2006 LAKE LAS VEGAS
WATER QUALITY MONITORING
REPORT

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ENVIRONMENTAL PROTECTION

I. INTRODUCTION

A. Project History

J. Carlton Adair, then President of the Port Holiday Authority conceived the idea of Lake Las Vegas in 1964. The 2243-acre development project was known as Port Holiday, and the lake was called "Lake Adair." Project land was acquired from the federal government under a land exchange act (PL88-639) authorized by Congress on October 8, 1964. Approximately 170 acres of privately owned land in the Lake Mead National Recreation Area (LMNRA) was exchanged for 2,243 acres in Las Vegas Wash (LVW). That property was located along the western border of the LMNRA in the LVW (Figure 1).

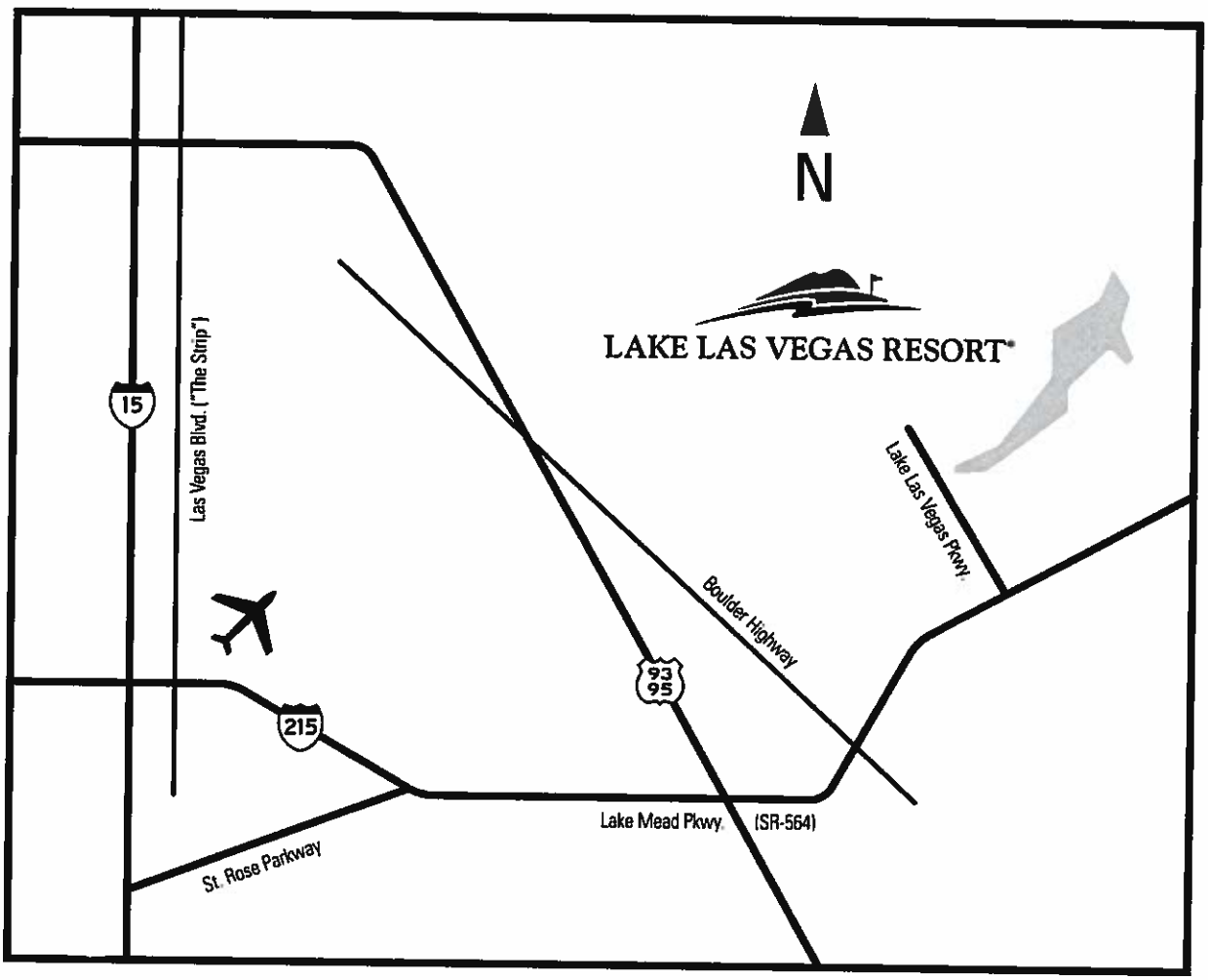
Carlton Adair halted the project in 1971, though a considerable amount of engineering and feasibility work had been done. The project remained idle until 1982 when it was reinitiated as the Lake at Las Vegas Project by Barry Silverton and the Pacific Malibu Development Corporation of Los Angeles, CA. Pacific Malibu and its prime consultant J. M. Montgomery (JMM) Consulting Engineers conducted extensive engineering and environmental studies during 1984-1987. Transcontinental Corporation of Santa Barbara, California, acquired controlling interest in the project in 1988. Transcontinental Corporation and its consultants completed the engineering and environmental studies and obtained the necessary local, state, and federal permits required to start construction of the project. Construction began on April 1, 1989. The project is now called "Lake Las Vegas Resort."

B. Project Description

The focal point of the project is a 320-acre recreational lake that is developed behind a 4800-ft., S-shaped earthen dam, 1500 ft. upstream of North Shore Road. The 190-ft. high dam was constructed with 3.0 million cubic yards of locally available materials. Lake elevation is maintained between 1401.85 ft. and 1404.85 ft. (NAVD 88). At an elevation of 1404.85 ft., the Lake has a storage capacity of approximately 10,000 acre feet, comprises 320 surface acres, a two mile length, a one mile width, and 12.3 miles of shoreline. Lake fill water is drawn from Lake Mead, and conveyed by the Basic Management Incorporated Pipeline (BMI). Approximately 7,000 – 9,000 acre-feet are required annually for project irrigation, seepage, evaporative losses from the lake.

Las Vegas Wash flows are by-passed under the lake through two 84-inch diameter reinforced concrete pipelines. The bypass system is 9,450 ft. in length and designed to pass Las Vegas Wash (LVW) flows up to approximately 1,200 cubic feet per second (cfs). Flows currently average approximately 301 cubic feet per second in LVW in 2006 (Savard, 2007).

Figure 1. **Location of Lake Las Vegas Resort, Clark County, Nevada**



II. METHODS

The revised Clark County 208 Water Management Plan was approved by the Clark County Board of County Commissioners on April 5, 1988 and certified by the State of Nevada on August 8, 1988. This plan required a water quality-monitoring program be developed for the reservoir at Lake Las Vegas Resort. The monitoring was required to insure that construction activities and operations of the reservoir did not violate the Las Vegas Wash water quality standards. The water quality-monitoring program was initiated in June 1991, and Lake Las Vegas has submitted annual reports to Nevada Division of Environmental Protection for review.

A. Lake Las Vegas Monitoring Sites

Since 1991, water quality monitoring was conducted on Lake Las Vegas monthly in January, February, November, and December, biweekly during March and October, and weekly during April through September.

Water quality monitoring was conducted at sites shown in Figure 2, at fixed points along the historical center channel in the deepest part of the Lake.

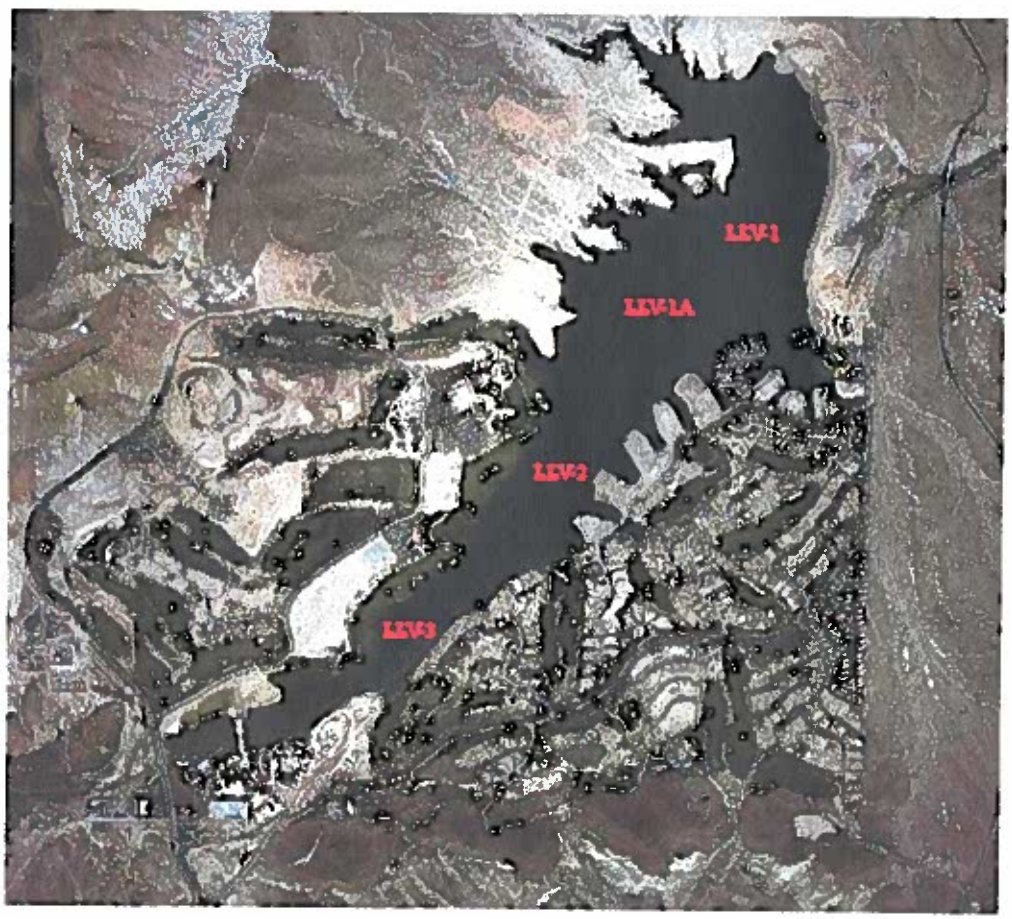


Figure 2. **Location of water quality monitoring stations at Lake Las Vegas.**

B. Field Measurements

Temperature, dissolved oxygen, pH, and specific conductance were measured throughout the vertical column at all sites with a Hydrolab Surveyor Model 4 a Water Quality Analyzer or an YSI Water Quality Analyzer (Table 1). Transparency was measured at each lake site with a Secchi disc. Duplicate measurements were made on approximately 10% of the measurements.

Table 1. **2006 Lake Las Vegas physical, chemical and biological analyses.**

Sampling Program			
Measurements	Depth(s)	Frequency	Method(s)
Physical			
Temperature (°C)	1.0 m Intervals Surface to Bottom	Variable	Electronic Multimeter
Dissolved Oxygen (mg/L)	"	"	"
pH (Std. Units)	"	"	"
Conductivity (µmhos/cm)	"	"	"
Secchi Depth (m)	Surface	"	"
Turbidity (NTU)	0 - 2.5 m Integrated	"	EPA 180.1
Chemical			
Total Nitrogen (µg/L)	0 - 2.5 m Integrated	"	APHA (1995)
Ammonia-N (µg/L)	"	"	EPA 350.2
Total Kjeldehl Nitrogen (µg/L)	"	"	EPA 351.3
Total Phosphorus (µg/L)	"	"	EPA 365.2
Ortho-Phosphorus (µg/L)	"	"	EPA 365.2
Total Suspended Solids (mg/L)	"	"	EPA 160.1
Total Dissolved Solids (mg/L)	"	"	EPA 160.2
Major Anions/Cations (mg/L)	"	"	EPA 200.7
Sulfate (mg/L)	"	"	EPA 375.4
BOD 5 (mg/L)	"	"	EPA 405.1
Biological			
Chlorophyll-a (µg/L)	"	"	Janik
Phytoplankton Counts (mg/m^3)	"	"	"
Zooplankton Counts (#/m^3)	0 - 15 m Net Tow	"	"
Fecal Coliform (MPN/100ml)	"	"	"

C. Chemical and Biological Analysis

Depth integrated water samples were collected from 0-2.5 m at main-lake sampling sites (Figure 2). Additional depth samples were also collected quarterly at 5 m, 10 m, and 20 m at site LLV-1A with a Van Dorn sampler. Samples requiring filtration were filtered through 0.45 µm millipore filters.

Analyses were run on field duplicates at a frequency of approximately 10% of the samples. A State of Nevada certified laboratory analyzed the chemical and biological analyses with EPA-approved methods. Samples were collected from the surface and near the bottom at site LLV-1A in December 2005 for analysis of toxic substances.

Monthly Zooplankton samples were collected at LLV-1 in a vertical tow from 0-15 m with an 80 µm Wisconsin plankton net. Phytoplankton (algae) was collected quarterly from the surface (0-2.5 m) from site LLV-1. Phytoplankton samples were identified and enumerated to the level of species when possible.

Phytoplankton

Utermohl Method

The inverted-microscope method or Utermohl method (Utermohl 1958, Kellar et al. 1980, Janik 1984) is used for enumeration and identification of phytoplankton samples.

Counting Procedure:

The procedure incorporates a stratified design using at least three (x 78, 280, 560) magnifications (Janik 1984). The rational for this approach is that phytoplankton in most lakes have greatest axial linear dimension (GALD) than spans three orders of magnitude from 1-2 µm to 1000 µm or more for filamentous taxa.

Sample Sedimentation:

Wild™ and Hydro-Bios™ combined plate chambers consisting of a top cylinder (Sedimentation cylinder) of 10 mL capacity and a bottom-plate chamber (base plate) are used. The bottom diameter of the base chamber is 25.5 mm. Volumes sedimented range from 2.0 – 10.0 mL depending of algal density.

Biovolumes:

Cell volumes are calculated based on the measurements of at least 20 individuals of each species and the geometrical formulae which most closely approximates the cell shape (Lund et al. 1958). Cell sizes are measured at x 560 with a calibrated ocular micrometer. For most organisms the measurements are taken from outside cell wall to outside cell wall.

Zooplankton

Samples are analyzed with a Wild M40 inverted phase contrast microscope (Wetzel and Likens 1979). Samples will be counted at: x 78. Higher magnification of x 280 and 560 are available to facilitate identifications.

Sample Preparation and Counting Procedure

The zooplankton sample is mixed by gently inverting the sample bottle for 30 seconds. A wide-bore automatic pipette is used to withdraw 2.9 mL of sample and fill a Hydro-Bios combination plate chamber.

A cover slip is then placed on top of the chamber and allowed to settle for 15 minutes before counting. A second chamber is then prepared for a total of 5.8 mL for each sample. The entire 510 mm^2 plate chamber is counted in continuous strips.

D. Statistical Analysis

Statistical analysis was performed using Jandels Sigma Stat Analytical software. All data sets were tested for normality and heterogeneity. Data sets were analyzed using appropriate non-parametric statistical tests for non-normal distributed data. Statistical significance was defined at an alpha of < 0.05 unless otherwise noted.

