CENTRAL ARIZONA PROJECT

ANNUAL WATER QUALITY REPORT

1996

Central Arizona Project

23636 North Seventh Street, Phoenix, Arizona 85024-3899 (602) 870-2333

May 1, 1997

Dear Reader:

The Central Arizona Project (CAP) is pleased to provide you with our first Annual Water Quality Report. This report offers our staff, customers, and other interested parties a summary of the 1996 water quality monitoring program. The information is intended to assist in the operation, maintenance, planning, and implementation of facilities and programs involving CAP water.

In 1996, the CAP delivered over 1.1 million acre-feet of water to customers in central and southern Arizona. As part of our responsibility for maintaining Arizona's single largest resource for renewable water supplies, we are taking an active role in monitoring and managing the water quality.

The development of the water quality monitoring program has been a joint effort with contributions from personnel in our Water Control, Environmental, Electronics, and Engineering Departments. In addition, discussions and feedback from several meetings with our M&I customers and other water users have enabled us to respond to their needs and desires and this relationship will continue into the future.

We hope this report is informative and beneficial. If you have any questions or suggestions, please contact me at (602) 870-2563 or Brian Henning at (602) 870-2567.

Sincerely,

Tim Kacerek

Timothy F. Kacerek, P.E.
Water Control Manager

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Prepared by the Water Control Department
May 1, 1997

BACKGROUND

The Central Arizona Project (CAP) delivers Colorado River water from Lake Havasu on Arizona's western border to central and southern Arizona. The total CAP system is 336 miles long and consists of open channel canals, siphon pipelines, tunnels, pumping plants, check structures, and turnouts. The CAP is Arizona's largest supplier of renewable water.

The CAP is a multi-purpose project and will deliver an average of 1.5 million acre-feet of water each year to cities, industries, Indian communities, and agricultural customers as it crosses the arid desert. The Colorado River water offsets groundwater mining which benefits the state in water conservation, long-term storage for future use, supplementing surface water supplies, and complying with the Arizona Groundwater Management Act. The CAP also provides flood control, power management, recreation, and fish and wildlife benefits. Other water-short areas of Arizona or other states such as California, Nevada, and New Mexico, may benefit from the CAP through water exchanges.

The CAP has a fully operational connection with the Salt River Project (SRP) canal system. This allows transfers and delivery of Colorado River water to SRP for customer use and direct recharge. SRP manages and operates a storage reservoir and canal system which supplies water to a 240,000 acre service area within the metropolitan area of Phoenix, Arizona.

WATER QUALITY STANDARDS

The CAP does not provide potable water directly to the public. Instead, the CAP is a raw water supplier and delivers Colorado River water to the municipal water treatment plants. These plants perform filtering and disinfection of the water to remove suspended particles and bacteria. The treated water is pumped through the municipal distribution system for domestic use.

The CAP has developed and performs a water quality monitoring program which addresses three areas:

1) Ongoing monitoring of primary pollutants and general water chemistry.
2) Ongoing corrosion and materials studies.
3) Customers' parameters of interest.

Water quality monitoring provides data and information to CAP staff and customers about patterns and trends in the canal and Lake Pleasant water quality. The data can also be used to identify potential pollution sources.

Water comes from two basic sources: (1) Colorado River, and (2) Lake Pleasant. As previously mentioned, the Colorado River is the main source of CAP water, but Agua Fria River inflows from rainfall/runoff on the Lake Pleasant watershed can mix with Colorado River water that is stored in the reservoir.

The canal system has cross-drainage overchute structures which are designed to prevent any offsite runoff from entering the canal. Onsite runoff along the aqueduct is minimal.

WATER QUALITY PROGRAM

The water quality program consists of scheduled grab samples which are analyzed by a commercial laboratory, and real-time water quality data from sensors installed at various locations along the canal system.

Grab Sample Program:

In January 1996, the CAP contracted with Montgomery Watson Laboratories, a State of Arizona licensed and certified laboratory, to perform the water quality grab sample tests. This program includes the following constituents and sampling sites:

- Water Quality Constituents:

General Parameters:	Temperature	(field measured)
	pH	(field measured)
	Dissolved Oxygen (DO)	(field measured)
	Conductivity	(field & lab measured)
	Total Dissolved Solids (TDS)	
	Alkalinity	
	Calcium	
	Chloride	
	Copper	
	Iron	
	Magnesium	
	Manganese	
	Sulfides	
	Turbidity	
	Total Algae Counts	
	Total Organic Carbon (TOC)	
Taste and Odor:	MIB / Geosmin	
Pathogens:	Giardia / Cryptosporidium	

Priority Pollutants:	Heavy Metals (As,Cd,Cr,Pb,Hg,Se,Ag)
	Volatile Organic Compounds (VOC's)
	Volatile Organic Aromatics (VOA's)
	Organophosphorus Pesticides
	Carbamate Pesticides
	Chlorinated Herbicides

The general parameters were sampled weekly and monthly depending on the scheduled site. The priority pollutants were sampled quarterly and the pathogens were sampled bi-monthly. MIB & Geosmin were sampled as needed which was mostly during the summer months.

- Water Quality Sampling Sites:

	CAP Canal at Milepost
Havasu Pump Plant	0
Little Harquahala Pump Plant	58
99th Avenue	149
7th Street	161
McKellips Road	194
Brady Pump Plant	254
San Xavier Pump Plant	318

The water quality data is presented in the attached tables. The data represents average monthly values for each site, including the yearly mean, maximum, and minimum. In addition, several graphs are attached which provide a graphical representation of site and time comparisons.

Real-Time Water Quality Program:

The real-time water quality program consists of a Hach turbidity meter and a Hydrolab multi-probe sensor installed at each of three sites:

(1) Havasu Pump Plant
(2) Hassayampa Pump Plant
(3) Waddell Pump/Generator Plant

The real-time data is collected and stored in the CAP's control system database and daily summary reports are generated. The following are the real-time parameters:

Hach: Turbidity (0-1000 NTU)

Hydrolab:

- Temperature
- pH
- Dissolved Oxygen
- Conductivity
- Total Dissolved Solids
- Turbidity

The real-time water quality data is available to the general public by calling a phone interface program on the CAP's control system. The number is (602) 870-2182.

HISTORICAL WATER QUALITY

Prior to 1996, the USBR and CAWCD had cooperated with the United States Geological Survey (USGS) for a water quality sampling program. The USGS collected monthly and quarterly grab samples at three sites on the CAP canal system:

(1) Planet Ranch Road bridge (MP 8)
(2) 7th street bridge (MP 162)
(3) County Road bridge just upstream of the Santa Rosa Turnout (MP 162)

The water quality program tested and analyzed over 50 parameters and the historical CAP water quality data is available in the annual USGS Water Resources Data for Arizona reports. The period of record for the historical data is October 1985 through September 1995. The cooperative agreement with the USGS sampling program expired on September 30, 1995.

Copies of the USGS annual reports can be obtained by contacting the USGS Tucson Office at (520) 670-6671.

Additionally, two real-time water quality monitoring stations were installed at Check Structure 11 (MP 106) and Check Structure 20 (MP 157) on the CAP canal system. The parameters included temperature, pH, conductivity, dissolved oxygen, and turbidity and the real-time data was monitored, collected and stored in the control system database. Daily summary reports were generated. As previously discussed, new real-time sensors were installed in 1996, and consequently, the water quality sensors and equipment have been abandoned at the two check structure sites.

The data from these two abandoned water quality programs is not included in this report.

LAKE PLEASANT RESERVOIR

The CAP aqueduct system utilizes Lake Pleasant as a seasonal pump-storage reservoir. During a typical year, Colorado River water is pumped into the lake from mid-October to mid-June when water demands and electricity costs are lower. From mid-June to mid-October, when water demands and electricity costs are higher, water is released from the lake for customer deliveries, while generating electricity and minimizing CAP pumping from the Colorado River.

The Agua Fria River drains into Lake Pleasant and the inflows vary each year. During dry years on the watershed, the reservoir storage is mostly Colorado River water, and during wet years with substantial runoff, the reservoir has a blend of Colorado River and Agua Fria River water.

The CAP administered three separate water quality sampling programs on Lake Pleasant in 1996:

(1) Sampling at Upper and Lower Portals of Intake Towers:

The CAP began scheduled water quality monitoring of Lake Pleasant in May 1995. The one-year program was contracted to Bolin Laboratories, a State of Arizona licensed laboratory, and consisted of monthly samples at the upper and lower intake portals on the towers. Initially, general parameters were analyzed, and in 1996, the monitoring included priority pollutants and heavy metals.

Refer to the attached tables for Lake Pleasant which present the monthly data from May 1995 through April 1996.

(2) Sampling at 20 & 100 foot depths - Intake Towers:

The water quality grab sampling contract with Montgomery Watson included this program. Refer to the attached tables which present Lake Pleasant monthly data at the corresponding depths from January 1996 through December 1996.

In general, the overall water quality of the Agua Fria River does not significantly differ from the Colorado River. Historically, the amount of total dissolved solids has been lower in the Agua Fria River water. During 1996, dry conditions prevailed and the Agua Fria River inflows to Lake Pleasant were 10% of normal, therefore the water chemistry parameters were very similar to Colorado River water. Refer to the attached table comparing Lake Havasu and Lake Pleasant data.

(3) Lake Pleasant Depth Profiles:

The largest changes in lake water chemistry are related to depth. Beginning in

May 1996, temperature, pH, specific conductivity, and dissolved oxygen were analyzed in depth profiles at four locations on the reservoir: (1) south side of intake towers, (2) north side of intake towers, (3) 2,000 yards north of New Waddell Dam, and (4) north of the submerged Old Waddell Dam. The profiles were completed by CAP staff who used a portable Hydrolab multi-probe water quality sensor.

Until December 1996, the profiles indicated that stratification occurred within the lake and a distinctive thermocline or boundary was formed between two layers. The upper layer (epilimnion) was oxygen rich, with a higher temperature, as well as having a slightly higher pH, conductivity, and TDS. The lower layer (hypolimnion), was very low in dissolved oxygen (anoxic conditions) with lower temperatures and slightly lower pH, conductivity, and TDS. Refer to the attached graphs for Lake Pleasant depth profiles on May 17 and October 4, 1996.

The oxygen deficit conditions at the lower depths may have profound impacts on water chemistry and composition. If the sediment/water interface is exposed to prolonged periods of anoxia, reducing conditions may prevail. This reduction may lead to sapropel formation, a compound which is high in hydrogen sulfide and methane and has a shiny, black color due to the presence of ferrous sulfide. This compound is responsible for the occasional "rotten-egg" odor associated with water releases from the hypolimnion layer through the lower portal on the intake towers. Additionally, nutrients, such as nitrogen and phosphorous become unbound from their ionic association with metals, such as iron, manganese, and aluminum. This process may free up nutrients which contribute to algae blooms in the canal system, and precipitate iron and manganese which causes discolored water and treatment problems.

The stratification forms during the latter part of the summer and fall, and the December 1996 profile indicated that between the November and December profiling samples, the lake had "turned over". This phenomenon is caused by the decrease in surface water temperatures which increase the surface water density and result in displacement or mixing of surface water with deeper water. This restores the lake to more uniform water chemistry profiles throughout the winter until the warming cycle begins again during the summer.

TASTE AND ODOR: COOPERATIVE RESEARCH PROGRAM

Municipal water treatment plants, that treat surface water supplies from the CAP and SRP systems, have experienced seasonal taste and odor episodes. The water has a "musty-moldy-earthy" taste and odor and is suspected to be associated with biological activity in reservoirs and canal systems. Currently, the water treatment plants apply activated carbon to reduce the offensive tastes and odors, but this method is expensive and does not control the substances which produce the taste and odor problems outside the water

treatment plants.

To address this issue, a jointly-funded research program was initiated in April 1996. The study will be a two (2) year program with a total cost of $180,000. The participants include the CAP, SRP, and the cities of Chandler, Glendale, Mesa, Scottsdale, and Tempe. The joint funding is approximately $15,000 per year per participant.

A University of Arizona research team was selected for this project and the objectives are:

- Identify sources and mechanisms of the taste and odor problems
- Present recommendations to prevent the taste and odor problems in drinking water

Compounds produced by Cyanobacteria (blue-green algae) are the suspect cause for the taste and odor problems. The research project will monitor and analyze several of the compounds. Two of the most common compounds are Geosmin and 2-methylisoborneol (MIB) which can produce odors at levels as low as 1 part per trillion (ppt). It should be noted that MIB and Geosmin are included in the water quality parameters of the CAP grab sampling program.

ANNUAL CANAL FLUSH

In 1996, due to the Centennial Siphon repair project, water deliveries were exclusively released from Lake Pleasant from July through November. During this time period, deliveries from the Colorado River ended at the Tonopah Turnout and the remaining 40 miles of CAP canal to the Waddell Turnout was inactive and stagnant.

Each year, in an effort to minimize the water quality impacts on CAP customers, this water is pumped into Lake Pleasant for a two day period.

The flush occurred December 3-4, 1996. Capacity flows of 3,000 cfs were pumped into Lake Pleasant, and concurrently, water deliveries were supplied from canal storage.

This has been a successful procedure over the last two years. A majority of the stagnant water and particulates were discharged into the reservoir and fresh Colorado River water replenished the canal system as normal flows and deliveries were resumed.

Water quality data indicated that during the flush, turbidity values abruptly increased from 2 NTU to 400-500 NTU and pH levels lowered from 8.8 to 8.1. Dissolved oxygen dropped from 10.0 mg/l to 7 mg/l. Conductivity and TDS did not significantly change.

WATER QUALITY IMPACT FROM BILL WILLIAMS RIVER

As previously mentioned, the CAP aqueduct system begins at Lake Havasu. The intake area for the Havasu Pumping Plant is located in a bay-like feature which is at the mouth of the Bill Williams River as it flows into Lake Havasu. The Bill Williams River together with its head waters at Alamo Lake, form the majority of the drainage area of west-central Arizona. During periods of heavy rainfall and runoff, the flows in the Bill Williams River dominate this area of Lake Havasu, and the water quality tends to be low in TDS but very turbid with high concentrations of organic matter and suspended sediments along with strong odors.

The water quality deteriorates and causes treatment problems for the municipalities. To avoid pumping this water into the CAP system and delivering it to customers, the Havasu pumps are shutdown until the water quality improves and clears up.

In 1993 and 1995, the Havasu pumping had to be curtailed for a week or more due to the releases from Alamo Lake. The reservoir watershed was dry in 1996 with little or no runoff, therefore no water quality episodes occurred on the Bill Williams River.

GENERAL DISCUSSION

Overall, the CAP water quality is very good. Many variables determine the quality of water and not just a single constituent.

Turbidity ▸ The suspended solids are very low with turbidity levels averaging 1-3 NTU with an occasional spike exceeding 100 NTU. The water in the canal and Lake Pleasant is very clear, and the lake bottom can be seen at depths of 25-30 feet. In general, when canal flows are lower or steady, the turbidity is low; when large flow increases occur, the higher velocities cause an increase in suspended particles and turbidity levels spike up until a new equilibrium is reached and the suspended material either settles in the pumping plant forebays or is diverted through the turnouts.

TDS ▸ Total dissolved solids represent the concentration of dissolved minerals in the water. The TDS levels in CAP water are high when compared to most groundwater sources. For the year, the average TDS was 680 mg/l and maintained consistent values throughout the canal system until the southern end near Tucson, where the average TDS was 870 mg/l. The high TDS concentrations in the Tucson area can be attributed to low water deliveries, minimal flows for water replenishment in the stagnant areas of the canal, and evaporation & seepage losses which further concentrate the minerals. Until regular deliveries are resumed in the Tucson area, the canal will remain in a stagnant mode and most constituents will remain at higher concentrations than normal.

pH ▸ The average pH ranged from 8.3 at the Havasu area to 8.9 at the Tucson area.

