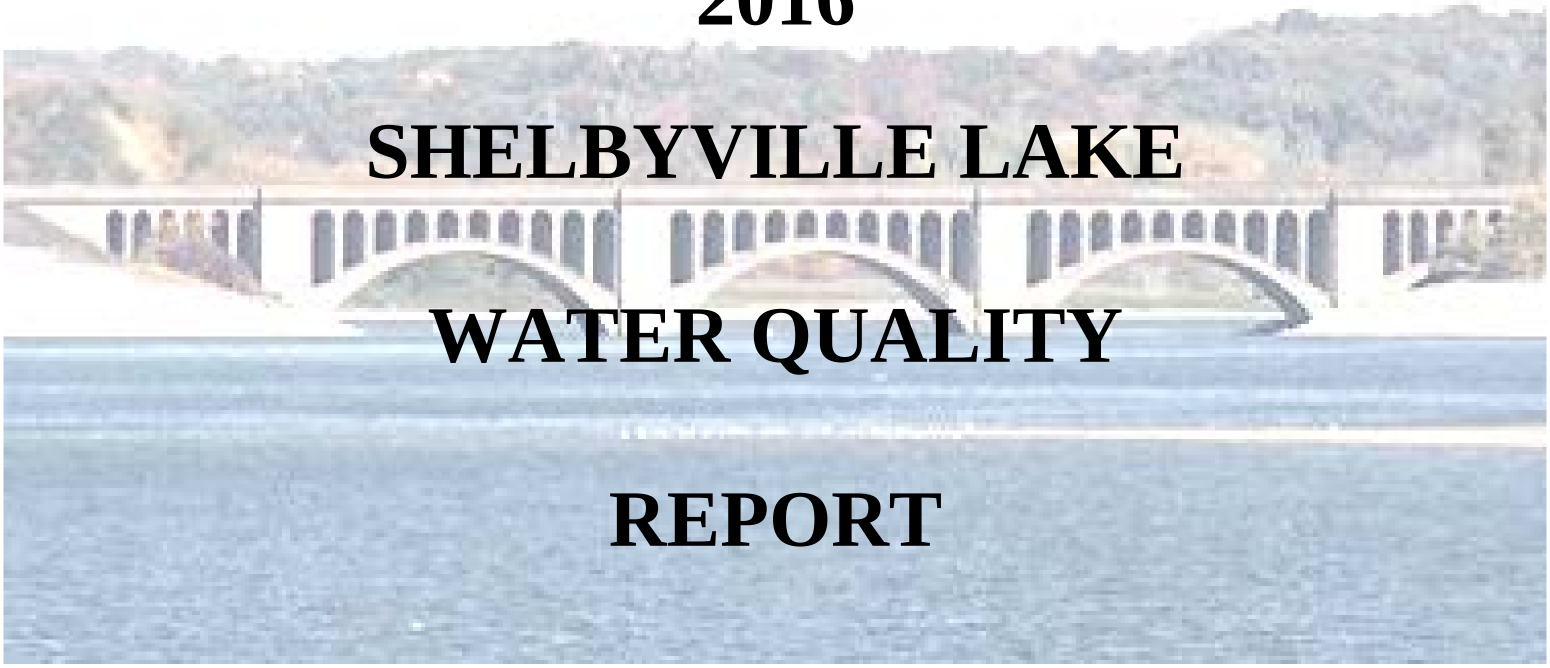
2016

SHELBYVILLE LAKE

WATER QUALITY

REPORT



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

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Executive Summary

The purpose of this report is to provide an annual analysis of the water quality in the lake for the past year. Shelbyville Lake is a multi-purpose reservoir located on the Kaskaskia River, one-half mile east and one-fourth mile north of the town of Shelbyville, Illinois and 120 miles northeast of St. Louis. The lake is 20 miles long, 1 to 1.5 miles wide, and has approximately 11,100 acres of water surface at summer pool. The lake is located on the Kaskaskia River at river mile 222 upstream from its confluence with the Mississippi River.

The water of Shelbyville Lake and the downstream river channel is generally good – or within acceptable limits as recommended by the State of Illinois. Despite overall good quality, in 2016 the Shelbyville Lake experienced exceedances for the following parameters during the sampling season: nitrogen, phosphorus, total suspended solids, pH, and E. coli. The lake is a shallow reservoir susceptible to high winds. These conditions prevent the lake from stratifying for long periods during the summer months. Several years ago a remote sensor was installed on the spillway wall to allow the project as well as water quality personnel to remotely monitor temperature and oxygen readings to avoid fish kills by altering release rates. No fish kills were observed during 2016.

All sampling sites met the appropriate state standards during 2016 except nitrogen, phosphorus, total suspended solids, and pH. All E. coli beach samples met appropriate state standards except at Sullivan Creek in August and Wilborn Creek in July and August. These bacteria exceedances were each preceded by rain events and repeat tests met standards. Phosphorus levels at the lake sites have exceeded the state standard on a routine basis. Generally phosphorus levels in the tailwater and lake site near the dam (site 2) are lower than the incoming tributary flows, which indicates that the lake is sinking the phosphorus. This is also occurring with nitrogen. The project area has several pollution potentials, with agriculture probably being the major contributor; but at present time, no major form of degradation to the lake or streams is apparent. Constant water quality monitoring will continue to check future degradation of the watershed.

WATER QUALITY MONITORING PROGRAM

1.0 GENERAL OVERVIEW

This report summarizes water quality activities of the St. Louis District for Fiscal Year 2016 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. According to the U.S. Environmental Protection Agency (USEPA) high levels of nutrients and poor lakeshore habitat are some of the most significant problems in our nation's lakes. Shoreline vegetation provides shelter for aquatic wildlife, reduces sediment and nutrient movement into the lake from runoff. The biology of a lake is characterized by the diversity of its organisms. The number and kinds of plant and animal species present is a direct measure of a lake's well-being. Water quality at Shelbyville Lake is directly assessed using stream and lake data from 5 site locations (see figure 1).

Water quality monitoring remains one of the Branch's 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 to 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 to continue to evaluate trend analysis in relation to baseline conditions at all projects.

Water quality data is provided to the Illinois Environmental Protection Agency (IEPA) to be used in the Illinois Integrated Water Quality Report, which is required every two years by the Clean Water Act Sections 303(d) and 305(b). IEPA does not monitor Shelbyville Lake. However, IEPA has stated that since the Corps lakes are the 3 largest lakes in the state, it is critical that their quality be routinely assessed. The state indicated that having the federally collected water quality data available now and in the future is critical to the state of Illinois meeting their mission in complying with the Clean Water Act Sections 305(b) and 303(d).

The National Water Quality Inventory Report to Congress 305(b) report is the primary vehicle for informing Congress and the public about general water quality conditions in the United States. This document characterizes our water quality, identifies widespread water quality problems of national significance, and describes various programs implemented to restore and protect our waters.

Under Section 303(d) of the 1972 Clean Water Act, states, territories and authorized tribes are required to develop a list of water quality limited segments. These waters on the list do not meet water quality standards, even after point sources of pollution have installed the minimum required levels of pollution control technology. The law requires that these jurisdictions establish priority rankings for water on the lists and develop action plans, called Total Maximum Daily Loads (TMDL), to improve water quality.

Currently the Illinois Environmental Protection Agency (IEPA) has listed Shelbyville Lake impaired for Total Suspended Solids and aquatic plants. The lists of sources for these impairments are runoff, crop production, shore modifications, and recreational pollution. Continued monitoring of the lake and its tributaries is vital in assisting the future assessment of the lake for these and other possible impairments. The water quality monitoring program represents the single metric that encompasses the overall health of the watershed as it is a direct measure of how well the environmental stewardship programs are working.

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 that 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 2016 to assure the safe conditions for human recreation, wildlife and aquatic life was maintained and managed within the lake system. In 2016 three sampling events were conducted at six sites. The 2016 water quality monitoring program began in May and continued through August. During the past several years, water quality monitoring has been reduced due to funding. Prior to 2009 five sampling events were conducted during the recreational season. In the initial phase of the sampling program during the 1970’s and 80’s six or seven sampling events were conducted. A restored number of sampling events would provide the ability to better evaluate water quality trends, to better defend project operations (lake levels, releases, maintenance projects, construction projects, etc.), to better confirm that we meet state water quality standards, and to better confirm that human health and safety are adequately protected. 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 12 (SBV-12), at Jonathan Creek Access, Site 13 (SBV-13), at West Eden Access, 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. During each sampling period one site is 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. In 2014, it was decided to replace sites 7 and 9 with other locations closer to the lake. Sites 12 and 13 replaced sites 7 and 9, respectively. These new sites were chosen to provide tributary sample sites closer to the lake so that additional tributaries were incorporated into the samples. These samples provide a more concise account of the water quality coming directly into Shelbyville Lake from its tributaries.

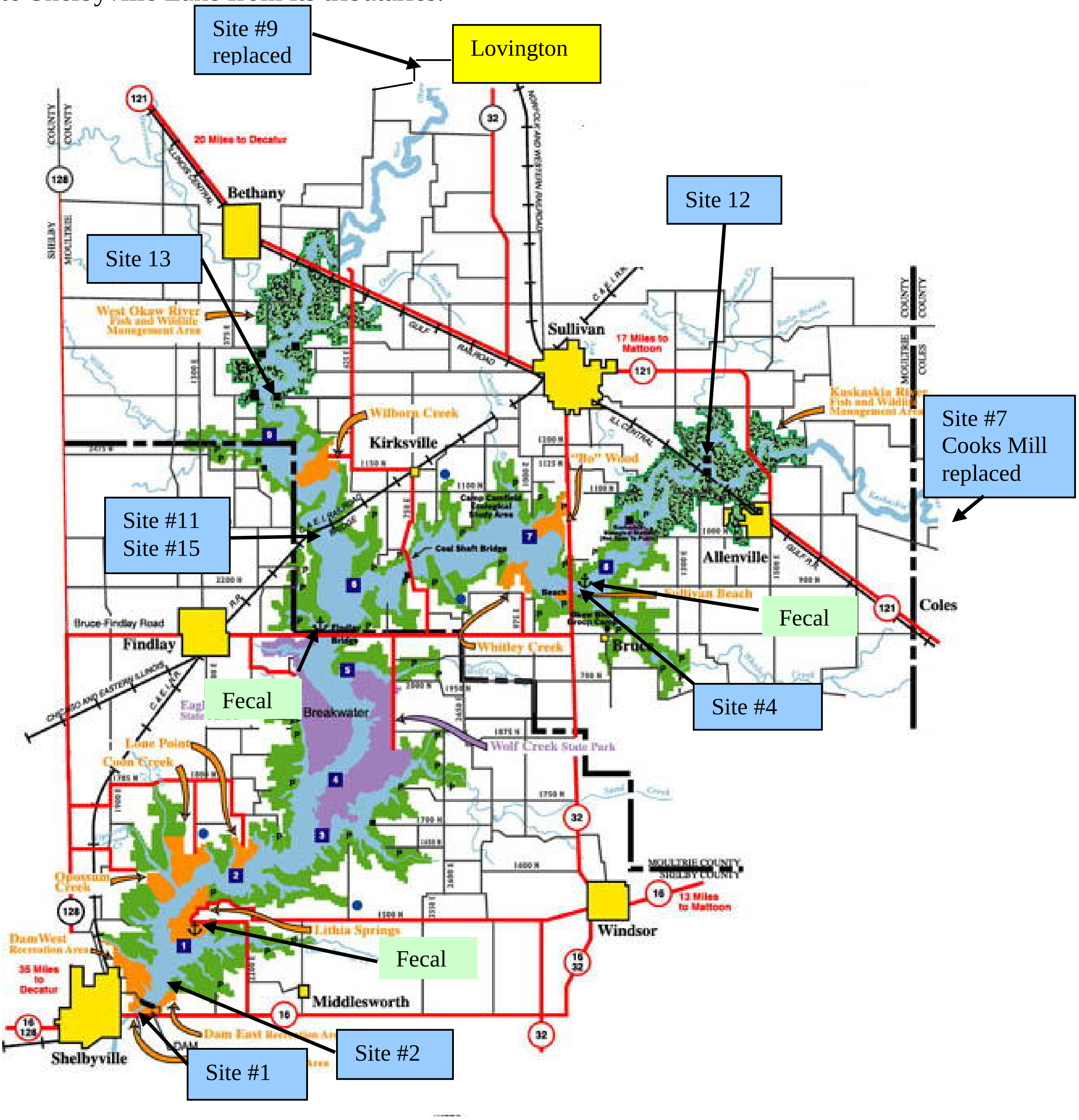


Figure 1
Location of sample sites
In 2014 sites 12 and 13 replaced sites 7 and 9 respectively.

2.0 WATER QUALITY ASSESSMENT CRITERIA

2.1 Water Quality

The water quality assessment criteria, which have been generally accepted criteria for sustaining adequate aquatic plant and animal growth were based upon the State of Illinois regulatory limits for certain contaminants. The sampling 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 water quality parameters were analyzed in Fiscal Year 2016 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), Escherichia coli (E. coli), pH, temperature, dissolved oxygen, specific conductance, oxidation-reduction potential (ORP), chlorophyll, pheophytin-a, pesticides and herbicides.

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 where a limit has been established for the parameters analyzed.

TABLE 2.1

State of Illinois
Water Quality Standards

PARAMETER	LIMIT
Temperature	Rise of 2.8^{o}C above normal seasonal temp
Ammonia Nitrogen	15 mg/L
Nitrate Nitrogen	10 mg/L
Total Iron	2.0 mg/L (2nd Contact & Aquatic Life)
Manganese	1.0 mg/L
Total Phosphate	0.05 mg/L Lakes; 0.61 mg/L Streams
E. Coli	Illinois standard is 235 E. coli per 100ml for single sample or 126 for geometric mean.
pH	Range: 6.5 to 9.0
DO	> 5.0 mg/L
Conductivity	1,667 *u*S/cm≈TDS of 1,000 mg/L
Total Suspended Solids (TSS)	116mg/L (Streams); >=12mg/L (Lakes)
Atrazine	0.003 mg/L[1]; 82ug/L[2]; 9ug/L[3]
Alachlor	0.002 mg/L (Drinking Water Standard)
Cyanazine	370ug/L Acute; 30ug/L[3]
Metolachlor	1.7mg/L Acute
Simazine	4.0ug/L [1]
Trifluralin	26ug/L Acute; 1.1ug/L[3]

Pendimethalin (PROWL)	70ug/L HSBL, 20ug/L[1]

[1] Drinking Water Standard
[2] Acute
[3] Chronic
Health Based Screening Levels (HBSL)

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, decreases 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. Phosphorus is typically the limiting nutrient in a water body. Therefore, addition of phosphorus to the ecosystem stimulates the growth of plants and algae. Phosphorus is delivered to lakes and streams by way of storm water runoff from agricultural fields, residential property, and construction sites. Other sources of phosphorus are anaerobic (absent of oxygen) decomposition of organic matter, leaking sewer systems, waterfowl, and point source pollution. The general standard for phosphorus in lake water is 0.05mg/L. Dissolved phosphorus, also called ortho-phosphorus, is generally found in much smaller concentrations than total phosphorus and is readily available for uptake. For this reason dissolved phosphorus 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. Metal 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 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 volatile suspended solids (VSS) that consist of organic material and nonvolatile suspended solids (NVSS), which is comprised of inorganic mineral 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 suspended solids indicate the presence of organics in suspension; and, therefore, show additional demand levels of oxygen. Illinois does not currently have a standard for TSS or TVSS. However, literature suggests that NVSS above 15mg/L could highly impair recreational lake use. A NVSS of 3 to 7mg/L might cause slight impairment.

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 high 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 235 colonies per 100ml per single sample water or geometric mean of 126 colonies per 100ml. 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. Since 2009 the St. Louis District has been using E. coli as the standard indicator.

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 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 holds 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^{o}C. Most aquatic organisms require a minimum concentration of dissolved oxygen to survive (5 mg/l or above). In spring, surface waters of the lake mix with the water below by 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. A rapid change in temperature within the metalimnion occurs and is referred to as a thermocline. 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 a neutral pH while readings below seven are acidic and above are alkaline. Most Illinois lakes range from 6 to 9 on the pH scale. If a body of water is alkaline, then it has the ability of act as buffer which can neutralize incoming acidic conditions. 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 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. Conductivity is also affected by water temperature. The warmer the water, the higher the conductivity. Conductivity in streams and rivers is affected by the geology of the area. Streams running through granite areas tend to have lower conductivity due to granite being composed of inert material, materials that do not ionize or dissolve into ionic compounds in water. Conversely, streams that run through areas of limestone or clay soils tend to have higher conductivity readings because of the presence of materials that ionize. Conductivity is useful as a general measure of water quality. A stream tends to have a relatively constant range of conductivity that once established can be used as a baseline. Significant changes, either high or low, might indicate a source of pollution has been introduced into the water. The pollution source could be a treatment plant, which raises the conductivity; or an oil spill, which would lower the conductivity.

Redox or Oxidation-Reduction Potential (ORP) is a measurement of oxygen reduction activity. 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. Positive readings indicate increased oxidizing potential while negative readings indicate increased reduction. The ORP probe is essentially a millivolt meter, measuring the voltage across 2 electrodes with the water in between. ORP values are used much like pH values to determine water quality. While pH readings characterize the state of a system relative to the receiving or donating hydrogen ions (base or acid), ORP readings characterize the relative state of losing or gaining electrons. The conversion of ammonia (NH_3) requires an oxidating environment to convert it into nitrites (NO_2) and nitrates (NO_3). Ammonia levels as low as 0.002mg/L can be harmful to fish. Generally ORP readings above 400mV are harmful to aquatic life. However, ORP is a non-specific measurement which is a reflection of a combination of effects of all the dissolved materials in the water. Therefore, the measurement of ORP in relatively clean water has only limited utility unless a predominant redox-active material is known to be present.

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: (1) color of water, (2) amount of phytoplankton in the water column, and (3) amount of inorganic material in the water column. Secchi depth integrates the combined impacts of all three of these factors. Water transparency was measured using a Secchi disk. Secchi disk readings were taken at all lake sites.

2.2 Sediment

In accordance with EM-1110-2-1201, sediment samples should be taken to monitor and assess potential impacts to aquatic and human health. To assess ecological risk, sample values are be compared against toxicity information published in the National Oceanic Atmospheric Administrations (NOAA) Screening Quick Reference Tables (SQRT) or similar references for ecological receptors in freshwater sediment. Without standards or other widely applicable numerical tools, NOAA scientists found it difficult to estimate the possible toxicological significance of chemical concentrations in sediment. Therefore, numerical sediment quality guidelines (SQG's) were developed as informal, interpretive tools. The SQGs were not promulgated as regulatory standards, but rather as informal, non-regulatory guidelines for interpreting chemical data from analyses of sediments. For potential ecological risk from inorganic contaminants, seven metals are typically of "most concern" with regards to fish and wildlife: Arsenic, Copper, Cadmium, Selenium, Mercury, Lead, and Zinc. Avian species are thought to be particularly sensitive to arsenic, which is considered a carcinogenic, mutagenic, and teratogenic contaminant in a variety of species in elevated doses over time. Avian species are also known to be particularly sensitive to lead in the environment with effects ranging from mortality, reduced growth and reproductive output, behavior changes, blood chemistry alterations, and lesions of major organs. Finally, the embryo stages in fish and avian species are known to be the most sensitive to selenium affecting reproductive success.

For potential human health risk, there are no known values in Illinois for sediments. While not a direct correlation, sample results are compared against Illinois Tiered Approach to Corrective Action Objectives (TACO) and Non-TACO lowest default target levels for all soil types and exposure pathways for soils.

3.0 SUMMARY OF MONITORING RESULTS

3.1 Water Quality Summary

The monitoring program for Shelbyville Lake during Fiscal Year 2016 revealed good water quality when compared to limits established by the IEPA for general use, secondary contact, and indigenous aquatic life. Normally seasonal change brings on gradual lake stratification during the summer months. Water quality trends on a yearly basis are hard to determine when only conducting 3 to 4 sampling events. However, over the course of a 5 year period these 3 to 4 sampling events per year are adequate to determine trends in water quality. 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.

E. coli are sampled at the marinas to ensure that the marina areas are not being contaminated by boats with restroom facilities. E. coli levels did not exceed the Illinois standard of 235 mpn/100ml at any of the marinas in FY16. The project office is notified as soon as any readings not meeting standards are received. Two samples at each beach are collected by the project every 2 weeks during the recreation season. All beaches were below the 235 standard during the recreational season except Sullivan Creek in August (648.8 col/100ml) and Wilborn Creek in July (980.4) and August (2419.6). Rainfall events can trigger high levels of E. coli. Records indicate rain events preceded each of these dates where there were exceedances. According to the Illinois Department of Health an E. coli count of greater than 235 colonies/100ml in any single of a two sample set shall require the submission of 2 additional samples to be collected on the same day within 24 hours after notification by the Department. Follow up samples were taken and the results were below the standard.

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. Manganese did not exceed the IL standard of 1.0mg/L for general use. 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. Illinois has a secondary contact and aquatic life standard. It does not currently have a general use standard for iron. Neither iron nor manganese exceeded the Illinois standard.

Nitrogen and phosphates are sampled at all sites. As for the past several years the 2016 phosphate results at the lake sites are above the 0.05 mg/L standard for most of the sampling season. These higher levels may be contributed to application of fertilizers and/or rain events. The tributaries contribute high levels of phosphates into the lake. As in previous years phosphorus levels dropped below the dam. Later in the year the lake was consuming phosphate before it was discharged downstream through the dam. In effect the lake is acting as a sink for phosphorus. Phosphorus in water is not considered directly toxic to humans and animals therefore, no drinking water standards have been established for phosphorus. However, phosphorus can cause health threats through the stimulation of toxic algal blooms and the resulting oxygen depletion. 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 phosphorus 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 2016.

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. Chlorophyll levels were in the moderate to high range during the 3 sampling events with an average concentration of 50 mg/cu m. This is another indicator that the lake is eutrophic (nutrient rich). High levels often indicate poor water quality and low levels suggest good conditions. However, short term 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. Chlorophyll is monitored to provide indicators of algae growth and therefore, potential oxygen depletion activity. Chlorophyll concentrations and cyanobacteria cell counts serve as proxies for the actual presence of algal toxins. Exposure to cyanobacteria or their toxins may produce allergic reactions such as skin rashes, eye irritations, respiratory symptoms, and in some cases more severe health effects. Microcystin is currently believed to be the most common cyanotoxin in lakes. While EPA does not currently have water quality criteria for algal toxins, the World Health Organization (WHO) has established recreational exposure guidelines for Chlorophyll a, cyanobacterial cell counts, and microcystin. Levels of chlorophyll 50 mg/cu m and greater are considered to create moderate risk according to the WHO. Shelbyville Lake was in the moderate risk of exposure category for chlorophyll. Illinois does not currently have a standard for chlorophyll. Shelbyville Lake also displayed moderately high chlorophyll levels for 2016. It is not unexpected for there to be elevated levels of chlorophyll in the tributaries during the warmer months. Though it is not considered an immediate concern, continued monitoring will allow for detection of an increasing trend.

Atrazine and Alachlor are pesticides that were sampled at all sites. These chemicals are herbicides used to control weed growth. Normally pesticides are detected early in the year, in the months of April and May when farmers apply the chemicals. Cyanizine, Metolachlor, Trifluralin and Simazine were also analyzed as part of the pesticide screening. None of these constituents exceeded Illinois standards. 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 management practices when using these chemicals.

Total Suspended Solids (TSS) and Total Volatile Suspended Solids (TVSS) samples are collected at all sites. Tributary sites did not exceed the Illinois standard of 116mg/L for streams. All lake samples exceeded the Illinois standard of 12mg/L for lakes for all sample dates except SBV-4 on July 7, 2016 (10.7mg/l). Solids can affect water quality by increasing temperature through the absorption of sunlight by the particles in the water, which also affects the clarity of the water. This can then affect the amount of oxygen in the water. As is the case with many of the Illinois lakes they are shallow and susceptible to high winds. These winds are constantly producing wave erosion of the banks and suspending material in the water. These conditions attribute to the lake exceeding the Illinois standard for TSS in lakes. Suspended solids within the lake were significantly decreased or less than levels in the tributaries. The solids appear to be dropping out of the water column as the water moves towards the dam. This results in improved water quality downstream as well as sedimentation in the lake bottom.

Total Organic Carbon (TOC) is collected at all sites. Data indicates that TOC is higher in the upper portions of the lake. Shelbyville TOC levels are very similar to Carlyle TOC levels for the 2016 sampling season. TOC is an indicator of the organic character of water. The larger the carbon or organic content, the more oxygen is consumed. Illinois does not currently have a standard for TOC. Since Illinois does not have a standard for this parameter, observations of high or low are relative to the current sampling period.

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. For the 2016 sampling season at Shelbyville Lake temperature and dissolved oxygen levels were well within the state guidelines.

pH is taken at all sites and at 1 meter intervals at lake sites. All sites were within the 6 to 9 pH range except for site SBV-11 on August 23, 2016. The pH at site SBV-11 on August 23 was recorded at 9.04 on the surface and 9.08 at a depth of about 4 meters. Variances in pH can be caused by increased runoff due to a rainfall event, unusual temperature extremes, or erosion from land disturbances. Another cause may be that photosynthesis uses up dissolved carbon dioxide, which acts like carbonic acid (H_2CO_3) in water. CO_2 removal in effect reduces the acidity of the water, thus the pH increases. This one minor exceedance of the state recommended pH range of 6.5-9 is not considered an issue.

Secchi disk readings indicate that as the water travels down the lake it becomes clearer. This is most likely the result of sediments dropping out of the water column as the water moves down stream toward the dam. Early in the year secchi disk readings may be approximately the same through the length of the lake due to lake turn over or wind mixing.

Conductivity and redox are taken at all sites and at 1 meter intervals at lake sites. Illinois does not currently have a standard for redox, but does have a standard of less than 1,667 uS/cm for conductivity. No sampling sites even approached this standard.

The remote sensor in the spillway was monitored and maintained throughout the year to allow the project as well as water quality personnel to remotely monitor temperature and oxygen readings to acquire data to inform operational actions in order to avoid fish kills. During low flow, water is discharged through the sluice gates from the bottom of the lake. This water tends to be low in oxygen and can create a low oxygen area below the dam. The sensor allows the project to monitor oxygen levels below the dam and make appropriate adjustments to avoid a possible fish kill. Normally allowing water to spill through the tainter gates or increasing the flow through the sluice gate will alleviate low oxygen levels below the dam. No fish kills were observed this year. The sonde was serviced approximately once each month from May through September. Recorded dissolved oxygen at the tail water area remained above 5 mg/l for the season with a few minor exceptions. These occurrences are likely due to instrument maintenance rather than actual conditions.

