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Phosphorus in Sediment in the Kent Park Lake Watershed, Johnson County, Iowa, 2014–15

Data Series 1001

U.S. Department of the Interior
U.S. Geological Survey

Cover photographs. Upper part of Kent Park Lake (background), photograph by U.S. Geological Survey. Historic bridge on a bay in Kent Park Lake (upper center), collection of a sediment core from a sedimentation basin in Kent Park Lake watershed (lower center left), and extracting a sediment core (lower center right). Center photographs courtesy of Johnson County Conservation Board.

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SALLY JEWELL, Secretary

U.S. Geological Survey
Suzette M. Kimball, Director

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Conversion Factors

[U.S. customary units to International System of Units]

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
foot (ft)	0.3048	meter (m)
	Area	
acre	4,047	square meter (m^2)
acre	0.4047	hectare (ha)
acre	0.004047	square kilometer (km^2)
square mile (mi^2)	259.0	hectare (ha)
square mile (mi^2)	2.590	square kilometer (km^2)
	Mass	
pound, avoirdupois (lb)	0.4536	kilogram (kg)
ton, short (2,000 lb)	0.9072	megagram (Mg)

Temperature in degrees Celsius (°C) may be converted to degrees Fahrenheit (°F) as follows:

$$°F = (1.8 \times °C) + 32.$$

Supplemental Information

Sediment concentrations are given in milligrams per kilogram (mg/kg).

Sediment particle sizes are given in millimeters (mm).

Acknowledgments

Cooperative funding for the collection and analysis of sediment samples was provided by the Johnson County, Iowa, Conservation Board. Personnel from the Johnson County Conservation Board assisted in the sampling design. These include Larry Gullett, Brad Friedhof, Dave Wehde and Jeremy Rieck. Jeremy Rieck also assisted in the collection of sediment samples.

Sediment samples were collected by Mike Linhart and Lance Gruhn from the U.S. Geological Survey. Mike Linhart photographed the sediment cores. An early draft of the report was reviewed by Timothy D. Straub and Kyle E. Juracek.

Phosphorus in Sediment in the Kent Park Lake Watershed, Johnson County, Iowa, 2014–15

By Stephen J. Kalkhoff

Abstract

Phosphorus data were collected from the Kent Park Lake watershed in Johnson County, Iowa, in 2014 and 2015 to obtain information to assist in the management of the water quality in the lake. Phosphorus concentrations were measured for sediment from several ponds in the watershed and sediment deposited in the lake. The first set of samples was collected in 2014 to understand phosphorus in several potential sources to the lake and the spatial variability in lake sediments. Phosphorus concentrations ranged from 68 to 380 milligrams per kilogram in lake sediment and from 57 to 220 milligrams per kilogram in sedimentation and dredge spoil ponds. Additional samples were collected in 2015 to determine how phosphorus concentrations vary with depth in the lake sediment. Phosphorus concentrations generally decreased with increasing depth within the lake sediment. In 2015, total phosphorus concentrations in lake sediment ranged from 50 to 340 milligrams per kilogram.

Introduction

Kent Park Lake, a popular recreation lake in Johnson County, Iowa, is used for fishing and swimming and is the centerpiece of the 1,000 or more acre Johnson County Kent Park (fig. 1). The lake is on Iowa's 303d list (Iowa Department of Natural Resources, 2013) as impaired for chlorophyll-*a* and bacteria. Kent Park Lake was formed by damming a small intermittent tributary to Clear Creek in the 1970s. Kent Park Lake is about 27 acres in size with a mean depth of 7.5 feet (ft) and a maximum depth of about 16 ft (Iowa Department of Natural Resources Fisheries Bureau, written commun.). Water drains into the lake from an about 1.0 square mile (mi^2) watershed that was formerly farmed and mainly used for pasture because of the moderately steep topographic relief. Much of the park area was reforested after acquisition by the Johnson County Conservation Board.

Problem

During the last decade, chlorophyll-*a* concentrations have been increasing during the summer in Kent Park Lake (fig. 2). Phosphorus, commonly the limiting element in algal and aquatic plant production (Carlson, 1977), also has been problematic. Two other constituents associated with water clarity, suspended solids and turbidity, also increased during some of 2000–15 (fig. 2). Suspended sediment transported to the lake has been identified as the source of increased total suspended solids and turbidity. Suspended sediment has also been suspected of transporting phosphorus to the lake (Filstrup and others, 2014). Once deposited, sediments in shallow waters can be resuspended by a variety of factors, including wind, runoff events, and recreational activities. This resuspension of sediments can promote algal growth even after land-use changes reduce nutrient input.

A preliminary assessment completed by the Iowa Department of Agriculture and Land Stewardship determined that an estimated 700 tons of suspended sediment are deposited in the lake yearly (Filstrup and others, 2014). Suspended sediment originates from gully erosion in small drainageways that flow directly into the lake and potentially from the headwaters of the watershed, which consist of farmland and a small cattle operation. The Kent Park Lake was dredged in 1991 to remove deposited sediment. Dredged sediment was deposited in two catch basins adjacent to the lake.

Objective and Scope

The objective of this report is to describe data collected to evaluate the amount of stored phosphorus in Kent Park Lake sediments and potential sources of suspended sediment to the lake. Sediment quality data were collected in two phases in summer 2014 and 2015. The first phase in 2014 documented phosphorus concentrations in surficial sediment from the lake, and dredge spoil and sedimentation ponds on intermittent streams that drain to Kent Park Lake (fig. 1). The second phase was intended to collect more detailed data on phosphorus in the bottom sediment in Kent Park Lake and how it varies with depth.