The increase in pH can be attributed to the progressive increase in dissolved, alkaline minerals due to the reasons mentioned in the previous paragraph.

Temperature ▸ Average temperatures for the year ranged from 67 to 70 degrees Fahrenheit with minimal differences between the Havasu, Phoenix, and Tucson areas of the canal system. However, monthly and seasonal temperatures varied considerably along the canal system. Refer to the attached 1996 water quality data tables.

TOC ▸ The average concentration of total organic carbon ranged from 2.9 mg/l at Havasu and progressively increased to 7.9 mg/l at the Tucson area. TOC is representative of the algae and other organic matter in the CAP water.

DO ▸ The average dissolved oxygen levels were fairly uniform throughout the canal system. However, the Havasu area had a lower average DO of 7.3 mg/l, which increased to an average 9.3 mg/l in the Phoenix area, then decreased to 7.6 mg/l in the Tucson area.

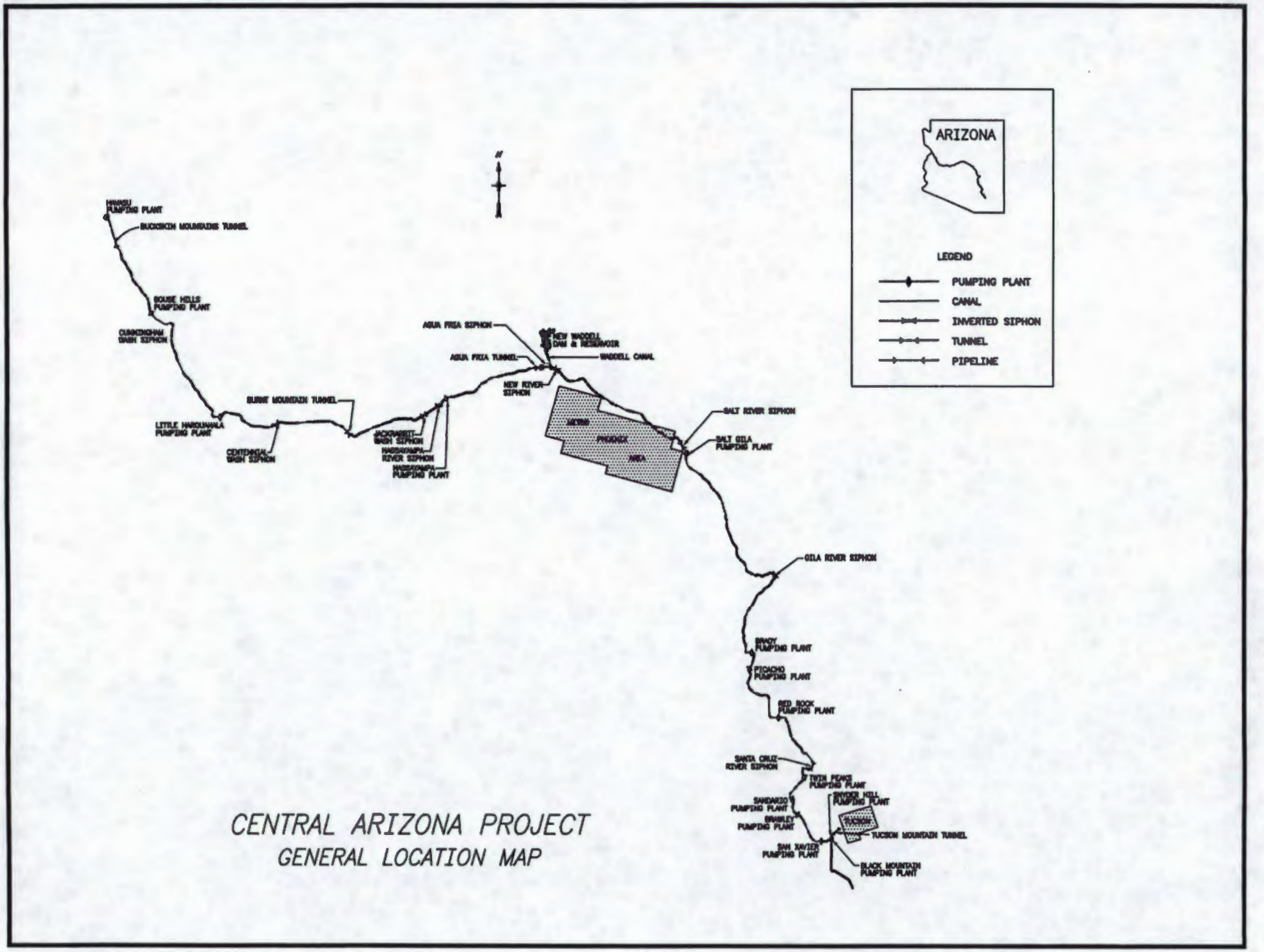
The differences in DO are not significant, but as discussed in the Lake Pleasant section, the lower DO in the southern end of the canal system would tend to free up more nutrients and with the higher water temperatures during the summer months, these conditions could attribute to the increase in biological growth and TOC levels.

Metals ▸ The concentrations of dissolved heavy metals are very low to undetectable throughout the CAP canal system.

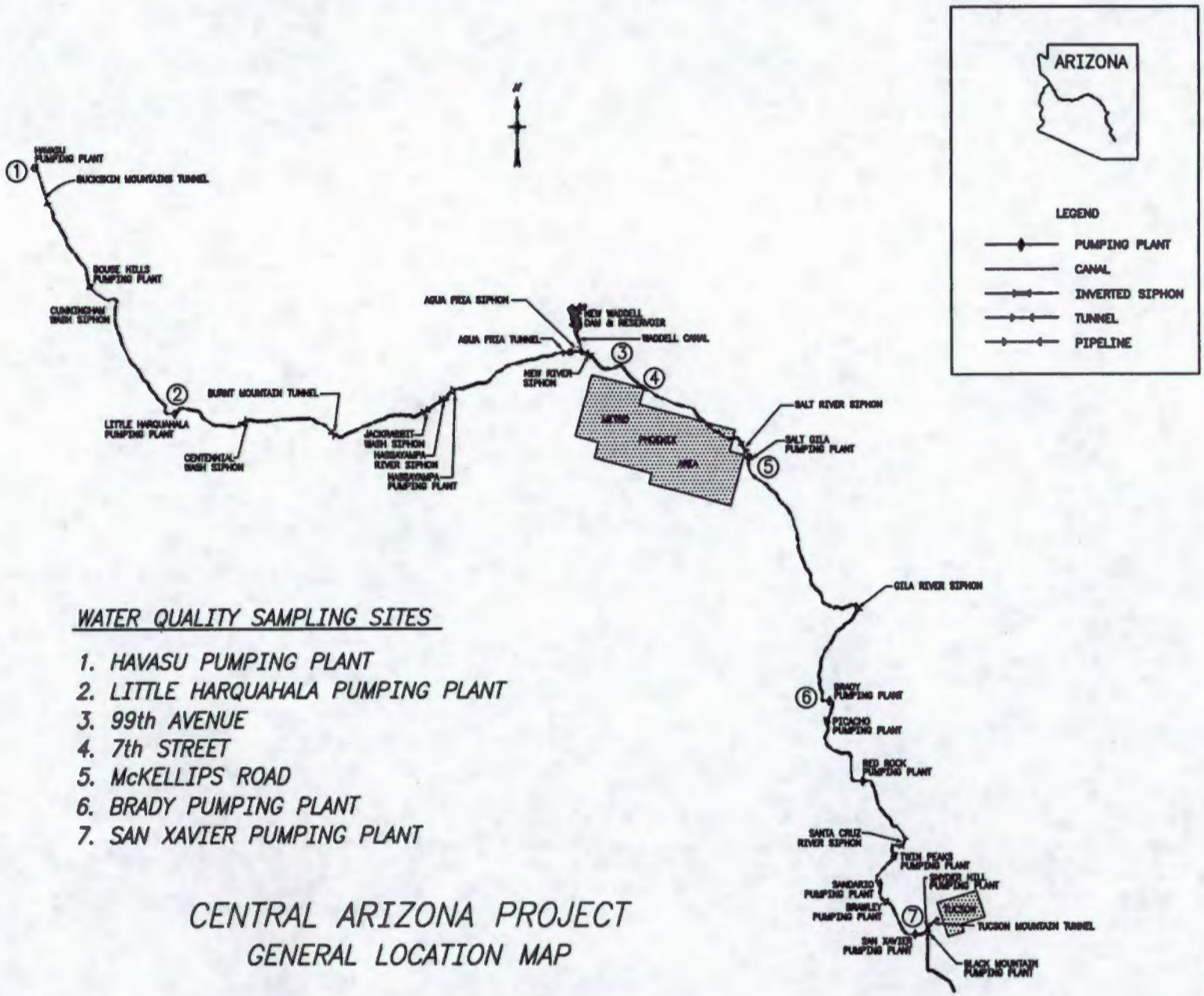
Pathogens ▸ A significant amount of public drinking water in the urban areas of central and southern Arizona is treated CAP water. One of the biggest concerns is the presence of pathogens in treated water, including Giardia and Cryptosporidium. In 1996, all designated sampling sites on the CAP system produced non-detectable results for Giardia and Cryptosporidium.

SUMMARY

This report has presented and discussed a variety of parameters in the CAP water quality monitoring program. The CAP is sensitive to customer needs, and as changes occur along with increased interest in other constituents, the water quality monitoring and sampling program will be revised accordingly and the data will be published in future annual water quality reports.



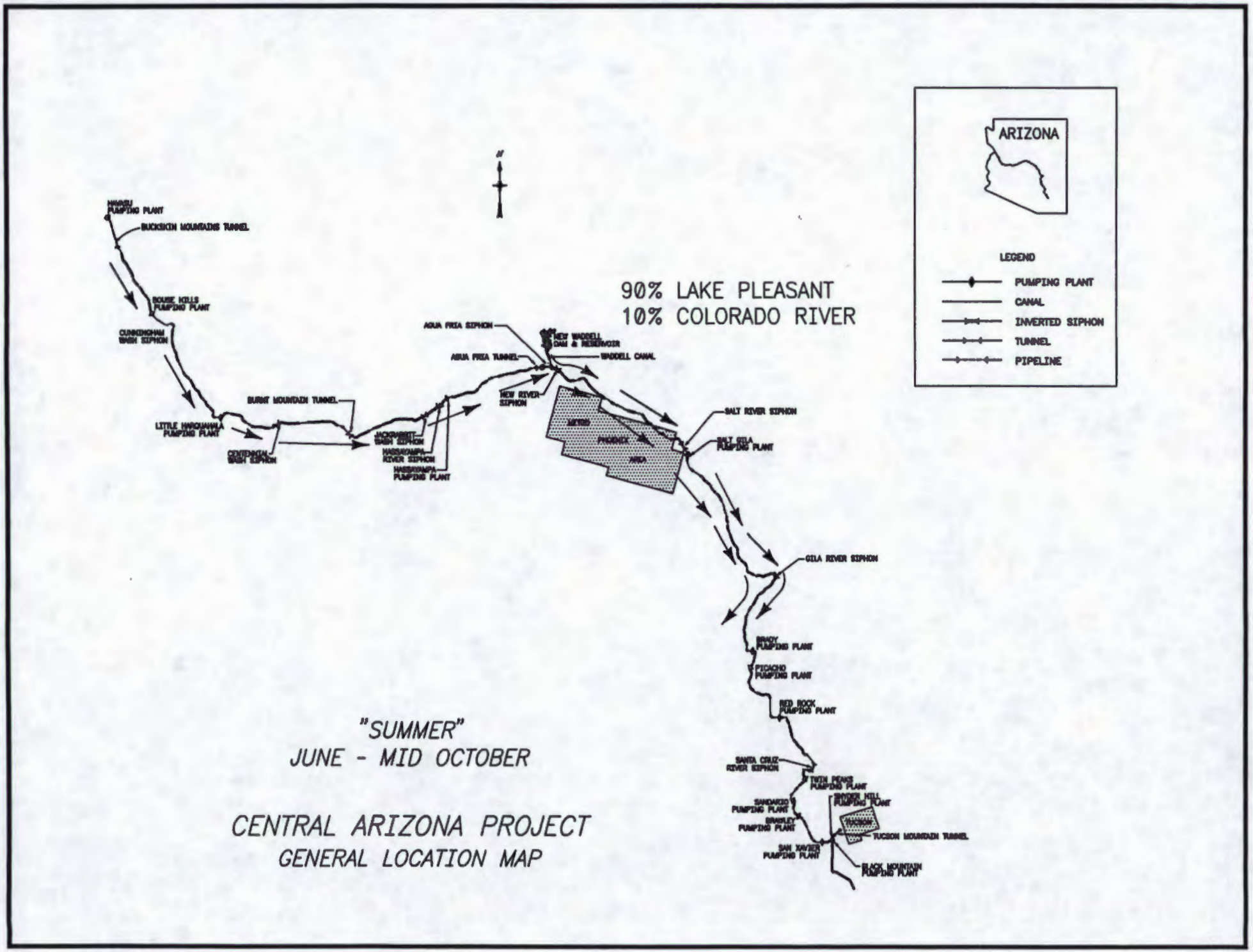
CENTRAL ARIZONA PROJECT
GENERAL LOCATION MAP

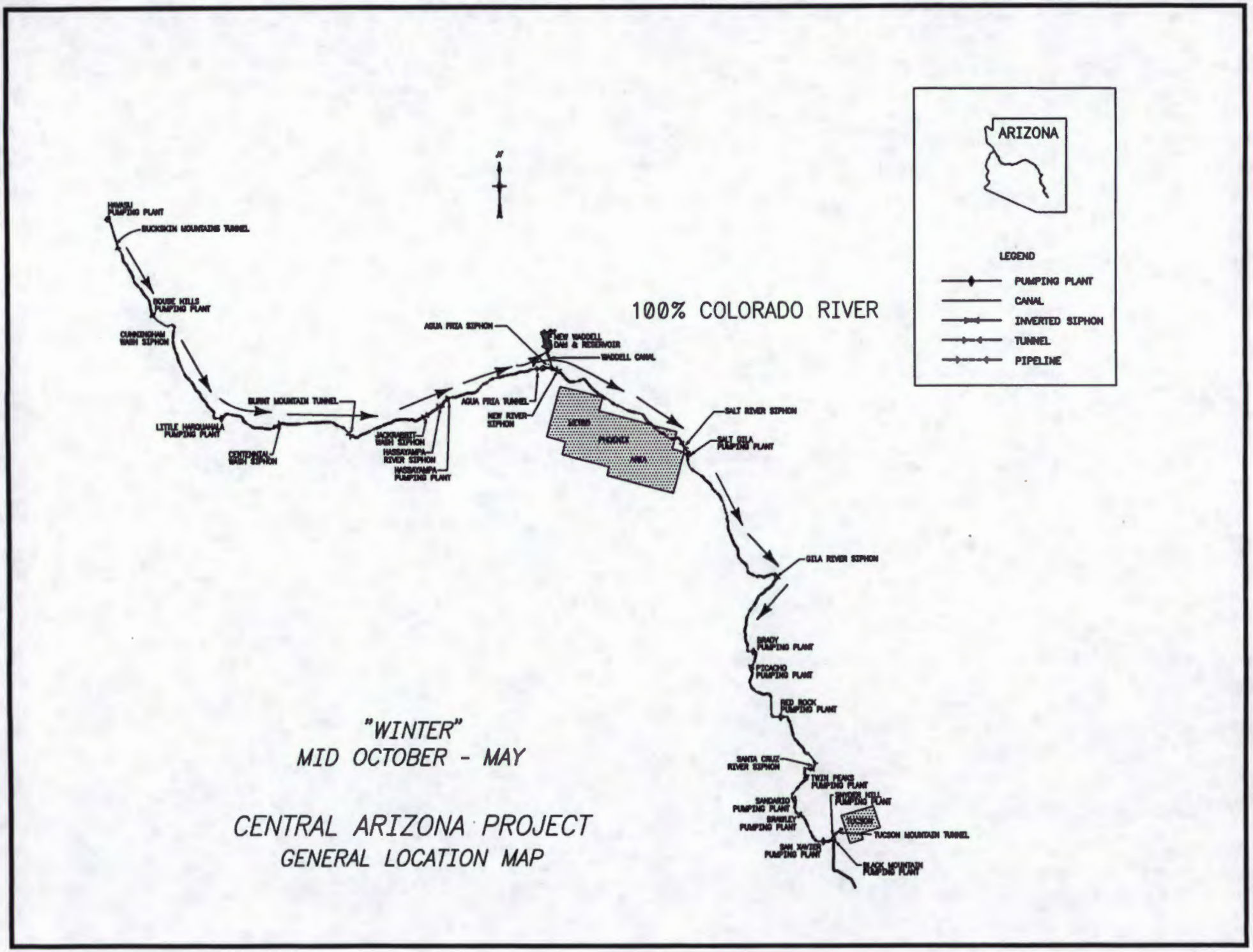


WATER QUALITY SAMPLING SITES

1. HAVASU PUMPING PLANT
2. LITTLE HARQUAHALA PUMPING PLANT
3. 99th AVENUE
4. 7th STREET
5. McKELLIPS ROAD
6. BRADY PUMPING PLANT
7. SAN XAVIER PUMPING PLANT