3.2 Sediment Summary

Sediment sampling was not conducted in 2016. Sediment sampling is normally conducted every 5 years if funding is available. Sediment sampling was last conducted in 2007.

4.0 PLANNED 2017 STUDIES

The Shelbyville Lake water quality monitoring will continue in Fiscal Year 2017 on a limited basis. There will be 4 sampling events in 2017. A restored number of sampling events would provide the ability to better evaluate water quality trends, to better defend project operations (lake levels, releases, maintenance projects, construction projects, etc.), to better confirm that we meet state water quality standards, and to better confirm that human health and safety are adequately protected. As with any record keeping or data analysis, the greater the sample size, the more reliable the findings. Shelbyville Lake is a high usage recreational lake. The monitoring of water quality is imperative to ensure the water quality is within acceptable limits for the designated usage.

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 12 (SBV-12) at Jonathan Creek Access, Site 13 (SBV-13) at West Eden Access, 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.

Sediment sampling will be conducted if funding is available.

In addition, water quality personnel will continue to maintain and remotely monitor the DO & temperature probe in the spillway.

APPENDIX A

DATA

LAB DATA
WATER SAMPLES

Site #	Collection Date	Reported Result	Flag	Parameter	Units
SVL-1	5/11/2016	0.20	<	Alachlor	UG/L
SVL-1	7/7/2016	0.20	<	Alachlor	UG/L
SVL-1	8/23/2016	0.22	<	Alachlor	UG/L
SVL-11	5/11/2016	0.25	<	Alachlor	UG/L
SVL-11	7/7/2016	0.20	<	Alachlor	UG/L
SVL-11	8/23/2016	0.21	<	Alachlor	UG/L
SVL-12	5/11/2016	0.24	<	Alachlor	UG/L
SVL-12	7/7/2016	0.21	<	Alachlor	UG/L
SVL-12	8/23/2016	0.22	<	Alachlor	UG/L
SVL-13	5/11/2016	0.20	<	Alachlor	UG/L
SVL-13	7/7/2016	0.20	<	Alachlor	UG/L
SVL-13	8/23/2016	0.25	<	Alachlor	UG/L
SVL-15	5/11/2016	0.21	<	Alachlor	UG/L
SVL-15	7/7/2016	0.21	<	Alachlor	UG/L
SVL-15	8/23/2016	0.20	<	Alachlor	UG/L
SVL-2	5/11/2016	0.22	<	Alachlor	UG/L
SVL-2	7/7/2016	0.20	<	Alachlor	UG/L
SVL-2	8/23/2016	0.25	<	Alachlor	UG/L
SVL-4	5/11/2016	0.21	<	Alachlor	UG/L
SVL-4	7/7/2016	0.20	<	Alachlor	UG/L
SVL-4	8/23/2016	0.22	<	Alachlor	UG/L
SVL-1	5/11/2016	0.10		Ammonia Nitrogen	MG/L
SVL-1	7/7/2016	0.34		Ammonia Nitrogen	MG/L
SVL-1	8/23/2016	0.96		Ammonia Nitrogen	MG/L
SVL-11	5/11/2016	0.10		Ammonia Nitrogen	MG/L
SVL-11	7/7/2016	0.033		Ammonia Nitrogen	MG/L
SVL-11	8/23/2016	0.072		Ammonia Nitrogen	MG/L
SVL-12	5/11/2016	0.074		Ammonia Nitrogen	MG/L
SVL-12	7/7/2016	0.072		Ammonia Nitrogen	MG/L
SVL-12	8/23/2016	0.089		Ammonia Nitrogen	MG/L
SVL-13	5/11/2016	0.093		Ammonia Nitrogen	MG/L
SVL-13	7/7/2016	0.033		Ammonia Nitrogen	MG/L
SVL-13	8/23/2016	0.054		Ammonia Nitrogen	MG/L

SVL-15	5/11/2016	0.060		Ammonia Nitrogen	MG/L
SVL-15	7/7/2016	0.030	<	Ammonia Nitrogen	MG/L
SVL-15	8/23/2016	0.062		Ammonia Nitrogen	MG/L
SVL-2	5/11/2016	0.043		Ammonia Nitrogen	MG/L
SVL-2	7/7/2016	0.055		Ammonia Nitrogen	MG/L
SVL-2	8/23/2016	0.11		Ammonia Nitrogen	MG/L
SVL-2-10	5/11/2016	0.12		Ammonia Nitrogen	MG/L
SVL-2-10	7/7/2016	0.072		Ammonia Nitrogen	MG/L
SVL-2-10	8/23/2016	0.064		Ammonia Nitrogen	MG/L
SVL-4	5/11/2016	0.095		Ammonia Nitrogen	MG/L
SVL-4	7/7/2016	0.030	<	Ammonia Nitrogen	MG/L
SVL-4	8/23/2016	0.085		Ammonia Nitrogen	MG/L
SVL-1	5/11/2016	0.10		Ammonia Nitrogen	MG/L
SVL-1	7/7/2016	0.34		Ammonia Nitrogen	MG/L
SVL-1	5/11/2016	0.20	<	Atrazine	UG/L
SVL-1	7/7/2016	0.42		Atrazine	UG/L
SVL-1	8/23/2016	0.57		Atrazine	UG/L
SVL-11	5/11/2016	1.1		Atrazine	UG/L
SVL-11	7/7/2016	0.64		Atrazine	UG/L
SVL-11	8/23/2016	0.60		Atrazine	UG/L
SVL-12	5/11/2016	0.64		Atrazine	UG/L
SVL-12	7/7/2016	0.27		Atrazine	UG/L
SVL-12	8/23/2016	0.22	<	Atrazine	UG/L
SVL-13	5/11/2016	2.6		Atrazine	UG/L
SVL-13	7/7/2016	0.20	<	Atrazine	UG/L
SVL-13	8/23/2016	0.26		Atrazine	UG/L
SVL-15	5/11/2016	0.95		Atrazine	UG/L
SVL-15	7/7/2016	0.85		Atrazine	UG/L
SVL-15	8/23/2016	0.57		Atrazine	UG/L
SVL-2	5/11/2016	0.22	<	Atrazine	UG/L
SVL-2	7/7/2016	0.67		Atrazine	UG/L
SVL-2	8/23/2016	0.66		Atrazine	UG/L
SVL-4	5/11/2016	0.33		Atrazine	UG/L
SVL-4	7/7/2016	0.77		Atrazine	UG/L
SVL-4	8/23/2016	0.22	<	Atrazine	UG/L
SVL-11	5/11/2016	56.2		Chlorophyll a	MG/CU.M.
SVL-11	7/7/2016	102		Chlorophyll a	MG/CU.M.
SVL-11	8/23/2016	83.7		Chlorophyll a	MG/CU.M.

SVL-15	5/11/2016	47.0		Chlorophyll a	MG/CU.M.
SVL-15	7/7/2016	43.6		Chlorophyll a	MG/CU.M.
SVL-15	8/23/2016	86.7		Chlorophyll a	MG/CU.M.
SVL-2	5/11/2016	15.0		Chlorophyll a	MG/CU.M.
SVL-2	7/7/2016	8.0		Chlorophyll a	MG/CU.M.
SVL-2	8/23/2016	26.9		Chlorophyll a	MG/CU.M.
SVL-4	5/11/2016	9.6		Chlorophyll a	MG/CU.M.
SVL-4	7/7/2016	41.9		Chlorophyll a	MG/CU.M.
SVL-4	8/23/2016	79.2		Chlorophyll a	MG/CU.M.
SVL-11	5/11/2016	56.2		Chlorophyll a	MG/CU.M.
SVL-1	5/11/2016	0.20	<	Chlorpyrifos	UG/L
SVL-1	7/7/2016	0.20	<	Chlorpyrifos	UG/L
SVL-1	8/23/2016	0.22	<	Chlorpyrifos	UG/L
SVL-11	5/11/2016	0.25	<	Chlorpyrifos	UG/L
SVL-11	7/7/2016	0.20	<	Chlorpyrifos	UG/L
SVL-11	8/23/2016	0.21	<	Chlorpyrifos	UG/L
SVL-12	5/11/2016	0.24	<	Chlorpyrifos	UG/L
SVL-12	7/7/2016	0.21	<	Chlorpyrifos	UG/L
SVL-12	8/23/2016	0.22	<	Chlorpyrifos	UG/L
SVL-13	5/11/2016	0.20	<	Chlorpyrifos	UG/L
SVL-13	7/7/2016	0.20	<	Chlorpyrifos	UG/L
SVL-13	8/23/2016	0.25	<	Chlorpyrifos	UG/L
SVL-15	5/11/2016	0.21	<	Chlorpyrifos	UG/L
SVL-15	7/7/2016	0.21	<	Chlorpyrifos	UG/L
SVL-15	8/23/2016	0.20	<	Chlorpyrifos	UG/L
SVL-2	5/11/2016	0.22	<	Chlorpyrifos	UG/L
SVL-2	7/7/2016	0.20	<	Chlorpyrifos	UG/L
SVL-2	8/23/2016	0.25	<	Chlorpyrifos	UG/L
SVL-4	5/11/2016	0.21	<	Chlorpyrifos	UG/L
SVL-4	7/7/2016	0.20	<	Chlorpyrifos	UG/L
SVL-4	8/23/2016	0.22	<	Chlorpyrifos	UG/L
SVL-1	5/11/2016	0.20	<	Chlorpyrifos	UG/L
SVL-1	7/7/2016	0.20	<	Chlorpyrifos	UG/L
SVL-1	8/23/2016	0.22	<	Chlorpyrifos	UG/L
SVL-11	5/11/2016	0.25	<	Chlorpyrifos	UG/L
SVL-1	5/11/2016	0.20	<	Cyanazine	UG/L
SVL-1	7/7/2016	0.20	<	Cyanazine	UG/L
SVL-1	8/23/2016	0.22	<	Cyanazine	UG/L

SVL-11	5/11/2016	0.25	<	Cyanazine	UG/L
SVL-11	7/7/2016	0.20	<	Cyanazine	UG/L
SVL-11	8/23/2016	0.21	<	Cyanazine	UG/L
SVL-12	5/11/2016	0.24	<	Cyanazine	UG/L
SVL-12	7/7/2016	0.21	<	Cyanazine	UG/L
SVL-12	8/23/2016	0.22	<	Cyanazine	UG/L
SVL-13	5/11/2016	0.20	<	Cyanazine	UG/L
SVL-13	7/7/2016	0.20	<	Cyanazine	UG/L
SVL-13	8/23/2016	0.25	<	Cyanazine	UG/L
SVL-15	5/11/2016	0.21	<	Cyanazine	UG/L
SVL-15	7/7/2016	0.21	<	Cyanazine	UG/L
SVL-15	8/23/2016	0.20	<	Cyanazine	UG/L
SVL-2	5/11/2016	0.22	<	Cyanazine	UG/L
SVL-2	7/7/2016	0.20	<	Cyanazine	UG/L
SVL-2	8/23/2016	0.25	<	Cyanazine	UG/L
SVL-1	5/11/2016	0.20		Iron	MG/L
SVL-1	7/7/2016	0.30		Iron	MG/L
SVL-1	8/23/2016	0.15		Iron	MG/L
SVL-2-10	5/11/2016	0.17		Iron	MG/L
SVL-2-10	7/7/2016	0.16		Iron	MG/L
SVL-2-10	8/23/2016	0.067		Iron	MG/L
SVL-1	5/11/2016	0.018		Manganese	MG/L
SVL-1	7/7/2016	0.24		Manganese	MG/L
SVL-1	8/23/2016	0.46		Manganese	MG/L
SVL-2-10	5/11/2016	0.015		Manganese	MG/L
SVL-2-10	7/7/2016	0.018		Manganese	MG/L
SVL-2-10	8/23/2016	0.012		Manganese	MG/L
SVL-1	5/11/2016	0.20	<	Metolachlor	UG/L
SVL-1	7/7/2016	0.40		Metolachlor	UG/L
SVL-1	8/23/2016	0.42		Metolachlor	UG/L
SVL-11	5/11/2016	1.2		Metolachlor	UG/L
SVL-11	7/7/2016	0.43		Metolachlor	UG/L
SVL-11	8/23/2016	0.21	<	Metolachlor	UG/L
SVL-12	5/11/2016	0.47		Metolachlor	UG/L
SVL-12	7/7/2016	0.40		Metolachlor	UG/L
SVL-12	8/23/2016	0.39		Metolachlor	UG/L
SVL-13	5/11/2016	2.0		Metolachlor	UG/L
SVL-13	7/7/2016	0.20	<	Metolachlor	UG/L

SVL-13	8/23/2016	0.25	<	Metolachlor	UG/L
SVL-15	5/11/2016	1.0		Metolachlor	UG/L
SVL-15	7/7/2016	0.55		Metolachlor	UG/L
SVL-15	8/23/2016	0.20	<	Metolachlor	UG/L
SVL-2	5/11/2016	0.22	<	Metolachlor	UG/L
SVL-2	7/7/2016	0.45		Metolachlor	UG/L
SVL-2	8/23/2016	0.28		Metolachlor	UG/L
SVL-4	5/11/2016	0.21		Metolachlor	UG/L
SVL-4	7/7/2016	0.49		Metolachlor	UG/L
SVL-4	8/23/2016	0.22	<	Metolachlor	UG/L
SVL-1	5/11/2016	0.20	<	Metolachlor	UG/L
SVL-1	5/11/2016	0.20	<	Metribuzin	UG/L
SVL-1	7/7/2016	0.20	<	Metribuzin	UG/L
SVL-1	8/23/2016	0.22	<	Metribuzin	UG/L
SVL-11	5/11/2016	0.25	<	Metribuzin	UG/L
SVL-11	7/7/2016	0.20	<	Metribuzin	UG/L
SVL-11	8/23/2016	0.21	<	Metribuzin	UG/L
SVL-12	5/11/2016	0.24	<	Metribuzin	UG/L
SVL-12	7/7/2016	0.21	<	Metribuzin	UG/L
SVL-12	8/23/2016	0.22	<	Metribuzin	UG/L
SVL-13	5/11/2016	0.42		Metribuzin	UG/L
SVL-13	7/7/2016	0.20	<	Metribuzin	UG/L
SVL-13	8/23/2016	0.25	<	Metribuzin	UG/L
SVL-15	5/11/2016	0.21	<	Metribuzin	UG/L
SVL-15	7/7/2016	0.21	<	Metribuzin	UG/L
SVL-15	8/23/2016	0.20	<	Metribuzin	UG/L
SVL-2	5/11/2016	0.22	<	Metribuzin	UG/L
SVL-2	7/7/2016	0.20	<	Metribuzin	UG/L
SVL-2	8/23/2016	0.25	<	Metribuzin	UG/L
SVL-4	5/11/2016	0.21	<	Metribuzin	UG/L
SVL-4	7/7/2016	0.20	<	Metribuzin	UG/L
SVL-4	8/23/2016	0.22	<	Metribuzin	UG/L
SVL-1	5/11/2016	0.20	<	Metribuzin	UG/L
SVL-1	5/11/2016	7.1		Nitrate as Nitrogen	MG/L
SVL-1	7/7/2016	4.3		Nitrate as Nitrogen	MG/L
SVL-1	8/23/2016	2.1		Nitrate as Nitrogen	MG/L
SVL-11	5/11/2016	8.5		Nitrate as Nitrogen	MG/L
SVL-11	7/7/2016	4.6		Nitrate as Nitrogen	MG/L

SVL-11	8/23/2016	1.5		Nitrate as Nitrogen	MG/L
SVL-12	5/11/2016	17.2		Nitrate as Nitrogen	MG/L
SVL-12	7/7/2016	4.8		Nitrate as Nitrogen	MG/L
SVL-12	8/23/2016	2.8		Nitrate as Nitrogen	MG/L
SVL-13	5/11/2016	14.1		Nitrate as Nitrogen	MG/L
SVL-13	7/7/2016	5.1		Nitrate as Nitrogen	MG/L
SVL-13	8/23/2016	0.068		Nitrate as Nitrogen	MG/L
SVL-15	5/11/2016	8.5		Nitrate as Nitrogen	MG/L
SVL-15	7/7/2016	5.7		Nitrate as Nitrogen	MG/L
SVL-15	8/23/2016	1.4		Nitrate as Nitrogen	MG/L
SVL-2	5/11/2016	7.1		Nitrate as Nitrogen	MG/L
SVL-2	7/7/2016	6.2		Nitrate as Nitrogen	MG/L
SVL-2	8/23/2016	4.0		Nitrate as Nitrogen	MG/L
SVL-2-10	5/11/2016	7.4		Nitrate as Nitrogen	MG/L
SVL-2-10	7/7/2016	5.9		Nitrate as Nitrogen	MG/L
SVL-2-10	8/23/2016	3.7		Nitrate as Nitrogen	MG/L
SVL-4	5/11/2016	12.9		Nitrate as Nitrogen	MG/L
SVL-4	7/7/2016	5.9		Nitrate as Nitrogen	MG/L
SVL-4	8/23/2016	0.90		Nitrate as Nitrogen	MG/L
SVL-1	5/11/2016	0.20	<	Pendimethalin	UG/L
SVL-1	7/7/2016	0.20	<	Pendimethalin	UG/L
SVL-1	8/23/2016	0.22	<	Pendimethalin	UG/L
SVL-11	5/11/2016	0.25	<	Pendimethalin	UG/L
SVL-11	7/7/2016	0.20	<	Pendimethalin	UG/L
SVL-11	8/23/2016	0.21	<	Pendimethalin	UG/L
SVL-12	5/11/2016	0.24	<	Pendimethalin	UG/L
SVL-12	7/7/2016	0.21	<	Pendimethalin	UG/L
SVL-12	8/23/2016	0.22	<	Pendimethalin	UG/L
SVL-13	5/11/2016	0.20	<	Pendimethalin	UG/L
SVL-13	7/7/2016	0.20	<	Pendimethalin	UG/L
SVL-13	8/23/2016	0.25	<	Pendimethalin	UG/L
SVL-15	5/11/2016	0.21	<	Pendimethalin	UG/L
SVL-15	7/7/2016	0.21	<	Pendimethalin	UG/L
SVL-15	8/23/2016	0.20	<	Pendimethalin	UG/L
SVL-2	5/11/2016	0.22	<	Pendimethalin	UG/L
SVL-2	7/7/2016	0.20	<	Pendimethalin	UG/L
SVL-2	8/23/2016	0.25	<	Pendimethalin	UG/L
SVL-4	5/11/2016	0.21	<	Pendimethalin	UG/L

SVL-4	7/7/2016	0.20	<	Pendimethalin	UG/L
SVL-4	8/23/2016	0.22	<	Pendimethalin	UG/L
SVL-1	5/11/2016	0.20	<	Pendimethalin	UG/L
SVL-11	5/11/2016	15.5		Pheophytin a	MG/CU.M.
SVL-11	7/7/2016	15.0		Pheophytin a	MG/CU.M.
SVL-11	8/23/2016	5.8		Pheophytin a	MG/CU.M.
SVL-15	5/11/2016	9.3		Pheophytin a	MG/CU.M.
SVL-15	7/7/2016	3.1		Pheophytin a	MG/CU.M.
SVL-15	8/23/2016	5.9		Pheophytin a	MG/CU.M.
SVL-2	5/11/2016	3.0		Pheophytin a	MG/CU.M.
SVL-2	7/7/2016	2.0	<	Pheophytin a	MG/CU.M.
SVL-2	8/23/2016	1.9		Pheophytin a	MG/CU.M.
SVL-4	5/11/2016	1.0	<	Pheophytin a	MG/CU.M.
SVL-4	7/7/2016	3.6		Pheophytin a	MG/CU.M.
SVL-4	8/23/2016	12.3		Pheophytin a	MG/CU.M.
SVL-1	5/11/2016	0.31		Phosphorus	MG/L
SVL-1	7/7/2016	0.036		Phosphorus	MG/L
SVL-1	8/23/2016	0.069		Phosphorus	MG/L
SVL-11	5/11/2016	0.41		Phosphorus	MG/L
SVL-11	7/7/2016	0.19		Phosphorus	MG/L
SVL-11	8/23/2016	0.14		Phosphorus	MG/L
SVL-12	5/11/2016	0.42		Phosphorus	MG/L
SVL-12	7/7/2016	0.15		Phosphorus	MG/L
SVL-12	8/23/2016	0.24		Phosphorus	MG/L
SVL-13	5/11/2016	0.47		Phosphorus	MG/L
SVL-13	7/7/2016	0.26		Phosphorus	MG/L
SVL-13	8/23/2016	0.41		Phosphorus	MG/L
SVL-15	5/11/2016	0.40		Phosphorus	MG/L
SVL-15	7/7/2016	0.074		Phosphorus	MG/L
SVL-15	8/23/2016	0.11		Phosphorus	MG/L
SVL-2	5/11/2016	0.31		Phosphorus	MG/L
SVL-2	7/7/2016	0.024		Phosphorus	MG/L
SVL-2	8/23/2016	0.025		Phosphorus	MG/L
SVL-2-10	5/11/2016	0.28		Phosphorus	MG/L
SVL-2-10	7/7/2016	0.028		Phosphorus	MG/L
SVL-2-10	8/23/2016	0.025		Phosphorus	MG/L
SVL-4	5/11/2016	0.33		Phosphorus	MG/L
SVL-4	7/7/2016	0.079		Phosphorus	MG/L

SVL-4	8/23/2016	0.34		Phosphorus	MG/L
SVL-1	5/11/2016	0.31		Phosphorus	MG/L
SVL-1	5/11/2016	0.010	<	Phosphorus, -ortho	MG/L
SVL-1	7/7/2016	0.010	<	Phosphorus, -ortho	MG/L
SVL-1	8/23/2016	0.010	<	Phosphorus, -ortho	MG/L
SVL-11	5/11/2016	0.010	<	Phosphorus, -ortho	MG/L
SVL-11	7/7/2016	0.067		Phosphorus, -ortho	MG/L
SVL-11	8/23/2016	0.010	<	Phosphorus, -ortho	MG/L
SVL-12	5/11/2016	0.031		Phosphorus, -ortho	MG/L
SVL-12	7/7/2016	0.12		Phosphorus, -ortho	MG/L
SVL-12	8/23/2016	0.20		Phosphorus, -ortho	MG/L
SVL-13	5/11/2016	0.040		Phosphorus, -ortho	MG/L
SVL-13	7/7/2016	0.015		Phosphorus, -ortho	MG/L
SVL-13	8/23/2016	0.21		Phosphorus, -ortho	MG/L
SVL-15	5/11/2016	0.010	<	Phosphorus, -ortho	MG/L
SVL-15	7/7/2016	0.012		Phosphorus, -ortho	MG/L
SVL-15	8/23/2016	0.010	<	Phosphorus, -ortho	MG/L
SVL-2	5/11/2016	0.010	<	Phosphorus, -ortho	MG/L
SVL-2	7/7/2016	0.010	<	Phosphorus, -ortho	MG/L
SVL-2	8/23/2016	0.010	<	Phosphorus, -ortho	MG/L
SVL-2-10	5/11/2016	0.010	<	Phosphorus, -ortho	MG/L
SVL-2-10	7/7/2016	0.010	<	Phosphorus, -ortho	MG/L
SVL-2-10	8/23/2016	0.010	<	Phosphorus, -ortho	MG/L
SVL-4	5/11/2016	0.040		Phosphorus, -ortho	MG/L
SVL-4	7/7/2016	0.012		Phosphorus, -ortho	MG/L
SVL-4	8/23/2016	0.12		Phosphorus, -ortho	MG/L
SVL-1	5/11/2016	0.010	<	Phosphorus, -ortho	MG/L
SVL-1	5/11/2016	7.8		Solids, Total Suspended	MG/L
SVL-1	7/7/2016	10.0		Solids, Total Suspended	MG/L
SVL-1	8/23/2016	3.3		Solids, Total Suspended	MG/L
SVL-11	5/11/2016	21.6		Solids, Total Suspended	MG/L
SVL-11	7/7/2016	19.2		Solids, Total Suspended	MG/L
SVL-11	8/23/2016	14.0		Solids, Total Suspended	MG/L
SVL-12	5/11/2016	56.0		Solids, Total Suspended	MG/L
SVL-12	7/7/2016	16.8		Solids, Total Suspended	MG/L
SVL-12	8/23/2016	17.4		Solids, Total Suspended	MG/L
SVL-13	5/11/2016	43.6		Solids, Total Suspended	MG/L
SVL-13	7/7/2016	46.0		Solids, Total Suspended	MG/L

SVL-13	8/23/2016	30.0		Solids, Total Suspended	MG/L
SVL-15	5/11/2016	20.8		Solids, Total Suspended	MG/L
SVL-15	7/7/2016	10.3		Solids, Total Suspended	MG/L
SVL-15	8/23/2016	14.3		Solids, Total Suspended	MG/L
SVL-2	5/11/2016	6.5		Solids, Total Suspended	MG/L
SVL-2	7/7/2016	5.0		Solids, Total Suspended	MG/L
SVL-2	8/23/2016	5.3		Solids, Total Suspended	MG/L
SVL-2-10	5/11/2016	7.6		Solids, Total Suspended	MG/L
SVL-2-10	7/7/2016	7.1		Solids, Total Suspended	MG/L
SVL-2-10	8/23/2016	5.7		Solids, Total Suspended	MG/L
SVL-4	5/11/2016	30.4		Solids, Total Suspended	MG/L
SVL-4	7/7/2016	10.7		Solids, Total Suspended	MG/L
SVL-4	8/23/2016	25.7		Solids, Total Suspended	MG/L
SVL-1	5/11/2016	7.8		Solids, Total Suspended	MG/L
SVL-1	5/11/2016	2.6		Solids, Volatile Suspended	MG/L
SVL-1	7/7/2016	2.5	<	Solids, Volatile Suspended	MG/L
SVL-1	8/23/2016	1.4	<	Solids, Volatile Suspended	MG/L
SVL-11	5/11/2016	7.6		Solids, Volatile Suspended	MG/L
SVL-11	7/7/2016	4.4		Solids, Volatile Suspended	MG/L
SVL-11	8/23/2016	6.7		Solids, Volatile Suspended	MG/L
SVL-12	5/11/2016	5.2		Solids, Volatile Suspended	MG/L
SVL-12	7/7/2016	2.0	<	Solids, Volatile Suspended	MG/L
SVL-12	8/23/2016	1.6		Solids, Volatile Suspended	MG/L
SVL-13	5/11/2016	5.6		Solids, Volatile Suspended	MG/L
SVL-13	7/7/2016	10.5		Solids, Volatile Suspended	MG/L
SVL-13	8/23/2016	7.5		Solids, Volatile Suspended	MG/L
SVL-15	5/11/2016	6.8		Solids, Volatile Suspended	MG/L
SVL-15	7/7/2016	2.9		Solids, Volatile Suspended	MG/L
SVL-15	8/23/2016	7.0		Solids, Volatile Suspended	MG/L
SVL-2	5/11/2016	2.3		Solids, Volatile Suspended	MG/L
SVL-2	7/7/2016	2.5	<	Solids, Volatile Suspended	MG/L
SVL-2	8/23/2016	2.3		Solids, Volatile Suspended	MG/L
SVL-2-10	5/11/2016	2.0		Solids, Volatile Suspended	MG/L
SVL-2-10	7/7/2016	2.9	<	Solids, Volatile Suspended	MG/L
SVL-2-10	8/23/2016	2.7		Solids, Volatile Suspended	MG/L
SVL-4	5/11/2016	4.0	<	Solids, Volatile Suspended	MG/L
SVL-4	7/7/2016	3.7		Solids, Volatile Suspended	MG/L
SVL-4	8/23/2016	8.9		Solids, Volatile Suspended	MG/L

