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2004 Lake Lorraine Water Quality Technical Report

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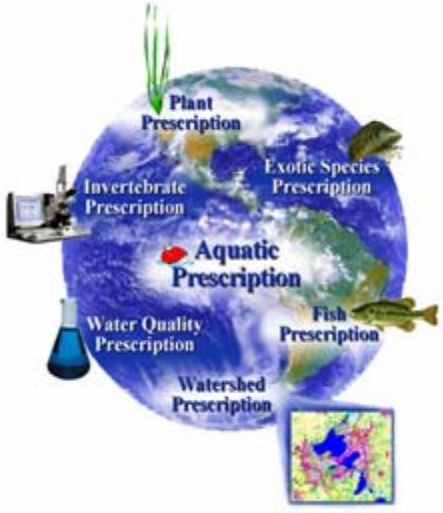

2004 Lake Lorraine Water Quality Technical Report

June 2008

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In cooperation with the Wisconsin Department of Natural Resources and the Walworth County Land and Water Resources Department

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Lake Lorraine Restoration Association

Bill Yoss	Director
Richard Mikulecky	Vice President
Dorothy Camodeca	President
Tony Novak	Treasurer
Christy Chmielewski	Secretary

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Executive Summary

Lake Lorraine is a 133-acre seepage lake located in Walworth County, Wisconsin. The watershed of Lake Lorraine is predominantly agricultural and is the reason the lake experiences advanced eutrophic conditions. Nutrient-high runoff from the watershed is causing elevated phosphorus concentrations, which in turn promote extensive algae and macrophyte growth within the lake.

The water quality of Lake Lorraine was sampled from May to October of 2004. A single sample station was selected at the deepest point in the lake. The parameters analyzed were soluble reactive phosphorus, total phosphorus, total Kjeldahl nitrogen, salinity, and chlorophyll *a*. These parameters were analyzed by the Wisconsin State Laboratory of Hygiene in Madison, Wisconsin. Temperature, dissolved oxygen, conductivity, and pH were measured and recorded on site. These parameters were measured with a YSI probe from the surface to the bottom. Secchi depth readings were also taken at the water quality sampling point. Measurements were taken from May to August and again in October.

The water quality results and Secchi readings show that Lake Lorraine is a eutrophic lake with a composite[1] TSI value of 55.3. Lake Lorraine did not thermally stratify in the summer of 2004. The condition of the lake's water quality is similar to that of other shallow, eutrophic lakes. The relatively high concentrations of phosphorus and chlorophyll *a* should produce an algal-dominated system. However, as the Secchi depth data show, the water clarity is not compromised. This is likely due to the abundant aquatic macrophyte growth which occurs from May to October.

[1] A composite TSI value was calculated by averaging the TSI_{TP}, $TSI_{Chl\ a}$ and TSI_S values.

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1.0 Introduction

Lake Lorraine is a 133-acre seepage lake located near the town of Richmond in Walworth County, WI. The watershed of Lake Lorraine is predominantly agricultural and is likely the reason the lake experiences advanced eutrophic conditions. Nutrient-high runoff from the watershed is causing elevated phosphorus concentrations, which in turn promote extensive algae and macrophyte growth within the lake. The residence time of the lake water is approximately seven months (0.59 years).

There is no existing water quality plan in place for Lake Lorraine, and little is known about the chemical and physical parameters of the lake water. In 2003, the Lake Lorraine Restoration Association contracted TLI to write a grant for WDNR funding. The purpose of the funding was to conduct baseline water quality monitoring in 2004. This report covers the water quality parameters sampled on site, water quality analyzed at the WSLOH, phytoplankton analyzed at the WSLOH, and zooplankton analyzed at PhycoTech. A watershed analysis and nutrient load estimate was also performed as part of this study.

Concurrent with this water quality monitoring, a whole-lake aquatic plant evaluation is being performed to help the Restoration Association create an aquatic plant management plan. The lake currently has the two invasive aquatic plant species, Eurasian water-milfoil (EWM) and curly-leaf pondweed (CLP). EWM typically creates nuisance conditions in the middle of summer when it grows to the water surface and then continues to grow while spreading and branching out across the lake surface. The physical characteristics of EWM make it difficult to navigate with propeller-driven motors. EWM is fueled by nutrient rich soils, runoff, internal loading and possibly through seasonal senescence of CLP.

There is some preliminary evidence that CLP can affect local water chemistry during its decay in the late spring. The Restoration Association is currently not managing its

aquatic macrophyte community. Major CLP populations[2] should be addressed by an aquatic plant management (APM) plan.

CLP is an exotic aquatic plant that impacts water quality. It was unintentionally introduced to Wisconsin during common carp stocking activities in the 1800's and is present in many Wisconsin lakes. CLP releases nutrients into the water column in mid-summer, promoting algal blooms (Crowell 2003). All aquatic plants contribute nutrients to lakes as they decay, but native plants die off in the late summer or early fall and their nutrients are consumed by bacteria instead of fueling algal growth. As much as 5.5 pounds of phosphorus per acre can be released from monotypic CLP beds (McComas 2000). Excess nutrients cause murky water conditions and algal blooms and may contribute to the advancement of EWM in infested lakes. EWM is tolerant of turbid and low-light conditions which actually exacerbate EWM growth and branching at the lake surface.

[2] Aquatic Engineering Inc. mapped over 100 acres of Curly-leaf pondweed in June 2004.

2.0 Methods

2.1 Water Sample Collection

A sample site was established at the north end of "mid-lake," the deepest location in the lake (approximately 8.5 feet deep). Water samples were collected by AEI ecologists and were delivered to the Wisconsin State Laboratory of Hygiene (WSLOH), located in Madison. The samples were analyzed for reactive phosphorus, total phosphorus, total Kjeldahl nitrogen, and chlorophyll *a*. These samples were collected with a composite surface sampling device from 0 to 6 feet deep and kept on ice until they arrived at the laboratory in Madison. Samples were collected May through August and again in October. Parameters measured during laboratory analysis were: total phosphorus, soluble reactive phosphorus, chlorophyll-*a*, pH, total Kjeldahl nitrogen, nitrate + nitrite, ammonia, alkalinity, and total dissolved solids.

2.2 On-Site Water Quality Measurements

Depth profiles were collected at the water quality monitoring sample site during the summer sampling periods (May, June, July, August and October). Data points were collected at one-meter intervals throughout the water column for dissolved oxygen, pH, conductivity, and temperature with a YSI SONDE probe.

2.3 Phytoplankton and Zooplankton Samples

Phytoplankton and zooplankton samples were collected in August at the lake water quality monitoring station. Zooplankton samples were collected from two feet above the lake bottom to the surface. A vertical tow net with 80 µm mesh and collection cup was used as a sampling device. Phytoplankton samples were collected the same way and mailed overnight to the Wisconsin State Lab of Hygiene in Madison, WI. All taxa were identified to the lowest practical taxonomic level, and the biovolume of each taxon was estimated. Zooplankton samples were mailed overnight to Phycotech, where all taxa

were identified to the lowest practical taxonomic level and the biovolume of each taxon was estimated.

2.4 Trophic Status Calculations

Trophic status was calculated for Lake Lorraine water samples using the following equations (the units of measurement required for each parameter are included as a subscript in the equation):

$TSI_{SD} = 60 - 14.41 * \ln (SD_m)$

$TSI_{chl} = 9.81 * \ln (chl_{\mu g}) + 30.6$

$TSI_{TP} = 14.42 * \ln (TP_{\mu g}) + 4.15$

The following scale is used to evaluate trophic status (Lillie and Mason 1983):

TSI < 30	oligotrophic
40 < TSI < 50	mesotrophic
TSI > 50	eutrophic

2.5 Watershed Delineation and Nutrient Load Estimate

The delineation was created by importing 1-arc-second National Elevation Dataset (NED) data obtained from the USGS into ArcGIS 9.1. Then, using the ArcHydro tools, which are supported by the Spatial Analyst extension, the NED data was run through a series of terrain preprocessing functions (fill sinks, flow direction, flow accumulation, stream definition, catchment grid delineation, and catchment polygon processing) to create a catchment polygon feature. All catchment polygons that overlap the lake where then merged into one polygon. The single resulting polygon is the watershed being analyzed for nutrient input purposes.

Land use data was obtained from the WDNR WebView service. The data was imported into Arc GIS, clipped to the watershed boundaries, split into land use categories and summed by total acreage. Nutrient loads estimates were created using WiLMS software

data from the land use analysis and the public use survey. Precipitation, evaporation, soil coefficients and other Walworth County default data were used when available. Assumptions made for the septic system estimates were:

1. 30 homes
2. 2.7 people per average home
3. 50% seasonal (60 days per year) and 50% year-round (365 days per year) residents (percentages based on public use survey results)

Nutrient reduction scenarios were run based on reducing point source or non-point source phosphorus loading by 25, 50 and 75 percent. The total annual phosphorus load was reported for each scenario.

3.0 Results

3.1 Phosphorous

Total phosphorus (TP) was reported for each sampling event. The average TP for Lorraine Lake in 2004 was 85.0µg/L with a maximum of 168µg/L and a minimum of 44µg/L. The TSI_{TP} value for Lake Lorraine is 68.2.

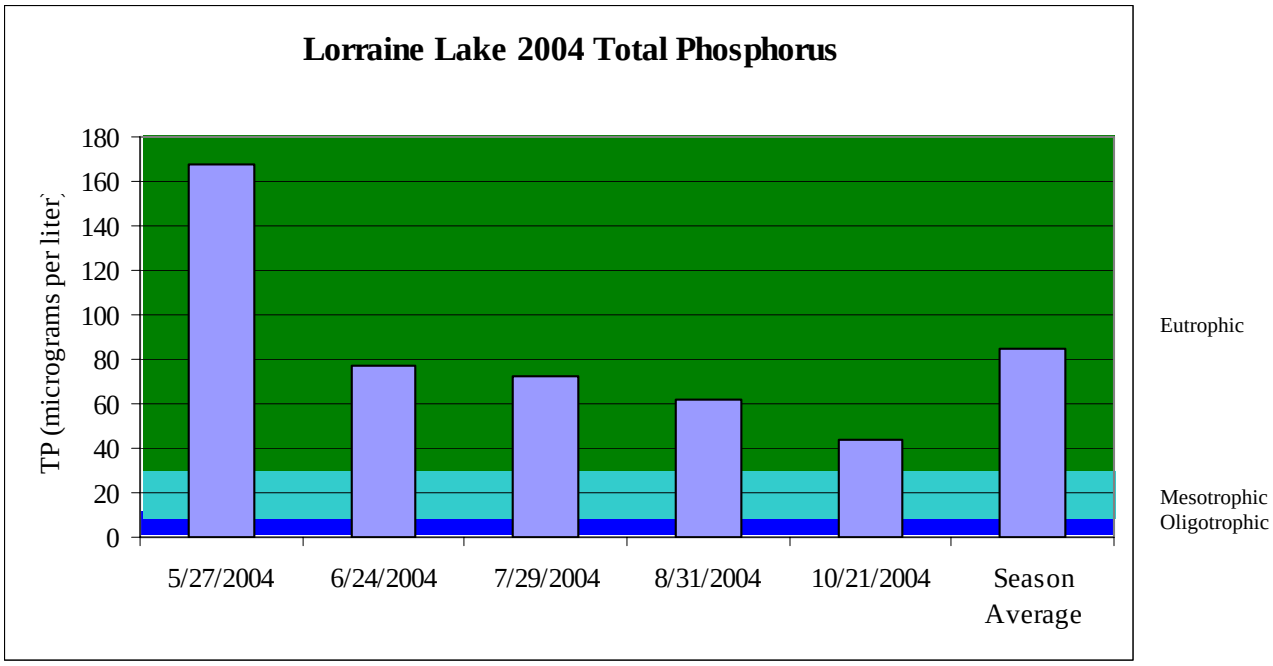

Figure 1. Total phosphorus measurements for Lake Lorraine, Walworth Co., WI. 2004.

3.2 Chlorophyll *a*

Chlorophyll *a* (Chl *a*) was also reported for each sampling event. The average Chl *a* for Lake Lorraine in 2004 was 22.2µg/L with a maximum of 30.8µg/L and a minimum of 6.0µg/L. The TSI_{chl} value for 2004 is 61.0.

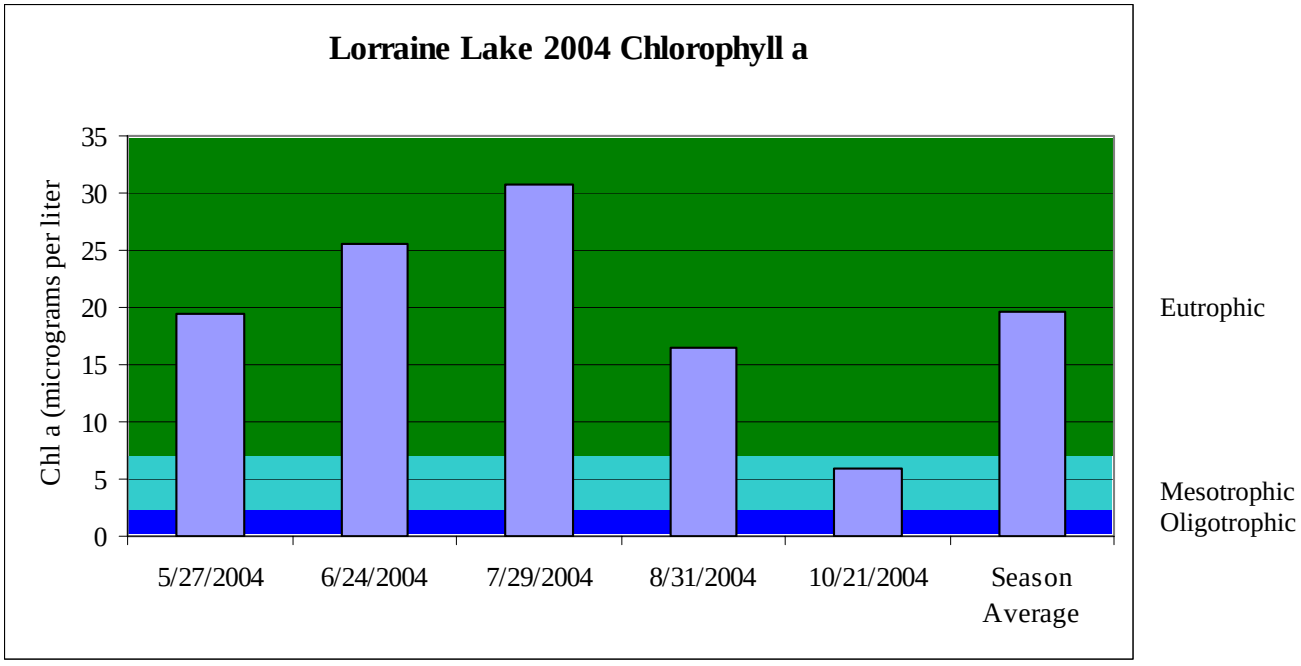

Figure 2. Chlorophyll *a* measurements for Lake Lorraine, Walworth Co., WI. 2004.

3.3 Secchi Depth

Secchi disk readings were collected four times in 2004. The average Secchi reading in 2004 was 5.0 feet. The maximum value observed was 6.0 feet and the minimum was 3.33 feet. The TSI_{SD} for Lake Lorraine in 2004 is 53.9.

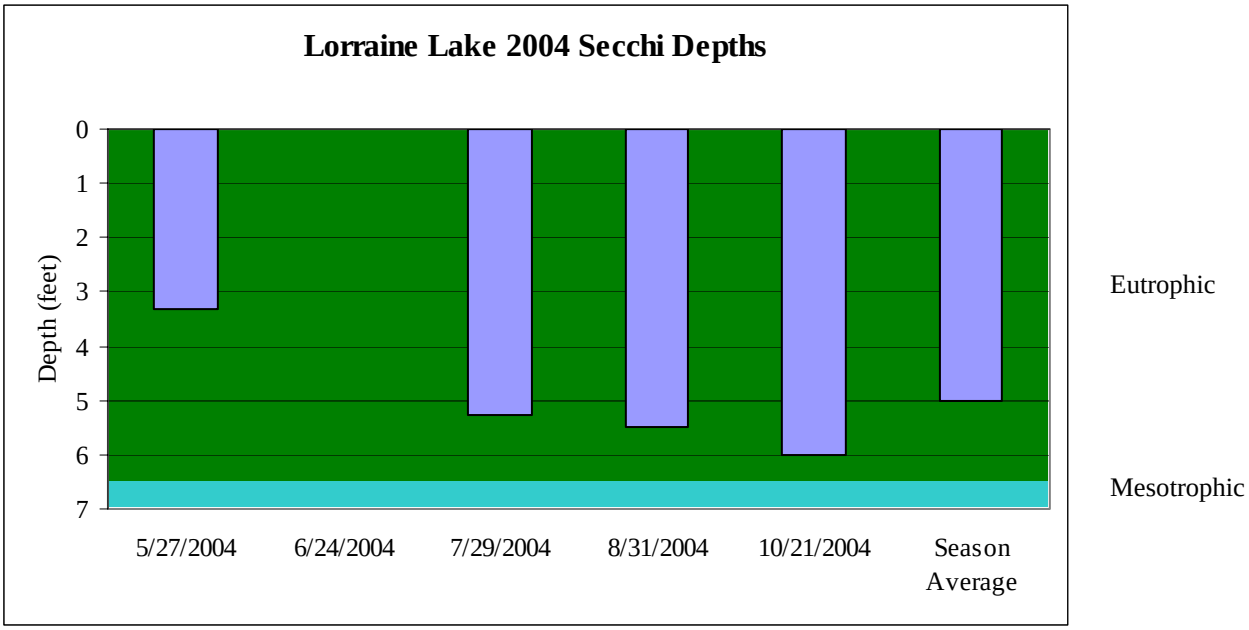

Figure 3. Secchi depth readings from the North and South basin sample locations in Lake Lorraine, Polk Co., WI. 2004.

