2005

SHELBYVILLE LAKE

WATER QUALITY

REPORT

U.S. ARMY CORPS OF ENGINEERS, ST. LOUIS DISTRICT
ENVIRONMENTAL QUALITY SECTION – WATER QUALITY

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WATER QUALITY MONITORING PROGRAM

1.0 GENERAL OVERVIEW

This report summarizes water quality activities of the St. Louis District for Fiscal Year 2005 in accordance with ER 1110-2-8154 Water Quality & Environmental management for Corps Civil Works Projects and ETL 1110-2-362 Environmental Engineering Initiatives for Water Management.

Water quality monitoring remains one of the Sections major responsibilities. The objective is to maintain a reasonable environmental monitoring program for the Mississippi River and the 5 lakes under the St. Louis District's control. The District's reservoirs consist of Mark Twain and Wappapello Lakes in Missouri, and Shelbyville, Carlyle and Rend Lakes in Illinois. Water quality sampling is conducted within the lakes and their tributaries to establish trend analysis and maintain water quality at or above state and federal regulations.

The main objective is to provide technical expertise of an environmental nature to all Corps elements requesting assistance in accordance with ER 1110-2-8154. This would include updating the water quality management priorities for the district's projects to ensure water quality meets the state and federal regulations, for protection of human health and the environment, and for the safety and economic welfare of those at Corps projects. Ongoing goals include ensuring that downstream water quality meets all state and federal regulations, is suitable for aquatic and human life, and continue to evaluate trend analysis in relation to baseline conditions at all projects.

1.1 INTRODUCTION

Shelbyville Lake is within the Kaskaskia River basin in central Illinois. The lake serves as a heavy recreational usage lake. The land surrounding the lake is used predominately for agriculture. Surrounding communities have existing industrial/commercial operations and residents which discharge wastewater into municipal wastewater treatment plants which ultimately discharge treated water into the Kaskaskia River basin. Agricultural runoff and municipal wastewater treatment facilities are the primary potential source of pollution into the Shelbyville Lake watershed. Additional sources are marinas, recreational watercraft discharges and wildlife fecal material runoff.

Water quality monitoring was conducted during 2005 to assure the safe conditions for human recreation, wildlife and aquatic life was maintained and managed within the lake system. The 2005 water quality monitoring program began in March and continued through September. During each sampling period one site was selected for quality control duplication and denoted as SBV-15. The locations of the six sampling sites are depicted on the lake map in Figure 1.

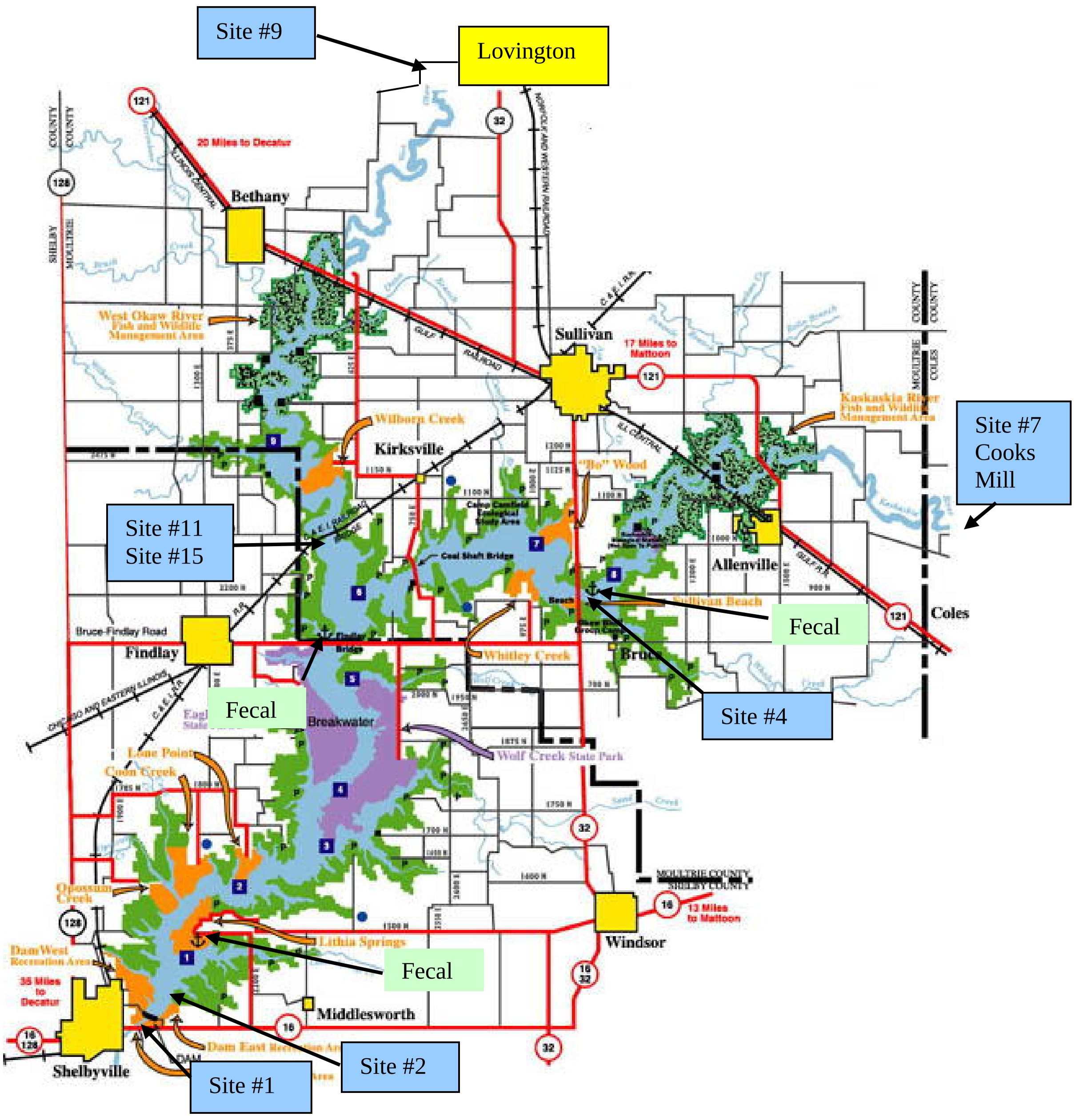


Figure 1
Location of sample sites

2.0 WATER QUALITY ASSESSMENT CRITERIA

The water quality assessment criteria were based upon the State of Illinois regulatory limits for certain contaminants, which has been generally accepted criteria for sustaining adequate aquatic plant and animal growth. The samplings and analysis which were conducted at the Shelbyville Lake sites reflect the minimal set of parameters needed to analyze the current status of water quality for the Shelbyville Lake system.

The following parameters were analyzed in the Fiscal Year 2005 samplings at Shelbyville Lake: Total Organic Carbon (TOC), iron, manganese, ammonia-nitrogen, nitrate-nitrogen, orthophosphate, total phosphate, Total Suspended Solids (TSS), Total Volatile Suspended Solids (TVSS), fecal coliform, pH, temperature, dissolved oxygen, specific conductance, oxidation-reduction potential (ORP), chlorophyll, pheophytin-a, atrazine and alachlor,

The Illinois Environmental Protection Agency in Title 35, Subtitle, C, classifies water quality criteria based on end usage. Subpart B contains regulations for general use water, while subparts C and D delineate those for public and food processing water and secondary contact and indigenous aquatic life standards, respectively. These standards are used to determine the aquatic water quality of the lake. Table 2.1 provides a listing of the regulatory limits for the parameters analyzed where a limit has been established.

TABLE 2.1

State of Illinois
Water Quality Standards

PARAMETER	LIMIT
Temperature	Rise < 2.8^{o}C
Ammonia Nitrogen	< 15 mg/L
Nitrate Nitrogen	10 mg/L
Iron	2.0 mg/L
Manganese	1.0 mg/L
Phosphorous as Phosphate	0.05 mg/L
Fecal Coliform	< 200 colonies/100 ml
pH	Range: 6.5 to 9.0
DO	> 5.0 mg/L
Atrazine	0.003 mg/L (Drinking Water Standard)
Alachlor	0.002 mg/L (Drinking Water Standard)

Nitrogen is an essential component of proteins, genetic material, chlorophyll, and other key organic molecules. All organisms require nitrogen in order to survive. Nitrogen exists in several forms. These forms include gaseous nitrogen (N_2), nitrites (NO_2), nitrate (NO_3), ammonia nitrogen (NH_3-N), and ammonium (NH_4). Ammonia can be toxic to fish and other aquatic organisms at certain levels. Unlike ammonia, ammonium (NH4) is not toxic to aquatic organisms and is readily available for uptake by plankton and macrophytes. Nitrogen levels have increased as human activities have accelerated the rate of fixed nitrogen being put into circulation. High nitrogen levels can cause eutrophication. Eutrophication increases biomass of phytoplankton, decrease water transparency, and causes oxygen depletion. Ammonia nitrogen is monitored so that the effects on fish spawning, hatching, growth rate and pathologic changes in gills, liver and kidney tissue can be related to the detected levels of ammonia nitrogen. Nitrate-nitrogen degrades to nitrite or produces ammonia which has a detrimental effect on aquatic life and, therefore, has been monitored to assure levels are below the regulatory "safe" limit.

Phosphate has been analyzed as phosphorus and has been monitored due to the potential for uptake by nuisance algae. Levels of phosphate can indicate the potential for rapid growth of algae (algae bloom) which can cause serious oxygen depletion during the algae decay process. Phosphorous is typically the limiting nutrient in a water body. Therefore, addition of phosphorous to the ecosystem stimulates the growth of plants and algae. Phosphorous is delivered to lakes and streams by way of storm water runoff from agricultural fields, residential property, and construction sites. Other sources of phosphorous are anaerobic decomposition of organic matter, leaking sewer systems, waterfowl, and point source pollution. The general standard for phosphorous in lake water is 0.05mg/L. Dissolved phosphorous also called ortho-phosphorous is generally found in much smaller concentrations than total phosphorous and is readily available for uptake. For this reason dissolved phosphorous concentrations are variable and difficult to use as an indicator of nutrient availability.

The metals manganese and iron are nutrients for both plants and animals. Living organisms require trace amounts of metals. However, excessive amounts can be harmful to the organism. Heavy metals exist in surface waters in three forms, colloidal, particulate, and dissolved. Water chemistry determines the rate of adsorption and desorption of metals to and from sediment. Metals are desorbed from the sediment if the water experiences increases in salinity, decreases in redox potential, or decreases in pH. Metals in surface waters can be from natural or human sources. Currently human sources contribute more metals than natural sources. Metals levels in surface water may pose a health risk to humans and the environment.

Photosynthetic activity can be hindered by the levels of total suspended solids. Total suspended solids concentrations, which cause the photosynthetic activity to be reduced by more than 10% from the seasonably established norm, can have a detrimental effect on aquatic life. Soil particles, organic material, and other debris comprise suspended solids in the water column. Secchi disk measurements are inverse to suspended solid measurements. As the total suspended solids (TSS) increase, the secchi disk depth or water transparency decreases. Total suspended solids can be an important indicator of the type and degree of turbidity. TSS measurements represent a combination of organic (volatile) and inorganic (non-volatile) particles in the water. In order to more accurately determine the types and amounts of suspended solids, volatile suspended solids (VSS) are analyzed. VSS concentration represents the organic portion of the total suspended solids. Organic material often includes plankton and additional plant and animal debris that is present in water. Total volatile solids indicate the presence of organics in suspension and, therefore, show additional demand levels of oxygen.

Chlorophyll and pheophytin-a are monitored to provide indicators of algae growth and, therefore, potential oxygen depletion activity. Chlorophyll is measured in lakes to estimate the type and amount of algal productivity in the water column. Chlorophyll a is present in green algae, blue-green algae, and in diatoms. Chlorophyll a is often used to indicate the degree of eutrophication. Chlorophyll b and c are used to estimate the extent of algal diversity and productivity. Chlorophyll b is common in green algae and is used as an auxiliary pigment for photosynthesis. Chlorophyll c is most common in diatom species and serves as an auxiliary pigment. Algal productivity and diversity can be determined by the concentrations of the individual pigments. For example high concentrations of chlorophyll a and b would indicate that green algae is abundant. High concentrations of chlorophyll a would indicate abundance of blue-green algae and concentrations of chlorophyll a and c would indicate diatoms are the dominant species. Chlorophyll production is currently being connected with hypoxia.

Fecal coliform bacteria is monitored for the protection of human health as it relates to full body contact of recreational waters. People can be exposed to disease-causing organisms, such as bacteria, viruses and protozoa in beach and recreational waters mainly through accidental ingestion of contaminated water or through skin contact. These organisms, called pathogens, usually come from the feces of humans and other warm-blooded animals. If taken into the body, pathogens can cause various illnesses and on rare occasions, even death. Waterborne illnesses include diseases resulting from bacteria infection such as cholera, salmonellosis, and gastroenteritis, viral infections such as hepatitis, gastroenteritis, and intestinal diseases, and protozoan infections such as ameobic dysentery and giardiasis. The most commonly monitored recreational water indicator organisms are fecal coliform, Escherichia coli, (E. coli) and enterococci. Fecal coliform are bacteria that live in the intestinal tracts of warm-blooded animals. The standard for fecal coliform is less than 200 colonies per 100ml of sample water. Fecal coliform was originally recommended in 1968 by the Federal Water Pollution Control Administration (predecessor to EPA) as an effective water quality indicator organism for recreational waters. Recent studies indicate that fecal coliform show less correlation to illness than other indicator organisms such as E. coli and enterococci. The Environmental Protection Agency (EPA) currently recommends E. coli or enterococci as an indicator organism for fresh waters. Although E. coli and enterococci are more costly they may become the standard in the near furure.

Atrazine and Alachlor herbicides are commonly used agricultural chemicals which can be readily transported by rainfall runoff. Both compounds are suspected of causing cancer and, therefore, were monitored for the protection of human and aquatic health. Organic compounds include many pesticides. A pesticide can be any substance that is intended to prevent, destroy, repel, or mitigate any pest. This includes insecticides, herbicides, fungicides, fumigants, algaecides and other substances. Herbicides which are pesticides used to kill vegetation are the most widely used and sampled. Ten of the most frequently used herbicides and detected in water are Atrazine, Metolachlor, Alachlor, 2,4-D, Trifluralin, Glyphosate, Dicamba, Cyanazine, Simazine, and 2,4,5-T. Two of the most widely used pesticides are Atrazine and Alachlor. Atrazine is a preemergence or postemergence herbicide use to control broadleaf weeds and annual grasses. Atrazine is most commonly detected in ground and surface water due to its wide use, and its ability to persist in soil and move in water. Alachlor is a Restricted Use Pesticide (RUP) due to the potential to contaminate groundwater. The drinking water standard for Atrazine is 0.003mg/L and 0.002 mg/L for Alachlor.

Temperature, dissolved oxygen and pH are monitored for the protection of aquatic life.

Temperature is important because it controls several aspects of water quality. Colder water hold more dissolved oxygen which is required by aquatic organisms. Plants grow more rapidly and use more oxygen in warmer water. Decomposition of organic matter which uses oxygen is accelerated in warmer water. Temperature can also determine the availability of toxic compounds such as ammonia. Since aquatic organisms are cold blooded, water temperature regulates their metabolism and ability to survive. The number and kinds of organisms that are found in streams or lakes is directly related to temperature. Certain organisms require a specific temperature range, such as trout, which require water temperatures below 20^oC. Most aquatic organisms require a minimum concentration of dissolved oxygen to survive. In spring, surface waters of the lake mix with the water below through wind and thermal action. This mixing diminishes as the upper layer of water becomes warmer and less dense. Solar insulation during the summer months stratifies the lake into three zones. The upper warmer water zone is called the epilimnion and the lower cooler water zone is called the hypolimnion. The epilimnion and the hypolimnion zones are divided by a transition zone known as the metalimnion. The thermocline located within the metalimnion exhibits a rapid change in water temperature. During the summer months the hypolimnion may become anaerobic. In this anaerobic zone, chemical reduction of iron and manganese, or the production of methane and sulfides can occur. Iron rapidly oxidizes in aerobic environments, but manganese oxidizes slowly and can remain in the reduced state for long distances down stream even in aerobic environments. The degree of acidity of water is measured by a logarithmetic scale ranging from 0 to 14 and is known as the pH scale. A reading of 7 indicates neutrality and readings below seven are acidic and above are alkaline. Most Illinois lakes range from 6 to 9 on the pH scale. The buffering capacity of water is the ability to neutralize acid better known as alkalinity. A high alkalinity concentration indicates an increased ability to neutralize pH and resist changes, whereas a low alkalinity concentration indicates that a water body is vulnerable to changes in pH.

Conductivity is a measure of a water's ability to conduct an electrical current. The ability to carry a current is often driven by the dissolved materials present in a water column. These materials can include dissolved ions and other materials in the water and thus are directly proportional to the concentration of total dissolved solids (TDS) present in the water column. Typically TDS concentrations represent 50-60% of the conductivity measurements.

Redox or Oxidation-Reduction Potential (ORP) is a measurement to oxidize materials. Oxidation involves an exchange of electrons between 2 atoms. The atom that loses an electron is oxidized and the one that gains an electron is reduced. ORP sensors measure the electrochemical potential between the solution and a reference electrode. Readings are expressed in millivolts with positive readings indicating increased oxidizing potential and negative readings being increased reduction. The ORP probe is essentially a millivolt meter, measuring the voltage across 2 electrodes with the water in between.

Water clarity is intuitively used by the public to judge water quality. Secchi depth has been used for many years as a limnological characterization tool for characterizing water clarity. Secchi depth is a measure of light penetration into a waterbody and is a function of the absorption and scattering of light in the water. There are three characteristics of water which affect the penetration of light. The three factors are the color of water, amount of phytoplankton in the water column, and amount of inorganic material in the water column. Secchi depth integrates the combined impacts of all the factors which influence water clarity. Water transparency was measured using a Secchi disk. Secchi disk readings were taken at all lake sites.

3.0 SUMMARY OF MONITORING RESULTS

The seasonal change brought on gradual lake stratification during the summer months. Fecal coli are sampled at the marinas to ensure that the marina areas are not being contaminated by boats with restroom facilities. Bacteria levels for all the marinas were below the Illinois standard of 200 colonies/100ml of sample water for the sampling period, April through September. The increase at this site may be attributed to the warm summer temperatures and the high usage of the facility. Due to a malfunction of the sonde, field data for March 1 was limited.

Total iron and total manganese are sampled above the dam near the bottom of the channel (SBV-2-10) and in the spillway area (SBV-1). As was previously stated living organisms require trace amounts of metals, however excessive amounts can be harmful to the organism. Neither iron nor manganese exceeded the Illinois Water Quality Standard at Shelbyville during 2005. Iron cycling is a function of oxidation-reduction processes. Elevated levels of iron near the bottom of a lake is not immediately detrimental to the overall lake system. Iron oxidizes relatively rapidly (minutes to hours); therefore any iron released through the spillway will be oxidized in a short period of time.

Nitrogen and phosphates are sampled at all sites. The 2005 phosphate results at all sites are above the 0.05 mg/L standard. Because phospherous in water is not considered directly toxic to humans and animals no drinking water standards have been established for phosphorous. However, phosphorous can cause health threats through the stimulation of toxic algal blooms and the resulting oxygen depletion. However, nitrates can pose a threat to human and animal health. Nitrate in water is toxic at high levels and has been linked to toxic effects of livestock and to blue baby disease (methemoglobinemia) in infants. The Maximum Contaminant Level (MCL) for nitrate-N in drinking water is 10mg/L to protect babies 3 to 6 months of age. The Illinois Water Quality Standard for ammonia nitrogen (NH_3-N) is 15mg/L. The increased levels of phosphate in combination with nitrogen and other lake conditions, such as temperature, pH and stagnant lake conditions, can lead to increased algae growth. Eutrophication is currently the most widespread water quality problem in the U.S. and many other countries. Restoration of eutrophic waters requires the reduction of nonpoint inputs of phosphorous and nitrogen. The resulting detrimental effects of algae toxins and oxygen depletion could result in health problems for fish and other aquatic species as well as land animals utilizing the water supply. There were no signs of any of these effects throughout 2005.

Chlorophyll *a* was sampled at 4 sites, SBV-2, SBV-4, SBV-11, and SBV-15. Chlorophyll a is a green pigment found in plants. Chlorophyll *a* concentrations are an indicator of phytoplankton abundance and biomass. They can be an effective measure of trophic status, and used as a measure of water quality. High levels often indicate poor water quality and low levels suggest good conditions. However, elevated levels are not necessarily bad. It is the long term persistence of elevated levels that is the problem. It is natural for chlorophyll *a* levels to fluctuate over time. Chlorophyll *a* tends to be higher after storm events and during the summer months when water temperatures and light levels are elevated. Chlorophyll can reduce the clarity of the water and the amount of oxygen available to other organisms. Illinois does not currently have a standard for chlorophyll. The data indicates a normal increase in chlorophyll levels during the warmer summer months, which is not a concern.

Temperature and dissolved oxygen levels were taken at all sites. Measurements were taken at 1 meter intervals at the lake sites. During the summer months the lake stratifies and a boundary is formed between the upper warmer water and the lower cooler water. This transition area is known as the thermocline, the area where the temperature drops significantly. Oxygen levels can also change drastically as a function of depth. This area where the oxygen level significantly drops is called the oxycline. The depth of the thermocline and oxycline can have an effect on the aquatic organisms. Occasionally the thermocline and oxycline are at or near the same depth.

Atrazine and Alachlor are pesticides that were sampled at all sites. These chemicals are herbicides used to control weed growth. Atrazine exceeded the 3.0ug/L standard at SBV-11 and had elevated levels at SBV-4 on May 24. The SBV-11 is located on the Okaw River arm near the C. & E. I. railroad bridge, and SBV-4 is located on the Kaskaskia River arm near Sullivan Marina. The Shelbyville Lake watershed consists largely of cropland. These substances can enter water bodies as a result of drift during spraying, surface runoff, and leaching through soil. In order to eliminate pesticide contamination of waters it is important for the public to be educated and institute best manage practices when using these chemicals.

Total Suspended Solids (TSS) and Total Volatile Suspended Solids (TVSS) samples are collected at all sites. Solids can affect water quality by increasing temperature through the absorption of sunlight by the particles in the water, which also effects the clarity of the water. This can then effect the amount of oxygen in the water. Illinois does not currently have a standard for TSS or TVSS.

Total Organic Carbon (TOC) is collected at all sites. TOC is an indicator of the organic character of water. The larger the carbon or organic content, the more oxygen is consumed. The highest values for TOC occurred in September. This may be a result of plant material, which had grown all summer and begins to decay. Illinois does not currently have a standard for TOC.

pH is taken at all sites and at 1 meter intervals at lake sites. All sites were within the 6 to 9 pH range. Variances in pH can be caused by a rainfall event.

Conductivity and redox are taken at all sites and at 1 meter intervals at lake sites. Illinois does not currently have a standard for conductivity or redox.

The monitoring program for Shelbyville Lake during Fiscal Year 2005 revealed good water quality when compared to limits established by the Illinois Environmental Protection Agency (IEPA) for general use, secondary contact, and indigenous aquatic life. Agricultural nutrient runoffs were primary concerns for the lake's water quality. Better land management practices, erosion control and buffering zones are methods used to reduce such contaminants from entering the lake. The St. Louis District personnel have been working continuously with lake personnel, area communities and other agencies in the implementation of educational programs and implementation planning to bring about the use of better management techniques to improve the lake's water quality.

4.0 PLANNED 2006 STUDIES

The Shelbyville Lake water quality monitoring will continue in Fiscal Year 2006. A total of five sampling events will be conducted between February and September in 2006. Shelbyville Lake provides water supplies to many communities and is a high usage recreational lake. The monitoring of water quality is imperative to assure the water quality is within acceptable limits for the designated usage.

The sampling plan will involve an intensive trend analysis of the contaminants entering Shelbyville Lake. The sampling sites include the following: Site 1 SBV-1 Spillway, Site 2 SBV-02 Lake side in front of Dam, Site 4 SBV-04 Kaskaskia River arm near Sullivan Marina, Site 7, SBV-7, at Cooks Mill, Site 9 SBV-9, at Hwy 32 at Lovington, and Site 11 SBV-11, Okaw River arm near the C. & E. I. railroad bridge. This combination of sites effectively represents the incoming contaminants and their effects on the lake.

A remote sensor will be installed in the spillway to allow project as well as water quality personnel to monitor temperature and oxygen readings to avoid fish kills. During low flow, water is discharged through the sluice gates from the bottom of the lake. This water is low in oxygen and can create a low oxygen area below the dam. The sensor will allow the project to track oxygen levels below the dam and make appropriate adjustments to avoid a possible fish kill. Normally allowing water to spill through the tainter gates will alleviate low oxygen levels below the dam.