SVL-1	5/11/2016	2.5		Total Organic Carbon	MG/L
SVL-1	7/7/2016	2.7		Total Organic Carbon	MG/L
SVL-1	8/23/2016	2.7		Total Organic Carbon	MG/L
SVL-11	5/11/2016	2.6		Total Organic Carbon	MG/L
SVL-11	7/7/2016	3.9		Total Organic Carbon	MG/L
SVL-11	8/23/2016	3.6		Total Organic Carbon	MG/L
SVL-12	5/11/2016	1.8		Total Organic Carbon	MG/L
SVL-12	7/7/2016	3.8		Total Organic Carbon	MG/L
SVL-12	8/23/2016	3.3		Total Organic Carbon	MG/L
SVL-13	5/11/2016	3.0		Total Organic Carbon	MG/L
SVL-13	7/7/2016	3.8		Total Organic Carbon	MG/L
SVL-13	8/23/2016	5.9		Total Organic Carbon	MG/L
SVL-15	5/11/2016	2.7		Total Organic Carbon	MG/L
SVL-15	7/7/2016	3.2		Total Organic Carbon	MG/L
SVL-15	8/23/2016	3.6		Total Organic Carbon	MG/L
SVL-2	5/11/2016	2.5		Total Organic Carbon	MG/L
SVL-2	7/7/2016	3.0		Total Organic Carbon	MG/L
SVL-2	8/23/2016	2.7		Total Organic Carbon	MG/L
SVL-2-10	5/11/2016	2.4		Total Organic Carbon	MG/L
SVL-2-10	7/7/2016	2.9		Total Organic Carbon	MG/L
SVL-2-10	8/23/2016	3.0		Total Organic Carbon	MG/L
SVL-4	5/11/2016	1.8		Total Organic Carbon	MG/L
SVL-4	7/7/2016	3.2		Total Organic Carbon	MG/L
SVL-4	8/23/2016	5.4		Total Organic Carbon	MG/L
SVL-1	5/11/2016	0.20	<	Trifluralin	UG/L
SVL-1	7/7/2016	0.20	<	Trifluralin	UG/L
SVL-1	8/23/2016	0.22	<	Trifluralin	UG/L
SVL-11	5/11/2016	0.25	<	Trifluralin	UG/L
SVL-11	7/7/2016	0.20	<	Trifluralin	UG/L
SVL-11	8/23/2016	0.21	<	Trifluralin	UG/L
SVL-12	5/11/2016	0.24	<	Trifluralin	UG/L
SVL-12	7/7/2016	0.21	<	Trifluralin	UG/L
SVL-12	8/23/2016	0.22	<	Trifluralin	UG/L
SVL-13	5/11/2016	0.20	<	Trifluralin	UG/L
SVL-13	7/7/2016	0.20	<	Trifluralin	UG/L
SVL-13	8/23/2016	0.25	<	Trifluralin	UG/L
SVL-15	5/11/2016	0.21	<	Trifluralin	UG/L
SVL-15	7/7/2016	0.21	<	Trifluralin	UG/L

SVL-15	8/23/2016	0.20	<	Trifluralin	UG/L
SVL-2	5/11/2016	0.22	<	Trifluralin	UG/L
SVL-2	7/7/2016	0.20	<	Trifluralin	UG/L
SVL-2	8/23/2016	0.25	<	Trifluralin	UG/L
SVL-4	5/11/2016	0.21	<	Trifluralin	UG/L
SVL-4	7/7/2016	0.20	<	Trifluralin	UG/L
SVL-4	8/23/2016	0.22	<	Trifluralin	UG/L
SVL-1	5/11/2016	0.20	<	Trifluralin	UG/L

Marinas

Site #	Collection Date	Reported Result	Flag	Parameter	Units
FIN MARINA	7/7/2016	25.0		E. Coliform	COL/100 ML
FIN MARINA	8/23/2016	1.0		E. Coliform	COL/100 ML
LS MARINA	7/7/2016	10.0		E. Coliform	COL/100 ML
LS MARINA	8/23/2016	3.0		E. Coliform	COL/100 ML
SUL MARINA	7/7/2016	34.0		E. Coliform	COL/100 ML
SUL MARINA	8/23/2016	11.0		E. Coliform	COL/100 ML

2015 Beach Sample Report - IDPH
Lake Shelbyville

Sample Date	Location	E. coli per 100mL Shallow	Deep
5/16/2016	Coon Creek Rec Area	4.1	4.1
6/8/2016	Coon Creek Rec Area	36.4	31.5
6/21/2016	Coon Creek Rec Area	3.1	1
7/11/2016	Coon Creek Rec Area	2	1
7/26/2016	Coon Creek Rec Area	93.2	19.9
8/30/2016	Coon Creek Rec Area	1	1
5/16/2016	Dam West Beach	3.1	2
6/8/2016	Dam West Beach	105	5.2
6/21/2016	Dam West Beach	1	1
7/11/2016	Dam West Beach	1	1
7/26/2016	Dam West Beach	107.6	2
8/17/2016	Dam West Beach	3.1	14.8
8/30/2016	Dam West Beach	2	1
5/16/2016	Lithia Springs Rec Area	2	4.1
6/8/2016	Lithia Springs Rec Area	2	4.1
6/21/2016	Lithia Springs Rec Area	1	1
7/11/2016	Lithia Springs Rec Area	2	1
7/26/2016	Lithia Springs Rec Area	13.2	1
8/17/2016	Lithia Springs Rec Area	7.5	3
8/30/2016	Lithia Springs Rec Area	1	1
5/16/2016	Sullivan Beach	75.9	77.1
6/8/2016	Sullivan Beach	67	35
6/21/2016	Sullivan Beach	6.3	5.2
7/11/2016	Sullivan Beach	3.1	1
7/26/2016	Sullivan Beach	34.5	14.6
8/17/2016	Sullivan Beach	648.8	44.8
8/22/2016	Sullivan Beach	18.7	
8/30/2016	Sullivan Beach	9.8	1
5/16/2016	Wilborn Creek Rec Area	27.5	19.7
6/8/2016	Wilborn Creek Rec Area	6.3	2
6/21/2016	Wilborn Creek Rec Area	4.1	2

2015 Beach Sample Report - IDPH
Lake Shelbyville

Sample Date	Location	E. coli per 100mL Shallow	Deep
7/11/2016	Wilborn Creek Rec Area	1	1
7/26/2016	Wilborn Creek Rec Area	980.4	4.1
8/3/2016	Wilborn Creek Rec Area	20.3	4.1
8/17/2016	Wilborn Creek Rec Area	2419.6	45.9
8/22/2016	Wilborn Creek Rec Area	24.6	
8/30/2016	Wilborn Creek Rec Area	4.1	3

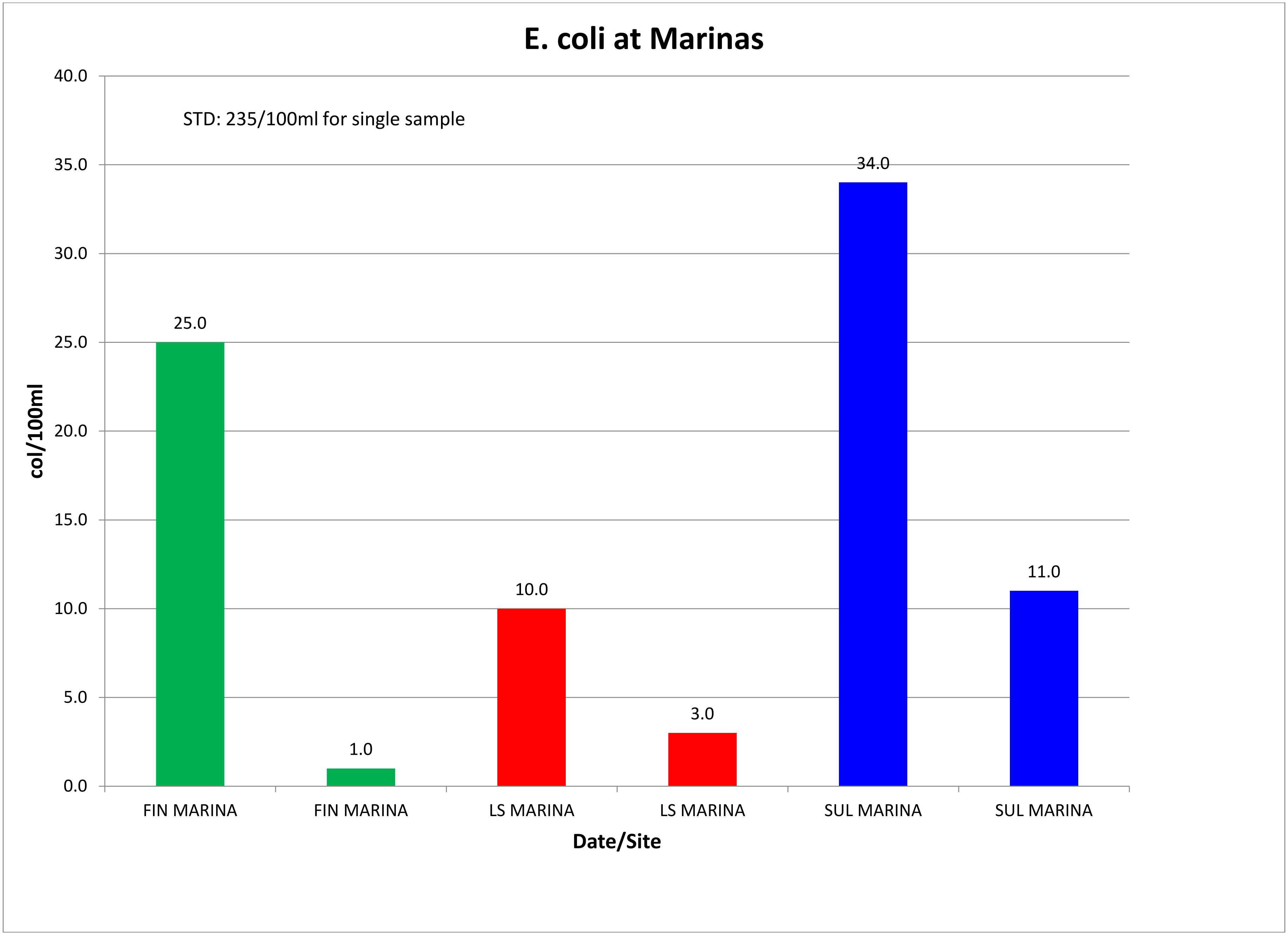
FIELD DATA

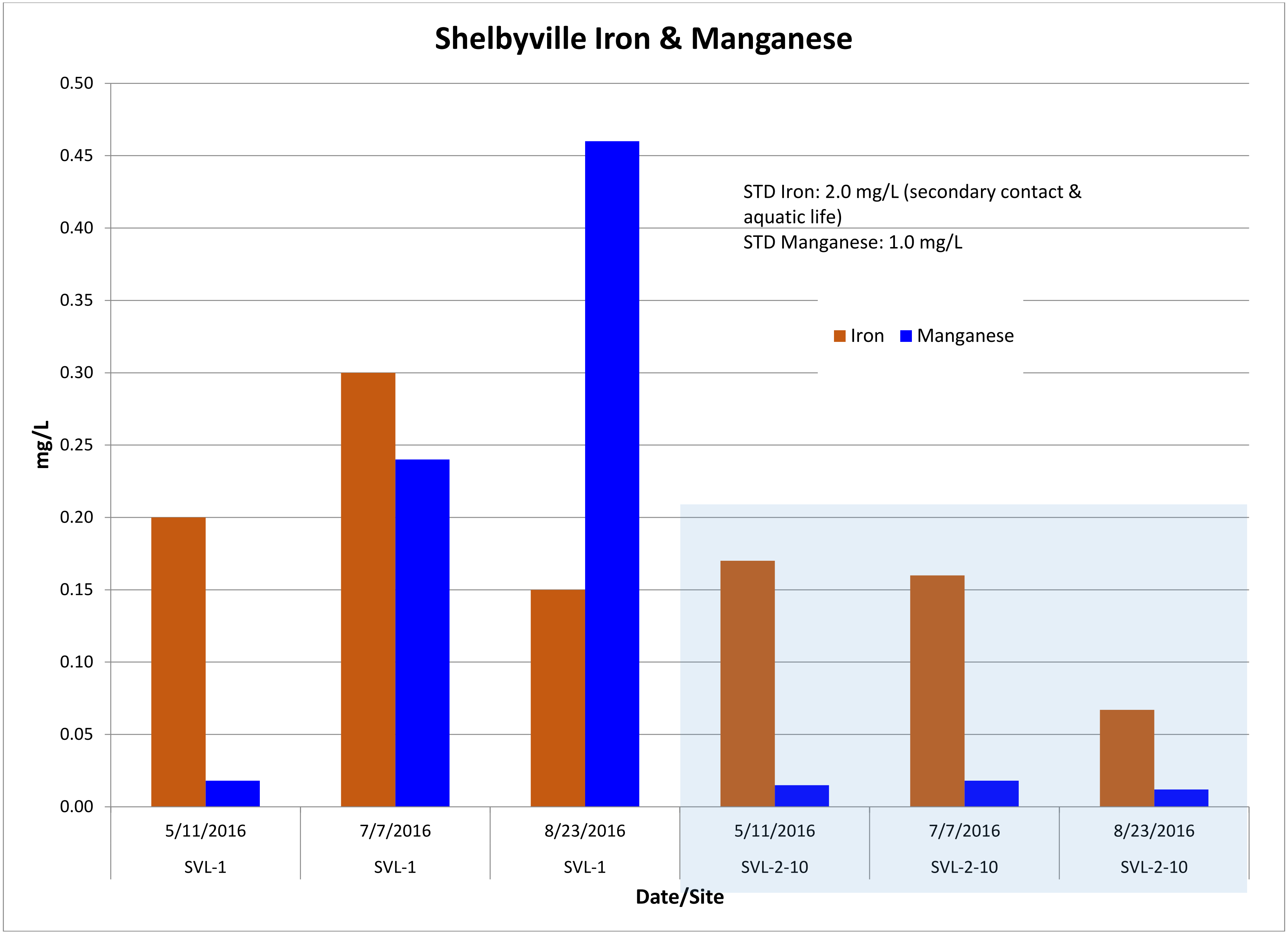
Site	Date	Depth	Water Temp (oC)	Redox (mv)	Cond (uS)	DO %	DO mg/l	pH	Time	Seechi (in)
SBV-1	5/11/2016	0.5	17.49	227	496	117	10.95	8.42	955	
SBV-1	7/7/2016	0.1	17.1	401	528	109.2	10.2	7.7	930	
SBV-1	8/23/2016	0.7	18.7	415	539	101	9.39	7.73	940	
SBV-11	5/11/2016	0.2	19.14	387	536	163	14.74	8.7	1114	16
SBV-11	5/11/2016	1	18.6	383	560	145	13.31	8.62	1114	
SBV-11	5/11/2016	2	17.98	381	584	121	11.21	8.47	1114	
SBV-11	5/11/2016	3	17.85	379	579	119	11.14	8.47	1114	
SBV-11	5/11/2016	4	17.81	376	579	118.8	11.01	8.47	1114	
SBV-11	5/11/2016	5	17.73	375	580	114	10.63	8.44	1114	
SBV-11	7/7/2016	0.2	25.9	361	478	109	8.6	8.4	1100	23
SBV-11	7/7/2016	1	25.9	361	478	109	8.5	8.4	1100	
SBV-11	7/7/2016	2	25.8	361	479	105	8.3	8.4	1100	
SBV-11	7/7/2016	3	25.7	361	479	91	7.2	8.3	1100	
SBV-11	7/7/2016	4	25.4	363	479	77	6.2	8.2	1100	
SBV-11	7/7/2016	5	25.2	364	480	65	5.1	8.1	1100	
SBV-11	7/7/2016	6	24.6	366	482	39.9	3.3	7.9	1100	
SBV-11	7/7/2016	7	24	366	482	34	2.7	7.8	1100	
SBV-11	7/7/2016	8	24.5	366	482	29	2.4	7.8	1100	
SBV-11	8/23/2016	0.4	27	282	338	141	11.07	9.04	1125	17
SBV-11	8/23/2016	1	27	278	338	140	11	9.07	1125	
SBV-11	8/23/2016	2	27	278	337	140	10.9	9.07	1125	
SBV-11	8/23/2016	3	27	277	337	139	10.9	9.08	1125	
SBV-11	8/23/2016	4	26.9	277	337	133	10.4	9.06	1125	
SBV-11	8/23/2016	5	26.8	277	337	126	9.9	9.03	1125	
SBV-11	8/23/2016	6	26.5	280	337	78.5	6.3	8.87	1125	
SBV-11	8/23/2016	7	26.4	281	337	61.8	4.89	8.78	1125	
SBV-11	8/23/2016	8	26.4	282	338	0	0	7.78	1125	
SBV-12	5/11/2016	0.3	16.08	245	614	101.3	9.75	7.86	1115	
SBV-12	7/7/2016	0.2	24.1	322	642	88.1	7.19	8.02	1103	
SBV-12	8/23/2016	0.4	23.56	399	638	96.8	8.04	8.02	1120	
SBV-13	5/11/2016	0.2	17.6	239	323	101.9	9.4	7.84	1200	
SBV-13	7/7/2016	0.2	26.46	382	531	162	12.72	8.47	1034	
SBV-13	8/23/2016	0.3	25.92	398	272	94.7	7.59	7.61	1042	

SBV-2	5/11/2016	0.2	17.84	237	492	126.4	11.69	8.46	1037	36
SBV-2	5/11/2016	1	17.33	240	494	120.8	11.33	8.44	1037	
SBV-2	5/11/2016	2	17.24	240	494	117	11.06	8.44	1037	
SBV-2	5/11/2016	3	17.21	241	494	115	10.95	8.43	1037	
SBV-2	5/11/2016	4	17.15	242	495	114	10.78	8.43	1037	
SBV-2	5/11/2016	5	16.92	244	497	108	10.25	8.39	1037	
SBV-2	5/11/2016	6	16.69	245	499	102	9.73	8.35	1037	
SBV-2	5/11/2016	7	15.16	247	508	70.3	6.89	8.09	1037	
SBV-2	5/11/2016	8	14.41	249	515	53.3	5.06	7.93	1037	
SBV-2	5/11/2016	9	12.53	250	527	35.1	3.48	7.82	1037	
SBV-2	5/11/2016	10	11.71	252	541	24.8	2.65	7.76	1037	
SBV-2	7/7/2016	0.1	25.5	352	462	94.8	7.5	8.2	1000	53
SBV-2	7/7/2016	1	25.3	352	461	93	7.4	8.2	1000	
SBV-2	7/7/2016	2	25.3	351	461	92	7.3	8.2	1000	
SBV-2	7/7/2016	3	25.2	351	461	91	7.3	8.2	1000	
SBV-2	7/7/2016	4	25.2	351	461	87	6.9	8.2	1000	
SBV-2	7/7/2016	5	25	353	465	72.8	5.8	8.1	1000	
SBV-2	7/7/2016	6	24.2	356	477	49.2	4	7.9	1000	
SBV-2	7/7/2016	7	21.2	361	507	0	0	7.6	1000	
SBV-2	7/7/2016	7.8	19.8	361	516	0	0	7.6	1000	
SBV-2	8/23/2016	0.4	26.1	326	381	91.4	7.28	8.4	1007	40
SBV-2	8/23/2016	1	26.1	326	380	93.4	7.43	8.41	1007	
SBV-2	8/23/2016	2	26.1	326	380	95.2	7.58	8.43	1007	
SBV-2	8/23/2016	3	26.1	325	379	95	7.57	8.44	1007	
SBV-2	8/23/2016	4	26	326	379.8	91.6	7.31	8.42	1007	
SBV-2	8/23/2016	5	26	326	379.7	90.5	7.2	8.4	1007	
SBV-2	8/23/2016	6	26	326	380	89.1	7.1	8.3	1007	
SBV-2	8/23/2016	7	25.9	326	379	96	7.63	8.43	1007	
SBV-2	8/23/2016	7.6	25.9	102	404	0	0	7.5	1007	
SBV-4	5/11/2016	0.3	19.33	404	635	103	9.29	8.17	1140	11
SBV-4	5/11/2016	1	19.16	400	635	102.5	9.25	8.17	1140	
SBV-4	5/11/2016	1.6	18.36	396	638	89.7	8.22	8.05	1140	
SBV-4	7/7/2016	0.3	25.2	358	552	133	10.6	8.5	1130	12
SBV-4	7/7/2016	1	25.1	358	554	124	9.9	8.5	1130	
SBV-4	7/7/2016	2	24.8	360	563	80	6.4	8.2	1130	
SBV-4	8/23/2016	0.5	26.1	242	424	154	12.3	8.7	1200	8
SBV-4	8/23/2016	1	25.4	245	428	120	9.6	8.6	1200	
SBV-4	8/23/2016	2	25.1	246	435	100	8.12	8.5	1200	

APPENDIX B

LAB DATA
GRAPHS


E. coli at Marinas
STD: 235/100ml for single sample
col/100ml
40.0
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
25.0
1.0
10.0
3.0
34.0
11.0
FIN MARINA
FIN MARINA
LS MARINA
LS MARINA
SUL MARINA
SUL MARINA
Date/Site


Shelbyville Iron & Manganese
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
mg/L
STD Iron: 2.0 mg/L (secondary contact & aquatic life)
STD Manganese: 1.0 mg/L
Iron
Manganese
5/11/2016
SVL-1
7/7/2016
SVL-1
8/23/2016
SVL-1
5/11/2016
SVL-2-10
7/7/2016
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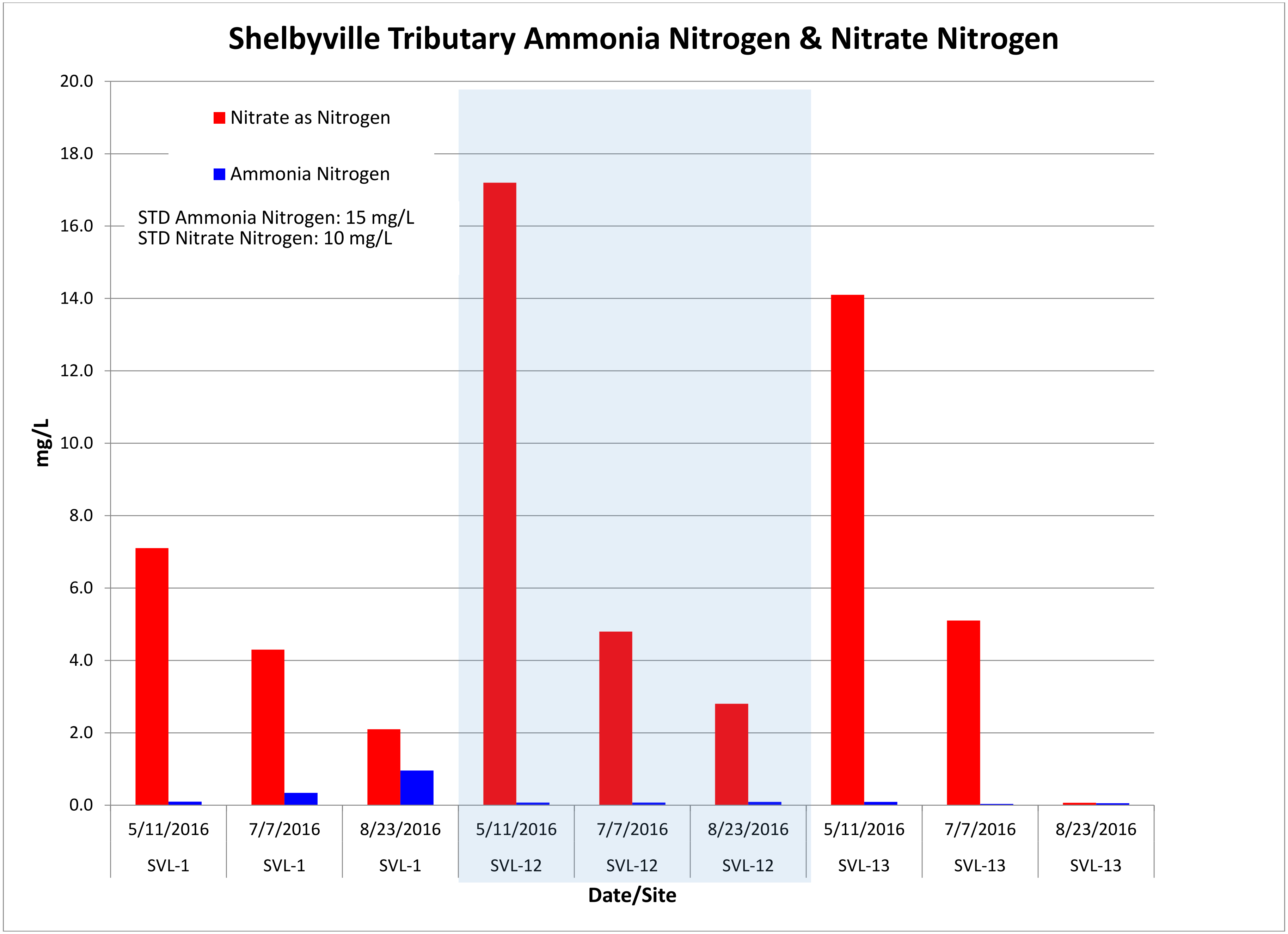
8/23/2016
SVL-2-10
Date/Site



