2011 Lake Las Vegas Water Quality Monitoring Report

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BUILDING A BETTER WORLD

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ndep
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protecting the future for generations

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I. INTRODUCTION

J. Carlton Adair conceived the idea of Lake Las Vegas in 1964. The project consisted of a 2,243-acre development project and a lake called Lake Adair. In 1988 Transcontinental Corporation of Santa Barbara, California, acquired controlling interest in the project and began construction on April 1, 1989. The 320 acre Lake is owned and operated by Lake Las Vegas Master Association. The Lake is part of a 3,592 acre residential and commercial development called Lake Las Vegas Resort (LLVR). LLVR is located less than 25 miles from both McCarran Airport and the Las Vegas Strip (**Figure 1**).

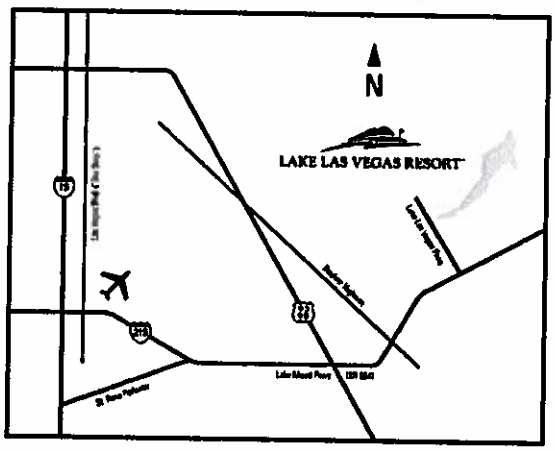

Figure 1. Location of Lake Las Vegas Resort, Clark County, Nevada.

At an elevation of 1,405.9 feet (ft) North American Vertical Datum (NAVD88), the Lake has a storage capacity of approximately 10,000 acre-feet (AF), comprising approximately of a two-mile length, a one-mile width, and 12.3 miles of shoreline. **Table 1** shows further details of the geometric characteristics of Lake Las Vegas (the Lake). Lake fill water is drawn from Lake Mead, and conveyed by the Basic Water Company (BWC) Pipeline. To meet the demands of irrigation, seepage, and evaporation approximately 7,000 AF of fill water must be added to the Lake each year.

Table 1. Approximate Geometric characteristics* of Lake Las Vegas, Clark County, Nevada.

Characteristic	Measurement
Drainage Area	1,800 square miles
Surface Area	320 acres
Maximum Length	2.1 miles
Maximum Width	1.0 miles
Maximum Depth	150 feet
Average Depth	33 feet
Volume	10,700 acre-feet
Length of Shoreline	12.6 miles

*Based on www.lakelasvegas.com/LLVResortFastFacts.pdf

Approved by the Clark County Board of County Commissioners on April 5, 1988 and certified by the State of Nevada on August 8, 1988, the approved Clark County 208 Water Quality Management Plan required a water quality-monitoring program to be developed for Lake Las Vegas. The water quality monitoring program was implemented to ensure that the Lake water's quality is maintained based on the water quality guidelines established for Lake Mead per the Nevada Administrative Code (NAC) as part of County 208 Amendment dated June 4, 1990, in order to 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 propagation of aquatic life, including a warm water fishery

The following are the guidelines as described in the County 208 Amendment, that the Lake water should adhere to.

1. The Lake waters should be free of:
    a. Visible floating, suspended, or settlable 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 milligrams per liter (mg/L) in the epilimnion during stratification, and 5 mg/L throughout the water column the rest of the year.
4. The average chlorophyll-a concentration in the epilimnion (0-2.5 meters) 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 the most probable number (MPN)/100 milliliter (mL) and not over 10% of such samples should exceed 400 MPN/100 mL;
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 2,000 mg/L throughout the water column;
8. Turbidity must not exceed that characteristic of natural conditions by more than 10 Nephelometric Turbidity Units (NTU).

Since June 1991, Lake Las Vegas has submitted annual reports to the Nevada Division of Environmental Protection for review. Through 2007, water quality monitoring was performed monthly in January, February, November, and December, biweekly in March and October, and weekly during the months from April through September at four sites within the Lake.

In 2008, the water sampling protocol was changed to monthly sampling and approved by the Nevada Division of Environmental Protection. The water quality sampling locations were reduced to two sites LLV-1A and LLV-3 and the new program required Lake water sampling to be done at varying depths instead of the conventional sampling from water surface at all the sites. These modifications to the previous water monitoring protocol were made in order to better understand the overall limnological response of the reservoir besides understanding the surface water quality.

In 2010, the water sampling protocol was temporarily modified to biweekly sampling at Site LLV-1A (**Figure 2**) to better monitor the water quality and changes in plankton populations due to a phytoplankton (*Prymnesium parvum*) bloom that occurred in December 2009. In 2011, sampling frequencies for field, biological, and chemical samples were conducted bi-weekly.

Figure 2. Water Quality monitoring sites at Lake Las Vegas.

II. METHODS

A. Lake Las Vegas Monitoring Sites

In accordance with the water quality monitoring protocol, vertical sampling was performed at 0 meters (m), 5m, 10m, and 20m depths at site LLV-1A (**Figure 2**).

B. Field Measurements

Temperature, dissolved oxygen, pH, and specific conductance were measured throughout the vertical column at LLV-1A with a Hydrolab Surveyor Model 4, a Water Quality Analyzer, or an YSI Water Quality Analyzer (**Table 2**). Transparency was measured at each Lake site with a Secchi disc. Duplicate measurements were made on approximately 10 percent of the measurements.

Table 2. 2011 Lake Las Vegas physical, chemical and biological analyses methods.

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 (Standard Units)	"	"	"
Conductivity (µmhos/cm)	"	"	"
Secchi Depth (m)	Variable	"	EPA 1991
Turbidity (NTU)	0 - 2.5 m Integrated	"	EPA 180.1
Sampling Program (continued)			
Measurements	Depth(s)	Frequency	Method(s)
Chemical			
Total Nitrogen (µg/L)	0 - 2.5 m Integrated	"	SM 4500.N
Ammonia-N (µg/L)	"	"	EPA 350.2
Total Kjeldehl Nitrogen (TKN) (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)	"	"	SM 10200H
Phytoplankton Counts (mg/m^3)	"	"	Janik 1994
Zooplankton Counts (#/m^3)	0 - 15 m Net Tow	"	Janik 1994
Fecal Coliform (MPN/100ml)	"	"	SM 9223B

C. Chemical and Biological Measurements and Analysis

Depth integrated water samples were collected from 0-2.5 m at main-lake sampling site LLV-1A utilizing an integrated pvc sampler known by the trade name of "Sludge Judge." Additional depth samples were also collected quarterly at 0 m, 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 (micrometer) millipore filters utilizing a hand operated pneumatic filler pump.

Analyses were run on field duplicates at a frequency of approximately 10 percent 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 2010 for analysis of toxic substances.

Zooplankton samples were collected at LLV-1A 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-1A. 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) that 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 sediment range from 2.0 – 10.0 mL depending on algal density.

Biovolumes:

Cell volumes are calculated based on the measurements of at least 20 individuals of each species and the geometrical formula which most closely approximate 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 1975 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.

IV. WATER QUALITY RESULTS

A. Lake Water Surface Elevation

Water for Lake Las Vegas is pumped from Lake Mead through BWC pipelines. In 2011, Lake Las Vegas surface elevations fluctuated by approximately two feet six inches (2.6) during the year, with approximately two thousand thirty six (2,036) AF of Lake Mead water being added during 2011 (**Figure 3**). Approximately two thousand twenty eight (2,028) AF of Lake water were lost to seepage/evaporation. Lake levels represented in **Figure 3** are measured on the first of each month.

In 2011, approximately seven hundred twenty (720) AF of stormwater discharged into the Lake. Additionally, Lake Las Vegas released eighty-two (82) AF of stormwater through the dam's appurtenance, back to the Las Vegas Wash. Water elevation was high at the beginning of 2011 due to major storms in December 2010. The water elevation again increased in the middle of September 2011 due to a rain event.

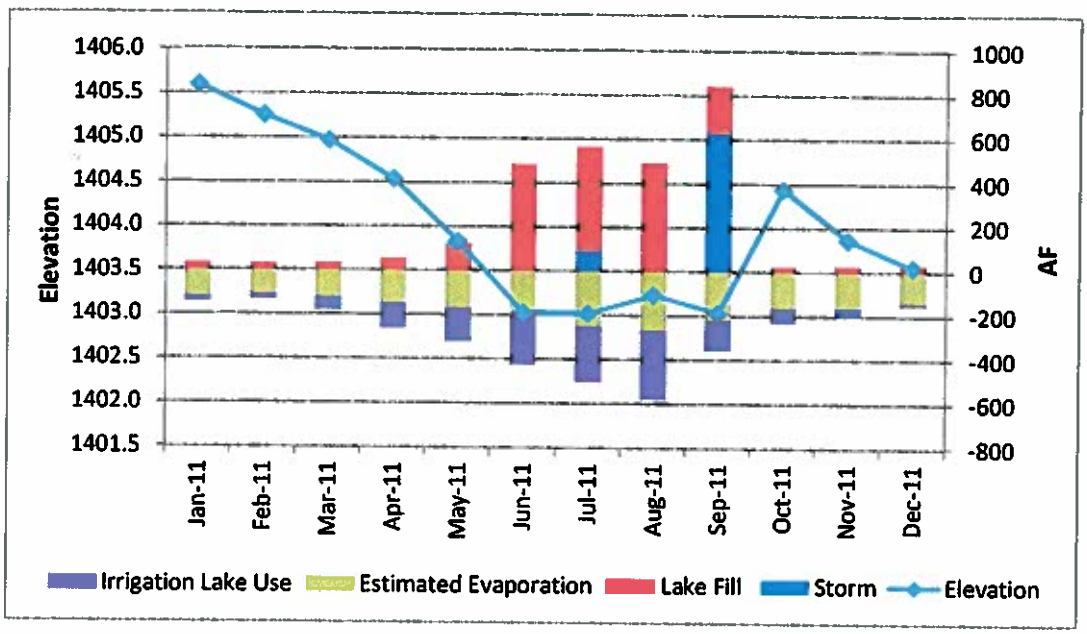

Figure 3. 2011 Lake Las Vegas surface elevations and Lake water budget.

B. Physical Analysis
Temperature

Deep reservoirs and lakes in temperate climates are subject to seasonal stratification due to solar thermal loading and wind induced mixing. During summer periods, as the day length increases with increased solar altitude, thermal loading of lakes and reservoirs significantly increases the thermal energy in the surface waters (Hutchinson 1959). Early in the season, wind often mixes these waters throughout the reservoir, both as the day length becomes progressively longer and solar thermal loading increases, wind generated mixing cannot thoroughly mix the solar warmed surface waters throughout the entire water body. The result is thermal stratification with warm, less dense waters on the surface, and cool denser waters at the bottom. Stratification typically results in three distinct vertical zones in the water column: the hypolimnion, the epilimnion, and the metalimnion (Wetzel 1975).

The hypolimnion is the deep water zone, filled with cold, dense water. It is often relatively quiescent because it is separated from contact with the atmosphere. Oxygen consumption due to decomposition of organic matter can lead to depressed levels of dissolved oxygen called hypolimnietic anoxia (Wetzel 1975). The epilimnion is the well-mixed surface layer that is in contact with the atmosphere and is thereby influenced by solar and wind energy. Primary production is a large component of the epilimnion because it generally corresponds with the photic zone and light availability. Between the hypolimnion and the epilimnion lies a transition layer called the metalimnion. The metalimnion is also called the thermocline because it is typified by a temperature gradient. The thermocline is an important physical factor for all biota, since it impedes vertical mixing and exchange between the epilimnion and the hypolimnion, acting to restrict nutrient and gas circulation due to the kinetic energy needed to pass from less dense, warm water through the gradient to denser, colder water (Hutchinson 1959).

Stratification in temperature zones is mostly seasonal. The stratification process is often reversed in the fall when cooler atmospheric temperatures reduce the surface temperatures of the reservoir. Differences in hypolimnion and epilimnion water temperatures and associated densities diminish allowing wind produced currents to mix the whole reservoir, a process known as turnover (Wetzel 1975).

Turnover has several important impacts on reservoir and lake systems. Top to bottom mixing in the fall redistributes the biotic and chemical components. This includes the reoxygenation of anoxic and depressed hypolimnetic waters, nutrient redistribution, and thermal homogeny.

Surface temperatures were measured at site LLV-1A with an observed average temperature of 18.6°C (range: 8.2 to 28.8°C) during 2011 (**Figure 4**). Temperature profiles reflected typical of lakes that stratify in the summer and destratify during the winter, however the lake was stratified for a shorter period in 2011 than in previous years. The reservoir started to see the beginnings of thermal stratification between March and April, and remained fully stratified until late October at LLV-1A (**Figure 5**). The thermocline was clearly observed at a depth between 10 and 14 meters. The shorter period of stratification may be attributed to storms at the end of 2010, and the change in ambient temperature patterns. The December 2010 storms affected the productivity of the lake from approximately January through April 2011.

Dissolved Oxygen

The distribution of oxygen in reservoirs is closely related to photosynthesis, respiration, thermal stratification, and organic matter. Oxygen is important in that its presence or absence influences not only the ability of organisms to occupy a particular zone of the reservoir, but also its bearing on the type of chemical reactions that can occur with regard to nutrient cycling. Plants and animals consume oxygen during respiration, but when the appropriate amount of light and nutrients are available, plants can produce diffusion from the atmosphere (reaeration). Oxygen in water is typically measured as dissolved oxygen (DO) and the loss of dissolved oxygen due to biological activity in the breakdown of organic matter is called the biological oxygen demand (BOD); loss due to chemical activity is the chemical oxygen demand. A dynamic equilibrium exists between oxygen gas in the atmosphere and the DO levels in aquatic systems that is a function of atmospheric pressure, temperature, and oxygen levels in water. This theoretical equilibrium is termed saturation dissolved oxygen. Temperature and saturation oxygen concentration have an inverse relationship: cold water has higher saturation dissolved oxygen than warm water. Oxygen saturation levels are often useful to consider because over saturation may be an indicator of high levels of photosynthesis while under saturation can indicate an increase in organic matter and/or pollutants or phytoplankton respiration.