CENTRAL ARIZONA PROJECT
GENERAL LOCATION MAP


ARIZONA
LEGEND
PUMPING PLANT
CANAL
INVERTED SIPHON
TUNNEL
PIPELINE
90% LAKE PLEASANT
10% COLORADO RIVER
HAVASU PUMPING PLANT
BUCKSKIN MOUNTAINS TUNNEL
BOUSE HILLS PUMPING PLANT
CUNNINGHAM WASH SIPHON
LITTLE HARQUAHALA PUMPING PLANT
CENTENNIAL WASH SIPHON
BURNT MOUNTAIN TUNNEL
JACKRABBIT WASH SIPHON
HASSAYAMPA RIVER SIPHON
HASSAYAMPA PUMPING PLANT
AGUA FRIA SIPHON
AGUA FRIA TUNNEL
NEW WADDELL DAM & RESERVOIR
WADDELL CANAL
NEW RIVER SIPHON
PHOENIX AREA
SALT RIVER SIPHON
SALT GILA PUMPING PLANT
GILA RIVER SIPHON
BRADY PUMPING PLANT
PICACHO PUMPING PLANT
RED ROCK PUMPING PLANT
SANTA CRUZ RIVER SIPHON
TWIN PEAKS PUMPING PLANT
SNYDER HILL PUMPING PLANT
SANDARIO PUMPING PLANT
BRAWLEY PUMPING PLANT
TUCSON
TUCSON MOUNTAIN TUNNEL
SAN XAVIER PUMPING PLANT
BLACK MOUNTAIN PUMPING PLANT
"SUMMER"
JUNE - MID OCTOBER
CENTRAL ARIZONA PROJECT
GENERAL LOCATION MAP


ARIZONA
LEGEND
PUMPING PLANT
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BUCKSKIN MOUNTAINS TUNNEL
ROUSE HILLS PUMPING PLANT
CUNNINGHAM WASH SIPHON
BURNT MOUNTAIN TUNNEL
LITTLE HARQUAHALA PUMPING PLANT
CENTENNIAL WASH SIPHON
JACKRABBIT WASH SIPHON
HASSAYAMPA RIVER SIPHON
HASSAYAMPA PUMPING PLANT
AGUA FRIA SIPHON
NEW WADDELL DAM & RESERVOIR
WADDELL CANAL
AGUA FRIA TUNNEL
NEW RIVER SIPHON
METRO PHOENIX AREA
SALT RIVER SIPHON
SALT GILA PUMPING PLANT
GILA RIVER SIPHON
BRADY PUMPING PLANT
PICACHO PUMPING PLANT
RED ROCK PUMPING PLANT
SANTA CRUZ RIVER SIPHON
TWIN PEAKS PUMPING PLANT
SANDARIO PUMPING PLANT
BRAWLEY PUMPING PLANT
SAHUARITA PUMPING PLANT
TUCSON MOUNTAIN TUNNEL
SAN XAVIER PUMPING PLANT
BLACK MOUNTAIN PUMPING PLANT
"WINTER"
MID OCTOBER - MAY
CENTRAL ARIZONA PROJECT
GENERAL LOCATION MAP

CAP CANAL

WATER QUALITY DATA

1996 WATER QUALITY DATA

CAP CANAL at HAVASU PUMPING PLANT

PARAMETER	UNITS	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	MEAN	MAX	MIN
Temperature	Deg. F		55	59	64	70	74	81	83	81	76	65	56	69.4	83.0	54.7
pH			8.0	8.2	8.4	8.7	8.4	8.4	8.3	8.2	8.1	8.2	8.2	8.3	8.7	8.0
Dissolved Oxygen	mg / l		5.8	7.2	8.7	8.3	8.3	7.6	7.2	6.7	6.2	6.2	6.2	7.1	8.7	5.8
Field Conductivity	umhos		1,078	1,076	1,072	1,052	1,028	1,046	1,037	1,054	924	1,046	1,060	1,043	1,078	924
Total Organic Carbon	mg / l		2.5	2.4	2.6	2.6	2.7	3.0	3.6	4.1	3.0	2.5	3.0	2.9	4.1	2.4
Algae Count	col / ml		34.0	67.3	24.9	100.3	136.3	694.0	928.0	1677.0	500.0	963.0	477.0	509.3	1677.0	24.9
Alkalinity	mg / l		135.0	135.0	135.0	134.0	135.0	125.0	121.0	125.0	180.0	120.0	130.0	134.1	180.0	120.0
Calcium	mg / l		79.0	81.0	77.8	81.0	80.3	79.6	76.0	73.0	79.0	77.0	81.0	78.6	81.0	73.0
Chloride	mg / l		94.0	91.0	92.6	91.3	91.7	88.2	87.6	85.0	89.0	85.0	89.0	89.5	94.0	85.0
Copper	µg/l		2.6	3.4	3.0	4.0	2.6	7.5	5.2	7.6	2.6	2.5	3.0	4.0	7.6	2.5
Iron	µg/l		102.0	59.0	117.8	81.0	57.2	50.0	80.8	62.5	99.0	78.0	103.0	80.9	117.8	50.0
Magnesium	mg / l		31.0	30.0	30.8	30.0	31.3	31.2	30.8	29.0	31.0	31.0	31.0	30.6	31.3	29.0
Manganese	µg/l		5.9	5.7	7.1	5.0	6.2	7.7	8.1	10.8	18.0	13.0	6.0	8.5	18.0	5.0
Sulfide	mg / l		ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Conductivity	umhos		1,031	1,080	1,076	1,045	1,040	1,034	1,054	1,008	1,200	945	1,069	1,053	1,200	945
TDS	mg / l		676.0	703.0	650.0	648.0	661.7	670.0	664.0	675.0	730.0	670.0	680.0	675.2	730.0	648.0
Turbidity	NTU		1.0	0.8	1.9	1.1	0.9	1.0	1.3	1.3	7.2	4.0	2.0	2.0	7.2	0.8
MIB	ng / l				ND	ND	ND	ND	ND			ND				
Geosmin	ng / l				ND	ND	ND	ND	ND			ND				
Giardia	cts/100 l		ND		ND		ND		ND		ND		ND			
Cryptosporidium	cts/100 l		ND		ND		ND		ND		ND		ND			
Heavy Metals																
Arsenic	µg/l		ND			2.6					2.9			1.8	2.9	0.0
Lead	µg/l		ND			0.84					0.6			0.5	0.8	0.0
Semi-VOA'S																
Caffeine	µg/l		0.3			0.04					ND			0.1	0.3	0.0
Di-n-butyl-phthalate	µg/l		0.6			ND					ND			0.2	0.6	0.0
VOC'S	µg/l		ND			ND					ND					
Aldicarbs	µg/l		ND			ND					ND					
Herbicides	µg/l		ND			ND					ND					

ND = Parameter was Not Detected

1996 WATER QUALITY DATA

CAP CANAL at LITTLE HARQUAHALA PUMPING PLANT

PARAMETER	UNITS	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	MEAN	MAX	MIN
Temperature	Deg. F	53	56	60	66	73	78	83	83	80	76	60	55	68.6	83.0	53.0
pH		8.2	8.3	8.1	8.5	8.5	8.4	8.4	8.4	8.3	8.2	8.1	8.6	8.3	8.6	8.1
Dissolved Oxygen	mg / l	11.9	10.9	8.0	8.2	8.1	8.2	8.4	8.5	8.2	6.2	8.5	10.7	8.8	11.9	6.2
Field Conductivity	umhos	1,065	1,052	1,037	1,070	1,066	1,032	1,048	943	932	923	930	937	1,003	1,070	923
Total Organic Carbon	mg / l	3.2	2.8	3.3	2.7	2.9	2.8	2.8	2.9	2.8	2.7	4.5	2.9	3.0	4.5	2.7
Algae Count	col / ml	13.2	34.0	89.8	42.9	89.5	10035.0	127.2	304.0	562.0	367.0	3290.0	262.5	1268.1	10035.0	13.2
Alkalinity	mg / l	148.8	135.0	135.0	135.0	131.3	133.3	122.0	116.0	122.5	120.0	115.0	127.5	128.5	148.8	115.0
Calcium	mg / l	82.5	80.0	83.8	77.6	82.0	81.7	78.8	74.6	72.3	77.0	77.0	79.8	78.9	83.8	72.3
Chloride	mg / l	97.1	94.0	91.2	92.2	90.3	88.7	87.2	88.4	86.3	91.0	91.0	88.8	90.5	97.1	86.3
Copper	µg/l	0.1	4.4	4.4	2.9	4.0	9.4	3.8	2.3	3.0	2.2	3.9	2.7	3.6	9.4	0.1
Iron	µg/l	0.2	113.0	146.8	146.8	67.0	73.3	50.0	50.0	50.0	62.0	51.0	172.5	81.9	172.5	0.2
Magnesium	mg / l	31.5	31.0	29.8	31.2	30.5	31.3	31.2	31.4	30.0	31.0	33.0	30.3	31.0	33.0	29.8
Manganese	µg/l	0.1	4.9	7.3	7.1	4.7	4.0	8.3	15.5	6.4	7.5	8.3	10.3	7.0	15.5	0.1
Sulfide	mg / l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Conductivity	umhos	1,116	1,031	1,090	1,056	1,058	1,025	1,052	1,040	1,025	1,030	930	1,048	1,042	1,116	930
TDS	mg / l	708.0	694.0	710.0	656.4	676.3	673.3	671.0	664.0	672.5	700.0	690.0	686.5	683.5	710.0	656.4
Turbidity	NTU	1.6	1.0	1.5	1.7	1.2	0.6	0.4	0.3	0.6	1.1	2.6	5.7	1.5	5.7	0.3
MIB	ng / l							5.6						5.6	5.6	5.6
Geosmin	ng / l							7.1						7.1	7.1	7.1
Giardia	cts/100 l		ND													
Cryptosporidium	cts/100 l		ND													
Heavy Metals																
Arsenic	µg/l															
Lead	µg/l															
Semi-VOA'S																
Caffeine	µg/l															
Di-n-butyl-phthalate	µg/l															
VOC'S	µg/l															
Aldicarbs	µg/l															
Herbicides	µg/l															

ND = Parameter was Not Detected

1996 WATER QUALITY DATA

CAP CANAL at 99TH AVENUE

PARAMETER	UNITS	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	MEAN	MAX	MIN
Temperature	Deg. F	54	57	60	66	75	77	68	73	78	69	62	55	66.1	78.0	54.0
pH		8.4	8.3	8.6	8.6	8.6	8.2	8.1	8.0	8.3	8.3	8.5	8.7	8.4	8.7	8.0
Dissolved Oxygen	mg/l	13.1	10.9	8.9	8.7	7.9	7.1	6.0	5.0	7.4	8.3	10.2	11.0	8.7	13.1	5.0
Field Conductivity	umhos	1,062	1,040	1,034	1,071	1,064	1,050	1,010	964	946	960	978	946	1,010	1,071	946
Total Organic Carbon	mg / l	3.1	2.8	3.2	2.9	2.7	2.7	2.8	3.0	3.2	3.5	3.4	2.9	3.0	3.5	2.7
Algae Count	col / ml	12.0	67.5	129.3	67.5	76.3	119.0	284.0	676.0	1329.0	4090.0	2893.3	784.5	877.4	4090.0	12.0
Alkalinity	mg / l	155.0	135.0	133.0	132.0	133.0	133.3	129.0	123.0	118.0	128.0	135.0	133.7	132.3	155.0	118.0
Calcium	mg / l	82.5	79.5	82.5	77.4	81.0	80.7	79.2	75.6	73.5	75.6	76.7	80.3	78.7	82.5	73.5
Chloride	mg / l	97.0	94.0	92.3	94.2	92.3	89.7	86.4	89.6	89.0	95.0	92.0	89.5	91.7	97.0	86.4
Copper	µg / l	0.1	3.2	4.7	3.5	3.6	3.4	4.0	2.2	5.5	7.5	2.3	3.5	3.6	7.5	0.1
Iron	µg / l	0.1	55.5	132.5	108.0	69.8	50.0	50.0	50.0	50.0	50.4	62.7	109.0	65.7	132.5	0.1
Magnesium	mg / l	31.8	30.3	30.0	31.4	30.8	31.7	31.2	31.6	31.3	33.6	33.3	31.3	31.5	33.6	30.0
Manganese	µg / l	0.1	4.4	7.4	5.6	4.9	6.7	17.8	19.3	45.0	127.0	109.3	17.2	30.4	127.0	0.1
Sulfide	mg / l	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND			
Conductivity	umhos	1,110	1,030	1,093	1,055	1,063	1,040	1,056	1,046	1,040	1,046	1,006	1,052	1,053	1,110	1,006
TDS	mg / l	696.0	688.0	708.0	665.0	679.0	665.0	661.0	670.0	685.0	689.6	683.3	687.0	681.4	708.0	661.0
Turbidity	NTU	1.4	1.2	1.5	1.7	1.0	0.9	0.5	1.3	0.5	0.8	1.5	2.0	1.2	2.0	0.5
MIB	ng / l							ND			ND	ND				
Geosmin	ng / l							ND			ND	ND				
Giardia	cts/100 l		ND		ND	ND			ND		ND		ND			
Cryptosporidium	cts/100 l		ND		ND	ND			ND		ND		ND			
Heavy Metals																
Arsenic	µg / l										5.5			5.5	5.5	5.5
Lead	µg / l										ND					
Semi-VOA'S																
Caffeine	µg / l										ND					
Di-n-butyl-phthalate	µg / l										0.7			0.7	0.7	0.7
VOC'S	µg / l										ND					
Aldicarbs	µg / l										ND					
Herbicides	µg / l										ND					