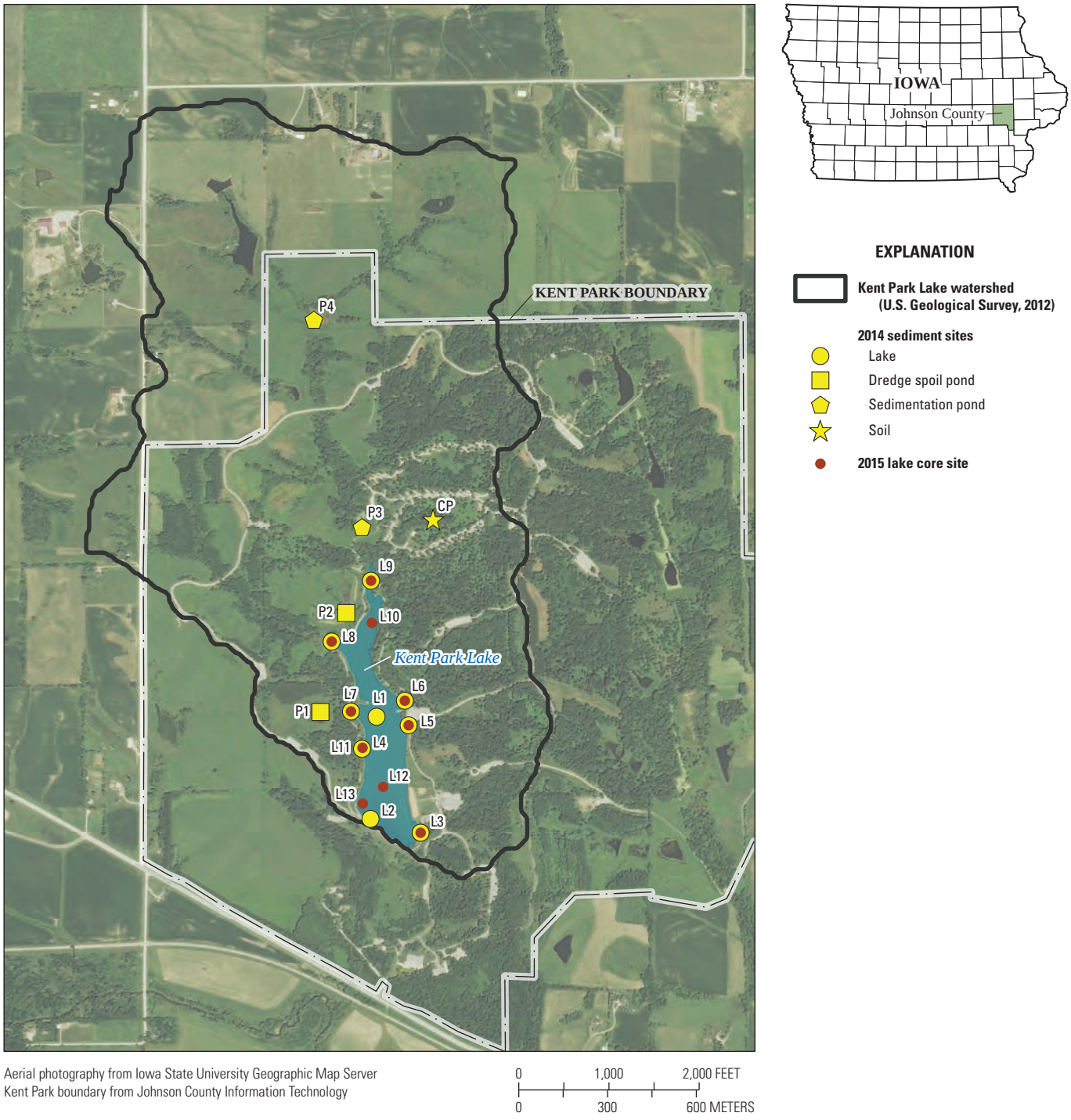


Figure 1. Location of sediment and core sampling sites in the Kent Park Lake watershed, Johnson County, Iowa, 2014–15.

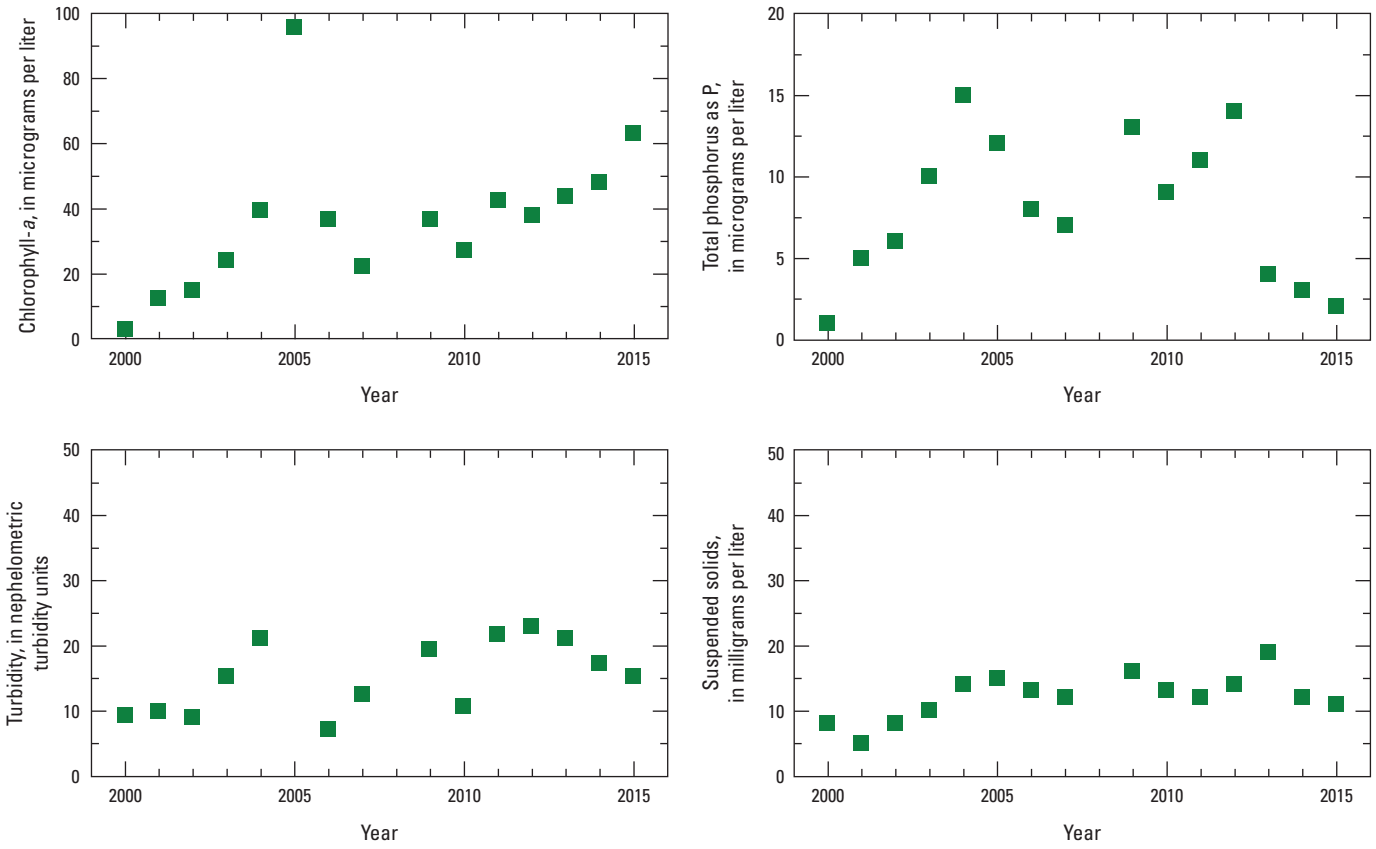


Figure 2. Water quality in Kent Park Lake, Johnson County, Iowa, during the summer. (Data from Iowa State University Web page at http://limnology.eeob.iastate.edu/lakereport/chemical_report.aspx.)

Particle-size distribution, phosphorus concentration, and moisture content were measured in sediment and soil samples from 14 sites in the lake and watershed in June 2014. Because phosphorus is more readily attached to smaller clay- and silt-sized particles rather than the larger sand-sized particles, the particle-size distribution was determined to better understand differences in phosphorus concentrations among sites. Kent Park Lake sediments were sampled from the inlet bays that receive tributary and small drainage way inflow, and deep-water areas that potentially represent a mix of suspended sediments from multiple sources. Suspended sediment data were also collected from dredge spoil ponds, sedimentation ponds, and one soil sample from one area of substantial gulley erosion. Subsequently, sediment depth and phosphorus concentration data in 10 sediment cores from Kent Park Lake were collected in August 2015 to document changes in phosphorus deposition with time in the shallow inlets and bays of the lake. One sediment core was obtained from a deep-water site where deposition is integrated from several areas.

Methods

Sediment Sample Collection in 2014

In summer 2014, a total of 13 sediment samples and 1 soil sample were collected in and around Kent Park Lake (fig. 1) for analysis of phosphorus, moisture content, and particle size. Nine samples were collected in the lake, including near the shallow-water inlet, near-shore sites where water from small drainageways enters the lake and deepest points in the lake using available bathymetry maps as a reference. Because previously dredged material in 1991 may contain substantial amounts of phosphorus if transported back to the lake in runoff, a sediment sample was collected from each of the two spoil basins containing dredged sediment from 1991. In addition, two sediment samples were collected in sediment retention basins upstream from the lake to determine if there are nutrients present that may be transported to the lake during runoff events.