Both seasonal and daily variations in oxygen can affect the components of a reservoir system. Seasonally, oxygen may remain at or close to equilibrium levels throughout the depth of the reservoir under isothermal (unstratified) conditions. Once thermal stratification occurs, the oxygen levels decrease, especially in the photic zones where significant respiration takes place. Anoxia can occur in the hypolimnion. At the same time that the hypolimnion is under saturated, the epilimnion may be supersaturated due to intense photosynthesis. The reservoir will not reach equilibrium across the oxygen gradient due to the thermocline barrier. On a daily basis, oxygen in the photic zone may fall below saturation levels in the early morning, increase as the light and therefore photosynthesis increases until super saturation is reached in the afternoon, only to be depleted again once night time respiration begins.

Dissolved oxygen concentrations at the Lake surface were measured at site LLV-1A with an observed average concentration of 9.7 mg/L (range: 6.2 to 14.4 mg/L) during 2011 (**Figure 4**).

Concentrations at depth exhibited the common dissolved oxygen trends found within monomictic lakes that stratify (**Figure 6**). During the months of thermal stratification, March through October, dissolved oxygen concentrations at the epilimnion were above 5.0 mg/L. Below the thermocline, concentrations were less than 5.0 mg/L. In reference to temperature, dissolved oxygen exhibited greater influence due to storms and weather patterns. Evident by the shorter stratification period (**Figure 6**).

Biological Oxygen Demand (BOD_5)

BOD_5 is an indirect measure of the concentration of biologically degradable material present in organic wastes. It usually reflects the amount of oxygen consumed in five days by biological processes breaking down organic waste (NALMS 2009).

Surface BOD_5 concentrations were measured at site LLV-1A with an observed average concentration of 3 mg/L (range: 2 to 5 mg/L) (**Figure 7**). BOD_5 concentrations increased in from January to April dues to high productivity from the December 2010 storms.

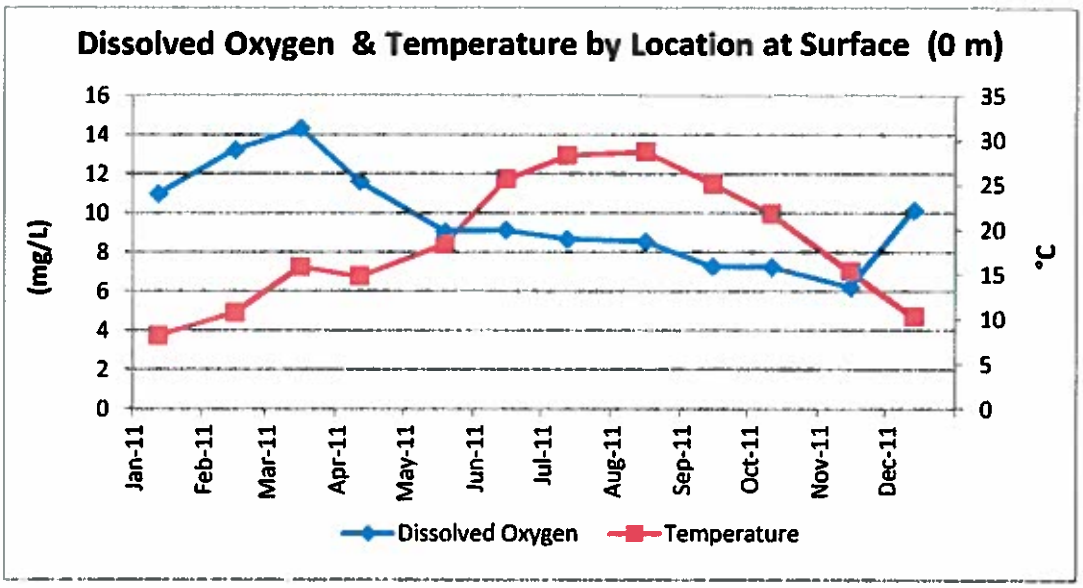

Figure 4. Lake Las Vegas surface water temperature (°C) and dissolved oxygen (mg/L) measurements at Lake monitoring sites in 2011.

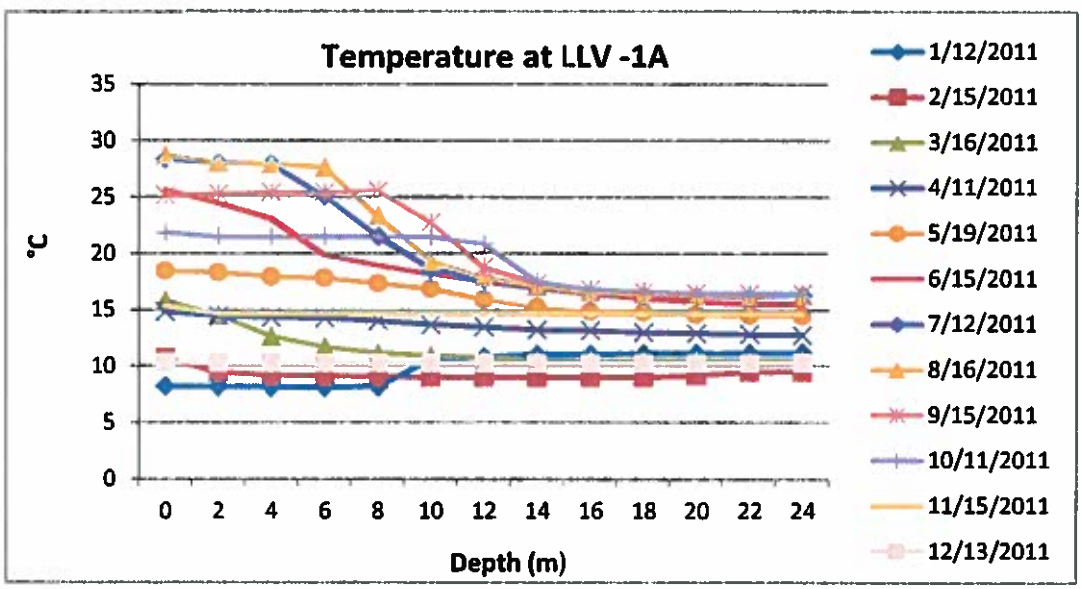

Figure 5. Lake Las Vegas monthly temperature (°C) profile at site LLV-1A during 2011.

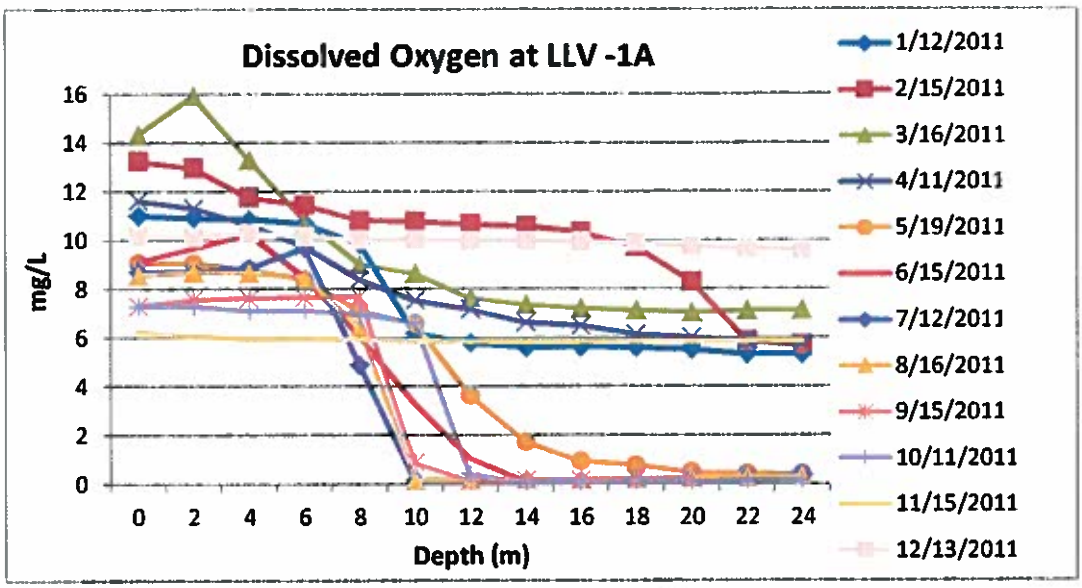

Figure 6. Lake Las Vegas monthly dissolved oxygen profile at site LLV-1A during 2011.

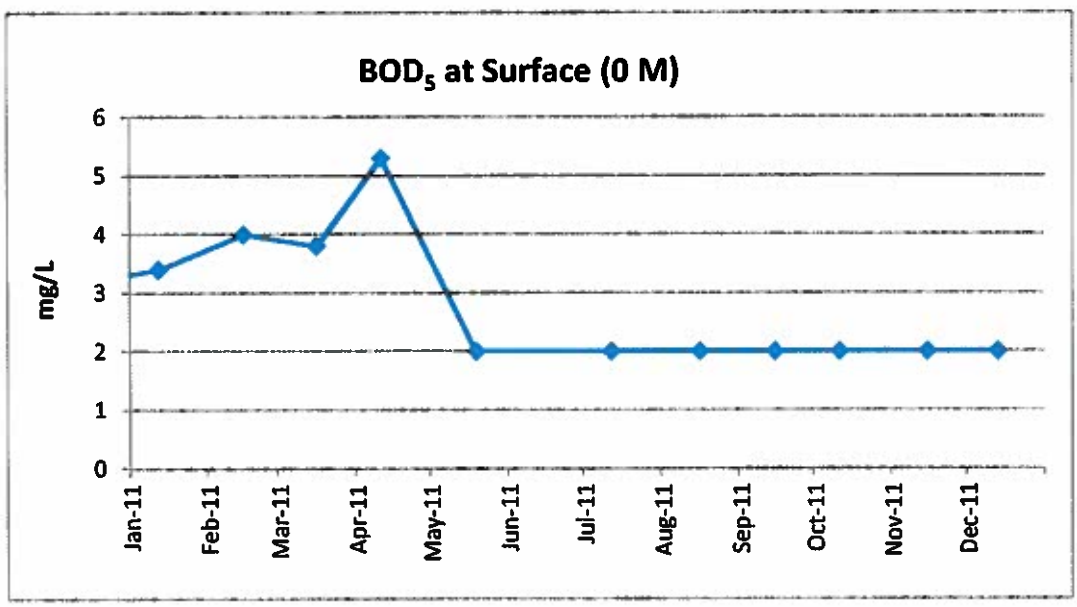

Figure 7. Lake Las Vegas Biochemical Oxygen Demand (mg/L) concentrations in surface waters at Lake monitoring site LLV-1A during 2011.

pH

The pH of a water body describes how acidic or alkaline the water is based on an exponential scale of 1 to 14. A pH reading of less than 7 indicates acidity, greater than 7 indicates alkaline conditions and a pH of 7 is considered neutral. Most lakes and reservoirs have a pH that ranges between 6 and 9. Changes in pH of a lake or reservoir may influence other nutrients and minerals including iron, ammonia, phosphate, and carbon dioxide. pH may vary with depth in a reservoir, especially during summer months when phytoplankton abundance and production may lead to higher pH values in areas of photosynthesis and lower in areas where respiration or decay of organic matter is occurring such as the hypolimnion. pH may be affected by photosynthesis and respiration since pH is closely related to the amount of and form of carbon the water column.

Surface water pH values were measured at site LLV-1A with an observed average concentration of 8.3 Standard Units (range: 7.6 to 8.8 Standard Units) (**Figure 8**). Variability can be attributed to storms in December 2010 and 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 (**Figure 9**).

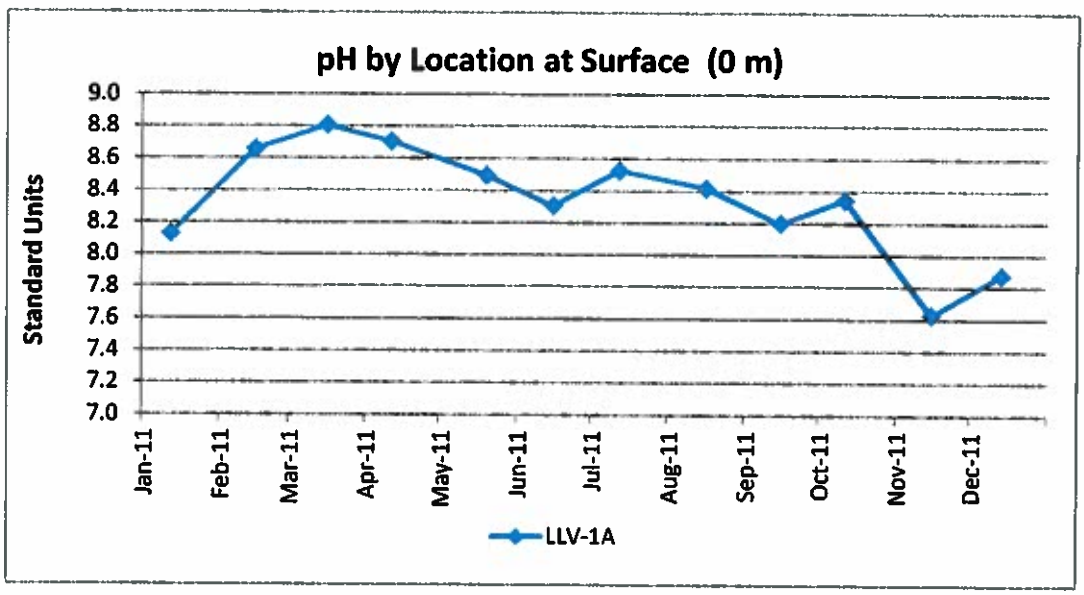

Figure 8. Lake Las Vegas surface water pH (standard units) measurements at Lake monitoring site LLV-1A during 2011.