ND = Parameter was Not Detected

1996 WATER QUALITY DATA

CAP CANAL at 7TH STREET

PARAMETER	UNITS	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	MEAN	MAX	MIN
Temperature	Deg. F		57	60	66	75	78	69	73	80				69.8	80.0	57.0
pH			8.2	8.3	8.6	8.4	8.4	8.4	8.3	8.3				8.4	8.6	8.2
Dissolved Oxygen	mg/l		10.4	8.9	8.9	8.8	8.4	7.9	7.4	6.9				8.5	10.4	6.9
Field Conductivity	umhos		1,044	1,027	1,072	1,057	1,049	1,000	975	958				1,023	1,072	958.0
Total Organic Carbon	mg / l		3.2	2.8	3.0	2.7	2.7	2.9	3.0	3.0				2.9	3.2	2.7
Algae Count	col / ml		82.0	140.0	101.0	79.0	159.0	407.0	150.0	1200.0				289.8	1200.0	79.0
Alkalinity	mg / l		122.3	131.2	132.0	130.0	130.0	129.0	125.0	120.0				127.4	132.0	120.0
Calcium	mg / l		78.5	83.8	77.0	80.8	79.7	79.0	82.0	69.0				78.7	83.8	69.0
Chloride	mg / l		95.5	70.8	93.2	93.0	88.7	85.2	88.0	89.0				87.9	95.5	70.8
Copper	ug / l		3.2	4.2	3.1	4.2	3.8	4.0	2.1	2.4				3.4	4.2	2.1
Iron	ug / l		115.5	159.3	109.0	50.0	83.9	50.0	50.0	50.0				83.5	159.3	50.0
Magnesium	mg / l		31.3	30.0	31.6	30.8	32.0	31.2	32.0	32.0				31.4	32.0	30.0
Manganese	ug / l		5.5	9.3	5.3	2.8	4.9	18.2	19.0	47.0				14.0	47.0	2.8
Sulfide	mg / l		ND	ND	ND	ND	ND	ND	ND	ND						
Conductivity	umhos		1,053	1,093	1,056	1,063	1,057	1,044	1,030	1,040				1,054	1,093	1,030
TDS	mg / l		691.0	710.0	660.0	690.0	678.3	663.0	642.0	690.0				678.0	710.0	642.0
Turbidity	NTU		1.2	3.1	1.6	0.5	0.8	0.4	0.4	0.5				1.1	3.1	0.4
MIB	ng / l				ND	ND	ND	ND	ND							
Geosmin	ng / l				ND	ND	7.4	ND	ND					1.5	7.4	0.0
Giardia	cts/100 l															
Cryptosporidium	cts/100 l															
Heavy Metals																
Arsenic	ug / l															
Lead	ug / l															
Semi-VOA'S																
Caffeine	ug / l															
Di-n-butyl-phthalate	ug / l															
VOC'S	ug / l															
Aldicarbs	ug / l															
Herbicides	ug / l															

ND = Parameter was Not Detected

1996 WATER QUALITY DATA

CAP CANAL at McKELLIPS ROAD

PARAMETER	UNITS	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	MEAN	MAX	MIN
Temperature	Deg. F		58	61	66	76	78	75	72	80		61	59	68.5	80.0	58.0
pH			8.0	8.0	8.6	8.4	8.4	8.4	8.3	8.3		8.7	8.8	8.4	8.8	8.0
Dissolved Oxygen	mg / l		10.2	9.1	8.9	7.8	7.5	7.8	7.6	7.8		10.1	11.0	8.8	11.0	7.5
Field Conductivity	umhos		1,062	1,036	1,070	1,055	1,013	1,010	985	940		976	970	1,012	1,070	940.0
Total Organic Carbon	mg / l		3.5	3.9	2.9	4.8	2.7	2.9	2.8	3.0		3.6	3.8	3.4	4.8	2.7
Algae Count	col / ml		260.0	487.5	89.8	133.3	134.0	482.0	490.0	3300.0		3575.0	1477.0	1042.9	3575.0	89.8
Alkalinity	mg / l		135.0	133.8	133.0	128.8	130.0	126.0	125.0	125.0		135.0	140.0	131.2	140.0	125.0
Calcium	mg / l		83.0	82.8	77.6	92.5	81.0	78.6	82.0	71.0		79.0	76.0	80.4	92.5	71.0
Chloride	mg / l		93.5	92.8	94.0	90.8	89.3	85.4	88.0	88.0		90.5	92.5	90.5	94.0	85.4
Copper	ug / l		4.1	5.7	3.2	3.9	8.7	6.1	2.0	2.6		2.9	2.2	4.1	8.7	2.0
Iron	ug / l		190.0	199.8	102.8	109.8	106.7	50.0	50.0	57.0		50.0	50.0	96.6	199.8	50.0
Magnesium	mg / l		32.0	30.0	31.4	31.0	31.7	31.0	32.0	31.0		33.5	31.5	31.5	33.5	30.0
Manganese	ug / l		32.0	31.0	8.5	56.9	6.3	13.3	19.0	66.0		65.0	28.5	32.7	66.0	6.3
Sulfide	mg / l		ND	ND	ND	ND	ND	ND	ND	ND		ND	ND			
Conductivity	umhos		1,090	1,100	1,040	1,065	1,040	1,062	1,010	1,040		960	988	1,039	1,100	960
TDS	mg / l		695.0	700.0	660.0	675.0	676.7	656.0	658.0	690.0		665.0	675.0	675.1	700.0	656.0
Turbidity	NTU		1.7	2.5	2.1	0.6	0.8	0.6	0.6	2.7		0.7	0.6	1.3	2.7	0.6
MIB	ng / l											ND				
Geosmin	ng / l											ND				
Giardia	cts/100 l				ND				ND							
Cryptosporidium	cts/100 l				ND				ND							
Heavy Metals																
Arsenic	ug / l															
Lead	ug / l															
Semi-VOA'S																
Caffeine	ug / l															
Di-n-butyl-phthalate	ug / l															
VOC'S	ug / l															
Aldicarbs	ug / l															
Herbicides	ug / l															

ND = Parameter was Not Detected

1996 WATER QUALITY DATA

CAP CANAL at BRADY PUMPING PLANT

PARAMETER	UNITS	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	MEAN	MAX	MIN
Temperature	Deg. F	51	57	57	68		80	79	77	83	80	61	58	68.3	83.0	51.0
pH		8.4	8.3	8.3	8.6		8.1	8.2	8.3	8.4	8.6	8.7	8.9	8.4	8.9	8.1
Dissolved Oxygen	mg / l	15.3	13.7	8.7	8.8		8.6	8.4	8.5	8.4	9.1	10.4	12.0	10.2	15.3	8.4
Field Conductivity	umhos	1,074	1,055	1,053	1,064		1,040	950	950	955	951	995	968	1,005	1,074	950.0
Total Organic Carbon	mg / l	4.8	2.7	2.5	2.9		3.8	3.1	3.0	4.0	3.8	4.2	4.8	3.6	4.8	2.5
Algae Count	col / ml	30.0	34.0	310.0	55.1		2600.0	284.0	600.0	3300.0	5000.0	788.0	650.0	1241.0	5000.0	30.0
Alkalinity	mg / l	130.0	125.0	130.0	125.0		125.0	125.0	125.0	125.0	115.0	120.0	125.0	124.5	130.0	115.0
Calcium	mg / l	69.0	71.0	82.0	141.5		78.0	81.0	83.0	69.0	75.0	74.0	73.0	81.5	141.5	69.0
Chloride	mg / l	96.0	96.0	92.0	96.0		94.0	88.0	87.0	91.0	94.0	95.0	95.0	93.1	96.0	87.0
Copper	ug / l	0.1	0.1	5.1	2.8		3.8	2.8	5.5	3.9	2.4	2.1	4.9	3.0	5.5	0.1
Iron	ug / l	0.5	0.1	50.0	54.5		50.0	50.0	105.0	57.0	82.0	50.0	53.0	50.2	105.0	0.1
Magnesium	mg / l	32.0	30.0	30.0	32.0		31.0	32.0	32.0	32.0	34.0	34.0	34.0	32.1	34.0	30.0
Manganese	ug / l	0.1	0.1	11.0	7.6		7.0	5.9	26.0	31.0	22.0	18.0	9.4	12.6	31.0	0.1
Sulfide	mg / l	ND	ND	ND	ND		ND	ND	ND	ND	ND	ND	ND			
Conductivity	umhos	1,120	990	1,090	982		1,000	1,050	1,010	1,050	1,020	970	1,000	1,026	1,120	970
TDS	mg / l	710.0	670.0	730.0	627.0		630.0	640.0	650.0	660.0	710.0	680.0	680.0	671.5	730.0	627.0
Turbidity	NTU	2.0	2.4	0.7	1.1		1.8	0.5	2.2	2.6	2.6	1.1	1.3	1.7	2.6	0.5
MIB	ng / l											5.7		5.7	5.7	5.7
Geosmin	ng / l											ND				
Giardia	cts/100 l						ND									
Cryptosporidium	cts/100 l						ND									
Heavy Metals																
Arsenic	ug / l		ND			3.0	ND				3.8			1.7	3.8	0.0
Chromium	ug / l		ND			8.5	ND				ND			2.1	8.5	0.0
Lead	ug / l		ND			ND	ND				ND					
Mercury	ug / l		ND			0.57	ND				ND			0.1	0.6	0.0
Semi-VOA'S																
Caffeine	ug / l		0.1			ND	0.1				ND			0.0	0.1	0.0
Di-n-butyl-phthalate	ug / l		ND			ND	ND				ND					
Diethyl-phthalate	ug / l		ND			1.4	2.7				ND			1.0	2.7	0.0
Pentachloro-phenol	ug / l		ND			3.0	ND				ND			0.8	3.0	0.0
VOC'S																
Toluene	ug / l		ND			1.5	ND				ND			0.4	1.5	0.0
Aldicarbs	ug / l		ND			ND	ND				ND					
Herbicides																
2,4 - D	ug / l		0.23			ND	ND				ND			0.1	0.2	0.0