E. Water Quality Guidelines

The water quality guidelines presented in table 2 are patterned after standards established for Lake Mead (NAC 445.1351). These guidelines were established and adapted as part of the Clark County 208 Amendment to protect and enhance the following beneficial uses at Lake Las Vegas:

1) Irrigation
2) Recreation not involving contact with the water (boating, sailing, canoeing);
3) Recreation involving contact with the water (swimming, bathing, diving);
4) Propagation of wildlife; and
5) Propagation of aquatic life, including a warm water fishery

Table 2. **Water quality guidelines for Lake Las Vegas**

1. The lake waters should be free of:
   a. Visible floating, suspended, or settleable solids,
   b. Sludge banks, lime infestations, heavy growths of attached plants (Periphyton) and animals, or of floating algae mats,
   c. Discoloration or excessive turbidity,
   d. Visible oil or slicks,
   e. Surfactant concentrations that produce foam when water is agitated or aerated,
   f. Toxicants in toxic amounts;
2. The pH as measured in standard units should range between 7.0 and 9.0 in 90% of the measurements.
3. Dissolved oxygen concentrations should be 5 mg/L in the epilimnion during stratification, and 5mg/L through out the water column the rest of the year.
4. The average chlorophyll-a concentration in the epilimnion (0-2.5 m) should not exceed 0.005 mg/L during April through September. The average must include at least two samples per month. The single value must not exceed .010 mg/L in 10% of the samples.
5. In all lake areas, the log mean of not less than five fecal coliform samples taken over a 30 day period during the recreational season (April-September) should not exceed 200 MPN/100 ml and not over 10% of such samples should exceed 400 MPN/100;
6. Average temperature in the epilimnion should not exceed 2°C above ambient temperature (e.g. temperature in epilimnion in Lake Mead;
7. Total dissolved solids concentrations should not exceed an annual average of 2000 mg/L throughout the water column;
8. Turbidity must not exceed that characteristic of natural conditions by more than 10 NTU.

III. WATER QUALITY RESULTS

A. Lake Water Surface Elevation

Water for Lake Las Vegas is pumped from the hypolimnion of Lake Mead through the Basic Management Incorporated (BMI) pipelines. Lake Las Vegas; Lake Mead inflows totaled two thousand twelve (2,012) acre-feet during 2006 (Figure 3). Two thousand one hundred thirty-one (2,131) acre-feet of lake water were lost to seepage/evaporation.

In 2006, approximately one thousand six-hundred seventy (1,670) acre-feet of storm water discharged into the lake. Additionally, Lake Las Vegas released approximately one thousand forty-five (1,045) acre-feet through the dam's appurtenance, back to the Las Vegas Wash.

There was a 0.1 foot drop in lake elevation in 2006. Elevations are referenced to NAVD88.

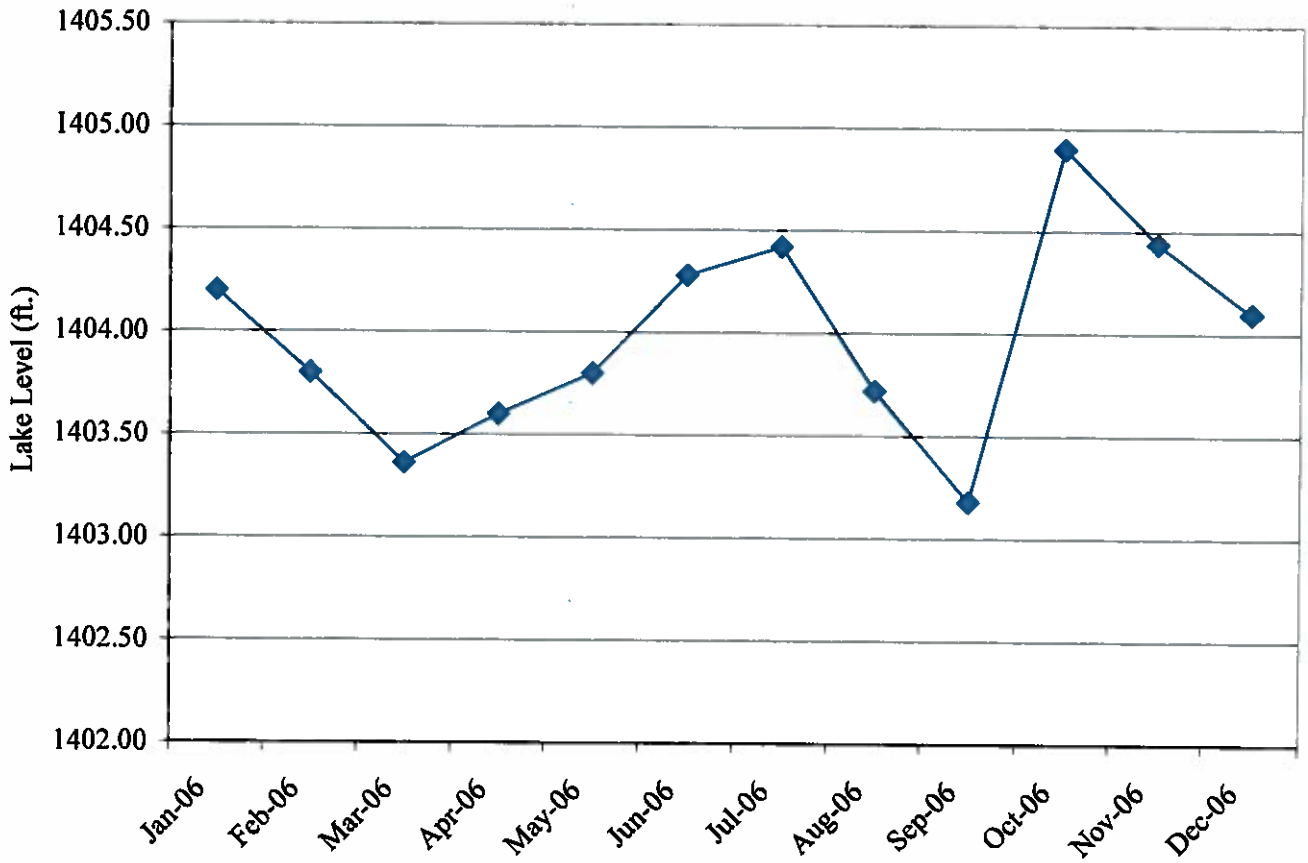


Figure 3. **2006 Lake Las Vegas Surface elevations.**

Table 3. **2006 Storm water inflow and outflow of Lake Las Vegas.**

Date	Inflow (AF)	Outflow Net (AF)	Recovery (AF)
10/6/2006	31	0	31
10/14/2006	1,643	1,045	598
Total	**1,674**	**1,045**	**629**

B. Physical Analysis

Temperature

Surface temperatures in Lake Las Vegas ranged from 9.0°C to 29.0°C during 2006, with the lowest temperatures found in January and the highest in July (Figure 4). The Lake was uniformly mixed top to bottom during December, but reflected various stages of thermal stratification during the remaining quarters through early spring. In 2006, cooler than normal ambient air temperatures slowed the stratification process and we did not observe vertical warming of the water column in the March sampling as has been seen in previous years (Table 4). The Lake remained stratified during the summer and early fall months.

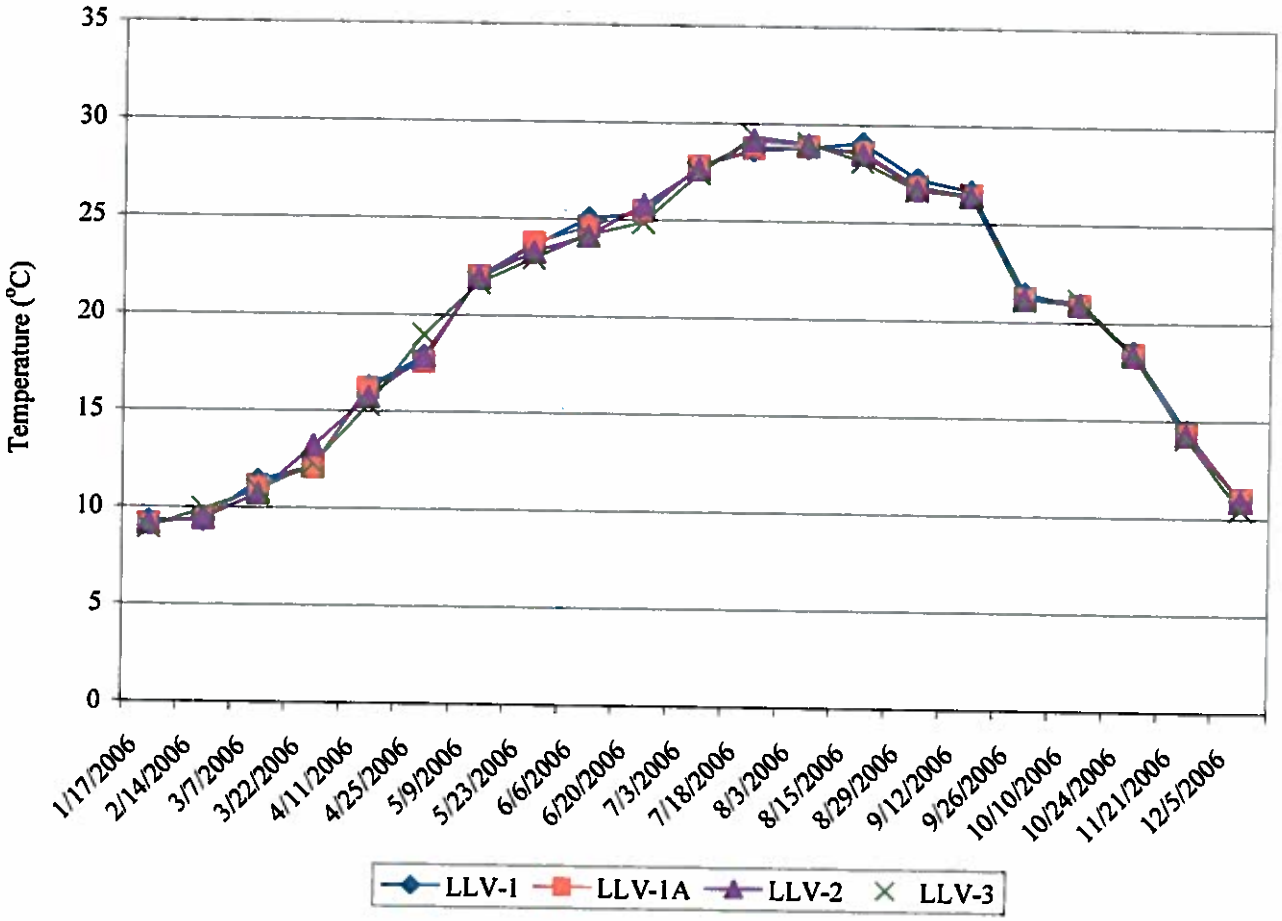


Figure 4. **Lake Las Vegas surface temperature (°C) measurements at Lake monitoring stations in 2006.**

Table 4. **Lake Las Vegas temperature (°C) profiles at Lake monitoring station LLV-1A during March, June, September, and December 2006.**

Depth (m)	3/22/2006	6/20/2006	9/19/2006	12/5/2006
0	12.1	25.5	23.4	11.0
2	11.6	24.8	23.2	11.0
4	11.5	24.7	23.2	11.0
6	11.5	24.3	23.2	10.9
8	11.4	22.6	23.1	10.9
10	11.4	21.0	23.1	10.9
12	11.3	18.6	22.9	10.9
14	11.3	16.2	20.6	10.9
16	11.2	15.2	17.1	10.9
18	11.2	14.7	16.2	10.9
20	11.1	14.5	15.6	10.9
22	11.1	14.4	15.4	10.8
24	11.1	14.4	15.4	10.8

Dissolved Oxygen

Dissolved oxygen concentrations at the lake surface did not have considerable variations between the sites throughout the year (Figure 5). Concentration ranged from approximately 5.0 to 10.9 mg/L. Concentrations at depth exhibited the common dissolved oxygen trends found within monomictic lakes that stratify (Table 5).

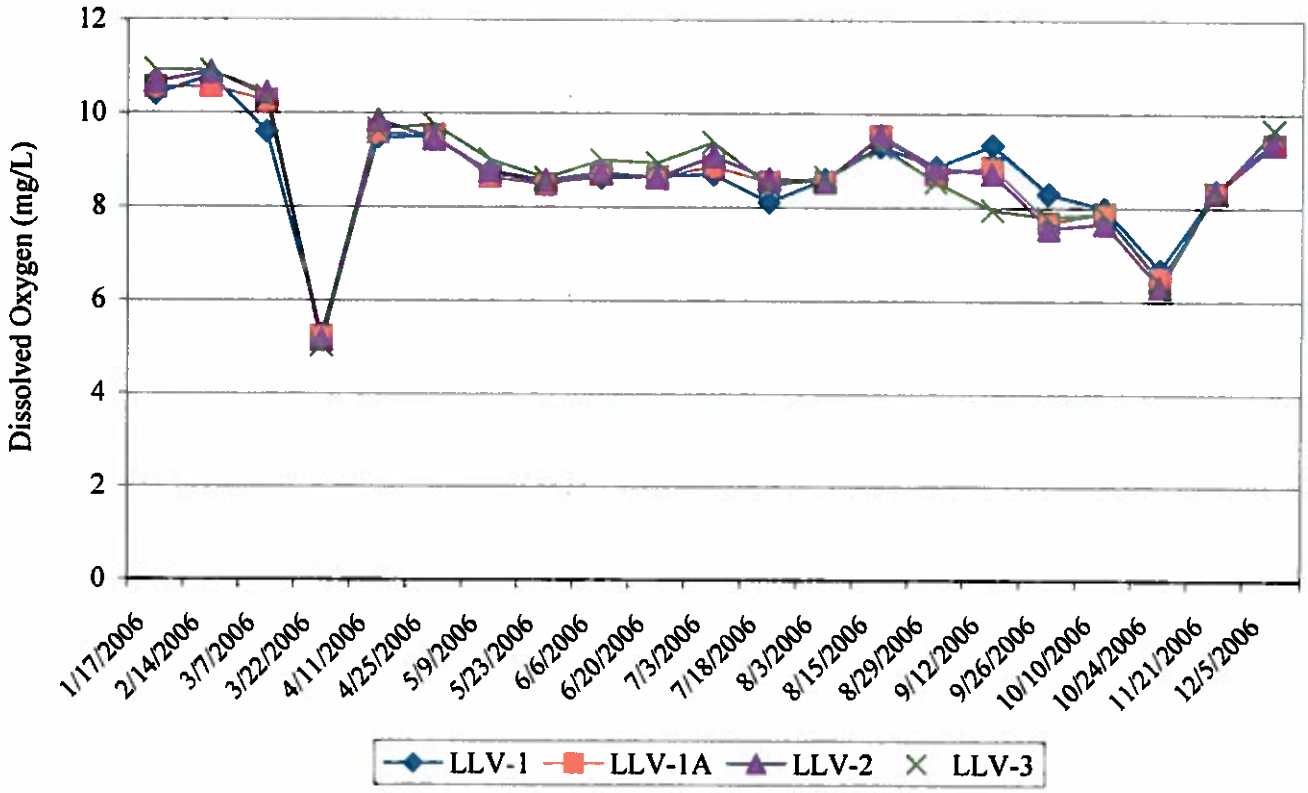


Figure 5. **Lake Las Vegas dissolved oxygen (mg/L) in surface waters at Lake monitoring stations during 2006.**

The Lake remained relatively well mixed during the late fall through late spring. During the period of stratification, dissolved oxygen concentrations, below the thermocline, were less than 5.0 mg/L (Table 5). Dissolved oxygen concentrations measured on March 22, 2006 appeared low in comparison to those collected two weeks prior and two weeks after. It appears that there was a problem with all readings from that day and I suspect that an unserviceable dissolved oxygen membrane is to blame.

