Coralville Reservoir Water Quality Project

Final Report, Jan 2005 – Dec 2005
Contract No. DACW25-03-P-0057

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Introduction

Description of the Area and Scope of the Project

The Coralville flood control dam is located in Johnson County, Iowa, about three miles north of Iowa City. The lake, at the conservation pool, 680 feet mean sea level (msl), is 21.7 miles long with a surface area of 2,650 acres, and at spillway level (712 feet msl) is 45.1 miles long with a surface area of 25,040 acres. Prior to February 1992 the level of the pool was normally reduced to 675 feet msl in late winter to facilitate the use of the impoundment for flood control. At this level, the reservoir has an area of 1,320 acres. More recent surveys indicated that at spillway level (712 feet msl) reservoir capacity was 420,960-acre feet, 17,720-acre feet at conservation pool level (680 feet msl), and 7,850-acre feet at 675 feet msl.

In February 1992 the reservoir operational procedure was modified. Under the current operational plan, the reservoir conservation pool will be held at 683 feet msl from December 15 to February 15 and then reduced to 679 feet msl by March 20. Pool level will be held at 679 feet msl from March 20 to June 20 and then be allowed to increase to the summer conservation pool of 683 feet msl where it will remain through September 15. The fall pool will be variable with a maximum elevation of 686 feet msl. During periods of high river flow the lake level often rises above these elevations due to downstream flow constraints.

The Coralville Reservoir Water Quality Project was initiated in 1964, and continued without interruption through October 1981. No sampling occurred from November 1981 through March 1982, but the project resumed on an abbreviated schedule in April 1982 and continued through January 1983 when it was again interrupted. Sampling was reinstituted in June of 1983 and continued through September 1985. Recent studies have covered the periods January-November 1986 through 1987, February-November 1988, February-September 1989, and January-October 1990, 1991, 1992, and 1993, and November to October for years 1993-2001. A one month lapse occurred November 2001 while the bulk of the project tasks transitioned to the current project managers, Jerald Schnoor and Craig Just, in the Department of Civil and Environmental Engineering at the University of Iowa. The most recent, final year report was for Jan 2004-Dec 2004.

The original purpose of the study was the determination of the effects of a flood control reservoir on the water quality and limnology of its parent river, but the long term nature of the project has made it possible to relate seasonal, hydrologic, and land use patterns to changes in water quality. During the current study, samples were routinely collected from the Iowa River upstream from the reservoir, at the abandoned Green Castle Bridge on Green Castle Avenue NW (formerly Road "O" and also formerly Johnson County Road W-48), from the surface, mid-depth, and bottom of the reservoir at the Mehaffey Bridge downstream from the Lake McBride Spillway, and from the Iowa River at The University of Iowa Water Treatment Plant (Figure 1). Samples were collected three times monthly in June, July and August; twice monthly in March, April, May, and September; and monthly in November, December, January, February, and October.

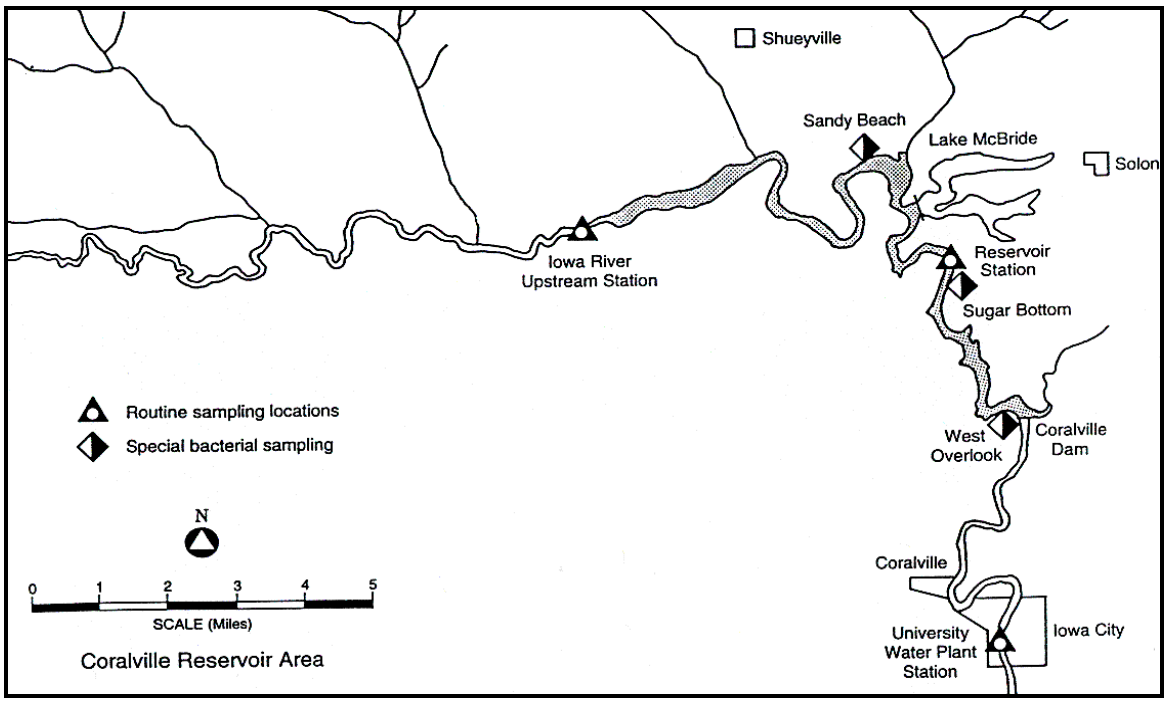

Figure 1: Coralville Reservoir Area.

Samples were routinely analyzed for temperature, suspended solids, dissolved oxygen, pH, alkalinity, carbon dioxide, hardness, ammonia, nitrite, nitrate, total Kjeldahl nitrogen, orthophosphate, total phosphate, total organic carbon, silica, biochemical oxygen demand, chlorophylls, and fecal coliform organisms. Sampling schedules and analytical procedures are summarized in Table 1.

Table 1: Test frequency, method and detection limit.

Parameter	Frequency	Method*	Detection Limit
Alkalinity, Phenolphthalein (mg/L as $CaCO_3$)	b	2320 B	1 mg/L
Alkalinity, Total (mg/L as $CaCO_3$)	b	2320 B	5 mg/L
Biochemical Oxygen Demand (mg/L)	a	5210 B	2 mg/L
Carbon Dioxide (mg/L)	b	4500-CO_2 C&D	0.1 mg/L
Dissolved Oxygen (mg/L)	a	4500-O C&G	0.1 mg/L
Escherichia coli (organisms per 100 mL)	c	9222 G	10 organisms/ 100 mL
Fecal Coliform Bacteria (organisms per 100 mL)	c	9222 D	10 organisms/ 100 mL
Hardness (total & calcium mg/L as $CaCO_3$)	b	2340 C, 3500-Ca B	5 mg/L
Ion Balance (meq/L)	e	1030 E	
Nitrogen, Ammonia (mg/L as N)	a	4500-NH_3 D	0.1 mg/L
Nitrogen, Nitrate (mg/L)	a	4500-NO_3^-	0.1 mg/L
Nitrogen, Nitrite (mg/L)	a	4500-NO_2^-	0.1 mg/L
Nitrogen, Total Kjeldahl (mg/L)	a	4500-N_{org}	0.1 mg/L
Pesticides in Common Carp (mg/kg)	once/year	EPA 3540	0.05 mg/kg
pH	a	4500-H^+ B	0.1
Phosphate, ortho	a	4500-P	0.1 mg/L
Phosphorus, total	a	4500-P	0.1 mg/L
Pigments, Chlorophylls & Pheophytin (mg/m^3)	d	10200 H	0.1 mg/m^3
Water Temperature (°C)	a	2550 B	0.1°C
Silica	a	4500-SiO_2	1 mg/L
Total Dissolved Organic Carbon	a	5310	0.1 mg/L
Total Suspended Solids (mg/L)	a	2540 D	10 mg/L

a) Three times monthly (June, July and August); twice monthly (March, April, May and September); monthly (November, December, January, February, and October).

b) Monthly (January – December).

c) Three times monthly (June, July, and August).

d) Two to three times monthly (May – September).

e) Monthly (January, February, May and October).

* *Standard Methods for Examination of Water and Wastewater, 20th Ed. unless otherwise noted*

Determinations of temperature, dissolved oxygen, and pH were made in the field at the time of sample collection. Other parameters were either calculated or determined in the laboratory.

Special studies for bacterial indicator organism levels near recreational areas, pesticide residues in fish, and ion balance determinations were also carried out. The most recent bacterial standards set two types of limits for indicator organisms in recreational waters:

- a limit on the geometric mean of 5 samples in a 30-day period (must be less than 126 cfu/100 mL)

- and a one-time maximum value (235 cfu/100 mL)

Beaches that exceed Iowa's proposed geometric mean water quality standard for bacteria will be posted with signs that state, "Swimming is Not Recommended."

If any of the values used to calculate the geometric mean is less than the detection limit (currently 10 cfu/100 mL), it is replaced with a value of one-half the detection limit. If an E. coli result exceeds the one time maximum of 235 organisms/100 mL or the geometric mean of 126 organisms/100 mL for five consecutive samples, reservoir operations personnel are notified immediately.

Beach water sampling commences two weeks prior to Memorial Day and extends to the second week following Labor Day each year. Each beach is sampled once per week during the season, on a Monday or Tuesday. An additional sample is collected during a week if resampling is required due to high bacteria concentrations.

Administrative and Fiscal

The project was continued under a similar arrangement as during the preceding period. The U.S. Army Corps of Engineers, Rock Island District, furnished the major portion of the financial support. IIHR – Hydroscience & Engineering, The University of Iowa, supplied the remainder of the funds for the project. The University of Iowa Department of Civil and Environmental Engineering furnished laboratory space.

Sampling Methods and Procedures

Sampling Locations

The sampling location names and coordinates are shown in Table 2.

Table 2: Sampling Locations.

Station Name	Location
Iowa River Upstream Station	N 41°47.513' W 91°42.882' Green Castle Avenue NW
Reservoir Station (surface, mid-depth, bottom)	N 41°46.489' W 91°33.667' Mehaffey Bridge Road
University Water Plant Station	N 41°39.494' W 91°32.462' Burlington Street, Iowa City
Sandy Beach	N 41°48.859' W 91°35.546'
Sugar Bottom Beach	N 41°45.492' W 91°33.385'
West Overlook Beach	N 41°43.479' W 91°31.915'

Sampling Procedures

Routine water samples were collected throughout the year. Laboratory work was performed in the Environmental Engineering and Science Laboratories. All water quality determinations were made in accordance with Standard Methods or EPA methods.

Samples for chlorides, sulfates, phosphates, sodium, and potassium were also analyzed on several occasions for ion balance determinations. Fish samples for pesticide analysis were collected within the reservoir and from the Iowa River below the dam. The

University Hygienic Laboratory carried out analyses for pesticides, some total Kjeldahl nitrogen and bacteria analysis.

Quality Control

Quality control procedures were implemented for all laboratory analyses, field sampling techniques, and data handling. Bacteriological procedures were performed in accordance with Standard Methods, utilizing sterilized collection bottles, sterile disposable petri dishes, and quality media. Incubator temperatures were routinely monitored with thermometers with National Bureau of Standards certification. Chemical procedures were performed in accordance with Standard Methods or EPA procedures. Standards were run within the matrix of the samples at all times. The reagents used were American Chemical Society certified quality or greater. All instruments involved in analyses were part of an annual or semi-annual preventive maintenance program.

Physical analyses were run in accordance with Standard Methods. Instruments utilized in the analyses were part of the preventive maintenance program. Residue weights were determined on balances that are calibrated yearly. Sampling procedures included preservation and/or any required special handling as directed in the EPA Quality Control Manual.

Observations

Hydrologic Conditions

The average impoundment inflow during the twelve month study period was 1,503 cfs compared to 1,850 cfs in 2004. The greatest inflow (8,130 cfs) occurred on May 20th, 2005 and the greatest outflow occurred on the same day (6,350 cfs) (Table 3, Figure 2 and Figure 3).

Table 3: Minimum, maximum and average flow into and out of the reservoir.

	USGS 05453100 Iowa River at Marengo, IA			USGS 05453520 Iowa River below Coralville Dam near Coralville, IA		
	max	min	average	max	min	average
Year 2005 maxima	8,130	8,030	8,090	6,350	6,230	6,270
Year 2005 minima	258	247	255	149	133	142
Year 2005 averages	1,644	1,484	1,503	1,735	1,555	1,641

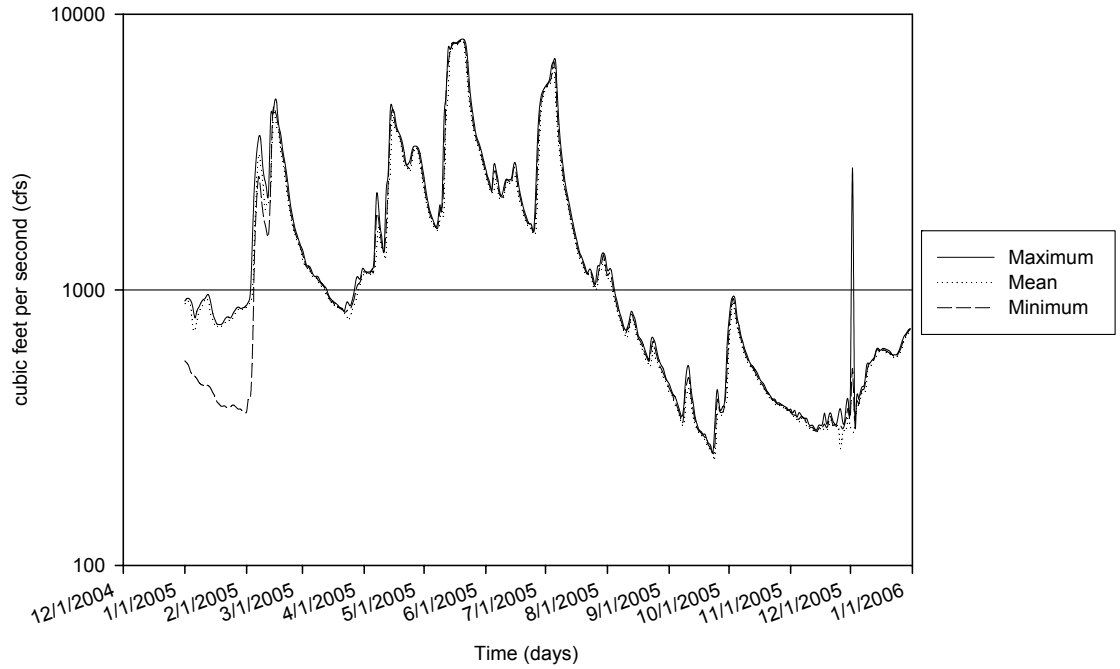

Figure 2: Minimum, maximum and mean impoundment inflow (cubic feet per second).

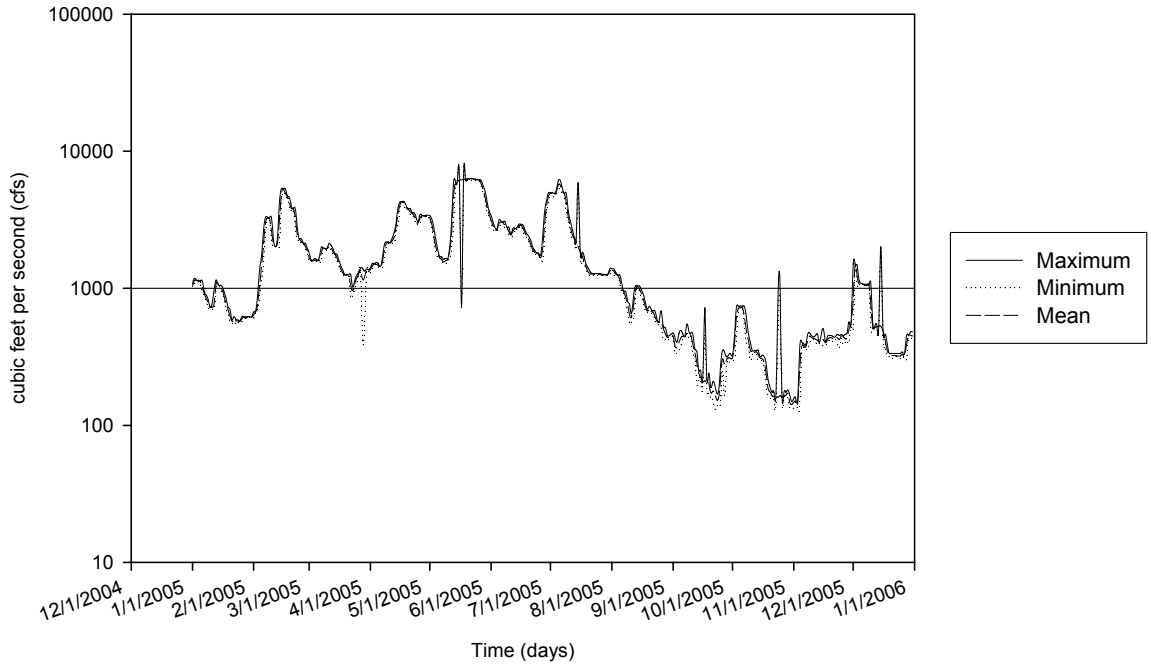

Figure 3: Minimum, maximum and mean impoundment outflow (cubic feet per second).

The reservoir pool level ranged from a minimum of 679.31 ft msl (Apr 24th) to a maximum of 686.8 ft msl on Nov 16th (Figure 4). The pool remained near 683 ft msl from the beginning of Jan 2005 to the end of Feb 2005. The pool level decreased gradually to 679 ft msl through the first half of Mar 2005 and remained there until the start of May 2005. The pool level increased slightly through May 2005, reaching nearly 686 ft msl, before dropping and being maintained at 683 ft msl during the summer. In Sep 2005 the pool gradually increased to 685 ft msl then to 686 ft msl during Oct 2005 then stabilized for most of Nov 2005 before dropping to 683 ft msl near the beginning of Dec 2005.

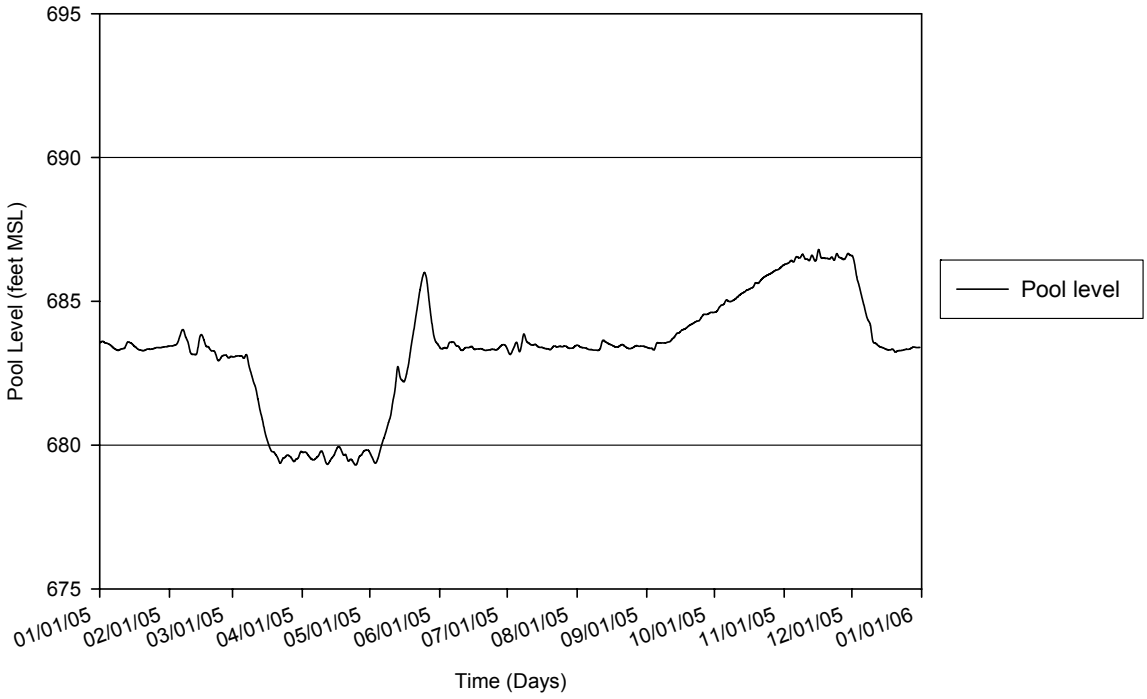

Figure 4: Reservoir pool level (*feet msl*) *versus time in days.*

Water Temperature

Significance to Water Quality

Temperature data is used to calculate various forms of alkalinity, in the calculation of salinity and in work involving calcium carbonate saturation and stability. Many limnological studies require water temperature as a function of depth to be reported. Discharges of industrial cooling waters that have been warmed to levels too far above the temperature of the receiving body are regulated to protect sensitive ecosystems.

Analytical Detail

The thermometer to be used should be capable of displaying data to 0.1°C and should have a minimal thermal capacity to ensure a quick response. Periodically, the thermometer should be checked against a National Institute of Standards and Technology certified precision thermometer.

Sampling and Storage

Temperature measurements are performed in the field (*in-situ* when possible); therefore, sample storage protocols are not applicable.

Results and Discussion

The water temperature data for all samples in 2005 is shown in Table 4. The minimum water temperature recorded for all samples was 0.8°C and the maximum was 29.2°C. The mean water temperature by sampling date in 2005 is shown in Figure 5. Figure 6 shows the year 2005 temperature (ºC) median, minima, maxima, lower quartiles, upper quartiles and standard deviation of all samples by location. The greatest median value for water temperature in year 2005 was at the reservoir mid-depth location. Water temperature data for years 2001-2005 by location (Figure 7) revealed maximum temperatures at the reservoir surface. Water temperature data for years 2001-2005 by year (Figure 8) indicates that the median value was greatest for year 2002 and the broadest range of values was in year 2003. The water temperature mean and standard deviation for years 2001-2005 for all samples by date is shown in Figure 9.

Table 4: Year 2005 water temperature data (℃) for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	0.8	2.6	1.4	1.6	2.0
2/28/2005	3.8	7.7	4.9	5.5	3.4
3/18/2005	3.9	7.8	5.6	8.9	5.6
3/26/2005	6.3	11.9	5.7	7.6	9.3
4/23/2005	13.6	13.1	12.9	13.0	16.8
4/30/2005	11.7	13.9	11.8	12.0	12.2
5/21/2005	17.1	18.1	18.0	17.9	19.0
5/28/2005	17.8	19.1	18.7	18.0	20.4
6/1/2005	19.8	20.5	21.6	20.1	19.8
6/6/2005	22.8	23.9	26.6	24.2	22.7
6/10/2005	25.3	25.4	25.4	29.2	24.9
7/15/2005	29.1	28.2	28.8	27.8	27.2
7/22/2005	28.9	29.1	28.9	28.3	27.1
7/28/2005	25.4	26.7	26.6	26.4	25.9
8/10/2005	28.1	28.3	27.6	27.1	26.7
8/17/2005	25.8	26.4	26.1	25.3	25.3
8/25/2005	23.0	24.7	24.9	25.4	24.3
9/8/2005	25.3	26.2	24.4	24.2	25.9
9/15/2005	20.7	23.7	23.8	23.7	22.3
10/13/2005	15.9	17.5	16.0	15.5	17.7
11/3/2005	11.3	15.3	12.5	15.4	13.6
12/9/2005	2.2	3.5	na	na	2.2
Minimum	0.8	2.6	1.4	1.6	2.0
Maximum	29.1	29.1	28.9	29.2	27.2
Mean	17.2	18.8	18.7	18.9	17.9
Median	18.8	19.8	21.6	20.1	20.1

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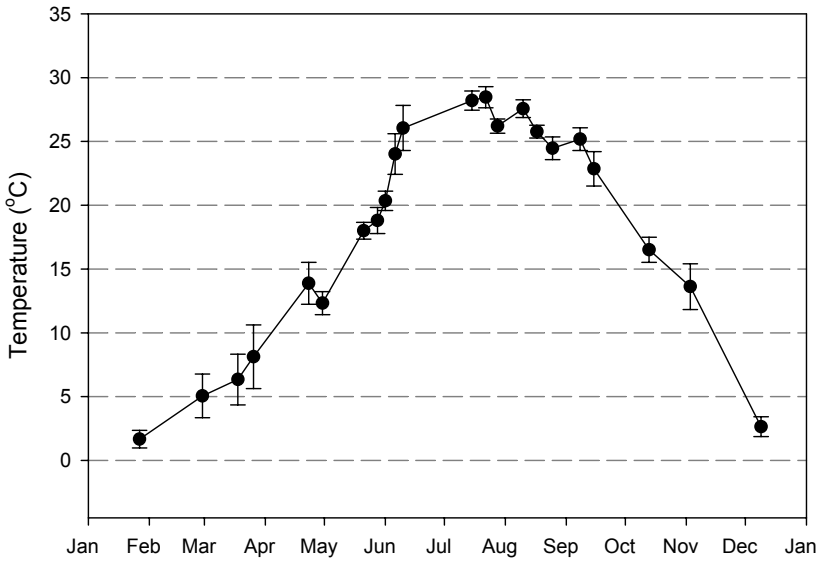

Figure 5: Year 2005 mean water temperature (ºC) with standard deviation for all sample locations by date.

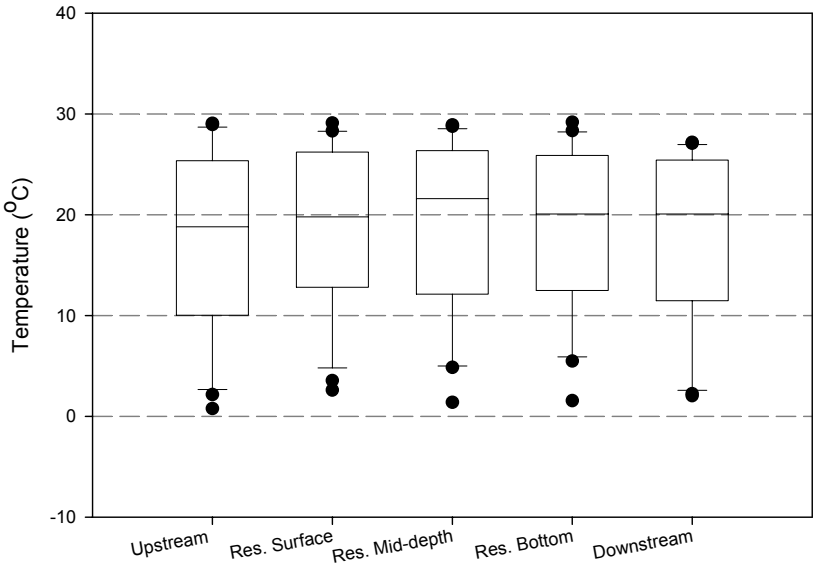

Figure 6: Year 2005 water temperature (ºC) median, minima, maxima, lower quartiles, upper quartiles and standard deviation of all samples by location.

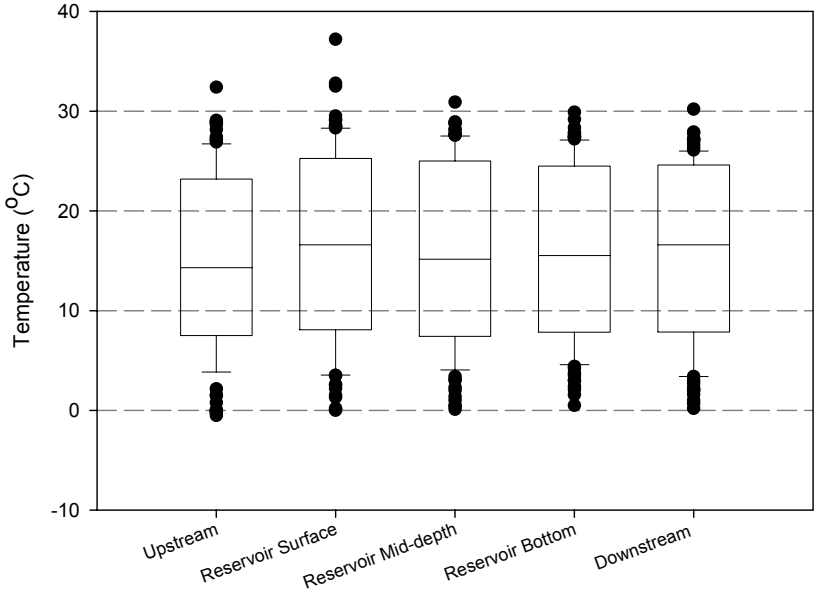

Figure 7: Years 2001-2005 water temperature (ºC) medians, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by location.

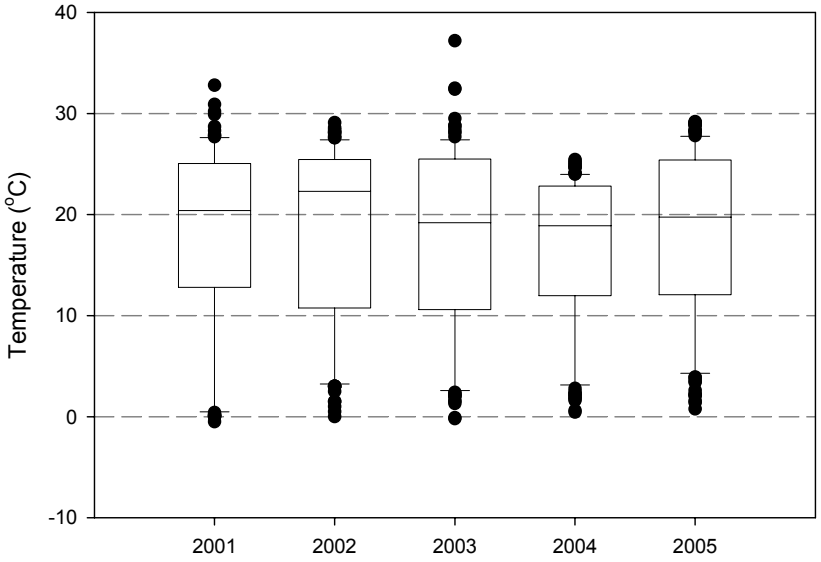

Figure 8: Years 2001-2005 water temperature (ºC) medians, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by year.

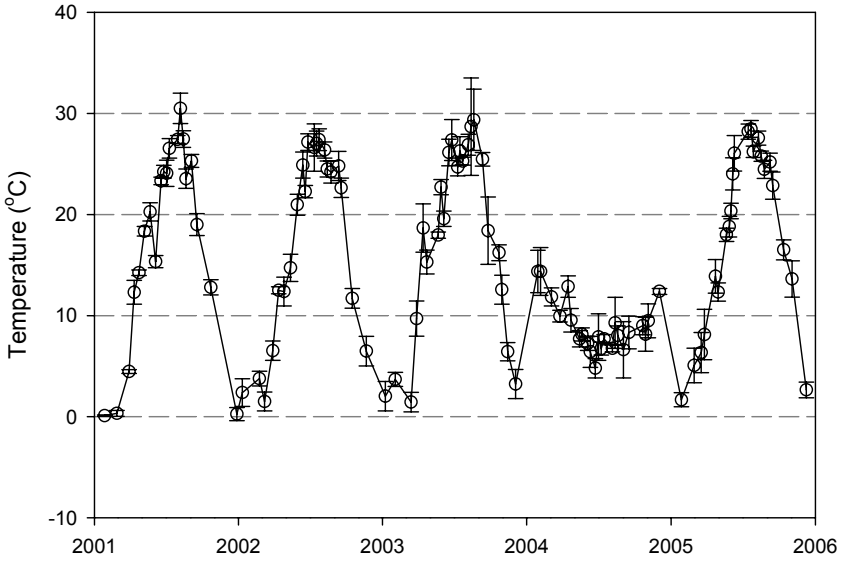

Figure 9: Years 2001-2005 water temperature (ºC) mean and standard deviation for all samples by date.

Total Suspended Solids

Significance to Water Quality

Solid matter can be suspended or dissolved in water or wastewater and water of effluent quality can be impacted by solids in a number of ways. Waters with high dissolved solids generally have poor taste; therefore, a limit of 500 mg/L is desirable for drinking water. Waters high in suspended solids may be undesirable for contact sports or recreational bathing. Solids analyses are important for biological and physical wastewater treatment operations and wastewater effluent solids levels are regulated by the federal government.

The term "total solids" is applied to the material residue left behind after evaporation of a sample resulting from specified drying procedures in an oven. "Total suspended solids" is the component in total solids that is retained by a filter. "Total dissolved solids" is the fraction that passes through the filter.

Analytical Detail

Sources of error and variability include sampling, subsampling and pipeting two-phase and three-phase waters. Some samples form a crust upon drying that may prevent water evaporation. Use of magnetic stir bars should be avoided when samples contain magnetic particles. The drying temperature impacts the results greatly and samples should be desiccated immediately after removal from the oven. Some samples may be stronger desiccants than those used in the desiccator which may cause a sample to absorb water. Residues dried at 103-105°C may retain mechanically occluded water and water of crystallization making constant weight attainment and slow process. Samples should be analyzed in duplicate for quality assurance purposes.

For this project, a well-mixed sample is filtered through a weighed standard glass-fiber filter and the residue retained on the filter is dried to a constant weight at 103 to 105°C. The increase in weight of the filter represents the total suspended solids. If the suspended material clogs the filter and prolongs filtration, it is sometimes necessary to increase the diameter of the filter or decreased the sample volume. Precision: Standard Methods reports the standard deviation as 5.2 mg/L at 15 mg/L and 24 mg/L at 242 mg/L. Single-lab duplicate analyses of 50 water and wastewater samples were made with a standard deviation of differences of 2.8 mg/L.

Sampling and Storage

Resistant-glass or plastic bottles that minimize suspension adherence should be used and the analysis should begin as soon as possible due to the impractical nature of sample preservation. The samples should be stored at 4°C up to the time of analysis to minimize microbial degradation of the solids.

Results and Discussion

The year 2005 total suspended solids (TSS) raw data for all samples is shown in Table 5. The median value of 124 mg/L for the upstream location is quite high in comparison to the other sampling sites. The year 2005 total suspended solids mean and standard deviation for all samples by date is shown in Figure 10. The year 2005 total suspended solids values for all samples by location (Figure 11) indicates the reservoir is a suspended solids trap with greater TSS values upstream relative to the reservoir and downstream locations. The greater water velocities at the upstream location result in elevated TSS values. The greatest total suspended solids value for years 2001-2005 (Figure 12) was at the upstream location at 727 mg/L on Aug 5, 2004. Total suspended solids analysis for all samples for years 2001-2005 (Figure 13) indicates that the greatest median value occurred in 2002. The total suspended solids mean and standard deviation for all samples by date for years 2001-2005 is shown in Figure 14.

Table 5: Year 2005 total suspended solids raw data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	<10	<10	<10	<10	<10
2/28/2005	70	18	25	25	38
3/18/2005	50	26	32	46	14
3/26/2005	48	34	32	36	30
4/23/2005	230	51	60	58	48
4/30/2005	150	17	12	<10	11
5/21/2005	92	33	30	32	32
5/28/2005	261	71	70	76	68
6/1/2005	164	28	70	45	46
6/6/2005	372	31	40	38	54
6/10/2005	140	22	152	78	32
7/15/2005	201	19	32	137	31
7/22/2005	169	19	24	126	25
7/28/2005	221	39	56	58	26
8/10/2005	87	13	32	69	19
8/17/2005	124	<10	28	76	31
8/25/2005	239	34	50	43	35
9/8/2005	80	10	13	26	23
9/15/2005	114	27	17	28	17
10/13/2005	115	11	20	48	16
11/3/2005	25	15	15	20	11
12/9/2005	16	11	na	na	16
Minimum	<10	<10	<10	<10	<10
Maximum	372	71	152	137	68
Mean	141	26	41	56	30
Median	124	24	32	46	30

If displayed, “na” means datum not available due to analysis error or other reason
If displayed, “<” means datum below detection level

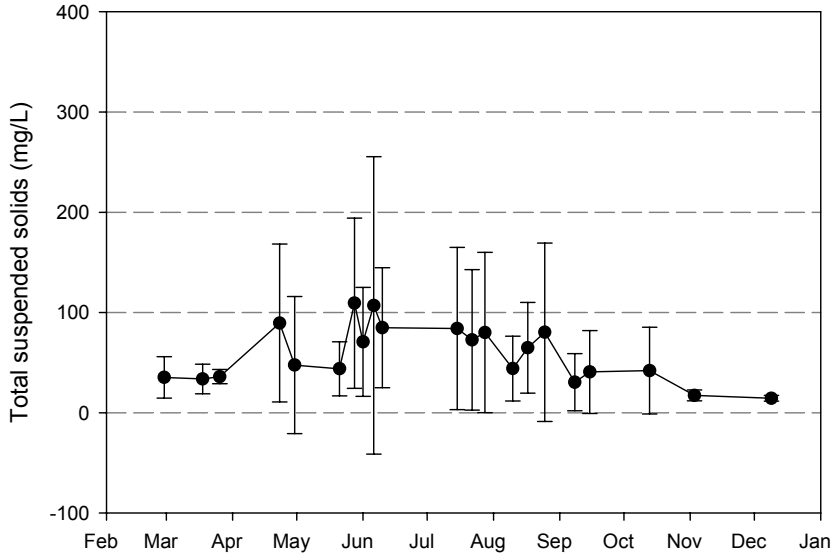

Figure 10: Year 2005 total suspended solids (TSS mg/L) mean and standard deviation for all samples by date.

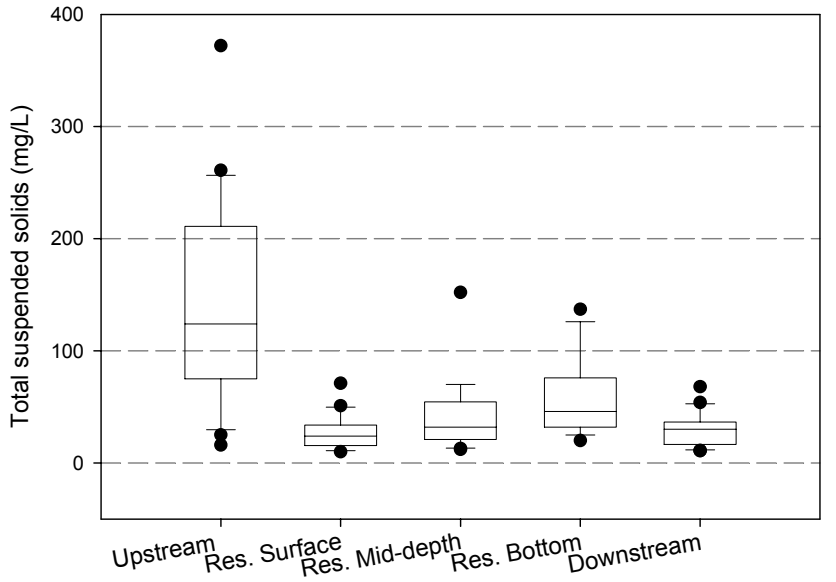

Figure 11: Year 2005 total suspended solids (TSS mg/L) median, minima, maxima, lower quartiles, upper quartiles and standard deviation of all samples by location.