APPENDIX A

DATA

LAB DATA

SITE	DEPTH (m)	DATE	STIME	TOC (mg/L)	Total Fe (mg/L)	Total Mn (mg/L)	NH_3N (mg/L)	NO_3-NO_2 (mg/L)	Ortho Phosphate (mg/L)	Total Phos (mg/L)	Total Suspended Solids (mg/L)	Total Volatile Suspended Solids (mg/L)
SVL-1	0	3/1/2005	1110	5.0	1.10	0.02	0.24	4.30	0.30	0.36	5	1
SVL-1	0	4/19/2005	0945	5.0	0.28	0.02	0.03	6.90	0.06	0.12	10	2
SVL-1	0	5/24/2005	0933	9.2	0.39	0.02	0.12	6.10	0.01	0.07	13	2
SVL-1	0	7/26/2005	0935	5.0	0.20	0.04	0.12	3.10	0.01	0.05	8	3
SVL-1	0	9/13/2005	0941	5.0	0.13	0.04	0.25	0.94	0.01	0.05	8	3
SVL-2	0	3/1/2005	1107	5.9			0.22	4.80	0.30	0.36	6	1
SVL-2	0	4/19/2005	1030	5.0			0.08	6.00	0.05	0.10	5	2
SVL-2-0	0	5/24/2005	1030	5.0			0.03	5.90	0.01	0.05	9	3
SVL-2	0	7/26/2005	1032	5.0			0.09	2.80	0.01	0.04	5	3
SVL-2	0	9/13/2005	1025	8.8			0.25	0.88	0.01	0.04	4	2
SVL-2-10	10	3/1/2005	1113	5.0	1.10	0.02	0.25	4.50	0.31	0.36	6	2
SVL-2-10	10	4/19/2005	1037	5.0	0.19	0.01	0.10	7.50	0.06	0.11	9	2
SVL-2-10	10	5/24/2005	1036	5.0	0.13	0.01	0.05	5.10	0.01	0.05	12	4
SVL-2-10	10	7/26/2005	1037	5.0	0.16	0.07	0.27	2.60	0.01	0.05	5	3
SVL-2-10	10	9/13/2005	1028	8.3	0.06	0.02	0.24	0.89	0.01	0.05	5	3
SVL-4	0	3/1/2005	1310	7.3			0.12	8.10	0.08	0.20	40	6
SVL-4	0	4/19/2005	1305	5.0			0.03	9.40	0.05	0.24	53	8
SVL-4	0	5/24/2005	1300	9.3			0.04	5.50	0.01	0.22	41	13
SVL-4	0	7/26/2005	1225	6.7			0.08	0.21	0.19	0.52	52	12
SVL-4	0	9/13/2005	1345	9.4			0.07	0.12	0.16	0.40	42	10
SVL-7	0	3/1/2005	1459	5.0			0.09	8.70	0.03	0.05	3	1
SVL-7	0	4/19/2005	1120	5.0			0.03	9.90	0.02	0.10	23	3
SVL-7	0	5/24/2005	1059	5.0			0.15	7.80	0.06	0.17	36	4
SVL-7	0	7/26/2005	1115	6.6			0.08	0.48	0.25	0.54	66	10
SVL-7	0	9/13/2005	1202	5.7			0.05	0.19	0.12	0.32	37	8
SVL-1	0	3/1/2005	1110	5.0	1.10	0.02	0.24	4.30	0.30	0.36	5	1
SVL-1	0	4/19/2005	0945	5.0	0.28	0.02	0.03	6.90	0.06	0.12	10	2

LAB DATA

SITE	DEPTH (m)	DATE	STIME	TOC (mg/L)	Total Fe (mg/L)	Total Mn (mg/L)	NH_3N (mg/L)	NO_{3-} NO_2 (mg/L)	Ortho Phosphate (mg/L)	Total Phos (mg/L)	Total Suspended Solids (mg/L)	Total Volatile Suspended Solids (mg/L)
SVL-9	0	3/1/2005	1300	5.0			0.09	9.10	0.03	0.06	8	1
SVL-9	0	4/19/2005	1203	5.0			0.03	10.50	0.01	0.04	3	1
SVL-9	0	5/24/2005	1156	9.2			0.20	9.00	0.02	0.06	28	2
SVL-9	0	7/26/2005	1206	7.7			0.03	0.13	0.15	0.40	25	7
SVL-9	0	9/13/2005	1252	11.4			0.03	0.09	0.03	0.45	102	25
SVL-11	0	3/1/2005	1230	5.0			0.18	6.40	0.19	0.24	11	2
SVL-11	0	4/19/2005	1230	5.0			0.03	7.90	0.01	0.09	18	7
SVL-11	0	5/24/2005	1200	6.2			0.06	5.60	0.01	0.14	22	6
SVL-11	0	7/26/2005	1143	5.0			0.08	1.20	0.01	0.08	13	6
SVL-11	0	9/13/2005	1411	5.0			0.03	0.07	0.01	0.14	17	9
SVL-15	0	3/1/2005	1242	6.0			0.18	6.70	0.18	0.24	10	1
SVL-15	0	4/19/2005	1236	5.0			0.03	7.90	0.01	0.10	16	6
SVL-15	0	5/24/2005	1207	5.0			0.09	5.90	0.01	0.16	23	8
SVL-15	0	7/26/2005	1147	5.0			0.06	1.30	0.01	0.08	11	5
SVL-15	0	9/13/2005	1416	10.6			0.03	0.09	0.01	0.14	18	8

LAB DATA

SITE	DEPTH (m)	DATE	STIME	Chlorophyll (mg/m^3)	Pheophytin (mg/m^3)	Atrazine (ug/L)	Alachlor (ug/L)	FECALCOL (colonies /100ml)
SVL-1	0	3/1/2005	1110			1.0	1.0	
SVL-1	0	4/19/2005	0945			1.0	1.0	
SVL-1	0	5/24/2005	0933			1.0	1.0	
SVL-1	0	7/26/2005	0935			1.0	1.0	
SVL-1	0	9/13/2005	0941			1.1	1.1	
SVL-2	0	3/1/2005	1107	5.0	5.0	1.1	1.1	
SVL-2	0	4/19/2005	1030	6.4	5.0	1.1	1.1	
SVL-2-0	0	5/24/2005	1030	14.7	5.0	1.1	1.1	
SVL-2	0	7/26/2005	1032	6.2	5.0	1.1	1.1	
SVL-2	0	9/13/2005	1025	5.3	5.0	1.0	1.0	
SVL-2-10	10	3/1/2005	1113					
SVL-2-10	10	4/19/2005	1037					
SVL-2-10	10	5/24/2005	1036					
SVL-2-10	10	7/26/2005	1037					
SVL-2-10	10	9/13/2005	1028					
SVL-4	0	3/1/2005	1310	5.1	5.0	1.1	1.1	
SVL-4	0	4/19/2005	1305	10.8	5.0	1.3	1.3	
SVL-4	0	5/24/2005	1300	101.0	16.6	2.6	1.1	
SVL-4	0	7/26/2005	1225	46.8	19.7	1.0	1.0	
SVL-4	0	9/13/2005	1345	36.3	16.1	1.1	1.1	
SVL-7	0	3/1/2005	1459			1.0	1.0	
SVL-7	0	4/19/2005	1120			1.0	1.0	
SVL-7	0	5/24/2005	1059			0.7	1.1	
SVL-7	0	7/26/2005	1115			1.0	1.0	
SVL-7	0	9/13/2005	1202			1.1	1.1	

LAB DATA

SITE	DEPTH (m)	DATE	STIME	Chlorophyll (mg/m^3)	Pheophytin (mg/m^3)	Atrazine (ug/L)	Alachlor (ug/L)	FECALCOL (colonies /100ml)
SVL-9	0	3/1/2005	SVL-9			1.0	1.0	
SVL-9	0	4/19/2005	SVL-9			1.0	1.0	
SVL-9	0	5/24/2005	SVL-9			1.0	1.0	
SVL-9	0	7/26/2005	SVL-9			1.0	1.0	
SVL-9	0	9/13/2005	SVL-9			1.1	1.1	
SVL-11	0	3/1/2005	SVL-11	5.0	5.0	1.0	1.0	
SVL-11	0	4/19/2005	SVL-11	21.5	8.0	1.1	1.1	
SVL-11	0	5/24/2005	SVL-11	38.6	7.1	6.3	1.0	
SVL-11	0	7/26/2005	SVL-11	13.9	5.0	0.6	1.0	
SVL-11	0	9/13/2005	SVL-11	26.6	8.9	1.0	1.0	
SVL-15	0	3/1/2005	SVL-15	5.0	5.0	1.0	1.0	
SVL-15	0	4/19/2005	SVL-15	17.9	8.7	1.0	1.0	
SVL-15	0	5/24/2005	SVL-15	39.0	5.2	4.8	1.1	
SVL-15	0	7/26/2005	SVL-15	16.7	5.0	0.8	1.0	
SVL-15	0	9/13/2005	SVL-15	24.1	8.1	1.1	1.1	

SITE	DEPTH (m)	DATE	STIME	Chlorophyll (mg/m^3)	Pheophytin (mg/m^3)	Atrazine (ug/L)	Alachlor (ug/L)	FECALCOL (colonies /100ml)
LS MARINA	0	4/19/2005	1005					2
LS MARINA	0	5/24/2005	1022					4
LS-MARINA	0	7/26/2005	0915					2
LS MARINA	0	9/13/2005	1010					32
FIN MARINA	0	4/19/2005	1215					40
FIN MARINA	0	5/24/2005	1143					42
FIN-MARINA	0	7/26/2005	1133					8
FIN MARINA	0	9/13/2005	1445					2
SUL MARINA	0	4/19/2005	1319					2
SUL MARINA	0	5/24/2005	1315					20
SUL MARINA	0	7/26/2005	1240					2
SUL MARINA	0	9/13/2005	1447					2

FIELD DATA

Site	Date	Depth (m)	H2OTemp (°C)	Redox (mV)	Cond (uS/cm)	pH	D.0.%	D.O.(mg/L)	Time	Seechi (in.)
SVL-1	3/1/2005	0.200	3.56	316	363	7.65	68.5	9.04	1110	
SVL-1	4/19/2005	0.616	12.81	275	498	8.41	125.4	13.06	945	
SVL-1	5/24/2005	0.79	14.5	69.9	521	8.04	112.7	11.44	9:33	
SVL-1	6/30/2005	0.43	27.8	81.2	493	8.3	96.9	7.6	0:00	
SVL-1	7/26/2005	0.612	26.61	98.2	412	7.40	115.6	9.27	935	
SVL-1	9/13/2005	0.382	24.88	81.9	345	7.5	80.1	6.61	941	
SVL-7	3/1/2005	0.763	3.97	227	646	8.21	43.4	5.68	1459	
SVL-7	4/19/2005	0.975	17.68	Not shown	652	8.1	33	3.1	1120	
SVL-7	5/24/2005	1.02	19.51	105	862	7.96	10.1	7.96	1059	
SVL-7	6/30/2005	0.35	29.3	58.4	769	8.01	86.9	6.62	1142	
SVL-7	9/13/2005	0.44	23.64	84.3	635	7.62	56.3	4.35	1202	
SVL-9	3/1/2005	1.030	2.64	297	640	8.05	28.8	3.93	1300	
SVL-9	4/19/2005	1.24	15.92	Not shown	632	8.15	37.6	3.2	1203	
SVL-9	5/24/2005	1.09	16.63	108	886	7.99	10.0	7.99	1156	
SVL-9	6/30/2005	0.48	26.9	84.6	805	7.69	108.6	7.16	1224	
SVL-9	7/26/2005	2.0	31.1	-14.4	480	7.52	16.2	1.2	1228	
SVL-9	9/13/2005	0.4	24.59	94.0	580	7.54	61.5	4.9	1252	
SVL-4	3/1/2005	0.551	4.24	73	511	6.50	130.8	17.01		
SVL-4	4/19/2005	0.145	19.57	167	661	8.14	132.8	12.45	1305	
SVL-4	4/19/2005	1	19.20	168	661	7.92	81.8	6.32		
SVL-4	5/24/2005	0.337	22.29	68.4	603	8.67	184.7	16.09	1300	11
SVL-4	5/24/2005	1.22	21.17	71.7	603	8.67	168.3	14.71		
SVL-4	6/30/2005	0.5	31.3	92.4	536	8.8	147.7	10.9	1342	
SVL-4	6/30/2005	1.2	31.3	97.4	536	8.8	148.1	10.9	1343	
SVL-4	6/30/2005	2.1	29.5	106.5	557	8.1	104	8	1344	
SVL-4	6/30/2005	3.0	29.5	108.8	556	8.4	102.4	7.4	1346	
SVL-4	6/30/2005	4.0	28.9	113.9	570	8.1	66.4	5.1	1347	
SVL-4	6/30/2005	5.2	28.2	114.9	587	7.8	32	2.3	1349	

FIELD DATA

Site	Date	Depth(m)	H2OTemp(^oC)	Redox (mV)	Cond (uS/cm)	pH	D.0.%	D.O.(mg/L)	Time	Seechi (in.)
SVL-4	7/26/2005	0.1	31.45	43.5	481	7.95	113.8	8.38	1225	
SVL-4	7/26/2005	1.0	31.38	41.9	479	7.96	105.8	7.71	1226	
SVL-4	9/13/2005	0.1	26.87	78.2	429	7.94	60.4	4.84	1345	8
SVL-4	9/13/2005	1.0	26.17	72.2	440	8.1	49.9	4.05	1346	
SVL-4	9/13/2005	2.0	25.51	69.2	489	8.1	42.7	3.45	1347	
SVL-4	9/13/2005	2.5	25.47	64.1	494	8.1	13.3	0.96	1348	
SVL-11	3/1/2005	1.970	4.38	59.0	403	6.75	115.9	15.02		
SVL-11	4/19/2005	0.05	19.14	229	530	8.48	178.7	16.37	1230	23
SVL-11	4/19/2005	1	18.90	225.2	540	8.38	164.6	15.48		
SVL-11	4/19/2005	2	18.25	226.4	553	8.30	148.6	13.96		
SVL-11	4/19/2005	3	17.84	228.1	565	8.21	134.6	12.74		
SVL-11	4/19/2005	4	17.64	229.1	570	8.16	123.7	11.84		
SVL-11	4/19/2005	5	16.95	233.2	590	7.98	97.3	9.30		
SVL-11	4/19/2005	6	17.02	232.6	587	8.03	97.4	9.47		
SVL-11	4/19/2005	7	17.04	231.9	586	8.04	101.1	9.77		
SVL-11	5/24/2005	0.22	20.82	71.0	492	8.56	126.3	11.29	1200	17
SVL-11	5/24/2005	1.123	20.48	72.4	498	8.48	120.7	10.89		
SVL-11	5/24/2005	2.048	20.05	75	501	8.42	109.8	9.96		
SVL-11	5/24/2005	3.079	19.92	76.2	502	8.41	105.8	9.63		
SVL-11	5/24/2005	4.1	19.73	77.2	504	8.37	100.0	9.03		
SVL-11	6/30/2005	0.23	30.5	108	676	8.0	135.9	10.2	1312	
SVL-11	6/30/2005	1.0	30.3	109.4	680	7.9	124.5	8.4	1313	
SVL-11	6/30/2005	2.0	29.8	111	686	7.8	103.5	7.8	1315	
SVL-11	6/30/2005	3.0	29.4	105	736	7.5	45.7	2.7	1316	
SVL-11	7/26/2005	0.27	30.73	71.8	371	8.20	136.4	10.18	1143	24
SVL-11	7/26/2005	1.02	30.68	61.2	370	8.30	138.1	10.3	1144	
SVL-11	7/26/2005	2.0	30.56	59.4	372	8.30	132.4	9.72	1145	
SVL-11	7/26/2005	3.1	30.12	58.2	375	8.18	116.9	8.45	1146	
SVL-11	7/26/2005	4.0	29.76	59.5	378	8.08	91.1	6.8	1147	

FIELD DATA

Site	Date	Depth(m)	H2OTemp(^oC)	Redox (mV)	Cond (uS/cm)	pH	D.0.%	D.O.(mg/L)	Time	Seechi (in.)
SVL-11	7/26/2005	5.0	29.62	61.9	380	7.98	75.3	5.71	1148	
SVL-11	7/26/2005	6.0	29.4	61.2	388	7.65	34.0	2.6	1149	
SVL-11	7/26/2005	7.0	29.11	-49.0	391	7.39	9.1	0.61	1150	
SVL-11	9/13/2005	0.1	26.78	8.9	326	8.66	105.2	8.38	1411	
SVL-11	9/13/2005	1.0	26.61	12.2	328	8.67	97.5	7.74	1412	
SVL-11	9/13/2005	2.0	26.37	18.1	331	8.58	76.5	6.23	1414	
SVL-11	9/13/2005	3.0	26.33	21.4	330	8.53	74.4	5.91	1415	
SVL-11	9/13/2005	4.0	26.26	25.4	327	8.45	66.3	5.21	1416	
SVL-11	9/13/2005	5.0	26.25	25.8	338	8.43	60.9	4.92	1418	
SVL-11	9/13/2005	6.0	26.21	27.4	338	8.39	56.5	4.48	1420	
SVL-11	9/13/2005	7.0	26.17	20.2	341	8.28	49.5	3.9	1421	
SVL-2	3/1/2005	0.519	3.50	81	318	10.37	90.3	11.99		
SVL-2	3/1/2005	1.585	3.48	81	312	9.76	93.9	12.47		
SVL-2	3/1/2005	2.969	4.38	82	313	9.14	93.3	12.39		
SVL-2	4/19/2005	0.20	12.87	270	497	8.48	113	12.03	1030	53
SVL-2	4/19/2005	1.0	12.85	266.9	498	8.50	111	11.82		
SVL-2	4/19/2005	2.0	12.68	266.6	499	8.48	107	11.33		
SVL-2	4/19/2005	3.0	12.51	266.1	501	8.48	105	11.38		
SVL-2	4/19/2005	4.0	12.31	266	505	8.41	101	10.78		
SVL-2	4/19/2005	5.0	12.22	266.6	505	8.40	100	10.68		
SVL-2	4/19/2005	6.0	12.19	266	503	8.40	97.9	10.49		
SVL-2	4/19/2005	7.0	12.16	266	501	8.39	98.0	10.55		
SVL-2	4/19/2005	8.0	12.12	266	501	8.38	96.4	10.51		
SVL-2	4/19/2005	9.0	12.06	266	501	8.38	97.3	10.40		
SVL-2	4/19/2005	10.0	11.79	266	501	8.27	91.5	9.96		
SVL-2	4/19/2005	11	11.50	269	501	8.24	83.6	9.29		
SVL-2	4/19/2005	12	11.23	269	502	8.19	83.6	8.97		
SVL-2	4/19/2005	13	11.20	270	502	8.02	81.1	8.69		
SVL-2	4/19/2005	14	11.05	270	503	8.01	75.3	8.29		

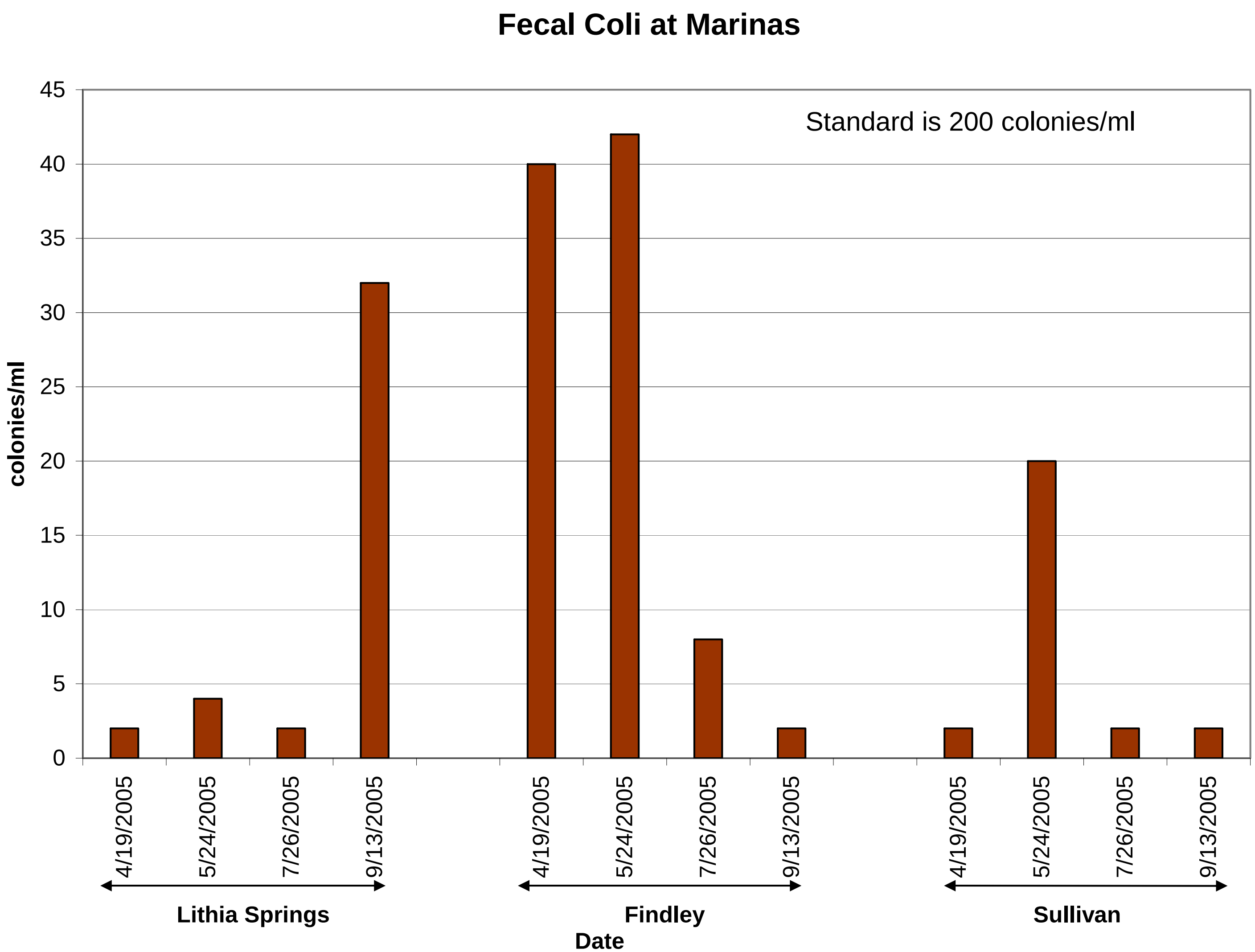
FIELD DATA

Site	Date	Depth(m)	H2OTemp(oC)	Redox (mV)	Cond (uS/cm)	pH	D.0.%	D.O.(mg/L)	Time	Seechi (in.)
SVL-2	5/24/2005	0.29	20.01	64.3	470	8.59	133.7	12.14	10:30	33
SVL-2	5/24/2005	1.17	19.91	66.1	470	8.59	132.3	12.03		
SVL-2	5/24/2005	2.17	19.81	67.2	470	8.57	129.5	11.78		
SVL-2	5/24/2005	3.3	19.77	68.7	470	8.54	124.8	11.38		
SVL-2	5/24/2005	4.2	19.77	69.4	470	8.55	126.1	11.41		
SVL-2	5/24/2005	5.2	19.71	70.2	470	8.53	123.2	11.25		
SVL-2	5/24/2005	6.2	19.69	70.7	471	8.53	122.4	11.18		
SVL-2	5/24/2005	7.04	19.61	71.1	471	8.51	120.6	11.01		
SVL-2	6/30/2005	0.11	28.5	56.3	486	8.5	140.7	11.36	1032	
SVL-2	6/30/2005	1.1	27.7	52.1	490	8.5	145.2	11.41	1033	
SVL-2	6/30/2005	2.0	27.5	53.5	491	8.5	136.8	10.8	1034	
SVL-2	6/30/2005	3.0	26.3	56.0	503	8.4	117.9	9.5	1035	
SVL-2	6/30/2005	4.0	24.7	63.1	518	8.1	67.4	5.6	1036	
SVL-2	6/30/2005	5.0	24.2	69.7	521	7.9	34.5	2.8	1037	
SVL-2	6/30/2005	6.0	23.5	73.4	523	7.7	8.0	0.7	1039	
SVL-2	6/30/2005	7.0	22.8	75.8	526	7.7	3.1	0.26	1040	
SVL-2	6/30/2005	8.0	21.8	77	529	7.6	1.8	0.16	1041	
SVL-2	6/30/2005	9.0	19.6	77	537	7.6	1.6	0.14	1042	
SVL-2	6/30/2005	10.0	18.2	78	543	7.6	1.3	0.12	1043	
SVL-2	7/26/2005	0.14	26.91	160.0	408	7.30	69.2	5.4	1032	57
SVL-2	7/26/2005	1.29	26.85	149.1	408	7.38	59.2	4.7	1033	
SVL-2	7/26/2005	2.1	26.74	143.4	408	7.38	53.6	4.27	1034	
SVL-2	7/26/2005	3.0	26.64	138.1	407	7.38	47.6	3.81	1035	
SVL-2	7/26/2005	4.1	26.15	136.3	409	7.33	23.0	1.8	1036	
SVL-2	7/26/2005	5.0	25.5	132.3	413	7.25	14.8	1.15	1037	
SVL-2	7/26/2005	6.15	24.81	129.8	417	7.18	9.9	0.8	1038	
SVL-2	7/26/2005	7.1	24.13	125.6	421	7.16	8.9	0.74	1039	
SVL-2	7/26/2005	8.1	22.61	94.0	432	7.11	7.7	0.67	1041	
SVL-2	7/26/2005	9.1	20.0	83.0	446	7.09	6.7	0.81	1042	
SVL-2	7/26/2005	10.0	19.05	66.5	439	7.06	6.000	0.53	1044	

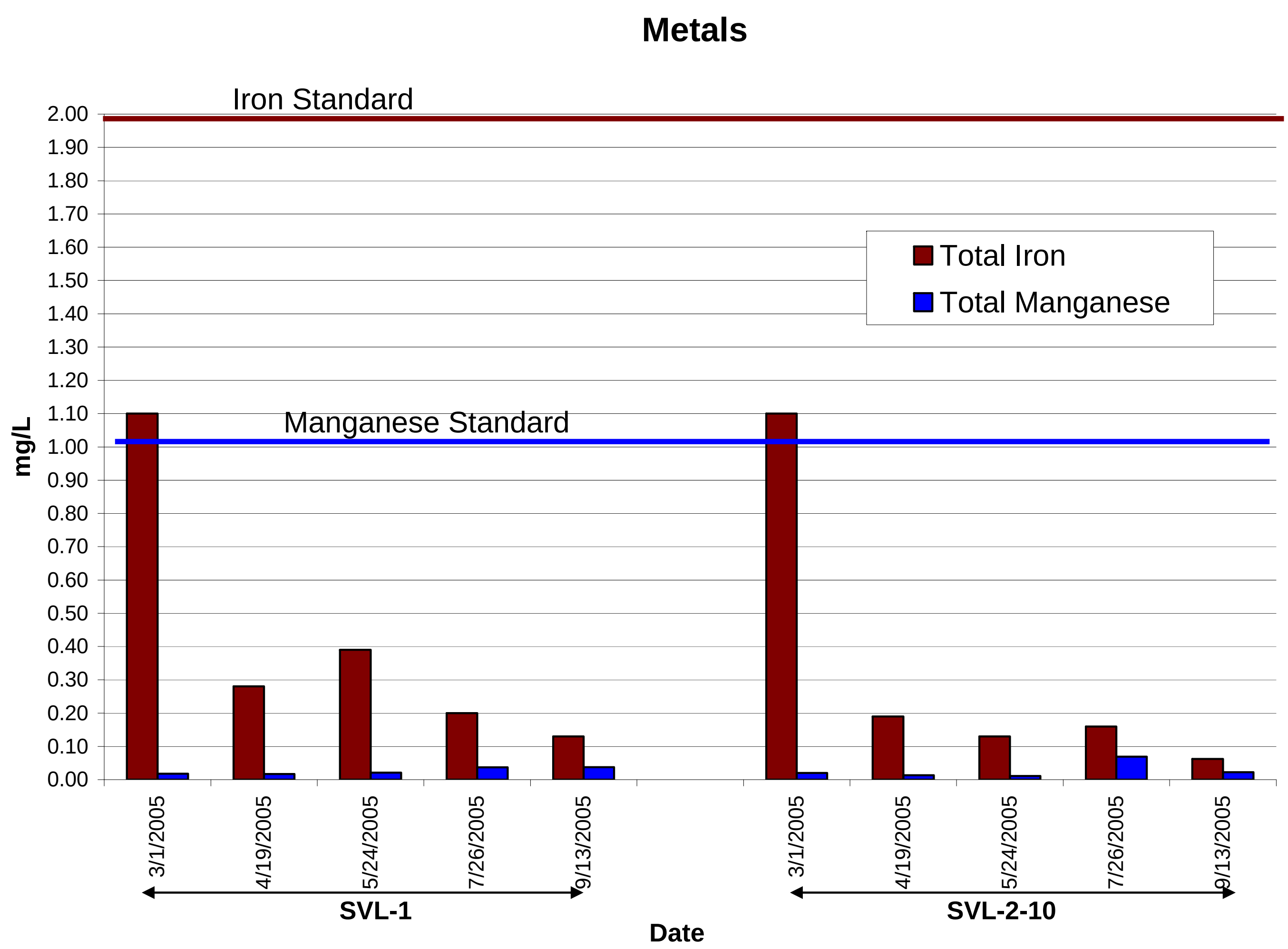
Site	Date	Depth(m)	H2OTemp(oC)	Redox (mV)	Cond (uS/cm)	pH	D.0.%	D.O.(mg/L)	Time	Seechi (in.)
SVL-2	9/13/2005	0.13	25.2	27.5	349	7.69	62.0	3.81	1025	60
SVL-2	9/13/2005	1	25.2	31.7	347	7.77	30.2	2.39	1027	
SVL-2	9/13/2005	2	25.16	28.7	347	7.82	29.2	2.42	1028	
SVL-2	9/13/2005	3	25.12	26.8	346	7.86	30.0	2.47	1029	
SVL-2	9/13/2005	4	25.08	24.9	346	7.89	31.3	2.58	1030	
SVL-2	9/13/2005	5	25.06	23.9	345	7.93	33.7	2.76	1032	
SVL-2	9/13/2005	6	25.02	24.8	348	7.86	21.2	1.72	1037	
SVL-2	9/13/2005	7	24.97	24.4	348	7.84	21.7	1.79	1039	
SVL-2	9/13/2005	8	23.6	22.6	363	7.76	11	1	1041	