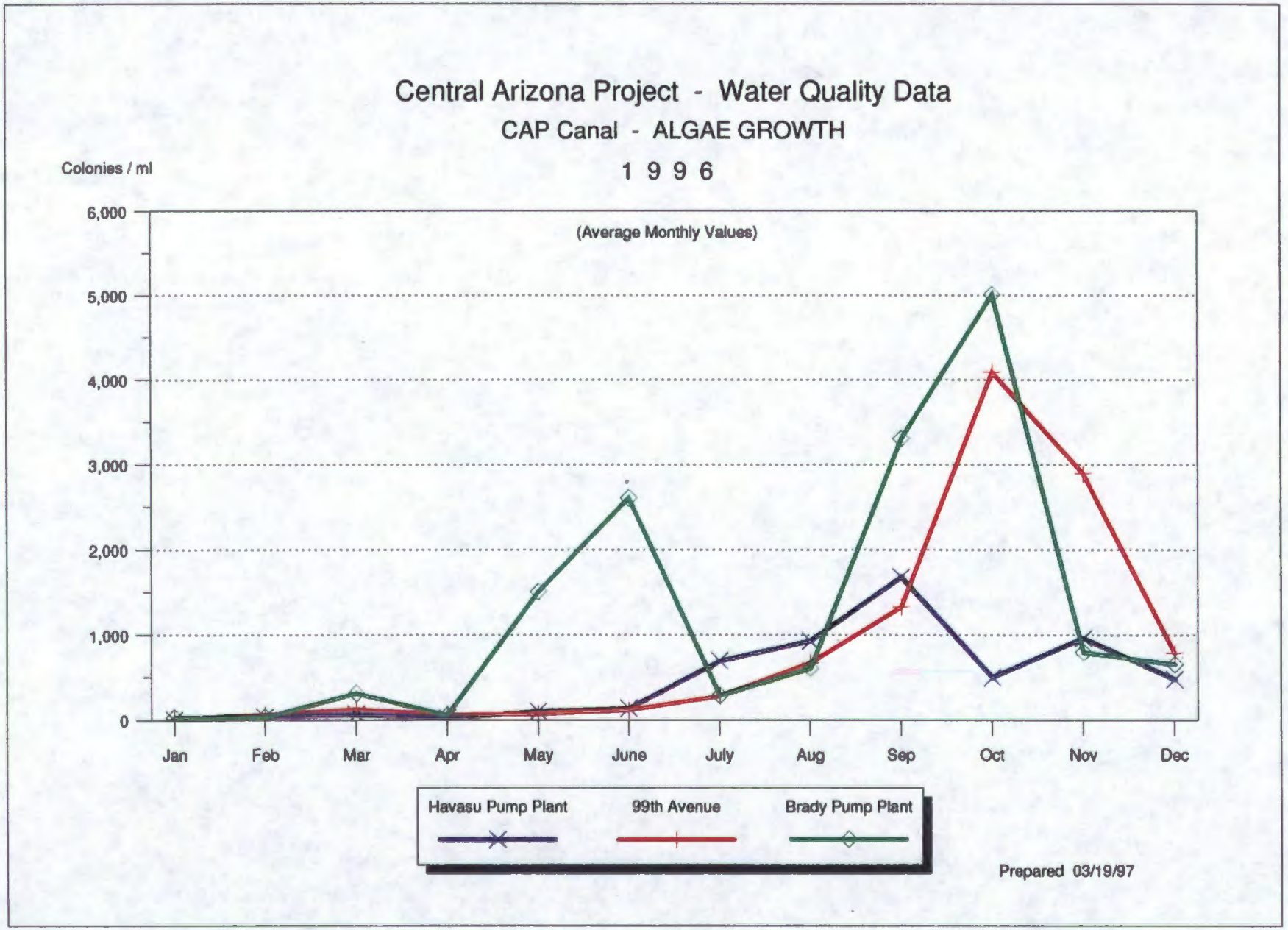
ND = Parameter was Not Detected

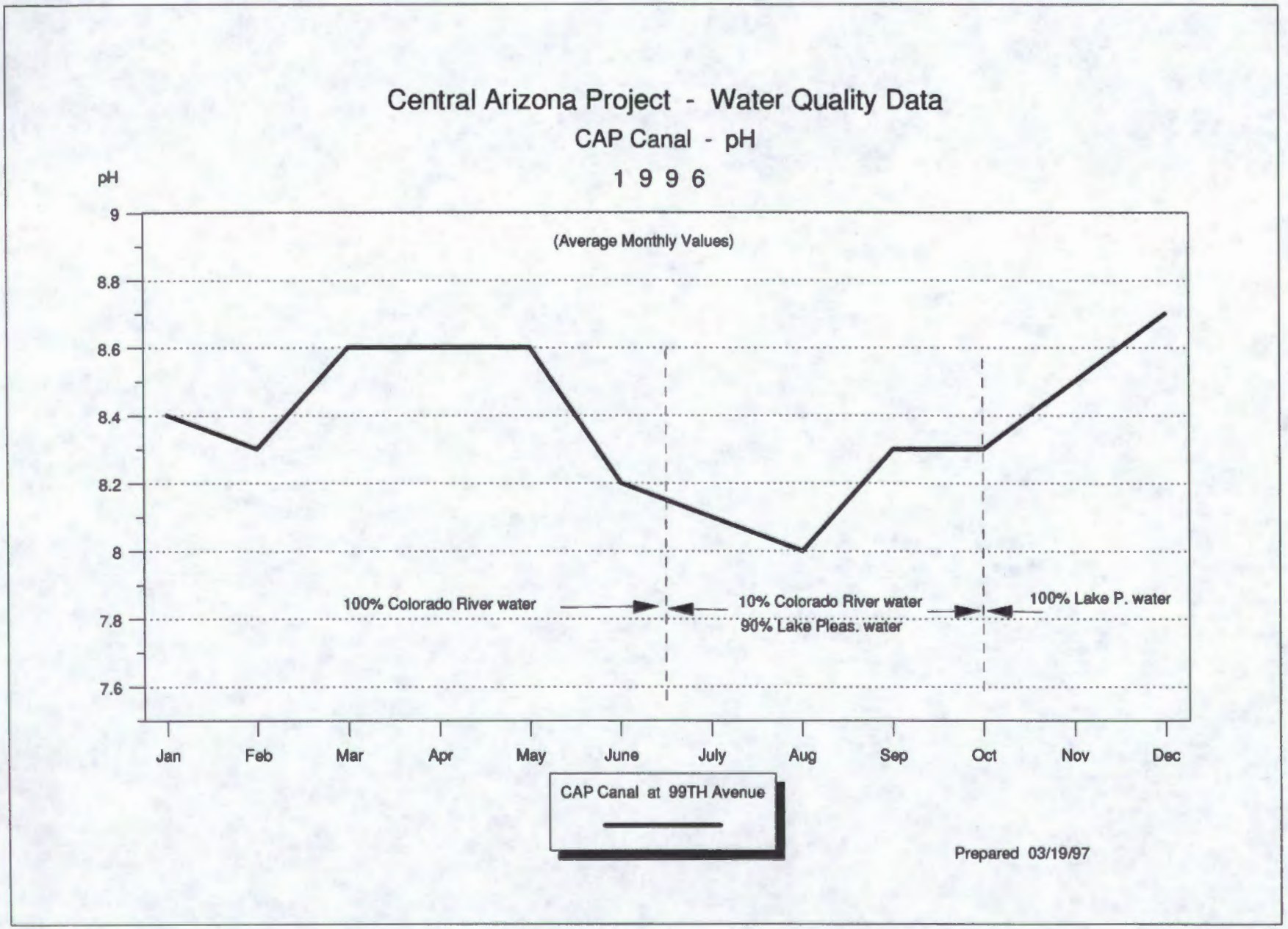
1996 WATER QUALITY DATA

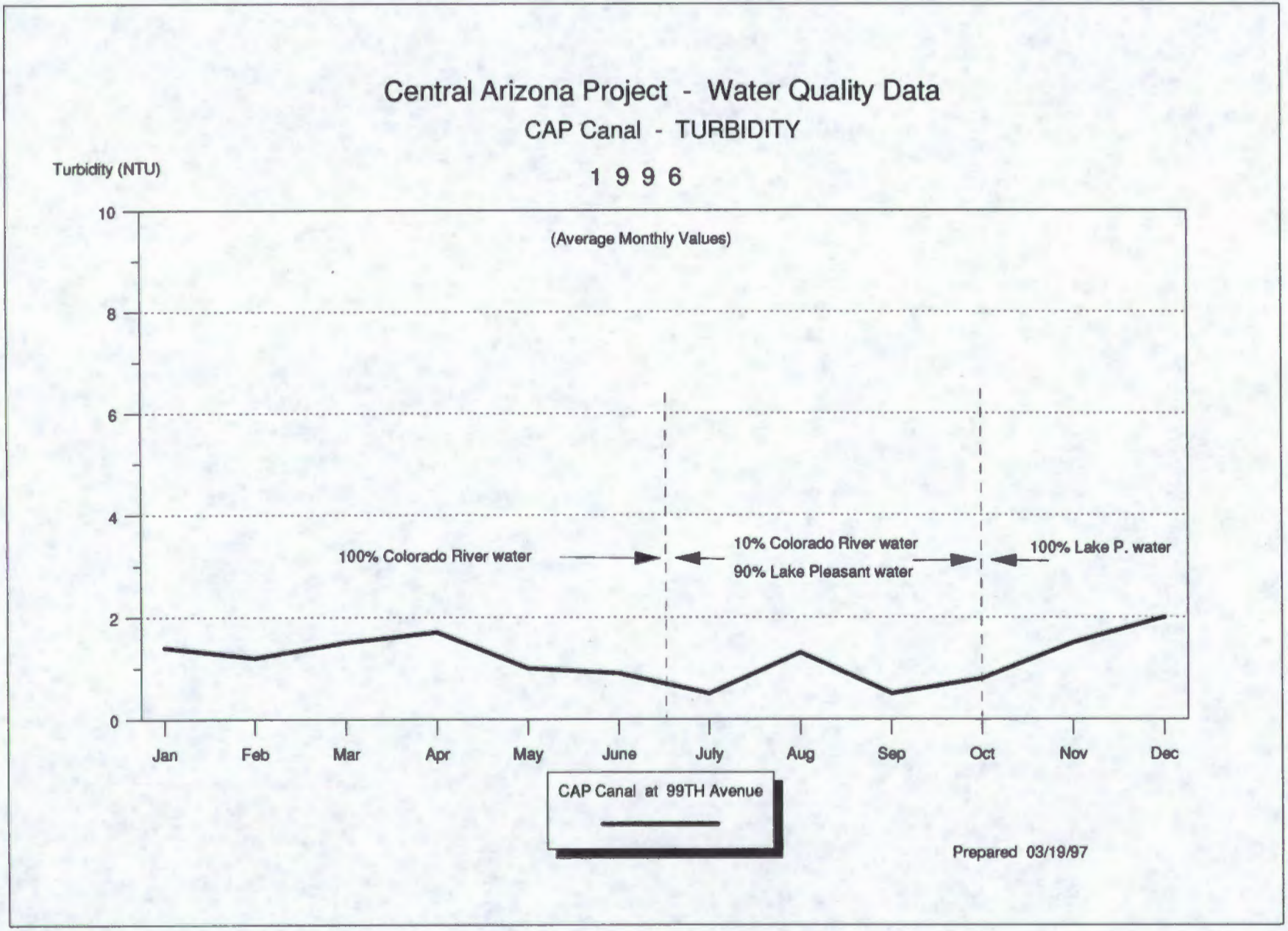
CAP CANAL at SAN XAVIER PUMPING PLANT

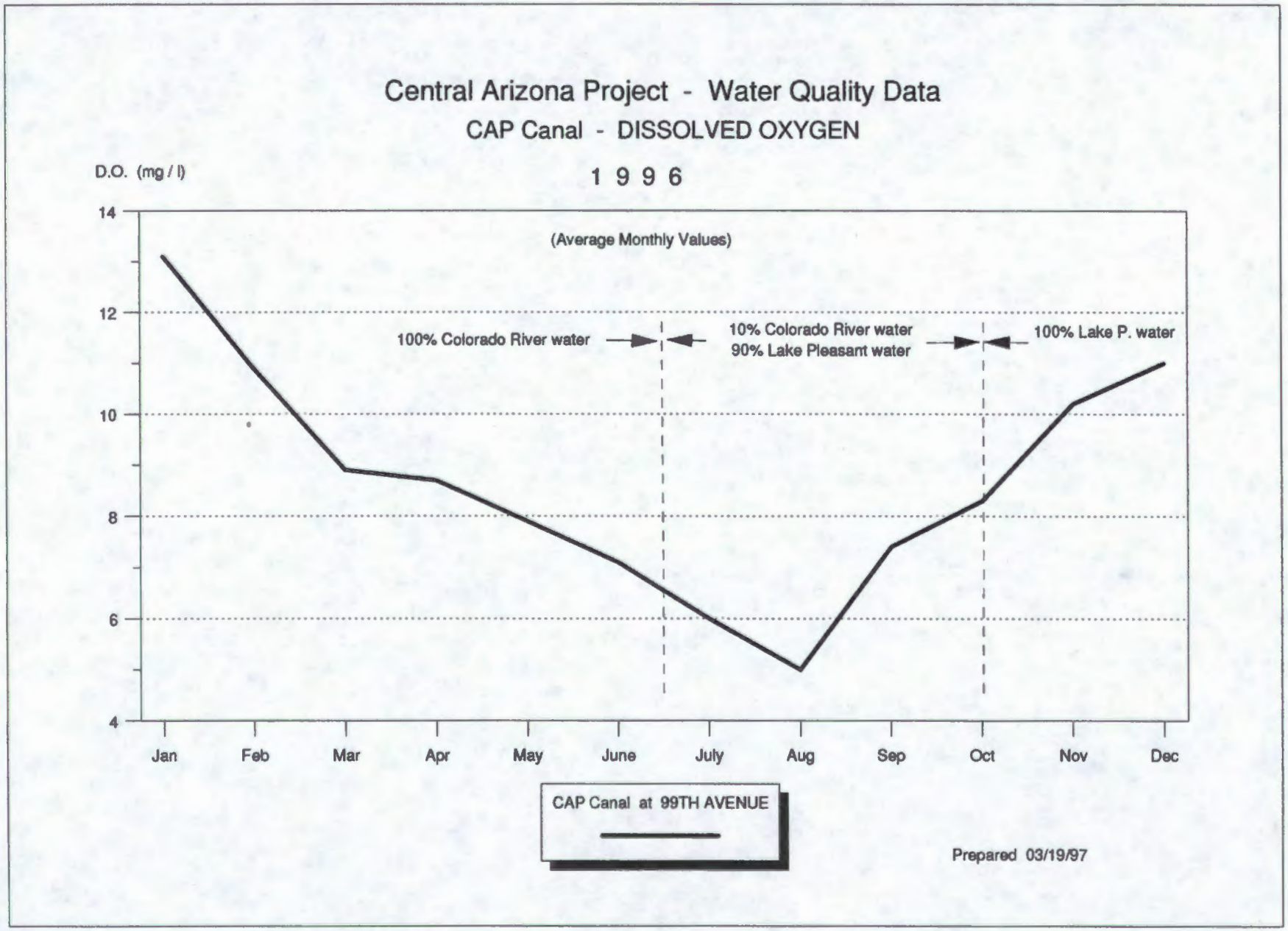
PARAMETER	UNITS	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	MEAN	MAX	MIN
Temperature	Deg. F				72		83		87	79	76	59	53	72.7	87.0	53.0
pH					8.7		8.9		8.9	8.9	8.8	9.0	9.0	8.9	9.0	8.7
Dissolved Oxygen	mg / l				6.4		6.4		7.4	8.4	6.1	8.1	9.0	7.4	9.0	6.1
Field Conductivity	umhos				1,003		1,325		1,300	1,334	1,360	1,209	1,500	1,290	1,500	1003.0
Total Organic Carbon	mg / l				2.6		8.6		10.0	3.0	10.0	10.0	11.0	7.9	11.0	2.6
Algae Count	col / ml				560.0		20000.0		7500.0	5500.0	12000.0	3100.0	3750.0	7487.1	20000.0	560.0
Alkalinity	mg / l				130.0		125.0		120.0	140.0	120.0	120.0	135.0	127.1	140.0	120.0
Calcium	mg / l				38.0		38.0		45.0	49.0	38.0	37.0	46.0	41.6	49.0	37.0
Chloride	mg / l				115.0		165.0		195.0	205.0	185.0	155.0	210.0	175.7	210.0	115.0
Copper	ug / l				4.5		3.4		6.6	6.2	4.3	3.6	2.4	4.4	6.6	2.4
Iron	ug / l				50.0		50.0		80.0	57.0	180.0	85.0	50.0	78.9	180.0	50.0
Magnesium	mg / l				20.0		34.0		43.0	47.0	38.0	32.0	45.0	37.0	47.0	20.0
Manganese	ug / l				13.0		17.0		94.0	100.0	120.0	33.0	58.0	62.1	120.0	13.0
Sulfide	mg / l				ND		ND		ND	ND	ND	ND	ND			
Conductivity	umho				914		1,070		1,580	1,690	1,440	1,130	1,590	1,345	1,690	914
TDS	mg / l				564.0		680.0		990.0	1130.0	910.0	780.0	1050.0	872.0	1130.0	564.0
Turbidity	NTU				1.8		2.0		3.9	4.0	5.7	2.9	3.0	3.3	5.7	1.8
MIB	ng / l				ND		ND									
Geosmin	ng / l				ND		ND									
Giardia	cts/100 l															
Cryptosporidium	cts/100 l															
Heavy Metals																
Arsenic	ug / l															
Lead	ug / l															
Semi-VOA'S																
Caffeine	ug / l															
Di-n-butyl-phthalate	ug / l															
VOC'S	ug / l															
Aldicarbs	ug / l															
Herbicides	ug / l															

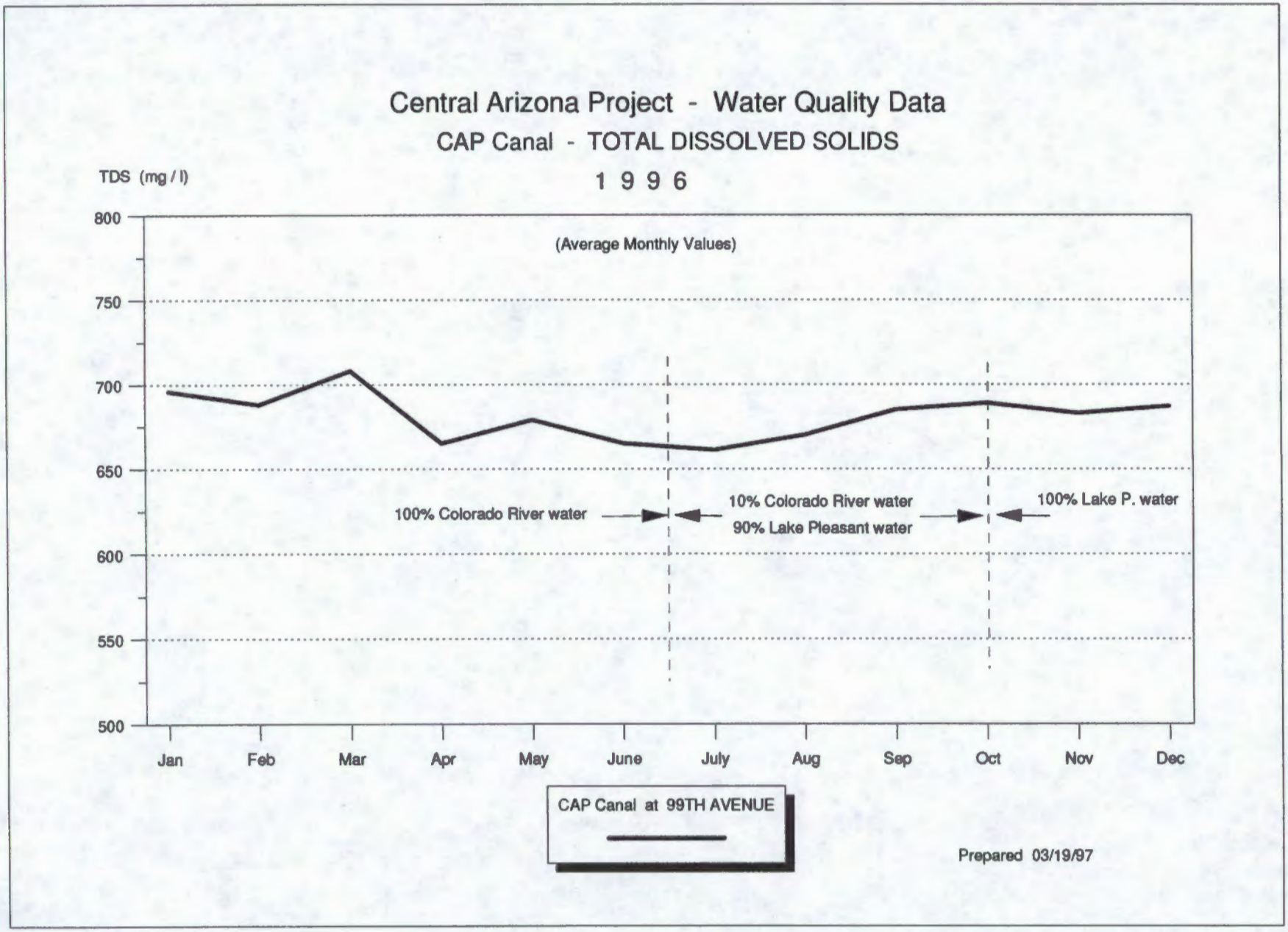
ND = Parameter was Not Detected


Central Arizona Project - Water Quality Data
CAP Canal - ALGAE GROWTH
1 9 9 6
Colonies / ml
(Average Monthly Values)
6,000
5,000
4,000
3,000
2,000
1,000
0
Jan
Feb
Mar
Apr
May
June
July
Aug
Sep
Oct
Nov
Dec
Havasu Pump Plant
99th Avenue
Brady Pump Plant
Prepared 03/19/97