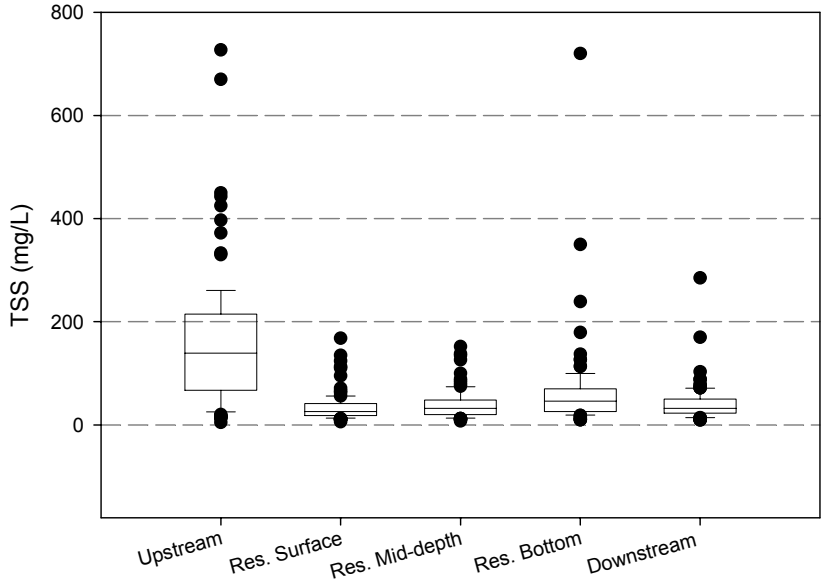

Figure 12: Years 2001-2005 total suspended solids (TSS mg/L) median, minima, maxima, lower quartiles, upper quartiles and standard deviation by sample location.

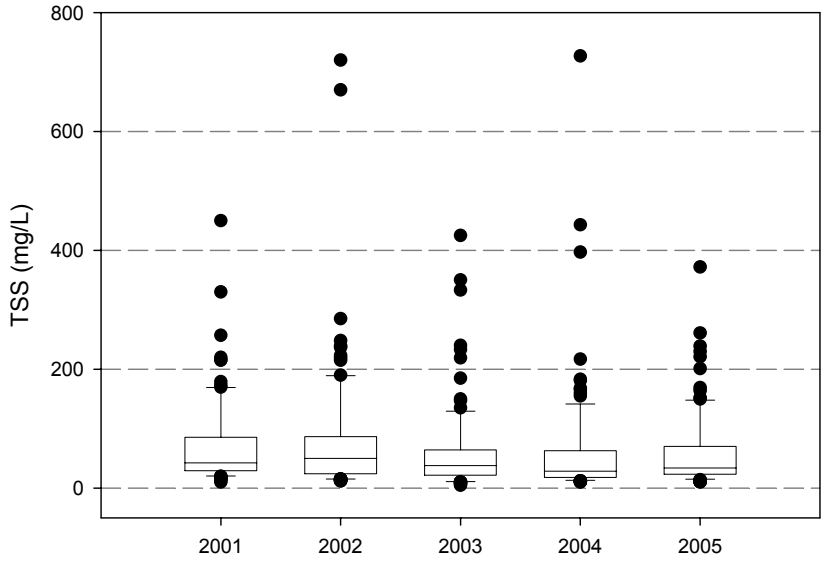

Figure 13: Years 2001-2005 total suspended solids (TSS mg/L) median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by year.

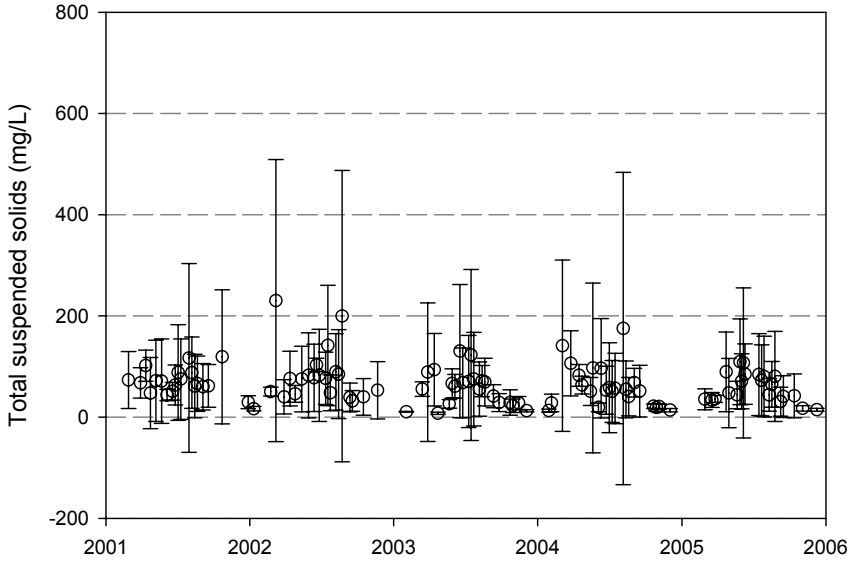

Figure 14: Years 2001-2005 total suspended solids (TSS mg/L) mean and standard deviation for all samples by date.

Dissolved Oxygen

Significance to Water Quality

The Iowa class "B" (WW) standard states that dissolved oxygen shall not be less than 5 mg/L at any time. This standard applies to the upper layer of stratification in a reservoir or lake. The dissolved oxygen levels in natural and wastewaters depend on the physical, chemical, and biochemical activities occurring in the water.

Analytical Detail

A Hydrolab Quanta-G (Hach Company) multisensor probe was utilized to measure dissolved oxygen (DO) and other water characteristics. The membrane electrode method is described in SM 4500-O G. The Hydrolab DO membrane was replaced and the sensor was calibrated at the beginning of each sampling event using distilled water and the saturated air method.

Sampling and Storage

Sample storage is typically not required since the Quanta-G probe casing is filled with sample immediately after collection with results recorded in the field. Occasionally, if the *in-situ* probe malfunctions, samples are returned to the lab in 300-mL, glass stoppered BOD bottles for measurement using the azide modified Winkler titration (SM 4500-O part C). Manganous sulfate and alkaline iodide-azide is added as soon as possible and the samples are water sealed and stored in the dark for no longer than eight hours prior to titration with sodium thiosulfate and starch indicator solution.

Results and Discussion

The Iowa class "B" (WW) standard of 5 mg/L of dissolved oxygen for surface waters was not violated for any samples collected in 2005 (Table 6). Dissolved oxygen concentration means in 2005 for the upstream, reservoir surface, reservoir mid-depth, reservoir bottom and the downstream locations were 9.6, 9.3, 8.5, 7.7, and 9.8 mg/L respectively compared to 9.3, 9.2, 8.6, 8.1, and 9.8 mg/L respectively in 2004. The year 2005 dissolved oxygen mean and standard deviation for all samples by date is shown in Figure 15. The year 2005 median values for all samples by location (Figure 16) indicate that the dissolved oxygen concentration is typically lowest at the reservoir bottom. The years 2001-2005 dissolved oxygen median values for all samples by location (Figure 17) also indicates that DO is typically lowest at the reservoir bottom historically and the range of values measured increases with depth. The years 2001-2005 dissolved oxygen medians for all samples by year indicate that year 2001 had the lowest values and year 2003 had the widest range of values (Figure 18). The years 2001-2005 dissolved oxygen mean and standard deviation for all samples by date is shown in Figure 19.

Table 6: Year 2005 dissolved oxygen (mg/L) raw data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	12.3	15.5	14.7	15.6	13.4
2/28/2005	12.8	12.4	12.4	10.9	18.3
3/18/2005	11.3	11.4	11.8	12.2	13.0
3/26/2005	12.5	11.5	13.0	12.8	12.0
4/23/2005	11.7	10.8	11.3	11.5	11.0
4/30/2005	9.8	9.3	9.4	9.6	10.4
5/21/2005	9.9	8.0	8.3	7.4	8.5
5/28/2005	10.1	8.5	8.0	8.2	8.4
6/1/2005	9.1	9.7	8.9	9.1	9.8
6/6/2005	7.3	7.8	8.0	7.8	8.1
6/10/2005	7.7	7.7	7.2	5.6	8.5
7/15/2005	6.7	7.0	6.7	5.6	7.2
7/22/2005	7.4	7.3	7.3	**3.7**	7.3
7/28/2005	7.4	6.2	6.3	7.3	7.6
8/10/2005	7.9	7.8	5.7	**2.7**	7.6
8/17/2005	8.4	8.2	**4.7**	**3.5**	7.5
8/25/2005	6.8	5.1	7.0	**2.5**	7.5
9/8/2005	7.3	8.5	6.1	5.9	7.7
9/15/2005	9.4	6.9	5.8	6.0	8.6
10/13/2005	8.9	9.1	6.7	6.4	8.7
11/3/2005	13.0	8.8	9.7	8.6	10.1
12/9/2005	14.2	17.0	na	na	15.4
Minimum	6.7	5.1	**4.7**	**2.5**	7.2
Maximum	14.2	17.0	14.7	15.6	18.3
Mean	9.6	9.3	8.5	7.7	9.8
Median	9.3	8.5	8.0	7.4	8.6

If displayed, “na” means datum not available due to analysis error or other reason
If displayed, “<” means datum below detection level

Values in bold font are below the Iowa class “B” (WW) standard of 5 mg/L. This standard applies only to surface waters.

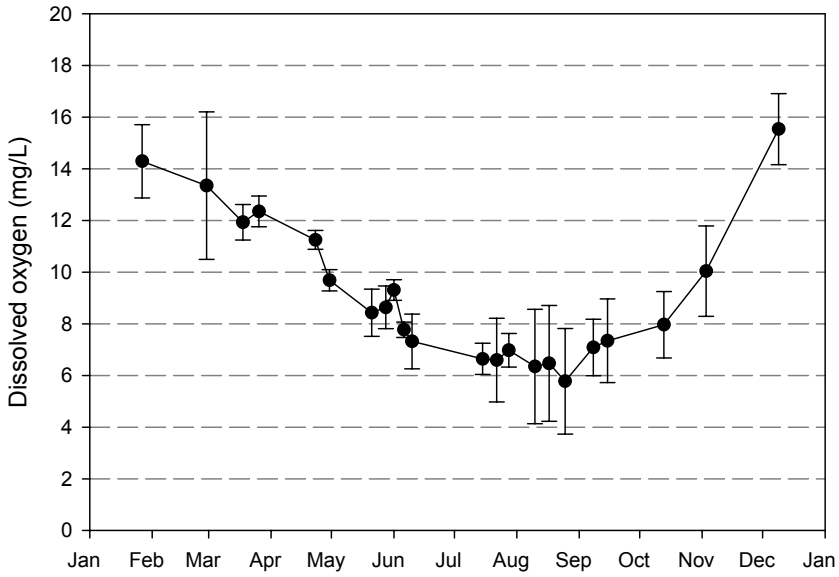

Figure 15: Year 2005 dissolved oxygen (DO mg/L) mean and standard deviation for all samples by date.

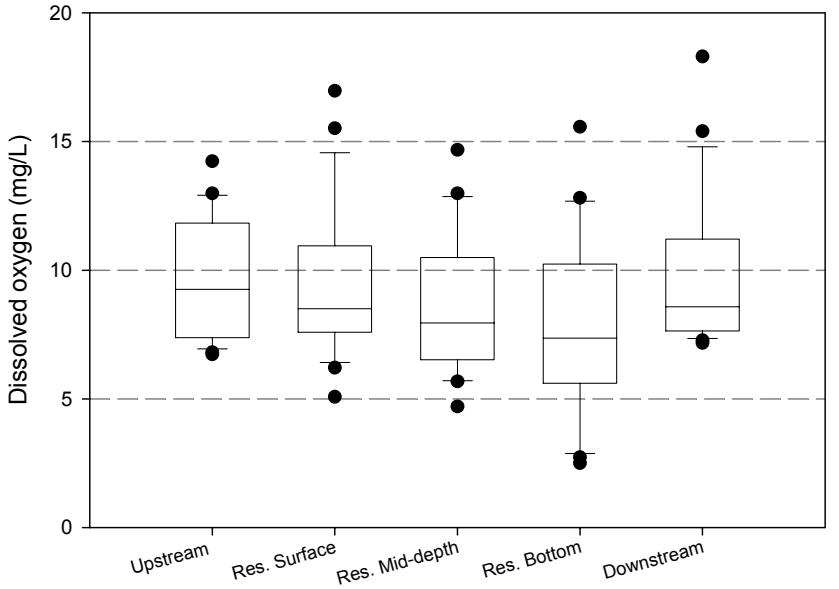

Figure 16: Year 2005 dissolved oxygen (DO mg/L) median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by location.

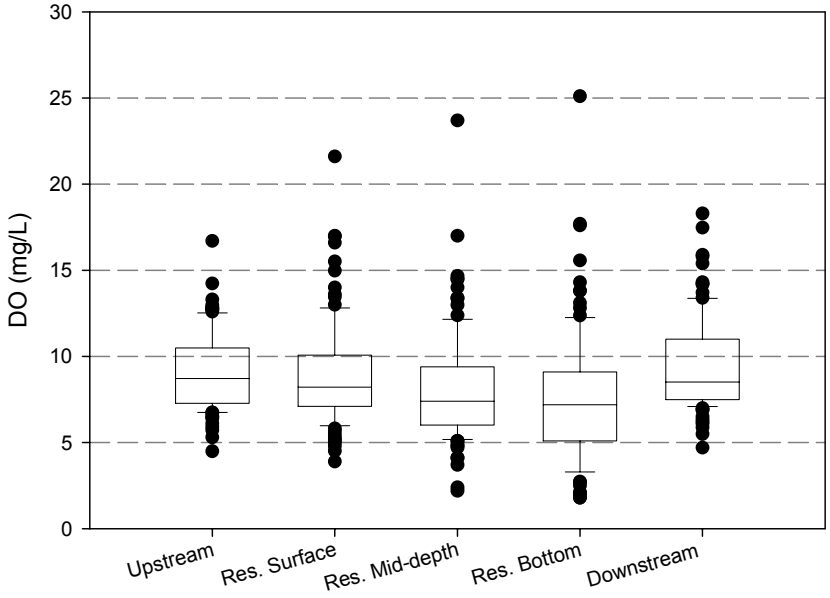

Figure 17: Years 2001-2005 dissolved oxygen (DO mg/L) median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by location.

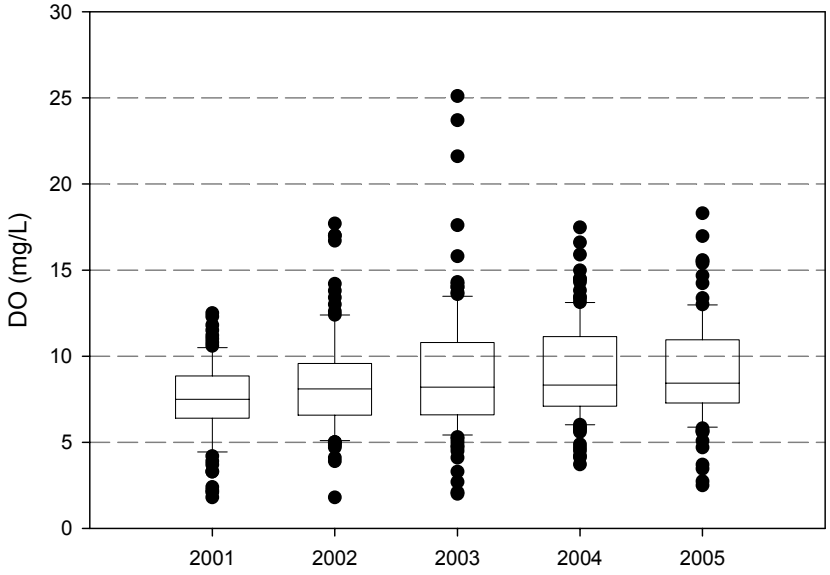

Figure 18: Years 2001-2005 dissolved oxygen (DO mg/L) medians, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by year.

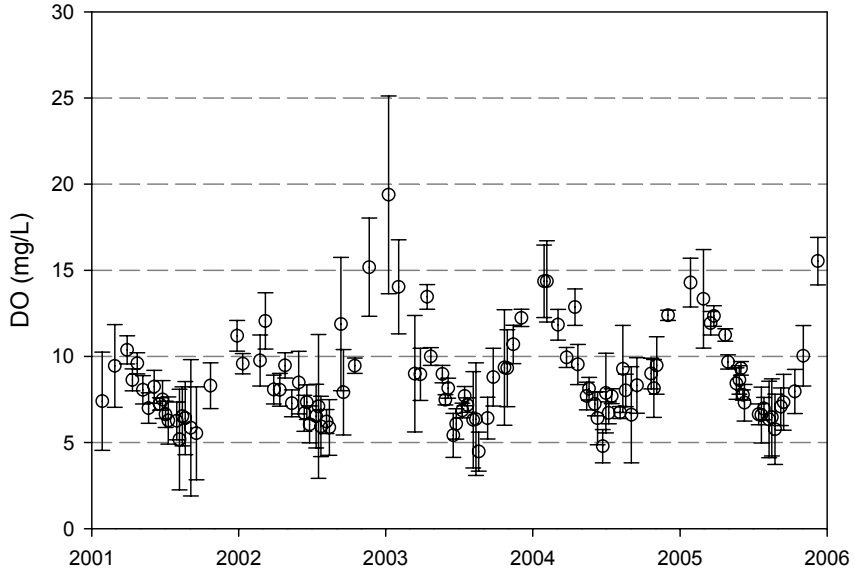

Figure 19: Years 2001-2005 dissolved oxygen (DO mg/L) mean and standard deviation for all samples by date.

Biochemical Oxygen Demand

Significance to Water Quality

The biochemical oxygen demand test utilizes standardized laboratory procedures to determine the relative oxygen needs of various water types (wastewaters, effluents, and surface waters). This empirical test measures the amount of molecular oxygen consumed by a sample during a specified incubation period (typically 5 days) and provides an indication of the ability of microorganisms to degrade carbonaceous compounds in the sample.

Analytical Detail

The method requires the use of airtight bottles (typically 300 mL) that are filled to overflowing and subsequently incubated at 20 ± 1°C in complete darkness for 5 days. The bottles should be cleaned with detergent, rinsed thoroughly and drained before use. To avoid drawing excess oxygen into the sample during incubation, bottles with a flared mouth are preferred so a "water seal" can be made around the glass stopper. A plastic cap is added to the bottles to reduce evaporation of the water seal.

Sampling and Storage

For grab samples, keep sample at or below 4°C and begin analysis within 6 hours of collection. Chilled samples are warmed to 20 ± 3°C before analysis.

Results and Discussion

The year 2005 biological oxygen demand (BOD_5 mg/L) raw data for all samples is shown in Table 7. Plotting the year 2005 BOD_5 mean and standard deviation for all samples by

date (Figure 20) reveals that the mean BOD_5 was greatest on Dec 9th and lowest on Jun 10th. Figure 21 shows the year 2005 biological oxygen demand median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by location. The median BOD_5 was lowest at the reservoir bottom in year 2005. An analysis of the years 2001-2005 BOD_5 median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by location (Figure 22) reveals that the BOD levels are typically greatest at the upstream and downstream locations. Further analysis of years 2001-2005 biological oxygen demand median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year (Figure 23) showed that the median BOD_5 was greatest in year 2001 and lowest in 2002. In Figure 24, the years 2001-2005 BOD_5 mean and standard deviation for all samples by date is shown.

Table 7: Year 2005 biological oxygen demand (mg/L) raw data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	7.4	9.5	8.7	8.9	8.2
2/28/2005	5.7	5.9	5.9	5.7	8.1
3/18/2005	5.1	6.0	5.6	6.7	7.2
3/26/2005	6.4	5.6	6.8	7.0	4.9
4/23/2005	7.4	6.2	7.0	7.2	6.5
4/30/2005	5.2	5.2	4.9	5.2	5.2
5/21/2005	6.6	4.0	4.3	3.5	4.0
5/28/2005	4.9	4.2	3.9	4.2	3.5
6/1/2005	4.9	5.5	5.1	4.8	5.6
6/6/2005	5.3	5.0	5.5	5.0	4.8
6/10/2005	3.3	4.0	3.3	3.2	4.1
7/15/2005	4.3	3.9	3.8	4.8	4.3
7/22/2005	5.3	4.6	5.3	3.1	4.8
7/28/2005	6.3	3.2	3.6	6.7	5.2
8/10/2005	6.9	5.4	5.0	2.2	6.0
8/17/2005	7.6	5.8	3.8	2.7	5.4
8/25/2005	6.4	4.2	6.2	1.8	5.6
9/8/2005	6.4	7.8	5.3	5.2	5.1
9/15/2005	8.6	6.0	4.6	5.1	6.1
10/13/2005	5.3	7.2	6.5	5.9	4.9
11/3/2005	10.3	7.6	8.2	7.6	7.2
12/9/2005	10.8	13.8	na	na	12.4
Minimum	3.3	3.2	3.3	1.8	3.5
Maximum	10.8	13.8	8.7	8.9	12.4
Mean	6.4	5.9	5.4	5.1	5.9
Median	6.3	5.5	5.3	5.1	5.3

If displayed, "na" means datum not available due to analysis error or other reason
If displayed, "<" means datum below detection level

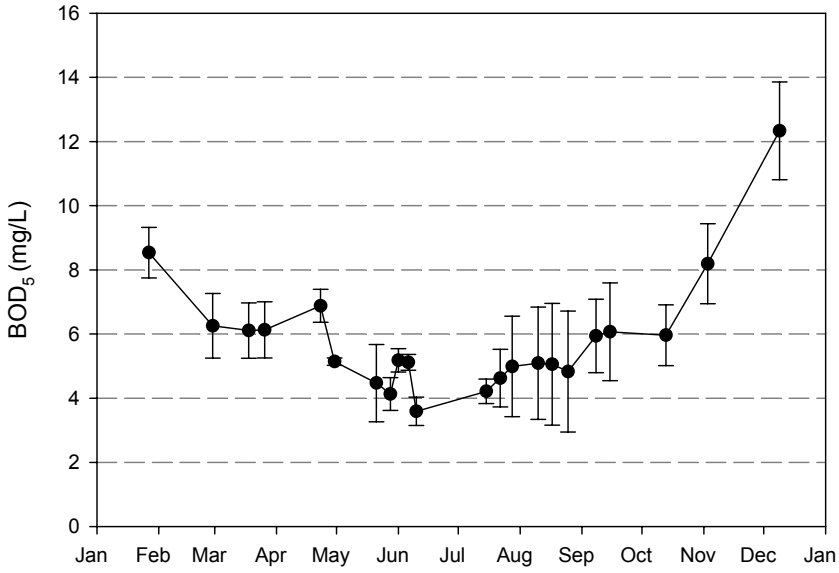

Figure 20: Year 2005 biological oxygen demand (BOD_5 mg/L) mean and standard deviation for all samples by date.

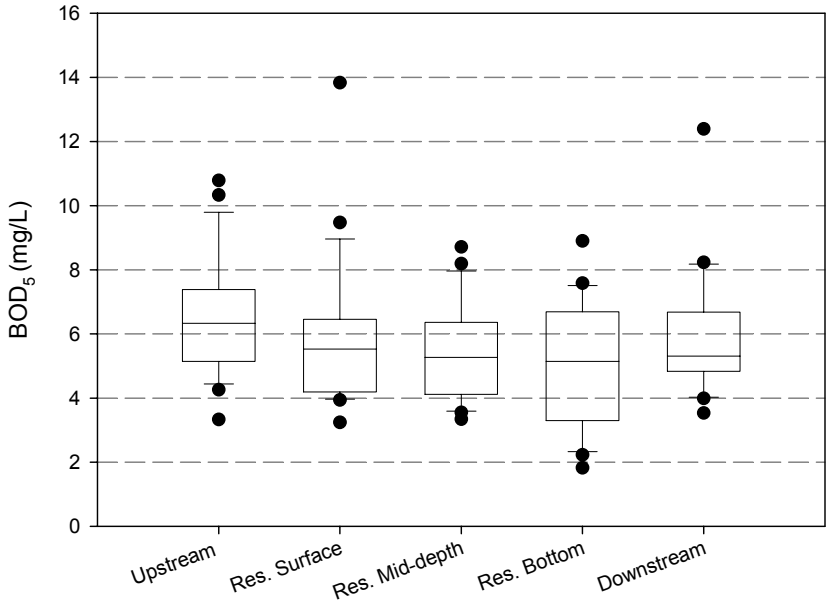

Figure 21: Year 2005 biological oxygen demand (BOD_5 mg/L) median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by location.

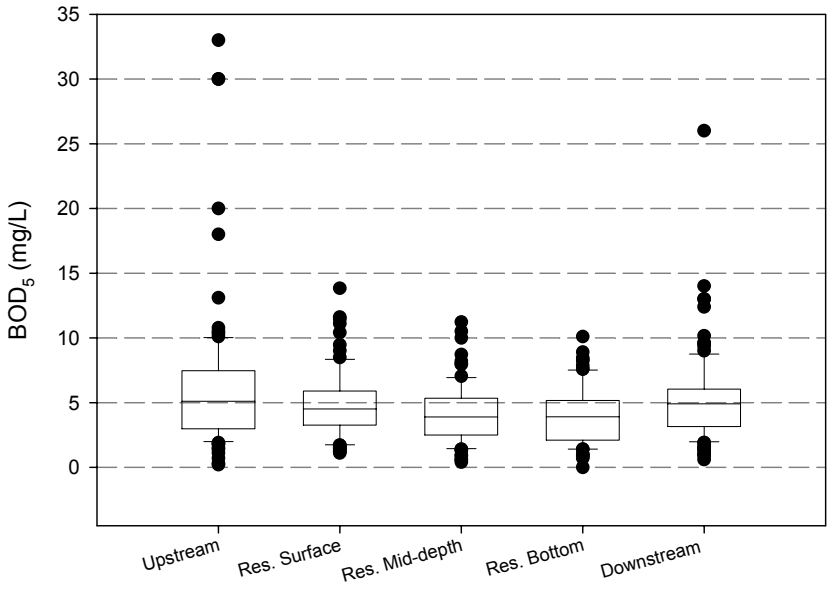

Figure 22: Years 2001-2005 biological oxygen demand (BOD_5 mg/L) median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by location.

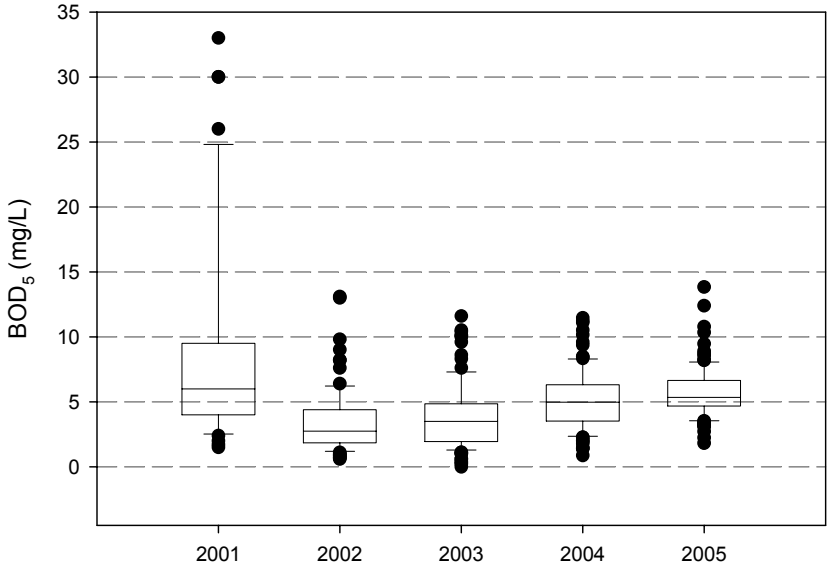

Figure 23: Years 2001-2005 biological oxygen demand (BOD_5 mg/L) median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year.

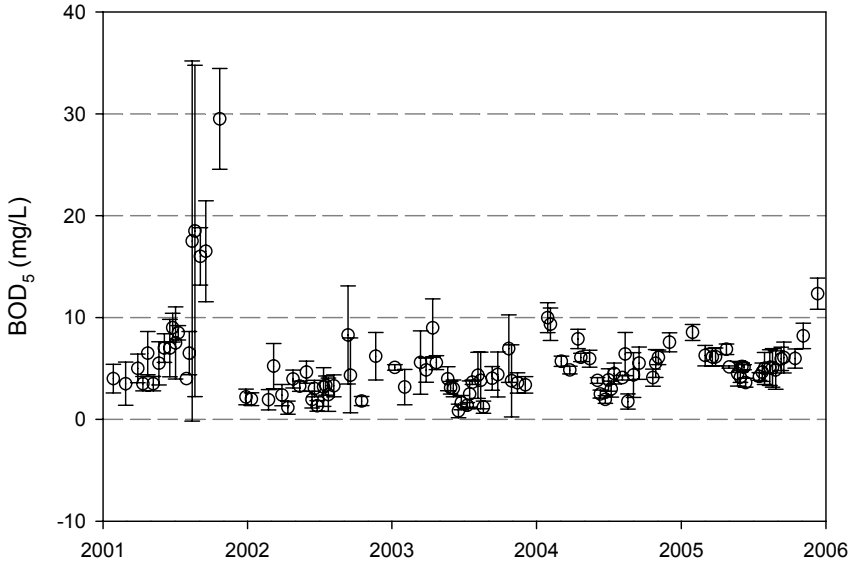

Figure 24: Years 2001-2005 biological oxygen demand (BOD_5 mg/L) mean and standard deviation for all samples by date.

Carbon Dioxide and pH

Significance to Water Quality

Surface waters normally contain less than 10 mg/L free carbon dioxide, but the actual concentration can vary greatly depending on pH and consumption by algae. Certain fish species are more susceptible to elevated CO_2 levels than others.

The pH of a water body is one of the most important and frequently reported values in all of water chemistry. The intensity of the acidic and basic nature of the water body is indicated by pH. Natural waters usually have pH values between 4 and 9, while most are slightly basic due to the presence of bicarbonates and carbonates of the alkali and alkaline earth metals.

Analytical Detail

Carbon dioxide was calculated from principles of equilibrium chemistry and was measured via titration to the phenolphthalein endpoint (pH 8.3) with sodium hydroxide (0.0227 N). The test assumes that strong mineral acids (i.e. H_2SO_4, HCl, HNO_3, etc.) are absent or negligible. Careful handling of the sample reduces carbon dioxide loss due to aeration during collection or swirling during analysis.

To measure pH, a probe is used to determine the activity of the hydrogen ions in solution potentiometrically using a standard hydrogen electrode coupled to a reference electrode. The probe is calibrated with various pH buffers of known hydrogen ion activity. An electrometric pH probe in a field deployable Hydrolab multiprobe system was utilized for most of the measurements reported. A Hach 2400 spectrophotometer system with pH probe was utilized for portions of this work as well. The electrode system is calibrated

against solutions of known pH (Fisher Scientific); usually buffers of pH 4, 7 and 10 are used. The manufacturer's recommendations for storage and preparation of the electrodes and meters are always followed. Electrodes are kept wet in storage solution when not in use. Before use, the electrode is removed from the storage solution, rinsed, and blotted dry with a lab wipe before placement in the initial calibration buffer. After the reading is recorded by the pH meter, the subsequent buffers are measured with electrode rinsing and blotting performed between each measurement. During sample analysis, equilibrium is established between the electrode and sample with the aid of minimal stirring to avoid excessive introduction of carbon dioxide. Once equilibration has been achieved, the pH reading is recorded.

Sampling and Storage

The samples were collected in clean plastic bottles, filled completely and capped tightly. Excessive agitation and exposure to air was avoided. Samples were chilled immediately and analyzed within eight hours of collection.

Results and Discussion

The raw data for carbon dioxide measurements completed in year 2005 are shown in Table 8. As shown in Figure 25, the greatest carbon dioxide concentrations occurred in late Feb 2005. Figure 26 shows year 2005 CO_2 concentration median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by location. In general, carbon dioxide concentrations are greatest at the upstream and reservoir bottom locations. The years 2001-2005 CO_2 concentration median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by sample location (Figure 27) indicates that carbon dioxide concentrations are typically greatest at the reservoir bottom and that values can vary substantially. Figure 28 shows that carbon dioxide median concentrations were greatest in year 2004 and most variable in year 2003 for the 2001-2005 time span. The years 2001-2005 carbon dioxide concentration mean and standard deviation for all samples by date is shown in Figure 29.

The raw pH data for year 2005 (Table 9) shows the greatest median pH value was at the upstream and reservoir surface location (8.24). Figure 30 shows that the lowest sampling event specific mean pH values were recorded in Feb of 2005. The year 2005 pH median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by location (Figure 31) affirms that the reservoir surface location had the highest range in pH value, even when the median was similar to the upstream location. The years 2001-2005 median pH values (Figure 32) vary slightly with the minimum value occurring at the reservoir bottom and the maximum value occurring at the reservoir surface. The years 2001-2005 pH median, minima, maxima, lower quartiles, upper quartiles and standard deviation values for all samples by year (Figure 33) show that the pH median was greatest in year 2003 and was lowest in year 2004. The years 2001-2005 pH means and standard deviations by date are shown in Figure 34.

Table 8: Year 2005 carbon dioxide (mg/L) measured data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	4.5	6.0	11.0	20.5	4.5
2/28/2005	20.0	22.5	20.0	20.0	17.5
3/18/2005	19.5	13.0	12.0	5.5	3.0
3/26/2005	6.0	10.0	18.5	20.0	13.0
4/23/2005	15.0	20.0	18.0	16.5	24.0
4/30/2005	15.5	9.5	14.5	20.0	20.0
5/21/2005	4.0	4.5	10.0	6.5	8.9
5/28/2005	<1.0	<1.0	<1.0	<1.0	<1.0
6/1/2005	<1.0	<1.0	<1.0	<1.0	<1.0
6/6/2005	<1.0	<1.0	<1.0	<1.0	<1.0
6/10/2005	<1.0	<1.0	<1.0	2.0	<1.0
7/15/2005	<1.0	<1.0	<1.0	<1.0	<1.0
7/22/2005	<1.0	<1.0	<1.0	4.5	<1.0
7/28/2005	<1.0	1.5	2.0	<1.0	<1.0
8/10/2005	<1.0	<1.0	<1.0	6.0	<1.0
8/17/2005	<1.0	<1.0	6.5	7.5	1.9
8/25/2005	<1.0	<1.0	2.5	3.0	<1.0
9/8/2005	<1.0	<1.0	6.5	7.5	<1.0
9/15/2005	<1.0	<1.0	1.5	1.5	<1.0
10/13/2005	<1.0	<1.0	4.0	5.0	1.0
11/3/2005	<1.0	<1.0	<1.0	<1.0	<1.0
12/9/2005	7.5	<1.0	na	na	<1.0
Minimum	<1.0	<1.0	<1.0	<1.0	<1.0
Maximum	20	22.5	20	20.5	24
Mean	na	na	na	na	na
Median	na	na	na	na	na

If displayed, “na” means datum not available due to analysis error or other reason
If displayed, “<” means datum below detection level

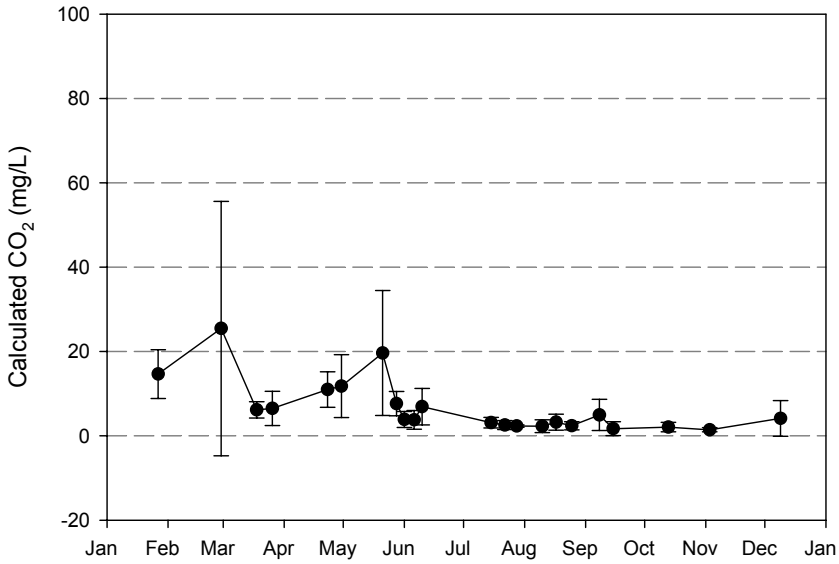

Figure 25: Year 2005 carbon dioxide (CO_2 mg/L) mean and standard deviation for all samples by date.

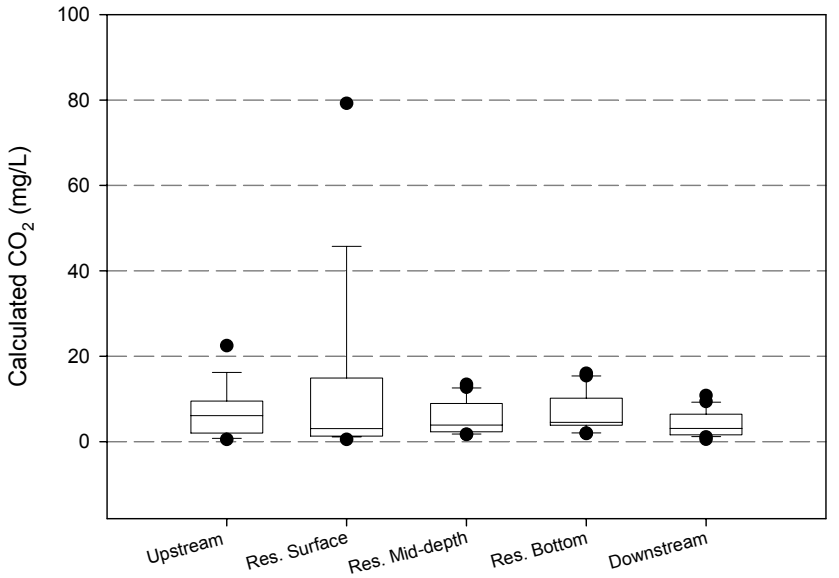

Figure 26: Year 2005 carbon dioxide (CO_2 mg/L) median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by location.