Table 5. **Lake Las Vegas dissolved oxygen (mg/L) profiles at station LLV-1A during March, June, September, and December 2006.**

Depth	3/22/2006	6/20/2006	9/19/2006	12/5/2006
0	5.2	8.7	7.7	9.4
2	5.2	8.7	7.7	9.4
4	5.2	8.6	7.4	9.4
6	5.2	8.7	7.4	9.3
8	5.2	7.7	7.2	9.4
10	5.2	6.6	7.0	9.4
12	5.2	3.8	5.5	9.3
14	5.2	1.9	0.1	9.4
16	5.2	1.2	0.1	9.3
18	5.2	1.0	0.1	9.3
20	5.1	0.9	0.1	9.3
22	5.1	1.1	0.1	9.3
24	5.2	1.3	0.2	9.3

pH

There was little seasonal variation in pH of surface waters in Lake Las Vegas during 2006 (Figure 6). Surface water pH values varied slightly between the four Lake sites ranging between 7.8 and 8.5 in 2006 (Figure 6). Minor variability can be attributed to spatial distribution of phytoplankton activity. Depth profiles of pH indicated the pH followed a similar trend of dissolved oxygen. During periods of stratification pH values decreased as bicarbonate concentrations declined with the onset of anaerobic conditions (Table 6).

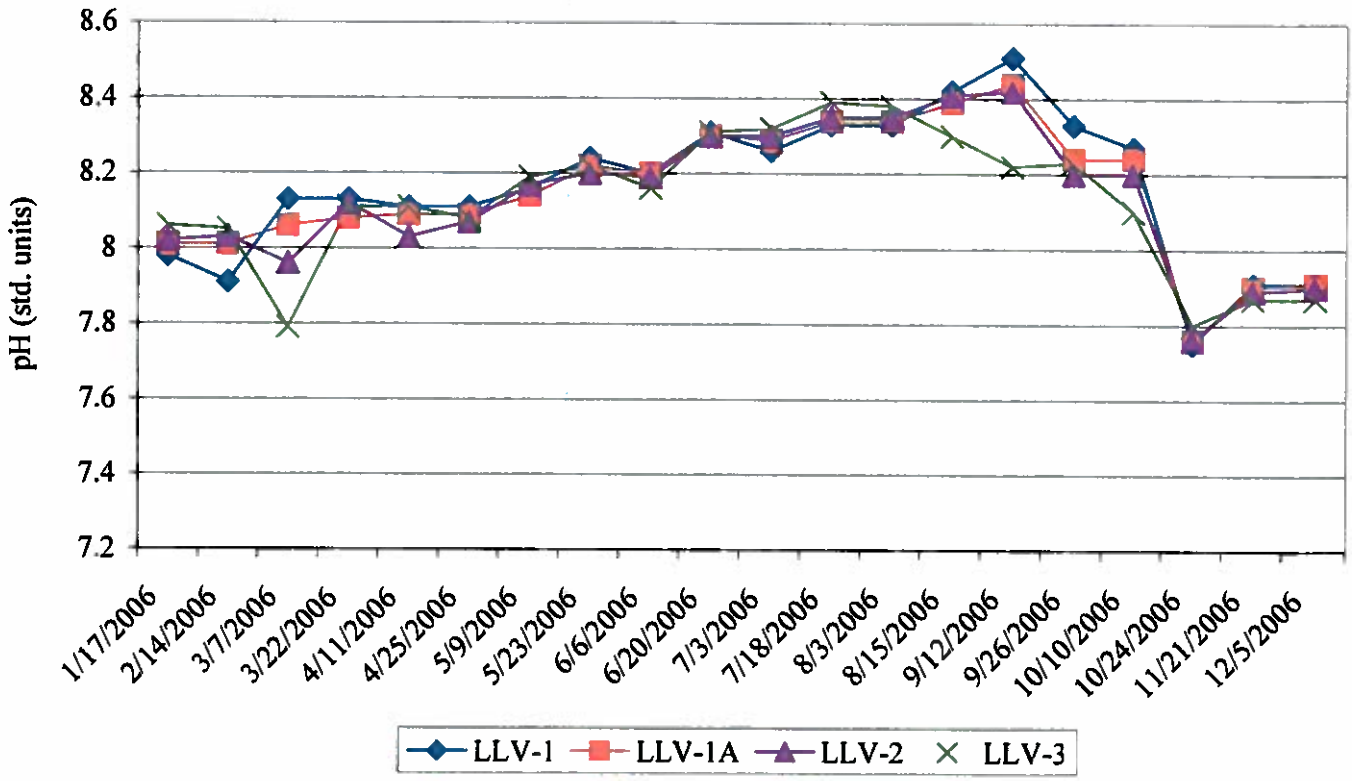


Figure 6. **Lake Las Vegas pH (standard units) in surface water at Lake monitoring stations during 2006.**

Table 6. **Lake Las Vegas pH (standard units) profiles at station LLV-1A during March, June, September and December 2006.**

Depth	3/22/2006	6/20/2006	9/19/2006	12/5/2006
0	8.1	8.3	8.3	7.9
2	8.1	8.3	8.3	7.9
4	8.1	8.3	8.3	7.9
6	8.1	8.2	8.2	7.9
8	8.1	8.0	8.2	7.9
10	8.1	7.8	8.2	7.9
12	8.1	7.6	7.9	7.9
14	8.1	7.5	7.4	7.9
16	8.1	7.5	7.4	7.9
18	8.1	7.6	7.4	7.9
20	8.1	7.6	7.3	7.9
22	8.1	7.6	7.3	7.9
24	8.1	7.7	7.4	7.9

Specific Conductance

Lake water specific conductivity ranged between roughly 1,866 µmho/cm and 2,194 µmho/cm at the surface during 2006 (Figure 7). Specific conductivity did not vary significantly between the four lake sites or with depth (Table 7).

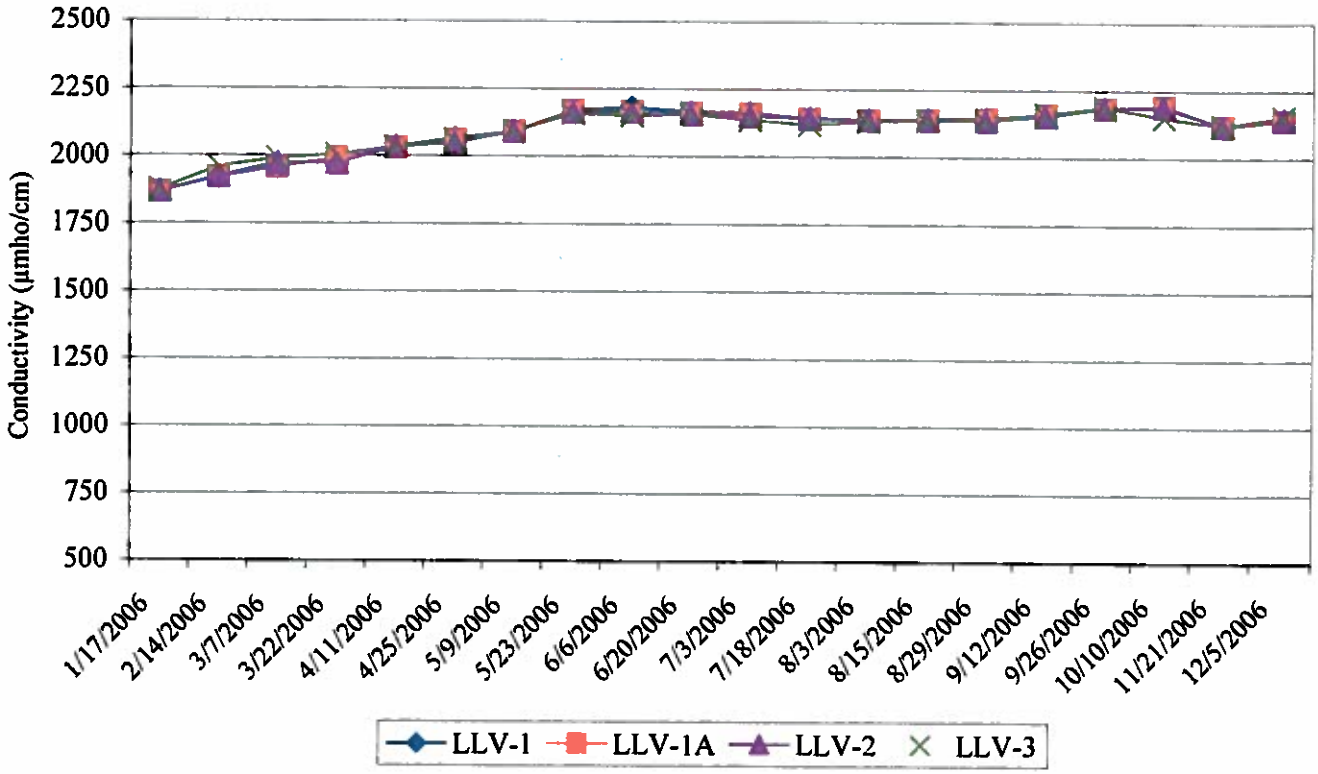


Figure 7. **Lake Las Vegas conductance (µmhos/cm) in surface waters at Lake monitoring stations during 2006.**

Table 7. **Lake Las Vegas conductance (µmhos/cm) profiles at station LLV-1A during March, June, September, and December 2006.**

Depth (m)	3/22/2006	6/20/2006	9/19/2006	12/5/2006
0	1992	2162	2166	2143
2	1994	2160	2163	2144
4	1993	2158	2165	2143
6	1992	2151	2166	2142
8	1992	2132	2164	2144
10	1997	2139	2168	2145
12	2000	2136	2169	2144
14	2003	2127	2170	2145
16	2009	2120	2127	2146
18	2009	2135	2151	2148
20	2016	2144	2183	2153
22	2014	2130	2187	2152
24	2025	2129	2196	2160

Transparency (Secchi)

There was considerable seasonal and spatial variability in Lake transparency values during 2006 with values ranging between 1.3 and 8.5 meters of lake depth. Transparency was high during the spring and fall and lower during the summer months. Sampling location LLV-3 continues to exhibit lower transparency values due to the shallow nature of the west end of the lake. This site is influenced by wind and boat activity (Figure 8).

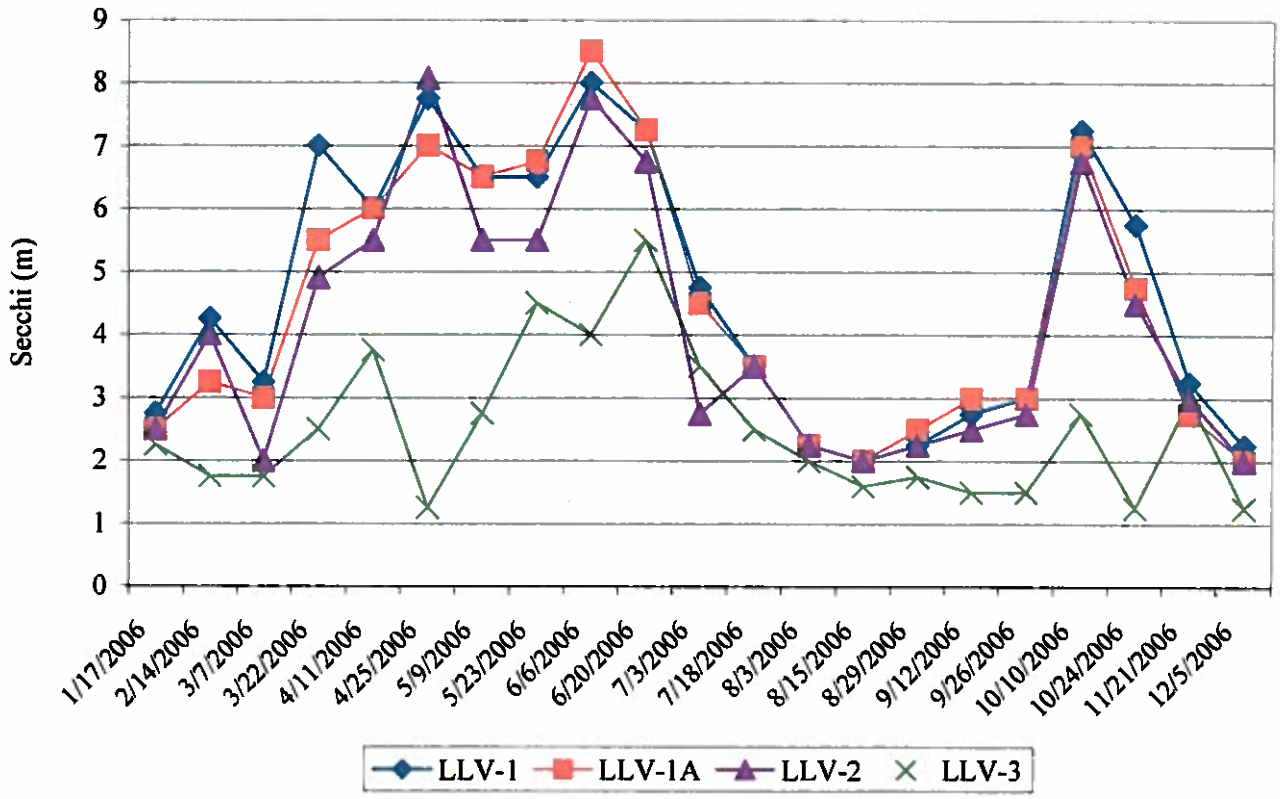


Figure 8. **Lake Las Vegas transparency (m) measurements in surface water at Lake monitoring stations during 2006.**

Turbidity

Monthly Turbidity values did not vary between the four sites with concentrations varying between 1.0 and 2.0 mg/L at the surface (0-2.5m). There was no difference in turbidity concentrations between depths at site LLV-1A in 2006 (p=1.0) (Table 8).

Table 8. **2006 Lake Las Vegas chemical concentrations at site LLV-1A during the months of March, June, September, and December at 0, 5, 10 and 20m depths.**

Date	Depth (m)	BOD5 (mg/L)	TDS (mg/L)	TSS (mg/L)	TURB (mg/L)	Chl-a (µg/L)	Ortho phos (µg/L)	Total phos (µg/L)	Nitrite + Nitrate (µg/L)	Ammonia (µg/L)	TKN (µg/L)	Total Nitrogen (µg/L)	Ca (mg/L)	Cl (mg/L)	HCO3 (mg/L)	SO4 (mg/L)	Na (mg/L)	K (mg/L)	Mg (mg/L)
3/22/2006	0	2	1432	1	1	1	5	19	2039	150	810	2849	175	210	90	713	167	18	48
3/22/2006	5	2	1438	1	1	1	5	18	2053	130	560	2613	174	219	90	719	171	18	47
3/22/2006	10	6	1426	2	1	1	6	21	1983	140	700	2683	172	219	90	717	166	18	47
3/22/2006	20	2	1448	3	1	1	8	19	1993	150	720	2713	171	230	95	721	170	18	47
6/20/2006	0	2	1492	2	1	1	5	16	1049	60	640	1689	176	284	100	798	174	18	50
6/20/2006	5	2	1522	2	1	3	5	18	1029	60	670	1699	175	280	100	796	170	18	49
6/20/2006	10	2	1492	2	1	2	5	26	1112	70	600	1712	170	279	105	778	167	18	47
6/20/2006	20	2	1520	6	1	1	16	41	1199	50	470	1669	174	280	110	791	166	18	47
9/19/2006	0	2	1494	5	1	2	5	15	291	50	1320	1611	165	253	75	804	220	18	23
9/19/2006	5	3	1500	5	1	3	5	18	292	50	570	862	166	248	75	789	238	20	54
9/19/2006	10	2	1412	3	1	1	5	11	302	50	320	622	176	257	75	817	229	22	57
9/19/2006	20	2	1464	2	1	1	63	78	5	270	1100	1105	215	260	130	774	220	23	61
12/5/2006	0	2	1600	9	1	3	16	38	555	160	590	1145	172	233	95	690	193	22	52
12/5/2006	5	3	1590	6	1	1	16	57	775	400	520	1295	172	232	110	688	199	23	53
12/5/2006	10	2	1604	7	1	1	13	57	534	210	500	1034	175	259	90	696	198	23	53
12/5/2006	20	2	1604	7	1	1	13	57	534	210	500	1034	175	259	90	696	198	23	53

C. Chemical Analysis

Total Suspended Solids

Monthly total suspended solids concentrations varied between 1.0 and 11.0 mg/L with no significant differences between the sites ($p>0.05$). The highest concentrations occurred post October storm (Figure 9). There were no significant differences in total suspended solids concentrations between depths at site LLV-1A in 2006 ($p=0.86$) with values ranging between 1.0 and 9.0 mg/L (Table 8).

