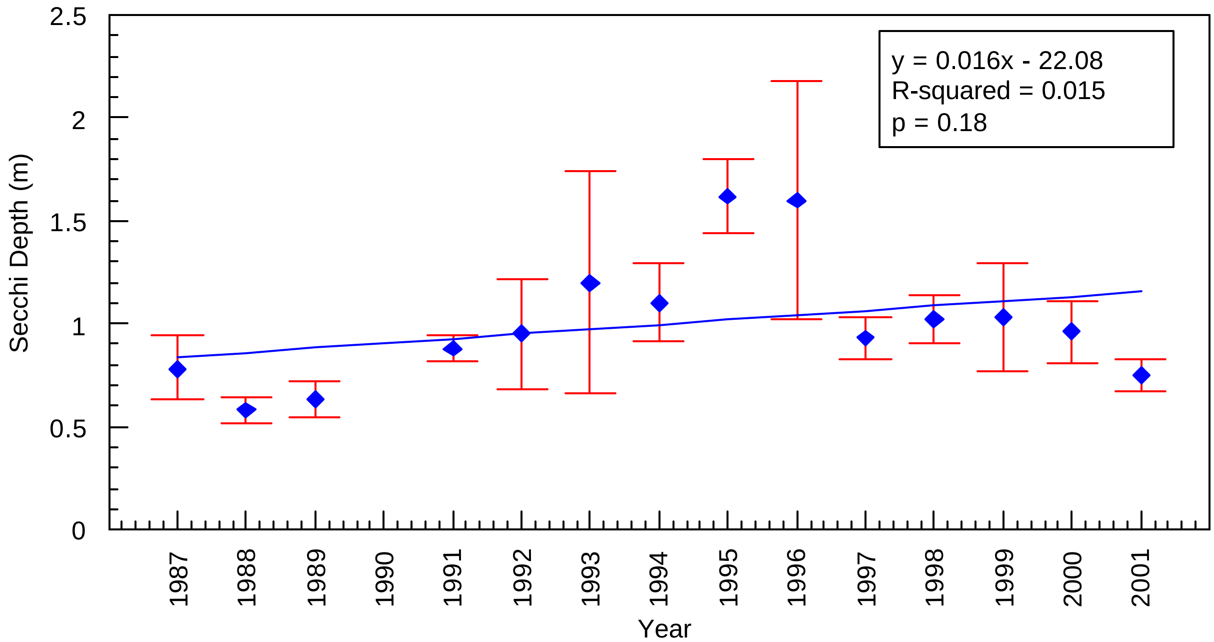

FIGURE 4: Seasonal mean (July to September) Secchi depths (m) measured in Cherry Creek Reservoir (1987 to 2001). Error bars represent a 95% confidence interval around each mean.

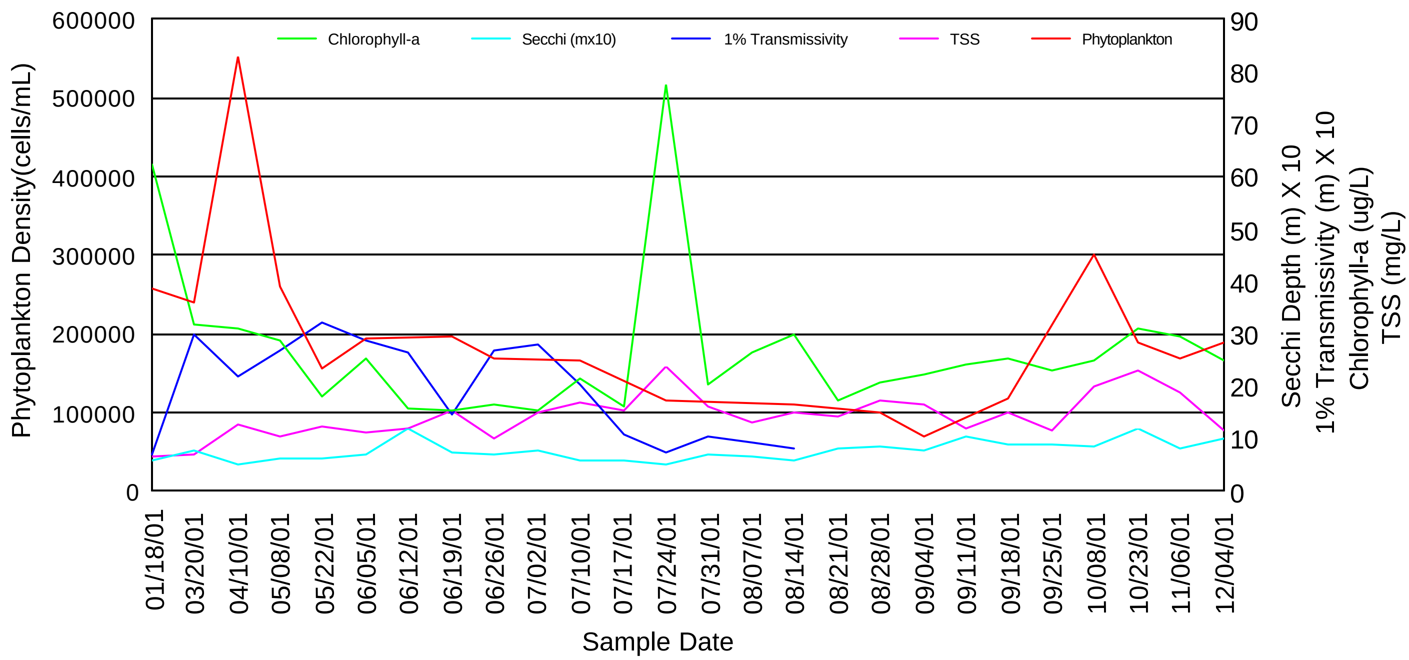

FIGURE 5: Relationship between Secchi depth (× 10), 1% transmissivity (× 10), chlorophyll and total suspended solids in Cherry Creek Reservoir, 2001.

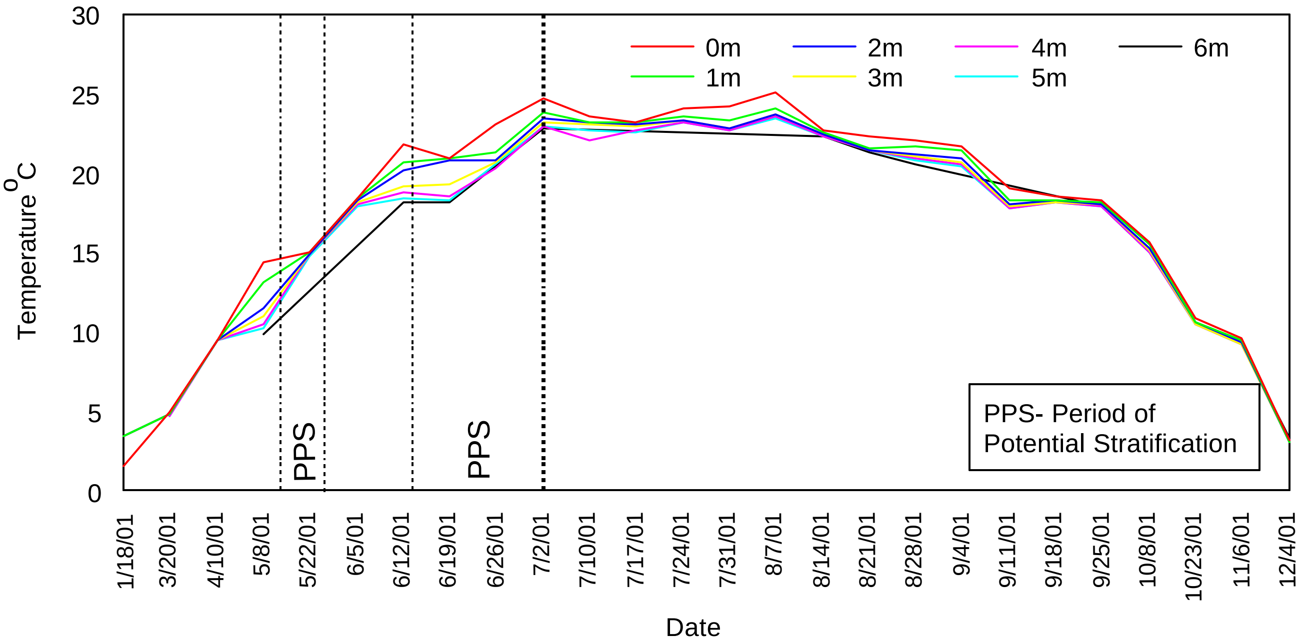

FIGURE 6: Temperature (EC) profiles recorded during routine monitoring at Site CCR-1 in 2001.

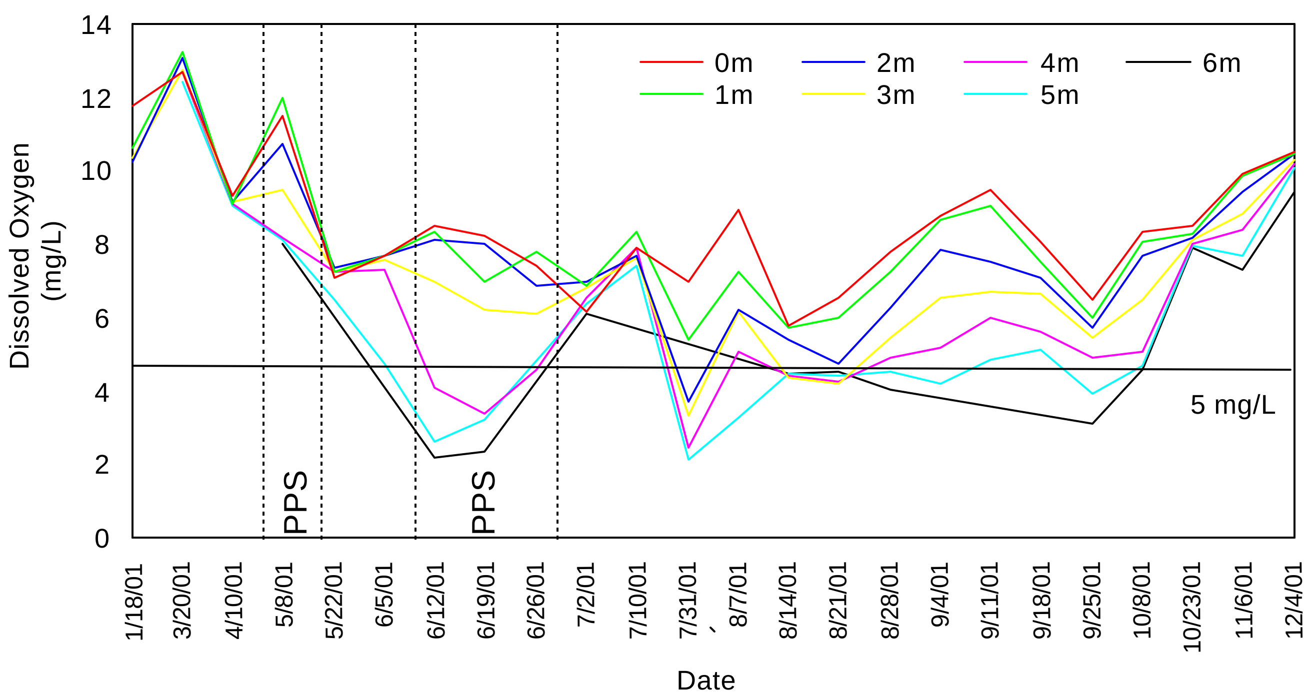

FIGURE 7: Dissolved oxygen (mg/L) profiles recorded during routing monitoring at Site CCR-1 in 2001.

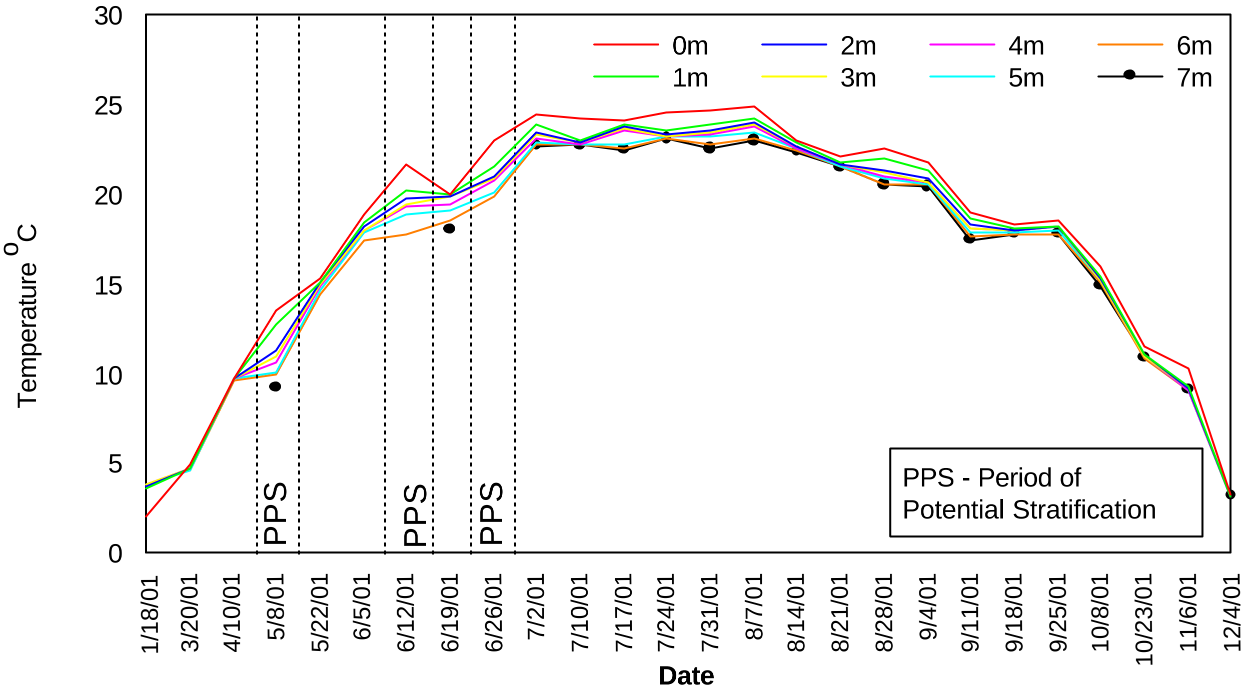

FIGURE 8: Temperature (EC) profiles recorded during routine monitoring at Site CCR-2 in 2001.

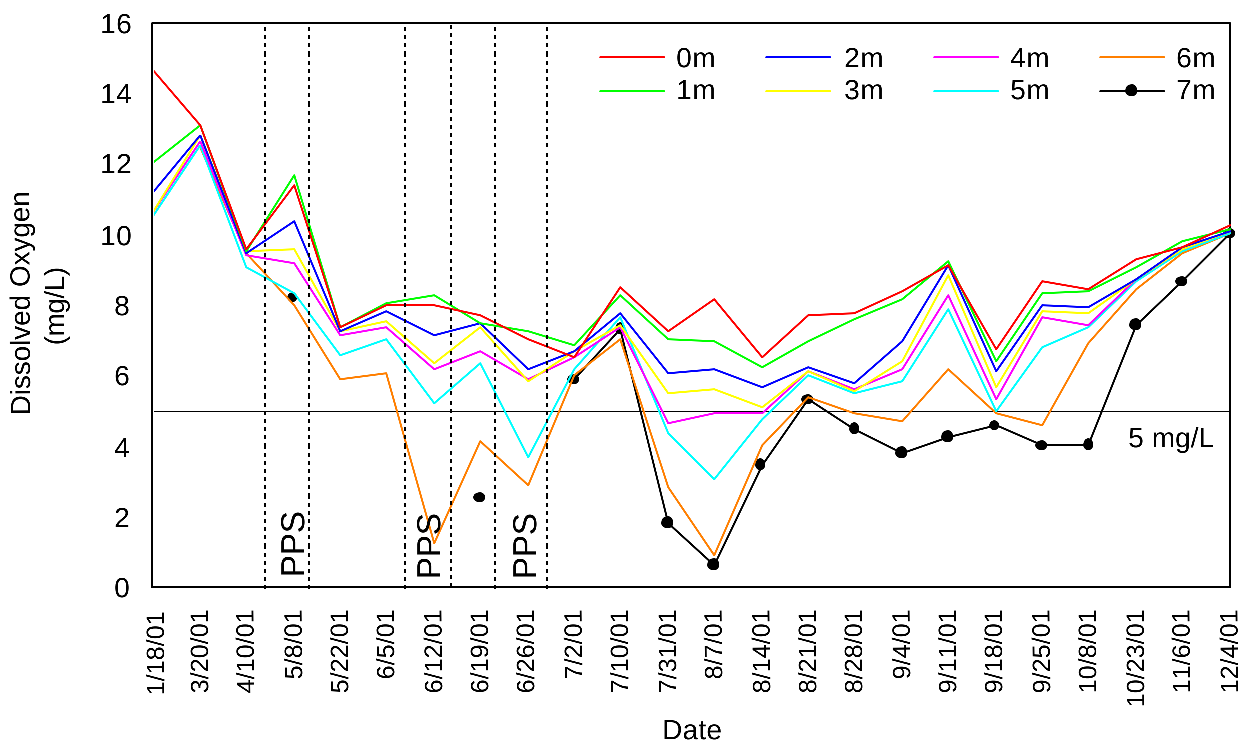

FIGURE 9: Dissolved oxygen (mg/L) profiles recorded during routine monitoring at Site CCR-2 in 2001.

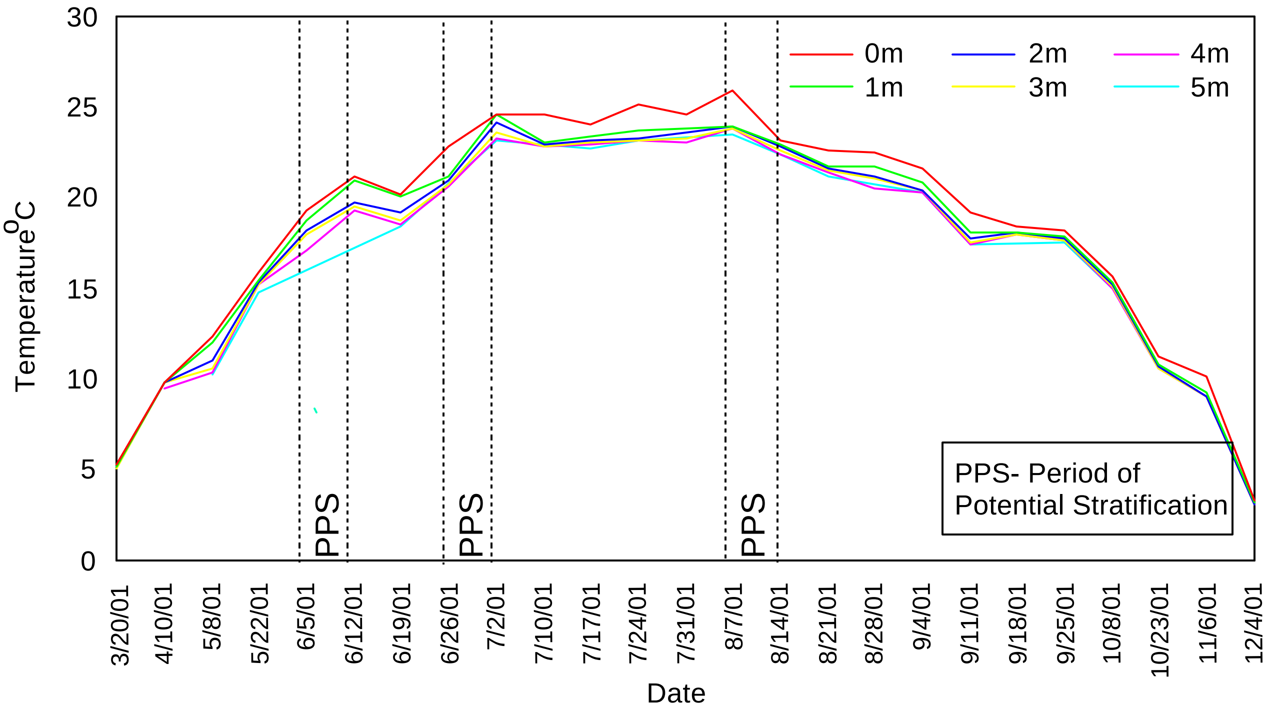

FIGURE 10: Temperature (EC) profiles recorded during routine monitoring at Site CCR-3 in 2001.

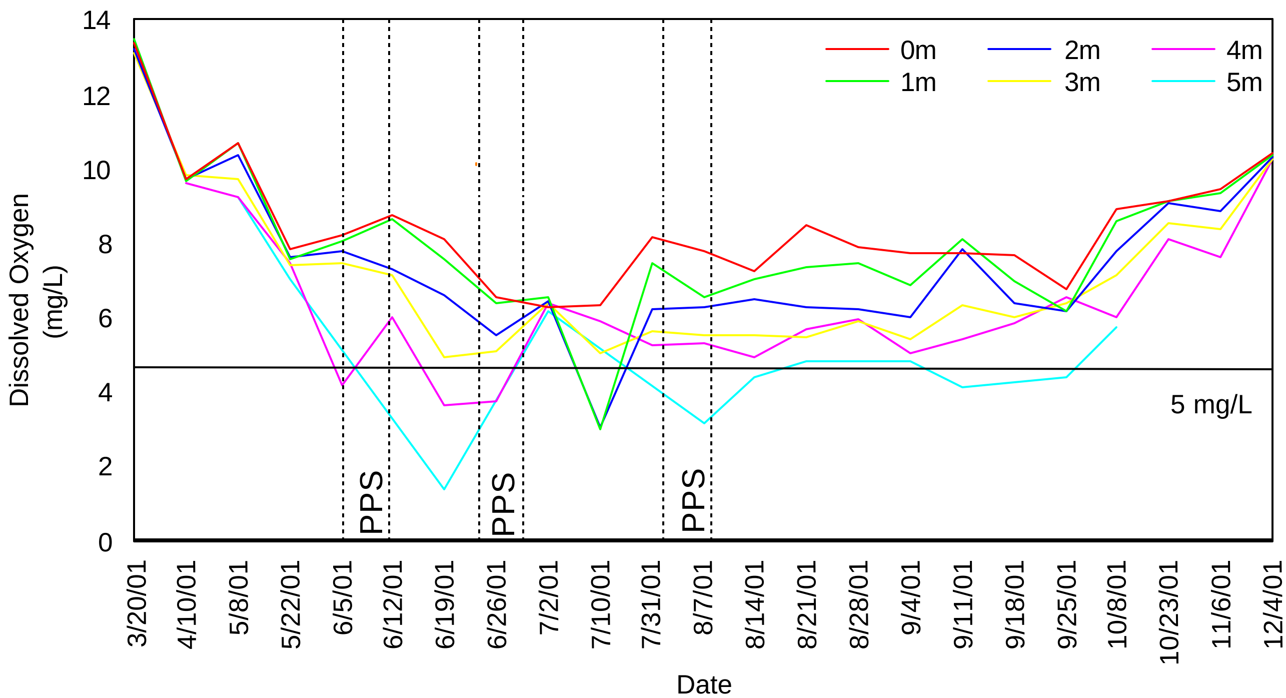

FIGURE 11: Dissolved oxygen (mg/L) profiles recorded during routine monitoring at Site CCR-3 in 2001.

The temperature in Cherry Creek Reservoir ranged from a high of 23.96EC in early August to a low of 3.16EC in early December. As in previous years, periods of limited thermal stratification were observed in the Reservoir. These stratification periods were most pronounced at Sites CCR-1 and CCR-2 (Figs. 6 and 8). Relative to the stratification observed as Sites CCR-1 and CCR-2, only minor stratification was observed at Site CCR-3, which is a much shallower site (Fig. 10). The first period of stratification occurred during May. Subsequent periods of stratification occurred through the month of June and early in August.

The concentration and depth distribution of dissolved oxygen was similar at the two deep-water sites, CCR-1 and CCR-2 (Figs. 7 and 9). The DO concentrations at Site CCR-3 followed the same trend as was observed at the deep-water sites, but because of the lesser stratification and shallow depth at this site, the magnitude of DO change was less than that at the deep-water sites (Fig. 11).

The reservoir was examined for periods of depressed dissolved oxygen levels, those below 5 mg/L. This value has been set by the Colorado Department of Public Health and Environment (2001) as the warmwater aquatic life standard. For lakes, this criteria is intended to apply to the upper levels when the lake is stratified (i.e., the epilimnion and metalimnion). As such, during those periods when the lake appears to be stratified (i.e., greater than a 2°C difference from surface to bottom), the 5 mg/L criteria would apply primarily to the middle and upper depths (perhaps 4-5 m).

DO concentrations were highest in the spring, fall, and winter as would be expected. A period of supersaturation in the top several meters of the reservoir occurred in July and was most likely due to the photosynthetic activities of phytoplankton in the photic zone of the reservoir. During periods of stratification, the lower layers of the reservoir experienced depressed DO concentrations. At Site CCR-1, the DO concentration dropped below 5.0 mg/L at levels at and below 4 meters for several weeks. This DO depression extended as shallow as 2-3 meters during late July and mid-August at Site CCR-1. Similar concentrations were observed at Site CCR-2 at levels at and below 6 m from late July to late September. Additionally, beginning in late July and lasting through mid-August, concentrations below 5.0 mg/L were observed at 4 and 5 m despite no measurable temperature stratification (Fig. 8). During this period, 29% of the whole-lake volume experienced DO depletion below 5.0 mg/L. DO depletion occurred in no more than 8.8% of the whole-lake volume for the rest of the year at Site CCR-2. Only one brief, extended period of DO depletion was observed at Site CCR-3. This occurred from mid-August to mid-September.

Reservoir Nutrients

Monitoring at Cherry Creek Reservoir has focused on the concentrations of phosphorus and nitrogen. Phosphorus and nitrogen are inorganic nutrients in aquatic systems and are necessary for life. Often, these nutrients are the limiting factor in the growth of algae (Cole 1979, Goldman and Horne 1983, Wetzel 2001, Cooke *et al.* 1993). Excessive amounts of these nutrients in aquatic systems may result in algal blooms which create aesthetic problems as well as potentially hazardous conditions for aquatic life.

In 2001, the whole reservoir mean concentration of total phosphorus in the photic zone ranged from 57 to 132 µg/L with an overall annual mean of 81 µg/L (Fig. 12). Between July and September the concentration of total phosphorus in the photic zone ranged from 62 to 132 µg/L, with a mean of 87 µg/L. These values are similar to those observed in 1997 through 2000 (Table 3). Although some peak values appeared related to inflow events, others occurred during periods of no significant inflow. Over the year, total phosphorus concentration in the photic zone was not significantly related to inflow ($p > 0.05$, $R^2 = 0.13$).

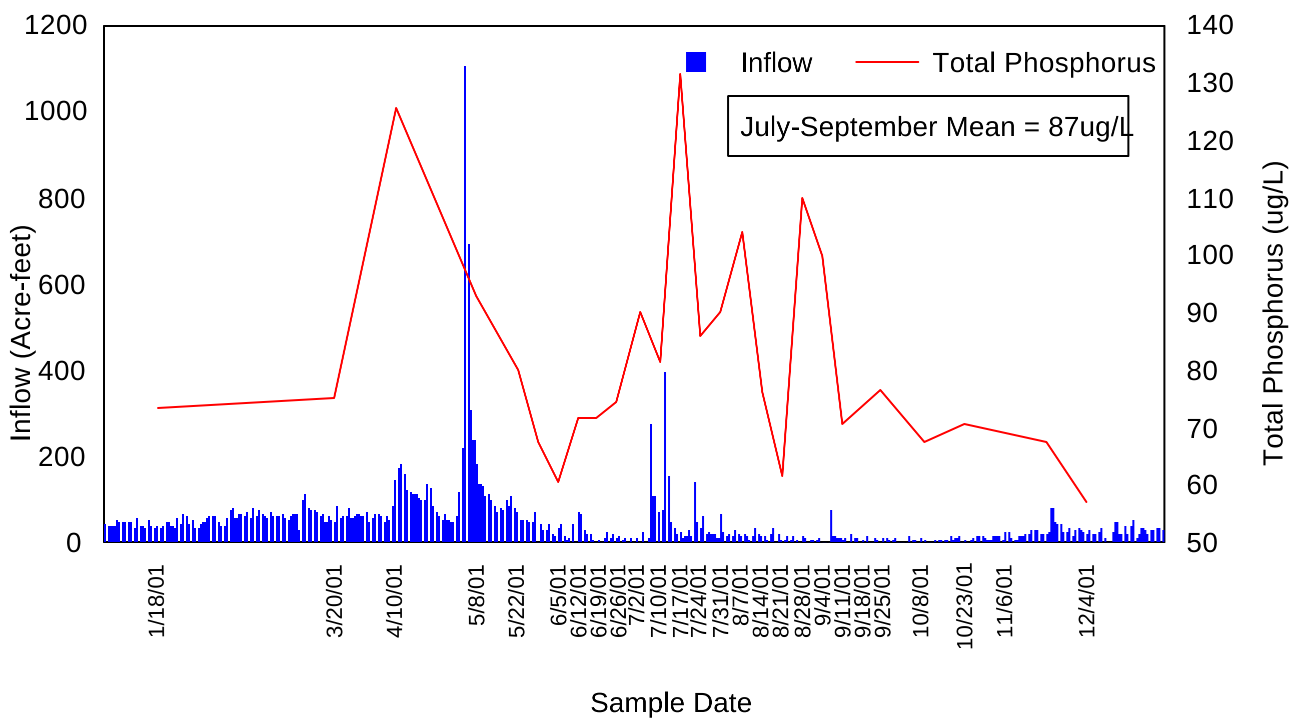

FIGURE 12: Relationship between TP (µg/L) and inflow (AF) in Cherry Creek Reservoir, 2001.

TABLE 3: Comparison of annual mean (monitoring period) and July-September mean phosphorus, nitrogen, and chlorophyll levels in Cherry Creek Reservoir, 1987-2001. Annual means based on January through December sampling.

Year	Source of Data	Total Nitrogen (µg/L) Annual	Total Nitrogen (µg/L) July-Sept.	Total Phosphorus (µg/L) Annual	Total Phosphorus (µg/L) July-Sept.	Mean Chlorophyll (µg/L) Annual	Mean Chlorophyll (µg/L) July-Sept.
1987	In-Situ 1987	1,580	741	86	93	11.1	8.3
1988	In-Situ 1988	902	1,053	52	49	21.8	31.8
1989	ASI 1990	803	828	45	39	8.5	5.6
1990	ASI 1991a	600	--	58	55	2.3	8.6
1991	ASI 1991b	1,067	1,237	86	56	9.7	9.8
1992	ASI 1993	790	970	54	66	12.1	17.0
1993	ASI 1994a	790	826	50	62	12.5	14.4
1994	CEC 1995	1,134	1,144	86	59	8.8	10.0
1995	CEC 1996	910	913	48	48	10.2	9.4
1996	CEC 1997	889	944	54	62	16.9	20.5
1997	CEC 1998	976	1,120	75	96	16.1	22.3
1998	CEC 1999	850	880	82	89	20.4	26.5
1999	CEC 2000	715	753	80	81	20.8	28.9
2000	CEC 2001	784	802	81	81	22.0	25.2
2001	Present Study	740	741	81	87	26.7	26.1
Long-term average		902	925	68	68	14.7	17.6
Median		850	897	75	62	12.5	17.0

Correlation analyses were also performed to determine the relationship of total phosphorus to other parameters measured in the reservoir. The whole reservoir mean concentration of total phosphorus in the photic zone was significantly (P # 0.05) related to chlorophyll *a* (slope = 0.63, R^2 = 0.22) and Secchi depth (slope = -65.4, R^2 = 0.41). Conversely, the whole reservoir mean concentration of phosphorus in the photic zone was not significantly ($P > 0.05$) related to aluminum (slope = -38.5, R^2 = 0.11), calcium (slope = 0.03, R^2 = 0.00), TSS (slope = 1.21, R^2 = 0.05), 1% transmittance (slope = -8.7, R^2 = 0.168), or phytoplankton density (slope = 1,078.9, R^2 = 0.05).

Nutrient profile samples collected in 2001 showed a well-mixed reservoir in spring and fall (Fig. 13). It appears there were brief periods of nutrient release from bottom sediments through the summer during periods of temperature stratification and low dissolved oxygen at the bottom (Figs. 8 and 9). Elevated total phosphorus concentrations at 7 m appear to coincide with elevated levels of TSS (Appendix A). In light of this observation, it is reasonable to assume that sampling equipment may have disrupted the underlying sediment yielding higher-than-expected concentrations of total phosphorus and TSS.

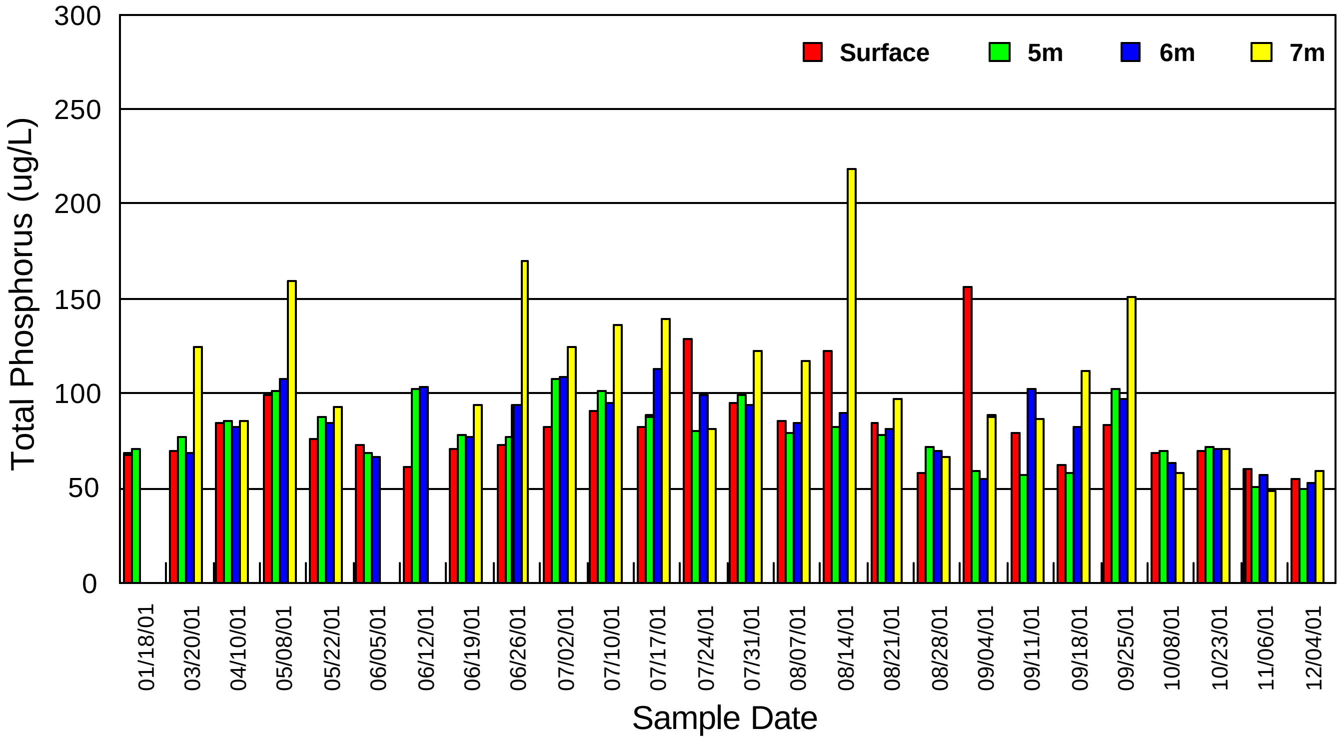

FIGURE 13: Phosphorus concentrations from profile samples at Site CCR-2, Cherry Creek Reservoir, 2001.

The whole reservoir mean concentration of total nitrogen in the photic zone ranged from 577 to 1,129 µg/L, with a mean of 740 µg/L in 2001 (Table 3). During the July to September period the whole reservoir mean total nitrogen concentration ranged from 587 to 974 µg/L, with a mean concentration of 741 µg/L (Table 3). Total nitrogen was significantly ($P < 0.05$) correlated with chlorophyll *a* (slope = 7.2, $R^2 = 0.50$) and Secchi depth (slope = 304.1, $R^2 = 0.21$).

Long-Term Phosphorus Trends in Cherry Creek Reservoir

Routine monitoring data collected since 1987 indicates a generally increasing trend in summer mean concentration of total phosphorus (Fig. 14). In 2001, the summer mean concentration of total phosphorus was 87 µg/L. This value is higher than the 1999 and 2000 value of 81 µg/L, but lower than the 1998 value, 89 µg/L. Statistical analyses performed 1987-2001 data indicates a significant ($p = 0.046$), but weak (slope = 0.129, $R^2 = 0.27$), upward trend.

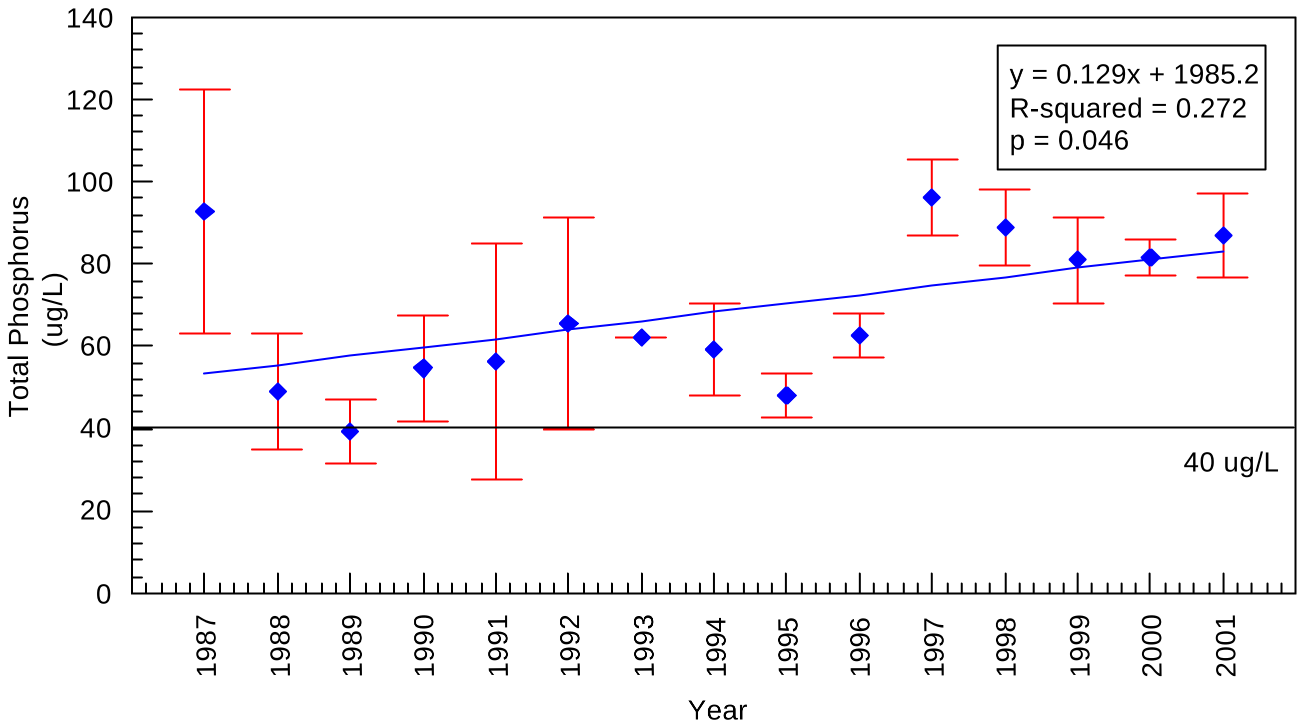

FIGURE 14: Seasonal mean (July to September) total phosphorus concentrations (µg/L) measured in Cherry Creek Reservoir, 1987-2001. Error bars represent a 95% confidence interval around each mean.

Annual mean concentration of TP was the same mean concentration value observed in 2000 (81 µg/L). This value further substantiates a leveling trend in the reservoir which began to emerge in 1998. Since 1998, annual mean TP values have ranged from 80 to 82 µg/L (Table 3).

Chlorophyll Levels

The mean whole reservoir concentration of chlorophyll *a* showed a general decreasing trend from January through early July (Fig. 15). Concentrations spiked to their highest annual level in mid-July (77.5 µg/L). Following the spike, concentrations of chlorophyll *a* dropped considerably and remained generally stable through December. The reservoir experienced its lowest concentration, 15.25 µg/L, in early July. The annual mean chlorophyll *a* concentration of 26.7 µg/L is the highest yet recorded (Table 3), superceding the 2000 value (22.0 µg/L). The July to September mean chlorophyll *a* concentration of 26.1 µg/L was also greater than the 2000 value of 25.2 µg/L. The 2001 seasonal mean is, however, less than both

1999 (28.9 µg/L) and 1998 (26.5 µg/L) values (Table 3). Both the year 2001 annual mean and the July to September mean exceeded the standard of 15 µg/L chlorophyll *a* for the reservoir.

Long-Term Chlorophyll Trends in Cherry Creek Reservoir

Since 1987, there has been a general increasing trend (slope = 0.29, R^2 = 0.32) in the July-to-September mean concentration of chlorophyll *a* in Cherry Creek Reservoir (Fig. 16). According to 2001 statistical review, this trend is significant (p = 0.027), but weak. To obtain further statistical analysis of these data, a one-way analysis of variance was performed. Results of this test indicate that there is no significant difference between seasonal mean chlorophyll *a* concentrations, from 1996 through 2001.

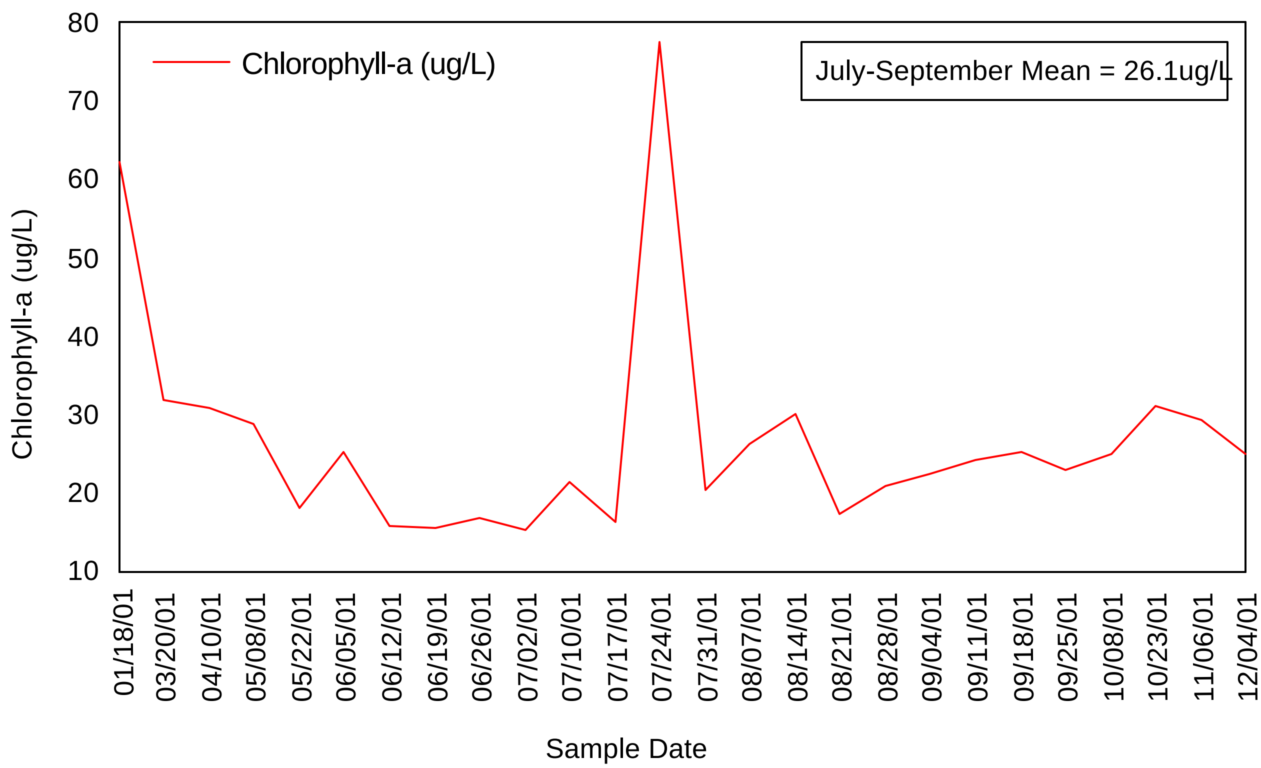

FIGURE 15: Concentration of chlorophyll (µg/L) in Cherry Creek Reservoir, 2001.

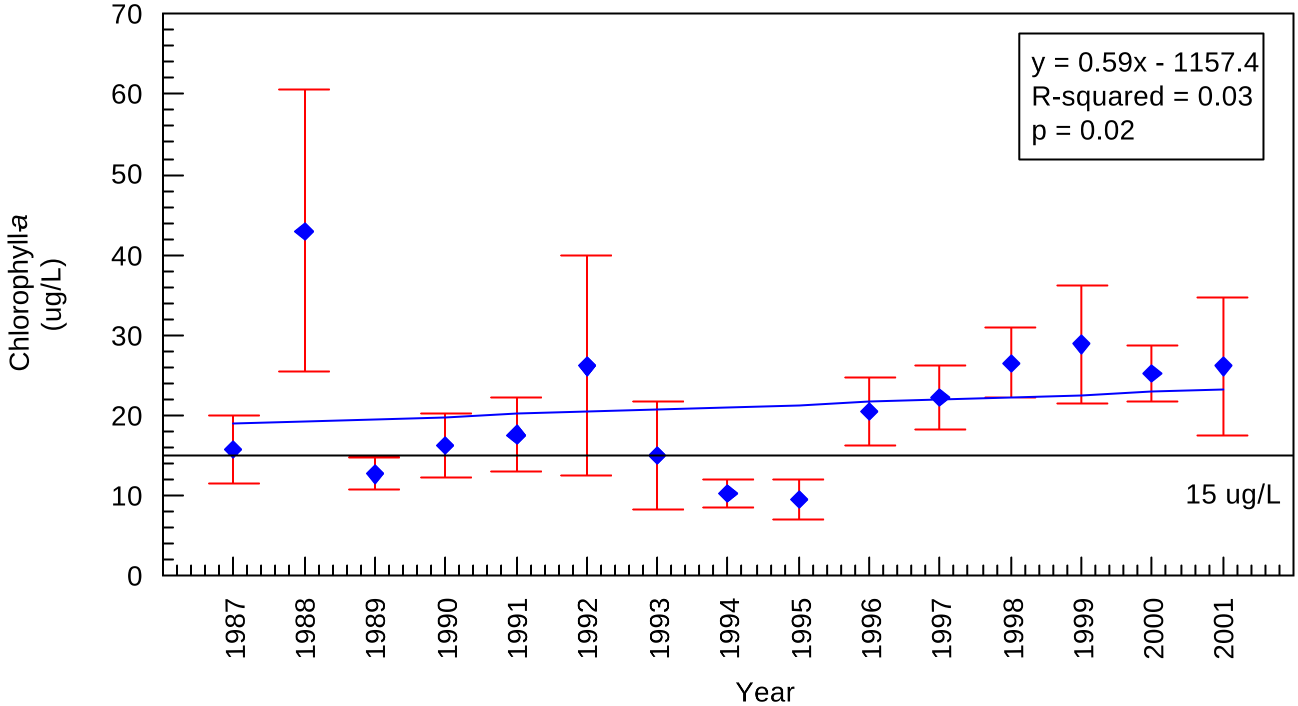

FIGURE 16: Seasonal mean (July to September) chlorophyll *a* concentrations measured in Cherry Creek Reservoir, 1987 to 2001. Error bars represent 95% confidence interval around each mean.

Reservoir Biology

Phytoplankton and Zooplankton

Phytoplankton Populations

The mean density of phytoplankton in Cherry Creek Reservoir ranged from 68,718 cells/mL on September 4 to 552,245 cells/mL on April 10 (Table 4). The number of taxa present in the reservoir ranged from a low of 33 on June 19 and reached a high of 50 on August 28. Phytoplankton abundances were highest in the spring and fall months. Annually, the community was dominated by blue-green algae. Green algae were the second most prevalent group. The April spike appears to be related to a concurrent total phosphorus concentration spike (Fig. 17). However, no significant relationship could be determined between phytoplankton density and total phosphorus concentration ($p > 0.05$). Additionally, no significant relationship could be determined between phytoplankton density and chlorophyll *a* or total nitrogen concentrations.