Central Arizona Project - Water Quality Data
CAP Canal - pH
1 9 9 6
pH
9
8.8
8.6
8.4
8.2
8
7.8
7.6
(Average Monthly Values)
100% Colorado River water
10% Colorado River water
90% Lake Pleas. water
100% Lake P. water
Jan
Feb
Mar
Apr
May
June
July
Aug
Sep
Oct
Nov
Dec
CAP Canal at 99TH Avenue
Prepared 03/19/97


Central Arizona Project - Water Quality Data
CAP Canal - TURBIDITY
1 9 9 6
Turbidity (NTU)
(Average Monthly Values)
10
8
6
4
2
0
100% Colorado River water
10% Colorado River water
90% Lake Pleasant water
100% Lake P. water
Jan
Feb
Mar
Apr
May
June
July
Aug
Sep
Oct
Nov
Dec
CAP Canal at 99TH Avenue
Prepared 03/19/97


Central Arizona Project - Water Quality Data
CAP Canal - DISSOLVED OXYGEN
1 9 9 6
D.O. (mg / l)
(Average Monthly Values)
100% Colorado River water
10% Colorado River water
90% Lake Pleasant water
100% Lake P. water
14
12
10
8
6
4
Jan
Feb
Mar
Apr
May
June
July
Aug
Sep
Oct
Nov
Dec
CAP Canal at 99TH AVENUE
Prepared 03/19/97


Central Arizona Project - Water Quality Data
CAP Canal - TOTAL DISSOLVED SOLIDS
1 9 9 6
TDS (mg / l)
(Average Monthly Values)
800
750
700
650
600
550
500
100% Colorado River water
10% Colorado River water
90% Lake Pleasant water
100% Lake P. water
Jan
Feb
Mar
Apr
May
June
July
Aug
Sep
Oct
Nov
Dec
CAP Canal at 99TH AVENUE
Prepared 03/19/97

LAKE PLEASANT RESERVOIR

WATER QUALITY DATA

RANGE AND AVERAGE VALUES FOR SELECTED WATER QUALITY CONSTITUENTS
CENTRAL ARIZONA PROJECT

1996

CONSTITUENT	LAKE HAVASU (Range[1]) (Average[2])	LAKE PLEASANT (Range) (Average)
pH	8.0 - 8.4 8.3	8.1 - 8.6 8.3
Alkalinity (mg/l*)	120 - 180 132	115 - 140 130
Calcium (mg/l)	71 - 87 79	71 - 82 77
Chloride (mg/l)	84 - 96 90	89 - 95 92
Copper (mg/l)	<0.002[3] - 0.015 0.004	<0.001 - 0.023 0.005
Iron (mg/l)	<0.050 - 1.040 0.106	<0.050 - 0.090 0.059
Magnesium (mg/l)	27 - 33 31	28 - 78 37
Manganese (mg/l)	<0.002 - 0.018 0.008	0.004 - 0.107 0.036
Specific Conductance (uS/cm**)	965 - 1200 1051	973 - 1090 1036
Total Dissolved Solids (mg/l)	600 - 730 671	470 - 710 641

[1] The range represents the lowest and highest values recorded during the sampling events.

[2] The average is the sum of the values for each sampling events divided by the number of sampling events.

[3] "<" preceding a number indicates that nothing was detected above that particular level (non-detects). When calculating average values, all non-detects were calculated in using the detection level as a default value.

* mg/l = milligrams per liter of water
** uS/cm = micro Siemen per cubic centimeter of water

LAKE PLEASANT - WATER QUALITY DATA
MAY 1995 Through APRIL 1996
INTAKE TOWER - UPPER GATE

PARAMETER	UNITS	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	MEAN	MAX	MIN
Temperature	Deg. F	61	54	70	84	78	67	63	55	55	56	55	65	63.6	84.0	54.0
pH		8.4	8.0	7.9	8.3	8.3	8.0	8.1	8.2	8.0	8.0	8.6	8.8	8.2	8.8	7.9
Dissolved Oxygen	mg / l	9.3	11.0	9.8	7.3	5.0	15.0	6.7	11.5	9.8	8.1	8.6	7.8	9.2	15.0	5.0
Conductivity	umhos	870	860	790	800	825	851	888	999	1,005	975	1,090	1,050	917	1,090	790.0
Total Organic Carbon	mg / l	12.9	4.1	9.9	5.1	4.3	4.5	3.7	3.5	4.0	2.7	3.2	3.1	5.1	12.9	2.7
Algae Count	col / ml	12.0	2.0	4.0	24.0	24.0	24.0	8.0	18.0	24.0	20.0	0.5	81.0	20.1	81.0	0.5
Alkalinity	mg / l	134.0	138.0	140.0	136.0	134.0	142.0	150.0	140.0	136.0	132.0	140.0	135.0	138.1	150.0	132.0
Calcium	mg / l	68.0	60.0	29.0	46.0	59.0	66.0	68.0	72.0	69.0	74.0	78.0	73.0	63.5	78.0	29.0
Copper	ug / l	10.0	10.0	10.0	10.0	10.0	10.0	10.0	27.0	10.0	10.0	2.1	23.0	11.8	27.0	2.1
Iron	ug / l	70.0	40.0	40.0	40.0	30.0	140.0	120.0	100.0	50.0	40.0	50.0	50.0	64.2	140.0	30.0
Magnesium	mg / l	25.0	24.0	11.0	20.0	26.0	26.0	28.0	28.0	28.0	29.0	78.0	33.0	29.7	78.0	11.0
Manganese	ug / l	20.0	10.0	10.0	10.0	10.0	50.0	60.0	70.0	10.0	10.0	3.0	2.0	22.1	70.0	2.0
TDS	mg / l	574.0	550.0	506.0	504.0	478.0	836.0	620.0	634.0	436.0	640.0	660.0	624.0	588.5	836.0	436.0
Turbidity	NTU	2.0	1.0	1.0	1.0	1.0	2.6	1.6	1.3	1.2	5.9	0.3	0.5	1.6	5.9	0.3

Sample Analysis Performed by Bolin Laboratory, May 1995 through February 1996
Sample Analysis Performed by Montgomery Watson Laboratory, March and April ,1996

LAKE PLEASANT - WATER QUALITY DATA
MAY 1995 Through APRIL 1996
INTAKE TOWER - LOWER GATE

PARAMETER	UNITS	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	MEAN	MAX	MIN
Temperature	Deg. F	58	55	61	60	60	67	63	55	54	54	55	56	58	67	54
pH		7.8	7.9	7.5	8.0	7.4	7.0	7.9	8.2	8.2	8.2	8.0	8.2	7.9	8.2	7.0
Dissolved Oxygen	mg / l	7.4	10.2	11.2	10.4	0.5	3.7	6.9	10.4	8.4	6.5	7.0	4.7	7.3	11.2	0.5
Conductivity	umhos	899	890	860	820	870	911	974	948	1,001	988	1,090	973	935	1,090	820.0
Total Organic Carbon	mg / l	12.8	3.7	2.3	3.9	3.6	10.1	4.0	3.6	3.7	2.9	3.1	2.8	4.7	12.8	2.3
Algae Count	col / ml	8.0	2.0	6.0	4.0	14.0	24.0	24.0	10.0	20.0	8.0	0.5	33.0	12.8	33.0	0.5
Alkalinity	mg / l	138.0	144.0	142.0	156.0	132.0	144.0	144.0	142.0	136.0	150.0	140.0	135.0	141.9	156.0	132.0
Calcium	mg / l	68.0	62.0	65.0	54.0	67.0	70.0	68.0	70.0	72.0	74.0	79.0	72.0	68.4	79.0	54.0
Copper	ug / l	10.0	10.0	10.0	10.0	10.0	10.0	10.0	19.0	10.0	10.0	2.1	2.1	9.4	19.0	2.1
Iron	ug / l	70.0	40.0	60.0	100.0	780.0	210.0	130.0	70.0	60.0	50.0	50.0	50.0	139.2	780.0	40.0
Magnesium	mg / l	24.0	24.0	26.0	22.0	26.0	27.0	28.0	28.0	30.0	30.0	79.0	32.0	31.3	79.0	22.0
Manganese	ug / l	30.0	20.0	30.0	100.0	360.0	150.0	60.0	50.0	10.0	40.0	13.0	13.0	73.0	360.0	10.0
TDS	mg / l	588.0	570.0	550.0	388.0	564.0	328.0	534.0	646.0	504.0	590.0	670.0	612.0	545.3	670.0	328.0
Turbidity	NTU	2.1	1.0	1.0	1.3	5.2	3.0	2.7	1.3	1.2	1.7	0.5	0.4	1.8	5.2	0.4

Sample Analysis Performed by Bolin Laboratory, May 1995 through February 1996
Sample Analysis Performed by Montgomery Watson Laboratory, March and April ,1996

1996 WATER QUALITY DATA

LAKE PLEASANT - UPPER INTERVAL (20' DEPTH)

PARAMETER	UNITS	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	MEAN	MAX	MIN
Temperature	Deg. F	55				67	72		84			63		68.2	84.0	55.0
pH		8.1				8.8	8.7		8.5			8.4		8.5	8.8	8.1
Dissolved Oxygen	mg/l	11.5				7.3	7.3		7.4			7.1		8.1	11.5	7.1
Field Conductivity	umhos	975				1,060	1,075		1,258			998		1,073	1,258	975.0
Total Organic Carbon	mg / l	3.8				3.1	3.7		3.9			4.4		3.8	4.4	3.1
Algae Count	col / ml	21.0					96.0		420.0			6340.0		1719.3	6340.0	21.0
Alkalinity	mg / l	140.0				135.0	130.0		115.0			130.0		130.0	140.0	115.0
Calcium	mg / l	70.5				80.0	77.0		79.0			77.0		76.7	80.0	70.5
Chloride	mg / l					95.0	92.0		95.0			91.0		93.3	95.0	91.0
Copper	ug / l	0.1				2.7	2.7		2.1			0.2		1.6	2.7	0.1
Iron	ug / l	0.1				50.0	50.0		50.0			50.0		40.0	50.0	0.1
Magnesium	mg / l	28.0				31.0	30.0		34.0			33.0		31.2	34.0	28.0
Manganese	ug / l	0.0				2.0	2.5		3.7			83.0		18.2	83.0	0.0
Sulfide	mg / l	ND				ND	ND		ND			ND				
Conductivity	umhos	1,002				1,040	1,050		1,080			1,030		1,040	1,080	1,002
TDS	mg / l	535.0				665.0	640.0		680.0			650.0		634.0	680.0	535.0
Turbidity	NTU	1.3				0.5	0.3		0.4			1.4		0.8	1.4	0.3
MIB	ng / l															
Geosmin	ng / l															
Giardia	cts/100 l															
Cryptosporidium	cts/100 l															
Heavy Metals																
Arsenic	ug / l	3.8				ND								1.9	3.8	0.0
Lead	ug / l	ND				ND										
Semi-VOA'S																
Caffeine	ug / l	ND				ND										
Di-n-butyl-phthalate	ug / l	ND				ND										
VOC'S	ug / l	ND				ND										
Aldicarbs	ug / l	ND				ND										
Herbicides	ug / l	ND				ND										

ND = Parameter was Not Detected

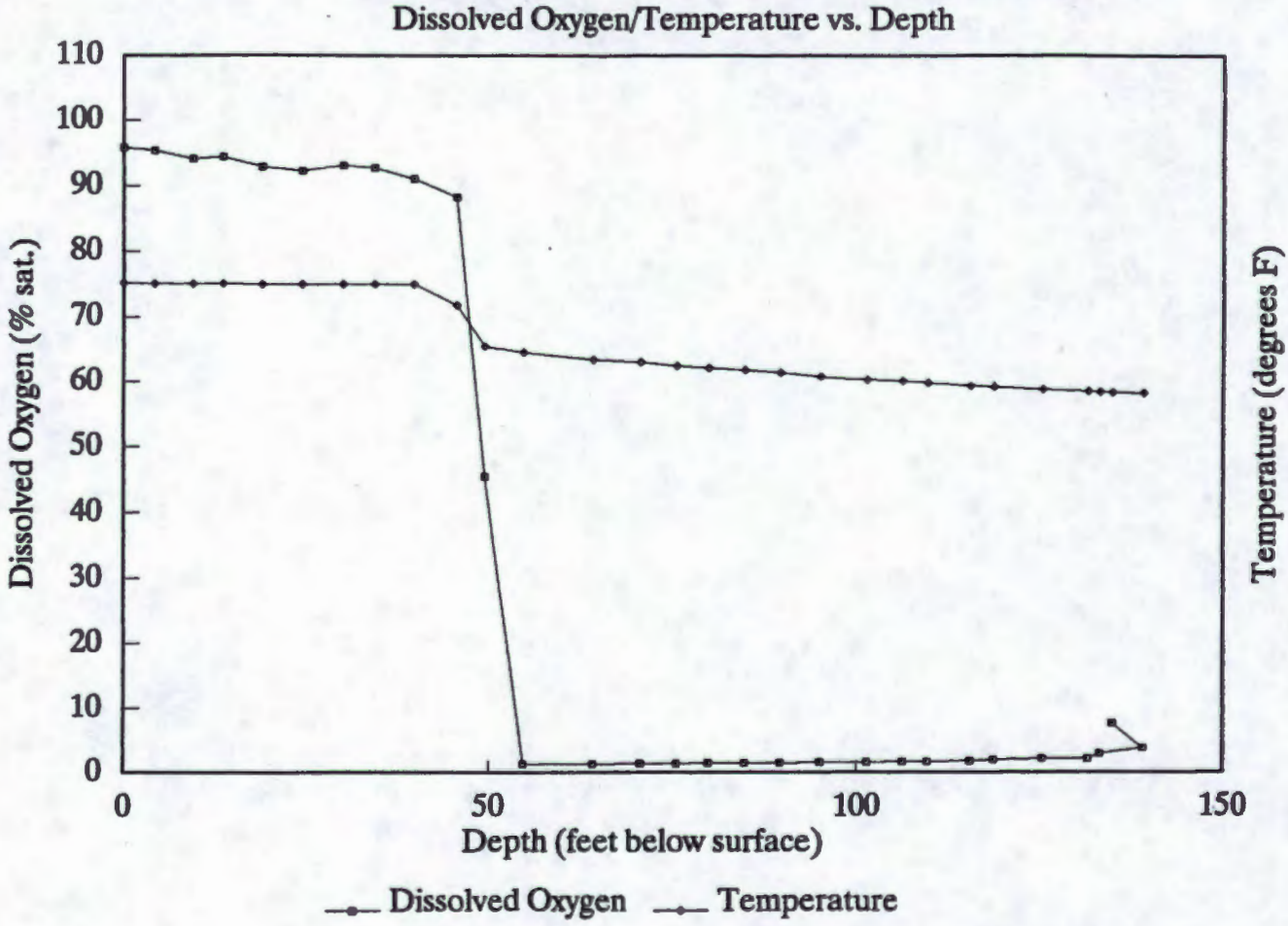
1996 WATER QUALITY DATA

LAKE PLEASANT - LOWER INTERVAL (100' DEPTH)

