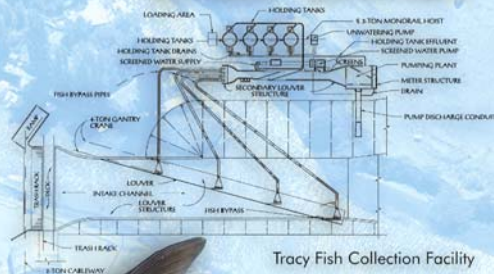


TRACY FISH FACILITY STUDIES CALIFORNIA



Delta Smelt



Splittail



Striped Bass

Volume 22

Semicontinuous Water Quality Measurements at the
Tracy Fish Collection Facility, Tracy, California,
April 2001 to March 2002

November 2003



U.S. Department of the Interior
Bureau of Reclamation
Mid-Pacific Region
Technical Service Center

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Volume 22

Semicontinuous Water Quality Measurements at the Tracy Fish Collection Facility, Tracy, California, April 2001 to March 2002

by

Douglas Craft¹
Ron Housewright²
John Fields²

November 2003

United States Department of the Interior
Bureau of Reclamation
Mid-Pacific Region
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EXECUTIVE SUMMARY

This report presents semicontinuous data for several water quality variables measured using a Hydrolab Datasonde 4a multiprobe (Hydrolab, Inc.) installed at Reclamation's Tracy Fish Collection Facility (TFCF), Tracy, California. The TFCF is the fish salvage facility at the head of the intake canal for the Tracy Pumping Plant (TPP), and removes entrained fish from Old River water before it is pumped into Reclamation's Delta Mendota Canal by the TPP. These facilities are located in the southern region of the Sacramento-San Joaquin River Delta (South Delta) that flows into San Francisco Bay in northern California.

The purpose of this study is to provide reliable baseline water quality data from the TFCF intake channel to aid fishery scientists and engineers performing experimental work to improve fish salvage. This program is required by the Central Valley Project Improvement Act of 1992 (CVPIA) and is a subproject of the Tracy Fish Facility Improvement Program (TFFIP), administered by the Reclamation Mid-Pacific Region, Sacramento, California.

This is the second year that a calibration and maintenance program has been in place for the Datasonde multiprobe, and the second report providing baseline water quality data for the TFCF. The variables measured in the Old River at the TFCF intake included temperature (T), pH, dissolved oxygen (DO), electrical conductivity (EC), oxidation-reduction (or redox) potential (Eh), and turbidity. The multiprobe was cleaned and calibrated on a weekly schedule, and data downloaded at monthly intervals from April 2001 through March 2002. Conterminous data sets for meteorology, tides, photo period, hydrology and irrigation pumping, fish salvage, and schedules for temporary barrier installation and removal were also compared to the water quality data. The water quality and supplemental data have been validated, peer-reviewed, collated, and archived in a Microsoft® Access database and are available on request.

Water quality data for April 1, 2001, through March 31, 2002, are comparable to the previous year's data despite a 29 percent decrease in San Joaquin River discharge compared to year one. Table ES-1 provides a summary of minimum, maximum, and median values for each of the measured water quality variables.

TABLE ES-1.—Summary water quality values observed in the intake channel of the Tracy Fish Collection Facility from April 1, 2001, through March 31, 2002

| Water Quality Variable | Minimum Value | Maximum Value | Median Value |
|---|-----------------------|---------------|--------------|
| Temperature, in degrees Celsius | 7.4 | 27.1 | 18.1 |
| Electrical conductivity, in microsiemens per centimeter | 236 | 1060 | 463 |
| Dissolved oxygen, in milligrams per liter | 3.33 | 11.7 | 7.94 |
| Oxidation-reduction potential, in millivolts | 252 | 653 | 554 |
| pH, in standard units | 6.29 | 8.47 | 7.65 |
| Turbidity, in Nephelometric turbidity units | 1-5 (detection limit) | >300 | 24.8 |

Daily variation for EC was greatest from February through March when temporary barriers were removed. Median percent DO saturation was 85.8 percent. DO saturation percentage was below 50 percent 0.05 percent of the time (around four hours during the year) and below 75 percent 13 percent of the time. pH less than 7 was observed 3.0 percent of the time and pH greater than 8.0 was observed 13 percent of the time. While turbidity was observed as high as 525 Nephelometric turbidity units (NTU), values above 100 NTU are well beyond the calibration range of the probe and represent very short duration spikes. Ten percent of turbidity data exceeded 48.9 NTU and 0.5 percent were greater than 100 NTU.

Other than basin-wide factors (hydrology, tides, and climate), the most significant influence on water quality at the TFCF appears to be the installation and removal of temporary channel barriers and operation of the Delta Cross Channel near Walnut Grove, California. When barriers are installed and the Cross Channel gates are open from April through October, daily variation and maximum EC are much lower than when higher conductivity water from the San Joaquin River flows relatively unimpeded to the TFCF. Another factor that may affect local water quality at the TFCF is the operation of the gates at Clifton Court Forebay during high tides. When temporary barriers are installed, the gate operations may be clearly seen in the probe depth data; however, the effect on water quality is more complex and deserves further study.

INTRODUCTION

This report is the third in a series from the subproject, *Chemical Monitoring and Assessment at the Tracy Fish Facility*, which is part of the Tracy Fish Facility Improvement Program (TFFIP). The TFFIP is an interdisciplinary research and evaluation program started in 1989 and required by the Central Valley Project Improvement Act of 1992 (CVPIA) to investigate design and operational improvements for the Tracy Fish Collection Facility (TFCF). The TFCF, located at the head of the intake channel for the Tracy Pumping Plant (TPP), was designed to collect (salvage) fish to prevent them from being pumped through the TPP into the Delta Mendota Canal (DMC). The TFCF represented state-of-the-art technology when originally installed in the 1950s; however, changing fishery and regulatory conditions have mandated updating of fish salvage technology and improvements. TFFIP fish salvage technology research and development benefits design and assessment for Reclamation's Tracy Demonstration Fish Facility (TDFF), a planned research facility to be located across the channel from the TFCF. Knowledge gained from these research efforts and facilities will also be applied for design and construction of future fish salvage facilities in the Sacramento-San Joaquin River Delta (South Delta).

The purpose of this TFFIP subproject is to develop a reference or "baseline" water quality data set that combines historical water chemistry data, agricultural chemical application data, data from semicontinuous Hydrolab probe monitoring of general water quality variables, and chemical analysis data from future water samples collected at the TFCF. A baseline water quality data set is important to the TFFIP because water quality influences the health of the local fish populations. During 1999, personnel from the Bureau of Reclamation (Reclamation) Mid-Pacific (MP) Regional Office, Sacramento, California, began a Hydrolab multiprobe calibration and maintenance program. This report summarizes the second full year of successfully validated multiprobe water quality measurements at the TFCF and is the followup to the Tracy Series Volume 17 report (Craft et al. 2002).

Project Background

Both the TFCF and the TPP were built in the early 1950s as part of the Reclamation’s Central Valley Project (CVP), a large water diversion infrastructure project that enabled agricultural expansion throughout most of the Central Valley of California. The Tracy facilities are located approximately 8 kilometers (km) northwest of Tracy, California. (See map in figure 1.)

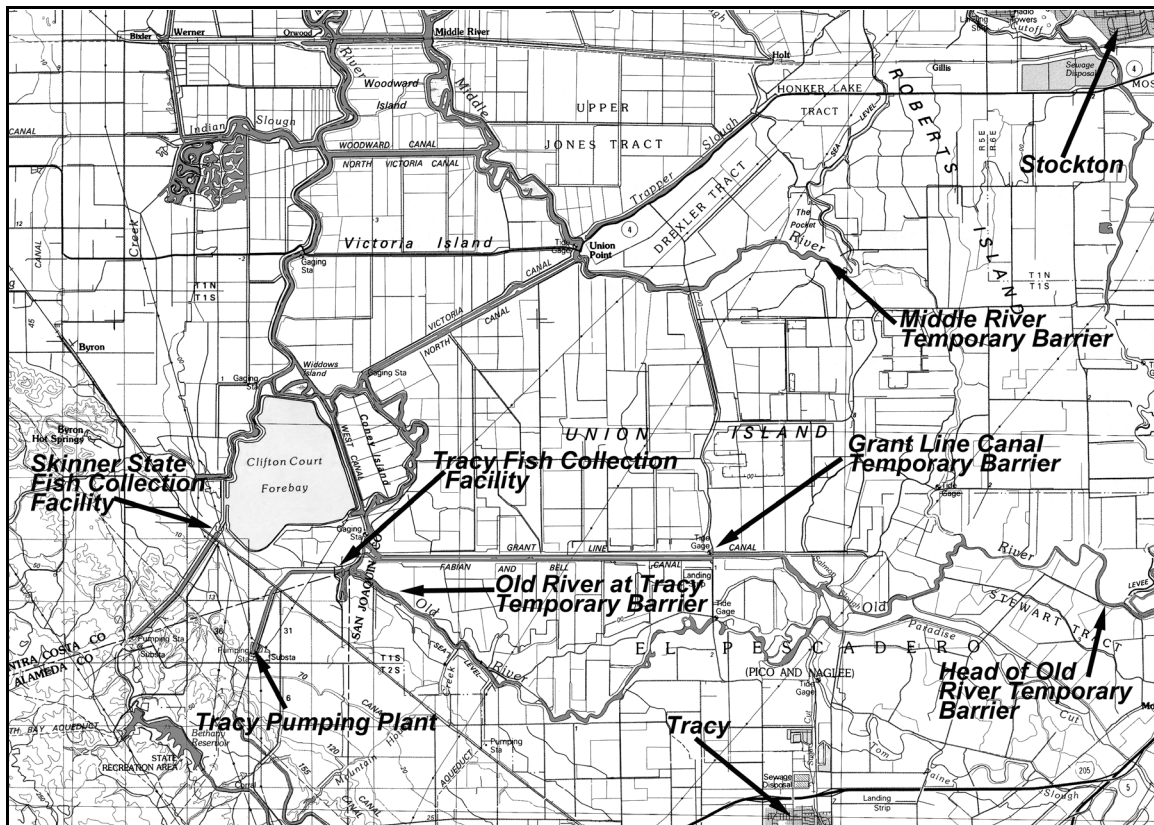


FIGURE 1.—Location of the Tracy Fish Collection Facility.

The TPP pumps water for irrigation, municipal, and industrial uses from the Old River into the DMC, which then flows southeast from the fish salvage and pumping facilities. The California Aqueduct is a similar nearby water diversion facility operated by the State of California (the State facility) at Clifton Court Forebay, located north of the TFCF. Before the CVP and similar State diversion systems were implemented, the San Joaquin River (SJR) water flowed north unimpeded into San Francisco Bay. Much of the SJR is now diverted south in the DMC, the Friant-Kern Canal, and other

State and Federal canals. Water from the South Delta is conveyed by a series of pumping stations on the DMC to the Mendota Pool to replace water diverted to the Friant-Kern Canal. DMC water flows by gravity southward down the San Joaquin Valley in a network of canals and then returns by way of the SJR (Liston et al. 1993).

General Factors Affecting Water Quality at the TFCF

The chemistry of TFCF intake water from the Old River, a South Delta distributary of the SJR, is the result of many variables interacting in a complex manner. Regional influences include basin-wide interactions between agricultural land use and runoff within the marine sedimentary geology of the Central Valley of California. The regional influences can change year to year because of hydrologic cycle variability and other trends, such as increasing urban populations and land use changes. Local influences include large-scale South Delta mixing of SJR and Sacramento River freshwater sources converging on San Francisco Bay, daily tidal fluctuations, artificial pumping from the TPP and entrainment of high tides at the State facility at Clifton Court Forebay, local irrigation return flows and chemical applications on crops, intermittent channel dredging, and the seasonal installation (usually in April and May) and removal (usually in September through November) of temporary channel barriers in the South Delta. The temporary barriers are embankments of piled rocks across the flow channels that retard return flow of high tide inflows and appear to influence the quality of water pumped through the TFCF. The complex interactions that produce the water quality observed at the TFCF underscore the need for accurate measurements that are location and temporally representative.

A major source water at the TFCF is the SJR; however, operation of diversion structures, such as the Cross Channel Canal near Walnut Grove, California, also allow for southerly transport and mixing of lower concentration Sacramento River water (median electrical conductivity [EC] = 150 microsiemens per centimeter [: S/cm]) into the South Delta near Tracy (State of California 1999, Craft et al. 2000). Old River water at the TFCF intake contains total dissolved solids (TDS) ranging from 300 to 1,100 milligrams per liter (mg/L), with median EC of 479 : S/cm (Craft et al. 2000), and contains sodium and chloride as the principal inorganic constituents. Daily tidal EC fluctuations of 100 to 300 : S/cm are commonly observed at the TFCF. The fluctuations are thought to be caused by up-gradient transport and mixing of lower concentration waters from the Mokelumne River and Sacramento River by the rising tidal salt wedge (State of California 1999). When local inflows from the SJR are

further impeded by temporary channel barriers and the opening of the Delta Cross-Channel Canal, increased influence from lower concentration water from the northern Central Valley watersheds may help produce better water quality (lower EC) and lower daily variation in EC at the TFCF.

Agricultural activity and associated chemical applications occur in the immediate vicinity of the TFCF (Craft et al. 2000). Irrigation return flows may contain nitrogen and phosphorus from fertilizer applications, dissolved and suspended organic carbon from vegetation decay, and herbicide, pesticide, and fungicide chemicals and their formulation additives (usually surfactants, adjuvants, and sticking agents). Storm runoff may also mobilize suspended matter, which increases turbidity and organic carbon in local waters. These varying and unpredictable chemical inputs enter the Grant Line and Fabian and Bell Canals, the Victoria and North Canals, the Tom Paine Slough and the Paradise Cut, and the Old and Middle Rivers.

METHODOLOGY

Hydrolab Datasonde

Temperature (T, in degrees Celsius [°C]), hydrogen-ion concentration (pH), dissolved oxygen (DO, in mg/L), EC, redox potential (Eh in millivolts [mV]), probe depth (in m), and turbidity (in Nephelometric turbidity units [NTU]) were measured at 30-minute intervals using a Hydrolab Datasonde multiprobe installed in a perforated pipe located behind the trash rack and intake structures of the TFCF (Craft et al. 2002). The Datasonde probe assembly included a stirrer which was activated during programmed probe measurements. Personnel from the Reclamation MP Region performed routine calibration and maintenance of the Datasonde on a weekly schedule. Reference photographs and the standard operating procedure followed for calibration and maintenance activities may be found in Craft et al. (2002). After the probe assembly was cleaned, EC was calibrated using a certified standard reference solution, pH using a two-buffer (VWR Scientific) calibration, and Eh using Zobell's solution. DO was calibrated using air saturated with water at a measured barometric pressure, and turbidity was calibrated using a certified 50 NTU microbead standard. Calibration for the Datasonde probe was verified before reinstallation in the PVC pipe, and calibration checks and notes were recorded on field sheets and in the field logbook. Turbidity measurements were also checked independently using a separate calibrated turbidity meter.

Computer and Database Methods

Datasonde readings were stored on internal probe memory and downloaded monthly to a PC using HyperTerminal software via the Surveyor 4a data logger. These data were then transmitted as ASCII text e-mail attachments that were imported into Microsoft® Excel spreadsheets. Data were then reviewed, plotted, and shared with the field crew for any required corrective actions. Anomalous data, such as negative values, extreme turbidity readings (>300 NTU), or values measured when the probe was not in the water, were discarded. Monthly water quality data files were combined in Excel to create the entire period of record file that was imported into Microsoft® Access as an 18,984-record table. Queried water quality data were exported to Excel files and plotted to identify any additional anomalous values that were subsequently removed. Statistical analyses were performed using SPSS® (Statistical Package for the Social Sciences, Windows® version 8.0). Queries exported from Access as Excel files were then converted to SPSS® file format using DBMSCopy (version 6.06, SPSS, Inc.). Processed and altered SPSS® files were also returned to Access as new tables, imported via conversion to an Excel spreadsheet or appended using cut and paste PC operations.

Precipitation, air temperature, and sunrise and sunset times were obtained from the National Oceanic and Atmospheric Administration's National Climate Data Center web site, <<http://www.ncdc.noaa.gov>>, for weather station 049001 – Tracy Pumping Plant. Flow discharge in the San Joaquin and Sacramento Rivers was downloaded from the U.S. Geological Survey (USGS) web site, <<http://water.wr.usgs.gov>>, for gage stations 11303500 – San Joaquin River Near Vernalis, California; 11254000 – San Joaquin River near Mendota, California; 11274000 – San Joaquin River near Newman, California; and 11447650 – Sacramento River at Freeport, California.

Daily total pumping at the TPP and Cross Channel operations data were obtained from the Reclamation Central Valley Operations Office, Sacramento, California. Operational schedules for the South Delta temporary barriers were obtained from the California Department of Water Resources, Office of State Water Project Planning web site, <http://sdelta.water.ca.gov/web_pg/tempmesr.html>.

Temporary barrier (T.B.) and Delta Cross Channel gate status data were coded as follows:

TABLE 1.—Coding used to describe operations of temporary barriers and other events affecting the chemistry at the TFCF

| Event | Installation | Installed | Removal | Not Installed |
|---------------------------|--------------|------------|---------|---------------|
| Old River at TFCF T.B. | 5 | 1 | 5 | 0 |
| Grant Line Canal T.B. | 6 | 2 | 6 | 0 |
| Head of Old River T.B. | 7 | 3 | 7 | 0 |
| Middle River T.B. | 8 | 4 | 8 | 0 |
| Delta Cross Channel Gates | N/A | 1.5 (open) | N/A | 0 (closed) |
| Channel Dredging | N/A | 6.5 (yes) | N/A | 0 (no) |
| Calibration Events | N/A | 0.5 (yes) | N/A | 0 (no) |
| Multiprobe Power Failures | N/A | 2.5 (yes) | N/A | 0 (no) |

Tidal, sunrise, sunset, and moon phase data were generated using harmonic constants in *Tides and Currents for Windows*, version 3.0, (Nobeltec Nautical Software, Beaverton, Oregon). Tidal data were calculated for the tide gage station located at the Grant Line Canal Bridge, approximately 11 km from the TFCF. These data provide a reference set to compare with Datasonde probe depth. Note that the actual tide stage at the Grant Line canal is significantly influenced by local runoff and water management operations; however, calculated values do not include these influences.

Fish salvage data for the TFCF and the Skinner Fish Collection Facility were obtained from the California Department of Fish and Game (Foss 2002).

RESULTS AND DISCUSSION

Table 2 summarizes parametric and rank statistics calculated for data collected from April 2001 through March 2002. Additional summary statistics are found in Appendix 1.

TABLE 2.—Summary of the second year of water quality data collected with the multiprobe at the TFCF

| <i>Statistic</i> | <i>Water T, °C</i> | <i>EC, μS/cm</i> | <i>DO, mg/L</i> | <i>DO Percent Saturation</i> | <i>pH, su</i> | <i>Redox Potential, mV</i> | <i>Turbidity, NTU</i> |
|--------------------|------------------------|---------------------------------|-----------------|----------------------------------|---------------|------------------------------------|---------------------------|
| <i>Valid n</i> | 16541 | 16548 | 16547 | 15129 | 16554 | 16559 | 16512 |
| <i>Missing n</i> | 975 | 968 | 969 | 2387 | 962 | 957 | 1004 |
| <i>Summary</i> | | | | | | | |
| <i>Mean</i> | 17.80 | 485 | 8.18 | 84.9 | 7.65 | 533 | 28.6 |
| <i>Median</i> | 18.10 | 463 | 7.94 | 85.8 | 7.65 | 554 | 24.8 |
| <i>Mode</i> | 23.90 | 338 | 7.72 | 88.5 | 7.47 | 565 | 18.0 |
| <i>Range</i> | 19.70 | 824 | 8.33 | 80.6 | 2.18 | 401 | 525.0 |
| <i>Minimum</i> | 7.40 | 236 | 3.33 | 38.3 | 6.29 | 252 | <1.0 |
| <i>Maximum</i> | 27.10 | 1060 | 11.70 | 119.0 | 8.47 | 653 | 525.0 |
| <i>Percentiles</i> | | | | | | | |
| <i>0.1</i> | 7.55 | 243 | 4.90 | 54.9 | 6.32 | 269 | 5.05 |
| <i>1</i> | 8.00 | 259 | 5.64 | 63.3 | 6.52 | 302 | 7.60 |
| <i>5</i> | 8.70 | 282 | 6.24 | 69.1 | 7.08 | 350 | 11.40 |
| <i>10</i> | 9.70 | 302 | 6.61 | 72.5 | 7.27 | 413 | 13.60 |
| <i>20</i> | 11.40 | 335 | 7.08 | 78.8 | 7.41 | 485 | 16.40 |
| <i>25</i> | 12.80 | 348 | 7.28 | 80.5 | 7.45 | 505 | 17.50 |
| <i>30</i> | 13.80 | 362 | 7.44 | 81.8 | 7.48 | 518 | 18.70 |
| <i>40</i> | 15.90 | 404 | 7.69 | 84.0 | 7.57 | 537 | 21.50 |
| <i>50</i> | 18.10 | 463 | 7.94 | 85.8 | 7.65 | 554 | 24.80 |
| <i>60</i> | 21.10 | 506 | 8.31 | 87.4 | 7.75 | 567 | 28.60 |
| <i>70</i> | 22.50 | 551 | 8.83 | 89.0 | 7.83 | 581 | 32.80 |
| <i>75</i> | 23.20 | 573 | 9.08 | 89.8 | 7.86 | 589 | 35.30 |
| <i>80</i> | 23.70 | 599 | 9.48 | 90.9 | 7.91 | 597 | 38.40 |
| <i>90</i> | 24.40 | 722 | 10.10 | 94.3 | 8.06 | 614 | 47.80 |
| <i>95</i> | 24.90 | 849 | 10.50 | 98.2 | 8.15 | 623 | 56.40 |
| <i>99</i> | 26.10 | 985 | 10.90 | 105.0 | 8.37 | 636 | 82.20 |
| <i>99.9</i> | 26.60 | 1050 | 11.30 | 115.0 | 8.44 | 648 | 184.00 |

The appendix figure A1-1 histograms for each of the water quality variables suggest that the data distributions are complex, with only pH and DO approximating a normal distribution for the period of record. T and EC both exhibit multi modal distributions. The multiple modes in the T distribution are probably associated with seasonal changes, while EC bimodality is probably related to the installation and removal of temporary channel barriers. Redox and turbidity show more log-normal distributions. Examination of the monthly histograms suggested that distributional properties for all the multiprobe variables change throughout the year. Given the lack of normality in the data, the median and rank-based statistics were used as less biased indicators of central tendency and extreme values.

A factor to consider regarding the simple daily and weekly summaries presented here is the phase relationship of daily tides and the 2-week spring and neap tide cycle. The 24.8-hour tidal cycle will introduce biases for estimates based on calendar days and weeks and may also render statistical comparisons of diel effects inaccurate. These biases may be minimized by applying tidal filters to data sets before calculating daily and weekly estimates; however, tidal filters were not applied to this data set.