TABLE 4: Mean density (cells/mL) of phytoplankton and total number of taxa collected from all three sites on Cherry Creek Reservoir, 2001.

Taxa	16 Jan	20 Mar	10 Apr	8 May	22 May	5 June	19 June	26 June	10 July
Diatoms									
Centrics	2,171	984	2,953	11,966	17,391	1,313	1,562	8,334	8,214
Pennates	0	1,318	12,285	174	643	598	11	87	35
Green Algae	39,748	65,214	68,929	39,321	33,283	65,703	37,143	29,829	7,121
Blue-Green Algae	188,424	146,842	438,910	201,184	96,955	123,295	152,705	126,766	149,401
Golden-Brown Algae	7,206	1,737	3,906	695	348	911	781	43	35
Euglenoids	0	0	0	0	15	260	65	98	35
Dinoflagellates	261	608	260	0	174	65	0	43	138
Cryptomonads	5,730	9,550	2,084	1,997	3,299	1,367	1,302	1,216	833
Miscellaneous	13,890	14,758	22,918	3,907	4,775	326	3,093	2,214	1,146
Mean Density	**257,430**	**241,011**	**522,245**	**259,244**	**156,883**	**193,838**	**196,662**	**168,630**	**166,958**
Total Taxa	**35**	**34**	**36**	**36**	**37**	**39**	**33**	**36**	**36**

Taxa	24 July	14 Aug.	28 Aug.	4 Sept.	18 Sept.	8 Oct.	23 Oct.	6 Nov.	4 Dec.
Diatoms									
Centrics	1,493	854	2,640	2,608	2,049	2,258	4,515	2,409	998
Pennates	122	22	220	556	347	0	608	1,303	1,562
Green Algae	30,066	3,691	9,893	11,670	8,292	27,284	37,598	41,170	41,947
Blue-Green Algae	80,418	99,431	82,541	50,855	94,385	266,379	133,344	110,015	134,588
Golden-Brown Algae	35	73	35	0	313	1,390	1,736	976	4,011
Euglenoids	18	30	18	35	61	87	608	195	104
Dinoflagellates	9	171	104	104	174	0	0	195	521
Cryptomonads	660	1,563	798	556	9,098	2,778	3,907	3,125	1,458
Miscellaneous	2,917	3,516	3,334	3,334	3,021	1,953	5,643	9,115	2,995
Mean Density	**115,738**	**109,351**	**99,583**	**69,718**	**117,740**	**302,129**	**187,959**	**168,503**	**188,184**
Total Taxa	**39**	**38**	**50**	**41**	**48**	**38**	**49**	**41**	**41**

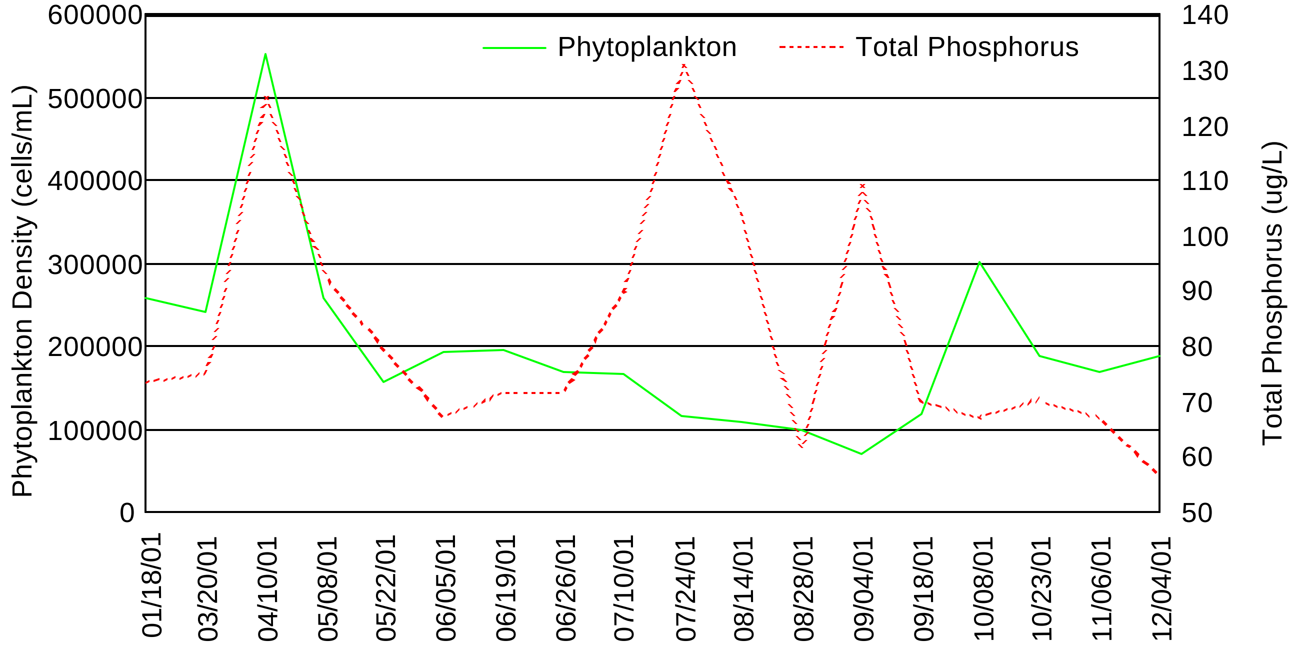

FIGURE 17: Comparison of mean phytoplankton densities from the three reservoir sampling sites to mean total phosphorus concentrations from three sites in Cherry Creek Reservoir, 2001.

Phytoplankton Historical Trends

As in previous years, the phytoplankton community was dominated by blue-green algae (Table 5). The proportion of the total phytoplankton abundance accounted for by blue-green algae in 2001 (75%) was similar to that observed in previous years (64 - 91%). Additionally, the proportions of the phytoplankton community comprised by green algae, diatoms, golden-brown algae, euglenoids, and cryptomonads were similar to that observed in previous years. The proportion of the community made up of dinoflagellates was slightly higher than that observed in recent years, but within the range of historic variation seen in other groups. Total abundance and total taxa observed in 2001 were slightly less than that seen in 2000.

TABLE 5: Reservoir mean phytoplankton density (cells/mL) and number of taxa in Cherry Creek Reservoir, 1984 to 2001.

Density, Richness	1984	1985	1986	1987	1988	1989	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Blue-Green Algae																	
Density	71,780	66,496	99,316	168,259	155,180	273,175	307,691	77,516	15,708	10,015	18,194	16,599	19,716	44,951	15,263	164,290	148,691
Taxa Richness	7	7	6	18	24	24	14	16	7	3	7	9	10	11	8	19	12
Green Algae																	
Density	5,864	11,760	25,595	11,985	19,177	55,415	18,688	41,899	1,198	314	355	738	2,461	1,809	898	43,881	33,217
Taxa Richness	11	10	13	58	76	66	46	48	16	2	11	11	1,518	18	18	71	56
Diatoms																	
Density	1,776	3,863	5,428	10,677	12,880	9,311	4,160	1,243	946	194	2,189	2,354	1,109	628	838	12,019	5,256
Taxa Richness	6	4	7	34	30	31	21	11	15	2	15	13	8	18	16	34	22
Golden-Brown Algae																	
Density	--	7	125	469	56	505	821	93	158	3	63	249	227	56	--	391	1,346
Taxa Richness	--	1	1	6	4	7	5	4	1	1	2	4	2	2	--	14	13
Euglenoids																	
Density	514	135	208	251	276	108	89	23	231	196	304	409	838	698	1,252	126	91
Taxa Richness	2	1	1	9	9	6	3	5	2	1	2	3	3	3	1	6	4
Dinoflagellates																	
Density	--	13	19	19	83	28	23	54	--	31	5	21	--	18	45	80	157
Taxa Richness	--	1	1	2	4	3	2	2	--	1	2	4	--	2	2	8	6
Cryptomonads																	
Density	1,513	718	1,113	1,090	2,689	1,689	628	529	332	450	919	1,104	1,487	1,393	559	2,472	2,851
Taxa Richness	2	3	3	6	4	5	2	3	1	1	1	1	1	1	1	4	6
Miscellaneous																	
Density	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1,923	5,714
Taxa Richness	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	1	1
Total Density	**81,447**	**82,992**	**131,804**	**192,750**	**190,341**	**340,231**	**329,773**	**121,357**	**18,573**	**11,203**	**22,029**	**21,474**	**25,838**	**49,453**	**18,855**	**225,182**	**197,323**
Total Taxa	**28**	**27**	**32**	**133**	**151**	**142**	**93**	**89**	**42**	**11**	**40**	**45**	**39**	**55**	**46**	**157**	**120**

Zooplankton Populations

The mean density of zooplankton in the reservoir ranged from 2,567 to 446,399 (Table 6). Zooplankton densities were lowest in early spring, trending higher until mid-summer when the trend became decreasing. The highest zooplankton density was observed in December, a spike that surmounted an increasing fall trend. Members of the Order Cladocera were the dominant group for the first half of the year. From July to December, the dominant taxa became rotifers. These shifts in community dominance are typical of zooplankton as many species of zooplankton exhibit distinct seasonal preferences and trends in temperate lakes (Boersma *et al.* 1996).

The density of phytoplankton appeared to be mildly influenced by zooplankton grazing pressures. Yet, the density of zooplankton in the Class Crustacea were not significantly ($P > 0.05$) related to the density of phytoplankton in the reservoir in 2001 (Fig. 18). Likewise, there was no statistical relationship between total density of zooplankton and the density of phytoplankton ($p > 0.05$).

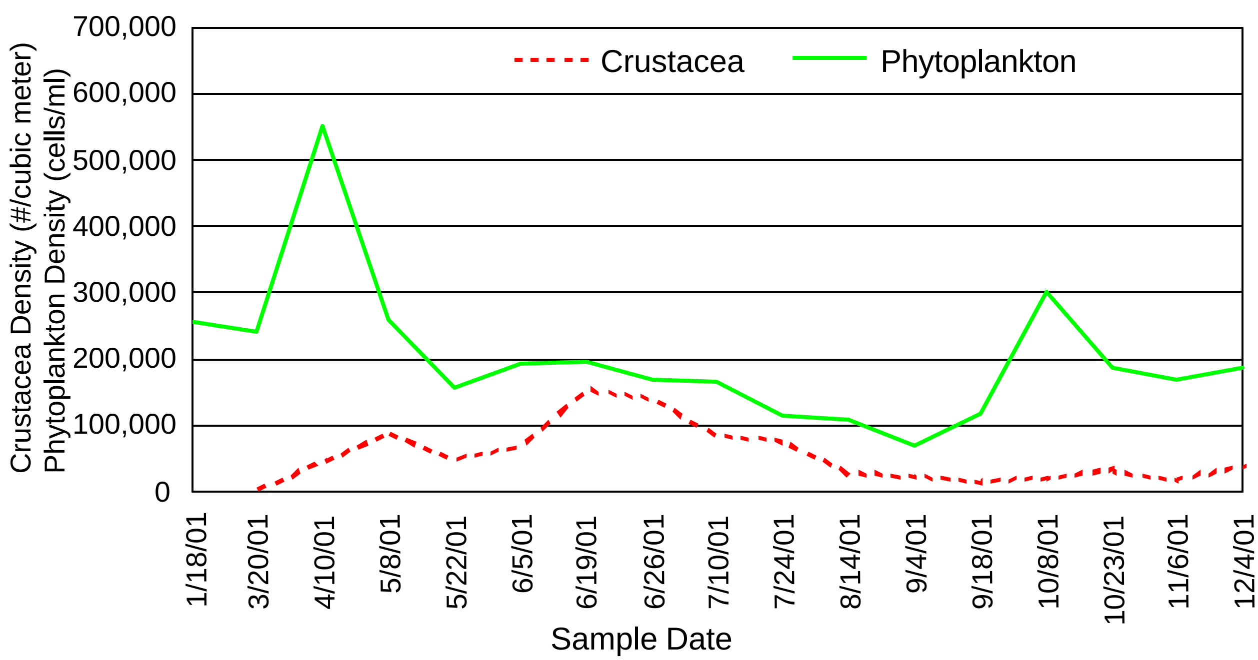

FIGURE 18: Seasonal density of phytoplankton (cells/mL) and crustacean zooplankton (no./m^3) in Cherry Creek Reservoir, 2001.

TABLE 6: Reservoir mean zooplankton density (No./m^3) and number of taxa collected from Cherry Creek Reservoir, 2001.

Taxa	3/20	4/10	5/8	5/22	6/5	6/19	6/26	7/10
ROTIFERA	--	773	33,195	37,260	37,760	94,404	42,522	51,471
CRUSTACEA								
Cladocera	233	7,346	63,312	42,243	60,480	132,927	121,304	67,643
Copepoda	2,334	27,839	23,785	5,597	6,400	23,284	20,437	14,954
Total Density (No./m^3)	**2,567**	**35,958**	**120,292**	**85,100**	**104,640**	**250,615**	**184,263**	**134,068**
Total Taxa	**3**	**13**	**16**	**18**	**15**	**14**	**11**	**10**

Taxa	7/24	8/14	9/4	9/18	10/8	10/23	11/6	12/4
ROTIFERA	81,200	27,362	27,293	13,800	48,181	129,990	106,334	410,632
CRUSTACEA								
Cladocera	11,165	10,417	10,218	5,700	5,756	15,644	7,333	26,245
Copepoda	65,975	17,778	16,268	11,350	13,320	18,204	12,712	9,522
Total Density (No./m^3)	**158,340**	**55,557**	**53,779**	**30,850**	**67,257**	**163,838**	**126,379**	**446,399**
Total Taxa	**8**	**7**	**7**	**7**	**7**	**7**	**7**	**8**

The mean total abundance of zooplankton observed in 2001 was slightly lower than that observed in 2000 (Table 7). Additionally, the total abundance observed in 2001 was well within the observed range of zooplankton density measured since 1994. A greater number of taxa was observed in 2001 relative to previous years.

Coliforms

Coliform bacteria are used as indicator organisms that may co-occur with pathogenic bacteria. The source of coliform bacteria is the gut of warm blooded animals such as geese, cows, and humans. The State of Colorado has water quality standards for contact recreation for both fecal coliform bacteria and *Escherichia coli* (State of Colorado Natural Bathing Beach Regulations, 1998). A limit of 200 fecal coliform per 100 ml and 235 *E. coli* per 100 ml has been placed on primary contact recreation waters, such as Cherry Creek Reservoir. These standards are generally applied in the main primary contact areas of the reservoir, i.e., at the Swim Beach. Cherry Creek State Park personnel regularly monitor *E. coli* levels at the Swim Beach (Appendix D). Due to high *E. coli* levels, the Swim Beach was closed July 14-27, 2001. During this period, *E. coli* levels ranged from 3.1 to 920.8 cells/mL (Appendix D), levels frequently equal to and above the Colorado water quality standards (Lyle Laverty, Colorado State Parks, pers. comm.).

Analyses of whole-lake composite samples were also conducted as part of the reservoir monitoring by the Authority to determine the concentration of fecal coliform bacteria. Data collected indicated that the concentration of fecal coliform bacteria ranged from <2 cells/100 ml to 30 cells/100 ml. The standard for contact recreation (200 cells/100 ml) was not exceeded at the three reservoir sites during monitoring events in 2001.

As part of the Swim Beach regulations, the allowable limit on *E. coli* for primary recreation waters in the state of Colorado is 235 cells/100 ml. The concentration of *E. coli* in Cherry Creek Reservoir (determined from whole-lake composite samples) ranged from below the detection limit of 2 cells/100 ml to a high of 30 cells/100 ml. Again, note that these values are not directly comparable to the values measured at the Swim Beach by the State Parks.

TABLE 7: Reservoir mean zooplankton density (No./m^3), percent composition (% in parentheses), and number of taxa in Cherry Creek Reservoir, 1994 to 2001.

Mean Density, Richness	1994		1995		1996		1997	
PROTOZOA								
Mean Density	260,212	(51%)	7,250	(6%)	47,573	(19%)	192,970	(74%)
Total Taxa	1		1		1		1	
ROTIFERA								
Mean Density	73,688	(14%)	19,956	(18%)	47,469	(19%)	17,019	(6%)
Total Taxa	7		6		10		7	
CRUSTACEA (Cladocera)								
Mean Density	74,515	(15%)	44,750	(40%)	81,062	(32%)	19,495	(8%)
Total Taxa	3		4		3		3	
CRUSTACEA (Copepoda)								
Mean Density	100,152	(20%)	40,438	(36%)	74,031	(30%)	31,265	(12%)
Total Taxa	4		2		3		2	
Total Mean Density	508,567		112,394		250,135		260,749	
Total Taxa	15		13		17		13	

Mean Density, Richness	1998		1999		2000		2001	
PROTOZOA								
Mean Density	37,922	(35%)	75,801	(39%)	4,297	(2%)	--	
Total Taxa	1		1		1		--	
ROTIFERA								
Mean Density	21,344	(20%)	28,913	(15%)	34,699	(20%)	71,386	(57%)
Total Taxa	7		8		10		7	
CRUSTACEA (Cladocera)								
Mean Density	28,222	(26%)	46,191	(24%)	56,976	(33%)	36,748	(29%)
Total Taxa	3		3		5		12	
CRUSTACEA (Copepoda)								
Mean Density	21,077	(19%)	43,801	(22%)	78,617	(45%)	18,110	(14%)
Total Taxa	4		2		6		11	
Total Mean Density	108,565		194,706		174,589		126,244	
Total Taxa	15		14		22		30	

Fish Populations

Historically, the fish community in Cherry Creek Reservoir has been composed of many species, including omnivores, insectivores, zooplanktivores, and piscivores (Table 8). Fish can exert a strong influence on the structure and productivity of phytoplankton and zooplankton communities through food web pathways between different levels (phytoplankton, zooplankton and fish) of the aquatic ecosystem (Carpenter *et al.* 1985). For instance, the removal of zooplanktivorous fish by trapping, natural winter kill, or the introduction of a piscivorous fish species can result in an increase in larger zooplankton and a subsequent decrease in phytoplankton (Smith 1986, Elser and Carpenter 1988, Sondergaard *et al.* 1990, Carpenter and Kitchell 1993). Changes in the zooplankton community caused by fish predation can be dramatic in eutrophic lakes, such as Cherry Creek Reservoir (Pérez-Fuentetaja *et al.* 1996). In addition, these trophic dynamics can affect the variability, distribution, and ratios of limiting nutrients, such as phosphorus and nitrogen (Vanni *et al.* 1996). Mechanisms that may possibly result because of fish predation include decreased herbivory by zooplankton when fish are abundant, modification of nutrient recycling rates by herbivorous zooplankton as fish abundance varies, and nutrient recycling by fish (Vanni and Layne 1996).

Stocking data from the Colorado Division of Wildlife (CDOW) shows that ten species and two hybrids have been stocked in Cherry Creek Reservoir from 1985 to 2001 (Table 8). The two stocked hybrids were the wiper, a cross between the striped bass and the white bass, and the tiger musky, a cross between a northern pike and a muskellunge. Of these 12 stocked fish taxa, channel catfish, rainbow trout, and walleye have been stocked every year.

The size of stocked fish has been variable both between species and within a given species. For example, channel catfish are stocked as fingerlings, rainbow trout as juveniles and adults, and walleye as fry (Table 8). Tiger musky (juveniles) and wipers have been stocked mostly as fry, but the CDOW did stock 10-inch long wipers in 1992. Other popular gamefish species stocked in smaller quantities and less regular intervals included largemouth bass and bluegill.

The CDOW did not conduct any fish population sampling in Cherry Creek Reservoir in 2001. The Division had planned to sample every two to three years, but has not yet fulfilled that goal.

TABLE 8: Quantity and size of fish stocked in Cherry Creek Reservoir, 1985 to 2001.

Year	Species	Size (inches)	Number
1985	Black crappie	5	7,234
	Channel catfish	2-8	116,784
	Rainbow trout	8-12	75,753
	Walleye	0.3	2,346,000
	Yellow perch	2	90,160
1986	Bluegill	1	111,968
	Channel catfish	4	25,594
	Cutthroat trout	6	52,228
	Rainbow trout	2-18	414,136
	Tiger musky	5-6	4,723
	Walleye	0.3	1,734,000
	Wiper	0.2	80,000
1987	Bluegill	0.2	70,000
	Channel catfish	4	25,600
	Largemouth bass	5	10,000
	Rainbow trout	2-26	129,715
	Tiger musky	7	4,000
	Walleye	0.2	1,760,000
1988	Channel catfish	3	16,000
	Largemouth bass	5	10,000
	Rainbow trout	9-10	293,931
	Tiger musky	8	4,500
	Walleye	0.2	1,760,000
1989	Channel catfish	2-4	10,316
	Largemouth bass	6	8,993
	Rainbow trout	8-22	79,919
	Walleye	0.2	1,352,000
	Wiper	0.2	99,000
1990	Channel catfish	3-4	25,599
	Rainbow trout	9-15	74,986
	Tiger musky	8	2,001
	Walleye	0.2	1,400,000
	Wiper	1	8,996
1991	Channel catfish	3	13,500
	Rainbow trout	9-10	79,571
	Tiger musky	5-8	6,500
	Walleye	0.2	1,300,000
	Wiper	1	9,000
1992	Blue catfish	3	9,000
	Channel catfish	4	13,500
	Rainbow trout	9-10	101,656
	Tiger musky	7	4,940
	Walleye	0.2	2,600,000
	Wiper	10	15,520
1993	Channel catfish	4	13,500
	Rainbow trout	9-10	92,601
	Tiger musky	9	4,500
	Walleye	0.2	2,600,000
	Wiper	1	9,003

TABLE 8: Continued.

Year	Species	Size (inches)	Number
1994	Blue catfish	3	21,000
	Channel catfish	4	23,625
	Cutthroat trout	9	9,089
	Flathead catfish	1	148
	Tiger musky	8	900
	Walleye	0.2	2,600,000
	Wiper	1-4	26,177
	Rainbow trout	9-18	62,615
1995	Channel catfish	4	18,900
	Rainbow trout	9-20	139,242
	Tiger musky	8	4,500
	Walleye	0.2	2,600,000
	Wiper	1	4,500
1996	Channel catfish	3	8,100
	Cutthroat trout	9-10	85,802
	Tiger musky	7	3,500
	Rainbow trout	4-22	163,007
	Walleye	0.2	3,202,940
	Wiper	1	8,938
1997	Cannel catfish	3	13,500
	Cutthroat trout	3-9	22,907
	Rainbow trout	10-24	74,525
	Tiger musky	6	4,500
	Walleye	0.2	2,600,000
	Wiper	1	9,000
1998	Channel catfish	4	7,425
	Rainbow trout	10-12	59,560
	Tiger musky	7	4,000
	Walleye	1.5	40,000
	Wiper	1.3	9,000
1999	Channel catfish	3.5	13,500
	Rainbow trout	10-19	32,729
	Tiger musky	7	3,000
	Walleye	0.2	2,400,000
	Wiper	1.3	9,000
2000	Channel catfish	4.1	13,500
	Northern pike	–	46
	Rainbow trout	4.5-20.3	180,166
	Rainbow/Cutthroat trout hybrid	–	5,600
	Tiger musky	8	4,086
	Walleye	0.23	2,400,000
2001	Channel catfish	3.5	13,500
	Rainbow trout	10-19	23,065
	Tiger musky	7	4,000
	Walleye	0.2	2,400,000

Phosphorus Concentration in Streams

The mean annual concentration of total phosphorus ranged from a low of 85 µg/L at CT-2 to a high of 212 µg/L at CC-10 (Table 9). At most stream sites, the summer (July to September) mean concentration of total phosphorus was higher than the annual mean. The summer mean concentration of total phosphorus ranged from a low of 103 µg/L at Site SC-1 to a high of 261 µg/L at Site CC-10. As expected, the concentration of total phosphorus measured in the storm flows in these streams was considerably higher than that observed under base flow conditions. The mean concentration of total phosphorus in storm samples ranged from a low of 202 µg/L at Site CT-2 to a high of 936 µg/L at Site SC-1. Concentrations of total phosphorus and total suspended solids observed during the January sampling event on Shop Creek were unseasonably high, perhaps indicative of a storm event that may be related to snowmelt. For this reason, January concentrations of total phosphorus and total suspended solids measured at Shop Creek were analyzed as storm samples.

TABLE 9: Comparison of mean baseflow and mean stormflow concentrations of total phosphorus (TP) and total suspended solids (TSS) in tributaries to Cherry Creek Reservoir, 2001.

	Baseflow				Stormflow	
	Summer		Annual		May - September	
Stream, Site	TP (µg/L)	TSS (mg/L)	TP (µg/L)	TSS (mg/L)	TP (µg/L)	TSS (mg/L)
Cherry Creek						
CC-10	261	45	212	33	396	85
CCO	120	36	115	30	--	--
Cottonwood Creek						
CT-1	160	86	100	41	360	166
CT-2	137	65	85	35	202	65
Shop Creek						
SC-1	103	6	125	6	963	48
SC-3	180	12	186	11	407	88

Long-Term Trends in Phosphorus Concentrations in Cherry Creek Reservoir Tributaries

Additional analyses were performed on data from the three main tributaries at Cherry Creek Reservoir (Sites CC-10, SC-3, and CT-2) to determine trends in phosphorus and orthophosphate concentrations from 1995 to 2001 (Figs. 19 - 25). Over this seven-year period, total phosphorus concentrations ranged from 22 µg/L to 553 µg/L, with a mean of 235 µg/L at Site CC-10 (Fig. 19). Total phosphorus at Site SC-3 ranged from 0.1 µg/L to 323 µg/L, with a mean of 112 µg/L, while total phosphorus concentrations at Site CT-2 ranged from 0.1 µg/L to 415 µg/L, with a mean total phosphorus concentration of 101 µg/L (Fig. 19). Orthophosphate concentrations at Site CC-10 ranged from 0.1 µg/L to 362 µg/L, with a mean at 184 µg/L (Fig. 19). 78% of the total phosphorus concentration measured at Site CC-10 was comprised of orthophosphate. Orthophosphate concentrations at Site SC-3 ranged from 0.1 µg/L to 273 µg/L, with a mean at 88 µg/L, also comprising 78% of the total phosphorus measured. Site CT-2 orthophosphate concentrations ranged from 3.0 µg/L to 175 µg/L, with a mean at 51 µ/L. Interestingly, at Site CT-2, orthophosphate made up only 50% of total measured phosphorus (Fig. 19).

Concentrations of total phosphorus exhibited significant, but weak, increasing trends over time at Sites CC-10 ($p = 0.00$, $R^2 = 0.085$, slope = 0.88) and SC-3 ($p = 0.00$, $R^2 = 0.172$, slope = 0.97) (Figs. 20 and 22). Concentrations of orthophosphate at Site CC-10 (Fig. 21) were not significantly related to time ($p > 0.05$, $R^2 = 0.006$). The relationship between orthophosphate concentration and time was significant and indicated a slight upward trend at Site SC-3 ($p = 0.00$, $R^2 = 0.138$, slope = 0.69) (Fig. 23). Both the total phosphorus and orthophosphate show a decreasing trend at Site CT-2 (Figs. 24 and 25), with the trend statistically significant from orthophosphate ($p = 0.00$, $R^2 = 0.347$, slope = 0.86). The observed downward trend in phosphorus concentrations at Site CT-2 from 1995-2001 may be an indication of the effectiveness of the Cottonwood Creek PRF, which was installed in 1996.

Historic Trends in Total Phosphorus Concentration and Discharge

Total phosphorus concentration was plotted against discharge for the three upstream tributaries (Figs. 26 - 28). Flow did not appear to track with total phosphorus concentrations at Site CC-10. At Sites SC-3 and CT-2, total phosphorus concentration appears to be somewhat better matched with discharge. However, statistical analyses performed on data sets from each site indicate that there is no significant relationship between total phosphorus concentration and discharge ($p > 0.05$) at these three sites.

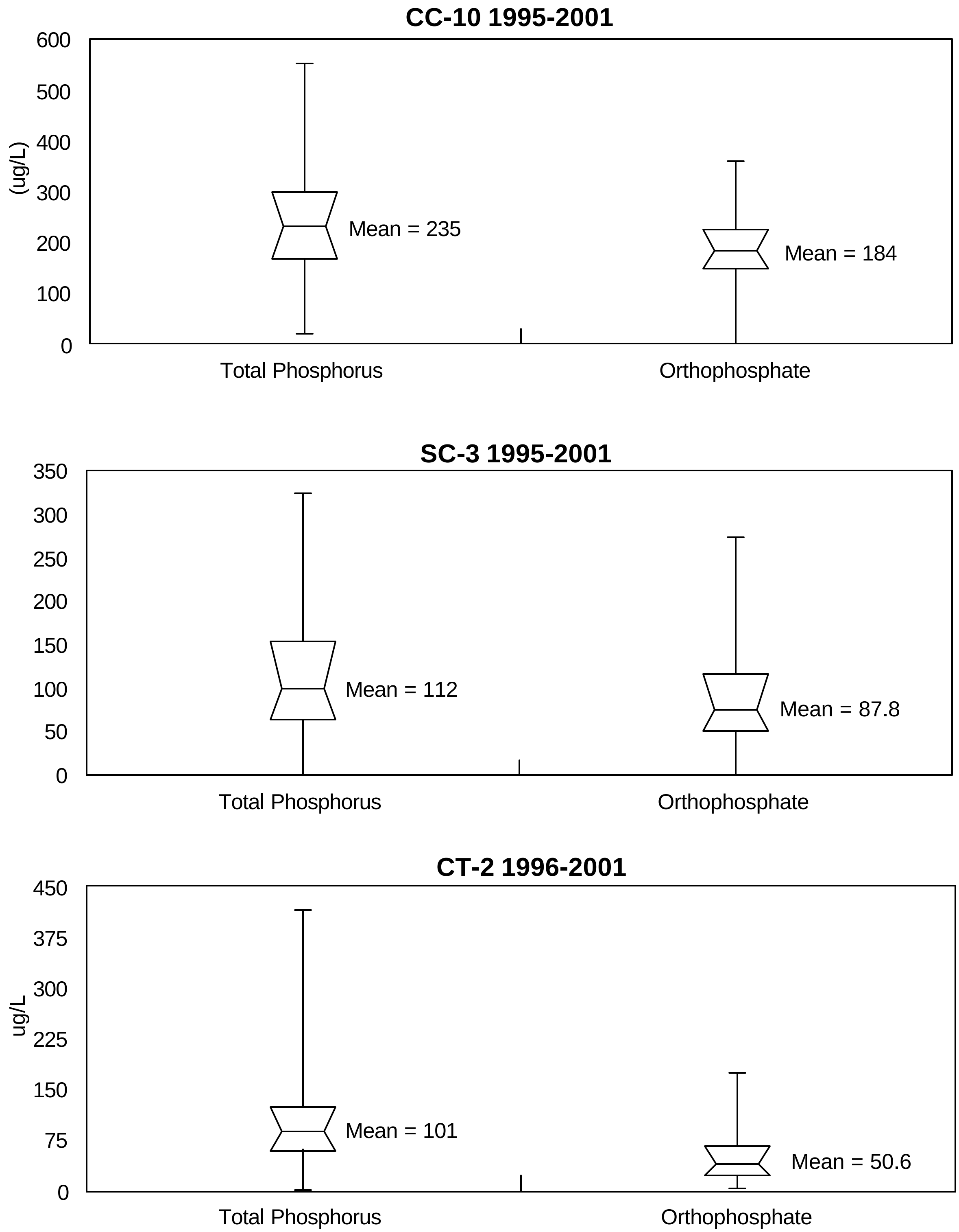

FIGURE 19: Total phosphorus and orthophosphate mean concentrations and box-plots in Cherry Creek Reservoir upstream tributaries (1995-2001).

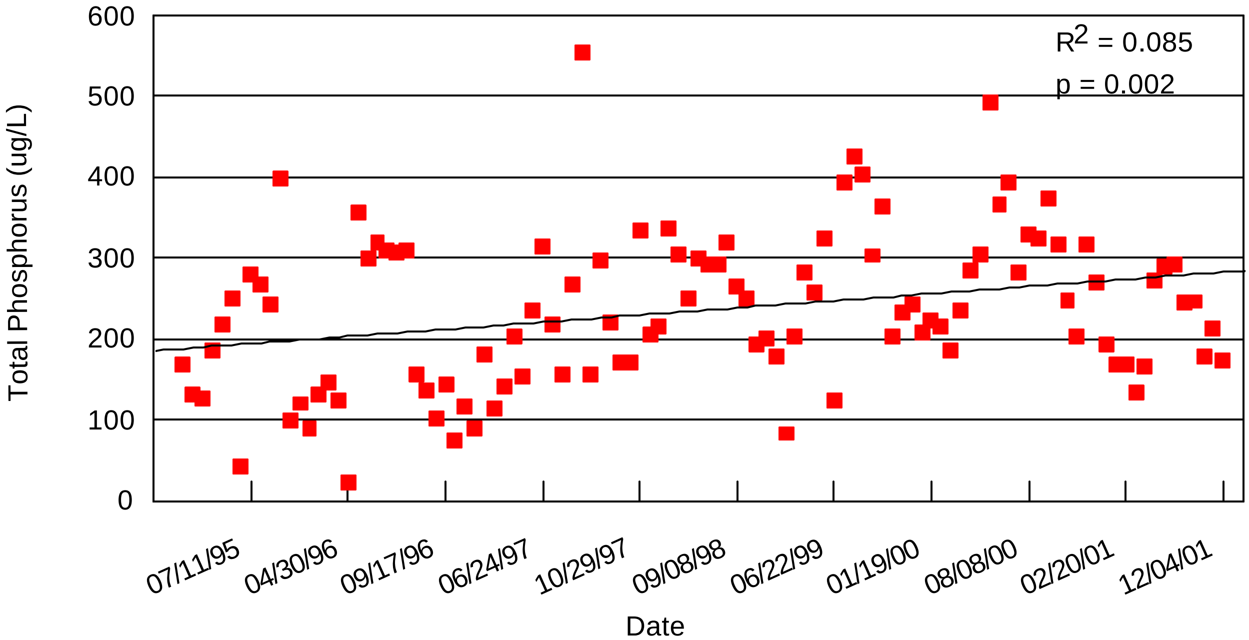

FIGURE 20: Mean total phosphorus concentrations measured in Site CC-10 (1995-2001).

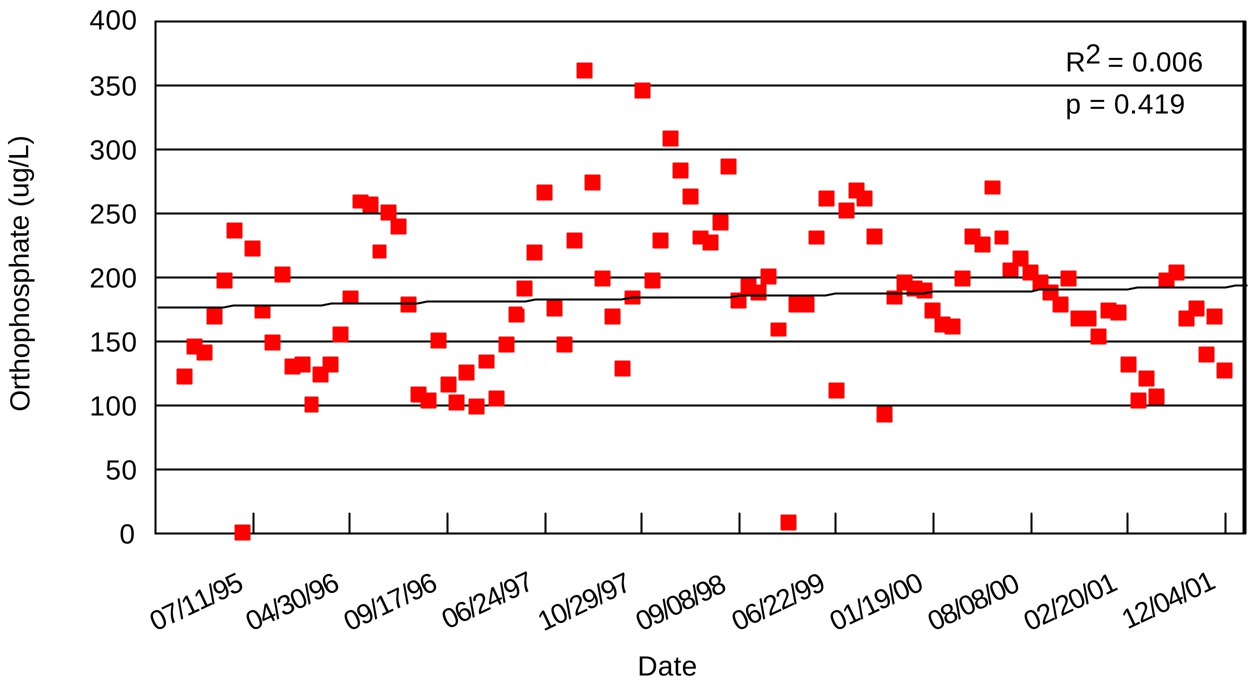

FIGURE 21: Mean orthophosphate concentrations measured in Site CC-10 (1995-2001).

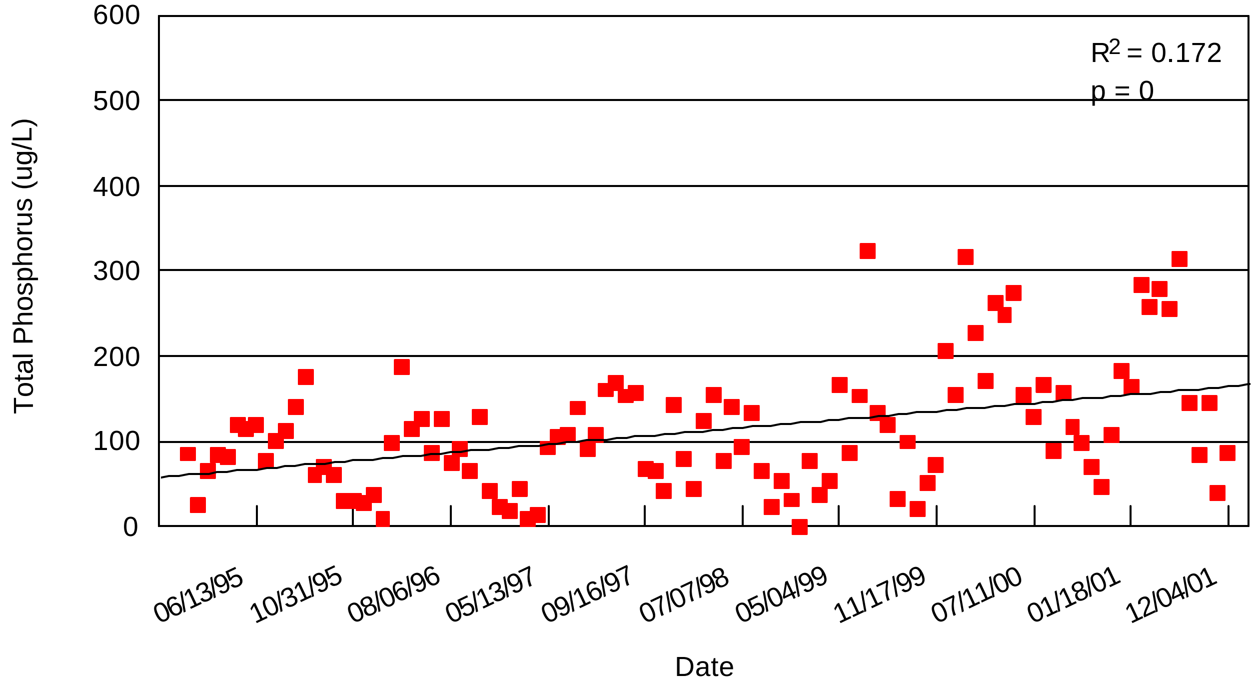

FIGURE 22: Mean total phosphorus concentrations measured in Site SC-3 (1995-2001).

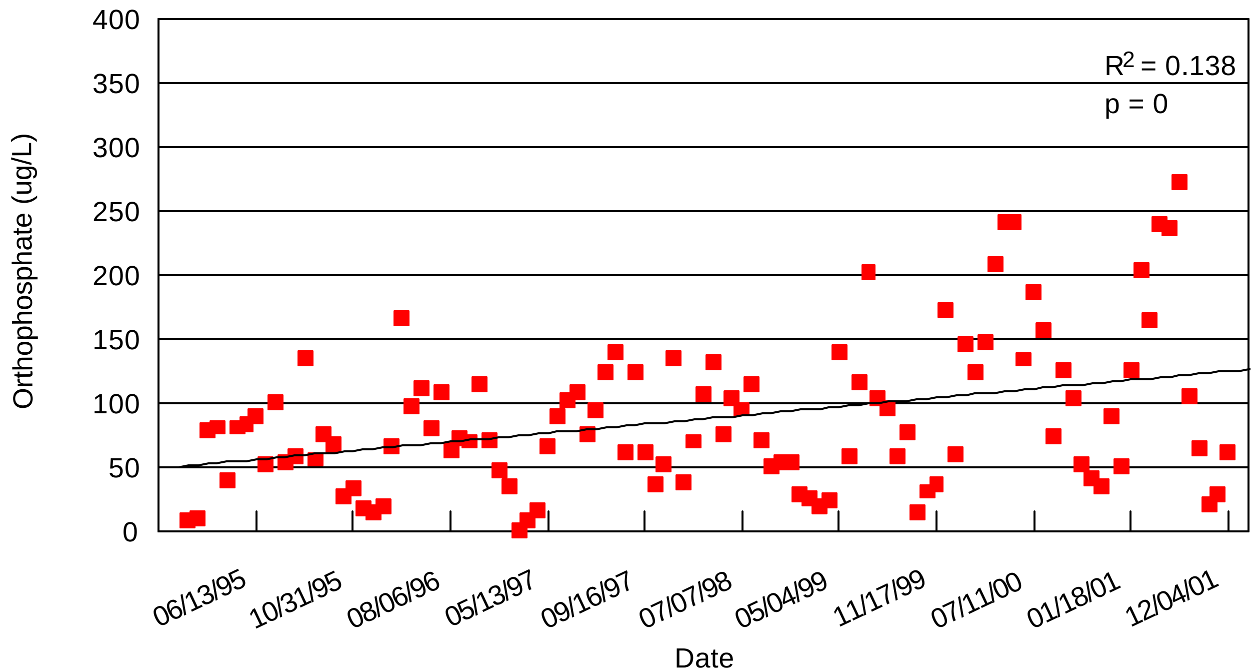

FIGURE 23: Mean orthophosphate concentrations measured in Site SC-3 (1995-2001).

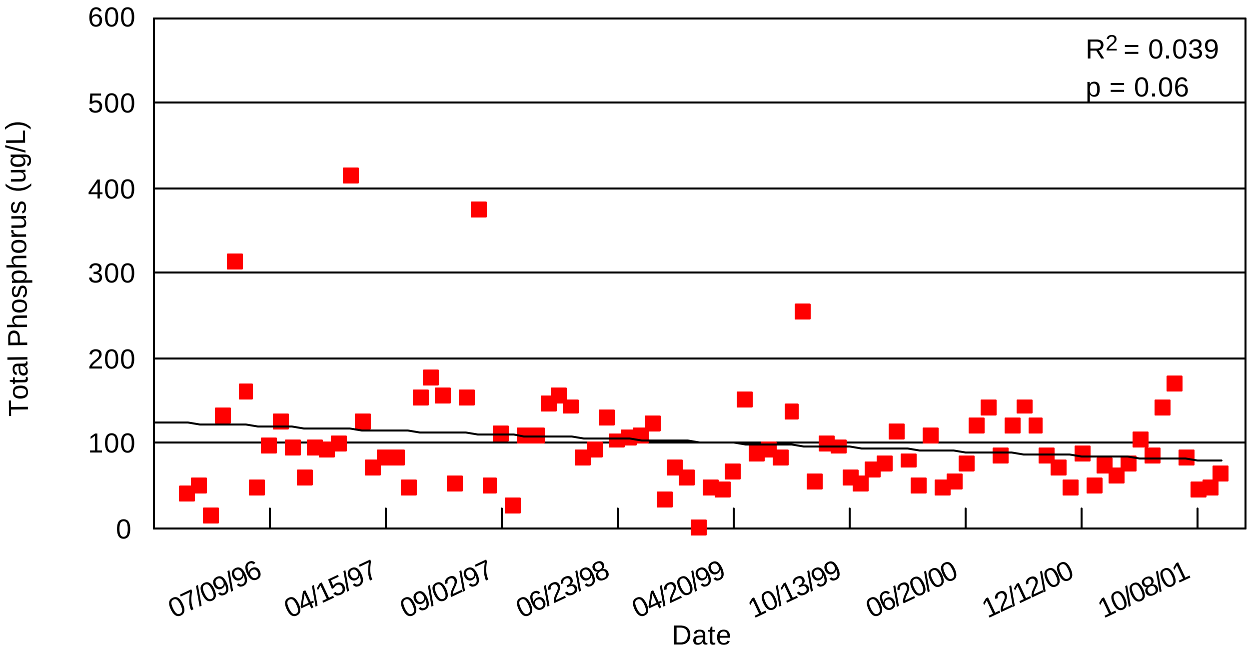

FIGURE 24: Mean total phosphorus concentrations measured in Site CT-2 (1995-2001).

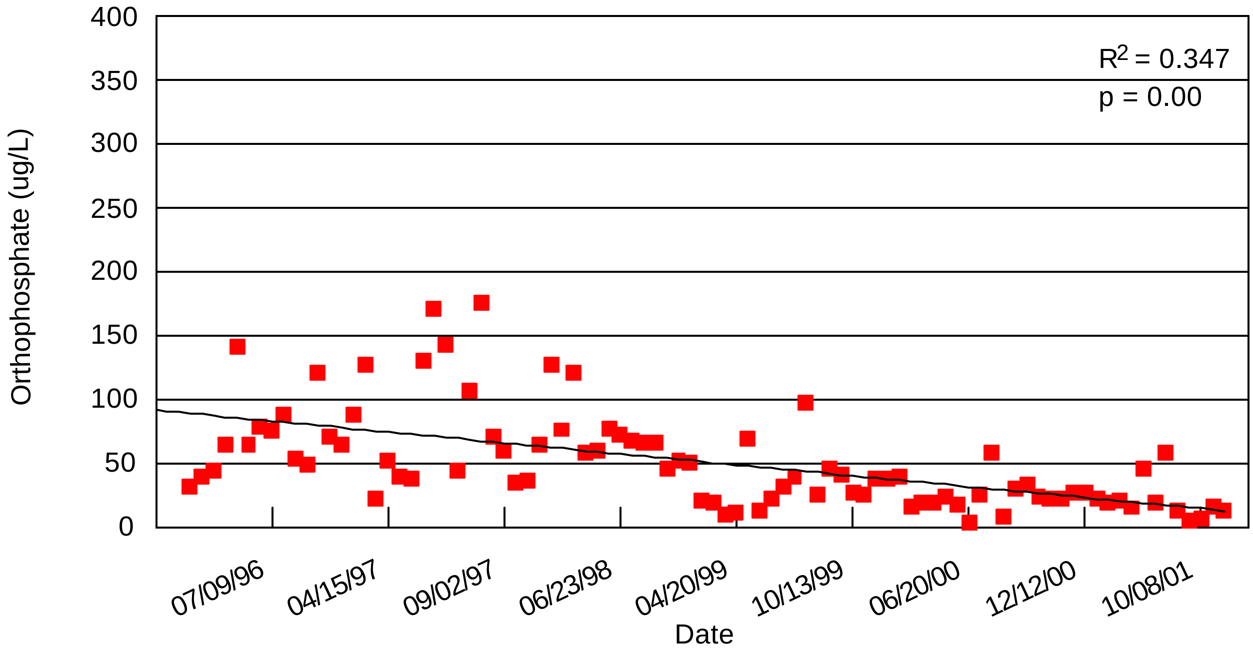

FIGURE 25: Mean orthophosphate concentrations measured in Site CT-2 (1995-2001).