Shelbyville Tributary Ammonia Nitrogen & Nitrate Nitrogen
🟥 Nitrate as Nitrogen
🟦 Ammonia Nitrogen
STD Ammonia Nitrogen: 15 mg/L
STD Nitrate Nitrogen: 10 mg/L
mg/L
20.0
18.0
16.0
14.0
12.0
10.0
8.0
6.0
4.0
2.0
0.0
5/11/2016
SVL-1
7/7/2016
SVL-1
8/23/2016
SVL-1
5/11/2016
SVL-12
7/7/2016
SVL-12
8/23/2016
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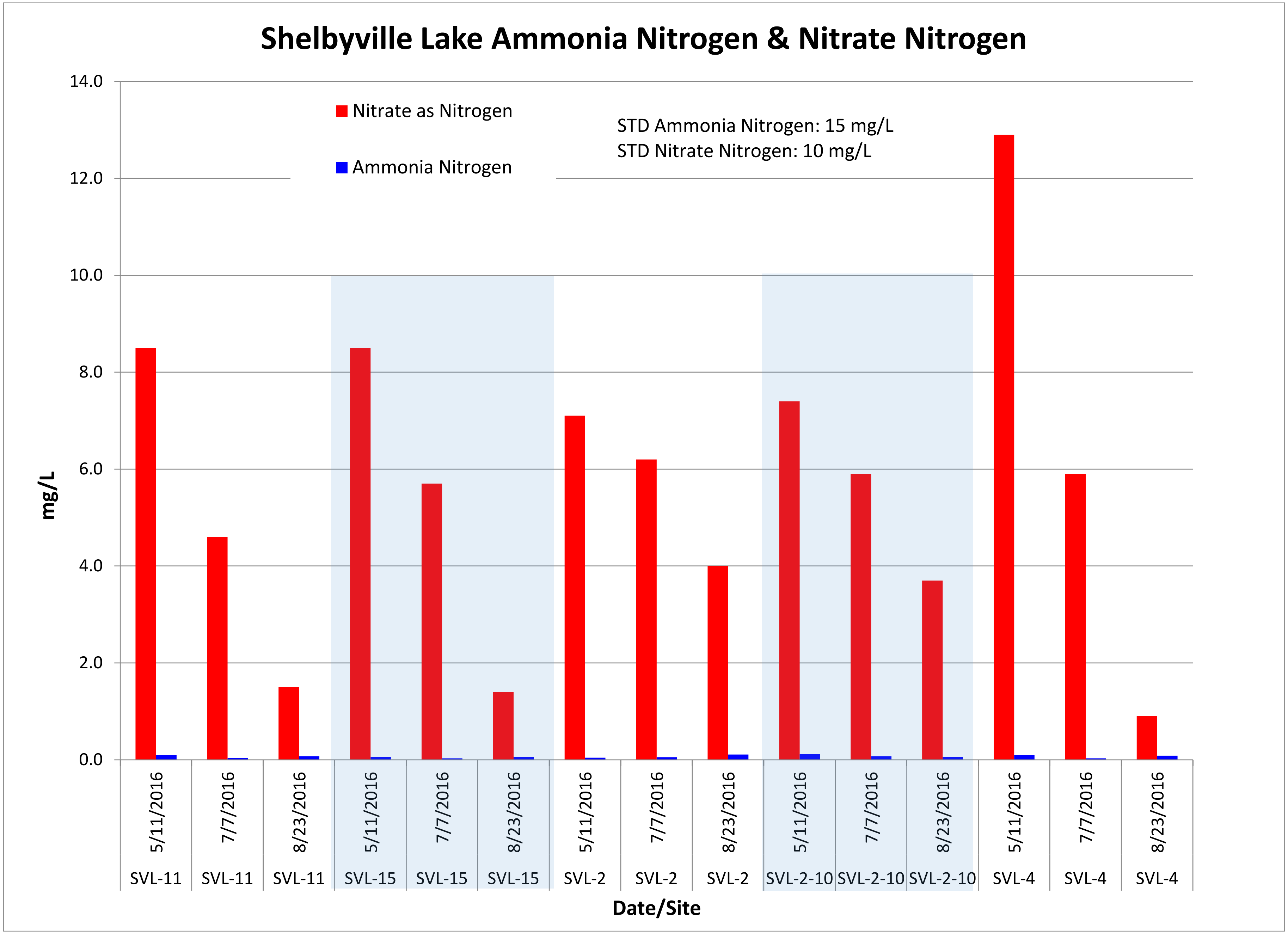
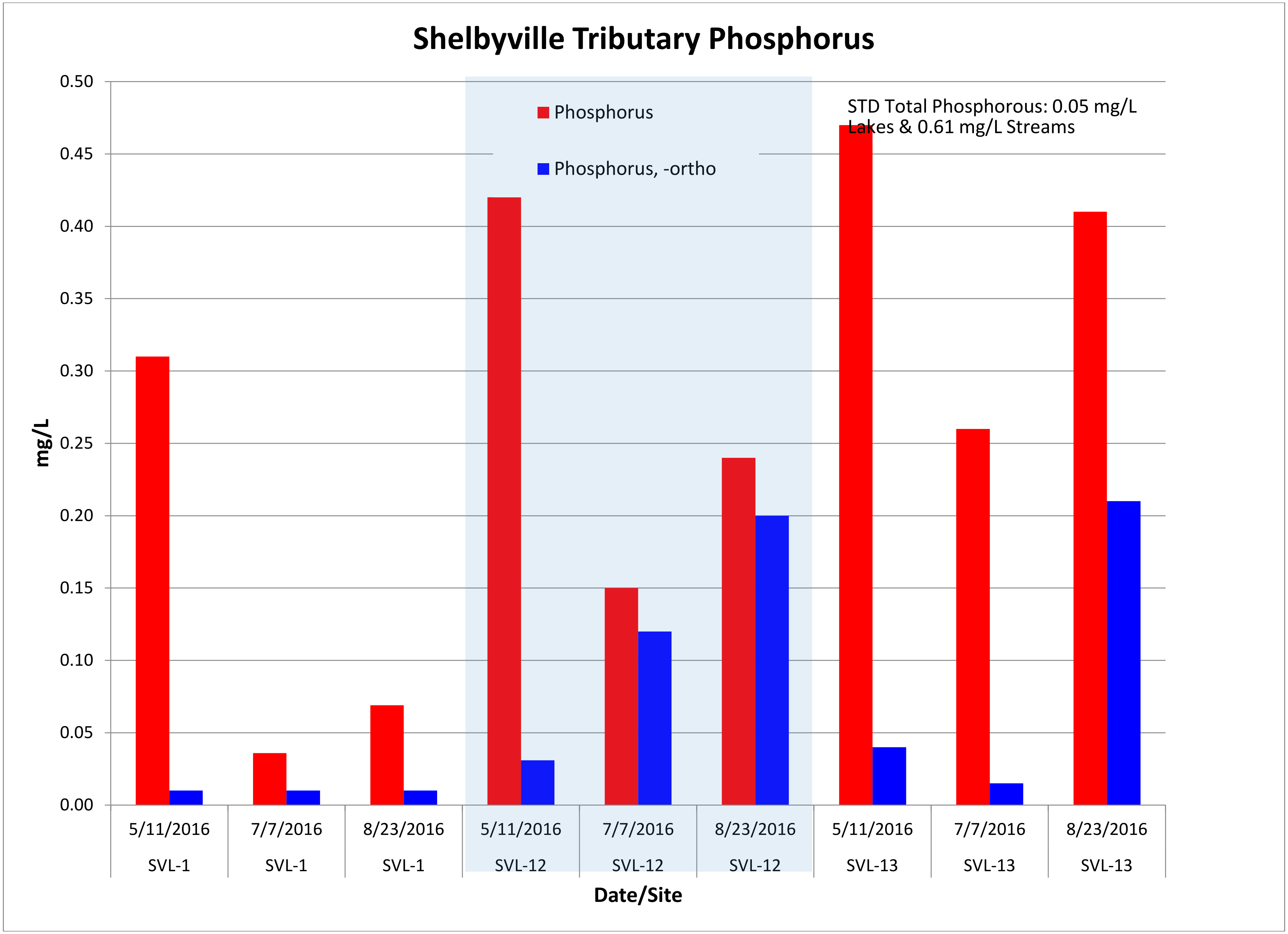
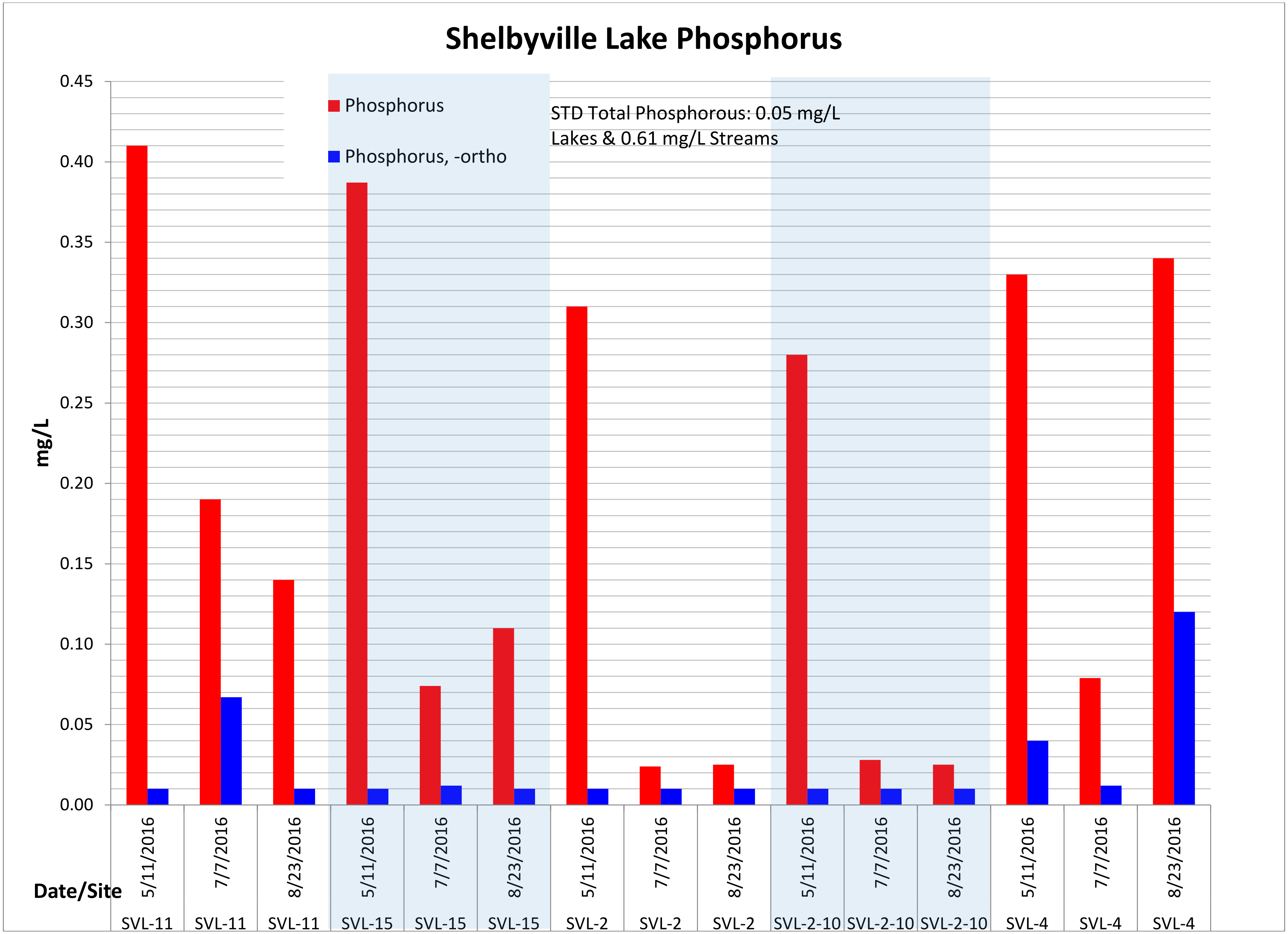
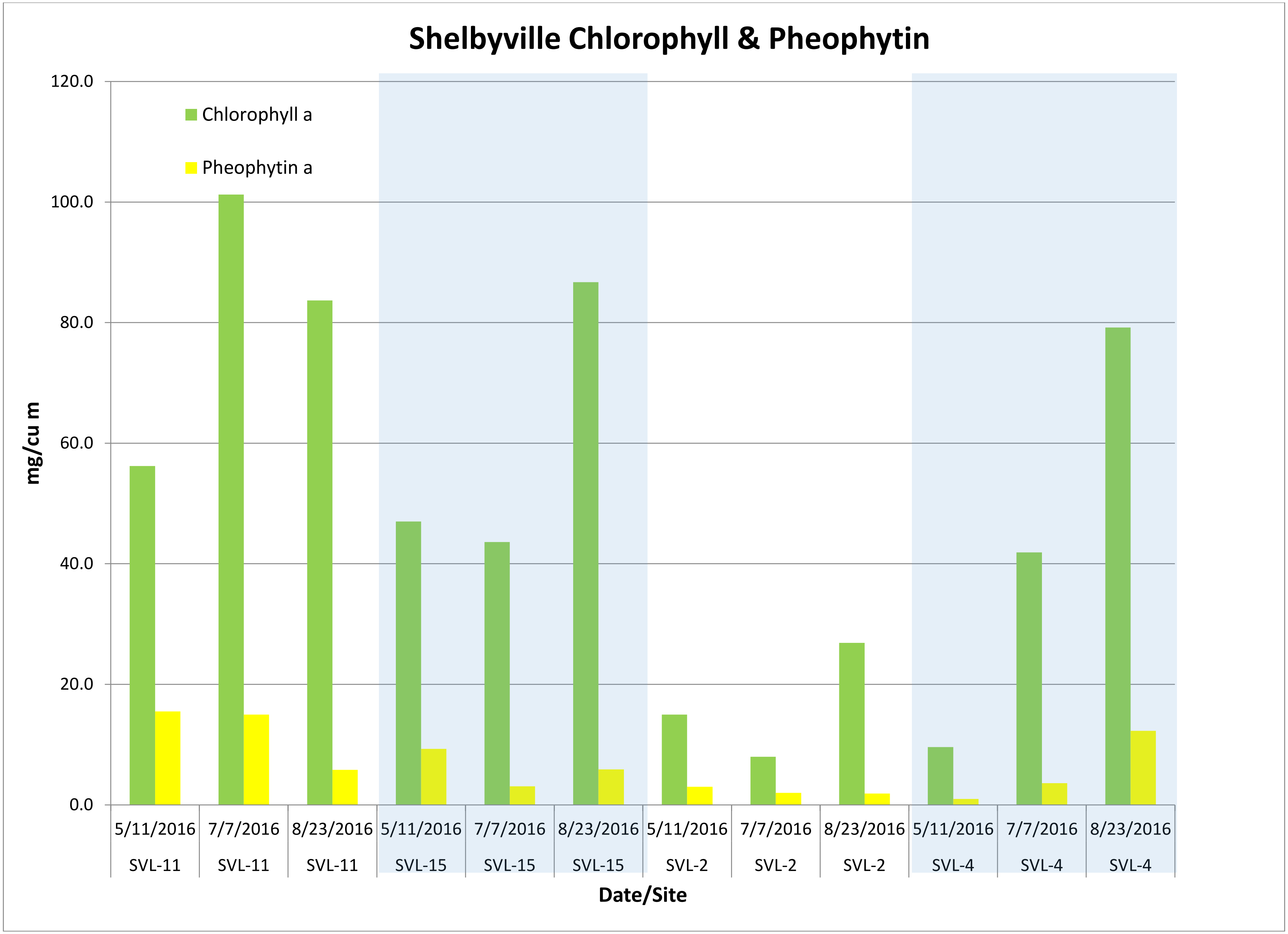
5/11/2016
SVL-13
7/7/2016
SVL-13
8/23/2016
SVL-13
Date/Site

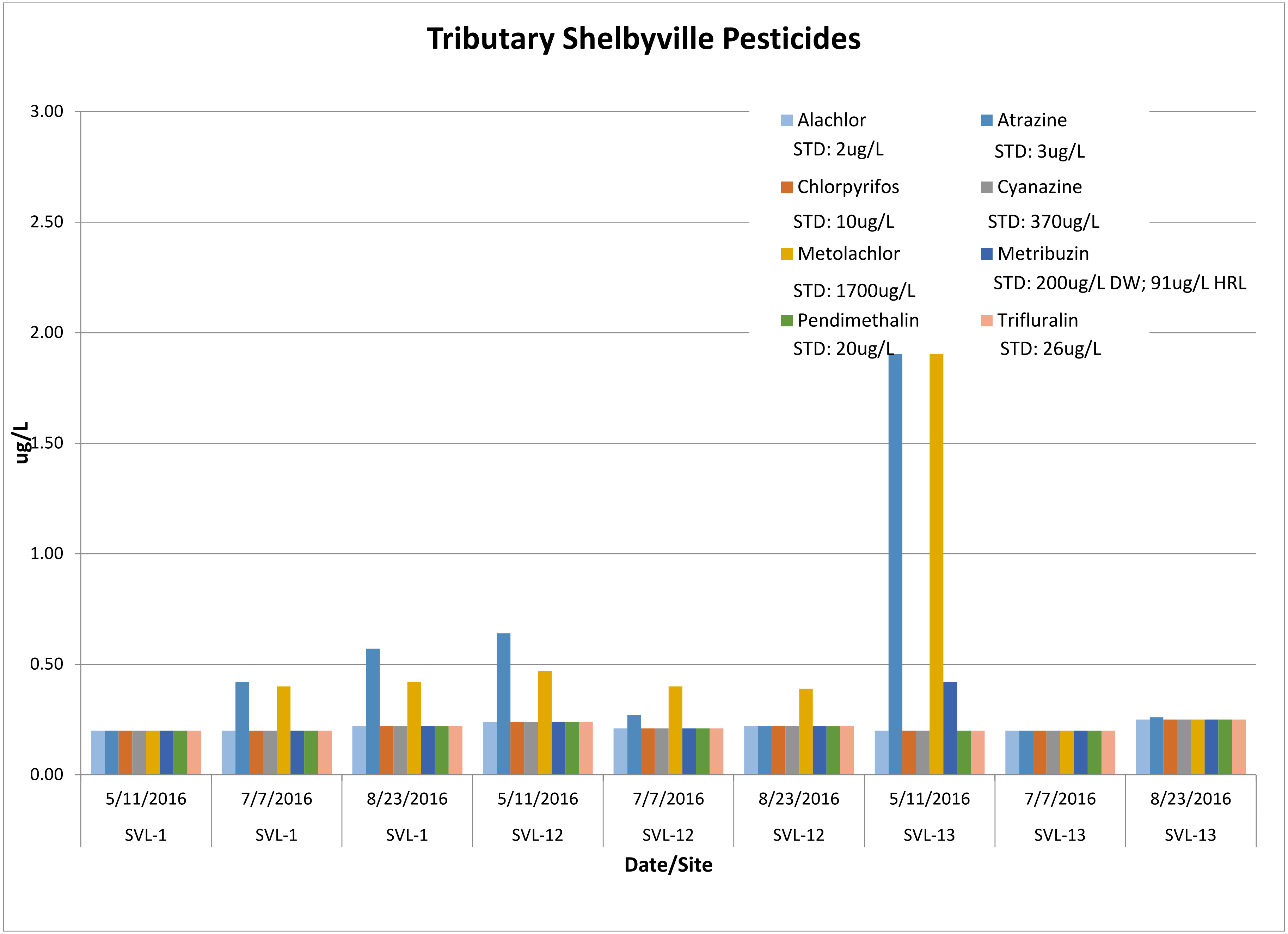


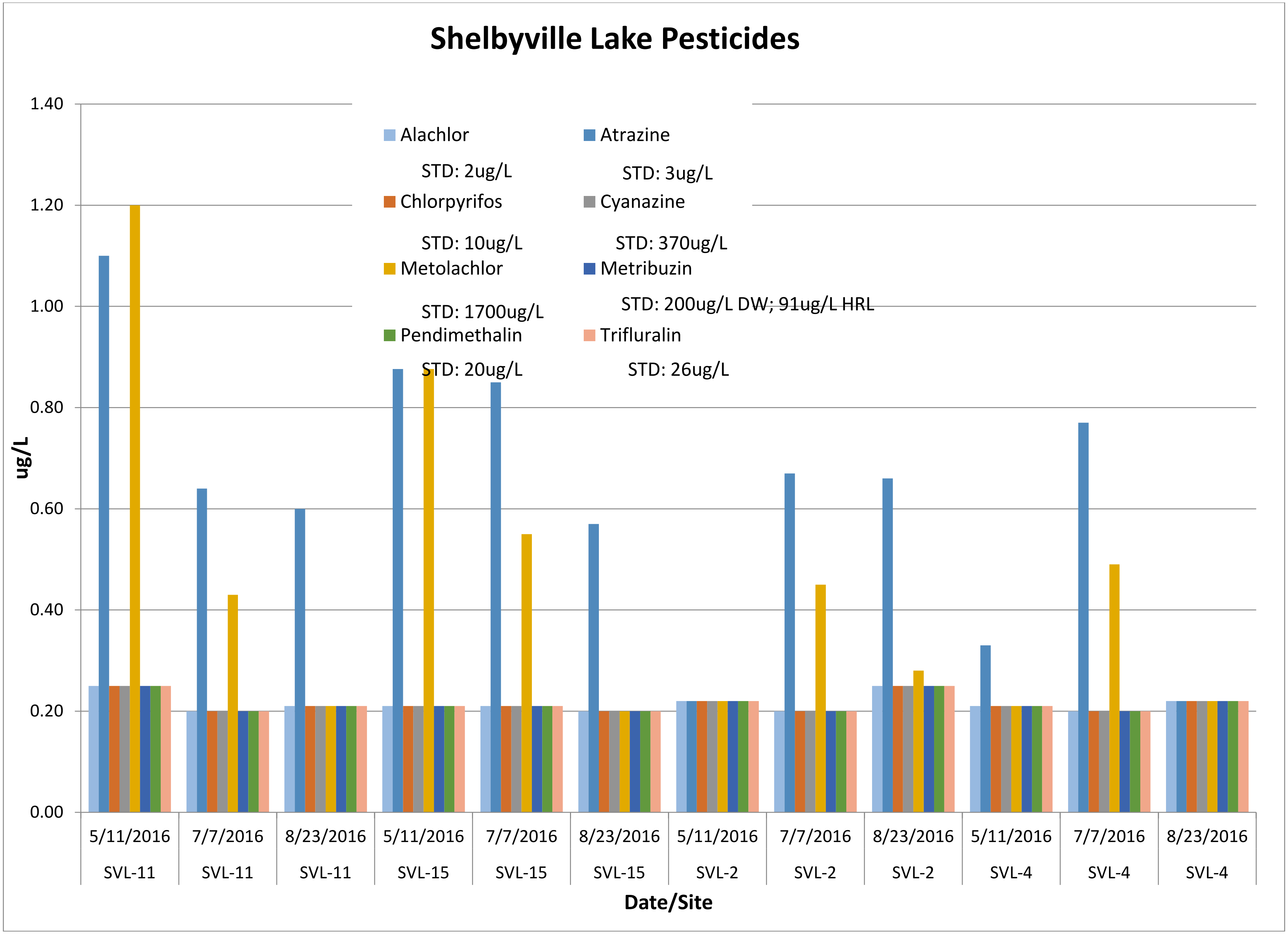
Shelbyville Lake Ammonia Nitrogen & Nitrate Nitrogen

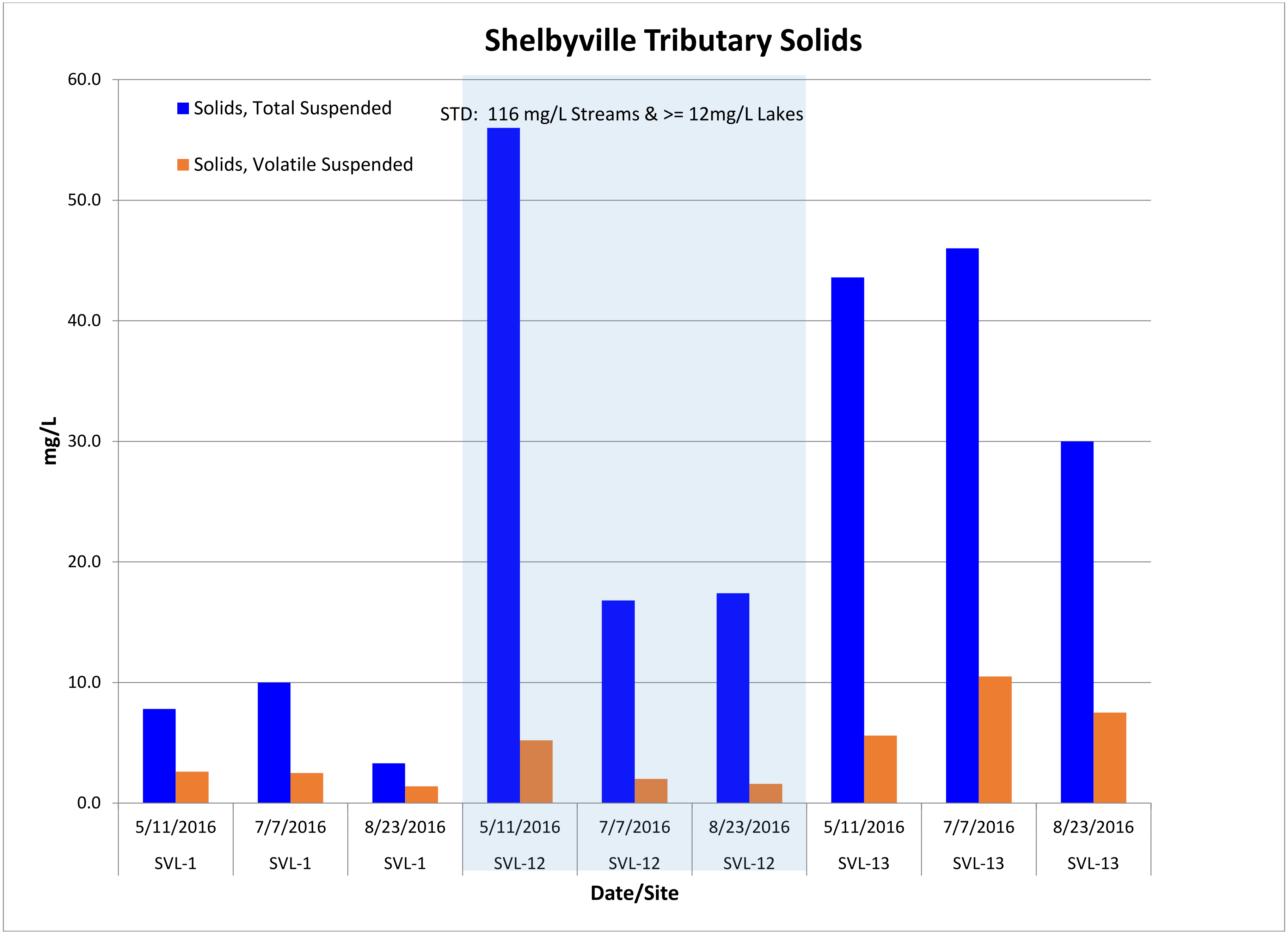

Shelbyville Tributary Phosphorus
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
mg/L
🟥 Phosphorus
🟦 Phosphorus, -ortho
STD Total Phosphorous: 0.05 mg/L Lakes & 0.61 mg/L Streams
5/11/2016
SVL-1
7/7/2016
SVL-1
8/23/2016
SVL-1
5/11/2016
SVL-12
7/7/2016
SVL-12
8/23/2016
SVL-12
5/11/2016
SVL-13
7/7/2016
SVL-13
8/23/2016
SVL-13
Date/Site