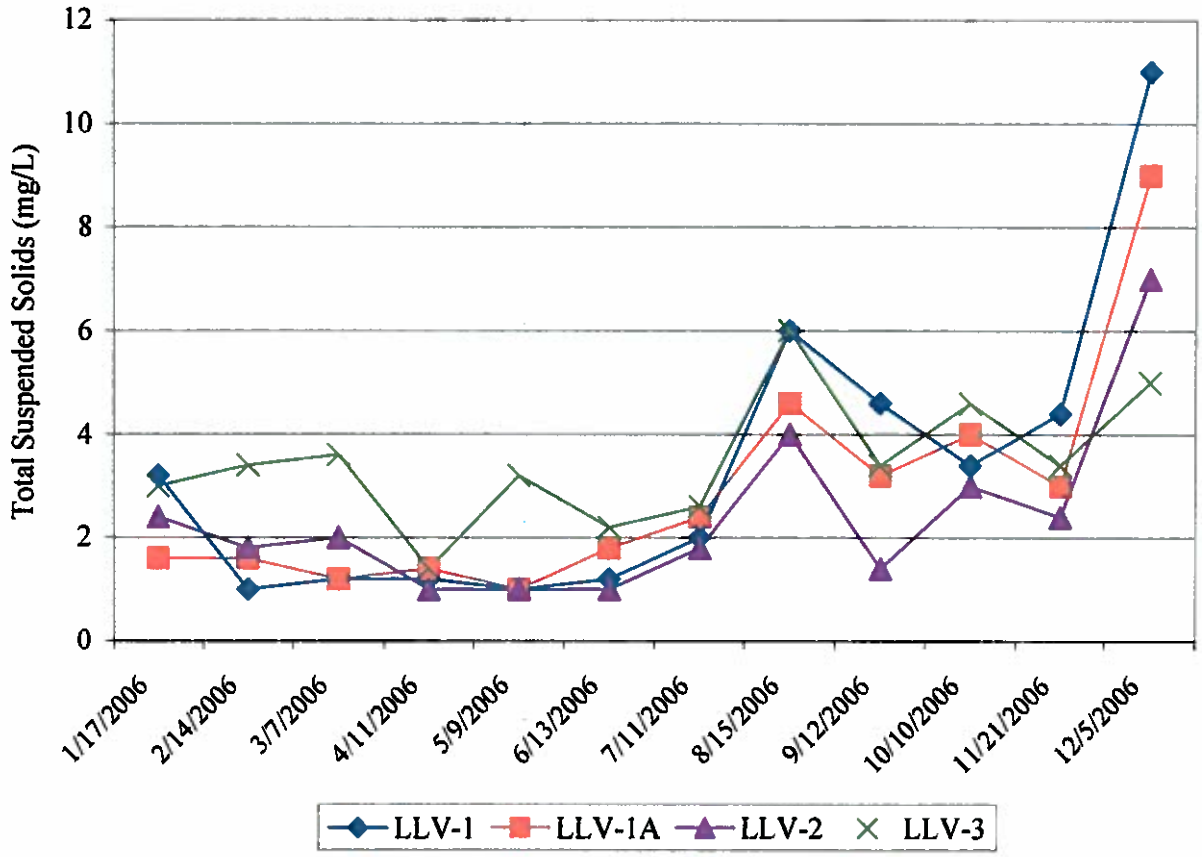


Figure 9. **Lake Las Vegas total suspended solids (mg/L) concentrations in surface waters at Lake monitoring stations during 2006.**

Total Dissolved Solids

There was no significant difference in monthly total dissolved solids (TDS) concentrations between the four Lake sites ($p>0.05$) (Figure 10). Monthly concentrations ranged between 1,332 and 1,800 mg/L at the surface (0-2.5m). TDS concentrations ranged between 1,412 and 1,604 mg/L at depth with no significant difference in total dissolved solids concentrations between depths at site LLV-1A in 2006 ($p=0.77$). TDS concentrations continue to remain below the 2,000 mg/L guideline for irrigation purposes (Table 8).

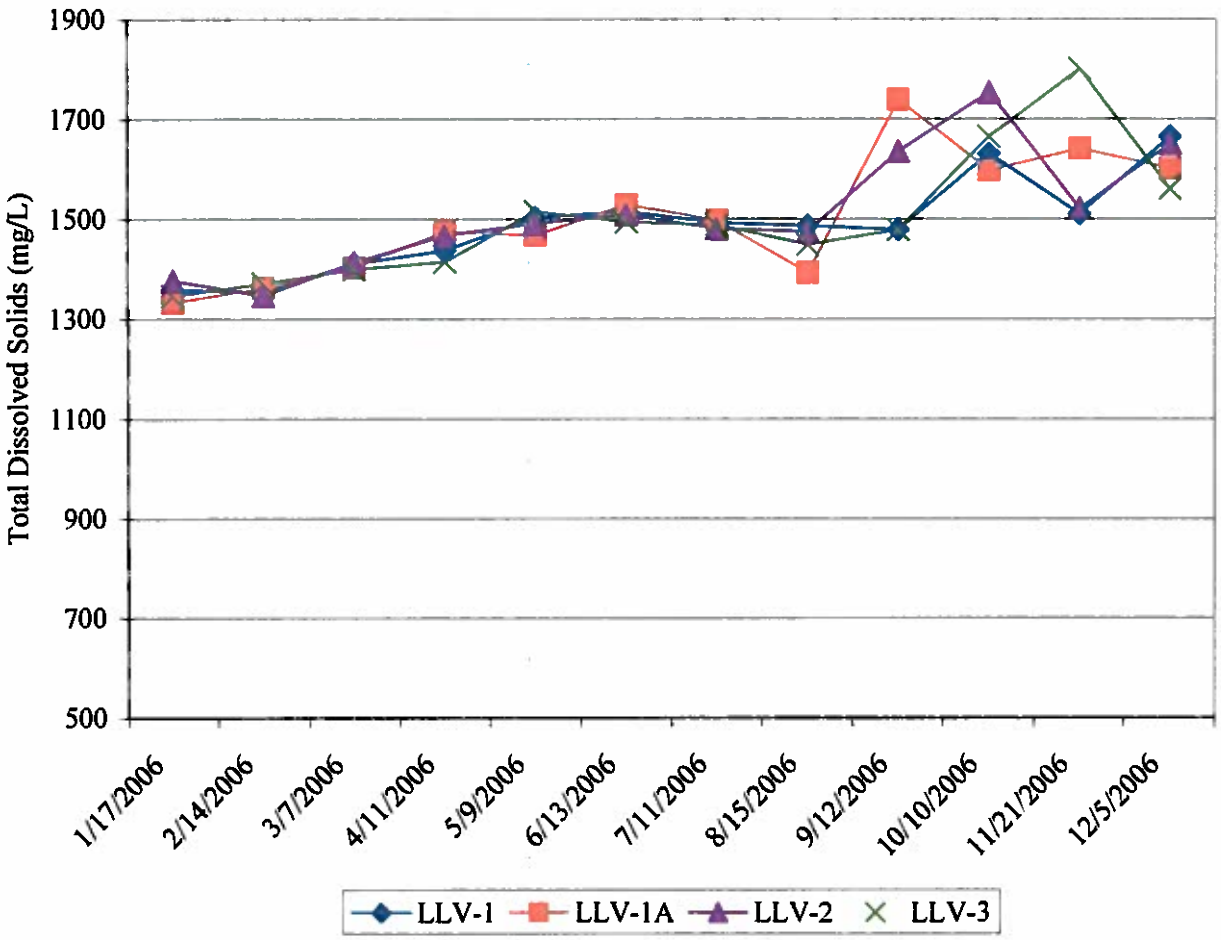


Figure 10. **Lake Las Vegas total dissolved solids (mg/L) concentrations at Lake monitoring stations during 2006.**

Major Ion Concentrations

Quarterly depth samples did not vary significantly at site LLV-1A for the ions of calcium, sodium, chloride, potassium, sulfate and magnesium ($p>0.05$) (Table 8). Calcium, Choride, Bicarbonate, Sodium, Potassium, and Magnesium concentrations did not vary with depth or time.

Total Phosphorus

Monthly concentrations ranged between 7 and 38 µg/L at the surface (0-2.5m). (Figure 11) This is compared to 10 and 76 µg/L last year. In 2006 there was no significant difference between the sites ($p>0.005$) (Figure 11). Monthly total phosphorus concentrations varied slightly (11 and 78 µg/L) between depths at site LLV-1A, but were not significantly different ($p=0.24$) (Table 8).

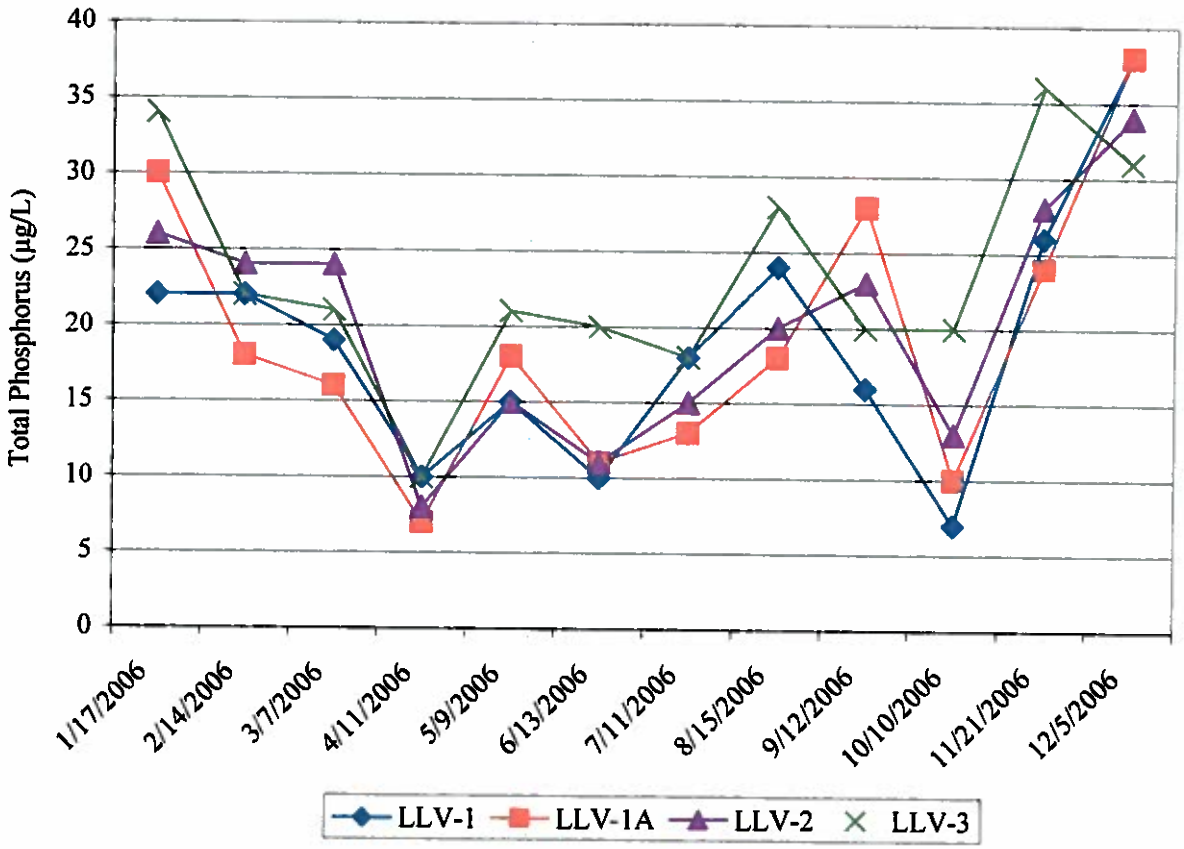


Figure 11. **Lake Las Vegas total phosphorus (µg/L) concentrations in surface waters at Lake monitoring stations during 2006.**

Ortho-Phosphorus

Monthly Ortho-phosphorus concentrations did not vary significantly between sites and ranged between 5 and 16 µg/L as compared with 5 and 56 µg/L in 2005 ($p>0.05$) (Figure 12). Monthly ortho-phosphorus concentrations did not show a significant difference between depths. ($p=0.16$) concentrations ranging between 5 and 63 µg/L (Table 8).

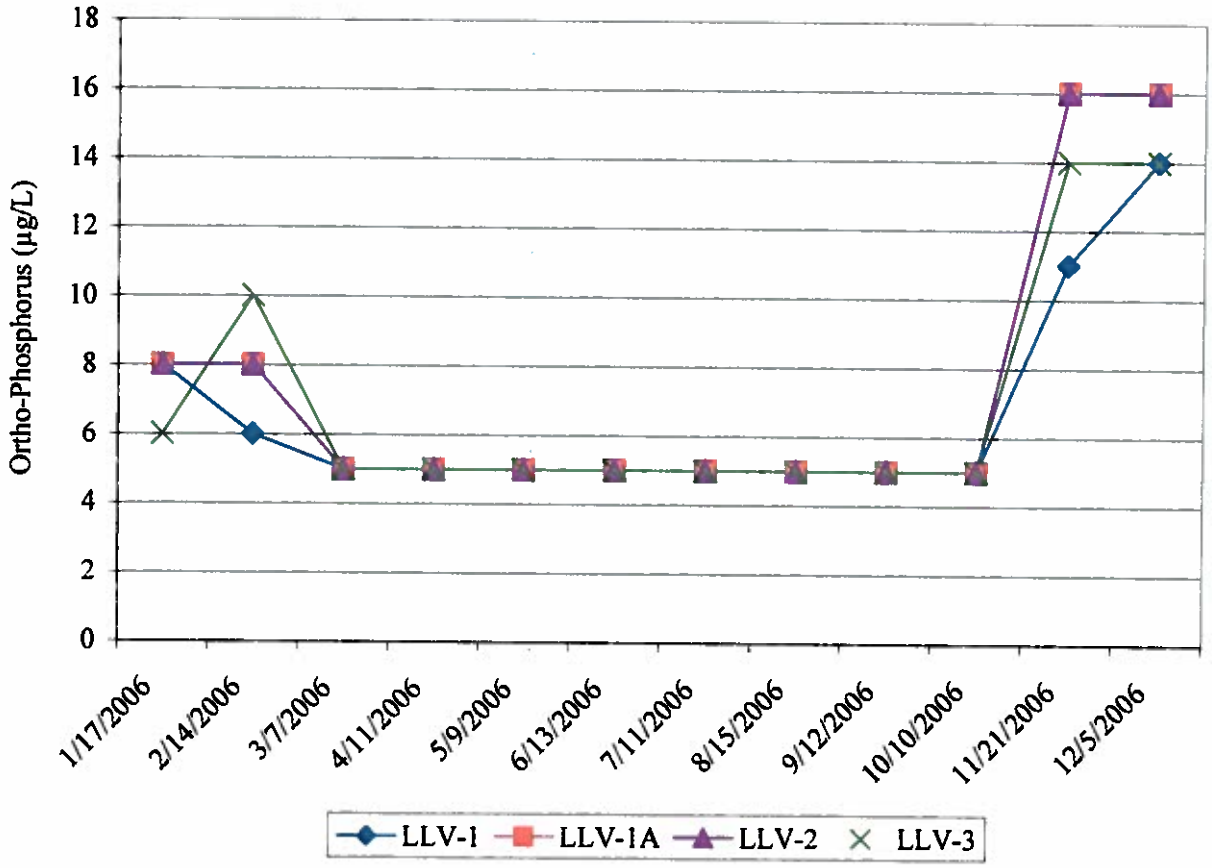


Figure 12. **Lake Las Vegas ortho-phosphorus µg/L concentrations in surface waters at Lake monitoring stations during 2006.**

(Nitrite + Nitrate) – Nitrogen

Monthly nitrite plus nitrate surface water concentrations ranged between 280 and 2,099 µg/L at the four Lake sites in 2006 with no significant difference as compared with 1,619 and 2,860 µg/L in 2005 ($p>0.05$) (Figure 13). Monthly nitrite plus nitrate concentrations were not significantly different by site or depth ($p=0.99$) (Table 8). Concentrations varied by depth between 5 and 2,039 µg/L.