Table A1-1 shows monthly summaries that include more detailed percentiles in the tails of the data distributions where extreme values are observed. Because data were consistently collected at 30-min intervals, the percentiles may be used to approximate the length of time extreme values were observed. For example, table 3 shows that the 0.1 percentile value for T is 7.55 °C. We can infer that temperatures equal to or below this value were observed only 0.1 percent of the year, or for around 8 to 9 hours. This approach provides more meaningful data when extreme values approach or exceed regulated water quality standards.

Annual median T was 18.1 °C. and ranged from 7.40 °C. to 27.1 °C. Minimum EC was 236 : S/cm, with a maximum of 1,060 : S/cm and a median of 463 : S/cm. Daily variation for EC was greatest from February through March when temporary barriers were removed. Median DO was 7.94 mg/L and ranged from 3.33 mg/L to 11.7 mg/L. Median percent DO saturation was 85.8 percent. DO saturation percentage was below 50 percent 0.05 percent of the time (263 minutes out of a year) and below 75 percent 13 percent of the time. Eh ranged from 252 to 653 mV, with a median of 554 mV, suggesting an oxidizing environment consistent with the presence of dissolved oxygen. Because of mixed potentials arising from several different Eh reactions occurring on the surface of the platinum Eh electrode, DO is a better indicator of Eh conditions in oxygenated surface waters (Lindsay 1979;

Stumm and Morgan 1996). Median pH was 7.65 and varied from 6.29 to 8.47. pH less than 7 was observed 3.0 percent of the time, and pH greater than 8.0 was observed 13 percent of the time. Turbidity ranged up to 525 NTU; however, such extreme values are well beyond the calibration range of the probe and represent very short duration spikes. Median turbidity was 24.8 NTU; 10 percent of turbidity data exceeded 48.9 NTU, and 0.5 percent was greater than 100 NTU.

Figures 2a through 2e show detailed plots of multiprobe data collected for the period of April 1, 2002, through March 31, 2002. The previous year's data (Craft et al. 2002) are also plotted in lighter color in each graph for comparison. Figures 3a through 3e provide summary plots of daily, weekly, and monthly median values for the year one and year two water quality data.

Background Data

Background data and events are summarized in figures 4a through 4f. Figures 4a and 4b show installation and removal of nearby temporary channel barriers. Operation of the temporary barriers in the Old River near the TFCF, in the Grant Line Canal, and the operations of the Delta Cross Channel Gates are shown in figure 4a. Figure 4b shows channel dredging at the TFCF intake and the head of the Old River temporary barrier and the probe calibration and power disruption events. Hydrologic data are plotted in figures 4c and 4d. Pumping at the TPP and the nearby State facility are plotted in figure 4c, and figure 4d shows a logarithmic plot that combines streamflow (in cubic feet per second) from USGS gage stations on the Sacramento and San Joaquin Rivers and pumping at the TPP. Precipitation data from the TPP weather station are summarized in figures 4e and 4f. Figure 4e shows precipitation events, and figure 4f shows minimum, average, and maximum air temperatures.

The year-two hydrology data in figure 4d show that the SJR responded to spring snowmelt from late April through early June and streamflow peaked during winter rainy season storms in late October and early February. A comparison of the year-two streamflows (total runoff 1.51×10^6 acre-feet per year [a-ft/yr]) at the SJR at Vernalis, California, to year-one streamflows (2.14×10^6 a-ft/yr) reveals that year two was drier by 630,000 a-ft, a 29.4-percent decrease in runoff. Despite the drier basin-year, local precipitation at TFCF during the second year was similar to year one. Local precipitation during year two, seen in figure 4e was 11.8 in (29.8 cm). Rain was measurable 72 days during year two.

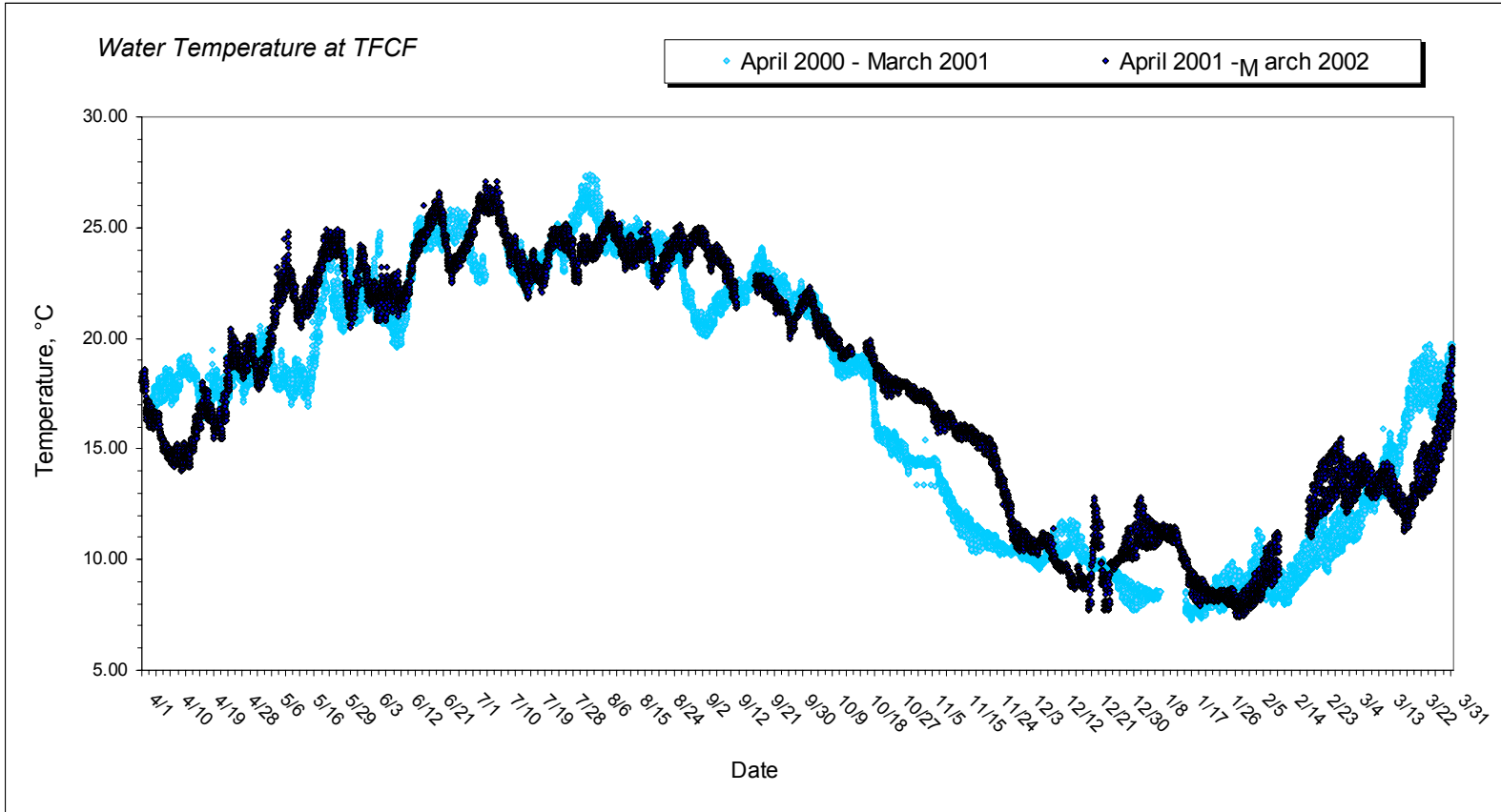


FIGURE 2a.—Two year record of Tracy Fish Collection Facility intake channel water temperature, in degrees Celsius. The darker plot represents the most recent year's data, and the lighter plot represents the first year's data (Craft et al. 2002).

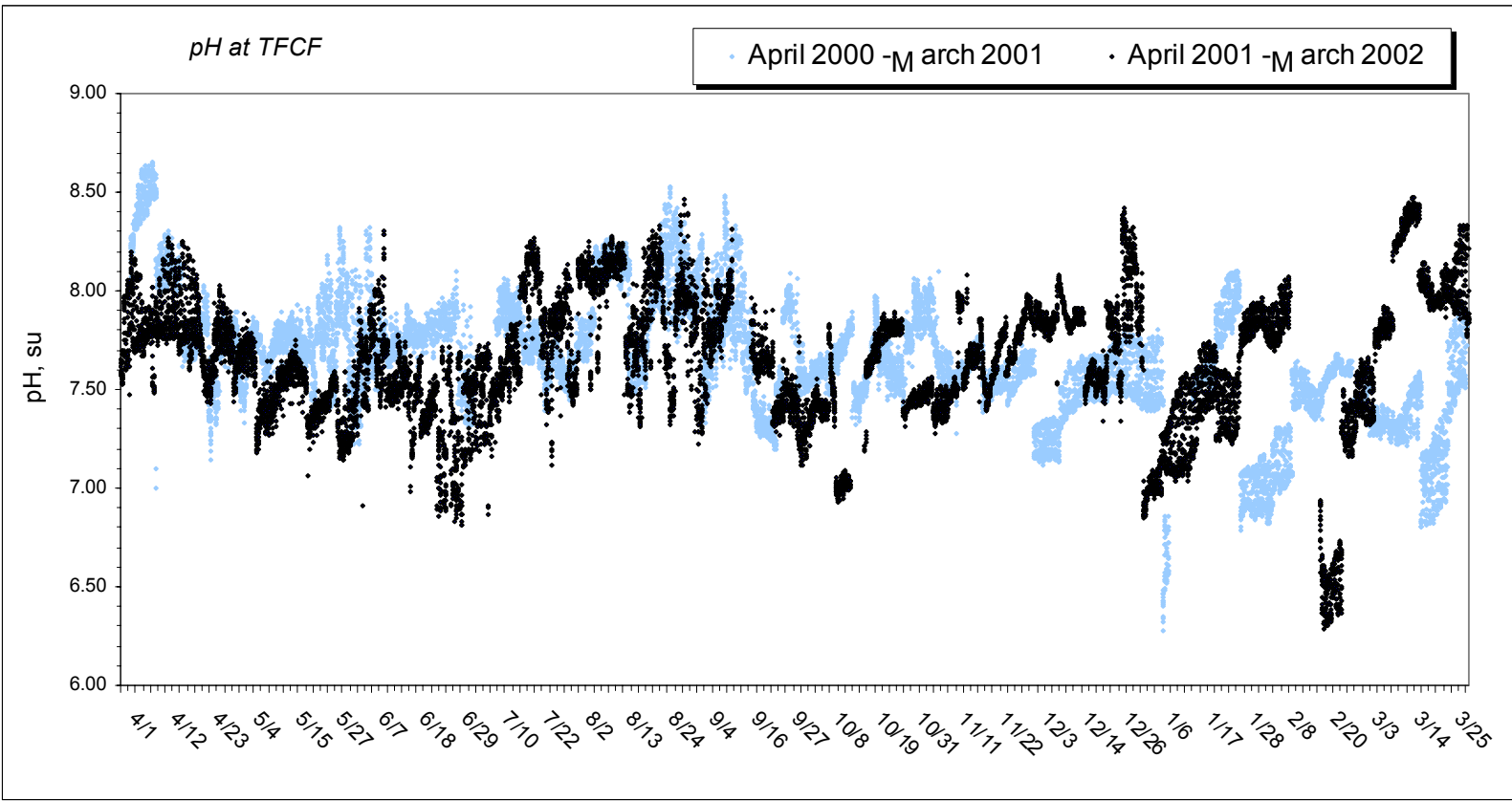


FIGURE 2b.—Two year record of Tracy Fish Collection Facility intake channel water pH, in standard units. The darker plot represents the most recent year's data, and the lighter plot represents the first year's data (Craft et al. 2002).

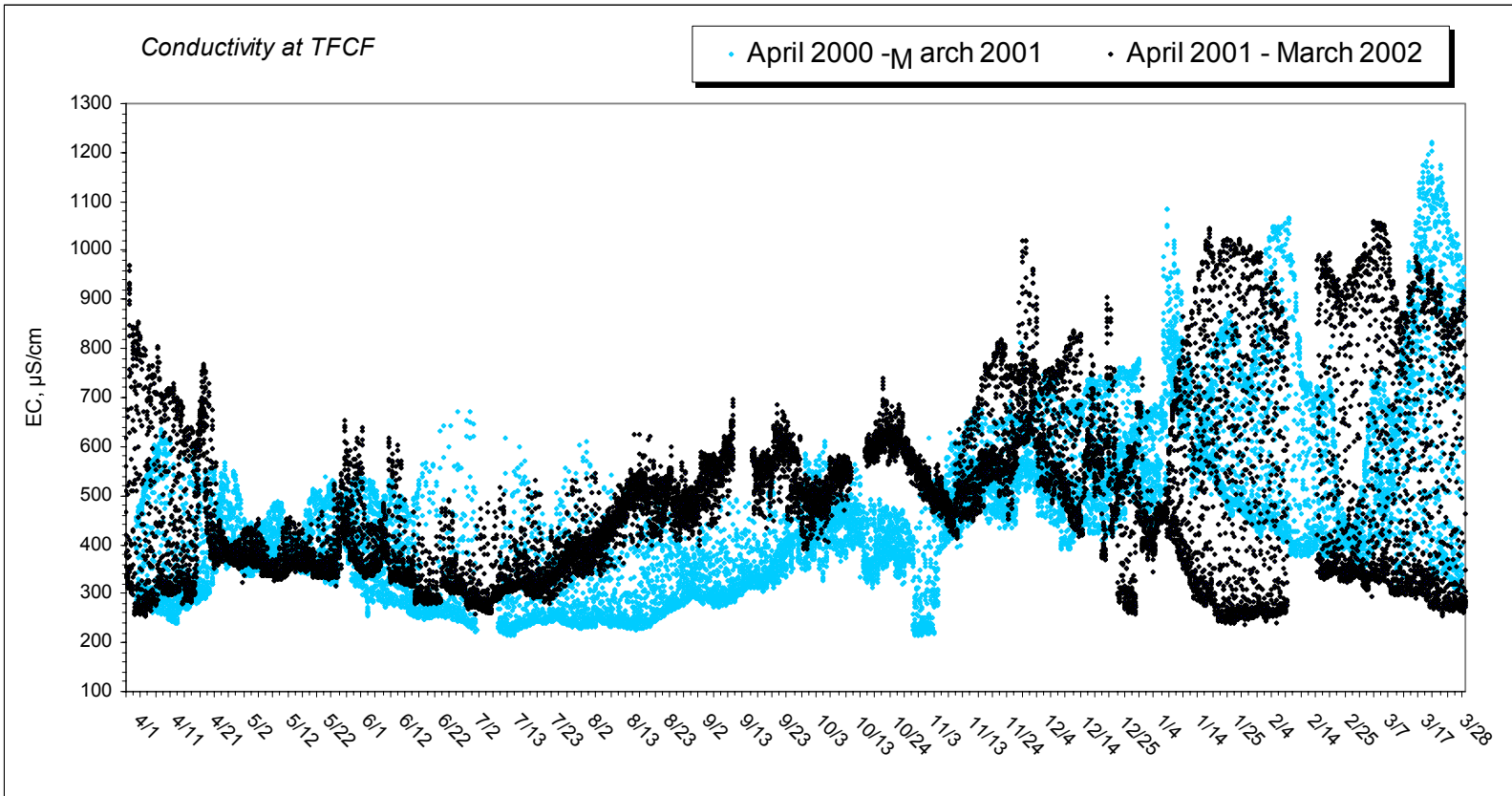


FIGURE 2c.—Two year record of Tracy Fish Collection Facility intake channel water electrical conductivity, in microsiemens per centimeter. The darker plot represents the most recent year's data, and the lighter plot represents the first year's data (Craft et al. 2002).

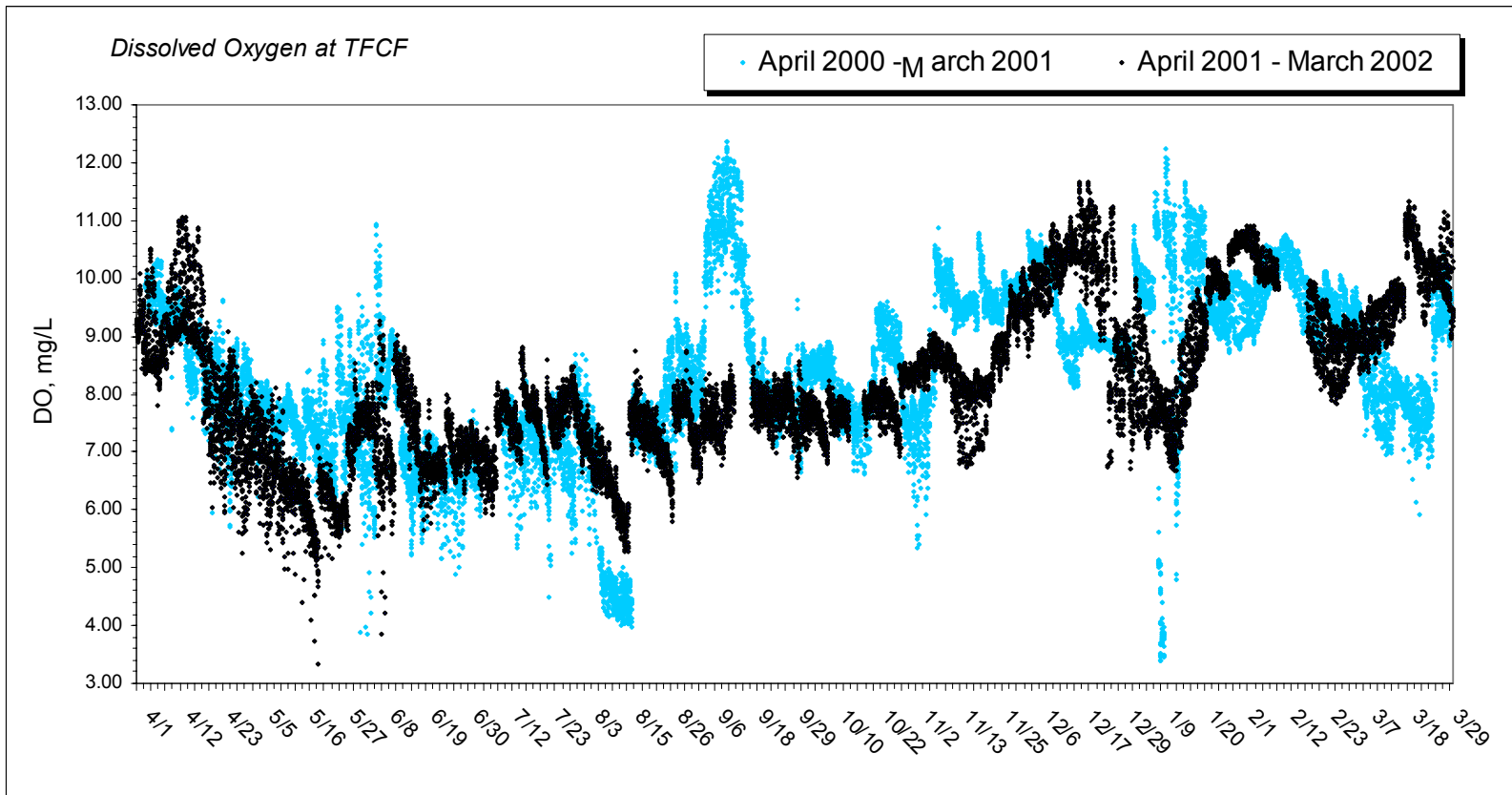


FIGURE 2d.—Two year record of Tracy Fish Collection Facility intake channel water dissolved oxygen, in milligrams per liter. The darker plot represents the most recent year's data, and the lighter plot represents the first year's data (Craft et al. 2002).

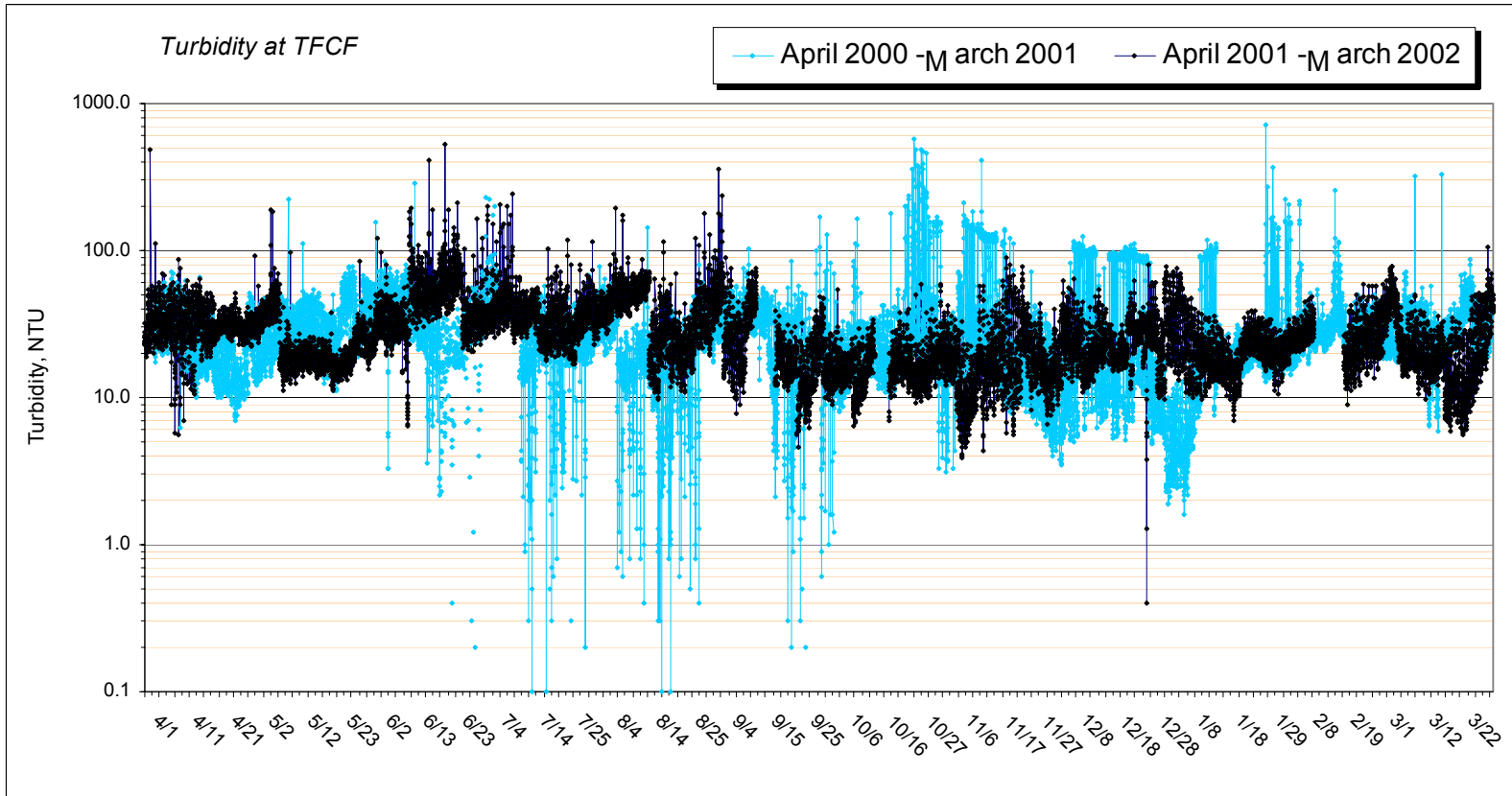


FIGURE 2e.—Two year record of Tracy Fish Collection Facility intake channel water turbidity, in Nephelometric turbidity units. The darker plot represents the most recent year's data, and the lighter plot represents the first year's data (Craft et al. 2002).