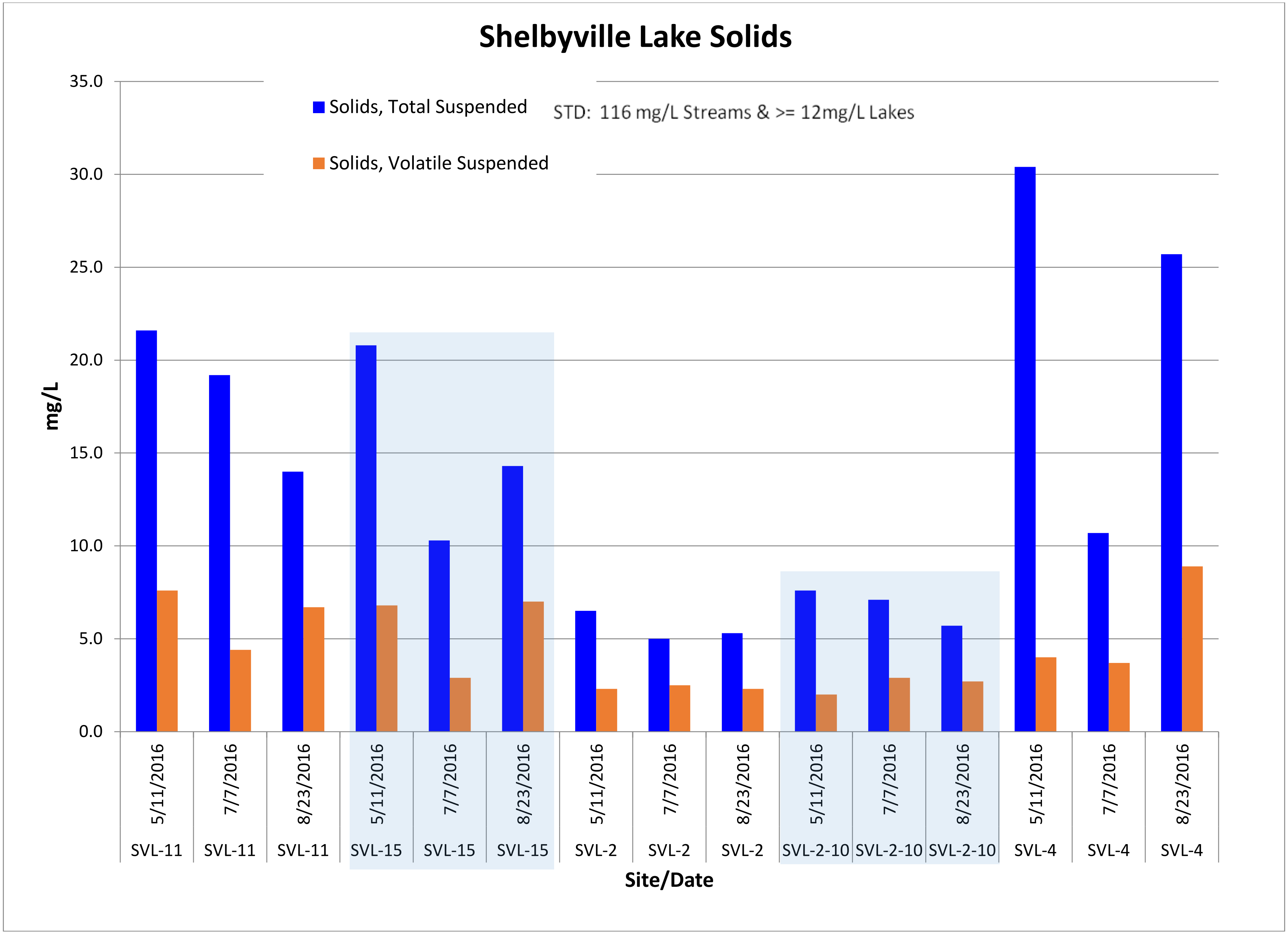

Shelbyville Lake Phosphorus
mg/L
0.45
0.40
0.35
0.30
0.25
0.20
0.15
0.10
0.05
0.00
Phosphorus
Phosphorus, -ortho
STD Total Phosphorous: 0.05 mg/L Lakes & 0.61 mg/L Streams
Date/Site
5/11/2016
7/7/2016
8/23/2016
5/11/2016
7/7/2016
8/23/2016
5/11/2016
7/7/2016
8/23/2016
5/11/2016
7/7/2016
8/23/2016
5/11/2016
7/7/2016
8/23/2016
SVL-11
SVL-11
SVL-11
SVL-15
SVL-15
SVL-15
SVL-2
SVL-2
SVL-2
SVL-2-10
SVL-2-10
SVL-2-10
SVL-4
SVL-4
SVL-4

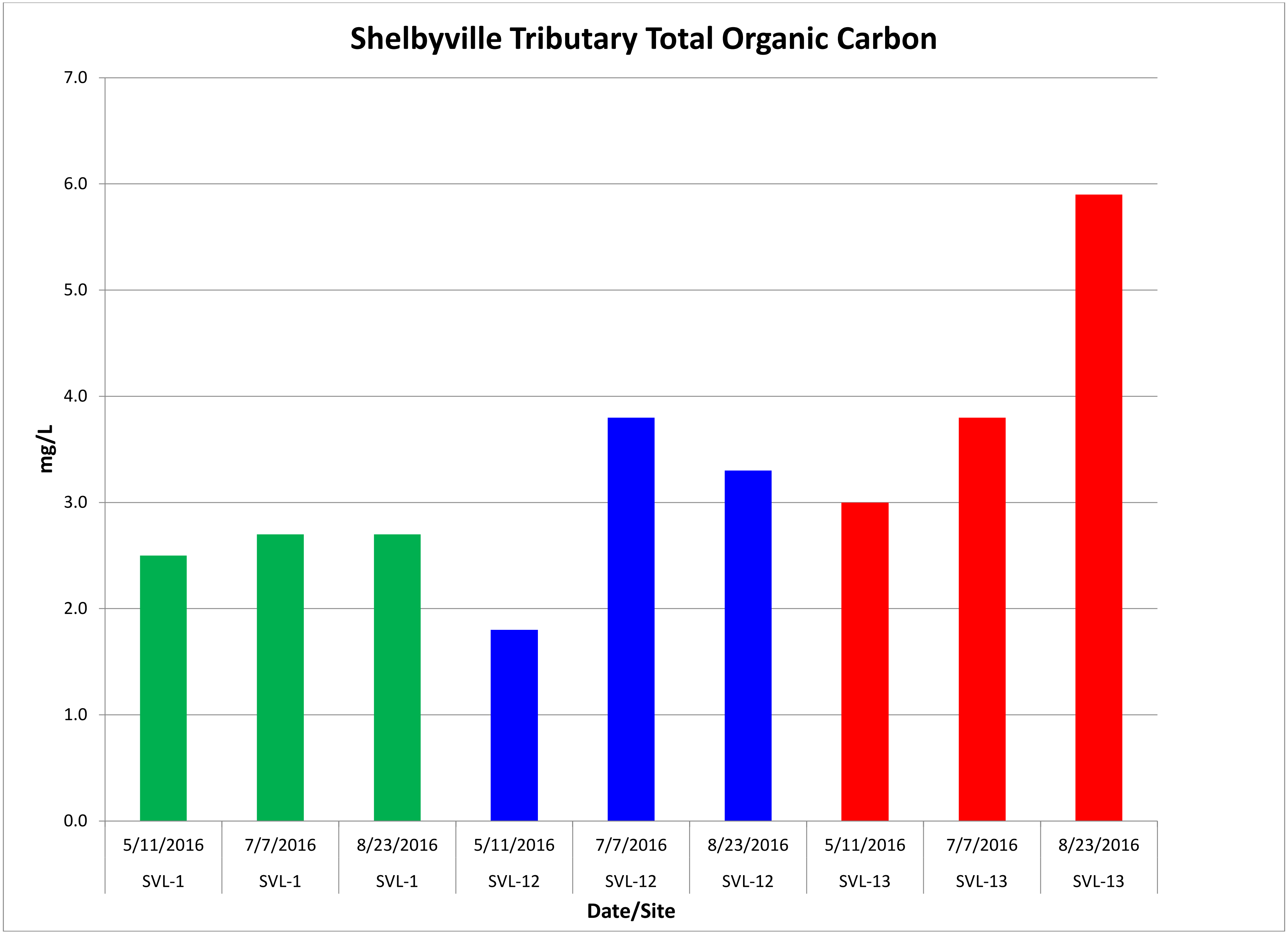

Shelbyville Chlorophyll & Pheophytin
Chlorophyll a
Pheophytin a
mg/cu m
120.0
100.0
80.0
60.0
40.0
20.0
0.0
5/11/2016
SVL-11
7/7/2016
SVL-11
8/23/2016
SVL-11
5/11/2016
SVL-15
7/7/2016
SVL-15
8/23/2016
SVL-15
5/11/2016
SVL-2
7/7/2016
SVL-2
8/23/2016
SVL-2
5/11/2016
SVL-4
7/7/2016
SVL-4
8/23/2016
SVL-4
Date/Site

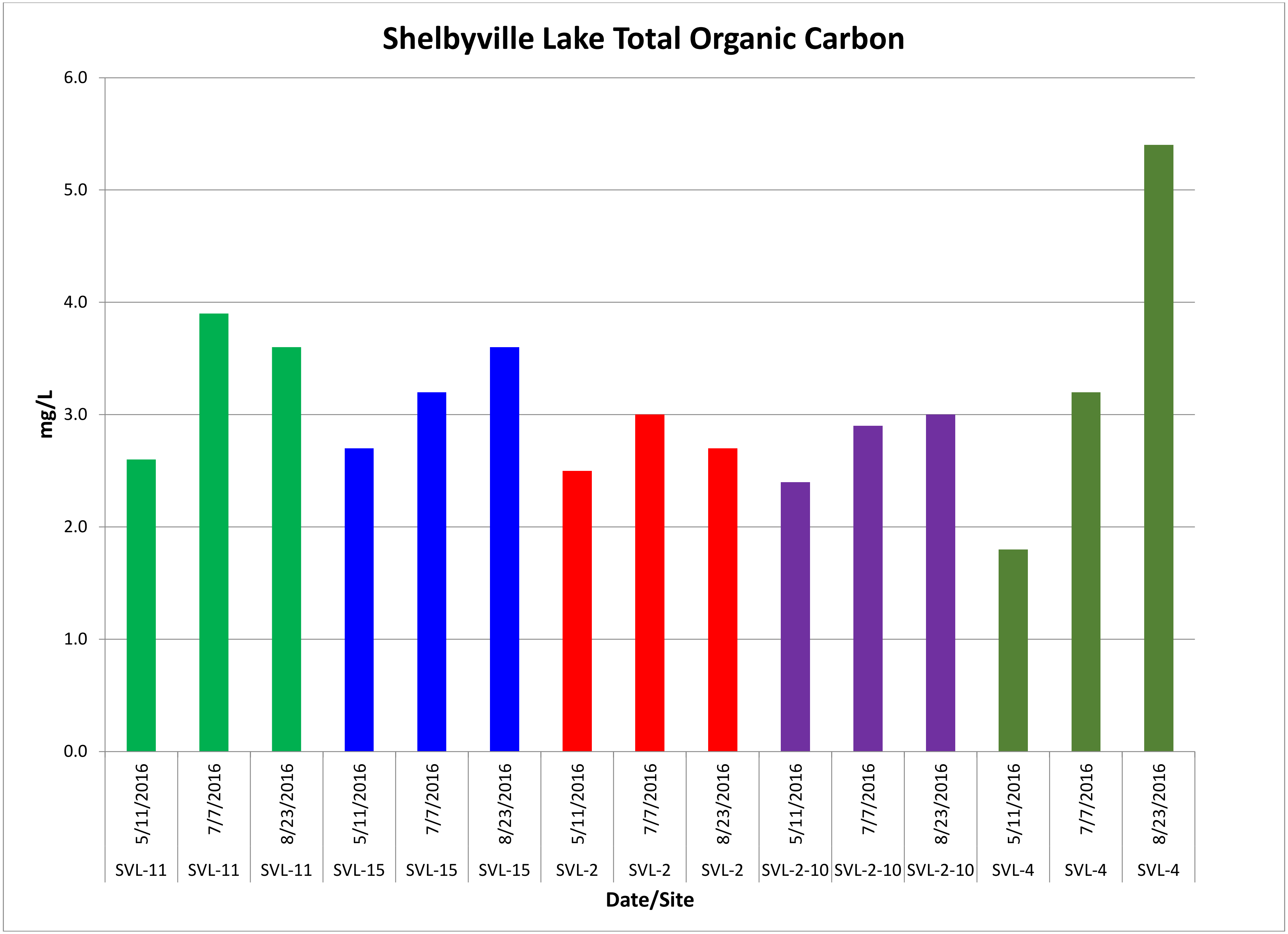

Tributary Shelbyville Pesticides
ug/L
3.00
2.50
2.00
1.50
1.00
0.50
0.00
Alachlor
STD: 2ug/L
Atrazine
STD: 3ug/L
Chlorpyrifos
STD: 10ug/L
Cyanazine
STD: 370ug/L
Metolachlor
STD: 1700ug/L
Metribuzin
STD: 200ug/L DW; 91ug/L HRL
Pendimethalin
STD: 20ug/L
Trifluralin
STD: 26ug/L
5/11/2016 SVL-1
7/7/2016 SVL-1
8/23/2016 SVL-1
5/11/2016 SVL-12
7/7/2016 SVL-12
8/23/2016 SVL-12
5/11/2016 SVL-13
7/7/2016 SVL-13
8/23/2016 SVL-13
Date/Site


Shelbyville Lake Pesticides
ug/L
0.00
0.20
0.40
0.60
0.80
1.00
1.20
1.40
Alachlor STD: 2ug/L
Atrazine STD: 3ug/L
Chlorpyrifos STD: 10ug/L
Cyanazine STD: 370ug/L
Metolachlor STD: 1700ug/L
Metribuzin STD: 200ug/L DW; 91ug/L HRL
Pendimethalin STD: 20ug/L
Trifluralin STD: 26ug/L
5/11/2016 SVL-11
7/7/2016 SVL-11
8/23/2016 SVL-11
5/11/2016 SVL-15
7/7/2016 SVL-15
8/23/2016 SVL-15
5/11/2016 SVL-2
7/7/2016 SVL-2
8/23/2016 SVL-2
5/11/2016 SVL-4
7/7/2016 SVL-4
8/23/2016 SVL-4
Date/Site


Shelbyville Tributary Solids
Solids, Total Suspended
Solids, Volatile Suspended
STD: 116 mg/L Streams & >= 12mg/L Lakes
mg/L
60.0
50.0
40.0
30.0
20.0
10.0
0.0
5/11/2016
SVL-1
7/7/2016
SVL-1
8/23/2016
SVL-1
5/11/2016
SVL-12
7/7/2016
SVL-12
8/23/2016
SVL-12
5/11/2016
SVL-13
7/7/2016
SVL-13
8/23/2016
SVL-13
Date/Site

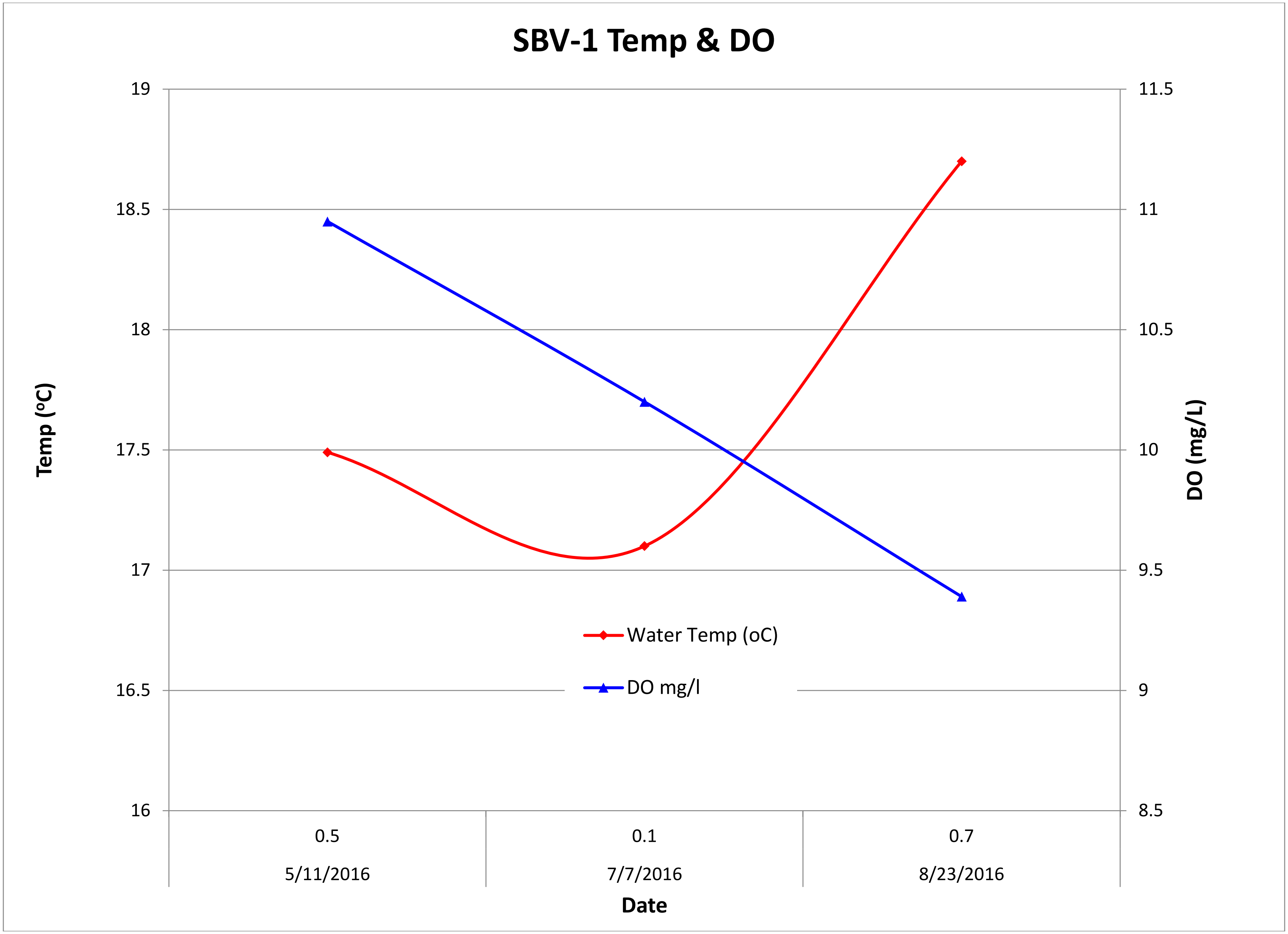

Shelbyville Lake Solids
Solids, Total Suspended
Solids, Volatile Suspended
STD: 116 mg/L Streams & >= 12mg/L Lakes
mg/L
35.0
30.0
25.0
20.0
15.0
10.0
5.0
0.0
5/11/2016
7/7/2016
8/23/2016
SVL-11
SVL-15
SVL-2
SVL-2-10
SVL-4
Site/Date

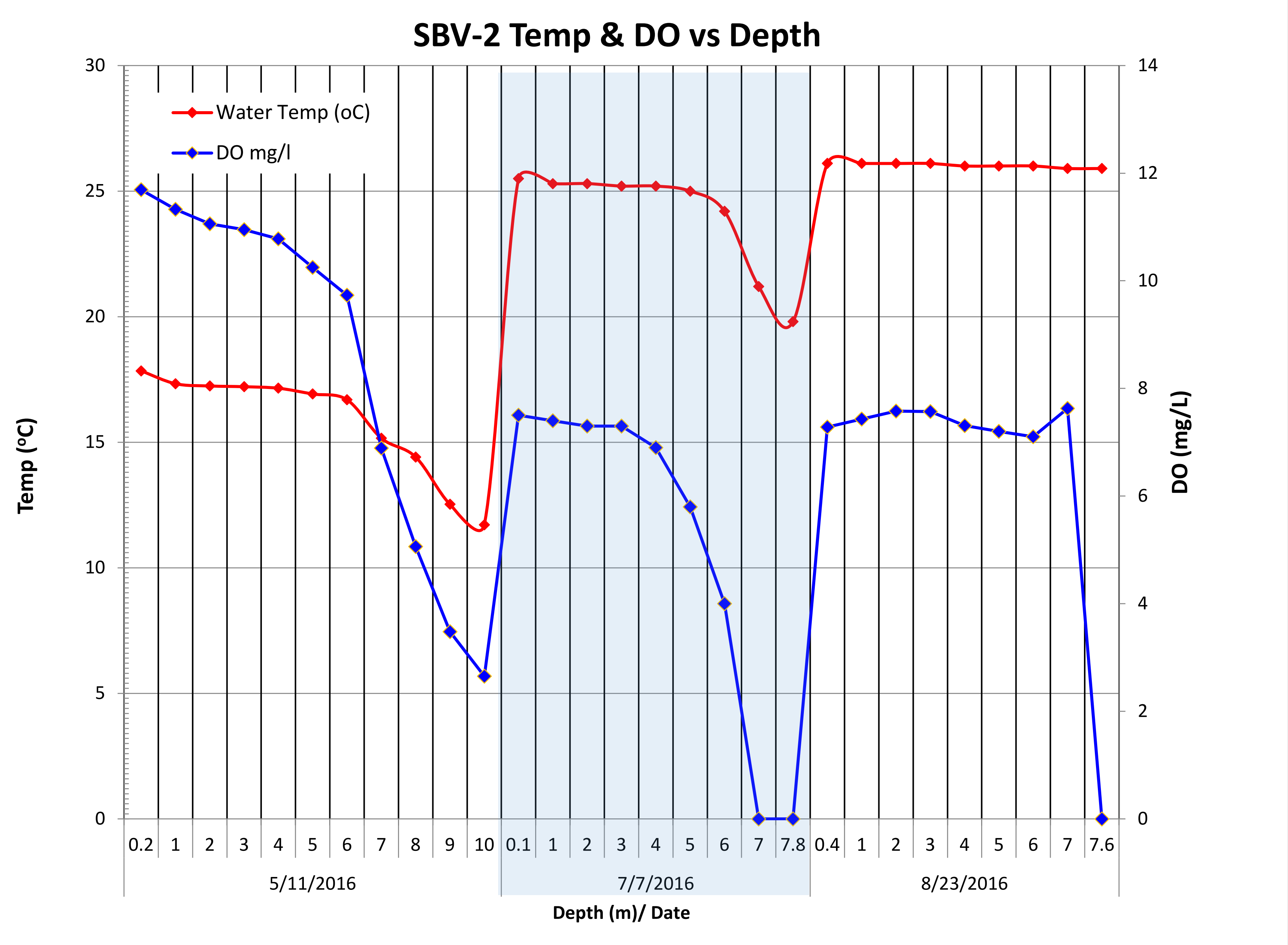

Shelbyville Tributary Total Organic Carbon
7.0
6.0
5.0
4.0
3.0
2.0
1.0
0.0
mg/L
5/11/2016
SVL-1
7/7/2016
SVL-1
8/23/2016
SVL-1
5/11/2016
SVL-12
7/7/2016
SVL-12
8/23/2016
SVL-12
5/11/2016
SVL-13
7/7/2016
SVL-13
8/23/2016
SVL-13
Date/Site