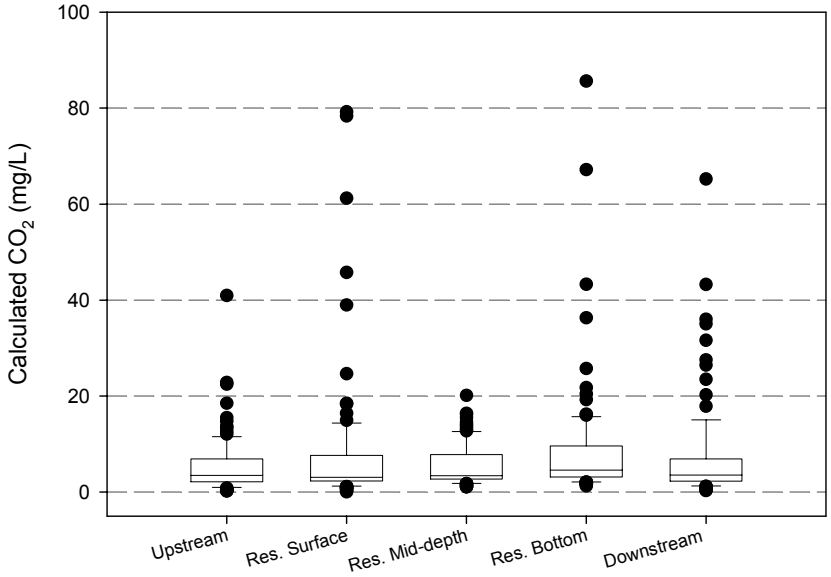

Figure 27: Years 2001-2005 carbon dioxide (CO_2 mg/L) median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by sample location.

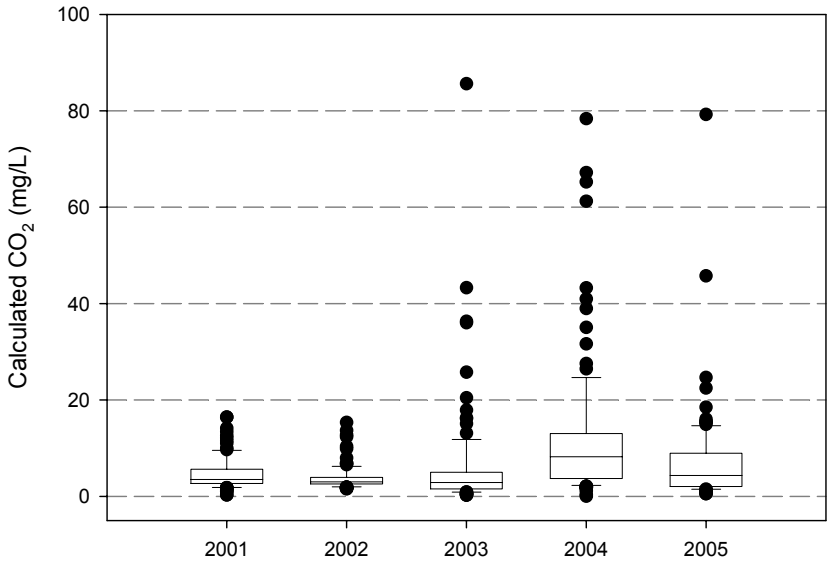

Figure 28: Years 2001-2005 carbon dioxide (CO_2 mg/L) medians, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by year.

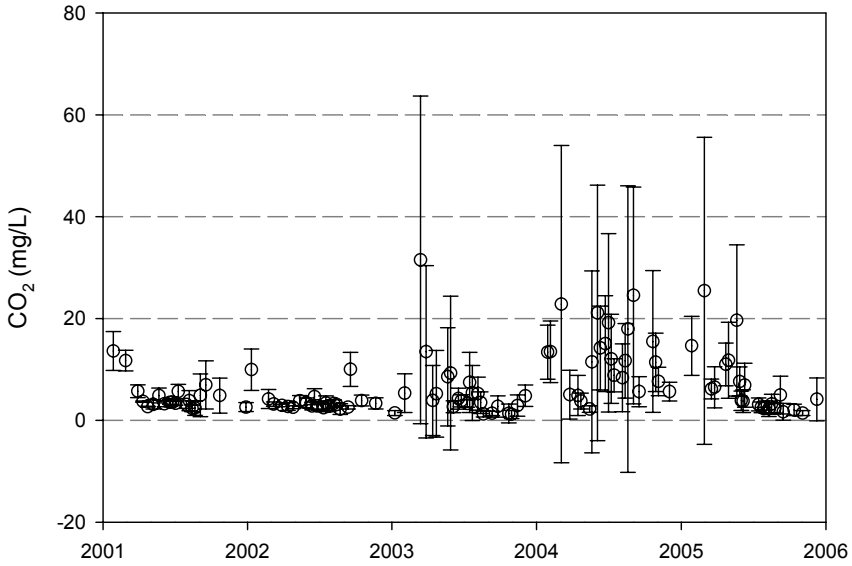

Figure 29: Years 2001-2005 carbon dioxide (CO_2 mg/L) mean and standard deviation for all samples by date.

Table 9: Year 2005 pH raw data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	7.35	7.52	7.58	7.52	7.89
2/28/2005	7.63	7.62	7.53	7.43	7.60
3/18/2005	7.90	7.75	7.90	7.83	8.16
3/26/2005	7.87	7.53	7.97	8.00	8.11
4/23/2005	7.73	7.38	7.69	7.66	7.70
4/30/2005	7.76	7.27	7.67	7.63	7.91
5/21/2005	7.44	6.95	7.50	7.42	7.63
5/28/2005	7.63	7.66	7.92	7.83	7.99
6/1/2005	8.48	8.17	8.06	8.03	7.82
6/6/2005	7.76	8.60	8.24	8.13	8.02
6/10/2005	8.28	7.99	7.96	7.55	7.60
7/15/2005	8.20	8.33	8.34	7.96	8.17
7/22/2005	8.31	8.45	8.18	8.07	8.44
7/28/2005	8.29	8.19	8.24	8.30	8.24
8/10/2005	9.21	8.50	8.43	8.02	8.42
8/17/2005	9.11	8.54	8.02	7.66	8.30
8/25/2005	9.20	8.51	7.91	8.07	8.34
9/8/2005	8.90	8.93	7.45	7.78	8.22
9/15/2005	8.65	8.37	8.18	7.76	8.66
10/13/2005	8.50	8.72	7.98	7.99	8.18
11/3/2005	8.73	8.44	8.28	8.30	8.42
12/9/2005	7.78	8.28	na	na	8.36
Minimum	7.35	6.72	7.45	7.42	7.60
Maximum	9.21	8.93	8.43	8.30	8.66
Mean	7.93	7.60	7.86	7.78	8.00
Median	8.24	8.24	7.97	7.83	8.17

If displayed, “na” means datum not available due to analysis error or other reason
If displayed, “<” means datum below detection level

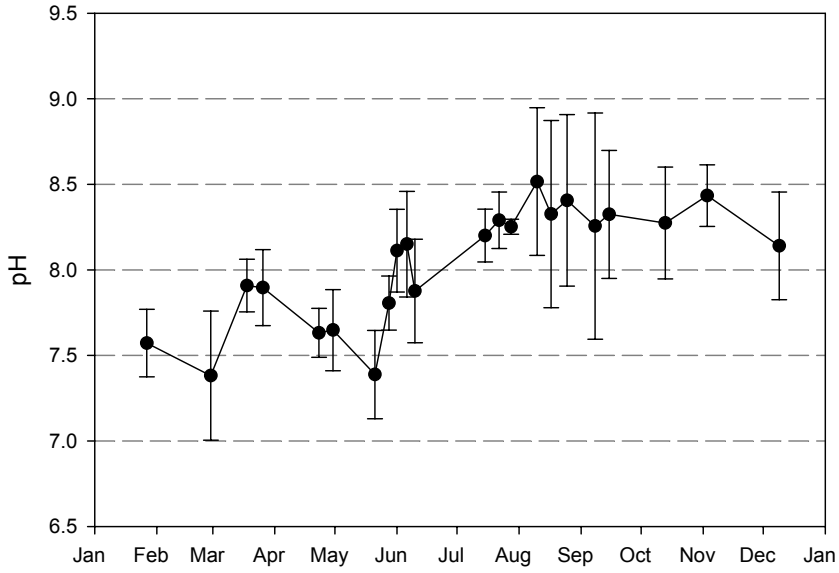

Figure 30: Year 2005 pH mean and standard deviation for all samples by date.

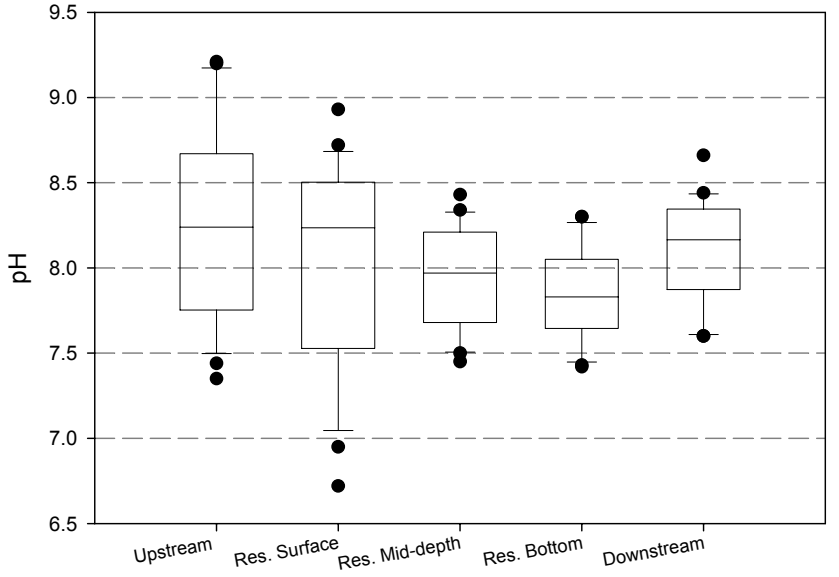

Figure 31: Year 2005 pH median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by location.

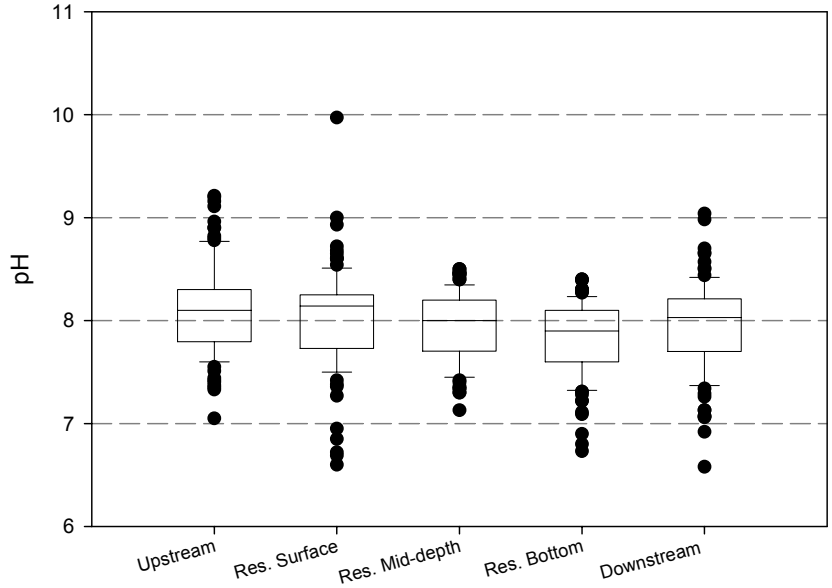

Figure 32: Years 2001-2005 pH median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by location.

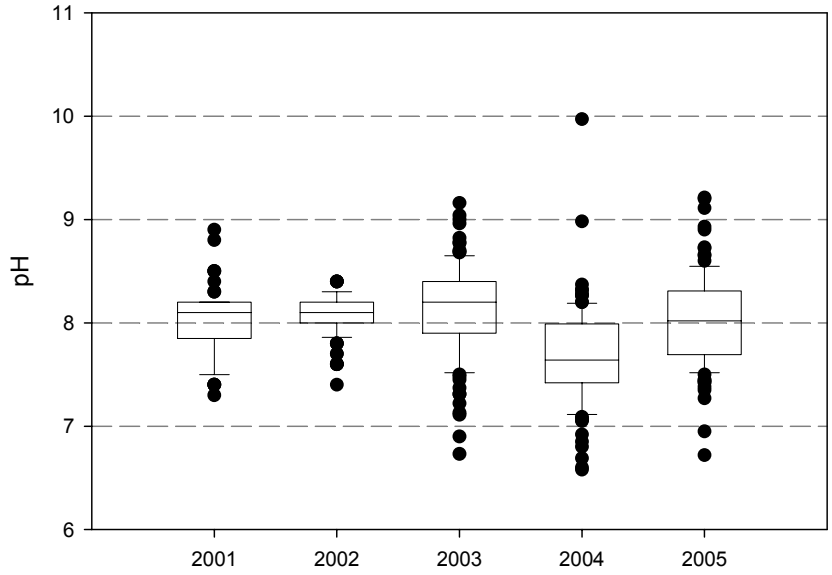

Figure 33: Years 2001-2005 pH median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by year.

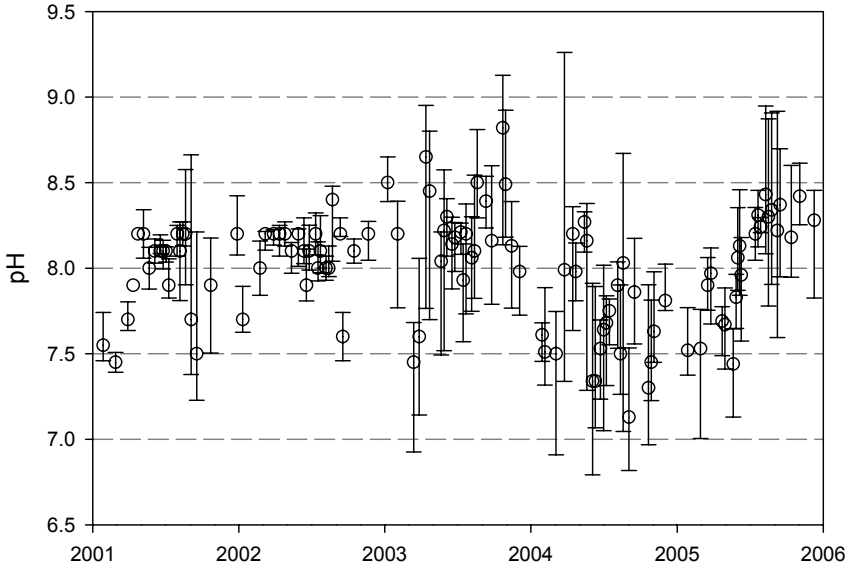

Figure 34: Years 2001-2005 pH mean and standard deviation for all samples by date.

Alkalinity

Significance to Water Quality

The acid-neutralizing capacity (or sum of all titratable bases) of a water is the alkalinity. Alkalinity is an aggregate measurement of several chemical constituents, mainly carbonate, bicarbonate, and hydroxide in surface waters.

Analytical Detail

Phenolphthalein alkalinity was determined potentiometrically by the low-alkalinity method (SM 2320B ¶ 4d).

Sampling and Storage

The samples were collected in clean plastic bottles, filled completely and capped tightly. Excessive agitation and exposure to air was avoided. Samples were chilled immediately and analyzed within eight hours of collection.

Results and Discussion

The raw total alkalinity data for year 2005 (Table 10) shows the lowest median concentration was 218 mg/L as $CaCO_3$ at the reservoir surface location. The greatest single measured concentration was 272 mg/L as $CaCO_3$ at the upstream location on Dec 9th. The year 2005 total alkalinity mean and standard deviation for all samples by date (Figure 35) shows the lowest alkalinity concentrations were in August and September. The year 2005 total alkalinity median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by location is shown in Figure 36 which reveals the upstream location as having the greatest total alkalinity median concentrations. For the 2001-2005 period, the total alkalinity median for all samples by location was also greatest at the upstream location (Figure 37). The years 2001-2005 total alkalinity

median, minima, maxima, lower quartiles, upper quartiles and standard deviation values for all samples by year (Figure 38) show that total alkalinity was greatest in year 2003 and lowest in year 2004. The years 2001-2005 total alkalinity mean and standard deviation for all samples by date is shown in Figure 39.

Table 10: Year 2005 total alkalinity (mg/L as $CaCO_3$) raw data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	252	248	256	266	248
2/28/2005	238	208	204	208	188
3/18/2005	244	240	234	242	238
3/26/2005	226	230	230	220	236
4/23/2005	238	222	222	222	224
4/30/2005	240	230	230	228	226
5/21/2005	214	204	202	202	190
5/28/2005	240	230	230	234	222
6/1/2005	236	230	226	222	224
6/6/2005	206	232	232	246	232
6/10/2005	224	232	208	216	216
7/15/2005	236	248	234	242	224
7/22/2005	224	242	240	244	236
7/28/2005	212	202	204	200	226
8/10/2005	104	214	230	240	216
8/17/2005	108	150	124	124	194
8/25/2005	102	136	138	136	164
9/8/2005	126	126	126	132	132
9/15/2005	124	130	134	130	136
10/13/2005	270	144	150	160	134
11/3/2005	238	186	190	194	148
12/9/2005	272	176	na	na	184
Minimum	102	126	124	124	132
Maximum	272	248	256	266	248
Mean	208	203	202	205	202
Median	231	218	222	220	219

If displayed, “na” means datum not available due to analysis error or other reason
If displayed, “<” means datum below detection level

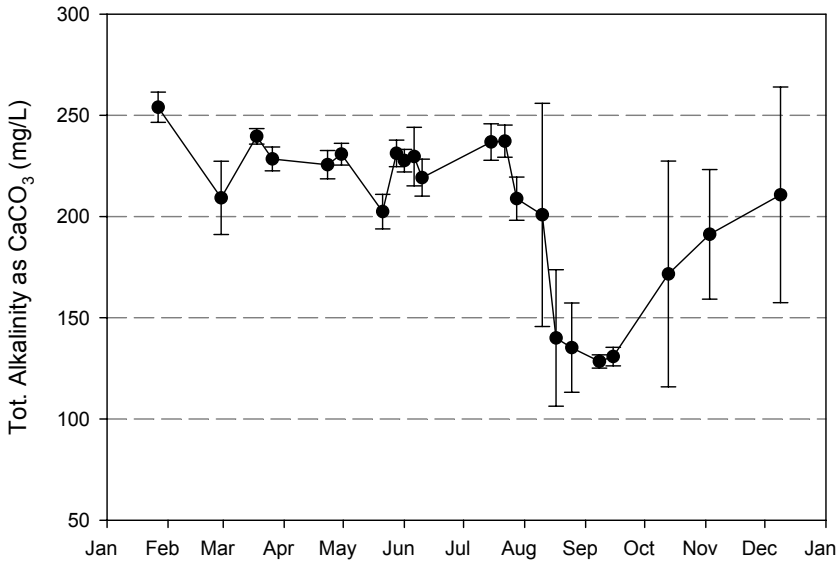

Figure 35: Year 2005 total alkalinity mean and standard deviation for all samples by date.

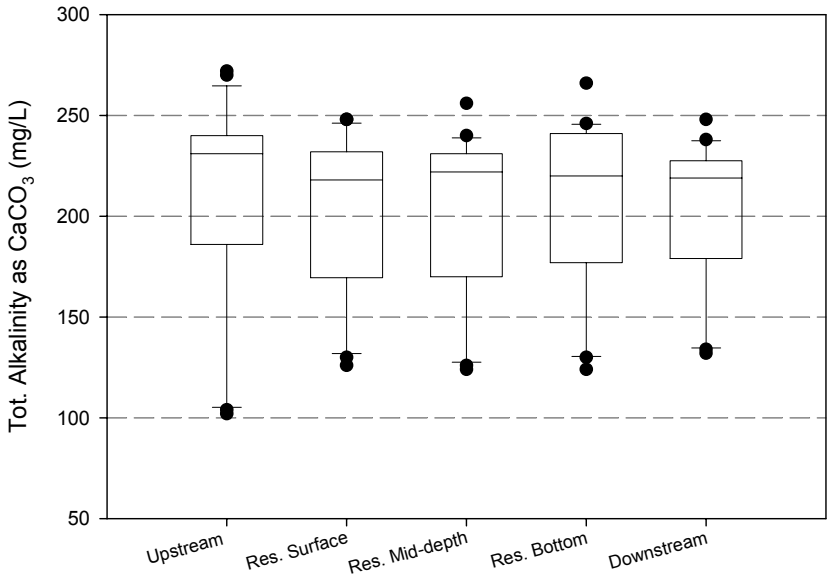

Figure 36: Year 2005 total alkalinity median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by location.

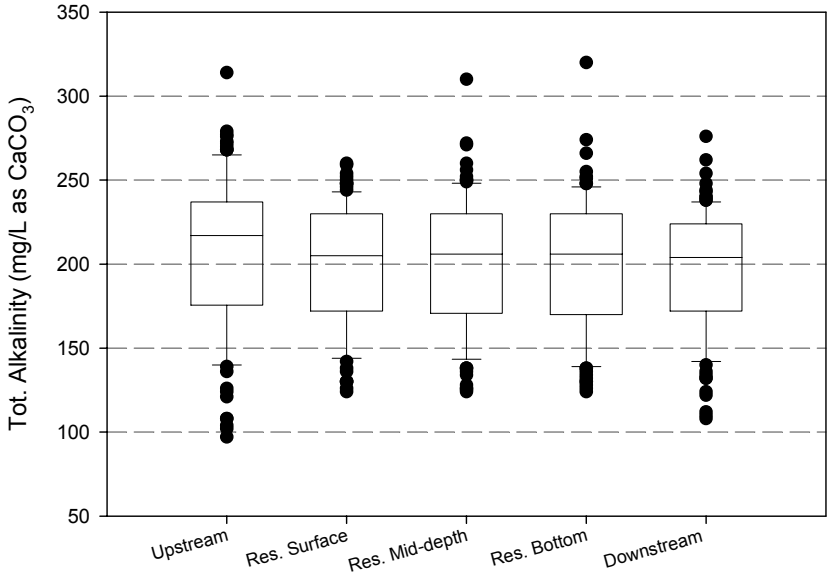

Figure 37: Years 2001-2005 total alkalinity median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

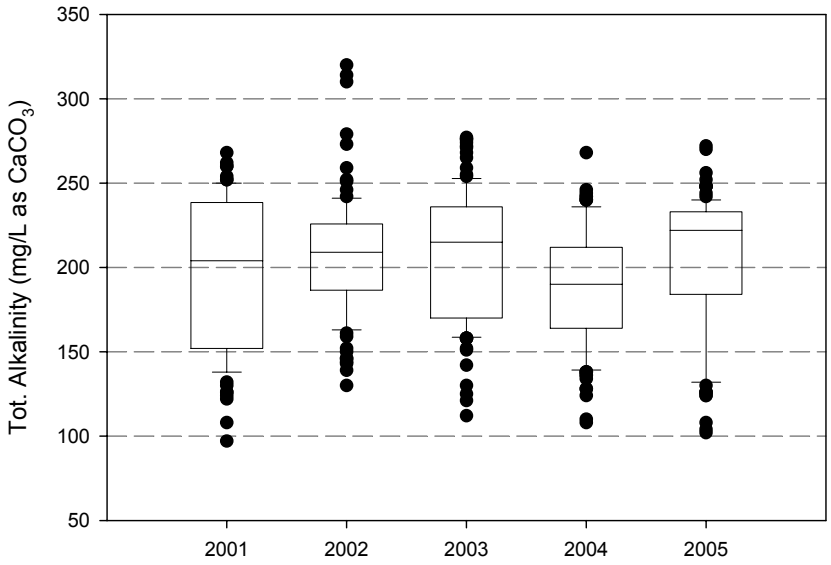

Figure 38: Years 2001-2005 total alkalinity median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by year.

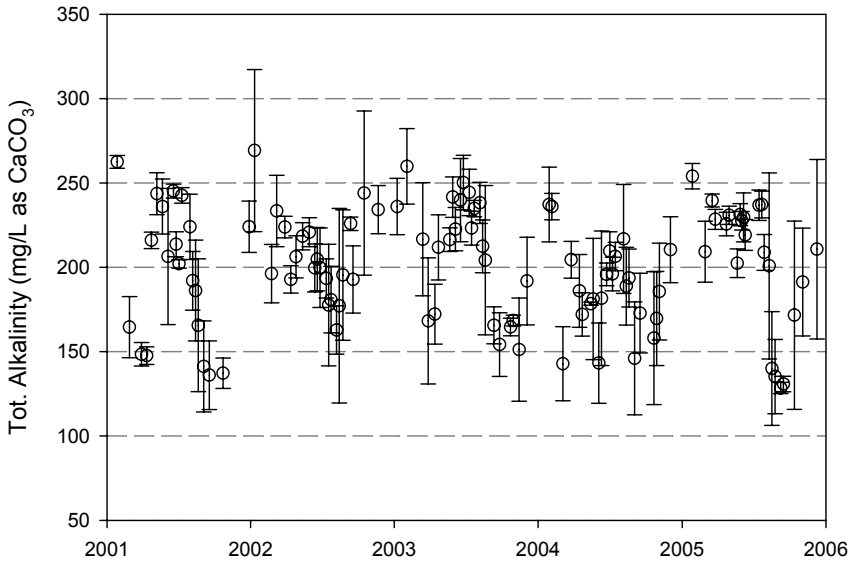

Figure 39: Years 2001-2005 total alkalinity mean and standard deviation for all samples by date.

Hardness

Significance to Water Quality

Total hardness is defined today as the sum of the calcium and magnesium concentrations, expressed in mg/L as $CaCO_3$. Historically, hardness was described as the capacity of water to precipitate soap. Hardness is a factor in Iowa waters, both surface waters and groundwater, which frequently come into contact with geological formations of limestone or dolomite leading to high concentrations of calcium and magnesium. Hard water in our homes causes scaling problems and poor detergent performance and can create a somewhat "chalky" tasting drinking water.

Analytical Detail

Total hardness is analyzed via SM 2340-C which is an ethylenediaminetetraacetic acid (EDTA) titration method utilizing an Eriochrome Black T dye indicator. The analysis is performed conveniently and accurately with the Hach digital titrator system (Hach Method 8213) with a 0.800 M EDTA cartridge and ManVer 2 Hardness Indicator Powder Pillow. The sample is initially buffered to pH 10.1, then the indicator is added forming a red complex. As the last of the complexed calcium and magnesium ions are titrated with EDTA, the indicator color changes to blue.

Calcium hardness is determined via SM 3500-Ca B which is also an EDTA titration method, but a different indicator dye is used to determine the endpoint. Hach Method 8204 is used. Initially, the sample is made alkaline (pH 12-13) with hydroxide solution to precipitate available magnesium. Much of the available calcium is bound by CalVer 2 indicator which forms a pink-red color when added. The EDTA reacts with the free

calcium ions first and then with the complexed calcium ions causing a color change to blue.

Sampling and Storage

The samples are collected in polyethylene containers and may be held up to seven days prior to analysis if refrigerated and acidified with nitric acid (final pH 2.0). Before analysis, the pH should be brought to 7.0 with ammonium hydroxide. For this project, hardness is always determined within eight hours of sample collection with no special preservation techniques beyond refrigeration.

Results and Discussion

The raw data for calcium hardness concentrations for all samples in year 2005 is shown in Table 11. The year 2005 calcium hardness mean and standard deviation values for all samples by date is shown in Figure 40. Calcium hardness concentrations peaked in the summer months in year 2005. Figure 41 shows the median calcium hardness concentration was lowest (178 mg/L as $CaCO_3$) at the reservoir surface location and greatest (207 mg/L as $CaCO_3$) at the upstream location in 2005. Figure 42 shows the years 2001-2005 calcium hardness median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location. The calcium hardness median concentration was greatest at the upstream location for this time period. Figure 43 shows the years 2001-2005 calcium hardness median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year. The greatest median calcium hardness concentration was in 2005 and the lowest was in 2004 for that time period. Figure 44 shows the mean and standard deviation of calcium hardness for all samples collected form 2001-2005.

Table 11: Year 2005 calcium hardness (mg/L as $CaCO_3$) raw data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	220	200	210	216	210
2/28/2005	200	164	168	166	150
3/18/2005	220	212	202	206	200
3/26/2005	114	84	104	94	96
4/23/2005	218	186	112	94	62
4/30/2005	238	236	218	214	210
5/21/2005	268	208	242	226	196
5/28/2005	216	210	224	228	224
6/1/2005	204	214	234	214	208
6/6/2005	246	252	250	244	256
6/10/2005	258	244	242	242	240
7/15/2005	210	212	218	216	204
7/22/2005	190	210	212	204	208
7/28/2005	160	170	178	184	200
8/10/2005	72	170	190	200	180
8/17/2005	64	114	98	100	172
8/25/2005	54	106	104	120	134
9/8/2005	72	94	94	94	110
9/15/2005	98	100	100	100	112
10/13/2005	260	96	98	120	102
11/3/2005	186	140	150	144	116
12/9/2005	220	122	na	na	126
Minimum	54	84	94	94	62
Maximum	268	252	250	244	256
Mean	181	170	174	173	169
Median	207	178	190	200	188

If displayed, “na” means datum not available due to analysis error or other reason
If displayed, “<” means datum below detection level

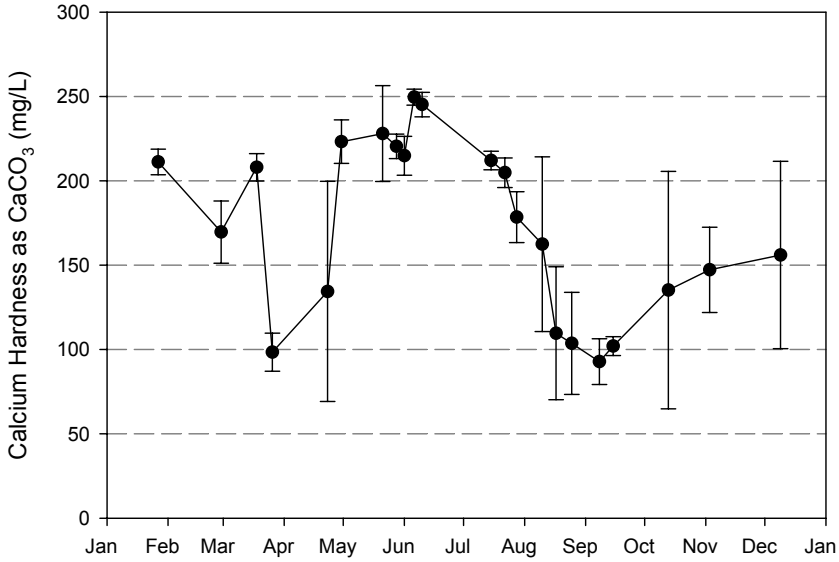

Figure 40: Year 2005 calcium hardness mean and standard deviation for all samples by date.

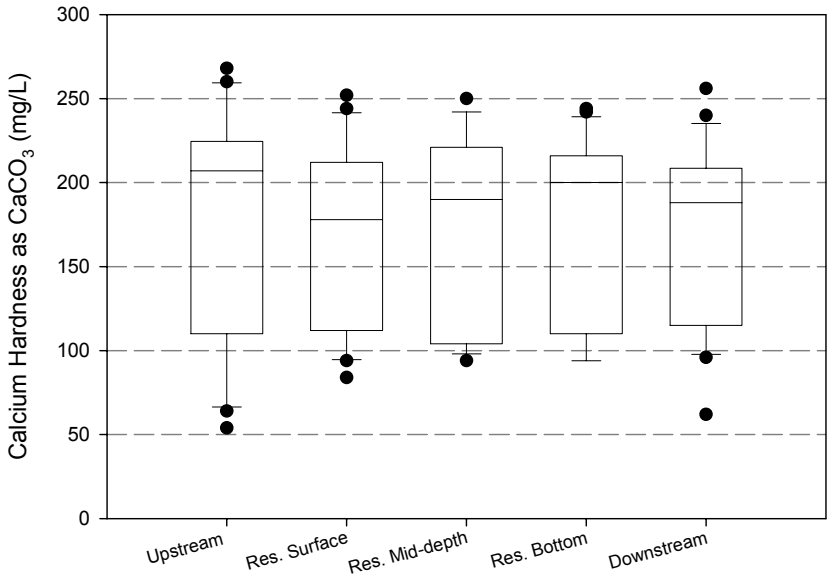

Figure 41: Year 2005 calcium hardness median, minima, maxima, lower quartiles, upper quartiles and standard deviation for all samples by location.

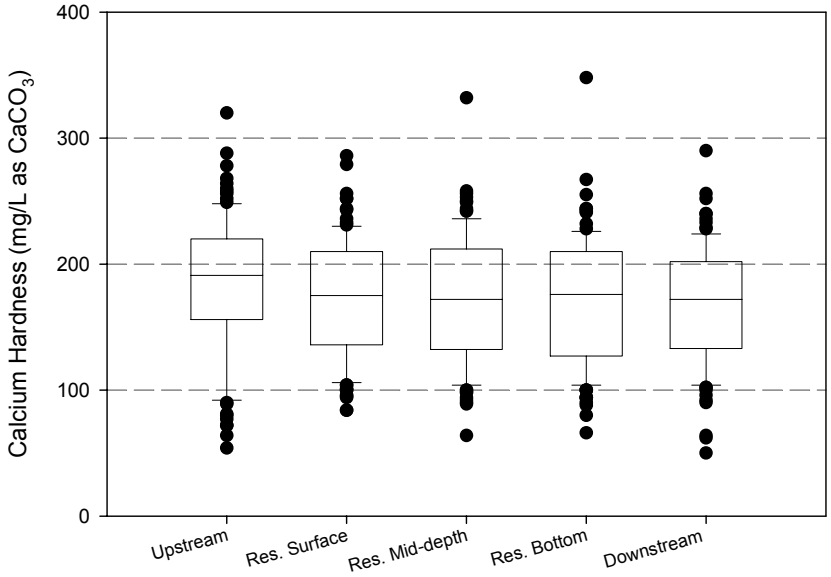

Figure 42: Years 2001-2005 calcium hardness median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

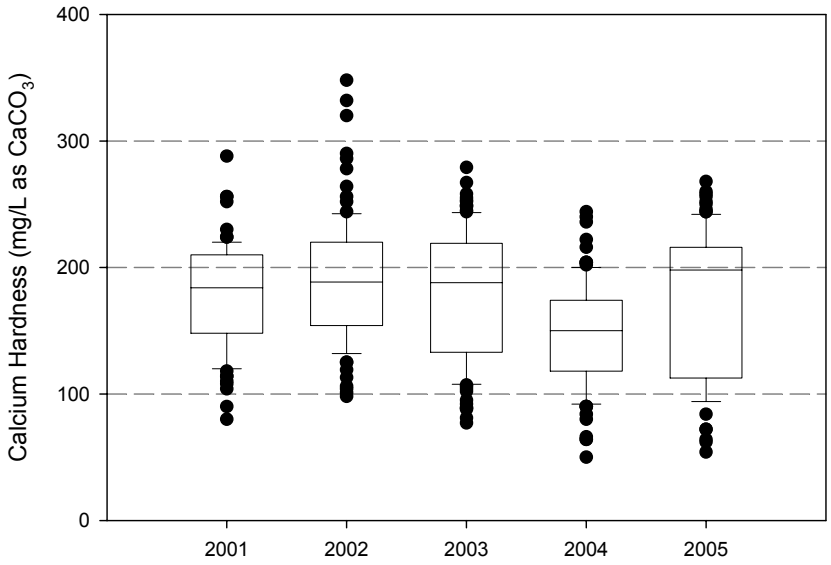

Figure 43: Years 2001-2005 calcium hardness median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year.

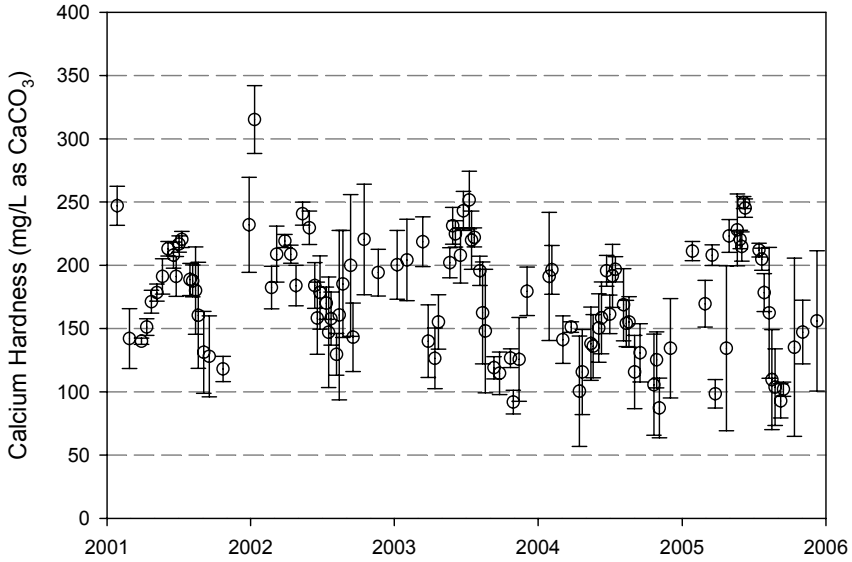

Figure 44: Years 2001-2005 calcium hardness mean and standard deviation for all samples by date.

The year 2005 total hardness concentration raw data is shown in Table 12. The yearly mean values by location were 277 mg/L upstream, 264 mg/L reservoir surface, 265 mg/L reservoir mid-depth, 269 mg/L reservoir bottom, and 265 mg/L downstream. This compares to 265 mg/L upstream, 240 mg/L reservoir surface, 236 mg/L reservoir mid-depth, 230 mg/L reservoir bottom, and 234 mg/L downstream in 2004. Total hardness concentration mean and standard deviation over time in 2005 is shown in Figure 45. A plot of the year 2005 total hardness medians, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location (Figure 46) shows the greatest median value at the upstream location and lowest median value at the reservoir mid-depth location. Figure 47 shows the years 2001-2005 total hardness median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location. The total hardness median value was greatest at the upstream location and lowest at the downstream location. Figure 48 shows the years 2001-2005 total hardness median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year. The lowest median total hardness concentration during this time period occurred in the year 2004. The years 2001-2005 total hardness mean and standard deviation for all samples by date is shown in Figure 49.