3.4 Other Parameters

Other parameters measured were total Kjeldahl nitrogen, soluble reactive phosphorus, temperature, conductivity, specific conductance, and salinity. These chemical and physical parameters affect water quality in many different ways and are discussed separately in the following sections.

3.4.1 Total Kjeldahl Nitrogen (TKN)

The Kjeldahl technique is a laboratory test for measuring the amount of organic nitrogen contained in water. The organic nitrogen concentration is actually the total Kjeldahl nitrogen concentration minus the ammonia concentration. Organic nitrogen may be either dissolved or suspended particulate matter in water. High levels of organic nitrogen in water may indicate excessive production or organic pollution from the watershed. Animal and human waste, decaying organic matter, and live organic material like tiny algae cells can cause organic nitrogen enrichment of lake water (Tippecanoe Environmental Lake and Watershed Foundation 2005). Nitrogen, like phosphorus, is an essential macronutrient needed for algal production. Most lakes, however, are phosphorus limited, and attempts to reduce lake nitrogen levels may have little effect on

algal biomass (Holdren 2001). The average TKN for Lake Lorraine in 2004 was 1,340µg/L. The N:P ratio was approximately 14:1 (by mass) and supports the fact that Lake Lorraine is phosphorus–limited. (Generally any ratio over 7:1 N:P by weight is phosphorus limited.)

3.4.2 Soluble Reactive Phosphorus (SRP)

Soluble reactive phosphorus, also known as SRP, is a dissolved form of phosphorus. Because dissolved phosphorus is readily available for uptake by plants, the amount of SRP found in a lake provides a good estimation of how much phosphorus is available for algae and plant growth. Because aquatic plant growth is typically limited by phosphorus, added phosphorus, especially in the dissolved, bio-available form, can fuel plant growth and cause algae blooms. Sources of SRP can include: failing septic systems, animal waste, fertilizers, decaying plants and animals, and resuspension from the lake bottom. Because phosphorus is cycled so rapidly through biota, SRP concentrations as low as 5 µg/L are enough to maintain eutrophic or highly productive conditions in lake systems (Tippecanoe Environmental Lake and Watershed Foundation 2005). The average SRP for Lake Lorraine in 2004 was 14.7µg/L.

3.4.3 Temperature

Temperature plays a major role in water quality, especially in lakes that become thermally stratified. Thermal stratification occurs when water in the top layer of a lake becomes heated by the sun and insufficient mixing action allows the warm water layer at the surface (epilimnion) to "float" on top of a cooler, more dense layer of water near the bottom (hypolimnion). As the summer progresses, the difference in density between the two layers increases, and, when the difference becomes too great for wind energy to mix, the lake becomes stratified (Holdren et al. 2001). The region between the epilimnion and hypolimnion is called the metalimnion. The particular depth within the metalimnion where the rate of change in temperature is greatest is called the thermocline (Holdren et al. 2001). In 2004 Lake Lorraine did not thermally stratify. Dense macrophyte growth and a shallow depth profile played a role in shading the water column and preventing a

thermocline from forming. The difference between the surface temperature and bottom temperature at the end of August was less than 1 degree Celsius.

3.4.4 Conductivity and Specific Conductance

Electrical conductivity in lake water comes from a variety of sources. Agricultural and industrial runoffs contribute large amounts of dissolved salts, which raise the electrical conductivity. Sewage from septic tanks and treatment facilities also add to the conductive properties in water. Another source of conductive properties comes from the hypolimnion of thermally stratified lakes. As planktonic algae die throughout the summer, a "rain" of dead algal cells is constantly falling on the sediments of the lake. Bacteria in and near the sediment aide in decomposition of the algal cells by breaking high energy bonds stored in the algal cell wall. When this occurs, CO_2 is released into the water, where it rapidly dissolves into carbonic acid, bicarbonate, and carbonate ions. These ions contribute to the conductive properties of the lake water. The conductivity of Lake Lorraine in 2004 was approximately 290µS/cm. This value is typical of freshwater lakes.

3.4.5 Dissolved Oxygen

Dissolved oxygen plays an important role in both the lake biological and chemical properties. Anoxic conditions make certain compounds more soluble in water. The chemical and biological properties are most affected during summer stratification when the hypolimnion does not mix with the oxygen rich epilimnion. As reported above, Lorraine did not thermally stratify in 2004. Although the water was the same temperature throughout the water column, a definite oxygen gradient was present in the lake. Readings from August 2004 show that dissolved oxygen levels gradually dropped as the probe approached the sediment. The saturation at the surface was 66.9%, while at two meters deep it was only 7.1%, and 5.1% just above the sediment. This oxygen depletion is likely due to a high biological oxygen demand caused by algae, plankton and bacteria. Decomposition of organic waste near the sediment consumes oxygen faster than it can be replaced through photosynthesis and natural mixing of the water in the lake.

3.5 Phytoplankton and Zooplankton

Phytoplankton

Composite surface samples were collected for phytoplankton analysis from the water quality site four times in 2004. The results show that Cyanophyta (blue-green algae) were the most common species present (by concentration) throughout the season (Table 1). The most common species present, by bio-volume, changed throughout the season (Table 1).

Table 1. Phytoplankton community composition for Lake Lorraine, Walworth Co., WI. 2004.

Date	**Organisms**	**Concentration (%)**	**Biovolume (%)**
5/27/2004	Cyanophyta	95	
	Chlorophyta		58
6/24/2004	Cyanophyta	93	
	Bacillariophyta		55
7/29/2004	Cyanophyta	>99	
	Pyrrophyta		69
8/31/2004	Cyanophyta	99	
	Pyrrophyta		96

Zooplankton

The most common organisms during the first survey in 2004 were Rotifera by concentration and Ostracoda by biovolume (Table 2). By late June, 2004, Rotifera were still the most common organisms, but the Copepoda population was on the rise and would continue to be the dominant group for the remaining two sampling periods. From June to August, the Copepoda and Ostracoda groups would be the largest contributors to the biovolume of zooplankton within the lake (Table 2).

Table 2. Zooplankton community dominant groups for Lake Lorraine, Walworth Co., WI. 2004.

Date	Organisms	Concentration (%)	Biovolume (%)
5/27/2004	Rotifera	45	<1
	Ostracoda	6	67
6/24/2004	Rotifera	39	2
	Copepoda	34	36
	Ostracoda	1	33
7/29/2004	Copepoda	62	41
	Ostracoda	1	36
8/31/2004	Copepoda	77	41
	Ostracoda	3	54

3.6 Watershed Delineation and Nutrient Load Estimate

The watershed delineation resulted in a 1,532 acre watershed which primarily extends north of the lake (Figure 8). The watershed land use types were analyzed and it was found that the majority of land use in the Lake Lorraine watershed is row crop and pasture or grassland (Table 3 and Figure 9).

Table 3. Land use results for the Lake Lorraine watershed.

Land use category	Total area (acres)
Row Crop	625.6
Pasture and Grassland	454.6
Forest	235.2
Wetlands	83.1
Water Surface	133

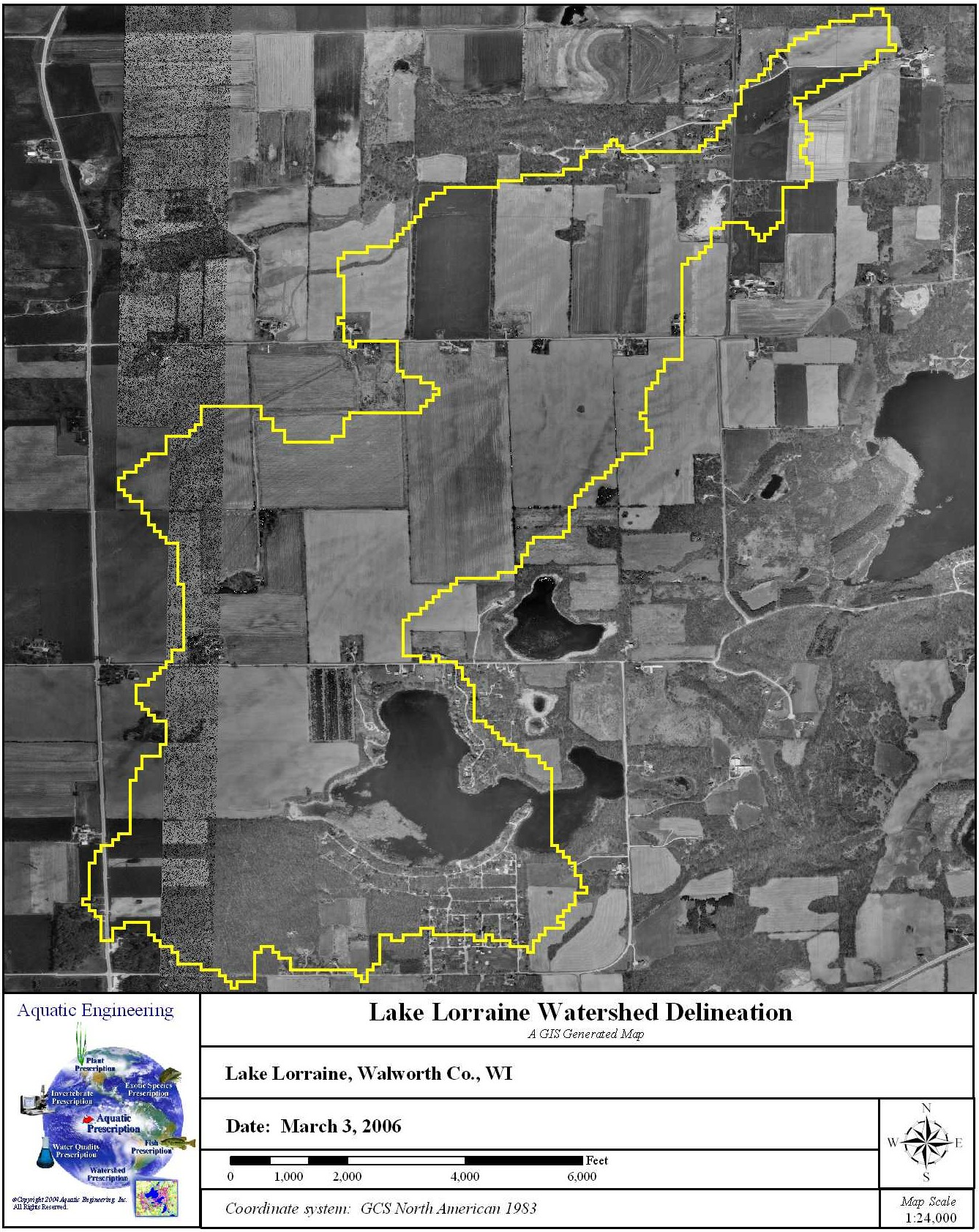

Figure 4. Watershed delineation for Lake Lorraine (Walworth County, WI).

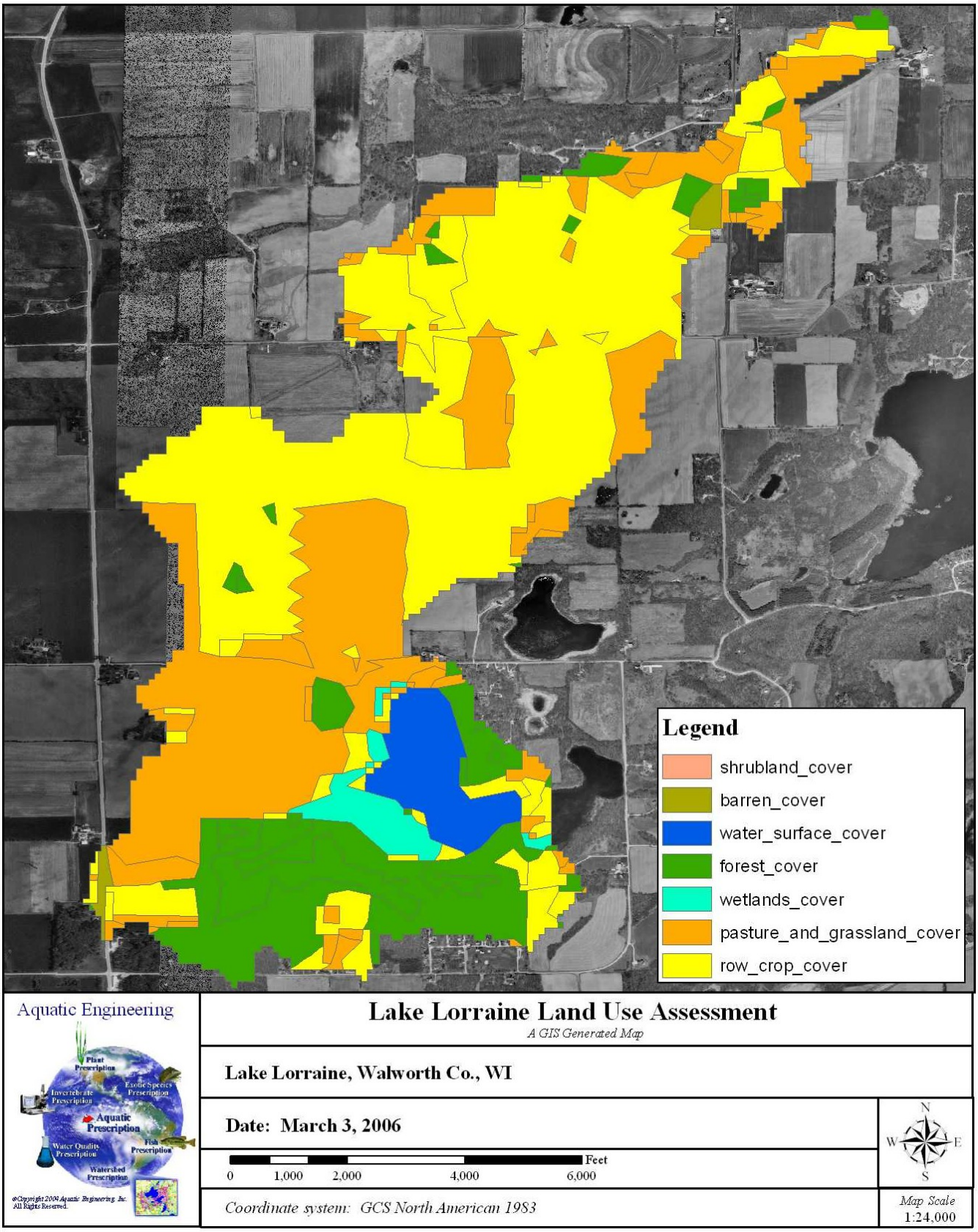

Figure 5. Land use results for Lake Lorraine (Walworth County, WI).

4.0 Discussion

4.1 Trophic Status Index

The TSI values for Lake Lorraine in 2004 show that it is a highly eutrophic lake. Secchi depths, chlorophyll-*a*, and total phosphorus values support the eutrophic status. Lake Lorraine has qualities expected of the eutrophic status which occur seasonally. Phosphorus and chlorophyll-*a* levels peak in the summer and decline in the winter. This cycle will continue as long as phosphorus is the limiting nutrient. As part of a future monitoring strategy, TSI values can be calculated and compared from year to year and will indicate whether the eutrophication process is increasing, decreasing, or remaining constant. Sudden changes would likely be due to major changes in the watershed and should be investigated.

4.2 Water Quality

Lake Lorraine is a phosphorus-limited lake that does not form a thermocline in the summer. It has water quality similar to other lakes in its region. The source of elevated nutrients is not known, and a comprehensive watershed analysis and hydrologic budget should be performed.

4.3 Phytoplankton and Zooplankton

These organisms are quite often the largest contributors to the bottom level of the food chain in aquatic systems. Macroinvertebrates, fish and some waterfowl feed on these organisms. Their relationships with their environment and responses to conditions, including predation, have been widely studied. Currently, criteria are being established which will allow ecologists to make predictions of water quality based on the assemblages of plankton in the water.

Phytoplankton

Although Cyanophyta (blue-green algae) dominated the concentration of the phytoplankton samples, green algae and diatoms were the bulk of the biomass in May and June. As the summer went on, the Dinoflagelates (*Ceratium* spp.) made up the majority of the phytoplanktonic biomass. There is not sufficient background information for phytoplanktonic populations in Wisconsin lakes to make a judgment of water quality based on this 2004 data. Continued sampling and analysis of these organisms would provide background information for the lake and may be used in the future to construct assessment criteria for water quality bio-monitoring.

Zooplankton

There is not enough data available regarding zooplankton in Wisconsin lakes to make any judgments on water quality based on the assemblage present in Lake Lorraine in 2004. Some bio-assessment criteria are available through the USEPA. These criteria require that the members of the population be broken down into their respective functional groups for analysis of the whole community. As with phytoplankton sampling, continuing this effort is important in establishing criteria for bio-monitoring.

4.4 Watershed and Phosphorus Modeling

The watershed delineation and land use assessment revealed that Lake Lorraine's main nutrient input is from watershed runoff. The only point source considered in the analysis was septic system input. As expected, a small number of residential homes contribute an insignificant amount of phosphorus compared to runoff from the watershed (Appendix D).