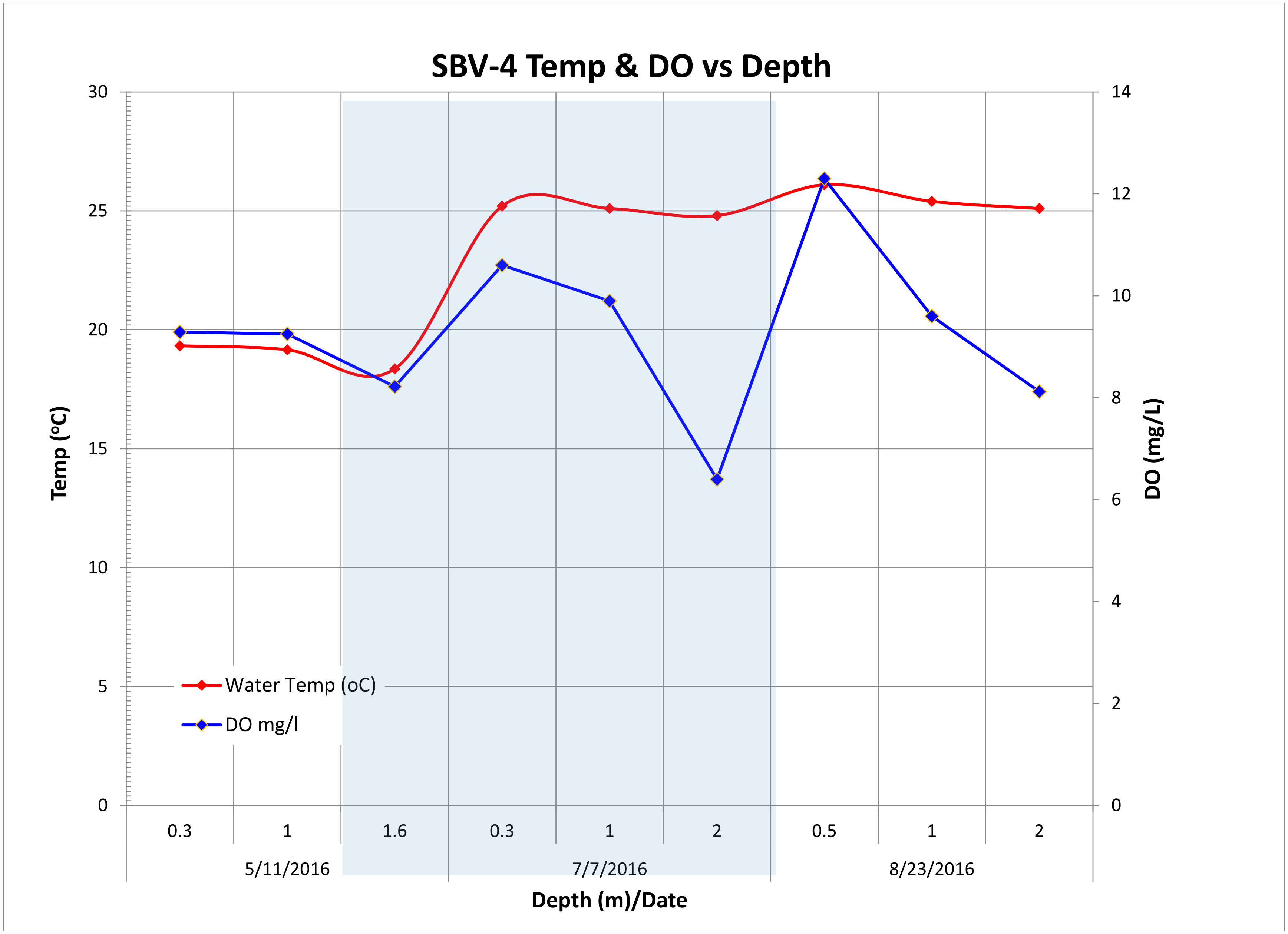

Shelbyville Lake Total Organic Carbon
mg/L
6.0
5.0
4.0
3.0
2.0
1.0
0.0
5/11/2016
SVL-11
7/7/2016
SVL-11
8/23/2016
SVL-11
5/11/2016
SVL-15
7/7/2016
SVL-15
8/23/2016
SVL-15
5/11/2016
SVL-2
7/7/2016
SVL-2
8/23/2016
SVL-2
5/11/2016
SVL-2-10
7/7/2016
SVL-2-10
8/23/2016
SVL-2-10
5/11/2016
SVL-4
7/7/2016
SVL-4
8/23/2016
SVL-4
Date/Site

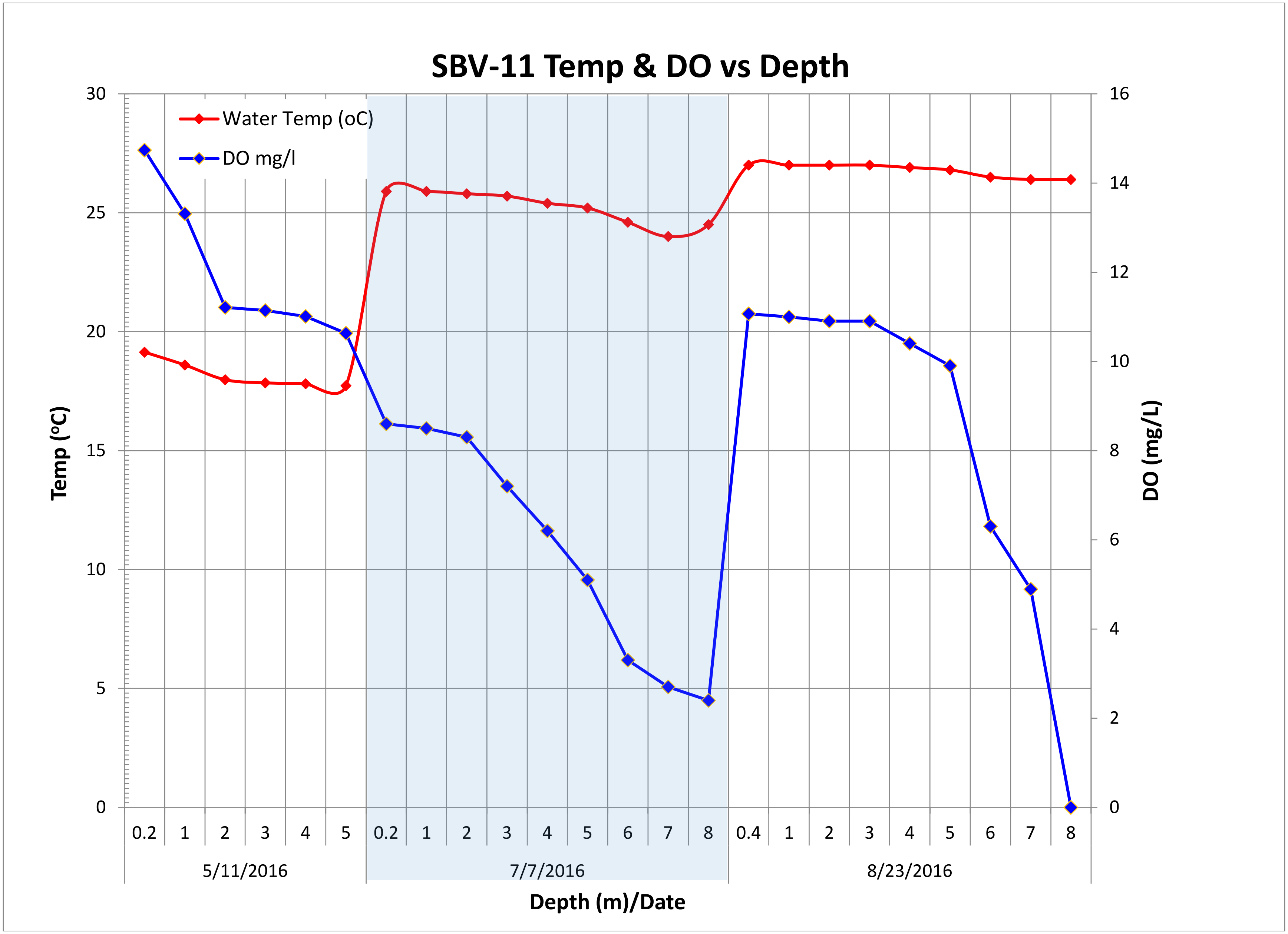
APPENDIX C

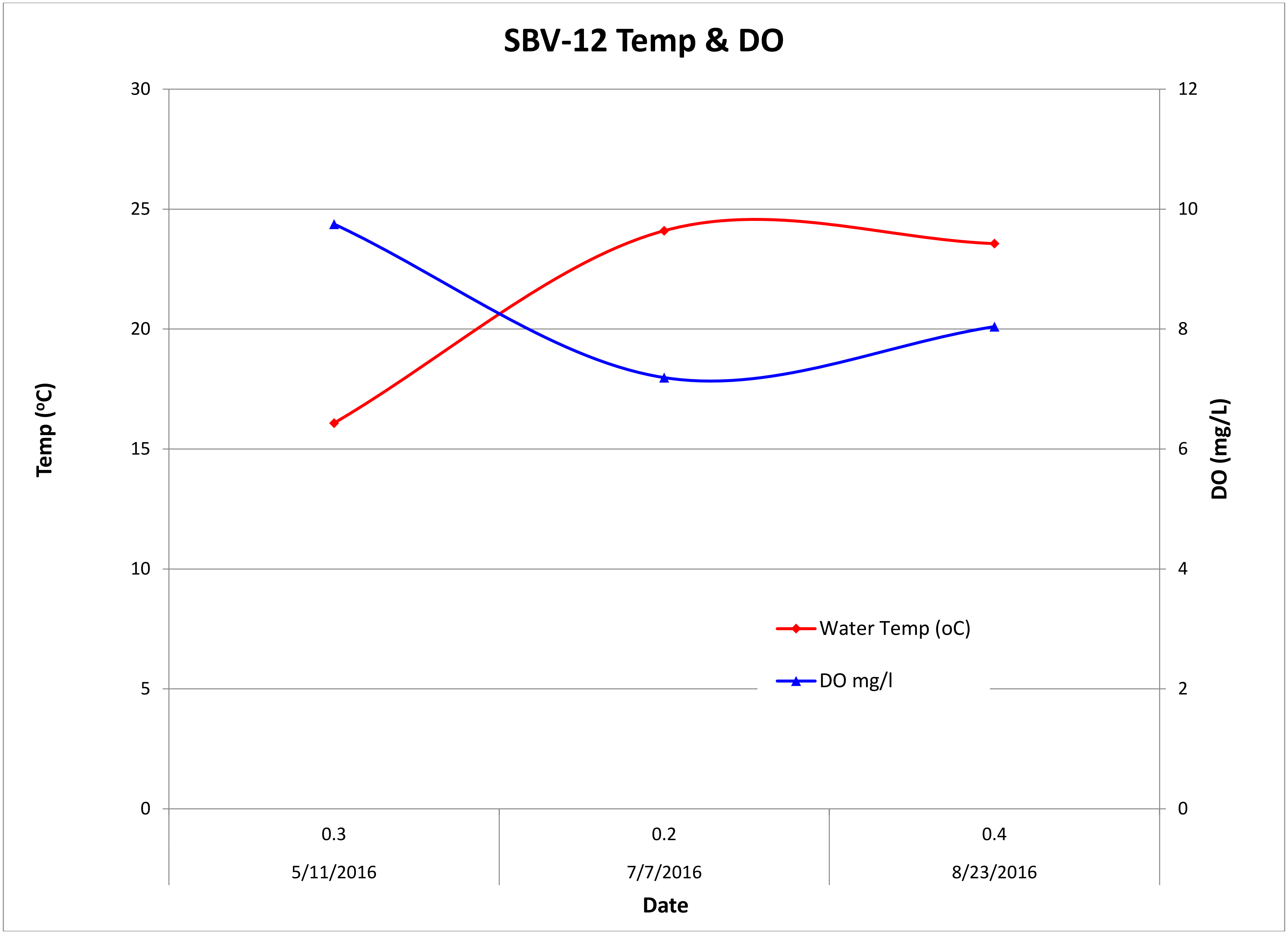
FIELD DATA GRAPHS

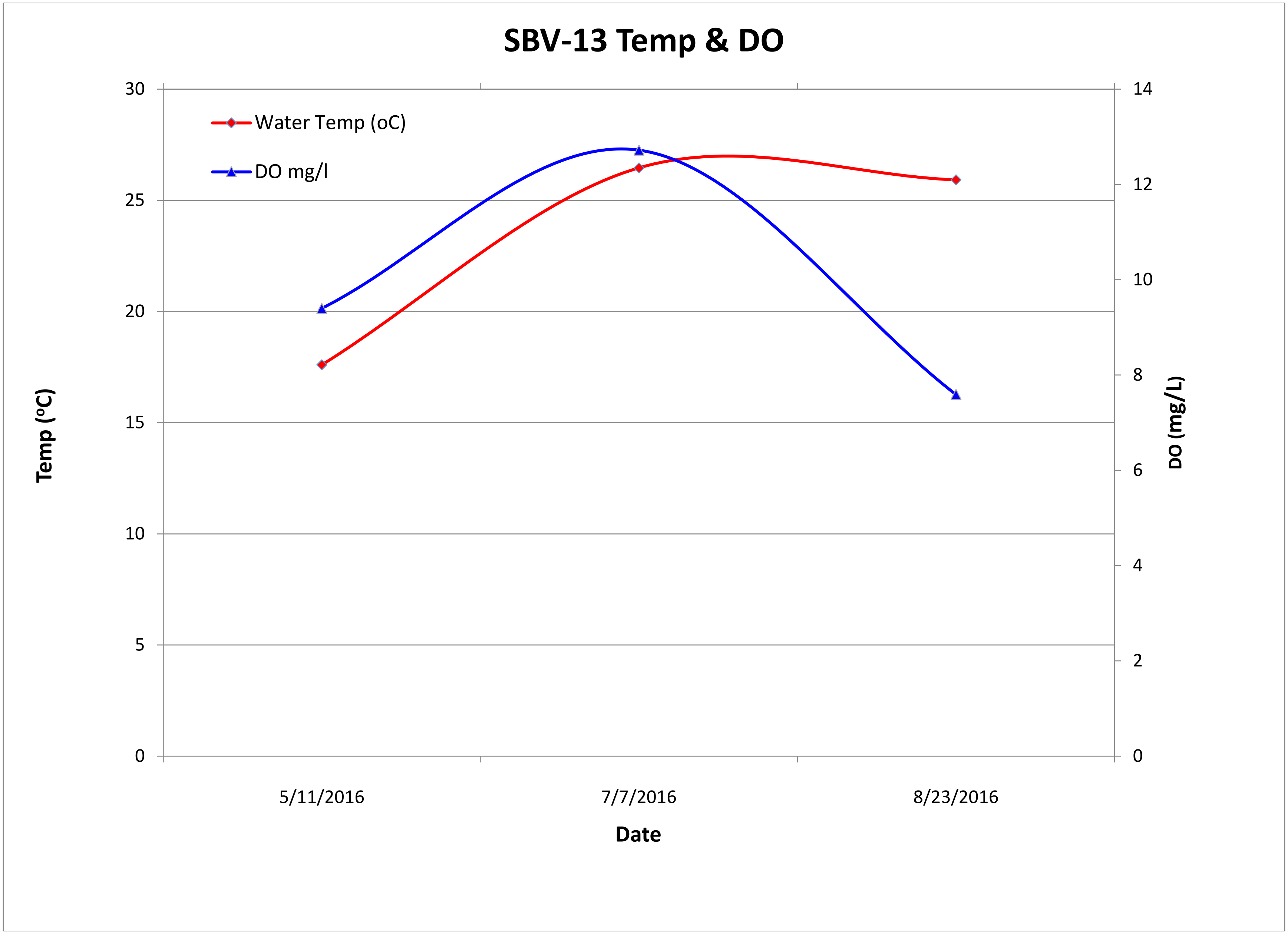

SBV-1 Temp & DO
Temp (°C)
19
18.5
18
17.5
17
16.5
16
DO (mg/L)
11.5
11
10.5
10
9.5
9
8.5
Water Temp (oC)
DO mg/l
0.5
5/11/2016
0.1
7/7/2016
0.7
8/23/2016
Date

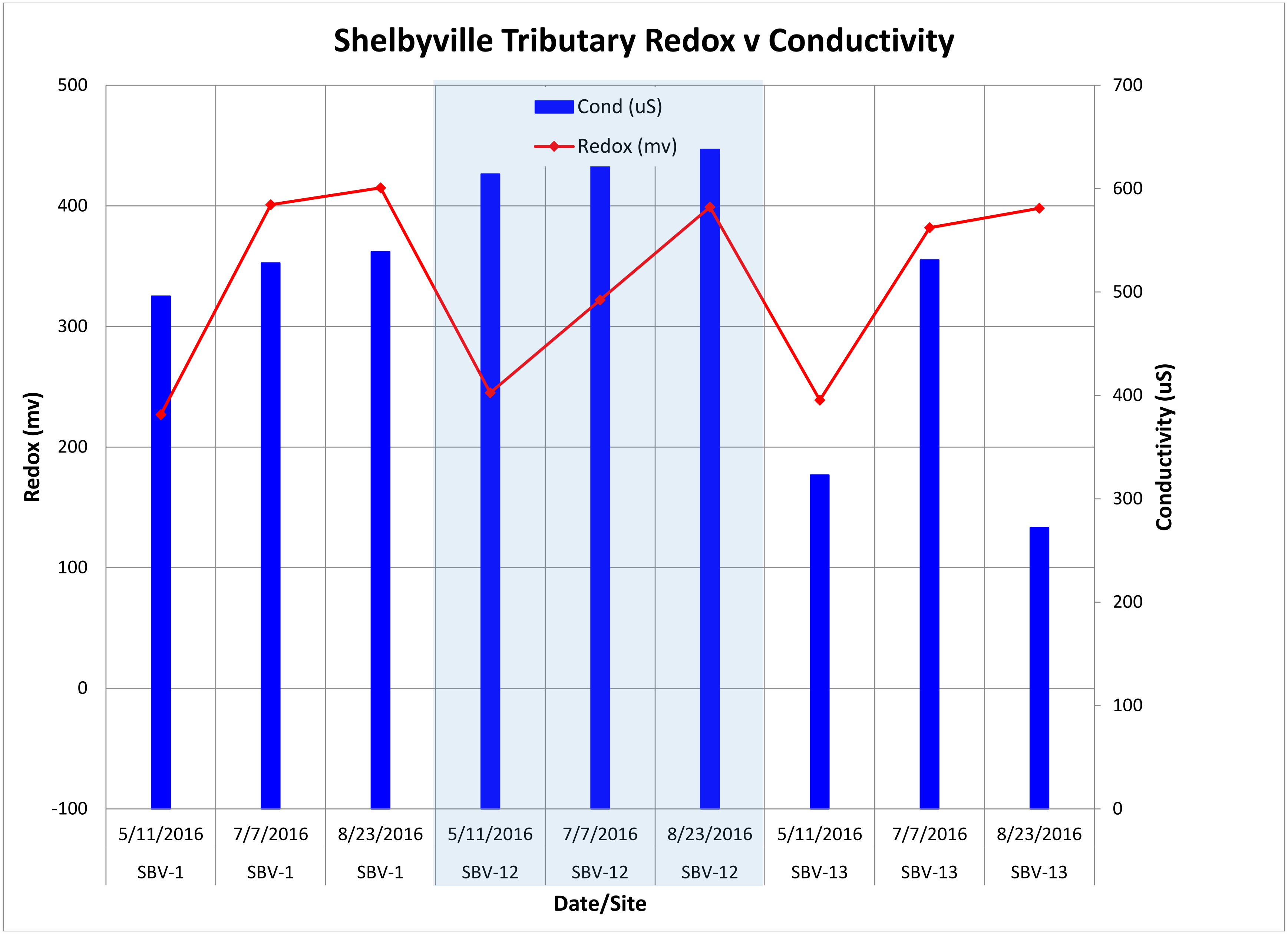

SBV-2 Temp & DO vs Depth
Water Temp (oC)
DO mg/l
Temp (ºC)
DO (mg/L)
30
25
20
15
10
5
0
14
12
10
8
6
4
2
0
0.2 1 2 3 4 5 6 7 8 9 10
0.1 1 2 3 4 5 6 7 7.8
0.4 1 2 3 4 5 6 7 7.6
5/11/2016
7/7/2016
8/23/2016
Depth (m)/ Date

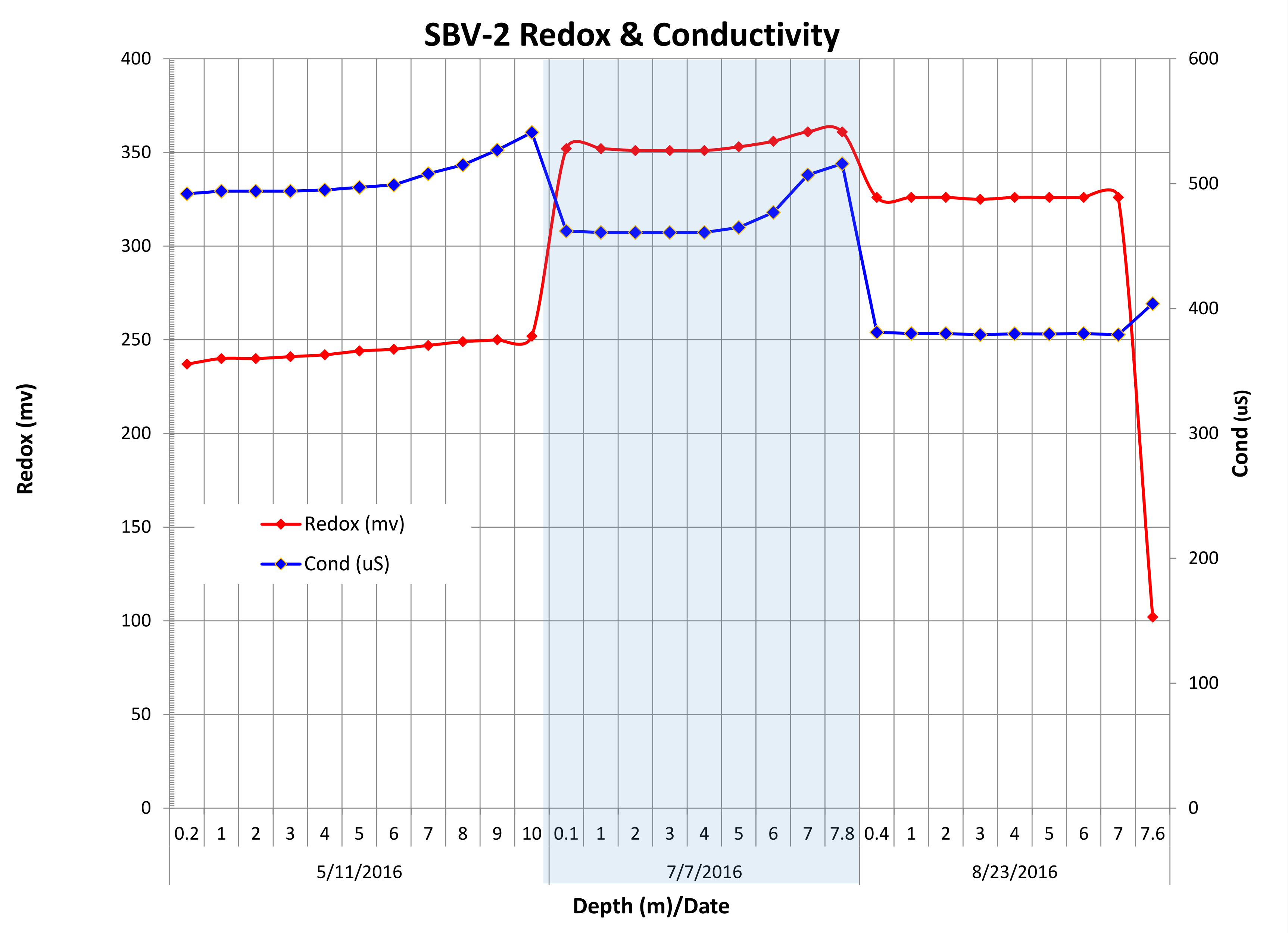

SBV-4 Temp & DO vs Depth
Temp (ºC)
DO (mg/L)
30
25
20
15
10
5
0
14
12
10
8
6
4
2
0
0.3
1
1.6
0.3
1
2
0.5
1
2
5/11/2016
7/7/2016
8/23/2016
Depth (m)/Date
Water Temp (oC)
DO mg/l

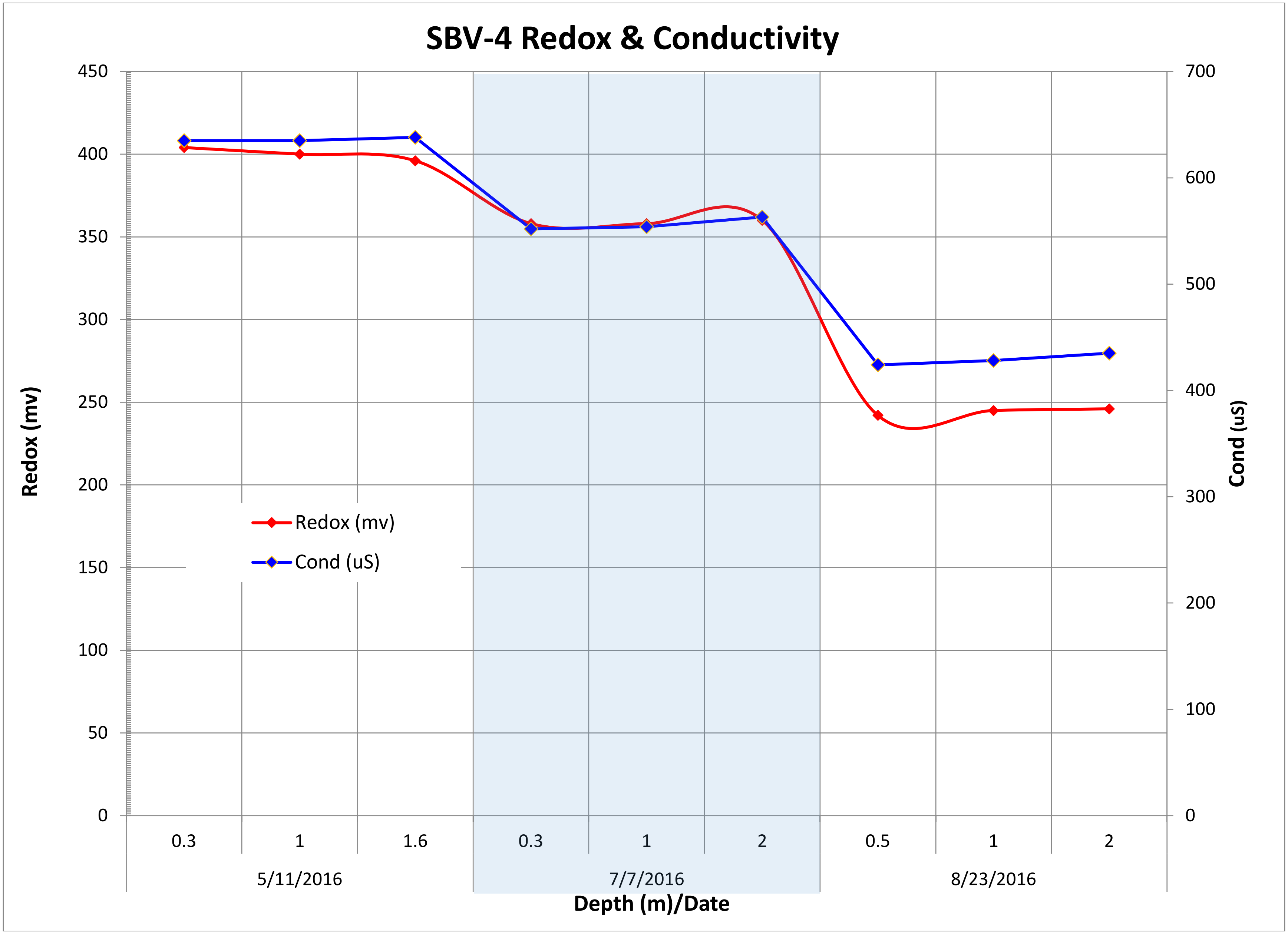

SBV-11 Temp & DO vs Depth
Water Temp (oC)
DO mg/l
Temp (ºC)
DO (mg/L)
30
25
20
15
10
5
0
16
14
12
10
8
6
4
2
0
0.2
1
2
3
4
5
0.2
1
2
3
4
5
6
7
8
0.4
1
2
3
4
5
6
7
8
5/11/2016
7/7/2016
8/23/2016
Depth (m)/Date