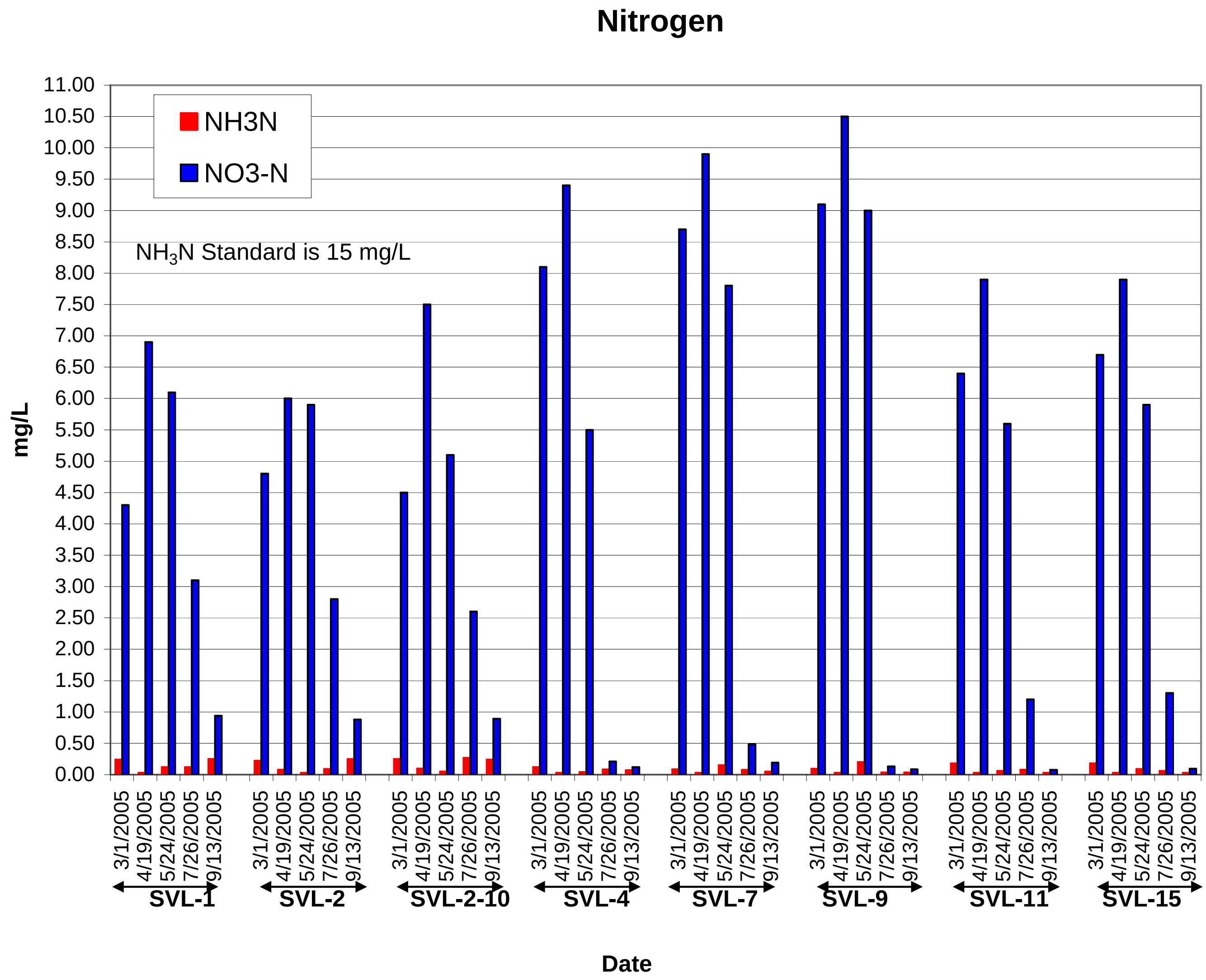
APPENDIX B

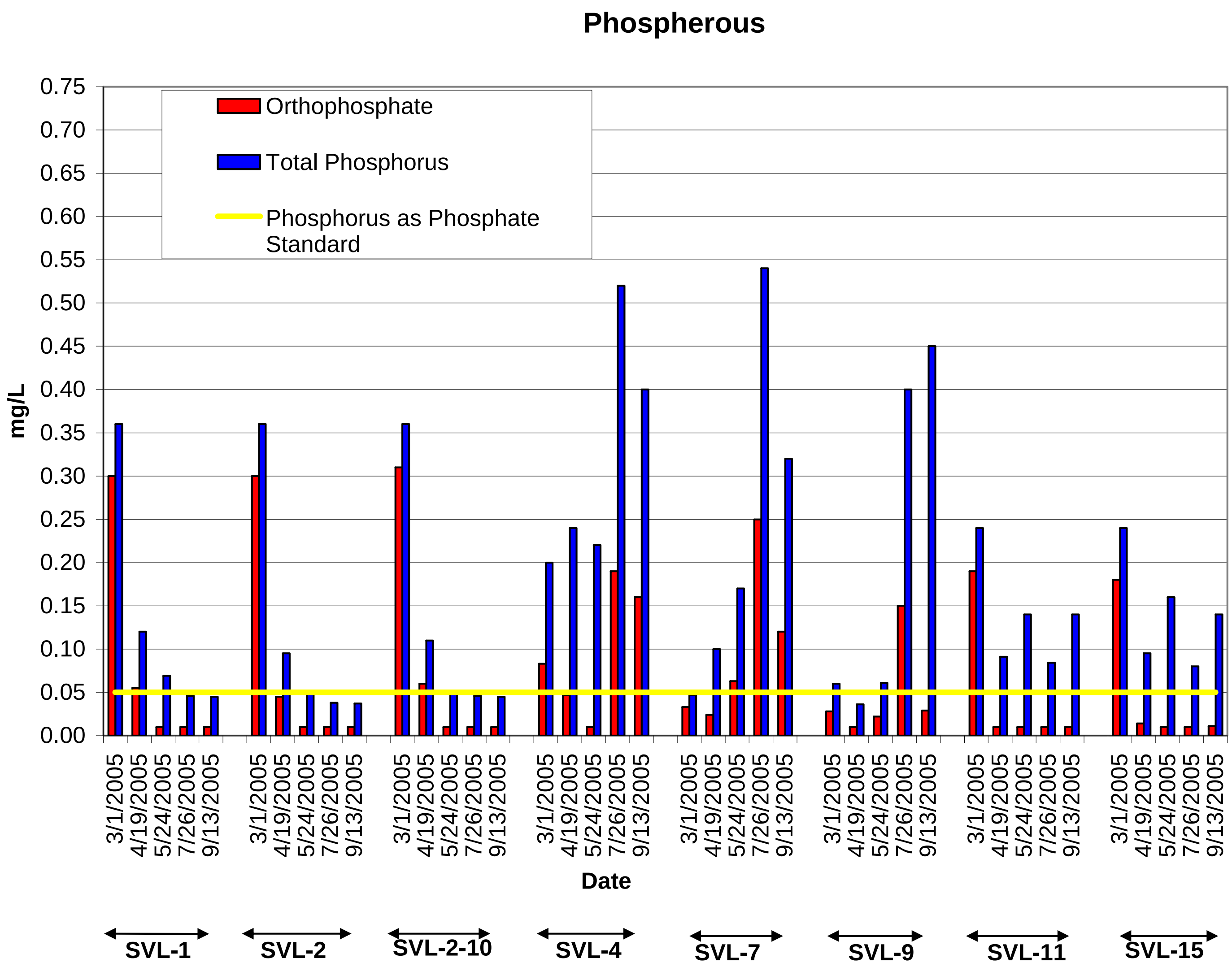
LAB DATA
GRAPHS

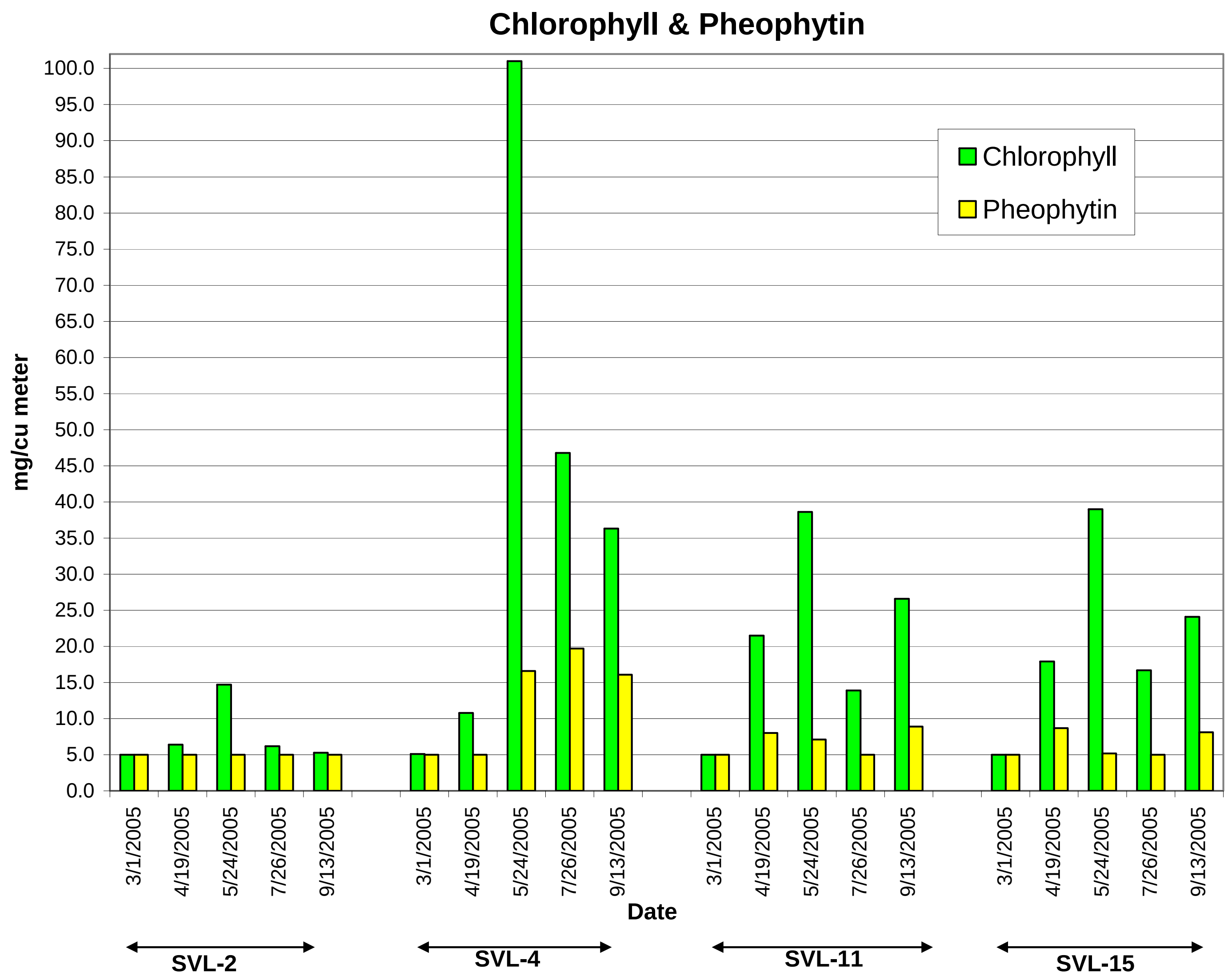


Fecal Coli at Marinas
Standard is 200 colonies/ml
colonies/ml
45
40
35
30
25
20
15
10
5
0
4/19/2005
5/24/2005
7/26/2005
9/13/2005
4/19/2005
5/24/2005
7/26/2005
9/13/2005
4/19/2005
5/24/2005
7/26/2005
9/13/2005
Lithia Springs
Findley
Sullivan
Date

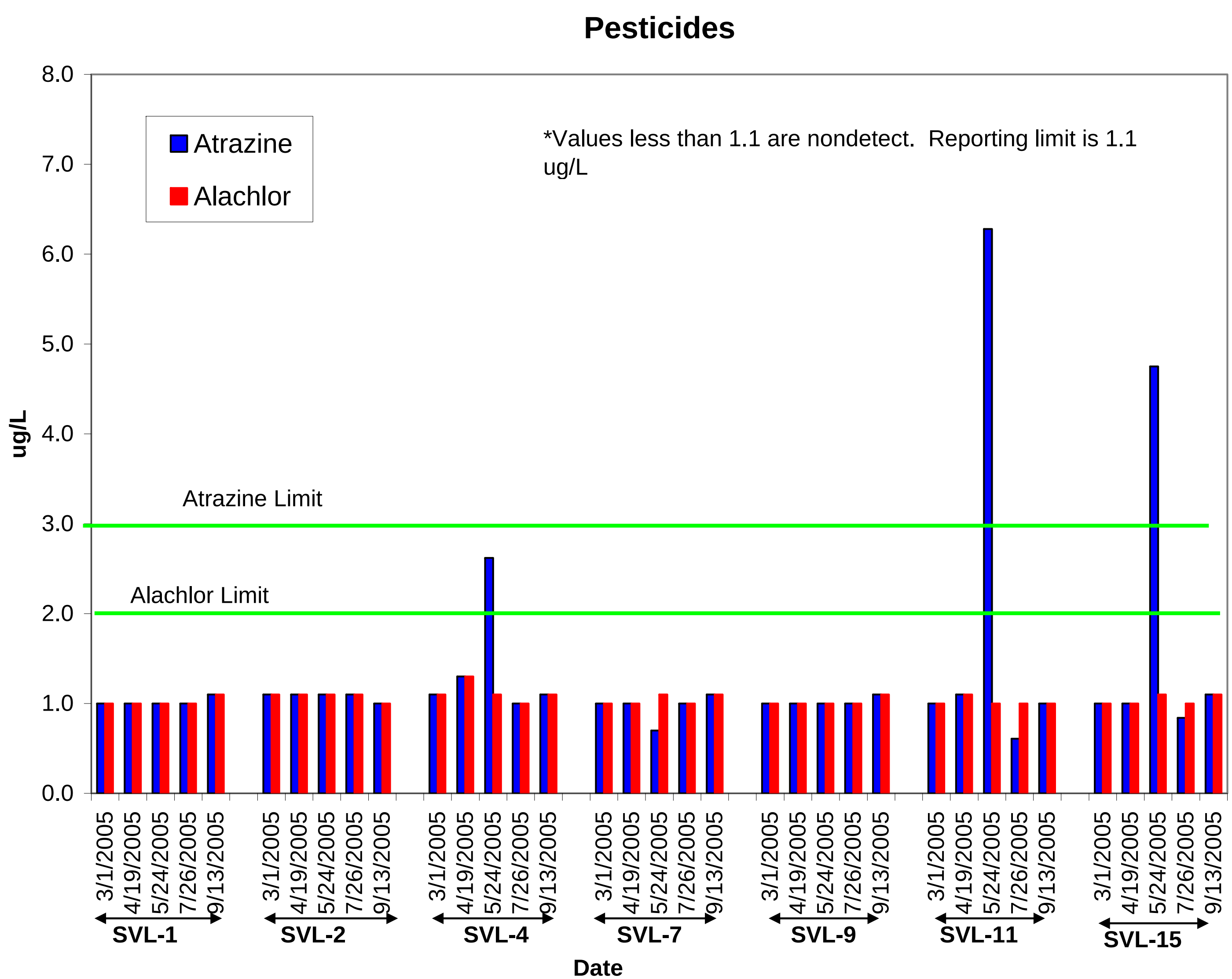

Metals
Iron Standard
Manganese Standard
Total Iron
Total Manganese
mg/L
2.00
1.90
1.80
1.70
1.60
1.50
1.40
1.30
1.20
1.10
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
3/1/2005
4/19/2005
5/24/2005
7/26/2005
9/13/2005
3/1/2005
4/19/2005
5/24/2005
7/26/2005
9/13/2005
SVL-1
SVL-2-10
Date


Nitrogen
NH3N
NO3-N
NH3N Standard is 15 mg/L
mg/L
0.00
0.50
1.00
1.50
2.00
2.50
3.00
3.50
4.00
4.50
5.00
5.50
6.00
6.50
7.00
7.50
8.00
8.50
9.00
9.50
10.00
10.50
11.00
3/1/2005
4/19/2005
5/24/2005
7/26/2005
9/13/2005
SVL-1
SVL-2
SVL-2-10
SVL-4
SVL-7
SVL-9
SVL-11
SVL-15
Date

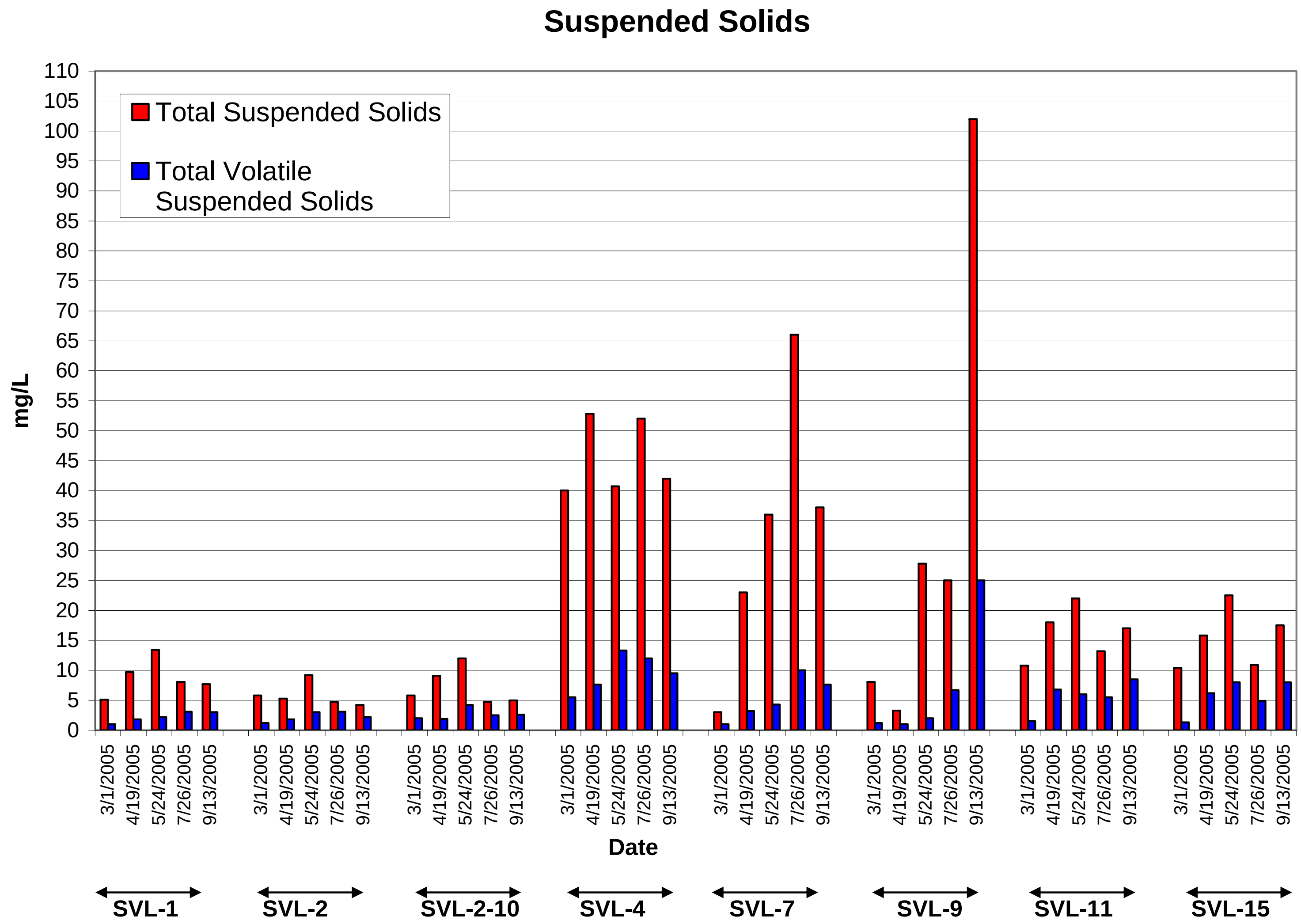

Phospherous
Orthophosphate
Total Phosphorus
Phosphorus as Phosphate Standard
mg/L
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
3/1/2005
4/19/2005
5/24/2005
7/26/2005
9/13/2005
Date
SVL-1
SVL-2
SVL-2-10
SVL-4
SVL-7
SVL-9
SVL-11
SVL-15

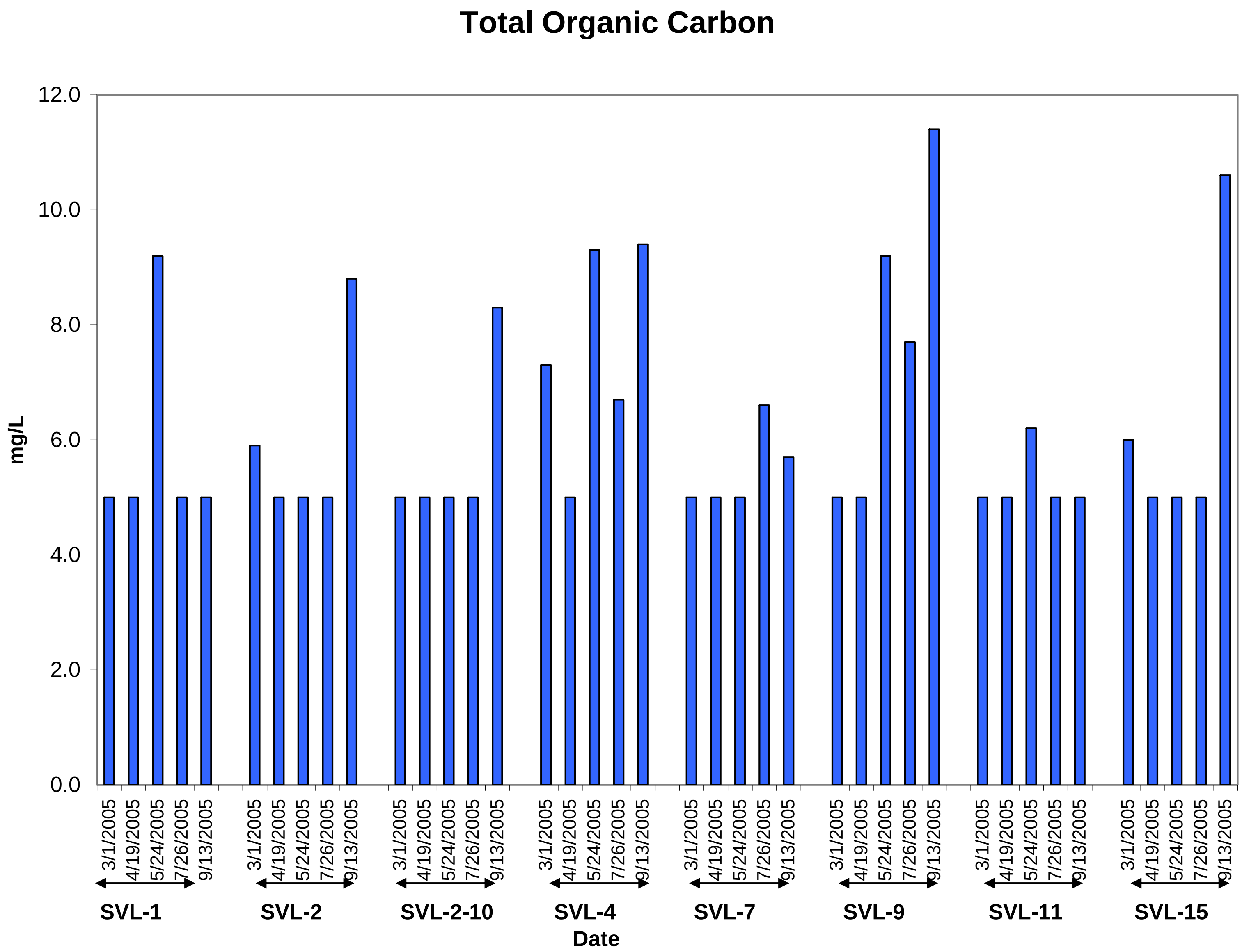


Chlorophyll & Pheophytin
mg/cu meter
100.0
95.0
90.0
85.0
80.0
75.0
70.0
65.0
60.0
55.0
50.0
45.0
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
Chlorophyll
Pheophytin
3/1/2005
4/19/2005
5/24/2005
7/26/2005
9/13/2005
Date
SVL-2
SVL-4
SVL-11
SVL-15



Pesticides
Atrazine
Alachlor
*Values less than 1.1 are nondetect. Reporting limit is 1.1 ug/L
Atrazine Limit
Alachlor Limit
ug/L
8.0
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
3/1/2005
4/19/2005
5/24/2005
7/26/2005
9/13/2005
SVL-1
SVL-2
SVL-4
SVL-7
SVL-9
SVL-11
SVL-15
Date