A hand-core sampler was used to collect bottom material samples from 9 lakebed sites (L1–L9), 2 dredge spoil ponds (P1 and P2), and 2 sedimentation ponds (P3 and P4) in 2014 (table 1). One soil sample was collected at a campground site (CP) in the floor of a gully that was actively eroding (fig. 1) Lakebed samples were collected from 7 sites in the inlet bays (L3–L9) and 2 deep lake sites (L1 and L2) using techniques described by Radtke (2005). The core sampler was 2 inches (in.) in diameter and 20 in. long. The full length of the corer generally was pushed into the bottom material to collect a sample. Bottom material in the sampler was extracted into a glass bowl and composited with a Teflon spatula. Composited sediment samples were divided into two parts. One part was submitted to the U.S. Geological Survey (USGS) Iowa Sediment Laboratory in Iowa City, Iowa, for particle-size analysis. The other part was sent to the USGS contract laboratory (RTI Laboratories, Inc., Livonia, Michigan) for analysis of phosphorus and moisture content.

Sediment Core Sampling in 2015

Follow up sediment core sites in Kent Park Lake (fig. 1) were selected based on the results of the first set of samples collected in 2014. Shallow-water sites in inlet bays near the sources of sediment to the lake were prioritized for resampling. Nine sites (L3–L11 and L13) near the inlet bays and one deep water site (L12) were sampled (fig. 1). Sediment cores were collected in 6-ft plastic core tubes that were 2 in. in diameter. The tubes were vibrated into the bottom sediment using a Vibracorer head mounted on the top of the core tube. The Vibracorer and sample tube was mounted on an “A” frame attached to two john boats (fig. 3). Use of the Vibracorer ensured that friction on the wall of the sample tube was reduced resulting in a more representative core. The core tube was driven through the bed sediment until refusal at the original soil surface. The core tube was then slowly withdrawn and the bottom capped to minimize loss of sediment. Once at the surface, the core tube was removed from the vibrator head, the overlying water was removed, and the tube was cut slightly longer than the core sample. The shortened core tube was then capped and labeled for later processing.

The sediment cores were brought to shore for processing. The core tube was cut lengthwise with a skill saw to access the sediment. Once the core tube was split, a description of the material that included visual differences, such as texture and color, was recorded. The cores were photographed to assist in

Table 1. Sampling sites for pond and lake sediment and soil samples in Kent Park, Johnson County, Iowa.

[Latitude and longitude are given in decimal degrees]

Map number (fig. 1)	Site identification number	Site name	Site type	Decimal latitude	Decimal longitude	Year sampled
CP	414356091434101	F.W. Kent County Park—Campground	Soil (gully)	41.732444	-91.728278	2014
L1	414335091435001	F.W. Kent County Park—Lake 1	Deep lake	41.726472	-91.730694	2014
L2	414324091435101	F.W. Kent County Park—Lake 2	Deep lake	41.723361	-91.731000	2014
L3	414322091434401	F.W. Kent County Park—Lake 3	Bay or inlet	41.722917	-91.728972	2014 and 2015
L4	414331091435201	F.W. Kent County Park—Lake 4	Bay or inlet	41.725500	-91.731306	2014
L5	414334091434501	F.W. Kent County Park—Lake 5	Bay or inlet	41.726194	-91.729389	2014 and 2015
L6	414337091434601	F.W. Kent County Park—Lake 6	Bay or inlet	41.726944	-91.729528	2014 and 2015
L7	414335091435401	F.W. Kent County Park—Lake 7	Bay or inlet	41.726639	-91.731722	2014 and 2015
L8	414343091435601	F.W. Kent County Park—Lake 8	Bay or inlet	41.728778	-91.732472	2014 and 2015
L9	414350091435101	F.W. Kent County Park—Lake 9	Bay or inlet	41.730611	-91.730833	2014 and 2015
L10	414345091435101	F.W. Kent County Park—Lake 10	Bay or inlet	41.729167	-91.730833	2015
L11	414331091435202	F.W. Kent County Park—Lake 11	Bay or inlet	41.719167	-91.597778	2015
L12	414327091434901	F.W. Kent County Park—Lake 12	Deep lake	41.540833	-91.730278	2015
L13	414325091435201	F.W. Kent County Park—Lake 13	Bay or inlet	41.723611	-91.731111	2015
P1	414335091435801	F.W. Kent County Park—Pond 1	Dredge spoil pond	41.726639	-91.732972	2014
P2	414346091435401	F.W. Kent County Park—Pond 2	Dredge spoil pond	41.729639	-91.731861	2014
P3	414356091435201	F.W. Kent County Park—Pond 3	Sedimentation pond	41.732250	-91.731167	2014
P4	414418091435801	F.W. Kent County Park—Pond 4	Sedimentation pond	41.738583	-91.733000	2014

Figure 3. Collection of a sediment core in Kent Park Lake, Johnson County, Iowa, August 2015.

documenting color and textural changes with depth. Only the upper 3 in. of each 6-in. interval were removed (fig. 4) because all material from the 6-in. interval was not needed for analysis of moisture and phosphorus content. The depth of the deposited sediment was different at each site; thus, the number of subsamples varied from core to core. Sediment samples were placed in glass containers and shipped on ice to the laboratory.

Sample Analysis

Sediment samples were analyzed by RTI Laboratories, Inc. (Livonia, Mich.), using U.S. Environmental Protection Agency approved methods. Total phosphorus concentrations in the sediment were analyzed using the automated ascorbic acid reduction method 4500–P (Standard Methods Committee, 2011). Moisture content was determined using the American Society for Testing and Materials (2010) method D2216.

Sediment samples were analyzed for clay-sized (less than 0.004 millimeter [mm]), silt-sized (greater than 0.004 mm and less than 0.062 mm), and sand-sized (greater than 0.062 mm) particles at the USGS Iowa City, Iowa, sediment laboratory by methods described in Guy (1969). Fine-grained materials are clay and silt particles that are 0.062 mm or less in size. The sediment samples were placed in an oven set at 103 degrees Celsius for several days until dry and then dry sieved to determine the sand fractions. Material passing through the 0.062-mm sieve was used with the visual accumulation tube-pipet method to determine the silt and clay fractions (Guy, 1969).

Figure 4. Core sample showing sediment removed for subsamples (top of core to right).

Quality Control

Additional samples were collected in the field and analyzed to ensure that cross contamination between samples did not happen and document variability in concentration that may be due to sampling and analytical methods. One bottom sediment sample collected in 2014 and one core sample collected in 2015 were split or replicated in the field to understand the variability of the phosphorus concentration and moisture content of these materials. Sample analyses were duplicated on three samples in the laboratory to quantify analytical variability. Six ambient samples were spiked with known amounts of phosphorus in the laboratory before analysis. The resultant concentration was used along with the ambient concentration of the sample to quantify the ability of the analytical method to recover all phosphorus in the sediment. Based on the results from the matrix-spike samples (table 2), between 90 and 109 percent of the phosphorus was recovered from the sediment samples.

Analysis of six duplicate laboratory samples for moisture content resulted in 0.28 to 2.4 relative percent difference (RPD) (table 3).

Phosphorus concentration and moisture content variability in field duplicate core samples collected in 2015 was small (table 4). The RPD of phosphorus concentrations ranged from 0.0 to 9.09 percent. The average RPD for the four duplicate samples was 5.35 percent. The RPD of the moisture content ranged from 0.00 to 2.90 percent with an average of 1.18 percent.

Table 2. Results of laboratory quality-control results for total phosphorus.