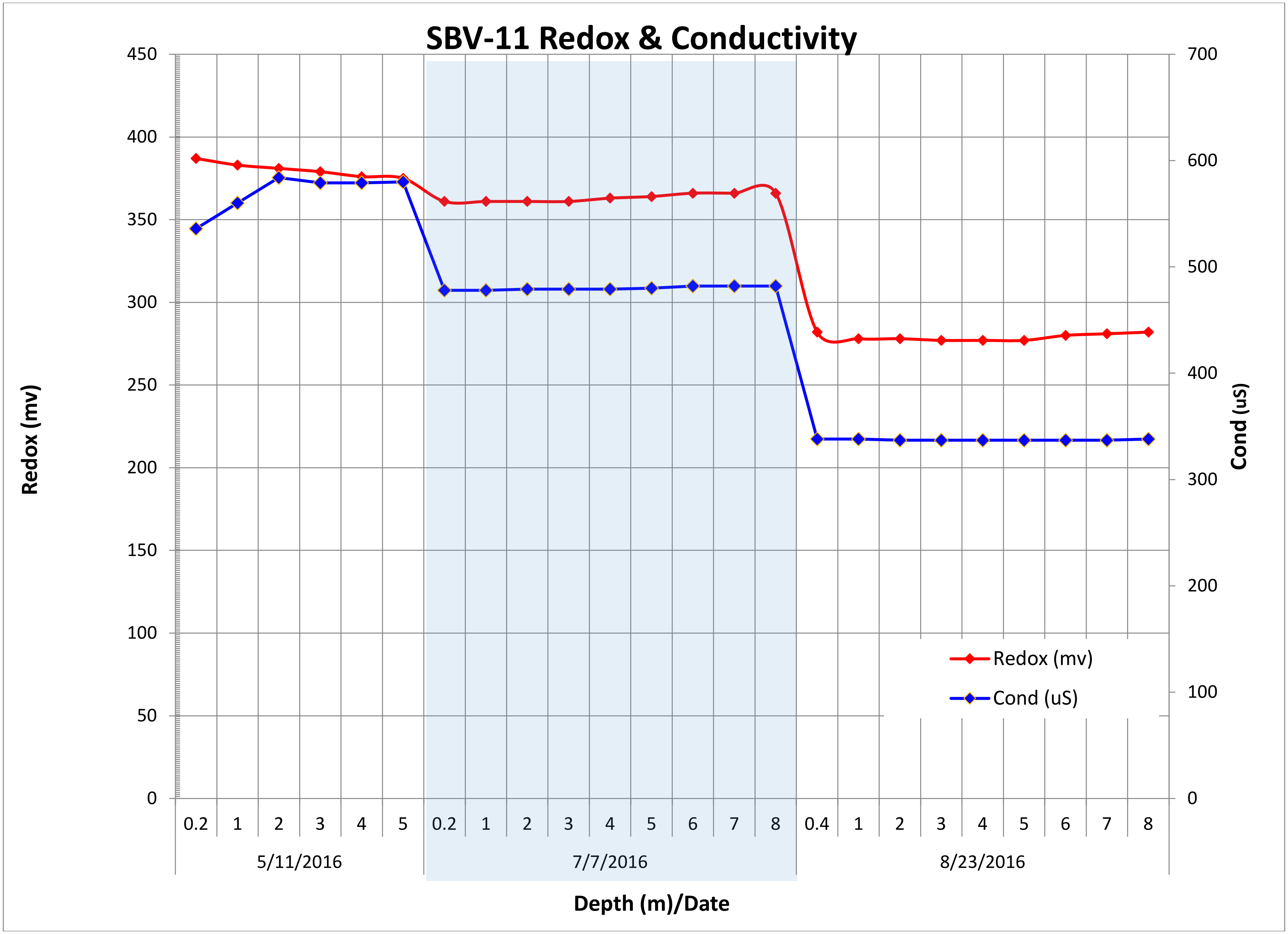

SBV-12 Temp & DO
Temp (oC)
DO (mg/L)
30
25
20
15
10
5
0
12
10
8
6
4
2
0
Water Temp (oC)
DO mg/l
0.3
5/11/2016
0.2
7/7/2016
0.4
8/23/2016
Date

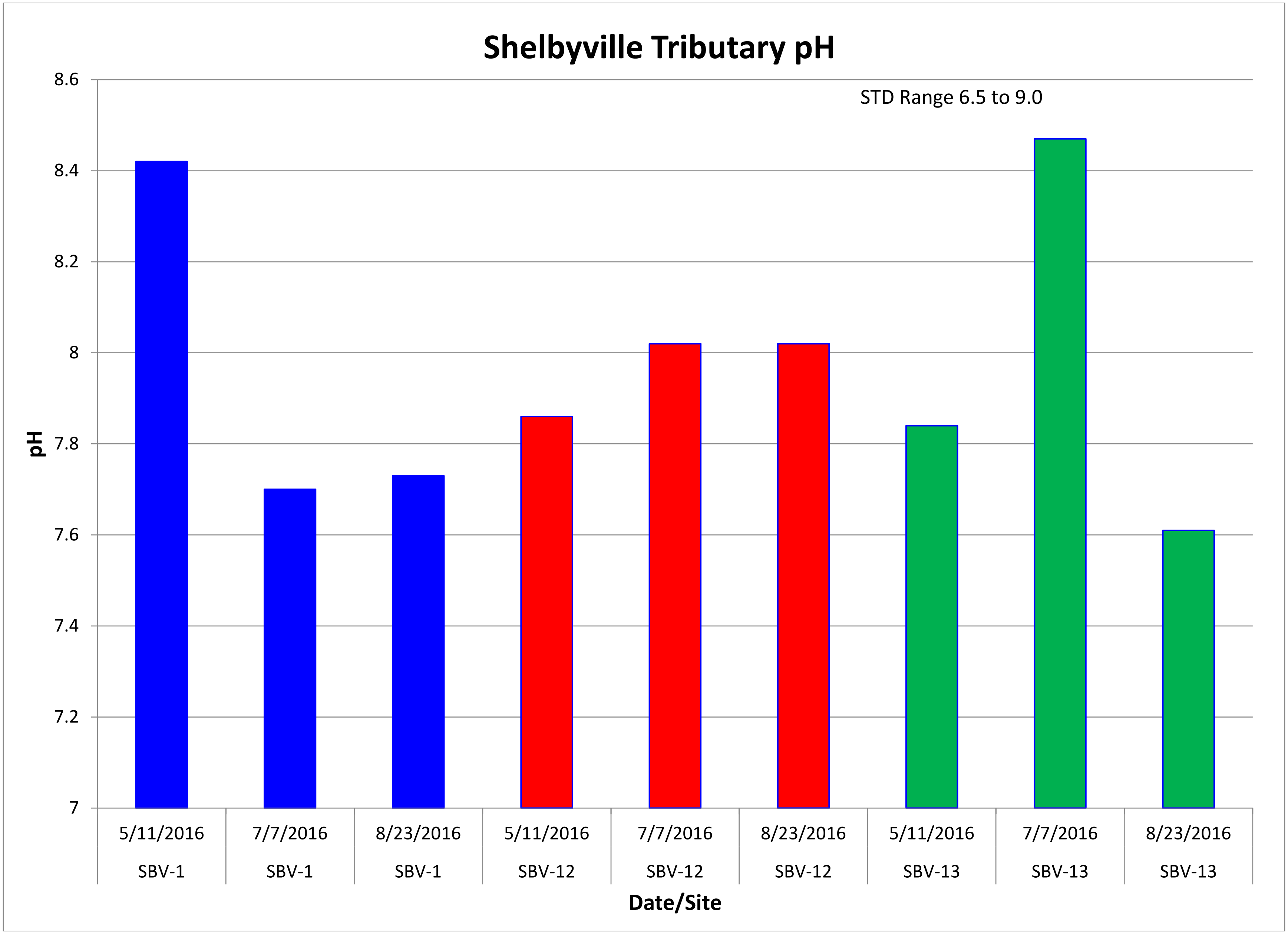

SBV-13 Temp & DO
Water Temp (oC)
DO mg/l
Temp (oC)
DO (mg/L)
Date
30
25
20
15
10
5
0
14
12
10
8
6
4
2
0
5/11/2016
7/7/2016
8/23/2016

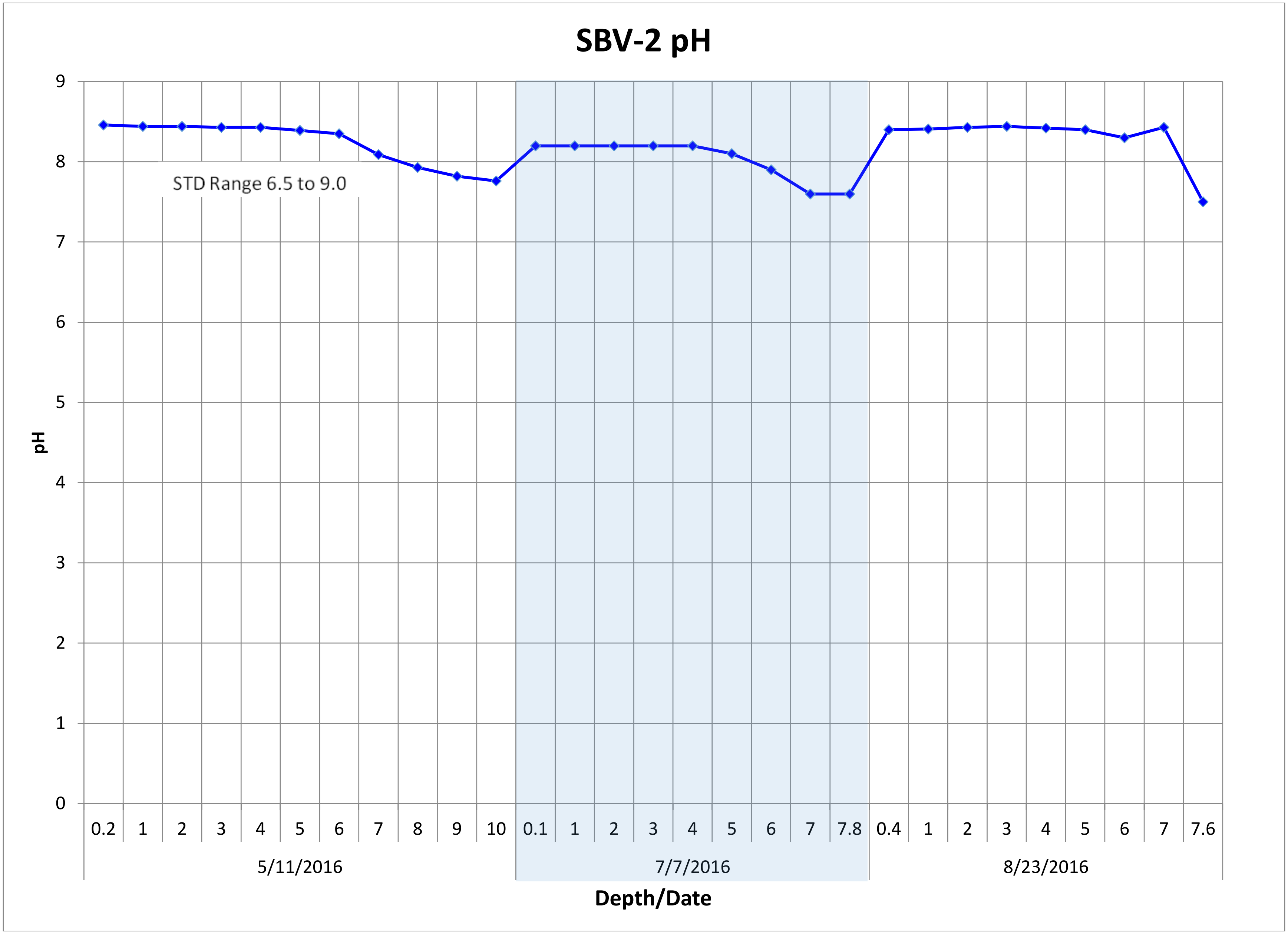

Shelbyville Tributary Redox v Conductivity
Cond (uS)
Redox (mv)
Redox (mv)
Conductivity (uS)
500
400
300
200
100
0
-100
700
600
500
400
300
200
100
0
5/11/2016
SBV-1
7/7/2016
SBV-1
8/23/2016
SBV-1
5/11/2016
SBV-12
7/7/2016
SBV-12
8/23/2016
SBV-12
5/11/2016
SBV-13
7/7/2016
SBV-13
8/23/2016
SBV-13
Date/Site

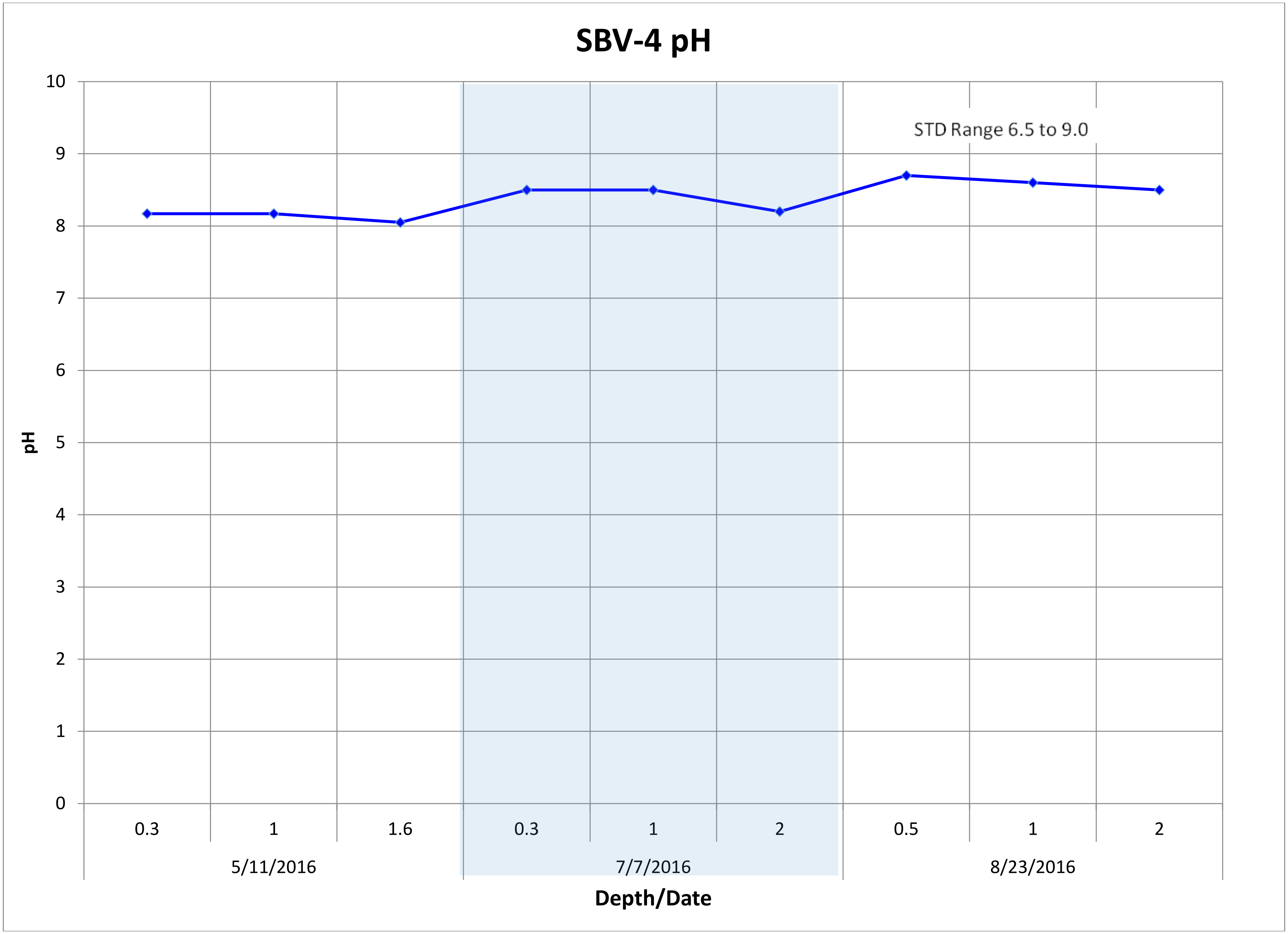

SBV-2 Redox & Conductivity
Redox (mv)
400
350
300
250
200
150
100
50
0
Cond (us)
600
500
400
300
200
100
0
Redox (mv)
Cond (uS)
0.2
1
2
3
4
5
6
7
8
9
10
0.1
1
2
3
4
5
6
7
7.8
0.4
1
2
3
4
5
6
7
7.6
5/11/2016
7/7/2016
8/23/2016
Depth (m)/Date

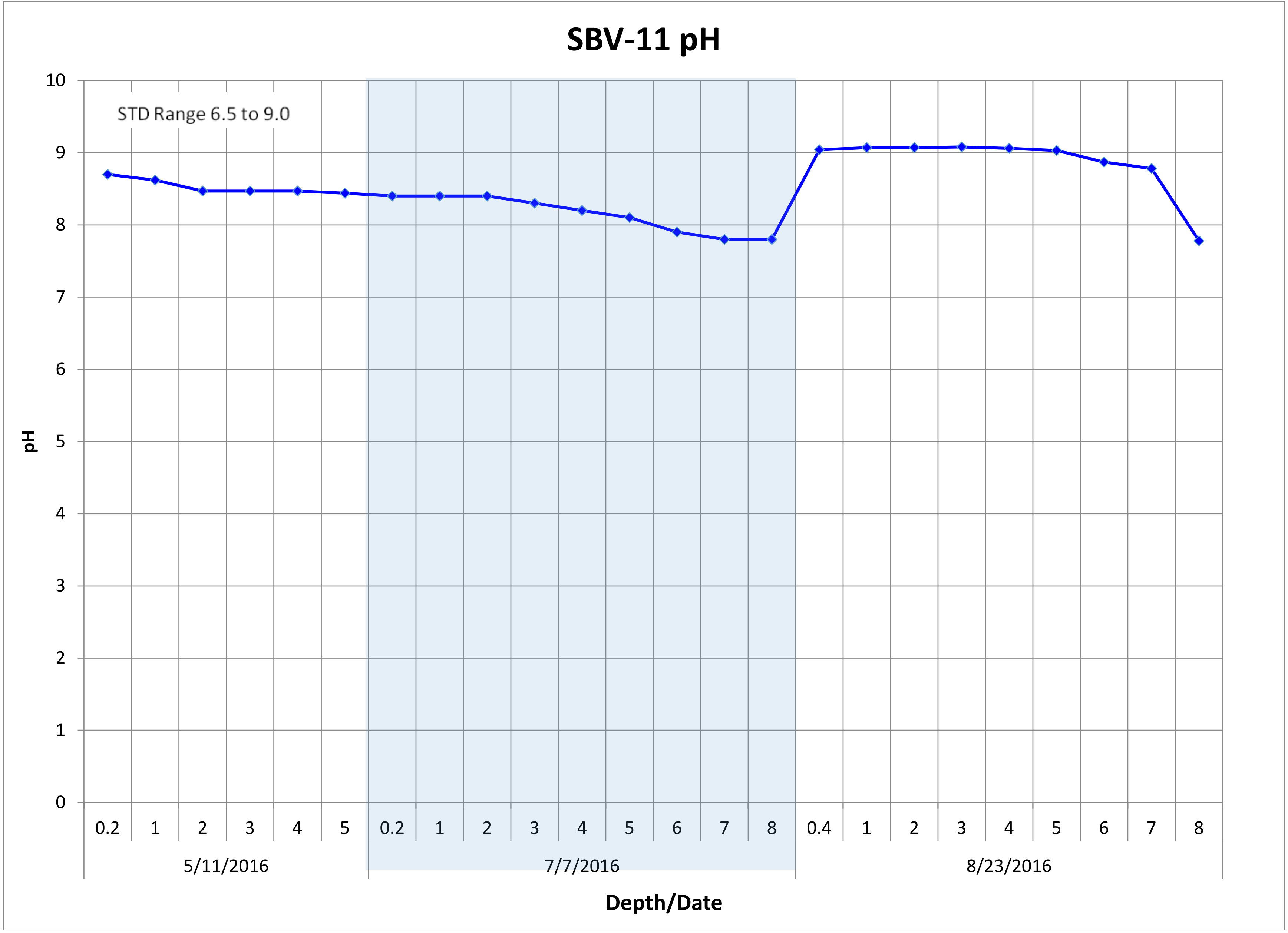

SBV-4 Redox & Conductivity
Redox (mv)
450
400
350
300
250
200
150
100
50
0
Cond (uS)
700
600
500
400
300
200
100
0
Redox (mv)
Cond (uS)
0.3
1
1.6
0.3
1
2
0.5
1
2
5/11/2016
7/7/2016
8/23/2016
Depth (m)/Date

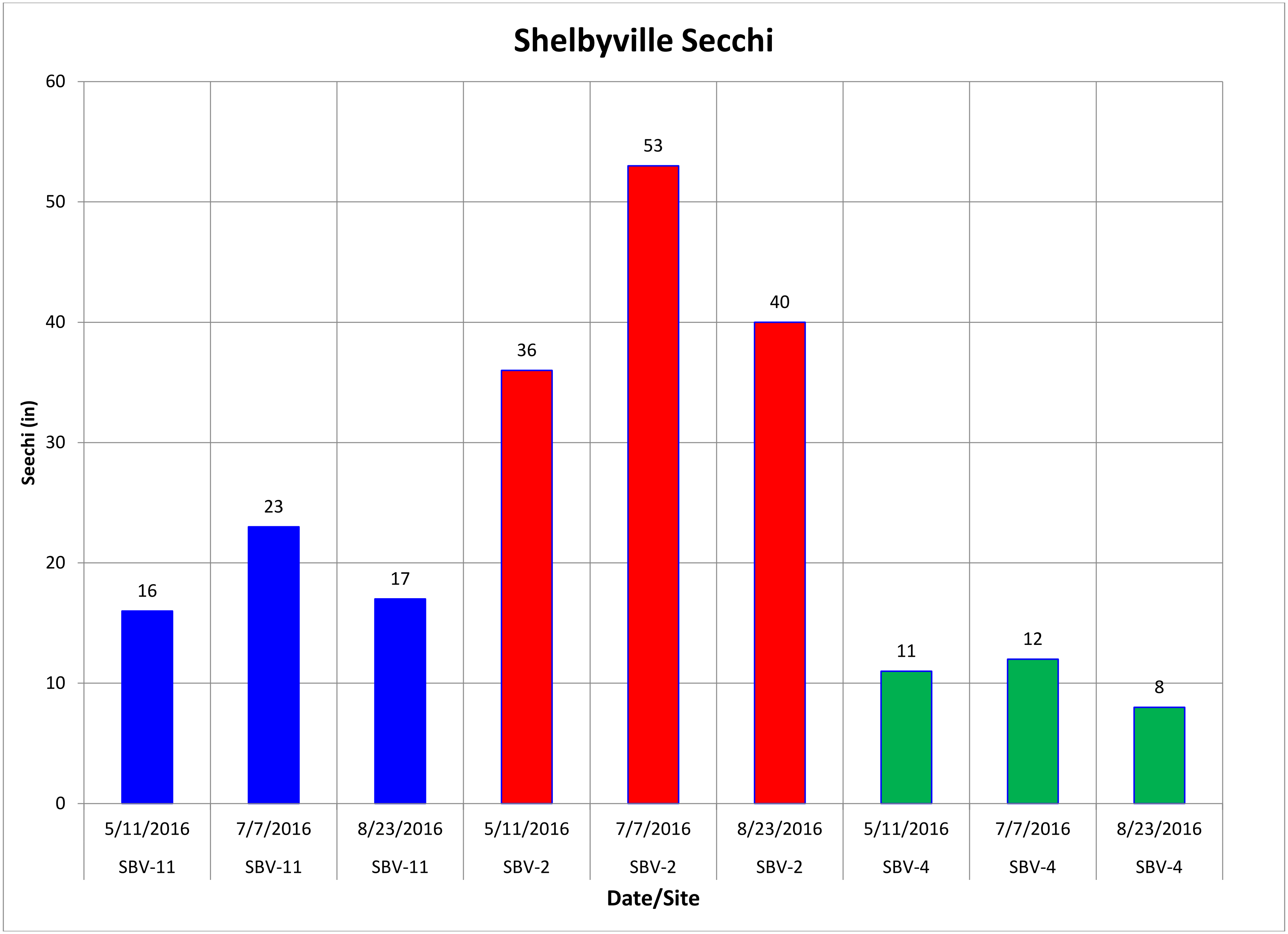

SBV-11 Redox & Conductivity
Redox (mv)
450
400
350
300
250
200
150
100
50
0
Cond (us)
700
600
500
400
300
200
100
0
0.2
1
2
3
4
5
0.2
1
2
3
4
5
6
7
8
0.4
1
2
3
4
5
6
7
8
5/11/2016
7/7/2016
8/23/2016
Depth (m)/Date
Redox (mv)
Cond (uS)