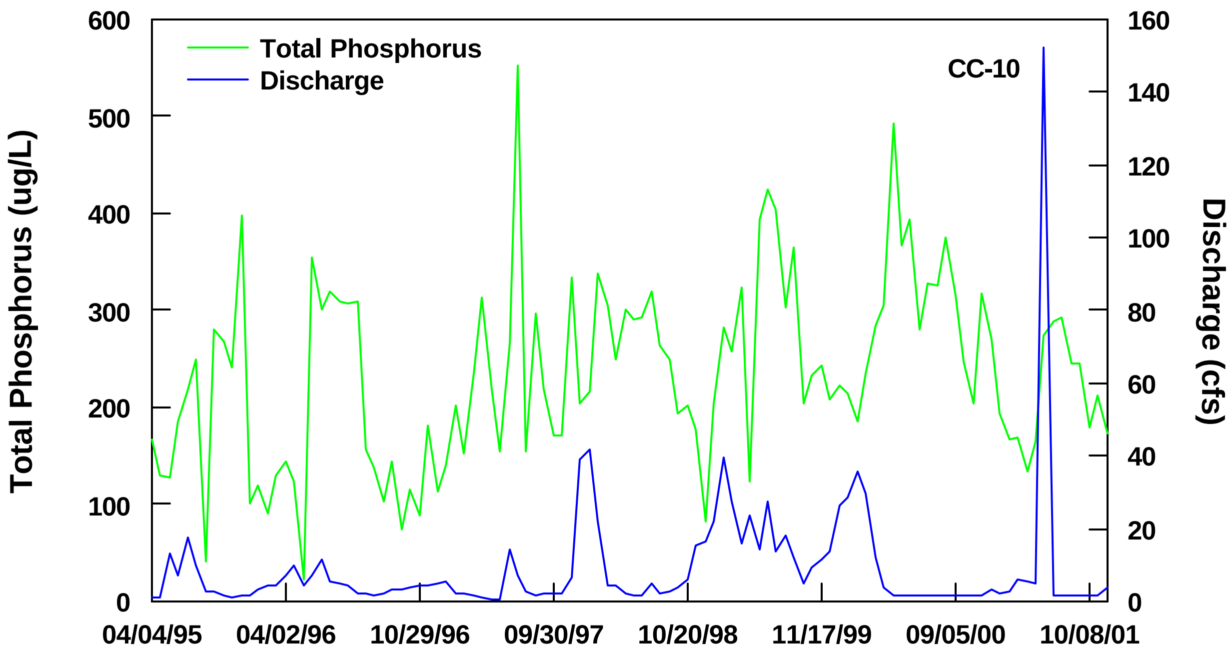

FIGURE 26: Relationship between total phosphorus concentrations and discharge measurements in Site CC-10, 2001.

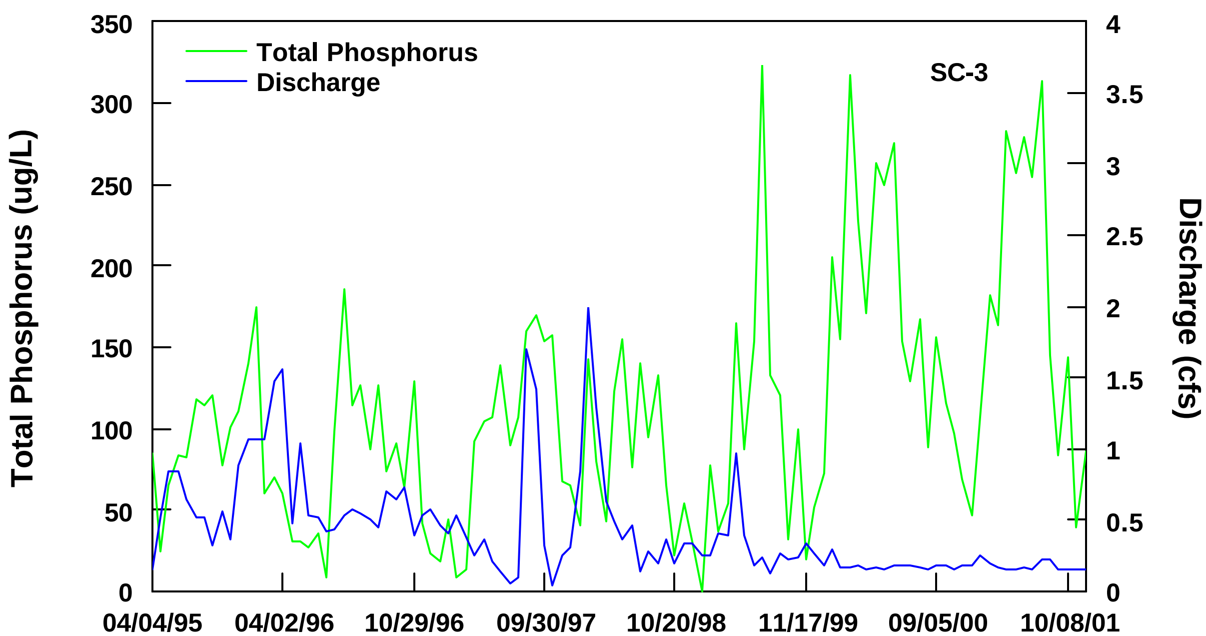

FIGURE 27: Relationship between total phosphorus concentrations and discharge measurements in Site SC-3, 2001.

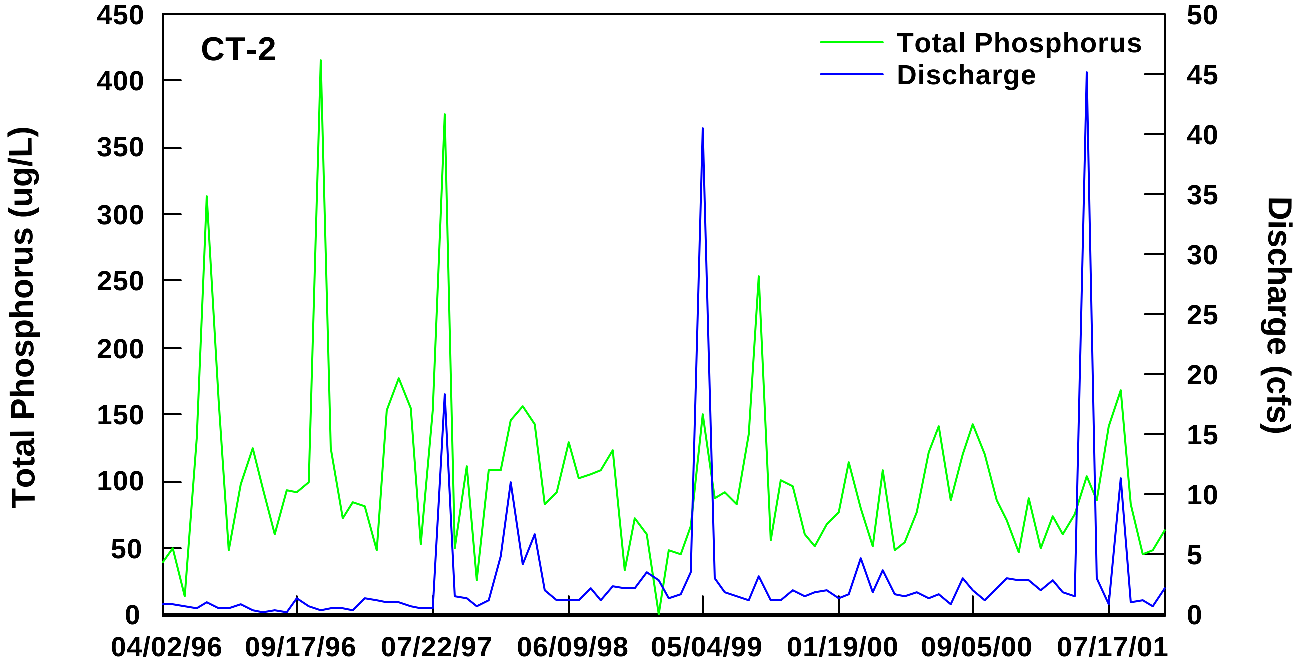

FIGURE 28: Relationship between total phosphorus concentrations and discharge measurements in Site CT-2, 2001.

Phosphorus Loading to Reservoir

Nutrients which can limit or enhance algal growth in a reservoir have many sources, both within the reservoir (internal loading) or from outside the reservoir (external loading). Fish and plankton excrement, direct sediment resupply, and the decay of organic matter are all internal sources of nutrients in a reservoir (Goldman and Horne 1983). Net internal phosphorus loading to Cherry Creek Reservoir has been estimated to be 4,000 lbs/year (Nürnberg and LaZerte 2000). Note that the TMAL of 14,270 lbs/year does not include these internal loads.

External source of nutrients include inflow from streams and precipitation which carry nutrients from soil erosion, agricultural runoff, treated waste water, and airborne particulates. While both phosphorus and nitrogen are potentially important, past analyses have concluded that Cherry Creek Reservoir is generally phosphorus limited (DRCOG 1985). In addition, phosphorus (unlike nitrogen) does not have a gas phase. Thus, phosphorus concentrations cannot be reduced by interactions with the atmosphere or gases within the water column. For these reasons, efforts in past years and during the present study have concentrated on the calculation of phosphorus loading. Phosphorus loading was determined for several primary sources in 2001, including the tributary streams Cottonwood Creek, Cherry Creek, and Shop Creek, as well as from precipitation and alluvium, as summarized below.

Phosphorus Loads from Tributary Streams

The majority of the phosphorus load to the reservoir was from surface flows in the Cherry Creek mainstem (6,330 lbs). Because Cherry Creek is monitored downstream of Shop Creek, the 137 lbs contributed by Shop Creek has been subtracted from the total load calculated from the site. Additional phosphorus was contributed by Cottonwood Creek (2,205 lbs). The total phosphorus load to Cherry Creek Reservoir from tributary streams in 2001 was 8,672 lbs (Table 10).

TABLE 10: Estimated net phosphorus loading (lbs/year) into Cherry Creek Reservoir, 1992 to 2001.

Source of Data	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	Mean
Shop Creek	138	136	134	108	116	186	206	162	120	137	144
Cherry Creek	5,470	2971	3,739	5,372	3,782	3,714	11,665	14,736	9,984	6,330	6,776
Cottonwood Creek	947	366	226	3,319	570	1,103	1,830	3,868	1,712	2,205	1,615
Subtotal for Streamflows	**6,555**	**3,473**	**4,099**	**8,799**	**4,468**	**5,003**	**13,701**	**18,766**	**11,816**	**8,672**	**8,535**
Cherry Creek Alluvium	555*	555*	470	597	635	520	476	537	449	503	530
Direct Precipitation	877	736	484	1,202	740	1,020	854	896	777	586	817
Total Load	**7,987**	**4,764**	**5,053**	**10,598**	**5,843**	**6,543**	**15,031**	**20,199**	**13,042**	**9,761**	**9,882**
Cherry Creek Outflow	1,314	711	993	2,049	992	996	4,207	9,650	3,688	4,842	2,944
Net Load	**6,673**	**4,053**	**4,060**	**8,549**	**4,851**	**5,547**	**10,824**	**10,549**	**9,354**	**4,919**	**6,938**

* Based on mean of 1994-1997 alluvial inflows minus alluvial outflows, or net alluvial loads.

Phosphorus Loads in Reservoir Outflow

The total outflow from Cherry Creek Reservoir as measured by the COE was 13,777 AF (Appendix C). The calculated phosphorus load leaving the reservoir in 2001 was determined to be 4,842 lbs

(Table 10). This is the value that would be subtracted from the total phosphorus input to the reservoir to calculate the net phosphorus load in the reservoir in 2001.

Phosphorus Loading from Precipitation

The mean concentration of total phosphorus in the rain samples collected in 2001 was 202 µg/L. The total phosphorus load contained in the 16.0 inches of rain that fell on the reservoir was determined to be 586 lbs (Table 10, and Appendix C). The long-term mean estimated total phosphorus loading from rain samples collected at the reservoir between 1987 and 2001 is 821 lbs (Table 11).

TABLE 11: Phosphorus loading into Cherry Creek Reservoir from precipitation, 1987 to 2001. Note that data from 1987-1991 are based on water years, while data for 1992 to present are based on calendar years.

Source of Data	Year	Annual Precipitation (in)	Estimated Annual Total Phosphorus from Precipitation (lbs)
In-Situ 1987	1987	18.1	870
In-Situ 1988	1988	23.3	1,119
ASI 1990	1989	13.0	625
ASI 1991a	1990	15.2	730
ASI 1991b	1991	16.5	793
ASI 1993	1992	18.5	877
ASI 1994a	1993	15.6	735
C&A 1995	1994	10.2	484
CEC 1996	1995	25.3	1,202
CEC 1997	1996	15.5	740
CEC 1998	1997	21.8	1,020
CEC 1999	1998	20.0	854
CEC 2000	1999	21.5	896
CEC 2001	2000	17.8	777
Present Study	2001	16.0	586
Mean		**17.9**	**821**

Mass Balance/Net Loading of Phosphorus to the Reservoir

Phosphorus Loading from Alluvium

The water quality and quantity of alluvial flows into Cherry Creek Reservoir were monitored by Halepaska & Associates, Inc. (JCHA). This monitoring resulted in a estimated net alluvial addition of 503 lbs total phosphorus to the reservoir (Table 10).

There are three principle sources of phosphorus loading to Cherry Creek Reservoir: tributary streams, alluvial flows, and precipitation (Table 10). During 2001, the three tributary streams contributing phosphorus loads to the reservoir included Cherry Creek (6,330 lbs without Shop Creek), Cottonwood Creek (2,205 lbs), and Shop Creek (137 lbs). The net load of phosphorus to the reservoir from the Cherry Creek alluvium was 503 lbs. The estimated phosphorus load to the reservoir from precipitation was 586 lbs. The estimated total load of phosphorus entering the reservoir in 2001 was determined to be 9,761 lbs (Table 10), which meets the TMAL of 14,270 lbs per year. The estimated phosphorus load leaving the reservoir in 2001 was determined to be 4,842 lbs. Using these two values, the net load of phosphorus to Cherry Creek Reservoir in 2001 was determined to be 4,919 lbs (Fig. 29, and Table 10). This represents a considerable decrease from loads observed in 1998, 1999, and 2000.

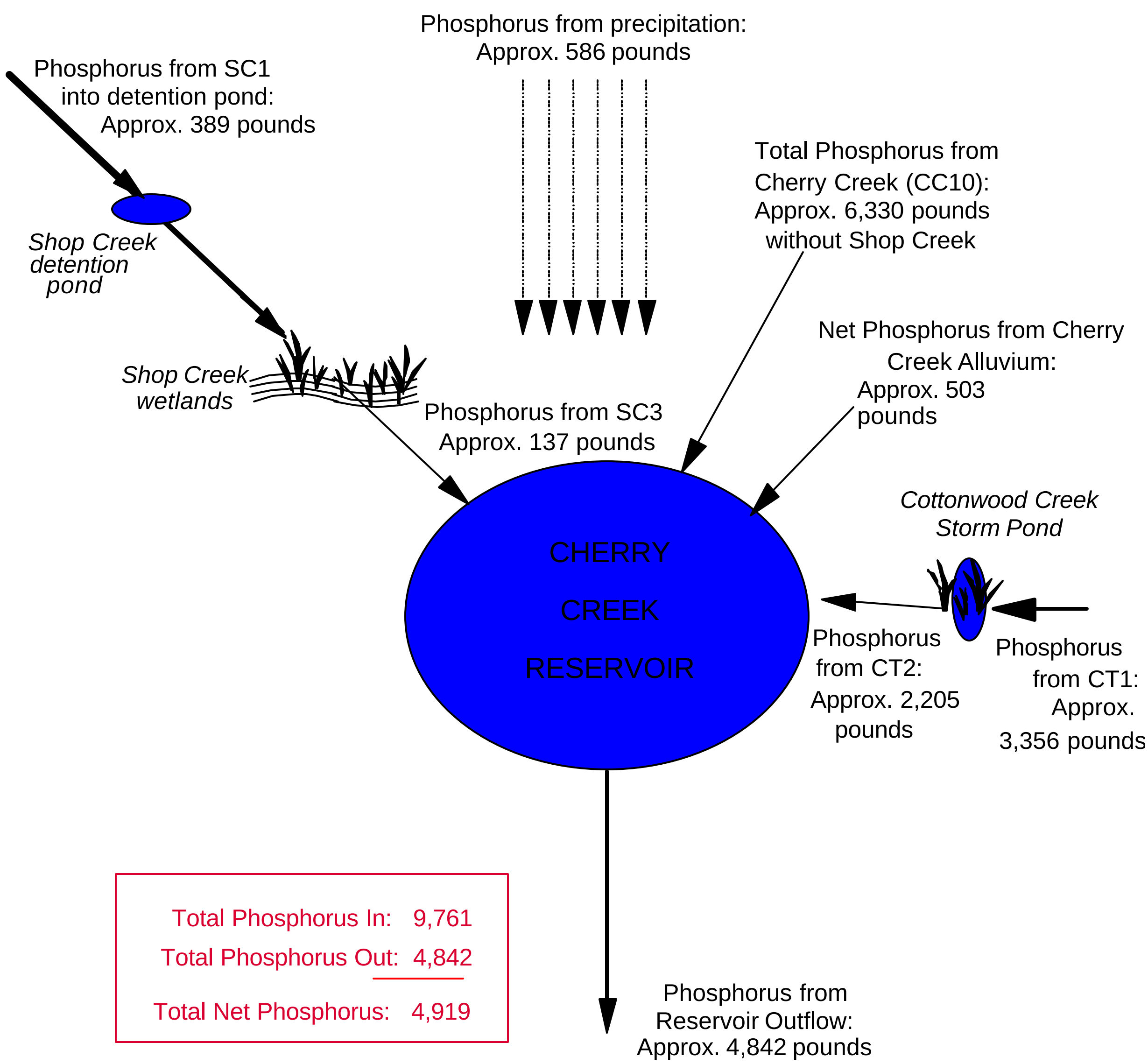

FIGURE 29: Mass balance diagram of phosphorus loading in Cherry Creek Reservoir, 2001.

Effectiveness of Pollutant Reduction Facilities

Cottonwood Creek Stormwater Detention Pond

The effectiveness of the Cottonwood Creek stormwater detention pond in reducing pollutant loads to the reservoir can be gauged by comparing concentration of total phosphorus and TSS and the loads of total phosphorus upstream and downstream of the pond (Table 12). During 2001, the mean concentration of total phosphorus decreased from 165 to 114 µg/L after passing through the pond (Table 12). This represents a 31% reduction in phosphorus concentration, the second highest reduction event since the pond's inception (Table 13). The load of total phosphorus was reduced from 3,356 lbs upstream of the pond to 2,205 lbs downstream of the pond, representing a 34% reduction in load (Table 13). This value is slightly lower than the 2000 value (39%) and the 45% mean reduction in load observed since the construction of the pond (Table 13). Finally, the concentration of TSS was decreased by 46% from 79 mg/L upstream to 43 mg/L downstream of the pond (Table 12). These data indicate that this PRF continues to be effective in reducing the loads of suspended solids and total phosphorus to Cherry Creek Reservoir.

Shop Creek Wetlands System

As with the PRF on Cottonwood Creek, the effectiveness of the detention pond/wetland system on Shop Creek is gauged by monitoring the concentration of phosphorus and TSS and the loading of phosphorus upstream and downstream of the facility. The concentration of total phosphorus decreased 39% from 348 µg/L at Site SC-1 to 251 µg/L at Site SC-3 (Table 12). Likewise, the estimated load of phosphorus below the pond/wetland system was reduced 65% from 389 lbs at Site SC-1 to 137 lbs at Site SC-3. This decrease in loads is most likely due to the reduction in flow from 1,209 AF at Site SC-1 to 345 AF at Site SC-3 (Table 12). The decrease in phosphorus load observed in 2001 (65%) is slightly higher than the mean decrease in phosphorus load of 63% attributed to this facility since 1990 (Table 14). The mean concentration of TSS increased from 17 mg/L upstream of the pond/wetland system to 33 mg/L downstream of the pond/wetland system (Table 12). Although loadings were not calculated from TSS, it is likely that the reduction in flow between these two sites still resulted in a decreased load of TSS downstream of the pond relative to that upstream of the facility. As with the Cottonwood Creek PRF and based on 2001 data, it is apparent that the Shop Creek facility continues to be effective in reducing the pollutant load to the reservoir (Table 14).

TABLE 12: Annual phosphorus, flow and total suspended solids (baseflows and stormflows combined) in Cottonwood Creek stormwater detention pond and Shop Creek wetlands system, 2001.

Sampling Site	Total Water Volume (AF)	Total Phosphorus Load (lbs)	Average Total Phosphorus (µg/L)	Average Total Suspended Solids (mg/L)
Annual				
Cottonwood Creek				
CT-1	4,534	3,356	165	79
CT-2	5,673	2,205	114	43
Shop Creek				
SC-1	1,209	389	348	17
SC-3	345	137	251	33

TABLE 13: Annual historical (1997 to 2001) total phosphorus and total suspended solids concentrations through the Cottonwood Creek stormwater detention pond.

Parameter	Water Year	Data Source	Sampling Sites CT-1	Sampling Sites CT-2	Difference	% Reduction
Annual Average Total Phosphorus	1997	CEC	200	133	-67	34
Concentration (µg/L)	1998	CEC	289	210	-79	27
(baseflow, storm samples	1999	CEC	158	157	- 1	0
combined)	2000	CEC	187	149	-38	20
	2001	CEC	165	114	-51	31
	Mean		200	153	-47	22
Annual Average Total Suspended	1997	CEC	207	87	-120	58
Solids (mg/L)	1998	CEC	311	129	-182	59
	1999	CEC	267	68	-199	74
	2000	CEC	96	64	- 32	33
	2001	CEC	79	43	- 43	46
	Mean		192	78	-115	54
Annual Loading of Total	1997	CEC	3,351	1,103	-2,248	67
Phosphorus (pounds)	1998	CEC	3,209	1,930	-1,279	40
	1999	CEC	6,329	3,868	-2,461	39
	2000	CEC	3,243	1,712	-1,531	47
	2001	CEC	3,356	2,205	-1,151	34
	Mean		3,898	2,164	1,734	45

TABLE 14: Historical total phosphorus and total suspended solids concentrations through the Shop Creek wetlands system. Note that data for 1990 to 1996 are based upon water year, while data for 1997 to 2001 are based on calendar year. NC = not calculated.

Parameter	Water Year	Data Source	Sampling Site SC-1	Sampling Site SC-3	Difference	% Reduction
Average Total Phosphorus Concentration (µg/L) (baseflow and storm samples combined)	1990	ASI	460	190	-270	59
	1991	ASI	320	300	-20	6
	1992	ASI	440	200	-240	55
	1993	ASI	380	190	-190	50
	1994	CEC	243	84	-159	65
	1995	CEC	368	100	-268	73
	1996	CEC	236	98	-138	59
	1997	CEC	144	131	-13	9
	1998	CEC	272	131	-141	53
	1999	CEC	168	140	-28	17
	2000	CEC	138	199	+61	-44
	2001	CEC	348	251	-98	28
	Mean		293	168	-125	36
Average Total Suspended Solids (mg/L)	1990	ASI	160	21	-139	87
	1991	ASI	74	22	-52	70
	1992	ASI	95	16	-79	83
	1993	ASI	492	14	-478	97
	1994	CEC	207	7	-200	97
	1995	CEC	144	8	-136	94
	1996	CEC	91	5	-86	95
	1997	CEC	103	28	-75	73
	1998	CEC	126	27	-99	79
	1999	CEC	104	36	-68	64
	2000	CEC	11	16	+5	-45
	2001	CEC	17	33	-16	85
	Mean		135	19	-119	73
Loading of Total Phosphorus (pounds)	1990	ASI	157[1]	86[1]	NC[1]	45
	1991	ASI	119	95	-24	20
	1992	ASI	156	88	-68	44
	1993	ASI	62[2]	46[2]	NC[2]	26
	1994	CEC	665	113	-552	83
	1995	CEC	299	128	-171	57
	1996	CEC	338	119	-219	65
	1997	CEC	603	186	-417	69
	1998	CEC	564	206	-358	64
	1999	CEC	350	162	-188	54
	2000	CEC	312	120	-192	62
	2001	CEC	389	137	-252	65
	Mean		335	162	-281	63

[1] Partial years (missing Oct. to Mar.).
[2] Partial years (missing Oct. to Apr.).

SUMMARY AND CONCLUSIONS

The transparency in Cherry Creek Reservoir, as measured by Secchi depth, was most influenced by TSS. The highest transparency was observed in the reservoir in mid-June and the lowest was measured in late summer. The whole-reservoir mean Secchi depth was 0.75 during the July to September period, a lower value than that observed in past years (Table 15).

TABLE 15: Water quality and total phosphorus loads data for Cherry Creek Reservoir, July-September 1992-2001.

Year	Chlorophyll *a* (µg/L)	Secchi Depth (m)	Total Phosphorus (µg/L)	Total Nitrogen (µg/L)	Annual Phosphorus Load (lbs/yr)*	Annual Inflow (ac/ft)*	Standardized Phosphorus Load (lbs/ac-ft)
1992	17.0	0.9	66	970	7,987	9,049	0.88
1993	14.4	1.2	62	826	4,764	6,643	0.71
1994	10.0	1.1	59	1,144	5,053	7,188	0.70
1995	9.4	1.6	48	913	10,598	11,786	0.90
1996	20.5	1.6	62	944	5,843	7,615	0.77
1997	22.3	1.0	96	1,120	6,552	10,447	0.63
1998	26.5	1.0	89	880	15,313	20,820	0.74
1999	28.9	1.0	81	753	20,209	30,032	0.67
2000	25.2	1.0	81	802	13,053	18,584	0.70
2001	26.1	0.75	87	757	9,761	15,360	0.64
10-Year Mean	20.0	1.1	73	911	9,914	13,752	0.73
Median	21.4	1.0	74	897	8,874	11,117	0.71

* Stream, alluvium, and precipitation.

Brief periods of weak thermal stratification were observed in the reservoir in 2001. Dissolved oxygen profiles indicated that anoxic conditions were sporadic in 2001, and oxygen concentrations were periodically reduced in lower levels of the reservoir. The temperature and oxygen profiles observed in the reservoir in 2001 were similar to those recorded in 2000 and typical of well mixed, shallow lakes.

Annual mean and summer mean concentrations of total phosphorus in the reservoir in 2001 were slightly higher than those measured in 2000. The goal of 40 µg/L total phosphorus was consistently exceeded in 2001. The summer mean total phosphorus concentration was higher than values recorded in 1999 and 2000, but lower than the 1997 value (Table 15). Since 1987, the goal of 40 µg/L total phosphorus as a July-September mean has been met once, in 1989.

The summer mean chlorophyll *a* concentration in Cherry Creek Reservoir was 26.1 µg/L, a value in excess of the 15 µg/L standard (Table 15). The summer mean concentration of chlorophyll *a* was higher than the mean calculated for 2000 (25.2 µg/L), but lower than the 1999 value (28.9 µg/L). The long-term summer mean chlorophyll *a* concentrations since 1996 indicate no significant difference between seasonal mean chlorophyll *a* concentrations over the past six years. Since 1987, the goal for a July-September chlorophyll *a* value of 15 µg/L has been met in four of 15 years, but only twice in the last ten years (Table 1).

The total precipitation at Cherry Creek Reservoir during 2001 was 16.0 inches. The total contribution from tributary streams was 15,360 AF which was lower than the 16,529 AF observed in 2000. The total phosphorus loads to the reservoir were estimated to be 586 lbs from precipitation, 8,672 lbs from surface flows, and 503 lbs from Cherry Creek alluvial flow. The total external load in 2001 of 9,761 lbs met the new TMAL of 14,270 lbs/year. The outflow from the reservoir during 2001 contained 4,842 lbs. The resulting net load of phosphorus to the reservoir in 2001 was 4,919 lbs. The net phosphorus load to the reservoir in 2001 was the lowest calculated estimate since 1994.

Pollution reduction facilities constructed on Cottonwood and Shop creeks continue to be effective in reducing the loads of phosphorus to the reservoir. In 2001, these PRFs reduced the instream load of phosphorus by 34% and 65%, respectively.

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APPENDIX A

RESERVOIR WATER QUALITY DATA

CCR Composite C&A Water Chemistry Data

Sample Date	Sample Name/ Location	Total Phosphorus	Total Dissolved Phosphorus	Orthophosphate	Total Nitrogen	Total Dissolved Nitrogen	NO3+NO2-N	NH4-N	pH	Alkalinity	Hardness	TSS	TVSS
Analytical Detection Limits		2	2	3	4	6	5	5		2 mg/L	2 mg/L	4 mg/L	4 mg/L
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L		mg/L	mg/L	mg/L	mg/L
01/18/01	CCR-1 Photic	79	20	4	836	453	<5	11	8.68	170	276		
03/20/01	CCR Composite	70	50	9	827	389	<5	6	8.22	164	274		
04/10/01	CCR Composite	84	7	9	908	418	<5	13	8.34	176	278		
05/08/01	CCR Composite	99	46	29	1000	572	7	38	7.98	162	264		
05/22/01	CCR Composite	76	21	12	801	428	6	26	8.25	164	256		
06/05/01	CCR Composite	73	14	7	640	439	9	14	8.33	162	264		
06/12/01	CCR Composite	61	12	8	677	445	<5	27	7.55	158	254		
06/19/01	CCR Composite	71	18	17	693	459	<5	19	7.76	156	256		
06/26/01	CCR Composite	73	6	9	800	488	<5	27	7.51	156	256		
07/02/01	CCR Composite	82	14	8	999	630	7	34	7.87	162	276	15.0	6.6
07/10/01	CCR Composite	91	21	14	791	510	5	31	7.78	152	260	17.0	7.4
07/17/01	CCR Composite	82	28	22	739	422	<5	9	8.02	154	246	15.5	7.2
07/24/01	CCR Composite	129	25	11	1138	483	<5	19	8.07	140	234	23.8	12.6
07/31/01	CCR Composite	95	14	7	827	455	<5	14	8.07	146	242	16.1	6.6
08/07/01	CCR Composite	85	12	6	861	446	<5	14	7.66	140	230	13.1	6.7
08/14/01	CCR Composite	122	26	13	697	441	<5	31	8.28	152	242	15.0	6.0
08/21/01	CCR Composite	84	51	9	762	461	<5	14	8.25	150	248	14.4	6.4
08/28/01	CCR Composite	58	9	7	673	452	<5	10	8.00	142	246	17.2	7.4
09/04/01	CCR Composite	156	15	6	745	469	<5	15	8.05	144	252	16.6	7.4
09/11/01	CCR Composite	79	7	6	614	469	<5	13	8.43	158	248	12.0	6.6
09/18/01	CCR Composite	62	5*	7*	753	394	<5	15	8.04	154	252	15.2	7.0
09/25/01	CCR Composite	83	12	5	751	471	6	21	8.45	152	248	11.6	5.0
10/08/01	CCR Composite	69	14	9	697	431	<5	6	7.83	148	252	19.8	8.8
10/23/01	CCR Composite	70	14	9	778	446	<5	9	7.84	150	262	23.0	9.2
11/06/01	CCR Composite	60	13	7	771	458	<5	11	7.85	146	266	19.0	8.6
12/04/01	CCR Composite	55	2**	5**	689	435	<5	12	7.92	150	276	11.6	5.8

* Data within acceptable (10 percent) difference between parameters

** Data outside acceptable (10 percent) difference between parameters

Note: January-June analysis of TSS & TVSS was performed by STL

CCR Composite C&A Water Chemistry Data

Date Collected	Site Name	Total Coliform Presumptive (#/100 ml)	Fecal Coliform (#/100 ml)	*E. coli* (#/100 ml)	Average Chlorophyll α (mg/m^3)
01/18/01	CCR composite				63.5
03/20/01	CCR composite				28.2
04/10/01	CCR composite				28.6
05/08/01	CCR composite				26.3
05/22/01	CCR composite				16.1
06/05/01	CCR composite	23	<2	2	23.6
06/12/01	CCR composite	80	2	4	15.6
06/19/01	CCR composite	23	2	2	15.2
06/26/01	CCR composite	23	<2	<2	15.0
07/02/01	CCR composite	23	<2	<2	14.7
07/10/01	CCR composite	23	13	8	19.3
07/17/01	CCR composite	13	8	13	14.7
07/24/01	CCR composite	80	2	2	79.8
07/31/01	CCR composite	80	2	2	21.1
08/07/01	CCR composite	30	<2	<2	27.9
08/14/01	CCR composite	30	4	2	30.4
08/21/01	CCR composite	240	<2	<2	22.6
08/28/01	CCR composite	240	2	2	20.9
09/04/01	CCR composite	130	4	4	23.3
09/11/01	CCR composite	50	2	2	26.4
09/18/01	CCR composite	240	8	8	25.8
09/25/01	CCR composite	240	13	23	22.9
10/08/01	CCR composite	130	17	17	25.1
10/23/01	CCR composite	80	30	30	28.2
11/06/01	CCR composite				26.4
12/04/01	CCR composite				21.4

CCR-2 C&A Water Chemistry Data

Sample Date	Sample Name/Location	Total Phosphorus	Total Dissolved Phosphorus	Orthophosphate	Total Nitrogen	Total Dissolved Nitrogen	NO3+NO2-N	NH4-N	pH	Alkalinity	Hardness	TSS	TVSS
Analytical Detection Limits		2	2	3	4	6	5	5		2 mg/L	2 mg/L	4 mg/L	4 mg/L
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L		mg/L	mg/L	mg/L	mg/L
01/18/01	CCR-2 Photic	68	10	3	907	445	26	<5	8.62	172	280		
01/18/01	CCR-2 5m	71	43	<3	807	440	10	19	8.56	174	284		
03/20/01	CCR-2 5m	77	13	7	815	385	<5	<3	8.66	170	278		
03/20/01	CCR-2 6m	69	13	7	758	388	<5	6	8.35	170	280		
03/20/01	CCR-2 7m	124	15	8	859	387	<5	6	8.35	170	282		
04/10/01	CCR-2 5m	85	8*	9*	899	415	<5	12	8.52	170	280		
04/10/01	CCR-2 6m	82	10	7	948	446	<5	18	8.48	172	278		
04/10/01	CCR-2 7m	85	13	9	972	452	<5	38	8.46	174	276		
05/08/01	CCR-2 5m	101	47	40	838	529	46	57	7.84	164	266		
05/08/01	CCR-2 6m	108	63	46	874	571	72	47	7.86	158	256		
05/08/01	CCR-2 7m	159	86	78	1036	703	113	116	7.75	152	240		
05/22/01	CCR-2 5m	87	29	12	766	408	<5	14	8.26	162	254		
05/22/01	CCR-2 6m	84	20	12	772	436	<5	20	8.30	164	258		
05/22/01	CCR-2 7m	93	26	17	792	380	<5	15	8.09	166	254		
06/05/01	CCR-2 5m	69	18	7	911	730	285	10	8.35	166	256		
06/05/01	CCR-2 6m	66	22	7	617	444	14	14	8.33	166	256		
06/12/01	CCR-2 5m	102	20	16	666	421	<5	43	7.78	158	252		
06/12/01	CCR-2 6m	103	43	39	640	414	<5	35	7.59	158	248		
06/19/01	CCR-2 5m	78	20	18	625	414	<5	13	7.85	156	258		
06/19/01	CCR-2 6m	77	27	25	669	421	<5	17	7.81	156	254		
06/19/01	CCR-2 7m	94	36	36	698	419	<5	52	7.77	158	258		
06/26/01	CCR-2 5m	77	29	17	769	473	<5	37	7.64	158	258		
06/26/01	CCR-2 6m	94	37	37	850	543	6	109	7.55	158	258		
06/26/01	CCR-2 7m	170	43*	46*	982	579	6	169	7.51	162	262		
07/02/01	CCR-2 5m	108	36	35	857	480	59	22	7.55	158	260	16.0	6.6
07/02/01	CCR-2 6m	109	49	47	869	527	12	39	7.63	160	262	19.0	6.8
07/02/01	CCR-2 7m	124	57	40	928	596	96	33	7.61	162	254	16.8	6.6
07/10/01	CCR-2 5m	101	23	17	751	463	5	35	7.85	150	262	21.8	6.6
07/10/01	CCR-2 6m	95	26	18	759	478	6	40	7.71	180	260	20.8	7.0
07/10/01	CCR-2 7m	136	33	23	893	526	6	67	7.77	152	264	38.2	9.6
07/17/01	CCR-2 5m	88	55	38	667	444	9	33	7.88	156	244	12.8	5.8
07/17/01	CCR-2 6m	113	53	52	752	524	28	116	7.83	158	238	14.2	6.0
07/17/01	CCR-2 7m	139	80	67	890	600	23	211	7.70	158	240	23.0	7.2
07/24/01	CCR-2 5m	80	30	16	805	402	<5	11	7.94	140	246	17.8	8.0
07/24/01	CCR-2 6m	99	32	18	800	473	6	20	7.62	150	238	18.6	7.2

* Data within acceptable (10 percent) difference between parameters

** Data outside acceptable (10 percent) difference between parameters

Note: January-June analysis of TSS & TVSS was performed by STL

CCR-2 C&A Water Chemistry Data

Sample Date	Sample Name/Location	Total Phosphorus ug/L	Total Dissolved Phosphorus ug/L	Ortho Phosphate ug/L	Total Nitrogen ug/L	Total Dissolved Nitrogen ug/L	NO3+NO2-N ug/L	NH4-N ug/L	pH	Alkalinity mg/L	Hardness mg/L	TSS mg/L	TVSS mg/L
Analytical Detection Limits		2	2	3	4	6	5	5		2 mg/L	2 mg/L	4 mg/L	4 mg/L
07/24/01	CCR-2 7m	81	18	17	752	454	<5	15	7.92	150	244	19.6	8.0
07/31/01	CCR-2 5m	99	20	13	785	474	10	34	7.98	148	240	18.4	6.0
07/31/01	CCR-2 6m	94	29	22	855	574	8	80	7.91	150	244	18.6	6.2
07/31/01	CCR-2 7m	122	50	33	891	570	20	137	7.71	150	246	28.4	6.6
08/07/01	CCR-2 5m	79	21	12	659	441	<5	19	7.71	144	234	13.0	6.4
08/07/01	CCR-2 6m	84	33	29	698	499	55	51	7.56	150	242	15.4	5.4
08/07/01	CCR-2 7m	117	34	29	785	535	6	65	7.60	150	238	23.2	7.0
08/14/01	CCR-2 5m	82	23	20	585	420	<5	78	8.19	154	240	14.4	5.4
08/14/01	CCR-2 6m	90	32	29	628	486	<5	141	8.15	158	246	21.0	7.8
08/14/01	CCR-2 7m	218	31	26	769	491	6	159	8.32	252	326	85.9	16.4
08/21/01	CCR-2 5m	78	26	8	751	461	<5	19	8.34	148	250	17.4	6.8
08/21/01	CCR-2 6m	81	30	9	659	426	<5	22	8.31	148	250	18.2	6.6
08/21/01	CCR-2 7m	97	33	13	789	463	9	45	8.25	148	246	42.8	9.8
08/28/01	CCR-2 5m	72	9	7	776	453	<5	12	8.17	144	244	18.6	8.4
08/28/01	CCR-2 6m	70	32	10	675	386	<5	9	7.97	142	244	25.8	9.4
08/28/01	CCR-2 7m	66	17	13	800	451	<5	10	8.82	170	244	20.4	7.4
09/04/01	CCR-2 5m	59	6	7	686	524	<5	13	7.92	142	244	15.8	5.8
09/04/01	CCR-2 6m	55	4	10	702	443	<5	14	8.02	146	248	13.2	5.2
09/04/01	CCR-2 7m	88	43	15	703	461	10	18	8.63	156	254	24.2	7.2
09/11/01	CCR-2 5m	57	13	6	418*	439*	<5	7	8.73	158	250	11.0	6.2
09/11/01	CCR-2 6m	102	3	8	415	340*	<5	9	8.64	160	252	14.2	6.2
09/11/01	CCR-2 7m	86	17	11	385*	424*	<5	6	8.23	152	252	22.6	7.8
09/18/01	CCR-2 5m	58	13	9	600	425	<5	13	8.14	142	240	14.8	7.2
09/18/01	CCR-2 6m	82	26	10	730	395	<5	21	7.97	148	250	22.2	8.6
09/18/01	CCR-2 7m	112	8*	13*	771	432	<5	38	8.01	148	256	27.8	8.2
09/25/01	CCR-2 5m	102	19	11	840	521	51	12	8.49	152	250	20.0	6.8
09/25/01	CCR-2 6m	97	17	13	1494	1139	755	14	8.35	150	250	23.2	7.6
09/25/01	CCR-2 7m	151	33	18	886	428	<5	35	8.29	156	252	54.3	10.2
10/08/01	CCR-2 5m	70	20	7	687	423	<5	8	8.11	154	250	20.8	9.0
10/08/01	CCR-2 6m	63	10*	12*	753	492	8	19	8.01	146	254	24.0	9.8
10/08/01	CCR-2 7m	58	11	9	670	416	13	7	8.12	146	256	19.8	8.6
10/23/01	CCR-2 5m	72	13	8	935	604	150	14	8.43	150	264	24.0	9.6
10/23/01	CCR-2 6m	71	13	7	753	435	11	9	8.44	154	260	20.4	8.2
10/23/01	CCR-2 7m	71	14	8	744	436	<5	8	8.30	152	266	22.6	8.8
11/06/01	CCR-2 5m	51	11	6	737	432	<5	9	7.98	146	278	13.0	5.6
11/06/01	CCR-2 6m	57	4*	6*	707	434	<5	9	8.06	150	284	12.6	6.4
11/06/01	CCR-2 7m	48	14	6	696	414	<5	7	8.19	154	290	9.8	5.4
12/04/01	CCR-2 5m	50	2**	6**	730	419	<5	11	8.18	148	260	22.6	9.2
12/04/01	CCR-2 6m	53	2**	5**	763	453	43	8	8.19	150	262	23.6	9.6
12/04/01	CCR-2 7m	59	2**	5**	948	608	223	9	8.20	148	260	27.4	10.4

* Data within acceptable (10 percent) difference between parameters

** Data outside acceptable (10 percent) difference between parameters

Whole Lake Composite: University of Missouri Water Chemistry Data

Sample Date	Sample Name/Location	Total Phosphorus	Total Dissolved Phosphorus	Orthophosphate	Total Nitrogen	Total Dissolved Nitrogen	NO3+NO2-N	NH4-N	Chl-a	Alkalinity
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L
01/18/01	CCR-1 Photic	62	13	5	640	580	12	0		
01/18/01	CCR-2 Photic	71	14	6	720	500	<5	0	61.1	
03/20/01	WL Composite	80	14	6	750	410	<5	17	35.5	161
04/10/01	WL Composite	167	6	4	710	410	40	19	33.2	164
05/08/01	WL Composite	87	28	19	900	590	62	18	31.2	157
05/22/01	WL Composite	84	29	12	710	480	86	41	20.1	146
06/05/01	WL Composite	62	12	5	640	460	70	49	26.7	154
06/12/01	WL Composite	60	13	7	490	300	40	4	16.1	143
06/12/01	WL Composite	62	13	7	540	300	36	16		144
06/19/01	WL Composite	72	20	11	560	380	28	0	16	144
06/26/01	WL Composite	70	16	8	600	550	41	36	18.4	144
07/02/01	WL Composite	67	12	3	820	500	1	50	15.8	145
07/10/01	WL Composite	89	23	13	640	540	0	52	23.4	158
07/17/01	WL Composite	81	32	19	620	460	0	0	17.8	140
07/24/01	WL Composite	134	16	7	1120	540	0	47	75.2	198
07/31/01	WL Composite	77	15	6	680	540	0	4	19.4	136
08/07/01	WL Composite	95	18	8	760	560	0	0	24.7	129
08/14/01	WL Composite	86	23	14	600	480	0	0	29.7	131
08/21/01	WL Composite	68	17	8	500	550	0	0	11.8	132
08/28/01	WL Composite	65	14	6	480	540	0	27	20.9	130
09/04/01	WL Composite	64	12	2	710	770	78	95	21.3	130
09/11/01	WL Composite				0	0	0	0	21.8	
09/18/01	WL Composite	79	18	6	830	600	26	6	24.5	130
09/25/01	WL Composite	70	11	5	670	490	0	9	23	135
10/08/01	WL Composite	66	13	7	780	470	0	0	25	133
10/23/01	WL Composite	71	15	9	730	480	0	10	33.9	136
11/06/01	WL Composite	75	13	3	810	530	0	46	32.3	137
12/04/01	WL Composite	59	12	2	0	0	0	67		

Whole Lake Composite: Severn Trent Labs Water Chemistry Data

Sample Date	Sample Name/ Location	TSS mg/L	TVSS mg/L	T. Al mg/L	T. Ca mg/L
	Analytical Detection Limits	4.0	10.0	0.10	0.20
01/18/01	CCR-1 Photic	6.8	<10.0	0.12	80.2
03/20/01	CCR-1,2,3	7.2	<10.0	0.13	71.3
04/10/01	CCR-1,2,3	12.8*	<10.0	0.26	80.1
05/08/01	CCR-1,2,3	10.6	<10.0	0.61	83.6
05/22/01	CCR-1,2,3	12.4	<10.0	<0.10	73.3
06/05/01	CCR-1,2,3	11.2	<10.0	<0.10	74.2
06/12/01	CCR-1,2,3	12.0	<10.0	0.15	80.9
06/19/01	CCR-1,2,3	15.6	<10.0	0.42	73.1
06/26/01	CCR-1,2,3	10.0	<10.0	0.27	72.7
07/02/01	CCR-1,2,3	9.2	<10.0	0.23	75.2
07/10/01	CCR-1,2,3	10.8	<10.0	0.67	80.9
07/17/01	CCR-1,2,3	<4.0	<10.0	0.10	74.7
07/24/01	CCR-1,2,3	20.0	<10.0	0.39	71.4
07/31/01	CCR-1,2,3	8.4	<10.0	0.18	69.5
08/07/01	CCR-1,2,3	7.4	<10.0	0.17	60.6
08/14/01	CCR-1,2,3	9.2	<10.0	0.18	65.2
08/21/01	CCR-1,2,3	12.6	<10.0	0.24	68.8
08/28/01	CCR-1,2,3			0.12**	69.4
09/04/01	CCR-1,2,3			0.29	69.8
09/11/01	CCR-1,2,3			0.17	66.7
09/18/01	CCR-1,2,3			0.42	69.6
09/25/01	CCR-1,2,3			0.11	69.2
10/08/01	CCR-1,2,3			0.29	70.9
10/23/01	CCR-1,2,3			0.28	64.7
11/06/01	CCR-1,2,3			0.11	71.6

* Elevated reporting limit

** Physical and chemical interferences may have been present

Note: July to December analysis of TSS & TVSS was performed by C&A

CCR-2: Severn Trent Labs Water Chemistry Data

Sample Date	Sample Name/ Location	TSS mg/L	TVSS mg/L	T. Al mg/L	T. Ca mg/L
	Analytical Detection Limits	4.0	10.0	0.20	0.10
1/18/2001	CCR-2 Photic	6.8	10.4	<0.10	77.3
01/18/01	CCR-2 5m	7.6	<10.0	0.18	76.8
03/20/01	CCR-2 5m	7.2	<10.0	0.16	79.6
03/20/01	CCR-2 6m	6.8	<10.0	0.18	79.7
03/20/01	CCR-2 7m	12.0	<10.0	1.60	82.0
04/10/01	CCR-2 5m	12.6	<10.0	0.45	81.0
04/10/01	CCR-2 6m	14.6	<10.0	0.40	83.9
04/10/01	CCR-2 7m	28.8	10.2	0.83	81.5
05/08/01	CCR-2 5m	11.6	<10.0	0.90	80.9
05/08/01	CCR-2 6m	11.4	<10.0	0.34	80.2
05/08/01	CCR-2 7m	13.2	<10.0	0.73	75.9
05/22/01	CCR-2 5m	14.2	<10.0	0.15	73.4
05/22/01	CCR-2 6m	14.6	<10.0	0.11	73.2
05/22/01	CCR-2 7m	24.0	<10.0	0.12	72.6
06/05/01	CCR-2 5m	10.0	<10.0	0.16	77.1
06/05/01	CCR-2 6m	9.6	<10.0	0.28	77.4
06/12/01	CCR-2 5m	<4.0	<10.0	0.85	77.9
06/12/01	CCR-2 6m	<4.0	<10.0	0.97	79.2
06/19/01	CCR-2 5m	11.6	<10.0	0.37	72.1
06/19/01	CCR-2 6m	12.0	<10.0	0.54	72.5
06/19/01	CCR-2 7m	12.6	<10.0	0.55	74.3
06/26/01	CCR-2 5m	7.0	<10.0	0.24	73.1
06/26/01	CCR-2 6m	6.0	<10.0	0.14	73.3
06/26/01	CCR-2 7m	48.0	12.4	1.90	74.6
07/02/01	CCR-2 5m	9.6	<10.0	0.12	75.5
07/02/01	CCR-2 6m	11.6	<10.0	0.13	74.2
07/02/01	CCR-2 7m	18.0	<10.0	0.18	75.1
07/10/01	CCR-2 5m	16.4	<10.0	0.60	80.1
07/10/01	CCR-2 6m	12.4	<10.0	0.21	79.1
07/10/01	CCR-2 7m	35.2	10.0	1.30	80.1
07/17/01	CCR-2 5m	<4.0	<10.0	0.16	74.6
07/17/01	CCR-2 6m	<4.0	<10.0	<0.10	74.4
07/17/01	CCR-2 7m	14.8	<10.0	0.80	73.9
07/24/01	CCR-2 5m	14.8	<10.0	0.46	71.0
07/24/01	CCR-2 6m	28.0	<10.0	0.47	71.9