The trophic response model suggests that Lake Lorraine has better than expected water clarity and chlorophyll a concentrations based on watershed inputs (Appendix D). The marsh adjacent to the lake is likely the reason that water clarity and chlorophyll *a* concentrations are lower than expected based on the watershed phosphorus estimates. Wetlands help "filter out" nutrients by creating biomass with available nutrients before

they have a chance to reach the lake. The annual decay and spring thaw may be the reason phosphorus concentrations were high in the first sampling event.

The rest of the watershed is agriculturally dominated. The best chance of decreasing nutrient loads exists in implementing watershed BMPs in the surrounding farms.

There may also be ground water interactions (springs) influencing water chemistry but no such interaction has been documented to date. A complete hydrologic analysis would be required to determine the exact sources of water for Lake Lorraine. However, the benefit of such an analysis does not warrant the cost at this point in the Association's management plan.

5.0 Recommendations

There are no current water quality goals or standards set by the Lake Lorraine Restoration Association. The water quality parameters measured as part of this study would suggest that the Association should, at minimum, set goals to protect the current water quality and more likely should set goals to improve water quality within the lake. An appropriate water quality improvement goal would be to improve the annual TSI_{SD} by one point per year over 10 years. This goal would result in a Secchi depth TSI value of 44 in the year 2016. How the Association accomplishes that goal would be the focus of their comprehensive lake management plan.

Since no water quality plan is currently in place, we recommend the following fundamental practices for improving the water quality of Lake Lorraine:

- Annual participation in self-help monitoring with Secchi disk readings and 2-meter surface integrated laboratory analysis for TP, chlorophyll *a*, TKN and SRP one year out of every three. Sampling should occur monthly from May to October during that year.
- Public education and implementation of rain gardens, buffer strips and shoreline restoration
- Manage nutrient enrichment in the summer by reducing CLP biomass in the spring
- Consider performing a complete hydrological budget to determine water sources
- Work with the County and local townships as they create their land use and zoning regulations to help minimize effects of future development

6.0 References

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Appendix A:
WSLOH Water Quality Lab Reports

Field #	Sample Description	Sample Collector	DNR Parameter Description	Result value	Units
TOP-52704	MID-LAKE - 2M INTEGRATED SURFACE WATER	OSMON	CONDUCTIVITY AT 25C	214	UMHOS/CM
TOP-52704	MID-LAKE - 2M INTEGRATED SURFACE WATER	OSMON	TOTAL DISSOLVED SOLIDS 180 C	120	MG/L
TOP-52704	MID-LAKE - 2M INTEGRATED SURFACE WATER	OSMON	TEMPERATURE AT LAB	ICED	C
TOP-52704	MID-LAKE - 2M INTEGRATED SURFACE WATER	OSMON	PH LAB	9.89	SU
TOP-52704	MID-LAKE - 2M INTEGRATED SURFACE WATER	OSMON	ALKALINITY TOTAL CACO3	91	MG/L
TOP-52704	MID-LAKE - 2M INTEGRATED SURFACE WATER	OSMON	NITROGEN NH3-N DISS	0.11	MG/L
TOP-52704	MID-LAKE - 2M INTEGRATED SURFACE WATER	OSMON	NITROGEN KJELDAHL TOTAL	1.64	MG/L
TOP-52704	MID-LAKE - 2M INTEGRATED SURFACE WATER	OSMON	NITROGEN NO3+NO2 DISS (AS N)	ND	MG/L
TOP-52704	MID-LAKE - 2M INTEGRATED SURFACE WATER	OSMON	PHOSPHORUS TOTAL	*0.168	MG/L
TOP-52704	MID-LAKE - 2M INTEGRATED SURFACE WATER	OSMON	PHOSPHORUS TOTAL DISS	0.108	MG/L
TOP-52704	MID-LAKE - 2M INTEGRATED SURFACE WATER	OSMON	PHOSPHATE ORTHO DISS	**	MG/L
TOP-52704	MID-LAKE - 2M INTEGRATED SURFACE WATER	OSMON	SAMPLE SIZE LITERS	200	ML
TOP-52704	MID-LAKE - 2M INTEGRATED SURFACE WATER	OSMON	CHLOROPHYLL A, FLUORESCENCE (WELSCHMAYER 1994)	19.4	UG/L
BOT	MID-LAKE - VAN DORN	OSMON	CONDUCTIVITY AT 25C	214	UMHOS/CM
BOT	MID-LAKE - VAN DORN	OSMON	TOTAL DISSOLVED SOLIDS 180 C	128	MG/L
BOT	MID-LAKE - VAN DORN	OSMON	TEMPERATURE AT LAB	ICED	C
BOT	MID-LAKE - VAN DORN	OSMON	PH LAB	9.87	SU
BOT	MID-LAKE - VAN DORN	OSMON	ALKALINITY TOTAL CACO3	92	MG/L
BOT	MID-LAKE - VAN DORN	OSMON	NITROGEN NH3-N DISS	ND	MG/L
BOT	MID-LAKE - VAN DORN	OSMON	PHOSPHORUS TOTAL	*0.091	MG/L
BOT-62404	MID-LAKE - VAN DORN	OSMON	CONDUCTIVITY AT 25C	238	UMHOS/CM
BOT-62404	MID-LAKE - VAN DORN	OSMON	TOTAL DISSOLVED SOLIDS 180 C	146	MG/L
BOT-62404	MID-LAKE - VAN DORN	OSMON	TEMPERATURE AT LAB	ICED	C
BOT-62404	MID-LAKE - VAN DORN	OSMON	PH LAB	9.18	SU
BOT-62404	MID-LAKE - VAN DORN	OSMON	ALKALINITY TOTAL CACO3	102	MG/L
BOT-62404	MID-LAKE - VAN DORN	OSMON	NITROGEN NH3-N DISS	*ND	MG/L
BOT-62404	MID-LAKE - VAN DORN	OSMON	PHOSPHORUS TOTAL	*0.078	MG/L
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	CONDUCTIVITY AT 25C	241	UMHOS/CM
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	TOTAL DISSOLVED SOLIDS 180 C	150	MG/L
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	TEMPERATURE AT LAB	ICED	C
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	PH LAB	9.11	SU
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	ALKALINITY TOTAL CACO3	104	MG/L
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	NITROGEN NH3-N DISS	*ND	MG/L
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	NITROGEN KJELDAHL TOTAL	*1.28	MG/L
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	NITROGEN NO3+NO2 DISS (AS N)	*ND	MG/L
TOP-	MID-LAKE - INTEGRATED SURFACE	OSMON	PHOSPHORUS TOTAL	*0.077	MG/L

62404

Field #	Sample Description	Sample Collector	DNR Parameter Description	Result value	Units
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	PHOSPHATE ORTHO DISS	0.024	MG/L
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	CHLOROPHYLL A, FLUORESCENCE (WELSCHMAYER 1994)	**	UG/L
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	CONDUCTIVITY AT 25C	241	UMHOS/CM
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	TOTAL DISSOLVED SOLIDS 180 C	150	MG/L
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	TEMPERATURE AT LAB	ICED	C
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	PH LAB	9.11	SU
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	ALKALINITY TOTAL CACO3	104	MG/L
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	NITROGEN NH3-N DISS	*ND	MG/L
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	NITROGEN KJELDAHL TOTAL	*1.28	MG/L
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	NITROGEN NO3+NO2 DISS (AS N)	*ND	MG/L
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	PHOSPHORUS TOTAL	*0.077	MG/L
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	PHOSPHATE ORTHO DISS	0.024	MG/L
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	SAMPLE SIZE LITERS	200	ML
TOP-62404	MID-LAKE - INTEGRATED SURFACE	OSMON	CHLOROPHYLL A, FLUORESCENCE (WELSCHMAYER 1994)	*25.6	UG/L
TOP-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	CONDUCTIVITY AT 25C	257	UMHOS/CM
TOP-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	TOTAL DISSOLVED SOLIDS 180 C	154	MG/L
TOP-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	TEMPERATURE AT LAB	ICED	C
TOP-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	PH LAB	8.56	SU
TOP-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	ALKALINITY TOTAL CACO3	*106	MG/L
TOP-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	NITROGEN NH3-N DISS	*ND	MG/L
TOP-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	NITROGEN KJELDAHL TOTAL	*1.15	MG/L
TOP-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	NITROGEN NO3+NO2 DISS (AS N)	*ND	MG/L
TOP-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	PHOSPHORUS TOTAL	*0.072	MG/L
TOP-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	PHOSPHATE ORTHO DISS	0.017	MG/L
TOP-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	SAMPLE SIZE LITERS	200	ML
TOP-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	CHLOROPHYLL A, FLUORESCENCE (WELSCHMAYER 1994)	30.8	UG/L
BOT-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	CONDUCTIVITY AT 25C	271	UMHOS/CM
BOT-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	TOTAL DISSOLVED SOLIDS 180 C	164	MG/L
BOT-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	TEMPERATURE AT LAB	ICED	C
BOT-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	PH LAB	8.1	SU
BOT-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	ALKALINITY TOTAL CACO3	*113	MG/L
BOT-072904	MID-LAKE - INTEGRATED SURFACE SAMPLER	STRASSER	NITROGEN NH3-N DISS	*0.030	MG/L

Appendix B:

PhycoTech Phytoplankton Raw Data

sample_id	sample_date	taxa_id	division	class_	order_	family	genus	total_biovolume_cul	algal_cell_concentration_cells
LL-52704-P	5/27/2004	1010	Bacillariophyta	Bacillariophyceae	Achnanthales	Achnanthaceae	Achnanthes	2436.0413	34.463
LL-52704-P	5/27/2004	1340	Bacillariophyta	Bacillariophyceae	Thalassiophysales	Catenulaceae	Amphora	2876.7953	0.3504
LL-52704-P	5/27/2004	1060	Bacillariophyta	Bacillariophyceae	Achnanthales	Cocconiedaceae	Cocconeis	13220.159	54.4152
LL-52704-P	5/27/2004	1090	Bacillariophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	Cymbella	807.3219	0.3504
LL-52704-P	5/27/2004	1140	Bacillariophyta	Bacillariophyceae	Eunotiales	Eunotiaceae	Eunotia	8889.4185	3.6277
LL-52704-P	5/27/2004	9707	Bacillariophyta	Fragilariophyceae	Fragilariales	Fragilariaceae	Fragilaria	351699.5832	758.1849
LL-52704-P	5/27/2004	1220	Bacillariophyta	Bacillariophyceae	Bacillarales	Bacillariaceae	Nitzschia	273.5205	1.8138
LL-52704-P	5/27/2004	2683	Chlorophyta	Chlorophyceae	Chlorococcales	Chlorococcaceae	.	4923.3686	32.6491
LL-52704-P	5/27/2004	2687	Chlorophyta	Chlorophyceae	Chlorococcales	Chlorococcaceae	.	34.1902	1.8138
LL-52704-P	5/27/2004	2684	Chlorophyta	Chlorophyceae	Chlorococcales	Chlorococcaceae	.	3282.2469	3.6277
LL-52704-P	5/27/2004	2180	Chlorophyta	Chlorophyceae	Zygnematales	Desmidiaceae	Cosmarium	289293.5861	14.5107
LL-52704-P	5/27/2004	2350	Chlorophyta	Chlorophyceae	Oedogoniales	Oedogoniaceae	Oedogonium	290387.668	6.7371
LL-52704-P	5/27/2004	2480	Chlorophyta	Chlorophyceae	Chlorococcales	Scenedesmaceae	Scenedesmus	364.694	7.2554
LL-52704-P	5/27/2004	2640	Chlorophyta	Chlorophyceae	Tetrasporales	Palmellopsidaceae	Sphaerocystis	486.2588	14.5107
LL-52704-P	5/27/2004	2550	Chlorophyta	Chlorophyceae	Chlorococcales	Chlorococcaceae	Tetraedron	2601.3707	0.7008
LL-52704-P	5/27/2004	4282	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	.	668.0056	2491.6285
LL-52704-P	5/27/2004	4060	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Aphanothece	669.556	526.0131
LL-52704-P	5/27/2004	4310	Cyanophyta	Cyanophyceae	Nostocales	Rivulariaceae	Calothrix	1367.6028	18.1384
LL-52704-P	5/27/2004	4094	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Coelosphaerium	37.9891	3.6277
LL-52704-P	5/27/2004	4160	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Merismopedia	91.1737	32.6491
LL-52704-P	5/27/2004	4170	Cyanophyta	Cyanophyceae	Oscillatoriales	Oscillatoriaceae	Oscillatoria	192.3192	27.2076
LL-52704-P	5/27/2004	4460	Cyanophyta	Cyanophyceae	Oscillatoriales	Nostocaceae	Pseudanabaena	402.4457	136.038
LL-52704-P	5/27/2004	4323	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Synechococcus	263.6536	655.6917
LL-52704-P	5/27/2004	4285	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Synechocystis	10500.606	440.763
LL-52704-P	5/27/2004	6010	Pyrrhophyta	Dinophyceae	Gonyaulacales	Certiaceae	Ceratium	18954.5583	0.3504
LL-62404-P	6/24/2004	1060	Bacillariophyta	Bacillariophyceae	Achnanthales	Cocconiedaceae	Cocconeis	2945.6067	12.5574
LL-62404-P	6/24/2004	1090	Bacillariophyta	Bacillariophyceae	Cymbellales	Cymbellaceae	Cymbella	1044.7716	1.7939
LL-62404-P	6/24/2004	1350	Bacillariophyta	Bacillariophyceae	Rhopalodiales	Rhopalodiaceae	Epithemia	267.8902	0.897
LL-62404-P	6/24/2004	9707	Bacillariophyta	Fragilariophyceae	Fragilariales	Fragilariaceae	Fragilaria	238396.8436	493.2251
LL-62404-P	6/24/2004	1160	Bacillariophyta	Bacillariophyceae	Cymbellales	Gomphonemataceae	Gomphonema	24731.787	7.6241
LL-62404-P	6/24/2004	1220	Bacillariophyta	Bacillariophyceae	Bacillarales	Bacillariaceae	Nitzschia	2811.1004	15.607
LL-62404-P	6/24/2004	2683	Chlorophyta	Chlorophyceae	Chlorococcales	Chlorococcaceae	.	105.2001	3.1393
LL-62404-P	6/24/2004	2070	Chlorophyta	Chlorophyceae	Chlorococcales	Characiaceae	Characium	199.2803	2.6909
LL-62404-P	6/24/2004	2180	Chlorophyta	Chlorophyceae	Zygnematales	Desmidiaceae	Cosmarium	360.6865	0.897
LL-62404-P	6/24/2004	2350	Chlorophyta	Chlorophyceae	Oedogoniales	Oedogoniaceae	Oedogonium	96370.9139	9.2619
LL-62404-P	6/24/2004	2360	Chlorophyta	Chlorophyceae	Chlorococcales	Oocystaceae	Oocystis	1578.0033	1.3454
LL-62404-P	6/24/2004	8450	Chlorophyta	Chlorophyceae	Chetophorales	Chaetophoraceae	Protoderma	1202.2882	17.9391
LL-62404-P	6/24/2004	2480	Chlorophyta	Chlorophyceae	Chlorococcales	Scenedesmaceae	Scenedesmus	258.304	6.7272
LL-62404-P	6/24/2004	4282	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	.	113.0085	421.5161
LL-62404-P	6/24/2004	4010	Cyanophyta	Cyanophyceae	Nostocales	Nostocaceae	Anabaena	91951.3779	2946.4927
LL-62404-P	6/24/2004	4050	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Aphanocapsa	1634.3608	556.1113
LL-62404-P	6/24/2004	4310	Cyanophyta	Cyanophyceae	Nostocales	Rivulariaceae	Calothrix	2682.6057	35.5794
LL-62404-P	6/24/2004	4094	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Coelosphaerium	9.3929	0.897
LL-62404-P	6/24/2004	4648	Cyanophyta	Cyanophyceae	Oscillatoriales	Oscillatoriaceae	Lyngbya	932.6249	261.7607
LL-62404-P	6/24/2004	4160	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Merismopedia	26.3	7.1756
LL-62404-P	6/24/2004	4260	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Microcystis	1653.1463	49.3325
LL-62404-P	6/24/2004	4170	Cyanophyta	Cyanophyceae	Oscillatoriales	Oscillatoriaceae	Oscillatoria	7322.9213	230.218
LL-62404-P	6/24/2004	4460	Cyanophyta	Cyanophyceae	Oscillatoriales	Nostocaceae	Pseudanabaena	1783.4424	467.6492
LL-62404-P	6/24/2004	4323	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Synechococcus	71.708	178.3337
LL-62404-P	6/24/2004	4285	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Synechocystis	154.3284	61.8898
LL-62404-P	6/24/2004	6010	Pyrrhophyta	Dinophyceae	Gonyaulacales	Certiaceae	Ceratium	14964.4242	0.2599
LL-72904-P	7/29/2004	1060	Bacillariophyta	Bacillariophyceae	Achnanthales	Cocconiedaceae	Cocconeis	23.0126	0.2392
LL-72904-P	7/29/2004	2080	Chlorophyta	Chlorophyceae	Volvocales	Chlamydomonadac	Chlamydomonas	25.2781	0.2392
LL-72904-P	7/29/2004	2340	Chlorophyta	Chlorophyceae	Zygnematales	Zygnemataceae	Mougeotia	721.3729	0.2392
LL-72904-P	7/29/2004	2350	Chlorophyta	Chlorophyceae	Oedogoniales	Oedogoniaceae	Oedogonium	4645.1953	1.5402
LL-72904-P	7/29/2004	2360	Chlorophyta	Chlorophyceae	Chlorococcales	Oocystaceae	Oocystis	87.0974	0.0578
LL-72904-P	7/29/2004	4282	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	.	17.3859	64.8486
LL-72904-P	7/29/2004	4010	Cyanophyta	Cyanophyceae	Nostocales	Nostocaceae	Anabaena	910.246	7.7627
LL-72904-P	7/29/2004	4040	Cyanophyta	Cyanophyceae	Nostocales	Nostocaceae	Aphanizomenon	67.6287	1.5946
LL-72904-P	7/29/2004	4080	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Chroococcus	32.061	1.9135
LL-72904-P	7/29/2004	4090	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Coelosphaerium	694.0575	66.2776
LL-72904-P	7/29/2004	4094	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Coelosphaerium	263.0012	25.1147
LL-72904-P	7/29/2004	4160	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Merismopedia	24.0458	3.827
LL-72904-P	7/29/2004	4260	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Microcystis	516.1328	15.4022
LL-72904-P	7/29/2004	4267	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Microcystis	577.098	17.2215
LL-72904-P	7/29/2004	4170	Cyanophyta	Cyanophyceae	Oscillatoriales	Oscillatoriaceae	Oscillatoria	8152.3178	40.5463
LL-72904-P	7/29/2004	4460	Cyanophyta	Cyanophyceae	Oscillatoriales	Nostocaceae	Pseudanabaena	5.0722	0.7176
LL-72904-P	7/29/2004	4323	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Synechococcus	86.9188	216.1621
LL-72904-P	7/29/2004	6010	Pyrrhophyta	Dinophyceae	Gonyaulacales	Certiaceae	Ceratium	37485.2747	0.6931
LL-72904-P	7/29/2004	6034	Pyrrhophyta	Dinophyceae	Gymnodinales	Gymnodiniaceae	Gymnodinium	36.0686	0.4784
LL-83104-P	8/31/2004	1220	Bacillariophyta	Bacillariophyceae	Bacillarales	Bacillariaceae	Nitzschia	131.5003	0.4186
LL-83104-P	8/31/2004	2180	Chlorophyta	Chlorophyceae	Zygnematales	Desmidiaceae	Cosmarium	4590.546	0.1427
LL-83104-P	8/31/2004	4282	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	.	89.2477	332.8896
LL-83104-P	8/31/2004	4010	Cyanophyta	Cyanophyceae	Nostocales	Nostocaceae	Anabaena	1544.4092	51.0666
LL-83104-P	8/31/2004	4090	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Coelosphaerium	2191.6713	209.2892
LL-83104-P	8/31/2004	4094	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Coelosphaerium	775.8534	74.0884
LL-83104-P	8/31/2004	4267	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Microcystis	3807.7193	95.4359
LL-83104-P	8/31/2004	4260	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Microcystis	234.9471	10.883
LL-83104-P	8/31/2004	4170	Cyanophyta	Cyanophyceae	Oscillatoriales	Oscillatoriaceae	Oscillatoria	23.6701	6.0275
LL-83104-P	8/31/2004	4460	Cyanophyta	Cyanophyceae	Oscillatoriales	Nostocaceae	Pseudanabaena	29.5875	4.1858
LL-83104-P	8/31/2004	4323	Cyanophyta	Cyanophyceae	Chroococcales	Chroococcaceae	Synechococcus	24.3373	60.5254
LL-83104-P	8/31/2004	6010	Pyrrhophyta	Dinophyceae	Gonyaulacales	Certiaceae	Ceratium	303078.3212	5.8601