Table 12: Year 2005 total hardness (mg/L as $CaCO_3$) raw data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
01/27/05	320	290	322	322	300
02/28/05	292	246	246	256	246
03/18/05	324	308	300	310	304
03/26/05	282	260	266	272	270
04/23/05	330	324	272	316	242
04/30/05	324	306	302	308	300
05/21/05	284	252	264	256	250
05/28/05	300	296	286	306	296
06/01/05	306	294	306	292	288
06/06/05	340	350	366	366	376
06/10/05	358	344	342	340	350
07/15/05	304	312	306	302	290
07/22/05	290	312	308	300	308
07/28/05	262	258	272	258	286
08/10/05	176	296	280	300	280
08/17/05	144	200	176	176	250
08/25/05	136	184	170	170	220
09/08/05	170	160	174	176	180
09/15/05	162	176	172	172	184
10/13/05	350	180	190	204	184
11/03/05	300	236	240	246	196
12/09/05	340	228	na	na	230
Minimum	136	160	170	170	180
Maximum	358	350	366	366	376
Mean	277	264	265	269	265
Median	300	275	272	292	275

If displayed, “na” means datum not available due to analysis error or other reason
If displayed, “<” means datum below detection level

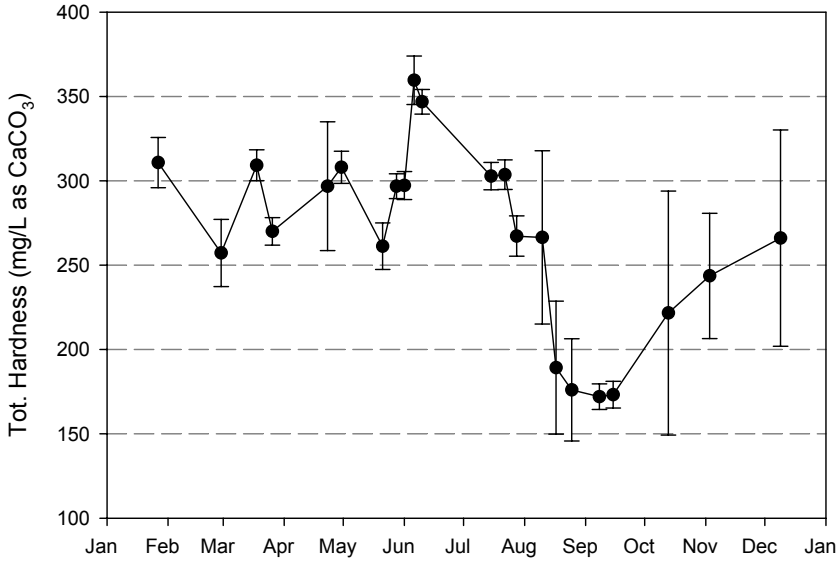

Figure 45: Year 2005 total hardness mean and standard deviation for all samples by date.

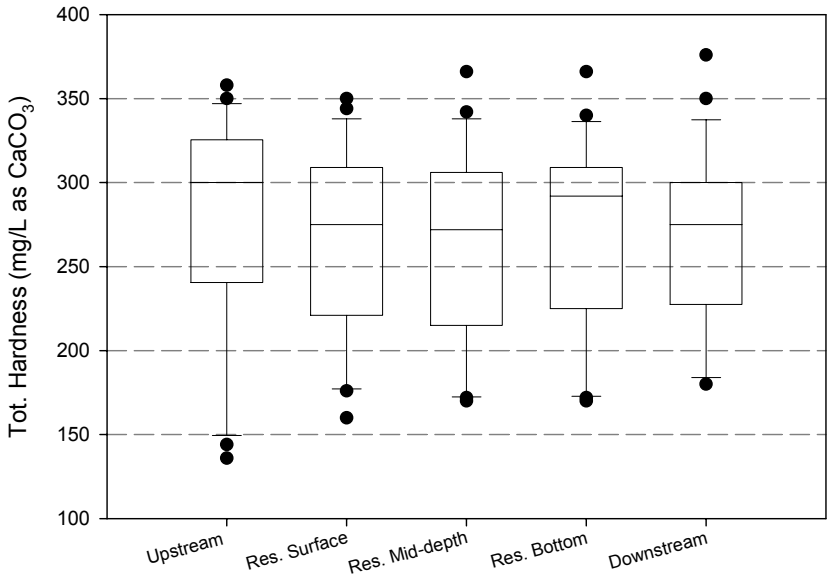

Figure 46: Year 2005 total hardness medians, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

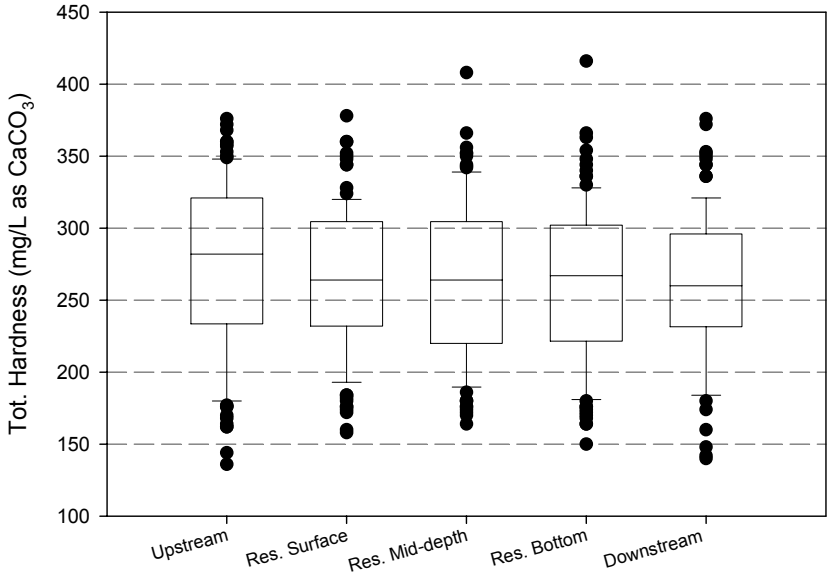

Figure 47: Years 2001-2005 total hardness median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

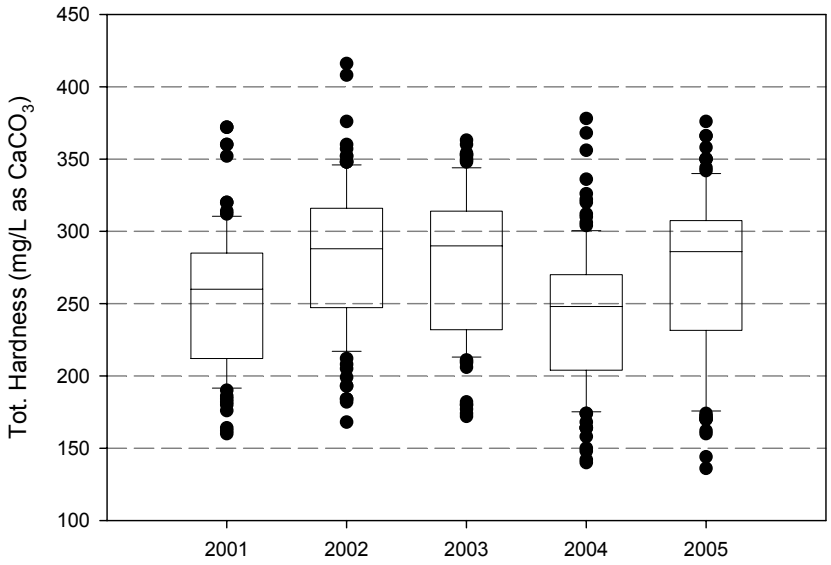

Figure 48: Years 2001-2005 total hardness median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year.

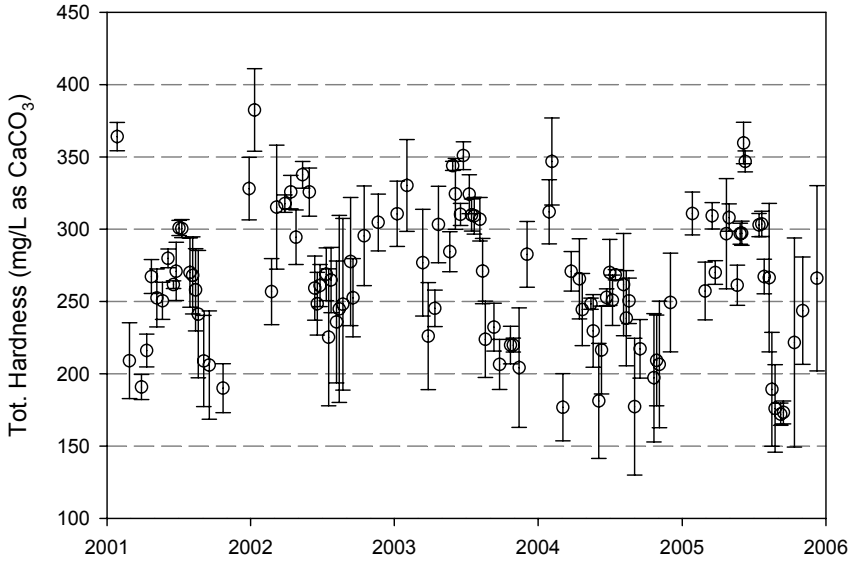

Figure 49: Years 2001-2005 total hardness mean and standard deviation for all samples by date.

Total Organic Carbon

Significance to Water Quality

The organic carbon in water and wastewater is composed of various organic compounds in several oxidation states. Many of the carbon compounds can be oxidized by biological or chemical processes. Biological oxygen demand (BOD), assimilable organic carbon, and chemical oxygen demand (COD) are useful techniques to characterize various organic carbon fractions, but total organic carbon is simple and convenient to measure and is many times done in lieu of other tests.

Results and Discussion

Table 13 shows the raw total organic carbon (TOC) data for the year 2005 for all locations. The mean TOC concentrations were 8.2 mg/L upstream, 4.2 mg/L reservoir surface, 4.1 mg/L reservoir mid-depth, 4.3 mg/L reservoir bottom, and 3.8 mg/L downstream. Figure 50 shows the year 2005 total organic carbon concentration mean and standard deviation for all sample locations by date. The TOC concentrations vary somewhat by location (Figure 51) with the greatest median concentration at the upstream location and the lowest median concentration at the downstream location. The greatest median TOC concentration by location for all samples analyzed in years 2001-2005 was at the upstream location (Figure 52) and the greatest median value by year for all samples collected in years 2001-2005 was in 2004 (Figure 53). The years 2001-2005 total organic carbon means and standard deviation values for all samples by date are shown in Figure 54.

Table 13: Year 2005 total organic carbon (mg/L) raw data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	1.3	3.3	4.0	2.6	2.4
2/28/2005	0.4	0.9	1.0	0.8	4.1
3/18/2005	2.4	1.3	2.9	1.8	7.4
3/26/2005	2.1	3.3	4.1	7.3	1.8
4/23/2005	8.0	4.9	3.7	3.4	2.4
4/30/2005	7.1	5.6	3.4	5.9	3.2
5/21/2005	5.2	4.4	5.1	3.8	2.9
5/28/2005	14.3	3.5	3.1	3.2	3.5
6/1/2005	5.7	3.5	3.3	2.6	2.7
6/6/2005	12.7	2.5	2.3	5.1	3.8
6/10/2005	6.7	4.6	4.0	5.0	4.2
7/15/2005	12.7	2.4	7.8	4.7	2.5
7/22/2005	4.5	2.6	3.2	4.8	3.6
7/28/2005	4.6	6.3	2.2	1.8	1.2
8/10/2005	13.6	2.9	4.3	3.9	1.8
8/17/2005	11.4	4.0	5.2	5.8	4.8
8/25/2005	15.4	4.1	4.0	4.5	4.4
9/8/2005	18.5	4.8	4.3	4.7	5.4
9/15/2005	17.1	6.4	6.9	6.1	4.9
10/13/2005	5.1	5.5	6.4	9.7	5.3
11/3/2005	4.1	6.3	4.0	3.3	3.1
12/9/2005	6.8	8.2	na	na	7.9
Minimum	0.4	0.9	1.0	0.8	1.2
Maximum	18.5	8.2	7.8	9.7	7.9
Mean	8.2	4.2	4.1	4.3	3.8
Median	6.8	4.1	4.0	4.5	3.6

If displayed, “na” means datum not available due to analysis error or other reason
If displayed, “<” means datum below detection level

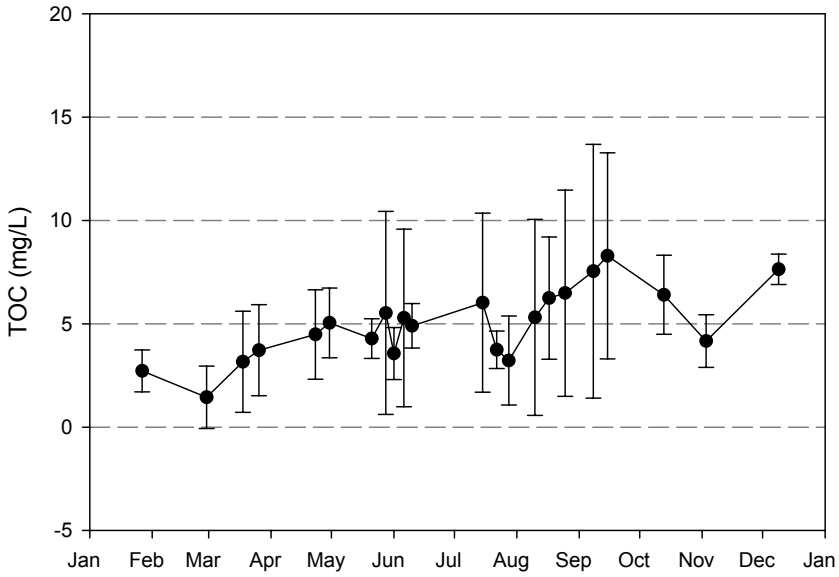

Figure 50: Year 2005 total organic carbon mean and standard deviation for all samples by date.

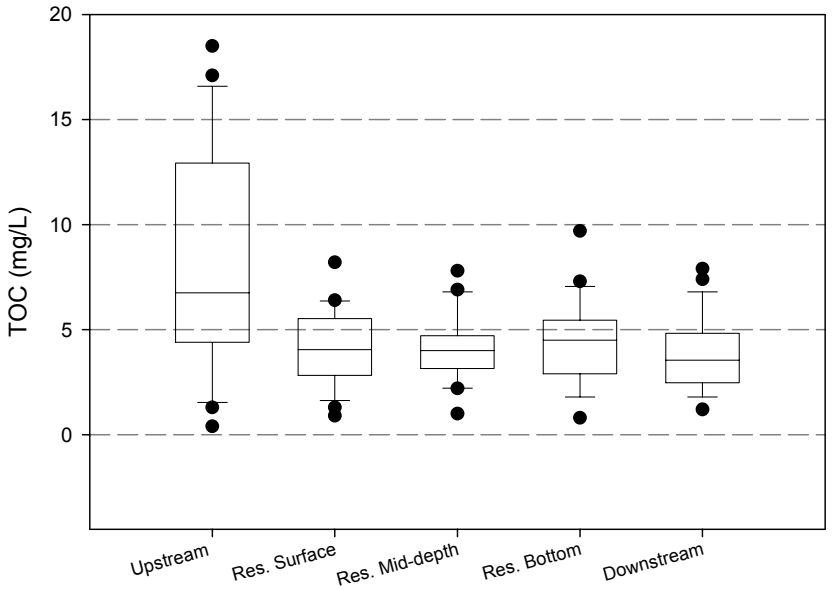

Figure 51: Year 2003 total organic carbon (TOC mg/L) median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

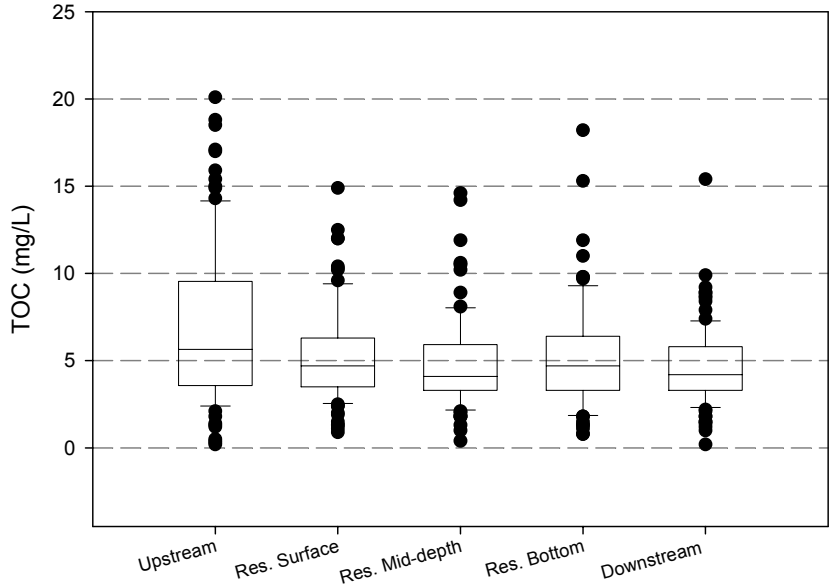

Figure 52: Years 2001-2005 total organic carbon median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

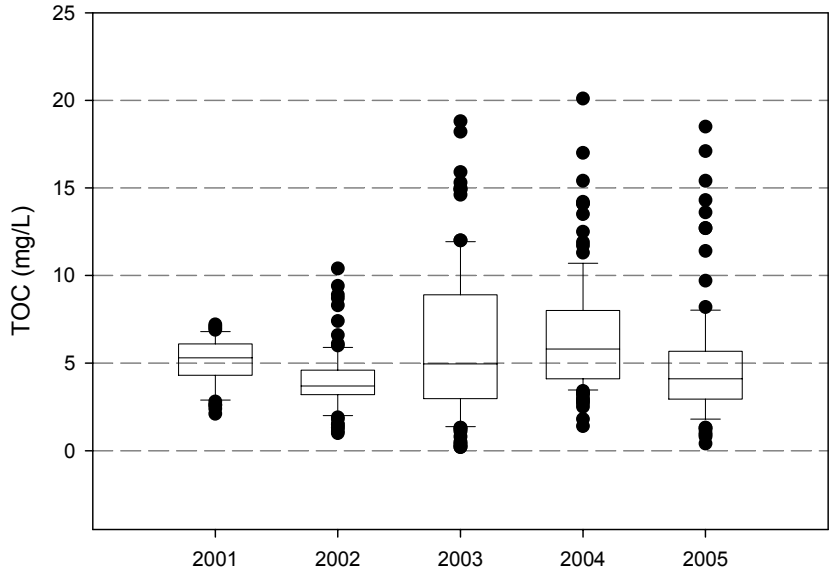

Figure 53: Years 2001-2005 total organic carbon median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year.

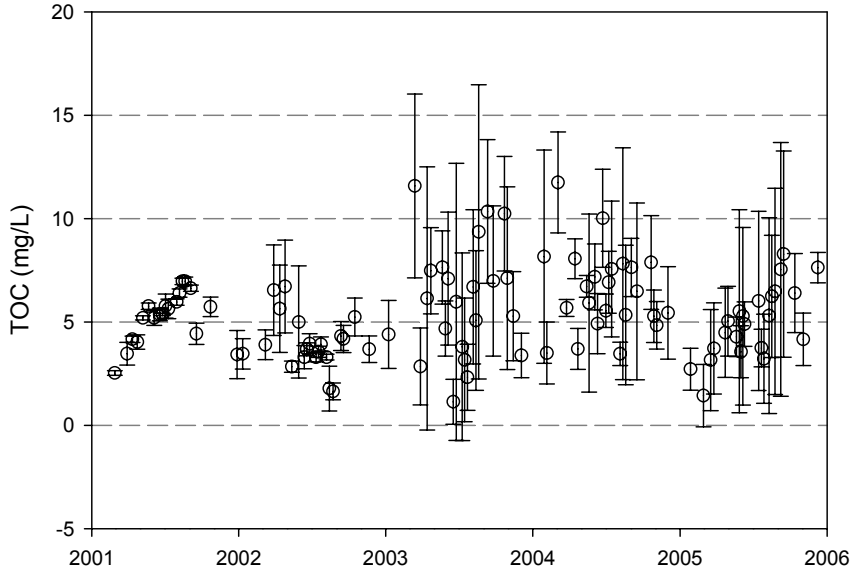

Figure 54: Years 2001-2005 total organic carbon means and standard deviation for all samples by date.

Nitrogen

Significance to Water Quality

For surface waters the nitrogen forms of greatest interest are nitrate, nitrite, ammonia and organic nitrogen. The forms of nitrogen, as well as molecular nitrogen (N_2), are components of the natural nitrogen cycle and are biochemically interconvertible. Organic nitrogen is defined as organically bound nitrogen in the trinegative oxidation state and, therefore, does not include all organic nitrogen compounds. Typically, organic nitrogen and ammonia are determined together using the "Kjeldahl nitrogen" test procedure. Proteins, peptides, nucleic acids and urea are a few components of organic nitrogen. Organic nitrogen concentrations vary from sub-milligram per liter values in oligotrophic lakes and streams to more than 20 mg/L in wastewater.

Nitrate typically occurs at trace levels in surface water, but due to heavy agricultural activities, the levels are much higher in most Iowa surface waters. A limit of 10 mg/L has been placed on finished drinking water supplies to avoid methemoglobinemia in infants. Nitrate is an essential nutrient for many photosynthetic autotrophs and can be the limiting nutrient in some waters.

Nitrite is typically at very low concentrations in surface waters as it is readily converted to nitrate or ammonia depending on the water chemistry. Nitrite is the actual etiologic nitrogen species responsible for methemoglobinemia and is therefore regulated at 1 mg/L in drinking water.

Ammonia is naturally present in most surface waters as a result of deamination of organic nitrogen compounds and by urea hydrolysis. Ammonia is particularly toxic to fish and

other aquatic life in the unionized form (NH_3) and when oxidized to nitrite and nitrate, an oxygen demand is exerted.

Analytical Detail

Ammonia nitrogen was measured using a modified Nessler Method. This method is a classic, but it is no longer advocated in Standard Methods due to the use of mercury-containing reagents. We continue to seek solid alternatives to this measurement technique. Nitrite was measured colorimetrically and nitrate was measured via ion chromatography.

Results and Discussion

Ammonia Nitrogen

The raw ammonia nitrogen data for year 2005 is shown in Table 14. Figure 55 shows ammonia nitrogen concentration mean and standard deviation for all samples by date. The maximum, single sampling event mean concentration was measured in Aug 2005 and the minimum mean concentration was in Nov 2005. Figure 56 shows the year 2005 ammonia nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location. Median concentrations were 0.1 mg/L-N at the upstream location, 0.2 mg/L-N at the reservoir surface, reservoir mid-depth and downstream locations, and 0.3 mg/L-N at the reservoir bottom location. Figure 57 shows the years 2001-2005 ammonia nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location and reveals that ammonia nitrogen median values have remained near 0.25 mg/L-N for all locations, with the greatest value occurring at the reservoir bottom. Figure 58 shows the years 2001-2005 ammonia nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year. The highest median value was in year 2002 at 0.4 mg/L-N. Figure 59 shows the years 2001-2005 ammonia nitrogen mean and standard deviation of all samples by date.

Table 14: Year 2005 ammonia nitrogen (mg/L-N) raw data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	0.18	0.1	<0.1	0.1	0.2
2/28/2005	0.2	0.5	0.4	0.4	0.5
3/18/2005	<0.1	0.2	0.1	0.1	0.1
3/26/2005	0.1	0.1	0.1	0.1	0.1
4/23/2005	0.1	0.3	0.3	0.3	0.3
4/30/2005	0.1	0.2	0.2	0.2	0.2
5/21/2005	0.2	0.2	0.2	0.2	0.2
5/28/2005	0.1	0.2	0.2	0.1	0.1
6/1/2005	0.1	0.2	0.2	0.1	0.2
6/6/2005	0.2	0.2	0.2	0.2	0.2
6/10/2005	0.1	0.3	0.2	0.3	0.2
7/15/2005	0.3	0.1	0.2	0.3	0.2
7/22/2005	<0.1	0.1	<1	0.1	<0.1
7/28/2005	0.1	0.5	0.5	0.5	0.2
8/10/2005	0.1	0.2	0.4	0.5	0.2
8/17/2005	0.1	0.2	0.7	0.9	0.2
8/25/2005	0.4	0.4	0.4	0.4	0.2
9/8/2005	0.1	0.1	0.7	0.8	0.1
9/15/2005	0.1	0.4	0.5	0.4	0.1
10/13/2005	0.1	0.1	0.5	0.6	0.1
11/3/2005	0.1	0.1	0.1	0.1	0.1
12/9/2005	0.2	0.2	na	na	0.3
Minimum	<0.1	0.1	<0.1	0.1	<0.1
Maximum	0.4	0.5	0.7	0.9	0.5
Mean	0.1	0.2	0.3	0.3	0.2
Median	0.1	0.2	0.2	0.3	0.2

If displayed, “na” means datum not available due to analysis error or other reason
If displayed, “<” means datum below detection level

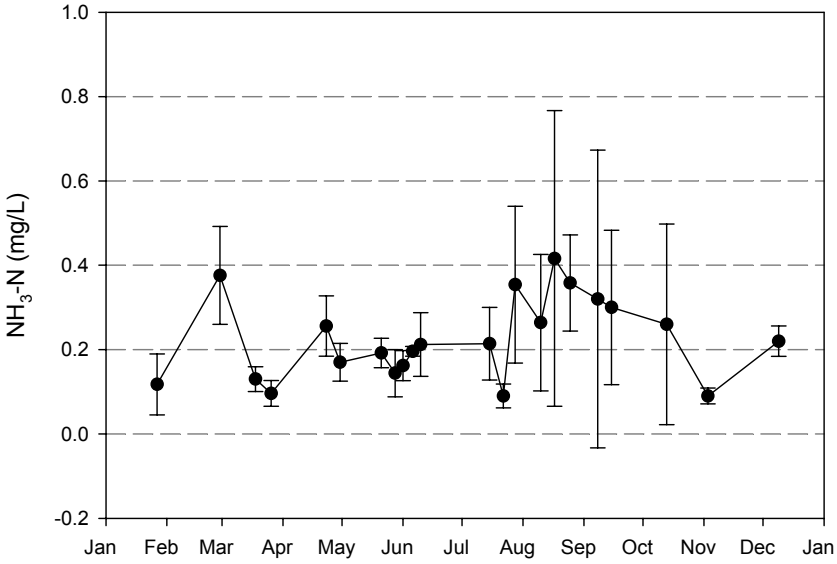

Figure 55: Year 2005 ammonia nitrogen mean and standard deviation for all samples by date.

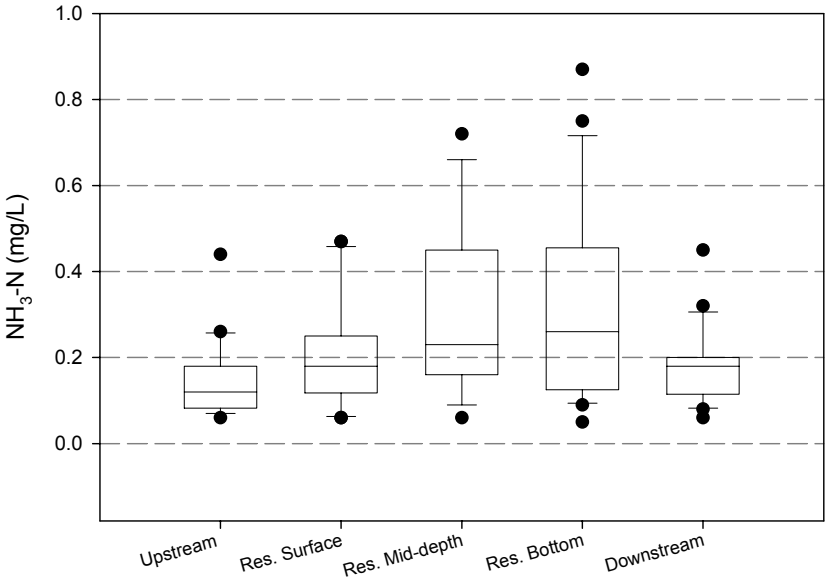

Figure 56: Year 2005 ammonia nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

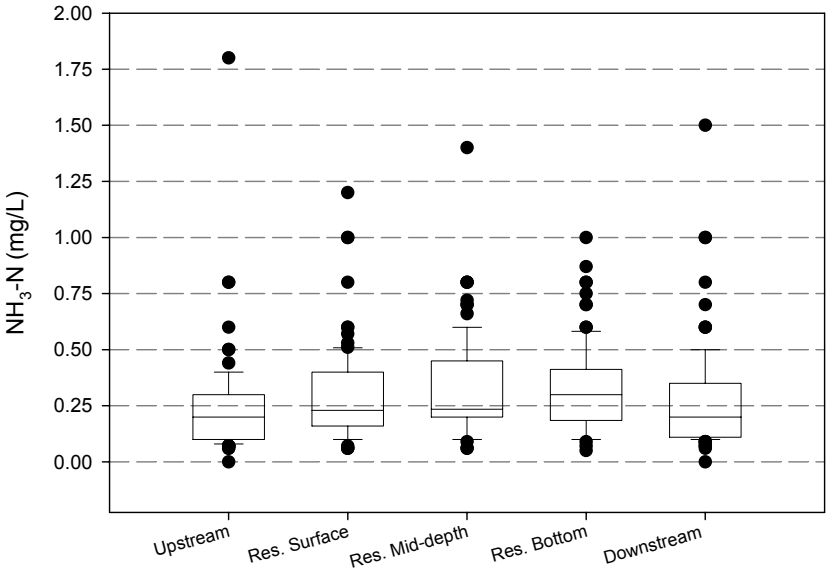

Figure 57: Years 2001-2005 ammonia nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

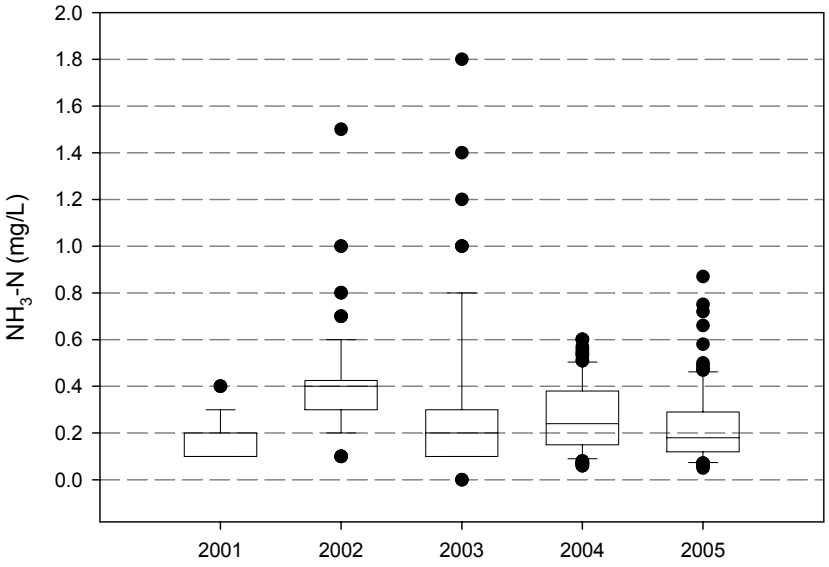

Figure 58: Years 2001-2005 ammonia nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year.

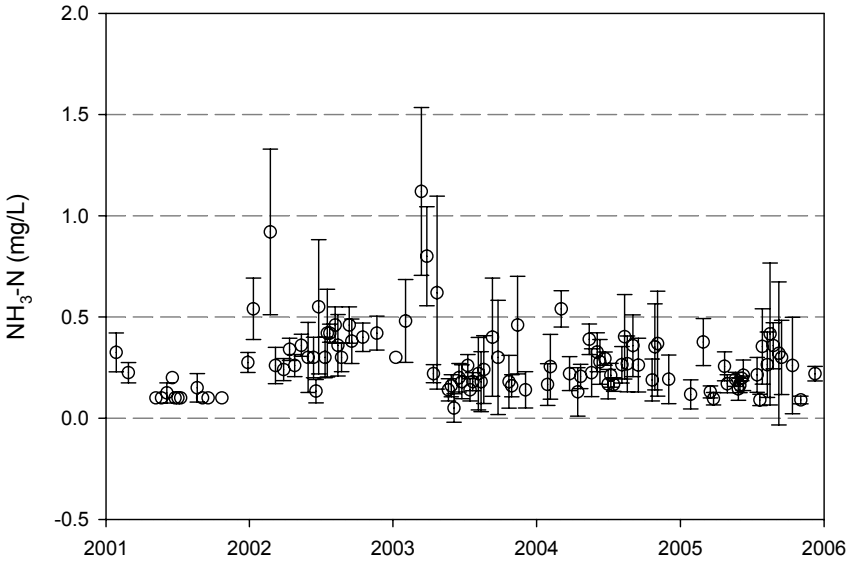

Figure 59: Years 2001-2005 ammonia nitrogen mean and standard deviation of all samples by date.

Nitrite Nitrogen

The nitrite raw data for 2005 is given in Table 15. Figure 60 shows the year 2005 nitrite nitrogen mean and standard deviation for all samples by date. Figure 61 shows the year 2005 nitrite nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations of all samples by location. The median nitrite value for year 2005 was lowest at the upstream location (0.01 mg/L-N) and greatest at the reservoir mid-depth and downstream locations (0.05 mg/L-N). Figure 62 shows the years 2001-2005 nitrite nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location. The median nitrite values over this time span shows that the upstream location regularly has a lower nitrite concentration when compared to the other locations. Figure 63 shows the years 2001-2005 nitrite nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year and Figure 64 shows the nitrite concentration mean and standard deviation with time for all samples collected from 2002-2005.

Table 15: Year 2005 nitrite nitrogen (mg/L-N) raw data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	0.02	0.02	0.02	0.01	0.02
2/28/2005	0.01	0.03	0.03	0.03	0.04
3/18/2005	0.01	0.02	0.02	0.02	0.03
3/26/2005	0.01	0.02	0.02	0.02	0.02
4/23/2005	0.02	0.04	0.05	0.04	0.06
4/30/2005	0.01	0.03	0.03	0.03	0.03
5/21/2005	0.08	0.10	0.09	0.09	0.08
5/28/2005	0.02	0.06	0.06	0.06	0.07
6/1/2005	0.01	0.04	0.05	0.04	0.05
6/6/2005	0.03	0.05	0.05	0.03	0.05
6/10/2005	0.01	0.06	0.06	0.07	0.05
7/15/2005	0.02	0.06	0.06	0.09	0.05
7/22/2005	0.01	0.06	0.05	0.08	0.04
7/28/2005	0.15	0.23	0.24	0.23	0.24
8/10/2005	0.03	0.06	0.09	0.09	0.07
8/17/2005	0.01	0.07	0.06	0.05	0.06
8/25/2005	0.01	0.03	0.02	0.01	0.06
9/8/2005	<0.01	0.01	0.02	0.02	0.22
9/15/2005	<0.01	0.03	0.03	0.03	0.01
10/13/2005	0.01	0.01	0.01	0.01	0.01
11/3/2005	0.03	0.11	0.09	0.09	0.01
12/9/2005	0.01	0.01	na	na	0.03
Minimum	<0.01	0.01	0.01	0.01	0.01
Maximum	0.15	0.23	0.24	0.23	0.24
Mean	0.03	0.05	0.05	0.05	0.06
Median	0.01	0.04	0.05	0.04	0.05

If displayed, “na” means datum not available due to analysis error or other reason
If displayed, “<” means datum below detection level

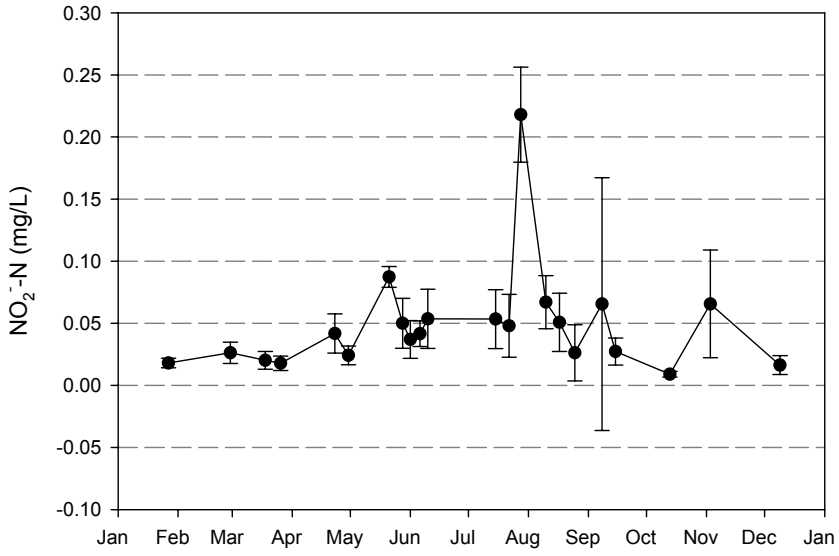

Figure 60: Year 2005 nitrite nitrogen mean and standard deviation for all samples by date.

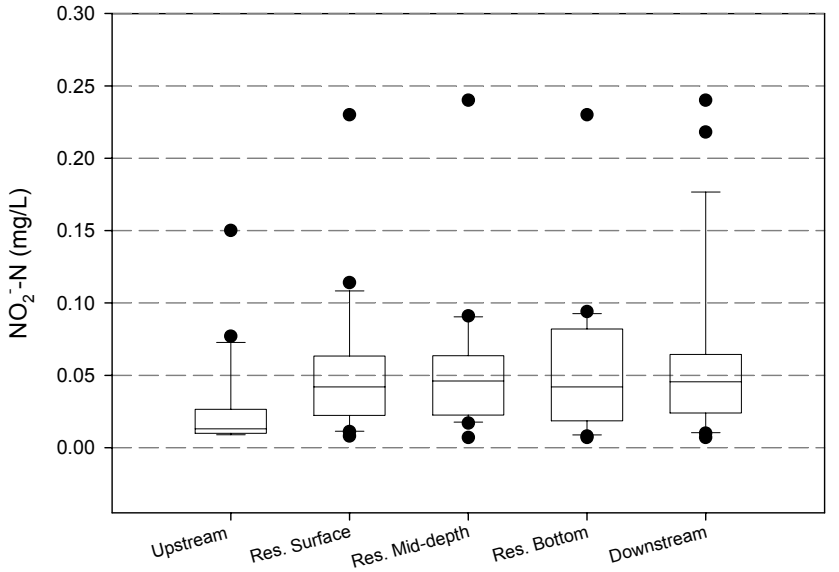

Figure 61: Year 2005 nitrite nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations of all samples by location.