[ft, foot; mg/kg, milligram per kilogram; --, not applicable]

Map number (fig. 1)	Site name	Sample depth (ft)	Quality-control type	Concentration (mg/kg)			Percent recovery
				Ambient	Spike added	Combined	
CP	F.W. Kent County Park—Campground	--	Matrix spike	25	130	150	93
		--	Duplicate matrix spike	25	130	140	90
L5	F.W. Kent County Park—Lake 5	0–0.3	Matrix spike	159	206	380	108
		0–0.3	Duplicate matrix spike	159	204	340	91
L7	F.W. Kent County Park—Lake 7	0–0.3	Matrix spike	86	204	310	109
		0–0.3	Duplicate matrix spike	86	220	290	91

Table 3. Results of laboratory quality-control samples for moisture content.

[Relative percent difference (RPD) is the laboratory reported value that is the percentage of the difference between two duplicates relative to the average concentration. ft, foot; --, not applicable]

Map number (fig. 1)	Site name	Sample depth (ft)	Quality-control type	Moisture (percent by weight)		Precision (RPD)
				Ambient	Duplicate	
L5	F.W. Kent County Park—Lake 5	--	Duplicate	45	44	0.93
P3	F.W. Kent County Park—Pond 3	--	Duplicate	51	50	2.2
L5	F.W. Kent County Park—Lake 5	0–0.3	Duplicate	52	53	0.28
L9	F.W. Kent County Park—Lake 9	0–0.3	Duplicate	54	55	1.9
L7	F.W. Kent County Park—Lake 7	0–0.3	Duplicate	55	55	0.56
L3	F.W. Kent County Park—Lake 3	0–0.3	Duplicate	50	52	2.4

Table 4. Results of field duplicate core samples for phosphorus and moisture content.

[Relative percent difference (RPD) is the laboratory reported value that is the percentage of the difference between two duplicates relative to the average concentration. ft, foot; mg/kg, milligram per kilogram]

Map number (fig. 1)	Site name	Sample depth (ft)	Phosphorus			Moisture (percent by weight)		
			Ambient concentration (mg/kg)	Duplicate concentration (mg/kg)	Precision (RPD)	Ambient	Duplicate	Precision (RPD)
L8	F.W. Kent County Park—Lake 8	0–0.3	180	190	5.41	63	63	0.00
L8	F.W. Kent County Park—Lake 8	1.8–2.1	150	140	6.90	35	34	2.90
L9	F.W. Kent County Park—Lake 9	0–0.3	230	210	9.09	55	54	1.83
L12	F.W. Kent County Park—Lake 12	0.6–0.9	340	340	0.00	68	68	0.00

Analytical Results

Sediment Quality Data from Kent Park Lake Sediments, Sedimentation Basins, and Upstream Soils

Particle Size

The proportion of fine-grained (clay and silt) and sand-sized particles in sediment samples collected in the Kent Park Lake watershed (fig. 1) were variable (fig. 5). The proportion of fine-grained particles (less than 0.0625 mm; to which phosphorus is most commonly attached) in the sediment samples ranged from 54 to 96 percent (table 5). Fine-grained material in sediment from the shallower bay and inlet sites (L3–L9) varied from 65 to 96 percent of the sample. In all but two of the seven samples from the bay and inlet sites, fine-grained material made up more than 80 percent of the material. The composition of sediment from the two deep lake sites L1 and L2 were relatively uniform with slightly more than 50 percent of the material consisting of fine-grained sediments (table 5). Samples from the dredge spoil pond sites P1 and site P2 consisted mainly of fine-grained material (more than 80 percent). The proportion of fine-grained material in the sedimentation ponds on the intermittent stream upstream from Kent Park Lake decreased from 95 percent at site P4 in the upper part of the basin to 57 percent at site P3 just upstream from the lake. A soil sample from an area of active erosion at site CP also consisted mainly (83 percent) of fine-grained material (table 5).

Sediment Quality

The phosphorus concentration in sediment samples collected in 2014 from Kent Park Lake (fig. 1) ranged from 68 to 380 milligrams per kilogram (mg/kg) (table 6). Generally, the greatest phosphorus concentrations were in the upper basin sedimentation ponds and in the bay where the intermittent streams enter the lake (fig. 6). The greatest concentration in the lake sediments was in the sample from L9, which is in the

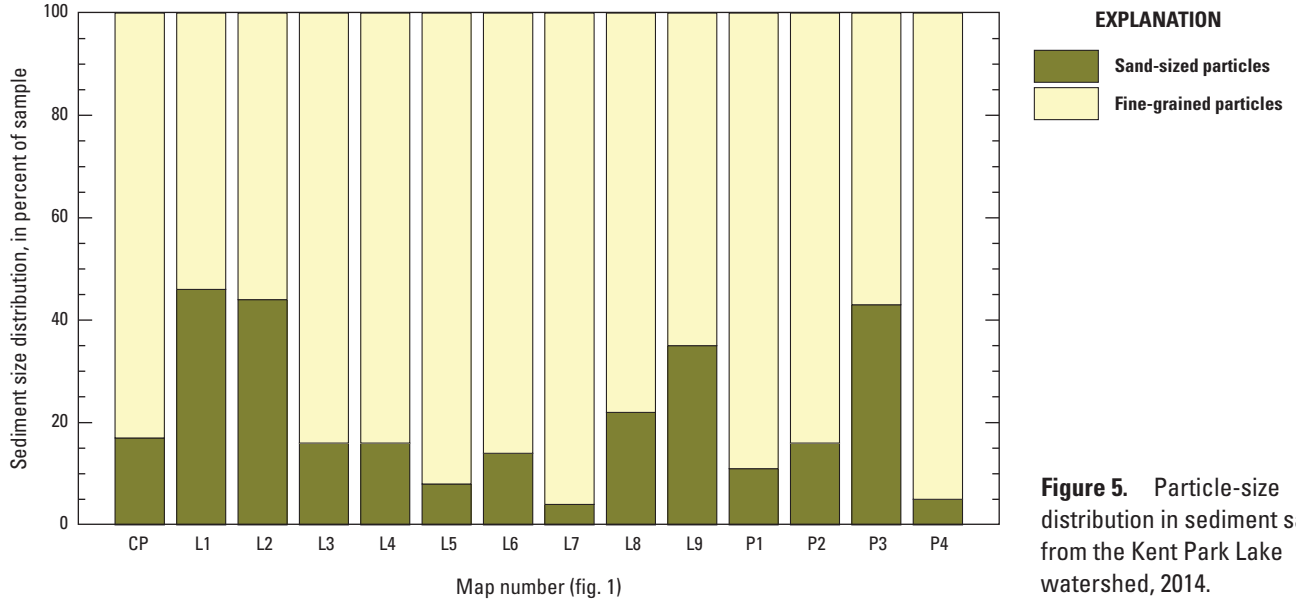


Figure 5. Particle-size distribution in sediment samples from the Kent Park Lake watershed, 2014.

Table 5. Particle-size distribution of pond and lake sediment and soil samples collected from Kent Park, Johnson County, Iowa.