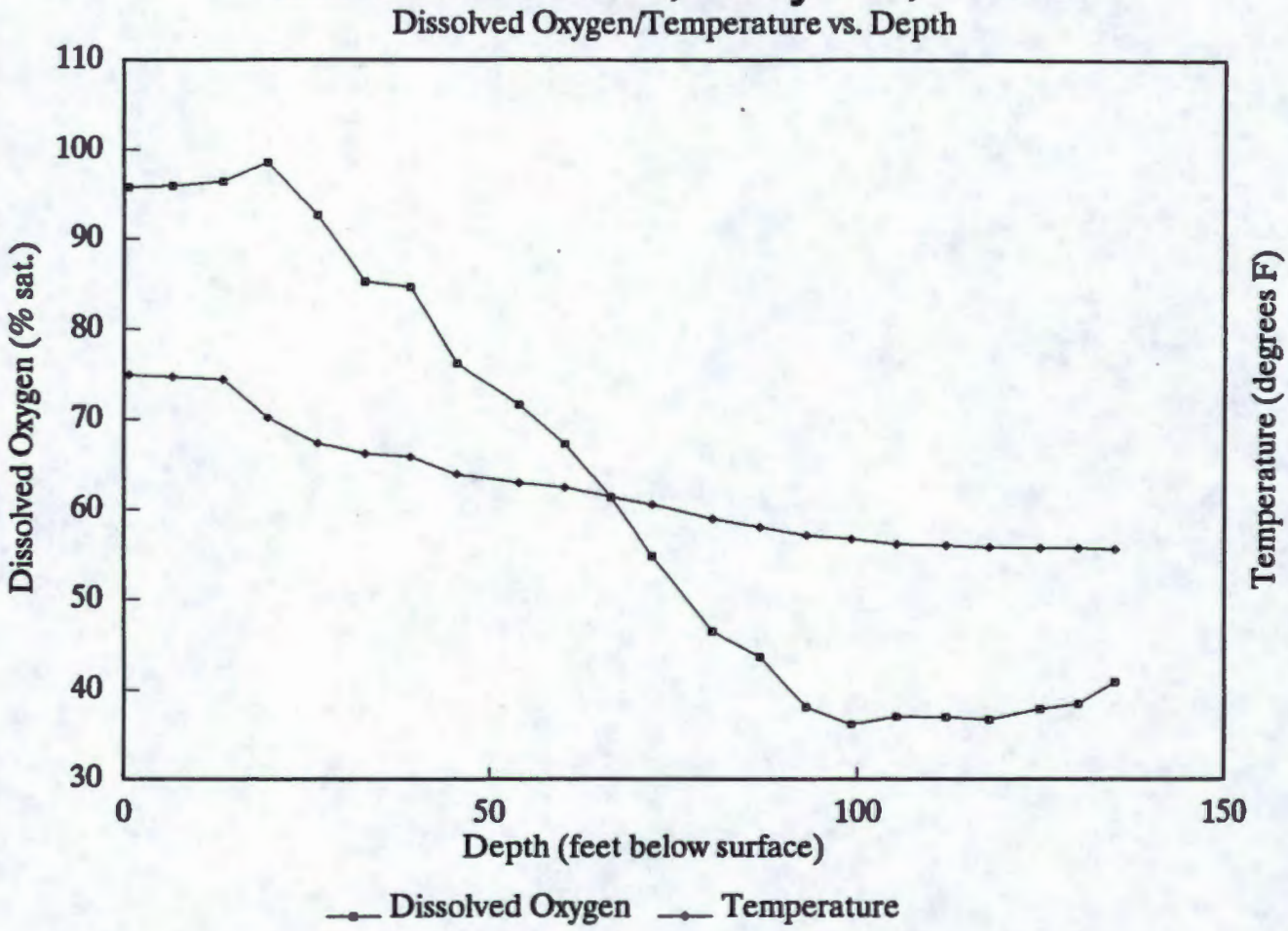
PARAMETER	UNITS	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	MEAN	MAX	MIN
Temperature	Deg. F	55				57	58					61		57.8	61.0	55.0
pH		8.2				8.2	8.2					7.8		8.1	8.2	7.8
Dissolved Oxygen	mg/l	10.4				4.1	3.8					0.3		4.7	10.4	0.3
Field Conductivity	umhos	1,010				1,040	1,050					960		1,015	1,050	960.0
Total Organic Carbon	mg / l	3.7				2.8	2.9					3.3		3.2	3.7	2.8
Algae Count	col / ml	15.0				40.0	41.0					1110.0		301.5	1110.0	15.0
Alkalinity	mg / l	142.0				140.0	135.0					130.0		136.8	142.0	130.0
Calcium	mg / l	71.0				83.0	80.0					77.0		77.8	83.0	71.0
Chloride	mg / l	87.0				90.0	85.0					88.0		87.5	90.0	85.0
Copper	ug / l	0.1				2.7	2.0					2.0		1.7	2.7	0.1
Iron	ug / l	0.1				50.0	50.0					50.0		37.5	50.0	0.1
Magnesium	mg / l	29.0				31.0	30.0					33.0		30.8	33.0	29.0
Manganese	ug / l	0.0				6.8	12.0					170.0		47.2	170.0	0.0
Sulfide	mg / l	ND				ND	ND					ND				
Conductivity	umhos	975				1,030	1,060					1,030		1,024	1,060	975
TDS	mg / l	575.0				645.0	670.0					660.0		637.5	670.0	575.0
Turbidity	NTU	1.3				0.3	0.3					1.7		0.9	1.7	0.3
MIB	ng / l															
Geosmin	ng / l															
Giardia	cts/100 l															
Cryptosporidium	cts/100 l															
Heavy Metals																
Arsenic	ug / l	3.8				ND								1.9	3.8	0.0
Lead	ug / l	ND				ND										
Semi-VOA'S																
Caffeine	ug / l	ND				ND										
Di-n-butyl-phthalate	ug / l	ND				ND										
VOC'S	ug / l	ND				ND										
Aldicarbs	ug / l	ND				ND										
Herbicides	ug / l	ND				ND										