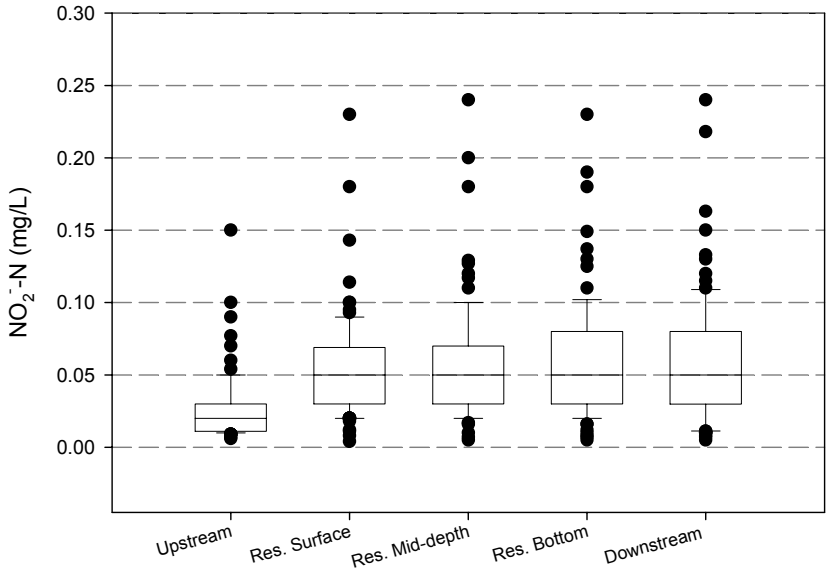

Figure 62: Years 2001-2005 nitrite nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

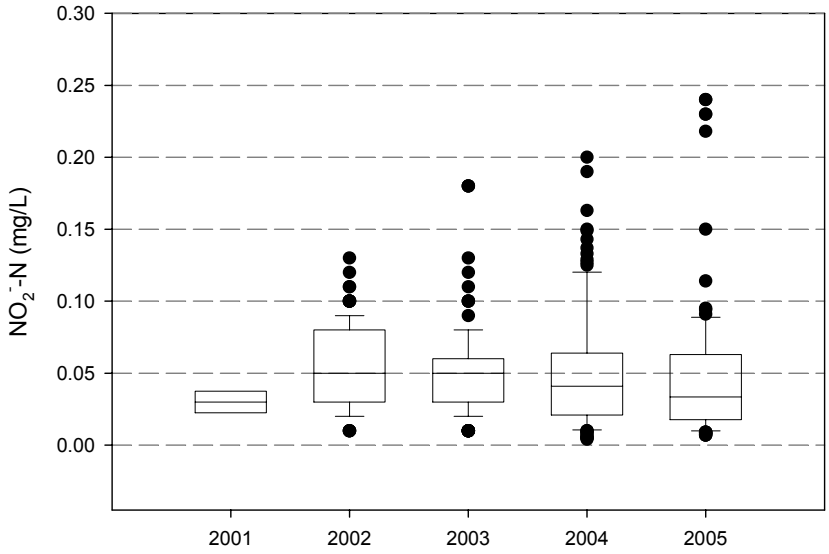

Figure 63: Years 2001-2005 nitrite nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year.

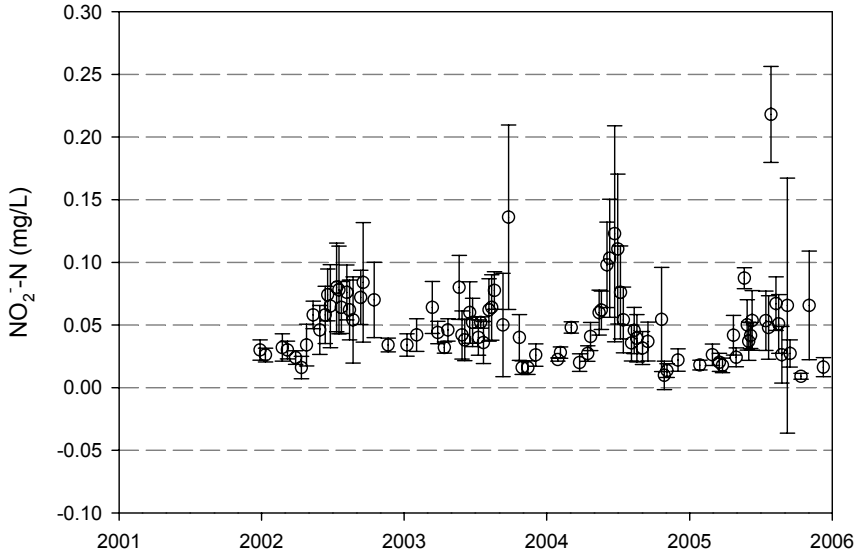

Figure 64: Years 2001-2005 nitrite nitrogen mean and standard deviation for all samples by date.

Nitrate Nitrogen

The nitrate nitrogen raw data for 2005 is given in Table 16. The drinking water maximum contaminant limit (MCL) of 10 mg/L-N nitrate was exceeded at several sampling locations during the spring and summer of 2005. On May 21st, May 28th, June 1st and June 10th all locations exceeded the MCL. On June 6th, all locations with the exception of the upstream site exceeded the MCL and on Jul 22nd the upstream location was in exceedance. Figure 65 shows the year 2005 nitrate nitrogen mean and standard deviation for all samples by date. It is clear that nitrate concentrations peak in the months after spring planting and then subside in the fall and winter. Figure 66 shows the year 2005 nitrate nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location. The median nitrate concentration was lowest at the upstream location (5.5 mg/L-N), and greatest at the downstream location (6.4 mg/L-N). Figure 67 shows the years 2001-2005 nitrate nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location. The historical pattern of gradual reduction in nitrate concentration as waters move from the upstream location, through the reservoir, to the downstream location is evident. Figure 68 shows the years 2001-2005 nitrate nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year. The greatest nitrate concentration median during that period was in year 2001 and the lowest median concentration was in 2002; the variable nature of nitrate concentration and loading to the watershed are highlighted in this figure. Figure 69 shows the years 2001-2005 nitrate nitrogen mean and standard deviation for all samples by date.

Table 16: Year 2005 nitrate nitrogen (mg/L-N) raw data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	4.72	3.8	4.5	4.7	4.3
2/28/2005	5.2	5.9	5.8	5.9	6.1
3/18/2005	3.4	4.3	5.3	4.8	4.8
3/26/2005	5.8	6.4	5.0	6.0	6.4
4/23/2005	6.9	7.9	8.6	6.5	8.4
4/30/2005	9.2	9.7	9.2	9.2	9.8
5/21/2005	**12.4**	**12.2**	**12.7**	**12.6**	**12.2**
5/28/2005	**13.9**	**12.6**	**12.3**	**12.5**	**11.9**
6/1/2005	**14.3**	**13.6**	**13.7**	**13.6**	**12.7**
6/6/2005	9.8	**10.8**	**10.9**	**13.2**	**11.4**
6/10/2005	**12.8**	**12.9**	**13.0**	**13.0**	**13.0**
7/15/2005	7.2	9.2	7.2	6.7	8.5
7/22/2005	**12.6**	9.3	9.1	8.3	8.8
7/28/2005	4.3	4.8	4.4	4.7	7.7
8/10/2005	2.9	4.1	4.1	3.9	3.1
8/17/2005	0.1	1.6	1.2	1.0	2.4
8/25/2005	0.6	0.5	0.2	0.3	2.5
9/8/2005	<0.1	<0.1	0.1	0.2	0.1
9/15/2005	<0.1	<0.1	<0.1	<0.1	<0.1
10/13/2005	2.5	0.2	0.6	1.2	0.6
11/3/2005	3.1	1.7	na	2.0	0.2
12/9/2005	4.0	0.8	na	na	0.6
Minimum	<0.1	<0.1	<0.1	<0.1	<0.1
Maximum	14.3	13.6	13.7	13.6	13.0
Mean	na	na	na	na	na
Median	5.5	6.1	5.8	6.0	6.4

If displayed, “na” means datum not available due to analysis error or other reason
If displayed, “<” means datum below detection level
Values in bold font represent criteria violations for drinking water use.

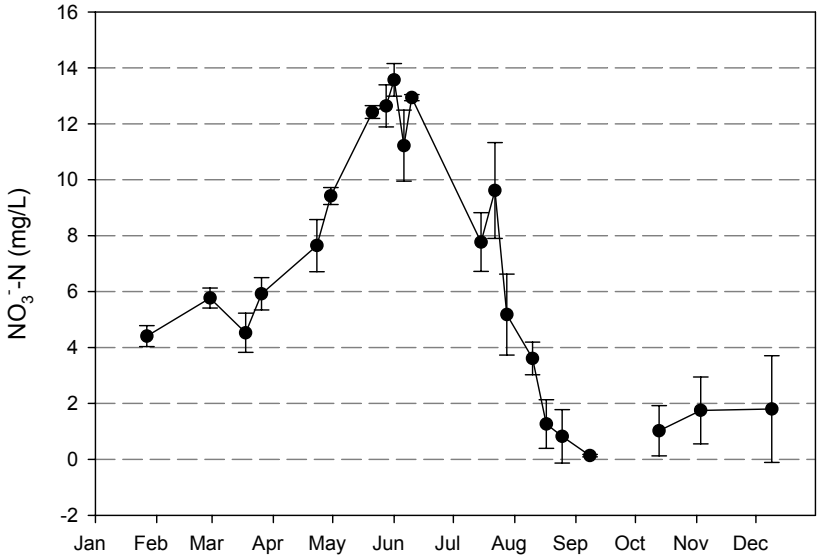

Figure 65: Year 2005 nitrate nitrogen mean and standard deviation for all samples by date.

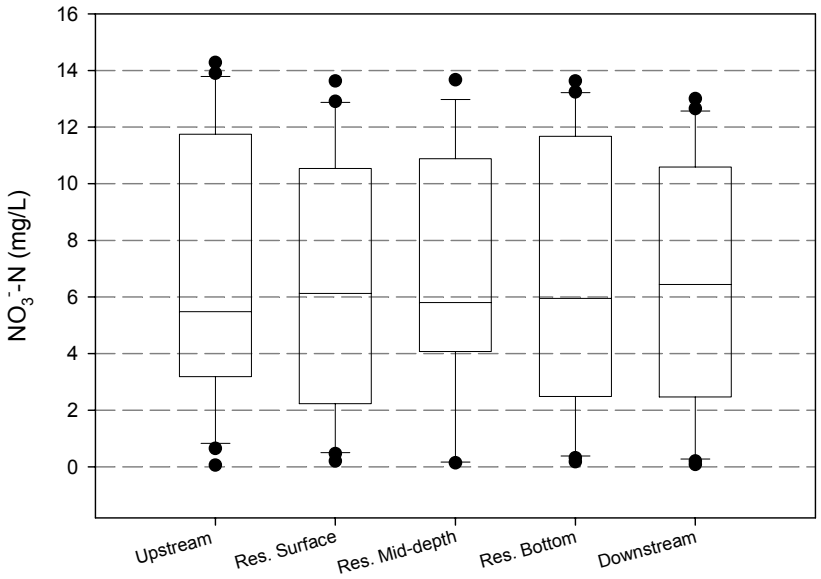

Figure 66: Year 2005 nitrate nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

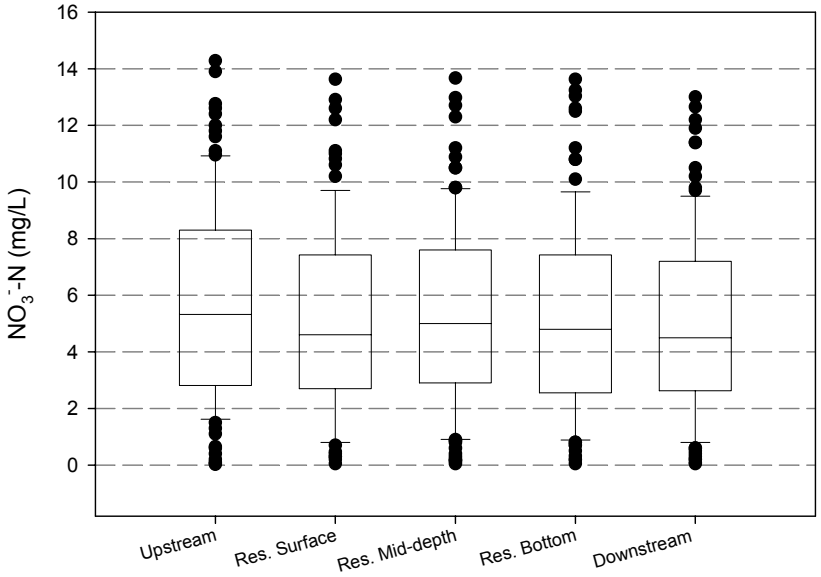

Figure 67: Years 2001-2005 nitrate nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

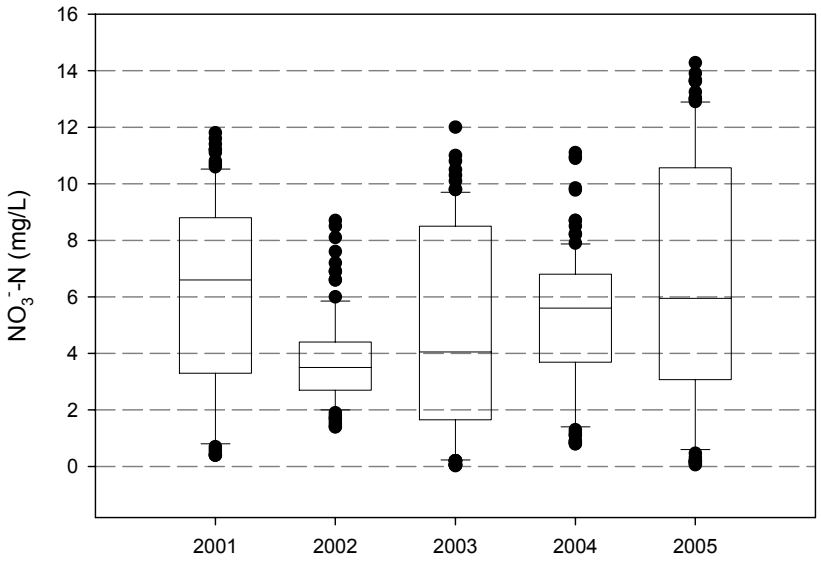

Figure 68: Years 2001-2005 nitrate nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year.

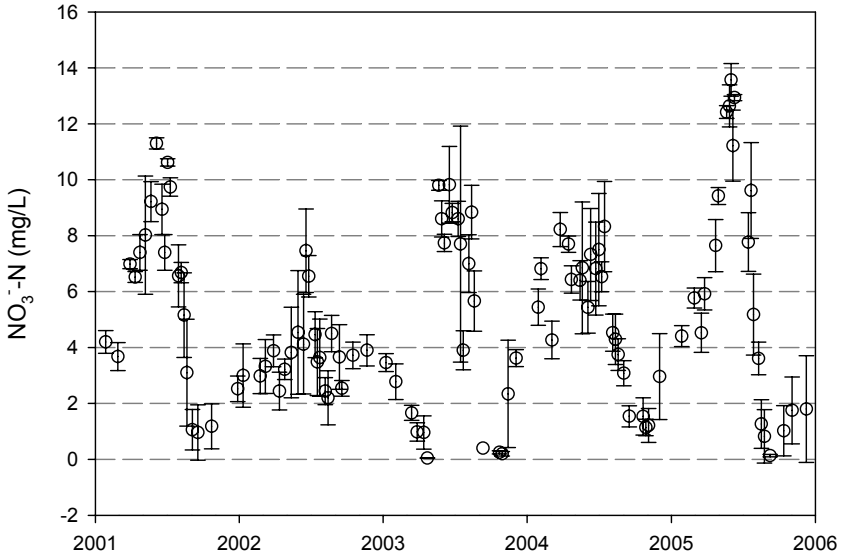

Figure 69: Years 2001-2005 nitrate nitrogen mean and standard deviation for all samples by date.

Kjeldahl Nitrogen

The Kjeldahl nitrogen (TKN) concentration raw data for year 2005 is shown in Table 17. Figure 70 shows the year 2005 total Kjeldahl nitrogen mean and standard deviation for all samples by date. Figure 71 shows the year 2005 total Kjeldahl nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location. The median TKN concentration for year 2005 was greatest at the upstream location (2.81 mg/L). Figure 72 shows the years 2001-2005 Kjeldahl nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location. The greatest median TKN concentration measured during this time period was at the upstream location. Figure 73 shows the years 2001-2005 Kjeldahl nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year. The greatest median TKN concentration was in year 2005 and the lowest was in 2002 for this time period. The years 2001-2005 Kjeldahl nitrogen mean and standard deviation for all samples by year is shown in Figure 74.

Table 17: Year 2005 Kjeldahl nitrogen (mg/L-N) raw data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	6.00	2.44	1.31	1.69	1.69
2/28/2005	3.56	3.00	3.00	3.19	2.63
3/18/2005	2.44	1.50	0.94	1.88	1.13
3/26/2005	2.81	1.31	1.13	1.88	2.25
4/23/2005	7.13	3.19	2.63	2.25	2.25
4/30/2005	1.69	1.50	2.25	1.31	1.50
5/21/2005	3.94	2.44	2.06	1.50	1.50
5/28/2005	2.81	2.06	2.25	1.50	1.50
6/1/2005	1.50	2.44	1.88	1.69	1.50
6/6/2005	1.31	1.88	1.69	1.50	2.44
6/10/2005	1.69	2.06	1.69	2.63	1.50
7/15/2005	5.63	4.13	2.44	1.88	3.19
7/22/2005	2.25	2.63	4.13	2.81	5.81
7/28/2005	2.25	2.25	3.00	3.00	4.13
8/10/2005	2.44	1.88	3.94	2.63	6.56
8/17/2005	4.13	1.69	3.75	3.38	1.31
8/25/2005	2.63	2.06	2.44	4.31	2.25
9/8/2005	6.19	2.81	2.44	3.19	5.06
9/15/2005	4.31	2.25	2.25	1.88	2.81
10/13/2005	5.63	3.00	1.88	1.69	1.69
11/3/2005	1.69	2.25	2.63	2.06	1.31
12/9/2005	3.00	2.06	na	na	2.63
Minimum	1.31	1.31	0.94	1.31	1.13
Maximum	7.13	4.13	4.13	4.31	6.56
Mean	3.41	2.31	2.37	2.28	2.57
Median	2.81	2.25	2.25	1.88	2.25

If displayed, “na” means datum not available due to analysis error or other reason
If displayed, “<” means datum below detection level

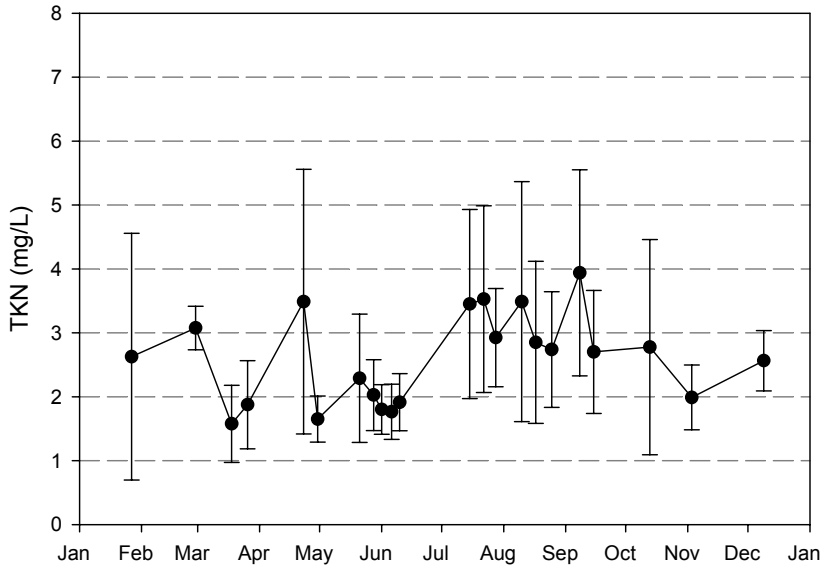

Figure 70: Year 2005 Kjeldahl nitrogen mean and standard deviation for all samples by date.

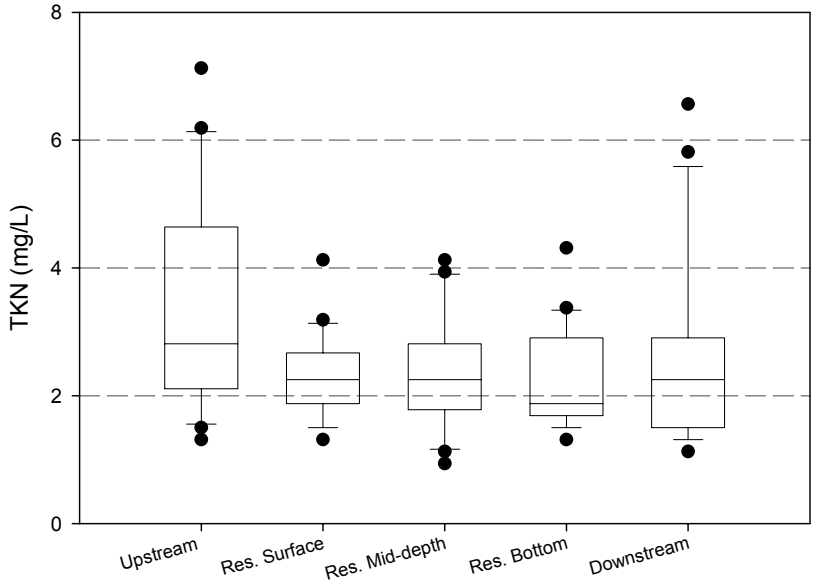

Figure 71: Year 2005 Kjeldahl nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

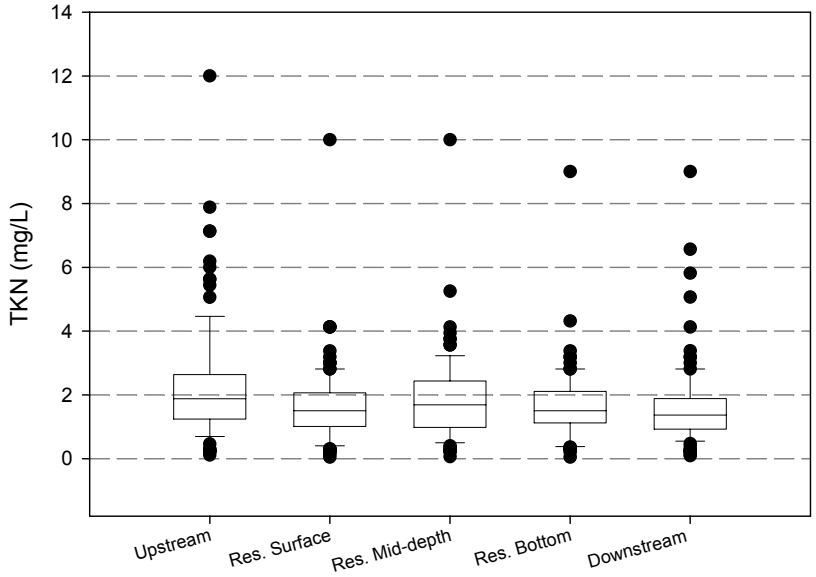

Figure 72: Years 2001-2005 Kjeldahl nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

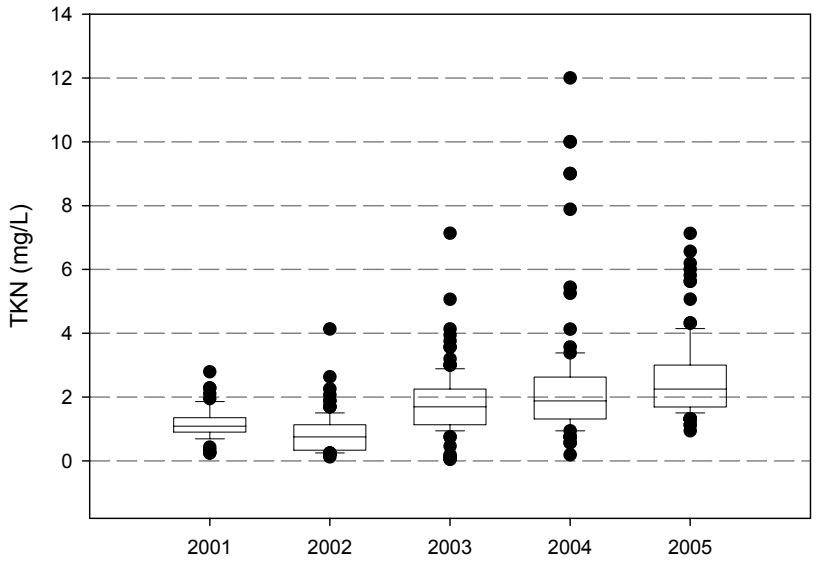

Figure 73: Years 2001-2005 Kjeldahl nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year.

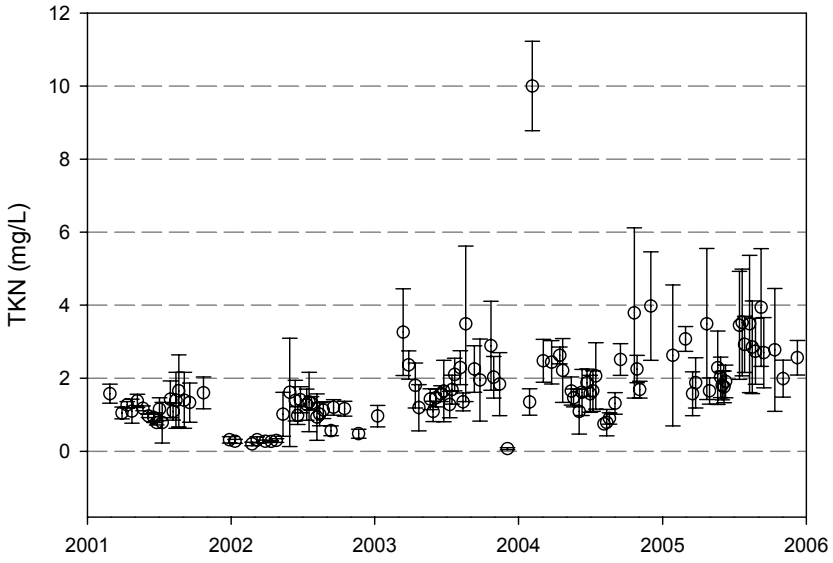

Figure 74: Years 2001-2005 Kjeldahl nitrogen mean and standard deviation for all samples by year.

Total Nitrogen

The total nitrogen raw data for year 2005 is shown in Table 18. Figure 75 shows the year 2005 total nitrogen (mg/L-N) mean and standard deviation for all samples by date. The main component of total nitrogen is nitrate; therefore, the trend in total nitrogen concentration over time is similar to nitrate. Figure 76 shows the year 2005 total nitrogen (mg/L-N) median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location. The greatest total nitrogen median value for year 2005 was at the downstream location. Figure 77 shows the years 2002-2005 total nitrogen (mg/L-N) median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location. The data shows that total nitrogen concentration is typically greatest at the upstream location. Figure 78 shows the years 2002-2005 total nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year. The greatest median total nitrogen concentration in that time period occurred in year 2005 and the minimum was in 2002. The years 2002-2005 total nitrogen mean and standard deviation for all data by date is shown in Figure 79.

Table 18: Year 2005 total nitrogen (mg/L-N) raw data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	10.7	6.3	5.8	6.4	6.0
2/28/2005	8.7	8.9	8.8	9.1	8.8
3/18/2005	5.9	5.8	6.3	6.7	6.0
3/26/2005	8.6	7.7	6.1	7.9	8.7
4/23/2005	14.0	11.1	11.3	8.8	10.7
4/30/2005	10.9	11.2	11.5	10.5	11.3
5/21/2005	16.4	14.7	14.9	14.2	13.8
5/28/2005	16.7	14.7	14.6	14.1	13.5
6/1/2005	15.8	16.1	15.6	15.4	14.2
6/6/2005	11.1	12.7	12.6	14.8	13.9
6/10/2005	14.5	15.0	14.7	15.7	14.6
7/15/2005	12.9	13.4	9.7	8.6	11.7
7/22/2005	14.9	12.0	13.2	11.2	14.7
7/28/2005	6.7	7.3	7.6	7.9	12.1
8/10/2005	5.4	6.0	8.1	6.6	9.7
8/17/2005	4.2	3.4	5.1	4.4	3.8
8/25/2005	3.3	2.6	2.6	4.6	4.8
9/8/2005	6.2	2.8	2.6	3.4	5.4
9/15/2005	4.3	2.3	2.3	1.9	2.8
10/13/2005	8.1	3.2	2.5	2.9	2.3
11/3/2005	4.8	4.1	na	4.1	1.5
12/9/2005	7.0	2.9	na	na	3.3
Minimum	3.3	2.3	2.3	1.9	1.5
Maximum	16.7	16.1	15.6	15.7	14.7
Mean	9.6	8.4	na	na	8.8
Median	8.7	7.5	8.5	7.9	9.2

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If displayed, “<” means datum below detection level

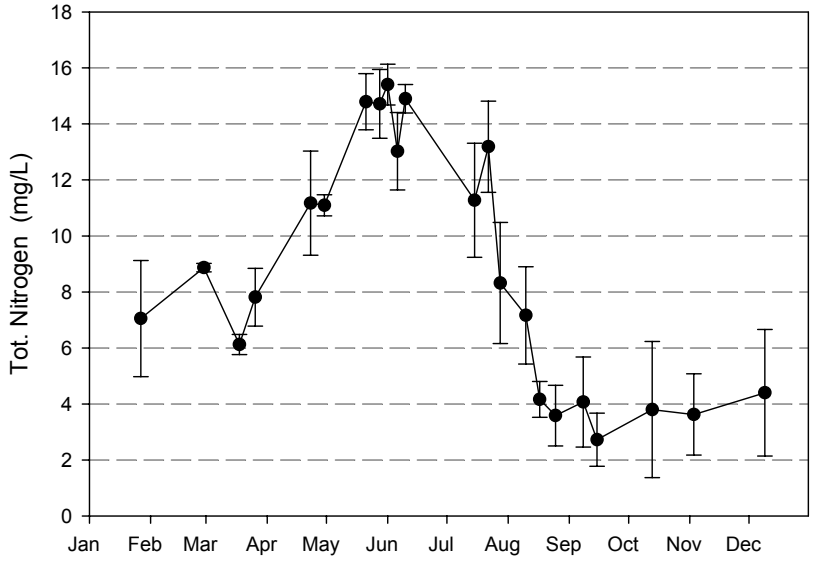

Figure 75: Year 2005 total nitrogen (mg/L-N) mean and standard deviation for all samples by date.

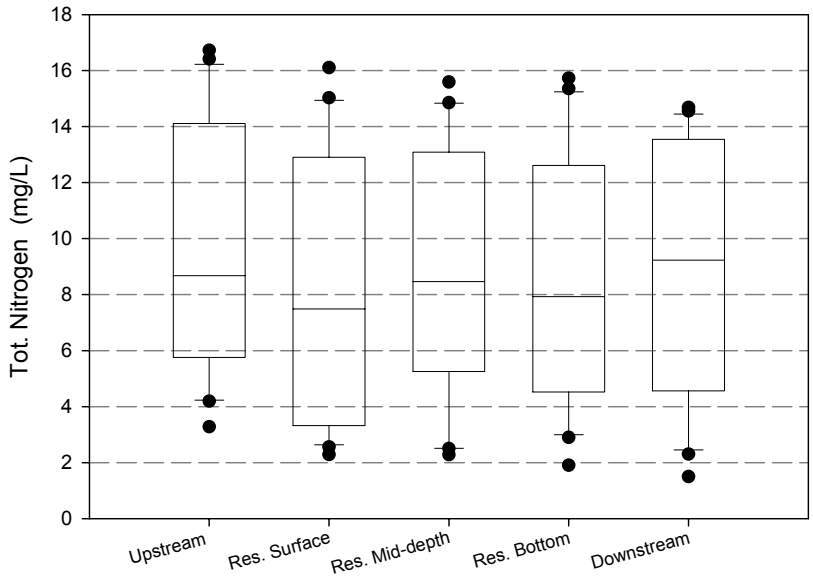

Figure 76: Year 2005 total nitrogen (mg/L-N) median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

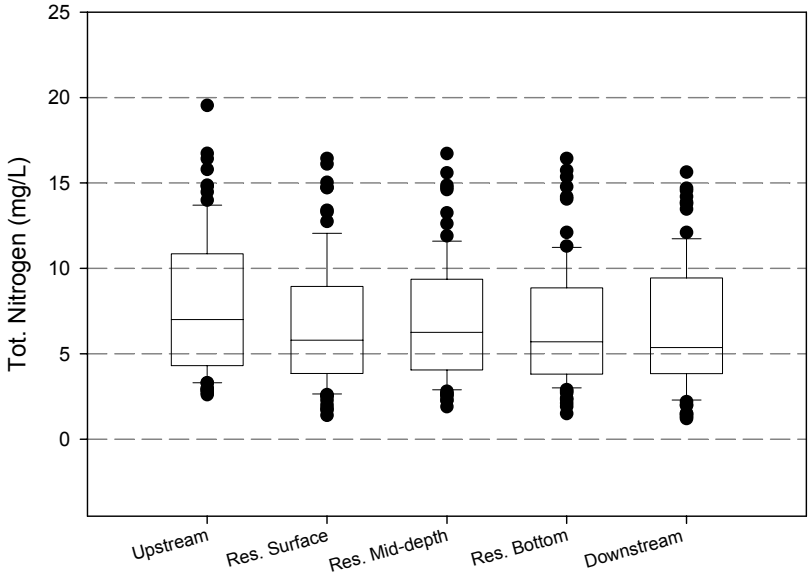

Figure 77: Years 2002-2005 total nitrogen (mg/L-N) median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

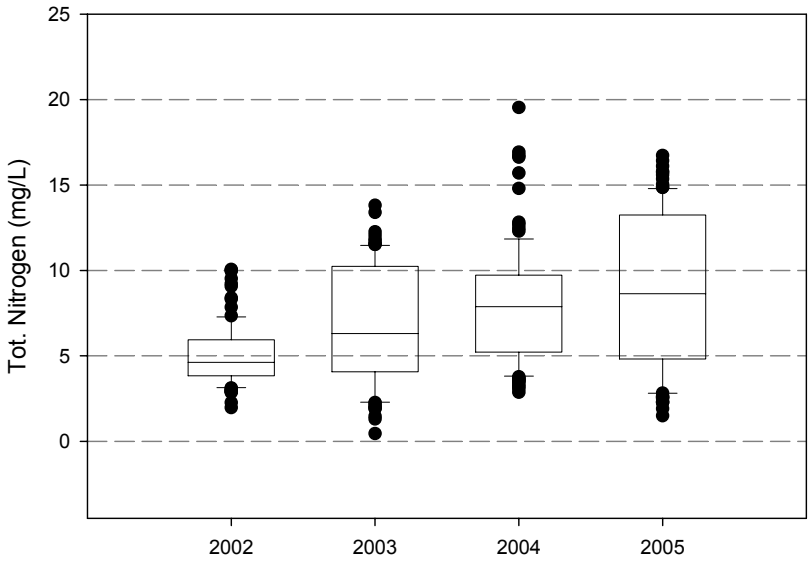

Figure 78: Years 2002-2005 total nitrogen median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year.

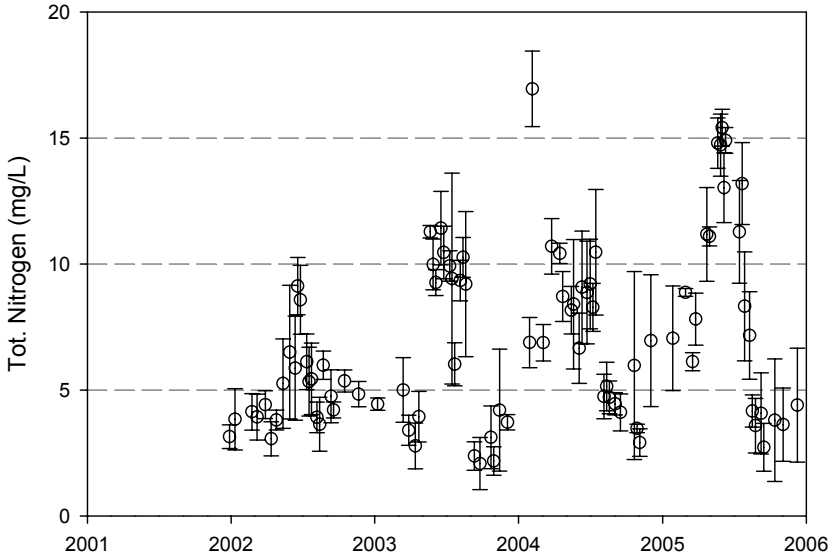

Figure 79: Years 2002-2005 total nitrogen mean and standard deviation for all data by date.

Phosphorus

Significance to Water Quality

Phosphorus occurs in natural waters nearly exclusively in the form of various phosphates; orthophosphates, condensed phosphates (pyro-, meta-, and other polyphosphates), and phosphates bound to organic matter. Phosphates exist in solution, adsorbed to particles, in detritus, and in aquatic organisms. Phosphorus is an essential element for organism growth and can be the limiting nutrient to primary productivity in water bodies.

Results and Discussion

Orthophosphate

The orthophosphate raw data for year 2005 is given in Table 19. The mean and median values are well above the recommendation maximum of 0.1 mg/L-P for fresh water. Figure 80 shows the year 2005 orthophosphate (mg/L-P) mean and standard deviation for all samples by date. Figure 81 shows the year 2005 orthophosphate median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location. The greatest median orthophosphate concentration in year 2005 was at the upstream location (0.24 mg/L-P), with all other locations having the same median value (0.21 mg/L-P) Figure 82 shows the years 2001-2005 orthophosphate median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location showing the highest median concentration at the reservoir bottom. Figure 83 shows the years 2001-2005 orthophosphate median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year. The greatest median concentration for this time span was in year 2002. The years 2001-2005 orthophosphate mean and standard deviation for all samples by date is shown in Figure 84.