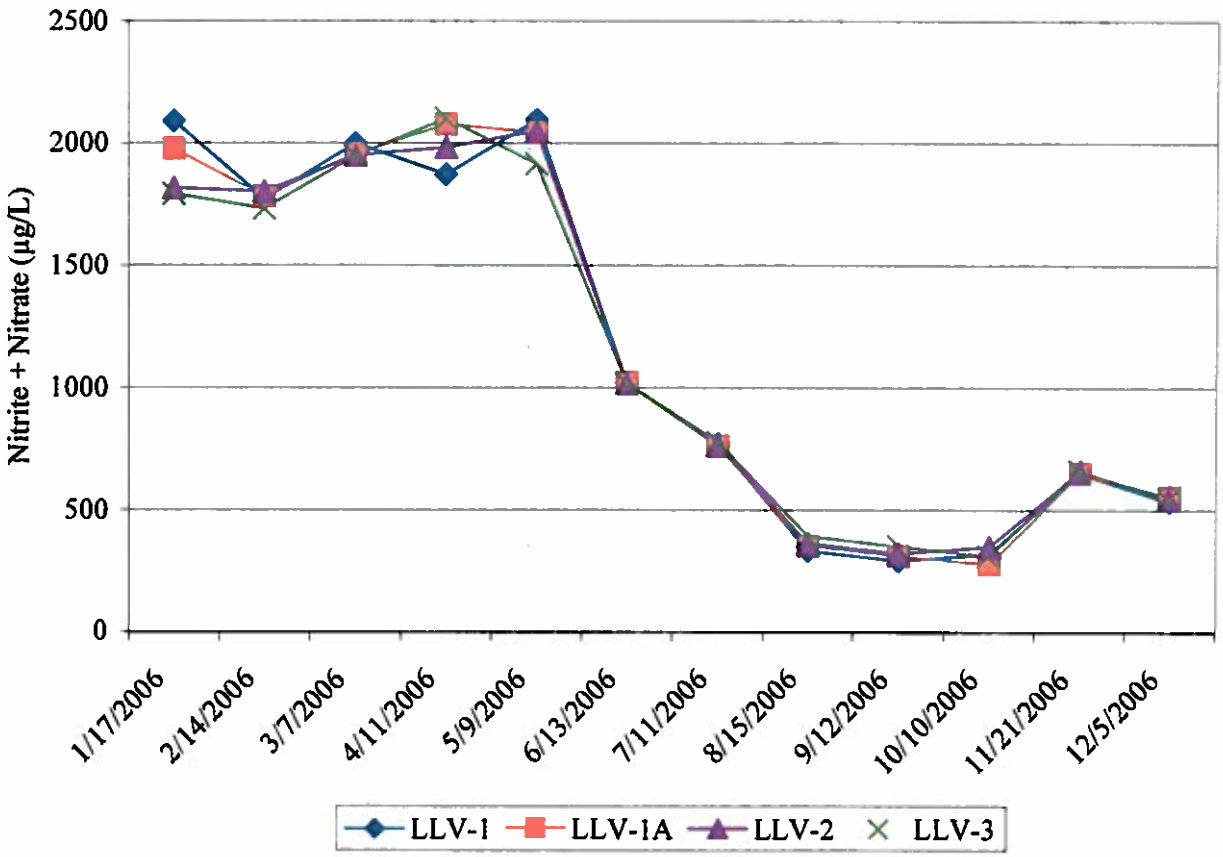


Figure 13. **Lake Las Vegas nitrite + nitrate (µg/L) concentrations in surface waters at Lake monitoring stations during 2006.**

Ammonia - Nitrogen

Monthly ammonia surface water concentrations ranged between 50 to 480 µg/L during 2006, with no significant difference between the four Lake sites as compared to 50 to 360 µg/L in 2005 ($p>0.05$) (Figure 14). Variability in concentrations between depths was not found significant for ammonia during 2006 at site LLV-1A with values ranging between 50 and 400 µg/L ($p=0.84$) (Table 8).

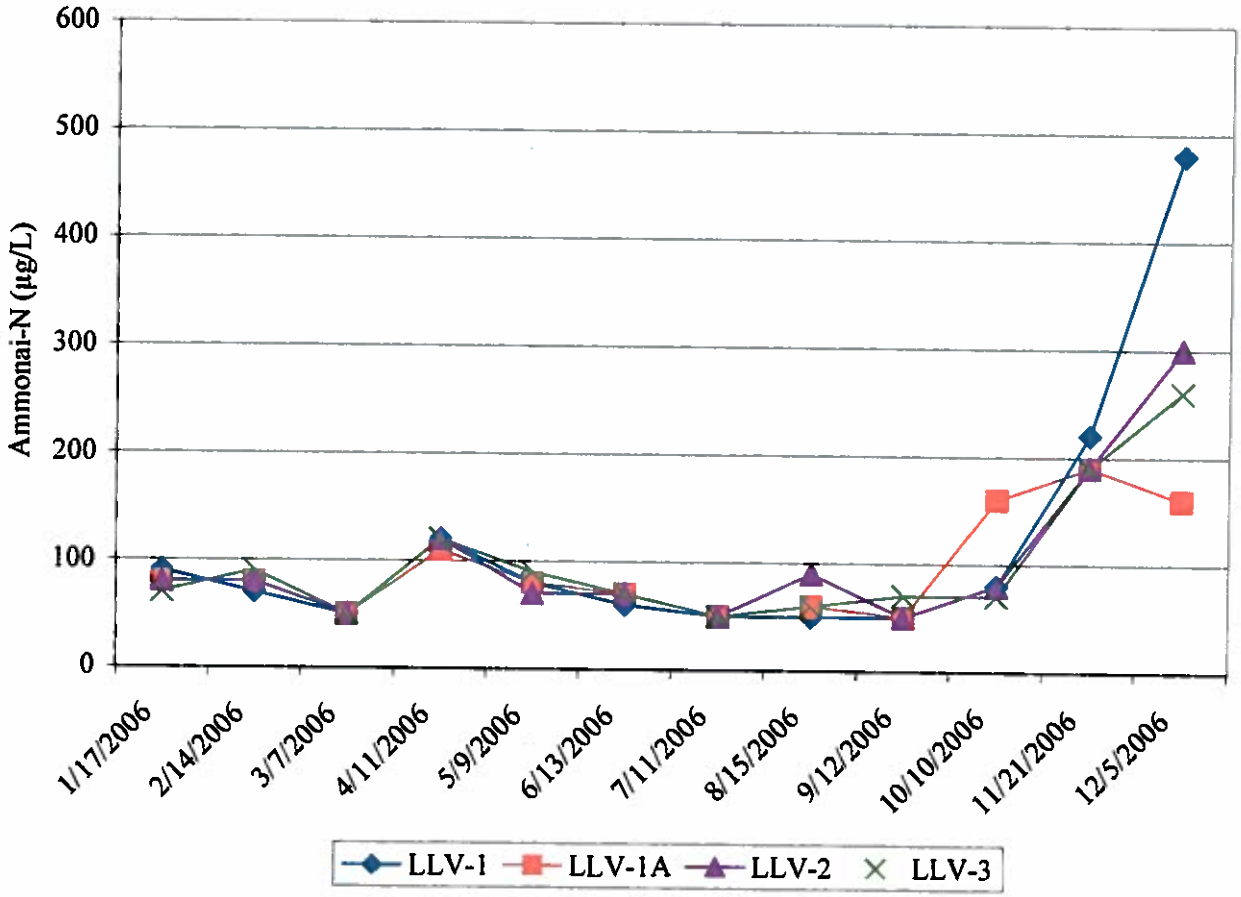


Figure 14. **Lake Las Vegas ammonia-N concentrations (µg/L) in surface waters at Lake monitoring stations during 2006.**

Total Nitrogen

Monthly total nitrogen concentrations ranged between 511 and 3,129 µg/L and were not significantly different between sites ($p>0.05$) but slightly elevated when compared to 2,479 and 3,702 µg/L in 2005 (Figure 15). No significant difference was found between depths at site LLV-1A during 2006 ($p=0.9$) concentrations varying between 622 and 2,061µg/L with depth (Table 8).

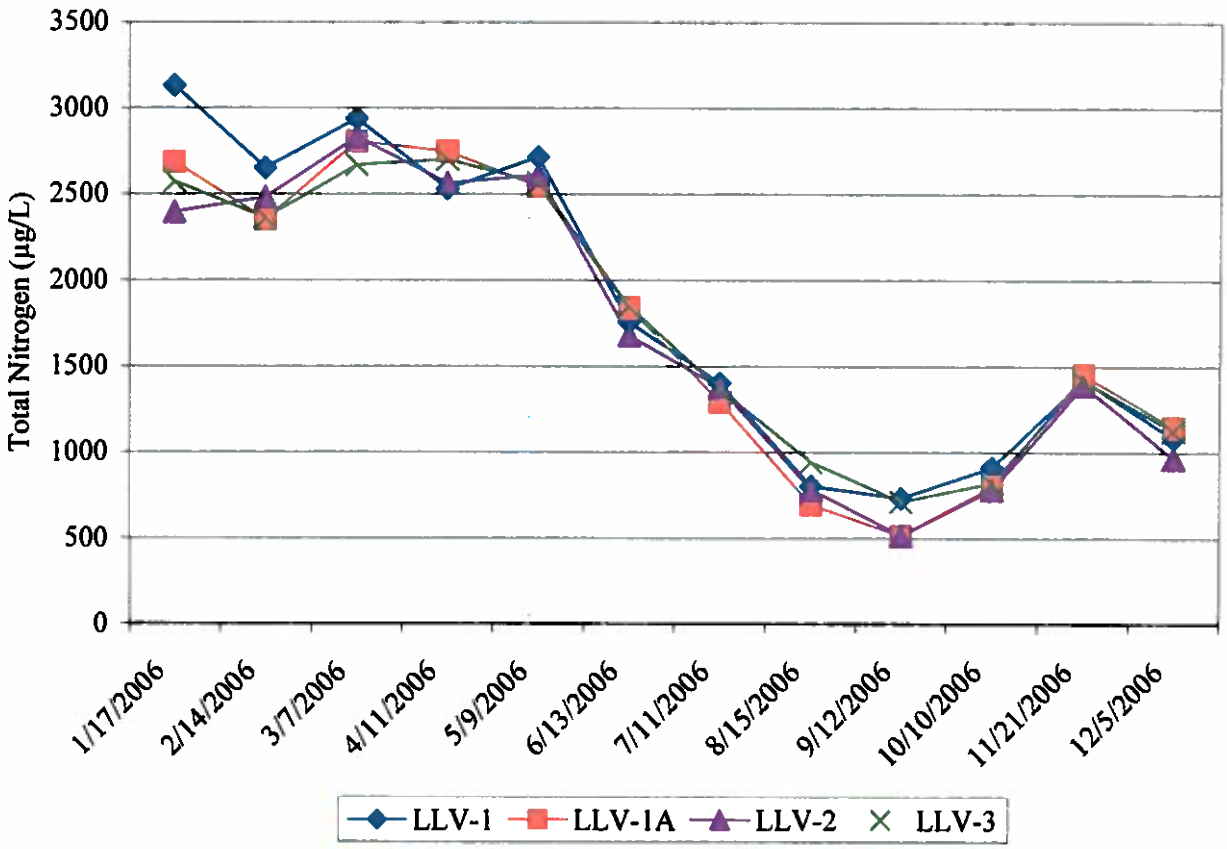


Figure 15. **Lake Las Vegas Total Nitrogen (µg/L) concentrations in surface waters at Lake monitoring stations during 2006.**

D. Biological Analysis

Zooplankton Species Composition and Abundance

Numerous species of zooplankton have been identified in the 0 – 15 m vertical plankton tows at station LLV-1 in 2006 (Table 9). Copepods dominated the population with a frequency of 78.6%, followed by Cladocerans (21%) and Rotifers (0.4%) during 2006.

Diaptomus sp. exhibited the greatest average annual average density in 2006 of 335,834 #/m^3 (Table 9). Of the Cladoceran family, *Daphnia pulex* dominated with average densities totaling 244,966 #/m^3 comprising 19% or the total biomass. This genus is well known for their ability to control phytoplankton populations in pelagic zones.

Table 9. **Lake Las Vegas zooplankton species identified in the 0 – 15 meter vertical plankton tows at station LLV-1 during 2006.**

Division	Genus/Species	#/m^3	FREQ %	RFREQ%
1. Cladocerans	*Alona sp.*	11,187	3	0.6
	Bosmina longirostris	29,630	8	1.7
	Daphnia galeata mendotae	8,001	2	0.4
	Daphnia juveniles	80,441	21	4.5
	Daphnia pulex	244,966	65	13.7
	Moina sp.	228	0	0.0
	Total Cladoceran	374,453	100	21.0
2. Copepods	*Ceratuim hirundinella*	225,663	16	12.7
	Copepodid	131,019	9	7.4
	Diacyclops bicuspidatus	5,199	0	0.3
	Diaptomus sp.	335,834	24	18.8
	Mesocyclops edax	49,428	4	2.8
	Nauplii	653,155	47	36.6
	Total Copepods	1,400,298	100	78.6
3. Rotifers	*Keratella cochlearis*	7,350	97	0.4
	Polyarthra sp.	262	3	0.0
	Total Rotifers	7,612	100	0.4

Chlorophyll-a

Chlorophyll-a concentrations ranged from 1 to 18 µg/L in surface water during 2006 compared to 1 to 20 µg/L in 2005. Concentrations were not significantly different between sites ($p>0.05$) (Table 8). September concentrations peaked with the presence of Cyanobacteria and Pyrrhophyta blooms (Figure 17).