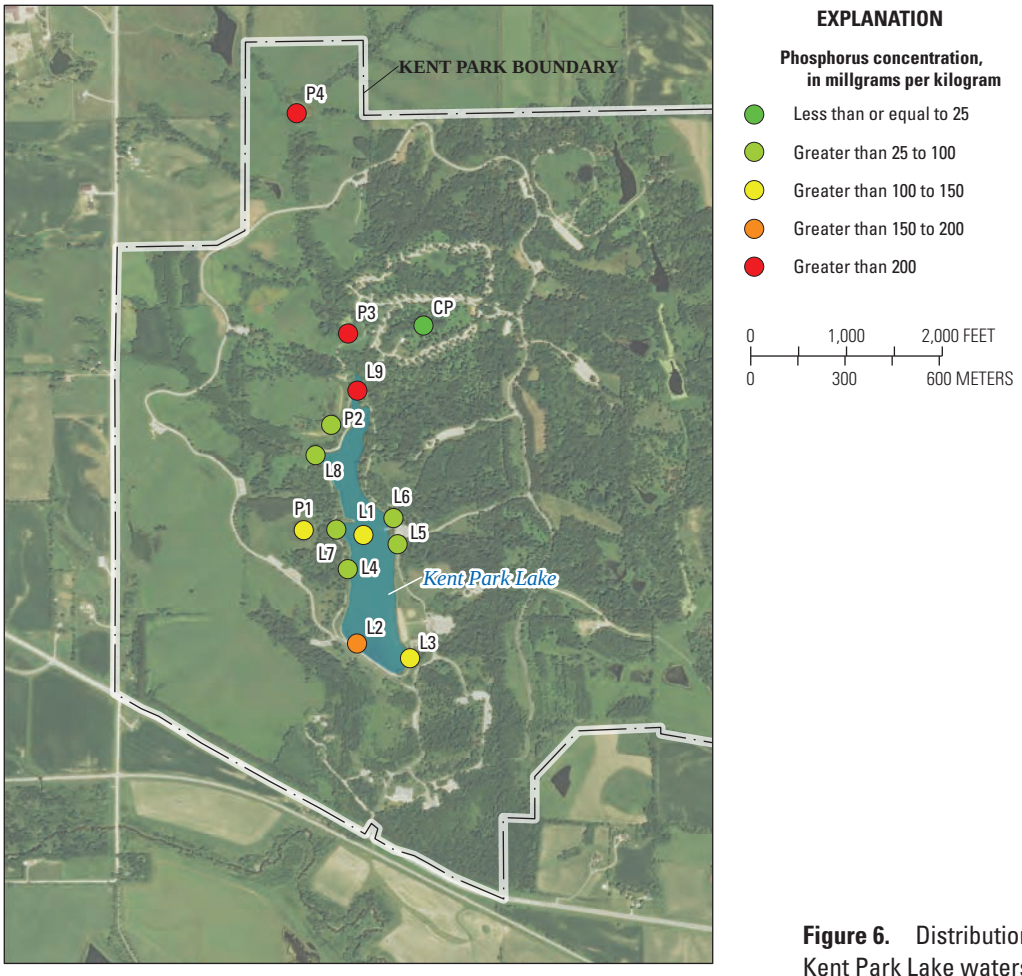
[Parameter codes given in parentheses. %, percent; SO, soil; BM, bottom material; --, no data]

Map number (fig. 1)	Site number	Site name	Sample date	Sample time	Sample material	Percent of bed sediment with diameter smaller than indicated size in millimeters (and parameter code)										Clay (%)	Silt (%)	Sand (%)
						Fine-grained material—clay and silt						Sand						
						0.002 (80294)	0.004 (80157)	0.008 (80293)	0.016 (80282)	0.031 (80283)	0.0625 (80164)	0.125 (80165)	0.25 (80166)	0.5 (80167)	1 (80168)			
CP	414356091434101	F.W. Kent County Park—Camp-ground	6/11/2014	1130	SO	18	20	22	31	58	83	90	95	99	100	20	63	17
L1	414335091435001	F.W. Kent County Park—Lake 1	6/10/2014	1230	BM	13	17	24	30	45	54	64	87	99	100	17	37	46
L2	414324091435101	F.W. Kent County Park—Lake 2	6/10/2014	1205	BM	22	26	31	37	50	56	66	80	95	100	26	30	44
L3	414322091434401	F.W. Kent County Park—Lake 3	6/10/2014	1130	BM	30	32	36	48	72	84	88	92	98	100	32	52	16
L4	414331091435201	F.W. Kent County Park—Lake 4	6/10/2014	1110	BM	21	26	28	35	62	84	92	98	100	--	26	58	16
L5	414334091434501	F.W. Kent County Park—Lake 5	6/10/2014	0900	BM	19	22	26	32	71	92	96	98	100	--	22	70	8
L6	414337091434601	F.W. Kent County Park—Lake 6	6/10/2014	0930	BM	22	29	31	41	68	86	94	97	99	99	29	57	14
L7	414335091435401	F.W. Kent County Park—Lake 7	6/10/2014	1050	BM	16	18	21	28	71	96	99	100	--	--	18	78	4
L8	414343091435601	F.W. Kent County Park—Lake 8	6/10/2014	1015	BM	14	18	20	27	59	78	85	94	100	--	18	60	22
L9	414350091435101	F.W. Kent County Park—Lake 9	6/10/2014	0950	BM	25	29	34	41	58	65	77	89	97	100	29	36	35
P1	414335091435801	F.W. Kent County Park—Pond 1	6/11/2014	0850	BM	20	23	28	42	74	90	93	99	100	--	23	67	11
P2	414346091435401	F.W. Kent County Park—Pond 2	6/11/2014	1050	BM	29	31	38	53	77	84	90	96	100	--	31	53	16
P3	414356091435201	F.W. Kent County Park—Pond 3	6/11/2014	0940	BM	18	24	25	28	48	57	67	86	98	100	24	33	43
P4	414418091435801	F.W. Kent County Park—Pond 4	6/11/2014	1020	BM	26	36	41	63	87	95	98	100	--	--	36	59	5

Table 6. Phosphorus concentration in pond and lake sediment and soil samples collected from Kent Park, Johnson County, Iowa, 2014.

[Parameter code given in parentheses. P, phosphorus; mg/kg, milligram per kilogram; SO, soil; BM, bottom material]

Map number (fig. 1)	Site identification number	Site name	Sample date	Sample time	Sample material	Total phosphorus as P (mg/kg) (00668)	Moisture (percent by weight) (46311)
CP	414356091434101	F.W. Kent County Park—Campground	6/11/2014	1130	SO	25	25
L1	414335091435001	F.W. Kent County Park—Lake 1	6/10/2014	1230	BM	150	47
L2	414324091435101	F.W. Kent County Park—Lake 2	6/10/2014	1205	BM	190	63
L3	414322091434401	F.W. Kent County Park—Lake 3	6/10/2014	1130	BM	140	46
L4	414331091435201	F.W. Kent County Park—Lake 4	6/10/2014	1110	BM	68	36
L5	414334091434501	F.W. Kent County Park—Lake 5	6/10/2014	0900	BM	95	45
L6	414337091434601	F.W. Kent County Park—Lake 6	6/10/2014	0930	BM	84	40
L7	414335091435401	F.W. Kent County Park—Lake 7	6/10/2014	1050	BM	83	37
L8	414343091435601	F.W. Kent County Park—Lake 8	6/10/2014	1015	BM	100	42
L9	414350091435101	F.W. Kent County Park—Lake 9	6/10/2014	0950	BM	380	54
P1	414335091435801	F.W. Kent County Park—Pond 1	6/11/2014	0850	BM	140	38
P2	414346091435401	F.W. Kent County Park—Pond 2	6/11/2014	1050	BM	57	32
P3	414356091435201	F.W. Kent County Park—Pond 3	6/11/2014	0940	BM	220	51
P4	414418091435801	F.W. Kent County Park—Pond 4	6/11/2014	1020	BM	210	46



Aerial photography from Iowa State University Geographic Map Server

Figure 6. Distribution of phosphorus in sediment in the Kent Park Lake watershed, 2014.

bay where the intermittent stream that drains the upper part of the watershed enters the lake. Phosphorus concentrations in sedimentation ponds on the intermittent stream upstream from Kent Park Lake were similar in site P4 (210 mg/kg) in the upper part of the watershed to site P3 (220 mg/kg) just upstream from the lake. A sample of soil that was actively eroding (site CP) from a headcut in a gully had a phosphorus concentration of 25 mg/kg, which was the smallest of any sample collected during the study. Sediment from the bays at the mouth of the drainageways that route directly to the lake generally had phosphorus concentrations less than 100 mg/kg. Sediment that had previously been dredged from the lake that is stored in two spoil ponds contained phosphorus concentrations of 140 mg/kg at site P1 and 57 mg/kg at site P2.