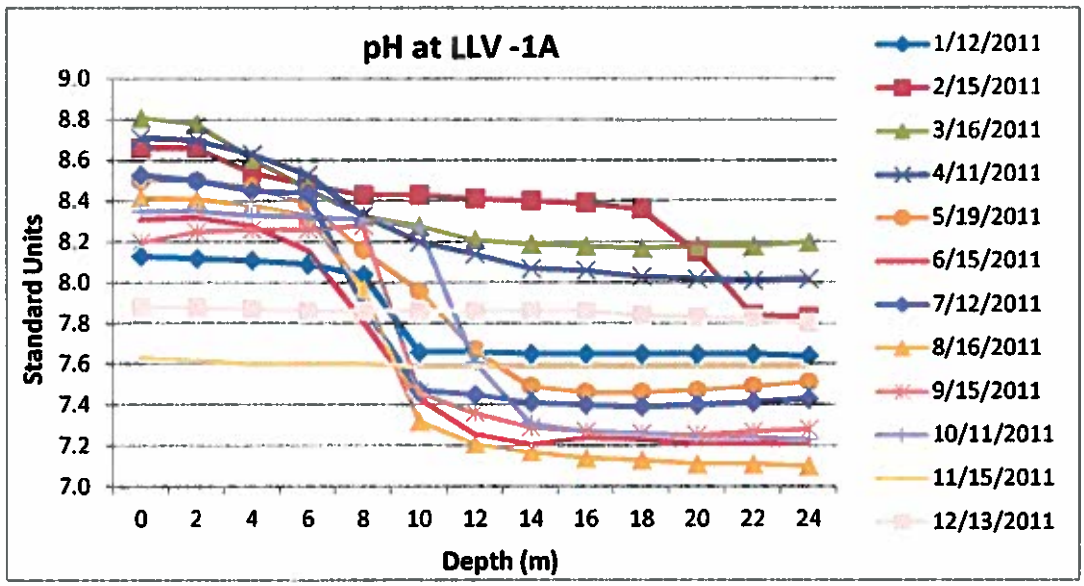

Figure 9. Lake Las Vegas monthly pH (standard units) profile at site LLV-1A during 2011.

Major Ion Concentrations

The spatial and temporal distribution of the major cations are separable into conservative ions, whose concentrations within a lake undergo relatively minor changes from biotic utilization or biotical mediated changes in the environment and dynamic ions whose concentrations can be influenced strongly by metabolism. Of the major cations, magnesium, sodium, and potassium ions are relatively conservative both in their chemical reactivity under typical freshwater conditions and their small biotic requirements (Wetzel 1975).

Quarterly depth samples did not vary significantly at site LLV-1A for the ions of calcium, sodium, chloride, potassium, sulfate and magnesium and bicarbonate (**Table 3**).

Some ion concentrations were higher and some were lower than previous years, however these variations are not significant.

Table 3. 2011 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	Ca (mg/L)	Cl (mg/L)	HCO_3 (mg/L)	SO_4 (mg/L)	Na (mg/L)	K (mg/L)	Mg (mg/L)
3/16/11	0	167	252	56	573	295	25	60
3/16/11	5	169	216	63	572	293	25	60
3/16/11	10	168	212	79	585	284	24	59
3/16/11	20	171	234	83	632	293	25	60
6/15/11	0	186	467	61	642	250	19	69
6/15/11	5	186	428	73	673	250	17	69
6/15/11	10	185	428	83	625	250	17	68
6/15/11	20	183	444	89	662	241	17	66
9/15/11	0	160	312	70	619	268	11	60
9/15/11	5	169	326	65	654	289	12	64
9/15/11	10	183	356	80	707	312	13	69
9/15/11	20	190	360	135	682	310	13	70
12/13/11	0	202	343	87	732	364	26	76
12/13/11	5	209	345	88	746	373	27	78.
12/13/11	10	205	369	88	777	361	26	77
12/13/11	20	212	376	88	760	396	28	80

Specific Conductance

Electrical conductivity is a measure of a body of water's ability to conduct electricity, and therefore a measure of the water's ionic activity and content. Higher concentrations of ionic (dissolved) constituents in a lake or reservoir lead to higher conductivity. Conductivity of the same water changes substantially as its temperature changes. Electrical Conductivity that is normalized at a temperature of 25 °C is called specific conductance, allowing direct comparison of various water samples or water bodies.

Surface conductivity was measured at site LLV-1A with an observed average of 2,478 micromhos per centimeter (µmhos/cm) (range: 2,055 to 2,680 µmhos/cm) during 2011. Specific conductivity did not vary significantly with depth, with the exception of changes in January and September due to storm events (**Figure 11**).

Total Dissolved Solids (TDS)

Total Dissolved Solids (TDS) is a measure of the amount of material dissolved in water (mostly inorganic salts). Typically these may be aggregates of carbonates, bicarbonates, chlorides, sulfates, phosphates, nitrates, and cations such as of calcium, magnesium, manganese, sodium, potassium, and other cations which form salts. The inorganic salts are measured by filtering a water sample to remove any suspended particulate material, evaporating the water, and weighing the solids that remain. An important use of the measure involves the examination of the quality of drinking water. Water that has a high content of inorganic material frequently has taste problems and/or water hardness problems. As an example, water that contains an excessive amount of dissolved salt (sodium chloride) is not suitable for drinking. High TDS solutions have the capability of changing the chemical nature of water. High TDS concentrations exert varying degrees of osmotic pressures and often become lethal to the biological inhabitants of an aquatic environment (NALMS 2009).

Monthly surface TDS concentrations were low at the beginning of 2011 due to storm events at the end of 2010. Concentrations were relatively stable throughout the spring and summer periods then increased during the fall and winter months (**Figure 10**). Monthly surface concentrations were measured at site LLV-1A with an observed average concentration of 1,645 mg/L (range: 1,370 to 1,840 mg/L) during 2011. The difference between the average concentration at the surface water and the maximum depth of 20 m is 79 mg/L at site LLV-1A (**Figure 12**). TDS concentrations remain below the annual average of 2,000 mg/L guideline for irrigation purposes.

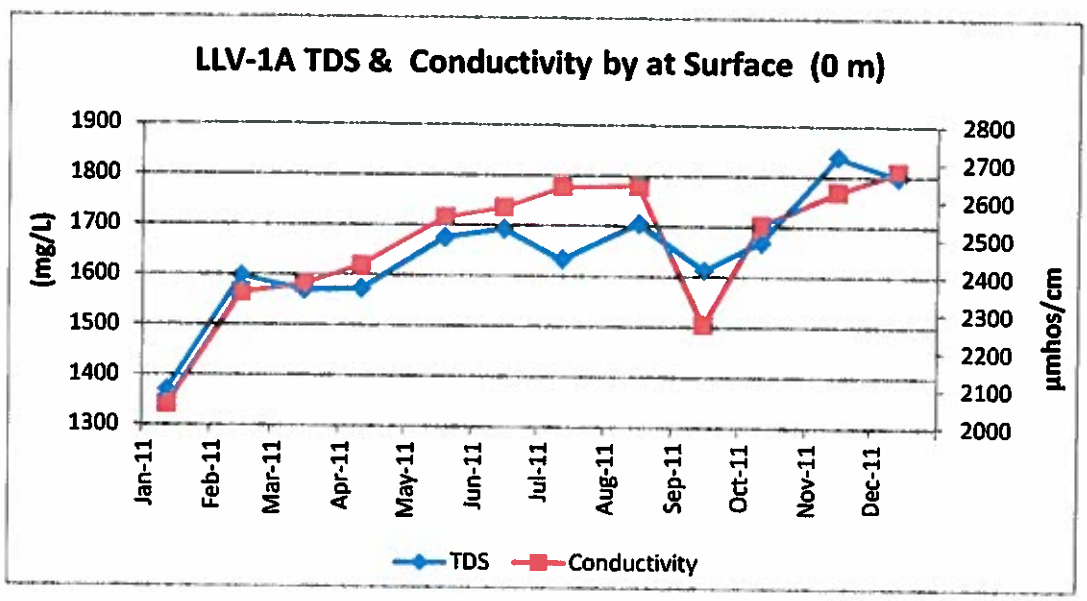

Figure 10. Lake Las Vegas surface conductance (µmhos/cm) and TDS (mg/L) measurements at Lake monitoring site LLV-1A during 2011.

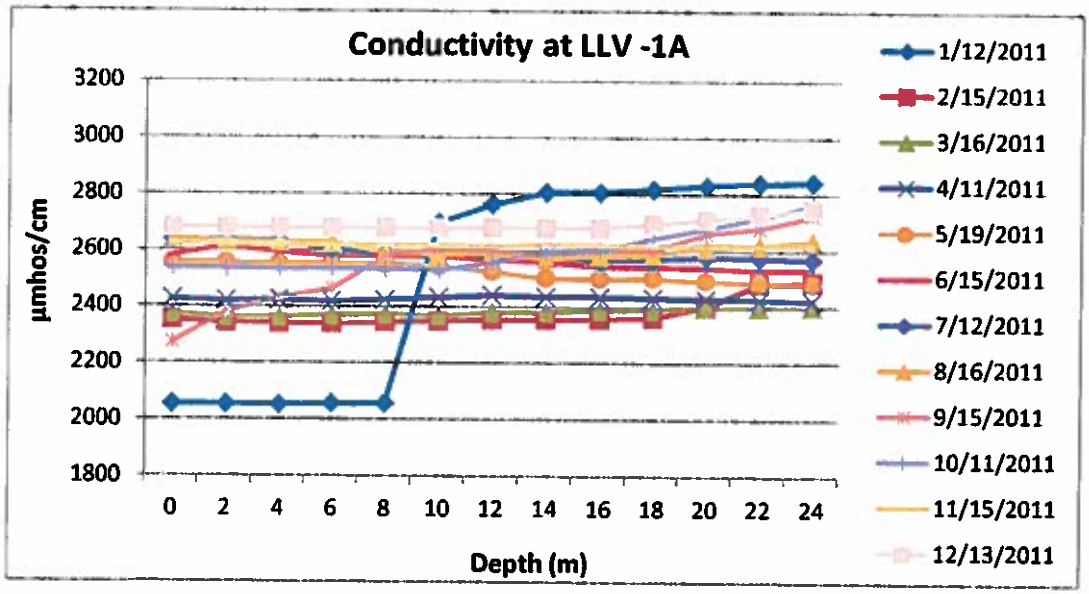

Figure 11. Lake Las Vegas monthly conductance (µmhos/cm) profile at site LLV-1A during 2011.

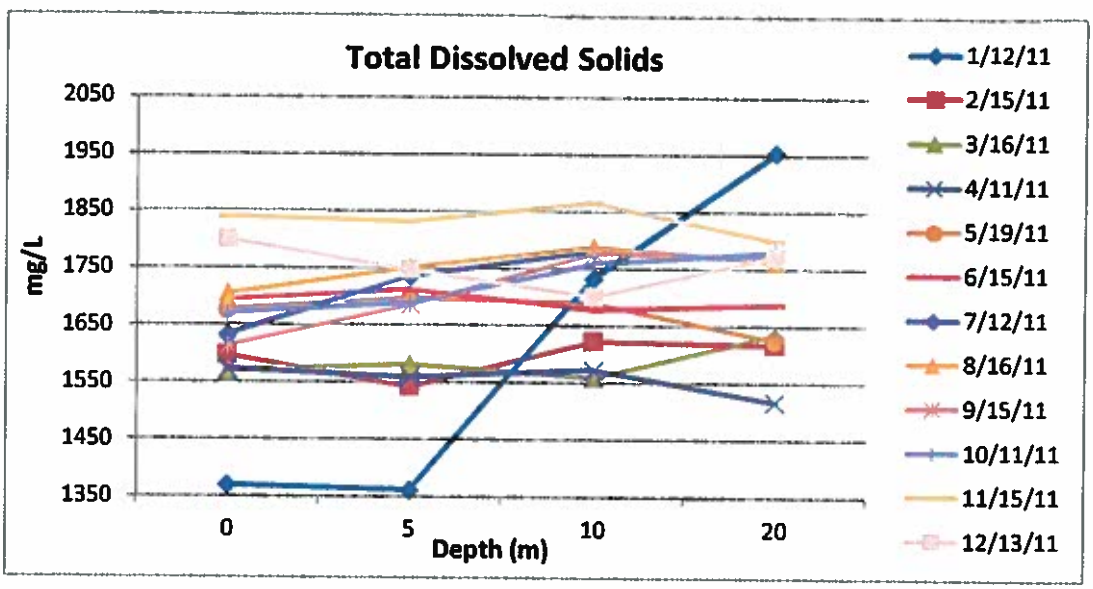

Figure 12. Lake Las Vegas monthly dissolved solids (mg/L) profiles at site LLV-1A during 2011.

Turbidity, Transparency (Secchi) and Total Suspended Solids (TSS)

Turbidity is a measure of the clarity of lake water. Total Suspended Solids (TSS), are dissolved inorganic material by evaporation found in a water system. (Wetzel 1975). The more suspended particles (TSS) in the water the less clear or transparent the lake water becomes. These reflective properties of lake water are usually measured by lowering a secchi disk into the water until it can no longer be seen. The average of at least two measurements is taken. A lower result indicates that the lake is more characteristically eutrophic, whereas a higher result indicates the lake is more characteristically oligotrophic. Measurement trends vary throughout the summer due to algae populations. Turbidity is related to total suspended solids influence by both internal and external sources such as: dust particles, phytoplankton, and organic matter. Turbidity is affected by wind action, precipitation and land use practices.

Lake turbidity during 2011 was poor, or more characteristically eutrophic. Monthly surface values were measured at site LLV-1A with an observed average concentration of 11 NTU (range: 2 to 32 NTU). Secchi disk monthly surface values, were measured at sites LLV-1A with an observed average concentration of 1.6 m (range: 0.8 to 3.0 m) during 2011 (**Figure 13**). Turbidity was highest from February through March and in October, which can be contributed to storms. Since turbidity, as estimated by secchi measurements is highly dependent on the concentration of suspended solids measured, similar inverse trends are often observed.

Monthly surface TSS concentrations were measured at site LLV-1A with an observed average concentration of 18 mg/L (range: 2 to 33 mg/L) during 2011 (**Figure 13**). The difference between the average concentration at the surface water and the maximum depth of 20 m is one (1) mg/L at site LLV-1A (**Figure 14**). The concentrations follow a similar trend in increase to TDS.