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Algae Analysis with Biovolume
Report and Data Set

Customer ID : 184
Calc Type : Phytoplankton - Tow Volume Calculated

Tracking Code: 040001-184 **Sample ID** LL-52704-P **Replicate #** 1

Customer ID: 184 **Sample Date:** 5/27/2004 **Level** Epi

Job Number: 1 **Station:** . **Depth** 0

System Name: Lake Lorraine **Site:** Mid-Lake **Preservative** Glutaraldehyde

Report Notes .

Taxa Id	Genus	Species	Subspecies	Variety	Form	Morph	Structure	Gald µm	Concentration NU/ml	Relative Concentration	Total Bivolume µm^3/ml	Relative Total Biovolume
Division:	**Bacillariophyta**											
1010	*Achnanthes*	*spp*	.	.	.	.	Vegetative	10	34.463	0.904	2,436.041	0.24
1340	*Amphora*	*1*	.	.	.	.	Vegetative	40	0.350	0.009	2,876.795	0.29
1060	*Cocconeis*	*spp*	.	.	.	.	Vegetative	12.6667	54.415	1.428	13,220.159	1.32
1090	*Cymbella*	*spp*	.	.	.	.	Vegetative	48	0.350	0.009	807.322	0.08
1140	*Eunotia*	*spp*	.	.	.	.	Vegetative	45	3.628	0.095	8,889.419	0.88
9707	*Fragilaria*	*sp. 1*	.	*(large) Job 07*	.	.	Vegetative	106.8	34.463	0.904	351,699.583	35.00
1220	*Nitzschia*	*spp*	.	.	.	.	Vegetative	24	1.814	0.048	273.521	0.03
						TOTALS	**Bacillariophyta**		**129.484**	**3.398**	**380,202.840**	**37.84**
Division:	**Chlorophyta**											
2684	**Chlorococcaceae*	*spp*	.	.	.	*> 10 um spherical*	Vegetative	12	3.628	0.095	3,282.247	0.33
2683	**Chlorococcaceae*	*spp*	.	.	.	*2-9.9 um spherical*	Vegetative	6	32.649	0.857	4,923.369	0.49
2687	**Chlorococcaceae*	*spp*	.	.	.	*> 1 um ovoid*	Vegetative	4	1.814	0.048	34.190	0.00
2180	*Cosmarium*	*spp*	.	.	.	.	Vegetative	55	7.255	0.190	289,293.586	28.79
2350	*Oedogonium*	*spp*	.	.	.	.	Vegetative	320	1.814	0.048	290,387.668	28.90
2480	*Scenedesmus*	*spp*	.	.	.	.	Vegetative	16	1.814	0.048	364.694	0.04
2640	*Sphaerocystis*	*spp*	.	.	.	.	Vegetative	40	1.814	0.048	486.259	0.05
2550	*Tetraedron*	*spp*	.	.	.	.	Vegetative	36	0.701	0.018	2,601.371	0.26
						TOTALS	**Chlorophyta**		**51.488**	**1.351**	**591,373.383**	**58.86**
Division:	**Cyanophyta**											
4282	**Chroococcaceae*	*spp*	.	.	.	*<1 um spherical*	Vegetative	0.8	2,491.629	65.378	668.006	0.07
4060	*Aphanothece*	*spp*	.	.	.	.	Vegetative	60	10.883	0.286	669.556	0.07

☑ = Identification is uncertain

* = Family level identification

4310	*Calothrix*	*spp*	.	.	.	.	Vegetative	60	1.814	0.048	1,367.603	0.14
4094	*Coelosphaerium*	*spp*	.	.	.	.	Vegetative	5	3.628	0.095	37.989	0.00
4160	*Merismopedia*	*spp*	.	.	.	.	Vegetative	8	5.442	0.143	91.174	0.01
4170	*Oscillatoria*	*spp*	.	.	.	.	Vegetative	60	1.814	0.048	192.319	0.02
4460	*Pseudanabaena*	*spp*	.	.	.	.	Vegetative	17	18.138	0.476	402.446	0.04
4323	*Synechococcus*	*sp. 1*	.	.	.	*< 1um ovoid*	Vegetative	1.2	655.692	17.205	263.654	0.03
4285	*Synechocystis*	*spp*	.	.	.	*>1 um spherical*	Vegetative	3.5	440.763	11.565	10,500.606	1.05
						TOTALS	**Cyanophyta**		**3,629.801**	**95.242**	**14,193.352**	**1.41**
Division:	**Pyrrhophyta**											
6010	*Ceratium*	*spp*	.	.	.	.	Vegetative	240	0.350	0.009	18,954.558	1.89
						TOTALS	**Pyrrhophyta**		**0.350**	**0.009**	**18,954.558**	**1.89**

☑ = Identification is uncertain

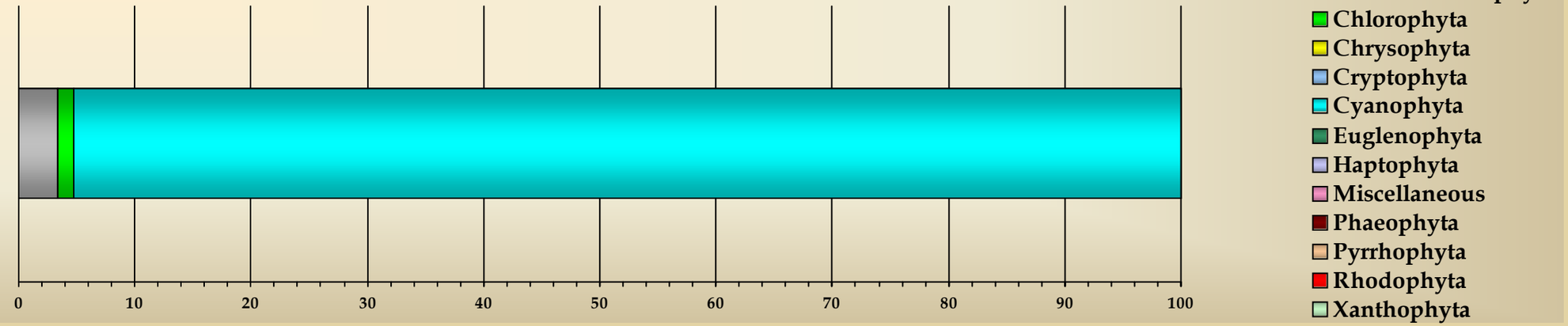
* = Family level identification

Summary Graphics

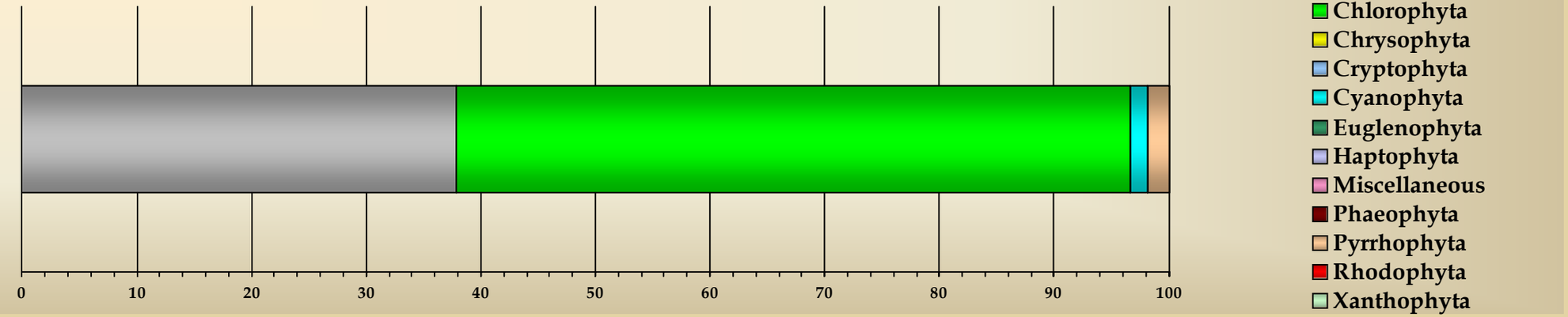
Total Sample Concentration
3,811.124

Total Sample Biovolume
1,004,724.133

Sample Concentration



Sample Biovolume



☑ = Identification is uncertain
* = Family level identification

Tracking Code: 040003-184 **Sample ID** LL-62404-P **Replicate #** 1

Customer ID: 184 **Sample Date:** 6/24/2004 **Level** Epi

Job Number: 1 **Station:** . **Depth** 4

System Name: Lake Lorraine **Site:** Mid-Lake **Preservative** Glutaraldehyde

Report Notes .

Taxa Id	Genus	Species	Subspecies	Variety	Form	Morph	Structure	Gald µm	Concentration NU/ml	Relative Concentration	Total Bivolume µm^3/ml	Relative Total Biovolume
Division:	**Bacillariophyta**											
1060	*Cocconeis*	*spp*	.	.	.	.	Vegetative	13.6667	12.557	1.597	2,945.607	0.60
1090	*Cymbella*	*spp*	.	.	.	.	Vegetative	28	1.794	0.228	1,044.772	0.21
1350	*Epithemia*	*spp*	.	.	.	.	Vegetative	28	0.897	0.114	267.890	0.05
9707	*Fragilaria*	*sp. 1*	.	*(large) Job 07*	.	.	Vegetative	388.6667	6.279	0.799	238,396.844	48.30
1160	*Gomphonema*	*spp*	.	.	.	.	Vegetative	40	7.624	0.970	24,731.787	5.01
1220	*Nitzschia*	*spp*	.	.	.	.	Vegetative	26.4	13.006	1.654	2,811.100	0.57
						TOTALS	**Bacillariophyta**		**42.157**	**5.362**	**270,198.000**	**54.74**
Division:	**Chlorophyta**											
2683	**Chlorococcaceae*	*spp*	.	.	.	*2-9.9 um spherical*	Vegetative	4	3.139	0.399	105.200	0.02
2070	*Characium*	*spp*	.	.	.	.	Vegetative	14	2.691	0.342	199.280	0.04
2180	*Cosmarium*	*spp*	.	.	.	.	Vegetative	16	0.897	0.114	360.687	0.07
2350	*Oedogonium*	*spp*	.	.	.	.	Vegetative	380	2.242	0.285	96,370.914	19.53
2360	*Oocystis*	*spp*	.	.	.	.	Vegetative	18	1.345	0.171	1,578.003	0.32
8450	*Protoderma*	*spp*	.	.	.	.	Vegetative	60	0.449	0.057	1,202.288	0.24
2480	*Scenedesmus*	*spp*	.	.	.	.	Vegetative	17.3333	2.242	0.285	258.304	0.05
						TOTALS	**Chlorophyta**		**13.006**	**1.654**	**100,074.676**	**20.28**
Division:	**Cyanophyta**											
4282	**Chroococcaceae*	*spp*	.	.	.	*<1 um spherical*	Vegetative	0.8	421.516	53.612	113.009	0.02
4010	*Anabaena*	*spp*	.	.	.	.	Vegetative	188	20.182	2.567	91,951.378	18.63
4050	*Aphanocapsa*	*spp*	.	.	.	.	Vegetative	108	8.970	1.141	1,634.361	0.33
4310	*Calothrix*	*spp*	.	.	.	.	Vegetative	28	7.624	0.970	2,682.606	0.54

☑ = Identification is uncertain

* = Family level identification

4094	*Coelosphaerium*	*spp*	.	.	.	.	Vegetative	5	0.897	0.114	9.393	0.00
4648	*Lyngbya*	*spp*	.	.	.	<5 *um filament*	Vegetative	92	7.624	0.970	932.625	0.19
4160	*Merismopedia*	*spp*	.	.	.	.	Vegetative	9	0.897	0.114	26.300	0.01
4260	*Microcystis*	*spp*	.	.	.	.	Vegetative	200	0.449	0.057	1,653.146	0.33
4170	*Oscillatoria*	*spp*	.	.	.	.	Vegetative	220	3.139	0.399	7,322.921	1.48
4460	*Pseudanabaena*	*spp*	.	.	.	.	Vegetative	50	19.285	2.453	1,783.442	0.36
4323	*Synechococcus*	*sp. 1*	.	.	.	< *1um ovoid*	Vegetative	1.2	178.334	22.682	71.708	0.01
4285	*Synechocystis*	*spp*	.	.	.	>*1 um spherical*	Vegetative	1.65	61.890	7.872	154.328	0.03
						TOTALS	**Cyanophyta**		**730.805**	**92.951**	**108,335.217**	**21.95**
Division:	**Pyrrhophyta**											
6010	*Ceratium*	*spp*	.	.	.	.	Vegetative	260	0.260	0.033	14,964.424	3.03
						TOTALS	**Pyrrhophyta**		**0.260**	**0.033**	**14,964.424**	**3.03**

☑ = Identification is uncertain

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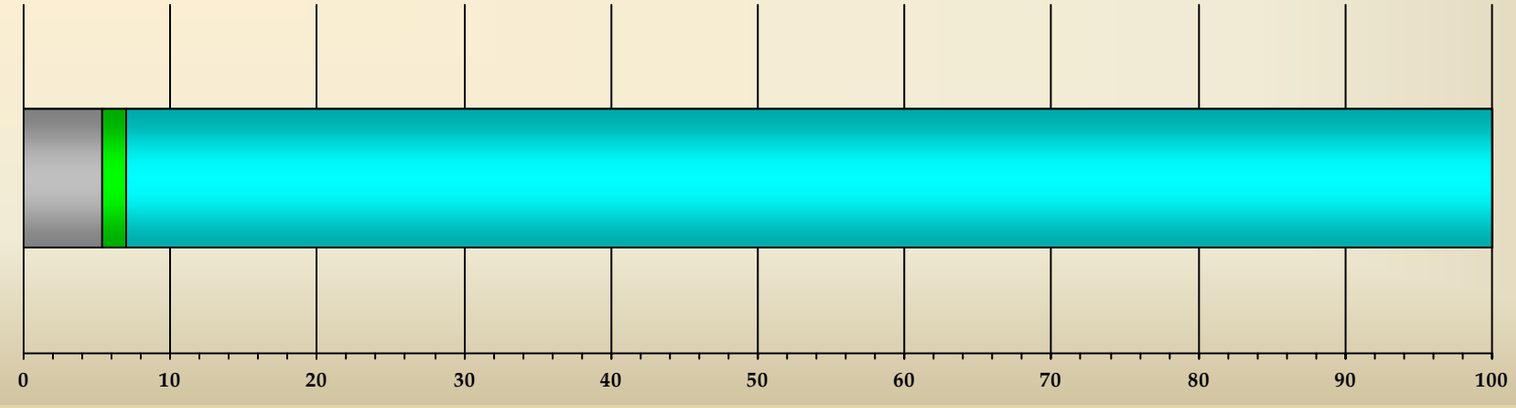
Summary Graphics