Sediment Quality Data from Kent Park Lake Sediment Cores

All cores collected in August 2015 from Kent Park Lake (fig. 1) were photographed (figs. 7–11). Generally, deposited sediment was dark gray to black. Sediments at the bottom of the core that were the original soil surface generally were a lighter tan or yellowish color (figs. 7, 10, and 11). Exceptions to the color pattern were seen in cores at site L6 (fig. 8*A*) where some sand was noted in the field description (table 7). The sandy sediments, like the original soil, also were a lighter tan color.

Phosphorus concentrations decreased with depth from several cores collected from Kent Park Lake in 2015 (table 7). The phosphorus concentration in the surficial sediment (0.0 to 0.3 ft) ranged from 50 mg/kg at site L11 to 420 mg/kg at the deep water site L12. Phosphorus concentrations in the shallowest sediment at the inlet or bay sites were 210 mg/kg or less (table 7). With the exception of site L7 and L12, phosphorus concentrations in sediment decreased between 0 and 37 percent from the shallowest to the deepest subsample. Phosphorus concentrations increased from 90 mg/kg at the top to 110 mg/kg at the bottom of the sediment core from site L7. The deep water core at site L12 had the greatest change (67 percent decrease) in phosphorus concentration from the top (420 mg/kg) to the bottom (140 mg/kg) of the core.

The moisture content in the sediment of Kent Park Lake decreasing with depth may be indicative of compaction of the sediments. The moisture content of the surficial sediments was frequently 50 percent or more; and subsamples at or near the bottom of the core, which were mainly the original soil surface, had moisture content less than 30 percent (table 7).

Upper part of Kent Park Lake in Johnson County, Iowa, photograph by U.S. Geological Survey.

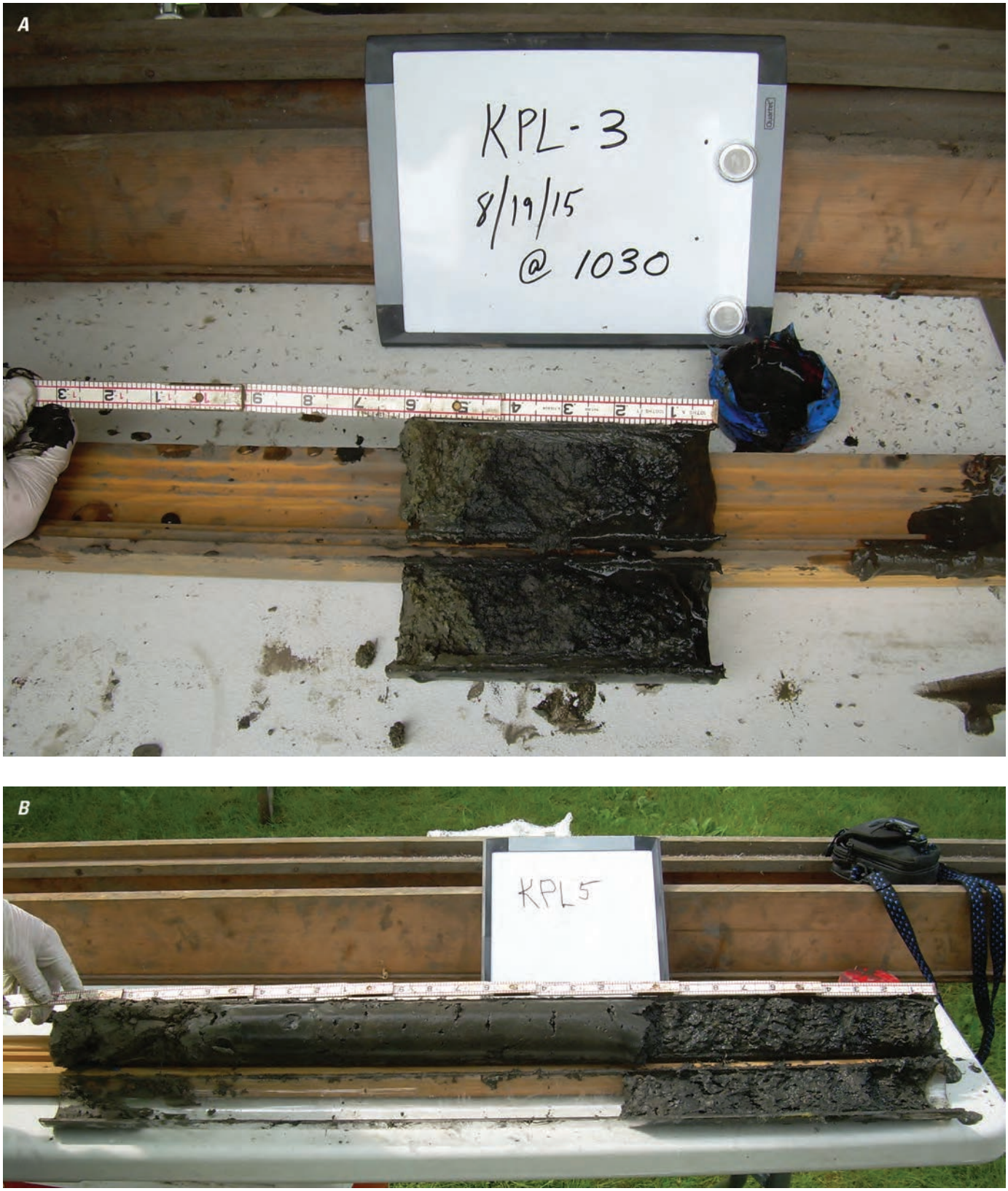


Figure 7. Sediment cores from Kent Park Lake, Johnson County, Iowa, August 2015 (top of the core is to the right). *A*, site L3 (KPL3). *B*, site L5 (KPL5).