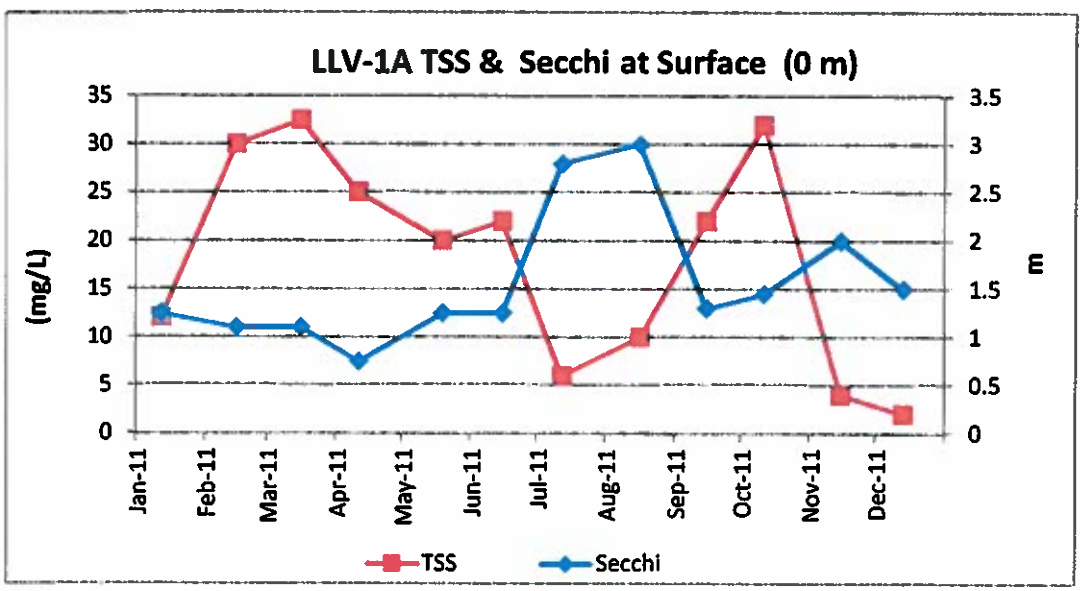

Figure 13. Lake Las Vegas surface total suspended solids (mg/L) and Secchi (m) measurements at Lake monitoring sites during 2011.

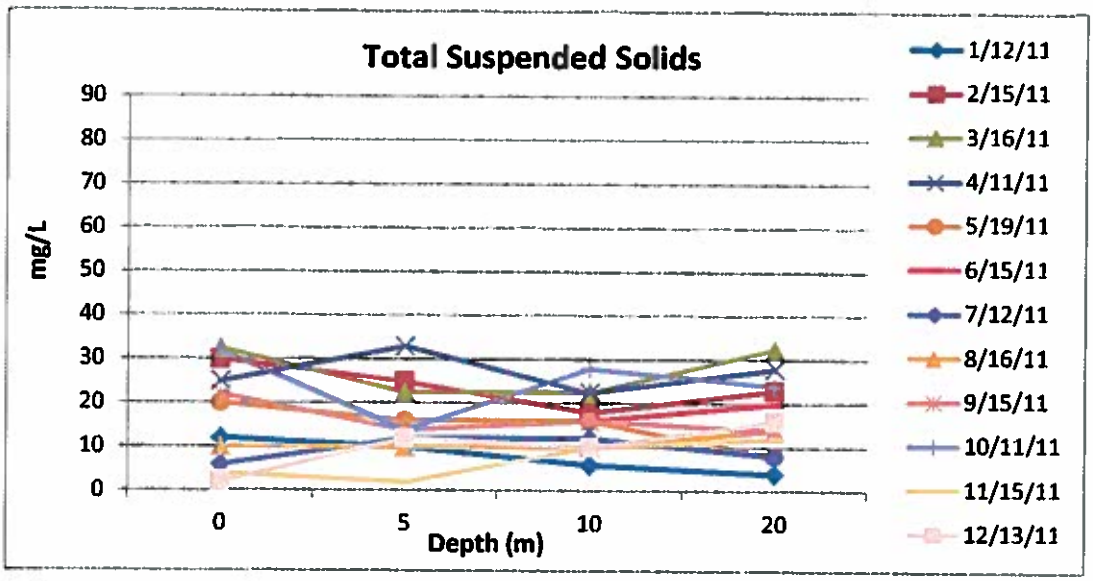

Figure 14. Lake Las Vegas monthly total suspended solids (mg/L) profiles at site LLV-1A during 2011.

C. Chemical Analysis

Phosphorus

Phosphorus is a common growth limiting nutrient in phytoplankton even though the quantity needed by plants is much smaller than other nutrients, such as carbon or nitrogen. Phosphorus's critical role as a growth limiting nutrient is partially due to the fact that the only biological available form of phosphorus is soluble phosphate (PO_4). (Wetzel 1975) Most phosphorus is unavailable to biota because it tends to strongly adsorb to particles in the water, with the exception of anoxic conditions. Phosphate may accumulate over the winter when primary production is at a minimum, but by late spring the levels of available phosphate may be reduced to less than 2.0 µg/L through algal uptake. This lack of available phosphate results in a system where phosphate is continuously recycled back to phytoplankton after excretion from fish, zooplankton, or bacterial activity. Internal loading from the sediments and lake mixing are important methods of returning phosphates that have left the photic zone and return them to the epilimnion for use. (Hutchinson 1957)

Surface total phosphorus concentrations were measured at site LLV-1A with an observed average concentration of 24 µg/L (range: 7 to 46 µg/L) (**Figure 15**). Storms in December 2010 attributed to peak total phosphorous concentration of 46 µg/L in February. Monthly total phosphorus concentrations varied with depth and were consistent with the typical stratified lake (**Figure 16**).

Surface otho-phosphorus concentrations were measured at site LLV-1A with an observed average concentration of 6 µg/L (range: 5 to 19 µg/L) (**Figure 15**). Ortho phosphorous was in

low concentrations during the majority of the year. Spikes at depth during August, September and October were likely due to sampling errors (**Figure 17**).

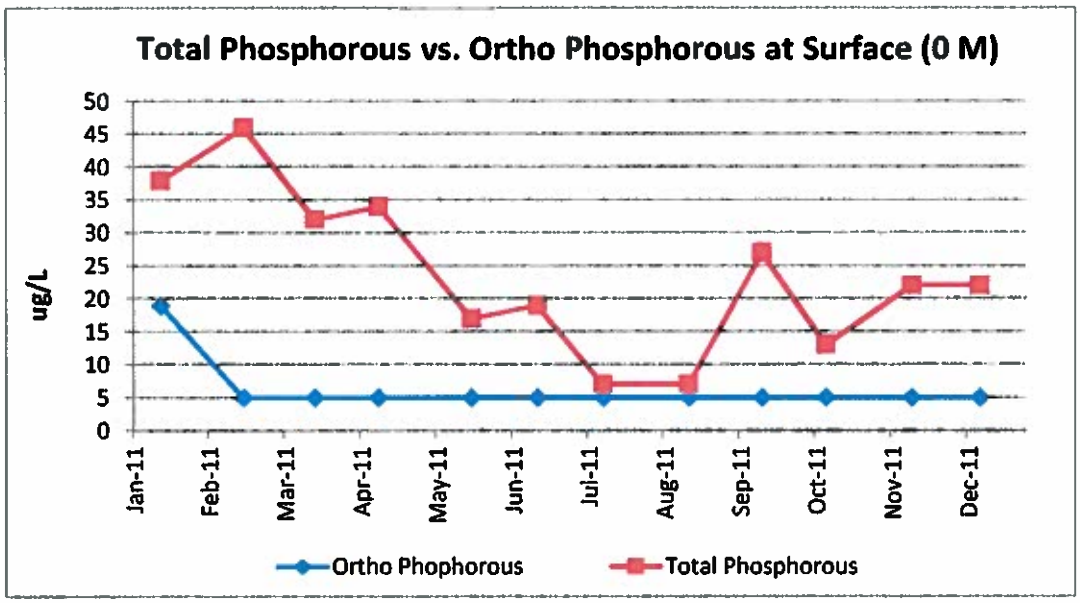

Figure 15. Lake Las Vegas surface total phosphorus (µg/L) and Ortho-phosphorous (µg/L) profiles at Lake monitoring sites during 2011.

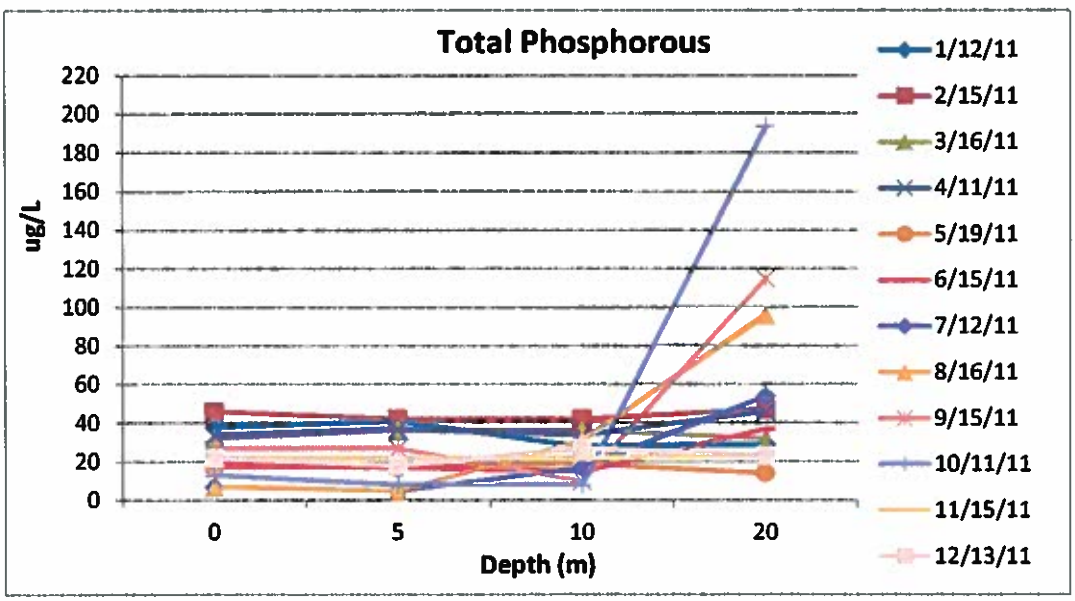

Figure 16. Lake Las Vegas monthly total phosphorus (µg/L) profiles at site LLV-1A during 2011.

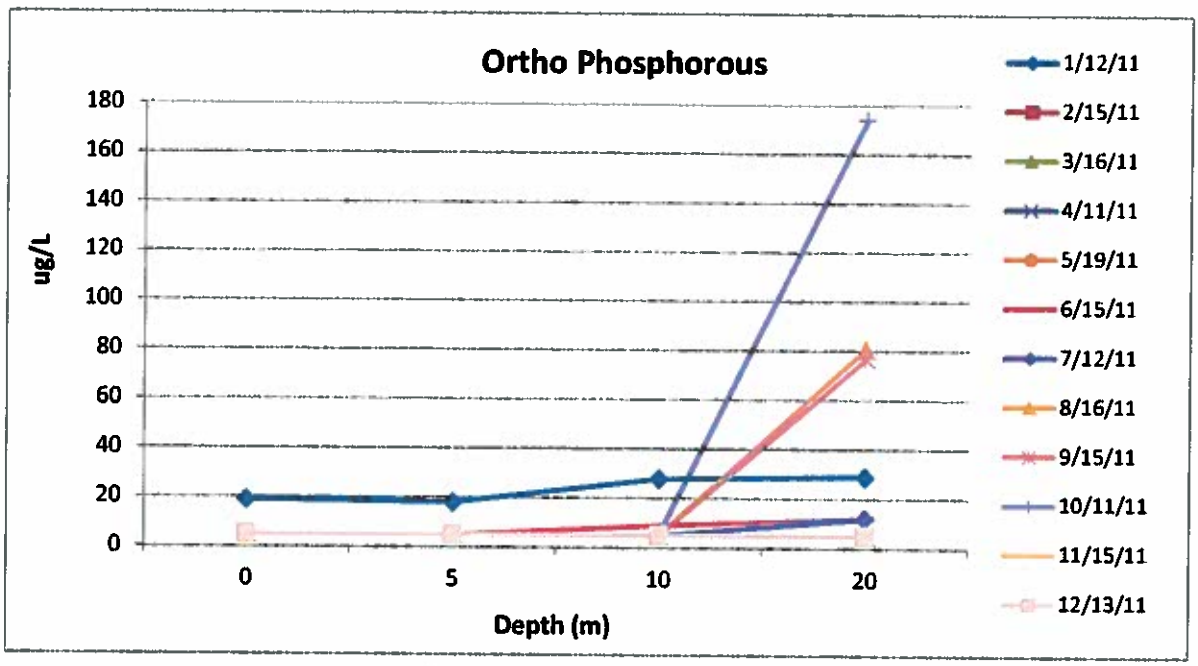

Figure 17. Lake Las Vegas monthly ortho-phosphorus µg/L profiles site LLV-1A during 2011.

Nitrogen

Nitrogen enters lakes and reservoirs as nitrate in rainfall and atmospheric deposition in the watershed, moving freely through soils and streams. In addition, decomposing bacteria breaks down organic matter and convert the nitrate to ammonia.

Nitrogen in aquatic systems may exist in several forms: dissolved nitrogen gas (N_2), organic nitrogen incorporated into organic matter, ionized (NH_4^+) and undissociated ammonia (NH_4OH+NH_3), nitrite ion (NO_2^-) and nitrate ion (NO_3^-). The prevalence of ionized versus undissociated ammonia is primarily pH dependent, such that the fraction as unionized species (NH_4OH+NH_3) increases significantly above pH = 8. Unionized ammonia is toxic to aquatic life. (Wetzel 1975) Under aerobic conditions, bacteria mediate the oxidation of ammonia to nitrate, with an intermediate step of nitrite, in a process known as nitrification. In the nitrification reaction, 1.0 g of ammonia consumes 4.57 g of oxygen (Charpa 1997). In the absence of oxygen, bacteria mediate the reduction of nitrate to nitrogen gas.

Monthly surface nitrate plus nitrite concentrations were measured at site LLV-1A with an observed average concentration of 435 µg/L (range: 5 to 910 µg/L) (**Figure 18**). Sampling results for August and October represented in **Figure 18** were reported at the non-detect level of five (5) µg/L. Concentrations varied by depth with the difference between the average concentration at the surface water and the maximum depth of 20 m being 58 µg/L at site LLV-1A. Concentrations were heavily influenced by thermal stratification and the presence of anaerobic conditions (**Figure 19**).

Ammonia - Nitrogen

Monthly ammonia surface water concentrations were relatively stable from March to October. Surface ammonia concentrations were measured at site LLV-1A with an observed average concentration of 253 µg/L (range: 50 to 2300 µg/L) (**Figure 18**). Variability in concentrations between depths during the spring and summer were significant for ammonia during 2011 (**Figure 20**) attributed to the low DO concentrations in the hypolimnion when the Lake was stratified. The difference between the average concentration at the surface water and the maximum depth of 20 m is 402 (µg/L) at site LLV-1A. These concentrations at depth are expected during stratification where de-nitrification occurs. Concentrations in November showed a significant increase, however samples taken in December resumed normal trending.