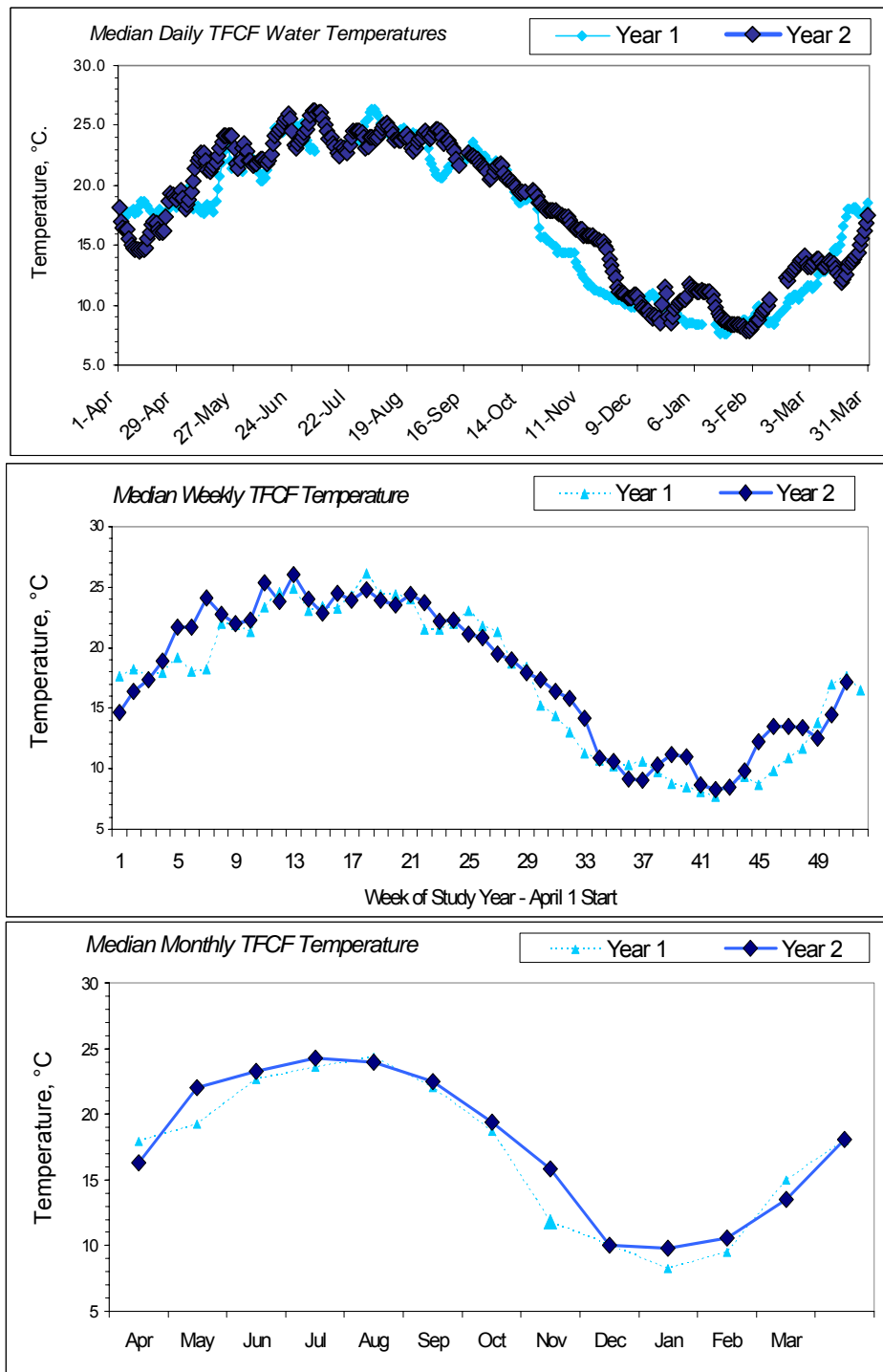


FIGURE 3a.— Daily, weekly, and monthly medians for water temperature, in degrees Celsius, for the intake channel at the Tracy Fish Collection Facility.

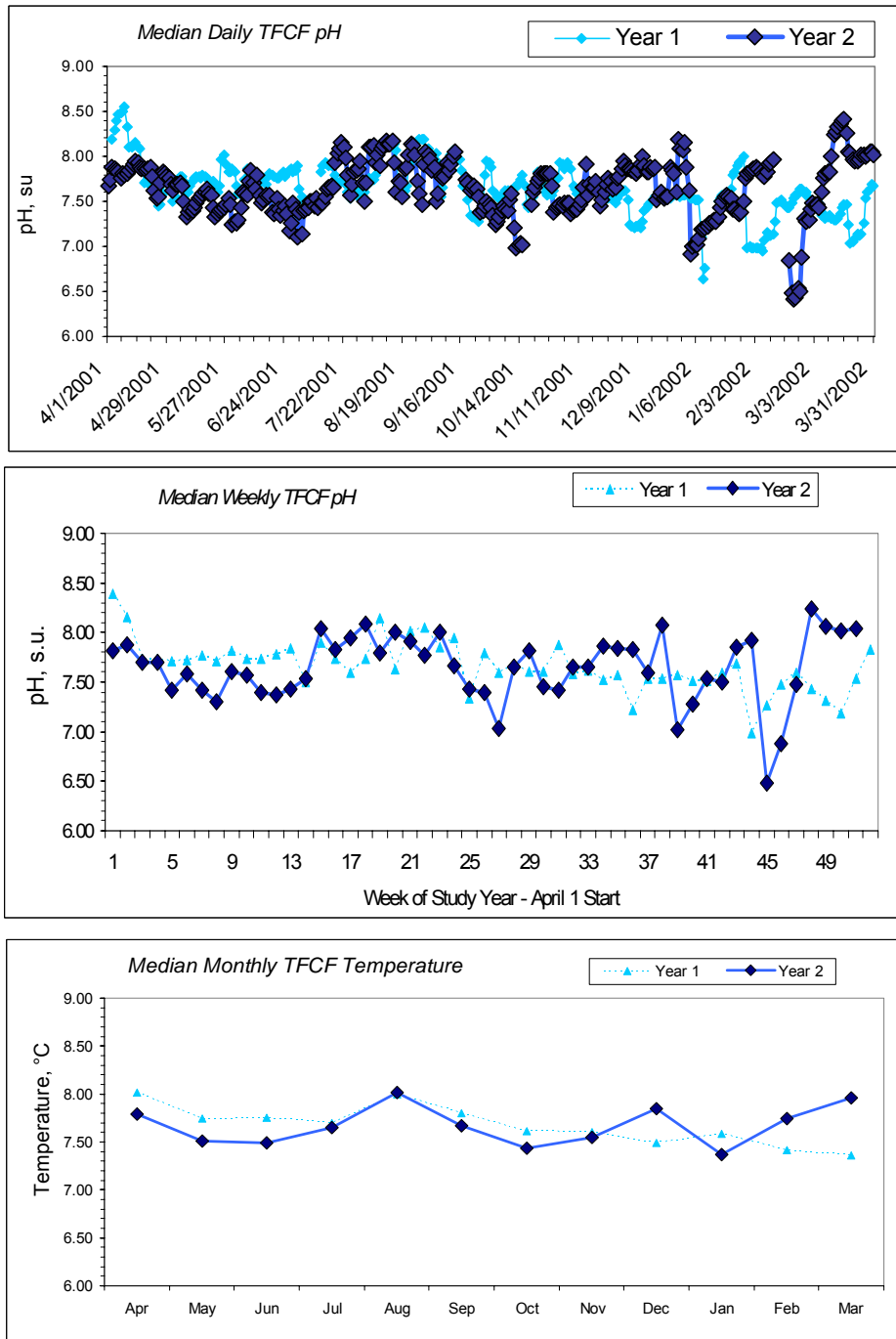


FIGURE 3b.—Daily, weekly, and monthly medians for pH, in standard units, for the intake channel for the Tracy Fish Collection Facility.

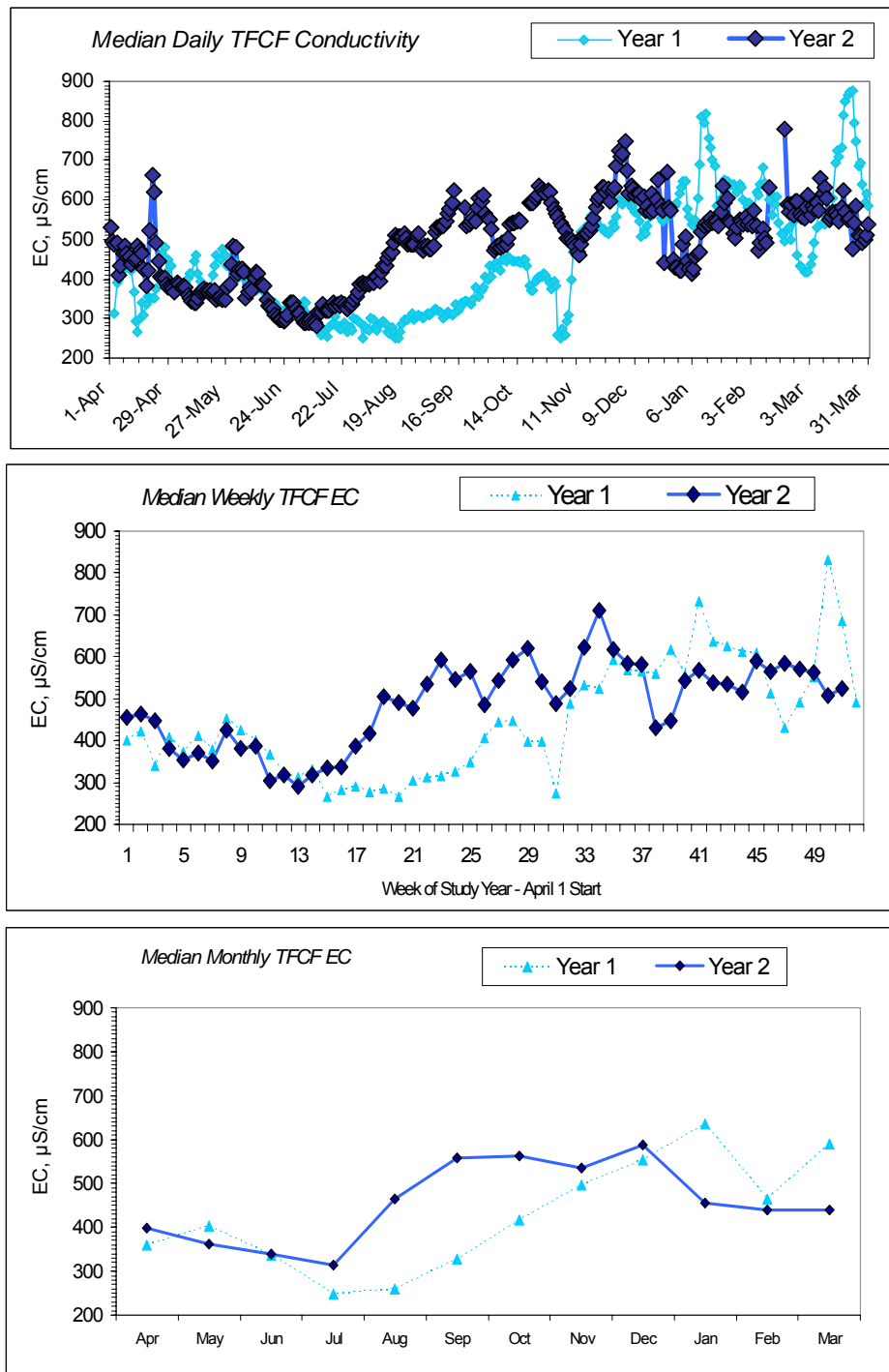


FIGURE 3c.— Daily, weekly, and monthly medians for conductivity, in microsiemens per centimeter, for the intake channel at the Tracy Fish Collection Facility.

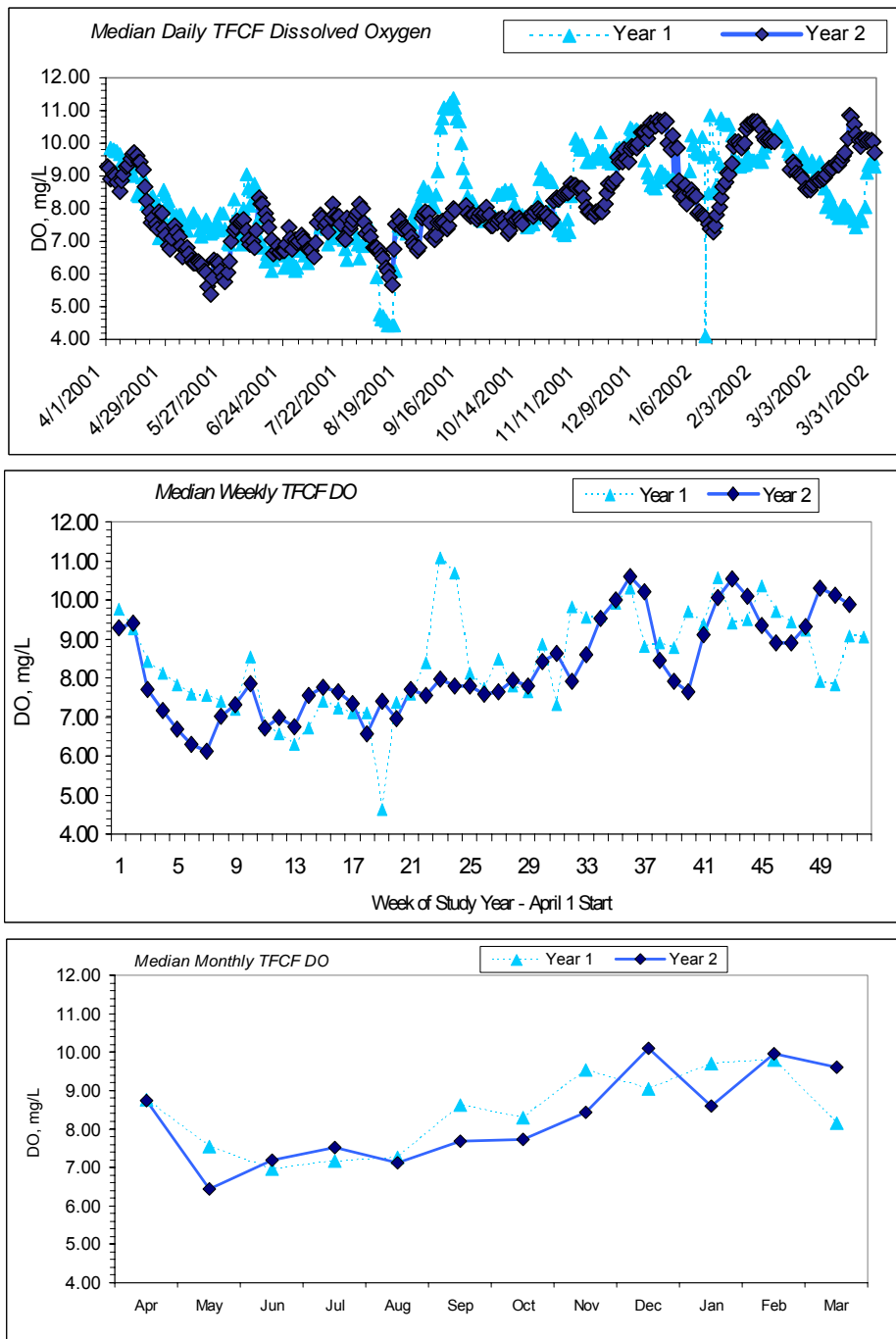


FIGURE 3d.— Daily, weekly, and monthly medians for dissolved oxygen, in milligrams per liter, for the intake channel at the Tracy Fish Collection Facility.

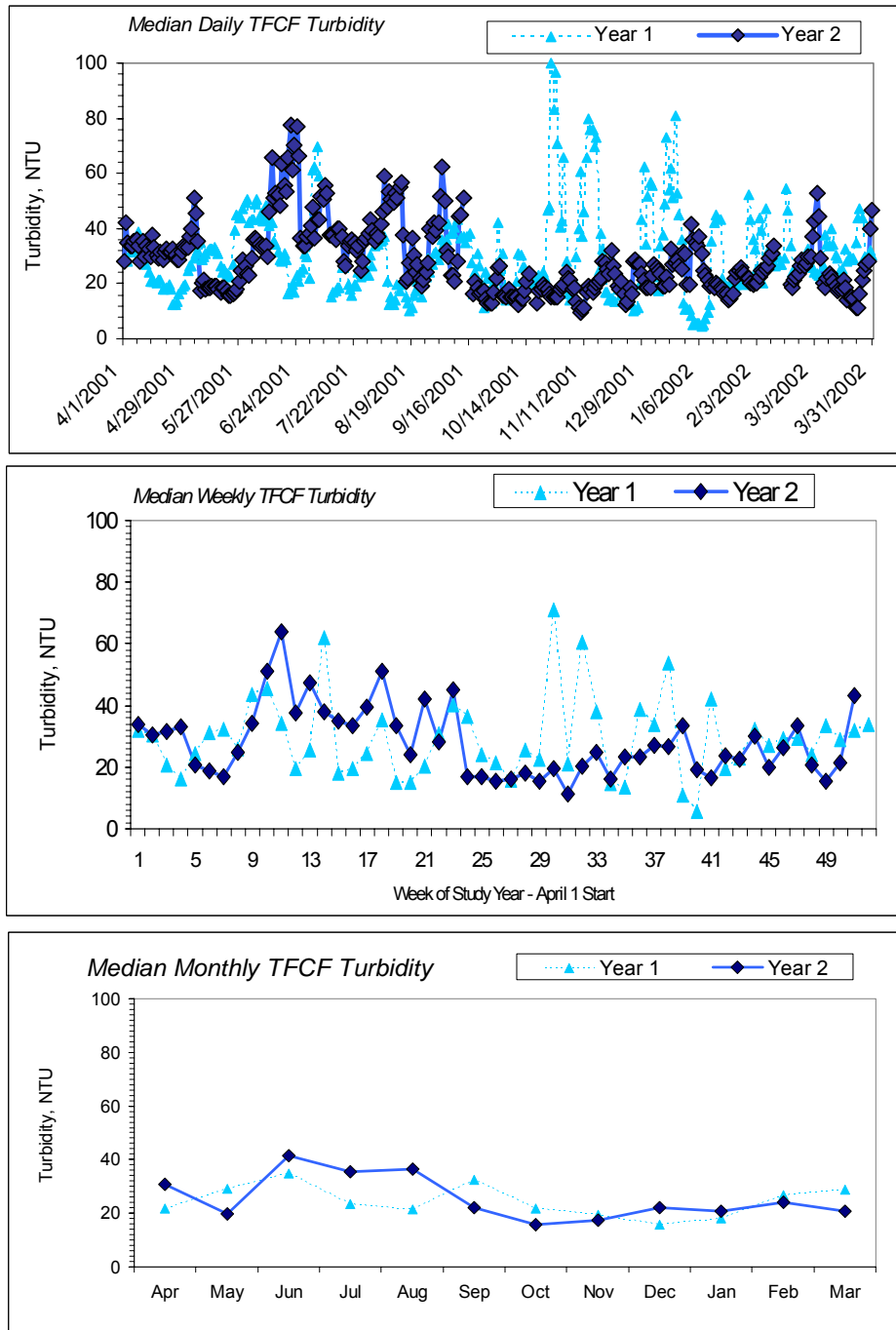


FIGURE 3e.— Daily, weekly, and monthly median values for turbidity, in Nephelometric turbidity units, for the intake channel at the Tracy Fish Collection Facility.

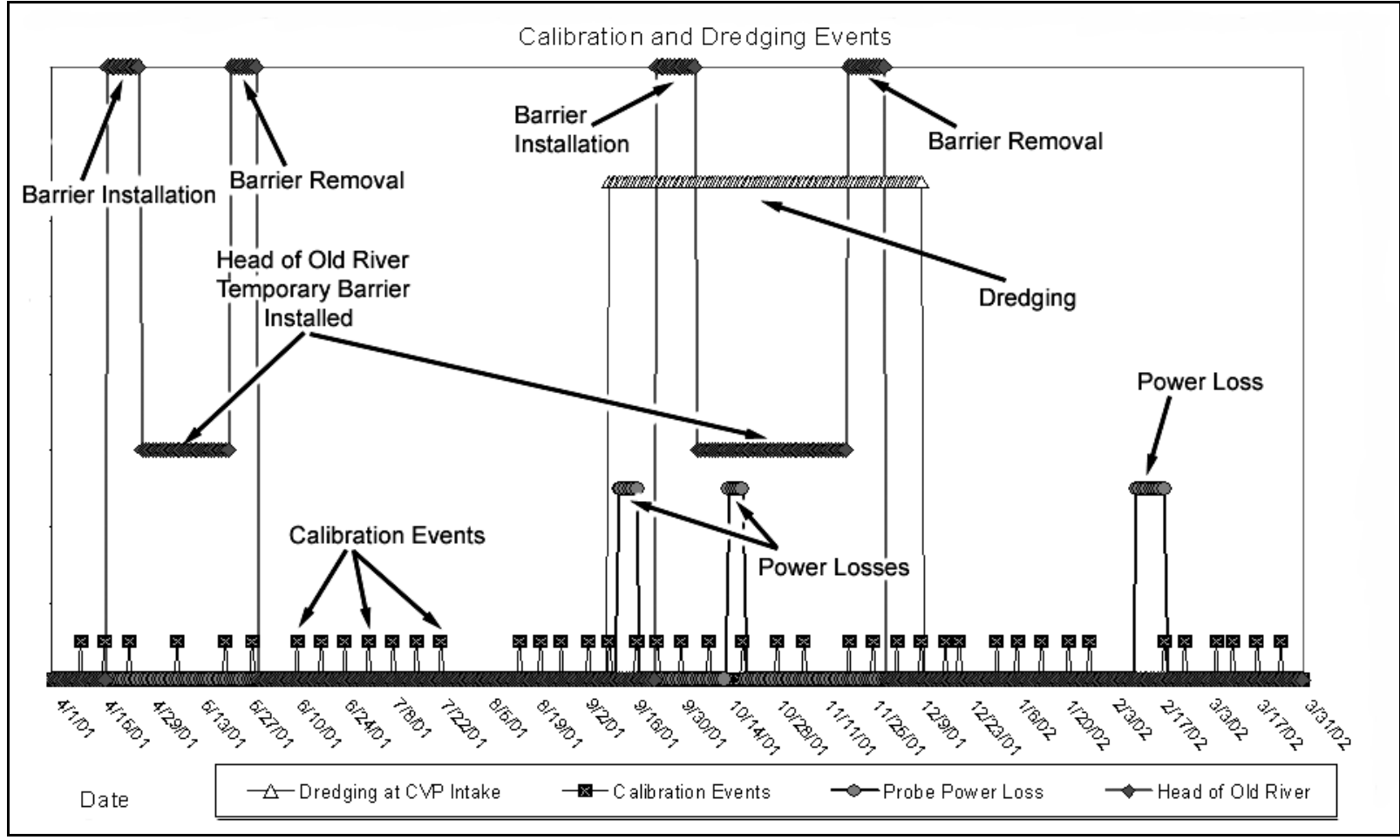


FIGURE 4b.—Head of Old River temporary barrier and channel dredging schedule along with Datasonde calibration schedule.