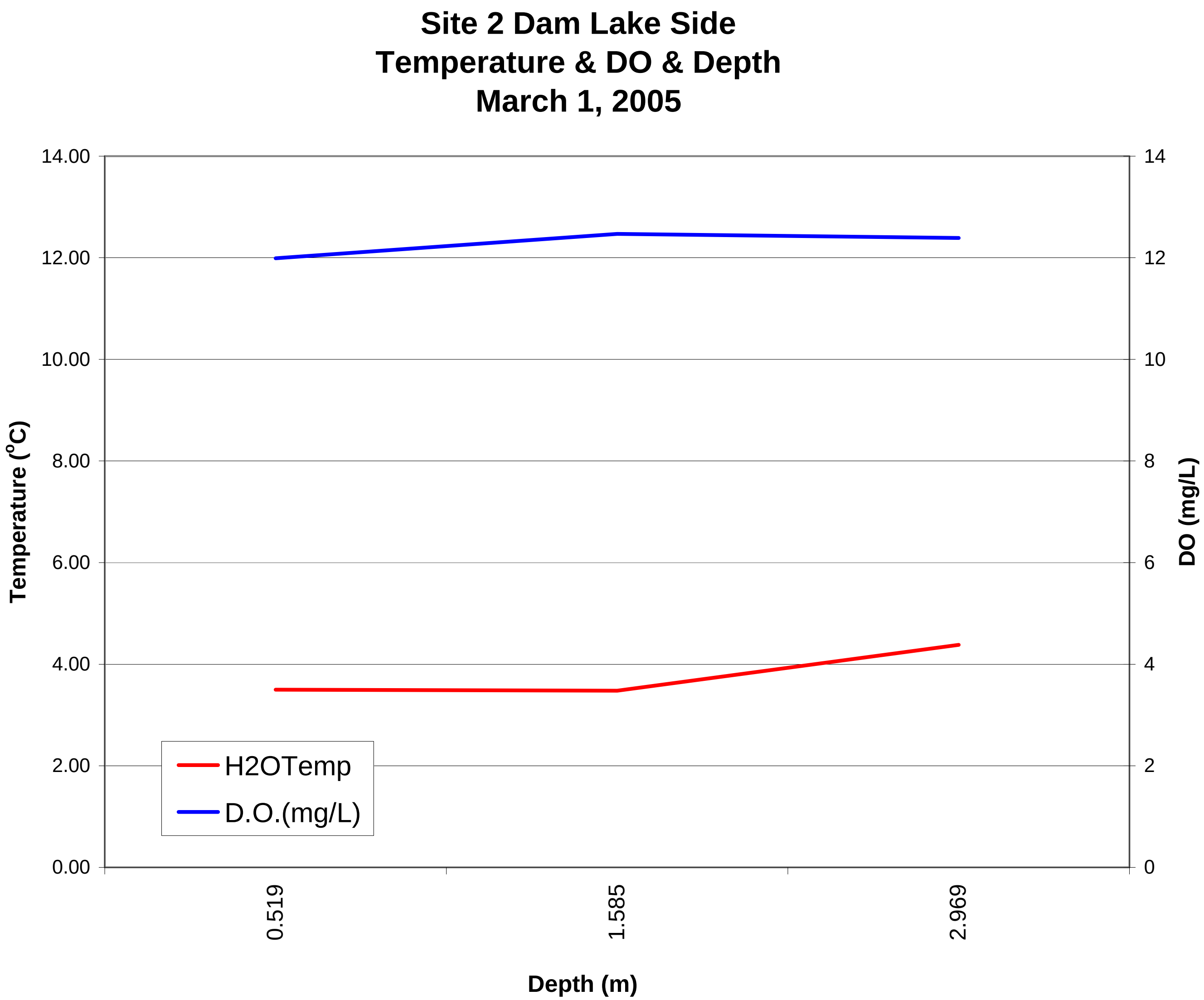

Suspended Solids
Total Suspended Solids
Total Volatile Suspended Solids
mg/L
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
35
30
25
20
15
10
5
0
3/1/2005
4/19/2005
5/24/2005
7/26/2005
9/13/2005
Date
SVL-1
SVL-2
SVL-2-10
SVL-4
SVL-7
SVL-9
SVL-11
SVL-15

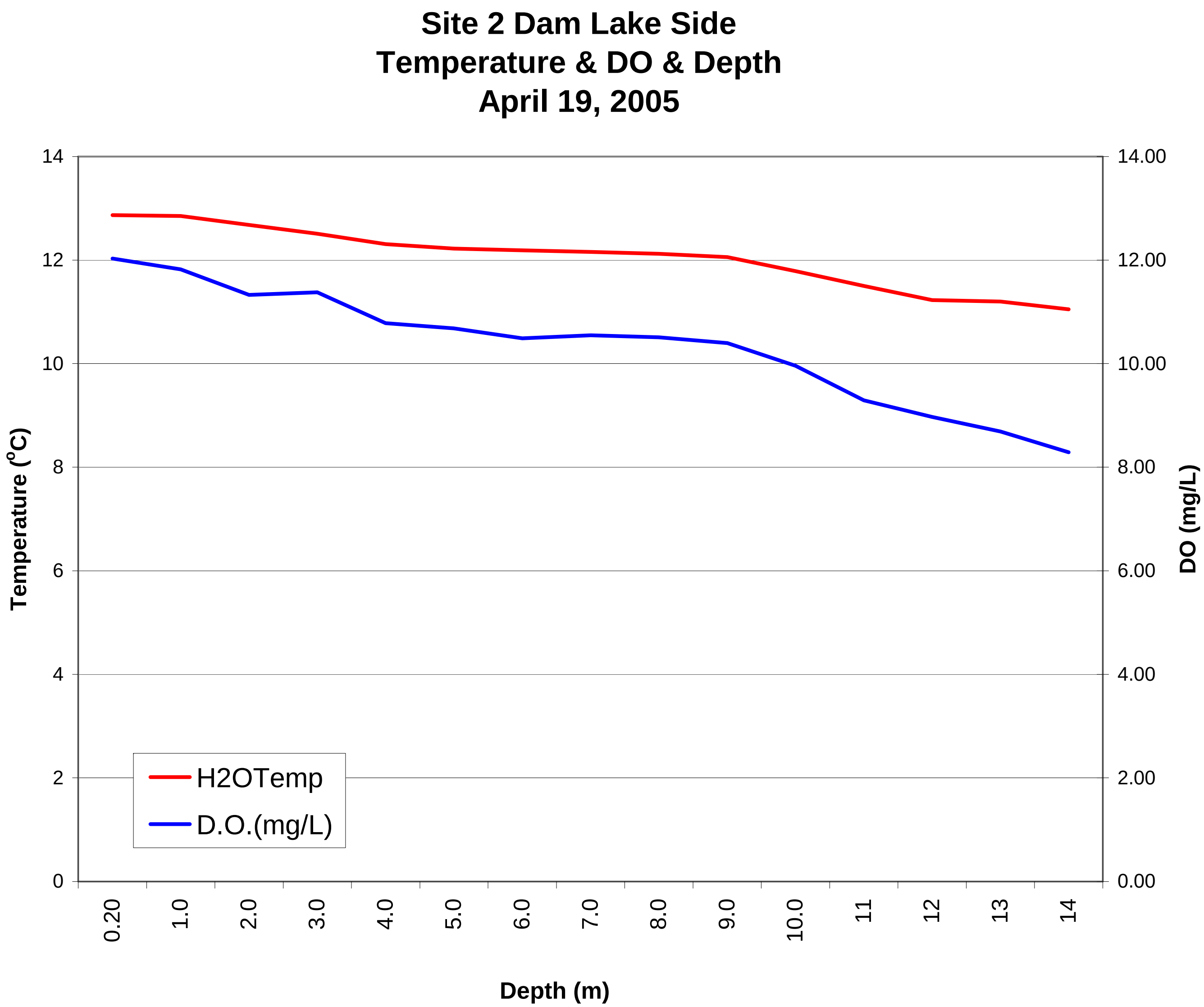

Total Organic Carbon
mg/L
12.0
10.0
8.0
6.0
4.0
2.0
0.0
3/1/2005
4/19/2005
5/24/2005
7/26/2005
9/13/2005
SVL-1
SVL-2
SVL-2-10
SVL-4
SVL-7
SVL-9
SVL-11
SVL-15
Date

APPENDIX C

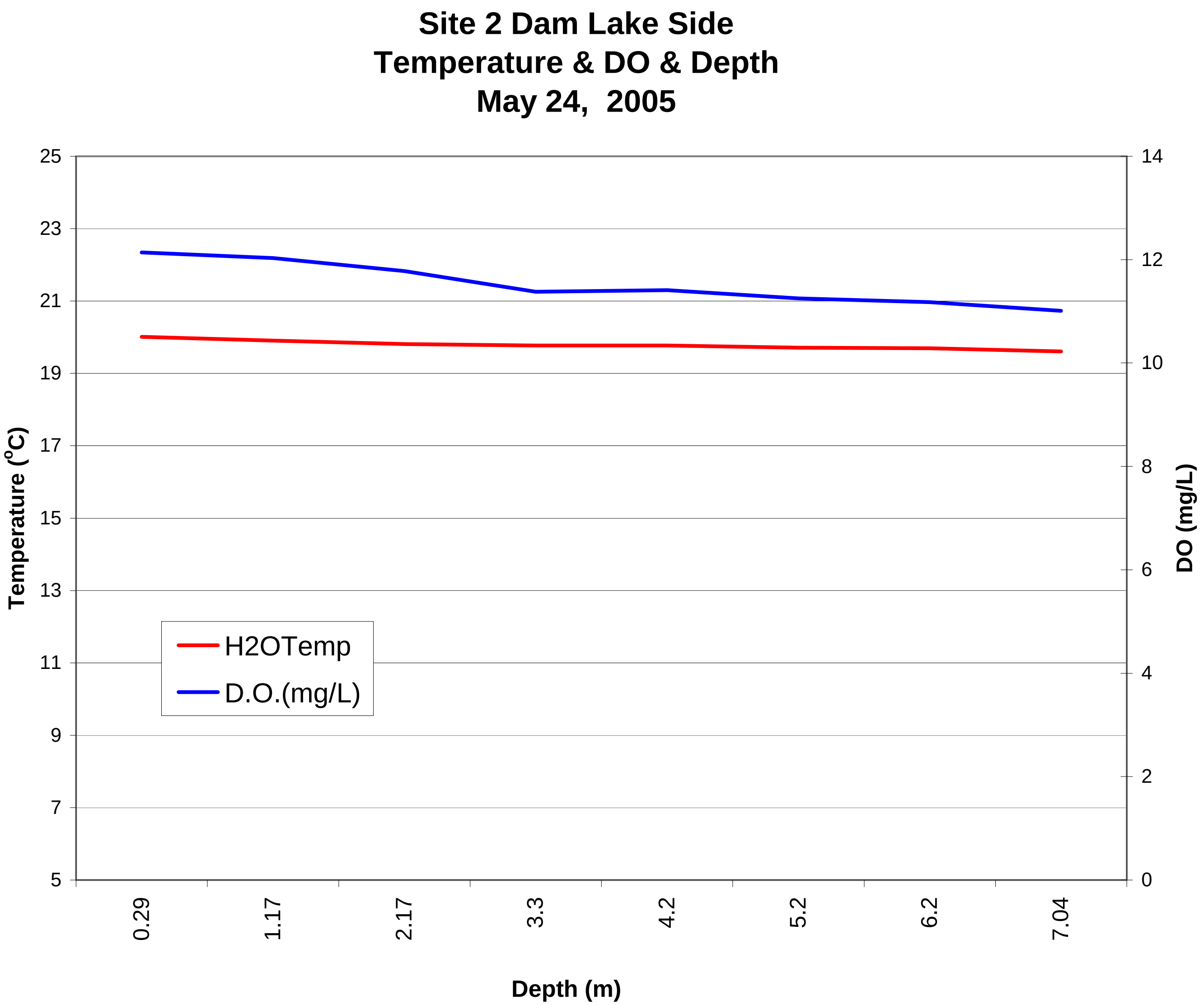
FIELD DATA
GRAPHS


Site 1 Spillway
Temperature & DO
Temperature (°C)
DO (mg/L)
Sample Date
3/1/2005
4/19/2005
5/24/2005
6/30/2005
7/26/2005
9/13/2005
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
0
2
4
6
8
10
12
14
H2OTemp
D.O.(mg/L)

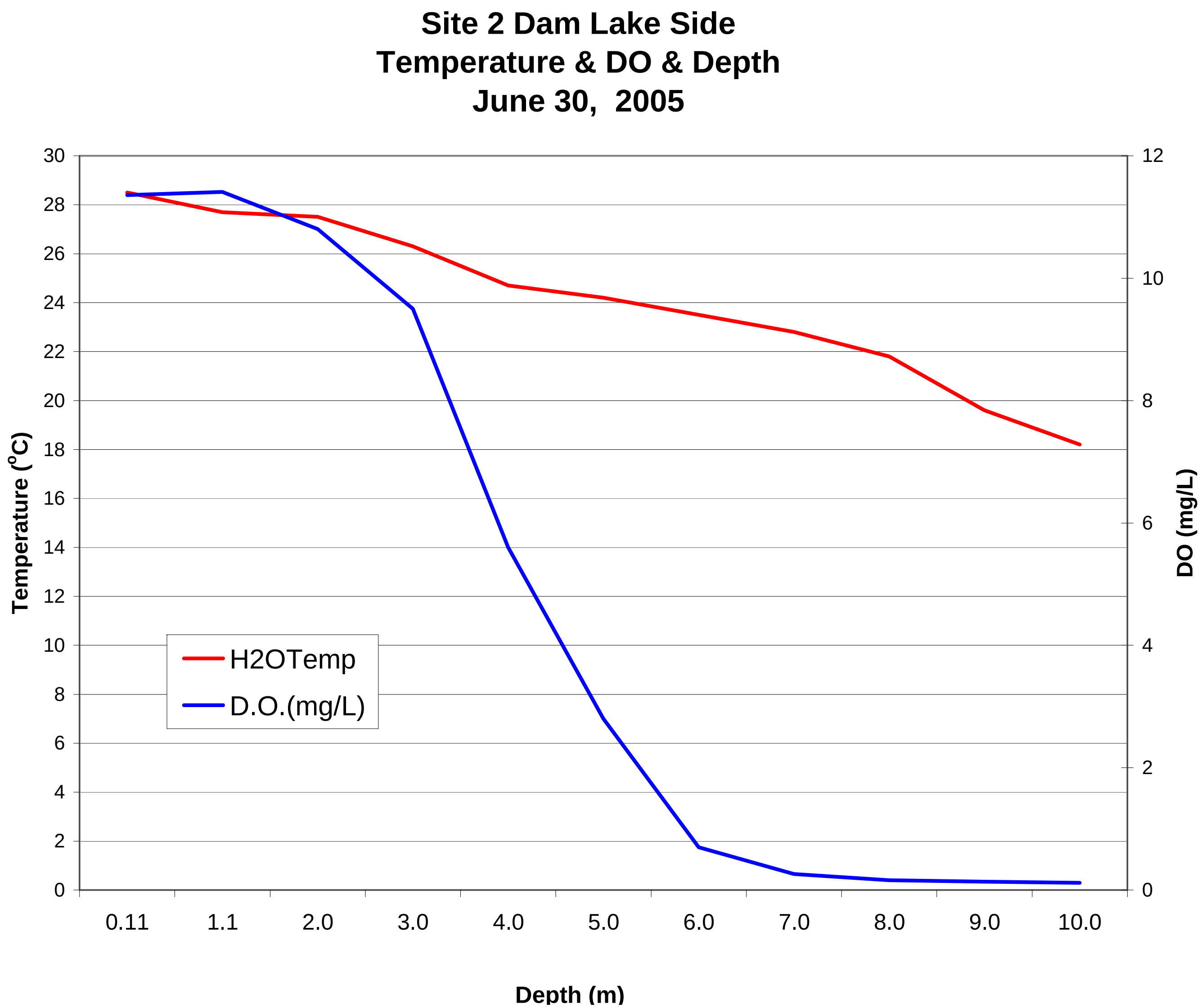

Site 2 Dam Lake Side
Temperature & DO & Depth
March 1, 2005
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Temperature (°C)
14
12
10
8
6
4
2
0
DO (mg/L)
H2OTemp
D.O.(mg/L)
0.519
1.585
2.969
Depth (m)

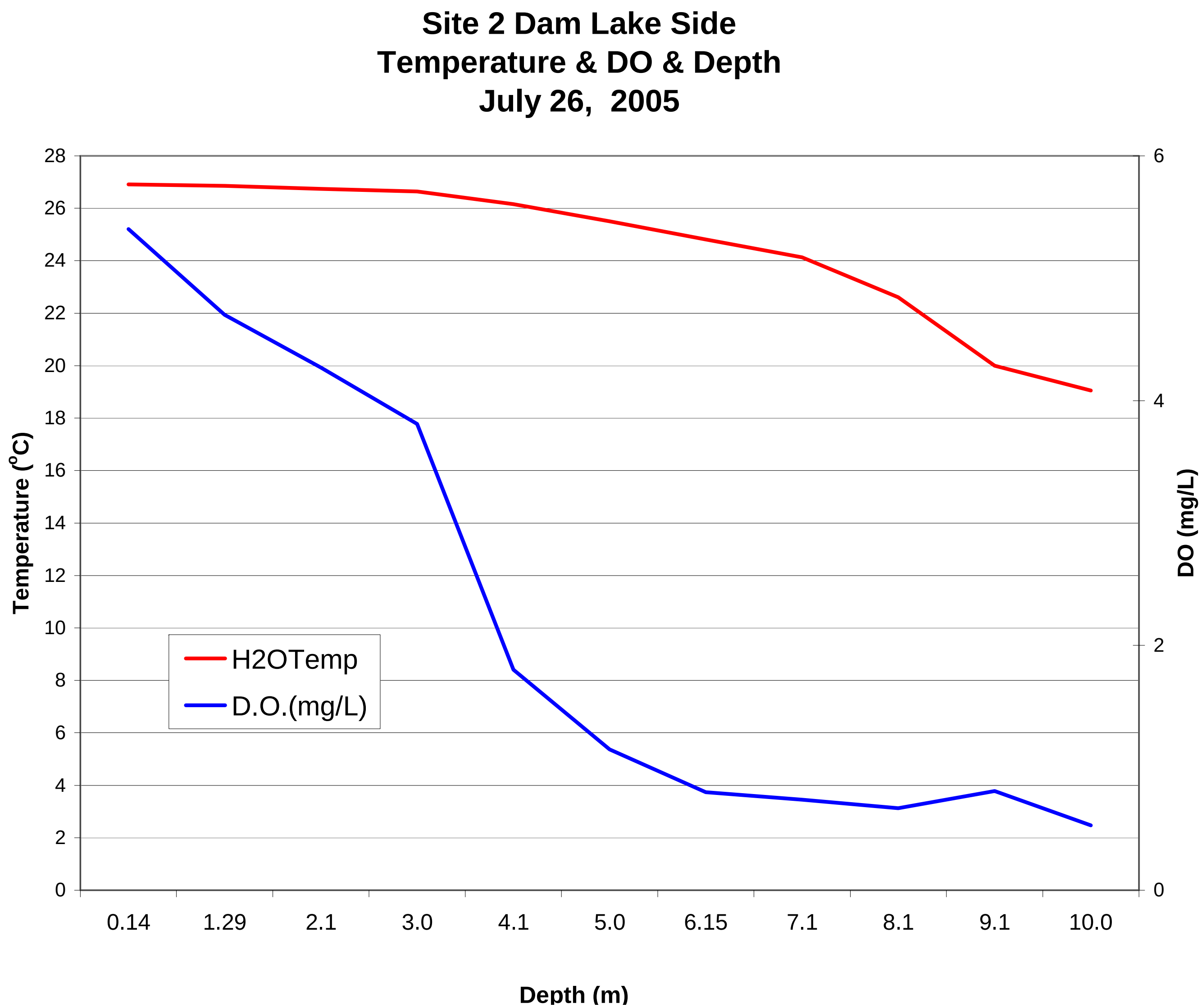


Site 2 Dam Lake Side
Temperature & DO & Depth
April 19, 2005
Temperature (°C)
DO (mg/L)
Depth (m)
H2OTemp
D.O.(mg/L)
0
2
4
6
8
10
12
14
0.00
2.00
4.00
6.00
8.00
10.00
12.00
14.00
0.20
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11
12
13
14

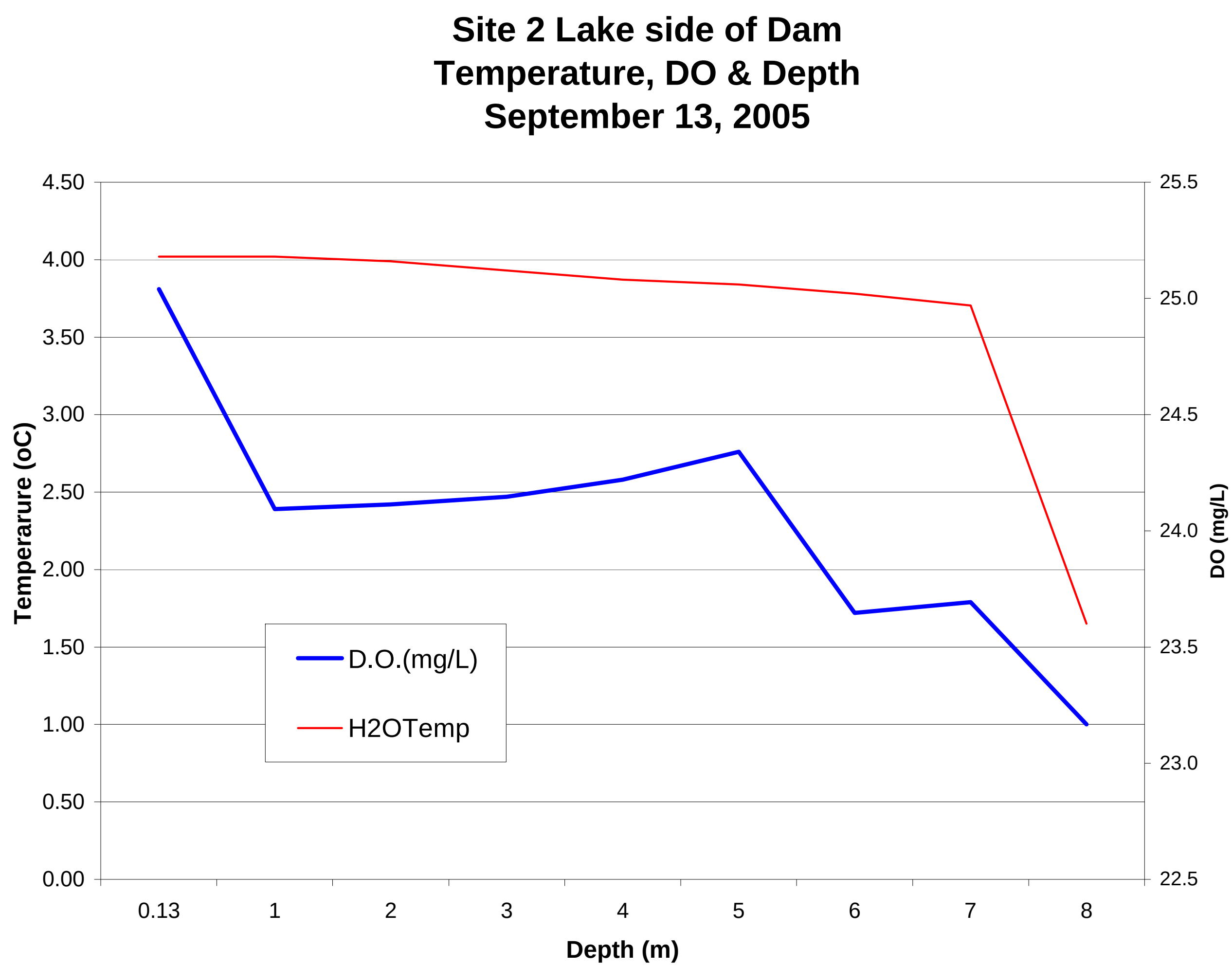


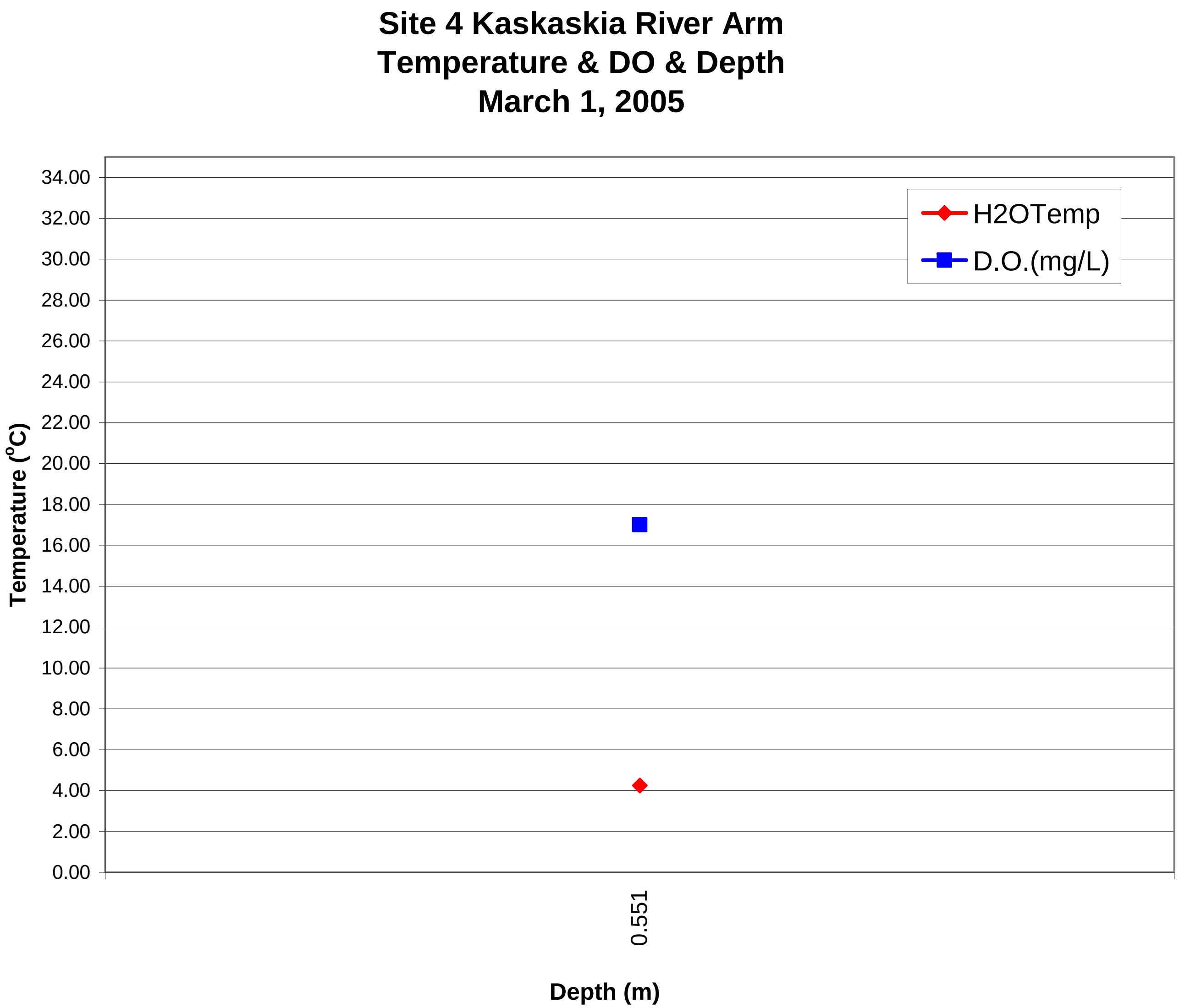
Site 2 Dam Lake Side
Temperature & DO & Depth
May 24, 2005
Temperature (°C)
25
23
21
19
17
15
13
11
9
7
5
DO (mg/L)
14
12
10
8
6
4
2
0
H2OTemp
D.O.(mg/L)
0.29
1.17
2.17
3.3
4.2
5.2
6.2
7.04
Depth (m)