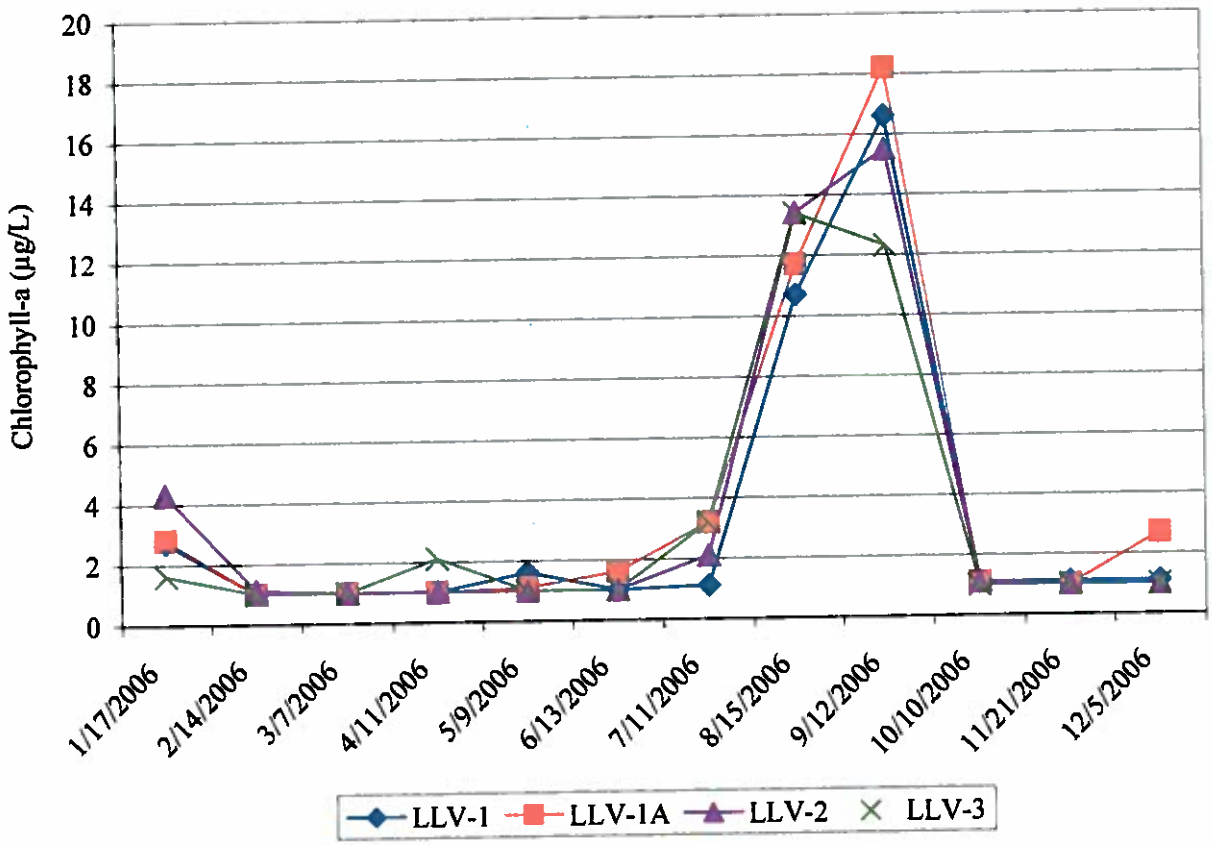


Figure 16. **Lake Las Vegas chlorophyll-a (µg/L) concentrations in surface waters at Lake monitoring stations during 2006.**

Phytoplankton

Eight (8) taxonomic divisions of phytoplankton were found at LLV-1 during 2006 (Table 10). By abundance the most frequently observed division in 2006 was Cyanobacteria (37.4%). The remaining seven (7) divisions relative frequencies were as follows: Bacillariophyceae (28.1%), Pyrrhophyta (23.9%), Haptophyta (4.3%) Cryptophyta (3.1%), Chlorophyta (2.6%), Chrysophyta (0.3%), Microflagellates (0.3%) were distributed in relation to Chlorophyta during the year (Table 10).

Table 10. **Lake Las Vegas phytoplankton species (mg/m^3) identified in the 0 – 2.5 meter composite sample at station LLV-1 during 2006.**

Division	Genus/Species	BIOMASS (mg/m^3)	FREQ %	RFREQ %
1. BACILLARIOPHYCEAE	*Achmanthes sp.*	1.4	0.0	0.0
	Achnanthidium sp.	1.4	0.0	0.0
	Anomoeoneis vitrea	5415.3	84.5	23.7
	Cyclotella glomerata	618.6	9.6	2.7
	Cyclotella 6-10 um	73.7	1.1	0.3
	Cyclotella meneghiniana	33.4	0.5	0.1
	Cyclotella 15-20um	43.5	0.7	0.2
	Cyclotella < 6um	68.3	1.1	0.3
	Cyclotella (10-14um)	13.7	0.2	0.1
	Cyclotella meneghiniana	114.4	1.8	0.5
	Nitzschia sp. (11-25um)	1.5	0.0	0.0
	Nitzschia spp.	0.5	0.0	0.0
	Synedra sp.	19.5	0.3	0.1
	Synedra ulna	5.5	0.1	0.0
	Total Bacillariophyceae	6410.7	100	28.1
2. CHLOROPHYTA	*Ankyra judayi*	1	0.17	0.0
	Botryococcus braunii	2.9	0.50	0.0
	Chlamydomonas sp.	21.3	3.65	0.1
	Chlamydomonas flobosa	35.3	6.04	0.2
	Eudorina elegans	2.6	0.45	0.0
	Mesostigma viride	2.9	0.50	0.0
	Monoraphidium arcuatum	0.2	0.03	0.0
	Monoraphidium contortum	2.1	0.36	0.0
	Monoraphidium minutum	0.3	0.05	0.0
	Monoraphidium sp.	0.5	0.09	0.0
	Nephroselmis olivacea	0.8	0.14	0.0
	Oocystis gigas v. incrassata	15.5	2.65	0.1
	Oocystis pusilla	3.7	0.63	0.0
	Oocystis sp.	25.4	4.35	0.1
	Pediastrum simplex	1.6	0.27	0.0
	Planktonema lauterbornii	5.2	0.89	0.0
	Pyramichlamys dissecta	151.6	25.95	0.7
	Quadrigula chodatii	0.2	0.03	0.0
	Quadrigula closeterioides	1.8	0.31	0.0
	Quadrigula lacustris	0.6	0.10	0.0
	Scenedesmus bijuga	1.3	0.22	0.0
	Scenedesmus communis	1	0.17	0.0
	Scenedesmus dimorphus	3.9	0.67	0.0
	Sphaerocystis schroeteri	287.3	49.18	1.3
	Tetraedron minimum	6.4	1.10	0.0
	Tetraedrom muticum	8.8	1.51	0.0
	Total Chlorophyta	584.2	100	2.6

Table 10 continued. **Lake Las Vegas phytoplankton species (mg/m^3) identified in the 0 – 2.5 meter composite sample at station LLV 1 during 2006.**

Division	Genus/Species	BIOMASS (mg/m^3)	FREQ %	RFREQ %
3. CHRYSOPHYTA	*Ochromonas sp.*	41.5	56.6	0.2
	Rhizochrysis sp.	31.8	43.4	0.1
	Total Chrysophyta	73.3	100.0	0.3
4. CRYPTOPHYTA	*Cryptomonas marssonii*	48.8	7.0	0.2
	Cryptomonas sp. (10 -15 um)	47.2	6.7	0.2
	Cryptomonas spp.	112	16.0	0.5
	Katavelpharis ovalis	1.7	0.2	0.0
	Rhodomonas lens	3.1	0.4	0.0
	Rhodomonas minuta	487.7	69.6	2.1
	Total Cryptophyta	700.5	100	3.1
5. CYANOBACTERIA	*Anabaena aphanizemenoides*	4109.4	48.2	18.0
	Anabaena sp.	3.4	0.0	0.0
	Anabaena bergeii v. limnetica	57.8	0.7	0.3
	Aphanocapsa delicatissima	40.6	0.5	0.2
	Aphanizomenon gracile	165.7	1.9	0.7
	Chroococcus minimus	443.8	5.2	1.9
	Single coccoid (<2 um)	69.1	0.8	0.3
	Cylindrospermopsis raciborskii	2872.6	33.7	12.6
	Lyngbya birgei	448.6	5.3	2.0
	Merismopedia punctata	9.1	0.1	0.0
	Merismopedia tenuissima	16.4	0.2	0.1
	Oscillatoria sp.	0.1	0.0	0.0
	Planktolyngbya limnetica	2	0.0	0.0
	Planktothrix perornata	140.3	1.6	0.6
	Planktolyngbya c.f. tallingii	0.1	0.0	0.0
	Pseudanabaena sp.	1.9	0.0	0.0
	Pseudanabaena c.f. biceps	3.8	0.0	0.0
	Pseudanabaena galeata	120	1.4	0.5
	Pseudanabaena limnetica	0.2	0.0	0.0
	Synechocystis aquatilis	0.9	0.0	0.0
	Synechococcus nidulans	18.5	0.2	0.1
	Total Cyanobacteria	8524.3	100	37.4
6. EUGLENOPHYTA	*euglena sp.*	2	100	0.0
	Total Euglenophyta	2	100	0.0
7. HAPTOPHYTA	*Chrysochromulina parva*	983.1	100	4.3
	Total Haptophyta	983.1	100	4.3

Table 10 continued. **Lake Las Vegas phytoplankton species (mg/m^3) identified in the 0 – 2.5 meter composite sample at station LLV-1 during 2006.**

Division	Genus/Species	BIOMASS (mg/m^3)	FREQ %	RFREQ %
8. MICROFLAGELLATES	*Microflagellates <3 um*	0.6	0.2	0.0
	Microflagellates 3-5 um	65.9	1.4	0.3
	Total Microflagellates	66.5	1.5	0.3
9. PYRRHOPHYTA	*Ceratium hirundinella*	5.2	0.1	0.0
	Glenodinium sp.	19.2	0.1	0.1
	Glenodinium pulvisculus	8.8	0.2	0.0
	Gymnodinium sp.	9.8	0.2	0.0
	Peridinium sp.	366.5	0.1	1.6
	Peridinium inconspicuum	15.4	0.3	0.1
	Peridinium penardiforme	5037.1	6.1	22.1
	Total Pyrrhophyta	5462	7.0	23.9
	TOTAL	**22806.6**		

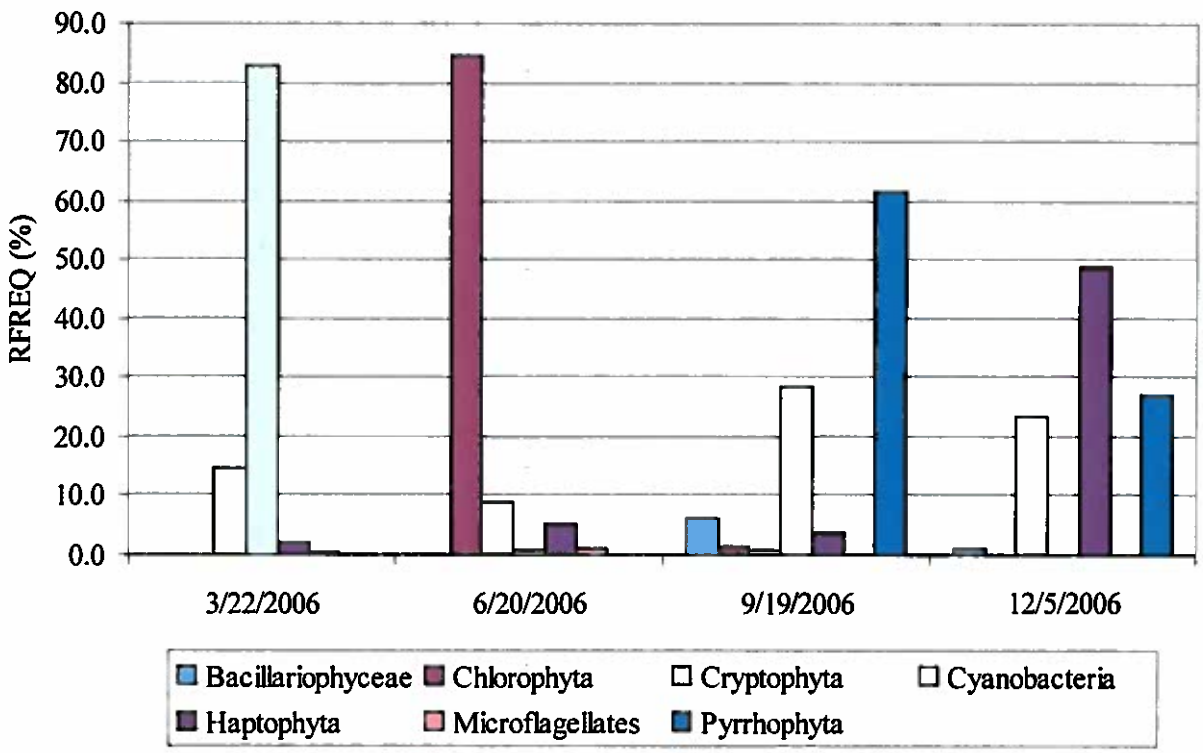


Figure 17. 2006 Quarterly Phytoplankton Relative Frequency.

In 2006 Bio-chemical oxygen demands (BOD_5) concentrations ranged between 2 and 5 mg/L. Concentrations fluctuated the greatest during the year, coinciding with algal cycles observed. These increases often occur with lake turn over in the fall and storm events.

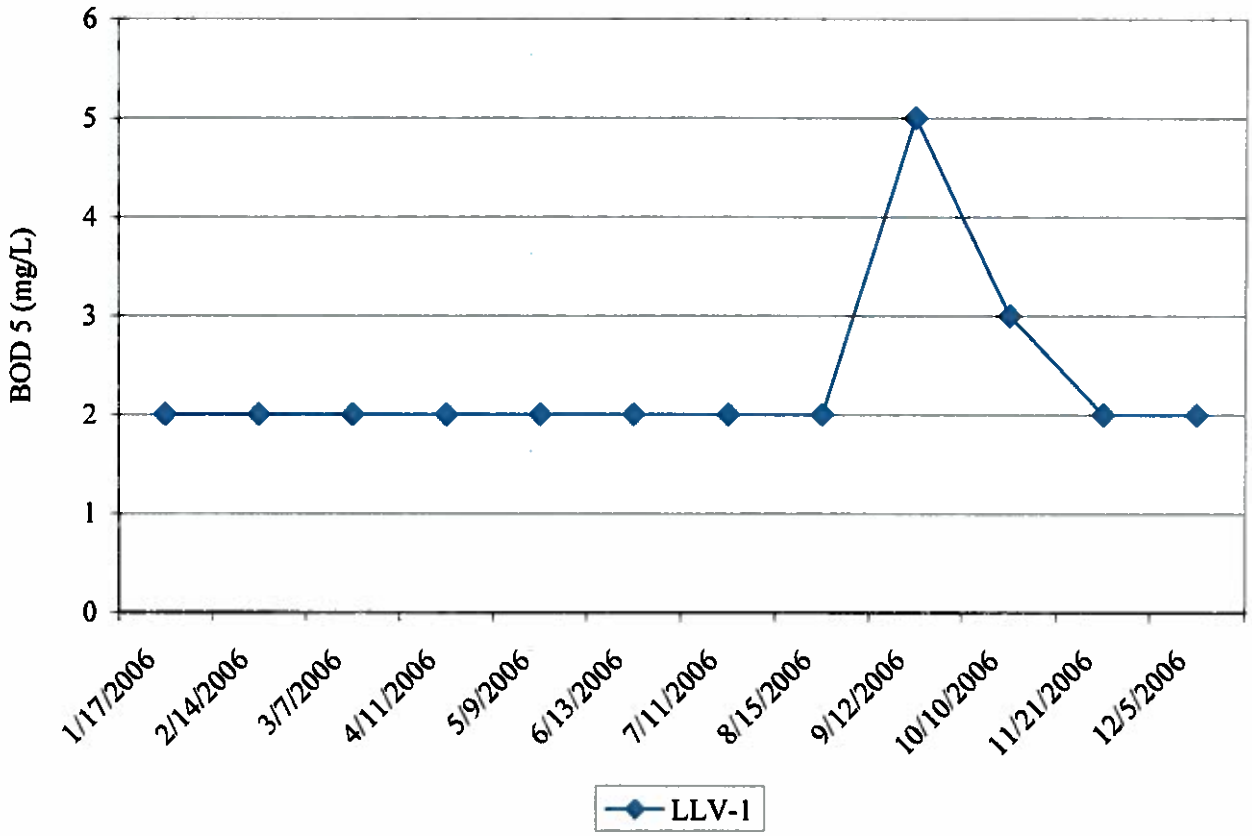


Figure 18. **Lake Las Vegas Biochemical Oxygen Demand (mg/L) concentrations in surface waters at Lake Monitoring Station (LLV-1) during 2006.**

Bacteria

Fecal coliform monitoring was completed on a monthly basis at Lake site LLV-1 in 2006. In 2006, bacteria sampling frequency was completed weekly during the months of April through October due to increased recreational use. Fecal coliform counts in surface waters were below body contact limits in 2006 (Figure 18).