Organic Nitrogen

Organic nitrogen concentrations are calculated by subtracting the ammonia concentration from the TKN concentration. Organic nitrogen is comprised of detritus and plankton suspended within the water column, and remaining insoluble until decomposition breaks down the organic matter and bacteria process and release the nitrogen back into the system.

Monthly organic nitrogen concentrations were measured at site LLV-1A with an observed average surface concentration of 510 µg/L (range 260 to 740 µg/L) (**Figure 18**). An observed increase in organic nitrogen was measured from April to August at site LLV-1A (**Figure 21**). This increase corresponds to an increase in phytoplankton activity during the same period, causing organic nitrogen concentrations to follow the same trend.

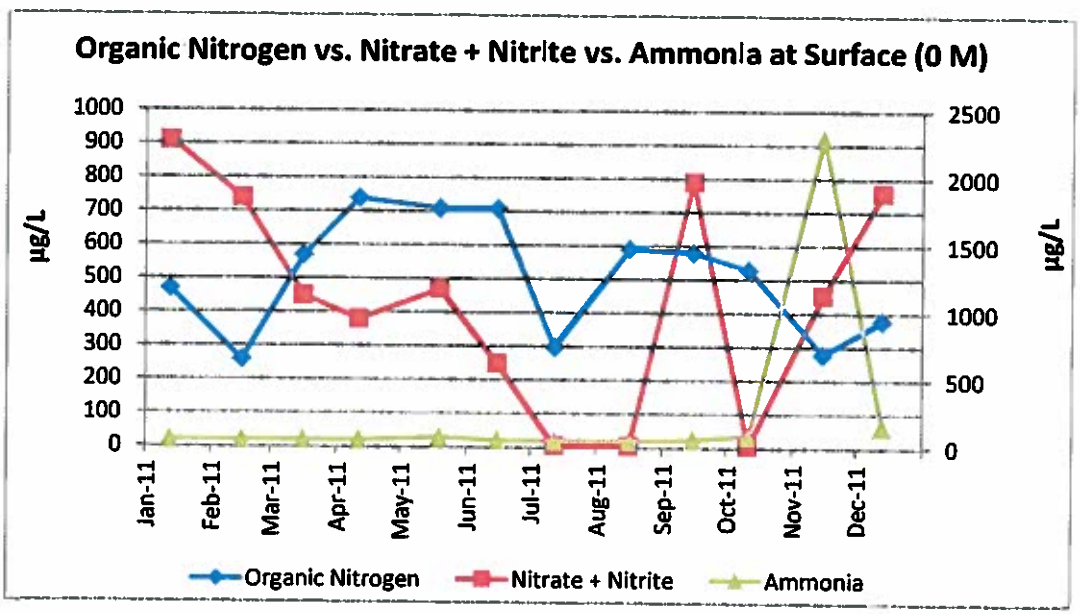

Figure 18. Lake Las Vegas surface nitrite + nitrate (µg/L), ammonia (µg/L), and Organic Nitrogen (µg/L) measures at Lake monitoring site LLV-1A during 2011.

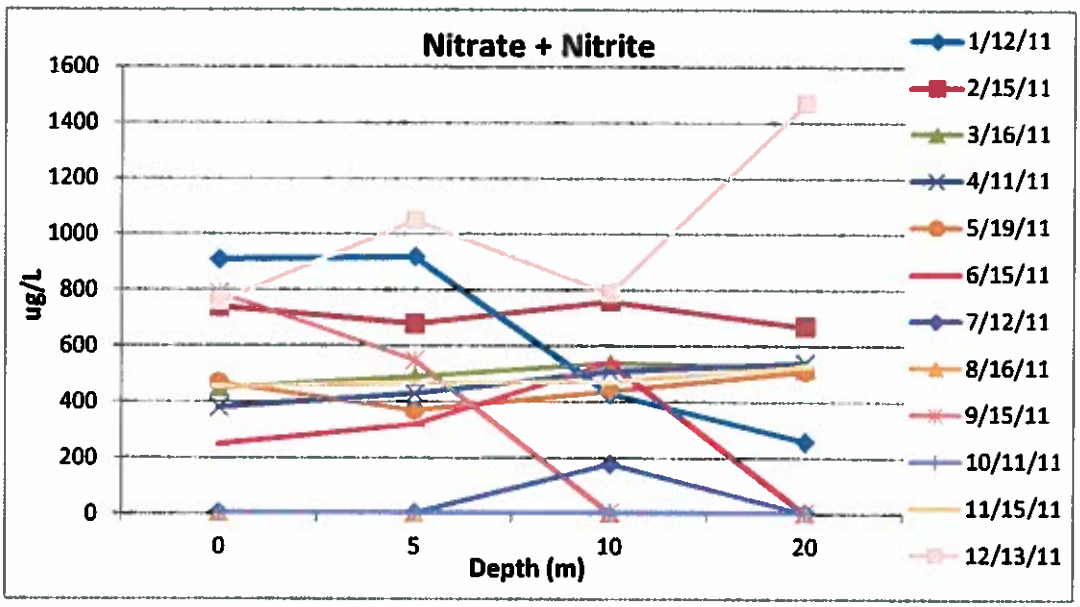

Figure 19. Lake Las Vegas monthly nitrate + nitrite (µg/L) profiles at site LLV-1A during 2011.

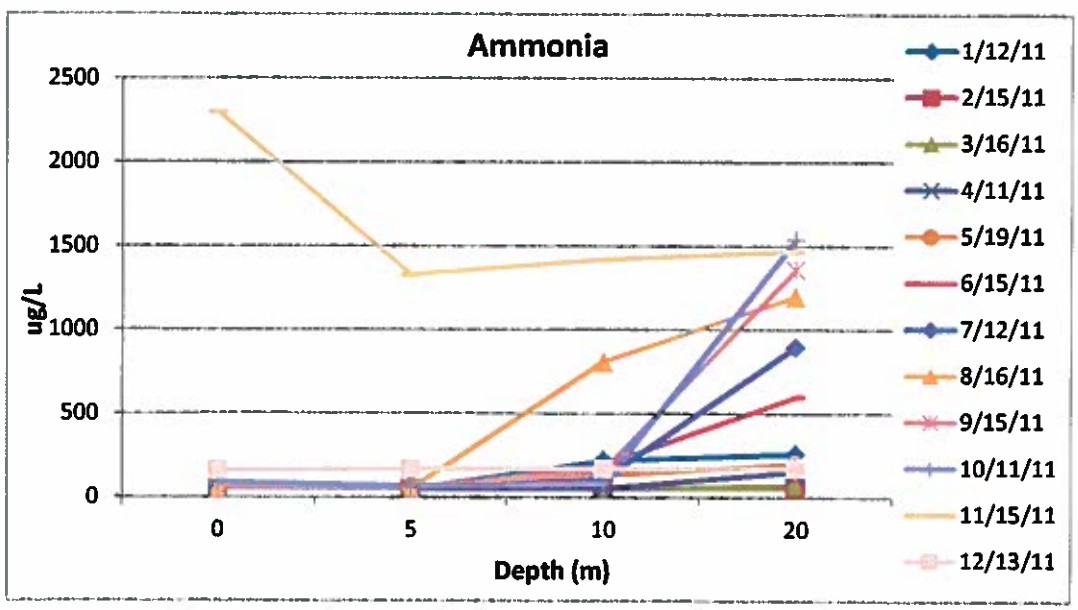

Figure 20. Lake Las Vegas monthly ammonia (µg/L) profiles at site LLV-1A during 2011.

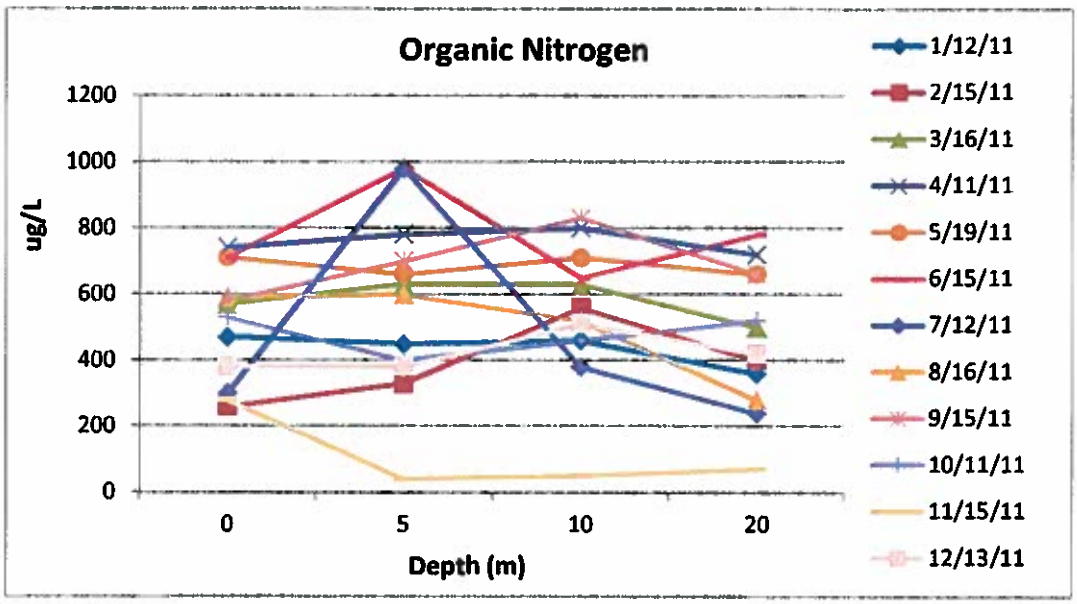

Figure 21. Lake Las Vegas monthly Organic Nitrogen (µg/L) profiles at site LLV-1A during 2011.

D. Biological Analysis

Phytoplankton Species Composition and Abundance

Phytoplankton, also commonly known as algae, are microscopic plants that grow in sunlit water that contains phosphates, nitrates, and other nutrients. Algae, like all aquatic plants, add oxygen to the water and are important in the fish food chain. Phytoplankton is either suspended in water (plankton) or attached to rocks and other substrates (periphyton). Their abundance, as measured by the amount of *chlorophyll a* (green pigment) in an open water sample, is commonly used to classify the trophic status of a lake. Phytoplankton are an essential part of the lake ecosystem and provide the food base for most lake organisms, including fish. Phytoplankton populations vary widely from day to day, as life cycles are short (NALMS 2009).

In December 2009 *Prymnesium parvum (P. parvum)* was collected and identified in the waters of the Lake at Lake Las Vegas. *P. parvum* is a microbial, toxigenic, unicellular, invasive species that can affect an entire ecosystem. *P. parvum* not only negatively affect its prey and competitors, but can also negatively affect non-targeted species. To meet energy needs, *P. parvum* can consume phytoplankton, zooplankton and bacteria.

Eight (8) taxonomic divisions of phytoplankton were found at site LLV-1A during 2011 (**Figure 22**). The results for phytoplankton and zooplankton are reported by monthly relative frequency. Relative frequency is the frequency (biomass volume) of each division or species divided by the total biomass volume of all divisions or species. By biomass, the most relatively frequent observed division in 2011 was Haptophyta (79.2%). The remaining seven (7) divisions relative frequencies were as follows: Cyanobacteria (9.6%), Chlorophyta (6.0%),

Bacillariophyceae (4.76%), Chrysophyta (0.27%) Cryptophyta (0.08%), Microflagellates (0.13%), and Pyrrhophyta (0.07%) were distributed in relation to Haptophyta during the year.

Species of phytoplankton in 2011 was still dominated by *P. parvum* of the taxonomic division, Haptophyta (Golden Algae), however other species were able to start to reestablish in the reservoir again. At site LLV-1A *P. parvum* had a 79.1% monthly relative frequency. Of the other species, no other species was observed to have a larger portion than 10% of the observed annual biomass. By comparison, in 2010 *P. parvum* had a 93.2% relative frequency and no other species were observed to have a larger portion than 2%.

There was a significant decrease in the monthly biomass volume for phytoplankton from 220,092 mg/m^3 in 2010 to 33,236 mg/m^3 in 2011. The biomass volume for *P. parvum* decreased from 206,874 mg/m^3 in 2010 to 26,318 mg/m^3 in 2011.

Phytoplankton populations were the most abundant during the spring months and declined after May (**Figure 23**). This was also observed in the *chlorophyll a* concentrations (**Figure 28**).

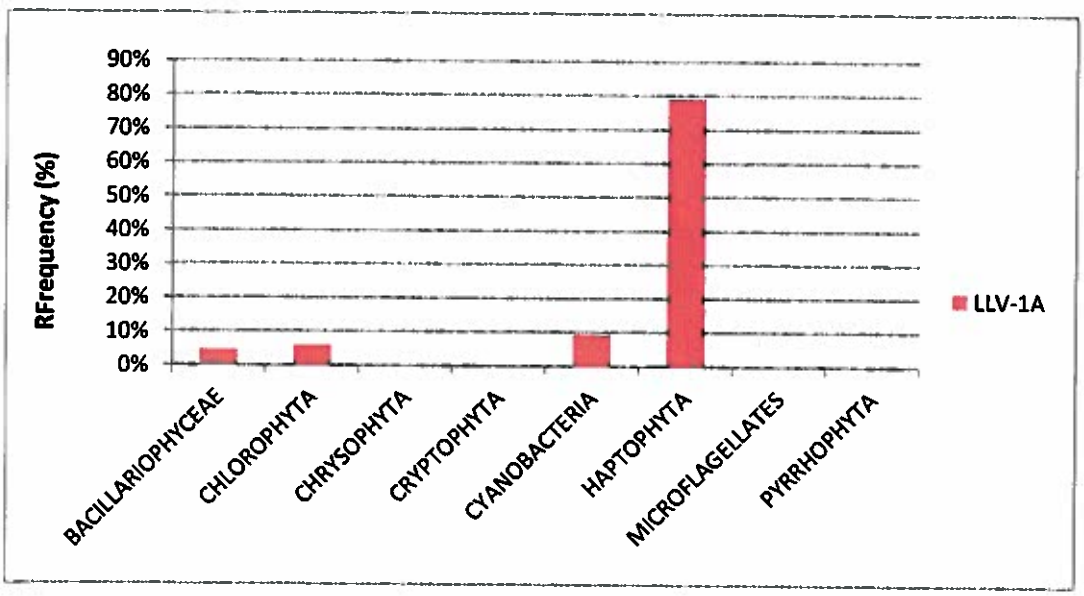

Figure 22. Lake Las Vegas Phytoplankton relative frequency by taxonomic division at site LLV-1A during 2011.