CCR-2: Severn Trent Labs Water Chemistry Data

Sample Date	Sample Name/ Location	TSS mg/L	TVSS mg/L	T. Al mg/L	T. Ca mg/L
07/24/01	CCR-2 7m	14.0	<10.0	0.49	71.8
07/31/01	CCR-2 5m	13.6	<10.0	0.25	70.6
07/31/01	CCR-2 6m	16.6	<10.0	0.20	71.2
07/31/01	CCR-2 7m	27.2	<10.0	1.10	70.4
08/07/01	CCR-2 5m	7.2	<10.0	0.19	61.2
08/07/01	CCR-2 6m	8.6	<10.0	0.37	63.2
08/07/01	CCR-2 7m	18.2	<10.0	0.17	62.8
08/14/01	CCR-2 5m	11.6	<10.0	0.34	64.0
08/14/01	CCR-2 6m	15.8	<10.0	0.39	65.9
08/14/01	CCR-2 7m	40.8	<10.0	2.20	69.6
08/21/01	CCR-2 5m	13.8	<10.0	0.27	66.7
08/21/01	CCR-2 6m	14.0	<10.0	<0.10	67.4
08/21/01	CCR-2 7m	37.6	14.4	0.25	71.0
08/28/01	CCR-2 5m			0.33	70.7
08/28/01	CCR-2 6m			0.25	67.9
08/28/01	CCR-2 7m			0.35	70.1
09/04/01	CCR-2 5m			0.32	68.6
09/04/01	CCR-2 6m			0.47	71.2
09/04/01	CCR-2 7m			0.40	69.4
09/11/01	CCR-2 5m			0.13	65.8
09/11/01	CCR-2 6m			0.21	68.8
09/11/01	CCR-2 7m			0.63	67.8
09/18/01	CCR-2 5m			0.37	68.0
09/18/01	CCR-2 6m			0.50	69.1
09/18/01	CCR-2 7m			1.20	69.9
09/25/01	CCR-2 5m			0.50	71.0
09/25/01	CCR-2 6m			0.47	71.4
09/25/01	CCR-2 7m			2.10	72.5
10/08/01	CCR-2 5m			0.22	70.8
10/08/01	CCR-2 6m			0.30	71.1
10/08/01	CCR-2 7m			0.17	71.0
10/23/01	CCR-2 5m			0.40	67.8
10/23/01	CCR-2 6m			0.29	66.0
10/23/01	CCR-2 7m			0.28	65.8
11/06/01	CCR-2 5m			<0.10	69.5
11/06/01	CCR-2 6m			0.11	82.0
11/06/01	CCR-2 7m			0.24	70.7
12/4/2001	CCR-2 5m			<0.10	76.2
12/4/2001	CCR-2 6m			<0.10	76.3
12/4/2001	CCR-2 7m			<0.10	76.7

* Elevated reporting limit

** Physical and chemical interferences may have been present

Note: July to December analysis of TSS & TVSS was performed by C&A

CHERRY CREEK
D.O. DATA, 2001
Site CCR-1

CCR-1
1/18/2001
Secchi: 0.7m
1% Trans: 0.9m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	1.54	11.77	484	8.01	383.6
1	3.39	10.62	520	7.92	383.5
2	3.45	10.26	522	7.99	382.1
3	3.37	10.38	532	8.08	380

CCR-1
3/20/2001
Secchi: 0.7m
1% Trans: 3.0m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	4.88	12.68	547	7.3	388.1
1	4.8	13.22	545	7.81	380.7
2	4.8	13.1	546	7.98	377.6
3	4.75	12.77	545	8.06	375.8
4	4.7	12.71	544	8.13	374.4
5	4.64	12.44	544	8.16	373.8

CCR-1
4/10/2001
Secchi: 0.6m
1% Trans: 2.0m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	9.46	9.3	625	7.06	419
1	9.46	9.12	626	7.55	408
2	9.46	9.14	625	7.86	401
3	9.46	9.18	626	8.01	397.1
4	9.45	9.11	626	8.09	394.5
5	9.45	9.05	626	8.13	392.5

CCR-1
5/8/2001
Secchi: 0.7m
1% Trans: 2.6m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	14.38	11.52	678	7.41	385.1
1	13.15	12.00	655	7.79	378.7
2	11.50	10.71	621	7.89	379.2
3	10.94	9.47	621	7.90	380.0
4	10.50	8.17	618	7.88	381.2
5	10.20	8.11	596	7.88	380.5
6	9.83	8.01	574	7.88	380.1

CCR-1
5/22/2001
Secchi: 0.6m
1% Trans: 3.5m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	15.03	7.08	656	7.84	361.1
1	14.98	7.24	655	8.04	355.2
2	14.93	7.38	655	8.11	353.0
3	14.87	7.27	654	8.15	351.7
4	14.88	7.24	654	8.17	351.1
5	14.79	6.50	655	8.25	337.0

CCR-1
6/5/2001
Secchi: 0.6m
1% Trans: 2.9m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	18.45	7.66	714	7.56	367.1
1	18.36	7.67	711	7.88	360.8
2	18.24	7.70	709	7.94	357.4
3	18.18	7.58	708	8.01	355.6
4	18.07	7.31	706	8.04	355.5
5	17.93	4.73	705	8.04	355.6

CCR-1
6/12/2001
Secchi: 1.0m
1% Trans: 2.7m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	21.82	8.49	714	7.66	353.0
1	20.72	8.33	698	7.95	352.2
2	20.12	8.13	690	7.99	353.2
3	19.20	7.00	681	7.94	359.5
4	18.74	4.10	675	7.83	363.8
5	18.42	2.61	670	7.81	367.5
6	18.17	2.16	666	7.75	369.5

CCR-1
6/19/2001
Secchi: 0.9m
1% Trans: 1.4m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	20.91	8.21	701	7.67	315.8
1	20.89	6.95	701	7.87	319.8
2	20.81	8.03	700	7.97	323.2
3	19.36	6.20	680	7.90	332.8
4	18.49	3.39	667	7.73	343.8
5	18.32	3.23	665	7.69	346.4
6	18.18	2.33	663	7.65	348.0

* "ND" denotes "No Data"

CCR-1 DO Data Continued

CCR-1
6/26/2001
Secchi: 0.6m
1% Trans: 2.7m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	23.14	7.42	740	8.10	318.5
1	21.27	7.81	711	8.13	321.9
2	20.80	6.86	706	8.09	329.3
3	20.67	6.13	704	8.05	333.6
4	20.32	4.57	699	7.97	340.5

CCR-1
7/2/2001
Secchi: 0.8m
1% Trans: 2.9m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	24.69	6.18	780	7.68	349.9
1	23.79	6.86	762	7.80	344.7
2	23.42	6.95	757	7.88	341.4
3	23.21	6.83	754	7.91	339.7
4	22.97	6.52	750	7.93	340.0
5	22.90	6.39	749	7.94	339.9
6	22.80	6.09	747	7.94	339.9

CCR-1
7/10/2001
Secchi: 0.7m
1% Trans: 2.3m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	23.54	7.90	757	6.55	382.9
1	23.19	8.35	751	6.74	377.6
2	23.20	7.70	751	6.90	3.72.9
3	23.04	7.61	748	7.06	369.7
4	22.02	7.90	743	7.12	367.5
5	22.69	7.42	741	7.22	368.0

CCR-1
7/17/2001
Secchi: 0.6m
1% Trans: 1.0m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	23.24	--	739	7.45	346.6
1	23.15	--	738	7.54	344.1
2	23.05	--	737	7.59	344.7
3	22.89	--	736	7.61	344.7
4	22.65	--	733	7.59	353.1
5	22.59	--	730	7.57	354.4

CCR-1
7/24/2001
Secchi: 0.5m
1% Trans: 0.9m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	24.11	--	740	7.91	354.0
1	23.54	--	731	7.91	356.6
2	23.37	--	730	7.87	359.9
3	23.34	--	731	7.84	363.5
4	23.26	--	732	7.80	366.8
5	23.20	--	732	7.77	370.4

CCR-1
7/31/2001
Secchi: 0.7m
1% Trans: 1.2m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	24.20	6.98	744	8.22	320.0
1	23.28	5.41	731	8.19	327.8
2	22.87	3.73	727	8.12	334.9
3	22.79	3.30	726	8.08	337.8
4	22.67	2.48	725	8.03	341.2
5	22.66	2.12	725	7.98	342.6

CCR-1
8/7/2001
Secchi: 0.6m
1% Trans: 0.9m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	25.12	8.93	749	7.80	349.8
1	24.07	7.26	735	7.93	356.3
2	23.76	6.22	732	7.94	361.7
3	23.68	6.16	730	7.94	363.8
4	23.56	5.06	731	7.93	369.3
5	23.46	3.27	732	7.90	375.3

CCR-1
8/14/2001
Secchi: 0.6m
1% Trans: 0.8m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	22.67	5.79	720	7.08	395.6
1	22.63	5.70	719	7.16	381.3
2	22.49	5.41	718	7.21	377.5
3	22.41	4.38	718	7.25	375.8
4	22.38	4.42	718	7.30	372.7
5	22.32	4.49	718	7.35	369.9
6	22.28	4.48	720	7.36	369.1

* "ND" denotes "No Data"

CCR-1 DO Data Continued

CCR-1
8/21/2001
Secchi: 0.9m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	22.31	6.53	722	7.86	336.0
1	21.62	6.02	711	7.89	337.6
2	21.47	4.72	710	7.88	341.6
3	21.45	4.20	710	7.87	343.1
4	21.43	4.27	710	7.86	343.0
5	21.42	4.44	710	7.87	343.1
6	21.37	4.52	710	7.88	342.7

CCR-1
8/28/2001
Secchi: 0.7m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	22.05	7.79	718	8.12	320.6
1	21.63	7.25	713	8.16	322.5
2	21.16	6.27	707	8.16	328.7
3	21.07	5.44	706	8.12	333.7
4	20.89	4.93	704	8.10	337.8
5	20.82	4.54	704	8.09	339.3
6	20.53	4.05	701	8.07	341.5

CCR-1
9/4/2001
Secchi: 0.8m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	21.73	8.76	717	8.49	298.2
1	21.40	8.64	711	8.42	301.5
2	20.92	7.83	706	8.39	306.4
3	20.70	6.54	704	8.34	312.7
4	20.50	5.18	702	8.30	318.4
5	20.44	4.20	701	8.26	321.4

CCR-1
9/11/2001
Secchi: 1.1m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	19.11	9.50	672	8.38	296.2
1	18.33	9.06	661	8.34	299.8
2	18.02	7.53	658	8.28	306.6
3	17.86	6.68	657	8.23	310.8
4	17.77	6.01	656	8.19	315.2
5	17.73	4.85	657	8.13	320.2

CCR-1
9/18/2001
Secchi: 1.0m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	18.58	8.06	671	8.50	275.1
1	18.34	7.50	668	8.45	280.6
2	18.25	7.06	667	8.41	285.2
3	18.22	6.66	667	8.39	289.4
4	18.13	5.63	667	8.35	294.7
5	18.13	5.10	667	8.32	297.1

CCR-1
9/25/2001
Secchi: 0.95m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	18.34	6.47	711	7.62	375.2
1	18.19	6.02	708	7.52	375.5
2	18.02	5.71	705	7.50	375.5
3	17.98	5.43	705	7.51	375.5
4	17.96	4.92	705	7.53	377.4
5	17.92	3.92	705	7.52	380.7
6	17.89	3.13	705	7.52	382.0

CCR-1
10/8/2001
Secchi: 0.8m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	15.60	8.34	672	8.29	304.9
1	15.46	8.09	669	8.19	307.4
2	15.27	7.71	666	8.14	310.4
3	15.11	6.49	665	8.09	315.6
4	15.05	5.06	666	8.03	320.5
5	15.05	4.70	666	8.01	321.1
6	15.06	4.56	666	7.97	323.5

CCR-1
10/23/2001
Secchi: 0.9m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	10.80	8.52	673	7.92	283.4
1	10.59	8.30	668	7.85	287.1
2	10.54	8.16	667	7.80	290.2
3	10.50	8.10	667	7.80	292.1
4	10.45	8.03	666	7.79	294.7
5	10.44	7.96	666	7.80	296.0
6	10.44	7.90	666	7.82	298.3

* "ND" denotes "No Data"

CCR-1 DO Data Continued

CCR-1
11/6/2001
Secchi: 0.9m
1% Trans: ND

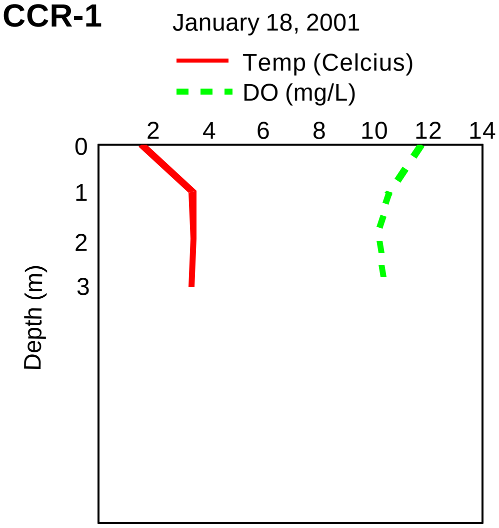
Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	9.55	9.89	603	7.63	304.5
1	9.42	9.87	301	7.77	307
2	9.29	9.43	300	7.79	309.4
3	9.26	8.83	599	7.83	311.2
4	9.21	8.37	599	7.82	313.8
5	9.18	7.68	599	7.82	315.7
6	9.18	7.32	600	7.82	316.6

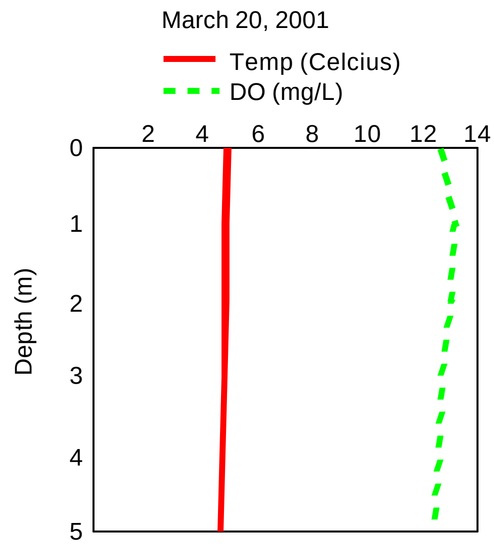
CCR-1
12/4/2001
Secchi: 0.9 m
1% Trans: ND

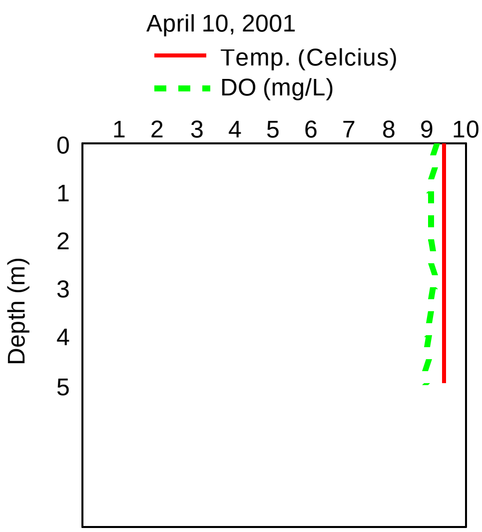
Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	3.16	10.53	544	7.99	250.2
1	3.07	10.48	540	7.83	256.4
2	3.05	10.44	539	7.84	259.7
3	3.1	10.31	539	7.84	262.2
4	3.17	10.17	541	7.86	264.7
5	3.18	10.07	542	7.89	266.8
6	3.32	9.45	549	7.83	269.4

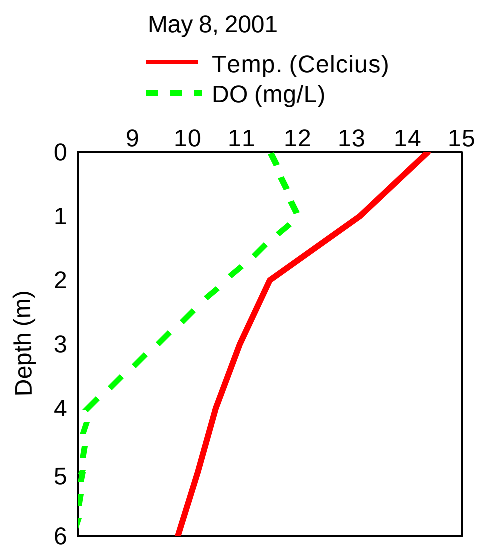
* "ND" denotes "No Data"

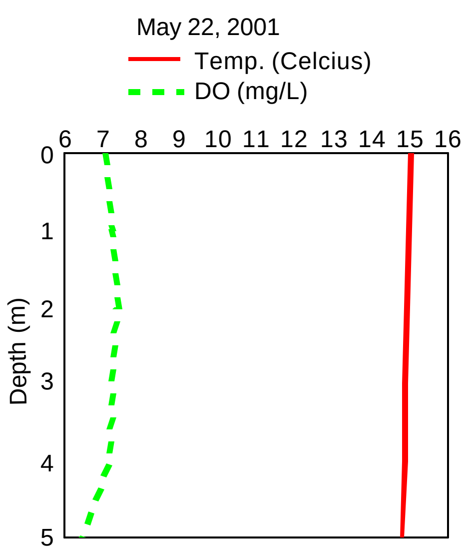
CCR-1

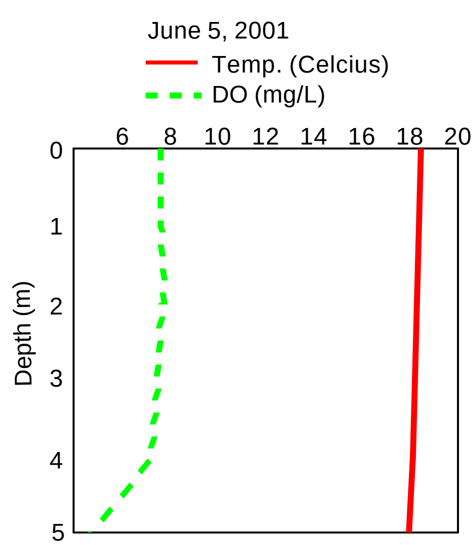

January 18, 2001
Temp (Celcius)
DO (mg/L)
2 4 6 8 10 12 14
0 1 2 3
Depth (m)


March 20, 2001
Temp (Celcius)
DO (mg/L)
2 4 6 8 10 12 14
0 1 2 3 4 5
Depth (m)

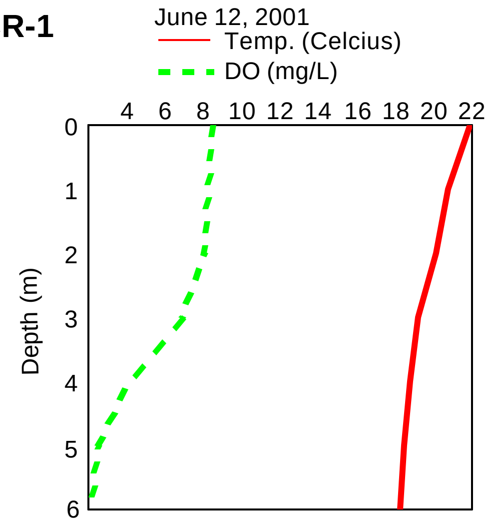

April 10, 2001
Temp. (Celcius)
DO (mg/L)
1 2 3 4 5 6 7 8 9 10
0 1 2 3 4 5
Depth (m)

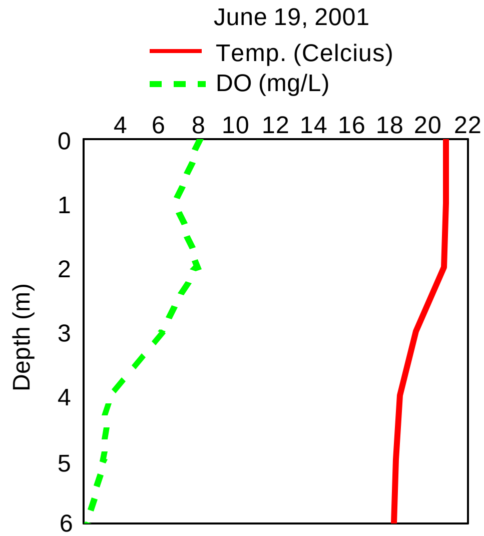

May 8, 2001
Temp. (Celcius)
DO (mg/L)
9 10 11 12 13 14 15
0 1 2 3 4 5 6
Depth (m)

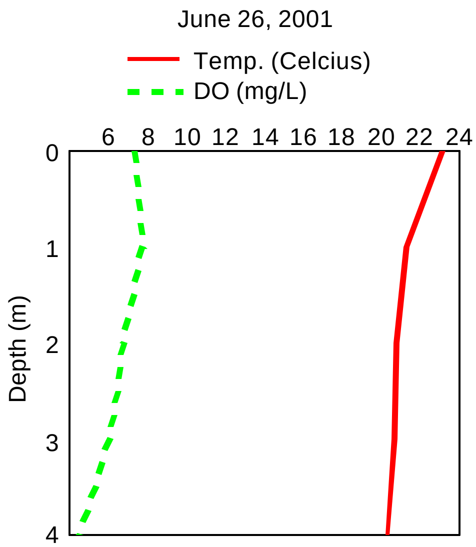

May 22, 2001
Temp. (Celcius)
DO (mg/L)
6 7 8 9 10 11 12 13 14 15 16
0 1 2 3 4 5
Depth (m)

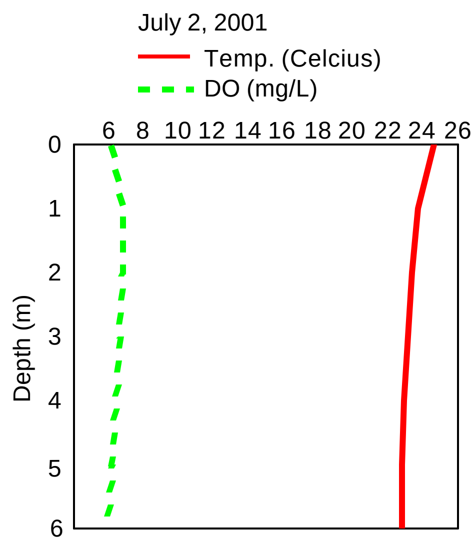

June 5, 2001
Temp. (Celcius)
DO (mg/L)
6 8 10 12 14 16 18 20
0 1 2 3 4 5
Depth (m)

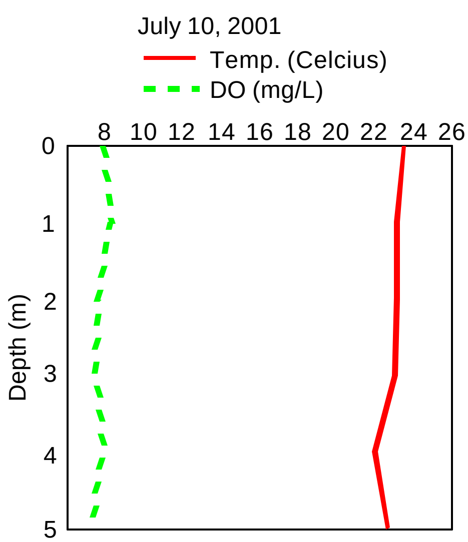
CCR-1

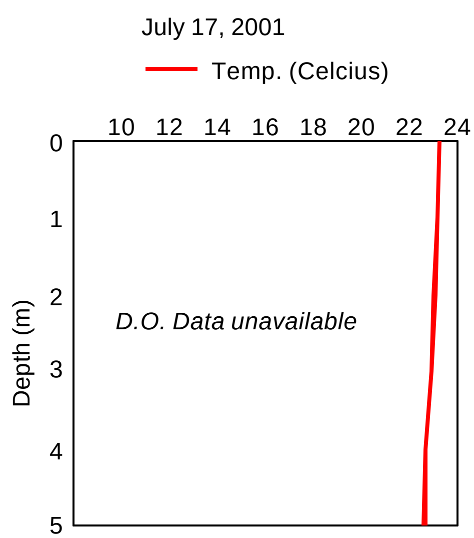

June 12, 2001
Temp. (Celcius)
DO (mg/L)
4 6 8 10 12 14 16 18 20 22
Depth (m)
0 1 2 3 4 5 6


June 19, 2001
Temp. (Celcius)
DO (mg/L)
4 6 8 10 12 14 16 18 20 22
Depth (m)
0 1 2 3 4 5 6

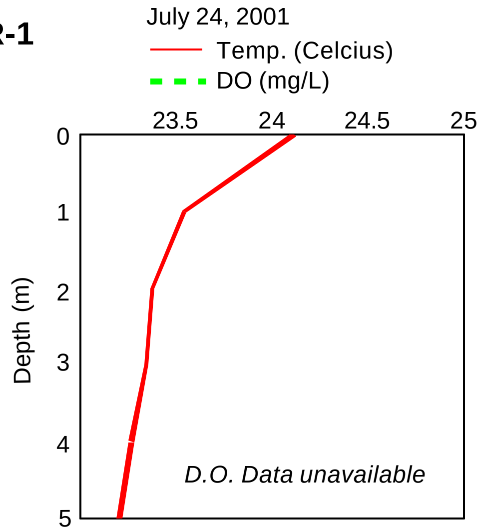

June 26, 2001
Temp. (Celcius)
DO (mg/L)
6 8 10 12 14 16 18 20 22 24
Depth (m)
0 1 2 3 4

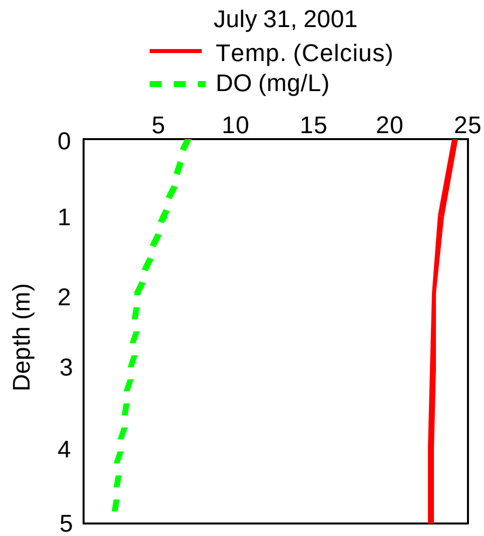

July 2, 2001
Temp. (Celcius)
DO (mg/L)
6 8 10 12 14 16 18 20 22 24 26
Depth (m)
0 1 2 3 4 5 6

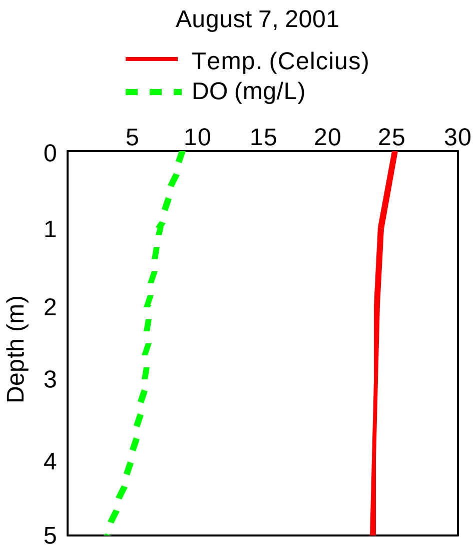

July 10, 2001
Temp. (Celcius)
DO (mg/L)
8 10 12 14 16 18 20 22 24 26
Depth (m)
0 1 2 3 4 5

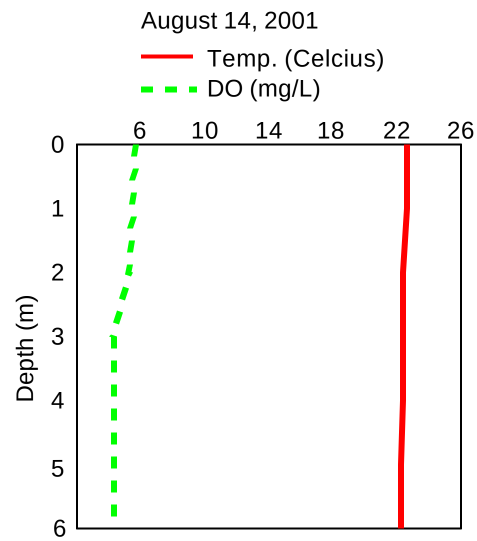

July 17, 2001
Temp. (Celcius)
10 12 14 16 18 20 22 24
Depth (m)
0 1 2 3 4 5
D.O. Data unavailable

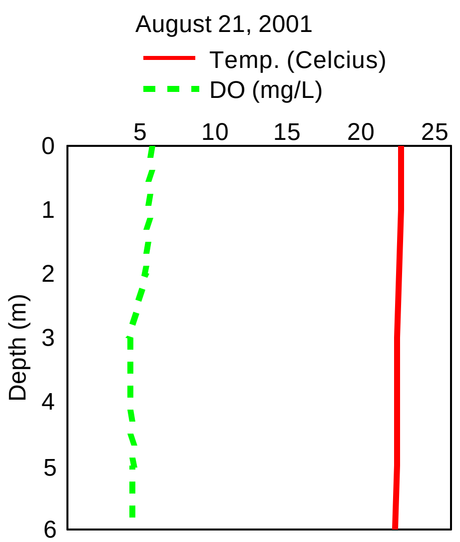
CCR-1

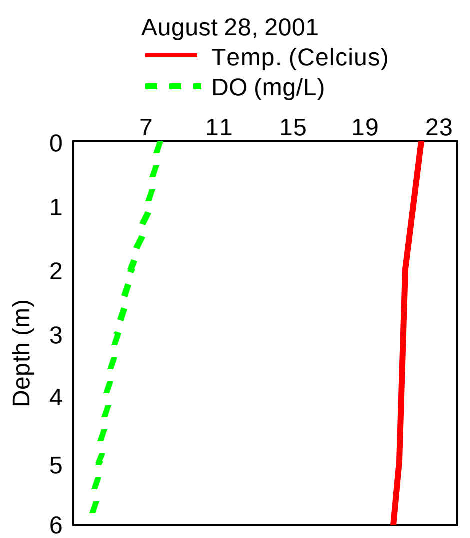

July 24, 2001
Temp. (Celcius)
DO (mg/L)
23.5
24
24.5
25
0
1
2
3
4
5
Depth (m)
D.O. Data unavailable


July 31, 2001
Temp. (Celcius)
DO (mg/L)
5
10
15
20
25
0
1
2
3
4
5
Depth (m)

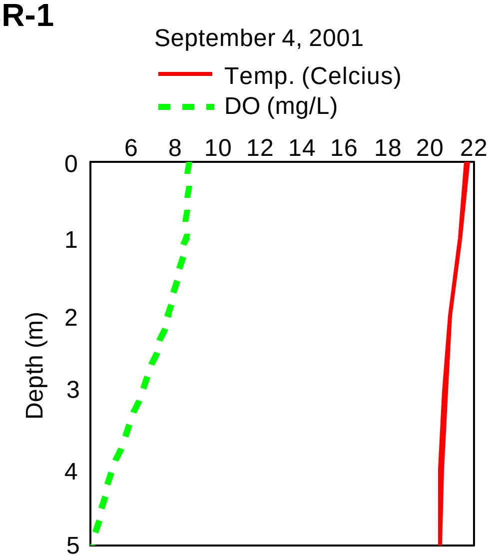

August 7, 2001
Temp. (Celcius)
DO (mg/L)
5
10
15
20
25
30
0
1
2
3
4
5
Depth (m)


August 14, 2001
Temp. (Celcius)
DO (mg/L)
6
10
14
18
22
26
0
1
2
3
4
5
6
Depth (m)

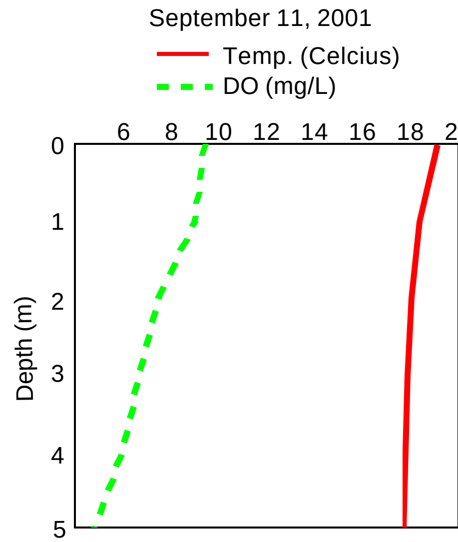

August 21, 2001
Temp. (Celcius)
DO (mg/L)
5
10
15
20
25
0
1
2
3
4
5
6
Depth (m)


August 28, 2001
Temp. (Celcius)
DO (mg/L)
7
11
15
19
23
0
1
2
3
4
5
6
Depth (m)

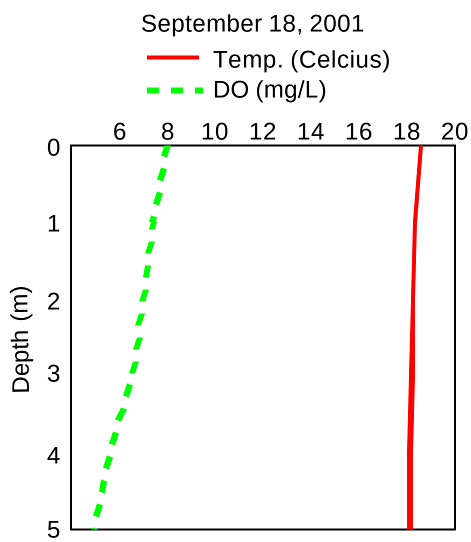
CCR-1



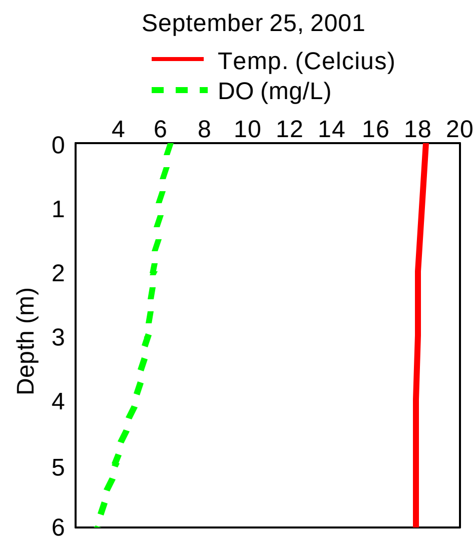
September 4, 2001
Temp. (Celcius)
DO (mg/L)
6 8 10 12 14 16 18 20 22
Depth (m)
0 1 2 3 4 5



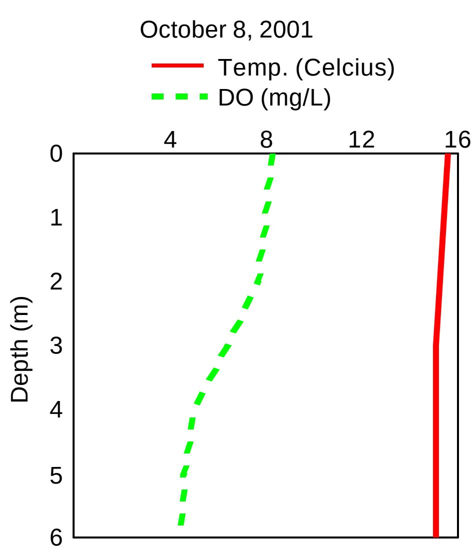
September 11, 2001
Temp. (Celcius)
DO (mg/L)
6 8 10 12 14 16 18 20
Depth (m)
0 1 2 3 4 5



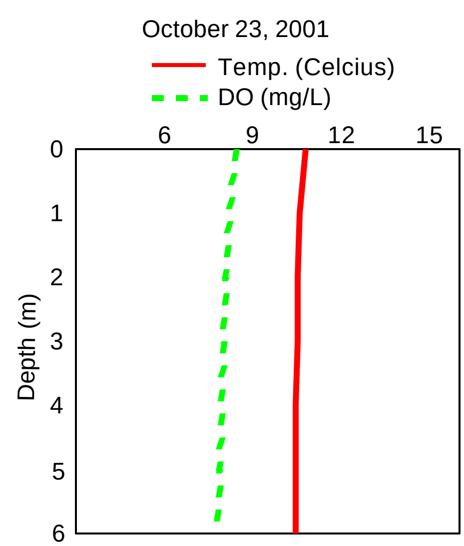
September 18, 2001
Temp. (Celcius)
DO (mg/L)
6 8 10 12 14 16 18 20
Depth (m)
0 1 2 3 4 5



September 25, 2001
Temp. (Celcius)
DO (mg/L)
4 6 8 10 12 14 16 18 20
Depth (m)
0 1 2 3 4 5 6

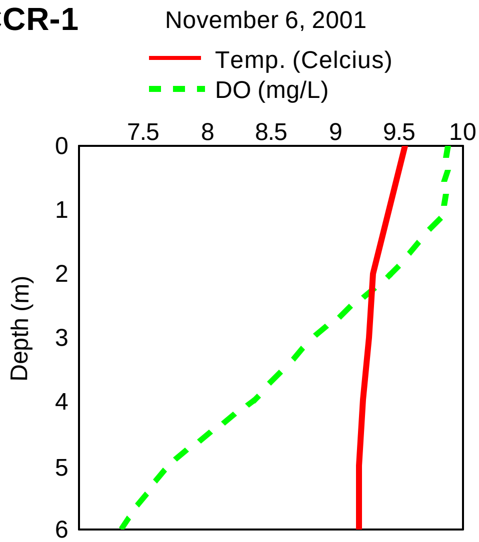


October 8, 2001
Temp. (Celcius)
DO (mg/L)
4 8 12 16
Depth (m)
0 1 2 3 4 5 6

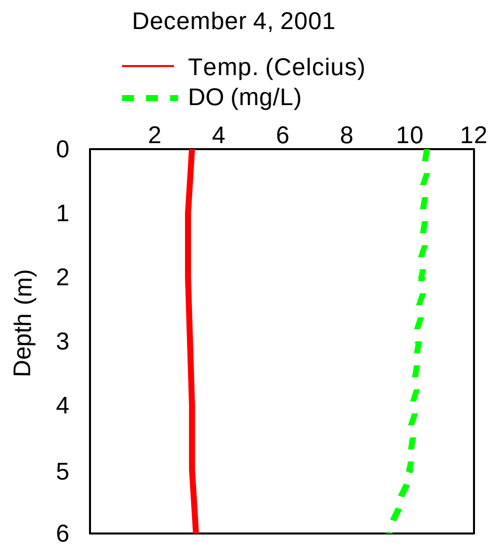


October 23, 2001
Temp. (Celcius)
DO (mg/L)
6 9 12 15
Depth (m)
0 1 2 3 4 5 6

CCR-1



November 6, 2001
Temp. (Celcius)
DO (mg/L)
7.5
8
8.5
9
9.5
10
0
1
2
3
4
5
6
Depth (m)



December 4, 2001
Temp. (Celcius)
DO (mg/L)
2
4
6
8
10
12
0
1
2
3
4
5
6
Depth (m)

CHERRY CREEK
D.O. DATA, 2001
Site CCR-2

CCR-2
1/18/2001
Secchi: 0.5m
1% Trans: 0.5m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	1.97	14.68	500	8.61	343
1	3.56	12.03	524	8.38	350.4
2	3.69	11.21	528	8.29	353.4
3	3.77	10.63	530	8.23	356.5
4	3.77	10.62	530	8.22	357.5
5	3.77	10.5	531	8.21	358.5

CCR-2
3/20/2001
Secchi: 0.8m
1% Trans: 0.3m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	4.9	13.09	545	8.45	353
1	4.74	13.09	543	8.46	354.9
2	4.71	12.84	542	8.45	355.3
3	4.64	12.85	541	8.44	356.5
4	4.65	12.65	541	8.45	356.8
5	4.6	12.57	540	8.44	357.7
6	4.57	12.5	540	8.44	358.5

CCR-2
4/10/2001
Secchi: 0.5m
1% Trans: 2.1m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	9.68	9.63	629	8.35	369.4
1	9.71	9.56	630	8.38	368.7
2	9.71	9.49	631	8.39	368.7
3	9.7	9.52	630	8.38	368.8
4	9.7	9.45	631	8.38	368.9
5	9.68	9.08	631	8.39	369.3
6	9.62	9.47	630	8.37	370.3

CCR-2
5/8/2001
Secchi: 0.6m
1% Trans: 2.8m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	13.53	11.43	655	8.35	325.9
1	12.72	11.7	634	8.38	327.5
2	11.32	10.4	597	8.32	333
3	10.91	9.61	599	8.27	336.1
4	10.56	9.19	601	8.24	337.9
5	10.03	8.34	581	8.19	341.2
6	9.93	8.03	580	8.16	342.7
7	9.19	8.22	535	8.15	343.9

CCR-2
5/22/2001
Secchi: 0.7m
1% Trans: 3.5m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	15.25	7.39	660	8.27	349.1
1	15.12	7.37	658	8.30	348.6
2	15.05	7.27	657	8.32	347.2
3	15.00	7.28	656	8.33	347.6
4	14.82	7.15	654	8.31	348.4
5	14.67	6.58	653	8.31	349.1
6	14.43	5.91	652	8.26	350.9

CCR-2
6/5/2001
Secchi: 0.9m
1% Trans: 3.4m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	18.87	7.99	719	8.22	339.6
1	18.41	8.08	711	8.28	338.0
2	18.17	7.86	707	8.29	338.6
3	18.00	7.55	705	8.27	340.0
4	17.94	7.40	705	8.27	340.7
5	17.89	7.03	704	8.26	341.0
6	17.40	6.06	698	8.21	346.1

CCR-2
6/12/2001
Secchi: 0.85m
1% Trans: 3.2m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	21.69	8.02	714	8.18	306.9
1	20.22	8.27	690	8.22	313.7
2	19.76	7.18	686	8.20	319.7
3	19.46	6.36	684	8.16	324.6
4	19.26	6.19	680	8.14	326.7
5	18.89	5.21	664	8.06	332.9
6	17.73	1.26	661	7.87	344.1

CCR-2
6/19/2001
Secchi: 0.8m
1% Trans: 1.5m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	20.03	7.71	690	7.95	325.7
1	19.98	7.49	689	8.01	328.0
2	19.89	7.51	687	8.02	329.3
3	19.85	7.36	686	8.04	331.1
4	19.39	6.71	680	8.01	334.7
5	19.14	6.34	678	7.98	338.0
6	18.47	4.16	668	7.90	344.8
7	18.06	2.54	663	7.80	348.2

* "ND" denotes " No Data"

CCR-2 DO Data Continued

CCR-2
6/26/2001
Secchi: 0.8m
1% Trans: 2.9m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	22.94	7.02	741	8.26	313.9
1	21.59	7.25	715	8.26	319.7
2	21.01	6.19	707	8.20	327.2
3	20.87	5.87	706	8.17	331.4
4	20.77	5.89	704	8.15	333.4
5	20.11	3.71	696	8.00	342.8
6	19.91	2.91	693	7.96	344.6

CCR-2
7/2/2001
Secchi: 0.8m
1% Trans: 2.8m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	24.43	6.53	775	8.11	325.9
1	23.92	6.88	766	8.11	328.8
2	23.46	6.70	760	8.12	330.6
3	23.31	6.71	756	8.13	332.4
4	23.08	6.54	753	8.12	335.7
5	22.89	6.18	751	8.11	339.9
6	22.73	6.02	749	8.08	340.9
7	22.70	5.89	749	8.07	342.4

CCR-2
7/10/2001
Secchi: 0.6m
1% Trans: 2.0m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	24.24	8.52	769	7.78	323.9
1	23.03	8.30	748	7.78	329.5
2	22.93	7.77	747	7.77	333.6
3	22.85	7.44	746	7.74	338.1
4	22.81	7.37	745	7.74	339.3
5	22.74	7.67	744	7.72	341.3
6	22.73	7.03	743	7.72	342.8
7	22.72	7.33	743	7.70	342.6

CCR-2
7/17/2001
Secchi: 0.6m
1% Trans: 1.2m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	24.10	--	751	8.03	319.6
1	23.83	--	744	8.08	320.8
2	23.73	--	743	8.10	322.1
3	23.63	--	742	8.11	323.9
4	23.53	--	740	8.13	325.5
5	22.75	--	723	8.04	338.8
6	22.55	--	717	7.98	344.0
7	22.47	--	717	7.94	346.6

CCR-2
7/24/2001
Secchi: 0.6m
1% Trans: 0.8m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	24.51	--	744	8.07	349.9
1	23.52	--	732	8.06	356.6
2	23.29	--	729	8.01	361.3
3	23.22	--	729	7.97	364.3
4	23.19	--	728	7.95	365.1
5	23.17	--	728	7.92	366.0
6	23.14	--	728	7.91	366.7
7	23.10	--	727	7.87	367.3

CCR-2
7/31/2001
Secchi: 0.7m
1% Trans: 0.9m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	24.62	7.25	750	8.18	329.2
1	23.92	7.06	740	8.18	331.9
2	23.56	6.08	735	8.18	336.2
3	23.49	5.49	735	8.16	339.7
4	23.35	4.64	733	8.12	343.6
5	23.17	4.40	731	8.11	345.1
6	22.78	2.84	728	8.06	349.7
7	22.55	1.82	727	8.02	353.0

CCR-2
8/7/2001
Secchi: 0.7m
1% Trans: 0.8m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	24.93	8.19	750	8.35	339.0
1	24.21	6.99	738	8.33	346.4
2	23.97	6.20	736	8.28	352.6
3	23.91	5.64	735	8.25	356.9
4	23.77	4.96	736	8.22	360.4
5	23.49	3.08	735	8.15	370.6
6	23.11	0.94	734	8.08	374.8
7	23.01	0.64	733	8.06	376.4

CCR-2
8/14/2001
Secchi: 0.6m
1% Trans: 0.8m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	22.97	6.52	726	7.91	331.5
1	22.88	6.24	725	7.93	331.4
2	22.70	5.69	724	7.93	333.8
3	22.62	5.13	722	7.91	336.5
4	22.59	4.92	721	7.90	337.7
5	22.54	4.77	720	7.89	339.1
6	22.41	4.05	719	7.88	341.8
7	22.36	3.47	719	7.86	343.6

* "ND" denotes " No Data"

CCR-2 DO Data Continued

CCR-2
8/21/2001
Secchi: 0.9m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	22.13	7.74	719	8.13	324.3
1	21.82	6.97	714	8.15	327.6
2	21.70	6.28	713	8.13	331.1
3	21.68	6.15	713	8.13	332.8
4	21.64	6.11	713	8.14	333.2
5	21.59	6.03	712	8.14	334.2
6	21.55	5.39	711	8.12	336.1
7	21.49	5.33	711	8.11	336.9

CCR-2
8/28/2001
Secchi: 1.0m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	22.52	7.78	724	8.44	309.1
1	21.97	7.59	717	8.44	313.2
2	21.31	5.79	710	8.39	322.5
3	21.16	5.59	707	8.35	323.8
4	20.98	5.63	706	8.34	325.8
5	20.86	5.50	703	8.32	327.8
6	20.59	4.94	701	8.28	332.2
7	20.55	4.50	700	8.27	333.1