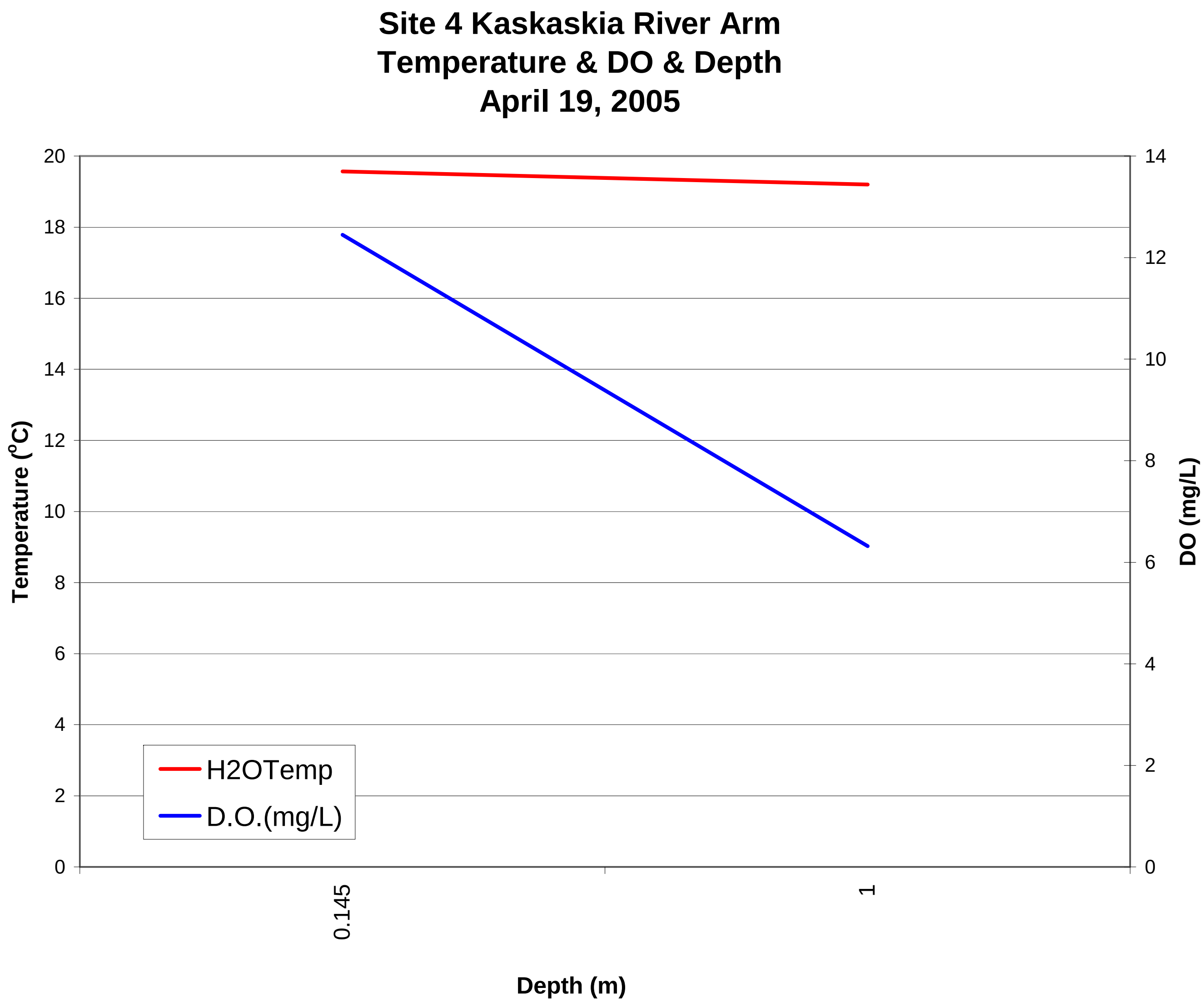

Site 2 Dam Lake Side
Temperature & DO & Depth
June 30, 2005
Temperature (°C)
DO (mg/L)
Depth (m)
H2OTemp
D.O.(mg/L)
0.11
1.1
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0



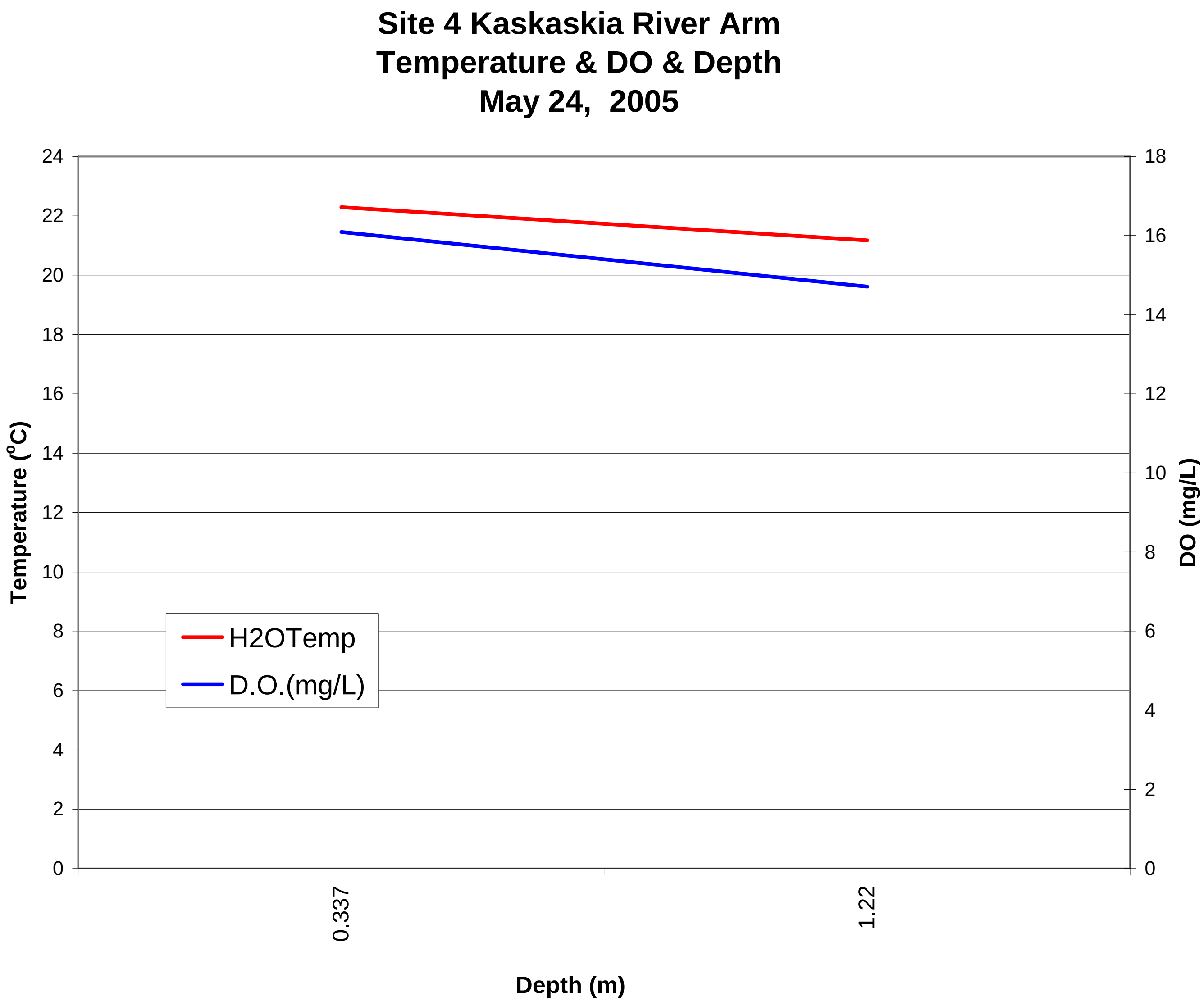
Site 2 Dam Lake Side
Temperature & DO & Depth
July 26, 2005
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
Temperature (°C)
6
4
2
0
DO (mg/L)
H2OTemp
D.O.(mg/L)
0.14
1.29
2.1
3.0
4.1
5.0
6.15
7.1
8.1
9.1
10.0
Depth (m)

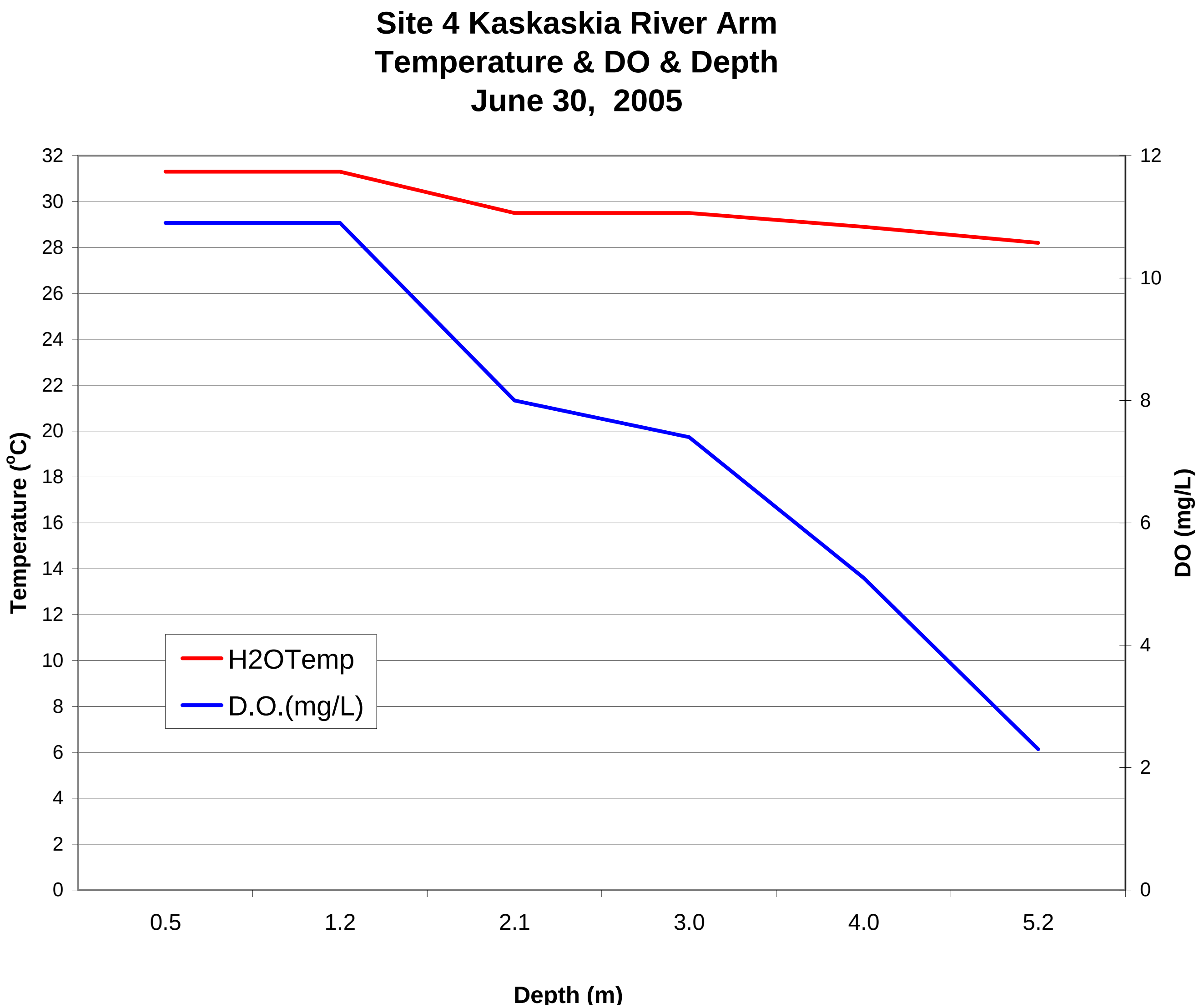

Site 2 Lake side of Dam
Temperature, DO & Depth
September 13, 2005
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Temperarure (oC)
25.5
25.0
24.5
24.0
23.5
23.0
22.5
DO (mg/L)
D.O.(mg/L)
H2OTemp
0.13
1
2
3
4
5
6
7
8
Depth (m)

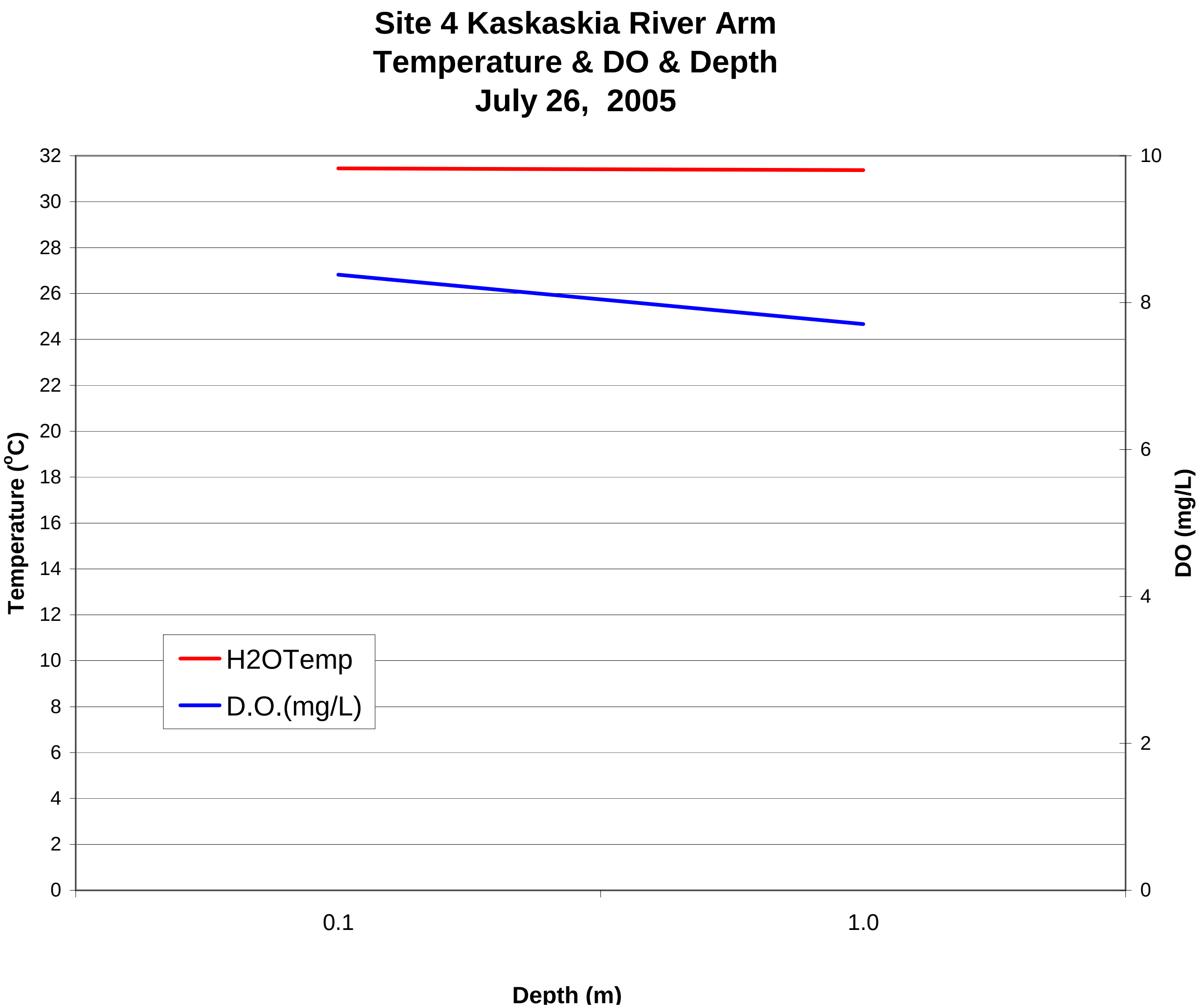

Site 4 Kaskaskia River Arm
Temperature & DO & Depth
March 1, 2005
H2OTemp
D.O.(mg/L)
Temperature (°C)
34.00
32.00
30.00
28.00
26.00
24.00
22.00
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.551
Depth (m)



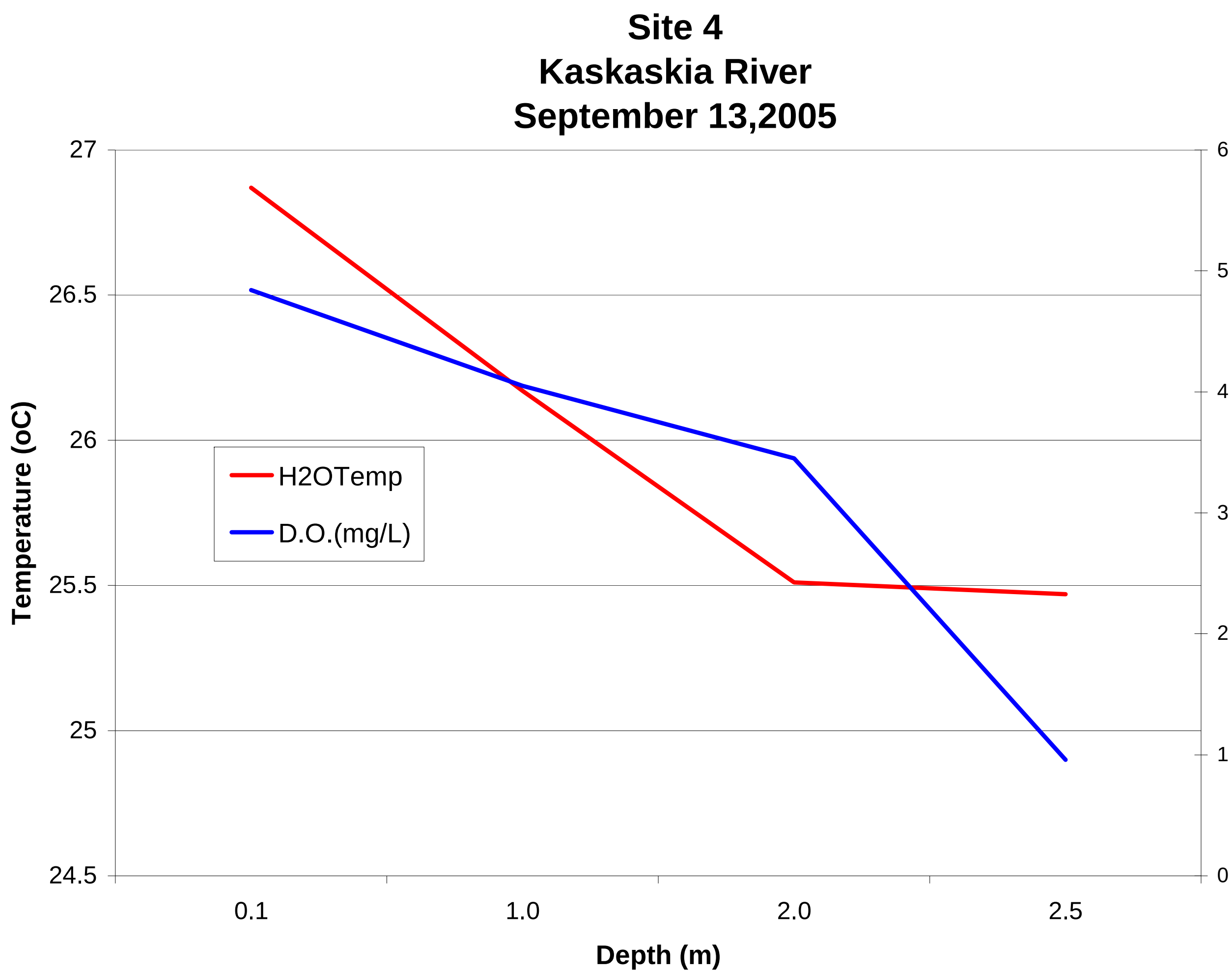
Site 4 Kaskaskia River Arm
Temperature & DO & Depth
April 19, 2005
Temperature (°C)
DO (mg/L)
Depth (m)
20
18
16
14
12
10
8
6
4
2
0
14
12
10
8
6
4
2
0
0.145
1
H2OTemp
D.O.(mg/L)


Site 4 Kaskaskia River Arm
Temperature & DO & Depth
May 24, 2005
Temperature (°C)
DO (mg/L)
24
22
20
18
16
14
12
10
8
6
4
2
0
18
16
14
12
10
8
6
4
2
0
H2OTemp
D.O.(mg/L)
0.337
1.22
Depth (m)

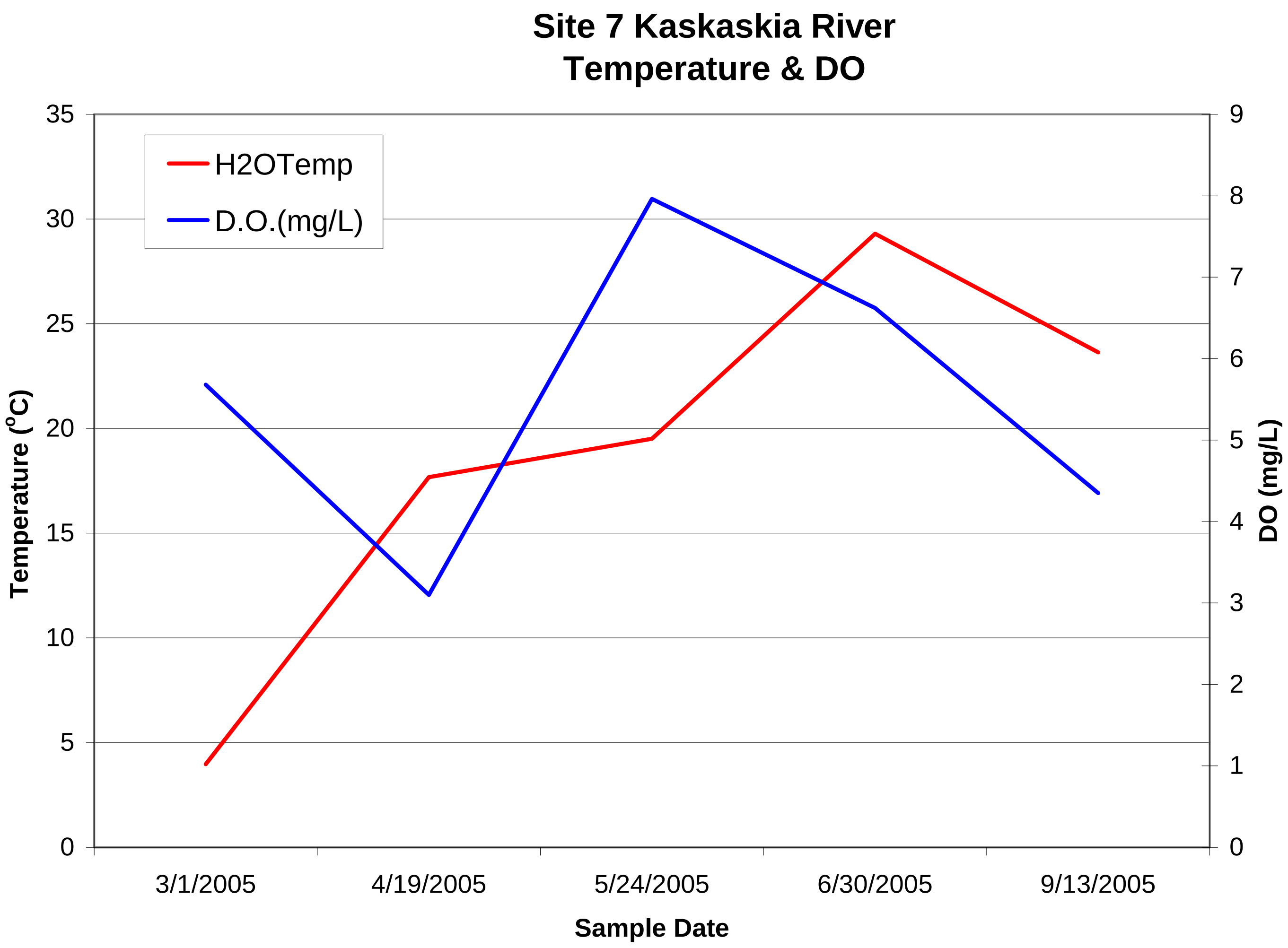

Site 4 Kaskaskia River Arm
Temperature & DO & Depth
June 30, 2005
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
Temperature (oC)
H2OTemp
D.O.(mg/L)
12
10
8
6
4
2
0
DO (mg/L)
0.5
1.2
2.1
3.0
4.0
5.2
Depth (m)



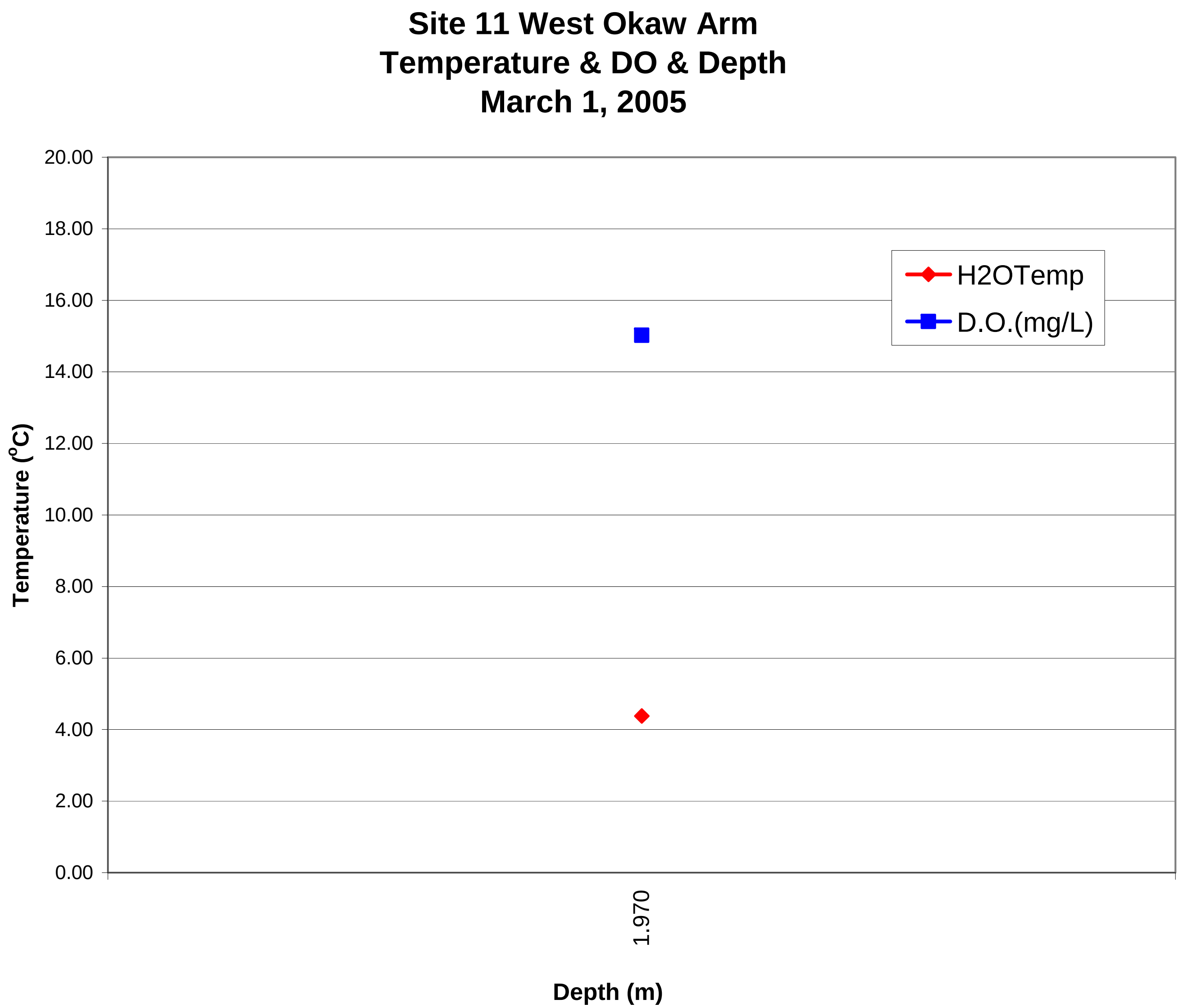
Site 4 Kaskaskia River Arm
Temperature & DO & Depth
July 26, 2005
Temperature (°C)
DO (mg/L)
Depth (m)
H2OTemp
D.O.(mg/L)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
0
2
4
6
8
10
0.1
1.0