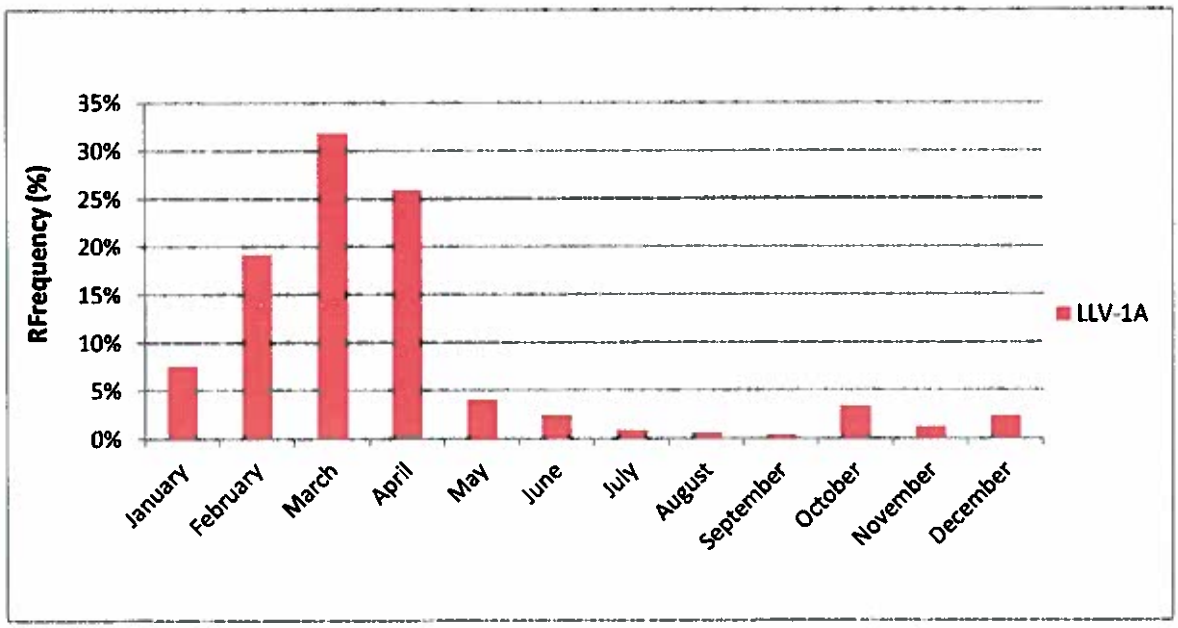

Figure 23. Lake Las Vegas Phytoplankton by month at site LLV-1A during 2011.

Zooplankton Species Composition and Abundance

Copepods dominated the zooplankton population with a relative frequency of 69.75%, of the biomass at site LLV-1A, followed by Rotifers (30.20% LLV-1A) and Cladocerans (0.05% LLV-1A) during 2011 (**Figure 24**). Several species of zooplankton have been identified in the 0 – 15 m vertical plankton tows at site LLV-1A in 2011 (**Figure 25**). Eleven (11) species were observed in 2011, but over 50 percent of the biomass was attributed to one species *Nauplii*, reflecting an overall lower diversity of zooplankton (**Figure 25**).

There was a significant increase in the biomass volume for zooplankton from 440,521 mg/m^3 in 2010 to 933,546 mg/m^3 in 2011 indicating zooplankton are starting to recover.

Zooplankton frequencies correlate with the *P. parvum* dominance consistent during most of the year and greatest during the month of March and April (**Figure 26**). In general, populations were greater during the summer and falls months fallowing the increase food (phytoplankton) in the spring. It has been noted that there is a negative relationship between *P. parvum* and Cladoceran (Remmel 2011). This negative relationship is evident by the almost nonexistent presence of Cladocerans in the Lake during 2011 (**Figure 24**).

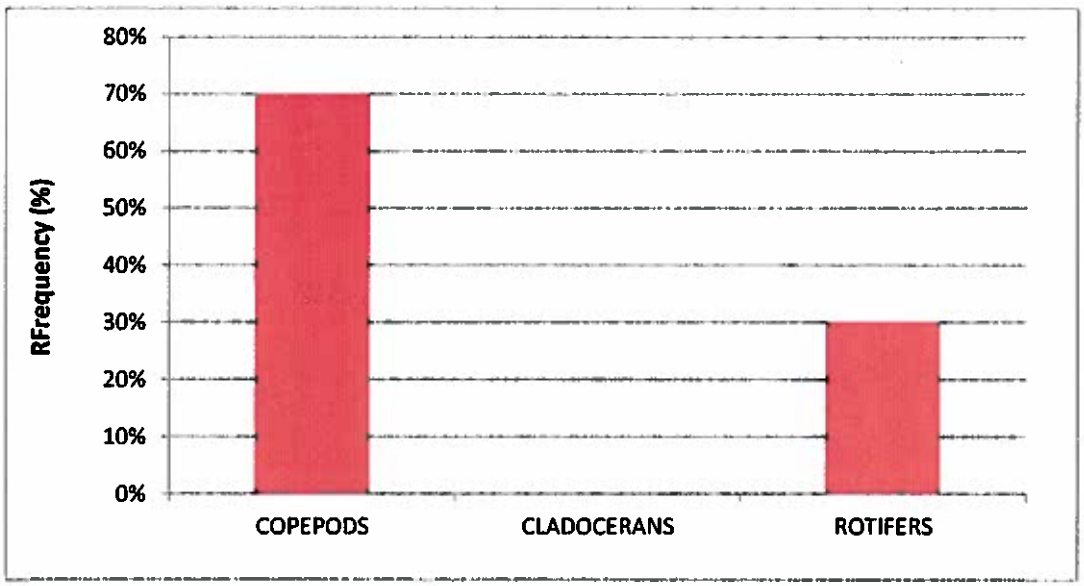

Figure 24. Lake Las Vegas Zooplankton relative frequency by kingdom at site LLV-1A during 2011.

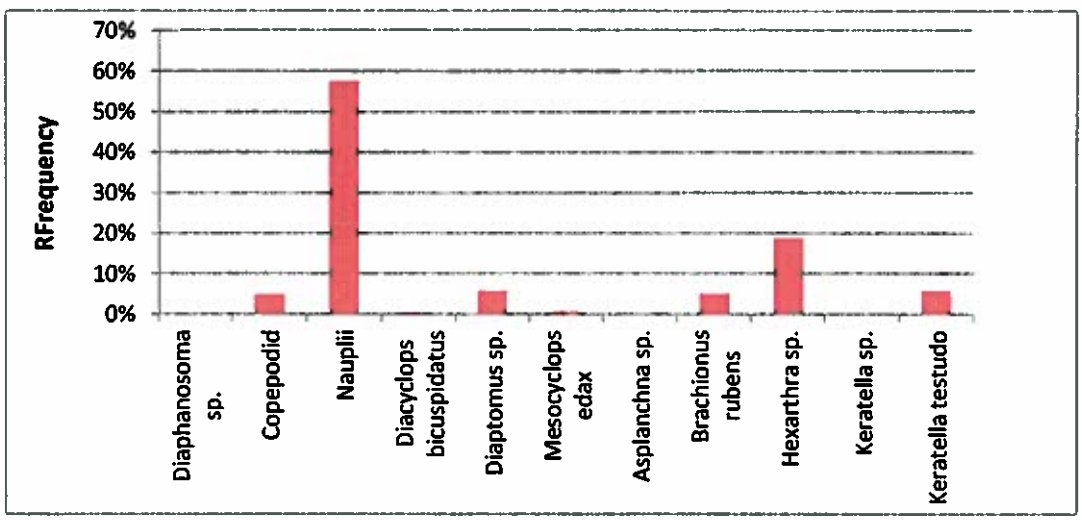

Figure 25. Lake Las Vegas Zooplankton relative frequency by species at site LLV-1A during 2011.

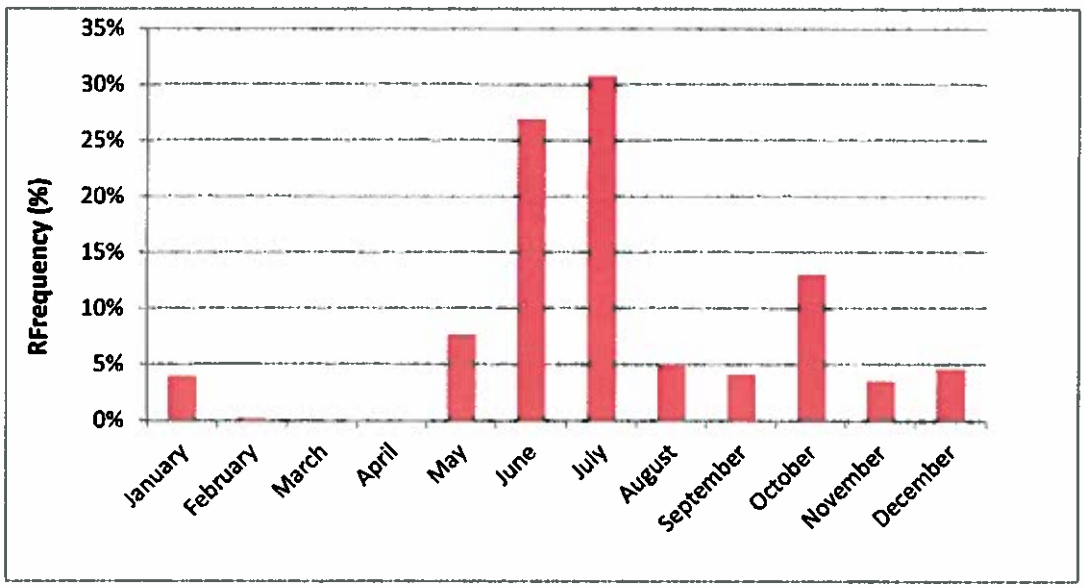

Figure 26. Lake Las Vegas Zooplankton frequency by month at site LLV-1A during 2011.

Chlorophyll a

Chlorophyll are the green pigments found in plants tissues. There are several known types of chlorophyll; *chlorophyll a* and *chlorophyll b* are the two most common forms. Chlorophyll is a major light gathering pigment of all photosynthetic organisms and is essential for the process of photosynthesis. The amount of *chlorophyll a* present in lake water depends on the abundance and species of algae. Different algae species have different levels of *Chlorophll a* within their cells. C*hlorophyll a* is used as a common indicator of water quality (NALMS 2009).

Surface *chlorophyll a* concentrations were measured at site LLV-1A with an observed average concentration of 20 µg/L (range: 3 to 56 µg/L) (**Figure 27**). Concentrations at the surface were above 5 µg/L for most of the year due to the *P. parvum* bloom. Concentrations with depth varied throughout the year, but were also above 5 µg/L due of the *P. parvum* bloom (**Figure 28**). The increase from January to April may be attributed to the productivity that occurred after the storm in December 2010.

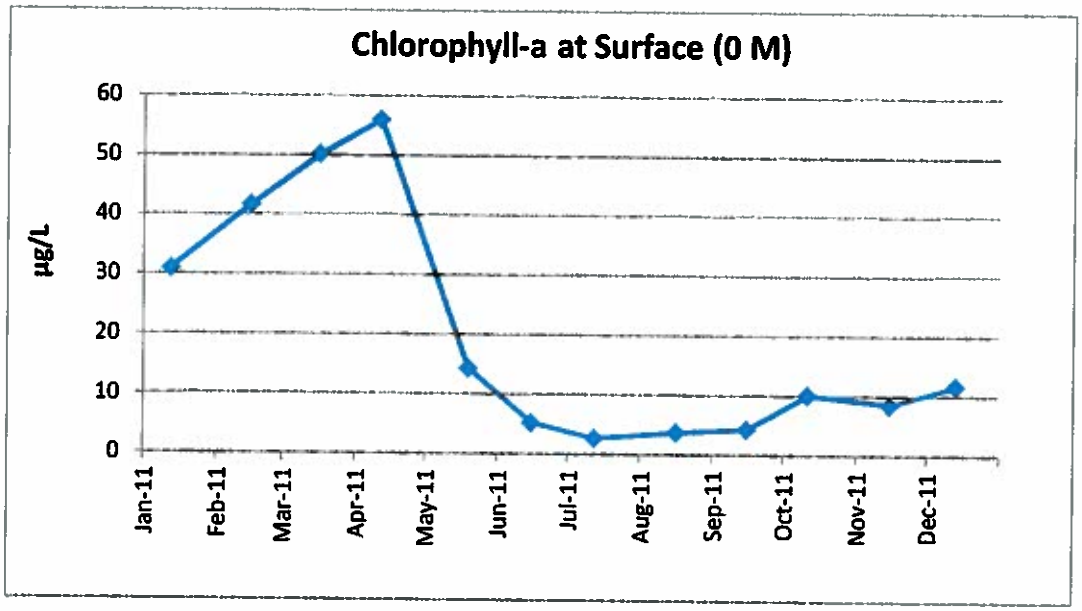

Figure 27. Lake Las Vegas *chlorophyll a* (mg/L) concentrations in surface waters at Lake monitoring sites during 2011.