CCR-2
9/4/2001
Secchi: 0.8m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	21.79	8.40	717	8.48	299.1
1	21.30	8.18	709	8.47	301.9
2	20.86	7.01	705	8.44	308.3
3	20.64	6.40	702	8.42	311.2
4	20.60	6.17	702	8.40	314.1
5	20.58	5.85	702	8.37	316.4
6	20.53	4.73	702	8.29	324.1
7	20.44	3.82	702	8.27	327.6

CCR-2
9/11/2001
Secchi: 1.0m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	18.97	9.17	673	8.22	312.4
1	18.62	9.25	667	8.25	312.2
2	18.35	9.15	663	8.27	313.0
3	18.13	8.86	660	8.28	314.2
4	18.05	8.30	659	8.27	317.0
5	17.88	7.87	657	8.25	318.4
6	17.59	6.18	655	8.22	325.7
7	17.44	4.28	654	8.18	331.0

CCR-2
9/18/2001
Secchi: 0.85m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	18.27	6.74	669	8.09	296.0
1	18.11	6.42	666	8.07	298.2
2	18.01	6.12	665	8.07	302.4
3	17.98	5.67	665	8.05	305.7
4	17.92	5.34	664	8.05	308.1
5	17.86	5.03	663	8.03	312.4
6	17.78	4.94	662	8.03	314.4
7	17.77	4.59	662	8.03	315.6

CCR-2
9/25/2001
Secchi: 0.85m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	18.48	8.67	714	7.89	244.8
1	18.24	8.37	707	7.90	251.3
2	18.19	8.02	706	7.91	257.2
3	18.16	7.86	707	7.95	262.9
4	18.14	7.67	707	7.96	266.0
5	17.98	6.84	705	7.96	273.8
6	17.80	4.59	704	7.94	278.3
7	17.77	4.02	704	7.90	278.7

CCR-2
10/8/2001
Secchi: 1.0m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	15.95	8.48	677	8.17	273.1
1	15.44	8.41	669	8.18	276.0
2	15.25	7.98	666	8.19	280.2
3	15.19	7.78	665	8.18	283.3
4	15.15	7.47	665	8.20	286.0
5	15.13	7.38	664	8.20	288.6
6	15.06	6.95	664	8.18	291.6
7	14.89	4.06	664	8.13	293.4

CCR-2
10/23/2001
Secchi: 0.8m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	11.48	9.33	685	8.32	286.8
1	11.09	9.11	679	8.22	289.2
2	11.00	8.75	677	8.13	293.9
3	10.96	8.75	676	8.14	295.2
4	10.93	8.73	675	8.12	296.7
5	10.90	8.68	675	8.13	298.1
6	10.80	8.48	673	8.12	299.5
7	10.91	7.44	673	8.14	301.5

* "ND" denotes " No Data"

CCR-2 DO Data Continued

CCR-2
11/6/2001
Secchi: 0.8m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	10.22	9.64	615	8.01	307.5
1	9.24	9.84	599	8.03	307.9
2	9.12	9.66	597	8.05	309.4
3	9.10	9.61	597	8.05	310.4
4	9.09	9.58	596	8.08	310.5
5	9.06	9.53	596	8.09	311.7
6	9.03	9.47	596	8.10	312.3
7	9.08	8.68	596	8.10	313.1

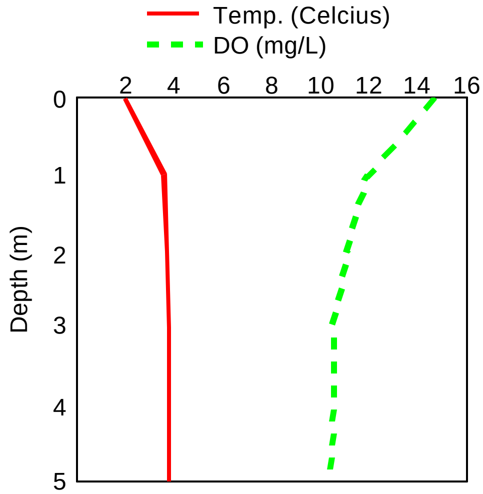
CCR-2
12/4/2001
Secchi: 1.1m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	3.20	10.26	543	8.08	261.0
1	3.16	10.18	544	8.08	263.0
2	3.15	10.13	535	8.08	264.0
3	3.16	10.10	541	8.09	266.3
4	3.15	10.09	542	8.10	268.0
5	3.15	10.06	538	8.12	269.3
6	3.14	10.05	541	8.11	270.2
7	3.18	10.03	541	8.14	271.5

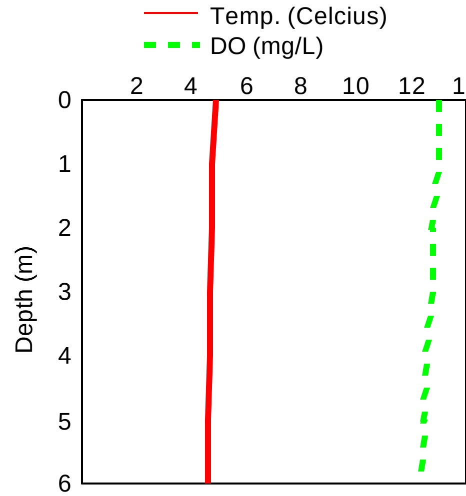
* "ND" denotes " No Data"

CCR-2

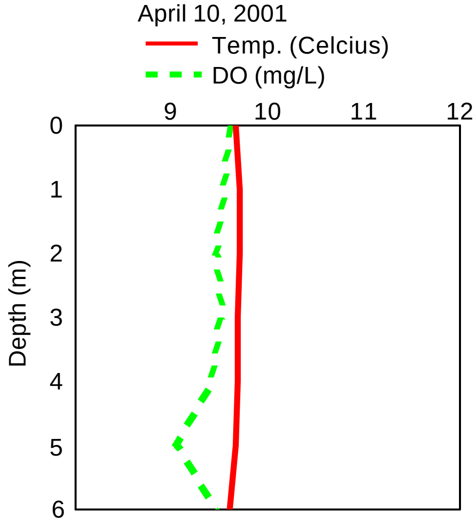
January 18, 2001



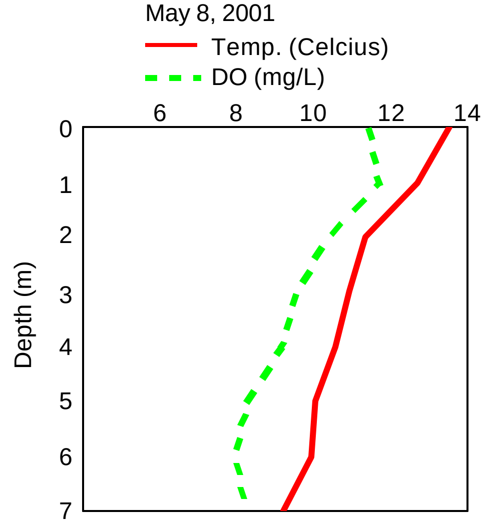
March 20, 2001



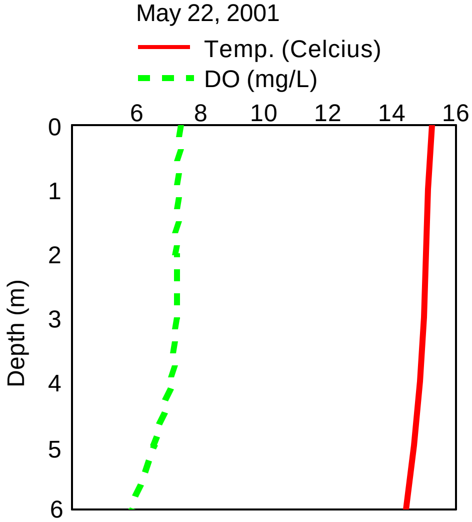
April 10, 2001



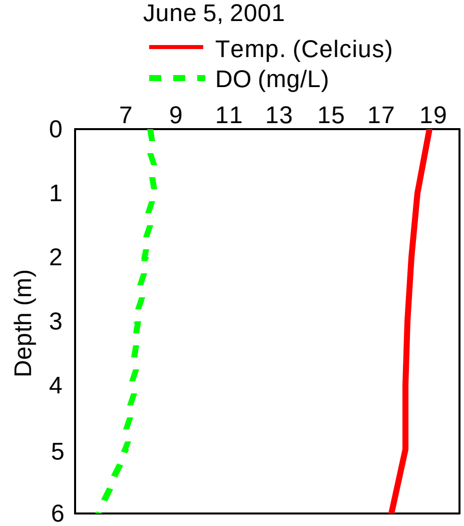
May 8, 2001



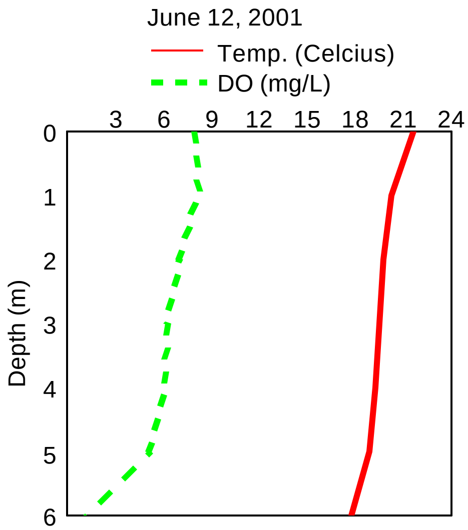
May 22, 2001

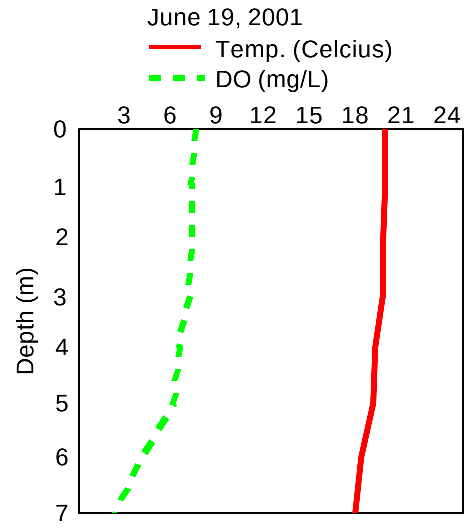


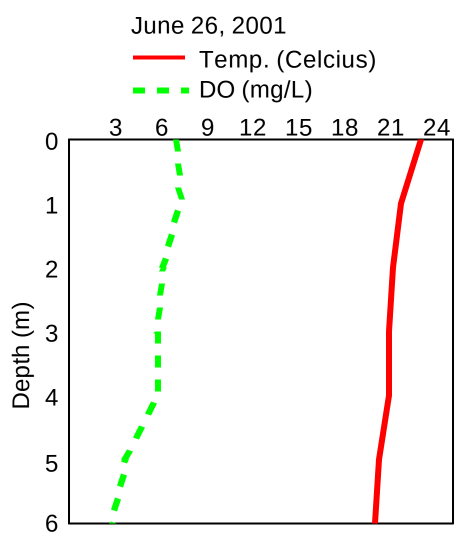
June 5, 2001

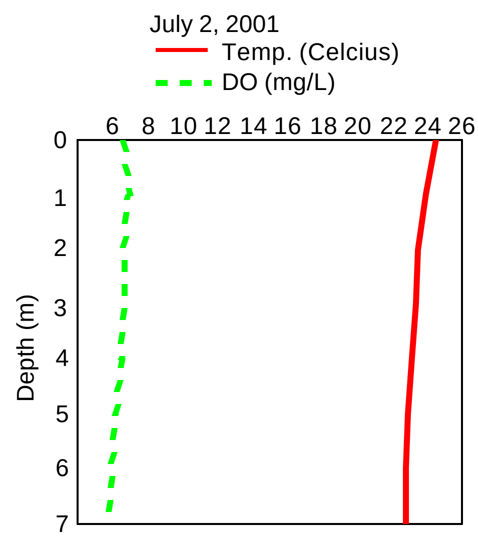


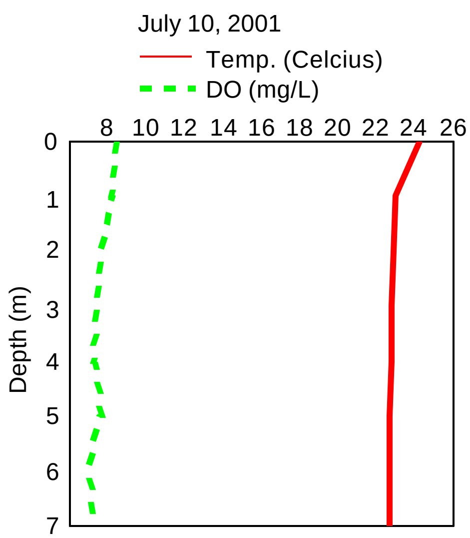
CCR-2

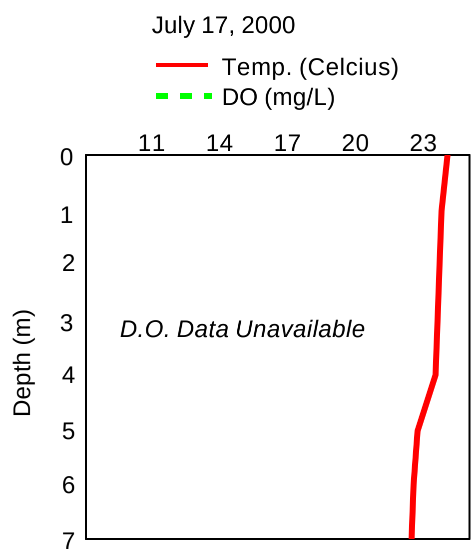

June 12, 2001
Temp. (Celcius)
DO (mg/L)
3 6 9 12 15 18 21 24
0 1 2 3 4 5 6
Depth (m)


June 19, 2001
Temp. (Celcius)
DO (mg/L)
3 6 9 12 15 18 21 24
0 1 2 3 4 5 6 7
Depth (m)

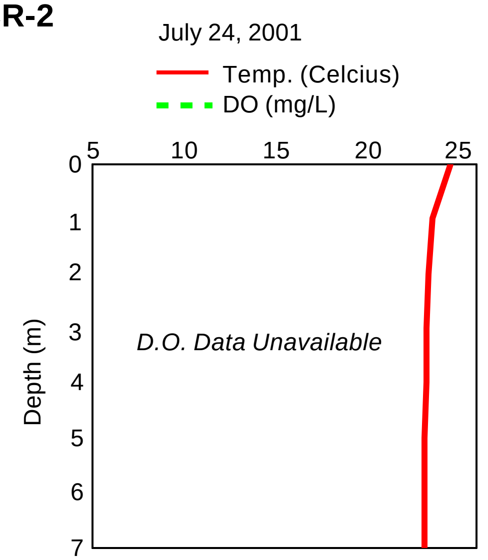

June 26, 2001
Temp. (Celcius)
DO (mg/L)
3 6 9 12 15 18 21 24
0 1 2 3 4 5 6
Depth (m)

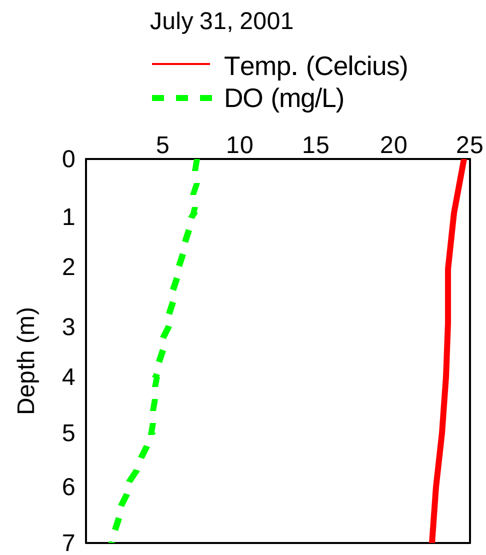

July 2, 2001
Temp. (Celcius)
DO (mg/L)
6 8 10 12 14 16 18 20 22 24 26
0 1 2 3 4 5 6 7
Depth (m)

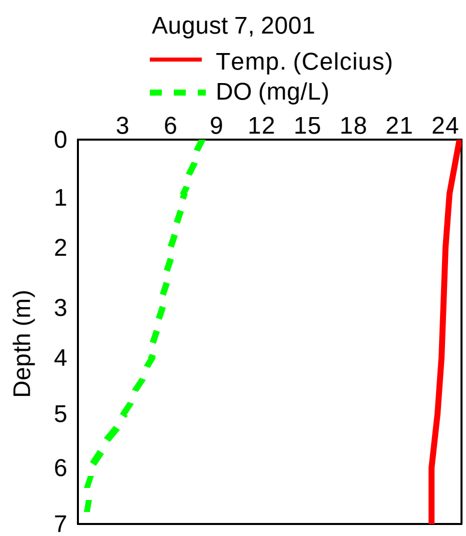

July 10, 2001
Temp. (Celcius)
DO (mg/L)
8 10 12 14 16 18 20 22 24 26
0 1 2 3 4 5 6 7
Depth (m)

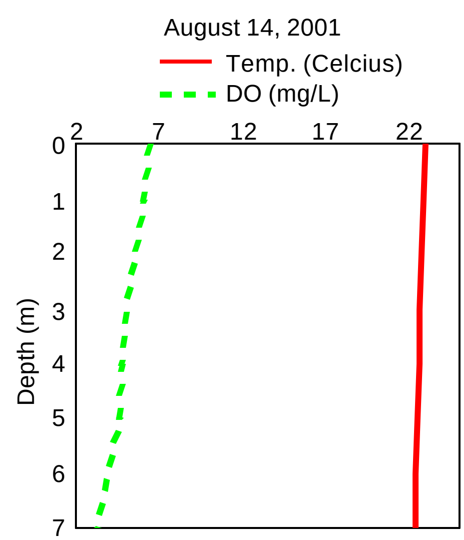

July 17, 2000
Temp. (Celcius)
DO (mg/L)
11 14 17 20 23
0 1 2 3 4 5 6 7
Depth (m)
D.O. Data Unavailable

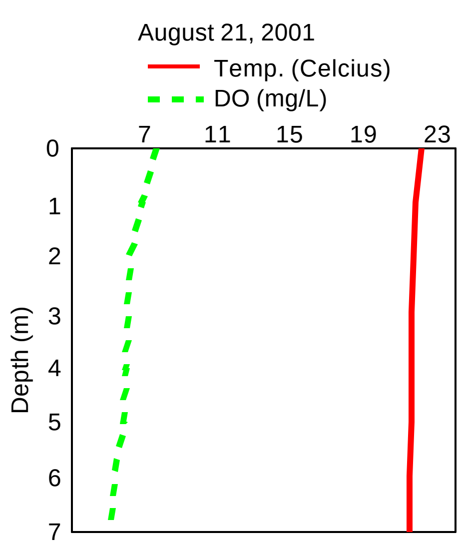
CCR-2

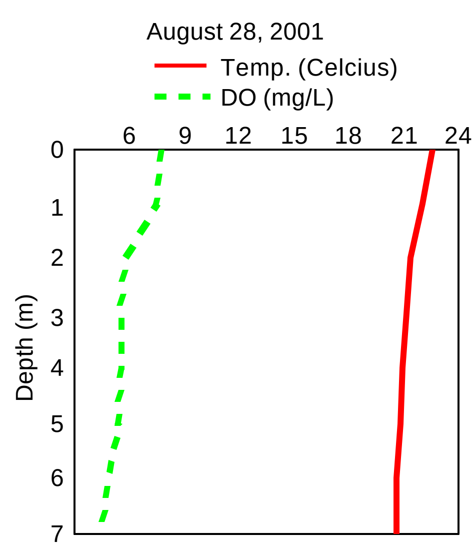

July 24, 2001
Temp. (Celcius)
DO (mg/L)
5
10
15
20
25
0
1
2
3
4
5
6
7
Depth (m)
D.O. Data Unavailable


July 31, 2001
Temp. (Celcius)
DO (mg/L)
5
10
15
20
25
0
1
2
3
4
5
6
7
Depth (m)

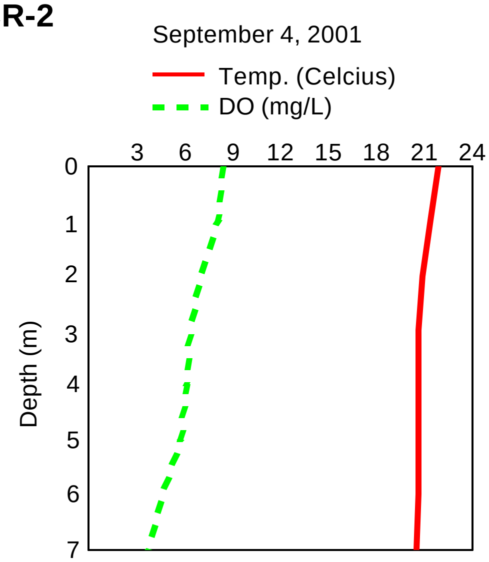

August 7, 2001
Temp. (Celcius)
DO (mg/L)
3
6
9
12
15
18
21
24
0
1
2
3
4
5
6
7
Depth (m)

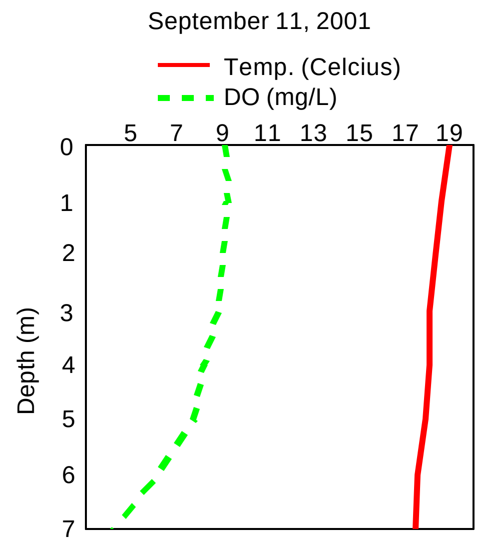

August 14, 2001
Temp. (Celcius)
DO (mg/L)
2
7
12
17
22
0
1
2
3
4
5
6
7
Depth (m)

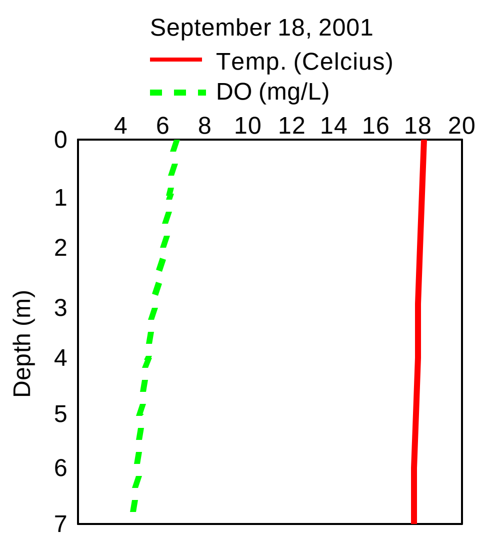

August 21, 2001
Temp. (Celcius)
DO (mg/L)
7
11
15
19
23
0
1
2
3
4
5
6
7
Depth (m)

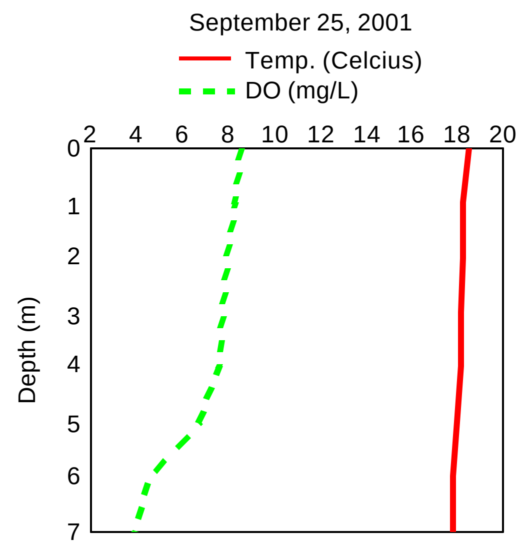

August 28, 2001
Temp. (Celcius)
DO (mg/L)
6
9
12
15
18
21
24
0
1
2
3
4
5
6
7
Depth (m)

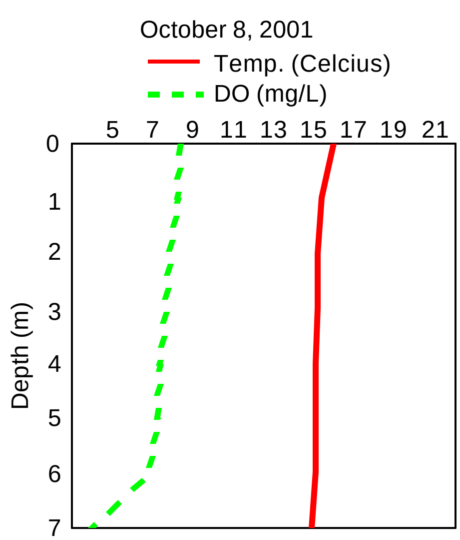
CCR-2

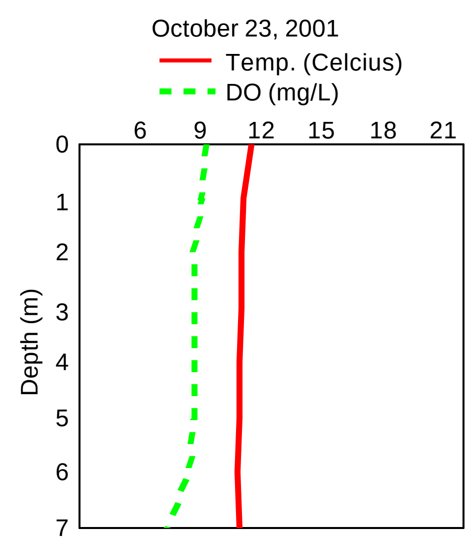

September 4, 2001
Temp. (Celcius)
DO (mg/L)
3 6 9 12 15 18 21 24
0 1 2 3 4 5 6 7
Depth (m)


September 11, 2001
Temp. (Celcius)
DO (mg/L)
5 7 9 11 13 15 17 19
0 1 2 3 4 5 6 7
Depth (m)

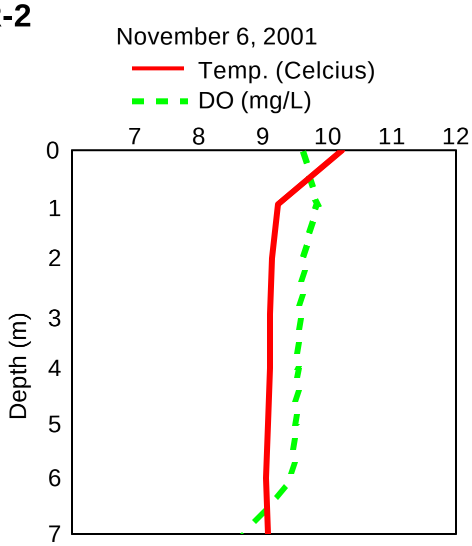

September 18, 2001
Temp. (Celcius)
DO (mg/L)
4 6 8 10 12 14 16 18 20
0 1 2 3 4 5 6 7
Depth (m)


September 25, 2001
Temp. (Celcius)
DO (mg/L)
2 4 6 8 10 12 14 16 18 20
0 1 2 3 4 5 6 7
Depth (m)

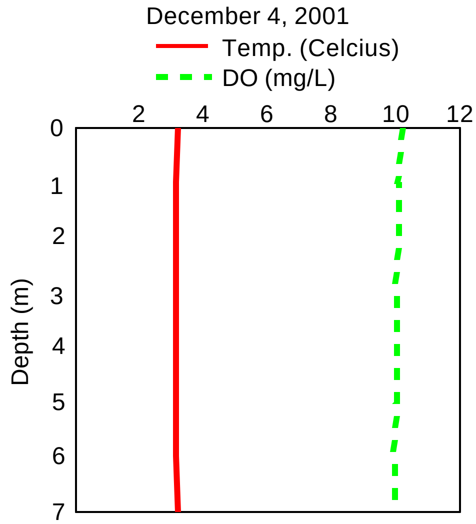

October 8, 2001
Temp. (Celcius)
DO (mg/L)
5 7 9 11 13 15 17 19 21
0 1 2 3 4 5 6 7
Depth (m)


October 23, 2001
Temp. (Celcius)
DO (mg/L)
6 9 12 15 18 21
0 1 2 3 4 5 6 7
Depth (m)

CCR-2



November 6, 2001
Temp. (Celcius)
DO (mg/L)
7 8 9 10 11 12
Depth (m)
0 1 2 3 4 5 6 7



December 4, 2001
Temp. (Celcius)
DO (mg/L)
2 4 6 8 10 12
Depth (m)
0 1 2 3 4 5 6 7

CHERRY CREEK
D.O. DATA, 2001
Site CCR-3

CCR-3
3/20/2001
Secchi: 0.8m
1% Trans: 3.0m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	5.28	13.37	552	8.52	356.2
1	5.21	13.49	550	8.51	356.4
2	5.16	13.23	550	8.52	357.1
3	5.04	13.09	548	8.51	357.3

CCR-3
4/10/2001
Secchi: 0.5m
1% Trans: 2.4m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	9.83	9.72	634	8.42	365.9
1	9.82	9.65	633	8.44	365.8
2	9.79	9.7	633	8.44	365.4
3	9.75	9.81	632	8.43	366.4
4	9.44	9.6	626	8.42	366.3

CCR-3
5/8/2001
Secchi: 0.6m
1% Trans: 2.6m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	12.34	10.65	628	8.32	312.2
1	12.03	10.66	625	8.31	314.6
2	10.99	10.37	613	8.3	317.4
3	10.61	9.7	603	8.26	321.1
4	10.38	9.21	595	8.25	323.8
5	10.24	9.22	591	8.23	325.9

CCR-3
5/22/2001
Secchi: 0.6m
1% Trans: 2.7m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	15.86	7.80	671	8.42	332.00
1	15.44	7.55	665	8.42	332.50
2	15.32	7.61	663	8.42	333.00
3	15.25	7.41	662	8.42	333.60
4	15.17	7.43	661	8.42	334.10
5	14.78	7.00	660	8.38	333.70

CCR-3
6/5/2001
Secchi: 0.6m
1% Trans: 2.3m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	19.31	8.22	730	8.36	314.0
1	18.72	8.05	719	8.38	315.6
2	18.22	7.77	711	8.37	318.7
3	17.96	7.46	706	8.35	321.0
4	17.09	4.19	699	8.15	334.1

CCR-3
6/12/2001
Secchi: 1.75m
1% Trans: 2.0m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	21.18	8.75	707	8.20	267.7
1	20.96	8.61	706	8.23	275.0
2	19.69	7.29	685	8.20	284.6
3	19.57	7.11	686	8.17	290.6
4	19.27	5.97	684	8.09	296.7

CCR-3
6/19/2001
Secchi: 0.55m
1% Trans: 1.5m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	20.16	8.07	695	8.01	335.9
1	20.02	7.54	692	8.03	336.9
2	19.23	6.60	679	8.00	341.2
3	18.73	4.91	672	7.93	346.9
4	18.58	3.63	670	7.85	351.2
5	18.37	1.36	667	7.77	307.0

CCR-3
6/26/2001
Secchi: 0.7m
1% Trans: 2.5m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	22.84	6.52	737	8.18	328.5
1	21.18	6.35	711	8.18	334.8
2	20.92	5.50	708	8.13	339.6
3	20.72	5.06	708	8.10	344.4
4	20.59	3.75	706	8.04	348.8

* "ND" denotes "No Data"

CCR-3 DO Data Continued

CCR-3
7/2/2001
Secchi: 0.7m
1% Trans: 2.7m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	24.59	6.24	781	8.16	331.6
1	24.54	6.52	778	8.16	332.0
2	24.14	6.45	771	8.15	332.0
3	23.6	6.37	764	8.15	332.8
4	23.31	6.36	759	8.14	334.2
5	23.18	6.15	753	8.14	336.1

CCR-3
7/10/2001
Secchi: 0.5m
1% Trans: 1.8m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	24.58	6.33	773	7.92	322.9
1	23.01	2.99	746	7.91	331.0
2	22.91	3.01	745	7.88	334.8
3	22.86	5.04	745	7.86	337.2
4	22.79	5.88	744	7.83	340.0

CCR-3
7/17/2001
Secchi: 0.6m
1% Trans: 1.1m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	24.00	--	746	8.13	342.6
1	23.39	--	738	8.14	343.5
2	23.13	--	734	8.11	346.9
3	23.01	--	732	8.08	349.9
4	22.92	--	731	8.05	352.1
5	22.7	--	727	8.01	355.6

CCR-3
7/24/2001
Secchi: 0.4m
1% Trans: 0.5m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	25.14	--	754	8.43	317.6
1	23.67	--	735	8.36	332.1
2	23.28	--	728	8.29	338.8
3	23.2	--	729	8.24	345.3
4	23.19	--	729	8.16	349.8
5	23.18	--	731	8.12	351.5

CCR-3
7/31/2001
Secchi: 0.7m
1% Trans: 1.0m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	24.59	8.13	752	8.25	303.9
1	23.79	7.43	738	8.26	312.6
2	23.56	6.22	735	8.21	322.1
3	23.32	5.63	732	8.20	326.4
4	23.05	5.22	730	8.18	329.6

CCR-3
8/7/2001
Secchi: 0.7m
1% Trans: 1.1m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	25.87	7.78	765	8.36	355.8
1	23.98	6.53	740	8.31	364.5
2	23.91	6.25	739	8.28	367.1
3	23.81	5.50	740	8.27	370.7
4	23.78	5.28	739	8.26	372.0
5	23.45	3.16	740	8.16	381.9

CCR-3
8/14/2001
Secchi: 0.6m
1% Trans: 0.8m

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	23.18	7.24	730	7.96	340.3
1	22.96	7.02	726	8.00	340.2
2	22.79	6.47	725	8.00	342.2
3	22.60	5.52	724	8.00	344.1
4	22.43	4.92	723	7.97	346.6
5	22.38	4.40	723	7.94	347.7

CCR-3
8/21/2001
Secchi: 0.7m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	22.62	8.45	726	8.47	305.7
1	21.75	7.33	714	8.42	313.3
2	21.63	6.25	713	8.40	318.7
3	21.54	5.46	717	8.35	322.9
4	21.41	5.66	716	8.31	326.2
5	21.16	4.81	726	8.30	327.9

* "ND" denotes "No Data"

CCR-3 DO Data Continued

CCR-3
8/28/2001
Secchi: 0.9m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	22.54	7.87	726	8.52	314.8
1	21.73	7.43	715	8.51	319.2
2	21.14	6.19	708	8.48	327.9
3	21.04	5.90	707	8.38	332.1
4	20.55	5.92	705	8.37	333.6

CCR-3
9/4/2001
Secchi: 0.7m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	21.62	7.71	717	8.44	301.5
1	20.83	6.85	707	8.46	308.3
2	20.43	6.01	702	8.43	314.9
3	20.37	5.40	701	8.40	318.3
4	20.29	5.02	700	8.37	321.6
5	20.29	4.81	700	8.35	323.3

CCR-3
9/11/2001
Secchi: 1.0m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	19.17	7.73	681	8.19	315.1
1	18.08	8.07	660	8.19	316.6
2	17.79	7.84	656	8.20	320.4
3	17.56	6.31	655	8.19	327.6
4	17.48	5.41	654	8.17	332.5
5	17.48	4.12	655	8.14	328.4

CCR-3
9/18/2001
Secchi: 0.85m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	18.45	7.66	672	8.29	260.4
1	18.13	6.94	667	8.26	266.8
2	18.04	6.36	665	8.25	274.2
3	17.99	6.00	665	8.23	279.2
4	17.99	5.85	665	8.22	282.4

CCR-3
9/25/2001
Secchi: 0.85m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	18.19	6.77	715	8.11	287.0
1	17.87	6.17	706	8.07	292.6
2	17.76	6.15	703	8.06	294.2
3	17.70	6.36	701	8.07	295.1
4	17.66	6.51	704	8.07	296.6
5	17.52	4.39	704	8.03	299.8

CCR-3
10/8/2001
Secchi: 0.8m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	15.70	8.88	675	8.31	260.2
1	15.33	8.56	667	8.31	268.8
2	15.24	7.79	666	8.30	273.2
3	15.10	7.14	665	8.29	277.2
4	15.01	6.00	664	8.26	281.9
5	15.01	5.71	664	8.25	283.3

CCR-3
10/23/2001
Secchi: 0.85m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	11.27	9.14	381	8.57	285.9
1	10.83	9.13	673	8.47	288.5
2	10.70	9.05	670	8.42	290.1
3	10.60	8.54	669	8.39	293.5
4	10.59	8.10	668	8.34	296.2

CCR-3
11/6/2001
Secchi: 0.75m
1% Trans: ND

Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	10.13	9.43	614	8.23	281.1
1	9.22	9.33	599	8.21	284.6
2	9.07	8.83	597	8.18	289.3
3	9.02	8.39	596	8.17	292.3
4	9.01	7.60	597	8.15	295.8

* "ND" denotes "No Data"

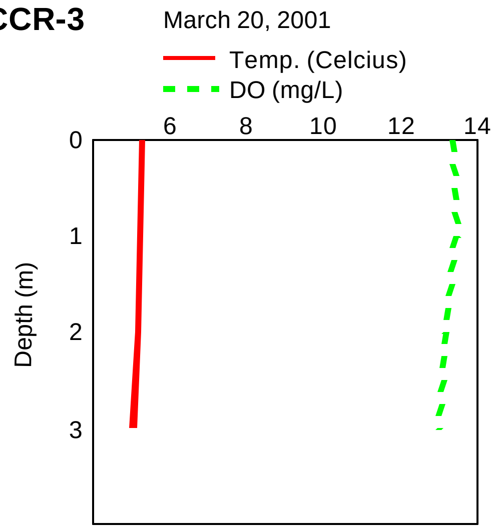
CCR-3 DO Data Continued

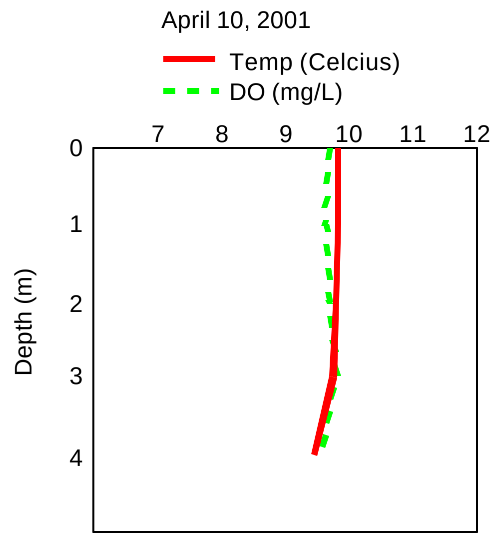
CCR-3
12/4/2001
Secchi: 1.0m
1% Trans: ND

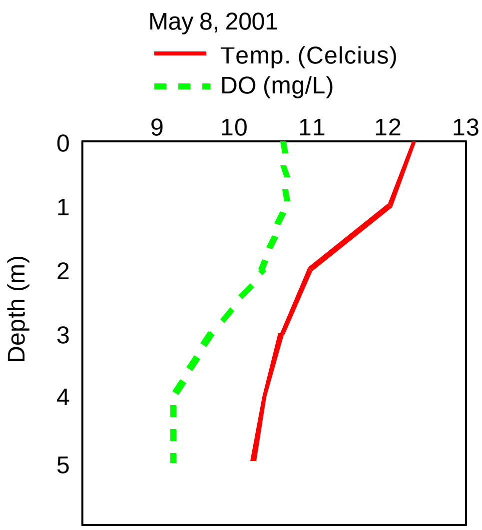
Depth (m)	Temp ©	DO	Cond.	pH	ORP
0	3.25	10.43	540	8.33	274.8
1	3.14	10.35	539	8.30	277.4
2	3.10	10.30	540	8.30	278.9
3	3.09	10.27	544	8.29	280.7
4	3.09	10.24	539	8.29	287.1

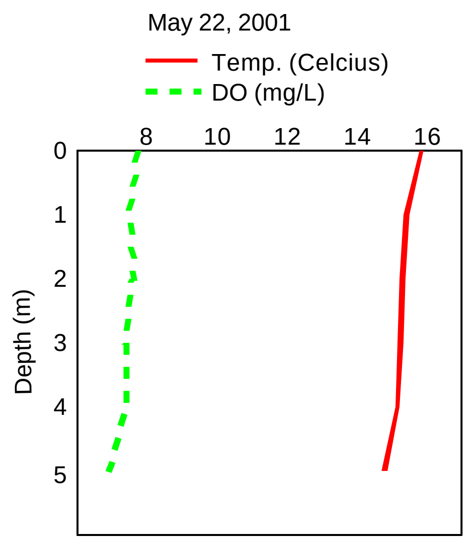
* "ND" denotes "No Data"

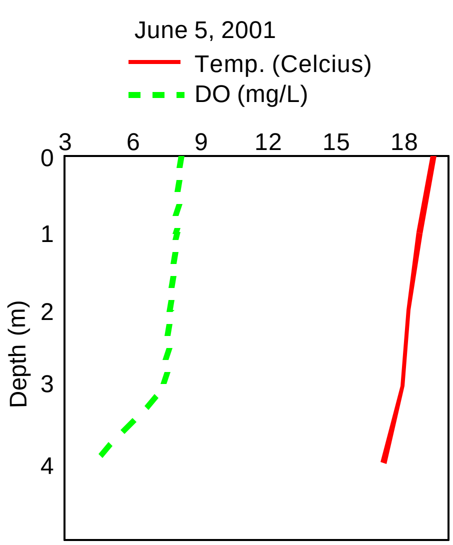
CCR-3

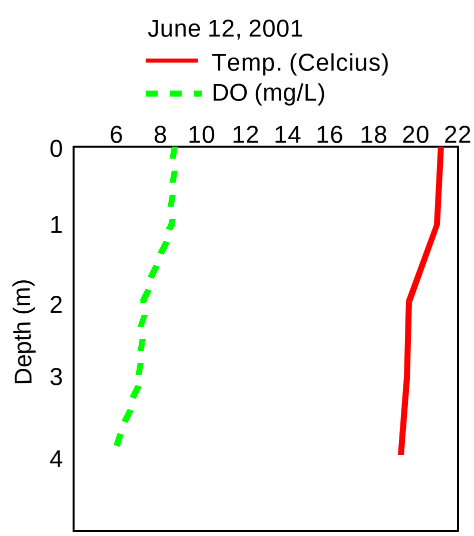

March 20, 2001
Temp. (Celcius)
DO (mg/L)
6 8 10 12 14
0 1 2 3
Depth (m)


April 10, 2001
Temp (Celcius)
DO (mg/L)
7 8 9 10 11 12
0 1 2 3 4
Depth (m)

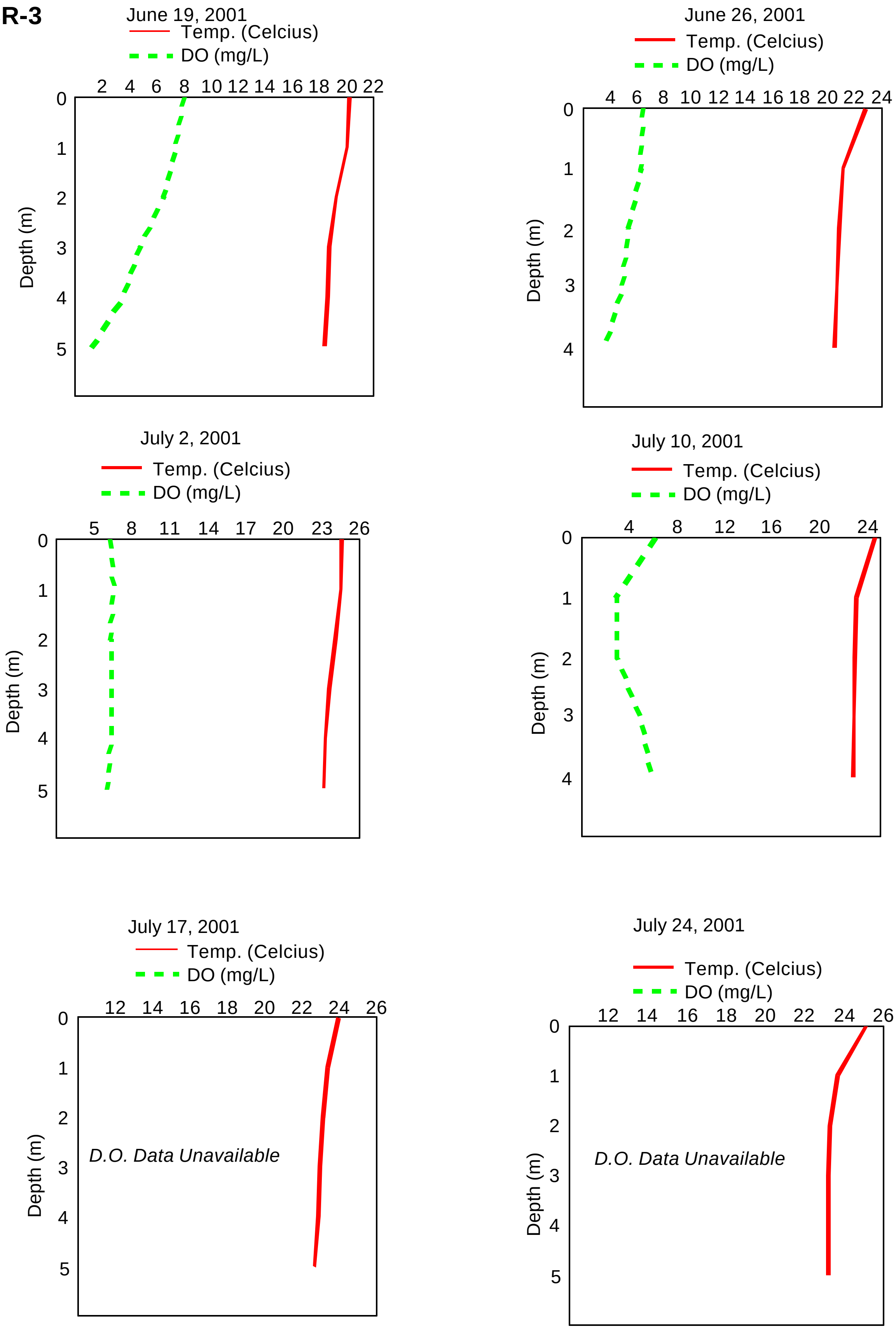

May 8, 2001
Temp. (Celcius)
DO (mg/L)
9 10 11 12 13
0 1 2 3 4 5
Depth (m)


May 22, 2001
Temp. (Celcius)
DO (mg/L)
8 10 12 14 16
0 1 2 3 4 5
Depth (m)

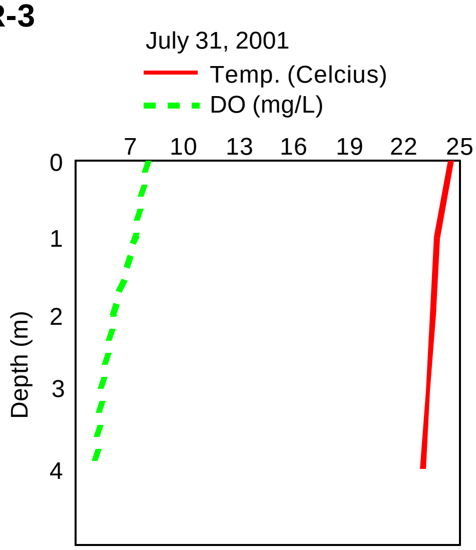

June 5, 2001
Temp. (Celcius)
DO (mg/L)
3 6 9 12 15 18
0 1 2 3 4
Depth (m)

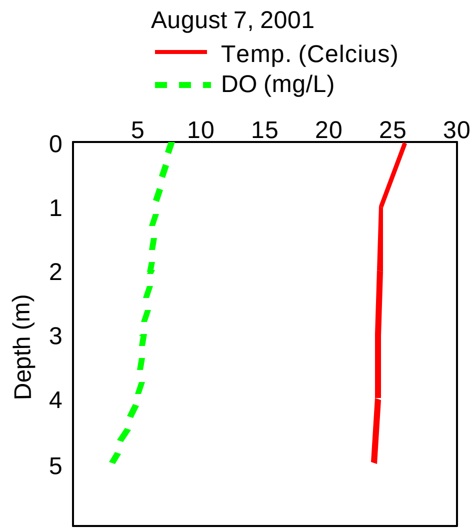

June 12, 2001
Temp. (Celcius)
DO (mg/L)
6 8 10 12 14 16 18 20 22
0 1 2 3 4
Depth (m)