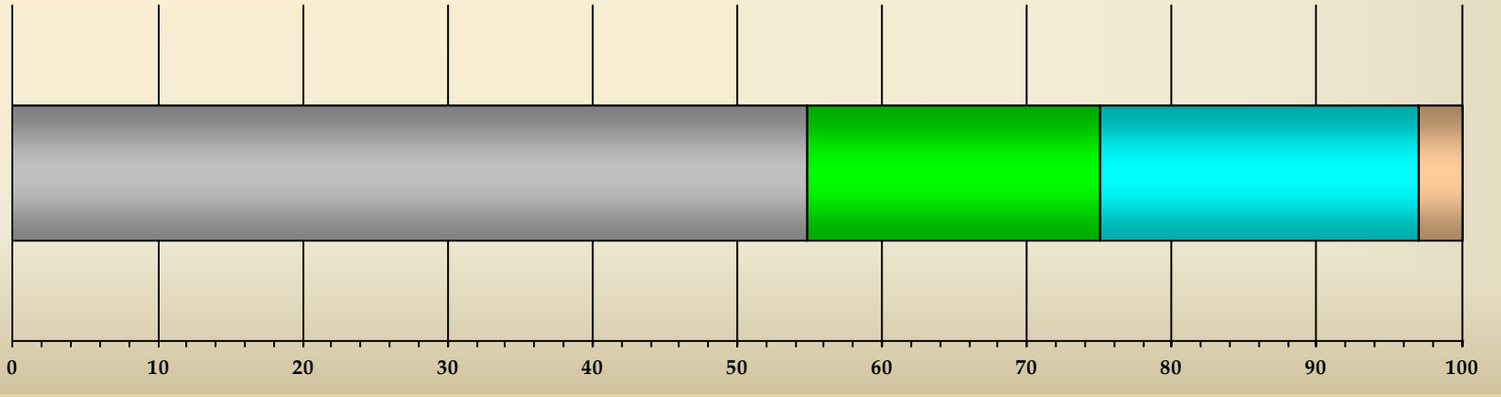
Total Sample Concentration	Total Sample Biovolume
786.228	493,572.317

Sample Concentration



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

Sample Biovolume



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

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040003-184

Tracking Code: 040011-184 **Sample ID** LL-72904-P **Replicate #** 1

Customer ID: 184 **Sample Date:** 7/29/2004 **Level** Epi

Job Number: 1 **Station:** . **Depth** 4

System Name: Lake Lorraine **Site:** Mid-Lake **Preservative** Glutaraldehyde

Report Notes .

Taxa Id	Genus	Species	Subspecies	Variety	Form	Morph	Structure	Gald µm	Concentration NU/ml	Relative Concentration	Total Bivolume µm^3/ml	Relative Total Biovolume
Division:	**Bacillariophyta**											
1060	*Cocconeis*	*spp*	.	.	.	.	Vegetative	10	0.239	0.073	23.013	0.04
						TOTALS	**Bacillariophyta**		**0.239**	**0.073**	**23.013**	**0.04**
Division:	**Chlorophyta**											
2080	*Chlamydomonas*	*spp*	.	.	.	.	Vegetative	6	0.239	0.073	25.278	0.05
2340	*Mougeotia*	*spp*	.	.	.	.	Vegetative	60	0.239	0.073	721.373	1.33
2350	*Oedogonium*	*spp*	.	.	.	.	Vegetative	800	0.116	0.035	4,645.195	8.54
2360	*Oocystis*	*spp*	.	.	.	.	Vegetative	20	0.058	0.018	87.097	0.16
						TOTALS	**Chlorophyta**		**0.652**	**0.198**	**5,478.944**	**10.08**
Division:	**Cyanophyta**											
4282	**Chroococcaceae*	*spp*	.	.	.	*<1 um spherical*	Vegetative	0.8	64.849	19.737	17.386	0.03
4010	*Anabaena*	*spp*	.	.	.	.	Vegetative	104	0.693	0.211	910.246	1.67
4040	*Aphanizomenon*	*spp*	.	.	.	.	Vegetative	40	0.239	0.073	67.629	0.12
4080	*Chroococcus*	*spp*	.	.	.	.	Vegetative	20	0.239	0.073	32.061	0.06
4090	*Coelosphaerium*	*spp*	.	.	.	.	Vegetative	170	0.520	0.158	694.058	1.28
4094	*Coelosphaerium*	*spp*	.	.	.	.	Vegetative	5	25.115	7.644	263.001	0.48
4160	*Merismopedia*	*spp*	.	.	.	.	Vegetative	20	0.239	0.073	24.046	0.04
4260	*Microcystis*	*spp*	.	.	.	.	Vegetative	133.3333	0.231	0.070	516.133	0.95
4267	*Microcystis*	*spp*	.	.	.	.	Vegetative	4	17.222	5.241	577.098	1.06
4170	*Oscillatoria*	*spp*	.	.	.	.	Vegetative	216	0.751	0.229	8,152.318	14.99
4460	*Pseudanabaena*	*spp*	.	.	.	.	Vegetative	12	0.239	0.073	5.072	0.01
4323	*Synechococcus*	*sp. 1*	.	.	.	*< 1um ovoid*	Vegetative	1.2	216.162	65.791	86.919	0.16

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* = Family level identification

						TOTALS	**Cyanophyta**		**326.499**	**99.372**	**11,345.966**	**20.87**
Division:	**Pyrrhophyta**											
6010	*Ceratium*	*spp*	.	.	.	.	Vegetative	250	0.693	0.211	37,485.275	68.95
6034	*Gymnodinium*	*sp. 3*	.	.	.	.	Vegetative	8	0.478	0.146	36.069	0.07
						TOTALS	**Pyrrhophyta**		**1.172**	**0.357**	**37,521.343**	**69.01**

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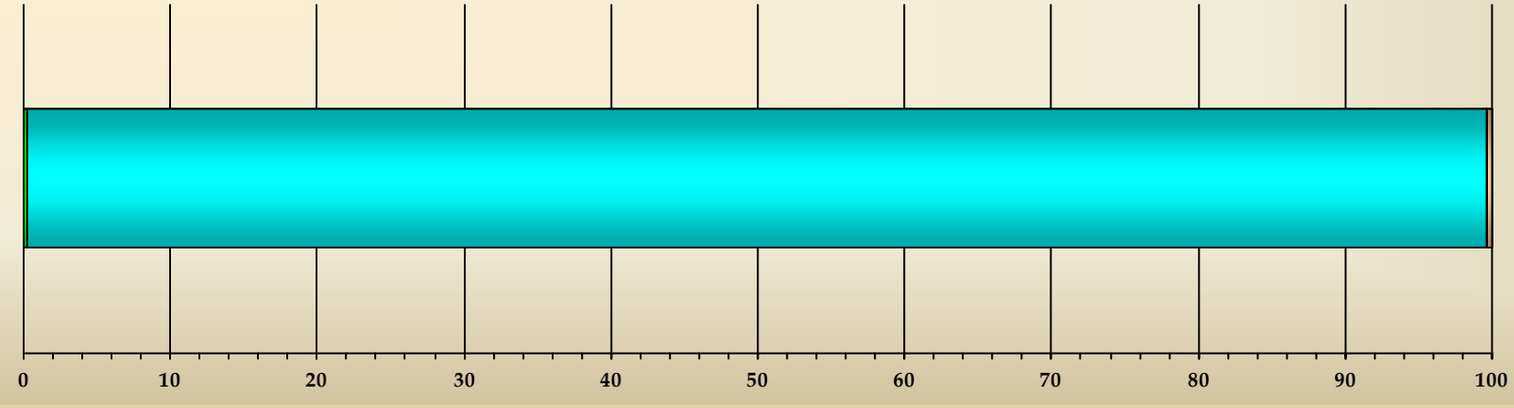
* = Family level identification

040011-184

Summary Graphics

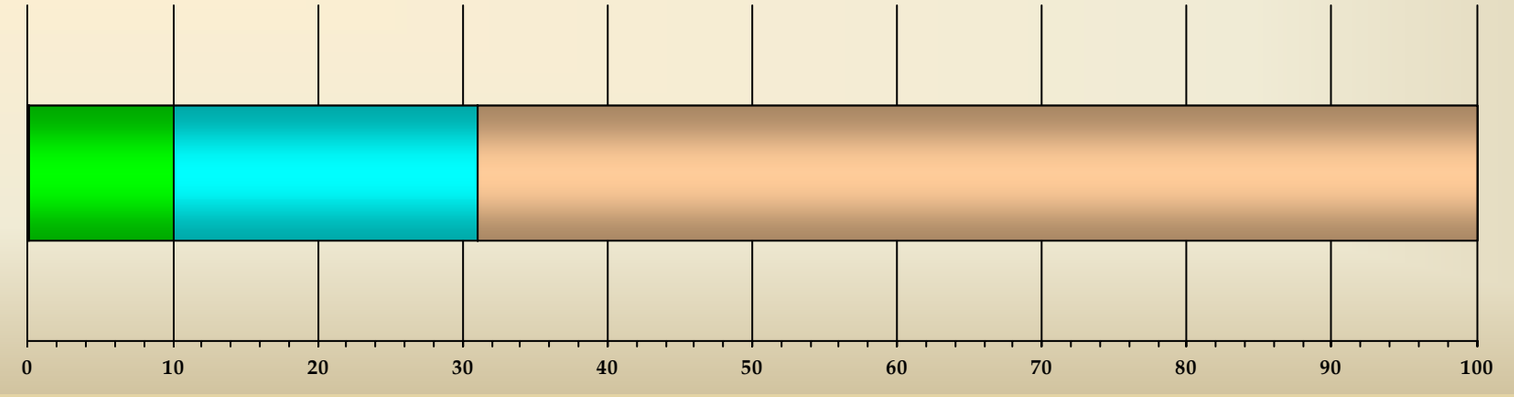
Total Sample Concentration	Total Sample Biovolume
328.561	54,369.265

Sample Concentration



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

Sample Biovolume



- Bacillariophyta
- Chloromonadophyta
- Chlorophyta
- Chrysophyta
- Cryptophyta
- Cyanophyta
- Euglenophyta
- Haptophyta
- Miscellaneous
- Phaeophyta
- Pyrrhophyta
- Rhodophyta
- Xanthophyta

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040011-184

Tracking Code: 040017-184 **Sample ID** LL-83104-P **Replicate #** 1

Customer ID: 184 **Sample Date:** 8/31/2004 **Level** Epi

Job Number: 1 **Station:** . **Depth** 4

System Name: Lake Lorraine **Site:** Mid-Lake **Preservative** Glutaraldehyde

Report Notes .

Taxa Id	Genus	Species	Subspecies	Variety	Form	Morph	Structure	Gald µm	Concentration NU/ml	Relative Concentration	Total Bivolume µm^3/ml	Relative Total Biovolume
Division:	**Bacillariophyta**											
1220	*Nitzschia*	*spp*	.	.	.	.	Vegetative	50	0.419	0.073	131.500	0.04
						TOTALS	**Bacillariophyta**		**0.419**	**0.073**	**131.500**	**0.04**
Division:	**Chlorophyta**											
2180	*Cosmarium*	*spp*	.	.	.	.	Vegetative	60	0.143	0.025	4,590.546	1.45
						TOTALS	**Chlorophyta**		**0.143**	**0.025**	**4,590.546**	**1.45**
Division:	**Cyanophyta**											
4282	**Chroococcaceae*	*spp*	.	.	.	*<1 um spherical*	Vegetative	0.8	332.890	57.746	89.248	0.03
4010	*Anabaena*	*spp*	.	.	.	.	Vegetative	60	3.349	0.581	1,544.409	0.49
4090	*Coelosphaerium*	*spp*	.	.	.	.	Vegetative	200	1.256	0.218	2,191.671	0.69
4094	*Coelosphaerium*	*spp*	.	.	.	.	Vegetative	5	74.088	12.852	775.853	0.25
4267	*Microcystis*	*spp*	.	.	.	.	Vegetative	4.2	95.436	16.555	3,807.719	1.20
4260	*Microcystis*	*spp*	.	.	.	.	Vegetative	40	0.837	0.145	234.947	0.07
4170	*Oscillatoria*	*spp*	.	.	.	.	Vegetative	24	1.256	0.218	23.670	0.01
4460	*Pseudanabaena*	*spp*	.	.	.	.	Vegetative	40	0.419	0.073	29.588	0.01
4323	*Synechococcus*	*sp. 1*	.	.	.	*< 1um ovoid*	Vegetative	1.2	60.525	10.499	24.337	0.01
						TOTALS	**Cyanophyta**		**570.055**	**98.886**	**8,721.443**	**2.76**
Division:	**Pyrrhophyta**											
6010	*Ceratium*	*spp*	.	.	.	.	Vegetative	270	5.860	1.017	303,078.321	95.75
						TOTALS	**Pyrrhophyta**		**5.860**	**1.017**	**303,078.321**	**95.75**