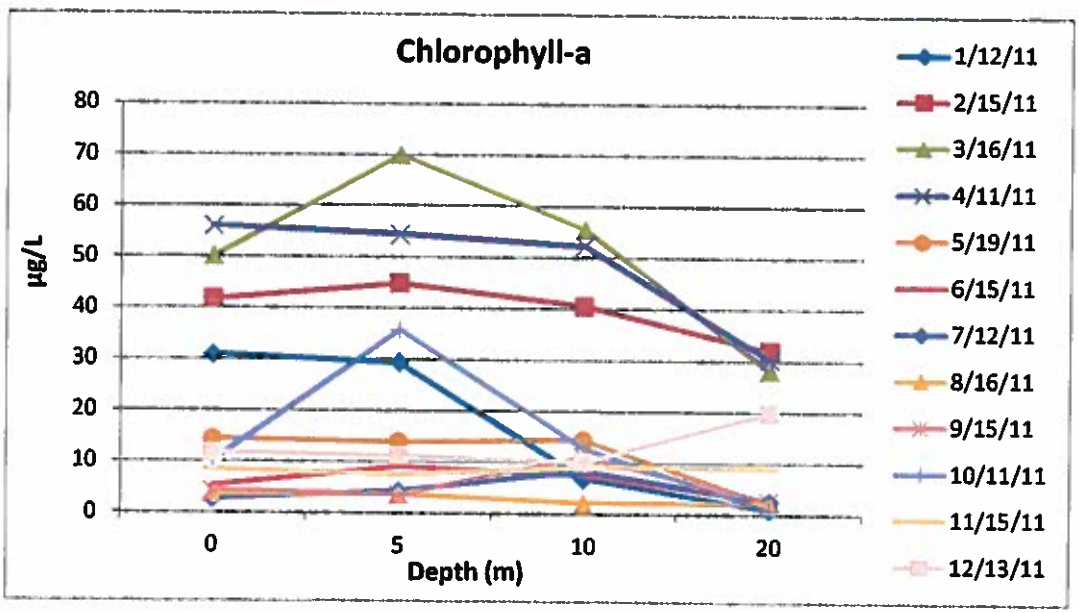

Figure 28. Lake Las Vegas monthly *chlorophyll a* (mg/L) profile at site LLV-1A during 2011.

Bacteria

Fecal coliform monitoring was completed on a monthly basis at site LLV-1A in 2011. The spike in September can be attributed to the sample being collected the day after a storm event. With the exception of the storm event incident, fecal coliform counts in surface waters were below body contact limits of 200 MPN / 100mL in 2011 (**Figure 29**). Fecal coliform were at or below the detection limit, averaging 63 MPN/100mL and ranging from 1 to 730 MPN/100mL at site LLV-1A.

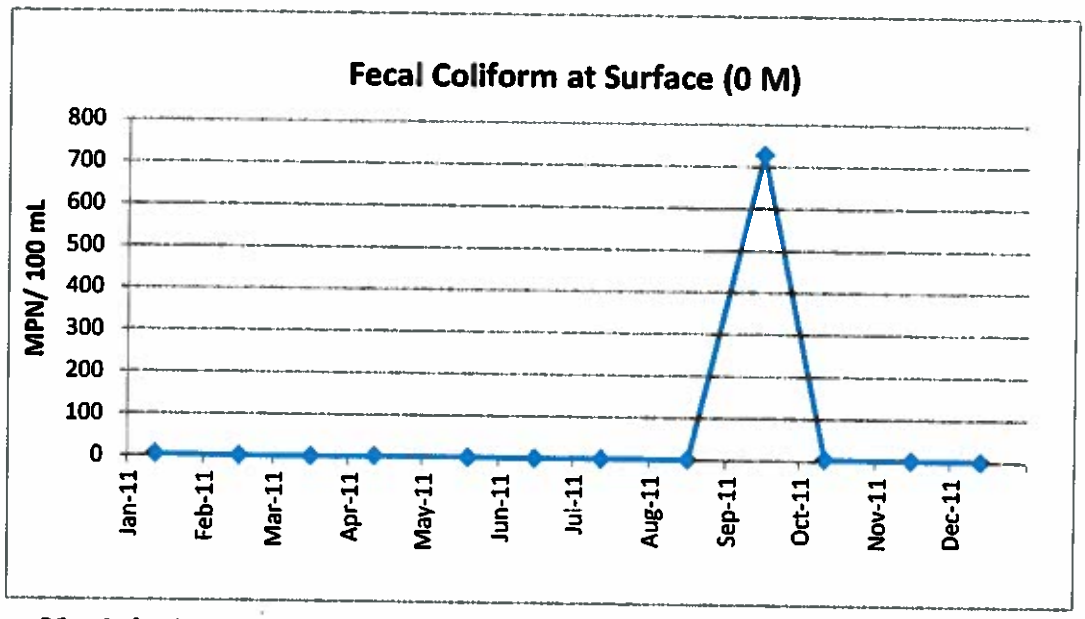

Figure 29. Lake Las Vegas fecal coliform counts (MPN/100ml) in surface waters at Lake monitoring sites during 2011.

Fish

The lake was not restocked with fish after the *P.* parvum caused mortality for many of the fish in the lake, In particular the common carp (*Cyprimas carpio)* was by far the dominant species affected.

Toxic Substances

Water samples for toxic analysis were collected from the surface (0m) and from the bottom (1m from bottom) of site LLV-1A on December 13, 2011. The 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 compound were also below levels of detection (**Appendix A**).

IV. SUMMARY

Most of the water quality guidelines were met this year by the Lake. pH results were between 7.0 and 9.0 in all measurements. Fecal coliform bacteria were below the action level of 200 MPN/100mL. Temperatures in the epilimnion did not exceed 2°C above ambient temperature. Total dissolved solids annual average concentration throughout the water column was 1,685 mg/L, below the exceedance level of 2,000 mg/L. The total dissolved solids and associated ions were exhibiting the highest concentrations in late fall due to summer evaporations. Concentrations of toxic metals, pesticides, herbicides and other toxic organic compounds were below detection limits.

Dissolved oxygen concentrations were above the proposed guideline of five (5) mg/L in the epilimnion during stratification and five (5) mg/L throughout the water column the rest of the year. Average *chlorophyll a* concentrations were above the proposed guideline of five (5) µg/L during April through September. The *chlorophyll a* guideline is applied at that time of year to protect water quality during the peak recreation period.

The monthly biomass volume of *P. parvum* significantly declined compared to 2010. Mild ambient temperatures caused the reservoir to stay stratified longer than normal. In addition, nutrients from stormwater presented conditions for *P. parvum* to re-establish during the summer months. Bimonthly sampling will continue in 2012 to monitor the succession of plankton and nutrients in the reservoir.

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VI. APPENDIX A

Annual Toxicity Analysis

SilverState
Analytical Laboratories

LABORATORY REPORT

DATE: January 05, 2012

REPORT NUMBER: 11-5451

CLIENT: Lake Las Vegas Master Association
1605 Lake Las Vegas Parkway
Henderson, Nevada 89011

CLIENT PROJECT:

CLIENT PO #:

Sampled By: Client
Date Sampled: 12/13/11
Time Sampled: Refer to COC

Submitted by: J. Pauli
Date Received: 12/13/11
Time Received: 1350

Report Attention: D. Laman

Sample ID	Parameter	Result	Unit	Detection Limit	Method	Date Analyzed	Analyst
LLV-1A 0m	Nitrite	0.51	mg/L	0.1	EPA300.0	12/14/11	NH
	Turbidity	1.92	NTU	1.0	EPA2130B	12/15/11	ET
LLV-1A 20m	Nitrite	0.50	mg/L	0.1	EPA300.0	12/14/11	NH
	Turbidity	1.98	NTU	1.0	EPA2130B	12/15/11	ET

ND: non-detect
EPA Flag: none
NOTE: 608, 8270, and 8151 subcontracted to Anatek Labs, Moscow, ID (See attached laboratory report).

REVIEWED BY:

John Sloan
Laboratory Director

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www.ssalabs.com

Silver State Analytical Laboratories
Report Number: 11-5451
January 05, 2012

Sample ID: LLV-1A 0m
Method: EPA8260B

Analyzed by: JS
Date Analyzed: 12/27/11

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: 11-5451
January 05, 2012

Sample ID: LLV-1A 20m
Method: EPA8260B

Analyzed by: JS
Date Analyzed: 12/27/11

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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Client: SILVER STATE ANALYTICAL LABS
Address: 3638 E. SUNSET ROAD
LAS VEGAS, NV 89120
Attn: JOHN SLOAN

Batch #: 111215015
Project Name: LAB ID 5451

Analytical Results Report

Sample Number	111215015-001	**Sampling Date**	12/13/2011	**Date/Time Received**	12/15/2011 11:05 AM
Client Sample ID	LLV-1A 0M / 5451-1	**Sampling Time**	10:30 AM	**Extraction Date**	12/19/2011
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
2,4,5-T	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
2,4,5-TP (Silvex)	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
2,4-D	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
2,4-DB	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
Chloramben	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
Dacthal	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
Dalapon	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
Dicamba	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
Dichloroprop	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
Dinoseb	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
Pentachlorophenol	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
Picloram	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	

Surrogate Data

Sample Number 111215015-001

Surrogate Standard	Method	Percent Recovery	Control Limits
3,5-Dichlorobenzoic Acid	EPA 8151A	84.5	35-145

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Certifications held by Anatek Labs WA: EPA:WA00169; CA:Cert2632; ID:WA00169; WA:C585; MT:Cert0095

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Client:	SILVER STATE ANALYTICAL LABS	**Batch #:**	111215015
Address:	3638 E SUNSET ROAD LAS VEGAS, NV 89120	**Project Name:**	LAB ID 5451
Attn:	JOHN SLOAN		

Analytical Results Report

Sample Number	111215015-002	**Sampling Date**	12/13/2011	**Date/Time Received**	12/15/2011 11:05 AM
Client Sample ID	LLV-1A 20M / 5451-2	**Sampling Time**	11:00 AM	**Extraction Date**	12/19/2011
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
2,4,5-T	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
2,4,5-TP (Silvex)	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
2,4-D	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
2,4-DB	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
Chloramben	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
Dacthal	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
Dalapon	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
Dicamba	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
Dichloroprop	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
Dinoseb	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
Pentachlorophenol	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	
Picloram	ND	ug/L	0.1	12/20/2011	SAT	EPA 8151A	

Surrogate Data

Sample Number 111215015-002

Surrogate Standard	Method	Percent Recovery	Control Limits
3,5-Dichlorobenzoic Acid	EPA 8151A	89.5	35-145

Authorized Signature

John Coddington, Lab Manager

MCL EPA's Maximum Contaminant Level
ND Not Detected
PQL Practical Quantitation Limit

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Certifications held by Anatek Labs WA: EPA:WA00169; CA:Cert2632; ID:WA00169; WA:C585; MT:Cert0095

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Client: SILVER STATE ANALYTICAL LABS
Address: 3638 E. SUNSET ROAD
LAS VEGAS, NV 89120
Attn: JOHN SLOAN

Batch #: 111215015
Project Name: LAB ID 5451

Analytical Results Report

Sample Number	111215015-001	**Sampling Date**	12/13/2011	**Date/Time Received**	12/15/2011 11:05 AM
Client Sample ID	LLV-1A 0M / 5451-1	**Sampling Time**	10:30 AM	**Extraction Date**	12/20/2011
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
4,4-DDD	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
4,4-DDE	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
4,4-DDT	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Aldrin	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
alpha-BHC	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Aroclor 1016 (PCB-1016)	ND	ug/L	0.2	12/22/2011	SAT	EPA 608	
Aroclor 1221 (PCB-1221)	ND	ug/L	0.2	12/22/2011	SAT	EPA 608	
Aroclor 1232 (PCB-1232)	ND	ug/L	0.2	12/22/2011	SAT	EPA 608	
Aroclor 1242 (PCB-1242)	ND	ug/L	0.2	12/22/2011	SAT	EPA 608	
Aroclor 1248 (PCB-1248)	ND	ug/L	0.2	12/22/2011	SAT	EPA 608	
Aroclor 1254 (PCB-1254)	ND	ug/L	0.2	12/22/2011	SAT	EPA 608	
Aroclor 1260 (PCB-1260)	ND	ug/L	0.2	12/22/2011	SAT	EPA 608	
beta-BHC	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Chlordane	ND	ug/L	0.1	12/22/2011	SAT	EPA 608	
delta-BHC	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Dieldrin	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Endosulfan I	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Endosulfan II	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Endosulfan sulfate	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Endrin	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Endrin aldehyde	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Endrin ketone	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
gamma-BHC (Lindane)	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Heptachlor	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Heptachlor epoxide	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Methoxychlor	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Toxaphene	ND	ug/L	0.1	12/22/2011	SAT	EPA 608	

Certifications held by Anatek Labs ID: EPA:ID00013; AZ:0701; CO:ID00013; FL(NELAP):E87893; ID:ID00013; IN:C-ID-01; KY:90142; MT:CERT0028; NM: ID00013; OR:ID200001-002; WA:C595
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Client:	SILVER STATE ANALYTICAL LABS	**Batch #:**	111215015
Address:	3638 E. SUNSET ROAD LAS VEGAS, NV 89120	**Project Name:**	LAB ID 5451
Attn:	JOHN SLOAN		

Analytical Results Report

Sample Number	111215015-001	**Sampling Date**	12/13/2011	**Date/Time Received**	12/15/2011 11:05 AM
Client Sample ID	LLV-1A 0M / 5451-1	**Sampling Time**	10:30 AM	**Extraction Date**	12/20/2011
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier

Surrogate Data

Sample Number 111215015-001

Surrogate Standard	Method	Percent Recovery	Control Limits
DCB	EPA 608	90.6	30-130

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Client: SILVER STATE ANALYTICAL LABS
Address: 3638 E. SUNSET ROAD
LAS VEGAS, NV 89120
Attn: JOHN SLOAN

Batch #: 111215015
Project Name: LAB ID 5451

Analytical Results Report

Sample Number	111215015-002	**Sampling Date**	12/13/2011	**Date/Time Received**	12/15/2011 11:05 AM
Client Sample ID	LLV-1A 20M / 5451-2	**Sampling Time**	11:00 AM	**Extraction Date**	12/20/2011
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
4,4-DDD	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
4,4-DDE	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
4,4-DDT	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Aldrin	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
alpha-BHC	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Aroclor 1016 (PCB-1016)	ND	ug/L	0.2	12/22/2011	SAT	EPA 608	
Aroclor 1221 (PCB-1221)	ND	ug/L	0.2	12/22/2011	SAT	EPA 608	
Aroclor 1232 (PCB-1232)	ND	ug/L	0.2	12/22/2011	SAT	EPA 608	
Aroclor 1242 (PCB-1242)	ND	ug/L	0.2	12/22/2011	SAT	EPA 608	
Aroclor 1248 (PCB-1248)	ND	ug/L	0.2	12/22/2011	SAT	EPA 608	
Aroclor 1254 (PCB-1254)	ND	ug/L	0.2	12/22/2011	SAT	EPA 608	
Aroclor 1260 (PCB-1260)	ND	ug/L	0.2	12/22/2011	SAT	EPA 608	
beta-BHC	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Chlordane	ND	ug/L	0.1	12/22/2011	SAT	EPA 608	
delta-BHC	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Dieldrin	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Endosulfan I	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Endosulfan II	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Endosulfan sulfate	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Endrin	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Endrin aldehyde	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Endrin ketone	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
gamma-BHC (Lindane)	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Heptachlor	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Heptachlor epoxide	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Methoxychlor	ND	ug/L	0.01	12/22/2011	SAT	EPA 608	
Toxaphene	ND	ug/L	0.1	12/22/2011	SAT	EPA 608	