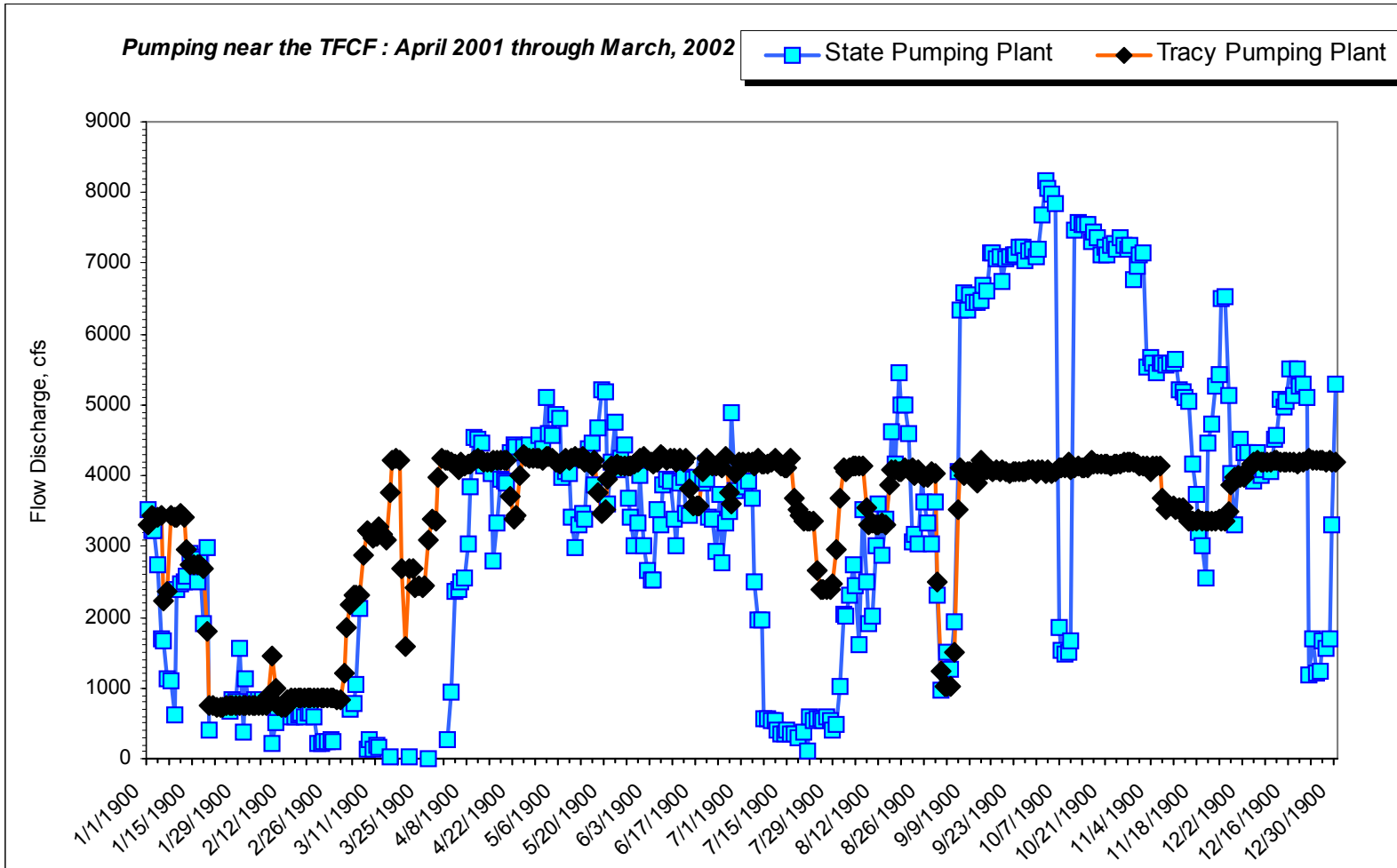


FIGURE 4c.—Daily pumping, in cubic feet per second, at the Tracy Pumping Plant and the State of California’s Harvey O. Banks Pumping Facility.

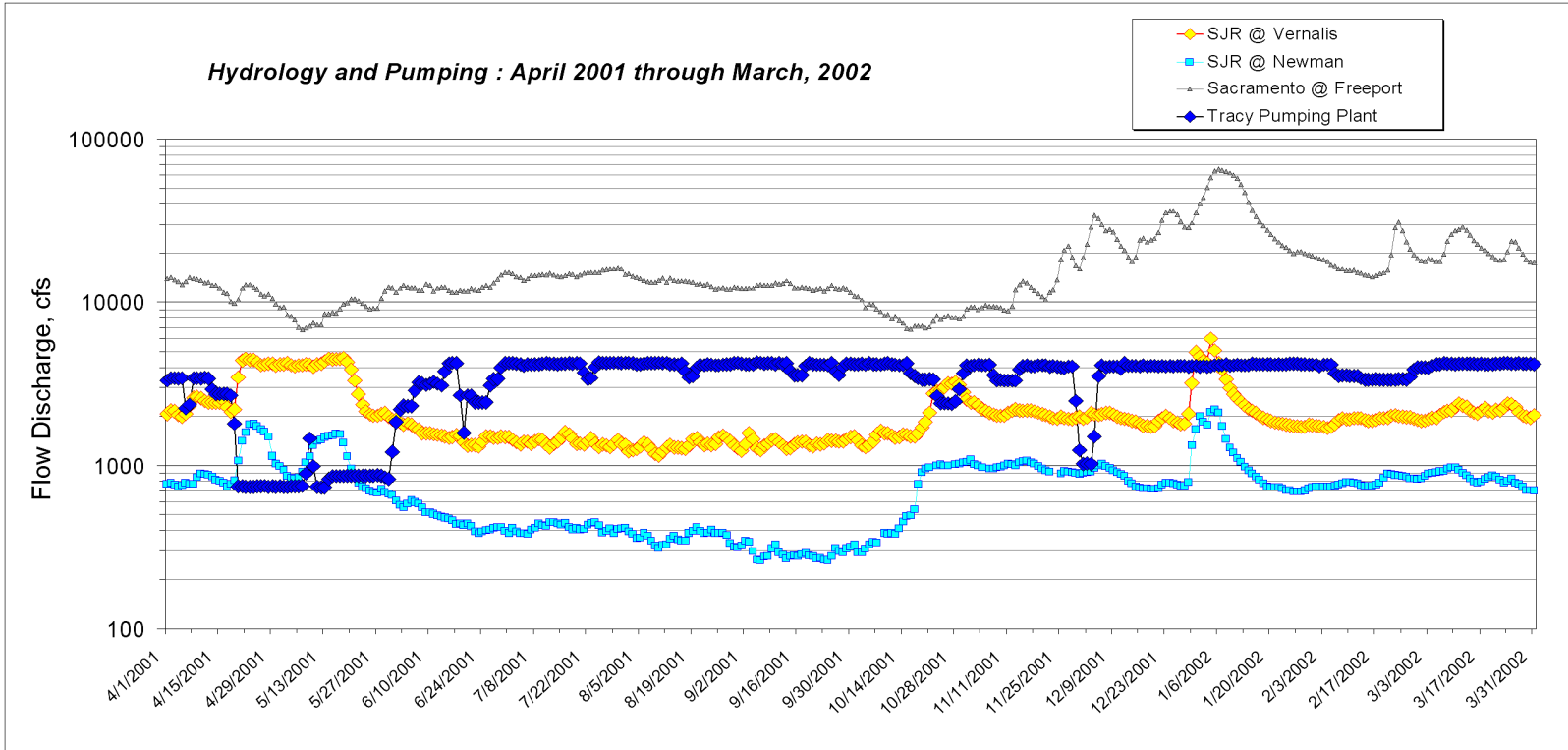


FIGURE 4d.—Flow, in cubic feet per second, for local rivers combined with pumping at the Tracy Pumping Plant. The data are plotted on a logarithmic scale.

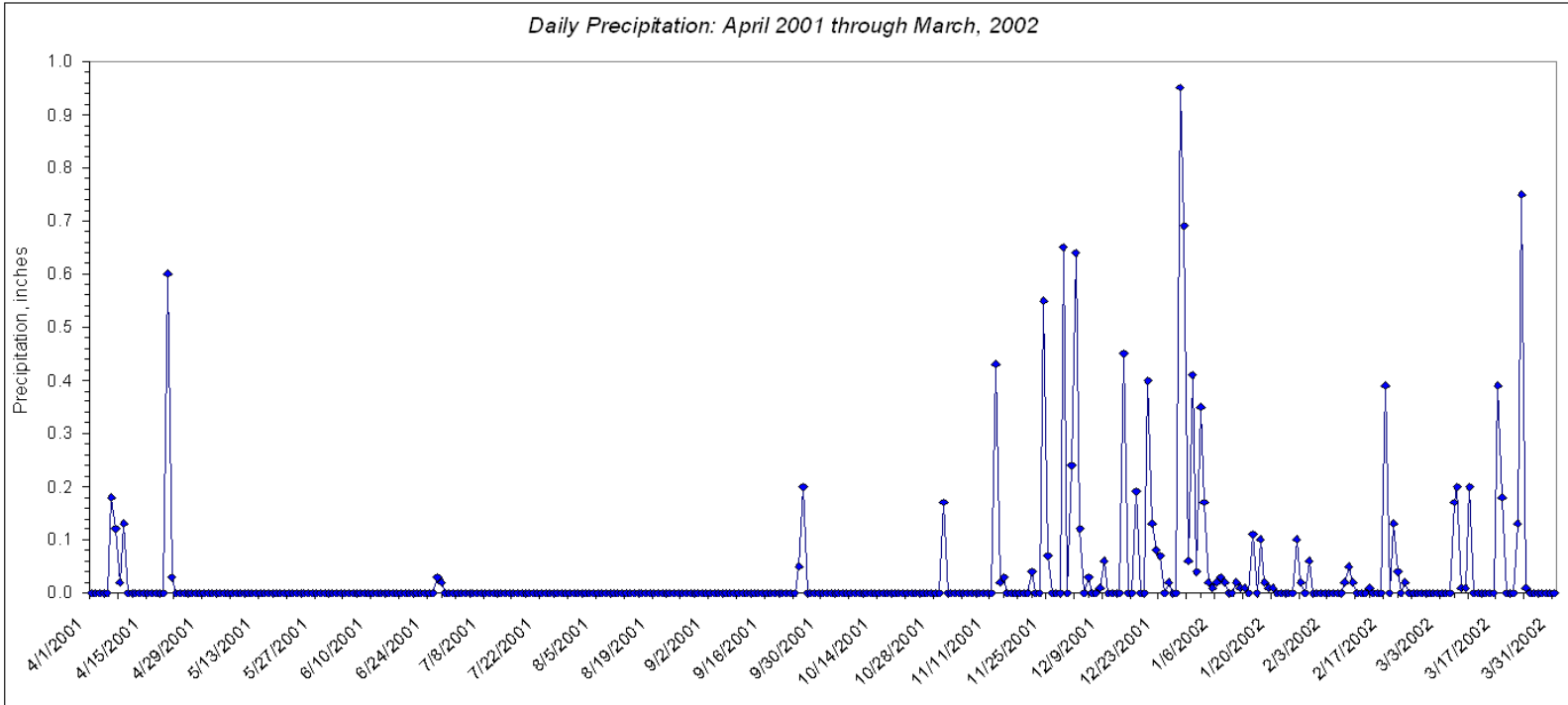


FIGURE 4e.—Precipitation events from April 1, 2001, through March 31, 2002.

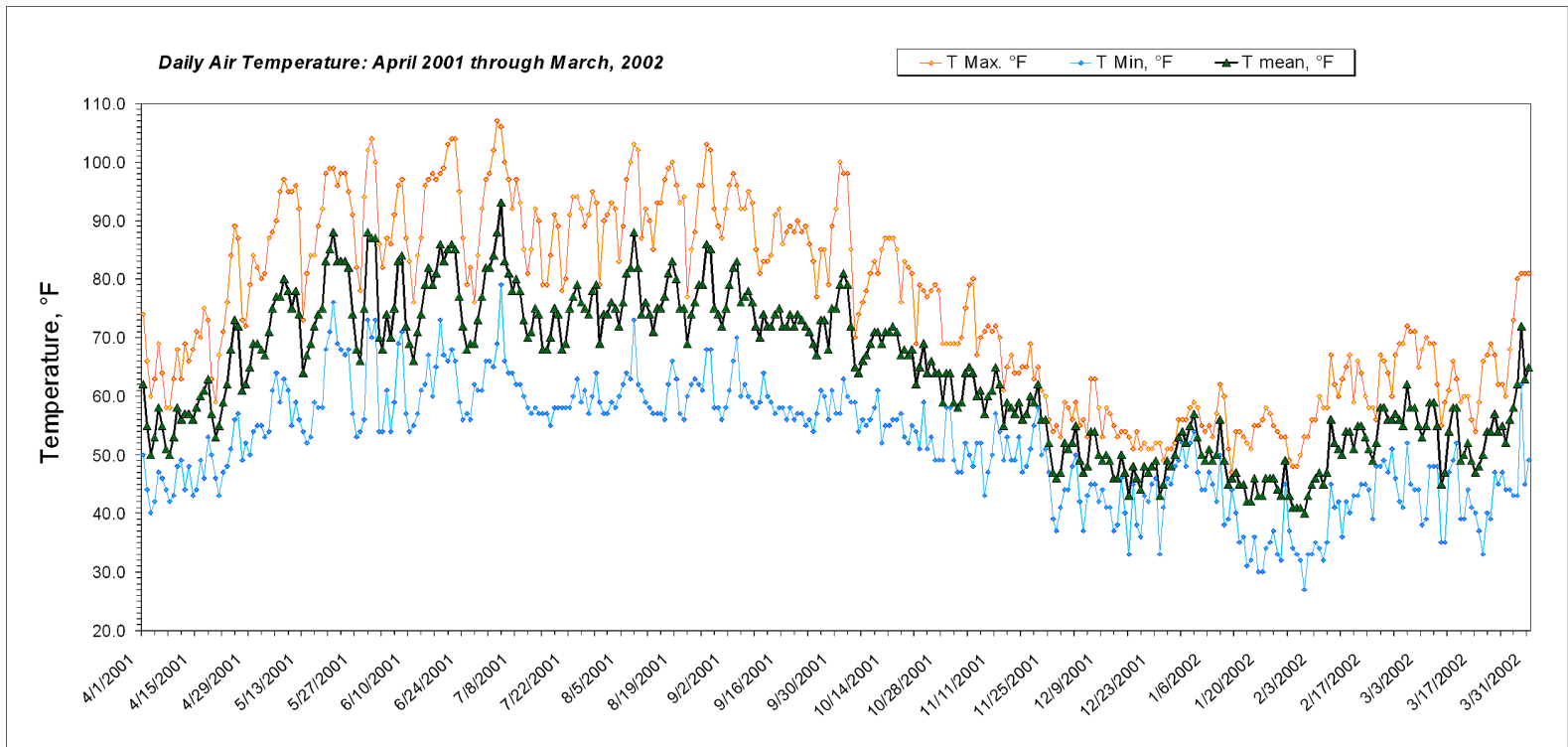


FIGURE 4f.—Minimum, maximum, and average air temperatures, in degrees Fahrenheit, at the Tracy Fish Collection Facility.

These data are comparable to year one's 64 days of measurable precipitation that totaled 11.1 in (28.2 cm). During mid-June through December, TPP pumping was approximately three times the discharge from the SJR at Vernalis, and year-two pumping was slightly elevated compared to year-one.

Figure 5 shows a 3-day comparison between measured probe depth and tidal stage calculated for the station in the Grant Line Canal located approximately 11 km from the TFCF. The upper graph shows probe depth and tide stage when temporary barriers are installed, and the lower graph compares tidal responses when temporary barriers are not installed. This figure demonstrates how measured tidal stage (by way of probe depth) is very different compared to theoretical calculations that do not account for local flow management and pumping. When barriers are installed and more inflow water comes from the north, the operation of the Clifton Court Forebay gates can be clearly seen as dips in the high tide peaks. When the local channels are open, the water level changes from the Clifton Court gates are not as apparent at high tides. Presumably, open channels encourage more inflow from the Old River upstream from Clifton Court Forebay.

Despite the complex variable interactions at the TFCF, figures 6a-6c show some interesting associations between some local events and responses in water quality (expressed as minimum and maximum daily values) and fish salvage. The most notable effects were observed for DO and EC, which appear to be associated with the installation and removal of temporary barriers. Figure 6a shows the DO (top graph) and EC along with temporary barrier status and dredging. DO shows its minimum value when barriers are installed; however, this is also the period when water temperatures are highest. Nonetheless, DO shows a rebound to higher values after barriers are removed and precipitation events increase in frequency. Electrical conductivity (bottom graph in figure 6a) shows a response in daily range to temporary barriers similar to that observed in last year's data: daily EC variability increases when barriers are removed and higher salinity SJR water flows into the TFCF from the Old River. Low EC variability is also associated with the opening of the Delta Cross Channel gates, which encourages greater flows to the South Delta of low EC water from the Sacramento River.

Figure 6b shows minimum and maximum turbidity along with local barrier status (top graph) and precipitation events (bottom graph). Here it is clear that higher turbidity values are seen when temporary barriers are installed, but interestingly, no apparent responses to barrier installation and removal or dredging. Perhaps the increase in turbidity is related to enhanced algal

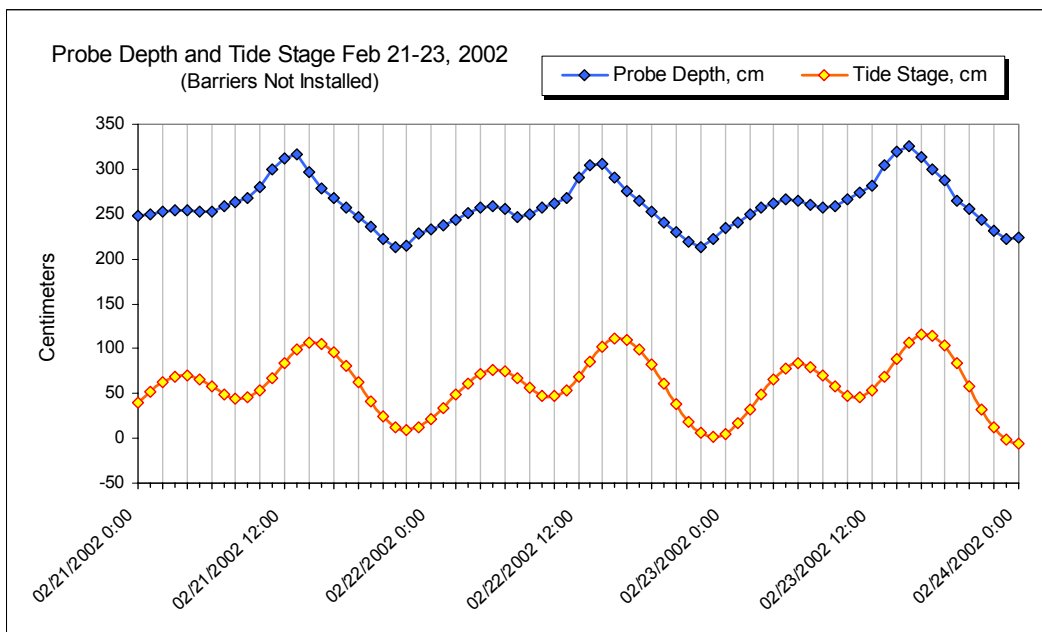
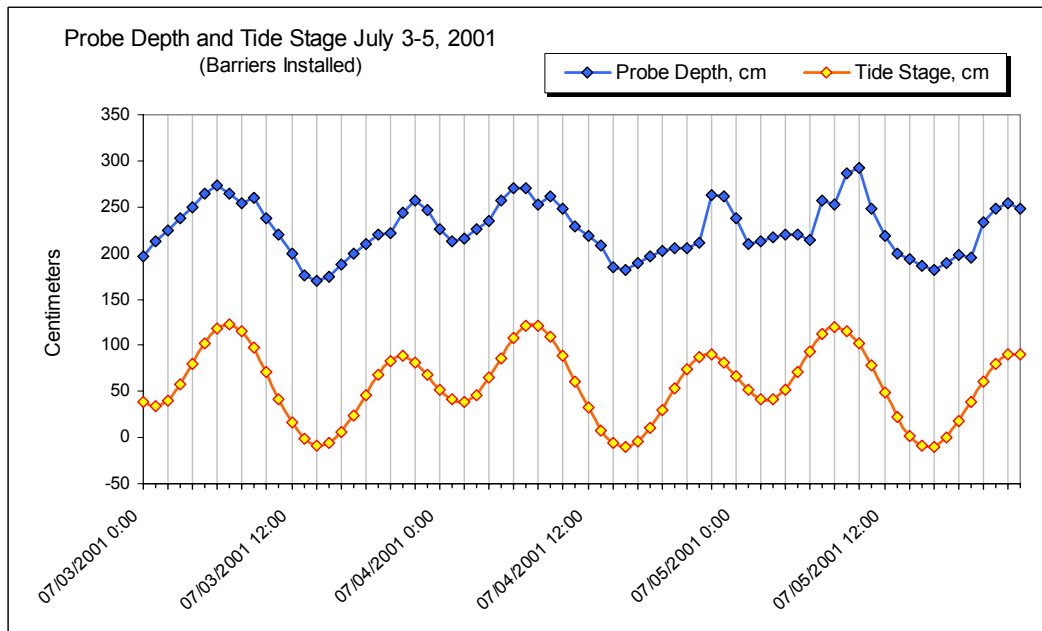


FIGURE 5.— Two detailed comparisons of probe depth at the Tracy Fish Collection Facility and tide stage calculated at the Grant Line Canal. The top graph is during July, when the local temporary channel barriers are in place, and the bottom graph is during February, when the channels are open.