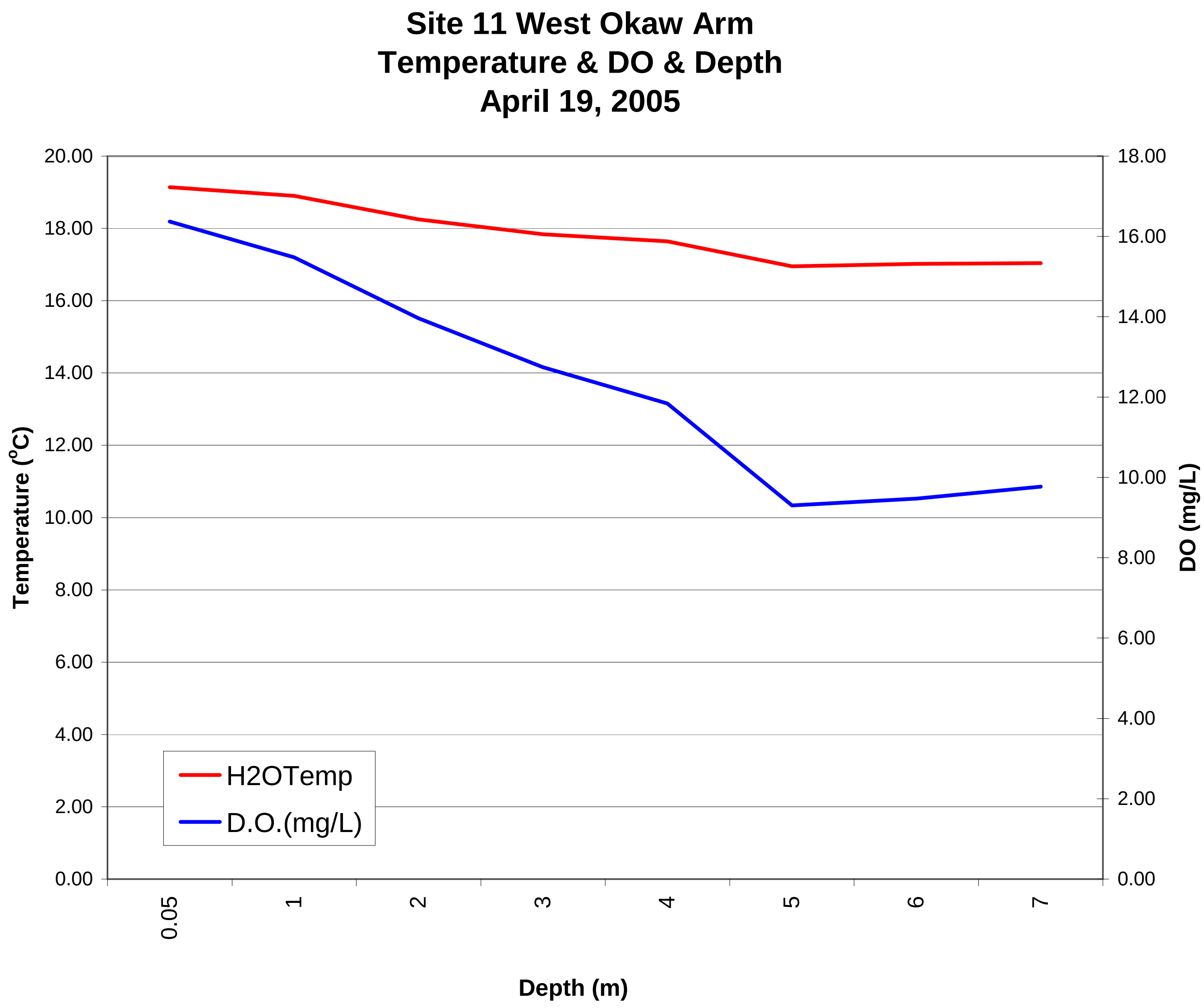
Site 4
Kaskaskia River
September 13,2005
Temperature (oC)
27
26.5
26
25.5
25
24.5
6
5
4
3
2
1
0
H2OTemp
D.O.(mg/L)
0.1
1.0
2.0
2.5
Depth (m)



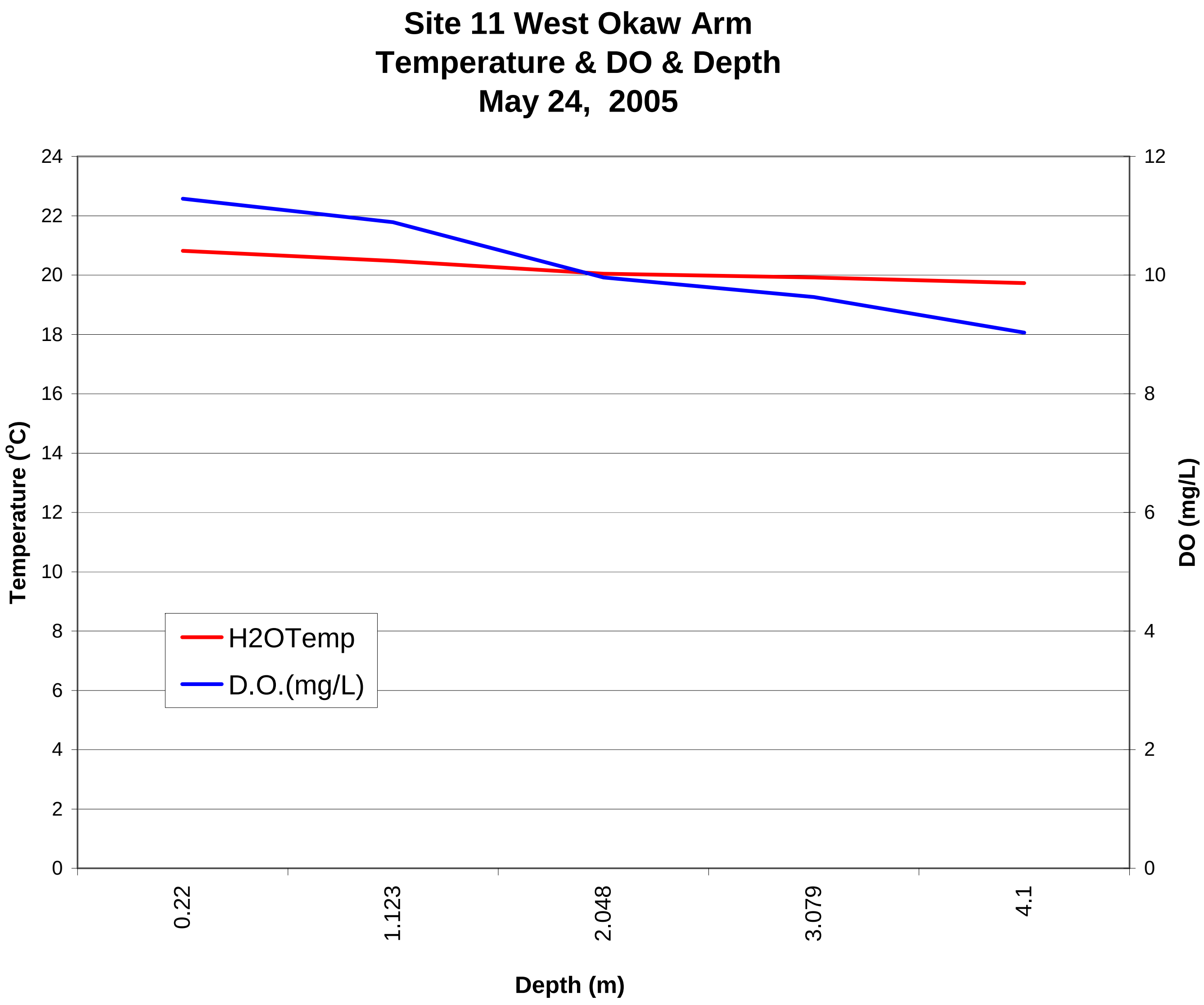
Site 7 Kaskaskia River
Temperature & DO
H2OTemp
D.O.(mg/L)
Temperature (°C)
DO (mg/L)
35
30
25
20
15
10
5
0
9
8
7
6
5
4
3
2
1
0
3/1/2005
4/19/2005
5/24/2005
6/30/2005
9/13/2005
Sample Date



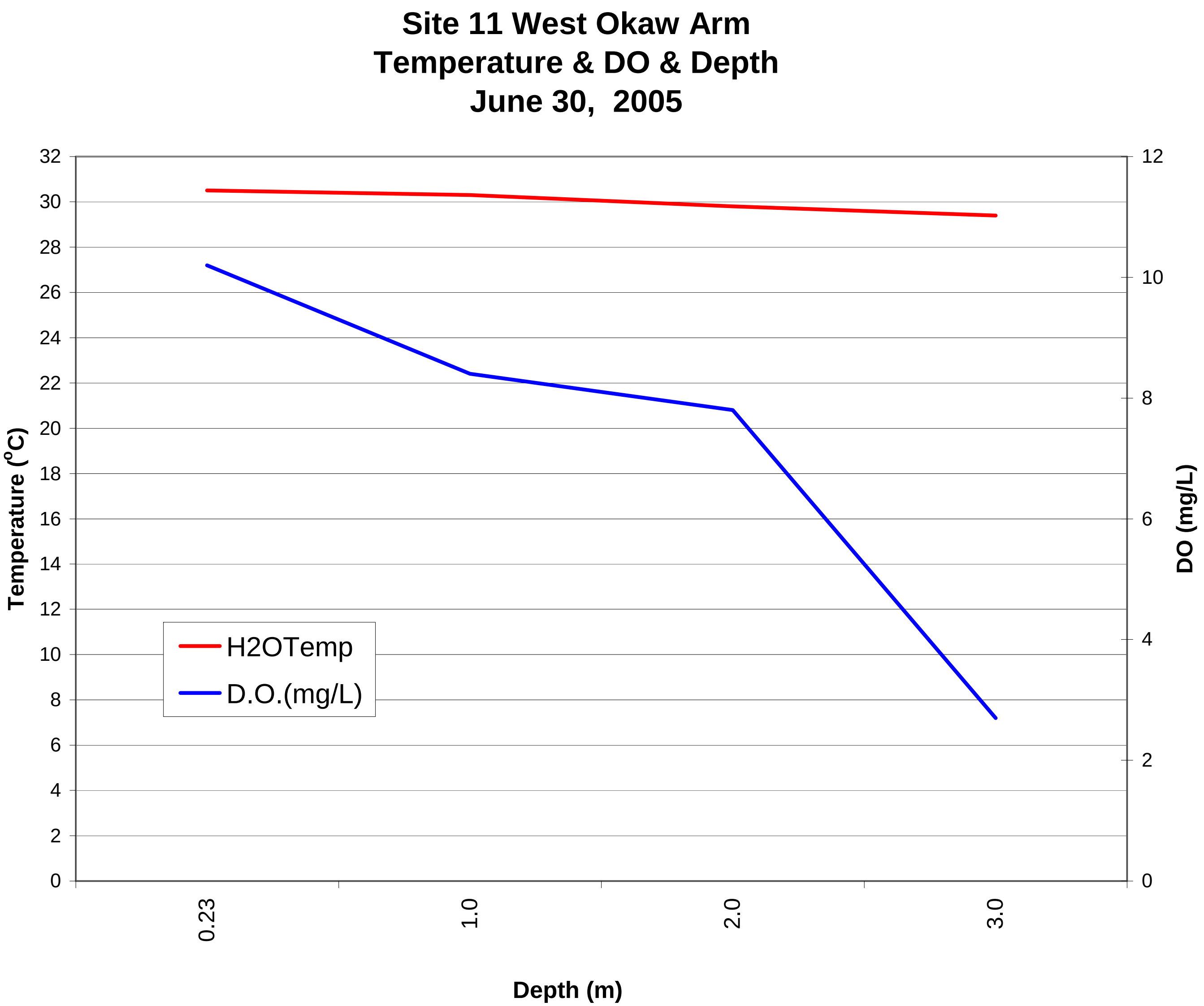
Site 11 West Okaw Arm
Temperature & DO & Depth
March 1, 2005
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
Temperature (°C)
H2OTemp
D.O.(mg/L)
1.970
Depth (m)



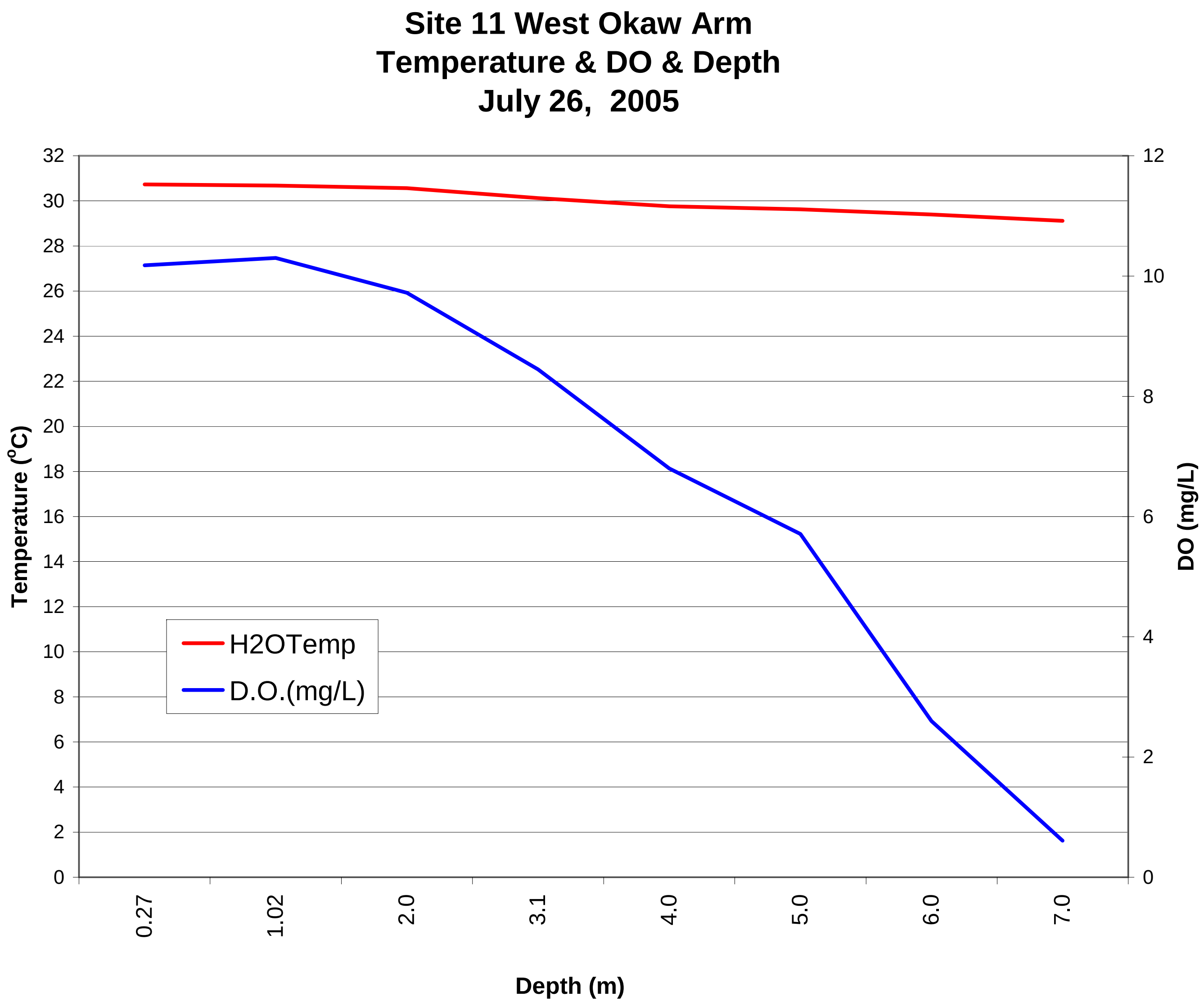
Site 11 West Okaw Arm
Temperature & DO & Depth
April 19, 2005
Temperature (°C)
DO (mg/L)
20.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
18.00
16.00
14.00
12.00
10.00
8.00
6.00
4.00
2.00
0.00
0.05
1
2
3
4
5
6
7
Depth (m)
H2OTemp
D.O.(mg/L)

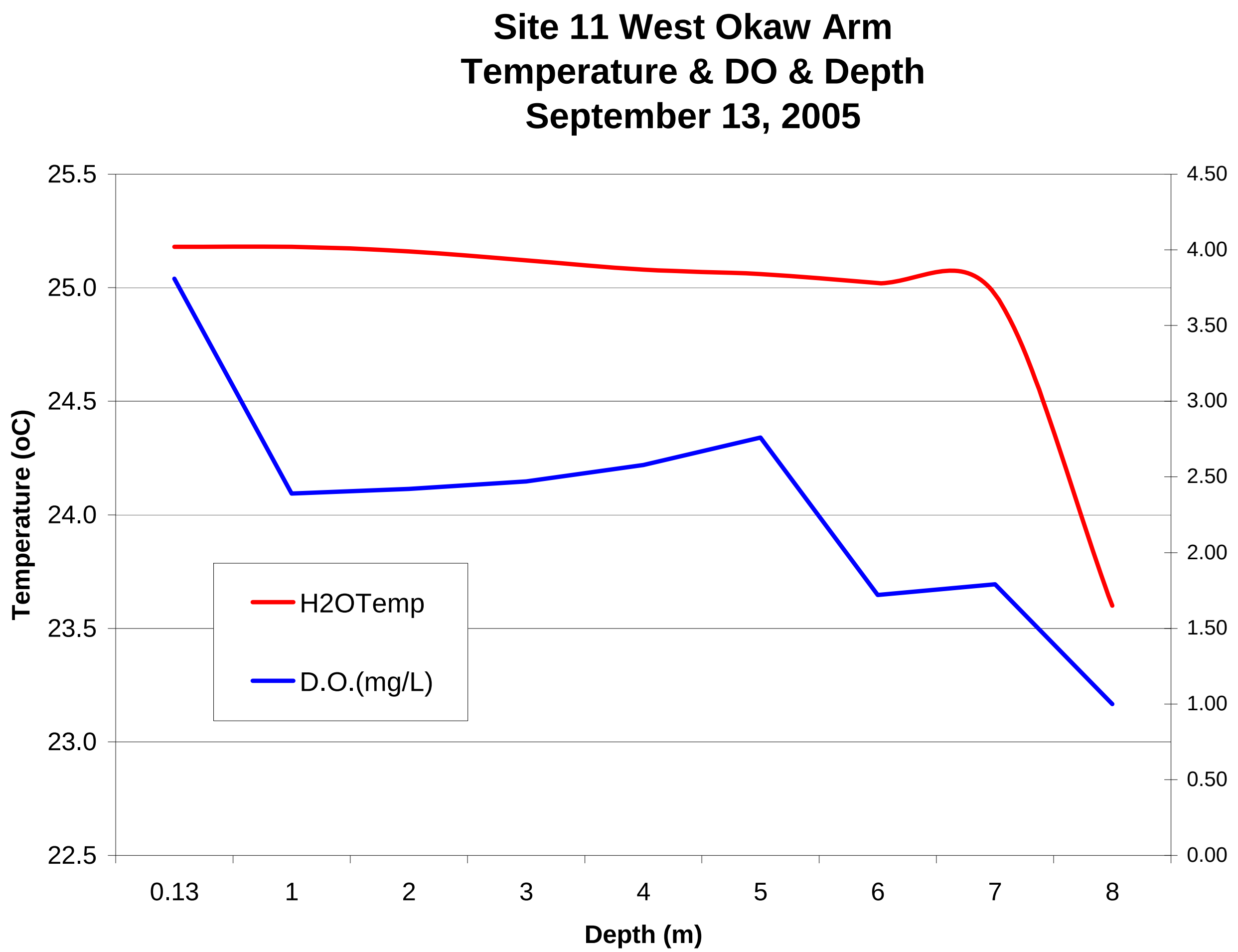


Site 11 West Okaw Arm
Temperature & DO & Depth
May 24, 2005
Temperature (°C)
DO (mg/L)
Depth (m)
0.22
1.123
2.048
3.079
4.1
H2OTemp
D.O.(mg/L)
0
2
4
6
8
10
12
14
16
18
20
22
24

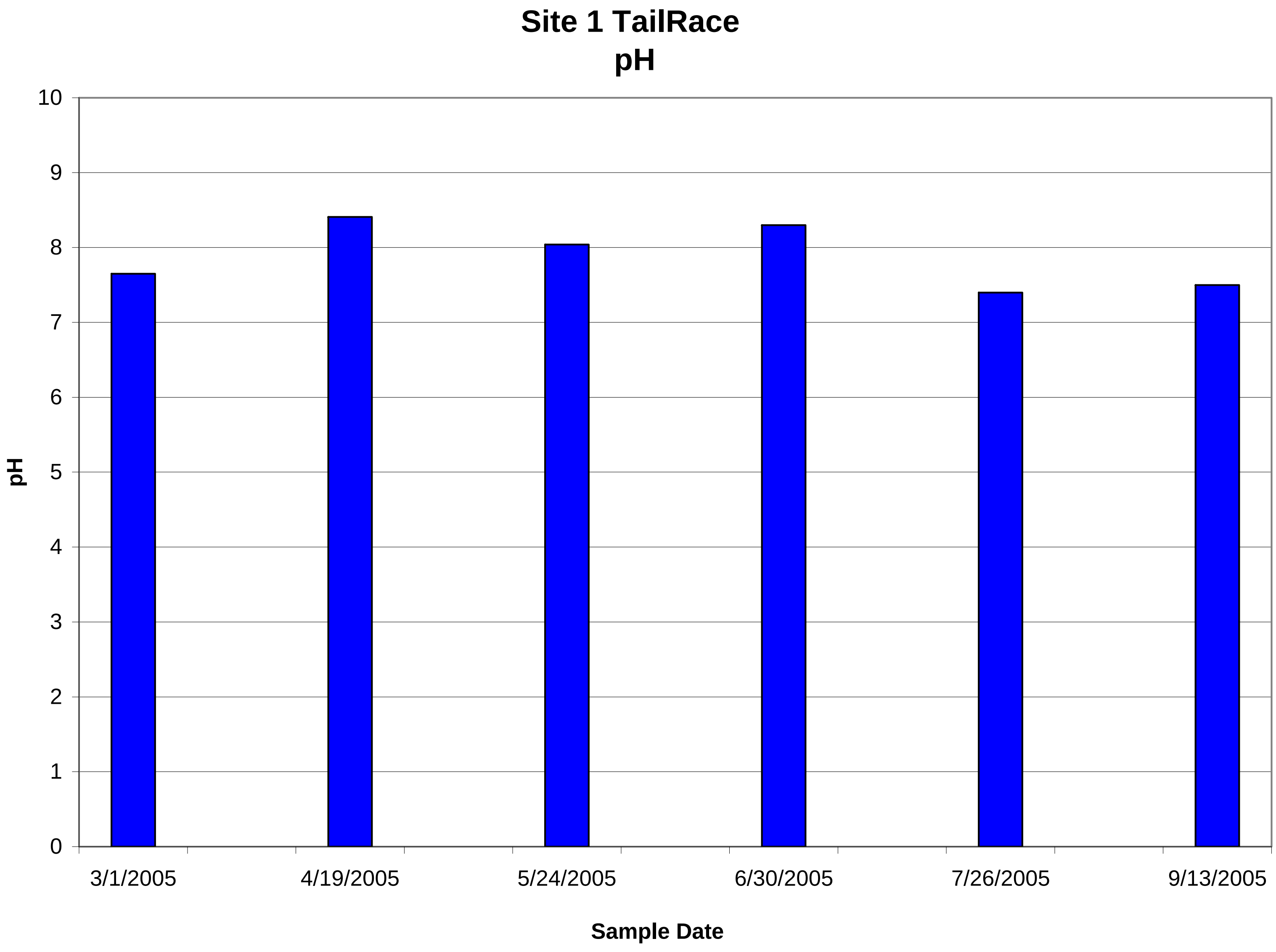


Site 11 West Okaw Arm
Temperature & DO & Depth
June 30, 2005
Temperature (°C)
32
30
28
26
24
22
20
18
16
14
12
10
8
6
4
2
0
DO (mg/L)
12
10
8
6
4
2
0
H2OTemp
D.O.(mg/L)
0.23
1.0
2.0
3.0
Depth (m)