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Client:	SILVER STATE ANALYTICAL LABS	**Batch #:**	111215015
Address:	3638 E. SUNSET ROAD LAS VEGAS, NV 89120	**Project Name:**	LAB ID 5451
Attn:	JOHN SLOAN		

Analytical Results Report

Sample Number	111215015-002	**Sampling Date**	12/13/2011	**Date/Time Received**	12/15/2011 11:05 AM
Client Sample ID	LLV-1A 20M / 5451-2	**Sampling Time**	11:00 AM	**Extraction Date**	12/20/2011
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier

Surrogate Data

Sample Number 111215015-002

Surrogate Standard	Method	Percent Recovery	Control Limits
DCB	EPA 608	95.2	30-130

Authorized Signature

John Coddington, Lab Manager

MCL	EPA's Maximum Contaminant Level
ND	Not Detected
PQL	Practical Quantitation Limit

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Attn: JOHN SLOAN

Batch #: 111215015
Project Name: LAB ID 5451

Analytical Results Report

Sample Number	111215015-001	**Sampling Date**	12/13/2011	**Date/Time Received**	12/15/2011 11:05 AM
Client Sample ID	LLV-1A 0M / 5451-1	**Sampling Time**	10:30 AM	**Extraction Date**	12/16/2011
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
1,2,4-Trichlorobenzene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
1,2-Dichlorobenzene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
1,2-Diphenyl hydrazine	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
1,3-Dichlorobenzene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
1,4-Dichlorobenzene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
1-Methylnaphthalene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,3,4,6-Tetrachlorophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,3,5,6-Tetrachlorophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,4,5-Trichlorophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,4,6-Trichlorophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,4-Dichlorophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,4-Dimethylphenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,4-Dinitrophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,4-Dinitrotoluene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,6-Dinitrotoluene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2-Chloronaphthalene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2-Chlorophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2-Methylnaphthalene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2-Methylphenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2-Nitroaniline	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2-Nitrophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
3,3'-Dichlorobenzidine	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	

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Address: 3638 E. SUNSET ROAD
LAS VEGAS, NV 89120
Attn: JOHN SLOAN

Batch #: 111215015
Project Name: LAB ID 5451

Analytical Results Report

Sample Number	111215015-001	**Sampling Date**	12/13/2011	**Date/Time Received**	12/15/2011 11:05 AM
Client Sample ID	LLV-1A 0M / 5451-1	**Sampling Time**	10:30 AM	**Extraction Date**	12/16/2011
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
3+4-Methylphenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
3-Nitroaniline	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
4,6-Dinitro-2-methylphenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
4-Bromophenyl-phenylether	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
4-Chloro-3-methylphenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
4-Chloroaniline	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
4-Chlorophenyl-phenylether	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
4-Nitroaniline	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
4-Nitrophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Acenaphthene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Acenaphthylene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Aniline	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Anthracene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Benzidine	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Benzo(ghi)perylene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Benzo[a]anthracene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Benzo[a]pyrene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Benzo[b]fluoranthene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Benzo[k]fluoranthene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Benzyl alcohol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
bis(2-Chloroethoxy)methane	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
bis(2-Chloroethyl)ether	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
bis(2-chloroisopropyl)ether	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	

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Client: SILVER STATE ANALYTICAL LABS
Address: 3638 E. SUNSET ROAD
LAS VEGAS, NV 89120
Attn: JOHN SLOAN

Batch #: 111215015
Project Name: LAB ID 5451

Analytical Results Report

Sample Number	111215015-001	**Sampling Date**	12/13/2011	**Date/Time Received**	12/15/2011 11:05 AM
Client Sample ID	LLV-1A 0M / 5451-1	**Sampling Time**	10:30 AM	**Extraction Date**	12/16/2011
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
bis(2-Ethylhexyl)phthalate	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Butylbenzylphthalate	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Carbazole	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Chrysene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Dibenz[a,h]anthracene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Dibenzofuran	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Diethylphthalate	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Dimethylphthalate	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Di-n-butylphthalate	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Di-n-octylphthalate	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Fluoranthene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Fluorene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Hexachlorobenzene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Hexachlorobutadiene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Hexachlorocyclopentadiene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Hexachloroethane	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Indeno[1,2,3-cd]pyrene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Isophorone	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Naphthalene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Nitrobenzene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Nitrosodimethylamine	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
n-Nitroso-di-n-propylamine	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
n-Nitrosodiphenylamine	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	

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Client: SILVER STATE ANALYTICAL LABS
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Batch #: 111215015
Project Name: LAB ID 5451

Analytical Results Report

Sample Number	111215015-001	**Sampling Date**	12/13/2011	**Date/Time Received**	12/15/2011 11:05 AM
Client Sample ID	LLV-1A 0M / 5451-1	**Sampling Time**	10:30 AM	**Extraction Date**	12/16/2011
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Pentachlorophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Phenanthrene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Phenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Pyrene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Pyridine	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	

Surrogate Data

Sample Number 111215015-001

Surrogate Standard	Method	Percent Recovery	Control Limits
2,4,6-Tribromophenol	EPA 8270C	82.0	53-122
2-Fluorobiphenyl	EPA 8270C	78.7	12-116
2-Fluorophenol	EPA 8270C	71.1	10-139
Nitrobenzene-d5	EPA 8270C	85.3	68-118
Phenol-d5	EPA 8270C	80.8	28-154
Terphenyl-d14	EPA 8270C	83.8	52-144

Certifications held by Anatek Labs ID: EPA:ID00013; AZ:0701; CO:ID00013; FL(NELAP):E87893; ID:ID00013; IN:C-ID-01; KY:90142; MT:CERT0028; NM: ID00013; OR:ID200001-002; WA:C595
Certifications held by Anatek Labs WA: EPA:WA00169; CA:Cert2632; ID:WA00169; WA:C585; MT:Cert0095

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Client: SILVER STATE ANALYTICAL LABS
Address: 3638 E. SUNSET ROAD
LAS VEGAS, NV 89120
Attn: JOHN SLOAN

Batch #: 111215015
Project Name: LAB ID 5451

Analytical Results Report

Sample Number	111215015-002	**Sampling Date**	12/13/2011	**Date/Time Received**	12/15/2011 11:05 AM
Client Sample ID	LLV-1A 20M / 5451-2	**Sampling Time**	11:00 AM	**Extraction Date**	12/16/2011
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
1,2,4-Trichlorobenzene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
1,2-Dichlorobenzene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
1,2-Diphenyl hydrazine	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
1,3-Dichlorobenzene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
1,4-Dichlorobenzene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
1-Methylnaphthalene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,3,4,6-Tetrachlorophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,3,5,6-Tetrachlorophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,4,5-Trichlorophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,4,6-Trichlorophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,4-Dichlorophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,4-Dimethylphenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,4-Dinitrophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,4-Dinitrotoluene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2,6-Dinitrotoluene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2-Chloronaphthalene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2-Chlorophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2-Methylnaphthalene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2-Methylphenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2-Nitroaniline	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
2-Nitrophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
3,3'-Dichlorobenzidine	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
3+4-Methylphenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	

Certifications held by Anatek Labs ID: EPA:ID00013; AZ:0701; CO:ID00013; FL(NELAP):E87693; ID:ID00013; IN:C-ID-01; KY:90142; MT:CERT0028; NM: ID00013; OR:ID200001-002; WA:C595
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LAS VEGAS, NV 89120
Attn: JOHN SLOAN

Batch #: 111215015
Project Name: LAB ID 5451

Analytical Results Report

Sample Number	111215015-002	**Sampling Date**	12/13/2011	**Date/Time Received**	12/15/2011 11:05 AM
Client Sample ID	LLV-1A 20M / 5451-2	**Sampling Time**	11:00 AM	**Extraction Date**	12/16/2011
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
3-Nitroaniline	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
4,6-Dinitro-2-methylphenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
4-Bromophenyl-phenylether	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
4-Chloro-3-methylphenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
4-Chloroaniline	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
4-Chlorophenyl-phenylether	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
4-Nitroaniline	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
4-Nitrophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Acenaphthene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Acenaphthylene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Aniline	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Anthracene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Benzidine	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Benzo(ghi)perylene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Benzo[a]anthracene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Benzo[a]pyrene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Benzo[b]fluoranthene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Benzo[k]fluoranthene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Benzyl alcohol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
bis(2-Chloroethoxy)methane	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
bis(2-Chloroethyl)ether	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
bis(2-chloroisopropyl)ether	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
bis(2-Ethylhexyl)phthalate	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	

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Project Name: LAB ID 5451

Analytical Results Report

Sample Number	111215015-002	**Sampling Date**	12/13/2011	**Date/Time Received**	12/15/2011 11:05 AM
Client Sample ID	LLV-1A 20M / 5451-2	**Sampling Time**	11:00 AM	**Extraction Date**	12/16/2011
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Butylbenzylphthalate	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Carbazole	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Chrysene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Dibenz[a,h]anthracene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Dibenzofuran	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Diethylphthalate	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Dimethylphthalate	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Di-n-butylphthalate	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Di-n-octylphthalate	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Fluoranthene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Fluorene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Hexachlorobenzene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Hexachlorobutadiene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Hexachlorocyclopentadiene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Hexachloroethane	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Indeno[1,2,3-cd]pyrene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Isophorone	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Naphthalene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Nitrobenzene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Nitrosodimethylamine	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
n-Nitroso-di-n-propylamine	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
n-Nitrosodiphenylamine	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Pentachlorophenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	

Certifications held by Anatek Labs ID: EPA:ID00013; AZ:0701; CO:ID00013; FL(NELAP):E87693; ID:ID00013; IN:C-ID-01; KY:90142; MT:CERT0028; NM: ID00013; OR:ID200001-002; WA:C565
Certifications held by Anatek Labs WA: EPA:WA00169; CA:Cert2632; ID:WA00169; WA:C585; MT:Cert0095

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Batch #: 111215015
Project Name: LAB ID 5451

Analytical Results Report

Sample Number	111215015-002	**Sampling Date**	12/13/2011	**Date/Time Received**	12/15/2011 11:05 AM
Client Sample ID	LLV-1A 20M / 5451-2	**Sampling Time**	11:00 AM	**Extraction Date**	12/16/2011
Matrix	Water	**Sample Location**			
Comments					

Parameter	Result	Units	PQL	Analysis Date	Analyst	Method	Qualifier
Phenanthrene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Phenol	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Pyrene	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	
Pyridine	ND	ug/L	0.5	12/27/2011	EMP	EPA 8270C	

Surrogate Data

Sample Number 111215015-002

Surrogate Standard	Method	Percent Recovery	Control Limits
2,4,6-Tribromophenol	EPA 8270C	83.1	53-122
2-Fluorobiphenyl	EPA 8270C	76.9	12-116
2-Fluorophenol	EPA 8270C	71.3	10-139
Nitrobenzene-d5	EPA 8270C	83.2	68-118
Phenol-d5	EPA 8270C	84.1	28-154
Terphenyl-d14	EPA 8270C	85.1	52-144

Authorized Signature

John Coddington, Lab Manager

MCL EPA's Maximum Contaminant Level
ND Not Detected
PQL Practical Quantitation Limit

This report shall not be reproduced except in full, without the written approval of the laboratory.
The results reported relate only to the samples indicated.
Soil/solid results are reported on a dry-weight basis unless otherwise noted.

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Certifications held by Anatek Labs WA: EPA:WA00169; CA:Cert2632; ID:WA00169; WA:C585; MT:Cert0095

SilverState Analytical Laboratories

CHAIN-OF-CUSTODY RECORD

3638 E. Sunset Road, Suite 100, Las Vegas, Nevada 89120
Phone: (702) 873-4478 Fax: (702) 873-7967

Page _____ of _____

Project/Job #:

Payment Method/PO #:

SEND INVOICE TO:
Name: David Laman
Company: Lake Las Vegas
Mailing Address: 1605 Lake Las Vegas Parkway
City, State, Zip: Henderson, NV 89011

REPORT RESULTS TO:
Name: David Laman
Company: Lake Las Vegas
Mailing Address: 1605 Lake Las Vegas Parkway
City, State, Zip: Henderson, NV 89011
Phone:
Fax:

Sampled By: Lake Las Vegas
Report Attention: D. Laman
On-Site pH/Temperature:

Turnaround Time (Specify Below with an X):
Standard 10 Business Days ☐
Rush: 24h | 48h | 72h | Other
NOTE: A surcharge is applied for rush samples

Other Pertinent Info: ANNUAL TOXIC ORGANICS SCREEN

ANALYSES REQUESTED

Circle Applicable Program: SDWA CWA RCRA Other
Reporting requirements: RL MDL PQL
Report Level: I II III IV
NOTE: Surcharges apply to Level III and IV

Date Sampled	Time Sampled	Sample Location/ Sample ID	Silver State Lab ID	Comp/ Grab	Matrix*	Preservative	Number/Type of Containers**	608 (PEST/PCB)	8260 (VOC)	8270 (SVOC)	8151 (Herbicides)	Nitrite, Turbidity								*Metals:
13 Dec 11	1030	LLV-1A 0 m	5451-1	G	AQ	varies		X	X	X	X	X								
13 Dec 11	1100	LLV-1A 20 m	-2	G	AQ	varies		X	X	X	X	X								

Tampering with sample name, date, time, and location may constitute fraud

Relinquished by Signature/Print: Jim Pauci — Time/Date: 1350 13Dec11

Received by Signature/Print: S. West — Time/Date: 1350 12-13-11

Method of Delivery:

Receiving Laboratory:

Special Instructions:

Authorized by: _____ Date: _____
Authorization is required to process samples. This obligates your organization for fee pertaining to services rendered. If collections or legal services are required to recover said fees, your organization will be responsible for all fees and cost in addition to service fees.

Note: Samples are discarded 30 days after results are reported. Samples deemed hazardous are returned to the client upon completion of analysis.

* Key: AQ – Aqueous S – Soil W – Waste OT – Other

** Key: P – Plastic G – Glass V – VOA Vial OT - Other