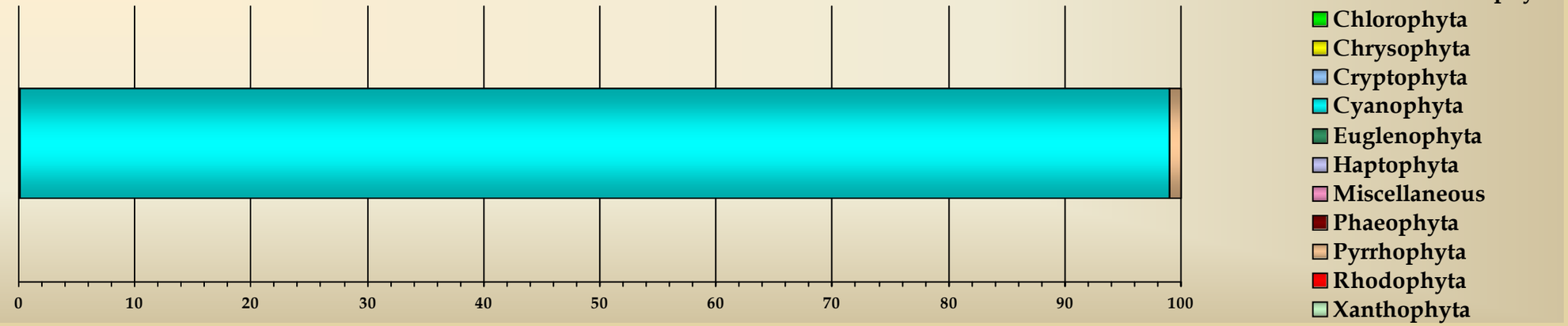
☑ = Identification is uncertain

* = Family level identification

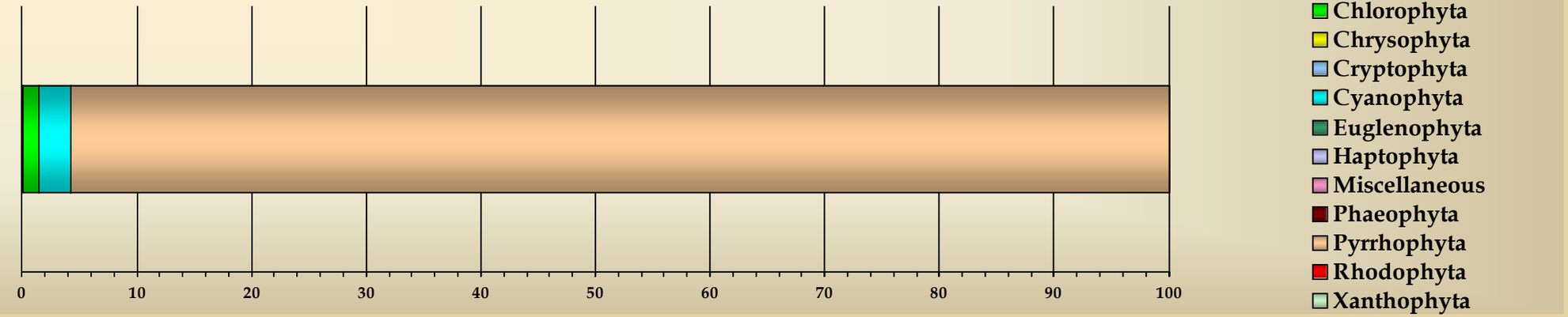
Summary Graphics

Total Sample Concentration	Total Sample Biovolume
576.477	316,521.810

Sample Concentration



Sample Biovolume



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040017-184

Species List

Taxa Code	Genus	Species	Subspecies	Variety	Form	Morph	Structure	Authority
Division: Bacillariophyta								
1010	*Achnanthes*	*spp*	.	.	.	.	Vegetative	(Greg.) Hust.
1340	*Amphora*	*1*	.	.	.	.	Vegetative	Ehrenberg
1060	*Cocconeis*	*spp*	.	.	.	.	Vegetative	Ehrenberg .
1090	*Cymbella*	*spp*	.	.	.	.	Vegetative	(Schmidt) Cleve
1350	*Epithemia*	*spp*	.	.	.	.	Vegetative	de Brebisson ex Kutzing
1140	*Eunotia*	*spp*	.	.	.	.	Vegetative	N”rpell-Schempp & Lange-Bert. in Lange-Bert.
9707	*Fragilaria*	*sp. 1*	.	*(large) Job 07*	.	.	Vegetative	Lyngbye
1160	*Gomphonema*	*spp*	.	.	.	.	Vegetative	C. Agardh
1220	*Nitzschia*	*spp*	.	.	.	.	Vegetative	Hassall
Division: Chlorophyta								
2687	*Chlorococcaceae*	*spp*	.	.	.	*> 1 um ovoid*	Vegetative	(Brandt) Beijerinck
2684	*Chlorococcaceae*	*spp*	.	.	.	*> 10 um spherical*	Vegetative	N/A
2683	*Chlorococcaceae*	*spp*	.	.	.	*2-9.9 um spherical*	Vegetative	N/A
2070	*Characium*	*spp*	.	.	.	.	Vegetative	A. Braun
2080	*Chlamydomonas*	*spp*	.	.	.	.	Vegetative	Ehrenberg
2180	*Cosmarium*	*spp*	.	.	.	.	Vegetative	Corda
2340	*Mougeotia*	*spp*	.	.	.	.	Vegetative	Kisselew
2350	*Oedogonium*	*spp*	.	.	.	.	Vegetative	De Bary
2360	*Oocystis*	*spp*	.	.	.	.	Vegetative	Snow
8450	*Protoderma*	*spp*	.	.	.	.	Vegetative	Kutzing .
2480	*Scenedesmus*	*spp*	.	.	.	.	Vegetative	Meyen
2640	*Sphaerocystis*	*spp*	.	.	.	.	Vegetative	Chodat
2550	*Tetraedron*	*spp*	.	.	.	.	Vegetative	(Reinsch) De Toni
Division: Cyanophyta								
4282	*Chroococcaceae*	*spp*	.	.	.	*<1 um spherical*	Vegetative	N/A
4010	*Anabaena*	*spp*	.	.	.	.	Vegetative	Bory
4040	*Aphanizomenon*	*spp*	.	.	.	.	Vegetative	J. Ralfs Ex Bornet and Flah.
4050	*Aphanocapsa*	*spp*	.	.	.	.	Vegetative	W. and G. S. West
4060	*Aphanothece*	*spp*	.	.	.	.	Vegetative	West and West 1912
4310	*Calothrix*	*spp*	.	.	.	.	Vegetative	(Naeg.) Born. and Flah.
4080	*Chroococcus*	*spp*	.	.	.	.	Vegetative	(Breb.) Naegeli
4090	*Coelosphaerium*	*spp*	.	.	.	.	Vegetative	Lemmermann
4094	*Coelosphaerium*	*spp*	.	.	.	.	Vegetative	Lemmermann

☑ = Identification is uncertain

* = Family level identification

4648	*Lyngbya*	*spp*	.	.	.	*<5 um filament diam*	Vegetative	.
4160	*Merismopedia*	*spp*	.	.	.	.	Vegetative	Thompson
4260	*Microcystis*	*spp*	.	.	.	.	Vegetative	(Kutzing) Lemmermann
4267	*Microcystis*	*spp*	.	.	.	.	Vegetative	(Kutzing) Lemmermann
4170	*Oscillatoria*	*spp*	.	.	.	.	Vegetative	Gomont
4460	*Pseudanabaena*	*spp*	.	.	.	.	Vegetative	Lauterborn
4323	*Synechococcus*	*sp. 1*	.	.	.	*< 1um ovoid*	Vegetative	Nageli
4285	*Synechocystis*	*spp*	.	.	.	*>1 um spherical*	Vegetative	N/A

Division: Pyrrhophyta

6010	*Ceratium*	*spp*	.	.	.	.	Vegetative	Dujardin
6034	*Gymnodinium*	*sp. 3*	.	.	.	.	Vegetative	Stein

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040017-184

Appendix C:
Zooplankton Raw Data

sample_id	system_name	sample_date	phylum	class_	subclass_	order_	family	genus	species	total_animal_biomass_ug	animal_concentration_cells
LL-52704-Z	Lake Lorraine	5/27/2004	Arthropoda	Branchiopoda	Phyllopoda	Diplostraca	Bosminidae	Bosmina	.	54.8057	99.7857
LL-52704-Z	Lake Lorraine	5/27/2004	Arthropoda	Branchiopoda	Phyllopoda	Diplostraca	Daphniidae	Ceriodaphnia	.	206.5306	33.2619
LL-52704-Z	Lake Lorraine	5/27/2004	Arthropoda	Maxillipoda	Copepoda	Cyclopoida	.	.	.	103.6732	77.6111
LL-52704-Z	Lake Lorraine	5/27/2004	Arthropoda	Ostracoda	Podocopa	.	.	.	.	701.8259	16.6309
LL-52704-Z	Lake Lorraine	5/27/2004	Arthropoda	Ostracoda	Podocopa	.	.	.	.	47.9526	5.5436
LL-52704-Z	Lake Lorraine	5/27/2004	Rotifera	Monogononta	.	Ploima	Brachionidae	Keratella	.	1.2469	127.5039
LL-52704-Z	Lake Lorraine	5/27/2004	Rotifera	Monogononta	.	Flosculariaceae	Testudinellidae	Testudinella	.	2.1799	66.5238
LL-62404-Z	Lake Lorraine	6/24/2004	Arthropoda	Branchiopoda	Phyllopoda	Diplostraca	Bosminidae	Bosmina	.	96.4703	145.6438
LL-62404-Z	Lake Lorraine	6/24/2004	Arthropoda	Branchiopoda	Phyllopoda	Diplostraca	Daphniidae	Ceriodaphnia	.	29.113	11.809
LL-62404-Z	Lake Lorraine	6/24/2004	Arthropoda	Branchiopoda	Phyllopoda	Diplostraca	Chydoridae	Chydorus	.	44.9636	51.1721
LL-62404-Z	Lake Lorraine	6/24/2004	Arthropoda	Maxillipoda	Copepoda	.	.	.	.	187.8489	247.9881
LL-62404-Z	Lake Lorraine	6/24/2004	Arthropoda	Maxillipoda	Copepoda	Cyclopoida	.	.	.	18.3375	23.6179
LL-62404-Z	Lake Lorraine	6/24/2004	Arthropoda	Maxillipoda	Copepoda	Cyclopoida	Cyclopidae	Cyclops	.	8.0047	3.9363
LL-62404-Z	Lake Lorraine	6/24/2004	Arthropoda	Ostracoda	Podocopa	.	.	.	.	166.1126	3.9363
LL-62404-Z	Lake Lorraine	6/24/2004	Arthropoda	Ostracoda	Podocopa	.	.	.	.	34.0492	3.9363
LL-62404-Z	Lake Lorraine	6/24/2004	Rotifera	Monogononta	.	Flosculariaceae	Conochilidae	Conochilus	.	0.0189	3.9363
LL-62404-Z	Lake Lorraine	6/24/2004	Rotifera	Monogononta	.	Ploima	Brachionidae	Keratella	.	0.1179	11.809
LL-62404-Z	Lake Lorraine	6/24/2004	Rotifera	Monogononta	.	Ploima	Lecanidae	Monostyla	.	0.3616	31.4905
LL-62404-Z	Lake Lorraine	6/24/2004	Rotifera	Monogononta	.	Ploima	Brachionidae	Platyias	quadricornis	0.387	7.8726
LL-62404-Z	Lake Lorraine	6/24/2004	Rotifera	Monogononta	.	Ploima	Synchaetidae	Polyarthra	.	0.5759	15.7453
LL-62404-Z	Lake Lorraine	6/24/2004	Rotifera	Monogononta	.	Flosculariaceae	Testudinellidae	Testudinella	.	11.236	240.1154
LL-62404-Z	Lake Lorraine	6/24/2004	Rotifera	Monogononta	.	Ploima	Trichocercidae	Trichocerca	.	0.262	3.9363
LL-72904-Z	Lake Lorraine	7/29/2004	Arthropoda	Branchiopoda	Phyllopoda	Diplostraca	Bosminidae	Bosmina	.	142.9566	185.1944
LL-72904-Z	Lake Lorraine	7/29/2004	Arthropoda	Branchiopoda	Phyllopoda	Diplostraca	Daphniidae	Ceriodaphnia	.	118.8002	73.1031
LL-72904-Z	Lake Lorraine	7/29/2004	Arthropoda	Maxillipoda	Copepoda	Cyclopoida	.	.	.	24.9452	38.9883
LL-72904-Z	Lake Lorraine	7/29/2004	Arthropoda	Maxillipoda	Copepoda	.	.	.	.	430.7173	526.342
LL-72904-Z	Lake Lorraine	7/29/2004	Arthropoda	Maxillipoda	Copepoda	Cyclopoida	Cyclopidae	Cyclops	.	16.2235	4.8735
LL-72904-Z	Lake Lorraine	7/29/2004	Arthropoda	Ostracoda	Podocopa	.	.	.	.	411.3265	9.7471
LL-72904-Z	Lake Lorraine	7/29/2004	Rotifera	Monogononta	.	Ploima	Brachionidae	Platyias	quadricornis	0.2395	4.8735
LL-72904-Z	Lake Lorraine	7/29/2004	Rotifera	Monogononta	.	Ploima	Synchaetidae	Polyarthra	.	0.6987	48.7354
LL-72904-Z	Lake Lorraine	7/29/2004	Rotifera	Monogononta	.	Flosculariaceae	Testudinellidae	Testudinella	.	0.8614	24.3677
LL-83104-Z	Lake Lorraine	8/31/2004	Arthropoda	Branchiopoda	Phyllopoda	Diplostraca	Bosminidae	Bosmina	.	76.1456	68.4653
LL-83104-Z	Lake Lorraine	8/31/2004	Arthropoda	Branchiopoda	Phyllopoda	Diplostraca	Daphniidae	Ceriodaphnia	.	9.0459	15.7997
LL-83104-Z	Lake Lorraine	8/31/2004	Arthropoda	Branchiopoda	Phyllopoda	Diplostraca	Chydoridae	Chydorus	.	3.065	5.2666
LL-83104-Z	Lake Lorraine	8/31/2004	Arthropoda	Maxillipoda	Copepoda	.	.	.	.	498.4498	658.3205
LL-83104-Z	Lake Lorraine	8/31/2004	Arthropoda	Maxillipoda	Copepoda	Calanoida	.	.	.	90.4637	136.9307
LL-83104-Z	Lake Lorraine	8/31/2004	Arthropoda	Maxillipoda	Copepoda	Cyclopoida	Cyclopidae	Cyclops	.	258.2792	42.1325
LL-83104-Z	Lake Lorraine	8/31/2004	Arthropoda	Ostracoda	Podocopa	.	.	.	.	1111.2451	26.3328
LL-83104-Z	Lake Lorraine	8/31/2004	Rotifera	Monogononta	.	Flosculariaceae	Conochilidae	Conochilus	.	0.1122	42.1325
LL-83104-Z	Lake Lorraine	8/31/2004	Rotifera	Monogononta	.	Ploima	Brachionidae	Keratella	.	0.0126	5.2666
LL-83104-Z	Lake Lorraine	8/31/2004	Rotifera	Monogononta	.	Ploima	Synchaetidae	Polyarthra	.	12.1935	89.5316

PhycoTech, Inc.
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info@phycotech.com - www.phycotech.com

Zooplankton Analysis with Biomass Estimates
Report and Data Set

Customer ID : 184
Calc Type : Zooplankton - Tow Volume Calculated (Field Method)

Tracking Code: 040002-184 **Sample ID** LL-52704-Z **Replicate #** 1

Customer ID: 184 **Sample Date:** 5/27/2004 **Level** Epi

Job Number: 1 **Station:** . **Depth** 0

System Name: Lake Lorraine **Site:** Mid-Lake **Preservative** Ethanol

Report Notes .

Taxa ID	*Genus*	*Species*	*Subspecies*	*Variety*	*Morph*	*Structure*	*Length* mm	*Concentration* Animal/L	*Relative Concentration*	*Total Biomass* µg/L	*Relative Total Biomass*
Phylum: Arthropoda											
Order:	**Cyclopoida**										
1000248	*.	spp	.	.	CI-CV	Whole Animal	0.7133	77.61	18.18	103.67	9.27
					TOTAL Cyclopoida			77.61	18.18	103.67	103.67
Phylum: Arthropoda											
Order:	**Diplostraca**										
128156	Ceriodaphnia	spp	.	.	All	Whole Animal	0.78	33.26	7.79	206.53	18.47
					TOTAL Diplostraca			33.26	7.79	206.53	206.53
Phylum: Arthropoda											
Order:	**Diplostraca**										
128131	Bosmina	spp	.	.	.	Whole Animal	0.3056	99.79	23.38	54.81	4.90
					TOTAL Diplostraca			99.79	23.38	54.81	54.81

☑ = Identification is uncertain

= = Subclass level identification

* = Family level identification

Phylum: Arthropoda

Order: ^Podocopa

127876	*.	spp	.	.	.	Whole Animal	0.5253	16.63	3.90	701.83	62.76
1000439	*.	spp	.	.	.	Cyst	0.28	5.54	1.30	47.95	4.29
					TOTAL	**^Podocopa**		22.17	5.19	749.78	749.78

Phylum: Rotifera

Order: Floscullariaceae

1000478	Testudinella	spp	.	.	.	Whole Animal	0.16	66.52	15.58	2.18	0.19
					TOTAL	**Floscullariaceae**		66.52	15.58	2.18	2.18

Order: Ploima

1000422	Keratella	spp	.	.	.	Whole Animal	0.114	127.50	29.87	1.25	0.11
					TOTAL	**Ploima**		127.50	29.87	1.25	1.25

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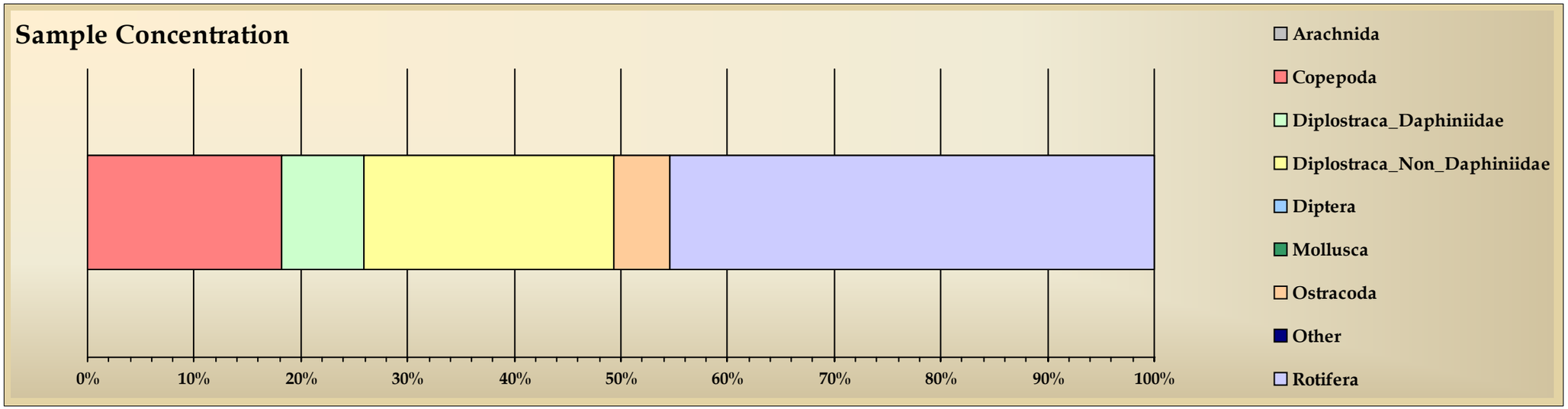
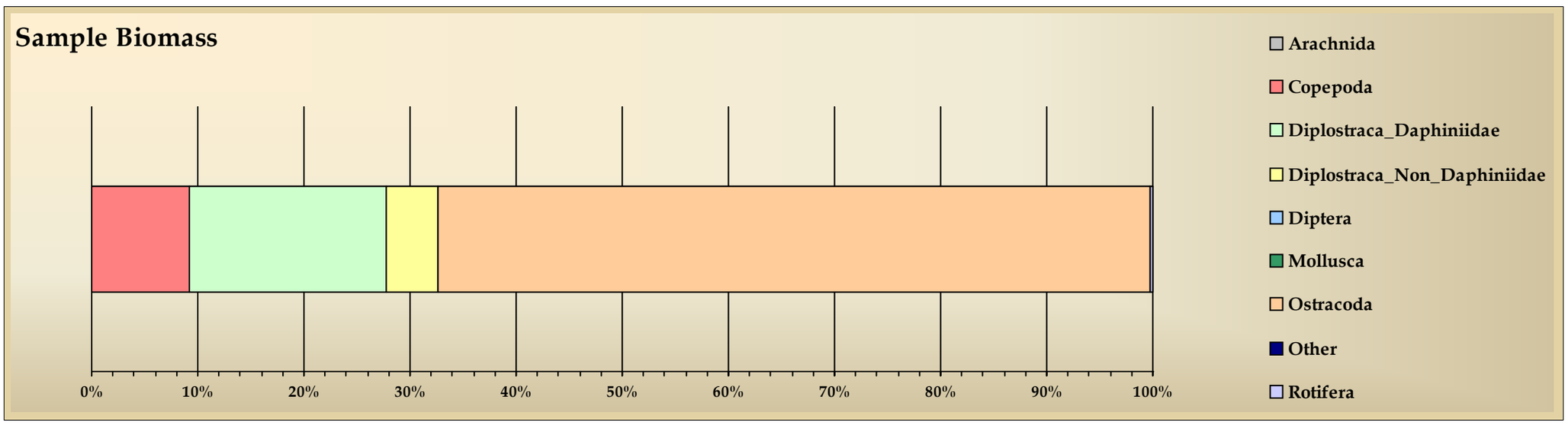
Total Sample Concentration	Total Sample Biomass
426.86	1,118.21





☑ = Identification is uncertain
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Tracking Code: 040004-184 **Sample ID** LL-62404-Z **Replicate #** 1

Customer ID: 184 **Sample Date:** 6/24/2004 **Level** Epi

Job Number: 1 **Station:** . **Depth** 4

System Name: Lake Lorraine **Site:** Mid-Lake **Preservative** Ethanol

Report Notes .