Table 19: Year 2005 orthophosphate (mg/L-P) raw data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	0.20	0.09	0.13	0.14	0.12
2/28/2005	0.27	0.31	0.36	0.29	0.27
3/18/2005	0.21	0.15	0.16	0.19	0.13
3/26/2005	0.19	0.13	0.12	0.12	0.10
4/23/2005	0.24	0.17	0.18	0.19	0.18
4/30/2005	0.31	0.25	0.23	0.24	0.26
5/21/2005	0.30	0.23	0.23	0.21	0.20
5/28/2005	0.24	0.24	0.20	0.18	0.17
6/1/2005	0.23	0.21	0.20	0.17	0.23
6/6/2005	0.23	0.21	0.23	0.20	0.28
6/10/2005	0.28	0.22	0.23	0.23	0.19
7/15/2005	0.34	0.32	0.37	0.36	0.32
7/22/2005	0.29	0.32	0.38	0.35	0.37
7/28/2005	0.15	0.23	0.24	0.23	0.24
8/10/2005	0.08	0.21	0.36	0.36	0.29
8/17/2005	0.06	0.15	0.16	0.24	0.25
8/25/2005	0.25	0.25	0.25	0.25	0.24
9/8/2005	0.06	0.13	0.21	0.22	0.14
9/15/2005	0.11	0.17	0.19	0.16	0.22
10/13/2005	0.55	0.06	0.08	0.08	0.08
11/3/2005	0.12	0.06	0.07	0.06	0.08
12/9/2005	0.30	0.03	na	na	0.08
Minimum	0.06	0.03	0.07	0.06	0.08
Maximum	0.55	0.32	0.38	0.36	0.37
Mean	0.23	0.19	0.22	0.21	0.20
Median	0.24	0.21	0.21	0.21	0.21

If displayed, “na” means datum not available due to analysis error or other reason
If displayed, “<” means datum below detection level

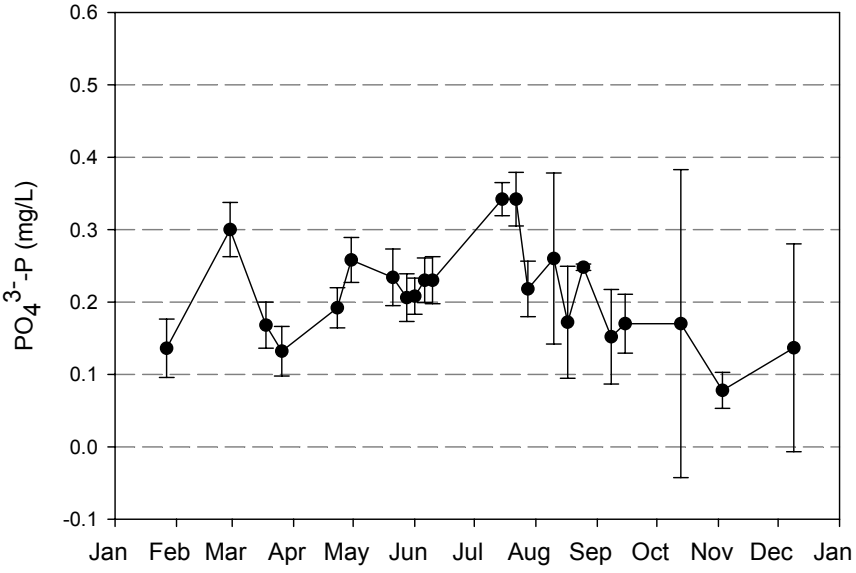

Figure 80: Year 2005 orthophosphate (mg/L-P) mean and standard deviation for all samples by date.

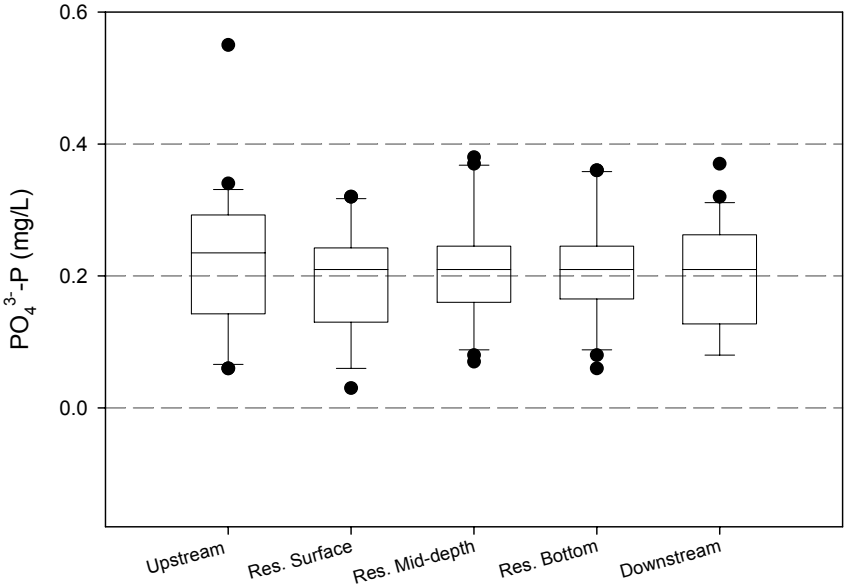

Figure 81: Year 2005 orthophosphate (mg/L-P) median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

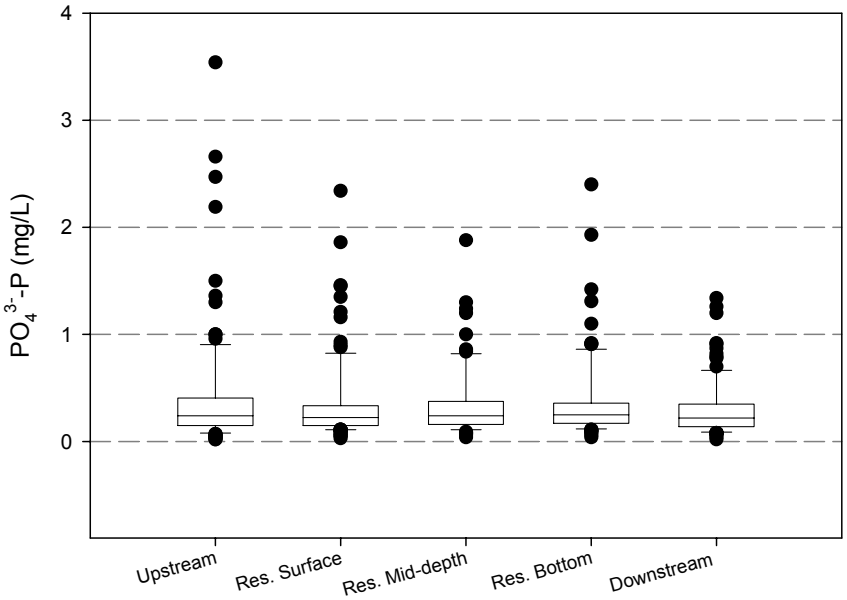

Figure 82: Years 2001-2005 orthophosphate (mg/L-P) median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

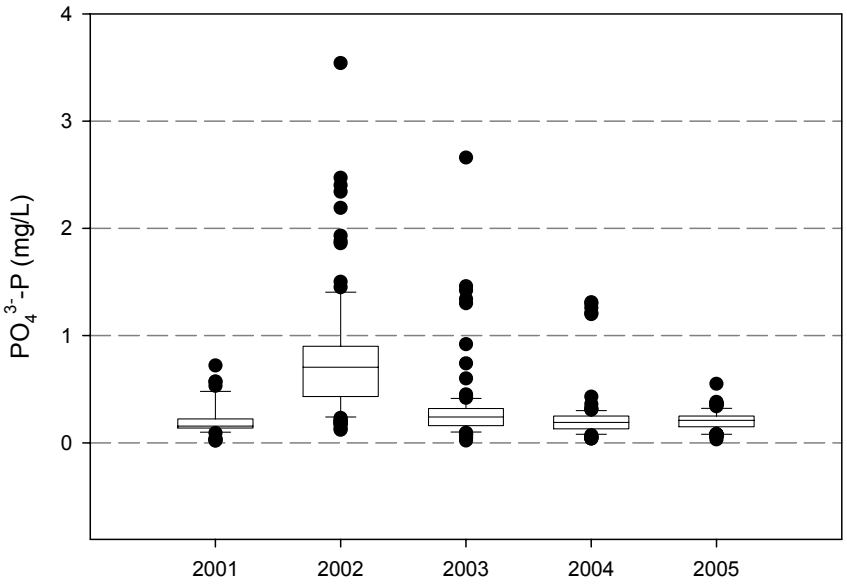

Figure 83: Years 2001-2005 orthophosphate (mg/L-P) median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year.

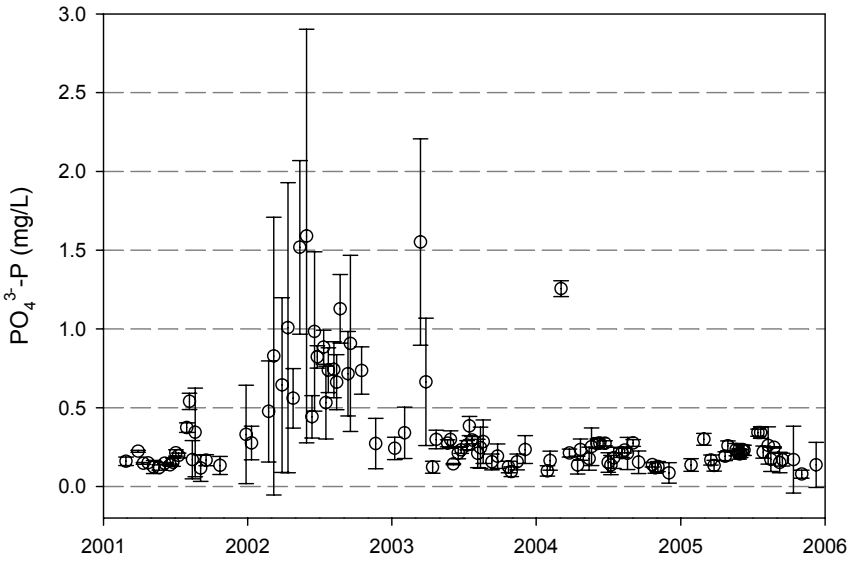

Figure 84: Years 2001-2005 orthophosphate (mg/L-P) mean and standard deviation for all samples by date.

Total Phosphorus

The year 2005 total phosphorus raw data is shown in Table 20. Figure 85 shows the year 2005 total phosphorus mean and standard deviation for all samples by date. Figure 86 shows the year 2005 total phosphorus median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location. The median total phosphorus concentration was greatest at the upstream location (0.47 mg/L-P), and lowest at the reservoir surface and downstream locations (0.26 mg/L-P). Figure 87 shows the years 2001-2005 total phosphorus median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location. Similar to the year 2004 data, the greatest median concentration was at the upstream location. Figure 88 shows the years 2001-2005 total phosphorus median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year. The greatest median total phosphorus concentration was in the year 2002 for that time period. Figure 89 shows years 2001-2005 total phosphorus mean and standard deviation for all samples by date.

Table 20: Year 2005 total phosphorus (mg/L-P) raw data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	0.26	0.15	0.19	0.16	0.12
2/28/2005	0.35	0.29	0.37	0.29	0.37
3/18/2005	0.34	0.28	0.24	0.26	0.20
3/26/2005	0.31	0.23	0.21	0.21	0.18
4/23/2005	0.69	0.38	0.41	0.40	0.33
4/30/2005	0.51	0.26	0.26	0.27	0.27
5/21/2005	0.41	0.25	0.24	0.25	0.28
5/28/2005	0.47	0.26	0.28	0.27	0.25
6/1/2005	0.46	0.26	0.31	0.31	0.25
6/6/2005	0.87	0.26	0.25	0.25	0.29
6/10/2005	0.47	0.22	0.28	0.41	0.25
7/15/2005	0.47	0.34	0.46	0.42	0.37
7/22/2005	0.64	0.35	0.30	0.40	0.27
7/28/2005	0.41	0.35	0.33	0.33	0.27
8/10/2005	0.41	0.22	0.38	0.44	0.28
8/17/2005	0.38	0.20	0.27	0.51	0.24
8/25/2005	0.74	0.26	0.26	0.29	0.24
9/8/2005	0.50	0.25	0.31	0.29	0.24
9/15/2005	0.42	0.24	0.25	0.29	0.26
10/13/2005	0.58	0.14	0.20	0.30	0.10
11/3/2005	0.35	0.20	0.34	0.17	0.18
12/9/2005	2.07	0.56	na	na	0.65
Minimum	0.26	0.14	0.19	0.16	0.10
Maximum	2.07	0.56	0.46	0.51	0.65
Mean	0.55	0.27	0.29	0.31	0.27
Median	0.47	0.26	0.28	0.29	0.26

If displayed, “na” means datum not available due to analysis error or other reason
If displayed, “<” means datum below detection level

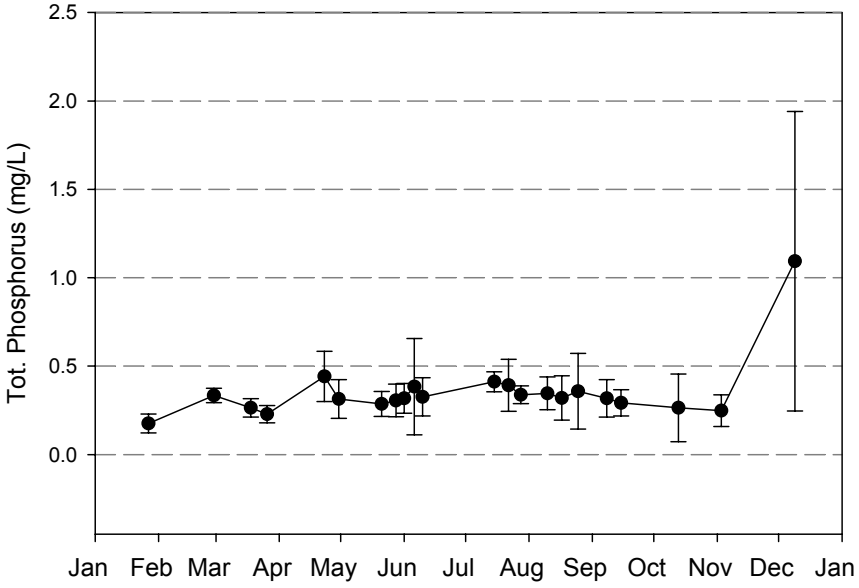

Figure 85: Year 2005 total phosphorus mean and standard deviation for all samples by date.

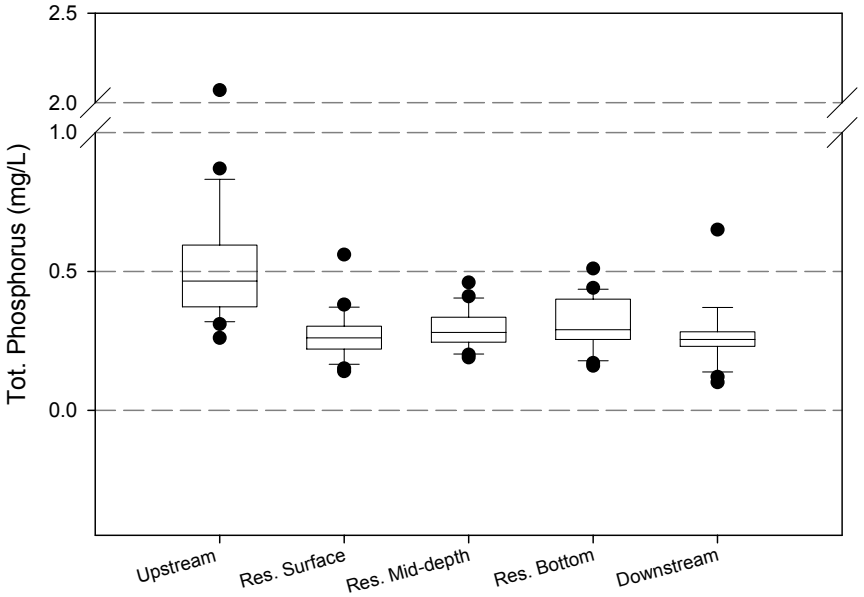

Figure 86: Year 2005 total phosphorus median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

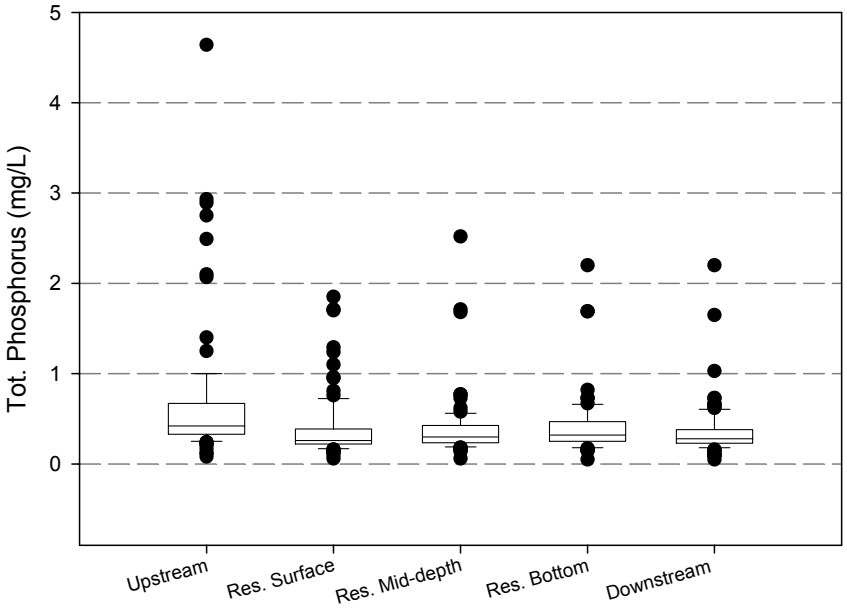

Figure 87: Years 2001-2005 total phosphorus median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

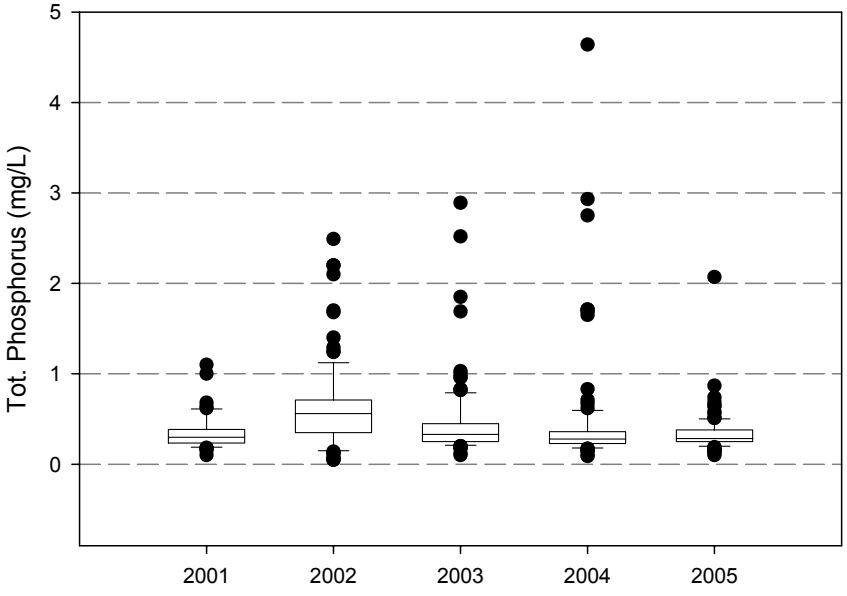

Figure 88: Years 2001-2005 total phosphorus median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year.

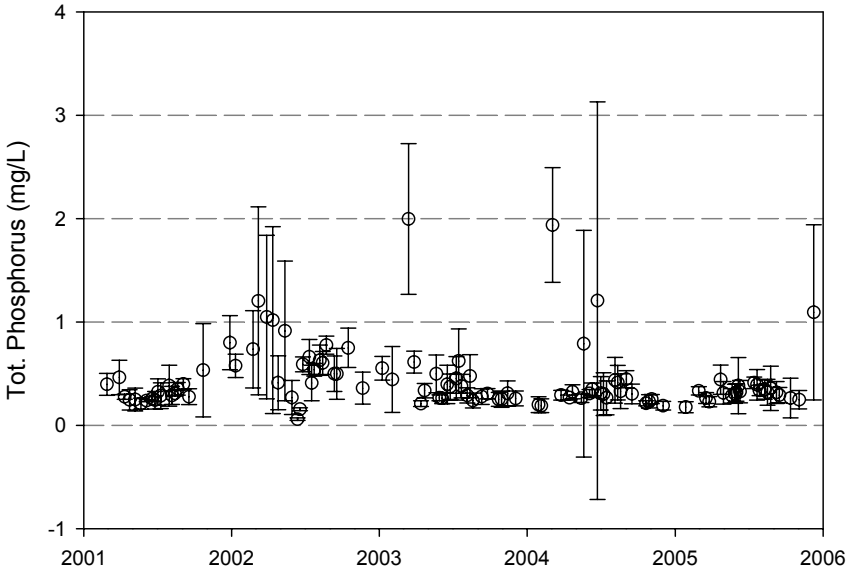

Figure 89: Years 2001-2005 total phosphorus mean and standard deviation for all samples by date.

Silica

Significance to Water Quality

Silicon does not occur in a free form in nature, but normally as free silica (SiO_2) in coarse rocks and microcrystalline quartz. Common aqueous forms of silica are H_4SiO_4 and $H_3SiO_4^-$. It is considered a nonessential trace element for most plants, but essential for most animals. There is no U.S. EPA drinking water standard maximum concentration level for silica.

Results and Discussion

The raw silica concentration data for 2005 is shown in Table 21. Figure 90 shows the year 2005 silica mean and standard deviation for all samples by date. Figure 91 shows the year 2005 silica median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location. The greatest median silica concentration in year 2005 was at the reservoir mid-depth and downstream locations (15 mg/L as SiO_2). Figure 92 shows the years 2001-2005 silica (mg/L as SiO_2) median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location. The upstream location had the greatest median silica concentrations and the reservoir bottom had the lowest median concentration during that time period. Figure 93 shows the years 2001-2005 silica (mg/L as SiO_2) median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year, with the highest median value occurring in 2005. Figure 94 shows the years 2001-2005 mean and standard deviation for all samples collected by date.

Table 21: Year 2005 silica (mg/L as SiO_2) raw data for all samples.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	11	4	<1	3	8
2/28/2005	13	14	17	15	16
3/18/2005	13	12	13	13	6
3/26/2005	6	7	8	6	6
4/23/2005	22	21	24	21	16
4/30/2005	18	17	15	12	11
5/21/2005	23	30	17	17	21
5/28/2005	17	21	21	26	22
6/1/2005	15	13	18	13	12
6/6/2005	14	27	14	37	18
6/10/2005	31	23	33	25	26
7/15/2005	16	13	14	13	14
7/22/2005	29	23	22	21	31
7/28/2005	<1	<1	<1	<1	<1
8/10/2005	4	18	19	20	15
8/17/2005	3	9	7	8	16
8/25/2005	6	26	27	27	21
9/8/2005	5	8	8	16	16
9/15/2005	4	7	5	8	7
10/13/2005	20	4	4	6	6
11/3/2005	12	13	8	11	6
12/9/2005	4	<1	na	na	2
Minimum	<1	<1	<1	<1	<1
Maximum	31	30	33	37	31
Mean	14	16	na	na	14
Median	13	14	15	14	15

If displayed, “na” means datum not available due to analysis error or other reason
If displayed, “<” means datum below detection level

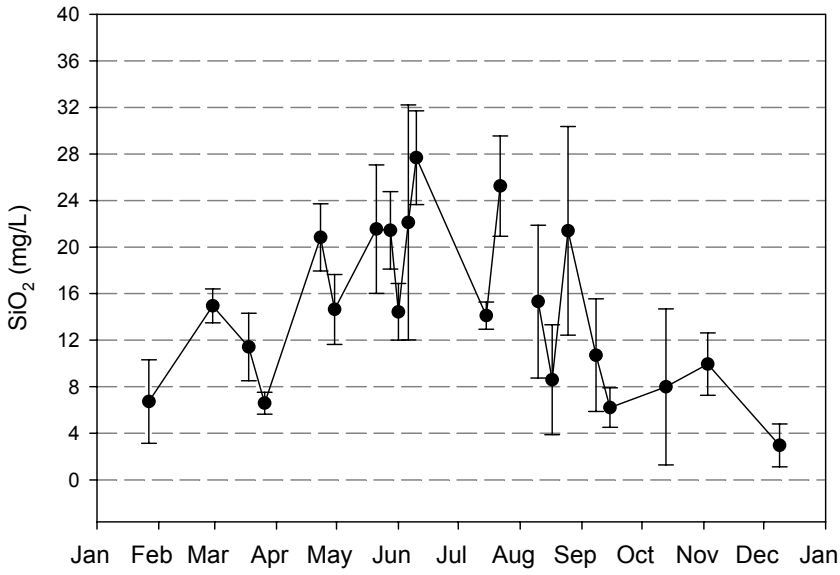

Figure 90: Year 2005 silica mean and standard deviation for all samples by date.

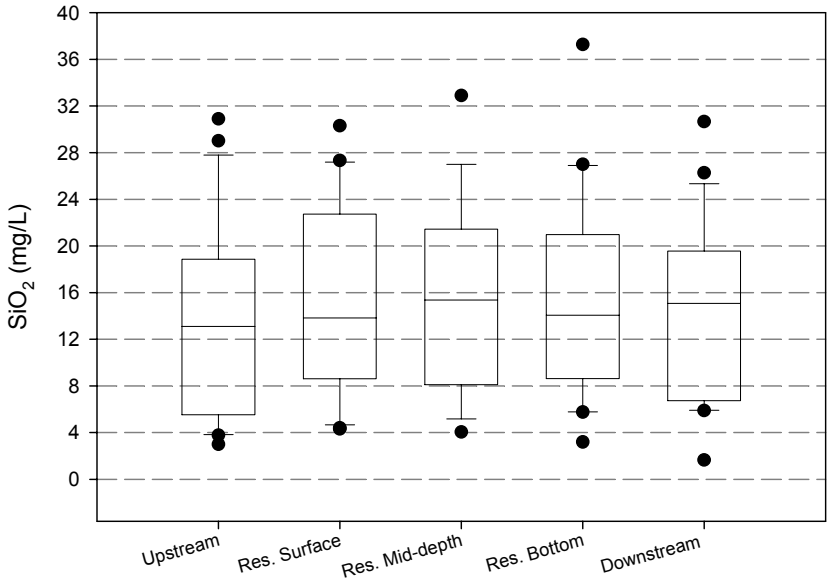

Figure 91: Year 2005 silica median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

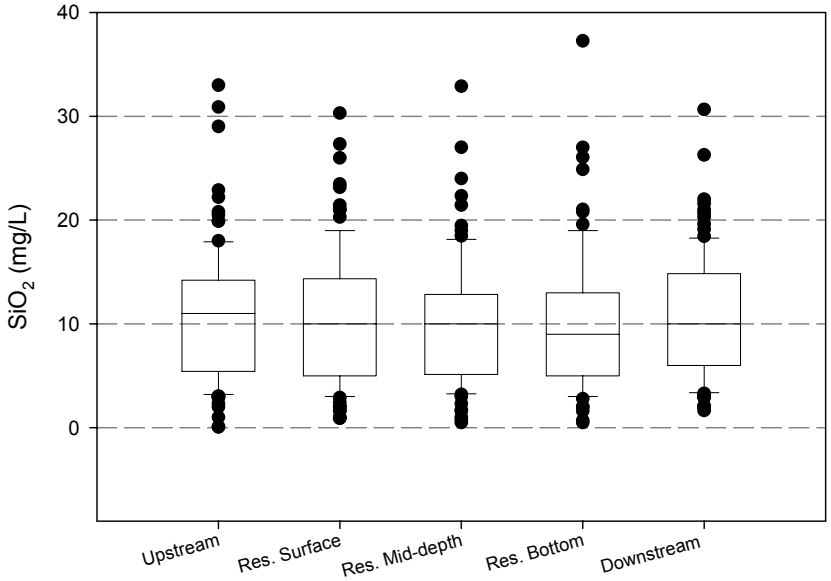

Figure 92: Years 2001-2005 silica (mg/L as SiO_2) median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by location.

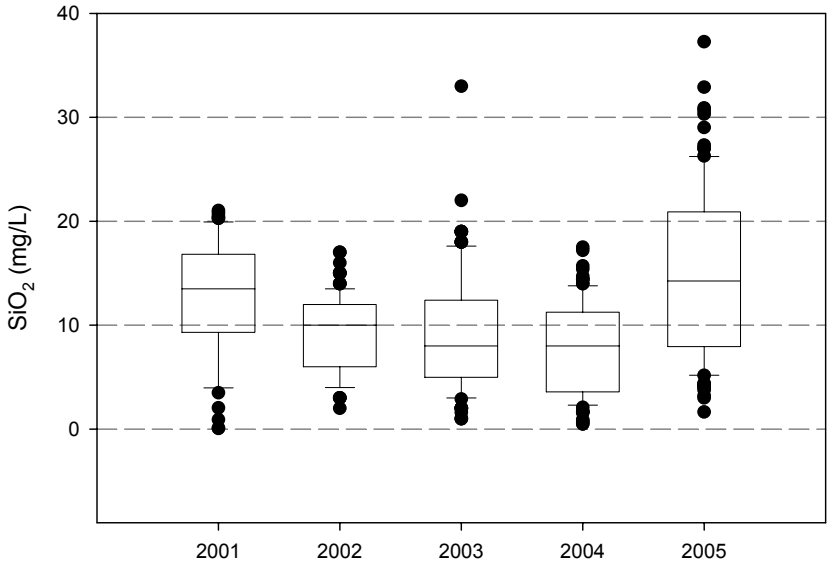

Figure 93: Years 2001-2005 silica (mg/L as SiO_2) median, minima, maxima, lower quartiles, upper quartiles and standard deviations for all samples by year.

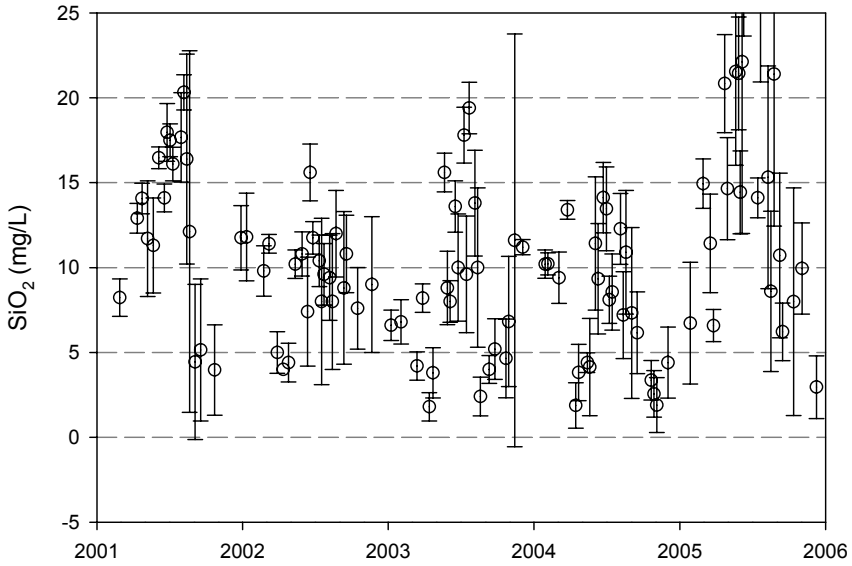

Figure 94: Years 2001-2005 silica (mg/L as SiO_2) mean and standard deviation for all samples by date.

Ion Balance

Significance to Water Quality

Ion balance calculations are done as a broad check of the overall correctness of an analytical data set (SM 1030 E). The test is based on the fact that all potable waters have the characteristic of electroneutrality. Therefore, the sum of all cations expressed in milliequivalents per liter, must equal the sum of all anions. The percentage difference is defined as:

$$\%\ difference \quad = \quad 100\ \frac{\sum cations - \sum anions}{\sum cations + \sum anions}$$

The acceptance criterion is ± 2% for anion sums between 3.0 and 10.0 meq/L (typical for the Coralville Reservoir).

Analytical Detail

Many of the anion and cation values determined for the project are done by ion chromatography with chemical background suppression (SM 4110 B). Potassium hydroxide eluent with an AS18 analytical column was used for anion analysis (chloride, bromide, nitrite, nitrate and sulfate only) and methanesulfonic acid eluent with a CS12A column was used for cation analysis (sodium and potassium only). A Dionex ion chromatography system was used for both analyses.

A standard ion solution (1000 mg/L each of Cl^-, Br^-, SO_4^{2-}; 226 mg/L NO_3^--N, 304 mg/L NO_2^--N, 326 mg/L PO_4^{3-}P,1807 mg/L Na^+ and 1225 mg/L K^+) was prepared with dry

salts and was stored in a refrigerator for no longer than 3 months. A working standard curve was prepared fresh on the day of analysis for calibration purposes. Field samples were analyzed with resulting peak areas compared to standard curves for quantification purposes.

Sampling and Storage

The samples were collected in clean plastic bottles, filled completely and capped tightly. Excessive agitation and exposure to air was avoided. Samples were chilled immediately and analyzed within eight hours of collection.

Results and Discussion

The ion balance results for the year 2005 are shown in Table 22. Many of the values exceed the 2% difference recommended by Standard Methods.

Table 22: Anion-Cation Balances.

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
1/27/2005	na	na	na	na	na
2/28/2005	na	na	na	na	na
3/18/2005	na	na	na	na	na
3/26/2005	-11.0	-16.1	-10.8	-12.9	-16.1
4/23/2005	na	na	na	na	na
4/30/2005	-4.1	-6.8	-5.7	-4.2	-8.2
5/21/2005	na	na	na	na	na
5/28/2005	na	na	na	na	na
6/1/2005	na	na	na	na	na
6/6/2005	na	na	na	na	na
6/10/2005	na	na	na	na	na
7/15/2005	-3.7	-8.0	-3.7	-4.5	-5.9
7/22/2005	na	na	na	na	na
7/28/2005	na	na	na	na	na
8/10/2005	na	na	na	na	na
8/17/2005	na	na	na	na	na
8/25/2005	na	na	na	na	na
9/8/2005	na	na	na	na	na
9/15/2005	na	na	na	na	na
10/13/2005	na	na	na	na	na
11/3/2005	na	na	na	na	na
12/9/2005	na	na	na	na	na

If displayed, “na” means datum not available due to analysis error or other reason
If displayed, “<” means datum below detection level

Escherichia coli and Fecal Coliform Bacteria

Significance to Water Quality

People may come into contact with disease causing organisms in waters used for recreation. Many pathogens are discharged to our surface waters in fecal wastes, both from human and animal sources, which have been improperly treated at wastewater facilities or marinas or from animal feed lots susceptible to runoff events. Operators of public beaches on lakes and reservoirs have the responsibility to test the waters periodically in an effort to protect human health. Non-pathogenic indicator organisms, such as *E. coli* and fecal coliform bacteria, are commonly present when environmental conditions support the growth of pathogens and therefore serve as an easy to measure surrogate test for the potential existence of human pathogens in surface water.

Sampling and Storage

A composite sample consisting of nine subsamples was collected at each beach. The subsamples were collected from three points along each of three transects. One transect was near the center of the beach and the remaining transects were near the ends of the beach, about 3 meters from the buoy line/shoreline. The three sampling locations along each transect were at points approximately ankle-, knee-, and chest-deep. A separate 100 to 250 mL sterilized, wide-mouth, screw-cap, polypropylene sample bottle was used for collecting each subsample. All subsample bottles were the same size. The downstream transect was sampled first, starting with the ankle-deep sample and then proceeding to the knee- and finally chest-deep sample. The center transect was sampled next in the same manner, followed by the upstream transect. Care was taken by the sampler to not disturb the bottom sediments while wading to the sampling locations. The sampler's body was positioned downstream from the volume of water to be sampled.

The following procedure was utilized at each sampling location: the screw-cap was removed from the bottle and the bottle was held at its base and plunged mouth-down into the water to the desired depth. The bottle was turned on its side (the mouth positioned into the current) and tipped slightly upwards to allow it to fill. The bottle was brought to the surface and a portion of the sample was poured out to allow for an air space of 2.5 cm before the cap was put in place. When the three samples from a transect were collected, the bottles were placed on ice before proceeding to the next transect where the process was repeated. After all nine subsamples were collected, they were poured into a 1 liter sterilized, wide-mouth, screw-cap, polypropylene bottle. To accomplish this, each subsample bottle was inverted five times to allow for complete mixing and the contents were then immediately poured into the composite bottle. The composite bottle was of sufficient size to allow for at least a 2.5 cm air space. The final sample for each beach was obtained by inverting the composite bottle five times and then immediately pouring a sample into a 100 to 250 ml sterilized, wide-mouth, screw-cap, polypropylene bottle (again allowing for at least a 2.5 cm air space for proper mixing). The bottle was capped and placed on ice. Several ancillary measurements were taken at this time (transparency; number of swimmers; number of water fowl, shore birds and gulls; wave height; wind speed and direction; and precipitation). Aseptic technique was used during sample collection in order to avoid sample contamination. Care was taken at all times to not touch the inside of the sample bottles or caps.

Samples were stored on ice (below 10°C) until time of analysis. The holding time did not exceed 24 hours. Samples were analyzed for E. coli and fecal coliform bacteria according to an EPA approved method as published in the July 21, 2003 Federal Register (40 CFR Part 136, Part III, Environmental Protection Agency, Guidelines Establishing Test Procedures for the Analysis of Pollutants; Analytical Methods for Biological Pollutants in Ambient Water; Final Rule). All indicator organism samples were processed by the University Hygienic Laboratory.

Results and Discussion

Table 23 shows the *Escherichia coli* data at Sandy Beach, Sugar Bottom, and the West Overlook (organisms per 100 mL) for the year 2005. The *E. coli* criterion was exceeded at all beaches on May 16th triggering in a resampling event on May 18th which showed the waters at all beaches to be within standards. There were no other violations during the 2005 sampling period. As of July 16, 2003, the State of Iowa commenced using *E. coli* as an indicator organism for fecal contamination, thus replacing fecal coliform bacteria.

Table 23: Escherichia coli at Sandy Beach, Sugar Bottom, and the West Overlook (organisms per 100 mL).