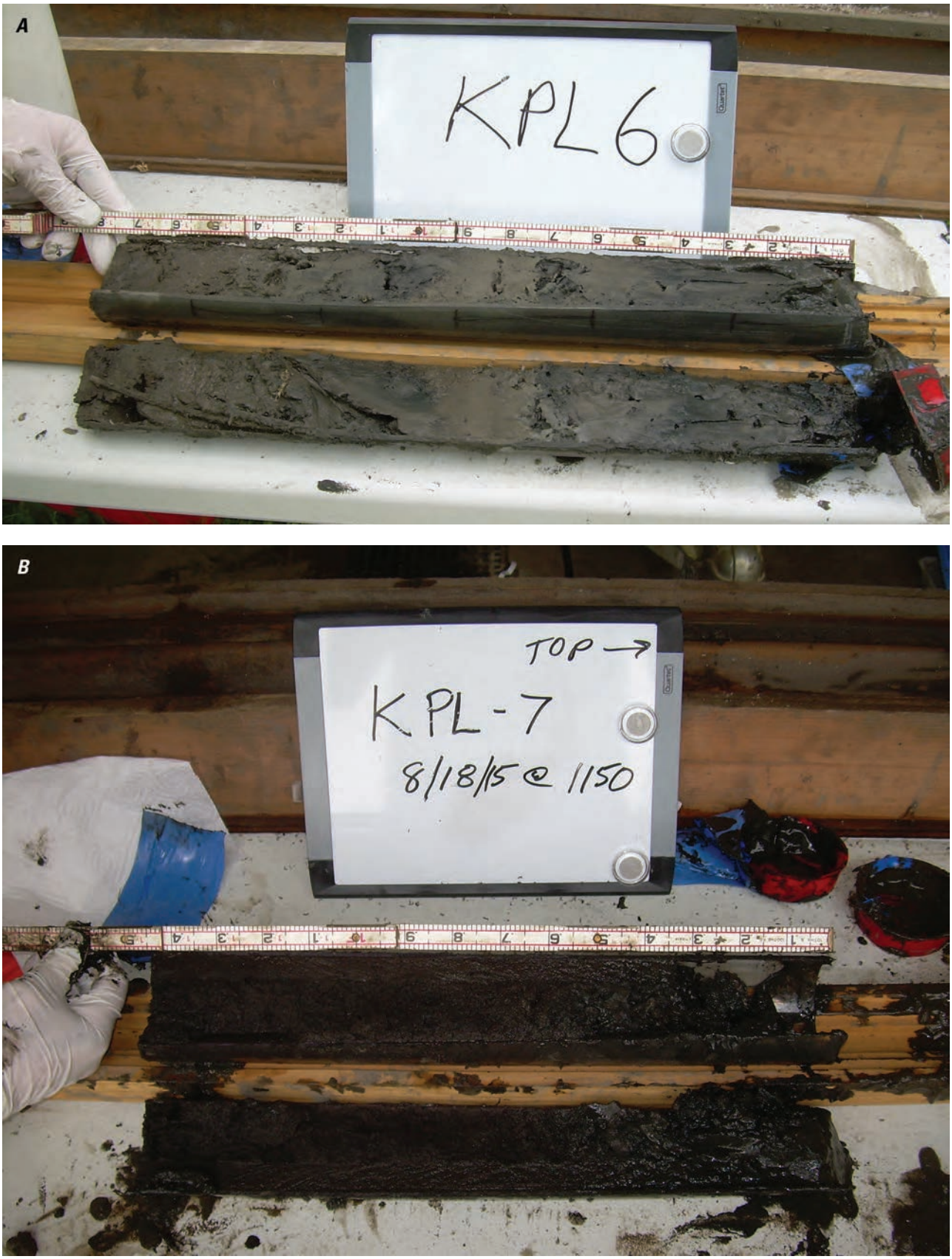


Figure 8. Sediment cores from Kent Park Lake, Johnson County, Iowa, August 2015 (top of the core is to the right). *A*, site L6 (KPL6). *B*, site L7 (KPL7).

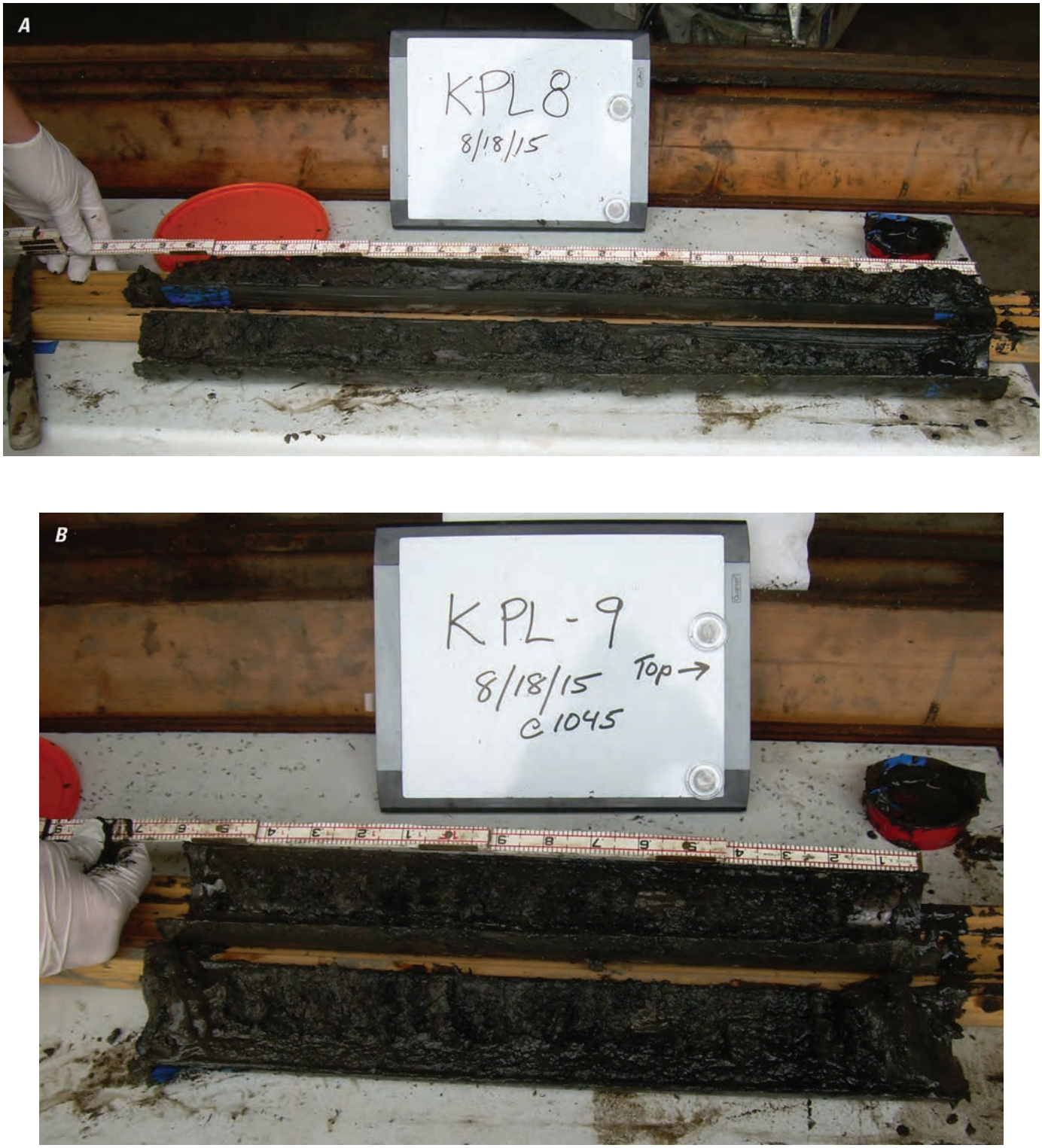


Figure 9. Sediment cores from Kent Park Lake, Johnson County, Iowa, August 2015 (top of the core is to the right). *A*, site L8 (KPL8). *B*, site L9 (KPL9).