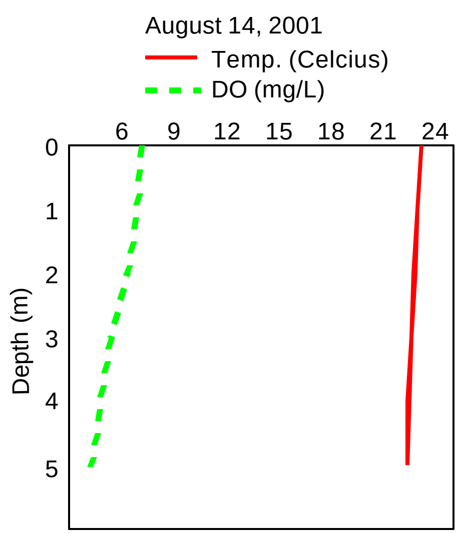
CCR-3

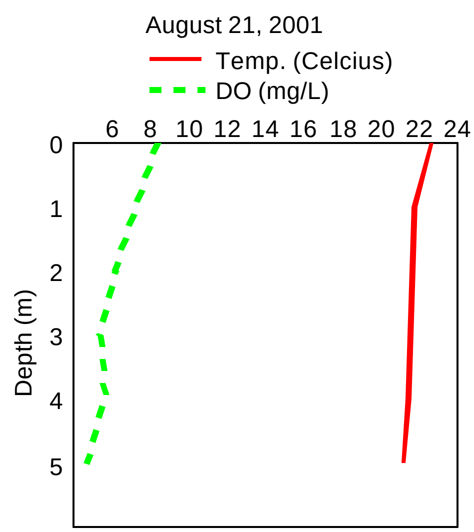

June 19, 2001
Temp. (Celcius)
DO (mg/L)
2 4 6 8 10 12 14 16 18 20 22
0 1 2 3 4 5
Depth (m)
June 26, 2001
Temp. (Celcius)
DO (mg/L)
4 6 8 10 12 14 16 18 20 22 24
0 1 2 3 4
Depth (m)
July 2, 2001
Temp. (Celcius)
DO (mg/L)
5 8 11 14 17 20 23 26
0 1 2 3 4 5
Depth (m)
July 10, 2001
Temp. (Celcius)
DO (mg/L)
4 8 12 16 20 24
0 1 2 3 4
Depth (m)
July 17, 2001
Temp. (Celcius)
DO (mg/L)
12 14 16 18 20 22 24 26
0 1 2 3 4 5
Depth (m)
D.O. Data Unavailable
July 24, 2001
Temp. (Celcius)
DO (mg/L)
12 14 16 18 20 22 24 26
0 1 2 3 4 5
Depth (m)
D.O. Data Unavailable

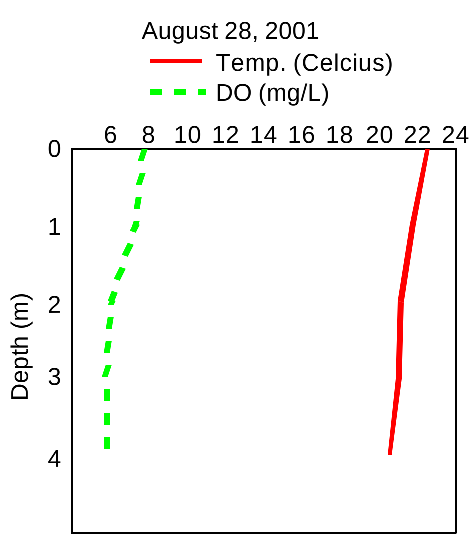
CCR-3

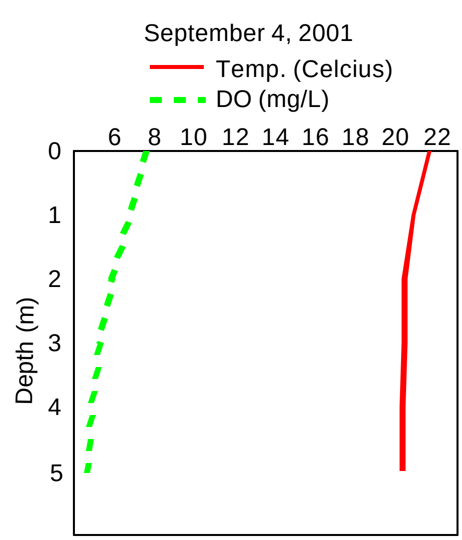

July 31, 2001
Temp. (Celcius)
DO (mg/L)
7 10 13 16 19 22 25
0 1 2 3 4
Depth (m)


August 7, 2001
Temp. (Celcius)
DO (mg/L)
5 10 15 20 25 30
0 1 2 3 4 5
Depth (m)

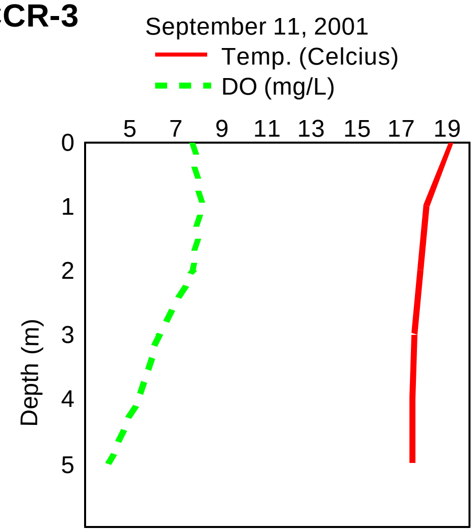

August 14, 2001
Temp. (Celcius)
DO (mg/L)
6 9 12 15 18 21 24
0 1 2 3 4 5
Depth (m)

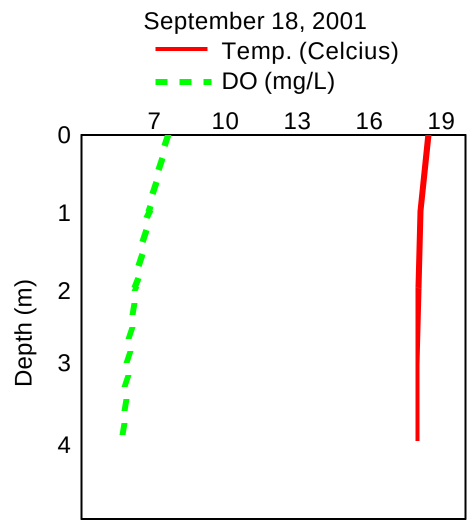

August 21, 2001
Temp. (Celcius)
DO (mg/L)
6 8 10 12 14 16 18 20 22 24
0 1 2 3 4 5
Depth (m)

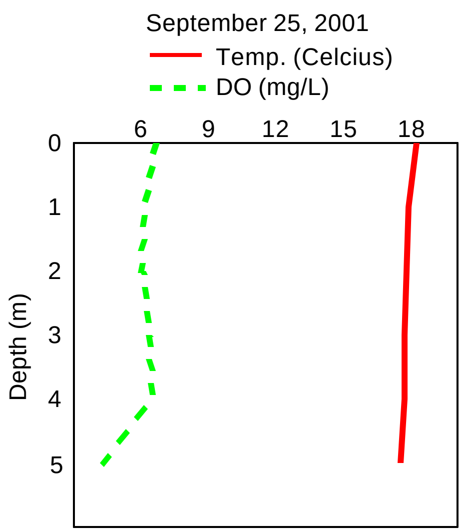

August 28, 2001
Temp. (Celcius)
DO (mg/L)
6 8 10 12 14 16 18 20 22 24
0 1 2 3 4
Depth (m)

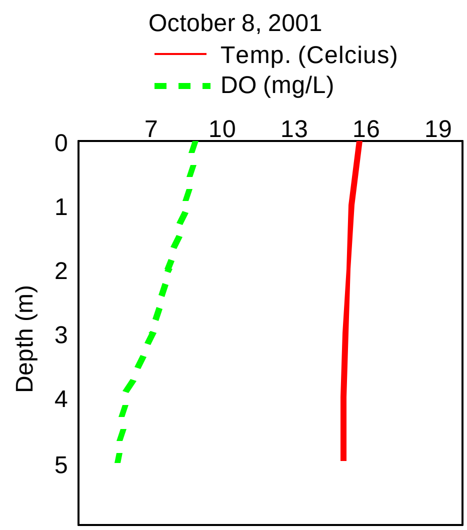

September 4, 2001
Temp. (Celcius)
DO (mg/L)
6 8 10 12 14 16 18 20 22
0 1 2 3 4 5
Depth (m)

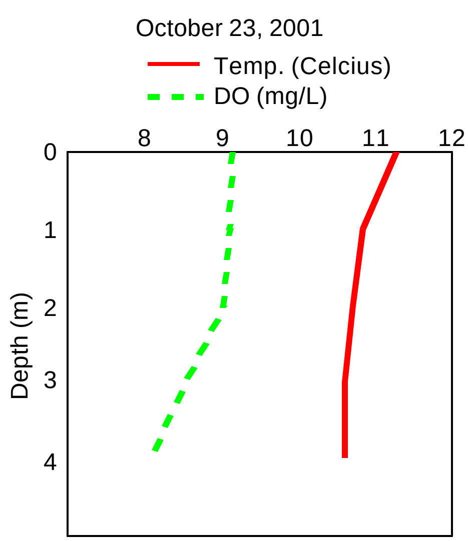
CCR-3

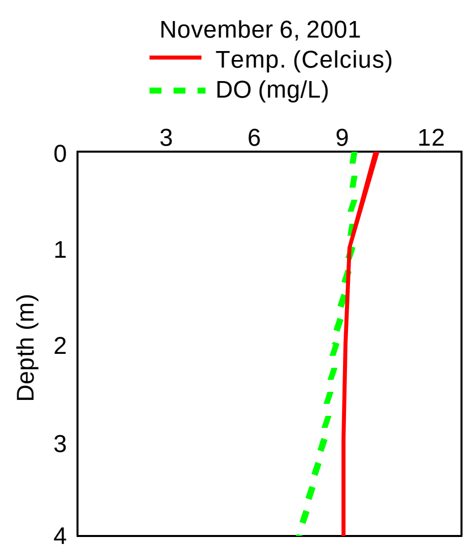

September 11, 2001
Temp. (Celcius)
DO (mg/L)
5 7 9 11 13 15 17 19
0 1 2 3 4 5
Depth (m)

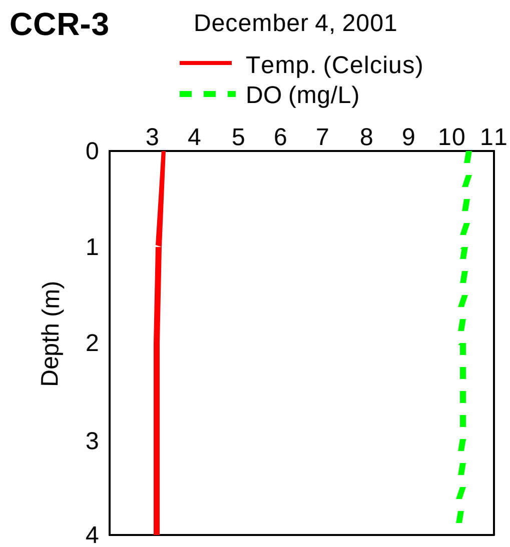

September 18, 2001
Temp. (Celcius)
DO (mg/L)
7 10 13 16 19
0 1 2 3 4
Depth (m)


September 25, 2001
Temp. (Celcius)
DO (mg/L)
6 9 12 15 18
0 1 2 3 4 5
Depth (m)


October 8, 2001
Temp. (Celcius)
DO (mg/L)
7 10 13 16 19
0 1 2 3 4 5
Depth (m)


October 23, 2001
Temp. (Celcius)
DO (mg/L)
8 9 10 11 12
0 1 2 3 4
Depth (m)


November 6, 2001
Temp. (Celcius)
DO (mg/L)
3 6 9 12
0 1 2 3 4
Depth (m)


CCR-3
December 4, 2001
Temp. (Celcius)
DO (mg/L)
3 4 5 6 7 8 9 10 11
0
1
2
3
4
Depth (m)

Cherry Creek Reservoir Secchi and 1% Transmissivity Depths for 2001

	CCR-1				CCR-2				CCR-3		
Date	Secchi (m)	1% Trans	Ratio	Date	Secchi (m)	1% Trans	Ratio	Date	Secchi (m)	1% Trans	Ratio
1/18/2001	0.70	0.90	1.29	1/18/2001	0.50	0.50	1.00	1/18/2001	ND	ND	ND
3/20/2001	0.70	3.00	4.29	3/20/2001	0.80	3.00	3.75	3/20/2001	0.80	3.00	3.75
4/10/2001	0.60	2.00	3.33	4/10/2001	0.50	2.10	4.20	4/10/2001	0.50	2.40	4.80
5/8/2001	0.70	2.60	3.71	5/8/2001	0.60	2.80	4.67	5/8/2001	0.60	2.60	4.33
5/22/2001	0.60	3.50	5.83	5/22/2001	0.70	3.50	5.00	5/22/2001	0.60	2.70	4.50
6/5/2001	0.60	2.90	4.83	6/5/2001	0.90	3.40	3.78	6/5/2001	0.60	2.30	3.83
6/12/2001	1.00	2.70	2.70	6/12/2001	0.85	3.20	3.76	6/12/2001	1.75	2.00	1.14
6/19/2001	0.90	1.40	1.56	6/19/2001	0.80	1.50	1.88	6/19/2001	0.55	1.50	2.73
6/26/2001	0.60	2.70	4.50	6/26/2001	0.80	2.90	3.63	6/26/2001	0.70	2.50	3.57
7/2/2001	0.80	2.90	3.63	7/2/2001	0.80	2.80	3.50	7/2/2001	0.70	2.70	3.86
7/10/2001	0.70	2.30	3.29	7/10/2001	0.60	2.00	3.33	7/10/2001	0.50	1.80	3.60
7/17/2001	0.60	1.00	1.67	7/17/2001	0.60	1.20	2.00	7/17/2001	0.60	1.10	1.83
7/24/2001	0.50	0.90	1.80	7/24/2001	0.60	0.80	1.33	7/24/2001	0.40	0.50	1.25
7/31/2001	0.70	1.20	1.71	7/31/2001	0.70	0.90	1.29	7/31/2001	0.70	1.00	1.43
8/7/2001	0.60	0.90	1.50	8/7/2001	0.70	0.80	1.14	8/7/2001	0.70	1.10	1.57
8/14/2001	0.60	0.80	1.33	8/14/2001	0.60	0.80	1.33	8/14/2001	0.60	0.80	1.33
8/21/2001	0.90	ND	ND	8/21/2001	0.90	ND	ND	8/21/2001	0.70	ND	ND
8/28/2001	0.70	ND	ND	8/28/2001	1.00	ND	ND	8/28/2001	0.90	ND	ND
9/4/2001	0.80	ND	ND	9/4/2001	0.80	ND	ND	9/4/2001	0.70	ND	ND
9/11/2001	1.10	ND	ND	9/11/2001	1.00	ND	ND	9/11/2001	1.00	ND	ND
9/18/2001	1.00	ND	ND	9/18/2001	0.85	ND	ND	9/18/2001	0.85	ND	ND
9/25/2001	0.95	ND	ND	9/25/2001	0.85	ND	ND	9/25/2001	0.85	ND	ND
10/8/2001	0.80	ND	ND	10/8/2001	1.00	ND	ND	10/8/2001	0.80	ND	ND
10/23/2001	0.90	ND	ND	10/23/2001	0.80	ND	ND	10/23/2001	1.85	ND	ND
11/6/2001	0.90	ND	ND	11/6/2001	0.80	ND	ND	11/6/2001	0.75	ND	ND
12/4/2001	0.90	ND	ND	12/4/2001	1.10	ND	ND	12/4/2001	1.00	ND	ND
Average	0.76	1.98	2.94	Average	0.78	2.01	2.85	Average	0.79	1.87	2.90
Median	0.70	2.15	2.99	Median	0.80	2.05	3.42	Median	0.70	2.00	3.57

* "ND" denotes "No Data"

APPENDIX B

STREAMWATER QUALITY AND PRECIPITATION DATA

CC-10 C&A Water Chemistry Data

Sample Date	Sample Name/ Location	Total Phosphorus ug/L	Total Dissolved Phosphorus ug/L	Ortho-Phosphate ug/L	Total Nitrogen ug/L	Total Dissolved Nitrogen ug/L	NO3+NO2-N ug/L	NH4-N ug/L	pH	Alkalinity mg/L	Hardness mg/L	TSS mg/L	TVSS mg/L
	Analytical Detection Limits	2	2	3	4	4	5	3		2	2	4	4
01/18/01	CC-10	236	188	174	1438	1340	1138	68	8.41	232	326		
02/20/01	CC-10	163	128*	133*	1595	1445	1025	184	8.25	208	276		
03/20/01	CC-10	131	103*	108*	740	630	427	8	8.15	192	310		
04/10/01	CC-10	169	123	123	818	770	422	29	8.24	214	282		
05/08/01	CC-10	281	180	176	1536	691	226	38	7.67	140	170		
06/05/01	CC-10	309	203	202	1014	902	553	78	8.03	240	346		
07/17/01	CC-10	295	216	213	1142	919	520	76	7.88	240	332	40.0	7.2
08/14/01	CC-10	244	171	168	911	756	541	47	8.25	250	330	46.0	7.6
09/04/01	CC-10	252	197	183	705	572	294	22	8.34	224	316	46.2	6.6
10/08/01	CC-10	191	165	144	1194	968	384	45	8.11	238	332	30.8	9.6
11/06/01	CC-10	201	162*	172*	984	914	604	72	8.22	236	352	19.8	7.0
12/04/01	CC-10	191	127	123	1281	1089	719	91	7.79	238	380	48.0	6.6
07/09/01	CC-10 storm	629	326	314	2014	1428	591	135	7.52	120	202		
07/12/01	CC-10 storm	293	189	172	1526	1211	687	74	7.90	142	186	40.4	7.6
07/24/01	CC-10 storm	262	136*	139*	1906	1518	798	63	7.35	180	246	55.4	11.2

*Data within acceptable (10 percent) difference between parameters.

Note: January-June analysis of TSS TVSS performed by STL

CC-O C&A Water Chemistry Data

Sample Date	Sample Name/ Location	Total Phosphorus ug/L	Total Dissolved Phosphorus ug/L	Ortho-Phosphate ug/L	Total Nitrogen ug/L	Total Dissolved Nitrogen ug/L	NO3+NO2-N ug/L	NH4-N ug/L	pH	Alkalinity mg/L	Hardness mg/L	TSS mg/L	TVSS mg/L
	Analytical Detection Limits	2	2	3	4	4	5	3		2	2	4	4
01/18/01	CC-0	114	14	4	858	470	10	43	8.53	182	282		
02/20/01	CC-0	62	41	26	908	700	156	103	8.26	182	290		
03/20/01	CC-0	63	17	8	782	412	<5	7	8.29	164	280		
04/10/01	CC-0	161	13	8	926	435	<5	21	8.44	176	276		
05/08/01	CC-0	164	77	75	1395	545	104	90	7.65	150	240		
05/29/01	CC-0 rel.	139	63	57	2217	567	24	18	8.15	168	268		
05/30/01	CC-0 rel.	148	38	32	839	482	18	8	8.06	164	264		
06/05/01	CC-0	194	94	87	799	479	23	63	8.19	170	262		
07/17/01	CC-0	156	73	71	841	526	26	124	7.8	152	244	44.6	7.6
08/14/01	CC-0	118	25	24	668	444	52	50	8.35	156	244	42.4	10
09/04/01	CC-0	86	7	3	796	493	<5	8	7.95	134	238	22.2	6.8
10/08/01	CC-0	68	12	6	735	472	32	11	8.17	144	256	28.2	7.2
11/06/01	CC-0	66	18	7	735	507	21	13	8.2	160	274	32.2	6.8
12/04/01	CC-0	73	23	18	820	475	60	10	8.07	154	280	33.8	7.8

"rel." designates dam release sample
Note: January-June analysis of TSS TVSS performed by STL

CT-1 C&A Water Chemistry Data

Sample Date	Sample Name/ Location	Total Phosphorus ug/L	Total Dissolved Phosphorus ug/L	Ortho-Phosphate ug/L	Total Nitrogen ug/L	Total Dissolved Nitrogen ug/L	NO3+NO2-N ug/L	NH4-N ug/L	pH	Alkalinity mg/L	Hardness mg/L	TSS mg/L	TVSS mg/L
	Analytical Detection Limits	2	2	3	4	4	5	3		2	2	4	4
01/18/01	CT-1	74	25	18	3847	3616	2758	663	8.53	222	500		
02/20/01	CT-1	71	25	19	2896	2633	1976	347	8.19	208	400		
03/20/01	CT-1	63	27	26	3612	3410	2565	646	7.67	152	390		
04/10/01	CT-1	108	34	17	3343	3196	2944	66	8.20	172	410		
05/08/01	CT-1	120	54*	55*	1445	1324	997	45	7.72	184	390		
06/05/01	CT-1	44	27	19	1246	1216	805	16	8.28	196	488		
07/17/01	CT-1	157	58	53	1357	1100	680	13	7.91	214	416	85.3	10.3
08/14/01	CT-1	201	36	25	1325	913	553	9	8.31	172	316	110.0	18.0
09/04/01	CT-1	123	13	14	2013	1607	743	53	8.27	200	514	63.6	12.4
10/08/01	CT-1	26	6*	7	1607	1484	1067	11	8.23	240	546	13.8	5.4
11/06/01	CT-1	164	112*	113*	5466	5119	1819		8.48	228	438	14.8	4.8
12/04/01	CT-1	47	9**	16**	3021	2834	2489	43	7.92	248	488	35.6	7.0
07/09/01	CT-1 storm	671	145	121	3859	2750	1685	201	7.03	68	160		
07/12/01	CT-1 storm	222	55	36	1836	1221	682	11	8.08	144	278	125.3	16.7
07/24/01	CT-1 storm	254	39	31	1716	1172	655	25	7.20	144	320	175.0	16.3
08/02/01	CT-1 storm	293	43	28	1840	1269	815	30	8.79	140	288	197.3	16.3

*Data within acceptable (10 percent) difference between parameters.
**Data outside acceptable (10 percent) difference between parameters.
Note: January -June analysis of TSS TVSS performed by STL

CT-2 C&A Water Chemistry Data

Sample Date	Sample Name/ Location	Total Phosphorus ug/L	Total Dissolved Phosphorus ug/L	Ortho-Phosphate ug/L	Total Nitrogen ug/L	Total Dissolved Nitrogen ug/L	NO3+NO2-N ug/L	NH4-N ug/L	pH	Alkalinity mg/L	Hardness mg/L	TSS mg/L	TVSS mg/L
	Analytical Detection Limits	2	2	3	4	4	5	3		2	2	4	4
01/18/01	CT-2	70	22	20	3842*	3877*	2968	933	8.31	220	478		
02/20/01	CT-2	70	26	21	2839	2575	1925	317	8.14	196	452		
03/20/01	CT-2	53	22	22	3509	3302	2519	652	7.66	152	392		
04/10/01	CT-2	56	17	14	3337	3023	2738	110	8.04	164	420		
05/08/01	CT-2	114	51	50	1488	1158	817	65	7.58	166	342		
06/05/01	CT-2	124	18*	20*	1372	1371	839	51	8.16	212	500		
07/17/01	CT-2	121	67	61	1208	1006	517	111	7.60	204	398	29.3	7.7
08/14/01	CT-2	187	25	14	1349	870	440	9	8.23	158	296	53.0	14.7
09/04/01	CT-2	83	6	6	1676	1487	995	18	8.29	202	496	32.2	7.4
10/08/01	CT-2	42	9	9	1883	1743	1129	53	8.14	258	556	29.6	8.2
11/06/01	CT-2	33	13**	16**	2131	2033	1714	49	7.98	258	488	29.6	6.6
12/04/01	CT-2	49	7**	16**	2880	2746	2347	67	7.85	238	498	39.2	7.2
07/09/01	CT-2 storm	231	65	55	1814	1266	513	175	7.40	90	200		
07/12/01	CT-2 storm	197	58	33	1629	993	453	10	7.74	130	250	63.3	13.0
07/24/01	CT-2 storm	157	28	21	1592	967	418	24	7.20	140	284	48.7	10.0
08/02/01	CT-2 storm	220	55	32	1525	1035	565	56	8.66	138	266	82.0	9.7

*Data within acceptable (10 percent) difference between parameters.
**Data outside acceptable (10 percent) difference between parameters.
Note: January-June analysis of TSS TVSS performed by STL

SC-1 C&A Water Chemistry Data

Sample Date	Sample Name/ Location	Total Phosphorus ug/L	Total Dissolved Phosphorus ug/L	Ortho-Phosphate ug/L	Total Nitrogen ug/L	Total Dissolved Nitrogen ug/L	NO3+NO2-N ug/L	NH4-N ug/L	pH	Alkalinity mg/L	Hardness mg/L	TSS mg/L	TVSS mg/L
	Analytical Detection Limits	2	2	3	4	4	5	3		2	2	4	4
02/20/01	SC-1	191	149	158	5967	5772	5577	316	8.12	312	368		
03/20/01	SC-1	131	80*	81*	5841*	5573*	5881*	88	7.80	304	390		
04/10/01	SC-1	90	37*	38*	6023	5748*	5934*	57	8.18	302	356		
05/08/01	SC-1	406	351	138	7495	6956	5245	1210	7.60	272	348		
06/05/01	SC-1	91	74	73	5370	5311	4854	107	7.91	280	338		
07/17/01	SC-1	83	77	77	5824	5556	5209	35	7.71	302	354	4.0	<4.0
08/14/01	SC-1	87	75	72	5026	4867	4852	32	8.05	308	352	7.0	<4.0
09/04/01	SC-1	139	63	72	5719*	5932*	5410	42	7.89	294	376	7.4	4.0
10/08/01	SC-1	79	65*	69*	5238	5227	5051	25	7.84	304	372	11.0	5.6
11/06/01	SC-1	35	24**	35**	5753	5522*	5602*	26	8.02	314	390	11.6	5.2
12/04/01	SC-1	40	30**	37**	5800	5611	5552	36	7.83	302	378	13.6	5.6
01/18/01	SC-1	2989	1908	1636	15149	14216	2650	4193	7.70	186	480		
07/09/01	SC-1 storm	299	135	120	4954	4608	3663	123	7.50	216	274		
07/12/01	SC-1 storm	158	126	111	4669	4374	3806	124	7.75	248	306	5.2	<4.0
07/24/01	SC-1 storm	407	170	143	3629	2424	1365	251	6.39	48	60	89.0	21.7

*Data within acceptable (10 percent) difference between parameters.
**Data outside acceptable (10 percent) difference between parameters.
Note: January to June analysis of TSS TVSS performed by STL

SC-3 C&A Water Chemistry Data

Sample Date	Sample Name/ Location	Total Phosphorus ug/L	Total Dissolved Phosphorus ug/L	Ortho-Phosphate ug/L	Total Nitrogen ug/L	Total Dissolved Nitrogen ug/L	NO3+NO2-N ug/L	NH4-N ug/L	pH	Alkalinity mg/L	Hardness mg/L	TSS mg/L	TVSS mg/L
	Analytical Detection Limits	2	2	3	4	4	5	3		2	2	4	4
03/20/01	SC-3	283	205	203	1764	1443	1170	15	8.03	268	380		
04/10/01	SC-3	257	183	165	1111	384	10	19	8.83	244	298		
05/08/01	SC-3	279	249	239	1103	982	574	42	7.74	186	216		
06/05/01	SC-3	255	242	236	689	674	293	31	7.93	242	282		
07/17/01	SC-3	313	291	273	842	757	330	64	7.76	214	226	7.0	<4.0
08/14/01	SC-3	145	124	105	1486	1395	982	15	8.15	274	306	8.4	4.0
09/04/01	SC-3	83	83	64	963	930	549	18	8.07	270	336	20.0	4.0
10/08/01	SC-3	144	38	21	1785	1053	689	9	8.06	280	320	20.6	11.0
11/06/01	SC-3	39	30	28	1570	1504	1248	19	8.25	300	344	14.8	4.8
12/04/01	SC-3	86	63	62	3831*	3865*	3524	69	7.86	272	372	25.2	5.8
01/18/01	SC-3	164	151	126	4482	4380	3999	534	8.03	372	400		
07/09/01	SC-3 storm	1078	99	84	4324	1609	861	359	7.40	74	98		
07/12/01	SC-3 storm	227	186	166	1423	1256	809	43	7.51	102	118	12.6	4.2
07/24/01	SC-3 storm	157	103	69	2273	1838	1167	18	6.48	130	144	13.0	4.8

*Data within acceptable (10 percent) difference between parameters.
**Data outside acceptable (10 percent) difference between parameters.
Note: January-June analysis of TSS TVSS performed by STL

Rain Gauge C&A Water Chemistry Data

Sample Date	Sample Name/ Location	Total Phosphorus ug/L	Total Dissolved Phosphorus ug/L	Ortho-Phosphate ug/L	Total Nitrogen ug/L	Total Dissolved Nitrogen ug/L	NO3+NO2-N ug/L	NH4-N ug/L	pH	Alkalinity mg/L	Hardness mg/L	TSS mg/L	TVSS mg/L
	Analytical Detection Limits	2	2	3	4	4	5	3		2	2	4	4
07/12/01	Rain Gauge	271	169	97	2484	1827	324	251	8.55	122	10		
07/24/01	Rain Gauge	148	78	69	2024	1642	516	745	6.12	30	10	29.6	9.8
08/02/01	Rain Gauge	189	116	98	2180	1703	837	556	16.50	20	4	17.1	7.1

Shop Creek Pond C&A Water Chemistry Data

Sample Date	Sample Name/ Location	Total Phosphorus ug/L	Total Dissolved Phosphorus ug/L	Ortho-Phosphate ug/L	Total Nitrogen ug/L	Total Dissolved Nitrogen ug/L	NO3+NO2-N ug/L	NH4-N ug/L	pH	Alkalinity mg/L	Hardness mg/L	TSS mg/L	TVSS mg/L
	Analytical Detection Limits	2	2	3	4	4	5	3		2	2	4	4
07/10/01	SC Pond Photic	323	235	212	3151	2662	1291	321	7.49	210	250	22.6	10.0
08/09/01	SC Pond Photic	163	111	79	4440	3978	2983	385	7.68	230	274	8.4	5.0
07/10/01	SC Pond Bottom	325	197	180	4583	3694	2736	339	7.16	96	130	90.2	17.6
08/09/01	SC Pond Bottom	149	97	84	4791	4466	3559	337	7.71	246	292	8.4	4.4

Note: January-June analysis of TSS TVSS performed by STL

Stream Water Quality C&A Water Chemistry Data

Date Collected	Site Name		Total Coliform Presumptive (#/100 ml)	Fecal Coliform (#/100 ml)	*E. coli* (#/100 ml)
06/05/01	CC-10		240	14	300
07/09/01	CC-10	(S)	1700	300	40
07/12/01	CC-10	(S)	500	40	50
07/17/01	CC-10		130	50	300
07/24/01	CC-10	(S)	3000	300	<20
08/14/01	CC-10		300	<20	30
09/04/01	CC-10		300	30	80
10/08/01	CC-10		300	80	
07/17/01	CT-1		110	20	80
11/06/01	CT-1		2400	500	500.0
06/05/01	CT-2		80	13	300
07/09/01	CT-2	(S)	800	300	130
07/12/01	CT-2	(S)	300	80	80
07/17/01	CT-2		230	40	230
07/24/01	CT-2	(S)	5000	230	130
08/02/01	CT-2	(S)	130	130	130
08/14/01	CT-2		300	130	30
09/04/01	CT-2		240	30	23
10/08/01	CT-2		240	23	23
11/06/01	CT-2		300	23	23

(S)- storm sample

Cherry Creek 10: University of Missouri Water Chemistry Data

Sample Date	Sample Name/Location	Total Phosphorus	Total Dissolved Phosphorus	Orthophosphate	Total Nitrogen	Total Dissolved Nitrogen	NO3+NO2-N	NH4-N	Alkalinity
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L
01/18/01	CC-10	98	164	169	1260	1300	863	0	214
02/20/01	CC-10	175	131	130	1370	1390	1002	22	187
03/20/01	CC-10	134	102	100	730	680	344	0	174
04/10/01	CC-10	161	125	119	740	650	503	18	178
05/08/01	CC-10	265	173	35*	700	680	237	9	134
06/05/01	CC-10	268	185	192	960	980	54	4	218
07/17/01	CC-10	288	216	192	740	830	544	31	217
07/24/01	CC-10	272	128	117	1550	1390	1046	20	162
08/14/01	CC-10	246	172	166	860	870	714	0	219
09/04/01	CC-10	239	153	167	850	710		11	202
10/08/01	CC-10	167	132	134	1130	950	373	142	217
11/06/01	CC-10	222	189	165	790	830	606	120	122
12/04/01	CC-10	155	131	130			756	142	

Cottonwood Creek 2: University of Missouri Water Chemistry Data

Sample Date	Sample Name/Location	Total Phosphorus	Total Dissolved Phosphorus	Orthophosphate	Total Nitrogen	Total Dissolved Nitrogen	NO3+NO2-N	NH4-N	Alkalinity
		ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	ug/L	mg/L
01/18/01	CT-2	29	28	25	3780	3790	2343	0	187
02/20/01	CT-2	77	22	18	2670	2430	6854	151	180
03/20/01	CT-2	69	23	19	3100	2970	2058	0	164
04/10/01	CT-2	94	25	16	2840	2610	2840	37	154
05/08/01	CT-2	94	48	42	1110	1090	959	7	160
06/05/01	CT-2	48	19	17	870	1180	1080	0	191
07/17/01	CT-2	161	63	55	690	890	72	309	200
07/24/01	CT-2	164	35	25	940	740	409	0	123
08/14/01	CT-2	151	22	11	1070	910	476	45	134
09/04/01	CT-2	84	10	3	1530	1400	993	36	184
10/08/01	CT-2	48	8	4	1860	1790	1454	84	230
11/06/01	CT-2	64	55	17	1730	1690	1859	94	136
12/04/01	CT-2	78	17	10					

* Data point removed from consideration due to outlier status

CC-10 Severn Trent Labs Water Chemistry Data

Sample Date	Sample Name/ Location	TSS mg/L	TVSS mg/L	T. Al mg/L	T. Ca mg/L
	Analytical Detection Limits	4.0	10.0	0.10	0.20
01/18/01	CC-10	14.4	<10.0	0.42	98.7
02/20/01	CC-10	14.4	<10.0	0.74	82.9
03/20/01	CC-10	6.4	<10.0	0.32	82.0
04/10/01	CC-10	5.2	<10.0	0.26	92.6
05/08/01	CC-10	46.4	<10.0	3.30	57.5
06/05/01	CC-10	44.4	<10.0	0.31	105.0
07/17/01	CC-10	32.8	<10.0	0.79	110.0
08/14/01	CC-10	41.6	<10.0	1.10	99.6
09/04/01	CC-10			1.50	98.3
10/08/01	CC-10			0.27	105.0
11/06/01	CC-10			0.31	108.0
12/04/01	CC-10			0.94	123.0
07/09/01	CC-10 storm	158.0	25.6	6.00	70.2
07/12/01	CC-10 storm	41.6	<10.0	1.70	57.1
07/24/01	CC-10 storm	48.8	12.4	1.90	76.8

Note: July-December analysis of TSS & TVSS performed by C&A

CC-0 Severn Trent Labs Water Chemistry Data

Sample Name/ Location	Sample Date	TSS mg/L	TVSS mg/L	T. Al mg/L	T. Ca mg/L
Analytical Detection Limits		4.0	10.0	0.10	0.20
01/18/01	CC-O	22.8	10.0	0.54	78.9
02/20/01	CC-O	4.0	<10.0	0.25	82.9
03/20/01	CC-O	7.2	<10.0	0.17	76.4
04/10/01	CC-O	19.8	<10.0	0.62	83.6
05/08/01	CC-O	25.2	<10.0	1.10	74.0
05/29/01	CC-O rel.	22.0	<10.0	1.20	76.3
05/30/01	CC-O rel.	91.2	16.8	2.10	77.7
06/05/01	CC-O	22.0	<10.0	0.24	74.8
07/17/01	CC-O	35.2	<10.0	1.70	74.1
08/14/01	CC-O	34.0	<10.0	1.00	66.0
09/04/01	CC-O			1.10	63.5
10/08/01	CC-O			0.62	72.9
11/06/01	CC-O			1.10	73.0
12/04/01	CC-O			0.58	78.0

Note: July-December analysis of TSS & TVSS performed by C&A

"rel." designates dam release sample

CT-1 Severn Trent Labs Water Chemistry Data

Sample Date	Sample Name/ Location	TSS mg/L	TVSS mg/L	T. Al mg/L	T. Ca mg/L
Analytical Detection Limits		4.0	10.0	0.10	0.20
01/18/01	CT-1	29.6	15.2	1.20	144.0
02/20/01	CT-1	31.2	<10.0	1.60	127.0
03/20/01	CT-1	22.0	<10.0	1.30	101.0
04/10/01	CT-1	21.8	<10.0	1.00	127.0
05/08/01	CT-1	58.8	<10.0	1.80	118.0
06/05/01	CT-1	6.4	<10.0	0.44	137.0
07/17/01	CT-1	76.0	11.2	1.70	129.0
08/14/01	CT-1	101.0	17.2	3.40	87.9
09/04/01	CT-1			2.20	136.0
10/08/01	CT-1			0.13	154.0
11/06/01	CT-1			0.27	120.0
12/04/01	CT-1			0.72	142.0
07/09/01	CT-1 storm	276.0*	44.0	15.6	48.4
07/12/01	CT-1 storm	130.0	20.8	5.30	77.3
07/24/01	CT-1 storm	166.0	20.4	7.80	90.8
08/02/01	CT-1 storm	95.6	13.2	4.60	84.6

Note: July-December analysis of TSS & TVSS performed by C&A

* Elevated reporting limit

CT-2 Severn Trent Labs Water Chemistry Data

Sample Date	Sample Name/ Location	TSS mg/L	TVSS mg/L	T. Al mg/L	T. Ca mg/L
	Analytical Detection Limits	4.0	10.0	0.10	0.20
01/18/01	CT-2	9.2	<10.0	0.65	133.0
02/20/01	CT-2	26.4	<10.0	1.30	120.0
03/20/01	CT-2	19.6	<10.0	1.20	113.0
04/10/01	CT-2	34.6	<10.0	1.60	118.0
05/08/01	CT-2	28.0	<10.0	0.96	112.0
06/05/01	CT-2	84.4	<10.0	2.20	144.0
07/17/01	CT-2	22.0	<10.0	1.50	123.0
08/14/01	CT-2	47.2	10.8	1.90	79.6
09/04/01	CT-2			1.40	141.0
10/08/01	CT-2			0.44	158.0
11/06/01	CT-2			0.62	138.0
12/04/01	CT-2			1.50	138.0
07/09/01	CT-2 storm	82.0	15.2	5.50	56.1
07/12/01	CT-2 storm	57.2	13.2	3.30	68.1
07/24/01	CT-2 storm	45.2	<10.0	3.30	82.2
08/02/01	CT-2 storm	77.6	16.4	3.20	81.5

Note: July-December analysis of TSS & TVSS performed by C&A

SC-1 Severn Trent Labs Water Chemistry Data

Sample Date	Sample Name/ Location	TSS mg/L	TVSS mg/L	T. Al mg/L	T. Ca mg/L
	Analytical Detection Limits	4.0	10.0	0.10	0.20
02/20/01	SC-1	<4.0	<10.0	0.11	106.0
03/20/01	SC-1	<4.0	<10.0	0.22	106.0
04/10/01	SC-1	<4.0	<10.0	<0.10	105.0
05/08/01	SC-1	<4.0	<10.0	<0.10	107.0
06/05/01	SC-1	<4.0	<10.0	<0.10	94.9
07/17/01	SC-1	<4.0	<10.0	<0.10	106.0
08/14/01	SC-1	<4.0	<10.0	<0.10	93.8
09/04/01	SC-1			<0.10	103.0
10/08/01	SC-1			<0.10	109.0
11/06/01	SC-1			<0.10	107.0
12/04/01	SC-1			<0.10	113.0
01/18/01	SC-1	94.0	30.0	2.50	70.3
07/09/01	SC-1 storm	<4.0	<10.0	0.20	87.7
07/12/01	SC-1 storm	6.0	<10.0	0.48	87.0
07/24/01	SC-1 storm	71.6	18.0	2.40	20.5

Note: July-December analysis of TSS & TVSS performed by C&A

SC-3 Severn Trent Labs Water Chemistry Data

Sample Date	Sample Name/ Location	TSS mg/L	TVSS mg/L	T. Al mg/L	T. Ca mg/L
	Analytical Detection Limits	4.0	10.0	0.10	0.20
03/20/01	SC-3	4.4	<10.0	<0.10	94.1
04/10/01	SC-3	<4.0	<10.0	<0.10	79.9
05/08/01	SC-3	8.0	<10.0	0.45	67.3
06/05/01	SC-3	<4.0	<10.0	<0.10	75.5
07/17/01	SC-3	6.0	<10.0	<0.10	70.6
08/14/01	SC-3	<4.0	<10.0	<0.10	83.9
09/04/01	SC-3			0.32	88.3
10/08/01	SC-3			<0.10	91.6
11/06/01	SC-3			0.10	93.4
12/04/01	SC-3			0.36	103.0
01/18/01	SC-3	5.2	<10.0	0.23	111.0
07/09/01	SC-3 storm	320*	62.7	15.10	41.4
07/12/01	SC-3 storm	9.2	<10.0	0.48	34.7
07/24/01	SC-3 storm	12.4	<10.0	0.52	43.6

Note: July-December analysis of TSS & TVSS performed by C&A

* Elevated detection limit

Rain Gauge Severn Trent Labs Water Chemistry Data

Sample Date	Sample Name/ Location	TSS mg/L	TVSS mg/L	T. Al mg/L	T. Ca mg/L
Analytical Detection Limits		4.0	10.0	0.10	0.20
07/12/01	Rain Gauge	7.2	<10.0	<0.10	4.1
07/24/01	Rain Gauge	19.6	<10.0	0.81	2.1
08/02/01	Rain Gauge	40.0	17.8	0.61	2.1

Shop Creek Pond Severn Trent Labs Water Chemistry Data

Sample Date	Sample Location	TSS mg/L	TVSS mg/L	T. Al mg/L	T. Ca mg/L
Analytical Detection Limits		4.0	10.0	0.10	0.20
08/09/01	SC Bottom	7.2	<10.0	0.16	74.9
08/09/01	SC Photic	7.6	<10.0	0.13	72.2

APPENDIX C

STREAMFLOW, RAINFALL, PHOSPHORUS LOADING CALCULATIONS, AND NORMALIZED U.S. ARMY CORPS OF ENGINEERS INFLOW DATA

Streamflow Determination

Stream discharge for Cherry Creek, Cottonwood Creek and Shop Creek were determined by developing a stage discharge relationship for each site (Table C-1). Water levels (stage) were monitored using ISCO Model 4220 and 6700 flowmeters. Flows were monitored daily on Cottonwood Creek, Shop Creek, and Cherry Creek with some dates estimated due to icing or flowmeter malfunctions. Rating curves were developed for each sampling site by measuring stream discharge (ft^3/sec) with a Marsh McBirney Model 2000 flowmeter, and recording the water level at the staff gage (ft) and ISCO flowmeter (ft). Data from 1999, 2000, and 2001 were used in calculating rating curves. In 1999, a minimum of three measurements over a range of discharges were taken at the following sampling sites: CC-10, CT-1, CT-2, and SC-3. In 2000, three measurements were taken at each of the following sites: CC-10, CT-1, CT-2, and SC-3. In 2001, one measurement was taken at Sites CT-2 and SC-1. Stream discharges at Site SC-1were determined using an ISCO pressure transducer located in an artificial pool formed by a two-stage Cipolletti weir. Thus, the Cipolletti weir equation was used to determine flow. Some time in summer, the weir washed out. Average daily flow levels were extrapolated at Site SC-1 for the remainder of the year. In order to make valid estimations of average daily level, several variables were examined: the baseflow before the weir washed out, previous year's data at Site SC-1, and daily precipitation data.

TABLE C-1: Stage (H, ft) discharge (Q, cfs) relationships for Sites CC-10, CT-1, CT-2, SC-3, and discharge equations for Site SC-1.

Site	Equation	R^2
CC-10	$Q = H^3 \times 3.42 + 1.50$	0.79
CT-1	$Q = H^{3.176} \times 1.486 + 0.1$	0.89
CT-2	$Q = H^3 \times 2.792 - 1.152$	0.93
SC-3	$Q = H^3 \times 3.554 + 0.156$	0.59
SC-1	$Q = (3.367 \; (\; L_1 \; (\; (H-14.2)^{1.5} + K)$	

L_1 = length of weir at stage $\leq$ 1.0 ft = 4.0 ft
K = correction factor, amount of water flow under or through weir . 0.5 cfs
L_2 = length of weir at stage >1.0 ft = 11.0 ft

Phosphorus loading was not determined for Site SC-2 in 2000 and 2001. Because this site is monitored at a detention pond, flows and loads have always been difficult to measure and calculate accurately. Further, a considerable record of phosphorus load determinations already exists for this site. In terms of measuring the performance of the entire Shop Creek pond and wetland system, the monitoring goals on Shop Creek are satisfied by calculation of flows and loads entering the Shop Creek Pollution Reduction Facility (at Site SC-1) and exiting this system, and prior to the confluence of the stream with Cherry Creek (monitored at Site SC-3).

Phosphorus Loading from Tributary Streams

For all streams, water chemistry, including concentration of total phosphorus was measured from stream samples taken at regular intervals and from storms during the months of January through December 2001 (Appendix B). In 1999, 2000, and 2001, all estimates of loading to Cherry Creek Reservoir were based upon calendar year (January to December). In previous years, loading had been estimated on a water year (October to September), but were later converted to calendar year from 1992 on.

The concentration of total phosphorus in the samples and corresponding flows, measured at sampling time, were paired in regression relationships (Table C-2). Regressions using data from previous reports (ASI 1994a, Chadwick Ecological Consultants, Inc. 1995, 1996, 1997, 1998, 1999, 2000, and 2001), combined with data from 2001, were developed to predict phosphorus concentrations from flow measurements for 2001. Note that for some sites, there is no significant relationship between flow values and phosphorus concentrations (e.g., the Cherry Creek inflow and outflow). In those cases, the phosphorus concentrations was based on the median value from the current year.

Using these relationships, the average daily phosphorus (P_{con}) was calculated from average daily flow for each tributary stream. Daily loadings in pounds/day (L_{day}) into the reservoir were then calculated using the equation below (Eq. 1), with L_{day} then summed over 2001 to obtain total annual phosphorus loading.

TABLE C-2 Regression equations relating streamflow (Q, ft^3/sec) to concentration of total phosphorus (P_{con}) in Cherry Creek, Cottonwood Creek, and Shop Creek for 2001.

Site	Equation	R^2
CC-10	P_{con} (mg/L) = 0.245	--
CC-O	P_{con} (mg/L) = 0.129	--
CT-1	P_{con} (mg/L) = 0.025 (Q + 0.054	0.57
CT-2	ln P_{con} (mg/L) = 0.39 (ln Q - 2.81	0.39
SC-1	P_{con} (mg/L) = 0.038 (Q + 0.055	0.96
SC-3	P_{con} (mg/L) = 0.121 (Q + 0.061	0.79

EQUATION 1:

$$L_{day} = \text{mg/L} \; (\; Q_{in} \; (\; \frac{86400 \text{ sec}}{\text{day}} \; (\; \frac{28.3169 \text{ L}}{\text{cf}} \; (\; \frac{2.205 \times 10^{-6} \text{ lbs}}{\text{mg}}$$

where:

L_{day} = pounds per day phosphorus loading,

mg/L = concentration of total phosphorus for a particular daily flow (based on the equation in Table C-2)

Q_{in} = mean daily flow in ft^3/sec.

Phosphorus Loading from Precipitation

Precipitation data are collected at the Cherry Creek dam by the U.S. Army Corps of Engineers (COE). To estimate phosphorus loading into the reservoir due to precipitation, COE data from 2001 were used, based on the assumption that precipitation generally fell evenly across the reservoir (Appendix B), although rain showers in the Cherry Creek Reservoir area can be localized. Calculation of phosphorus loading into Cherry Creek reservoir from precipitation was based on the median phosphorus concentration from 2001 and Equation 2.