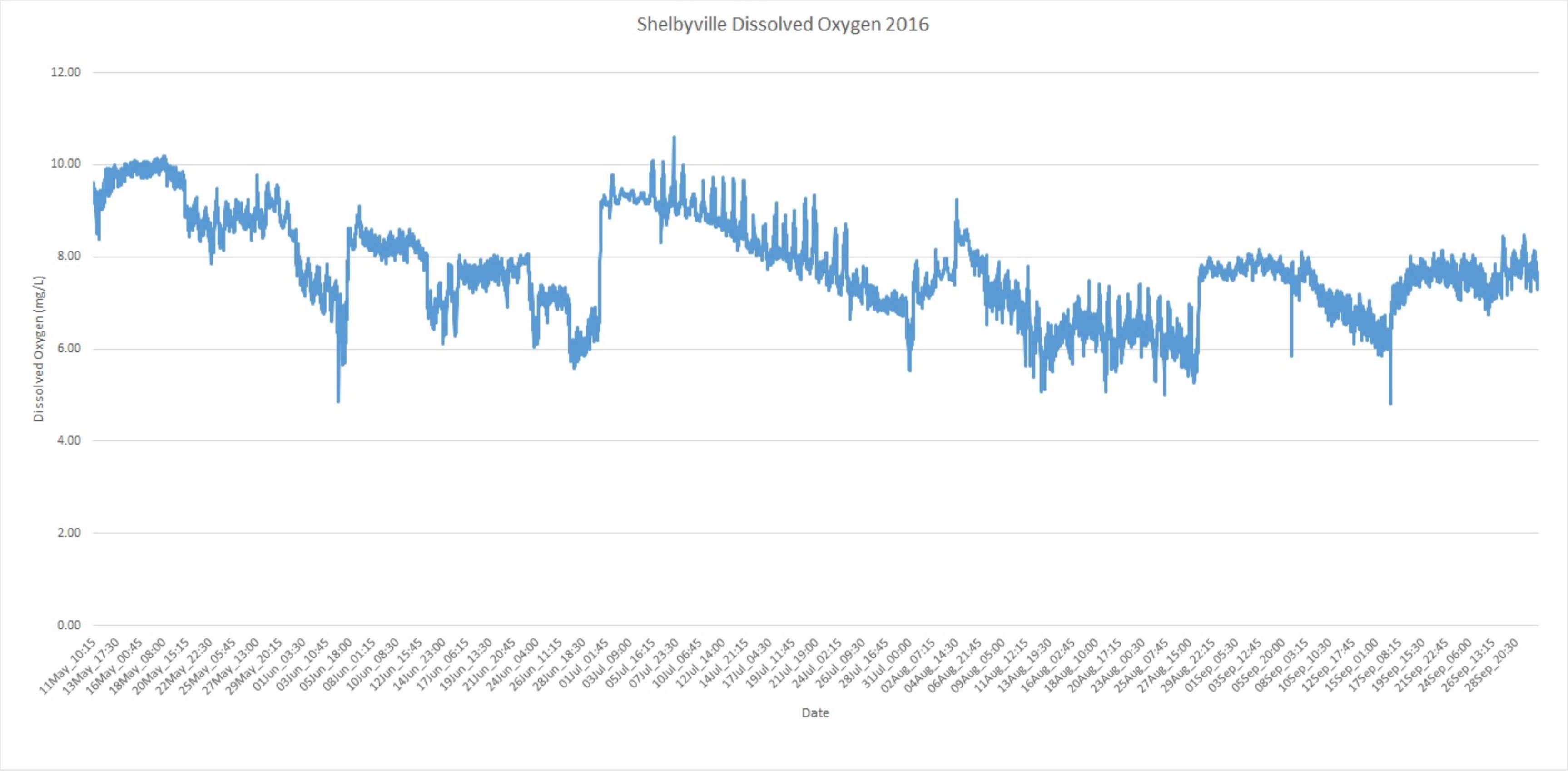

Shelbyville Tributary pH
STD Range 6.5 to 9.0
pH
8.6
8.4
8.2
8
7.8
7.6
7.4
7.2
7
5/11/2016
SBV-1
7/7/2016
SBV-1
8/23/2016
SBV-1
5/11/2016
SBV-12
7/7/2016
SBV-12
8/23/2016
SBV-12
5/11/2016
SBV-13
7/7/2016
SBV-13
8/23/2016
SBV-13
Date/Site


SBV-2 pH
9
8
7
6
5
4
3
2
1
0
pH
STD Range 6.5 to 9.0
0.2
1
2
3
4
5
6
7
8
9
10
0.1
1
2
3
4
5
6
7
7.8
0.4
1
2
3
4
5
6
7
7.6
5/11/2016
7/7/2016
8/23/2016
Depth/Date


SBV-4 pH
10
9
8
7
6
5
4
3
2
1
0
pH
STD Range 6.5 to 9.0
0.3
1
1.6
0.3
1
2
0.5
1
2
5/11/2016
7/7/2016
8/23/2016
Depth/Date


SBV-11 pH
STD Range 6.5 to 9.0
pH
10
9
8
7
6
5
4
3
2
1
0
0.2
1
2
3
4
5
0.2
1
2
3
4
5
6
7
8
0.4
1
2
3
4
5
6
7
8
5/11/2016
7/7/2016
8/23/2016
Depth/Date

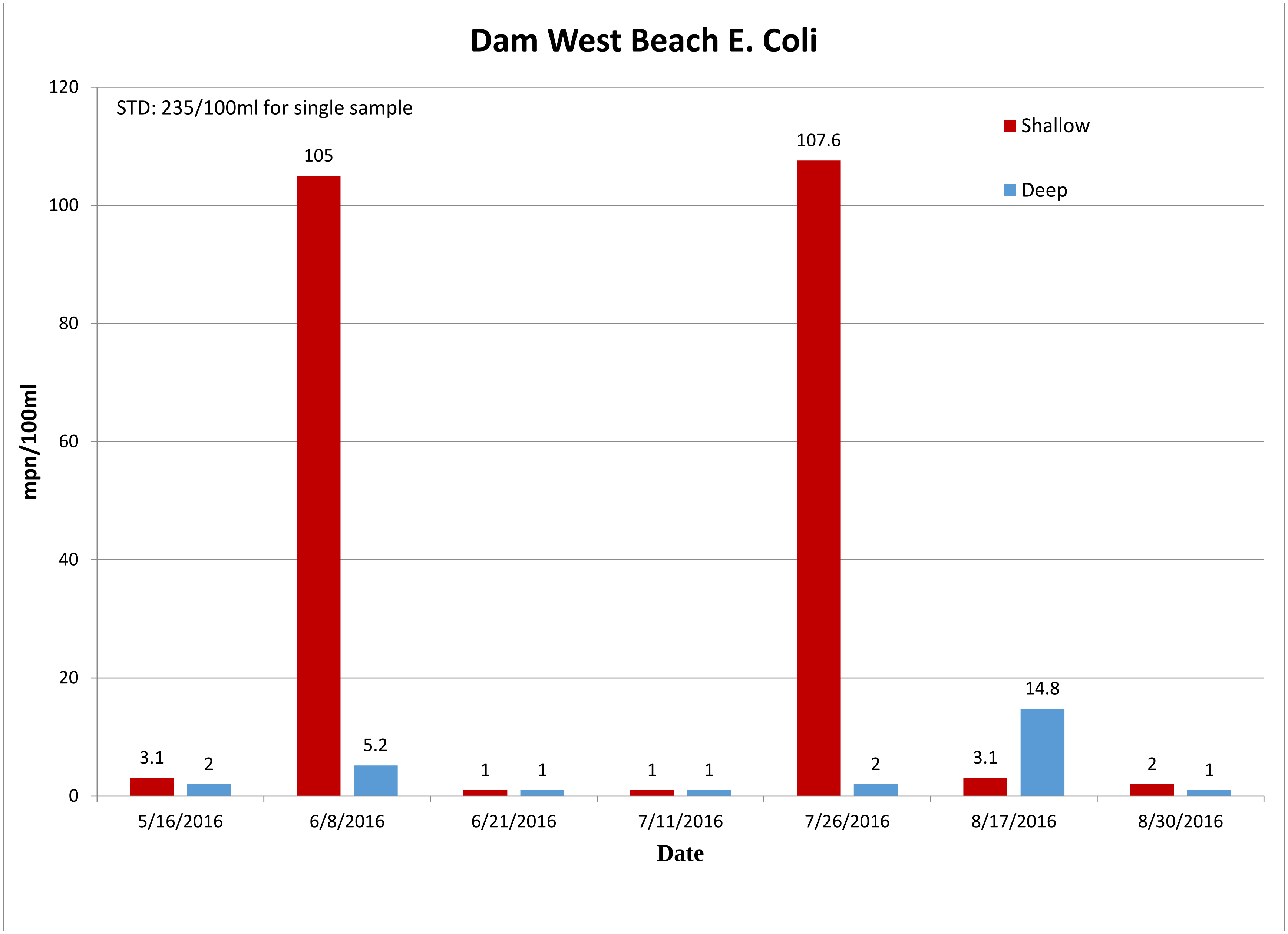

Shelbyville Secchi
Seechi (in)
60
50
40
30
20
10
0
16
23
17
36
53
40
11
12
8
5/11/2016
SBV-11
7/7/2016
SBV-11
8/23/2016
SBV-11
5/11/2016
SBV-2
7/7/2016
SBV-2
8/23/2016
SBV-2
5/11/2016
SBV-4
7/7/2016
SBV-4
8/23/2016
SBV-4
Date/Site

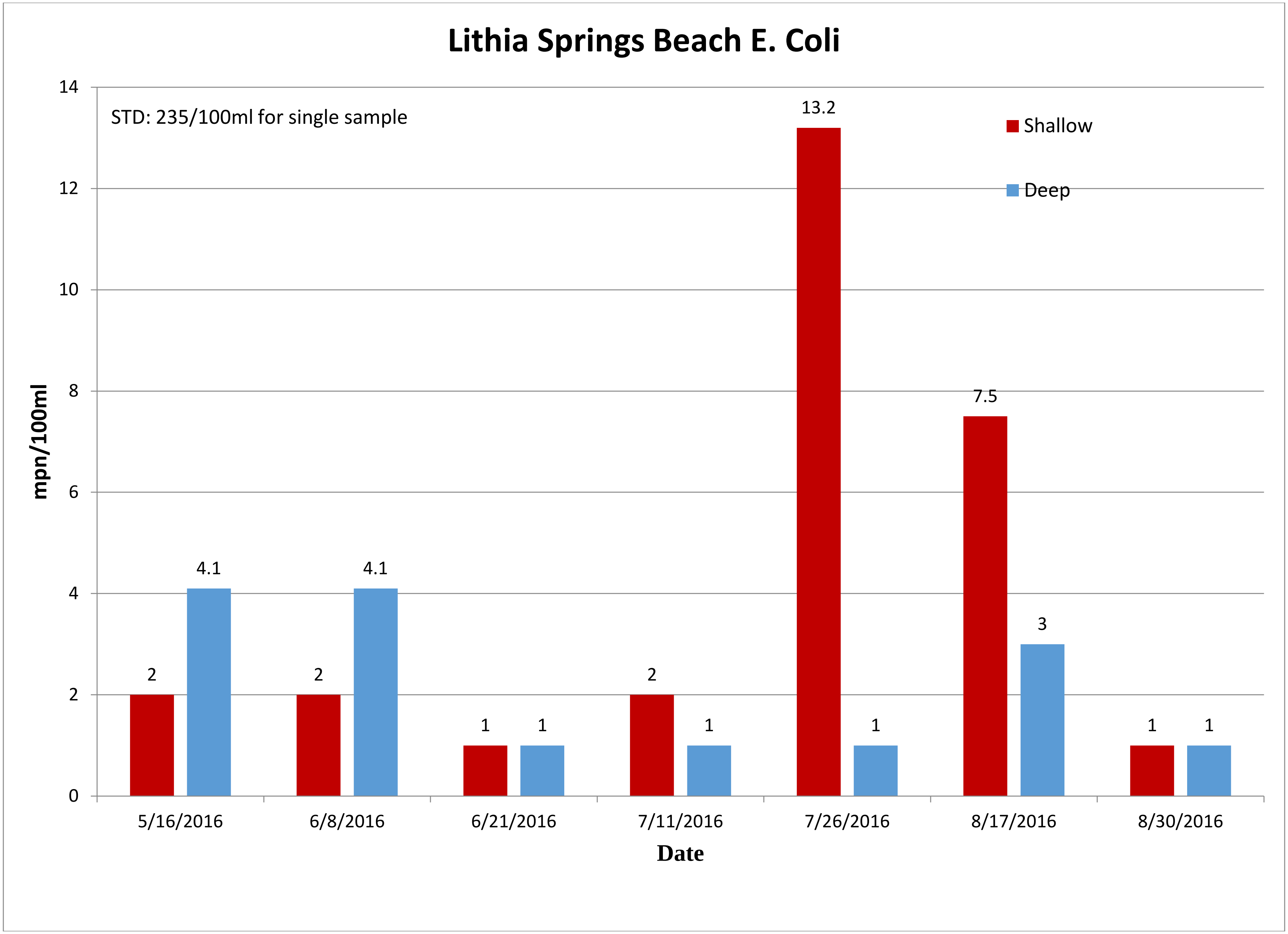


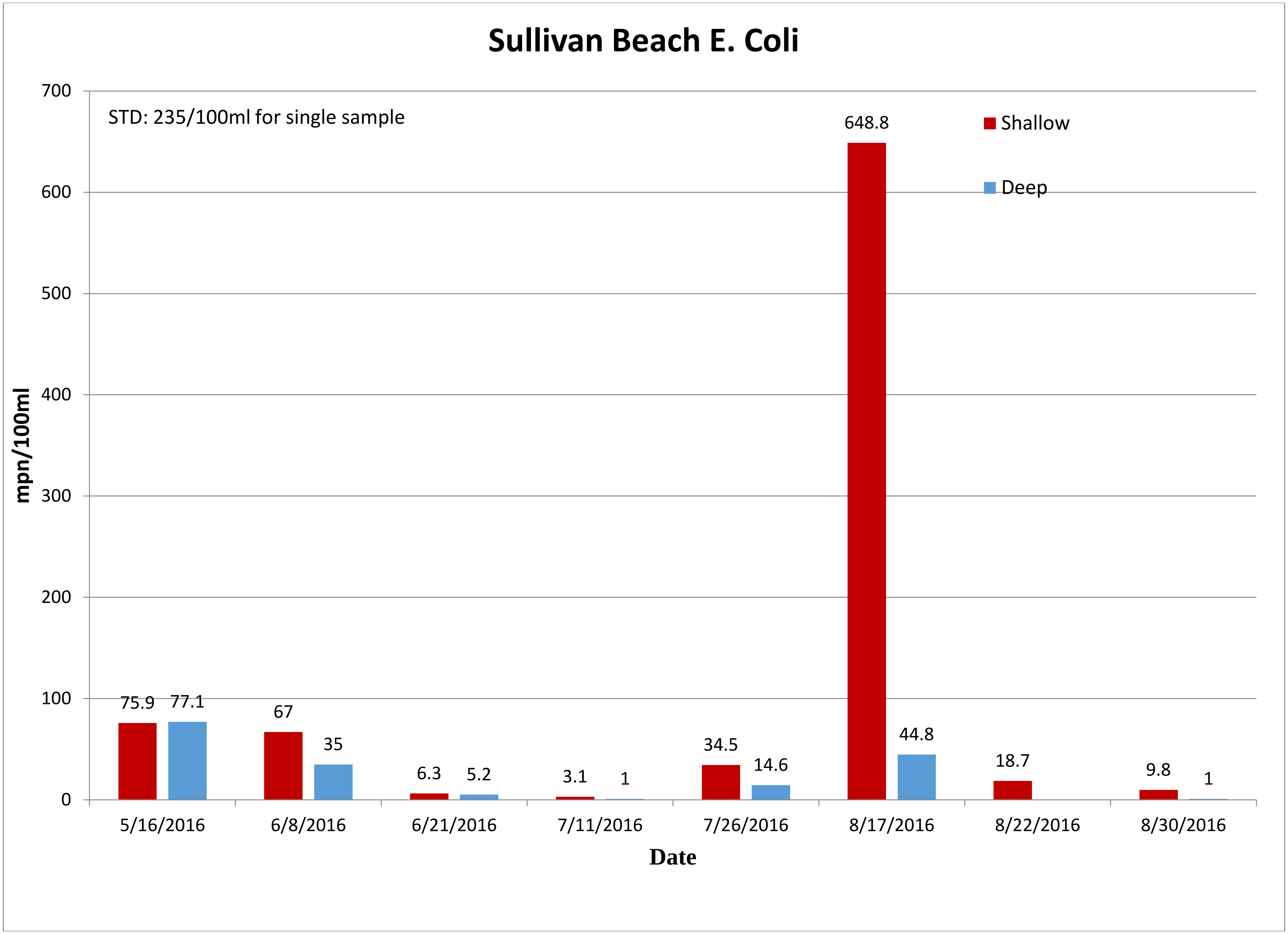
Dissolved Oxygen in spillway as monitored by remote sonde

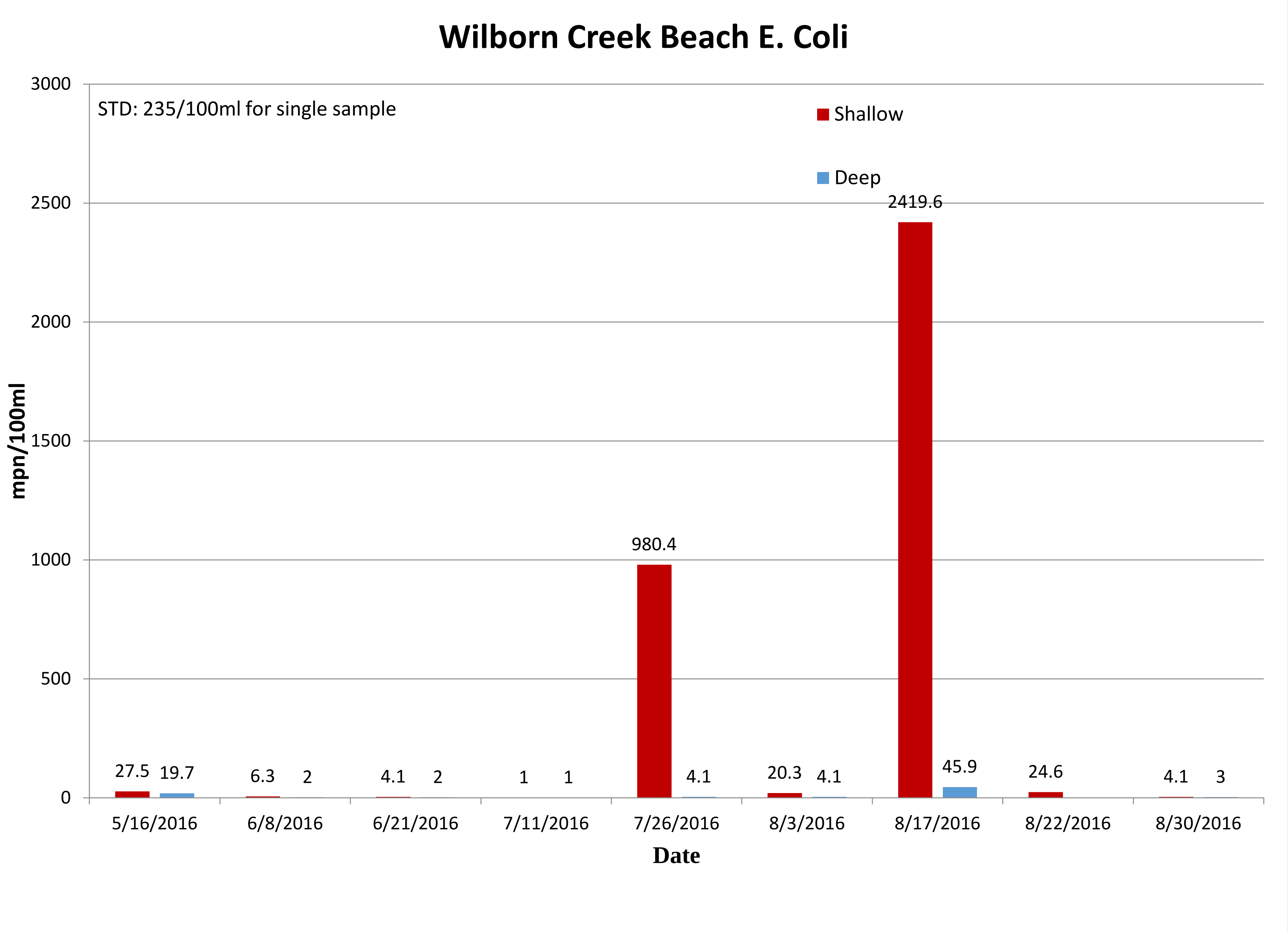
APPENDIX D

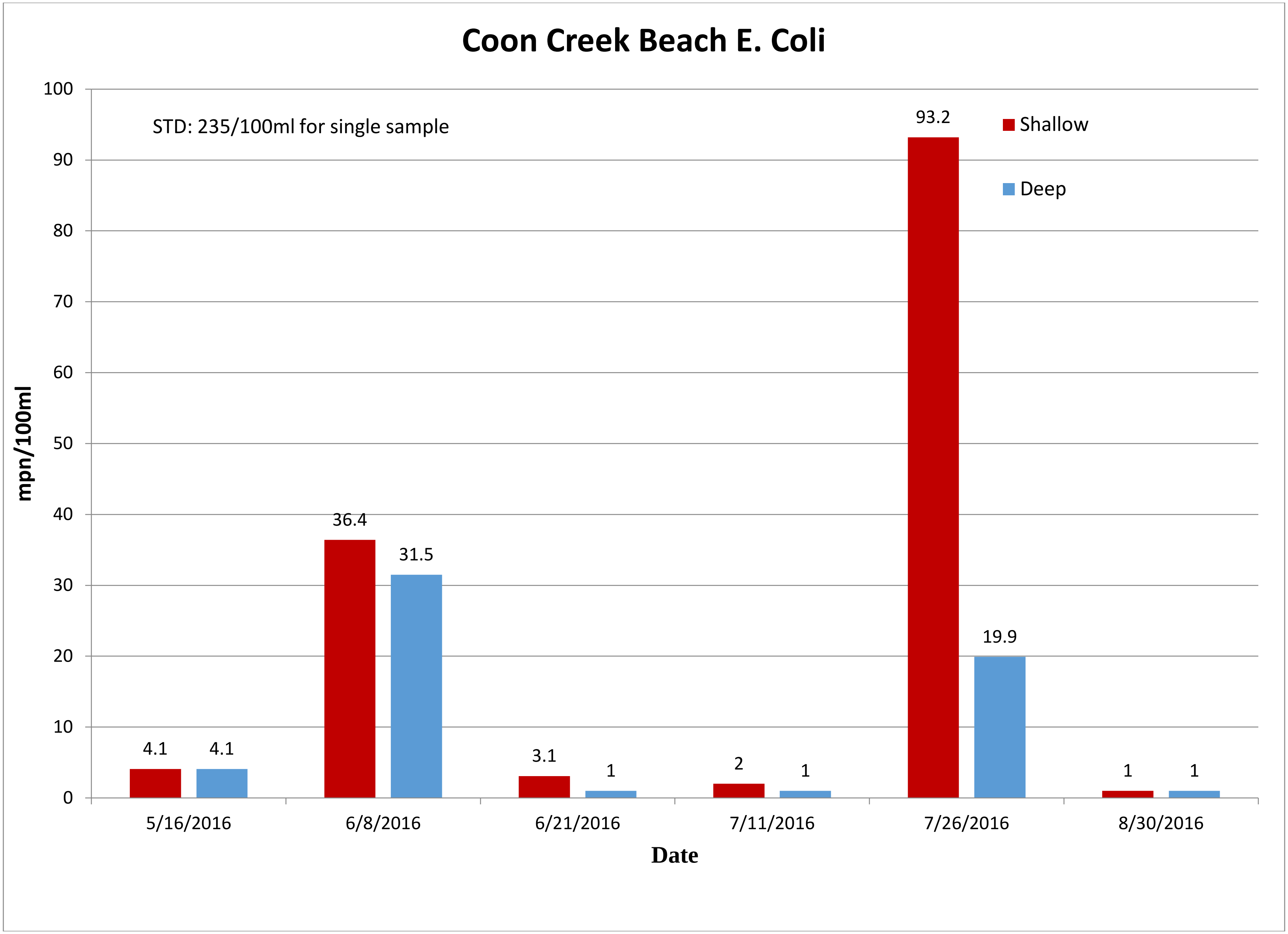
BEACH GRAPHS


Dam West Beach E. Coli
STD: 235/100ml for single sample
Shallow
Deep
mpn/100ml
Date
120
100
80
60
40
20
0
5/16/2016
6/8/2016
6/21/2016
7/11/2016
7/26/2016
8/17/2016
8/30/2016
3.1
2
105
5.2
1
1
1
1
107.6
2
3.1
14.8
2
1


Lithia Springs Beach E. Coli
STD: 235/100ml for single sample
🟥 Shallow
🟦 Deep
mpn/100ml
0
2
4
6
8
10
12
14
2
4.1
2
4.1
1
1
2
1
13.2
1
7.5
3
1
1
5/16/2016
6/8/2016
6/21/2016
7/11/2016
7/26/2016
8/17/2016
8/30/2016
Date


Sullivan Beach E. Coli
STD: 235/100ml for single sample
🟥 Shallow
🟦 Deep
mpn/100ml
700
600
500
400
300
200
100
0
75.9
77.1
67
35
6.3
5.2
3.1
1
34.5
14.6
648.8
44.8
18.7
9.8
1
5/16/2016
6/8/2016
6/21/2016
7/11/2016
7/26/2016
8/17/2016
8/22/2016
8/30/2016
Date


Wilborn Creek Beach E. Coli
STD: 235/100ml for single sample
Shallow
Deep
mpn/100ml
Date
3000
2500
2000
1500
1000
500
0
5/16/2016
6/8/2016
6/21/2016
7/11/2016
7/26/2016
8/3/2016
8/17/2016
8/22/2016
8/30/2016
27.5
19.7
6.3
2
4.1
2
1
1
980.4
4.1
20.3
4.1
2419.6
45.9
24.6
4.1
3


Coon Creek Beach E. Coli
STD: 235/100ml for single sample
🟥 Shallow
🟦 Deep
mpn/100ml
0
10
20
30
40
50
60
70
80
90
100
4.1
4.1
36.4
31.5
3.1
1
2
1
93.2
19.9
1
1
5/16/2016
6/8/2016
6/21/2016
7/11/2016
7/26/2016
8/30/2016
Date