Date	Sandy Beach	West Overlook	Sugar Bottom
May 16, 2005	590	340	300
May 18, 2005	130	150	130
May 23, 2005	130	91	50
May 31, 2005	30	10	10
June 6, 2005	70	20	90
June 13, 2005	30	<10	50
June 20, 2005	30	<10	<10
June 27, 2005	73	<10	30
July 5, 2005	91	82	100
July 11, 2005	45	30	130
July 18, 2005	10	10	<10
July 25, 2005	<10	<10	<10
August 1, 2005	<10	10	20
August 8, 2005	<10	<10	<10
August 15, 2005	36	40	<10
August 22, 2005	40	<10	<10
August 29, 2005	10	10	40
September 6, 2005	50	20	20
September 12, 2005	<10	<10	20
September 20, 2005	<10	<10	<10

> *The Iowa Class "1" standards for Escherichia coli are 126 organisms/100 mL (geometric mean of at least 5 samples over 30 days) and 235 organisms/100 mL for any one sample.*

Table 24 shows the fecal coliform data at Sandy Beach, Sugar Bottom, and the West Overlook (organisms per 100 mL) for the year 2005. Fecal coliform bacteria is no longer used as a determinant for regulated water quality standards.

Table 24: Fecal coliform bacteria at Sandy Beach, Sugar Bottom, and the West Overlook (organisms per 100 mL).

Date	Sandy Beach	West Overlook	Sugar Bottom
May 16, 2005	590	510	350
May 18, 2005	170	160	230
May 23, 2005	130	50	91
May 31, 2005	30	10	10
June 6, 2005	70	20	100
June 13, 2005	30	< 10	60
June 20, 2005	30	<10	<10
June 27, 2005	120	<10	40
July 5, 2005	140	91	100
July 11, 2005	45	30	140
July 18, 2005	10	10	<10
July 25, 2005	10	<10	<10
August 1, 2005	20	10	20
August 8, 2005	<10	<10	<10
August 15, 2005	55	40	<10
August 22, 2005	40	<10	<10
August 29, 2005	10	10	40
September 6, 2005	80	20	30
September 12, 2005	<10	<10	20
September 20, 2005	<10	<10	<10

> *The former Iowa Class "A" standard stated that from April 1 through October 31 the fecal coliform content shall not exceed 200 organisms/100 mL except when waters are materially affected by surface runoff.*

Table 25 shows the bacteria results for the river and reservoir locations sampled during June, July and August. Iowa Class "1" violations for *E. coli* were reported for the upstream and downstream locations on June 6th and the upstream location on June 10th.

Table 25: Escherichia coli/fecal coliform bacteria at all river locations (organisms per 100 mL).

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
June 1, 2005	40/90	20/20	<10/<10	20/20	55/63
June 6, 2005	9100/11,000	<10/<10	<10/<10	20/20	1300/1400
June 10, 2005	1000/1500	30/40	20/45	110/150	170/190
July 15, 2005	110/130	<10/<10	<10/<10	10/10	40/40
July 22, 2005	<10/<10	<10/<10	<10/<10	110/130	60/60
July 28, 2005	200/200	<10/<10	<10/<10	<10/<10	150/410
August 10, 2005	50/55	<10/<10	<10/<10	<10/<10	10/36
August 17, 2005	30/30	10/10	<10/<10	<10/10	64/82
August 25, 2005	40/55	<10/<10	<10/<10	<10/<10	200/280

If displayed, "na" means datum not available due to analysis error or other reason
If displayed, "<" means datum below detection level

Pesticides in Fish

Analytical Detail

A total of 20 fish (common carp) were collected from the Iowa River and the reservoir on Oct 29th with the help of staff from the Lake McBride Fisheries Station. Ten fish were collected in various areas of the reservoir north of the Mehaffey Bridge with most of the take coming near the Lake McBride spillway. These fish were separated into two groups (Reservoir - Composite A and Composite B), then measured and weighed before being wrapped in aluminum foil for subsequent freezing. Ten additional fish were taken from the Iowa River north of City Park with most of the fish collected near the old Iowa River Power Company dam. These fish were separated into two groups (Downstream – Composite A and Composite B), then measured and weighed before being wrapped in aluminum foil for subsequent freezing. The fish were then taken to the University Hygienic Laboratory for pesticide analysis using preparation method EPA/AOAC and analytical method EPA 8081A. Whole fish composites were used for the analysis. The molecular structures of the pesticides are shown in Figure 95 and Figure 96.

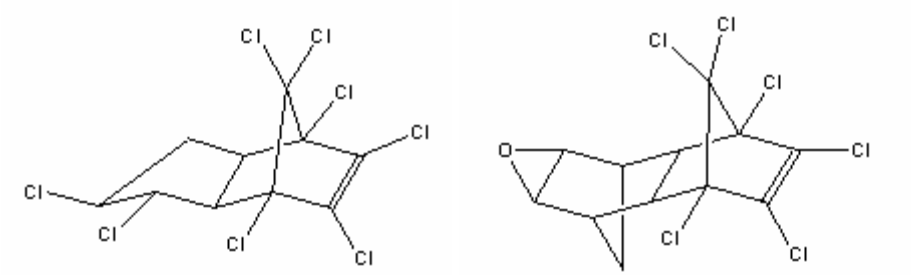

Figure 95: Molecular structures of chlordane and dieldrin.

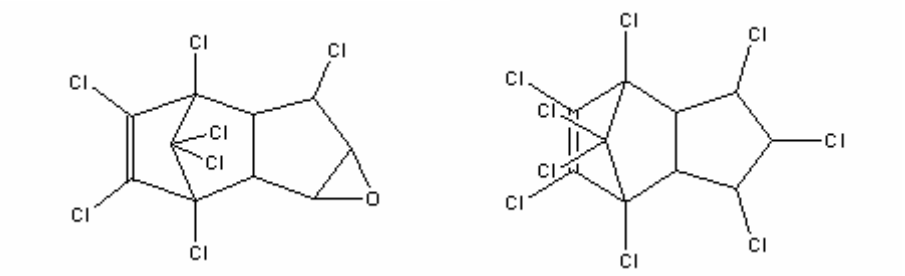

Figure 96: Molecular structures of heptachlor epoxide and nonachlor.

Results and Discussion

The pesticides in fish results as reported by the University Hygienic Laboratory are reported in Table 26. The average fish lengths for the reservoir composite samples A and B were 45.1 and 43.1 cm respectively. The average fish lengths for the downstream composite samples were 50.1 and 48.2 cm. Dieldrin and DDE were detected in all samples with values between 0.008-0.031 mg/kg and 0.020-0.068 mg/kg respectively. The percent lipid content was between 3.53 and 7.32 percent for all composite samples.

Table 26: Pesticides in Fish.

Coralville Reservoir Water Quality

Pesticides in Fish

	Reservoir (Near Lake McBride Spillway)				Downstream (Iowa City)			
	Composite A		Composite B		Composite A		Composite B	
	Length (cm)	Weight (g)	Length (cm)	Weight (g)	Length (cm)	Weight (g)	Length (cm)	Weight (g)
Fish 1	45.2	980	43.2	789	47.2	1188	48.3	1148
Fish 2	46.2	1048	43.2	889	51.3	1701	48.0	1256
Fish 3	44.2	953	46.0	971	52.3	1479	50.0	1252
Fish 4	47.8	1134	41.9	871	51.8	1633	46.0	1043
Fish 5	42.2	826	41.4	748	48.0	1379	48.5	1297
Average	**45.1**	**988**	**43.1**	**854**	**50.1**	**1476**	**48.2**	**1199**

Analyte	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)	Concentration (mg/kg)
Dieldrin	0.008	0.008	0.031	0.025
alpha-Chlordane	<0.005	<0.005	<0.005	<0.005
gamma-Chlordane	<0.005	<0.005	<0.005	<0.005
cis-Nonachlor	<0.005	<0.005	0.012	0.007
trans-Nonachlor	<0.005	<0.005	0.013	0.014
Oxychlordane	<0.005	<0.005	<0.005	<0.005
Heptachlor Epoxide	<0.005	<0.005	<0.005	<0.005
DDE	0.020	0.030	0.041	0.068
Percent Lipids	3.53%	4.20%	7.32%	5.89%

Pigments

Results and Discussion

The chlorophyll *a, b and c* results are found in Table 27, Table 28, and Table 29. The pheophytin *a* results are given in Table 30. In general, the chlorophyll *a* concentrations were quite low, but pheophytin *a* concentrations were quite high especially in late summer 2005 at the upstream location as algae decay was occurring more rapidly.

Table 27: Pigment, Chlorophyll a (mg/cubic meter)

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
5/21/2005	<1	<1	<1	<1	<1
5/28/2005	<1	<1	<1	<1	<1
6/1/2005	4.5	17.1	5.1	5.5	7.0
6/6/2005	3.3	23.1	30.7	29.1	17.2
6/10/2005	4.6	10.8	9.1	3.2	6.7
7/15/2005	8	55	31	12	42
7/22/2005	35	71	37	16	98
7/28/2005	12	20	9	6	16
8/10/2005	85	81	12	4	21
8/17/2005	45	30	15	5	10
8/25/2005	16	20	14	43	58
9/8/2005	25	31	4	10	19
9/15/2005	17	24	14	11	28

If displayed, "na" means datum not available due to analysis error or other reason
If displayed, "<" means datum below detection level

Table 28: Pigment, Chlorophyll b (mg/cubic meter)

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
5/21/2005	na	na	na	na	na
5/28/2005	na	na	na	na	na
6/1/2005	<1	<1	<1	<1	<1
6/6/2005	<1	<1	<1	<1	<1
6/10/2005	<1	<1	<1	<1	<1
7/15/2005	<1	17	3	<1	3
7/22/2005	<1	4	2	1	4
7/28/2005	1	1	2	<1	2
8/10/2005	<1	6	1	<1	1
8/17/2005	<1	<1	<1	<1	<1
8/25/2005	<1	<1	<1	4	4
9/8/2005	<1	1	<1	<1	1
9/15/2005	<1	<1	<1	<1	1

If displayed, "na" means datum not available due to analysis error or other reason
If displayed, "<" means datum below detection level

Table 29: Pigment, Chlorophyll c (mg/cubic meter)

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
5/21/2005	na	na	na	na	na
5/28/2005	na	na	na	na	na
6/1/2005	1.6	2.2	<1	<1	<1
6/6/2005	<1	1.8	3.1	1.9	1.3
6/10/2005	<1	<1	<1	<1	<1
7/15/2005	<1	20	4	<1	4
7/22/2005	2	6	4	1	10
7/28/2005	2	2	2	<1	3
8/10/2005	9	6	1	<1	2
8/17/2005	6	3	2	<1	1
8/25/2005	2	2	2	8	9
9/8/2005	3	2	<1	<1	1
9/15/2005	2	2	<1	<1	1

If displayed, "na" means datum not available due to analysis error or other reason
If displayed, "<" means datum below detection level

Table 30: Pigment, Pheophytin a (mg/cubic meter)

Date	Upstream	Reservoir Surface	Reservoir Mid-depth	Reservoir Bottom	Downstream
5/21/2005	2.74	12.19	14.11	8.54	11.58
5/28/2005	9.57	36.65	31.89	34.12	45.00
6/1/2005	14.85	30.28	26.79	26.30	27.78
6/6/2005	20.63	35.78	36.60	35.85	24.64
6/10/2005	26.25	13.94	14.41	23.71	19.51
7/15/2005	24.68	35.54	26.76	47.23	22.81
7/22/2005	96.40	33.49	24.92	40.71	38.80
7/28/2005	75.65	28.15	29.10	27.00	24.30
8/10/2005	697.36	48.59	31.87	44.61	28.66
8/17/2005	552.01	62.11	30.33	36.77	27.33
8/25/2005	600.65	36.28	31.64	15.34	26.59
9/8/2005	236.87	110.30	33.23	17.84	98.94
9/15/2005	329.47	37.65	32.45	30.44	39.16

If displayed, "na" means datum not available due to analysis error or other reason
If displayed, "<" means datum below detection level

Summary of Criteria Violations

Table 31: Summary of Criteria Violations.

Date	Parameter	Location
May 21st, 2005	Nitrate	Upstream, reservoir surface, reservoir mid-depth, reservoir bottom, downstream
May 28th, 2005	Nitrate	Upstream, reservoir surface, reservoir mid-depth, reservoir bottom, downstream
June 1st, 2005	Nitrate	Upstream, reservoir surface, reservoir mid-depth, reservoir bottom, downstream
June 6th, 2005	Nitrate	Reservoir surface, reservoir mid-depth, reservoir bottom, downstream
June 10th, 2005	Nitrate	Upstream, reservoir surface, reservoir mid-depth, reservoir bottom, downstream
July 22nd, 2005	Nitrate	Upstream
May 16th, 2005	E. coli	Sandy Beach, West Overlook, Sugar Bottom

Summary of Applicable Water Quality Standards

Table 32: Applicable Water Quality Standards and Criteria.

Parameter	Value		Reference
Dissolved Oxygen (mg/L) *applies only to upper stratification layer in lakes	> 5.0 mg/L > 5.0 mg/L	Iowa Class B (LW) EPA criterion, freshwater aquatic	IAC, p 8, sec 61.3(3)b(1) FR, Jun 24, 1986, p 22978
Escherichia coli (organisms per 100 mL)	126 organisms/ 100 mL (geometric mean) 235 organisms/ 100 mL sample maximum	Iowa Class A1 (Mar 15 – Nov 15) EPA criterion, recreational bathing	IAC, p 11, sec 61.3(3)a(1) EPA-4405-84-002
Fecal Coliform Bacteria (organisms per 100 mL)	No longer regulated	Iowa Class A (Apr 1 – Oct 31)	na
Nitrogen, Ammonia (mg/L as N)	Table 33 thru Table 35	Iowa Class B	IAC, p 8, sec 61.3(3)b(3)
Nitrogen, Nitrate and Nitrite(mg/L)	10 mg/L	Iowa Class C	IAC, p 17, sec 61.3(3) Table 1
Nitrogen, Nitrite (mg/L)	1 mg/L	Iowa Class C	IAC, p 17, sec 61.3(3) Table 1
Nitrogen, Total Kjeldahl (mg/L)	 0.963 mg/L 2.62 mg/L	EPA Ecoregion VI, subregion WCBP Lakes and reservoirs Rivers and Streams	 EPA-822-B-00-008 EPA-822-B-00-017
Pesticides in Common Carp (mg/kg)	< 300 ppb for most	FDA action level for food fish	FDA
pH	6.5 – 9.0 6.5 – 9.0	Iowa Class A, B, C EPA CCC criteria, freshwater	IAC, pp 8-9a, sec 61.3(3)a(2) EPA-822-Z-99-001
Phosphate, total	 0.06 mg/L 0.12 mg/L	EPA Ecoregion VI, subregion WCBP Lakes and reservoirs Rivers and Streams	 EPA-822-B-00-008 EPA-822-B-00-017
Pigments, Chlorophyll *a* (mg/m^3)	 14.6 mg/m^3 7.85 mg/m^3	EPA Ecoregion VI, subregion WCBP Lakes and reservoirs Rivers and Streams	 EPA-822-B-00-008 EPA-822-B-00-017
Water Temperature (°C)	No increase >3°C Increase <1°C per hour No increase above 32°C	Iowa Class B (WW)	IAC, p 9, sec 61.3(3)b(5)

Table 33: Acute criterion for ammonia in Iowa streams.

Acute Criterion, mg/l as N (or Criterion Maximum Concentration, CMC)		
pH	Class B(WW), B(LR) & B(LW)	Class B(CW) Cold Water
6.5	48.8	32.6
6.6	46.8	31.3
6.7	44.6	29.8
6.8	42.0	28.0
6.9	39.1	26.1
7.0	36.1	24.1
7.1	32.8	21.9
7.2	29.5	19.7
7.3	26.2	17.5
7.4	23.0	15.3
7.5	19.9	13.3
7.6	17.0	11.4
7.7	14.4	9.64
7.8	12.1	8.11
7.9	10.1	6.77
8.0	8.40	5.62
8.1	6.95	4.64
8.2	5.72	3.83
8.3	4.71	3.15
8.4	3.88	2.59
8.5	3.20	2.14
8.6	2.65	1.77
8.7	2.20	1.47
8.8	1.84	1.23
8.9	1.56	1.04
9.0	1.32	0.885

Table 34: Chronic Criterion for Ammonia in Iowa Streams – Early Life Stages Present.

	Temperature, °C									
pH	**0**	**14**	**16**	**18**	**20**	**22**	**24**	**26**	**28**	**30**
6.5	6.67	6.67	6.06	5.33	4.68	4.12	3.62	3.18	2.80	2.46
6.6	6.57	6.57	5.97	5.25	4.61	4.05	3.56	3.13	2.75	2.42
6.7	6.44	6.44	5.86	5.15	4.52	3.98	3.50	3.07	2.70	2.37
6.8	6.29	6.29	5.72	5.03	4.42	3.89	3.42	3.00	2.64	2.32
6.9	6.12	6.12	5.56	4.89	4.30	3.78	3.32	2.92	2.57	2.25
7.0	5.91	5.91	5.37	4.72	4.15	3.65	3.21	2.82	2.48	2.18
7.1	5.67	5.67	5.15	4.53	3.98	3.50	3.08	2.70	2.38	2.09
7.2	5.39	5.39	4.90	4.31	3.78	3.33	2.92	2.57	2.26	1.99
7.3	5.08	5.08	4.61	4.06	3.57	3.13	2.76	2.42	2.13	1.87
7.4	4.73	4.73	4.30	3.78	3.32	2.92	2.57	2.26	1.98	1.74
7.5	4.36	4.36	3.97	3.49	3.06	2.69	2.37	2.08	1.83	1.61
7.6	3.98	3.98	3.61	3.18	2.79	2.45	2.16	1.90	1.67	1.47
7.7	3.58	3.58	3.25	2.86	2.51	2.21	1.94	1.71	1.50	1.32
7.8	3.18	3.18	2.89	2.54	2.23	1.96	1.73	1.52	1.33	1.17
7.9	2.80	2.80	2.54	2.24	1.96	1.73	1.52	1.33	1.17	1.03
8.0	2.43	2.43	2.21	1.94	1.71	1.50	1.32	1.16	1.02	0.897
8.1	2.10	2.10	1.91	1.68	1.47	1.29	1.14	1.00	0.879	0.773
8.2	1.79	1.79	1.63	1.43	1.26	1.11	0.973	0.855	0.752	0.661
8.3	1.52	1.52	1.39	1.22	1.07	0.941	0.827	0.727	0.639	0.562
8.4	1.29	1.29	1.17	1.03	0.906	0.796	0.700	0.615	0.541	0.475
8.5	1.09	1.09	0.990	0.870	0.765	0.672	0.591	0.520	0.457	0.401
8.6	0.920	0.920	0.836	0.735	0.646	0.568	0.499	0.439	0.386	0.339
8.7	0.778	0.778	0.707	0.622	0.547	0.480	0.422	0.371	0.326	0.287
8.8	0.661	0.661	0.601	0.528	0.464	0.408	0.359	0.315	0.277	0.244
8.9	0.565	0.565	0.513	0.451	0.397	0.349	0.306	0.269	0.237	0.208
9.0	0.486	0.486	0.442	0.389	0.342	0.300	0.264	0.232	0.204	0.179

Table 35: Chronic Criterion for Ammonia in Iowa Streams – Early Life Stages Absent.

	Temperature, °C									
pH	**0–7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15***	**16***
6.5	10.8	10.1	9.51	8.92	8.36	7.84	7.35	6.89	6.46	6.06
6.6	10.7	9.99	9.37	8.79	8.24	7.72	7.24	6.79	6.36	5.97
6.7	10.5	9.81	9.20	8.62	8.08	7.58	7.11	6.66	6.25	5.86
6.8	10.2	9.58	8.98	8.42	7.90	7.40	6.94	6.51	6.10	5.72
6.9	9.93	9.31	8.73	8.19	7.68	7.20	6.75	6.33	5.93	5.56
7.0	9.60	9.00	8.43	7.91	7.41	6.95	6.52	6.11	5.73	5.37
7.1	9.20	8.63	8.09	7.58	7.11	6.67	6.25	5.86	5.49	5.15
7.2	8.75	8.20	7.69	7.21	6.76	6.34	5.94	5.57	5.22	4.90
7.3	8.24	7.73	7.25	6.79	6.37	5.97	5.60	5.25	4.92	4.61
7.4	7.69	7.21	6.76	6.33	5.94	5.57	5.22	4.89	4.59	4.30
7.5	7.09	6.64	6.23	5.84	5.48	5.13	4.81	4.51	4.23	3.97
7.6	6.46	6.05	5.67	5.32	4.99	4.68	4.38	4.11	3.85	3.61
7.7	5.81	5.45	5.11	4.79	4.49	4.21	3.95	3.70	3.47	3.25
7.8	5.17	4.84	4.54	4.26	3.99	3.74	3.51	3.29	3.09	2.89
7.9	4.54	4.26	3.99	3.74	3.51	3.29	3.09	2.89	2.71	2.54
8.0	3.95	3.70	3.47	3.26	3.05	2.86	2.68	2.52	2.36	2.21
8.1	3.41	3.19	2.99	2.81	2.63	2.47	2.31	2.17	2.03	1.91
8.2	2.91	2.73	2.56	2.40	2.25	2.11	1.98	1.85	1.74	1.63
8.3	2.47	2.32	2.18	2.04	1.91	1.79	1.68	1.58	1.48	1.39
8.4	2.09	1.96	1.84	1.73	1.62	1.52	1.42	1.33	1.25	1.17
8.5	1.77	1.66	1.55	1.46	1.37	1.28	1.20	1.13	1.06	0.990
8.6	1.49	1.40	1.31	1.23	1.15	1.08	1.01	0.951	0.892	0.836
8.7	1.26	1.18	1.11	1.04	0.976	0.915	0.858	0.805	0.754	0.707
8.8	1.07	1.01	0.944	0.885	0.829	0.778	0.729	0.684	0.641	0.601
8.9	0.917	0.860	0.806	0.756	0.709	0.664	0.623	0.584	0.548	0.513
9.0	0.790	0.740	0.694	0.651	0.610	0.572	0.536	0.503	0.471	0.442

Distribution List

Bound Version with CD:

John Castle
Coralville Lake
USACE

Don Koch
Geological Survey Bureau
Iowa Department of Natural Resources

Ken Lloyd
University of Iowa Water Plant

Donna Lutz
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Ed Moreno
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Appendix A

QA/QC Control Charts

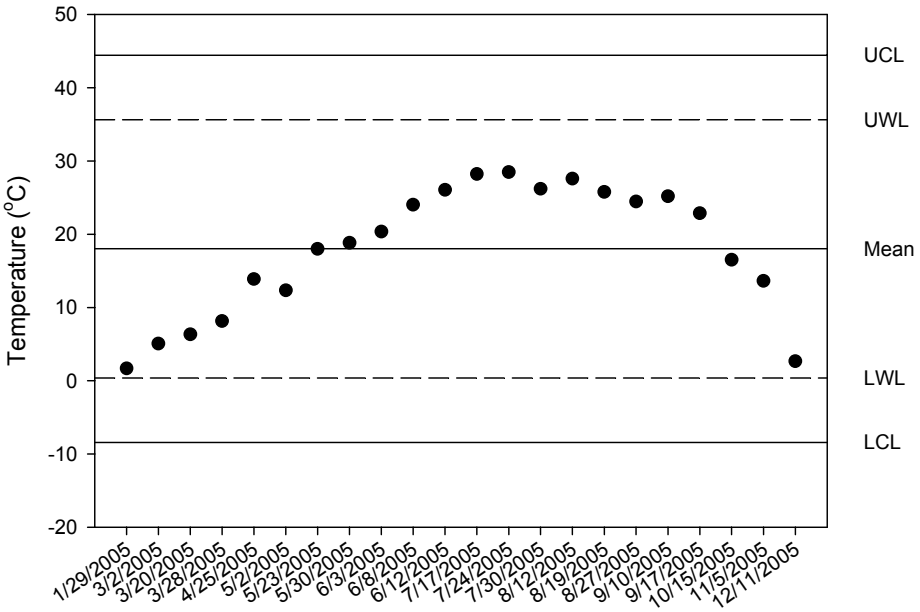

Figure 97: Year 2005 water temperature accuracy chart.

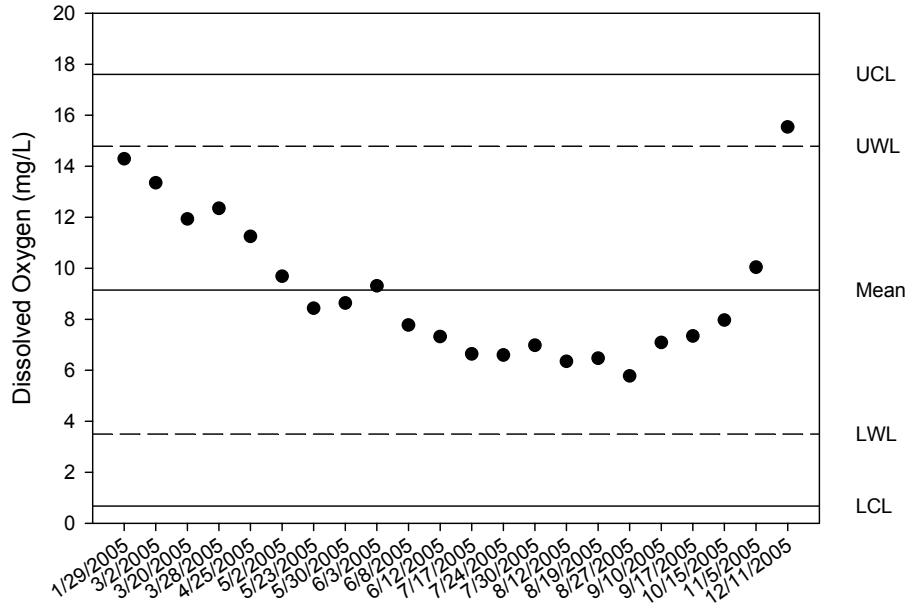

Figure 98: Year 2005 dissolved oxygen accuracy chart.

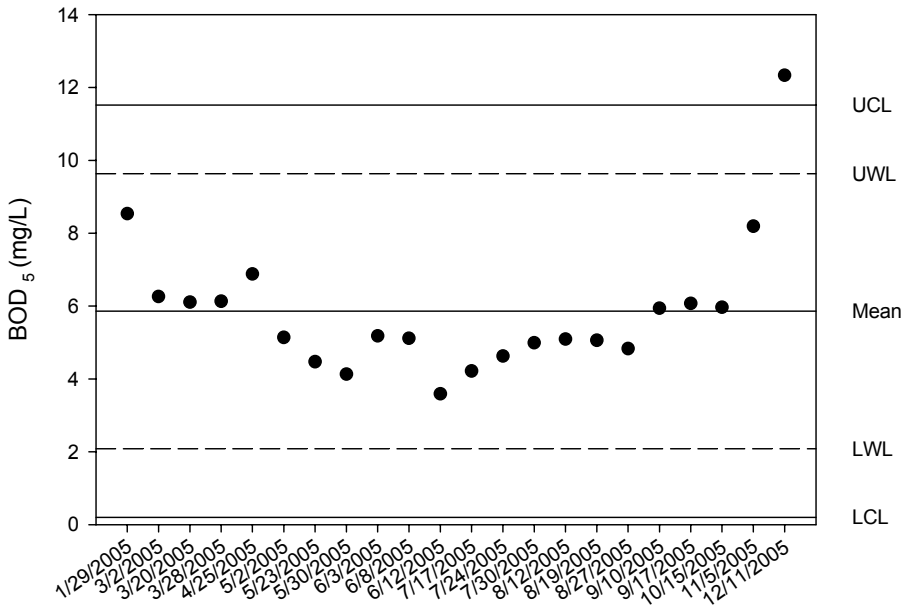

Figure 99: Year 2005 biological oxygen demand accuracy chart.

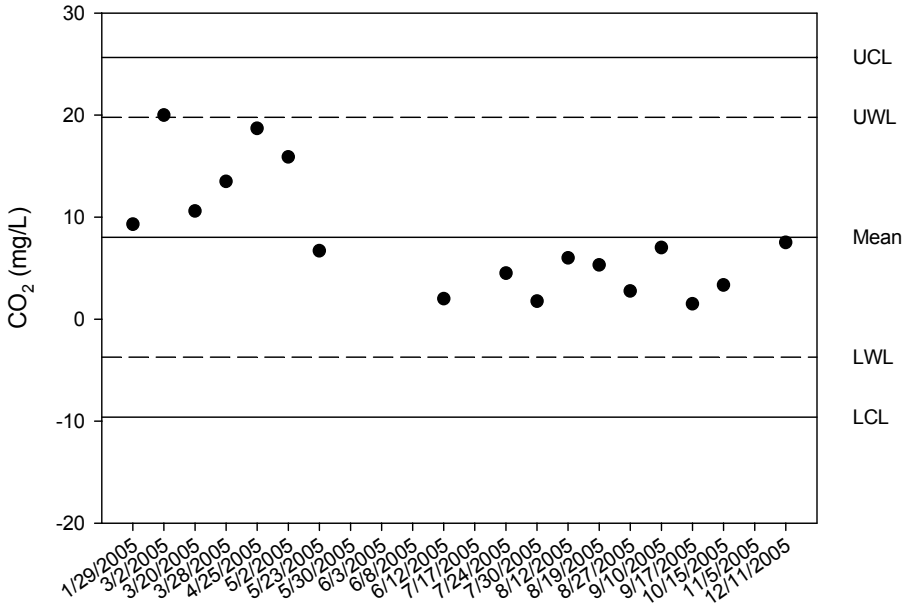

Figure 100: Year 2005 carbon dioxide accuracy chart.

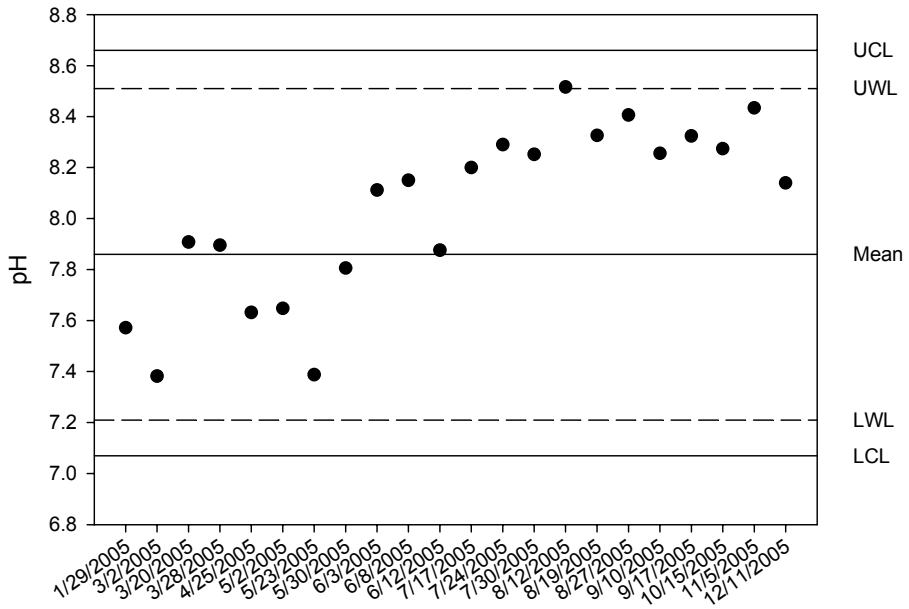

Figure 101: Year 2005 pH accuracy chart.

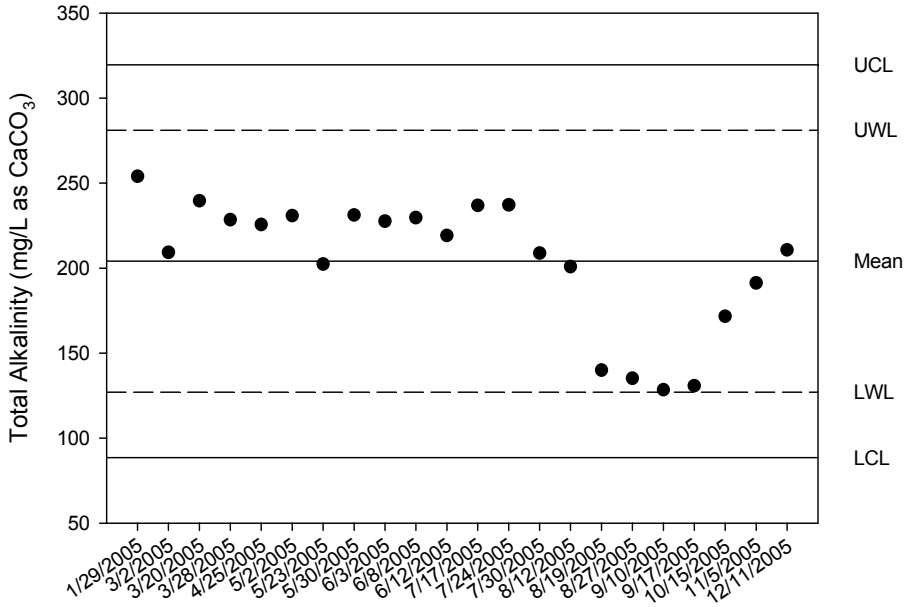

Figure 102: Year 2005 total alkalinity accuracy chart.

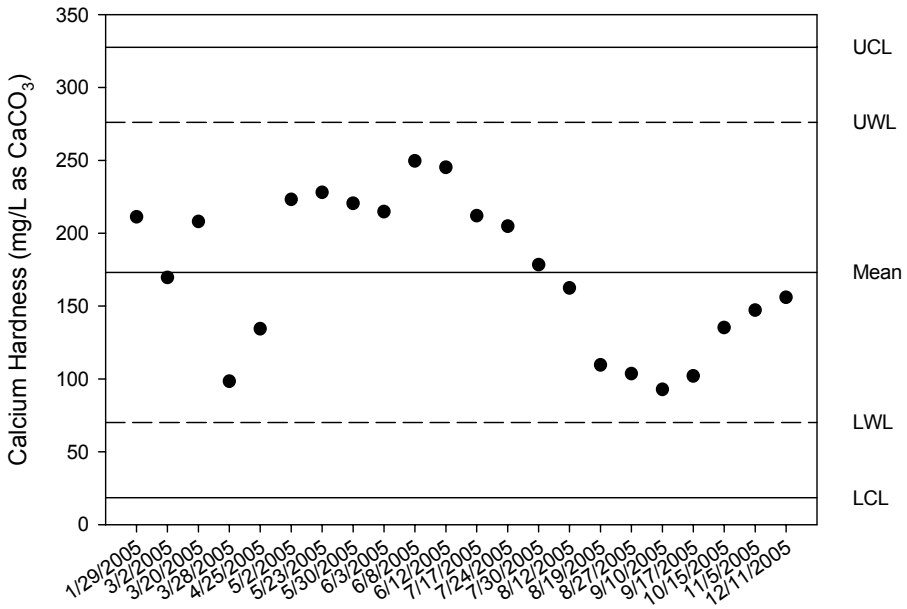

Figure 103: Year 2005 calcium hardness accuracy chart.

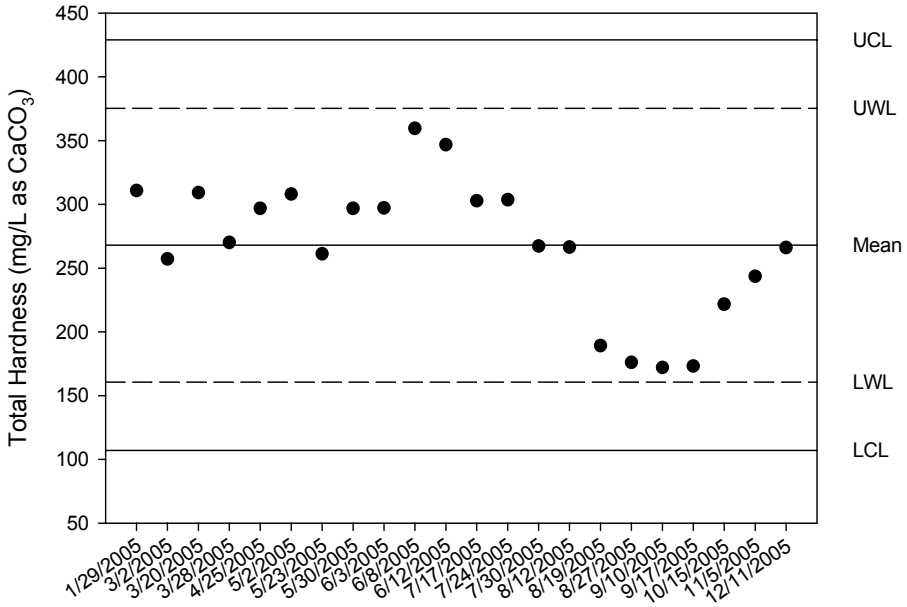

Figure 104: Year 2005 total hardness accuracy chart.

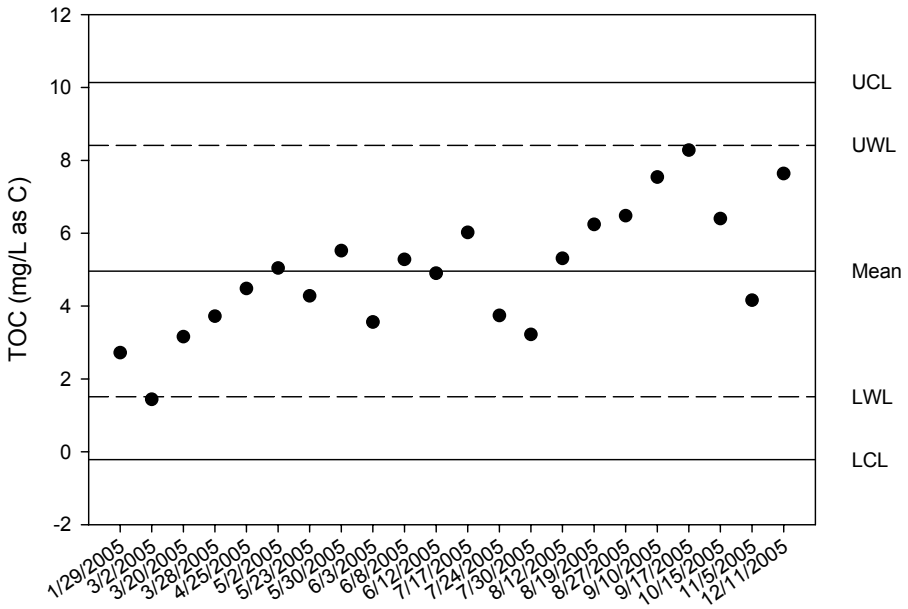

Figure 105: Year 2005 organic carbon accuracy chart.