EQUATION 2:

$$L_{precip} = PR/12 \;(\; A_{res} \;(\; 43650\ ft^2/acre \;(\; mg/L \;(\; \frac{28.31692}{cf} \;(\; \frac{2.206 \times 10^{-6}\ lbs}{mg}$$

where:

L_{precip} = pounds of phosphorus from precipitation,

PR = rainfall precipitation in inches,

A_{res} = surface area of the reservoir (852 ac), and

mg/L = median concentration of phosphorus.

Cherry Creek Reservoir Outflow

Streamflow out of Cherry Creek Reservoir is monitored by a COE flow station throughout the year. Water samples were taken once a month in Cherry Creek downstream at the dam during 2001. These samples were assessed for water quality, and a regression relationship between the concentration of total phosphorus and the measured flow in the stream was attempted. However, this regression was not significant. In the relationship in Equation 1, loads leaving the reservoir were calculated based on a median total phosphorus concentration of 0.129 mg/L in 2001 (Table C-2).

Normalization with U.S. Corps of Engineers (COE) Inflow Data

The COE monitors inflow to Cherry Creek Reservoir as a function of change in storage, reservoir level, outflow, precipitation, and evaporation. Daily and monthly inflow (AF) are calculated by accounting for outflow, precipitation, and evaporation in the change in reservoir level. As presented above, CEC monitors inflow to the reservoir using gaging stations on Cherry Creek, Cottonwood Creek, and Shop Creek (the three main surface inflows), along with estimates of direct precipitation and net alluvial inflow (provided by JCHA). From these data, CEC calculates an estimated total inflow (AF) and phosphorus loading (lbs) to the reservoir.

Given differences in the two methods for determining inflow, combined with the potential for unmonitored multiple Cherry Creek channels in the wetlands adjacent to the reservoir, an exact match between COE and CEC calculated inflows is not expected. In 2001, COE inflows were calculated at 15,360 AF, while CEC calculated inflows were 9,895 AF (see following summary data tables). Thus, CEC outflows were adjusted by first subtracting monthly estimates of direct precipitation and net alluvial inflow from the COE values, then determining the proportion each stream contributed to the remaining monthly inflows using CEC streamflows values. For example, if Cherry Creek, Cottonwood Creek, and Shop Creek contributed 300 AF, 200 AF, and 100 AF, respectively, the percentage each stream contributed to COE "streamflow" would be 50%, 33%, and 17%. The percentages were then multiplied by the inflow measured by COE (minus precipitation and alluvial inflow) to adjust the estimate of monthly load from each stream's inflow to Cherry Creek Reservoir. These values were then combined with the direct precipitation and net alluvial inflow to re-estimate monthly and then annual total phosphorus loading to the reservoir.

Values for Sites CT-1 and SC-1 were normalized based on the percent difference between CEC and COE inflows at Sites CT-2 and SC-3. For instance, if Sites CT-2 and SC-3 values increased by 1.5% after normalization with COE values, then Sites CT-1 and SC-1 (CEC values) were then multiplied by 1.5%.

2001	Total Af CEC	Total AF COE
January	305.16	1268.87
February	440.74	1582.84
March	623.13	1900.45
April	1145.36	2515.68
May	3604.14	4380.26
June	421.01	555.07
July	476.54	1251.14
August	270.71	370.24
September	223.74	161.15
October	209.29	135.05
November	267.10	511.15
December	344.60	728.04
Annual Total	8,331.52	15,359.94

CC-10

	Af CEC	Af COE	P lbs CEC	lbs COE
January	186.83	776.85	124.71	518.55
February	294.44	1057.41	196.57	705.94
March	441.97	1347.94	295.05	899.86
April	802.47	1762.56	535.67	1176.55
May	2639.43	3207.81	1761.87	2141.27
June	106.38	140.25	70.96	93.56
July	151.71	398.31	101.21	265.72
August	92.91	127.07	61.98	84.76
September	89.51	64.47	59.67	42.98
October	97.24	62.75	64.88	41.87
November	130.34	249.43	86.96	166.42
December	233.01	492.27	155.56	328.65
	5,266.23	9,687.12	3,515.09	6466.13

CT-2

	Af CEC	Af COE	P lbs CEC	lbs COE
January	118.33	492.02	25.12	104.47
February	146.31	525.43	35.07	125.95
March	181.16	552.51	48.70	148.53
April	342.89	753.12	148.13	325.35
May	964.71	1172.45	585.78	711.92
June	314.63	414.82	125.21	165.08
July	324.83	852.83	147.07	386.14
August	177.80	243.17	53.33	72.93
September	134.23	96.68	38.78	27.93
October	112.05	72.30	23.49	15.16
November	136.76	261.72	37.71	72.17
December	111.59	235.77	23.24	49.09
	3,065.29	5,672.82	1291.62	2204.72

SC-3

	Af CEC	Af COE	P lbs CEC	lbs COE
January	13.45	55.93	3.70	15.38
February	10.41	37.38	2.50	8.99
March	10.75	32.80	2.46	7.51
April	13.27	29.15	4.23	9.29
May	30.67	37.27	29.90	36.34
June	11.35	14.97	3.05	4.02
July	16.86	44.26	5.09	13.37
August	11.77	16.10	2.73	3.74
September	10.59	7.63	2.46	1.77
October	45.68	29.48	42.47	27.41
November	9.65	18.47	2.12	4.06
December	10.20	21.54	2.26	4.76
Annual Total	194.66	344.98	102.98	136.64

	Precip (af)	Alluvium (af)	Outflow (af)
January	41.89	61.58	954.36
February	7.10	55.62	841.50
March	51.83	61.58	1976.04
April	153.36	59.59	2781.90
May	227.20	61.58	4276.80
June	9.23	59.59	247.50
July	406.12	61.58	1112.76
August	75.26	61.58	300.96
September	54.67	59.59	0.00
October	3.55	61.58	0.00
November	98.69	59.59	209.88
December	8.52	61.58	1075.14
	1,137.42	725.00	13,776.84

	Precip (lbs)	Alluvium (lbs)	Outflow (lbs)
January	21.59	42.72	335.43
February	3.66	38.59	295.76
March	26.71	42.72	694.53
April	79.03	41.34	977.76
May	117.09	42.72	1503.18
June	4.76	41.34	86.99
July	209.29	42.72	391.11
August	38.78	42.72	105.78
September	28.17	41.34	0.00
October	1.83	42.72	0.00
November	50.86	41.34	73.77
December	4.39	42.72	377.88
	586.16	503.00	4842.19

Cottonwood Creek 1				normalized	normalized
	Af CEC	P lbs CEC	lbs/ac	af	lbs P
January	118.75	33.41	0.28	147.30	41.44
February	152.77	52.51	0.34	195.31	67.13
March	213.83	88.70	0.41	283.94	117.79
April	348.41	339.58	0.97	507.03	494.19
May	426.77	613.24	1.44	777.92	1117.83
June	210.21	104.11	0.50	369.65	183.07
July	339.20	423.71	1.25	468.40	585.09
August	209.32	91.02	0.43	362.37	157.58
September	194.22	102.47	0.53	463.86	244.73
October	165.08	54.77	0.33	420.92	139.65
November	188.43	80.68	0.43	286.89	122.84
December	170.17	57.35	0.34	250.72	84.49
Total	2737.16	2041.55		4534.33	3355.84

Shop Creek 1				normalized	normalized
	Af CEC	P lbs CEC	lbs/af	af	lbs P
January	38.67	8.35	0.22	47.97	10.36
February	44.24	10.35	0.23	56.56	13.23
March	49.54	11.95	0.24	65.79	15.86
April	65.10	20.99	0.32	94.73	30.55
May	89.90	49.52	0.55	163.88	90.26
June	55.00	13.51	0.25	96.71	23.76
July	87.59	44.59	0.51	120.96	61.57
August	60.37	15.83	0.26	104.51	27.40
September	58.54	15.38	0.26	139.81	36.73
October	56.83	13.96	0.25	144.90	35.61
November	58.54	15.38	0.26	89.12	23.41
December	56.83	13.96	0.25	83.73	20.57
Total	721.15	233.77		1208.68	389.32

2001
Cherry Creek 10
Average Discharge (cfs)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	2.72	2.72	6.05	6.57	2.58	1.72	1.70	1.55	1.50	1.51	1.63	3.25
2	2.32	2.58	5.57	6.30	2.67	1.72	1.70	1.53	1.50	1.51	1.62	3.91
3	2.62	3.68	5.81	6.18	6.30	1.74	1.70	1.51	1.50	1.51	1.62	4.08
4	3.19	3.99	5.46	5.69	23.51	1.74	1.70	1.51	1.50	1.52	1.62	3.99
5	3.06	5.02	5.46	5.81	292.83	1.72	1.69	1.51	1.50	1.55	1.62	3.60
6	3.39	5.46	5.57	5.93	292.83	1.70	1.69	1.51	1.50	1.55	1.62	3.39
7	3.25	5.02	5.57	6.43	213.88	1.72	1.70	1.52	1.50	1.54	1.62	3.46
8	3.12	3.99	5.35	5.24	151.94	1.70	3.25	1.59	1.61	1.54	1.95	3.25
9	2.83	2.62	5.69	4.62	84.05	1.72	2.44	1.52	1.54	1.55	1.77	3.83
10	3.46	4.34	6.84	4.82	58.88	1.70	1.70	1.52	1.51	1.57	1.70	3.60
11	3.46	5.24	13.27	11.50	43.66	1.70	1.72	1.52	1.50	1.58	1.67	3.60
12	2.58	4.92	11.50	56.23	28.05	1.72	1.72	1.51	1.50	1.58	1.67	3.60
13	2.72	5.35	10.49	53.67	18.01	1.81	9.91	1.51	1.50	1.58	1.67	3.60
14	2.44	5.93	9.55	34.09	13.27	3.91	8.18	1.51	1.50	1.58	1.67	3.60
15	2.44	6.18	9.01	19.83	11.71	1.72	1.70	1.51	1.50	1.60	1.69	3.60
16	2.48	5.57	8.18	22.80	6.98	1.72	1.59	1.51	1.50	1.61	1.69	3.60
17	2.72	4.92	7.71	21.11	6.18	1.72	1.59	1.51	1.50	1.59	1.69	4.34
18	2.83	5.35	6.84	17.14	7.12	1.70	1.59	1.51	1.50	1.59	1.72	4.16
19	2.78	5.69	5.46	13.99	8.84	1.74	1.59	1.51	1.50	1.58	1.77	3.53
20	2.58	5.93	5.57	12.36	4.82	1.72	1.59	1.51	1.50	1.59	1.74	3.68
21	2.78	6.70	6.30	10.49	17.72	1.72	1.59	1.51	1.50	1.59	1.75	3.83
22	2.89	7.12	6.84	15.77	10.68	1.72	1.59	1.51	1.50	1.58	1.77	3.91
23	3.00	7.12	6.98	18.01	6.98	1.72	1.60	1.51	1.50	1.59	3.46	3.39
24	3.00	7.86	6.30	10.88	4.43	1.72	9.01	1.51	1.50	1.62	5.13	3.39
25	3.60	6.84	6.70	7.41	3.19	1.70	2.24	1.51	1.50	1.65	3.46	3.46
26	3.46	6.70	7.86	6.05	2.40	1.70	1.93	1.51	1.50	1.65	3.25	4.25
27	3.68	6.05	7.12	4.62	2.10	1.70	1.72	1.51	1.50	1.63	2.89	4.34
28	4.08	5.81	7.56	4.34	1.88	1.70	1.72	1.50	1.50	1.63	2.83	4.43
29	3.99		7.41	4.08	2.07	1.70	1.59	1.50	1.50	1.63	3.60	4.43
30	3.53		8.34	3.32	1.79	1.70	1.59	1.50	1.51	1.63	3.91	4.34
31	3.39		6.84		1.72		1.55	1.50		1.63		4.25
Total	94.36	148.70	223.22	405.29	1333.05	53.73	76.62	46.93	45.21	49.11	65.83	117.68
Max	4.08	7.86	13.27	56.23	292.83	3.91	9.91	1.59	1.61	1.65	5.13	4.43
Min	2.32	2.58	5.35	3.32	1.72	1.70	1.55	1.50	1.50	1.51	1.62	3.25
Ac-ft	186.83	294.44	441.97	802.47	2639.43	106.38	151.71	92.91	89.51	97.24	130.34	233.01

2001
Cherry Creek 10
Phosphorus Loading (lbs/day)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	3.6	3.6	8	8.68	3.4	2.27	2.25	2.05	1.98	1.99	2.16	4.3
2	3.06	3.4	7.37	8.33	3.53	2.27	2.25	2.02	1.98	2	2.14	5.17
3	3.47	4.86	7.68	8.16	8.33	2.29	2.25	2	1.98	2	2.14	5.39
4	4.21	5.28	7.22	7.52	31.07	2.29	2.25	1.99	1.98	2.01	2.14	5.28
5	4.05	6.64	7.22	7.68	387.03	2.27	2.23	1.99	1.98	2.05	2.14	4.76
6	4.47	7.22	7.37	7.84	387.03	2.25	2.23	1.99	1.98	2.05	2.14	4.47
7	4.3	6.64	7.37	8.5	282.68	2.27	2.25	2.01	1.98	2.04	2.14	4.57
8	4.13	5.28	7.07	6.92	200.81	2.25	4.3	2.1	2.13	2.04	2.58	4.3
9	3.74	3.47	7.52	6.11	111.09	2.27	3.22	2	2.04	2.05	2.34	5.06
10	4.57	5.74	9.04	6.37	77.82	2.25	2.25	2.01	1.99	2.07	2.25	4.76
11	4.57	6.92	17.55	15.2	57.7	2.25	2.27	2	1.99	2.08	2.21	4.76
12	3.4	6.5	15.2	74.32	37.07	2.27	2.27	2	1.98	2.09	2.21	4.76
13	3.6	7.07	13.86	70.93	23.8	2.39	13.1	1.99	1.98	2.09	2.21	4.76
14	3.22	7.84	12.62	45.05	17.55	5.17	10.81	1.99	1.98	2.09	2.21	4.76
15	3.22	8.16	11.91	26.21	15.48	2.27	2.25	2	1.98	2.12	2.23	4.76
16	3.28	7.37	10.81	30.14	9.22	2.27	2.1	1.99	1.98	2.13	2.23	4.76
17	3.6	6.5	10.19	27.91	8.16	2.27	2.1	1.99	1.99	2.1	2.23	5.74
18	3.74	7.07	9.04	22.66	9.41	2.25	2.1	1.99	1.99	2.1	2.27	5.5
19	3.67	7.52	7.22	18.49	11.69	2.29	2.1	1.99	1.98	2.09	2.34	4.66
20	3.4	7.84	7.37	16.34	6.37	2.27	2.1	1.99	1.98	2.1	2.29	4.86
21	3.67	8.86	8.33	13.86	23.42	2.27	2.1	1.99	1.98	2.1	2.32	5.06
22	3.81	9.41	9.04	20.85	14.12	2.27	2.1	1.99	1.98	2.09	2.34	5.17
23	3.97	9.41	9.22	23.8	9.22	2.27	2.12	1.99	1.98	2.1	4.57	4.47
24	3.97	10.39	8.33	14.39	5.86	2.27	11.91	1.99	1.98	2.14	6.78	4.47
25	4.76	9.04	8.86	9.79	4.21	2.25	2.96	1.99	1.98	2.18	4.57	4.57
26	4.57	8.86	10.39	8	3.17	2.25	2.55	1.99	1.98	2.18	4.3	5.62
27	4.86	8	9.41	6.11	2.78	2.25	2.27	1.99	1.98	2.16	3.81	5.74
28	5.39	7.68	9.99	5.74	2.48	2.25	2.27	1.99	1.98	2.16	3.74	5.86
29	5.28	0	9.79	5.39	2.73	2.25	2.1	1.99	1.99	2.16	4.76	5.86
30	4.66	0	11.02	4.38	2.37	2.25	2.1	1.99	1.99	2.16	5.17	5.74
31	4.47	0	9.04	0	2.27	0	2.05	1.99	0	2.16	0	5.62
Total	124.71	196.57	295.05	535.67	1761.87	70.96	101.21	61.98	59.67	64.88	86.96	155.56
Mean	4.02	6.34	9.52	17.28	56.83	2.29	3.26	2.00	1.92	2.09	2.81	5.02
Max	5.39	10.39	17.55	74.32	387.03	5.17	13.1	2.1	2.13	2.18	6.78	5.86
Min	3.06	0	7.07	0	2.27	0	2.05	1.99	0	1.99	0	4.3

Note: The above data have not been normalized to the COE

2001
Cherry Creek Outflow
Discharge (cfs)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	19	0	44	22	16	16	0	5	0	0	0	14
2	19	0	44	22	16	16	0	5	0	0	0	14
3	19	0	44	22	16	16	0	5	0	0	0	21
4	19	0	44	22	16	13	0	5	0	0	0	26
5	19	0	44	24	16	10	0	5	0	0	0	26
6	19	0	44	26	16	10	0	5	0	0	0	26
7	19	0	44	26	28	10	0	6	0	0	0	26
8	19	0	44	26	75	10	0	5	0	0	0	26
9	19	0	39	26	104	10	0	5	0	0	0	26
10	19	0	34	26	129	10	2	6	0	0	0	26
11	19	0	34	26	183	4	5	5	0	0	0	11
12	19	5	34	26	197	0	5	5	0	0	0	0
13	20	10	34	26	196	0	14	5	0	0	0	0
14	20	10	34	68	195	0	20	6	0	0	2	12
15	19	10	34	88	195	0	21	6	0	0	3	17
16	20	17	34	88	111	0	20	6	0	0	3	17
17	20	22	34	88	51	0	29	5	0	0	3	17
18	21	22	34	88	51	0	35	5	0	0	3	17
19	21	22	34	88	51	0	35	5	0	0	3	17
20	21	22	26	88	51	0	35	5	0	0	3	17
21	21	22	21	88	51	0	35	5	0	0	4	17
22	21	30	22	88	51	0	35	5	0	0	4	17
23	21	37	22	88	51	0	35	5	0	0	4	17
24	21	37	22	67	39	0	35	5	0	0	4	17
25	8	37	22	50	25	0	35	5	0	0	4	17
26	0	37	22	40	25	0	35	5	0	0	10	17
27	0	41	22	20	25	0	35	5	0	0	14	17
28	0	44	22	16	25	0	34	5	0	0	14	17
29	0		22	16	37	0	34	5	0	0	14	17
30	0		22	16	98	0	23	2	0	0	14	17
31	0		22		20		5	0		0		17
Total	482	425	998	1405	2160	125	562	152	0	0	106	543
Mean	15.55	15.18	32.19	46.83	69.68	4.17	18.13	4.90	0.00	0.00	3.53	17.52
Max	21	44	44	88	197	16	35	6	0	0	14	26
Min	0	0	21	16	16	0	0	0	0	0	0	0
Ac-ft	954.36	841.50	1976.04	2781.90	4276.80	247.50	1112.76	300.96	0.00	0.00	209.88	1075.14

2001
Cherry Creek Outflow
Phosphorus Loading (lbs)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	13.22	0.00	30.62	15.31	11.13	11.13	0.00	3.48	0.00	0.00	0.00	9.74
2	13.22	0.00	30.62	15.31	11.13	11.13	0.00	3.48	0.00	0.00	0.00	9.74
3	13.22	0.00	30.62	15.31	11.13	11.13	0.00	3.48	0.00	0.00	0.00	14.61
4	13.22	0.00	30.62	15.31	11.13	9.05	0.00	3.48	0.00	0.00	0.00	18.09
5	13.22	0.00	30.62	16.70	11.13	6.96	0.00	3.48	0.00	0.00	0.00	18.09
6	13.22	0.00	30.62	18.09	11.13	6.96	0.00	3.48	0.00	0.00	0.00	18.09
7	13.22	0.00	30.62	18.09	19.49	6.96	0.00	4.18	0.00	0.00	0.00	18.09
8	13.22	0.00	30.62	18.09	52.19	6.96	0.00	3.48	0.00	0.00	0.00	18.09
9	13.22	0.00	27.14	18.09	72.38	6.96	0.00	3.48	0.00	0.00	0.00	18.09
10	13.22	0.00	23.66	18.09	89.77	6.96	1.39	4.18	0.00	0.00	0.00	18.09
11	13.22	0.00	23.66	18.09	127.35	2.78	3.48	3.48	0.00	0.00	0.00	7.66
12	13.22	3.48	23.66	18.09	137.10	0.00	3.48	3.48	0.00	0.00	0.00	0.00
13	13.92	6.96	23.66	18.09	136.40	0.00	9.74	3.48	0.00	0.00	0.00	0.00
14	13.92	6.96	23.66	47.32	135.70	0.00	13.92	4.18	0.00	0.00	1.39	8.35
15	13.22	6.96	23.66	61.24	135.70	0.00	14.61	4.18	0.00	0.00	2.09	11.83
16	13.92	11.83	23.66	61.24	77.25	0.00	13.92	4.18	0.00	0.00	2.09	11.83
17	13.92	15.31	23.66	61.24	35.49	0.00	20.18	3.48	0.00	0.00	2.09	11.83
18	14.61	15.31	23.66	61.24	35.49	0.00	24.36	3.48	0.00	0.00	2.09	11.83
19	14.61	15.31	23.66	61.24	35.49	0.00	24.36	3.48	0.00	0.00	2.09	11.83
20	14.61	15.31	18.09	61.24	35.49	0.00	24.36	3.48	0.00	0.00	2.09	11.83
21	14.61	15.31	14.61	61.24	35.49	0.00	24.36	3.48	0.00	0.00	2.78	11.83
22	14.61	20.88	15.31	61.24	35.49	0.00	24.36	3.48	0.00	0.00	2.78	11.83
23	14.61	25.75	15.31	61.24	35.49	0.00	24.36	3.48	0.00	0.00	2.78	11.83
24	14.61	25.75	15.31	46.63	27.14	0.00	24.36	3.48	0.00	0.00	2.78	11.83
25	5.57	25.75	15.31	34.80	17.40	0.00	24.36	3.48	0.00	0.00	2.78	11.83
26	0.00	25.75	15.31	27.84	17.40	0.00	24.36	3.48	0.00	0.00	6.96	11.83
27	0.00	28.53	15.31	13.92	17.40	0.00	24.36	3.48	0.00	0.00	9.74	11.83
28	0.00	30.62	15.31	11.13	17.40	0.00	23.66	3.48	0.00	0.00	9.74	11.83
29	0.00	0.00	15.31	11.13	25.75	0.00	23.66	3.48	0.00	0.00	9.74	11.83
30	0.00	0.00	15.31	11.13	68.20	0.00	16.01	1.39	0.00	0.00	9.74	11.83
31	0.00	0.00	15.31	0.00	13.92	0.00	3.48	0.00	0.00	0.00	0.00	11.83
Total	335.43	295.76	694.53	977.76	1503.18	86.99	391.11	105.78	0.00	0.00	73.77	377.88
Mean	10.82	9.54	22.40	31.54	48.49	2.81	12.62	3.41	0.00	0.00	2.38	12.19
Max	14.61	30.62	30.62	61.24	137.10	11.13	24.36	4.18	0.00	0.00	9.74	18.09
Min	0.00	0.00	14.61	0.00	11.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00

2001
Cottonwood Creek 1
Discharge (cfs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.54	3.35	2.61	3.52	3.27	3.12	2.11	3.52	2.75	2.55	2.75	2.48
2	1.59	2.48	2.48	3.27	3.27	3.12	2.23	12.09	2.75	2.61	2.75	2.55
3	1.68	2.55	2.35	2.97	11.51	3.04	2.17	4.53	2.75	2.61	2.68	2.89
4	1.78	2.42	2.35	2.89	32.93	3.20	2.23	3.20	2.75	2.42	2.68	2.97
5	1.89	2.61	2.29	2.89	39.20	2.97	2.82	2.75	2.75	2.97	2.75	2.75
6	1.89	2.61	2.42	3.69	27.38	2.75	2.42	3.52	2.75	2.61	2.61	2.68
7	1.84	2.17	2.75	3.27	15.78	2.75	2.29	3.35	2.75	2.42	2.61	2.61
8	1.84	2.29	2.48	2.68	7.39	2.82	14.40	2.61	17.76	2.35	5.60	2.55
9	1.84	5.26	2.55	2.75	4.43	2.82	7.97	2.89	5.49	2.29	3.20	2.61
10	1.89	3.52	5.15	2.97	3.52	2.61	3.35	3.95	3.60	2.82	2.68	2.61
11	1.89	2.82	8.42	23.44	2.75	2.48	5.60	3.52	3.20	2.42	2.55	2.68
12	1.89	2.97	5.49	28.44	2.75	2.68	8.89	3.12	2.82	2.48	2.75	2.61
13	1.84	2.82	5.26	16.26	2.75	12.09	41.46	3.12	2.82	2.35	2.42	3.04
14	2.11	2.61	4.14	9.71	2.75	12.09	20.75	4.43	2.75	2.29	2.42	2.61
15	2.75	3.69	3.27	6.33	2.75	3.78	6.58	3.95	2.68	2.55	2.55	2.61
16	1.89	2.75	3.12	4.83	2.75	3.04	4.73	3.52	2.68	2.82	2.55	3.04
17	2.29	2.68	2.89	4.23	2.75	2.82	4.23	3.12	3.04	2.97	2.55	3.27
18	2.11	2.68	2.97	4.23	2.75	2.75	3.35	2.75	2.97	2.97	2.61	3.04
19	1.84	2.61	2.97	3.60	2.75	2.61	2.48	2.75	2.61	3.04	2.97	2.61
20	1.78	2.75	3.04	3.27	2.75	2.61	3.12	2.75	2.48	3.04	2.42	2.61
21	1.73	2.68	3.12	2.97	2.75	2.75	3.20	2.75	2.48	3.04	2.35	2.68
22	1.84	2.42	3.44	8.27	2.75	2.68	3.12	2.75	2.29	3.12	2.55	3.04
23	1.78	2.48	3.52	7.25	2.75	5.04	3.04	2.75	2.23	2.89	11.90	3.27
24	1.78	2.42	3.20	4.23	4.63	4.53	4.73	2.75	2.35	2.75	4.14	2.82
25	1.89	2.17	2.75	3.35	4.05	2.82	2.05	2.75	2.35	2.75	2.89	2.75
26	1.89	2.23	4.63	3.20	3.78	2.68	2.42	2.75	2.35	2.75	3.60	2.75
27	1.84	2.68	3.78	2.97	3.69	2.55	1.63	2.75	2.42	2.68	3.04	2.75
28	1.94	2.42	3.35	2.82	3.52	2.42	1.59	2.75	2.48	2.75	3.44	2.75
29	2.17		3.27	2.82	4.63	2.35	1.63	2.75	2.48	2.75	2.55	2.75
30	2.29		4.33	2.82	3.60	2.17	2.17	2.75	2.48	2.61	2.61	2.75
31	2.68		3.60		3.20		2.55	2.75		2.68		2.75
Total	59.97	77.16	107.99	175.96	215.54	106.17	171.31	105.72	98.09	83.38	95.17	85.95
Max	2.75	5.26	8.42	28.44	39.20	12.09	41.46	12.09	17.76	3.12	11.90	3.27
Min	1.54	2.17	2.29	2.68	2.75	2.17	1.59	2.61	2.23	2.29	2.35	2.48
Ac-ft	118.75	152.77	213.83	348.41	426.77	210.21	339.20	209.32	194.22	165.08	188.43	170.17

2001
Cottonwood Creek 1
Phosphorus Loading (lbs/day)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	0.77	2.50	1.68	2.70	2.40	2.22	1.22	2.70	1.82	1.62	1.82	1.55
2	0.80	1.55	1.55	2.40	2.40	2.22	1.32	23.25	1.82	1.68	1.82	1.62
3	0.87	1.62	1.43	2.05	21.23	2.13	1.27	4.08	1.82	1.68	1.75	1.97
4	0.95	1.49	1.43	1.97	155.83	2.31	1.32	2.31	1.82	1.49	1.75	2.05
5	1.03	1.68	1.38	1.97	218.68	2.05	1.90	1.82	1.82	2.05	1.82	1.82
6	1.03	1.68	1.49	2.91	109.10	1.82	1.49	2.70	1.82	1.68	1.68	1.75
7	0.99	1.27	1.82	2.40	38.19	1.82	1.38	2.50	1.82	1.49	1.68	1.68
8	0.99	1.38	1.55	1.75	9.52	1.90	32.17	1.68	47.71	1.43	5.86	1.62
9	0.99	5.27	1.62	1.82	3.93	1.90	10.88	1.97	5.66	1.38	2.31	1.68
10	1.03	2.70	5.08	2.05	2.70	1.68	2.50	3.26	2.80	1.90	1.75	1.68
11	1.03	1.90	12.01	80.90	1.82	1.55	5.86	2.70	2.31	1.49	1.62	1.75
12	1.03	2.05	5.66	117.33	1.82	1.75	13.24	2.22	1.90	1.55	1.82	1.68
13	0.99	1.90	5.27	40.40	1.82	23.25	243.93	2.22	1.90	1.43	1.49	2.13
14	1.22	1.68	3.52	15.55	1.82	23.25	64.10	3.93	1.82	1.38	1.49	1.68
15	1.82	2.91	2.40	7.24	1.82	3.02	7.76	3.26	1.75	1.62	1.62	1.68
16	1.03	1.82	2.22	4.56	1.82	2.13	4.39	2.70	1.75	1.90	1.62	2.13
17	1.38	1.75	1.97	3.65	1.82	1.90	3.65	2.22	2.13	2.05	1.62	2.40
18	1.22	1.75	2.05	3.65	1.82	1.82	2.50	1.82	2.05	2.05	1.68	2.13
19	0.99	1.68	2.05	2.80	1.82	1.68	1.55	1.82	1.68	2.13	2.05	1.68
20	0.95	1.82	2.13	2.40	1.82	1.68	2.22	1.82	1.55	2.13	1.49	1.68
21	0.91	1.75	2.22	2.05	1.82	1.82	2.31	1.82	1.55	2.13	1.43	1.75
22	0.99	1.49	2.59	11.62	1.82	1.75	2.22	1.82	1.38	2.22	1.62	2.13
23	0.95	1.55	2.70	9.20	1.82	4.90	2.13	1.82	1.32	1.97	22.56	2.40
24	0.95	1.49	2.31	3.65	4.23	4.08	4.39	1.82	1.43	1.82	3.52	1.90
25	1.03	1.27	1.82	2.50	3.39	1.90	1.17	1.82	1.43	1.82	1.97	1.82
26	1.03	1.32	4.23	2.31	3.02	1.75	1.49	1.82	1.43	1.82	2.80	1.82
27	0.99	1.75	3.02	2.05	2.91	1.62	0.84	1.82	1.49	1.75	2.13	1.82
28	1.07	1.49	2.50	1.90	2.70	1.49	0.80	1.82	1.55	1.82	2.59	1.82
29	1.27	0.00	2.40	1.90	4.23	1.43	0.84	1.82	1.55	1.82	1.62	1.82
30	1.38		3.79	1.90	2.80	1.27	1.27	1.82	1.55	1.68	1.68	1.82
31	1.75		2.80		2.31		1.62	1.82		1.75		1.82
Total	33.41	52.51	88.70	339.58	613.24	104.11	423.71	91.02	102.47	54.77	80.68	57.35
Mean	2.09	3.50	5.54	21.91	38.33	6.72	26.48	5.69	6.61	3.42	5.21	3.58
Max	1.82	5.27	12.01	117.33	218.68	23.25	243.93	23.25	47.71	2.22	22.56	2.40
Min	0.77	0.00	1.38	1.75	1.82	1.27	0.80	1.68	1.32	1.38	1.43	1.55

Note: The above data have not been normalized to the COE

2001
Cottonwood Creek 2
Discharge (cfs)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	1.72	2.56	2.56	2.27	2.08	4.98	2.08	1.48	1.24	1.24	1.81	2.08
2	1.72	2.56	2.46	2.08	2.56	3.67	2.17	12.57	1.09	1.40	1.90	1.99
3	1.81	2.98	2.27	1.99	10.50	3.09	2.27	8.46	0.82	1.48	1.99	1.90
4	1.81	2.98	1.99	1.81	27.77	3.09	2.17	3.44	1.02	1.48	1.81	2.27
5	1.81	2.98	1.90	1.64	51.40	3.09	3.44	1.90	0.88	1.99	1.81	2.17
6	1.81	2.56	1.81	1.81	55.03	2.98	2.67	1.72	1.24	2.08	0.69	1.90
7	1.72	2.56	1.81	2.77	47.92	2.77	2.27	3.32	1.24	1.56	0.07	1.99
8	1.81	2.56	1.99	1.99	45.14	2.88	2.88	1.99	10.94	1.24	0.12	1.72
9	1.90	2.56	1.90	1.48	42.47	2.88	37.44	1.72	13.30	1.24	0.12	1.64
10	1.90	2.56	2.77	1.64	37.93	2.56	18.00	2.17	5.27	1.72	0.17	1.72
11	1.90	2.56	8.65	8.08	28.98	2.17	6.51	3.21	2.88	1.81	0.22	1.81
12	1.90	2.56	8.27	30.65	18.61	2.27	7.72	3.09	2.17	1.64	0.22	1.81
13	1.90	2.56	5.72	28.58	10.94	5.12	3.21	3.44	1.90	1.56	0.22	1.90
14	1.81	2.56	5.12	18.00	6.35	37.93	1.40	11.39	1.72	1.32	1.09	1.64
15	1.72	2.56	3.55	9.65	4.04	14.07	1.48	3.32	1.56	1.56	2.67	1.72
16	2.08	2.56	2.88	6.19	3.09	6.35	1.32	-0.02	1.56	1.99	5.42	1.64
17	2.08	2.56	2.56	3.92	3.67	4.43	0.95	2.67	1.81	2.08	3.55	2.17
18	2.08	2.56	2.37	3.21	9.05	3.92	0.56	5.57	2.08	2.17	2.08	2.77
19	2.08	2.56	2.08	2.67	8.65	3.44	0.28	2.17	1.90	2.17	2.37	1.90
20	1.90	2.88	1.99	2.27	5.72	3.32	0.12	1.81	1.48	2.27	1.99	1.81
21	1.81	2.98	1.81	2.17	5.72	3.21	0.03	1.72	1.32	2.37	1.81	1.64
22	1.99	2.67	1.81	4.98	4.98	3.21	0.03	1.24	1.17	2.37	1.64	1.64
23	1.90	2.56	2.17	12.32	4.98	3.79	4.84	1.32	1.02	2.27	8.46	1.64
24	1.81	2.56	2.17	7.18	4.98	11.62	24.70	1.17	1.09	2.27	9.25	1.64
25	1.90	2.56	2.08	3.32	4.30	5.72	8.65	1.32	1.09	2.27	3.92	1.64
26	1.90	2.56	2.88	2.37	4.30	4.43	12.57	1.56	1.09	2.17	3.44	1.40
27	1.90	2.56	3.32	2.27	4.30	3.67	6.19	1.24	1.09	1.99	3.79	1.64
28	2.08	2.56	2.56	2.08	4.98	3.09	3.09	1.24	1.24	1.81	2.17	1.64
29	2.27		2.27	1.90	9.25	2.77	2.08	1.32	1.32	1.81	1.99	1.64
30	2.37		3.09	1.90	9.25	2.37	1.64	1.09	1.24	1.64	2.27	1.64
31	2.37		2.67		8.27		1.32	1.17		1.64		1.64
Total	59.76	73.89	91.50	173.18	487.23	158.91	164.06	89.80	67.79	56.59	69.07	56.36
Max	2.37	2.98	8.65	30.65	55.03	37.93	37.44	12.57	13.30	2.37	9.25	2.77
Min	1.72	2.56	1.81	1.48	2.08	2.17	0.03	-0.02	0.82	1.24	0.07	1.40
Ac-ft	118.33	146.31	181.16	342.89	964.71	314.63	324.83	177.80	134.23	112.05	136.76	111.59

2001
Cottonwood Creek 2
Phosphorus Loading (lbs/day)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	0.69	1.20	1.20	1.01	0.90	3.03	0.90	0.56	0.44	0.44	0.74	0.90
2	0.69	1.20	1.14	0.90	1.20	1.98	0.96	10.95	0.37	0.52	0.79	0.84
3	0.74	1.48	1.01	0.84	8.53	1.56	1.01	6.32	0.24	0.56	0.84	0.79
4	0.74	1.48	0.84	0.74	32.98	1.56	0.96	1.81	0.33	0.56	0.74	1.01
5	0.74	1.48	0.79	0.65	77.59	1.56	1.81	0.79	0.27	0.84	0.74	0.96
6	0.74	1.20	0.74	0.74	85.32	1.48	1.27	0.69	0.44	0.90	0.19	0.79
7	0.69	1.20	0.74	1.34	70.39	1.34	1.01	1.72	0.44	0.60	0.01	0.84
8	0.74	1.20	0.84	0.84	64.79	1.41	1.41	0.84	9.03	0.44	0.02	0.69
9	0.79	1.20	0.79	0.56	59.52	1.41	49.96	0.69	11.86	0.44	0.02	0.65
10	0.79	1.20	1.34	0.65	50.86	1.20	18.05	0.96	3.27	0.69	0.03	0.69
11	0.79	1.20	6.52	5.93	35.00	0.96	4.39	1.64	1.41	0.74	0.04	0.74
12	0.79	1.20	6.12	37.82	18.90	1.01	5.56	1.56	0.96	0.65	0.04	0.74
13	0.79	1.20	3.67	34.31	9.03	3.15	1.64	1.81	0.79	0.60	0.04	0.79
14	0.74	1.20	3.15	18.05	4.24	50.86	0.52	9.55	0.69	0.48	0.37	0.65
15	0.69	1.20	1.89	7.59	2.26	12.81	0.56	1.72	0.60	0.60	1.27	0.69
16	0.90	1.20	1.41	4.09	1.56	4.24	0.48	0.00	0.60	0.84	3.40	0.65
17	0.90	1.20	1.20	2.17	1.98	2.57	0.30	1.27	0.74	0.90	1.89	0.96
18	0.90	1.20	1.07	1.64	6.93	2.17	0.15	3.53	0.90	0.96	0.90	1.34
19	0.90	1.20	0.90	1.27	6.52	1.81	0.05	0.96	0.79	0.96	1.07	0.79
20	0.79	1.41	0.84	1.01	3.67	1.72	0.02	0.74	0.56	1.01	0.84	0.74
21	0.74	1.48	0.74	0.96	3.67	1.64	0.00	0.69	0.48	1.07	0.74	0.65
22	0.84	1.27	0.74	3.03	3.03	1.64	0.00	0.44	0.40	1.07	0.65	0.65
23	0.79	1.20	0.96	10.66	3.03	2.07	2.91	0.48	0.33	1.01	6.32	0.65
24	0.74	1.20	0.96	5.04	3.03	9.82	28.03	0.40	0.37	1.01	7.15	0.65
25	0.79	1.20	0.90	1.72	2.47	3.67	6.52	0.48	0.37	1.01	2.17	0.65
26	0.79	1.20	1.41	1.07	2.47	2.57	10.95	0.60	0.37	0.96	1.81	0.52
27	0.79	1.20	1.72	1.01	2.47	1.98	4.09	0.44	0.37	0.84	2.07	0.65
28	0.90	1.20	1.20	0.90	3.03	1.56	1.56	0.44	0.44	0.74	0.96	0.65
29	1.01		1.01	0.79	7.15	1.34	0.90	0.48	0.48	0.74	0.84	0.65
30	1.07		1.56	0.79	7.15	1.07	0.65	0.37	0.44	0.65	1.01	0.65
31	1.07		1.27		6.12		0.48	0.40		0.65		0.65
Total	25.12	35.07	48.70	148.13	585.78	125.21	147.07	53.33	38.78	23.49	37.71	23.24
Mean	1.57	2.42	3.04	9.56	36.61	8.08	9.19	3.33	2.50	1.47	2.43	1.45
Max	1.07	1.48	6.52	37.82	85.32	50.86	49.96	10.95	11.86	1.07	7.15	1.34
Min	0.69	1.20	0.74	0.56	0.90	0.96	0.00	0.00	0.24	0.44	0.01	0.52

Note: The above data have not been normalized to the COE.

2001
Shop Creek 1
Average Discharge (cfs)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.65	0.70	0.93	0.75	0.86	0.93	0.93	0.93	0.93	0.93	0.93	0.93
2	0.65	0.86	0.70	0.75	1.28	0.93	0.93	2.71	0.93	0.93	0.93	0.93
3	0.65	0.80	0.65	0.80	2.18	0.93	0.93	0.93	0.93	0.93	0.93	0.93
4	0.65	0.80	0.65	0.80	5.41	0.93	0.93	0.93	0.93	0.93	0.93	0.93
5	0.65	0.75	0.65	0.75	10.68	0.93	0.93	0.93	0.93	0.93	0.93	0.93
6	0.65	0.70	0.65	1.13	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
7	0.65	0.65	0.65	0.75	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
8	0.65	0.70	0.65	0.75	0.93	0.93	1.70	0.93	2.71	0.93	0.93	0.93
9	0.65	0.70	0.65	0.75	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
10	0.65	0.86	1.70	0.99	0.99	0.93	0.93	0.93	0.93	0.93	0.93	0.93
11	0.65	1.06	1.62	4.30	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
12	0.65	0.93	0.93	3.05	0.80	0.93	2.71	0.93	0.93	0.93	0.93	0.93
13	0.65	0.80	0.80	1.28	0.70	0.93	10.14	0.93	0.93	0.93	0.93	0.93
14	0.65	0.80	0.75	0.93	0.75	0.93	3.91	0.93	0.93	0.93	0.93	0.93
15	0.65	1.13	0.70	0.80	0.80	0.93	0.93	0.93	0.93	0.93	0.93	0.93
16	0.65	0.80	0.80	0.80	0.86	0.93	0.93	0.93	0.93	0.93	0.93	0.93
17	0.65	0.80	0.70	0.75	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
18	0.65	0.75	0.70	0.80	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
19	0.61	0.80	0.70	0.80	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
20	0.65	0.80	0.70	0.80	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
21	0.65	0.75	0.70	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
22	0.51	0.75	0.75	2.71	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
23	0.50	0.75	0.75	0.93	0.93	0.93	0.93	0.93	0.93	0.93	2.71	0.93
24	0.50	0.75	0.70	0.80	0.93	0.93	1.70	0.93	0.93	0.93	0.93	0.93
25	0.50	0.75	0.70	0.80	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
26	0.50	0.70	0.99	0.80	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
27	0.54	0.93	0.75	0.86	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
28	0.61	0.75	0.75	0.80	0.93	0.93	0.93	0.93	0.93	0.93	0.93	0.93
29	0.75		0.99	0.80	1.70	0.93	0.93	0.93	0.93	0.93	0.93	0.93
30	0.80		0.75	0.86	1.70	0.93	0.93	0.93	0.93	0.93	0.93	0.93
31	0.70		0.93		0.93		0.93	0.93		0.93		0.93
Total	19.53	22.34	25.02	32.88	45.41	27.78	44.24	30.49	29.56	28.70	29.56	28.70
Max	0.80	1.13	1.70	4.30	10.68	0.93	10.14	2.71	2.71	0.93	2.71	0.93
Min	0.50	0.65	0.65	0.75	0.70	0.93	0.93	0.93	0.93	0.93	0.93	0.93
Ac-ft	38.67	44.24	49.54	65.10	89.90	55.00	87.59	60.37	58.54	56.83	58.54	56.83

2001
Shop Creek 1
Phosphorus Loading (lbs/day)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	0.28	0.31	0.45	0.34	0.41	0.45	0.45	0.45	0.45	0.45	0.45	0.45
2	0.28	0.41	0.31	0.34	0.72	0.45	0.45	2.31	0.45	0.45	0.45	0.45
3	0.28	0.37	0.28	0.37	1.63	0.45	0.45	0.45	0.45	0.45	0.45	0.45
4	0.28	0.37	0.28	0.37	7.59	0.45	0.45	0.45	0.45	0.45	0.45	0.45
5	0.28	0.34	0.28	0.34	26.57	0.45	0.45	0.45	0.45	0.45	0.45	0.45
6	0.28	0.31	0.28	0.60	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
7	0.28	0.28	0.28	0.34	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
8	0.28	0.31	0.28	0.34	0.45	0.45	1.10	0.45	2.31	0.45	0.45	0.45
9	0.28	0.31	0.28	0.34	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
10	0.28	0.41	1.10	0.50	0.50	0.45	0.45	0.45	0.45	0.45	0.45	0.45
11	0.28	0.54	1.01	5.06	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
12	0.28	0.45	0.45	2.82	0.37	0.45	2.31	0.45	0.45	0.45	0.45	0.45
13	0.28	0.37	0.37	0.72	0.31	0.45	24.07	0.45	0.45	0.45	0.45	0.45
14	0.28	0.37	0.34	0.45	0.34	0.45	4.29	0.45	0.45	0.45	0.45	0.45
15	0.28	0.60	0.31	0.37	0.37	0.45	0.45	0.45	0.45	0.45	0.45	0.45
16	0.28	0.37	0.37	0.37	0.41	0.45	0.45	0.45	0.45	0.45	0.45	0.45
17	0.28	0.37	0.31	0.34	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
18	0.28	0.34	0.31	0.37	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
19	0.26	0.37	0.31	0.37	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
20	0.28	0.37	0.31	0.37	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
21	0.28	0.34	0.31	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
22	0.21	0.34	0.34	2.31	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
23	0.20	0.34	0.34	0.45	0.45	0.45	0.45	0.45	0.45	0.45	2.31	0.45
24	0.20	0.34	0.31	0.37	0.45	0.45	1.10	0.45	0.45	0.45	0.45	0.45
25	0.20	0.34	0.31	0.37	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
26	0.20	0.31	0.50	0.37	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
27	0.22	0.45	0.34	0.41	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
28	0.26	0.34	0.34	0.37	0.45	0.45	0.45	0.45	0.45	0.45	0.45	0.45
29	0.34		0.50	0.37	1.10	0.45	0.45	0.45	0.45	0.45	0.45	0.45
30	0.37		0.34	0.41	1.10	0.45	0.45	0.45	0.45	0.45	0.45	0.45
31	0.31		0.45		0.45		0.45	0.45		0.45		0.45
Total	8.35	10.35	11.95	20.99	49.52	13.51	44.59	15.83	15.38	13.96	15.38	13.96
Mean	0.27	0.37	0.39	0.70	1.60	0.45	1.44	0.51	0.51	0.45	0.51	0.45
Max	0.37	0.60	1.10	5.06	26.57	0.45	24.07	2.31	2.31	0.45	2.31	0.45
Min	0.20	0.28	0.28	0.34	0.31	0.45	0.45	0.45	0.45	0.45	0.45	0.45