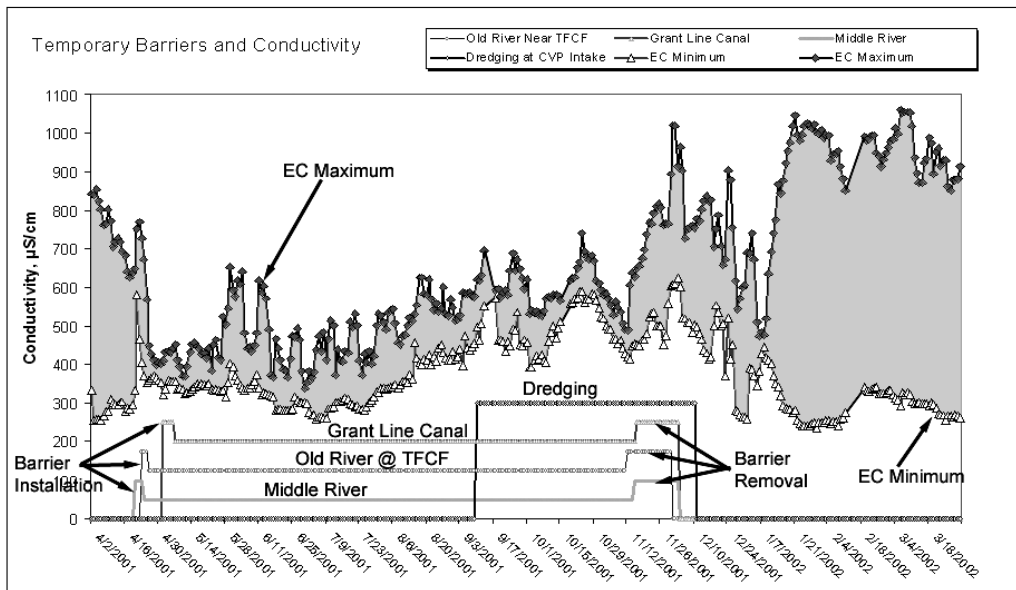
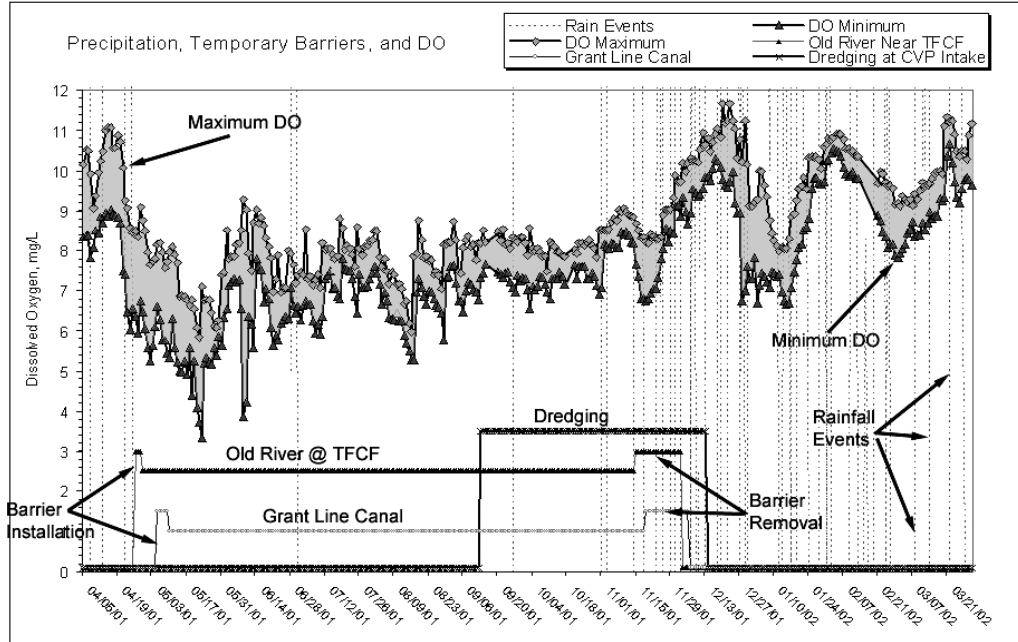


FIGURE 6a.—Effects of local events on dissolved oxygen in milligrams per liter (top) and conductivity in microsiemens per centimeter (bottom).

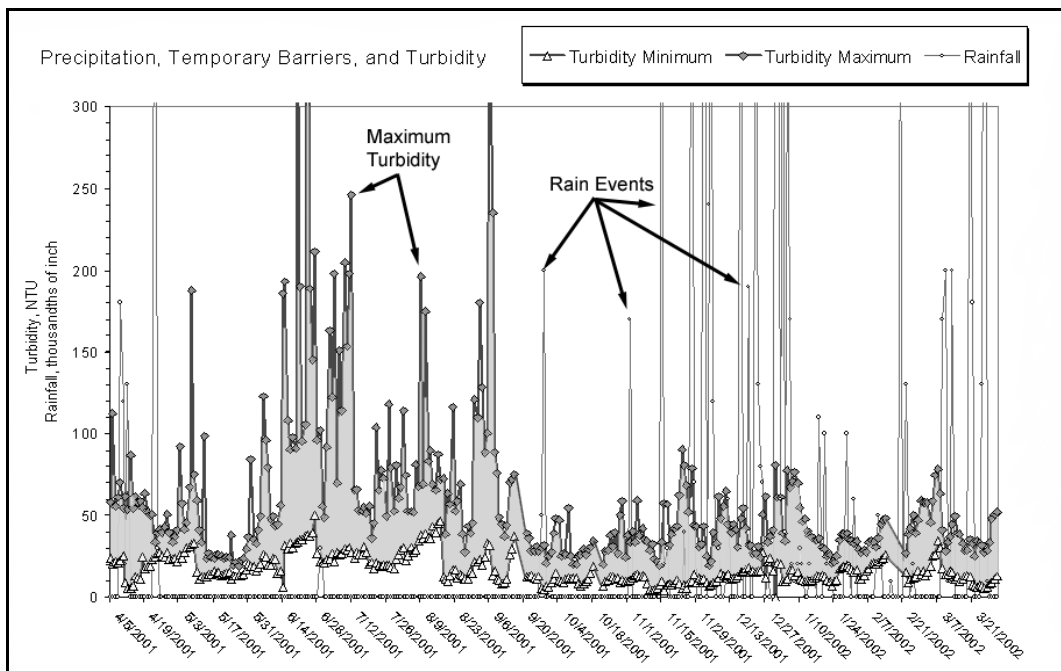
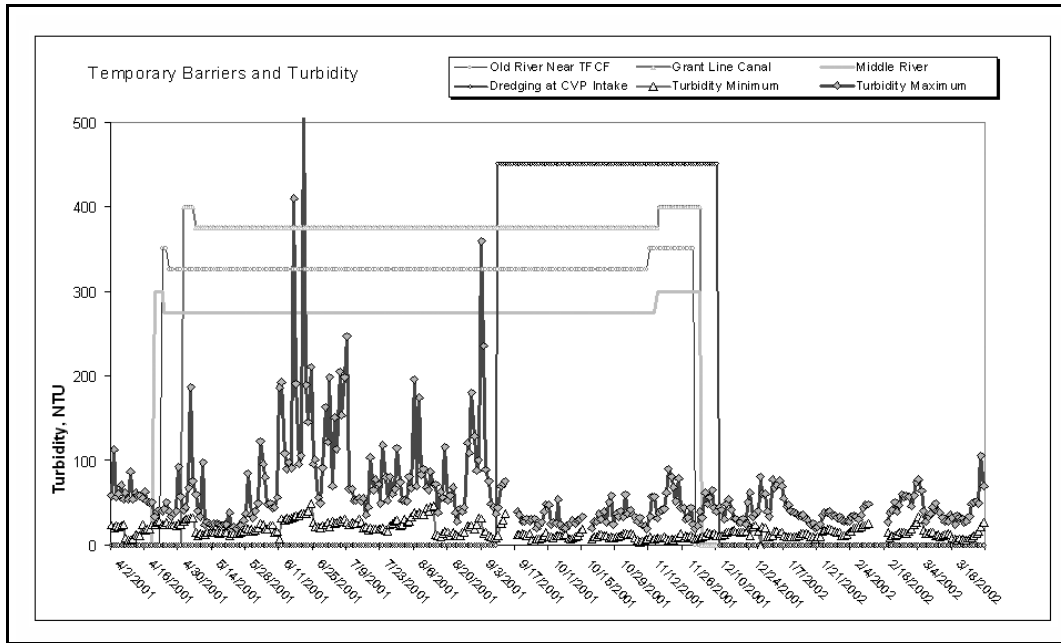


FIGURE 6b.—Turbidity in NTU with temporary barriers schedule (top) and precipitation events (below).

productivity associated with the agricultural season and higher water temperatures. The lack of response associated with nearby channel dredging may be an artifact of the position of the Hydrolab probe—on the north side of the inflow channel—and the potential for incompletely mixed sediment plumes traversing the center of the channel. The bottom graph in figure 6b also shows that precipitation events do not appear to show spikes in turbidity as were observed during a large October 2000 rainfall event in last year’s data (Craft et al. 2002). Perhaps there is a threshold storm intensity and duration before a rain event produces a turbidity spike in TFCF waters.

Figure 6c shows total fish salvage (all species) at the TFCF and clear reductions in salvage associated with installation and removal of temporary barriers. This effect is presumably caused by an interruption of normal fish migration patterns and the potential depletion of local fish numbers in the vicinity of the TFCF and the Clifton Court intake. Notably, the fish salvage numbers increase abruptly as soon as the temporary barriers are breached.

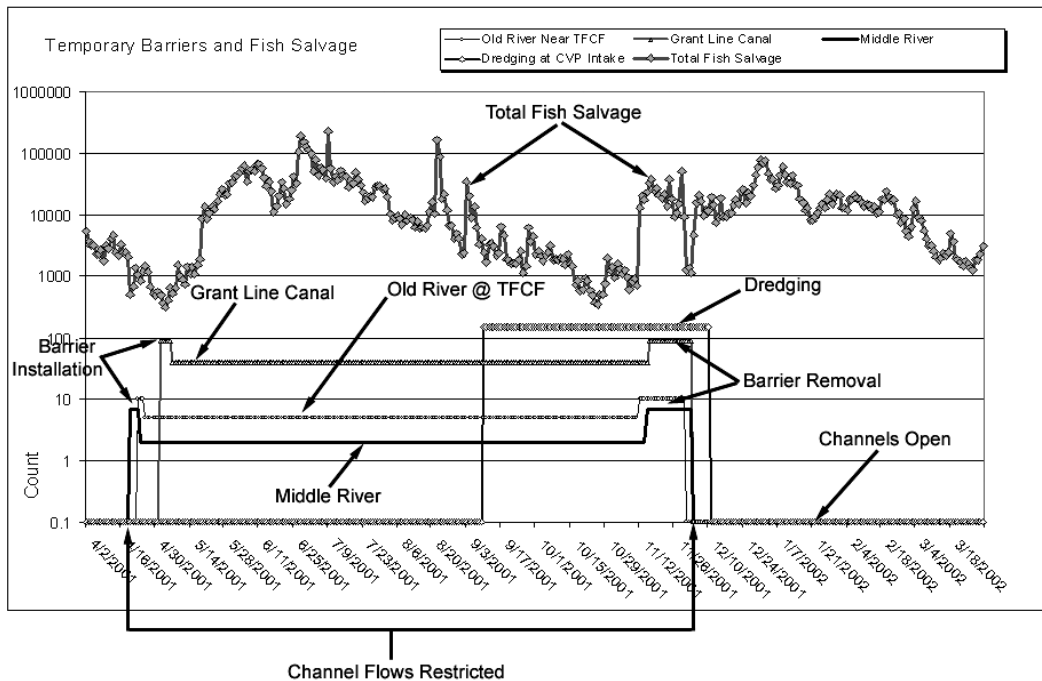


FIGURE 6c.—Total fish salvage at the Tracy Fish Collection Facility with temporary barrier schedules.

Diel factors would be expected to influence chemistry and biological responses in any natural surface water system; however, any diel effect for a water quality variable would have to first account for shifting tidal variation seen throughout the month. While these relationships are important, a more sophisticated and detailed statistical analysis of the data is beyond the scope of this report.

CONCLUSIONS

The second year of reliable water quality data at the TFCF provides an interesting comparison to year one data. The year two T, DO, and EC follow similar seasonal patterns that are consistent with snowmelt runoff and Central Valley watershed processes, and the EC data again suggest that the South Delta temporary barriers have a significant influence on maximum EC observed at the TFCF. It also appears that installation and removal of temporary barriers reduces TFCF fish salvage numbers. Neither year's pH data shows any obvious or consistent response to factors that influence T, DO, Eh, and EC. The second year DO suggests an improvement, with DO below the EPA recommended water quality criteria of 5.0 mg/L (Environmental Protection Agency 1976) only 0.05 percent of the time (compared to 2.9 percent during the previous year). Turbidity spikes were not clearly associated with rainfall events or temporary barriers, however, highest turbidity was observed when barriers were in place.

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Appendix 1

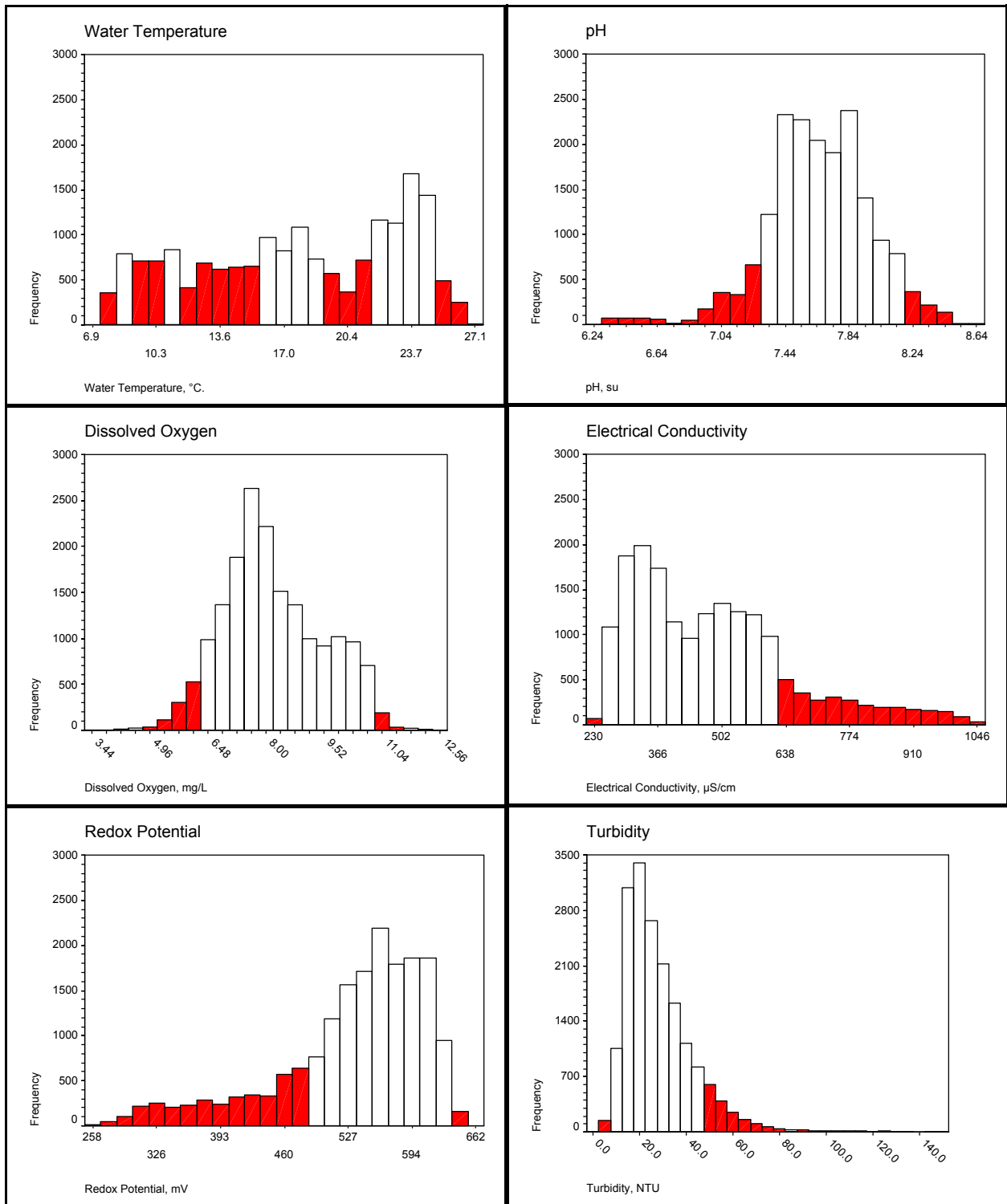


FIGURE A1-1.—Histograms of water quality data collected at the TFCF April 1, 2001, through March 31, 2002.

TABLE A1-1.—Percentile values, by month, for water quality data measured at the TFCF from April 1, 2002, through March 31, 2002

| | | <i>T, °C</i> | <i>EC, : S/cm</i> | <i>Percent DO Sat</i> | <i>DO, mg/L</i> | <i>pH, s.u.</i> | <i>Eh, mV</i> | <i>Turbidity, NTU</i> |
|--------------------|----------------|--------------|-------------------|-----------------------|-----------------|-----------------|---------------|-----------------------|
| APRIL | Valid | 1342 | 1342 | 1342 | 1342 | 1342 | 1342 | 1342 |
| | Missing | 15 | 15 | 15 | 15 | 15 | 15 | 15 |
| Percentiles | 0.1 | 14.0 | 255 | 57.6 | 5.37 | 7.43 | 253 | 5.7 |
| | 0.5 | 14.1 | 257 | 62.8 | 5.86 | 7.46 | 265 | 9.0 |
| | 1 | 14.2 | 259 | 65.0 | 6.03 | 7.47 | 269 | 11.3 |
| | 2 | 14.2 | 264 | 67.8 | 6.43 | 7.49 | 278 | 13.9 |
| | 3 | 14.3 | 266 | 69.6 | 6.55 | 7.50 | 285 | 16.6 |
| | 4 | 14.3 | 271 | 70.7 | 6.65 | 7.53 | 289 | 19.5 |
| | 5 | 14.4 | 274 | 71.4 | 6.76 | 7.54 | 298 | 21.1 |
| | 6 | 14.4 | 279 | 72.2 | 6.87 | 7.56 | 301 | 21.8 |
| | 7 | 14.5 | 282 | 72.9 | 6.97 | 7.57 | 305 | 22.3 |
| | 8 | 14.5 | 285 | 73.6 | 7.03 | 7.58 | 310 | 23.0 |
| | 9 | 14.5 | 288 | 74.1 | 7.07 | 7.60 | 314 | 23.2 |
| | 10 | 14.6 | 292 | 74.8 | 7.15 | 7.61 | 319 | 23.6 |
| | 20 | 14.9 | 314 | 80.1 | 7.63 | 7.70 | 372 | 26.0 |
| | 30 | 15.3 | 358 | 83.7 | 8.08 | 7.75 | 411 | 27.9 |
| | 40 | 15.9 | 377 | 86.0 | 8.45 | 7.77 | 438 | 29.4 |
| | 50 | 16.2 | 400 | 87.8 | 8.66 | 7.79 | 459 | 30.9 |
| | 60 | 16.5 | 433 | 89.4 | 8.92 | 7.81 | 473 | 32.5 |
| | 70 | 16.8 | 547 | 90.9 | 9.06 | 7.86 | 490 | 34.3 |
| | 80 | 18.2 | 639 | 93.5 | 9.30 | 7.93 | 509 | 37.4 |
| | 90 | 19.0 | 702 | 99.2 | 9.86 | 8.05 | 534 | 43.8 |
| | 91 | 19.0 | 707 | 99.7 | 9.93 | 8.06 | 538 | 44.9 |
| | 92 | 19.1 | 714 | 101 | 10.0 | 8.07 | 542 | 45.4 |
| | 93 | 19.2 | 719 | 102 | 10.1 | 8.08 | 547 | 46.8 |
| | 94 | 19.3 | 734 | 103 | 10.2 | 8.09 | 550 | 47.8 |
| | 95 | 19.4 | 745 | 104 | 10.2 | 8.12 | 555 | 49.1 |
| | 96 | 19.5 | 763 | 105 | 10.4 | 8.14 | 558 | 50.7 |
| | 97 | 19.6 | 780 | 107 | 10.5 | 8.15 | 563 | 52.1 |
| | 98 | 19.8 | 798 | 108 | 10.7 | 8.17 | 565 | 54.6 |
| | 99 | 20.0 | 822 | 109 | 10.9 | 8.21 | 569 | 58.2 |
| | 99.5 | 20.1 | 839 | 112 | 11.0 | 8.24 | 583 | 67.7 |
| | 99.9 | 20.4 | 853 | 115 | 11.1 | 8.26 | 593 | 105.4 |

| Table A1-1 - Continued | | T, °C | EC, : S/cm | Percent DO Sat | DO, mg/L | pH, s.u. | Eh, mV | Turbidity, NTU |
|-------------------------------|----------------|--------------|-----------------------|---------------------------|-----------------|-----------------|---------------|---------------------------|
| MAY | Valid | 1473 | 1473 | 1473 | 1473 | 1473 | 1473 | 1472 |
| | Missing | 13 | 13 | 13 | 13 | 13 | 13 | 14 |
| Percentiles | 0.1 | 17.7 | 318 | 40.2 | 3.51 | 7.10 | 263 | 11.2 |
| | 0.5 | 17.8 | 330 | 52.9 | 4.70 | 7.16 | 275 | 12.3 |
| | 1 | 17.9 | 331 | 56.4 | 4.94 | 7.18 | 290 | 13.1 |
| | 2 | 18.0 | 332 | 59.3 | 5.21 | 7.19 | 310 | 13.7 |
| | 3 | 18.1 | 333 | 60.6 | 5.30 | 7.21 | 335 | 14.1 |
| | 4 | 18.2 | 333 | 61.4 | 5.39 | 7.23 | 356 | 14.2 |
| | 5 | 18.3 | 334 | 62.2 | 5.45 | 7.24 | 368 | 14.4 |
| | 6 | 18.4 | 334 | 62.6 | 5.54 | 7.26 | 376 | 14.7 |
| | 7 | 18.5 | 335 | 63.1 | 5.58 | 7.28 | 384 | 14.8 |
| | 8 | 18.7 | 335 | 63.7 | 5.63 | 7.29 | 393 | 15.0 |
| | 9 | 18.8 | 336 | 64.2 | 5.65 | 7.30 | 399 | 15.1 |
| | 10 | 18.9 | 336 | 64.6 | 5.68 | 7.31 | 405 | 15.2 |
| | 20 | 20.1 | 340 | 67.7 | 5.95 | 7.36 | 448 | 16.4 |
| | 30 | 21.1 | 349 | 69.4 | 6.12 | 7.41 | 488 | 17.5 |
| | 40 | 21.6 | 356 | 70.9 | 6.28 | 7.45 | 514 | 18.5 |
| | 50 | 22.0 | 361 | 72.5 | 6.43 | 7.51 | 543 | 19.7 |
| | 60 | 22.4 | 368 | 74.2 | 6.53 | 7.55 | 572 | 21.3 |
| | 70 | 22.8 | 379 | 76.4 | 6.73 | 7.59 | 597 | 24.6 |
| | 80 | 23.6 | 399 | 78.4 | 6.99 | 7.63 | 606 | 32.0 |
| | 90 | 24.0 | 431 | 81.7 | 7.38 | 7.69 | 619 | 39.0 |
| | 91 | 24.1 | 435 | 82.0 | 7.41 | 7.69 | 621 | 40.0 |
| | 92 | 24.2 | 439 | 82.4 | 7.43 | 7.70 | 623 | 41.0 |
| | 93 | 24.2 | 445 | 82.7 | 7.50 | 7.71 | 624 | 41.9 |
| | 94 | 24.3 | 451 | 83.2 | 7.55 | 7.72 | 627 | 43.2 |
| | 95 | 24.3 | 463 | 83.7 | 7.63 | 7.72 | 628 | 44.4 |
| | 96 | 24.4 | 478 | 84.1 | 7.69 | 7.73 | 629 | 45.7 |
| | 97 | 24.5 | 502 | 84.9 | 7.76 | 7.74 | 630 | 47.4 |
| | 98 | 24.6 | 526 | 86.9 | 7.84 | 7.77 | 632 | 51.6 |
| | 99 | 24.7 | 566 | 90.4 | 7.99 | 7.79 | 634 | 58.0 |
| | 99.5 | 24.8 | 593 | 94.3 | 8.13 | 7.81 | 635 | 69.5 |
| | 99.9 | 24.9 | 647 | 100 | 8.47 | 7.87 | 637 | 184.8 |