Taxa ID	*Genus*	*Species*	*Subspecies*	*Variety*	*Morph*	*Structure*	*Length* mm	*Concentration* Animal/L	*Relative Concentration*	*Total Biomass* µg/L	*Relative Total Biomass*
Phylum: Arthropoda											
Order:	**^Copepoda**										
1000303	*.	spp	.	.	.	nauplius	0.1312	247.99	30.73	187.85	31.42
					TOTAL ^Copepoda			247.99	30.73	187.85	187.85
Order:	**Cyclopoida**										
1000248	*.	spp	.	.	CI-CV	Whole Animal	0.56	23.62	2.93	18.34	3.07
128191	Cyclops	spp	.	.	.	Whole Animal	0.64	3.94	0.49	8.00	1.34
					TOTAL Cyclopoida			27.55	3.41	26.34	26.34
Phylum: Arthropoda											
Order:	**Diplostraca**										
128156	Ceriodaphnia	spp	.	.	All	Whole Animal	0.56	11.81	1.46	29.11	4.87
					TOTAL Diplostraca			11.81	1.46	29.11	29.11

☑ = Identification is uncertain
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* = Family level identification

Phylum: Arthropoda

Order: Diplostraca

128131	Bosmina	spp	.	.	.	Whole Animal	0.3267	145.64	18.05	96.47	16.14
128140	Chydorus	spp	.	.	Female	Whole Animal	0.232	51.17	6.34	44.96	7.52
					TOTAL Diplostraca			196.82	24.39	141.43	141.43

Phylum: Arthropoda

Order: ^Podocopa

127876	*.	spp	.	.	.	Whole Animal	0.48	3.94	0.49	166.11	27.78
1000439	*.	spp	.	.	.	Cyst	0.28	3.94	0.49	34.05	5.70
					TOTAL ^Podocopa			7.87	0.98	200.16	200.16

Phylum: Rotifera

Order: Flosculariaceae

1000064	Conochilus	spp	.	.	.	Whole Animal	0.08	3.94	0.49	0.02	0.00
1000478	Testudinella	spp	.	.	.	Whole Animal	0.1787	240.12	29.76	11.24	1.88
					TOTAL Flosculariaceae			244.05	30.24	11.25	11.25

Order: Ploima

1000422	Keratella	spp	.	.	.	Whole Animal	0.12	11.81	1.46	0.12	0.02
1000480	Monostyla	spp	bulla	.	.	Whole Animal	0.096	31.49	3.90	0.36	0.06
125509	Platyias	quadricornis	.	.	.	Whole Animal	0.16	7.87	0.98	0.39	0.06
131848	Polyarthra	spp	.	.	.	Whole Animal	0.108	15.75	1.95	0.58	0.10
131850	Trichocerca	spp	.	.	.	Whole Animal	0.2	3.94	0.49	0.26	0.04
					TOTAL Ploima			70.85	8.78	1.70	1.70

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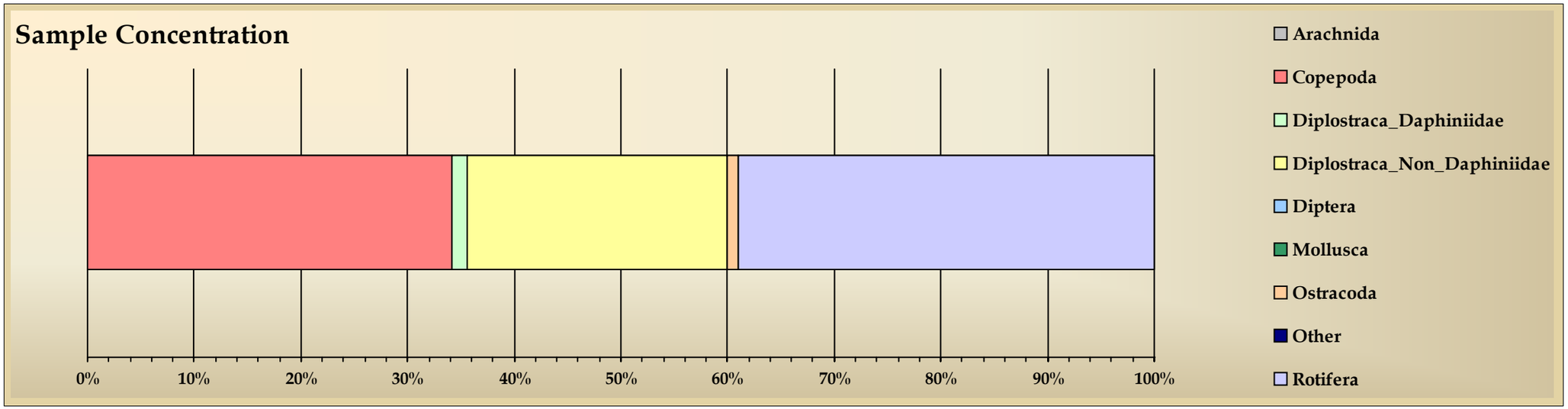
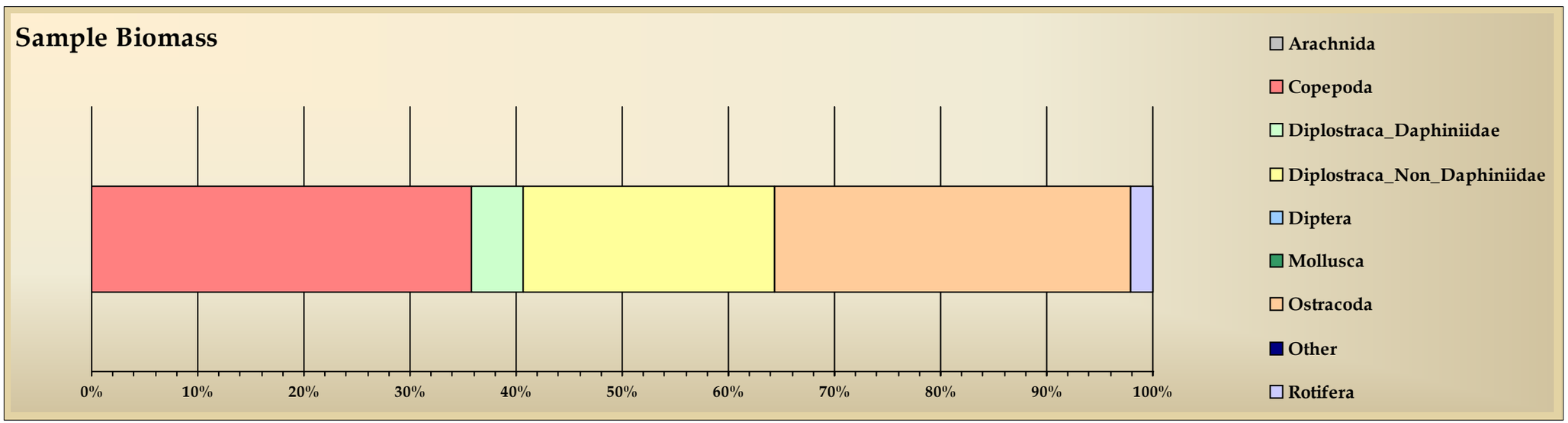
Total Sample Concentration	Total Sample Biomass
806.95	597.86





☑ = Identification is uncertain
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Tracking Code: 040012-184 **Sample ID** LL-72904-Z **Replicate #** 1

Customer ID: 184 **Sample Date:** 7/29/2004 **Level** Epi

Job Number: 1 **Station:** . **Depth** 4

System Name: Lake Lorraine **Site:** Mid-Lake **Preservative** Ethanol

Report Notes .

Taxa ID	*Genus*	*Species*	*Subspecies*	*Variety*	*Morph*	*Structure*	*Length* mm	*Concentration* Animal/L	*Relative Concentration*	*Total Biomass* µg/L	*Relative Total Biomass*
Phylum: Arthropoda											
Order:	**^Copepoda**										
1000303	*.	spp	.	.	.	nauplius	0.1488	526.34	57.45	430.72	37.56
					TOTAL ^Copepoda			526.34	57.45	430.72	430.72
Order:	**Cyclopoida**										
1000248	*.	spp	.	.	CI-CV	Whole Animal	0.54	38.99	4.26	24.95	2.18
128191	Cyclops	spp	.	.	.	Whole Animal	0.8	4.87	0.53	16.22	1.41
					TOTAL Cyclopoida			43.86	4.79	41.17	41.17
Phylum: Arthropoda											
Order:	**Diplostraca**										
128156	Ceriodaphnia	spp	.	.	All	Whole Animal	0.48	73.10	7.98	118.80	10.36
					TOTAL Diplostraca			73.10	7.98	118.80	118.80

☑ = Identification is uncertain

= = Subclass level identification

* = Family level identification

Phylum: Arthropoda

Order: Diplostraca

128131	Bosmina	spp	.	.	.	Whole Animal	0.33	185.19	20.21	142.96	12.47
					TOTAL Diplostraca			185.19	20.21	142.96	142.96

Phylum: Arthropoda

Order: ^Podocopa

127876	*.	spp	.	.	.	Whole Animal	0.52	9.75	1.06	411.33	35.87
					TOTAL ^Podocopa			9.75	1.06	411.33	411.33

Phylum: Rotifera

Order: Floscullariaceae

1000478	Testudinella	spp	.	.	.	Whole Animal	0.164	24.37	2.66	0.86	0.08
					TOTAL Floscullariaceae			24.37	2.66	0.86	0.86

Order: Ploima

125509	Platyias	quadricornis	.	.	.	Whole Animal	0.16	4.87	0.53	0.24	0.02
131848	Polyarthra	spp	.	.	.	Whole Animal	0.08	48.74	5.32	0.70	0.06
					TOTAL Ploima			53.61	5.85	0.94	0.94

☑ = Identification is uncertain
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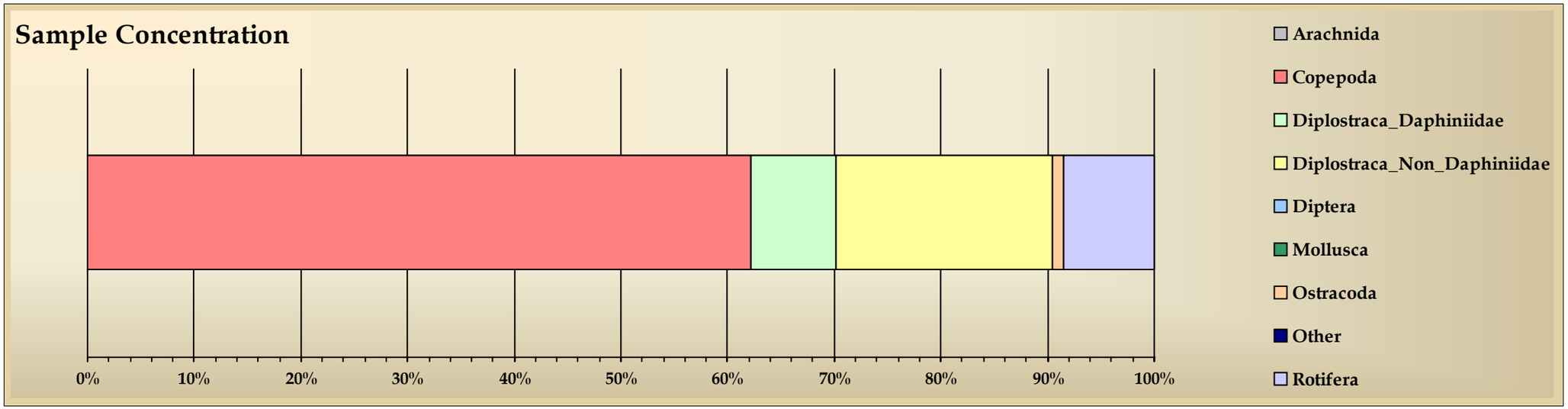
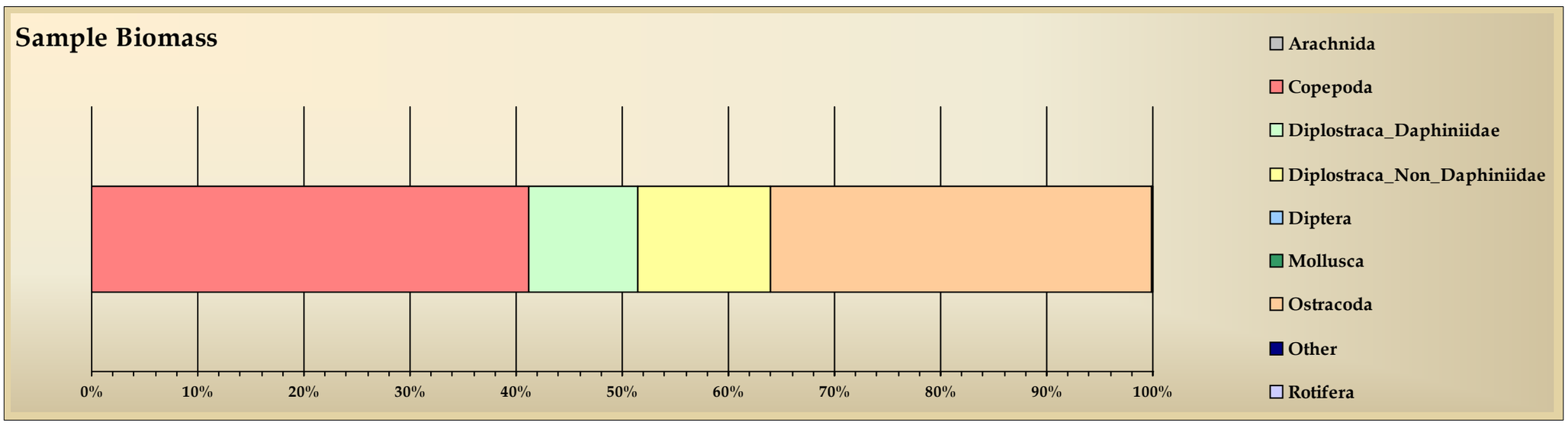
Total Sample Concentration	Total Sample Biomass
916.23	1,146.77





☑ = Identification is uncertain
= = Subclass level identification
* = Family level identification

Tracking Code: 040018-184 **Sample ID** LL-83104-Z **Replicate #** 1

Customer ID: 184 **Sample Date:** 8/31/2004 **Level** Epi

Job Number: 1 **Station:** . **Depth** 4

System Name: Lake Lorraine **Site:** Mid-Lake **Preservative** Ethanol

Report Notes .