Note: Data have not been normalized to the COE

2001
Shop Creek 3
Average Discharge (cfs)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.38	0.17	0.17	0.16	0.16	0.16	0.16	0.18	0.16	2.75	0.16	0.16
2	0.31	0.17	0.16	0.16	0.16	0.16	0.16	0.30	0.16	2.75	0.16	0.16
3	0.21	0.17	0.16	0.16	0.25	0.16	0.16	0.20	0.16	2.75	0.16	0.16
4	0.18	0.17	0.16	0.16	1.38	0.16	0.17	0.19	0.16	2.75	0.16	0.16
5	0.18	0.17	0.16	0.16	4.89	0.16	0.16	0.18	0.16	2.75	0.16	0.16
6	0.18	0.25	0.16	0.16	2.75	0.16	0.17	0.24	0.16	2.75	0.16	0.16
7	0.17	0.60	0.16	0.18	1.98	0.16	0.17	0.34	0.16	2.75	0.16	0.16
8	0.17	0.25	0.16	0.16	0.17	0.16	0.50	0.21	0.48	0.16	0.21	0.18
9	0.17	0.16	0.16	0.16	0.16	0.16	0.55	0.23	0.31	0.16	0.17	0.17
10	0.17	0.16	0.18	0.16	0.16	0.16	0.17	0.21	0.19	0.16	0.16	0.18
11	0.16	0.16	0.44	0.37	0.16	0.16	0.17	0.18	0.17	0.16	0.16	0.18
12	0.16	0.17	0.25	1.43	0.16	0.16	0.48	0.18	0.17	0.16	0.16	0.18
13	0.16	0.25	0.18	0.38	0.16	0.21	0.57	0.18	0.16	0.16	0.16	0.18
14	0.16	0.16	0.17	0.23	0.16	1.00	1.09	0.23	0.16	0.16	0.16	0.18
15	0.16	0.16	0.16	0.17	0.16	0.23	0.42	0.22	0.16	0.16	0.16	0.18
16	0.16	0.16	0.17	0.16	0.16	0.17	0.25	0.19	0.16	0.16	0.16	0.18
17	0.18	0.16	0.17	0.16	0.16	0.16	0.22	0.18	0.16	0.16	0.16	0.17
18	0.17	0.16	0.16	0.16	0.17	0.16	0.21	0.17	0.17	0.16	0.16	0.16
19	0.17	0.16	0.16	0.16	0.17	0.16	0.20	0.17	0.17	0.16	0.16	0.16
20	0.16	0.16	0.16	0.16	0.16	0.16	0.18	0.17	0.16	0.16	0.16	0.16
21	0.16	0.16	0.16	0.16	0.28	0.16	0.18	0.16	0.16	0.16	0.16	0.16
22	0.16	0.16	0.16	0.25	0.16	0.16	0.18	0.16	0.16	0.16	0.16	0.16
23	0.16	0.16	0.16	0.23	0.16	0.16	0.25	0.16	0.16	0.16	0.16	0.16
24	0.16	0.16	0.16	0.17	0.16	0.16	0.44	0.16	0.16	0.16	0.18	0.16
25	0.16	0.16	0.16	0.16	0.16	0.16	0.21	0.17	0.16	0.16	0.16	0.16
26	0.16	0.16	0.17	0.16	0.16	0.16	0.19	0.16	0.16	0.16	0.16	0.16
27	0.16	0.17	0.16	0.16	0.16	0.16	0.19	0.16	0.16	0.16	0.18	0.16
28	0.16	0.16	0.16	0.16	0.16	0.16	0.18	0.16	0.16	0.16	0.17	0.16
29	0.21		0.16	0.16	0.17	0.16	0.18	0.16	0.16	0.16	0.16	0.16
30	0.92		0.19	0.16	0.16	0.16	0.18	0.16	0.16	0.16	0.16	0.16
31	0.60		0.17		0.16		0.18	0.16		0.16		0.16
Total	6.79	5.26	5.43	6.70	15.49	5.73	8.51	5.94	5.35	23.07	4.87	5.15
Max	0.92	0.60	0.44	1.43	4.89	1.00	1.09	0.34	0.48	2.75	0.21	0.18
Min	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16	0.16
Ac-ft	13.45	10.41	10.75	13.27	30.67	11.35	16.86	11.77	10.59	45.68	9.65	10.20

2001
Shop Creek 3
Phosphorus Loading (lbs/day)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
1	0.22	0.08	0.07	0.07	0.07	0.07	0.07	0.08	0.07	5.83	0.07	0.07
2	0.16	0.08	0.07	0.07	0.07	0.07	0.07	0.15	0.07	5.83	0.07	0.07
3	0.10	0.08	0.07	0.07	0.12	0.07	0.07	0.09	0.07	5.83	0.07	0.07
4	0.08	0.08	0.07	0.07	1.69	0.07	0.08	0.09	0.07	5.83	0.07	0.07
5	0.08	0.07	0.07	0.07	17.19	0.07	0.07	0.08	0.07	5.83	0.07	0.07
6	0.08	0.12	0.07	0.07	5.83	0.07	0.07	0.12	0.07	5.83	0.07	0.07
7	0.08	0.43	0.07	0.08	3.20	0.07	0.07	0.18	0.07	5.83	0.07	0.07
8	0.08	0.12	0.07	0.07	0.07	0.07	0.33	0.09	0.31	0.07	0.09	0.08
9	0.07	0.07	0.07	0.07	0.07	0.07	0.38	0.11	0.16	0.07	0.07	0.08
10	0.07	0.07	0.08	0.07	0.07	0.07	0.08	0.10	0.09	0.07	0.07	0.08
11	0.07	0.07	0.27	0.21	0.07	0.07	0.07	0.08	0.07	0.07	0.07	0.08
12	0.07	0.07	0.12	1.80	0.07	0.07	0.31	0.08	0.07	0.07	0.07	0.08
13	0.07	0.12	0.08	0.22	0.07	0.09	0.40	0.08	0.07	0.07	0.07	0.08
14	0.07	0.07	0.08	0.11	0.07	0.99	1.13	0.11	0.07	0.07	0.07	0.08
15	0.07	0.07	0.07	0.07	0.07	0.11	0.25	0.10	0.07	0.07	0.07	0.08
16	0.07	0.07	0.07	0.07	0.07	0.08	0.12	0.09	0.07	0.07	0.07	0.08
17	0.08	0.07	0.08	0.07	0.07	0.07	0.10	0.08	0.07	0.07	0.07	0.07
18	0.08	0.07	0.07	0.07	0.07	0.07	0.09	0.08	0.07	0.07	0.07	0.07
19	0.07	0.07	0.07	0.07	0.08	0.07	0.09	0.07	0.07	0.07	0.07	0.07
20	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.07	0.07	0.07	0.07	0.07
21	0.07	0.07	0.07	0.07	0.15	0.07	0.08	0.07	0.07	0.07	0.07	0.07
22	0.07	0.07	0.07	0.12	0.07	0.07	0.08	0.07	0.07	0.07	0.07	0.07
23	0.07	0.07	0.07	0.11	0.07	0.07	0.12	0.07	0.07	0.07	0.07	0.07
24	0.07	0.07	0.07	0.07	0.07	0.07	0.27	0.07	0.07	0.07	0.08	0.07
25	0.07	0.07	0.07	0.07	0.07	0.07	0.09	0.07	0.07	0.07	0.07	0.07
26	0.07	0.07	0.08	0.07	0.07	0.07	0.09	0.07	0.07	0.07	0.07	0.07
27	0.07	0.08	0.07	0.07	0.07	0.07	0.09	0.07	0.07	0.07	0.08	0.07
28	0.07	0.07	0.07	0.07	0.07	0.07	0.08	0.07	0.07	0.07	0.08	0.07
29	0.10		0.07	0.07	0.07	0.07	0.08	0.07	0.07	0.07	0.07	0.07
30	0.86		0.09	0.07	0.07	0.07	0.08	0.07	0.07	0.07	0.07	0.07
31	0.43		0.07		0.07		0.08	0.07		0.07		0.07
Total	3.70	2.50	2.46	4.23	29.90	3.05	5.09	2.73	2.46	42.47	2.12	2.26
Mean	0.12	0.09	0.08	0.14	0.96	0.10	0.16	0.09	0.08	1.37	0.07	0.07
Max	0.86	0.43	0.27	1.80	17.19	0.99	1.13	0.18	0.31	5.83	0.09	0.08
Min	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07

Note: Data have not been normalized to the COE

2001
Precipitation (in.)

Date	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0	0	0	0	0	0	0	0.01	0	0	0	0
2	0	0	0	0	0	0	0	0.26	0	0	0	0
3	0	0	0	0	0.08	0.02	0	0.01	0	0	0	0
4	0	0	0	0	0.39	0.02	0	0	0	0	0	0
5	0	0	0	0	1.42	0	0.01	0	0	0	0	0
6	0	0	0	0	0.75	0	0.01	0	0	0	0	0
7	0	0	0	0.04	0	0	0.02	0.3	0	0	0	0
8	0	0	0	0	0	0	0.01	0	0.51	0	0.3	0
9	0	0	0	0.04	0	0	1.32	0.09	0.15	0	0	0
10	0	0	0	1.56	0	0.02	0	0.05	0.03	0	0	0
11	0	0	0.65	0.4	0.1	0	0	0.04	0	0	0	0
12	0	0	0.06	0	0	0	0.5	0	0	0	0	0.02
13	0	0	0	0	0	0	0.51	0.1	0	0	0	0
14	0	0	0	0	0	0.02	2.63	0.15	0	0	0	0
15	0	0	0	0	0	0	0	0.04	0	0.05	0	0
16	0.1	0.1	0	0	0	0	0	0	0	0	0	0.05
17	0	0	0	0	0	0	0	0	0.03	0	0	0
18	0	0	0	0	0	0	0	0	0.05	0	0	0
19	0	0	0	0	0.04	0	0	0	0	0	0.14	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0.05	0	0	0	0	0	0	0
22	0	0	0	0.04	0	0	0	0	0	0	0	0.05
23	0	0	0	0.08	0	0	0	0	0	0	0.04	0
24	0	0	0	0	0	0.04	0.66	0	0	0	0.55	0
25	0	0	0	0	0	0.01	0	0.01	0	0	0	0
26	0	0	0.02	0	0	0	0.05	0	0	0	0.35	0
27	0	0	0	0	0	0	0	0	0	0	0.01	0
28	0	0	0	0	0.03	0	0	0	0	0	0	0
29	0.49		0	0	0.19	0	0	0	0	0	0	0
30	0		0	0	0.15	0	0	0	0	0	0	0
31	0		0		0		0	0		0		0
Total	0.59	0.10	0.73	2.16	3.20	0.13	5.72	1.06	0.77	0.05	1.39	0.12
Mean	0.02	0.00	0.02	0.07	0.10	0.00	0.18	0.03	0.03	0.00	0.05	0.00
Max	0.49	0.10	0.65	1.56	1.42	0.04	2.63	0.30	0.51	0.05	0.55	0.05
Min	0	0	0	0	0	0	0	0	0	0	0	0
Ac-ft	41.89	7.10	51.83	153.36	227.20	9.23	406.12	75.26	54.67	3.55	98.69	8.52

2001
Precipitation
Phosphorus Loading (lbs/day)

Day	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.00	0.00	0.00	0.00
2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.51	0.00	0.00	0.00	0.00
3	0.00	0.00	0.00	0.00	2.93	0.73	0.00	0.37	0.00	0.00	0.00	0.00
4	0.00	0.00	0.00	0.00	14.27	0.73	0.00	0.00	0.00	0.00	0.00	0.00
5	0.00	0.00	0.00	0.00	51.96	0.00	0.37	0.00	0.00	0.00	0.00	0.00
6	0.00	0.00	0.00	0.00	27.44	0.00	0.37	0.00	0.00	0.00	0.00	0.00
7	0.00	0.00	0.00	1.46	0.00	0.00	0.73	10.98	0.00	0.00	0.00	0.00
8	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.00	18.66	0.00	10.98	0.00
9	0.00	0.00	0.00	1.46	0.00	0.00	48.30	3.29	5.49	0.00	0.00	0.00
10	0.00	0.00	0.00	57.08	0.00	0.73	0.00	1.83	1.10	0.00	0.00	0.00
11	0.00	0.00	23.78	14.64	3.66	0.00	0.00	1.46	0.00	0.00	0.00	0.00
12	0.00	0.00	2.20	0.00	0.00	0.00	18.29	0.00	0.00	0.00	0.00	0.73
13	0.00	0.00	0.00	0.00	0.00	0.00	18.66	3.66	0.00	0.00	0.00	0.00
14	0.00	0.00	0.00	0.00	0.00	0.73	96.23	5.49	0.00	0.00	0.00	0.00
15	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.46	0.00	1.83	0.00	0.00
16	3.66	3.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.83
17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.10	0.00	0.00	0.00
18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.83	0.00	0.00	0.00
19	0.00	0.00	0.00	0.00	1.46	0.00	0.00	0.00	0.00	0.00	5.12	0.00
20	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
21	0.00	0.00	0.00	0.00	1.83	0.00	0.00	0.00	0.00	0.00	0.00	0.00
22	0.00	0.00	0.00	1.46	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.83
23	0.00	0.00	0.00	2.93	0.00	0.00	0.00	0.00	0.00	0.00	1.46	0.00
24	0.00	0.00	0.00	0.00	0.00	1.46	24.15	0.00	0.00	0.00	20.12	0.00
25	0.00	0.00	0.00	0.00	0.00	0.37	0.00	0.37	0.00	0.00	0.00	0.00
26	0.00	0.00	0.73	0.00	0.00	0.00	1.83	0.00	0.00	0.00	12.81	0.00
27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.00
28	0.00	0.00	0.00	0.00	1.10	0.00	0.00	0.00	0.00	0.00	0.00	0.00
29	17.93		0.00	0.00	6.95	0.00	0.00	0.00	0.00	0.00	0.00	0.00
30	0.00		0.00	0.00	5.49	0.00	0.00	0.00	0.00	0.00	0.00	0.00
31	0.00		0.00		0.00		0.00	0.00		0.00		0.00
Total	21.59	3.66	26.71	79.03	117.09	4.76	209.29	38.78	28.17	1.83	50.86	4.39
Mean	0.70	0.13	0.86	2.63	3.78	0.16	6.75	1.25	0.94	0.06	1.70	0.14
Max	17.93	3.66	23.78	57.08	51.96	1.46	96.23	10.98	18.66	1.83	20.12	1.83
Min	0	0	0	0	0	0	0	0	0	0	0	0

APPENDIX D

BIOLOGICAL DATA

2001 CHERRY CREEK PHYTOPLANKTON
COMPOSITE

GENUS/SPECIES	01/16/01	03/20/01	04/10/01	05/08/01	05/22/01	06/05/01	06/19/01	06/26/01	07/10/01	07/24/01	08/14/01	08/28/01	09/04/01	09/18/01	10/08/01	10/23/01	11/06/01	12/04/01
BACILLARIOPHYTA																		
Order Centrales																		
Cyclotella meneghiniana																		9
Cyclotella ocellata								43	5,209									
Cyclotella pseudostelligera						65		43										
Cyclotella sp. 1	1,997	955	2,084	11,806	16,928	1,107	1,237		2,813	833	449	1,910	1,181	451	1,042	1,997	1,563	833
Melosira cf. distans	174		521		29			87	18	486	318	313	871	313	521	1,476	651	
Melosira italica				29		130				139	58	139		347		868		
Stephanodiscus medius		29	260	87	434		260	608	174	35	29	278	556	938	695	174	195	156
Stephanodiscus minutulus								7,553										
Stephanodiscus niagarae			88	44		11	65											
Order Pennales																		
Asterionella formosa					322	521												
Cymbella sp.		15																
Fragilaria brevistriata						77												
Fragilaria capucina												88		26				
Fragilaria crotonensis										18			278	104				
Navicula cryptocephala												35						
Nitzschia acicularis		1,129	11,720	174	87			87		69		35	35			521		
Nitzschia gracilis														9		87	326	260
Nitzschia palea							11		35		11	35	104	35				52
Synedra delicatissima												9						
Synedra tenera		174	521		234					35		9	139	104			977	1,094
Synedra ulna											11							
Synedra ulna v. ulna			44									9		69				156
CHLOROPHYTA																		
Ankistrodesmus falcatus	7,639	19,967	4,688	174	347	130	521	260	486	1,111	478	660	1,007	3,229	3,473	3,559	2,930	1,979
Characium limnetcum								43										
Chlamydomonas globosa	347	260	1,302	87	608					35								
Chlamydomonas incerta											43	69			87			
Chlorogonium sp.												35	139	313				
Closterium moniliferum						11				26				9	29			
Closterium sp.													35					9
Coelastrum astroideum	347			117								35				59		
Coelastrum microporum									210									
Coelastrum sp.					117													
Crucigenia quadrata				585	2,778	1,042	88		278	281								
Crucigenia tetrapedia	234	521	4,167	695	1,389		781	260		278	405	417		208	695			
Cyst (Chlorophyte)																87		
Dictyosphaerium pulchellum	22,571	22,154	34,377	31,322	18,751	55,525	27,502	24,446	2,917	5,000	1,592	3,820	3,334	1,129	14,584	23,439	28,257	29,262
Eudorina elegans												70				234		
Gonium sp.										139			210	139				
Kirchneriella sp.									278									
Lagerheimia ciliata													35			87		
Lagerheimia quadriseta	87	87														868	195	4,896
Lobomonas sp.							130	43					35					
Micractinium pusillum			521															
Monoraphidium sp.	868	3,125	3,125	955	1,389	195	1,042	608	174	313	58	139	35	69	434	2,344	977	833

2001 CHERRY CREEK PHYTOPLANKTON
COMPOSITE

GENUS/SPECIES	01/16/01	03/20/01	04/10/01	05/08/01	05/22/01	06/05/01	06/19/01	06/26/01	07/10/01	07/24/01	08/14/01	08/28/01	09/04/01	09/18/01	10/08/01	10/23/01	11/06/01	12/04/01
Nephroselmis olivacea									35		130	69	69	243			65	
Non-motile Chlorococcales-spherical	608	174	1,042	434	695	65	391	478	278	35	43	208		139	608	695	260	
Oocystis parva	434	1,302	260	174	1,042	586	1,208	1,432	1,333	347	217	333	556	174	695	347	326	313
Oocystis pusilla		8,681	3,386	174			391											
Pandorina morum													556	140	409	59	1,042	140
Pediastrum duplex							789	651	193	140						234		
Pediastrum tetras					336	11					116						88	
Phacotus sp.		87			260	2,474	1,172	130	35	347	29	1,389	3,229	1,389	434	174	1,042	417
Pyramichlamys dissecta	15					65		43	35	21,008	29	451	1,146	208	608			
Quadrigula lacustris									35							174		
Scenedesmus abundans	174															347		313
Scenedesmus acutus												35						
Scenedesmus balatonicus							263	88		278		417						
Scenedesmus bijuga				59		130			69	139	29	69		69				365
Scenedesmus dimorphus				59		195				35		35	139	139	695	521	195	35
Scenedesmus dispar				59	347	912	391	87	278	69	232		139		695	347	260	
Scenedesmus quadricauda	174	521		1,042	174	1,693	521	87	69	208	116	417	347	486	1,667	1,418	781	104
Scenedesmus quadricauda v. longispina						260						139						208
Scenedesmus quadricauda v. quadrispina																		
Scenedesmus semipulcher			175										208					
Scenedesmus serratus	868	1,042	3,125	1,215	1,389	260	651	434				139			174	174	781	104
Scenedesmus verrucosus										69					347			
Schroederia judayi								43	35		29	139	35	104		174	195	
Selenastrum minutum	87	87	521						35	69	29	69	69		434	260	65	
Spermatozopsis exsultans												35	69	35				
Sphaerocystis schroeteri				347				132		139								
Staurastrum natator				87	15													
Teilingia granulata					87													
Tetraedron caudatum							195	43	35					35	521	174	65	
Tetraedron minimum			521	87	521	130	326	174	35			9	35	35		87	260	52
Tetraedron muticum			260															
Tetrastrum heteracanthum	347	3,473	4,167	260	260	456											521	417
Tetrastrum staurogeniaeforme	4,861	3,733	7,292	1,389	2,778	1,563	781	347	278		116	695	243		695	1,736	2,865	2,500
Treubaria setigerum	87																	
CYANOPHYTA																		
Anabaena circinalis										1,077	289	1,007	903	2,292				
Anabaena flos-aquae																347		
Anabaena sp.															73			
Aphanocapsa delicatissima	20,835	5,643	43,545	4,688	8,102	4,037	7,878	6,077	62,504	5,250	579	4,167	16,043	3,646	64,368	54,712	8,985	40,857
Chroococcus minutus						65				69								
Cyanogranis ferruginea														4,223	59,862	4291	7,422	3,750
Merismopedia tenuissima	11,668	1,563	4,167															2,292
Non-motile blue-greens (<1.1 um)	85,823	69,731	230,000	140,000	53,640	90,517	96,551	62,356	48,276	54,712	58,333	46,666	22,529	43,448	83,141	45,594	38,218	46,130
Non-motile blue-greens (>1 um)	521	174	781	174								69				174		104
Oscillatoria agardhii			10,417									5,452		964	877	1,388	603	
Oscillatoria limnetica	5,209				347	515						1,042	3,334	9,237	1,736	5,382	6,511	3,907
Synechococcus sp. 1	64,368	69,731	150,000	56,322	34,866	28,161	48,276	58,333	38,621	19,310	40,230	24,138	8,046	30,575	56,322	21,456	48,276	37,548

2001 CHERRY CREEK PHYTOPLANKTON

COMPOSITE

GENUS/SPECIES	01/16/01	03/20/01	04/10/01	05/08/01	05/22/01	06/05/01	06/19/01	06/26/01	07/10/01	07/24/01	08/14/01	08/28/01	09/04/01	09/18/01	10/08/01	10/23/01	11/06/01	12/04/01
CHRYSOPHYTA																		
Chrysococcus minutus				434			130								87	260	130	
Chrysolykos Skujai																87		
Dinobryon bavaricum (single)								43										
Dinobryon sertularia (single)										35					87		65	52
Erkenia sp.	6,945	1,042	2,344	174	174	130					15			278	955	868	781	3,959
Kephyrion gracilis			260			65									87	174		
Kephyrion skujae	87																	
Kephyrion sp.														35				
Mallomonas caudata												35						
Mallomonas sp.	87					586	456		35							87		
Ochromonas sp.	87	695	1,302	87	174										174	260		
Synura sp. (single)						130	195											
Uroglena sp. (single)											58							
EUGLENOPHYTA																		
Euglena sp.								11	35	18	15							
Phacus sp.					15	65					15	18	35	26				
Trachelomonas sp.														35		521	130	104
Trachelomonas volvocina						195	65	87							87	87	65	
PYRRHOPHYTA																		
Ceratium hirundinella											11							
Gymnodinium sp. 1														35				
Gymnodinium sp. 2	174	87						43			15	69	69	69			65	313
Gymnodinium sp. 3		347	260		87				69		116	35	35	35			130	52
Peridinium umbonatum	87	174			87	65			69		29			35				156
Peridinium wisconsinense										9								
CRYPTOPHYTA																		
Cryptomonas erosa	1,215	521		608	868		130	304	69	139	87	69	174	35	174	608	130	260
Cryptomonas lucens	2,084	521	521	174			65											
Cryptomonas ovata													35					
Cryptomonas rostratiformis																		52
Rhodomonas minuta v. nannoplanctica	2,431	8,508	1,563		2,431	1,367	1,107	912	764	521	1,476	729	347	9,063	2,604	3,299	2,995	1,146
Rhodomonas sp.				1,215														
MISCELLANEOUS																		
Misc. microflagellate	13,890	14,758	22,918	3,907	4,775	326	3,093	2,214	1,146	2,917	3,516	3,334	3,334	3,021	1,953	5,643	9,115	2,995
Total Density (Cells/ml)	257,430	241,011	552,245	259,244	156,883	193,838	196,662	168,630	166,958	115,738	109,351	99,583	69,718	117,740	302,129	187,959	168,503	188,184
Total # of Taxa	35	34	36	36	37	39	33	36	36	39	38	50	41	48	38	49	41	41

2001 CHERRY CREEK ZOOPLANKTON
COMPOSITE

GENUS/SPECIES	03/20/01	04/10/01	05/08/01	05/22/01	06/05/01	06/19/01	06/26/01	07/10/01	07/24/01	08/14/01	09/04/01	09/18/01	10/08/01	10/23/01	11/06/01	12/04/01
ROTIFERA																
Ascomorpha spp.			19,678	6,977	2,000	4,657	4,615	2,608	4,205	556	2,286	650	1,973	6,542	17,600	29,265
Asplanchna spp.					3,040	847	2,307	174	580	278	672	450	1,644	284	3,667	232
Hexarthra sp.												50				
Keratella cochlearis		773	12,833	29,517	32,480	86,783	35,270	48,515	66,555	16,528	19,898	12,450	43,084	121,742	73,578	380,206
Keratella quadrata			684	613	240	1,270		174								
Lecane spp.										6,667	2,958		164	569		697
Polyarthra vulgaris				153		847	330		9,860	3,333	1,479	200	1,316	853	11,489	232
CRUSTACEA																
CLADOCERA																
Bosmina longirostris	233	6,380	51,847	31,050	47,280	100,753	103,504	64,165	11,020	10,417	10,218	5,700	5,756	15,644	7,333	26,245
Ceriodaphnia reticulata						2,117										
Daphnia magna					240											
Daphnia pulex		773	1,369	4,293	4,480	7,620	4,285	1,043	145							
Echinisco rosea			6,673	1,917	320											
Eubosmina coregoni				383												
Eubosmina hagmanni			1,198	3,297	6,400	16,087	10,878	1,391								
Eubosmina tubicen			171	230		423	330	348								
Eurycercus spp.			856													
Kurzia latissima			171	230	80											
Moina micrura					1,280	5,927	2,307	696								
Unidentified Cladocern		193	1,027	843	400											
COPEPODA																
Acanthocyclops vernalis		1,740		230												
Copepodid	1,789	11,987	6,160	1,380	1,200	6,350	6,922	3,999	2,465	972	1,210	800	1,151	5,973	1,956	2,323
Cyclops bicuspidatus thomasi	467															
Harpaticodea spp.		193														
Microcyclops varicans		967	9,069	1,457	640	847	659									
Microcyclops varicans rubellus		193	856	307												
nauplii		4,060	342	153	2,560	847	10,219	1,391	60,755	16,667	14,789	10,450	11,511	9,102	8,800	1,161
Orthocyclops modestus		5,413														
Paracyclops fimbriatus poppei		1,740	4,107	767	240	1,693			145							1,161
Skistodiaptomus oregonensis		580	171	613	1,760	13,547	2,637	9,564	2,610	139	269	100	658	3,129	1,467	4,877
Tropocyclops prasinus		773														
Unidentified Calanoid		193	3,080	690											489	
Unidentified Cyclopoid	78															
Total (#/cubic meter)	2,567	35,958	120,292	85,100	104,640	250,615	184,263	134,068	158,340	55,557	53,779	30,850	67,257	163,838	126,379	446,399
Total # of Taxa*	3	13	16	18	15	14	11	10	8	7	7	7	7	7	7	8

* Does not include Copepodids or nauplii if present

C.C. CAROLYN
FYI + FORWARD TO CENTRAL FILES

MEMORANDUM

COLORADO STATE PARKS
Lyle Laverty, Division Director

TO: ~~BOB~~ Steve Cannon PER OUR DISCUSSION

FROM: MASON

SUBJECT: SWIMBEACH CLOSURES

DATE: 01/11/02

CC:

Bob- Here are the dates you requested for the 2001 season closures and readings. One of the dates may not be exact, but should be very close (re-opening of beach on 07/27/01 after initial spill).

- **First closure of Swimbeach occurred on 07/14/01 after report of initial spill (readings for the north and south end of the swim area were within state limits, but the beach was closed out of precaution because e-coli readings were high in other testing locations).**

- **Reservoir was completely closed to body contact from 07/15/01 through 07/18/01 because of high e-coli readings at other testing locations, and re-opened on 07/19/01.**

- **Swimbeach remained closed from 07/14/01 through approximately 07/27/01 out of precaution and because of high e-coli readings on 07/20/01, 07/21/01, and 07/25/01 (see attached special testing results).**

- **After 2nd spill there was a partial closure of the Swimbeach south swim area because of an extremely high reading on the south end of the swim area reported on 08/18/01 (circled on attached test results for 2nd spill). The beach re-opened on 08/19/01 because the sample taken from the south swim area was probably contaminated by the person taking the test.**

I also included the regularly scheduled test results for your consideration. If you have any questions or need additional information please contact me.

Cherry Creek Reservoir Swim Beach *E.Coli* Testing
2001
(number per 100 ml)
[All samples were collected in approx 3' of water, at a depth of 12"]

Date	Time	North End of Beach		South End of Beach		Notes
		Total Coliform	*E. Coli*	Total Coliform	*E. Coli*	
5/21/01	12:20	137.6	7.3	148.3	35.0	
5/23/01	12:30	172.3	3.1	129.1	2.0	
5/29/01	10:15	488.4	21.3	260.2	21.6	
6/4/01	10:45	2419.2	6.3	435.2	9.8	
6/7/01	10:45	84.8	7.0	120.7	4.0	
6/13/01	9:15	691.0	15.6	372.4	17.9	
6/19/01	10:50	648.8	5.2	298.2	21.2	
6/25/01	10:40	290.9	10.7	325.5	11.0	
6/28/01	10:30	517.2	5.2	579.4	17.3	
7/5/01	10:45	>2419.2	15.8	1299.7	60.9	
7/11/01	10:55	>2419.2	177.9	2419.2	146.7	
8/6/01	09:15	>2419.2	8.4	>2419.2	4.1	
8/9/01	10:30	>2419.2	17.3	>2419.2	14.8	
8/23/01	14:00	1986.3	34.1	>2419.2	19.9	
8/28/01	12:15	>2419.2	3.1	2419.2	2.0	
9/4/01	11:00	365.4	1.0	770.1	9.6	
9/13/01	11:00	1119.9	5.1	2419.2	5.1	
9/19/01	10:00	1203.3	36.4	1732.9	17.5	

REGULARLY SCHEDULED TEST RESULTS — EXACT CLOSURE DATES DO NOT APPEAR ON THIS PRINTOUT — INFO ITEM FOR YOU IF YOU NEED IT.

REGULARLY SCHEDULED SWIMBEACH TEST RESULTS (SWIMBEACH ONLY)
5/21/01 - 9/19/01

Cherry Creek Reservoir *E.Coli* Testing
2001
(number per 100 ml)

7/11/01 — RES. CLOSED — CLOSED — SB — OPEN

Date	Time	CCSB - North E. Coli	CCSB - South E. Coli	Perimeter E. Coli	Peoria E. Coli	Prairie Loop E. Coli	Overflow Pond E. Coli	Outlet Pipe E. Coli	Below Outlet Dam E. Coli	Overflow Pond - North E. Coli	Overflow Pond - South E. Coli	Overflow Pond Outlet	West Ramp	Notes
7/16/01	11 - 11:30am	45.0	15.8	261.3	178.2	42.8	nt	nt	nt					
7/16/01	6 - 6:40pm	73.8	22.6	613.1	228.2	53.6	54.7	435.2	49.6					
7/17/01	6:45-7:45am	14.8	13.1	325.5	410.6	63.1	29.2	579.4	27.2					
7/17/01	4:15-5:35pm	52.8	25.9	235.9	201.4	118.2	26.5	189.2	45.0					
7/18/01	7:00-8:35 am	50.4	35.9	193.5	365.4	34.5	36.4	290.9	18.9					
7/19/01	5:50-6:04pm	37.3	42.2	129.6	387.3	101.9	?	?	32.7	29.2	39.9	206.3		new sample sites?
7/19/01	7 - 7:40 am	15.2	32.3	461.1	813.1	79.8			22.6	27.5	45.7	290.9		or new names for
7/19/01	15:45-16:30	26.2	20.1	78.9	196.8	48.1	-	-	19.3	40.8	72.3	198.9		old sample sites?
7/20/01	06:20-0720	14.5	44.1	816.4	387.3	307.6	-	-	3.6	60.1	57.3	66.2		
7/20/01	17:00-17:40	58.1	920.8	228.2	90.7	23.1	-	-	14.6	62.4	9.8	29.4		S.SB levels above max
7/21/01	0615-0715	14.5	10.9	248.9	547.3	113.7	-	-	14.6	38.8	45.5	135.4		pond aeration system on
7/21/01	4:30:00 PM*	186.0	261.3	178.2	313.0	39.9	-	-	14.1	53.8	9.8	113.7		S.SB levels above max, *SB time only
7/22/01	6:55-8:20am	8.5	18.7	218.7	686.7	156.6	-	-	11.0	35.9	21.7	40.4		
7/22/01	16:35 - 17:58	128.1	133.4	101.7	272.3	60.1	-	-	25.7	16.8	39.9	29.2		
7/23/01	6:21 - 7:33 am	3.1	4.1	275.5	648.8	224.7			19.9	83.6	34.5	14.8		
7/24/01	6:30 - 7:30 am	161.6	178.5	<2419.2	<2419.2	2419.2			57.3	517.2	1553.1	1986.3		Storm event previous night--turbid samples
7/25/01	6:20 - 7:35 am	37.3	290.9	435.2	410.6	517.2			44.8	365.4	218.7	770.1		S.SB levels above max
7/26/01	6:22 - 7:41 am	10.9	7.4	770.1	648.8	579.4			27.2	648.8	613.1	1046.2		
7/27/01	06:37 - 08:08	1.0	118.7	198.9	156.5	193.5	-	-	10.7	410.6	178.9	579.4		
7/28/01	06:32 - 07:33	1.0	5.2	93.2	172.3	238.2	-	-	19.9	272.3	193.5	686.7		
7/29/01	6:25-7:30 am	2.0	2.0	193.5	517.2	238.2			5.2	547.5	325.5	517.2		
7/30/01	6:47-7:43 am	19.3	12.2	248.1	579.4	231.0			8.5	648.8	517.2	410.6	7.3	

HIGHLIGHTS = READINGS WHICH EXCEEDED STATE LIMITS

SPECIAL TESTING FOR INITIAL SEWAGE SPILL (SWIMBEACH + VARIOUS OTHER LOCATIONS)
07/16/01 – 07/30/01

SPECIAL TESTING
Cherry Creek Reservoir Swim Beach *E.Coli* Testing
2001
(number per 100 ml)

Date	Time	North End of Beach		South End of Beach		Cottonwood Creek	Detention Pond	Notes
		Total Coliform	*E. Coli*	Total Coliform	*E. Coli*	*E. Coli*	*E. Coli*	
8/13/2001	8:30	2419.2	4.1	>2419.2	12.1			
8/13/2001	14:00	>2419.2	11.0	>2419.2	34.5			
8/14/2001	13:40	1986.3	3.0	1299.7	2.0			
8/15/2001	10:30 -10:35	1413.6	13.2	1553.1	26.9	387.3		
8/16/2001	9:20-9:50	1203.3	7.3	866.4	14.5	129.6	218.7	
8/16/2001	2:30	866.4	26.1	648.8	17.5			
8/17/2001	7:16	866.4	7.4	2419.2	1732.9			
8/18/2001	7:20	1413.6	9.7	1203.3	23.5			PARTIAL CLOSURE
8/19/2001	7:20	2419.2	6.3	2419.2	4.1			RE-OPENED
8/20/2001	07:10	770.1	26.9	1119.9	18.5			

HIGHLIGHT = 1 DAY PARTIAL CLOSURE OF SOUTH END OF THE SWIM AREA.

SPECIAL TESTING FOR 2ND SEWAGE SPILL (SWIMBEACH + OTHER LOC)
08/13/01 — 08/20/01

APPENDIX E

QUALITY ASSURANCE/QUALITY CONTROL

QA/QC Analysis

A number of steps are taken to assure the quality of water chemistry and chlorophyll data being collected. First, field blanks are taken into the field during water quality sampling. Secondly, Chadwick & Associates, Inc. (C&A) laboratory and Severn-Trent Laboratories (STL) perform internal QA/QC for each set of samples for each sampling period. Lastly, duplicate aliquots are sent to an independent laboratory (University of Missouri-Columbia [MU]) for analysis. Chlorophyll analysis is conducted by C&A aquatic biological laboratory. As with the water quality samples, a split chlorophyll sample is sent to MU for analysis.

Data quality for total phosphorus (TP), total dissolved phosphorus (TDP), soluble reactive phosphorus (SRP, measured as orthophosphate), total nitrogen (TN), nitrate-nitrite, and chlorophyll for C&A and MU laboratories were compared using a simple, least squares regression analysis. To determine if the laboratories are in agreement on the data, the regression must meet the following criteria:

1. The linear regression must represent a significant relationship ($p \leq 0.05$),
2. The regressions should have a slope at or near 1, and
3. The regression should explain the majority of the observed variance (i.e., $R^2 \geq 0.50$).

When these three criteria are met, the values reported by C&A and MU are averaged. In cases when one or more of the criteria are not met, the data do not meet the independent QA/QC and only the MU data are used.

<u>2001</u>

Comparison of data collected during the 2001 field season shows good agreement between C&A and MU for TP, TDP, SRP, TN, and nitrate-nitrite (Table E-1). Regression slopes were all significantly different ($p = 0.00$) from zero, with slope values ranging from 0.82 to 1.18. Values for R^2 ranged from 0.63 to 0.98. Because of the close correlation between the results from the two labs, values from both labs were averaged. As with the nutrient data, the chlorophyll data generated by the two labs were highly correlated and averaged together.

TABLE E-1: Summary statistics from comparison between Chadwick & Associates, Inc. laboratories and University of Missouri-Columbia laboratories for phosphorus and nitrogen species, and chlorophyll for 2001.

	p	Slope	R^2	Lab Used
Total Phosphorus	0.00	0.82	0.80	Both
Total Dissolved Phosphorus	0.00	0.92	0.95	Both
Total Nitrogen	0.00	0.90	0.94	Both
Total Dissolved Nitrogen	0.00	0.89	0.98	Both
Soluble Reactive Phosphorus (Orthophosphate)	0.00	0.88	0.91	Both
Nitrate-Nitrite	0.00	1.18	0.63	Both
Chlorophyll	0.00	0.91	0.92	Both

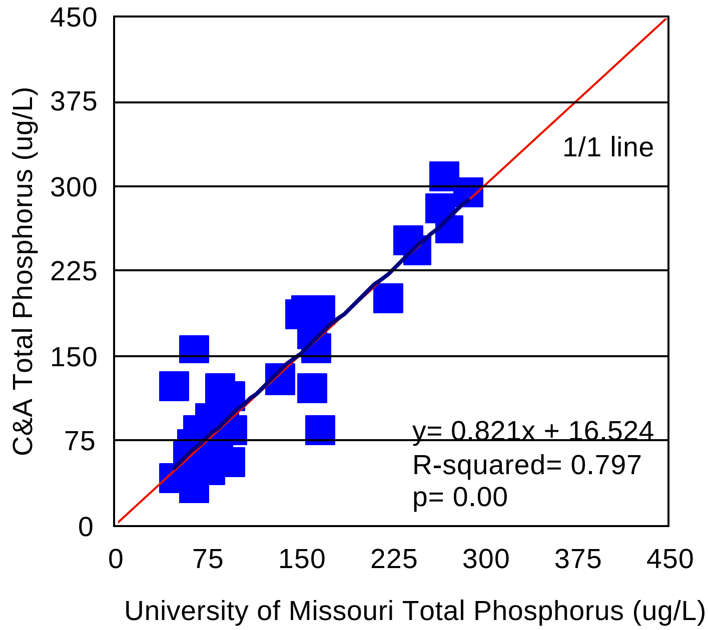


FIGURE E-1: Relationship between Chadwick & Associates, Inc. laboratory total phosphorus and University of Missouri-Columbia total phosphorus for 2001.

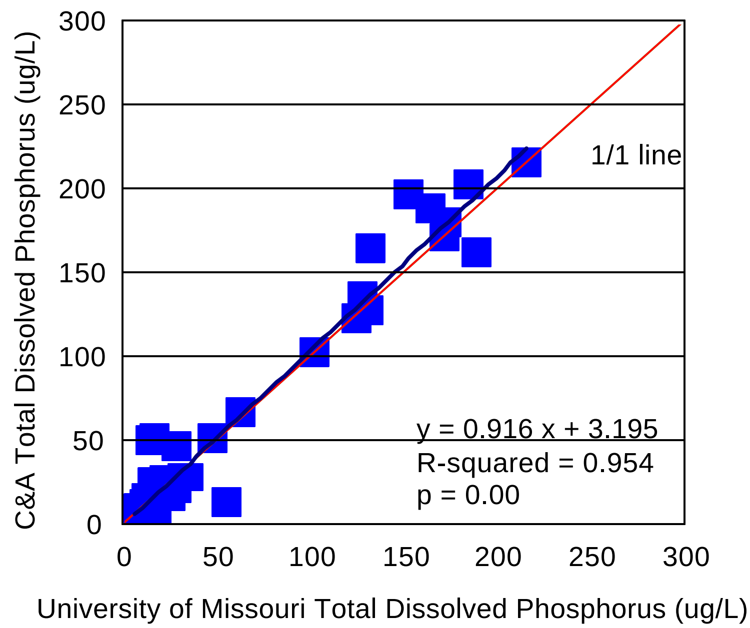


FIGURE E-2: Relationship between Chadwick & Associates, Inc. laboratory total dissolved phosphorus and University of Missouri-Columbia total dissolved phosphorus for 2001.

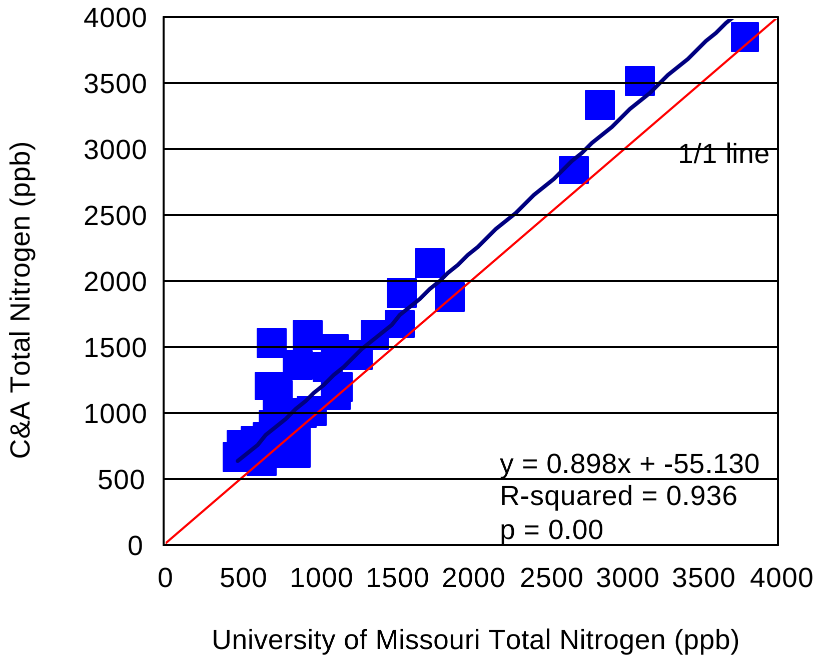


FIGURE E-3: Relationship between Chadwick & Associates, Inc. laboratory total nitrogen and University of Missouri-Columbia total nitrogen for 2001.

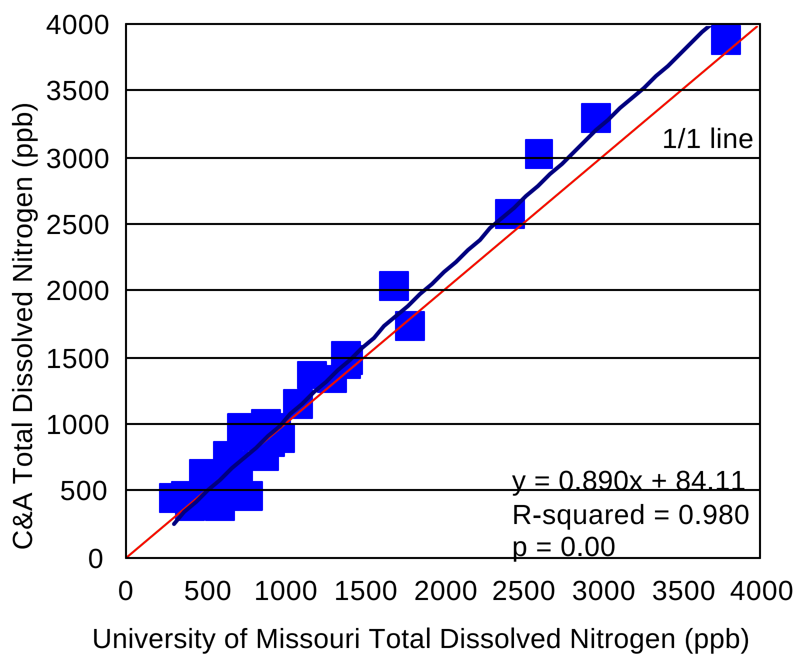


FIGURE E-4: Relationship between Chadwick & Associates, Inc. laboratory total dissolved nitrogen and University of Missouri-Columbia total dissolved nitrogen for 2001.

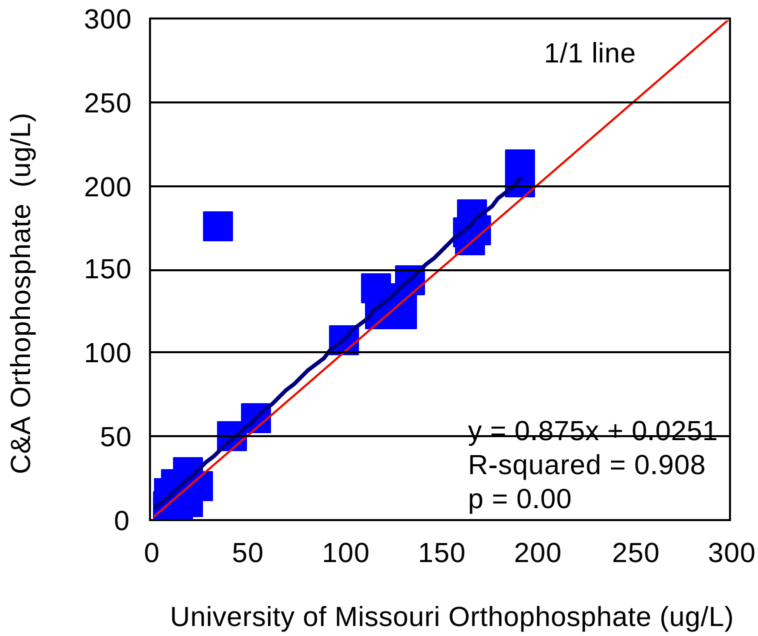


FIGURE E-5: Relationship between Chadwick & Associates, Inc. laboratory orthophosphate and University of Missouri-Columbia orthophosphate for 2001.

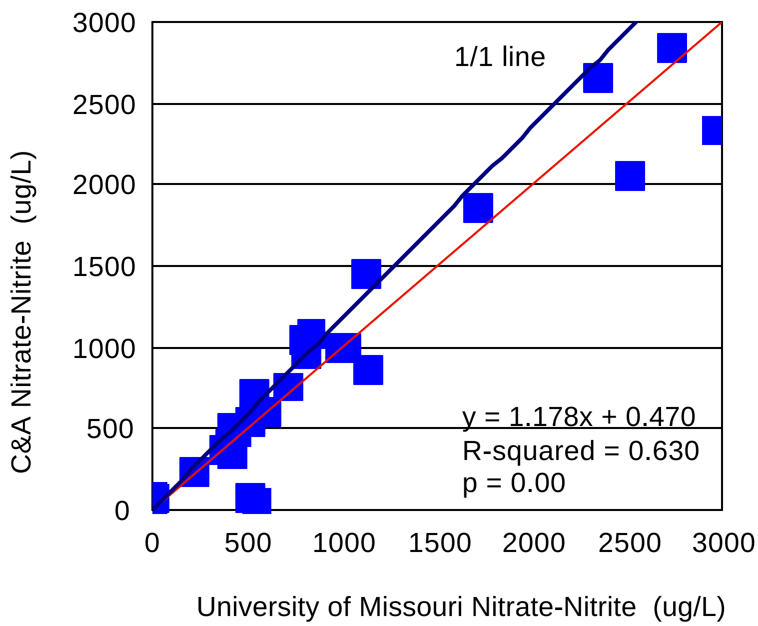


FIGURE E-6: Relationship between Chadwick & Associates, Inc. laboratory nitrate-nitrite and University of Missouri-Columbia nitrate-nitrite for 2001.

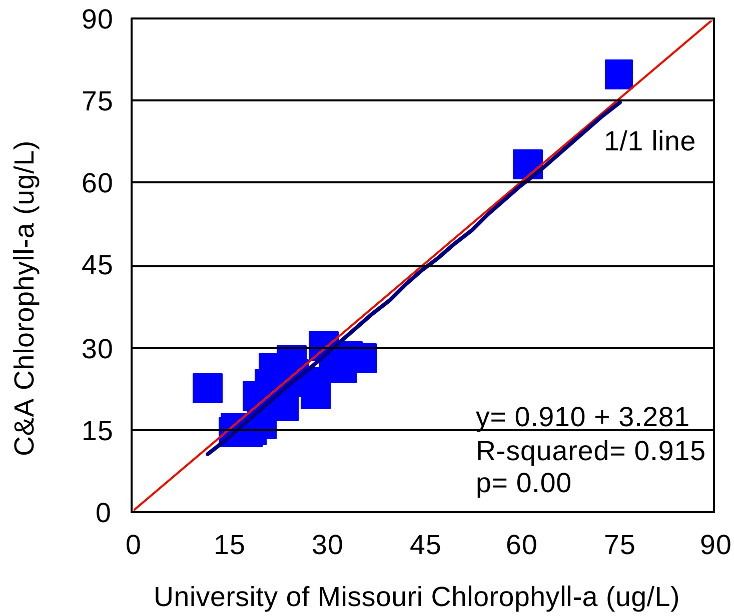


FIGURE E-7: Relationship between Chadwick & Associates, Inc. laboratory chlorophyll and University of Missouri-Columbia chlorophyll for 2001.