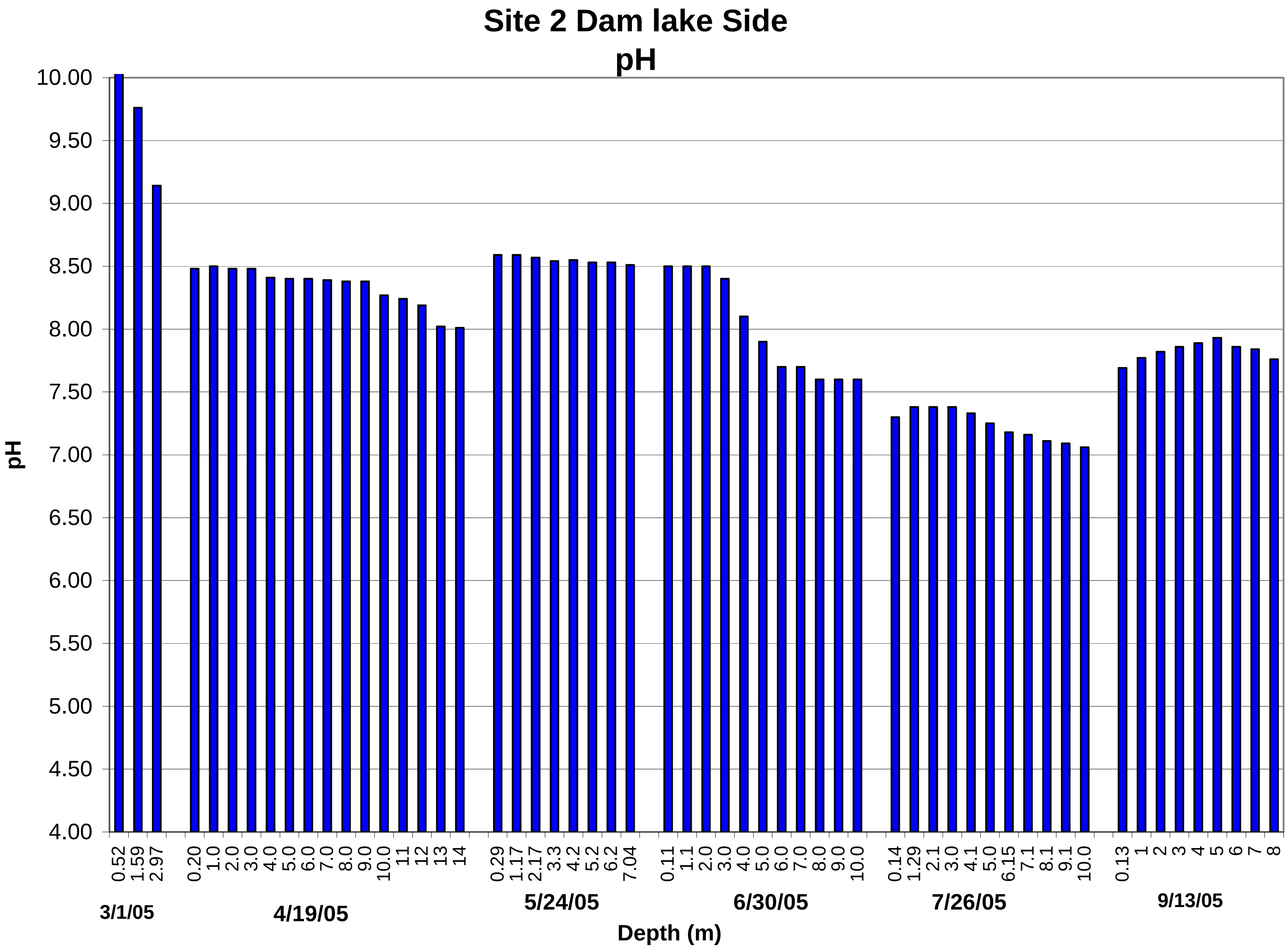

Site 11 West Okaw Arm
Temperature & DO & Depth
July 26, 2005
Temperature (°C)
DO (mg/L)
Depth (m)
H2OTemp
D.O.(mg/L)
0
2
4
6
8
10
12
14
16
18
20
22
24
26
28
30
32
0
2
4
6
8
10
12
0.27
1.02
2.0
3.1
4.0
5.0
6.0
7.0



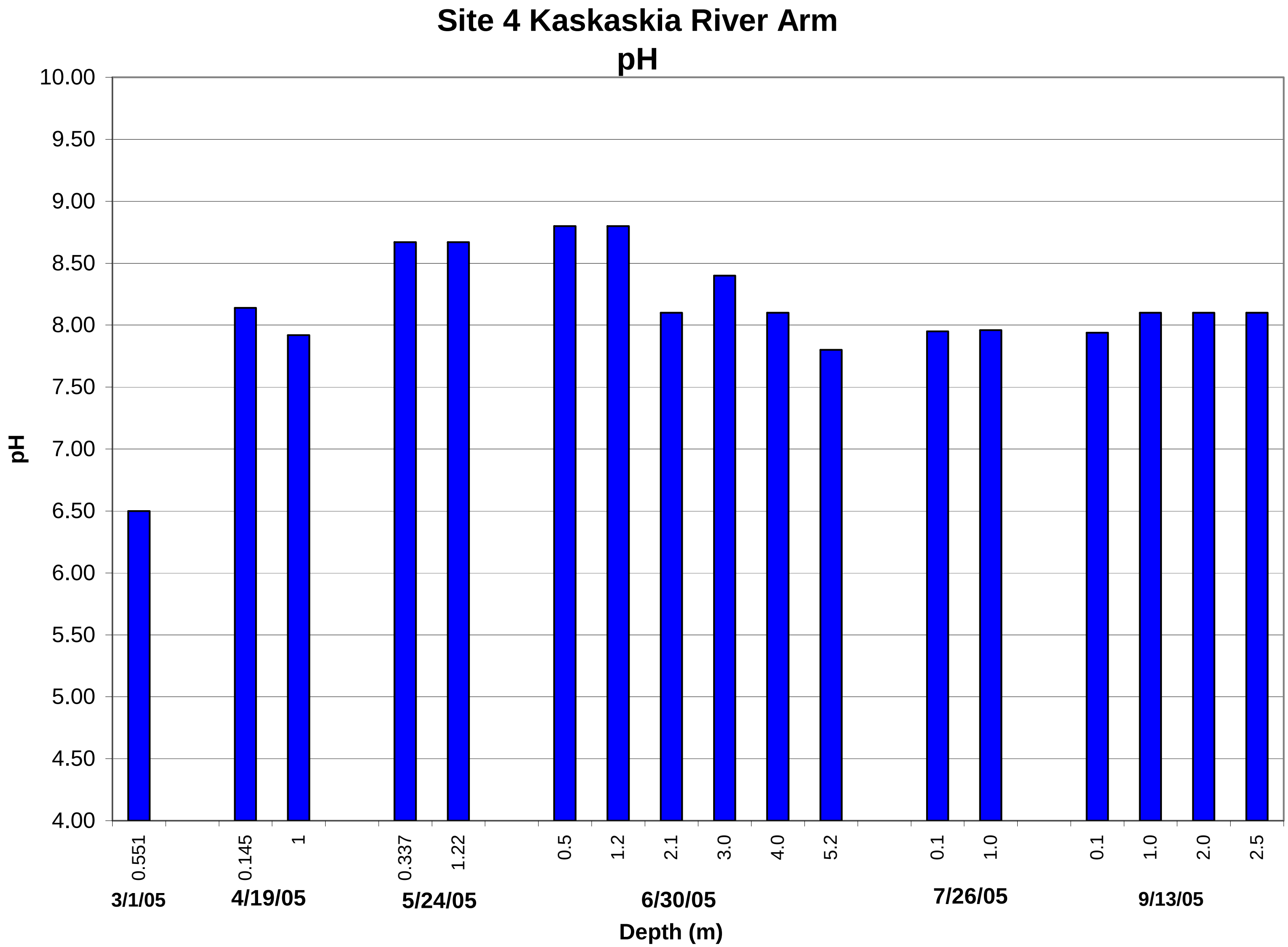
Site 11 West Okaw Arm
Temperature & DO & Depth
September 13, 2005
Temperature (oC)
25.5
25.0
24.5
24.0
23.5
23.0
22.5
4.50
4.00
3.50
3.00
2.50
2.00
1.50
1.00
0.50
0.00
H2OTemp
D.O.(mg/L)
0.13
1
2
3
4
5
6
7
8
Depth (m)

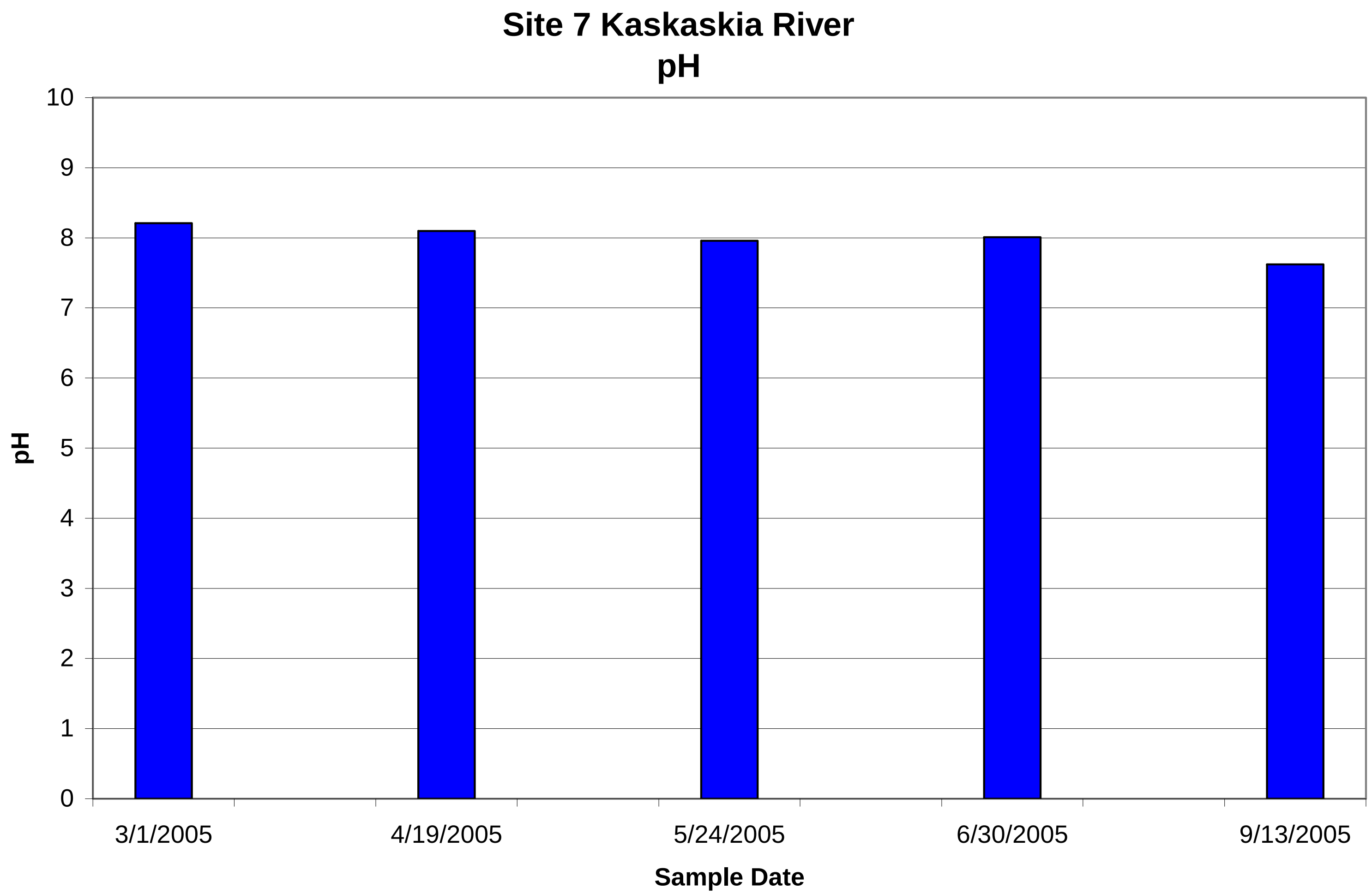


Site 1 TailRace
pH
pH
10
9
8
7
6
5
4
3
2
1
0
3/1/2005
4/19/2005
5/24/2005
6/30/2005
7/26/2005
9/13/2005
Sample Date

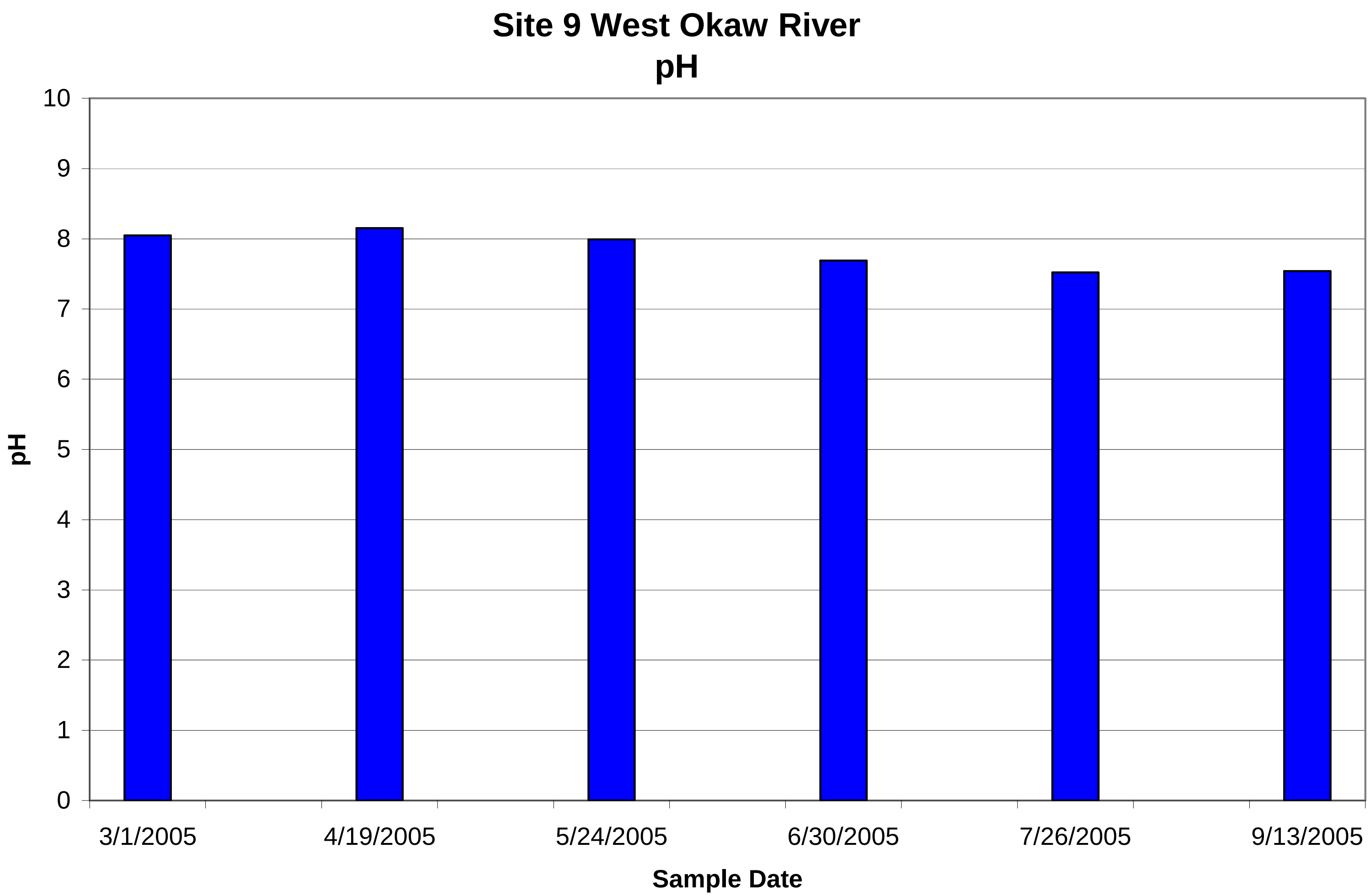


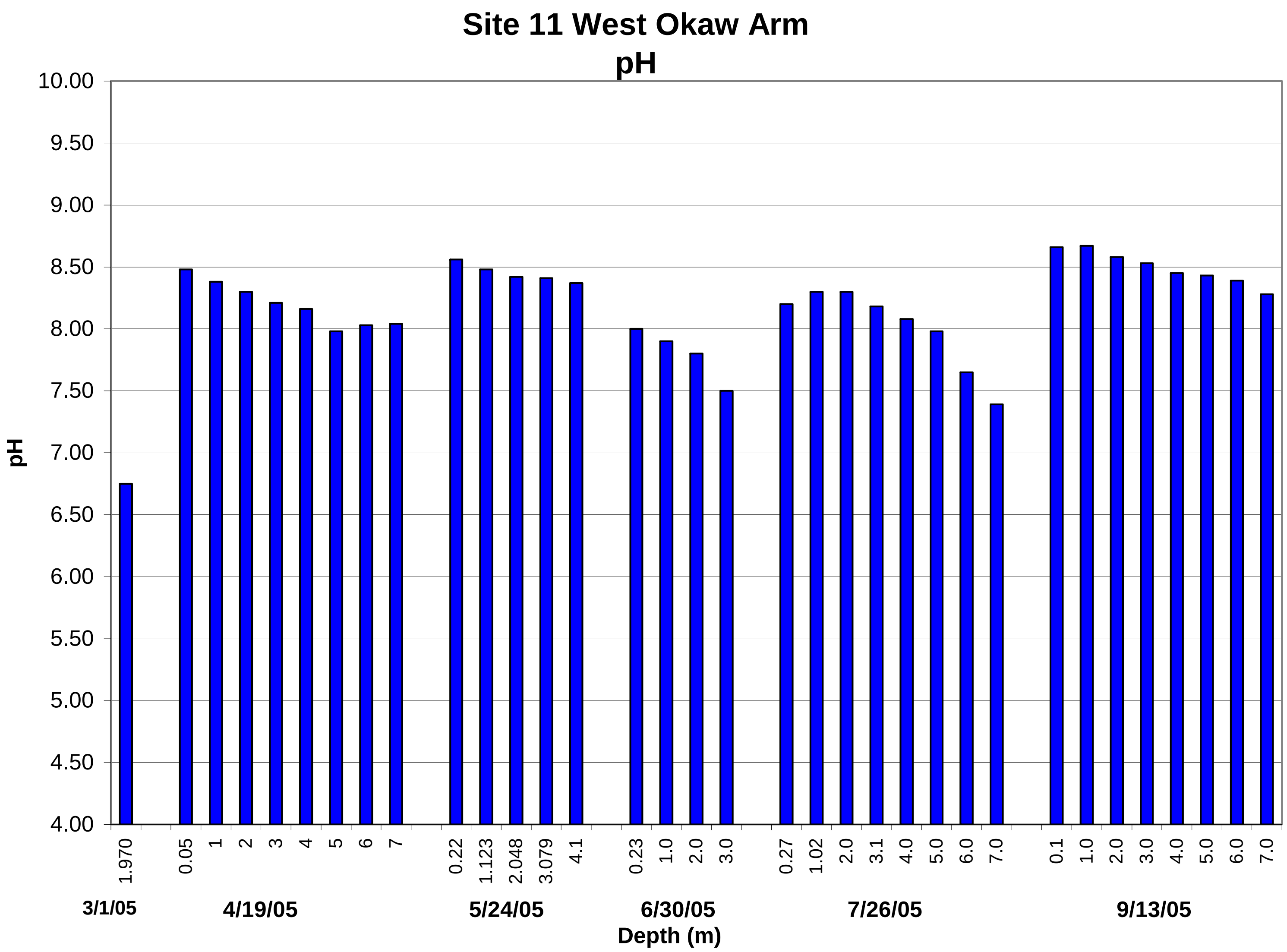
Site 2 Dam lake Side
pH
10.00
9.50
9.00
8.50
8.00
7.50
7.00
6.50
6.00
5.50
5.00
4.50
4.00
pH
0.52 1.59 2.97
0.20 1.0 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0 11 12 13 14
0.29 1.17 2.17 3.3 4.2 5.2 6.2 7.04
0.11 1.1 2.0 3.0 4.0 5.0 6.0 7.0 8.0 9.0 10.0
0.14 1.29 2.1 3.0 4.1 5.0 6.15 7.1 8.1 9.1 10.0
0.13 1 2 3 4 5 6 7 8
3/1/05
4/19/05
5/24/05
6/30/05
7/26/05
9/13/05
Depth (m)

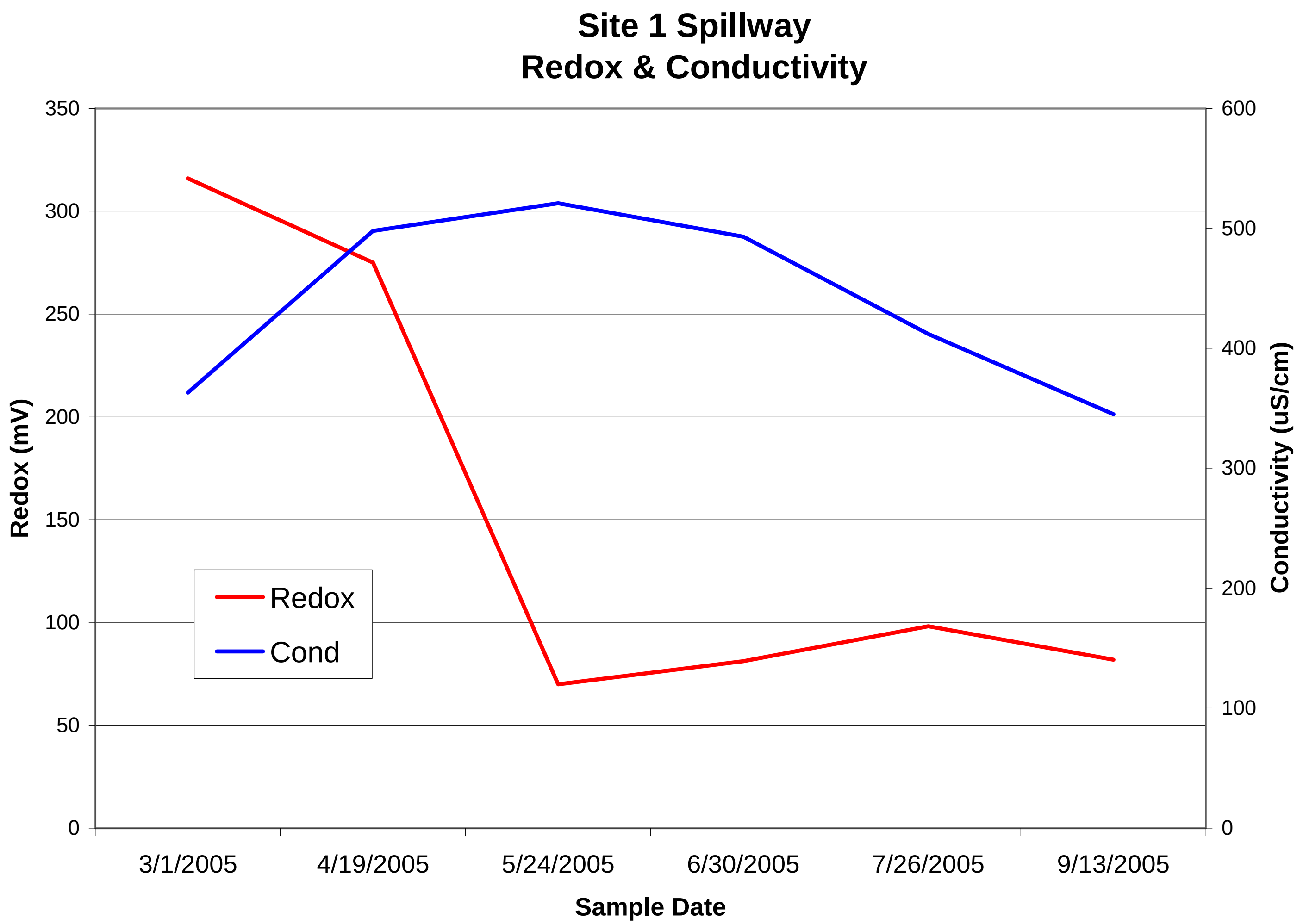

Site 4 Kaskaskia River Arm
pH
10.00
9.50
9.00
8.50
8.00
7.50
7.00
6.50
6.00
5.50
5.00
4.50
4.00
pH
0.551
0.145
1
0.337
1.22
0.5
1.2
2.1
3.0
4.0
5.2
0.1
1.0
0.1
1.0
2.0
2.5
3/1/05
4/19/05
5/24/05
6/30/05
7/26/05
9/13/05
Depth (m)

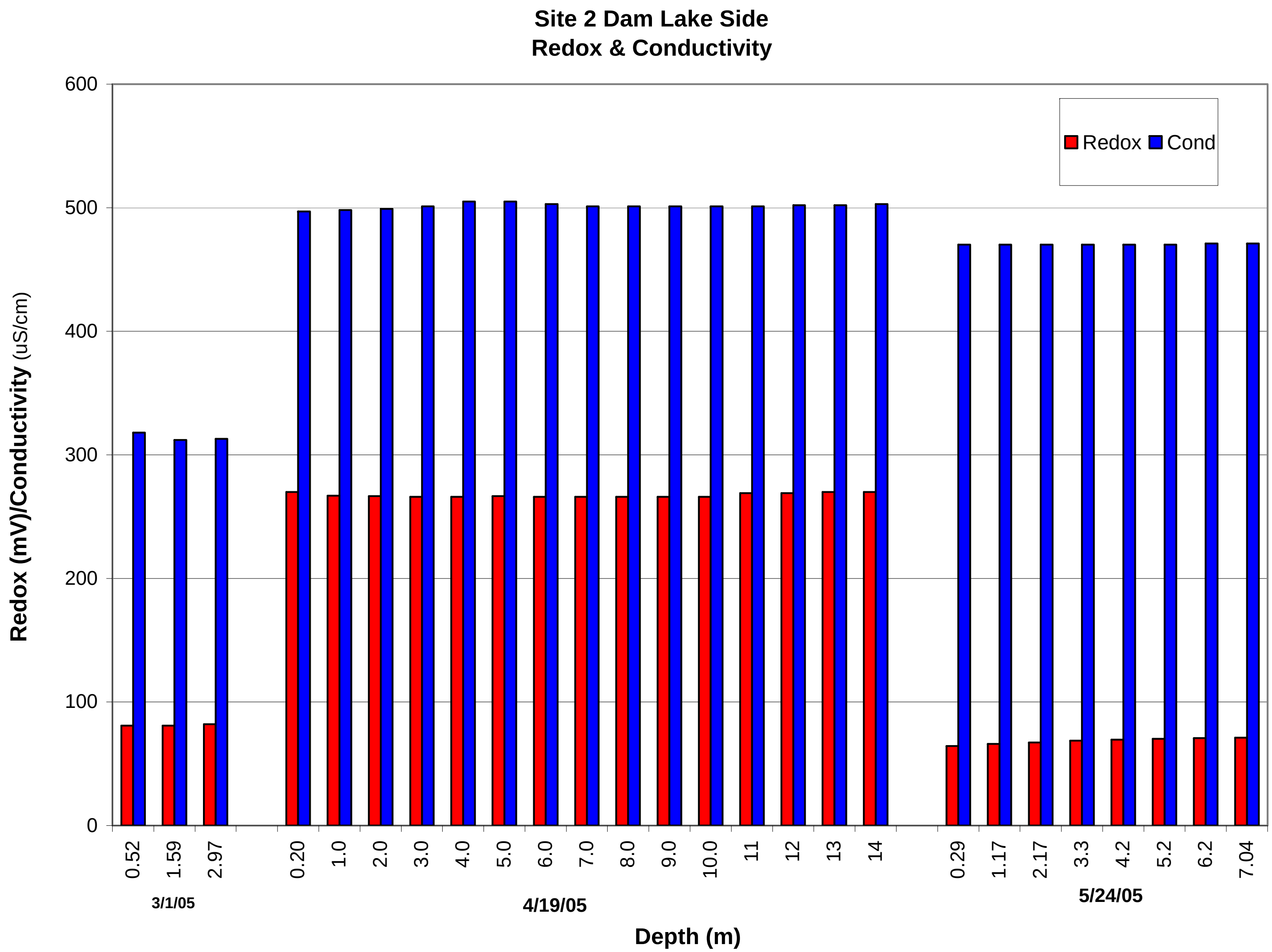


Site 7 Kaskaskia River
pH
10
9
8
7
6
5
4
3
2
1
0
pH
3/1/2005
4/19/2005
5/24/2005
6/30/2005
9/13/2005
Sample Date