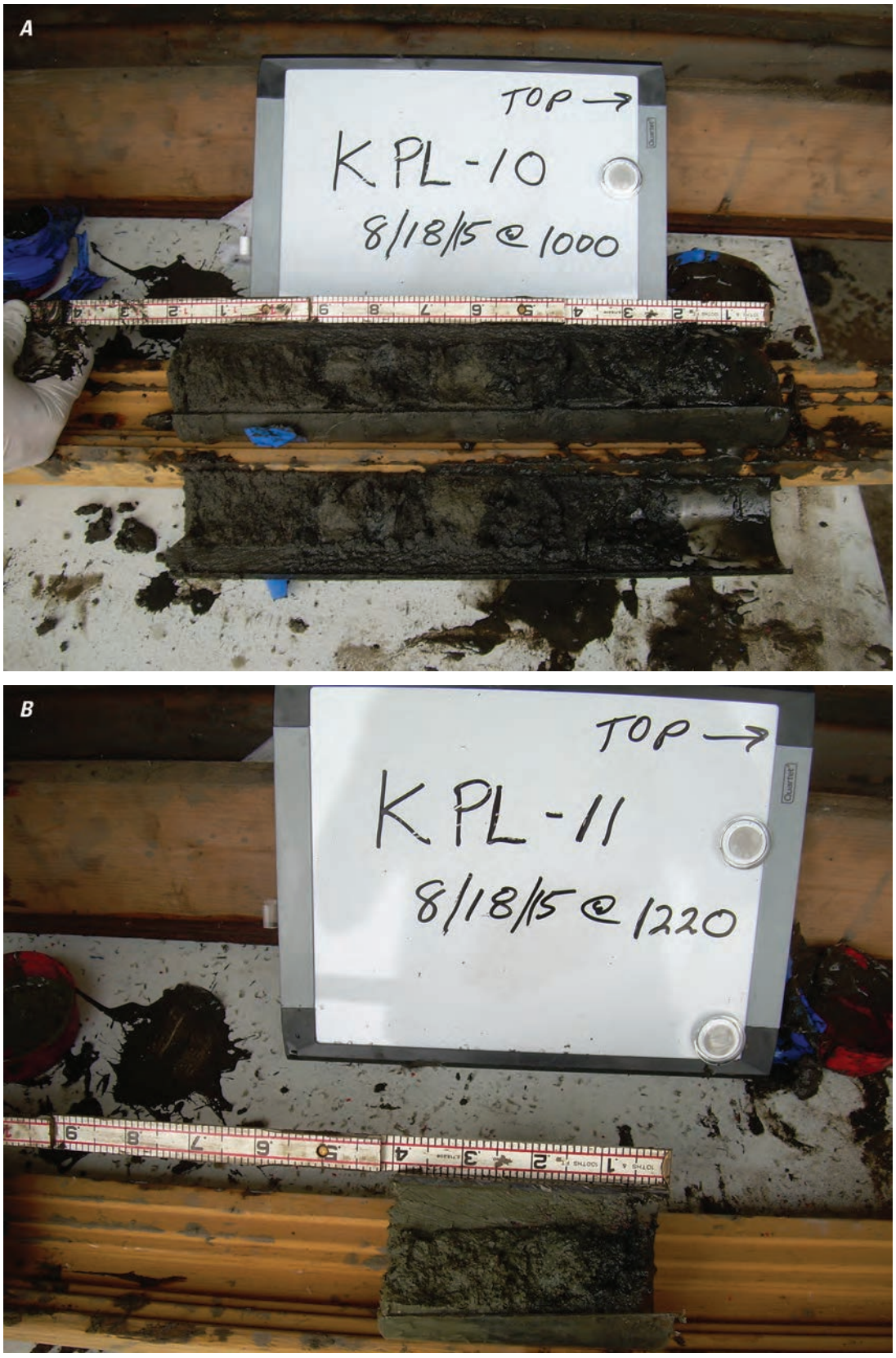


Figure 10. Sediment cores from Kent Park Lake, Johnson County, Iowa, August 2015 (top of the core is to the right). *A*, site L10 (KPL10). *B*, site L11 (KPL11).

Figure 11. Sediment cores from Kent Park Lake, Johnson County, Iowa, August 2015 (top of the core is to the right). *A*, site L12 (KPL12). *B*, site L13 (KPL13).

Table 7. Phosphorus and moisture content of bed sediment in Kent Park Lake, Johnson County, Iowa, August 2015.

[--, not applicable]

Map number (fig. 1)	Site identification number	Site name	Sample date	P81903 Depth to bottom at sample location (foot)	Sediment core length (foot)	Sample interval from top of core (foot)	P00668 Phosphorus, bed sediment, total, dry weight (milligram per kilogram as phosphorus)	P00495 Moisture content, fraction of dry weight (percent)	Comment
L3	414322091434401	F.W. Kent County Park—Lake 3	8/19/2015	7.0	0.6	0.0 to 0.2	100	50	Black silt mud.
						0.2 to 0.4	80	27	Gray some black silt mud.
						0.4 to 0.6	70	19	Brown limestone gravel some sand and silt.
L5	414334091434501	F.W. Kent County Park—Lake 5	8/17/2015	4.9	3.2	0.0 to 0.3	160	53	--
						0.6 to 0.9	130	48	--
						1.2 to 1.5	180	38	--
						1.8 to 2.1	120	35	--
						2.4 to 2.7	100	20	Interface of clay and silt.
L6	414337091434601	F.W. Kent County Park—Lake 6	8/17/2015	4.7	1.7	0.0 to 0.3	130	45	Dark-black silt.
						0.6 to 0.9	130	31	Clay/sand wood debris.
						1.2 to 1.5	130	28	Sand/clay with organic debris; drier clay at bottom.
L7	414335091435401	F.W. Kent County Park—Lake 7	8/18/2015	4.8	1.4	0.0 to 0.3	90	55	Gray to black clay mud.
						0.6 to 0.9	50	25	Black clay sand organic debris.
						1.2 to 1.4	110	26	Black loamy very dry.
L8	414343091435601	F.W. Kent County Park—Lake 8	8/18/2015	6.0	2.5	0.0 to 0.3	180	63	Dark silty clay.
						0.6 to 0.9	140	48	Silty clay.
						1.2 to 1.5	210	47	Silty clay more sand.
						1.8 to 2.1	150	35	Clay more organic.
L9	414350091435101	F.W. Kent County Park—Lake 9	8/18/2015	7.3	1.6	0.0 to 0.3	210	54	Silty-dark mud.
						0.6 to 0.9	200	56	Silty clay.
						1.2 to 1.5	180	40	Clay no hardpan.
L10	414345091435101	F.W. Kent County Park—Lake 10	8/18/2015	6.8	1.2	0 0 to 0.3	170	60	Black silt muck.
						0.6 to 0.9	170	31	Black gray interbedded clay and silt.

Table 7. Phosphorus and moisture content of bed sediment in Kent Park Lake, Johnson County, Iowa, August 2015.—Continued

[--, not applicable]

Map number (fig. 1)	Site identification number	Site name	Sample date	P81903 Depth to bottom at sample location (foot)	Sediment core length (foot)	Sample interval from top of core (foot)	P00668 Phosphorus, bed sediment, total, dry weight (milligram per kilogram as phosphorus)	P00495 Moisture content, fraction of dry weight (percent)	Comment
L11	414331091435202	F.W. Kent County Park—Lake 11	8/18/2015	4.4	0.4	0.0 to 0.4	50	22	Top 0.2 Silt 0.2–0.4 Clay hardpan.
L12	414327091434901	F.W. Kent County Park—Lake 12	8/19/2015	13.0	2.1	0.0 to 0.3	420	78	Brownish mud and silt.
						0.6 to 0.9	340	68	Black mud clay.
						1.2 to 1.5	280	64	Black and gray silt clay some organic debris.
						1.8 to 2.1	140	42	Gray mostly clay.
L13	414325091435201	F.W. Kent County Park—Lake 13	8/19/2015	7.5	0.3	0.0 to 0.3	80	24	Mostly clay gray, very hard.

Summary

Physical and chemical properties that include moisture content, particle-size analysis, and phosphorus concentrations were determined from sediments collected in the Kent Park Lake, Iowa watershed in 2014 and 2015. This information was collected from both surficial lake sediment and at various depths in the lake sediment, sedimentation ponds on intermittent tributaries to the lake, and from dredge spoil ponds to understand the conditions that are contributing to increasing algal growth in the lake. These data will be used by the Johnson County Conservation Board to develop a lake improvement plan "to ensure that water that is safe, clean, and visually appealing for water based recreation activities such as swimming, fishing, and boating while providing a healthy aquatic environment and a sustainable fishery"

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