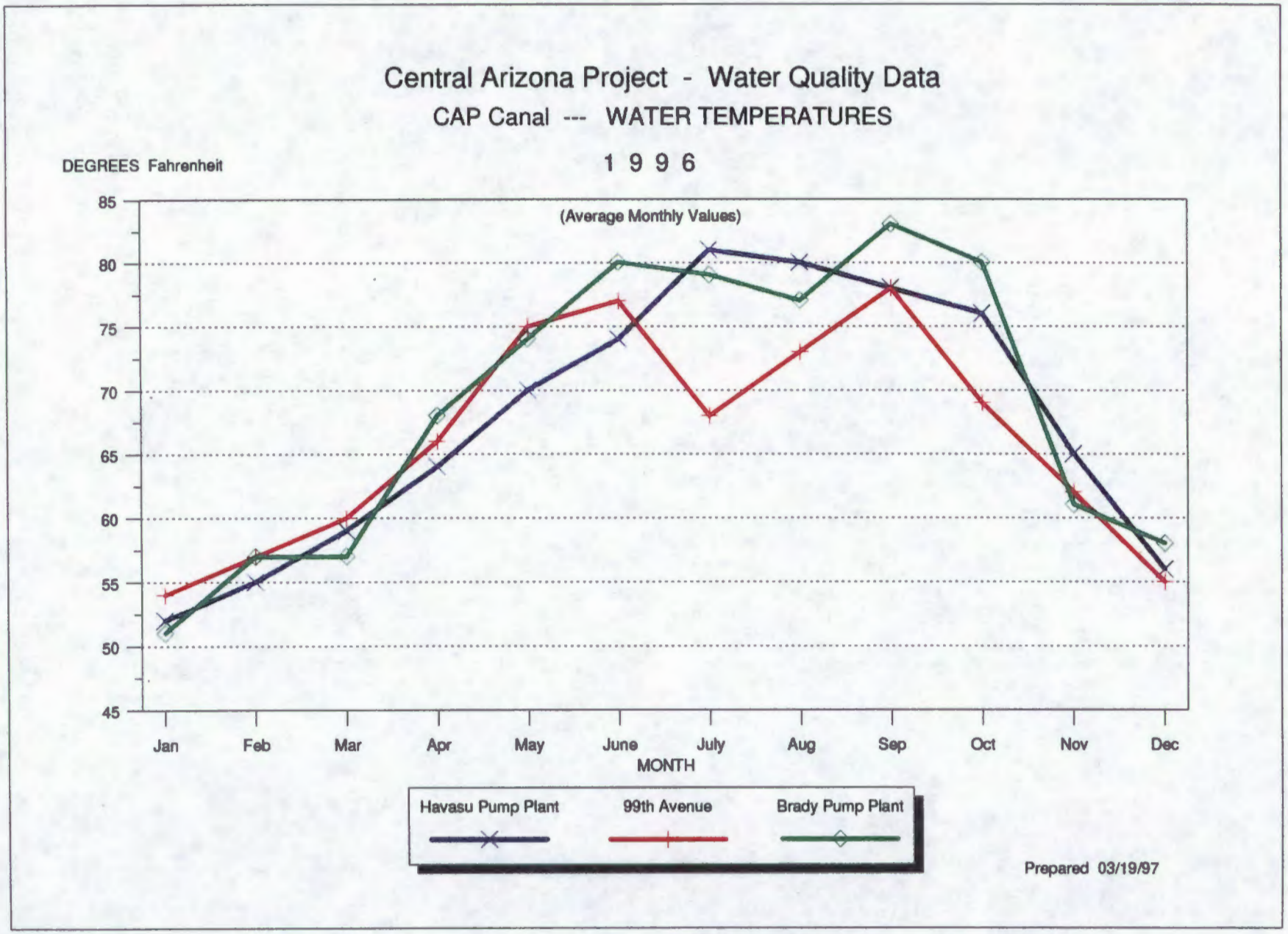
ND = Parameter was Not Detected

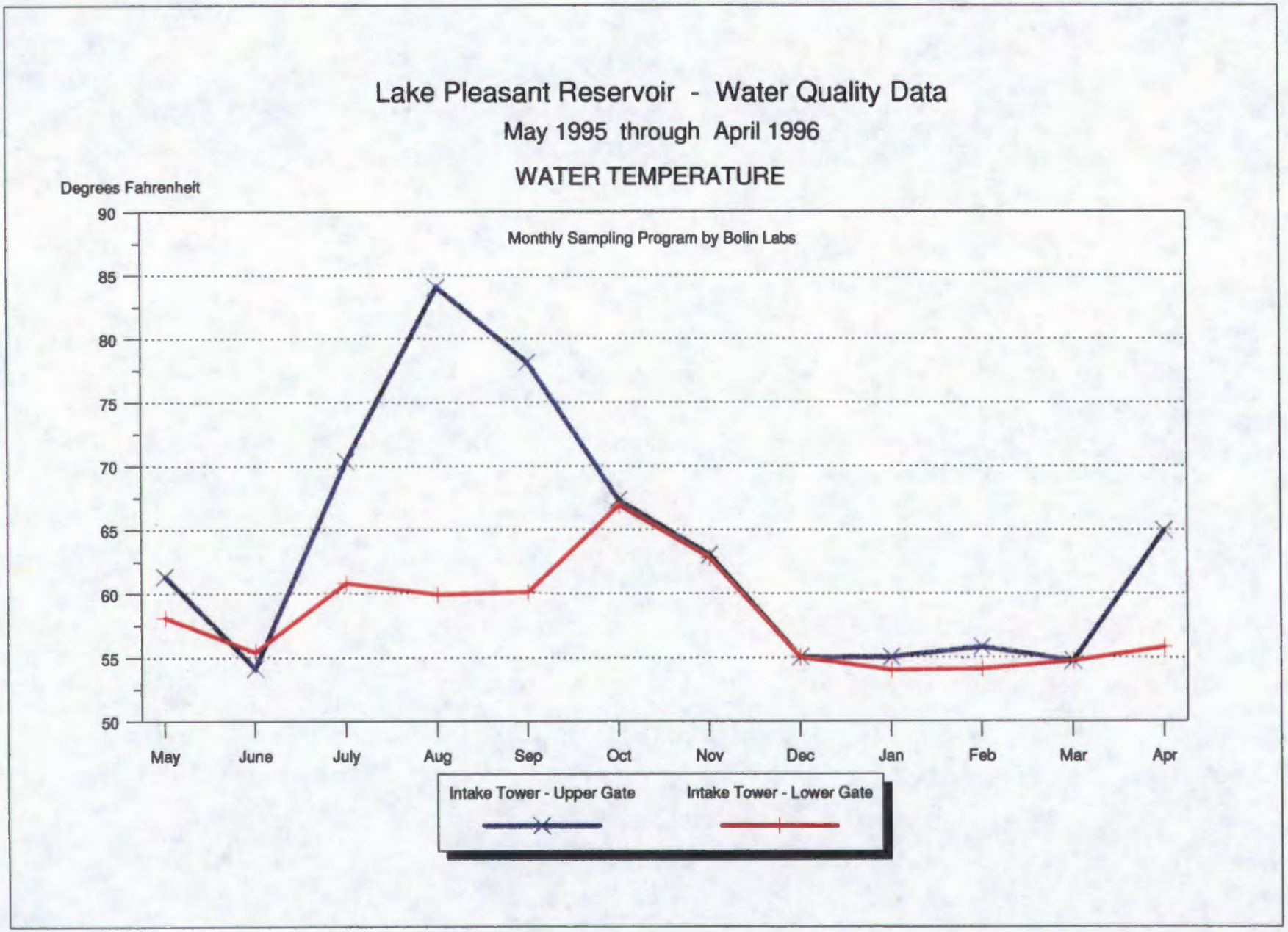
Lake Pleasant, October 4, 1996

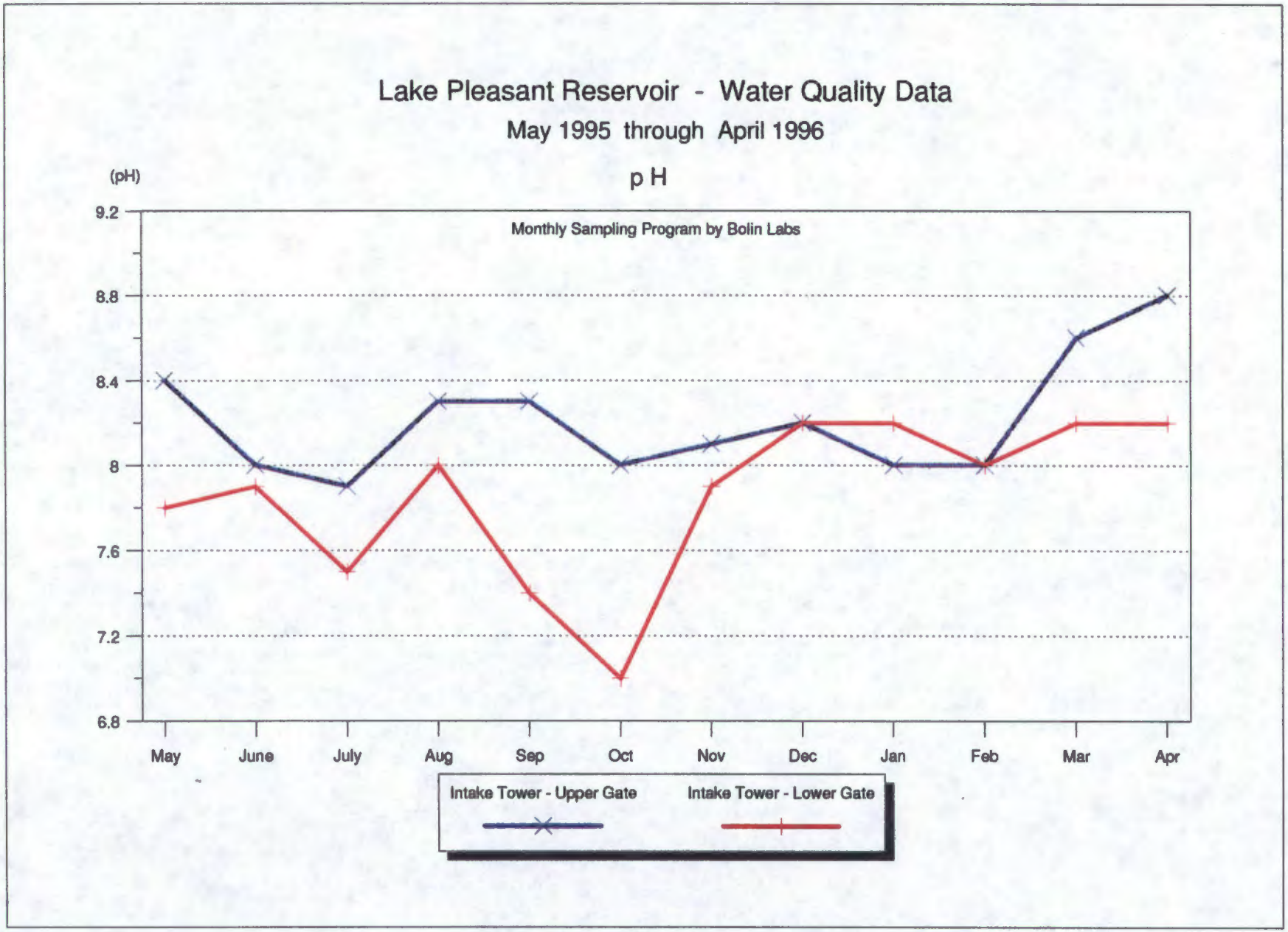


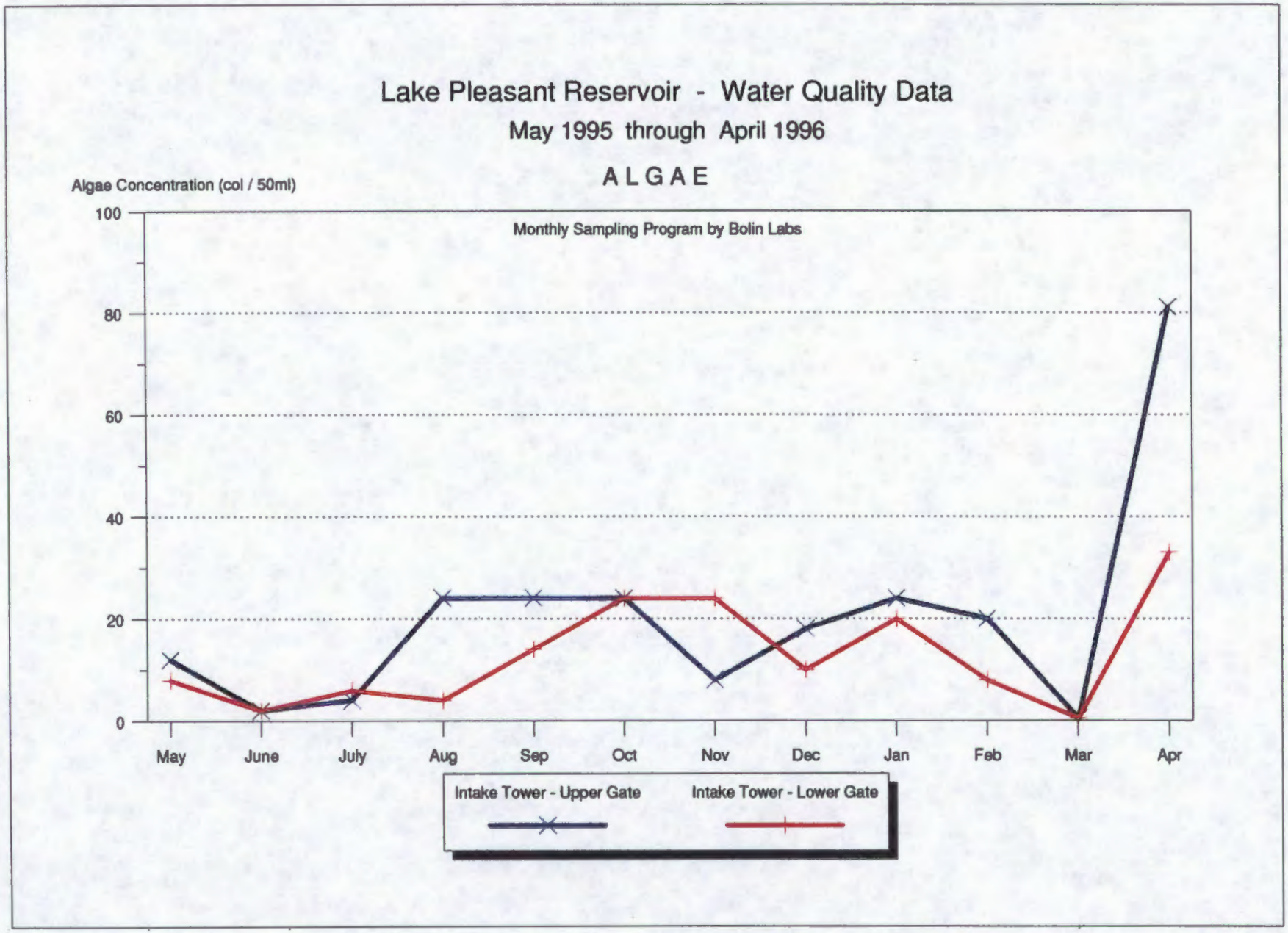
Lake Pleasant, May 17, 1996

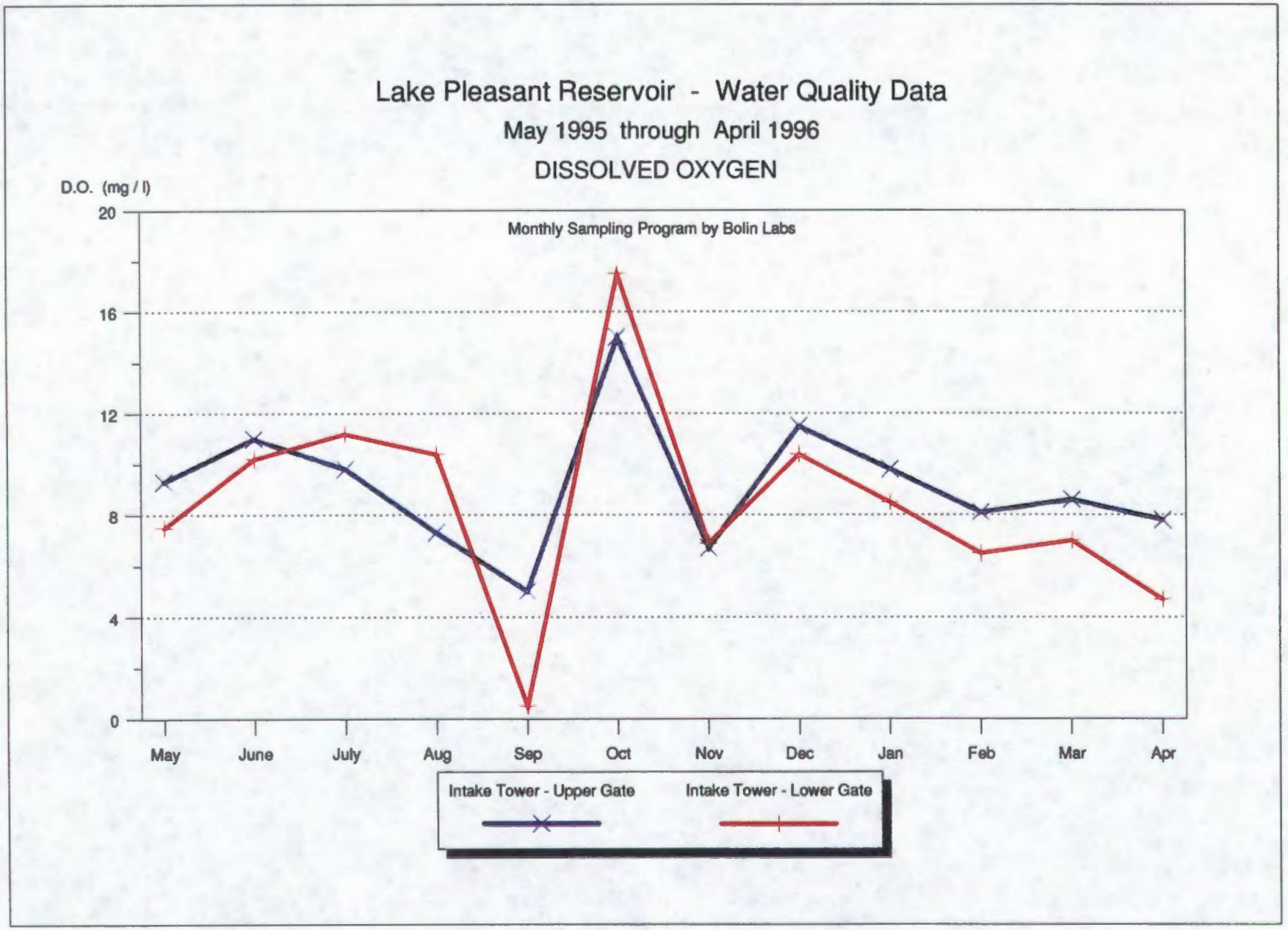


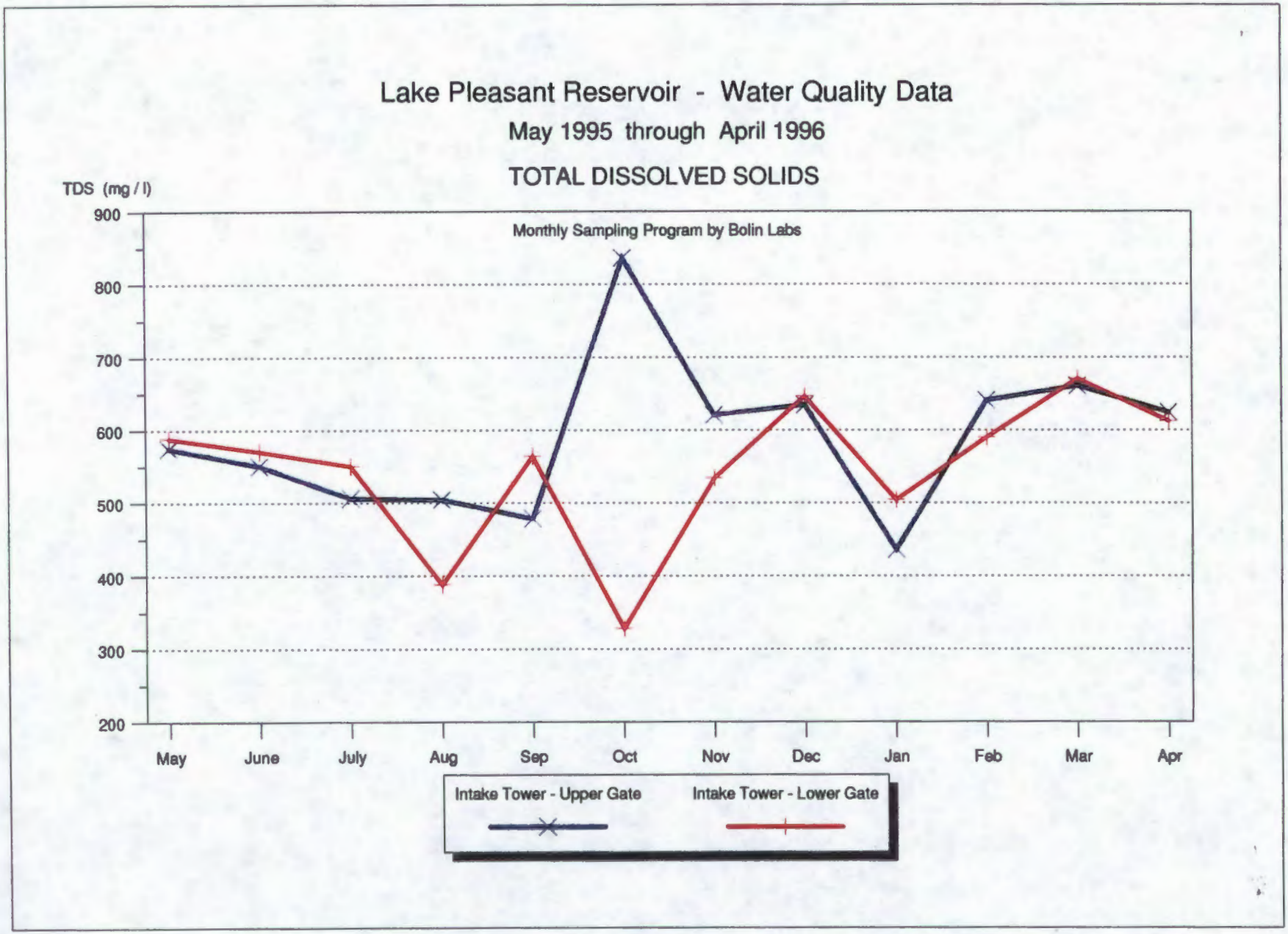

Central Arizona Project - Water Quality Data
CAP Canal --- WATER TEMPERATURES
1 9 9 6
DEGREES Fahrenheit
(Average Monthly Values)
85
80
75
70
65
60
55
50
45
Jan
Feb
Mar
Apr
May
June
July
Aug
Sep
Oct
Nov
Dec
MONTH
Havasu Pump Plant
99th Avenue
Brady Pump Plant
Prepared 03/19/97


Lake Pleasant Reservoir - Water Quality Data
May 1995 through April 1996
WATER TEMPERATURE
Degrees Fahrenheit
Monthly Sampling Program by Bolin Labs
90
85
80
75
70
65
60
55
50
May
June
July
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Intake Tower - Upper Gate
Intake Tower - Lower Gate


Lake Pleasant Reservoir - Water Quality Data
May 1995 through April 1996
(pH)
p H
Monthly Sampling Program by Bolin Labs
9.2
8.8
8.4
8
7.6
7.2
6.8
May
June
July
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Intake Tower - Upper Gate
Intake Tower - Lower Gate


Lake Pleasant Reservoir - Water Quality Data
May 1995 through April 1996
A L G A E
Algae Concentration (col / 50ml)
Monthly Sampling Program by Bolin Labs
100
80
60
40
20
0
May
June
July
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Intake Tower - Upper Gate
Intake Tower - Lower Gate


Lake Pleasant Reservoir - Water Quality Data
May 1995 through April 1996
DISSOLVED OXYGEN
D.O. (mg / l)
Monthly Sampling Program by Bolin Labs
20
16
12
8
4
0
May
June
July
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Intake Tower - Upper Gate
Intake Tower - Lower Gate


Lake Pleasant Reservoir - Water Quality Data
May 1995 through April 1996
TOTAL DISSOLVED SOLIDS
TDS (mg / l)
Monthly Sampling Program by Bolin Labs
900
800
700
600
500
400
300
200
May
June
July
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Intake Tower - Upper Gate
Intake Tower - Lower Gate