| Table A1-1 - Continued | | T, °C | EC, : S/cm | Percent DO Sat | DO, mg/L | pH, s.u. | Eh, mV | Turbidity, NTU |
|-------------------------------|----------------|--------------|-----------------------|---------------------------|-----------------|-----------------|---------------|---------------------------|
| JUNE | Valid | 1435 | 1434 | 1435 | 1435 | 1435 | 1435 | 1427 |
| | Missing | 5 | 6 | 5 | 5 | 5 | 5 | 13 |
| Percentiles | 0.1 | 20.8 | 279 | 46.2 | 4.01 | 6.84 | 287 | 6.5 |
| | 0.5 | 20.8 | 281 | 63.7 | 5.56 | 6.89 | 295 | 8.5 |
| | 1 | 20.9 | 282 | 68.6 | 5.78 | 6.91 | 305 | 15.2 |
| | 2 | 21.1 | 283 | 71.9 | 6.08 | 6.96 | 317 | 19.5 |
| | 3 | 21.4 | 284 | 73.8 | 6.20 | 6.98 | 335 | 20.6 |
| | 4 | 21.5 | 284 | 74.8 | 6.32 | 7.03 | 343 | 21.4 |
| | 5 | 21.6 | 285 | 75.5 | 6.40 | 7.10 | 349 | 22.5 |
| | 6 | 21.6 | 286 | 76.1 | 6.45 | 7.15 | 353 | 23.3 |
| | 7 | 21.7 | 286 | 76.5 | 6.49 | 7.17 | 358 | 24.0 |
| | 8 | 21.7 | 287 | 77.0 | 6.52 | 7.18 | 362 | 24.7 |
| | 9 | 21.7 | 288 | 77.4 | 6.54 | 7.20 | 365 | 25.3 |
| | 10 | 21.8 | 288 | 77.8 | 6.57 | 7.21 | 366 | 25.7 |
| | 20 | 22.0 | 303 | 80.3 | 6.70 | 7.31 | 386 | 29.8 |
| | 30 | 22.3 | 316 | 81.6 | 6.81 | 7.39 | 467 | 33.5 |
| | 40 | 22.8 | 329 | 83.2 | 6.97 | 7.45 | 546 | 37.0 |
| | 50 | 23.3 | 339 | 84.8 | 7.19 | 7.49 | 569 | 41.4 |
| | 60 | 23.7 | 350 | 86.7 | 7.41 | 7.53 | 582 | 45.9 |
| | 70 | 24.2 | 368 | 88.4 | 7.58 | 7.58 | 598 | 51.7 |
| | 80 | 24.7 | 390 | 90.2 | 7.76 | 7.64 | 607 | 59.6 |
| | 90 | 25.4 | 441 | 94.3 | 8.15 | 7.73 | 616 | 73.7 |
| | 91 | 25.5 | 448 | 95.0 | 8.18 | 7.74 | 617 | 75.7 |
| | 92 | 25.6 | 459 | 95.5 | 8.24 | 7.75 | 618 | 79.0 |
| | 93 | 25.6 | 469 | 95.9 | 8.32 | 7.76 | 619 | 81.8 |
| | 94 | 25.7 | 480 | 96.5 | 8.37 | 7.78 | 620 | 84.0 |
| | 95 | 25.8 | 498 | 97.0 | 8.44 | 7.83 | 621 | 88.2 |
| | 96 | 25.8 | 527 | 98.0 | 8.51 | 7.88 | 623 | 91.8 |
| | 97 | 25.9 | 546 | 98.8 | 8.60 | 7.91 | 624 | 97.8 |
| | 98 | 26.0 | 564 | 100.0 | 8.67 | 7.98 | 628 | 110.2 |
| | 99 | 26.1 | 589 | 101.0 | 8.84 | 8.01 | 631 | 131.1 |
| | 99.5 | 26.2 | 609 | 102.2 | 8.96 | 8.17 | 634 | 182.4 |
| | 99.9 | 26.6 | 637 | 105.6 | 9.24 | 8.30 | 636 | 475.7 |

| Table A1-1 - Continued | | T, °C | EC, : S/cm | Percent DO Sat | DO, mg/L | pH, s.u. | Eh, mV | Turbidity, NTU |
|-------------------------------|----------------|--------------|-----------------------|---------------------------|-----------------|-----------------|---------------|---------------------------|
| JULY | Valid | 1471 | 1470 | 1471 | 1471 | 1471 | 1471 | 1463 |
| | Missing | 17 | 18 | 17 | 17 | 17 | 17 | 25 |
| Percentiles | 0.1 | 21.8 | 259 | 74.3 | 5.92 | 6.81 | 447 | 17.0 |
| | 0.5 | 21.9 | 261 | 76.1 | 6.09 | 6.87 | 460 | 18.1 |
| | 1 | 22.0 | 262 | 77.2 | 6.22 | 6.90 | 473 | 18.8 |
| | 2 | 22.3 | 265 | 78.1 | 6.37 | 6.99 | 482 | 19.8 |
| | 3 | 22.5 | 267 | 78.8 | 6.42 | 7.14 | 491 | 20.2 |
| | 4 | 22.6 | 270 | 79.3 | 6.47 | 7.17 | 494 | 21.1 |
| | 5 | 22.6 | 271 | 79.7 | 6.52 | 7.19 | 497 | 21.6 |
| | 6 | 22.6 | 272 | 80.1 | 6.59 | 7.20 | 499 | 22.3 |
| | 7 | 22.7 | 274 | 80.5 | 6.62 | 7.23 | 500 | 22.9 |
| | 8 | 22.7 | 276 | 80.8 | 6.66 | 7.25 | 503 | 23.4 |
| | 9 | 22.7 | 277 | 81.3 | 6.69 | 7.27 | 505 | 23.7 |
| | 10 | 22.7 | 278 | 81.7 | 6.71 | 7.32 | 506 | 24.2 |
| | 20 | 23.1 | 290 | 84.2 | 6.96 | 7.47 | 520 | 28.1 |
| | 30 | 23.5 | 303 | 85.9 | 7.15 | 7.53 | 528 | 30.7 |
| | 40 | 23.9 | 309 | 87.8 | 7.34 | 7.58 | 536 | 33.3 |
| | 50 | 24.3 | 314 | 89.1 | 7.51 | 7.65 | 542 | 35.5 |
| | 60 | 24.6 | 322 | 90.5 | 7.63 | 7.71 | 552 | 38.1 |
| | 70 | 24.9 | 337 | 92.0 | 7.75 | 7.84 | 566 | 40.9 |
| | 80 | 25.6 | 357 | 93.5 | 7.88 | 7.94 | 579 | 44.7 |
| | 90 | 26.1 | 385 | 95.5 | 8.04 | 8.07 | 595 | 51.6 |
| | 91 | 26.1 | 392 | 95.7 | 8.06 | 8.09 | 597 | 52.6 |
| | 92 | 26.1 | 396 | 95.8 | 8.08 | 8.11 | 599 | 54.2 |
| | 93 | 26.2 | 401 | 96.0 | 8.10 | 8.13 | 601 | 56.4 |
| | 94 | 26.2 | 406 | 96.4 | 8.13 | 8.14 | 604 | 58.4 |
| | 95 | 26.3 | 412 | 96.9 | 8.16 | 8.15 | 606 | 60.9 |
| | 96 | 26.3 | 421 | 97.3 | 8.24 | 8.16 | 607 | 65.1 |
| | 97 | 26.4 | 438 | 97.9 | 8.31 | 8.17 | 613 | 69.4 |
| | 98 | 26.4 | 466 | 99.0 | 8.45 | 8.19 | 617 | 79.0 |
| | 99 | 26.7 | 498 | 99.9 | 8.58 | 8.22 | 629 | 119.5 |
| | 99.5 | 26.8 | 509 | 100.9 | 8.66 | 8.24 | 634 | 157.7 |
| | 99.9 | 27.1 | 531 | 102.7 | 8.80 | 8.26 | 640 | 226.8 |

| Table A1-1 - Continued | | T, °C | EC, : S/cm | Percent DO Sat | DO, mg/L | pH, s.u. | Eh, mV | Turbidity, NTU |
|-------------------------------|----------------|--------------|-----------------------|---------------------------|-----------------|-----------------|---------------|---------------------------|
| AUGUST | Valid | 1479 | 1480 | 1481 | 1481 | 1481 | 1484 | 1473 |
| | Missing | 9 | 8 | 7 | 7 | 7 | 4 | 15 |
| Percentiles | 0.1 | 22.4 | 336 | 62.3 | 5.29 | 7.31 | 438 | 9.9 |
| | 0.5 | 22.5 | 340 | 63.4 | 5.38 | 7.33 | 488 | 11.3 |
| | 1 | 22.6 | 343 | 64.6 | 5.49 | 7.36 | 497 | 11.8 |
| | 2 | 22.6 | 352 | 66.6 | 5.64 | 7.40 | 510 | 12.6 |
| | 3 | 22.7 | 355 | 67.9 | 5.74 | 7.42 | 517 | 13.6 |
| | 4 | 22.8 | 358 | 68.8 | 5.79 | 7.43 | 520 | 14.6 |
| | 5 | 23.0 | 362 | 69.5 | 5.84 | 7.45 | 523 | 15.3 |
| | 6 | 23.1 | 367 | 70.2 | 5.91 | 7.46 | 526 | 15.8 |
| | 7 | 23.2 | 372 | 70.9 | 5.95 | 7.47 | 529 | 16.4 |
| | 8 | 23.2 | 375 | 71.4 | 6.01 | 7.49 | 532 | 16.9 |
| | 9 | 23.3 | 377 | 71.8 | 6.03 | 7.50 | 533 | 17.5 |
| | 10 | 23.3 | 380 | 72.2 | 6.06 | 7.50 | 535 | 18.1 |
| | 20 | 23.6 | 404 | 77.8 | 6.47 | 7.65 | 547 | 22.5 |
| | 30 | 23.7 | 426 | 80.1 | 6.70 | 7.78 | 555 | 27.2 |
| | 40 | 23.9 | 446 | 82.3 | 6.94 | 7.91 | 562 | 32.1 |
| | 50 | 24.0 | 465 | 84.3 | 7.12 | 8.02 | 568 | 36.5 |
| | 60 | 24.2 | 483 | 86.3 | 7.29 | 8.07 | 574 | 41.7 |
| | 70 | 24.4 | 497 | 88.7 | 7.47 | 8.11 | 581 | 46.6 |
| | 80 | 24.6 | 511 | 91.1 | 7.66 | 8.14 | 591 | 51.1 |
| | 90 | 24.9 | 528 | 93.4 | 7.81 | 8.17 | 606 | 55.9 |
| | 91 | 25.0 | 530 | 93.7 | 7.82 | 8.18 | 607 | 57.1 |
| | 92 | 25.0 | 531 | 94.0 | 7.85 | 8.18 | 609 | 58.5 |
| | 93 | 25.0 | 534 | 94.3 | 7.87 | 8.19 | 612 | 60.2 |
| | 94 | 25.1 | 536 | 94.6 | 7.90 | 8.20 | 616 | 61.3 |
| | 95 | 25.1 | 539 | 95.1 | 7.93 | 8.21 | 619 | 62.7 |
| | 96 | 25.1 | 542 | 95.5 | 7.97 | 8.22 | 621 | 64.6 |
| | 97 | 25.2 | 547 | 95.9 | 8.01 | 8.23 | 626 | 67.8 |
| | 98 | 25.3 | 553 | 96.7 | 8.07 | 8.24 | 630 | 70.4 |
| | 99 | 25.4 | 567 | 98.0 | 8.17 | 8.27 | 637 | 87.1 |
| | 99.5 | 25.5 | 582 | 98.8 | 8.26 | 8.33 | 645 | 113.9 |
| | 99.9 | 25.6 | 626 | 103.3 | 8.74 | 8.45 | 653 | 188.4 |

| <i>Table A1-1 - Continued</i> | | <i>T, °C</i> | <i>EC, : S/cm</i> | <i>Percent DO Sat</i> | <i>DO, mg/L</i> | <i>pH, s.u.</i> | <i>Eh, mV</i> | <i>Turbidity, NTU</i> |
|-------------------------------|----------------|--------------|-------------------|-----------------------|-----------------|-----------------|---------------|-----------------------|
| SEPTEMBE | Valid | 1175 | 1184 | 1184 | 1184 | 1188 | 1189 | 1176 |
| | Missing | 264 | 255 | 255 | 255 | 251 | 250 | 263 |
| Percentiles | 0.1 | 20.0 | 400 | 78.0 | 6.49 | 7.23 | 460 | 4.8 |
| | 0.5 | 20.2 | 423 | 78.9 | 6.63 | 7.29 | 476 | 6.3 |
| | 1 | 20.4 | 433 | 79.9 | 6.75 | 7.29 | 489 | 6.7 |
| | 2 | 20.4 | 443 | 81.0 | 6.81 | 7.32 | 511 | 7.6 |
| | 3 | 20.5 | 449 | 81.4 | 6.88 | 7.34 | 515 | 8.2 |
| | 4 | 20.5 | 454 | 81.9 | 6.92 | 7.35 | 519 | 8.8 |
| | 5 | 20.6 | 459 | 82.2 | 6.98 | 7.36 | 522 | 9.6 |
| | 6 | 20.8 | 463 | 82.6 | 7.05 | 7.36 | 525 | 10.5 |
| | 7 | 20.9 | 467 | 82.9 | 7.08 | 7.37 | 528 | 10.9 |
| | 8 | 20.9 | 470 | 83.2 | 7.13 | 7.37 | 530 | 11.3 |
| | 9 | 21.0 | 473 | 83.7 | 7.16 | 7.38 | 532 | 11.7 |
| | 10 | 21.0 | 475 | 84.0 | 7.19 | 7.39 | 536 | 12.0 |
| | 20 | 21.4 | 499 | 85.9 | 7.35 | 7.45 | 550 | 14.2 |
| | 30 | 21.8 | 525 | 87.0 | 7.48 | 7.53 | 560 | 16.3 |
| | 40 | 22.2 | 546 | 87.9 | 7.60 | 7.63 | 567 | 18.6 |
| | 50 | 22.5 | 558 | 88.9 | 7.69 | 7.67 | 573 | 22.1 |
| | 60 | 23.0 | 569 | 89.8 | 7.77 | 7.74 | 580 | 26.2 |
| | 70 | 23.5 | 579 | 90.8 | 7.87 | 7.83 | 588 | 31.8 |
| | 80 | 24.0 | 592 | 91.9 | 7.98 | 7.92 | 595 | 40.3 |
| | 90 | 24.4 | 613 | 93.5 | 8.10 | 7.99 | 604 | 50.2 |
| | 91 | 24.5 | 615 | 93.7 | 8.12 | 7.99 | 606 | 51.6 |
| | 92 | 24.5 | 618 | 94.0 | 8.13 | 8.00 | 607 | 54.5 |
| | 93 | 24.6 | 621 | 94.3 | 8.14 | 8.01 | 608 | 56.5 |
| | 94 | 24.7 | 622 | 94.7 | 8.16 | 8.02 | 610 | 57.5 |
| | 95 | 24.7 | 626 | 94.9 | 8.19 | 8.03 | 611 | 60.4 |
| | 96 | 24.8 | 628 | 95.3 | 8.22 | 8.05 | 613 | 63.6 |
| | 97 | 24.8 | 634 | 95.7 | 8.25 | 8.07 | 616 | 67.3 |
| | 98 | 24.9 | 643 | 96.2 | 8.30 | 8.09 | 621 | 71.1 |
| | 99 | 24.9 | 655 | 97.5 | 8.35 | 8.14 | 633 | 87.4 |
| | 99.5 | 25.0 | 667 | 98.3 | 8.41 | 8.26 | 637 | 118.0 |
| | 99.9 | 25.0 | 694 | 99.4 | 8.53 | 8.39 | 643 | 337.5 |

| Table A1-1 - Continued | | T, °C | EC, : S/cm | Percent DO Sat | DO, mg/L | pH, s.u. | Eh, mV | Turbidity, NTU |
|-------------------------------|----------------|--------------|-----------------------|---------------------------|-----------------|-----------------|---------------|---------------------------|
| OCTOBER | Valid | 1282 | 1285 | 1285 | 1283 | 1285 | 1286 | 1284 |
| | Missing | 205 | 202 | 202 | 204 | 202 | 201 | 203 |
| Percentiles | 0.1 | 17.4 | 392 | 73.1 | 6.58 | 6.93 | 380 | 6.6 |
| | 0.5 | 17.5 | 404 | 74.6 | 6.81 | 6.95 | 398 | 7.4 |
| | 1 | 17.5 | 412 | 75.3 | 6.91 | 6.97 | 409 | 8.2 |
| | 2 | 17.6 | 427 | 76.5 | 6.99 | 6.98 | 437 | 9.1 |
| | 3 | 17.7 | 441 | 77.1 | 7.07 | 6.99 | 454 | 9.6 |
| | 4 | 17.7 | 453 | 77.8 | 7.12 | 6.99 | 463 | 10.1 |
| | 5 | 17.8 | 460 | 78.1 | 7.14 | 7.00 | 476 | 10.3 |
| | 6 | 17.8 | 464 | 78.6 | 7.18 | 7.01 | 486 | 10.4 |
| | 7 | 17.8 | 468 | 79.1 | 7.21 | 7.02 | 495 | 10.7 |
| | 8 | 17.8 | 470 | 79.6 | 7.24 | 7.02 | 501 | 11.0 |
| | 9 | 17.9 | 474 | 79.9 | 7.27 | 7.03 | 505 | 11.2 |
| | 10 | 17.9 | 478 | 80.1 | 7.29 | 7.03 | 508 | 11.4 |
| | 20 | 18.0 | 498 | 81.5 | 7.47 | 7.26 | 535 | 12.7 |
| | 30 | 18.4 | 517 | 82.7 | 7.59 | 7.36 | 557 | 13.8 |
| | 40 | 19.1 | 541 | 83.7 | 7.66 | 7.40 | 579 | 14.8 |
| | 50 | 19.4 | 563 | 84.4 | 7.74 | 7.43 | 608 | 15.8 |
| | 60 | 19.8 | 580 | 85.3 | 7.81 | 7.57 | 615 | 16.8 |
| | 70 | 20.2 | 596 | 86.1 | 7.89 | 7.69 | 620 | 18.2 |
| | 80 | 20.8 | 611 | 86.9 | 7.99 | 7.79 | 626 | 20.2 |
| | 90 | 21.6 | 624 | 88.4 | 8.14 | 7.82 | 633 | 23.2 |
| | 91 | 21.6 | 625 | 88.5 | 8.17 | 7.82 | 634 | 24.0 |
| | 92 | 21.6 | 628 | 88.8 | 8.21 | 7.82 | 635 | 24.9 |
| | 93 | 21.7 | 630 | 89.0 | 8.25 | 7.83 | 636 | 25.6 |
| | 94 | 21.7 | 633 | 89.2 | 8.27 | 7.83 | 636 | 26.1 |
| | 95 | 21.8 | 638 | 89.4 | 8.32 | 7.84 | 637 | 26.8 |
| | 96 | 21.8 | 642 | 89.9 | 8.36 | 7.84 | 639 | 28.0 |
| | 97 | 21.9 | 650 | 90.1 | 8.39 | 7.84 | 642 | 29.8 |
| | 98 | 22.0 | 661 | 91.3 | 8.43 | 7.85 | 645 | 33.7 |
| | 99 | 22.1 | 676 | 92.5 | 8.48 | 7.87 | 647 | 40.5 |
| | 99.5 | 22.1 | 693 | 95.4 | 8.51 | 7.88 | 649 | 45.5 |
| | 99.9 | 22.2 | 738 | 98.0 | 8.55 | 7.89 | 651 | 58.4 |

| <i>Table A1-1 - Continued</i> | | <i>T, °C</i> | <i>EC, S/cm</i> | <i>Percent DO Sat</i> | <i>DO, mg/L</i> | <i>pH, s.u.</i> | <i>Eh, mV</i> | <i>Turbidity, NTU</i> |
|-------------------------------|----------------|--------------|-----------------|-----------------------|-----------------|-----------------|---------------|-----------------------|
| NOVEMBER | Valid | 1433 | 1431 | 1430 | 1430 | 1431 | 1431 | 1429 |
| | Missing | 7 | 9 | 10 | 10 | 9 | 9 | 11 |
| Percentiles | 0.1 | 10.5 | 414 | 67.6 | 6.73 | 7.29 | 454 | 3.9 |
| | 0.5 | 10.7 | 424 | 68.1 | 6.80 | 7.33 | 466 | 4.8 |
| | 1 | 10.9 | 432 | 68.6 | 6.83 | 7.33 | 478 | 5.2 |
| | 2 | 11.0 | 448 | 70.0 | 7.02 | 7.35 | 491 | 6.0 |
| | 3 | 11.3 | 452 | 70.8 | 7.11 | 7.36 | 499 | 6.5 |
| | 4 | 11.5 | 458 | 72.7 | 7.26 | 7.38 | 504 | 7.1 |
| | 5 | 11.6 | 460 | 74.5 | 7.47 | 7.38 | 509 | 7.5 |
| | 6 | 11.6 | 463 | 76.0 | 7.58 | 7.38 | 512 | 7.9 |
| | 7 | 12.0 | 466 | 77.2 | 7.72 | 7.39 | 516 | 8.2 |
| | 8 | 12.2 | 467 | 78.1 | 7.81 | 7.40 | 520 | 8.5 |
| | 9 | 12.4 | 469 | 78.8 | 7.86 | 7.40 | 522 | 8.9 |
| | 10 | 12.5 | 471 | 79.2 | 7.90 | 7.41 | 526 | 9.2 |
| | 20 | 14.2 | 488 | 80.9 | 8.08 | 7.45 | 556 | 11.7 |
| | 30 | 15.3 | 504 | 82.4 | 8.22 | 7.47 | 574 | 13.8 |
| | 40 | 15.5 | 518 | 83.8 | 8.31 | 7.50 | 587 | 15.8 |
| | 50 | 15.8 | 536 | 85.5 | 8.44 | 7.55 | 593 | 17.5 |
| | 60 | 16.0 | 553 | 86.4 | 8.57 | 7.62 | 604 | 19.2 |
| | 70 | 16.4 | 568 | 87.3 | 8.67 | 7.65 | 609 | 21.6 |
| | 80 | 16.9 | 591 | 88.6 | 8.78 | 7.72 | 616 | 25.4 |
| | 90 | 17.4 | 690 | 89.9 | 8.98 | 7.78 | 621 | 33.0 |
| | 91 | 17.4 | 709 | 90.1 | 9.01 | 7.79 | 622 | 34.1 |
| | 92 | 17.5 | 727 | 90.3 | 9.05 | 7.79 | 622 | 35.7 |
| | 93 | 17.5 | 739 | 90.5 | 9.19 | 7.80 | 623 | 37.1 |
| | 94 | 17.5 | 744 | 90.7 | 9.27 | 7.82 | 623 | 38.8 |
| | 95 | 17.5 | 753 | 90.9 | 9.37 | 7.85 | 624 | 42.9 |
| | 96 | 17.5 | 762 | 91.1 | 9.49 | 7.90 | 624 | 45.4 |
| | 97 | 17.6 | 769 | 91.3 | 9.57 | 7.93 | 625 | 48.7 |
| | 98 | 17.6 | 790 | 91.7 | 9.63 | 7.95 | 626 | 53.4 |
| | 99 | 17.7 | 805 | 92.0 | 9.72 | 7.96 | 628 | 59.9 |
| | 99.5 | 17.7 | 811 | 92.6 | 9.75 | 7.98 | 629 | 65.4 |
| | 99.9 | 17.8 | 873 | 93.4 | 9.84 | 8.05 | 631 | 86.3 |