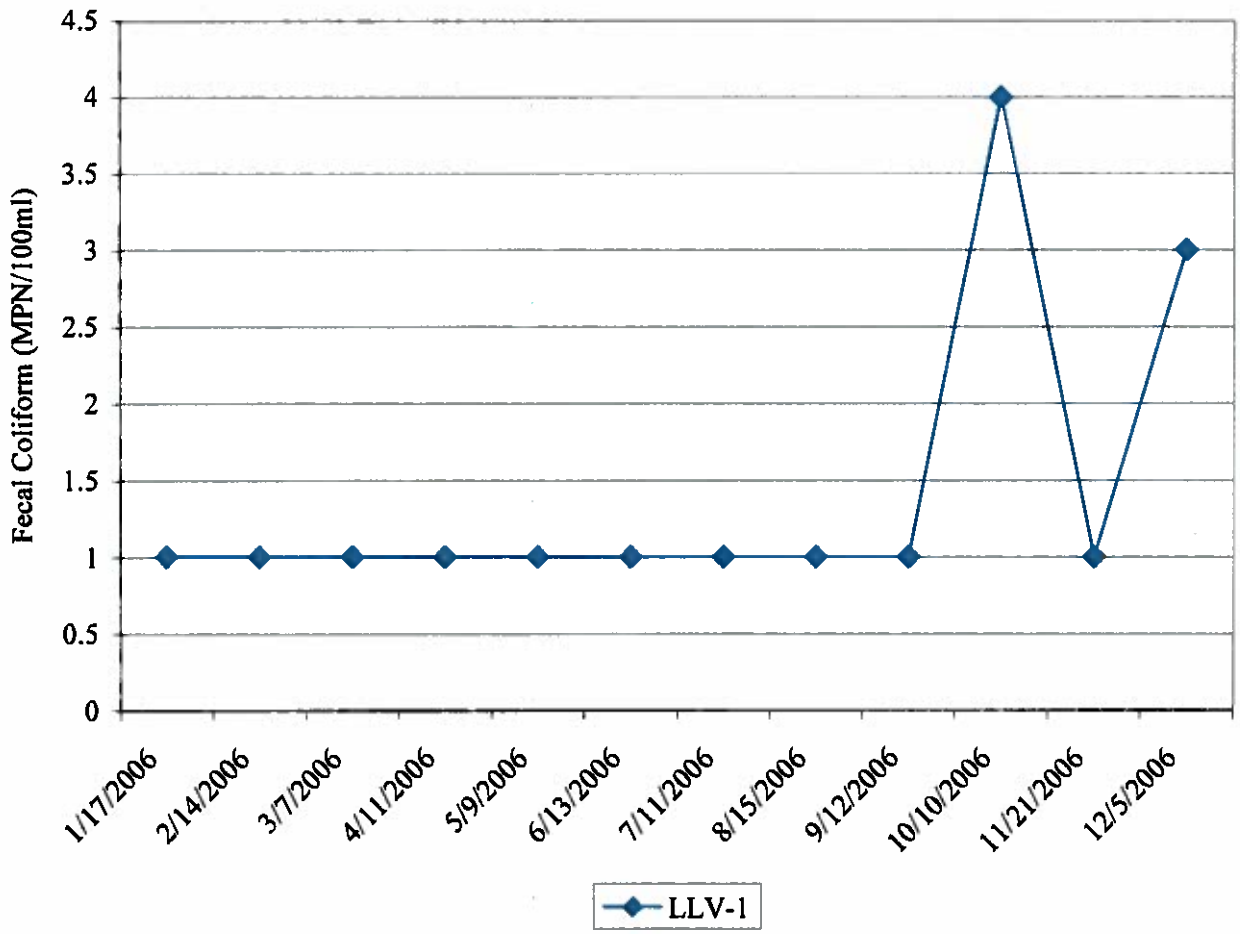


Figure 18. **Lake Las Vegas fecal coliform counts (MPN/100ml) in surface waters at Lake monitoring station (LLV-1) during 2006.**

Toxic Substances

Water samples for toxic analysis were collected from the surface (0m) and bottom (1m from bottom) of station LLV-1 during December 2006, when the lake was completely mixed. These samples were analyzed for toxic metals, trihalomethanes, pesticides, herbicides, PCBs, and various other organic and inorganic chemicals. Trace metal concentrations were well below the recommended MCLs. Concentrations of pesticides, herbicides and other toxic organic compounds also were below levels of detection. (Appendix C).

IV. SUMMARY

The water quality in Lake Las Vegas was within the proposed water quality guidelines for recreational uses. Average chlorophyll-a concentrations were at or below the proposed guideline of five (5) µg/L during April–June, but exceeded the guidelines during the months of July and October. The chlorophyll-a guideline is applied at that time of year to protect water quality during the peak recreation period. Fecal coliform bacteria were below the action level of 200 MPN/100ml. Concentrations of toxic metals, pesticides, herbicides and other toxic organic compounds were below detection limits. Water quality in Lake Las Vegas continues to be very good. The Total dissolved solids and associated ions were exhibiting the highest concentrations in late fall due to summer evaporations. At the current concentrations, irrigation water is being removed from the lake without the need to blend with Lake Mead Water.

V. REFERENCES

208 Amendment for the City of Henderson – Lake at Las Vegas Project. Transcontinental Properties/City of Henderson. March 1988.

Janik, J. 1984. *The role of nanoplankton in the phytoplankton dynamics of four Colorado River reservoirs: Lakes Powell. Mead, Mohave, and Havasu.* M.S. Thesis, University of Nevada, Las Vegas. 133 pp.

Kellar, P. E, S. A. Paulson, and L. J. Paulson. 1980. *Methods for analysis of biological, chemical, and physical analyses in reservoirs.* Tech Report #5, Lake Mead Limnological Research Center, Las Vegas, NV. 234 pp.

Leavitt, S., M. Solas, L.J. Paulson, and Ms. Schmeltzer. August 1990. *Methods for Biological, Chemical and Physical Analyses in Lakes and Reservoirs.* West Lakes. Las Vegas, NV.

Lund, J. W. G., C. Kipling, and E. D. LeCren. 1958. *The inverted microscope method of estimating algal numbers and the statistical basis of estimations by counting.* Hydribiologia. 11:143-170

Savard, C. 2007. Personal Communication.

Utermohl, H. 1958. *Zur vervollkommnung der quantitiven phytoplankton methodik*. Mitt. Int. Verein. Limnol. 9:1-38.

Wetzel, R. G. and G. E. Likens. 1979. *Limnological Methods*. W. B. Saunders Company, Philadelphia. 357 pp.

VI. APPENDIX

Annual Toxicity Analysis

Silver State Analytical Laboratories
Report Number: 06-3736
December 18, 2006

Sample ID: LLV 1A 0m
Method: 8260B GCMS

Analyzed by: AF
Date Analyzed: 12/11/06

Compound	Result µg/L	Reporting Limit µg/L	Compound	Result µg/L	Reporting Limit µg/L
Bromomethane	ND	5	Carbon disulfide	ND	15
Bromobenzene	ND	5	Carbon tetrachloride	ND	5
Bromochloromethane	ND	5	Chlorobenzene	ND	5
Bromodichloromethane	ND	5	Chloroethane	ND	5
Bromoform	ND	5	Chloroform	ND	5
2-Butanone (MEK)	ND	25	Chloromethane	ND	5
2-Chloroethyl vinyl ether	ND	5	cis-1,2-Dichloroethene	ND	5
2-Chlorotoluene	ND	5	cis-1,3-Dichloropropene	ND	5
2-Hexanone	ND	20	Dibromochloromethane	ND	5
4-Chlorotoluene	ND	5	Dibromomethane	ND	5
4-Methyl-2-Pentanone	ND	20	Dichlorodifluoromethane	ND	5
Acrylonitrile	ND	20	Dimethyl Disulfide	ND	5
Benzene	ND	4	Ethylbenzene	ND	5
1,1,1,2-Tetrachloroethane	ND	5	Hexachlorobutadiene	ND	5
1,1,1-Trichloroethane	ND	5	Isopropylbenzene (Cumene)	ND	5
1,1,2,2- Tetrachloroethane	ND	5	m and p-Xylene	ND	5
1,1,2-Trichloroethane	ND	5	Methylene chloride	ND	5
1,1-Dichloroethane	ND	5	Methyl-tert-butylether	ND	5
1,1-Dichloroethene	ND	5	Naphthalene	ND	5
1,1-Dichloropropene	ND	5	n-Butylbenzene	ND	5
1,2,3-Trichlorobenzene	ND	5	n-Propylbenzene	ND	5
1,2,3-Trichloropropane	ND	5	o-Xylene	ND	5
1,2,4-Trichlorobenzene	ND	5	p-Isopropyltoluene	ND	5
1,2,4-Trimethylbenzene	ND	5	sec-Butylbenzene	ND	5
1,2-Dibromo-3-chloropropane	ND	5	Styrene	ND	5
1,2-Dibromoethane	ND	5	tert-Butylbenzene	ND	5
1,2-Dichlorobenzene	ND	5	Tetrachloroethene	ND	4
1,2-Dichloroethane	ND	5	Toluene	ND	5
1,2-Dichloropropane	ND	5	trans-1,2-Dichloroethene	ND	5
1,3,5-Trimethylbenzene	ND	5	trans-1,3-Dichloropropene	ND	5
1,3-Dichlorobenzene	ND	5	Trichloroethene	ND	5
1,3-Dichloropropane	ND	5	Trichlorofluoromethane	ND	5
1,4-Dichlorobenzene	ND	5	Vinyl chloride	ND	5
2,2-Dichloropropane	ND	5			

ND: non-detect
EPA Flag: none

Silver State Analytical Laboratories
Report Number: 06-3736
December 18, 2006

Sample ID: LLV 1A 20m
Method: 8260B GCMS

Analyzed by: AF
Date Analyzed: 12/11/06

Compound	Result µg/L	Reporting Limit µg/L	Compound	Result µg/L	Reporting Limit µg/L
Bromomethane	ND	5	Carbon disulfide	ND	15
Bromobenzene	ND	5	Carbon tetrachloride	ND	5
Bromochloromethane	ND	5	Chlorobenzene	ND	5
Bromodichloromethane	ND	5	Chloroethane	ND	5
Bromoform	ND	5	Chloroform	ND	5
2-Butanone (MEK)	ND	25	Chloromethane	ND	5
2-Chloroethyl vinyl ether	ND	5	cis-1,2-Dichloroethene	ND	5
2-Chlorotoluene	ND	5	cis-1,3-Dichloropropene	ND	5
2-Hexanone	ND	20	Dibromochloromethane	ND	5
4-Chlorotoluene	ND	5	Dibromomethane	ND	5
4-Methyl-2-Pentanone	ND	20	Dichlorodifluoromethane	ND	5
Acrylonitrile	ND	20	Dimethyl Disulfide	ND	5
Benzene	ND	4	Ethylbenzene	ND	5
1,1,1,2-Tetrachloroethane	ND	5	Hexachlorobutadiene	ND	5
1,1,1-Trichloroethane	ND	5	Isopropylbenzene (Cumene)	ND	5
1,1,2,2- Tetrachloroethane	ND	5	m and p-Xylene	ND	5
1,1,2-Trichloroethane	ND	5	Methylene chloride	ND	5
1,1-Dichloroethane	ND	5	Methyl-tert-butylether	ND	5
1,1-Dichloroethene	ND	5	Naphthalene	ND	5
1,1-Dichloropropene	ND	5	n-Butylbenzene	ND	5
1,2,3-Trichlorobenzene	ND	5	n-Propylbenzene	ND	5
1,2,3-Trichloropropane	ND	5	o-Xylene	ND	5
1,2,4-Trichlorobenzene	ND	5	p-Isopropyltoluene	ND	5
1,2,4-Trimethylbenzene	ND	5	sec-Butylbenzene	ND	5
1,2-Dibromo-3-chloropropane	ND	5	Styrene	ND	5
1,2-Dibromoethane	ND	5	tert-Butylbenzene	ND	5
1,2-Dichlorobenzene	ND	5	Tetrachloroethene	ND	4
1,2-Dichloroethane	ND	5	Toluene	ND	5
1,2-Dichloropropane	ND	5	trans-1,2-Dichloroethene	ND	5
1,3,5-Trimethylbenzene	ND	5	trans-1,3-Dichloropropene	ND	5
1,3-Dichlorobenzene	ND	5	Trichloroethene	ND	5
1,3-Dichloropropane	ND	5	Trichlorofluoromethane	ND	5
1,4-Dichlorobenzene	ND	5	Vinyl chloride	ND	5
2,2-Dichloropropane	ND	5			

ND: non-detect
EPA Flag: none

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SILVER STATE ANALYTICAL LABS
RON WINTER
5070 S. ARVILLE STE. 6
LAS VEGAS, NV 89118

Project: EPA 608/8270/8151
Report Date: 19-Dec-06

Certificate of Analysis

EPA Method 608/8081A/8082 - Organochlorine Pesticides/PCB's

Sample Name: LLV-1A 0M
Sample Location: 3736-1
Sampling Date: 12/5/2006
Sampling Time: 11:10
Date Received: 12/7/2006

Lab #: 06X4107-01
Matrix: WASTE WATER
Analyst: SAT
Extract Date: 12/6/2006
Analysis Date: 12/7/2006

Analyte	Result	Units	PQL
alpha-BHC:	ND	µg/L	0.01
gamma-BHC (Lindane):	ND	µg/L	0.01
Heptachlor:	ND	µg/L	0.01
Aldrin:	ND	µg/L	0.01
beta-BHC:	ND	µg/L	0.01
delta-BHC:	ND	µg/L	0.01
Heptachlor Epoxide:	ND	µg/L	0.01
Endosulfan I:	ND	µg/L	0.01
4,4'-DDE:	ND	µg/L	0.01
Dieldrin:	ND	µg/L	0.01
Endrin:	ND	µg/L	0.01
Endosulfan II:	ND	µg/L	0.01
4,4'-DDD:	ND	µg/L	0.01
4,4'-DDT:	ND	µg/L	0.01
Endrin Aldehyde:	ND	µg/L	0.01
Endosulfan Sulfate:	ND	µg/L	0.01
Methoxychlor:	ND	µg/L	0.01
Endrin Ketone:	ND	µg/L	0.01
Chlordane:	ND	µg/L	0.20
Toxaphene:	ND	µg/L	0.20
Arochlor 1016:	ND	µg/L	0.20
Arochlor 1221:	ND	µg/L	0.20
Arochlor 1232:	ND	µg/L	0.20
Arochlor 1242:	ND	µg/L	0.20
Arochlor 1248:	ND	µg/L	0.20
Arochlor 1254:	ND	µg/L	0.20
Arochlor 1260:	ND	µg/L	0.20

Surrogate Standard	% Recovery	% Rec AR
DCB %R	92.5	30-130

ND Not Detected PQL Practical Quantitation Limit

Anatek Labs, Inc.