Taxa ID	*Genus*	*Species*	*Subspecies*	*Variety*	*Morph*	*Structure*	*Length* mm	*Concentration* Animal/L	*Relative Concentration*	*Total Biomass* µg/L	*Relative Total Biomass*
Phylum: Arthropoda											
Order:	**^Copepoda**										
1000303	*.	spp	.	.	.	nauplius	0.127	658.32	60.39	498.45	24.21
					TOTAL ^Copepoda			658.32	60.39	498.45	498.45
Order:	**Calanoida**										
131853	*.	spp	.	.	.	Copepidite	0.4	136.93	12.56	90.46	4.39
					TOTAL Calanoida			136.93	12.56	90.46	90.46
Order:	**Cyclopoida**										
128191	Cyclops	spp	.	.	.	Whole Animal	1.04	42.13	3.86	258.28	12.54
					TOTAL Cyclopoida			42.13	3.86	258.28	258.28
Phylum: Arthropoda											
Order:	**Diplostraca**										
128156	Ceriodaphnia	spp	.	.	All	Whole Animal	0.3	15.80	1.45	9.05	0.44
					TOTAL Diplostraca			15.80	1.45	9.05	9.05

☑ = Identification is uncertain

= = Subclass level identification

* = Family level identification

Phylum: Arthropoda

Order: Diplostraca

128131	Bosmina	spp	.	.	.	Whole Animal	0.376	68.47	6.28	76.15	3.70
128140	Chydorus	spp	.	.	Female	Whole Animal	0.2	5.27	0.48	3.07	0.15
					TOTAL Diplostraca			73.73	6.76	79.21	79.21

Phylum: Arthropoda

Order: ^Podocopa

127876	*.	spp	.	.	.	Whole Animal	0.16	26.33	2.42	1,111.25	53.97
					TOTAL ^Podocopa			26.33	2.42	1,111.25	1,111.25

Phylum: Rotifera

Order: Floscullariaceae

1000064	Conochilus	spp	.	.	.	Whole Animal	0.1	42.13	3.86	0.11	0.01
					TOTAL Floscullariaceae			42.13	3.86	0.11	0.11

Order: Ploima

1000422	Keratella	spp	.	.	.	Whole Animal	0.08	5.27	0.48	0.01	0.00
131848	Polyarthra	spp	.	.	.	Whole Animal	0.16	89.53	8.21	12.19	0.59
					TOTAL Ploima			94.80	8.70	12.21	12.21

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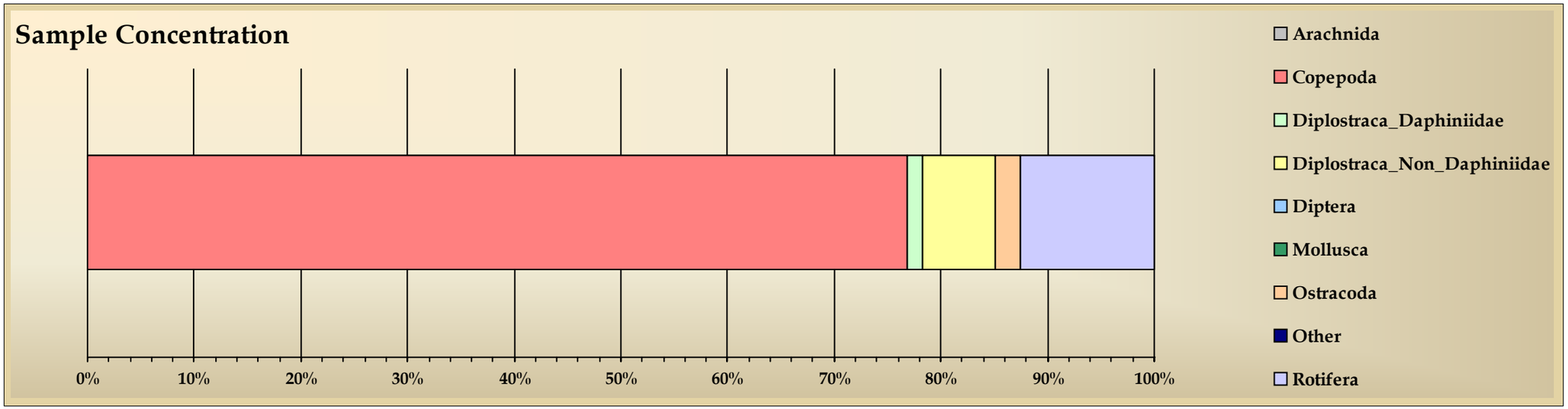
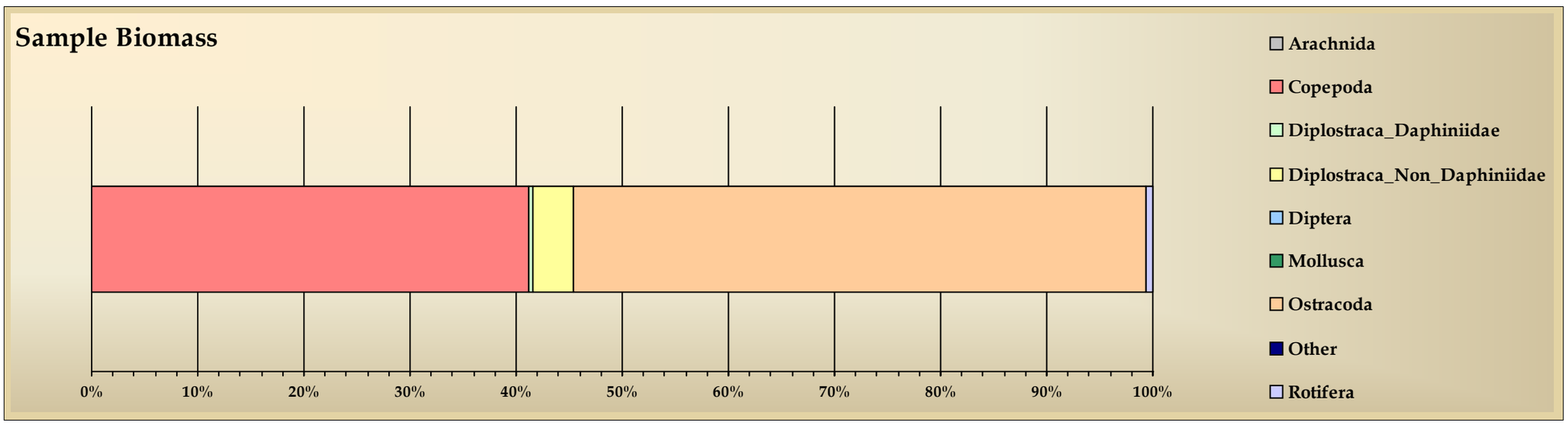
* = Family level identification

Total Sample Concentration	Total Sample Biomass
1,090.18	2,059.01





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Species List

Taxa Code	Genus	Species	Subspecies	Variety	Form	Morph	Structure	Authority
Order : Calanoida								
131853	.	spp	.	.	.	.	Copepidite	Esterley 1911
1000248	.	spp	.	.	.	CI-CV	Whole Animal	Burmeister, 1834
1000303	.	spp	.	.	.	.	nauplius	Esterley 1911
128191	Cyclops	spp	.	.	.	.	Whole Animal	Muller, 1785
Order : Diplostraca								
128156	Ceriodaphnia	spp	.	.	.	All	Whole Animal	Mean of C. lacustris, C. quadrangula and C. reticulata; multiple sources
Order : Diplostraca								
128131	Bosmina	spp	.	.	.	.	Whole Animal	Baird, 1845
128140	Chydorus	spp	.	.	.	Female	Whole Animal	Leach, 1843
Order : ^Podocopa								
127876	.	spp	.	.	.	.	Whole Animal	Hoff 1942
1000439	.	spp	.	.	.	.	Cyst	Hoff 1942
Order : Floscullariaceae								
1000064	Conochilus	spp	.	.	.	.	Whole Animal	Rousselet 1892
1000422	Keratella	spp	.	.	.	.	Whole Animal	(Ehrenberg 1834)
1000480	Monostyla	spp	bulla	.	.	.	Whole Animal	Ehrenberg
125509	Platyias	quadricornis	.	.	.	.	Whole Animal	(Ehrenberg 1832)
131848	Polyarthra	spp	.	.	.	.	Whole Animal	Carlin 1943
1000478	Testudinella	spp	.	.	.	.	Whole Animal	(Hermann 1783)
131850	Trichocerca	spp	.	.	.	.	Whole Animal	Lamarck, 1901

☑ = Identification is uncertain

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040018-184

Appendix D:
WiLMS Model Reports

Date: 3/3/2006 Scenario: 1

Lake Id: 777500

Watershed Id: 0

Hydrologic and Morphometric Data

Tributary Drainage Area: 1366.5 acre
Total Unit Runoff: 8.00 in.
Annual Runoff Volume: 911.0 acre-ft
Lake Surface Area <As>: 113.0 acre
Lake Volume <V>: 560.0 acre-ft
Lake Mean Depth <z>: 5.0 ft
Precipitation - Evaporation: 4.2 in.
Hydraulic Loading: 950.5 acre-ft/year
Areal Water Load <qs>: 8.4 ft/year
Lake Flushing Rate <p>: 1.70 1/year
Water Residence Time: 0.59 year
Observed spring overturn total phosphorus (SPO): 168.0 mg/m^3
Observed growing season mean phosphorus (GSM): 70.0 mg/m^3
% NPS Change: 0%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre	Low	Most Likely	High	Loading %	Low	Most Likely	High
	(ac)	Loading (kg/ha-year)				Loading (kg/year)		
Row Crop AG	625.6	0.50	1.00	3.00	75.6	127	253	760
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	454.6	0.10	0.30	0.50	16.5	18	55	92
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	0.0	0.05	0.10	0.25	0.0	0	0	0
Wetlands	33.1	0.10	0.10	0.10	0.4	1	1	1
Forest	253.2	0.05	0.09	0.18	2.8	5	9	18
Lake Surface	113.0	0.10	0.30	1.00	4.1	5	14	46

POINT SOURCE DATA

Point Sources	Water Load	Low	Most Likely	High	Loading %
	(m^3/year)	(kg/year)	(kg/year)	(kg/year)	

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.30	0.50	0.80	
# capita-years	47.0				
% Phosphorous Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.28	2.35	7.52	0.7

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	344.6	738.6	2038.3	100.0
Total Loading (kg)	156.3	335.0	924.6	100.0
Areal Loading (lb/ac-year)	3.05	6.54	18.04	
Areal Loading (mg/m^2-year)	341.81	732.58	2021.81	
Total PS Loading (lb)	0.0	0.0	0.0	
Total PS Loading (kg)	0.0	0.0	0.0	
Total NPS Loading (lb)	333.9	703.1	1920.9	
Total NPS Loading (kg)	151.5	318.9	871.3	

Date: 3/3/2006 Scenario: 2

Lake Id: 777500
Watershed Id: 0

Hydrologic and Morphometric Data

Tributary Drainage Area: 1366.5 acre
Total Unit Runoff: 8.00 in.
Annual Runoff Volume: 911.0 acre-ft
Lake Surface Area <As>: 113.0 acre
Lake Volume <V>: 560.0 acre-ft
Lake Mean Depth <z>: 5.0 ft
Precipitation - Evaporation: 4.2 in.
Hydraulic Loading: 950.5 acre-ft/year
Areal Water Load <qs>: 8.4 ft/year
Lake Flushing Rate <p>: 1.70 1/year
Water Residence Time: 0.59 year
Observed spring overturn total phosphorus (SPO): 168.0 mg/m^3
Observed growing season mean phosphorus (GSM): 70.0 mg/m^3
% NPS Change: -25%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre	Low	Most Likely	High	Loading %	Low	Most Likely	High
	(ac)	Loading (kg/ha-year)				Loading (kg/year)		
Row Crop AG	625.6	0.50	1.00	3.00	74.4	95	190	570
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	454.6	0.10	0.30	0.50	16.2	14	41	69
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	0.0	0.05	0.10	0.25	0.0	0	0	0
Wetlands	33.1	0.10	0.10	0.10	0.4	1	1	1
Forest	253.2	0.05	0.09	0.18	2.7	4	7	14
Lake Surface	113.0	0.10	0.30	1.00	5.4	5	14	46

POINT SOURCE DATA

Point Sources	Water Load	Low	Most Likely	High	Loading %
	(m^3/year)	(kg/year)	(kg/year)	(kg/year)	

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.30	0.50	0.80	
# capita-years	47.0				
% Phosphorous Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.28	2.35	7.52	0.9

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	261.1	562.8	1558.1	100.0
Total Loading (kg)	118.4	255.3	706.7	100.0
Areal Loading (lb/ac-year)	2.31	4.98	13.79	
Areal Loading (mg/m^2-year)	259.01	558.22	1545.47	
Total PS Loading (lb)	0.0	0.0	0.0	
Total PS Loading (kg)	0.0	0.0	0.0	
Total NPS Loading (lb)	250.4	527.3	1440.7	
Total NPS Loading (kg)	113.6	239.2	653.5	

Date: 3/3/2006 Scenario: 3

Lake Id: 777500

Watershed Id: 0

Hydrologic and Morphometric Data

Tributary Drainage Area: 1366.5 acre
Total Unit Runoff: 8.00 in.
Annual Runoff Volume: 911.0 acre-ft
Lake Surface Area <As>: 113.0 acre
Lake Volume <V>: 560.0 acre-ft
Lake Mean Depth <z>: 5.0 ft
Precipitation - Evaporation: 4.2 in.
Hydraulic Loading: 950.5 acre-ft/year
Areal Water Load <qs>: 8.4 ft/year
Lake Flushing Rate <p>: 1.70 1/year
Water Residence Time: 0.59 year
Observed spring overturn total phosphorus (SPO): 168.0 mg/m^3
Observed growing season mean phosphorus (GSM): 70.0 mg/m^3
% NPS Change: -50%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre	Low	Most Likely	High	Loading %	Low	Most Likely	High
	(ac)	**Loading (kg/ha-year)**				**Loading (kg/year)**		
Row Crop AG	625.6	0.50	1.00	3.00	72.1	63	127	380
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	454.6	0.10	0.30	0.50	15.7	9	28	46
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	0.0	0.05	0.10	0.25	0.0	0	0	0
Wetlands	33.1	0.10	0.10	0.10	0.4	1	1	1
Forest	253.2	0.05	0.09	0.18	2.6	3	5	9
Lake Surface	113.0	0.10	0.30	1.00	7.8	5	14	46

POINT SOURCE DATA

Point Sources	Water Load	Low	Most Likely	High	Loading %
	(m^3/year)	**(kg/year)**	**(kg/year)**	**(kg/year)**	

SEPTIC TANK DATA

Description	**Low**	**Most Likely**	**High**	**Loading %**
Septic Tank Output (kg/capita-year)	0.30	0.50	0.80	

# capita-years	47.0					
% Phosphorous Retained by Soil		98.0	90.0	80.0		
Septic Tank Loading (kg/year)		0.28	2.35	7.52	1.3	

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	177.6	387.0	1077.8	100.0
Total Loading (kg)	80.6	175.5	488.9	100.0
Areal Loading (lb/ac-year)	1.57	3.42	9.54	
Areal Loading (mg/m^2-year)	176.21	383.86	1069.13	
Total PS Loading (lb)	0.0	0.0	0.0	
Total PS Loading (kg)	0.0	0.0	0.0	
Total NPS Loading (lb)	166.9	351.6	960.4	
Total NPS Loading (kg)	75.7	159.5	435.7	

Date: 3/3/2006 Scenario: 4

Lake Id: 777500
Watershed Id: 0

Hydrologic and Morphometric Data

Tributary Drainage Area: 1366.5 acre
Total Unit Runoff: 8.00 in.
Annual Runoff Volume: 911.0 acre-ft
Lake Surface Area <As>: 113.0 acre
Lake Volume <V>: 560.0 acre-ft
Lake Mean Depth <z>: 5.0 ft
Precipitation - Evaporation: 4.2 in.
Hydraulic Loading: 950.5 acre-ft/year
Areal Water Load <qs>: 8.4 ft/year
Lake Flushing Rate <p>: 1.70 1/year
Water Residence Time: 0.59 year
Observed spring overturn total phosphorus (SPO): 168.0 mg/m^3
Observed growing season mean phosphorus (GSM): 70.0 mg/m^3
% NPS Change: -75%
% PS Change: 0%

NON-POINT SOURCE DATA

Land Use	Acre	Low	Most Likely	High	Loading %	Low	Most Likely	High
	(ac)	|---- Loading (kg/ha-year) ----|				|----- Loading (kg/year) ----|		

Row Crop AG	625.6	0.50	1.00	3.00	66.1	32	63	190
Mixed AG	0.0	0.30	0.80	1.40	0.0	0	0	0
Pasture/Grass	454.6	0.10	0.30	0.50	14.4	5	14	23
HD Urban (1/8 Ac)	0.0	1.00	1.50	2.00	0.0	0	0	0
MD Urban (1/4 Ac)	0.0	0.30	0.50	0.80	0.0	0	0	0
Rural Res (>1 Ac)	0.0	0.05	0.10	0.25	0.0	0	0	0
Wetlands	33.1	0.10	0.10	0.10	0.3	0	0	0
Forest	253.2	0.05	0.09	0.18	2.4	1	2	5
Lake Surface	113.0	0.10	0.30	1.00	14.3	5	14	46

POINT SOURCE DATA

Point Sources	Water Load (m^3/year)	Low (kg/year)	Most Likely (kg/year)	High (kg/year)	Loading %

SEPTIC TANK DATA

Description		Low	Most Likely	High	Loading %
Septic Tank Output (kg/capita-year)		0.30	0.50	0.80	
# capita-years	47.0				
% Phosphorous Retained by Soil		98.0	90.0	80.0	
Septic Tank Loading (kg/year)		0.28	2.35	7.52	2.5

TOTALS DATA

Description	Low	Most Likely	High	Loading %
Total Loading (lb)	94.2	211.2	597.6	100.0
Total Loading (kg)	42.7	95.8	271.1	100.0
Areal Loading (lb/ac-year)	0.83	1.87	5.29	
Areal Loading (mg/m^2-year)	93.41	209.50	592.79	
Total PS Loading (lb)	0.0	0.0	0.0	
Total PS Loading (kg)	0.0	0.0	0.0	
Total NPS Loading (lb)	83.5	175.8	480.2	
Total NPS Loading (kg)	37.9	79.7	217.8	

Expanded Trophic Response Module

Date: 3/2/2006 Scenario: 1
Total Phosphorus: 70 mg/m^3
Growing Season
Chorophyll a: 22 mg/m^3
Secchi Disk Depth: 1.5 m

Wisconsin Regional Prediction Equations:

		Stratified		Mixed	
	Region	Seepage	Drainage	Seepage	Drainage
Use Chlorophyll_a To Predict	South	1.2	1.1	0.8	0.7
Secchi Disk Depth (m)	Central	1.9	1.2	0.6	No Data
	North	1.6	1.2	1.3	1.2
Use Total Phosphorus To	South	1.2	0.8	0.6	0.6
Predict Secchi Disk Depth (m)	Central	2.7	0.4	0.6	No Data
	North	1.8	1.0	1.1	0.8
Use Total Phosphorus To	South	15.0	45.1	22.3	28.9
Predict Chlorophyll_a (mg/m^3))	Central	13.6	121.5	21.3	No Data
	North	8.2	19.9	16.3	12.3