| <i>Table A1-1 - Continued</i> | | <i>T, °C</i> | <i>EC, : S/cm</i> | <i>Percent DO Sat</i> | <i>DO, mg/L</i> | <i>pH, s.u.</i> | <i>Eh, mV</i> | <i>Turbidity, NTU</i> |
|-------------------------------|----------------|--------------|-------------------|-----------------------|-----------------|-----------------|---------------|-----------------------|
| DECEMBER | Valid | 1468 | 1465 | 129 | 1465 | 1465 | 1465 | 1463 |
| | Missing | 19 | 22 | 1358 | 22 | 22 | 22 | 24 |
| Percentiles | 0.1 | 7.7 | 263 | 80.2 | 6.75 | 7.34 | 267 | 0.0 |
| | 0.5 | 7.7 | 265 | 80.2 | 6.97 | 7.45 | 276 | 6.1 |
| | 1 | 7.8 | 271 | 80.4 | 7.45 | 7.46 | 285 | 8.3 |
| | 2 | 8.0 | 281 | 80.9 | 7.76 | 7.48 | 294 | 9.9 |
| | 3 | 8.0 | 289 | 81.1 | 7.86 | 7.49 | 300 | 10.9 |
| | 4 | 8.1 | 297 | 81.4 | 7.98 | 7.51 | 303 | 11.7 |
| | 5 | 8.1 | 305 | 82.0 | 8.07 | 7.51 | 305 | 12.2 |
| | 6 | 8.7 | 324 | 82.2 | 8.30 | 7.52 | 308 | 12.5 |
| | 7 | 8.8 | 369 | 82.6 | 8.48 | 7.53 | 310 | 12.8 |
| | 8 | 8.8 | 380 | 83.1 | 8.58 | 7.54 | 312 | 13.2 |
| | 9 | 8.9 | 402 | 83.3 | 8.61 | 7.54 | 312 | 13.4 |
| | 10 | 8.9 | 423 | 83.7 | 8.67 | 7.54 | 314 | 13.8 |
| | 20 | 9.1 | 488 | 84.6 | 9.30 | 7.63 | 327 | 16.1 |
| | 30 | 9.6 | 528 | 85.2 | 9.61 | 7.81 | 342 | 18.1 |
| | 40 | 9.7 | 558 | 85.6 | 9.91 | 7.83 | 437 | 20.1 |
| | 50 | 10.0 | 587 | 86.6 | 10.10 | 7.85 | 494 | 22.1 |
| | 60 | 10.3 | 608 | 87.6 | 10.22 | 7.87 | 546 | 24.2 |
| | 70 | 10.6 | 644 | 88.4 | 10.39 | 7.89 | 571 | 27.0 |
| | 80 | 10.8 | 717 | 90.2 | 10.52 | 7.93 | 582 | 30.1 |
| | 90 | 11.0 | 764 | 91.4 | 10.76 | 8.06 | 588 | 34.9 |
| | 91 | 11.1 | 768 | 91.8 | 10.82 | 8.10 | 589 | 35.4 |
| | 92 | 11.1 | 775 | 92.0 | 10.85 | 8.12 | 590 | 35.7 |
| | 93 | 11.2 | 788 | 92.3 | 10.91 | 8.14 | 590 | 36.4 |
| | 94 | 11.2 | 803 | 92.3 | 10.97 | 8.16 | 591 | 37.3 |
| | 95 | 11.3 | 821 | 92.3 | 11.05 | 8.19 | 593 | 38.8 |
| | 96 | 11.4 | 828 | 92.3 | 11.11 | 8.22 | 595 | 39.8 |
| | 97 | 11.5 | 845 | 92.4 | 11.16 | 8.26 | 596 | 42.0 |
| | 98 | 11.7 | 878 | 92.5 | 11.24 | 8.30 | 597 | 44.4 |
| | 99 | 12.3 | 938 | 93.0 | 11.35 | 8.34 | 599 | 51.1 |
| | 99.5 | 12.5 | 983 | 93.2 | 11.55 | 8.37 | 601 | 56.7 |
| | 99.9 | 12.8 | 1019 | 93.2 | 11.66 | 8.41 | 602 | 73.4 |

| <i>Table A1-1 - Continued</i> | | <i>T, °C</i> | <i>EC, S/cm</i> | <i>Percent DO Sat</i> | <i>DO, mg/L</i> | <i>pH, s.u.</i> | <i>Eh, mV</i> | <i>Turbidity, NTU</i> |
|-------------------------------|----------------|--------------|-----------------|-----------------------|-----------------|-----------------|---------------|-----------------------|
| JANUARY | Valid | 1473 | 1473 | 1389 | 1473 | 1473 | 1473 | 1473 |
| | Missing | 15 | 15 | 99 | 15 | 15 | 15 | 15 |
| Percentiles | 0.1 | 7.4 | 238 | 61.4 | 6.68 | 6.85 | 308 | 7.2 |
| | 0.5 | 7.5 | 241 | 62.0 | 6.78 | 6.87 | 327 | 9.6 |
| | 1 | 7.6 | 242 | 62.7 | 6.85 | 6.88 | 346 | 10.2 |
| | 2 | 7.7 | 247 | 63.9 | 6.96 | 6.90 | 354 | 10.6 |
| | 3 | 7.8 | 250 | 64.6 | 7.07 | 6.95 | 364 | 11.1 |
| | 4 | 7.9 | 253 | 65.3 | 7.14 | 6.96 | 380 | 11.3 |
| | 5 | 8.0 | 255 | 65.9 | 7.18 | 6.97 | 387 | 11.6 |
| | 6 | 8.0 | 257 | 66.3 | 7.23 | 6.98 | 481 | 12.0 |
| | 7 | 8.1 | 261 | 66.7 | 7.28 | 6.99 | 494 | 12.4 |
| | 8 | 8.1 | 264 | 67.1 | 7.34 | 6.99 | 499 | 12.6 |
| | 9 | 8.1 | 266 | 67.6 | 7.37 | 7.00 | 503 | 13.0 |
| | 10 | 8.2 | 270 | 68.0 | 7.42 | 7.01 | 505 | 13.2 |
| | 20 | 8.3 | 325 | 70.5 | 7.63 | 7.10 | 516 | 15.6 |
| | 30 | 8.5 | 391 | 72.2 | 7.86 | 7.19 | 527 | 17.4 |
| | 40 | 8.9 | 424 | 74.2 | 8.18 | 7.28 | 534 | 18.9 |
| | 50 | 9.8 | 456 | 76.6 | 8.60 | 7.37 | 544 | 20.8 |
| | 60 | 10.6 | 486 | 80.5 | 9.07 | 7.45 | 572 | 22.8 |
| | 70 | 10.9 | 606 | 83.8 | 9.74 | 7.54 | 597 | 25.0 |
| | 80 | 11.1 | 722 | 85.3 | 9.94 | 7.65 | 607 | 28.2 |
| | 90 | 11.5 | 892 | 88.5 | 10.32 | 7.79 | 619 | 36.7 |
| | 91 | 11.5 | 918 | 88.7 | 10.40 | 7.80 | 620 | 38.6 |
| | 92 | 11.5 | 930 | 88.8 | 10.45 | 7.81 | 623 | 39.9 |
| | 93 | 11.6 | 953 | 89.1 | 10.48 | 7.82 | 626 | 41.5 |
| | 94 | 11.7 | 970 | 89.4 | 10.52 | 7.83 | 629 | 44.6 |
| | 95 | 11.7 | 984 | 89.6 | 10.56 | 7.84 | 633 | 46.5 |
| | 96 | 11.9 | 995 | 89.9 | 10.58 | 7.87 | 638 | 48.3 |
| | 97 | 11.9 | 1002 | 90.1 | 10.61 | 7.88 | 641 | 52.8 |
| | 98 | 12.3 | 1013 | 90.3 | 10.64 | 7.90 | 642 | 57.5 |
| | 99 | 12.4 | 1019 | 90.6 | 10.72 | 7.96 | 644 | 65.5 |
| | 99.5 | 12.7 | 1025 | 91.0 | 10.76 | 8.01 | 646 | 69.2 |
| | 99.9 | 12.8 | 1046 | 91.5 | 10.79 | 8.09 | 648 | 76.9 |

| <i>Table A1-1 - Continued</i> | | <i>T, °C</i> | <i>EC, S/cm</i> | <i>Percent DO Sat</i> | <i>DO, mg/L</i> | <i>pH, s.u.</i> | <i>Eh, mV</i> | <i>Turbidity, NTU</i> |
|-------------------------------|----------------|--------------|-----------------|-----------------------|-----------------|-----------------|---------------|-----------------------|
| FEBRUARY | Valid | 950 | 950 | 950 | 950 | 950 | 950 | 950 |
| | Missing | 394 | 394 | 394 | 394 | 394 | 394 | 394 |
| Percentiles | 0.1 | 7.5 | 241 | 77.3 | 7.82 | 6.29 | 443 | 8.9 |
| | 0.5 | 7.6 | 250 | 78.6 | 7.94 | 6.30 | 463 | 11.6 |
| | 1 | 7.6 | 252 | 79.1 | 7.98 | 6.31 | 472 | 12.4 |
| | 2 | 7.7 | 255 | 79.8 | 8.07 | 6.33 | 475 | 12.8 |
| | 3 | 7.8 | 256 | 80.1 | 8.11 | 6.34 | 480 | 13.5 |
| | 4 | 7.8 | 257 | 80.6 | 8.15 | 6.35 | 484 | 14.2 |
| | 5 | 7.9 | 258 | 80.9 | 8.21 | 6.36 | 485 | 14.7 |
| | 6 | 7.9 | 259 | 81.2 | 8.29 | 6.37 | 490 | 15.3 |
| | 7 | 7.9 | 260 | 81.5 | 8.32 | 6.38 | 492 | 15.6 |
| | 8 | 8.0 | 261 | 81.8 | 8.38 | 6.39 | 494 | 15.9 |
| | 9 | 8.0 | 262 | 82.2 | 8.44 | 6.40 | 496 | 16.4 |
| | 10 | 8.1 | 263 | 82.5 | 8.48 | 6.41 | 499 | 16.7 |
| | 20 | 8.5 | 288 | 85.0 | 8.88 | 6.56 | 520 | 19.0 |
| | 30 | 9.0 | 336 | 86.4 | 9.13 | 7.16 | 538 | 20.8 |
| | 40 | 9.4 | 355 | 87.1 | 9.54 | 7.30 | 547 | 22.5 |
| | 50 | 10.6 | 440 | 87.9 | 9.95 | 7.74 | 553 | 24.1 |
| | 60 | 12.0 | 618 | 88.6 | 10.08 | 7.80 | 558 | 25.5 |
| | 70 | 12.6 | 783 | 89.4 | 10.22 | 7.84 | 563 | 27.3 |
| | 80 | 13.3 | 879 | 90.2 | 10.49 | 7.88 | 567 | 29.5 |
| | 90 | 14.1 | 933 | 91.6 | 10.66 | 7.92 | 573 | 33.6 |
| | 91 | 14.2 | 941 | 91.9 | 10.68 | 7.92 | 574 | 34.1 |
| | 92 | 14.3 | 945 | 92.1 | 10.69 | 7.93 | 575 | 34.6 |
| | 93 | 14.4 | 950 | 92.5 | 10.70 | 7.94 | 575 | 35.1 |
| | 94 | 14.5 | 956 | 92.8 | 10.72 | 7.95 | 576 | 36.0 |
| | 95 | 14.6 | 970 | 93.2 | 10.73 | 7.96 | 577 | 37.2 |
| | 96 | 14.7 | 977 | 93.6 | 10.75 | 7.97 | 578 | 39.2 |
| | 97 | 14.8 | 982 | 93.9 | 10.77 | 7.99 | 580 | 40.7 |
| | 98 | 15.0 | 988 | 94.2 | 10.78 | 8.02 | 584 | 43.0 |
| | 99 | 15.2 | 993 | 94.5 | 10.84 | 8.04 | 590 | 48.7 |
| | 99.5 | 15.3 | 1001 | 94.8 | 10.89 | 8.05 | 602 | 57.1 |
| | 99.9 | 15.5 | 1009 | 95.5 | 10.90 | 8.07 | 606 | 59.2 |

| <i>Table A1-1 - Continued</i> | | <i>T, °C</i> | <i>EC, : S/cm</i> | <i>Percent DO Sat</i> | <i>DO, mg/L</i> | <i>pH, s.u.</i> | <i>Eh, mV</i> | <i>Turbidity, NTU</i> |
|-------------------------------|----------------|--------------|-----------------------|---------------------------|-----------------|-----------------|---------------|---------------------------|
| MARCH | Valid | 1476 | 1476 | 1476 | 1476 | 1476 | 1476 | 1476 |
| | Missing | 11 | 11 | 11 | 11 | 11 | 11 | 11 |
| Percentiles | 0.1 | 11.3 | 257 | 79.2 | 8.06 | 7.29 | 372 | 5.6 |
| | 0.5 | 11.4 | 263 | 80.3 | 8.19 | 7.31 | 385 | 6.2 |
| | 1 | 11.5 | 266 | 80.7 | 8.24 | 7.32 | 391 | 6.7 |
| | 2 | 11.8 | 270 | 81.6 | 8.38 | 7.34 | 402 | 7.4 |
| | 3 | 11.9 | 272 | 82.1 | 8.45 | 7.35 | 407 | 7.8 |
| | 4 | 12.0 | 274 | 82.5 | 8.52 | 7.37 | 410 | 8.2 |
| | 5 | 12.1 | 275 | 82.9 | 8.58 | 7.38 | 414 | 8.5 |
| | 6 | 12.2 | 277 | 83.3 | 8.66 | 7.39 | 418 | 9.0 |
| | 7 | 12.2 | 279 | 83.6 | 8.71 | 7.41 | 420 | 9.5 |
| | 8 | 12.3 | 281 | 83.9 | 8.74 | 7.41 | 423 | 9.9 |
| | 9 | 12.4 | 283 | 84.2 | 8.76 | 7.43 | 428 | 10.2 |
| | 10 | 12.4 | 288 | 84.5 | 8.80 | 7.45 | 430 | 10.7 |
| | 20 | 12.8 | 312 | 86.2 | 8.97 | 7.75 | 454 | 14.1 |
| | 30 | 13.0 | 332 | 88.1 | 9.15 | 7.83 | 472 | 16.5 |
| | 40 | 13.2 | 354 | 89.7 | 9.38 | 7.92 | 497 | 18.2 |
| | 50 | 13.5 | 439 | 91.6 | 9.60 | 7.96 | 515 | 20.7 |
| | 60 | 13.7 | 635 | 95.9 | 9.78 | 8.01 | 528 | 23.8 |
| | 70 | 14.1 | 805 | 98.4 | 9.97 | 8.09 | 539 | 28.5 |
| | 80 | 14.6 | 874 | 99.7 | 10.27 | 8.25 | 555 | 35.4 |
| | 90 | 15.8 | 944 | 102.2 | 10.61 | 8.37 | 566 | 43.6 |
| | 91 | 15.9 | 951 | 102.8 | 10.69 | 8.37 | 566 | 45.1 |
| | 92 | 16.1 | 959 | 103.2 | 10.74 | 8.38 | 567 | 46.1 |
| | 93 | 16.3 | 963 | 103.7 | 10.77 | 8.39 | 569 | 47.6 |
| | 94 | 16.4 | 972 | 104.2 | 10.81 | 8.40 | 571 | 48.8 |
| | 95 | 16.7 | 982 | 105.4 | 10.85 | 8.40 | 574 | 50.2 |
| | 96 | 17.0 | 989 | 106.2 | 10.89 | 8.41 | 589 | 52.1 |
| | 97 | 17.4 | 1005 | 107.8 | 10.94 | 8.42 | 595 | 55.0 |
| | 98 | 17.8 | 1018 | 109.4 | 10.99 | 8.43 | 603 | 59.2 |
| | 99 | 18.5 | 1049 | 115.2 | 11.12 | 8.44 | 610 | 65.3 |
| | 99.5 | 19.1 | 1053 | 117.0 | 11.21 | 8.45 | 615 | 73.0 |
| | 99.9 | 19.5 | 1060 | 118.5 | 11.34 | 8.47 | 618 | 92.5 |

TABLE A1-2.—Rank summaries and percentiles for water quality variables measured at the TFCF from April 2000 through March 2002. Year 1 includes April 1, 2000, through March 31, 2001. Year 2 includes April 1, 2001, through March 31, 2002

| | | <i>Temperature, °C</i> | | <i>Conductivity, : S/cm</i> | | <i>DO, mg/L</i> | | <i>pH, su</i> | | <i>Turbidity, NTU</i> | | |
|--------------------|----------------|------------------------|---------------|-----------------------------|---------------|-----------------|---------------|---------------|---------------|-----------------------|---------------|-------------|
| | | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> | |
| APRIL | Valid | 1,303 | 1,423 | 1,303 | 1,423 | 1,306 | 1,423 | 1,306 | 1,423 | 1,306 | 1,423 | |
| | Missing | 137 | 15 | 137 | 15 | 134 | 15 | 134 | 15 | 134 | 15 | |
| Percentiles | 0.1 | 16.4 | 14.0 | 239 | 255 | 5.72 | 5.39 | 7.03 | 7.43 | 6.4 | 5.7 | |
| | 0.5 | 16.5 | 14.2 | 242 | 257 | 6.07 | 5.89 | 7.24 | 7.46 | 7.6 | 9.1 | |
| | 1 | 16.5 | 14.2 | 245 | 259 | 6.42 | 6.04 | 7.30 | 7.47 | 8.9 | 11.5 | |
| | 5 | 16.8 | 14.4 | 262 | 275 | 7.38 | 6.80 | 7.47 | 7.54 | 10.9 | 21.1 | |
| | 25 | 17.4 | 15.1 | 290 | 324 | 8.28 | 7.91 | 7.71 | 7.72 | 15.4 | 26.7 | |
| | Median | 50 | 17.9 | 16.3 | 359 | 399 | 8.77 | 8.74 | 8.02 | 7.79 | 21.9 | 30.8 |
| | 75 | 18.4 | 17.7 | 477 | 601 | 9.33 | 9.19 | 8.23 | 7.89 | 29.7 | 35.5 | |
| | 95 | 18.9 | 19.3 | 569 | 758 | 9.90 | 10.2 | 8.54 | 8.11 | 42.8 | 48.9 | |
| | 99 | 19.2 | 20.0 | 608 | 846 | 10.2 | 10.8 | 8.62 | 8.21 | 55.3 | 58.3 | |
| | 99.5 | 19.2 | 20.1 | 615 | 921 | 10.3 | 11.0 | 8.63 | 8.24 | 60.1 | 67.8 | |
| 99.9 | 19.5 | 20.4 | 634 | 970 | 10.3 | 11.1 | 8.65 | 8.26 | 71.1 | 328 | | |
| | | | | | | | | | | | | |
| MAY | Valid | 1,466 | 1,473 | 1,466 | 1,473 | 1,466 | 1,473 | 1,466 | 1,473 | 1,466 | 1,472 | |
| | Missing | 22 | 13 | 22 | 13 | 22 | 13 | 22 | 13 | 22 | 14 | |
| Percentiles | 0.1 | 16.9 | 17.7 | 320 | 318 | 5.90 | 3.51 | 7.35 | 7.10 | 11.2 | 11.2 | |
| | 0.5 | 17.1 | 17.8 | 324 | 330 | 6.23 | 4.70 | 7.42 | 7.16 | 13.0 | 12.3 | |
| | 1 | 17.3 | 17.9 | 330 | 331 | 6.35 | 4.94 | 7.44 | 7.18 | 14.0 | 13.1 | |
| | 5 | 17.5 | 18.3 | 342 | 334 | 6.74 | 5.45 | 7.49 | 7.24 | 16.8 | 14.4 | |
| | 25 | 18.2 | 20.9 | 362 | 344 | 7.24 | 6.03 | 7.67 | 7.39 | 23.2 | 17.0 | |
| | Median | 50 | 19.3 | 22.0 | 403 | 361 | 7.55 | 6.43 | 7.74 | 7.51 | 29.2 | 19.7 |
| | 75 | 21.5 | 23.2 | 462 | 388 | 7.81 | 6.87 | 7.81 | 7.61 | 38.9 | 28.0 | |
| | 95 | 23.3 | 24.3 | 498 | 463 | 8.32 | 7.63 | 7.99 | 7.72 | 56.9 | 44.4 | |
| | 99 | 23.9 | 24.7 | 519 | 565 | 9.03 | 7.99 | 8.21 | 7.79 | 65.9 | 58.0 | |
| | 99.5 | 24.0 | 24.8 | 524 | 592 | 9.23 | 8.13 | 8.27 | 7.81 | 70.1 | 69.5 | |
| 99.9 | 24.2 | 24.9 | 533 | 647 | 9.49 | 8.47 | 8.32 | 7.87 | 173 | 185 | | |