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SILVER STATE ANALYTICAL LABS
RON WINTER
5070 S. ARVILLE STE. 6
LAS VEGAS, NV 89118

Project: EPA 608/8270/8151
Report Date: 19-Dec-06

Certificate of Analysis

EPA Method 608/8081A/8082 - Organochlorine Pesticides/PCB's

Sample Name: LLV-1A 20M
Sample Location: 3736-2
Sampling Date: 12/5/2006
Sampling Time: 11:30
Date Received: 12/7/2006

Lab #: 06X4107-02
Matrix: WASTE WATER
Analyst: SAT
Extract Date: 12/6/2006
Analysis Date: 12/7/2006

Analyte	Result	Units	PQL
alpha-BHC:	ND	µg/L	0.01
gamma-BHC (Lindane):	ND	µg/L	0.01
Heptachlor:	ND	µg/L	0.01
Aldrin:	ND	µg/L	0.01
beta-BHC:	ND	µg/L	0.01
delta-BHC:	ND	µg/L	0.01
Heptachlor Epoxide:	ND	µg/L	0.01
Endosulfan I:	ND	µg/L	0.01
4,4'-DDE:	ND	µg/L	0.01
Dieldrin:	ND	µg/L	0.01
Endrin:	ND	µg/L	0.01
Endosulfan II:	ND	µg/L	0.01
4,4'-DDD:	ND	µg/L	0.01
4,4'-DDT:	ND	µg/L	0.01
Endrin Aldehyde:	ND	µg/L	0.01
Endosulfan Sulfate:	ND	µg/L	0.01
Methoxychlor:	ND	µg/L	0.01
Endrin Ketone:	ND	µg/L	0.01
Chlordane:	ND	µg/L	0.20
Toxaphene:	ND	µg/L	0.20
Arochlor 1016:	ND	µg/L	0.20
Arochlor 1221:	ND	µg/L	0.20
Arochlor 1232:	ND	µg/L	0.20
Arochlor 1242:	ND	µg/L	0.20
Arochlor 1248:	ND	µg/L	0.20
Arochlor 1254:	ND	µg/L	0.20
Arochlor 1260:	ND	µg/L	0.20

Surrogate Standard	% Recovery	% Rec AR
DCB %R	101	30-130

Approved by: John W. Cobb

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SILVER STATE ANALYTICAL LABS
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5070 S. ARVILLE STE. 6
LAS VEGAS, NV 89118

Sample Name: LLV-1A 0M

Sample Location:	3736-1
Sampling Date:	12/5/2006
Sampling Time:	11:10
Date Received:	12/7/2006
Report Date:	19-Dec-06

Certificate of Analysis

EPA Method 8270C/625 - GC/MS Semivolatile Organics

Analyte	Result	Units	PQL
Acenaphthene	ND	ug/L	0.5
Acenaphthylene	ND	ug/L	0.5
Anthracene	ND	ug/L	0.5
Benzidine	ND	ug/L	0.5
Benzo(k)fluoranthene	ND	ug/L	0.5
Benzo(b)fluoranthene	ND	ug/L	0.5
Benzo(ghi)perylene	ND	ug/L	0.5
Benzo(a)anthracene	ND	ug/L	0.5
Benzo(a)pyrene	ND	ug/L	0.5
Benzyl alcohol	ND	ug/L	0.5
Bis(2-chlorethoxy)methane	ND	ug/L	0.5
Bis(2-chloroisopropyl)ether	ND	ug/L	0.5
Bis(2-chloroethyl)ether	ND	ug/L	0.5
Bis(2-ethylhexyl)phthalate	ND	ug/L	0.5
4-Bromophenyl phenyl ether	ND	ug/L	0.5
Butylbenzylphthalate	ND	ug/L	0.5
4-Chloroaniline	ND	ug/L	0.5
2-Chloronaphthalene	ND	ug/L	0.5
4-Chloro-3-methylphenol	ND	ug/L	0.5
2-Chlorophenol	ND	ug/L	0.5
4-Chlorophenyl phenyl ether	ND	ug/L	0.5
Chrysene	ND	ug/L	0.5
Dibenz(ah)anthracene	ND	ug/L	0.5
Dibenzofuran	ND	ug/L	0.5
Di-n-butyl phthalate	ND	ug/L	0.5
1,3-Dichlorobenzene	ND	ug/L	0.5
1,2-Dichlorobenzene	ND	ug/L	0.5
1,4-Dichlorobenzene	ND	ug/L	0.5
3,3-Dichlorobenzidine	ND	ug/L	0.5
2,4-Dichlorophenol	ND	ug/L	0.5
2,6-Dichlorophenol	ND	ug/L	0.5
Diethyl phthalate	ND	ug/L	0.5
2,4-Dimethylphenol	ND	ug/L	0.5
Dimethyl phthalate	ND	ug/L	0.5
4,6-Dinitro-2-methylphenol	ND	ug/L	0.5
2,4-Dinitrophenol	ND	ug/L	0.5
2,4-Dinitrotoluene	ND	ug/L	0.5
2,6-Dinitrotoluene	ND	ug/L	0.5
Di-n-octyl phthalate	ND	ug/L	0.5
1,2-Diphenylhydrazine	ND	ug/L	0.5

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SILVER STATE ANALYTICAL LABS
RON WINTER
5070 S. ARVILLE STE. 6
LAS VEGAS, NV 89118

Sample Name: LLV-1A 0M
Sample Location: 3736-1
Sampling Date: 12/5/2006
Sampling Time: 11:10
Date Received: 12/7/2006
Report Date: 19-Dec-06

Certificate of Analysis (Continued)

EPA Method 8270C/625 - GC/MS Semivolatile Organics

Analyte	Result	Units	PQL
Fluoranthene	ND	ug/L	0.5
Fluorene	ND	ug/L	0.5
Hexachlorobenzene	ND	ug/L	0.5
Hexachlorobutadiene	ND	ug/L	0.5
Hexachlorocyclopentadiene	ND	ug/L	0.5
Hexachloroethane	ND	ug/L	0.5
Indeno(123,cd)pyrene	ND	ug/L	0.5
Isophorone	ND	ug/L	0.5
2-Methylnaphthalene	ND	ug/L	0.5
2-Methylphenol	ND	ug/L	0.5
4+3-Methylphenol	ND	ug/L	0.5
Naphthalene	ND	ug/L	0.5
2-Nitroaniline	ND	ug/L	0.5
3-Nitroaniline	ND	ug/L	0.5
4-Nitroaniline	ND	ug/L	0.5
Nitrobenzene	ND	ug/L	0.5
2-Nitrophenol	ND	ug/L	0.5
4-Nitrophenol	ND	ug/L	0.5
N-nitrosodibutylamine	ND	ug/L	0.5
N-Nitrosodimethylamine	ND	ug/L	0.5
N-nitrosodiphenylamine	ND	ug/L	0.5
N-nitrosodipropylamine	ND	ug/L	0.5
Pentachlorophenol	ND	ug/L	0.5
Phenanthrene	ND	ug/L	0.5
Phenol	ND	ug/L	0.5
Pyrene	ND	ug/L	0.5
Pyridine	ND	ug/L	0.5
1,2,4-Trichlorobenzene	ND	ug/L	0.5
2,4,5-Trichlorophenol	ND	ug/L	0.5
2,4,6-Trichlorophenol	ND	ug/L	0.5

Surrogate Standard	% Recovery	QC Limits
2-Fluorophenol %R	68.1	21-110
Phenol-d5 %R	65.9	10-110
Nitrobenzene-d5 %R	85.6	25-130
2-Fluorobiphenyl %R	81.9	19-130
2,4,6-Tribromophenol %R	98.1	10-123
Terphenyl-d14 %R	115.2	10-125

Lab #: 06X4107-01
Matrix: WASTE WATER
Analyst: EMP
Extract Date: 12/11/2006
Analysis Date: 12/15/2006

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SILVER STATE ANALYTICAL LABS
RON WINTER
5070 S. ARVILLE STE. 6
LAS VEGAS, NV 89118

Sample Name: LLV-1A 20M

Sample Location:	3736-2
Sampling Date:	12/5/2006
Sampling Time:	11:30
Date Received:	12/7/2006
Report Date:	19-Dec-06

Certificate of Analysis

EPA Method 8270C/625 - GC/MS Semivolatile Organics

Analyte	Result	Units	PQL
Acenaphthene	ND	ug/L	0.5
Acenaphthylene	ND	ug/L	0.5
Anthracene	ND	ug/L	0.5
Benzidine	ND	ug/L	0.5
Benzo(k)fluoranthene	ND	ug/L	0.5
Benzo(b)fluoranthene	ND	ug/L	0.5
Benzo(ghi)perylene	ND	ug/L	0.5
Benzo(a)anthracene	ND	ug/L	0.5
Benzo(a)pyrene	ND	ug/L	0.5
Benzyl alcohol	ND	ug/L	0.5
Bis(2-chlorethoxy)methane	ND	ug/L	0.5
Bis(2-chloroisopropyl)ether	ND	ug/L	0.5
Bis(2-chloroethyl)ether	ND	ug/L	0.5
Bis(2-ethylhexyl)phthalate	ND	ug/L	0.5
4-Bromophenyl phenyl ether	ND	ug/L	0.5
Butylbenzylphthalate	ND	ug/L	0.5
4-Chloroaniline	ND	ug/L	0.5
2-Chloronaphthalene	ND	ug/L	0.5
4-Chloro-3-methylphenol	ND	ug/L	0.5
2-Chlorophenol	ND	ug/L	0.5
4-Chlorophenyl phenyl ether	ND	ug/L	0.5
Chrysene	ND	ug/L	0.5
Dibenz(ah)anthracene	ND	ug/L	0.5
Dibenzofuran	ND	ug/L	0.5
Di-n-butyl phthalate	ND	ug/L	0.5
1,3-Dichlorobenzene	ND	ug/L	0.5
1,2-Dichlorobenzene	ND	ug/L	0.5
1,4-Dichlorobenzene	ND	ug/L	0.5
3,3-Dichlorobenzidine	ND	ug/L	0.5
2,4-Dichlorophenol	ND	ug/L	0.5
2,6-Dichlorophenol	ND	ug/L	0.5
Diethyl phthalate	ND	ug/L	0.5
2,4-Dimethylphenol	ND	ug/L	0.5
Dimethyl phthalate	ND	ug/L	0.5
4,6-Dinitro-2-methylphenol	ND	ug/L	0.5
2,4-Dinitrophenol	ND	ug/L	0.5
2,4-Dinitrotoluene	ND	ug/L	0.5
2,6-Dinitrotoluene	ND	ug/L	0.5
Di-n-octyl phthalate	ND	ug/L	0.5
1,2-Diphenylhydrazine	ND	ug/L	0.5

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LAS VEGAS, NV 89118

Sample Name: LLV-1A 20M
Sample Location: 3736-2
Sampling Date: 12/5/2006
Sampling Time: 11:30
Date Received: 12/7/2006
Report Date: 19-Dec-06

Certificate of Analysis (Continued)

EPA Method 8270C/625 - GC/MS Semivolatile Organics

Analyte	Result	Units	PQL
Fluoranthene	ND	ug/L	0.5
Fluorene	ND	ug/L	0.5
Hexachlorobenzene	ND	ug/L	0.5
Hexachlorobutadiene	ND	ug/L	0.5
Hexachlorocyclopentadiene	ND	ug/L	0.5
Hexachloroethane	ND	ug/L	0.5
Indeno(123,cd)pyrene	ND	ug/L	0.5
Isophorone	ND	ug/L	0.5
2-Methylnaphthalene	ND	ug/L	0.5
2-Methylphenol	ND	ug/L	0.5
4+3-Methylphenol	ND	ug/L	0.5
Naphthalene	ND	ug/L	0.5
2-Nitroaniline	ND	ug/L	0.5
3-Nitroaniline	ND	ug/L	0.5
4-Nitroaniline	ND	ug/L	0.5
Nitrobenzene	ND	ug/L	0.5
2-Nitrophenol	ND	ug/L	0.5
4-Nitrophenol	ND	ug/L	0.5
N-nitrosodibutylamine	ND	ug/L	0.5
N-Nitrosodimethylamine	ND	ug/L	0.5
N-nitrosodiphenylamine	ND	ug/L	0.5
N-nitrosodipropylamine	ND	ug/L	0.5
Pentachlorophenol	ND	ug/L	0.5
Phenanthrene	ND	ug/L	0.5
Phenol	ND	ug/L	0.5
Pyrene	ND	ug/L	0.5
Pyridine	ND	ug/L	0.5
1,2,4-Trichlorobenzene	ND	ug/L	0.5
2,4,5-Trichlorophenol	ND	ug/L	0.5
2,4,6-Trichlorophenol	ND	ug/L	0.5

Surrogate Standard	% Recovery	QC Limits
2-Fluorophenol %R	73.3	21-110
Phenol-d5 %R	71.4	10-110
Nitrobenzene-d5 %R	91.4	25-130
2-Fluorobiphenyl %R	87.6	19-130
2,4,6-Tribromophenol %R	110.3	10-123
Terphenyl-d14 %R	121.6	10-125

Lab #: 06X4107-02
Matrix: WASTE WATER
Analyst: EMP
Extract Date: 12/11/2006
Analysis Date: 12/15/2006

Approved by: John W. Cobb

ND Not Detected PQL Practical Quantitation Limit Project: EPA 608/8270/8151

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5070 S. ARVILLE STE. 6
LAS VEGAS, NV 89118

Project: EPA 608/8270/8151
Report Date: 19-Dec-06

Certificate of Analysis

EPA Method 8151A - Phenoxy Acid Herbicides

Sample Name: LLV-1A 0M
Sample Location: 3736-1
Sampling Date: 12/5/2006
Sampling Time: 11:10
Date Received: 12/7/2006
Lab #: 06X4107-01
Matrix: WASTE WATER
Analyst: SAT
Extract Date: 12/14/2006
Analysis Date: 12/14/2006

Analyte	Result	Units	PQL
Dalapon:	ND	µg/L	0.1
Dicamba:	ND	µg/L	0.1
Dichlorprop:	ND	µg/L	0.1
2,4-D:	ND	µg/L	0.1
Pentachlorophenol:	ND	µg/L	0.1
Silvex:	ND	µg/L	0.1
2,4,5-T:	ND	µg/L	0.1
2,4-DB:	ND	µg/L	0.1
Dinoseb:	ND	µg/L	0.1
Dacthal:	ND	µg/L	0.1
Picloram:	ND	µg/L	0.1

Surrogate Standard	% Recovery	
3,5-Dichlorobenzoic Acid %R	101	AR = 35-135

Sample Name: LLV-1A 20M
Sample Location: 3736-2
Sampling Date: 12/5/2006
Sampling Time: 11:30
Date Received: 12/7/2006
Lab #: 06X4107-02
Matrix: WASTE WATER
Analyst: SAT
Extract Date: 12/14/2006
Analysis Date: 12/14/2006

Analyte	Result	Units	PQL
Dalapon:	ND	µg/L	0.1
Dicamba:	ND	µg/L	0.1
Dichlorprop:	ND	µg/L	0.1
2,4-D:	ND	µg/L	0.1
Pentachlorophenol:	ND	µg/L	0.1
Silvex:	ND	µg/L	0.1
2,4,5-T:	ND	µg/L	0.1
2,4-DB:	ND	µg/L	0.1
Dinoseb:	ND	µg/L	0.1
Dacthal:	ND	µg/L	0.1
Picloram:	ND	µg/L	0.1

Surrogate Standard	% Recovery	
3,5-Dichlorobenzoic Acid %R	102	AR = 35-135

Approved by: John W. Cobb

ND Not Detected PQL Practical Quantitation Limit