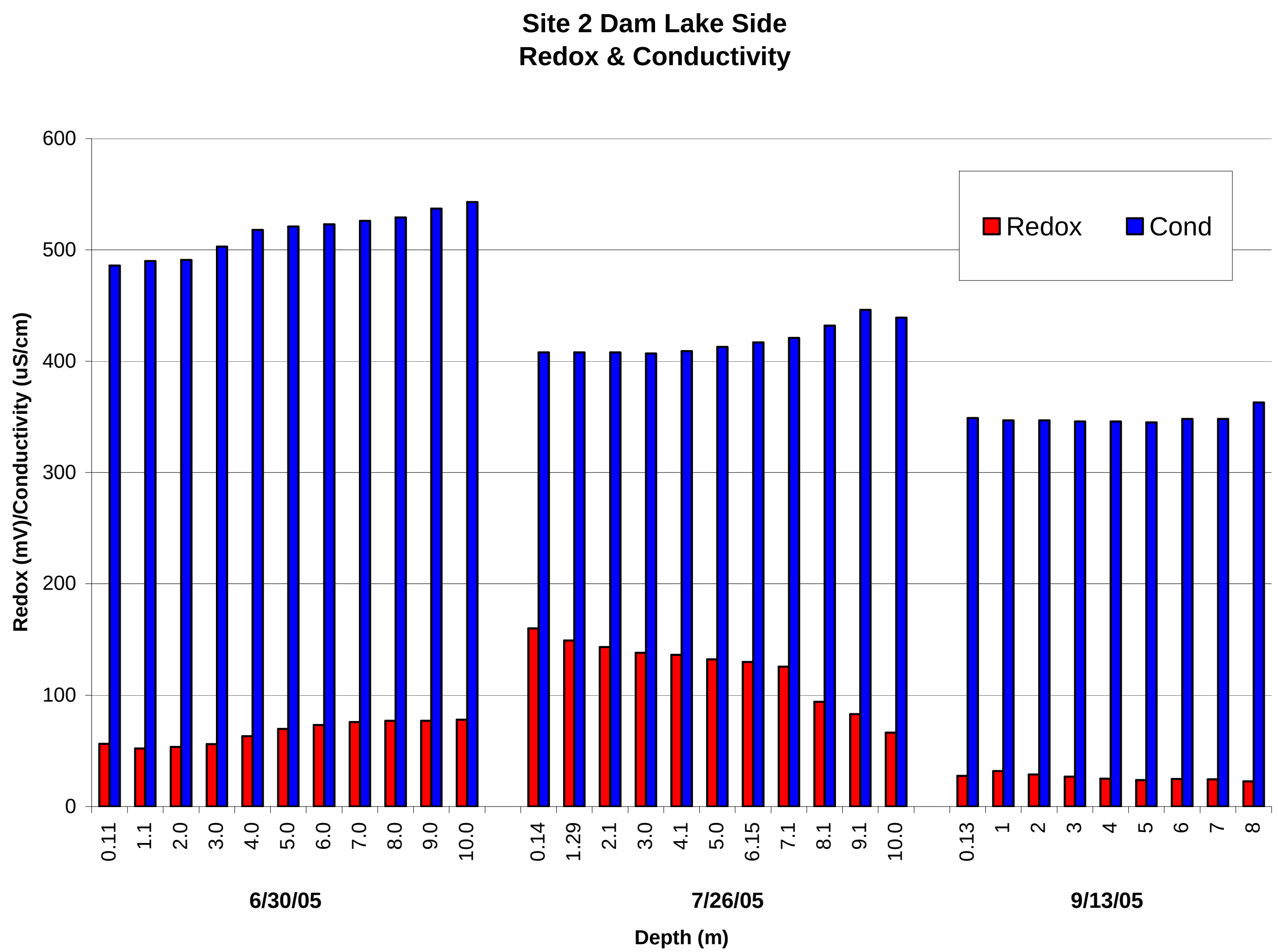

Site 9 West Okaw River
pH
10
9
8
7
6
5
4
3
2
1
0
pH
3/1/2005
4/19/2005
5/24/2005
6/30/2005
7/26/2005
9/13/2005
Sample Date


Site 11 West Okaw Arm
pH
10.00
9.50
9.00
8.50
8.00
7.50
7.00
6.50
6.00
5.50
5.00
4.50
4.00
pH
1.970
0.05
1
2
3
4
5
6
7
0.22
1.123
2.048
3.079
4.1
0.23
1.0
2.0
3.0
0.27
1.02
2.0
3.1
4.0
5.0
6.0
7.0
0.1
1.0
2.0
3.0
4.0
5.0
6.0
7.0
3/1/05
4/19/05
5/24/05
6/30/05
7/26/05
9/13/05
Depth (m)

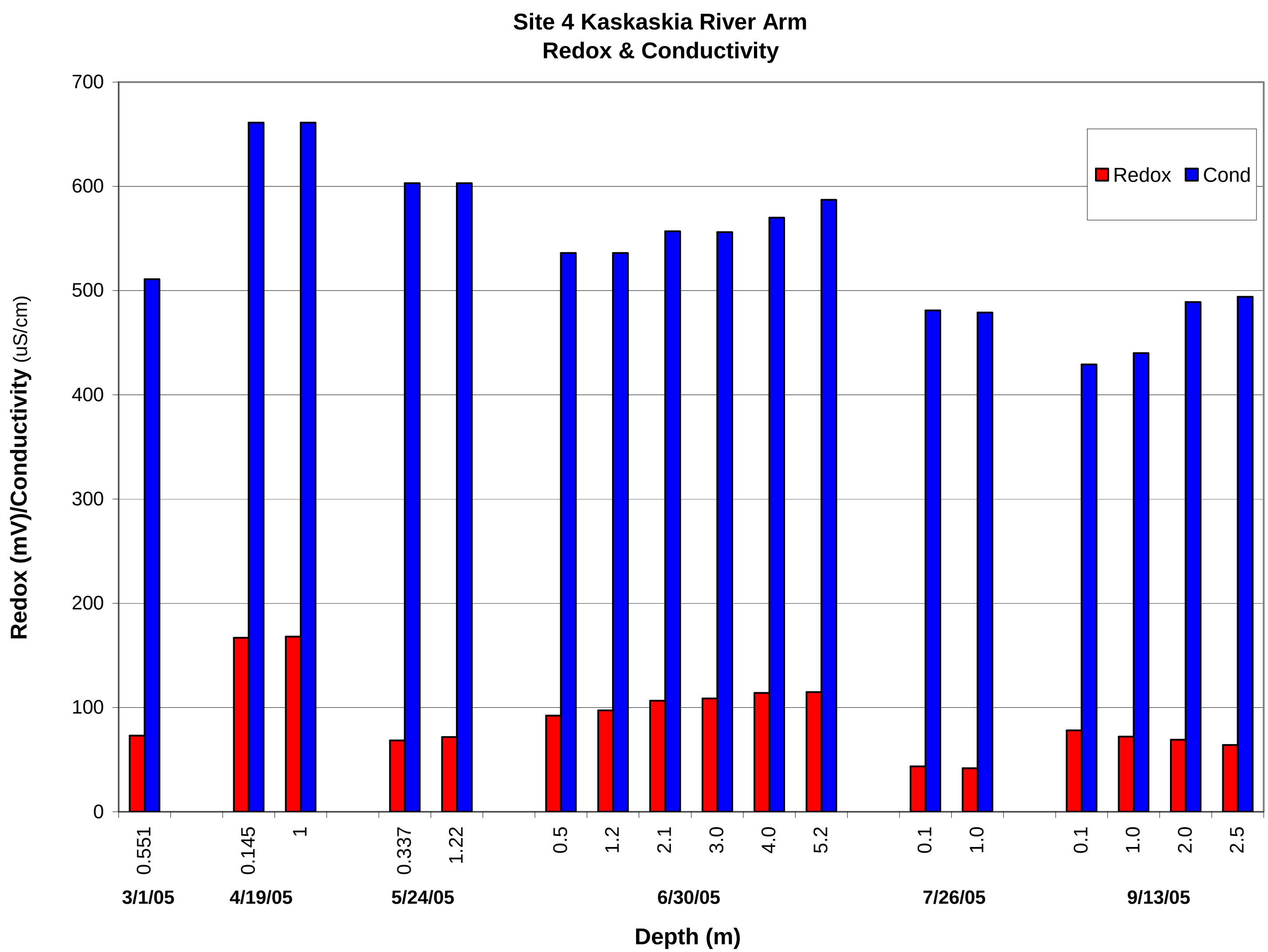

Site 1 Spillway
Redox & Conductivity
Redox (mV)
Conductivity (uS/cm)
Sample Date
350
300
250
200
150
100
50
0
600
500
400
300
200
100
0
3/1/2005
4/19/2005
5/24/2005
6/30/2005
7/26/2005
9/13/2005
Redox
Cond

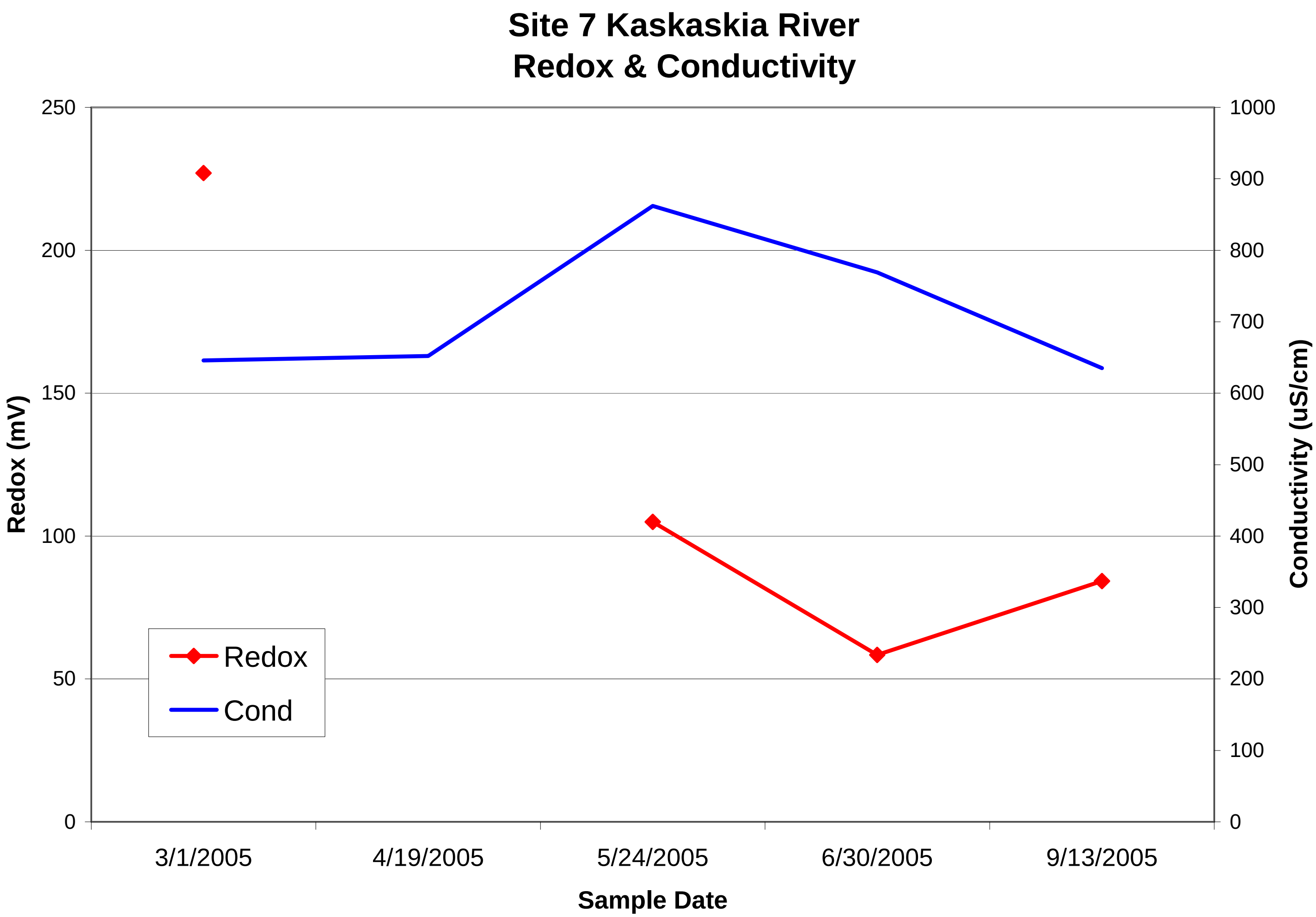


Site 2 Dam Lake Side
Redox & Conductivity
Redox (mV)/Conductivity (uS/cm)
600
500
400
300
200
100
0
Redox
Cond
0.52
1.59
2.97
0.20
1.0
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
11
12
13
14
0.29
1.17
2.17
3.3
4.2
5.2
6.2
7.04
3/1/05
4/19/05
5/24/05
Depth (m)

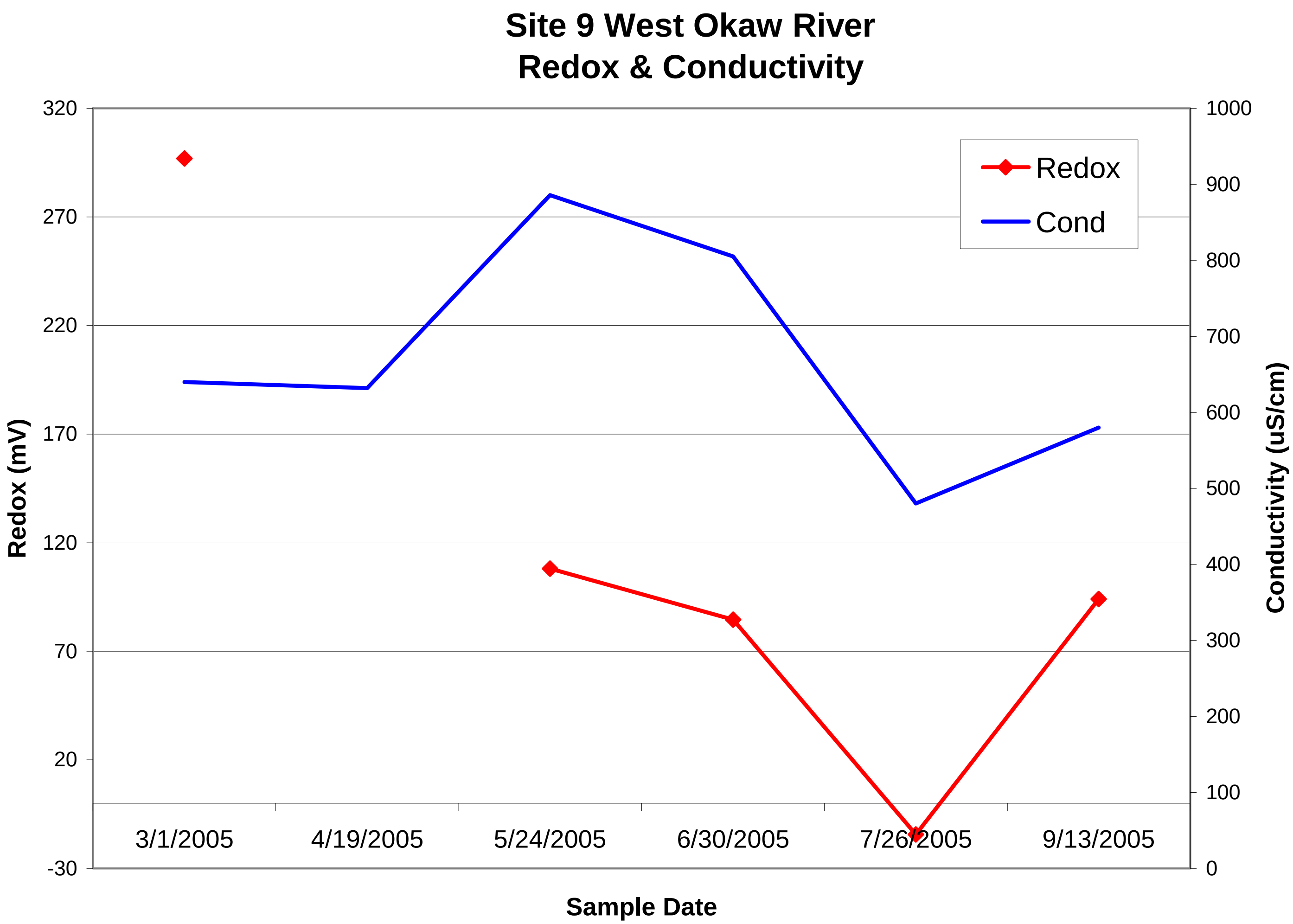


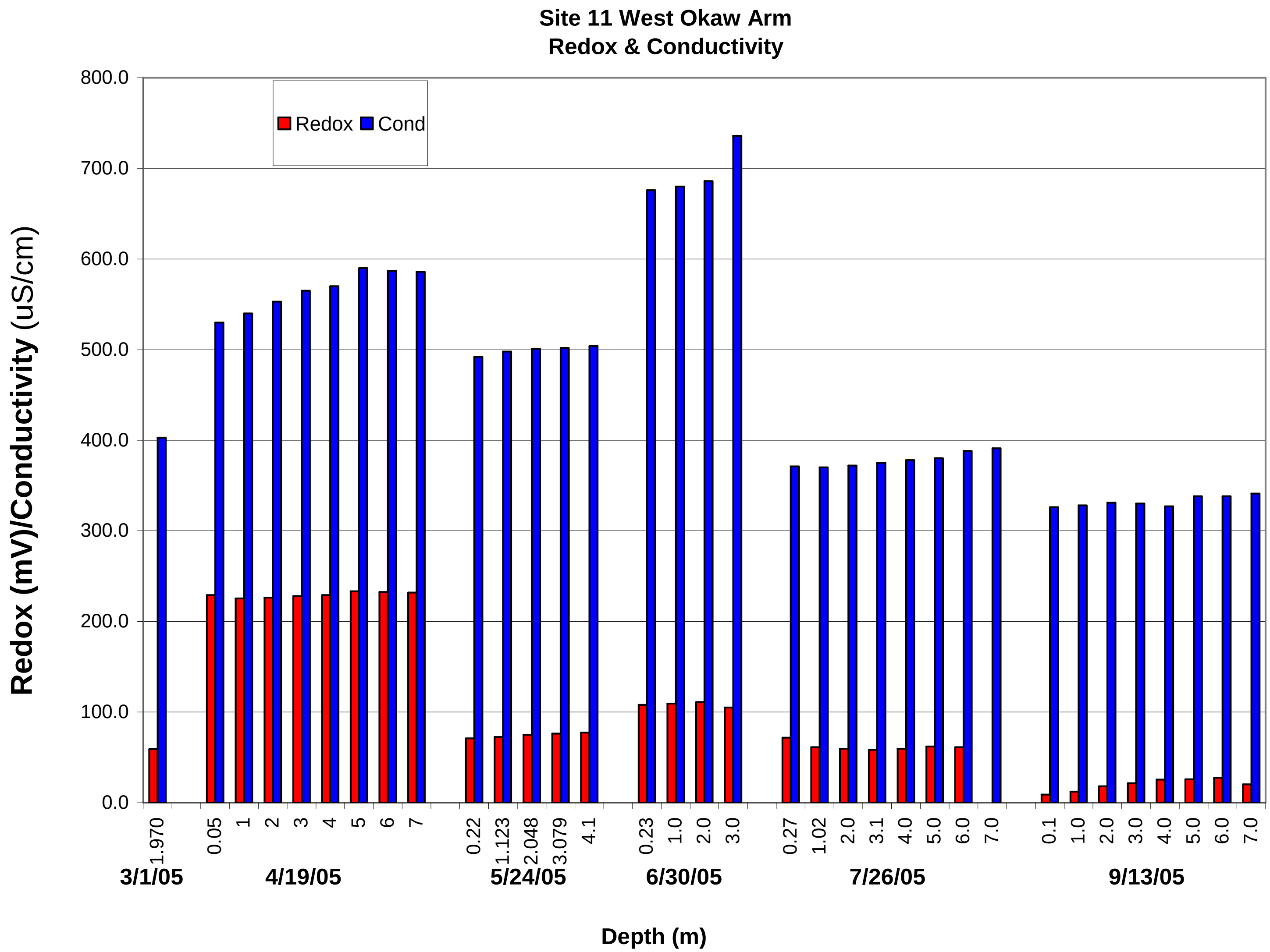
Site 2 Dam Lake Side
Redox & Conductivity
600
500
400
300
200
100
0
Redox (mV)/Conductivity (uS/cm)
Redox
Cond
0.11
1.1
2.0
3.0
4.0
5.0
6.0
7.0
8.0
9.0
10.0
0.14
1.29
2.1
3.0
4.1
5.0
6.15
7.1
8.1
9.1
10.0
0.13
1
2
3
4
5
6
7
8
6/30/05
7/26/05
9/13/05
Depth (m)


Site 4 Kaskaskia River Arm
Redox & Conductivity
Redox (mV)/Conductivity (uS/cm)
700
600
500
400
300
200
100
0
Redox
Cond
0.551
0.145
1
0.337
1.22
0.5
1.2
2.1
3.0
4.0
5.2
0.1
1.0
0.1
1.0
2.0
2.5
3/1/05
4/19/05
5/24/05
6/30/05
7/26/05
9/13/05
Depth (m)

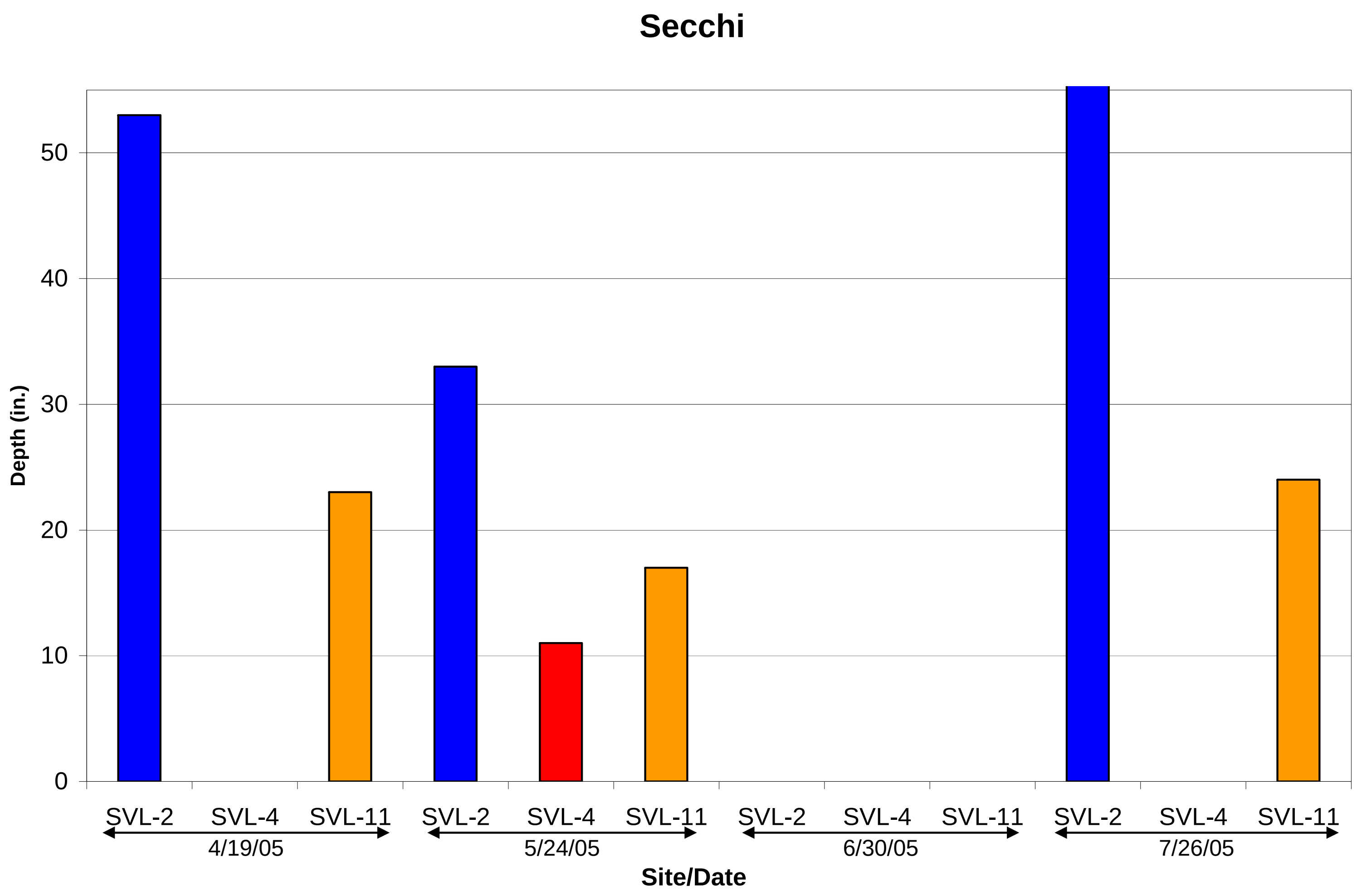


Site 7 Kaskaskia River
Redox & Conductivity
Redox (mV)
Conductivity (uS/cm)
Sample Date
250
200
150
100
50
0
1000
900
800
700
600
500
400
300
200
100
0
3/1/2005
4/19/2005
5/24/2005
6/30/2005
9/13/2005
Redox
Cond


Site 9 West Okaw River
Redox & Conductivity
Redox (mV)
Conductivity (uS/cm)
Sample Date
Redox
Cond
320
270
220
170
120
70
20
-30
1000
900
800
700
600
500
400
300
200
100
0
3/1/2005
4/19/2005
5/24/2005
6/30/2005
7/26/2005
9/13/2005



Site 11 West Okaw Arm
Redox & Conductivity
Redox
Cond
800.0
700.0
600.0
500.0
400.0
300.0
200.0
100.0
0.0
Redox (mV)/Conductivity (uS/cm)
1.970
0.05
1
2
3
4
5
6
7
0.22
1.123
2.048
3.079
4.1
0.23
1.0
2.0
3.0
0.27
1.02
2.0
3.1
4.0
5.0
6.0
7.0
0.1
1.0
2.0
3.0
4.0
5.0
6.0
7.0
3/1/05
4/19/05
5/24/05
6/30/05
7/26/05
9/13/05
Depth (m)



Secchi
Depth (in.)
0
10
20
30
40
50
SVL-2
SVL-4
SVL-11
SVL-2
SVL-4
SVL-11
SVL-2
SVL-4
SVL-11
SVL-2
SVL-4
SVL-11
4/19/05
5/24/05
6/30/05
7/26/05
Site/Date