| Table A1-2: Continued | | Temperature, °C | | Conductivity, : S/cm | | DO, mg/L | | pH, su | | Turbidity, NTU | |
|------------------------------|----------------|------------------------|---------------|-----------------------------|---------------|-----------------|---------------|---------------|---------------|-----------------------|---------------|
| | | Year 1 | Year 2 | Year 1 | Year 2 | Year 1 | Year 2 | Year 1 | Year 2 | Year 1 | Year 2 |
| JUNE | Valid | 1,165 | 1,439 | 1,163 | 1,438 | 1,163 | 1,439 | 1,163 | 1,439 | 1,163 | 1,431 |
| | Missing | 275 | 5 | 277 | 6 | 277 | 5 | 277 | 5 | 277 | 13 |
| Percentiles | 0.1 | 19.6 | 20.8 | 243 | 279 | 3.85 | 4.01 | 7.22 | 6.84 | - | 6.5 |
| | 0.5 | 19.7 | 20.8 | 249 | 281 | 4.56 | 5.56 | 7.29 | 6.89 | - | 8.5 |
| | 1 | 19.8 | 20.9 | 250 | 282 | 5.18 | 5.78 | 7.32 | 6.91 | 0.1 | 15.2 |
| | 5 | 20.4 | 21.6 | 256 | 285 | 5.71 | 6.40 | 7.45 | 7.10 | 8.3 | 22.5 |
| | 25 | 21.5 | 22.1 | 282 | 311 | 6.48 | 6.74 | 7.67 | 7.35 | 25.6 | 31.7 |
| Median | 50 | 22.6 | 23.3 | 336 | 339 | 6.96 | 7.18 | 7.75 | 7.49 | 34.7 | 41.4 |
| | 75 | 24.6 | 24.4 | 449 | 376 | 8.21 | 7.64 | 7.82 | 7.62 | 44.8 | 55.9 |
| | 95 | 25.3 | 25.8 | 525 | 498 | 9.12 | 8.44 | 7.99 | 7.83 | 61.9 | 88.2 |
| | 99 | 25.6 | 26.1 | 561 | 589 | 10.2 | 8.84 | 8.21 | 8.01 | 71.2 | 131.1 |
| | 99.5 | 25.8 | 26.2 | 581 | 609 | 10.5 | 8.95 | 8.27 | 8.17 | 74.2 | 181.9 |
| | 99.9 | 26.0 | 26.6 | 666 | 637 | 10.9 | 9.23 | 8.32 | 8.30 | 263 | 475 |
| | | | | | | | | | | | |
| JULY | Valid | 1,063 | 1,470 | 1,070 | 1,470 | 1,065 | 1,470 | 1,070 | 1,470 | 951 | 1,462 |
| | Missing | 416 | 18 | 409 | 18 | 414 | 18 | 409 | 18 | 528 | 26 |
| Percentiles | 0.1 | 22.0 | 21.8 | 216 | 259 | 4.52 | 5.92 | 7.31 | 6.81 | 0.1 | 17.0 |
| | 0.5 | 22.1 | 21.9 | 217 | 261 | 5.22 | 6.09 | 7.32 | 6.87 | 0.3 | 18.1 |
| | 1 | 22.1 | 22.1 | 218 | 262 | 5.42 | 6.22 | 7.34 | 6.90 | 0.7 | 18.8 |
| | 5 | 22.6 | 22.6 | 225 | 271 | 6.05 | 6.52 | 7.46 | 7.19 | 4.4 | 21.6 |
| | 25 | 23.1 | 23.3 | 240 | 296 | 6.72 | 7.05 | 7.59 | 7.50 | 18.4 | 29.5 |
| Median | 50 | 23.6 | 24.3 | 247 | 314 | 7.17 | 7.51 | 7.70 | 7.65 | 23.5 | 35.5 |
| | 75 | 24.3 | 25.2 | 291 | 346 | 7.52 | 7.81 | 7.84 | 7.88 | 31.1 | 42.4 |
| | 95 | 25.3 | 26.3 | 476 | 412 | 7.90 | 8.16 | 7.97 | 8.15 | 56.1 | 61.0 |
| | 99 | 25.9 | 26.7 | 565 | 498 | 8.08 | 8.58 | 8.03 | 8.22 | 85.5 | 120 |
| | 99.5 | 26.0 | 26.8 | 620 | 509 | 8.33 | 8.66 | 8.04 | 8.24 | 136 | 158 |
| | 99.9 | 26.2 | 27.1 | 669 | 531 | 8.66 | 8.80 | 8.06 | 8.26 | 232 | 227 |

| <i>Table A1-2: Continued</i> | | <i>Temperature, °C</i> | | <i>Conductivity, : S/cm</i> | | <i>DO, mg/L</i> | | <i>pH, su</i> | | <i>Turbidity, NTU</i> | |
|------------------------------|----------------|------------------------|---------------|-----------------------------|---------------|-----------------|---------------|---------------|---------------|-----------------------|---------------|
| | | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> |
| AUGUST | Valid | 1,462 | 1,479 | 1,462 | 1,480 | 1,462 | 1,481 | 1,462 | 1,481 | 1,385 | 1,473 |
| | Missing | 26 | 9 | 26 | 8 | 26 | 7 | 26 | 7 | 103 | 15 |
| Percentiles | 0.1 | 21.4 | 22.4 | 227 | 336 | 3.99 | 5.29 | 7.48 | 7.31 | - | 9.9 |
| | 0.5 | 21.5 | 22.5 | 228 | 340 | 4.03 | 5.38 | 7.50 | 7.33 | 0.4 | 11.3 |
| | 1 | 21.6 | 22.6 | 229 | 344 | 4.06 | 5.49 | 7.51 | 7.36 | 0.8 | 11.8 |
| | 5 | 22.2 | 23.0 | 232 | 362 | 4.26 | 5.84 | 7.56 | 7.45 | 3.8 | 15.3 |
| | 25 | 23.9 | 23.7 | 241 | 416 | 4.84 | 6.60 | 7.74 | 7.71 | 14.4 | 25.0 |
| Median | 50 | 24.3 | 24.0 | 260 | 466 | 7.27 | 7.12 | 8.00 | 8.02 | 21.3 | 36.5 |
| | 75 | 24.9 | 24.5 | 301 | 503 | 7.78 | 7.56 | 8.16 | 8.12 | 29.8 | 48.9 |
| | 95 | 26.4 | 25.1 | 435 | 539 | 8.81 | 7.93 | 8.28 | 8.21 | 42.9 | 62.7 |
| | 99 | 26.9 | 25.4 | 527 | 567 | 9.21 | 8.17 | 8.42 | 8.27 | 53.4 | 87.1 |
| | 99.5 | 27.2 | 25.5 | 562 | 583 | 9.82 | 8.26 | 8.44 | 8.33 | 57.6 | 114 |
| | 99.9 | 27.4 | 25.7 | 607 | 626 | 10.1 | 8.74 | 8.53 | 8.45 | 119 | 188 |
| | | | | | | | | | | | |
| SEPTEMBER | Valid | 1,385 | 1,175 | 1,385 | 1,184 | 1,385 | 1,184 | 1,385 | 1,188 | 1,385 | 1,176 |
| | Missing | 55 | 264 | 55 | 255 | 55 | 255 | 55 | 251 | 55 | 263 |
| Percentiles | 0.1 | 20.1 | 20.0 | 273 | 400 | 6.91 | 6.49 | 7.20 | 7.23 | - | 4.8 |
| | 0.5 | 20.2 | 20.3 | 276 | 423 | 7.21 | 6.63 | 7.22 | 7.29 | - | 6.3 |
| | 1 | 20.2 | 20.4 | 278 | 434 | 7.37 | 6.75 | 7.23 | 7.29 | - | 6.7 |
| | 5 | 20.6 | 20.7 | 285 | 459 | 7.60 | 6.98 | 7.28 | 7.36 | 2.4 | 9.6 |
| | 25 | 21.3 | 21.6 | 297 | 513 | 7.95 | 7.43 | 7.50 | 7.49 | 22.5 | 15.1 |
| Median | 50 | 22.0 | 22.5 | 328 | 558 | 8.62 | 7.69 | 7.80 | 7.67 | 32.5 | 22.1 |
| | 75 | 22.6 | 23.8 | 366 | 583 | 10.6 | 7.92 | 7.95 | 7.88 | 38.8 | 35.9 |
| | 95 | 23.4 | 24.7 | 425 | 626 | 11.7 | 8.19 | 8.21 | 8.03 | 47.2 | 60.4 |
| | 99 | 23.9 | 24.9 | 486 | 655 | 12.0 | 8.35 | 8.37 | 8.14 | 57.2 | 87.4 |
| | 99.5 | 24.0 | 25.0 | 505 | 667 | 12.2 | 8.41 | 8.42 | 8.26 | 70.4 | 118 |
| | 99.9 | 24.1 | 25.0 | 533 | 694 | 12.4 | 8.53 | 8.48 | 8.39 | 102 | 337 |

| <i>Table A1-2: Continued</i> | | <i>Temperature, °C</i> | | <i>Conductivity, : S/cm</i> | | <i>DO, mg/L</i> | | <i>pH, su</i> | | <i>Turbidity, NTU</i> | |
|------------------------------|----------------|------------------------|---------------|-----------------------------|---------------|-----------------|---------------|---------------|---------------|-----------------------|---------------|
| | | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> |
| OCTOBER | <i>Valid</i> | 1,443 | 1,282 | 1,443 | 1,285 | 1,443 | 1,283 | 1,443 | 1,285 | 1,319 | 1,284 |
| | <i>Missing</i> | 32 | 205 | 32 | 202 | 32 | 204 | 32 | 202 | 156 | 203 |
| Percentiles | 0.1 | 13.9 | 17.4 | 315 | 392 | 6.63 | 6.58 | 7.33 | 6.93 | - | 6.6 |
| | 0.5 | 14.1 | 17.4 | 324 | 403 | 6.74 | 6.81 | 7.38 | 6.95 | - | 7.4 |
| | 1 | 14.2 | 17.5 | 329 | 412 | 6.82 | 6.91 | 7.39 | 6.97 | - | 8.2 |
| | 5 | 14.7 | 17.8 | 346 | 460 | 7.30 | 7.14 | 7.46 | 7.00 | 10.2 | 10.3 |
| | 25 | 15.7 | 18.1 | 381 | 506 | 7.70 | 7.52 | 7.54 | 7.31 | 16.2 | 13.3 |
| Median | 50 | 18.7 | 19.4 | 417 | 563 | 8.30 | 7.73 | 7.61 | 7.43 | 21.7 | 15.8 |
| | 75 | 20.4 | 20.5 | 452 | 605 | 8.67 | 7.93 | 7.70 | 7.75 | 29.3 | 19.2 |
| | 95 | 21.9 | 21.8 | 504 | 640 | 9.28 | 8.32 | 7.83 | 7.83 | 115 | 26.8 |
| | 99 | 22.1 | 22.1 | 569 | 681 | 9.47 | 8.48 | 7.93 | 7.85 | 288 | 39.7 |
| | 99.5 | 22.3 | 22.1 | 584 | 693 | 9.50 | 8.51 | 7.96 | 7.87 | 381 | 42.8 |
| | 99.9 | 22.5 | 22.3 | 609 | 738 | 9.61 | 8.55 | 8.02 | 7.89 | 547 | 57.2 |
| | | | | | | | | | | | |
| NOVEMBER | <i>Valid</i> | 1401 | 1433 | 1401 | 1431 | 1401 | 1430 | 1401 | 1431 | 1397 | 1429 |
| | <i>Missing</i> | 37 | 7 | 37 | 9 | 37 | 10 | 37 | 9 | 41 | 11 |
| Percentiles | 0.1 | 10.2 | 10.5 | 216 | 414 | 5.37 | 6.73 | 7.32 | 7.29 | 3.2 | 3.9 |
| | 0.5 | 10.3 | 10.7 | 217 | 424 | 5.91 | 6.80 | 7.41 | 7.33 | 3.9 | 4.8 |
| | 1 | 10.3 | 10.9 | 218 | 431 | 6.23 | 6.83 | 7.43 | 7.33 | 5.9 | 5.2 |
| | 5 | 10.4 | 11.6 | 226 | 460 | 7.12 | 7.47 | 7.47 | 7.38 | 8.9 | 7.5 |
| | 25 | 10.9 | 14.9 | 414 | 496 | 8.73 | 8.15 | 7.53 | 7.46 | 13.6 | 13.0 |
| Median | 50 | 11.8 | 15.8 | 497 | 536 | 9.53 | 8.44 | 7.60 | 7.55 | 19.3 | 17.5 |
| | 75 | 14.3 | 16.5 | 545 | 579 | 9.80 | 8.72 | 7.73 | 7.68 | 32.9 | 23.2 |
| | 95 | 14.5 | 17.5 | 632 | 752 | 10.3 | 9.37 | 7.96 | 7.85 | 132 | 42.9 |
| | 99 | 14.6 | 17.7 | 661 | 805 | 10.6 | 9.72 | 8.03 | 7.96 | 156 | 59.9 |
| | 99.5 | 14.6 | 17.7 | 668 | 811 | 10.7 | 9.75 | 8.04 | 7.98 | 165 | 65.4 |
| | 99.9 | 15.1 | 17.8 | 688 | 873 | 10.8 | 9.84 | 8.08 | 8.05 | 335 | 86.3 |

| Table A1-2: Continued | | Temperature, °C | | Conductivity, : S/cm | | DO, mg/L | | pH, su | | Turbidity, NTU | |
|-----------------------|----------------|-----------------|-------------|----------------------|------------|-------------|-------------|-------------|-------------|----------------|-------------|
| | | Year 1 | Year 2 | Year 1 | Year 2 | Year 1 | Year 2 | Year 1 | Year 2 | Year 1 | Year 2 |
| DECEMBER | Valid | 1,482 | 1,468 | 1,480 | 1,465 | 1,480 | 1,463 | 1,480 | 1,465 | 1,480 | 1,463 |
| | Missing | 6 | 19 | 8 | 22 | 8 | 24 | 8 | 22 | 8 | 24 |
| Percentiles | 0.1 | 8.1 | 7.7 | 392 | 263 | 8.11 | 6.75 | 7.12 | 7.34 | 3.5 | - |
| | 0.5 | 8.2 | 7.7 | 395 | 265 | 8.17 | 6.97 | 7.13 | 7.45 | 4.2 | 6.1 |
| | 1 | 8.3 | 7.8 | 402 | 271 | 8.20 | 7.45 | 7.14 | 7.46 | 4.9 | 8.3 |
| | 5 | 9.0 | 8.1 | 428 | 305 | 8.52 | 8.07 | 7.16 | 7.51 | 5.9 | 12.2 |
| | 25 | 9.7 | 9.3 | 498 | 514 | 8.86 | 9.52 | 7.37 | 7.77 | 9.8 | 17.3 |
| Median | 50 | 10.0 | 10.0 | 554 | 587 | 9.04 | 10.1 | 7.49 | 7.85 | 15.8 | 22.1 |
| | 75 | 10.3 | 10.7 | 656 | 684 | 10.0 | 10.5 | 7.60 | 7.90 | 84.0 | 28.3 |
| | 95 | 11.3 | 11.3 | 736 | 822 | 10.5 | 11.1 | 7.69 | 8.19 | 96.5 | 38.8 |
| | 99 | 11.6 | 12.3 | 752 | 938 | 10.6 | 11.4 | 7.74 | 8.34 | 107 | 51.1 |
| | 99.5 | 11.6 | 12.5 | 757 | 983 | 10.7 | 11.6 | 7.76 | 8.37 | 111 | 56.7 |
| | 99.9 | 11.8 | 12.8 | 804 | 1,019 | 10.8 | 11.7 | 7.81 | 8.41 | 121 | 73.4 |
| | | | | | | | | | | | |
| JANUARY | Valid | 1,137 | 1,473 | 1,464 | 1,473 | 1,451 | 1,473 | 1,155 | 1,473 | 1,464 | 1,473 |
| | Missing | 351 | 15 | 24 | 15 | 37 | 15 | 333 | 15 | 24 | 15 |
| Percentiles | 0.1 | 7.3 | 7.4 | 422 | 238 | 3.38 | 6.68 | 6.29 | 6.85 | 1.7 | 7.2 |
| | 0.5 | 7.4 | 7.5 | 436 | 241 | 3.49 | 6.78 | 6.41 | 6.87 | 2.2 | 9.6 |
| | 1 | 7.5 | 7.7 | 443 | 242 | 3.67 | 6.85 | 6.46 | 6.88 | 2.4 | 10.2 |
| | 5 | 7.6 | 8.0 | 472 | 255 | 5.11 | 7.18 | 6.74 | 6.97 | 3.2 | 11.6 |
| | 25 | 7.9 | 8.4 | 540 | 363 | 9.23 | 7.74 | 7.44 | 7.12 | 8.7 | 16.6 |
| Median | 50 | 8.3 | 9.8 | 635 | 456 | 9.71 | 8.60 | 7.58 | 7.37 | 17.9 | 20.8 |
| | 75 | 8.6 | 11.0 | 732 | 673 | 10.4 | 9.84 | 7.75 | 7.58 | 21.6 | 26.3 |
| | 95 | 9.2 | 11.7 | 851 | 984 | 11.1 | 10.6 | 8.02 | 7.84 | 76.0 | 46.5 |
| | 99 | 9.6 | 12.4 | 958 | 1,019 | 11.6 | 10.7 | 8.09 | 7.96 | 105 | 65.5 |
| | 99.5 | 9.7 | 12.7 | 1,009 | 1,025 | 11.9 | 10.8 | 8.09 | 8.01 | 139 | 69.2 |
| | 99.9 | 9.9 | 12.8 | 1,083 | 1,046 | 12.2 | 10.8 | 8.10 | 8.09 | 550 | 76.9 |

| <i>Table A1-2: Continued</i> | | <i>Temperature, °C</i> | | <i>Conductivity, : S/cm</i> | | <i>DO, mg/L</i> | | <i>pH, su</i> | | <i>Turbidity, NTU</i> | |
|------------------------------|-----------------------|------------------------|---------------|-----------------------------|---------------|-----------------|---------------|---------------|---------------|-----------------------|---------------|
| | | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> |
| <i>FEBRUARY</i> | <i>Valid</i> | 1,332 | 950 | 1,332 | 950 | 1,332 | 950 | 1,332 | 950 | 1,332 | 950 |
| | <i>Missing</i> | 12 | 394 | 12 | 394 | 12 | 394 | 12 | 394 | 12 | 394 |
| <i>Percentiles</i> | <i>0.1</i> | 8.0 | 7.5 | 371 | 241 | 8.68 | 7.82 | 6.82 | 6.29 | 13.9 | 8.9 |
| | <i>0.5</i> | 8.0 | 7.6 | 374 | 250 | 8.79 | 7.94 | 6.83 | 6.30 | 14.9 | 11.6 |
| | <i>1</i> | 8.0 | 7.7 | 377 | 252 | 8.82 | 7.98 | 6.85 | 6.31 | 15.6 | 12.4 |
| | <i>5</i> | 8.2 | 7.9 | 383 | 258 | 8.96 | 8.21 | 6.89 | 6.36 | 17.7 | 14.7 |
| | <i>25</i> | 8.8 | 8.8 | 417 | 330 | 9.40 | 9.03 | 7.07 | 6.65 | 22.7 | 20.0 |
| <i>Median</i> | <i>50</i> | 9.5 | 10.6 | 464 | 440 | 9.80 | 9.95 | 7.42 | 7.74 | 26.7 | 24.1 |
| | <i>75</i> | 10.3 | 13.0 | 691 | 841 | 10.2 | 10.4 | 7.57 | 7.85 | 32.0 | 28.4 |
| | <i>95</i> | 11.7 | 14.6 | 976 | 971 | 10.6 | 10.7 | 7.63 | 7.96 | 62.4 | 37.2 |
| | <i>99</i> | 12.1 | 15.2 | 1,048 | 993 | 10.7 | 10.8 | 7.65 | 8.04 | 151 | 48.7 |
| | <i>99.5</i> | 12.2 | 15.3 | 1,054 | 1,001 | 10.7 | 10.9 | 7.67 | 8.05 | 164 | 57.1 |
| | <i>99.9</i> | 12.4 | 15.5 | 1,066 | 1,009 | 10.7 | 10.9 | 7.68 | 8.07 | 248 | 59.2 |
| | | | | | | | | | | | |
| <i>MARCH</i> | <i>Valid</i> | 1,478 | 1,476 | 1,475 | 1,476 | 1,475 | 1,476 | 1,475 | 1,476 | 1,475 | 1,476 |
| | <i>Missing</i> | 10 | 11 | 13 | 11 | 13 | 11 | 13 | 11 | 13 | 11 |
| <i>Percentiles</i> | <i>0.1</i> | 10.4 | 11.3 | 307 | 256 | 6.03 | 8.06 | 6.80 | 7.29 | 6.1 | 5.6 |
| | <i>0.5</i> | 10.6 | 11.4 | 311 | 263 | 6.90 | 8.19 | 6.82 | 7.31 | 7.6 | 6.2 |
| | <i>1</i> | 10.8 | 11.5 | 313 | 266 | 6.98 | 8.24 | 6.84 | 7.32 | 8.4 | 6.7 |
| | <i>5</i> | 11.1 | 12.1 | 346 | 275 | 7.24 | 8.58 | 6.97 | 7.38 | 19.4 | 8.5 |
| | <i>25</i> | 12.7 | 12.9 | 428 | 323 | 7.79 | 9.04 | 7.27 | 7.79 | 24.3 | 15.4 |
| <i>Median</i> | <i>50</i> | 15.0 | 13.5 | 589 | 439 | 8.16 | 9.60 | 7.36 | 7.96 | 28.6 | 20.7 |
| | <i>75</i> | 17.6 | 14.3 | 808 | 848 | 9.18 | 10.2 | 7.47 | 8.21 | 34.3 | 31.6 |
| | <i>95</i> | 18.8 | 16.7 | 1,092 | 982 | 9.69 | 10.9 | 7.74 | 8.40 | 48.3 | 50.2 |
| | <i>99</i> | 19.5 | 18.4 | 1,150 | 1,049 | 9.98 | 11.1 | 7.88 | 8.44 | 62.6 | 65.3 |
| | <i>99.5</i> | 19.7 | 19.1 | 1,173 | 1,053 | 10.1 | 11.2 | 7.90 | 8.45 | 68.9 | 73.0 |
| | <i>99.9</i> | 19.7 | 19.6 | 1,219 | 1,060 | 10.4 | 11.3 | 7.92 | 8.47 | 325 | 92.5 |

| <i>Table A1-2: Continued</i> | | <i>Temperature, °C</i> | | <i>Conductivity, : S/cm</i> | | <i>DO, mg/L</i> | | <i>pH, su</i> | | <i>Turbidity, NTU</i> | |
|------------------------------|-----------------------|------------------------|---------------|-----------------------------|---------------|-----------------|---------------|---------------|---------------|-----------------------|---------------|
| | | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> | <i>Year 1</i> | <i>Year 2</i> |
| <i>ALL DATA</i> | <i>Valid</i> | 16,117 | 16,541 | 16,444 | 16,548 | 16,429 | 16,545 | 16,138 | 16,554 | 16123 | 16512 |
| | <i>Missing</i> | 1,379 | 975 | 1,052 | 968 | 1,067 | 971 | 1,358 | 962 | 1373 | 1004 |
| <i>Percentiles</i> | <i>0.1</i> | 7.47 | 7.55 | 217 | 243 | 3.70 | 4.90 | 6.49 | 6.32 | 0.0 | 5.1 |
| | <i>0.5</i> | 7.61 | 7.80 | 224 | 254 | 4.14 | 5.44 | 6.82 | 6.39 | 0.0 | 6.7 |
| | <i>1</i> | 7.73 | 8.00 | 227 | 259 | 4.35 | 5.64 | 6.88 | 6.52 | 2.1 | 7.6 |
| | <i>5</i> | 8.36 | 8.70 | 241 | 282 | 6.25 | 6.24 | 7.13 | 7.08 | 6.6 | 11.4 |
| | <i>25</i> | 10.9 | 12.8 | 327 | 348 | 7.55 | 7.28 | 7.49 | 7.45 | 17.0 | 17.5 |
| <i>Median</i> | <i>50</i> | 18.0 | 18.1 | 426 | 463 | 8.49 | 7.94 | 7.64 | 7.65 | 24.6 | 24.8 |
| | <i>75</i> | 22.1 | 23.2 | 534 | 573 | 9.50 | 9.08 | 7.81 | 7.86 | 34.1 | 35.3 |
| | <i>95</i> | 24.7 | 24.9 | 775 | 849 | 10.5 | 10.5 | 8.18 | 8.15 | 79.0 | 56.4 |
| | <i>99</i> | 26.0 | 26.1 | 1031 | 985 | 11.3 | 10.9 | 8.47 | 8.37 | 131 | 82.2 |
| | <i>99.5</i> | 26.4 | 26.3 | 1086 | 1008 | 11.7 | 11.1 | 8.53 | 8.40 | 156 | 99.9 |
| | <i>99.9</i> | 26.9 | 26.6 | 1148 | 1046 | 12.0 | 11.3 | 8.61 | 8.44 | 315 | 184 |