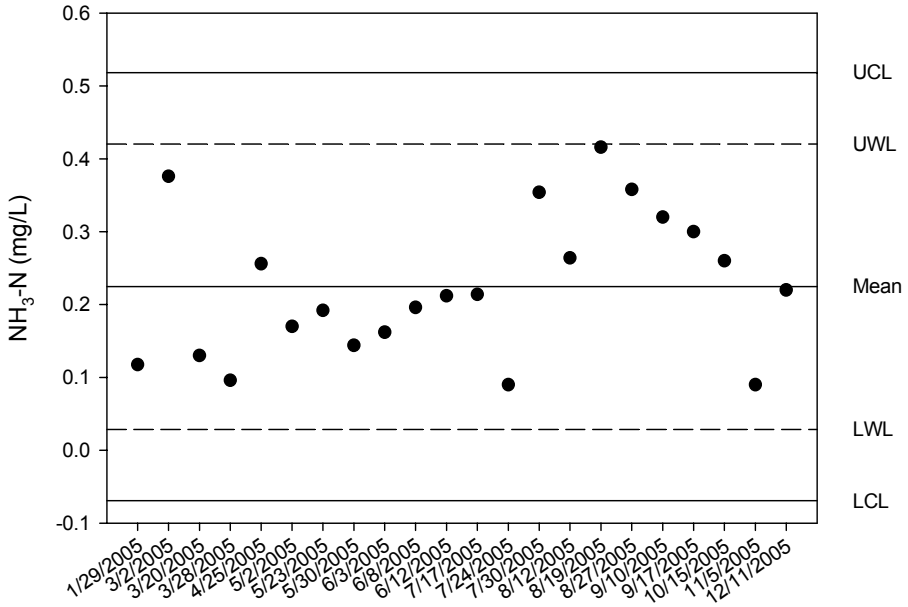

Figure 106: Year 2005 ammonia nitrogen accuracy chart.

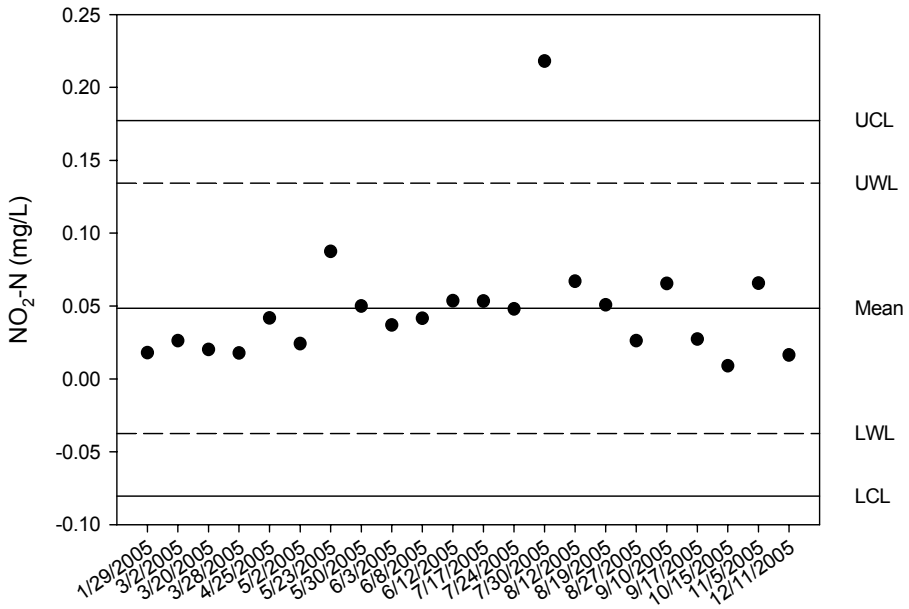

Figure 107: Year 2005 nitrite nitrogen accuracy chart.

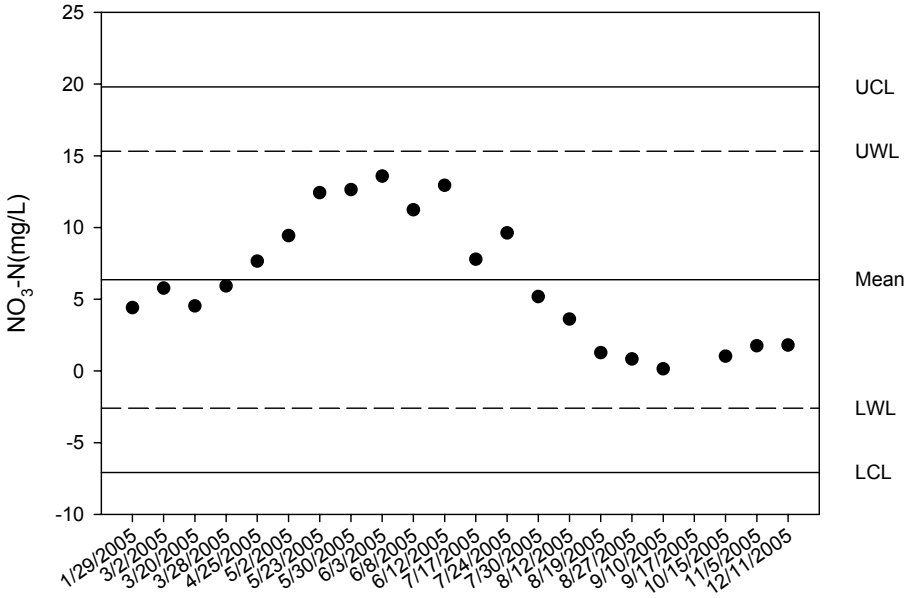

Figure 108: Year 2005 nitrate nitrogen accuracy chart.

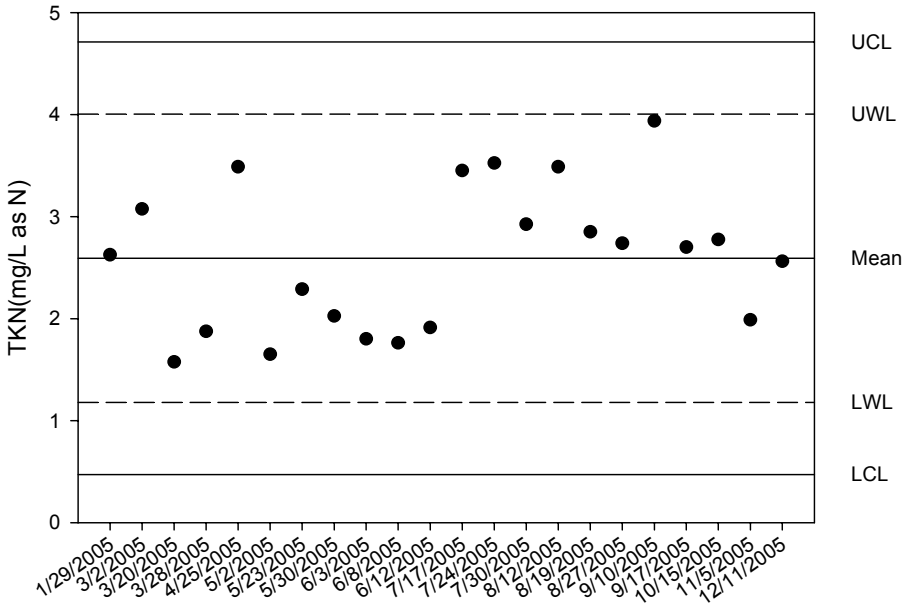

Figure 109: Year 2005 total Kjeldahl nitrogen accuracy chart.

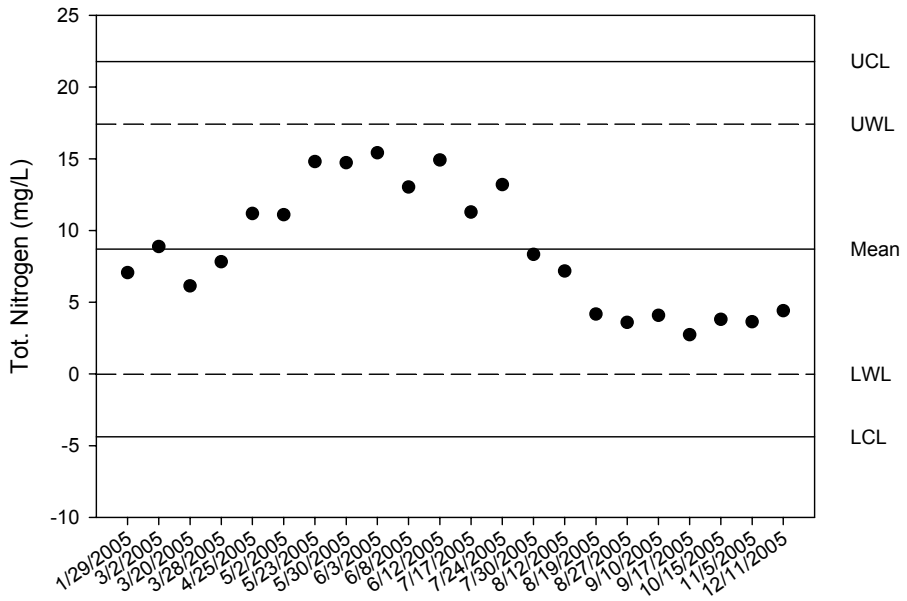

Figure 110: Year 2005 total nitrogen accuracy chart.

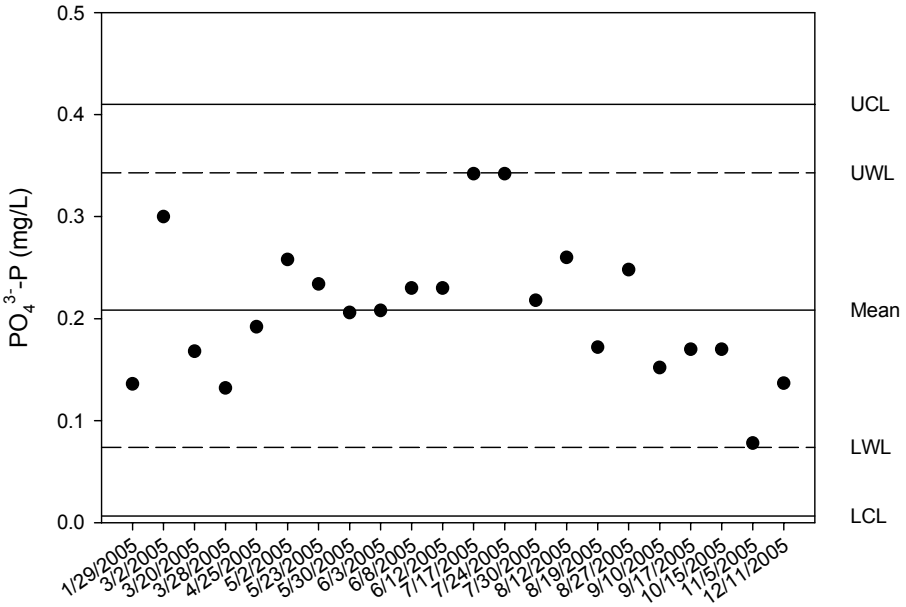

Figure 111: Year 2005 orthophosphate accuracy chart.

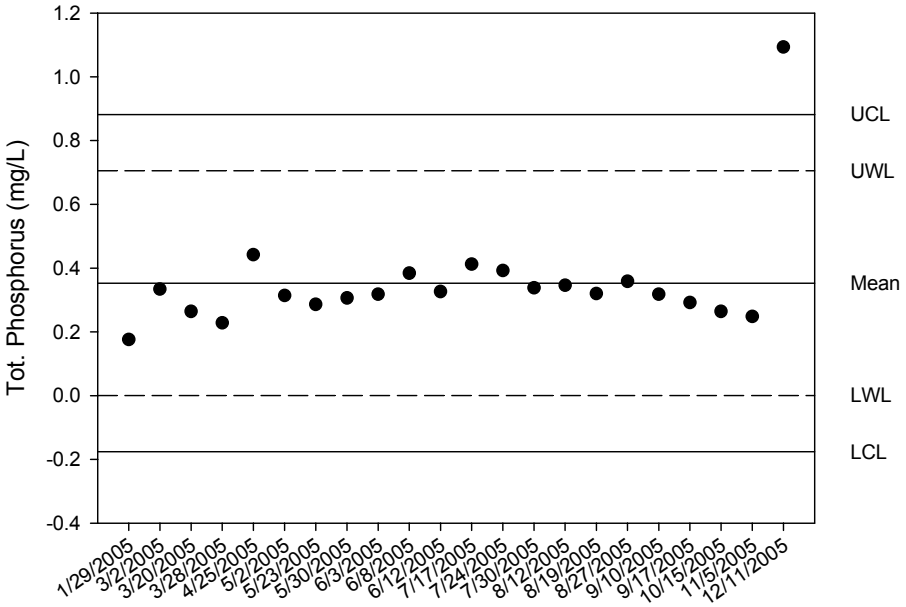

Figure 112: Year 2005 total phosphorus accuracy chart.

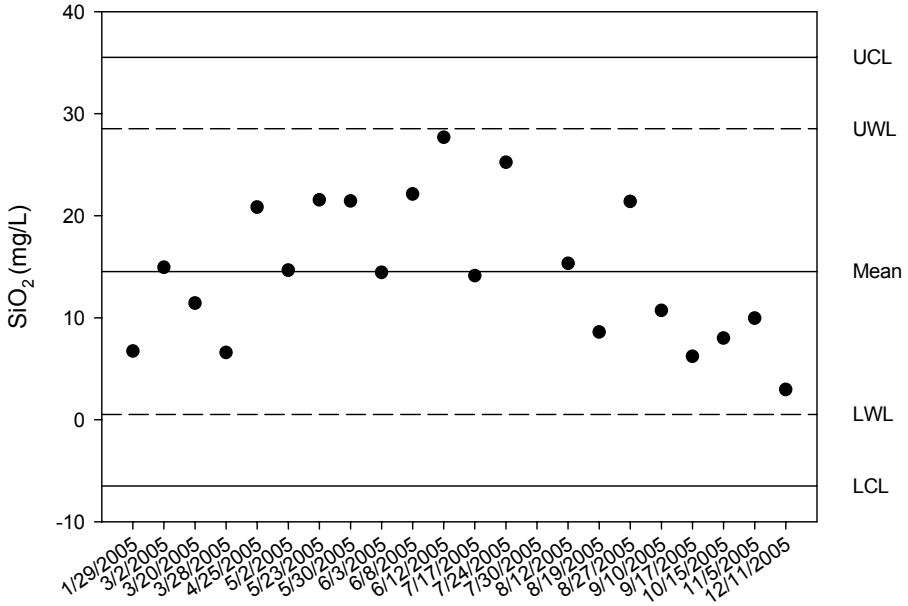

Figure 113: Year 2005 silica accuracy chart.

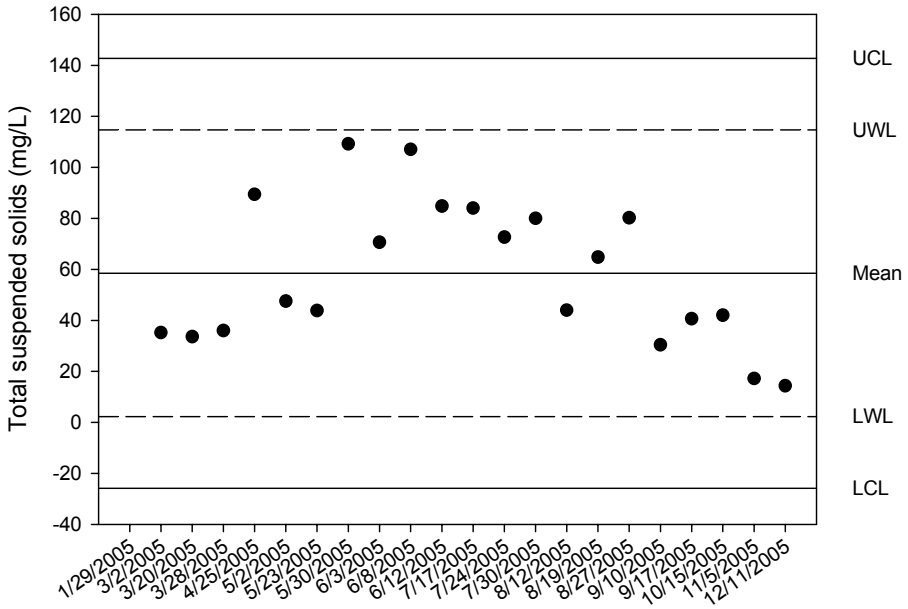

Figure 114: Year 2005 total suspended solids accuracy chart.

Department of Civil and Environmental Engineering

IIHR – Hydroscience & Engineering

Coralville Reservoir Water Quality Project

Monthly Report, January 2005

Claudia Espinosa-Villegas
Craig Just
Tatsuaki Nakato
Jerald Schnoor

General Conditions

Samples were collected on Jan 27th at all river and reservoir locations. The general conditions and hydrologic parameters for each sampling event are highlighted in Table 1. The stream flow data is taken from the USGS website and is considered provisional.

Table 1: General conditions and hydrologic parameters for each sampling event.

Date	Air Temp. Noon		Sky	Previous Day Precipitation
	°C	°F		inches
27-Jan-05	-9.0	15.8	Scattered Clouds	0

Date	Inflow, USGS05453100			Outflow, USGS05453520			Pool Level
	max cfs	min cfs	mean cfs	max cfs	min cfs	mean cfs	ft msl
27-Jan-05	860	840	*	620	600	613	na

* the reported mean reservoir inflow was 373 cfs which cannot be true given the maximum and minimum reported values of 860 and 840 cfs respectively.

Water Quality Observations

The physical, chemical and biological water quality results are shown in Table 2 and Table 3 for the reservoir and river locations. Quality assurance and quality control data are shown in Table 4 and Table 5. The field report(s) for the month are included in Appendix A.

The water temperature was between 0.8 and 2.6°C at all locations with a mean of 1.7°C. The dissolved oxygen concentration was lowest at upstream location (12.3 mg/L) and greatest at the reservoir bottom (15.6 mg/L). The pH was between 7.35 and 7.89 for all sample locations with a mean of 7.57. The titrated carbon dioxide concentrations were between 4.5 and 20.5 mg/L with the minima occurring at the upstream and downstream locations and the maximum occurring at the reservoir bottom. Phenolphthalein alkalinity was less than 0.1 mg/L as $CaCO_3$ for all samples except the reservoir surface which had a value of 6 mg/L as $CaCO_3$. Total alkalinity was between 248 and 266 mg/L as $CaCO_3$ for all samples with a mean of 254 mg/L as $CaCO_3$. Calcium hardness was lowest (200 mg/L as $CaCO_3$) at the reservoir surface and greatest (220 mg/L as $CaCO_3$) at the upstream location. Total hardness was between 290 and 322 mg/L as $CaCO_3$ for all samples with a mean of 311 mg/L as $CaCO_3$.

Ammonia nitrogen concentrations were between non-detect (<0.1 mg/L-N) and 0.2 mg/L-N for all samples collected. Nitrite nitrogen concentrations were 0.02 mg/L-N for all locations except the reservoir bottom which had a value of 0.01 mg/L-N. The nitrate concentration was lowest (3.8 mg/L-N) at the reservoir surface and greatest (4.7 mg/L-N)

at the upstream and reservoir bottom locations. Total Kjeldahl nitrogen was between 1.31 and 6.00 mg/L-N for all samples with a mean of 2.63 mg/L-N. Total nitrogen was lowest (5.8 mg/L-N) at the reservoir mid-depth location and greatest (10.7 mg/L-N) at the upstream location. Reactive (ortho) phosphate was between 0.09 and 0.20 mg/L-P for all locations and total phosphorus was lowest at the downstream location (0.12 mg/L-P) and greatest (0.26 mg/L-P) at the upstream location.

The silica concentration was between non-detect (<1 mg/L as SiO_2) and 11 mg/L as SiO_2 for all samples and total organic carbon was lowest (1.3 mg/L) at the upstream location and greatest (4.0 mg/L) at the reservoir mid-depth location. Total suspended solids were less than 10 mg/L for all samples collected in January 2005. The biological oxygen demand was between 7.4 and 9.5 mg/L for all samples with a mean of 8.5 mg/L.

No other parameters were measured in January 2005.

Table 2: Results, Jan 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Iowa River Upstream (Green Castle Avenue)																
27-Jan-05	0.8	12.3	7.35	4.5	22.5	<0.1	252	220	320	0.2	0.02	4.7	6.00	10.7	0.20	0.26
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)																
27-Jan-05	2.6	15.5	7.52	6.0	14.9	6	248	200	290	0.1	0.02	3.8	2.44	6.3	0.09	0.15
Coralville Reservoir - MID-DEPTH																
27-Jan-05	1.4	14.7	7.58	11.0	13.4	<0.1	256	210	322	<0.1	0.02	4.5	1.31	5.8	0.13	0.19
Coralville Reservoir - BOTTOM																
27-Jan-05	1.6	15.6	7.52	20.5	16.0	<0.1	266	216	322	0.1	0.01	4.7	1.69	6.4	0.14	0.16
Iowa River Downstream - University Water Plant (Iowa City)																
27-Jan-05	2.0	13.4	7.89	4.5	6.3	<0.1	248	210	300	0.2	0.02	4.3	1.69	6.0	0.12	0.12
MIN	0.8	12.3	7.35	4.5	6.3	<0.1	248	200	290	<0.1	0.01	3.8	1.31	5.8	0.09	0.12
MAX	2.6	15.6	7.89	20.5	22.5	6	266	220	322	0.2	0.02	4.7	6.00	10.7	0.20	0.26
MEAN	1.7	14.3	7.57	9.3	14.6	na	254	211	311	na	0.02	4.4	2.63	7.1	0.14	0.18

Table 36: Results, Jan 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion Balance	Pigments				Indicator Org.	
					Cl	SO_4	Na	K		chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Iowa River Upstream (Green Castle Avenue)															
27-Jan-05	11	1.3	<10	7.4	na	na	na	na	na	na	na	na	na	na	na
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)															
27-Jan-05	4	3.3	<10	9.5	na	na	na	na	na	na	na	na	na	na	na
Coralville Reservoir - MID-DEPTH															
27-Jan-05	<1	4.0	<10	8.7	na	na	na	na	na	na	na	na	na	na	na
Coralville Reservoir - BOTTOM															
27-Jan-05	3	2.6	<10	8.9	na	na	na	na	na	na	na	na	na	na	na
Iowa River Downstream - University Water Plant (Iowa City)															
27-Jan-05	8	2.4	<10	8.2	na	na	na	na	na	na	na	na	na	na	na
MIN	<1	1.3	<10	7.4	na	na	na	na	na	na	na	na	na	na	na
MAX	11	4.0	<10	9.5	na	na	na	na	na	na	na	na	na	na	na
MEAN	na	2.7	na	8.5	na	na	na	na	na	na	na	na	na	na	na

Table 4: Quality Assurance/Control, Jan 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Duplicate (O)																
27-Jan-05	na	na	na	6.0	na	<0.1	258	220	306	0.17	0.02	4.8	5.44	10.3	0.27	0.27
% diff.	na	na	na	-33.3	na	na	-2.4	0.0	4.4	5.6	22.7	-1.7	9.4	4.5	-35.0	-3.8
Replicate (WP)																
27-Jan-05	na	na	na	5.5	na	<0.1	248	204	296	0.19	0.02	4.3	1.69	6.0	0.13	0.13
% diff.	na	na	na	-22.2	na	na	0.0	2.9	1.3	-5.6	23.8	0.0	0.0	0.1	-8.3	-8.3
Standards (% Recovery)																
27-Jan-05	na	na	na	na	na	na	na	na	na	98	na	na	na	na	127	115
Spikes (% Recovery)																
27-Jan-05	na	na	na	110	na	na	100	na	105	50	na	na	na	na	95.1	100.3
Spike 2	na	na	na	117	na	na	97	na	100	74	na	na	na	na	97.9	100.1
Spike 3	na	na	na	96	na	na	96	na	93	98	na	na	na	na	91.5	99.2

Table 5: Quality Assurance/Control, Jan 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2 mg/L	TOC mg/L	TSS mg/L	BOD_5 mg/L	Additional Anions Cl mg/L	Additional Anions SO_4 mg/L	Additional Cations Na mg/L	Additional Cations K mg/L	Ion Balance % diff.	Pigments chl *a* mg/m^3	Pigments pheo *a* mg/m^3	Pigments chl *b* mg/m^3	Pigments chl *c* mg/m^3	Indicator Org. Fecal Org. / 100 mL	Indicator Org. *E. coli* Org. / 100 mL
Duplicate (O)															
27-Jan-05	8.9	1.7	<10	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	19.1	-30.8	na	na	na	na	na	na	na	na	na	na	na	na	na
Replicate (WP)															
27-Jan-05	10	2.5	<10	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	-21.7	-4.2	na	na	na	na	na	na	na	na	na	na	na	na	na
Standards (% Recovery)															
27-Jan-05	95	100	na	na	na	na	na	na	na	na	na	na	na	na	na
Spikes (% Recovery)															
27-Jan-05	110.5	55.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	112.1	88.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	117.0	81.0	na	na	na	na	na	na	na	na	na	na	na	na	na

Appendix A: Supporting Information

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp.		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	27-Jan-05	0.8	12.3	7.35	4.5	<0.1	252	220	320	-9.0	15.8	Scattered Clouds	0
Res-Surface	27-Jan-05	2.6	15.5	7.52	6.0	6	248	200	290	-9.0	15.8	Scattered Clouds	0
Res-Mid	27-Jan-05	1.4	14.7	7.58	11.0	<0.1	256	210	322	-9.0	15.8	Scattered Clouds	0
Res-Bottom	27-Jan-05	1.6	15.6	7.52	20.5	<0.1	266	216	322	-9.0	15.8	Scattered Clouds	0
Downstream	27-Jan-05	2.0	13.4	7.89	4.5	<0.1	248	210	300	-9.0	15.8	Scattered Clouds	0

Comments:
Upstream location had 9-10 inches of ice cover.

Department of Civil and Environmental Engineering

IIHR – Hydroscience & Engineering

Coralville Reservoir Water Quality Project

Monthly Report, February 2005

Claudia Espinosa-Villegas
Craig Just
Tatsuaki Nakato
Jerald Schnoor

General Conditions

Samples were collected on Feb 28th at all river and reservoir locations. The general conditions and hydrologic parameters for each sampling event are highlighted in Table 1. The stream flow data is taken from the USGS website and is considered provisional.

Table 1: General conditions and hydrologic parameters for each sampling event.

Date	Air Temp. Noon		Sky	Previous Day Precipitation
	°C	°F		inches
28-Feb-05	-7.0	19.4	Light snow	0.07

Date	Inflow, USGS05453100			Outflow, USGS05453520			Pool Level
	max	min	mean	max	min	mean	
	cfs	cfs	cfs	cfs	cfs	cfs	ft msl
28-Feb-05	1,450	1,400	1,420	1,970	1,790	1,880	683.03

Water Quality Observations

The physical, chemical and biological water quality results are shown in Table 2 and Table 3 for the reservoir and river locations. Quality assurance and quality control data are shown in Table 4 and Table 5. The field report(s) for the month are included in Appendix A.

The water temperature was between 3.4 and 7.7°C at all locations with a mean of 5.1°C. The dissolved oxygen concentration was lowest at the reservoir bottom location (10.9 mg/L) and greatest at the downstream location (18.3 mg/L). The pH was between 6.72 and 7.63 for all sample locations with a mean of 7.21. The titrated carbon dioxide concentrations were between 17.5 and 22.5 mg/L with the minimum occurring at the downstream location and the maximum occurring at the reservoir surface. Phenolphthalein alkalinity was less than 0.1 mg/L as $CaCO_3$ for all samples except the upstream location which had a value of 4 mg/L as $CaCO_3$. Total alkalinity was between 188 and 238 mg/L as $CaCO_3$ for all samples with a mean of 209 mg/L as $CaCO_3$. Calcium hardness was lowest (150 mg/L as $CaCO_3$) at the downstream location and greatest (200 mg/L as $CaCO_3$) at the upstream location. Total hardness was between 246 and 292 mg/L as $CaCO_3$ for all samples with a mean of 257 mg/L as $CaCO_3$.

Ammonia nitrogen concentrations were between 0.2 and 0.5 mg/L-N for all samples collected. Nitrite nitrogen concentrations ranged from 0.01 mg/L-N for the upstream location, to 0.5 mg/L-N for the reservoir surface and downstream locations. The nitrate concentration was lowest (5.2 mg/L-N) at the upstream location and greatest (6.1 mg/L-N) at the downstream location. Total Kjeldahl nitrogen was between 2.63 and 3.56 mg/L-N for all samples with a mean of 3.08 mg/L-N. Total nitrogen was lowest (8.7

mg/L-N) at upstream location and greatest (9.1 mg/L-N) at the reservoir bottom. Reactive (ortho) phosphate was between 0.27 and 0.36 mg/L-P for all locations and total phosphorus was lowest at the reservoir surface and bottom (0.29 mg/L-P) and greatest (0.37 mg/L-P) at the reservoir mid-depth and downstream locations.

The silica concentration was between 13 mg/L as SiO_2 and 17 mg/L as SiO_2 for all samples and total organic carbon was lowest (0.4 mg/L) at the upstream location and greatest (4.1 mg/L) at downstream location. Total suspended solids ranged from 18 mg/L for the reservoir surface to 70 mg/L for the upstream location. The biological oxygen demand was between 5.7 and 8.1 mg/L for all samples with a mean of 6.3 mg/L.

No other parameters were measured in February 2005.

Table 2: Results, Feb 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Iowa River Upstream (Green Castle Avenue)																
28-Feb-05	3.8	12.8	7.63	20.0	11.1	4	238	200	292	0.2	0.01	5.2	3.56	8.7	0.27	0.35
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)																
28-Feb-05	7.7	12.4	7.62	22.5	na	<0.1	208	164	246	0.5	0.03	5.9	3.00	8.9	0.31	0.29
Coralville Reservoir - MID-DEPTH																
28-Feb-05	4.9	12.4	7.53	20.0	12.0	<0.1	204	168	246	0.4	0.03	5.8	3.00	8.8	0.36	0.37
Coralville Reservoir - BOTTOM																
28-Feb-05	5.5	10.9	7.43	20.0	15.4	<0.1	208	166	256	0.4	0.03	5.9	3.19	9.1	0.29	0.29
Iowa River Downstream - University Water Plant (Iowa City)																
28-Feb-05	3.4	18.3	7.60	17.5	9.4	<0.1	188	150	246	0.5	0.04	6.1	2.63	8.8	0.27	0.37
MIN	3.4	10.9	6.72	17.5	9.4	<0.1	188	150	246	0.2	0.01	5.2	2.63	8.7	0.27	0.29
MAX	7.7	18.3	7.63	22.5	79.2	4	238	200	292	0.5	0.04	6.1	3.56	9.1	0.36	0.37
MEAN	5.1	13.3	7.21	20.0	25.4	na	209	170	257	0.4	0.03	5.8	3.08	8.9	0.30	0.33

Table 3: Results, Feb 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion Balance	Pigments				Indicator Org.	
					Cl	SO_4	Na	K		chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Iowa River Upstream (Green Castle Avenue)															
28-Feb-05	13	0.4	70	5.7	na	na	na	na	na	na	na	na	na	na	na
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)															
28-Feb-05	14	0.9	18	5.9	na	na	na	na	na	na	na	na	na	na	na
Coralville Reservoir - MID-DEPTH															
28-Feb-05	17	1.0	25	5.9	na	na	na	na	na	na	na	na	na	na	na
Coralville Reservoir - BOTTOM															
28-Feb-05	15	0.8	25	5.7	na	na	na	na	na	na	na	na	na	na	na
Iowa River Downstream - University Water Plant (Iowa City)															
28-Feb-05	16	4.1	38	8.1	na	na	na	na	na	na	na	na	na	na	na
MIN	13	0.4	18	5.7	na	na	na	na	na	na	na	na	na	na	na
MAX	17	4.1	70	8.1	na	na	na	na	na	na	na	na	na	na	na
MEAN	15	1.4	35	6.3	na	na	na	na	na	na	na	na	na	na	na

Table 4: Quality Assurance/Control, Feb 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Duplicate (O)																
28-Feb-05	na	na	na	32.5	na	4	236	164	282	0.19	0.02	5.3	4.13	9.4	0.24	0.47
% diff.	na	na	na	-62.5	na	0.0	0.8	18.0	3.4	-5.6	-23.1	-2.7	-15.8	-8.1	11.1	-34.3
Replicate (WP)																
28-Feb-05	na	na	na	19.5	na	<0.1	186	146	244	0.46	0.04	6.1	2.63	8.8	0.29	0.34
% diff.	na	na	na	-11.4	na	na	1.1	2.7	0.8	-2.2	5.4	0.0	0.0	0.0	-7.4	8.1
Standards (% Recovery)																
27-Jan-05	na	na	na	na	na	na	na	na	na	102	na	na	80	na	109	109
Spikes (% Recovery)																
28-Feb-05	na	na	na	90	na	na	103	na	117	86.7	na	na	na	na	99.2	100.5
Spike 2	na	na	na	88	na	na	96	na	97	97.7	na	na	na	na	108	105.7
Spike 3	na	na	na	95	na	na	100	na	92	85.6	na	na	na	na	92.1	102.6

Table 5: Quality Assurance/Control, Feb 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion Balance	Pigments				Indicator Org.	
					Cl	SO_4	Na	K		chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Duplicate (O)															
28-Feb-05	12.4	2.0	36	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	3.9	-400.0	48.6	na	na	na	na	na	na	na	na	na	na	na	na
Replicate (WP)															
28-Feb-05	13	4.2	32	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	16.0	-2.4	15.8	na	na	na	na	na	na	na	na	na	na	na	na
Standards (% Recovery)															
28-Feb-05	94	104	na	na	na	na	na	na	na	na	na	na	na	na	na
Spikes (% Recovery)															
28-Feb-05	109.5	107.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	101.3	110.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	110.8	95.0	na	na	na	na	na	na	na	na	na	na	na	na	na

Appendix A: Supporting Information

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp.		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	28-Feb-05	3.8	12.8	7.63	20.0	4	238	200	292	-7.0	19.4	Light snow	0.07
Res-Surface	28-Feb-05	7.7	12.4	6.72	22.5	<0.1	208	164	246	-7.0	19.4	Light snow	0.07
Res-Mid	28-Feb-05	4.9	12.4	7.53	20.0	<0.1	204	168	246	-7.0	19.4	Light snow	0.07
Res-Bottom	28-Feb-05	5.5	10.9	7.43	20.0	<0.1	208	166	256	-7.0	19.4	Light snow	0.07
Downstream	28-Feb-05	3.4	18.3	7.60	17.5	<0.1	188	150	246	-7.0	19.4	Light snow	0.07

Comments:

Department of Civil and Environmental Engineering

IIHR – Hydroscience & Engineering

Coralville Reservoir Water Quality Project

Monthly Report, March 2005

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General Conditions

Samples were collected on Mar 18th and Mar 26th at all river and reservoir locations. The general conditions and hydrologic parameters for each sampling event are highlighted in Table 1. The stream flow data is taken from the USGS website and is considered provisional.

Table 1: General conditions and hydrologic parameters for each sampling event.

Date	Air Temp. Noon		Sky	Previous Day Precipitation
	°C	°F		inches
18-Mar-05	7.5	45.5	Clear	0.00
26-Mar-05	6.1	43.0	Partly cloudy	0.09

Date	Inflow, USGS05453100			Outflow, USGS05453520			Pool Level
	max	min	mean	max	min	mean	
	cfs	cfs	cfs	cfs	cfs	cfs	ft msl
18-Mar-05	890	875	879	1,350	1,240	1,290	679.79
26-Mar-05	920	855	887	1,320	1,230	1,280	679.66

Water Quality Observations

The physical, chemical and biological water quality results are shown in Table 2 and Table 3 for the reservoir and river locations. Quality assurance and quality control data are shown in Table 4 and Table 5. The field report(s) for the month are included in Appendix A.

The water temperature minimum on Mar 18th was 3.9°C (upstream) and the maximum was 8.9°C (reservoir bottom). For Mar 26th the minimum and maximum temperature was 5.7 and 11.9°C at the reservoir mid-depth and surface respectively. Site specific dissolved oxygen concentrations were lower on Mar 18th compared to Mar 26th, with the exception of the downstream location. The monthly minimum of 11.3 mg/L was well above the criterion for healthy lakes and streams. The pH ranged from 7.53 to 8.16 for the dates sampled, with the maxima occurring at the downstream location on March 18th and 26th (8.16 and 8.11).

Titrated carbon dioxide values were between 3 and 20 mg/L for all samples collected in Mar 2005 with a mean of 12.1 mg/L. Phenolphthalein alkalinity was non-detectable at several locations on Mar 18th and was between 6 and 12 mg/L for all samples collected Mar 26th. Total alkalinity values were lower on Mar 26th compared to Mar 18th for all sample locations with a low of 220 mg/L as $CaCO_3$ and a high of 244 mg/L as $CaCO_3$ for the month. Calcium hardness for the month was much lower on March 26th with values ranging from 84 to 114 mg/L as $CaCO_3$, while March 26th calcium hardness ranged from 200 to 220 mg/L as $CaCO_3$. Total hardness values were also lower site-by-site on Mar 26th compared to Mar 18th, with a monthly range of 260 to 324 mg/L as $CaCO_3$ and an average of 290 mg/L as $CaCO_3$ for all samples collected.

Ammonia nitrogen ranged from <0.1 mg/L-N at the upstream location (March 18th), to 0.2 mg/L-N at the reservoir surface (March 18th); all other values for the month were 0.1 mg/L-N. Nitrite values ranged from 0.01 to 0.03 mg/L-N for the month. Nitrate values ranged from 3.4 to 6.4 mg/L-N with a monthly average of 5.2 mg/L-N. Total Kjeldahl nitrogen was highest at the upstream location for both sample sets (2.44 and 2.81 mg/L respectively); all other values were between 0.94 and 2.25 mg/L. Total nitrogen values were generally lower on March 18th than March 26th, with the exception of the mid-depth reservoir location. Total nitrogen ranged from 5.8 mg/L-N to 8.7 mg/L-N, with a monthly mean of 7.0 mg/L-N. Orthophosphate concentrations had a monthly mean of 0.15 mg/L-P, a minimum of 0.10 mg/L-P at the downstream location on March 26th, and a maximum of 0.21 mg/L-P on March 18th at the upstream location. The same trend was present for total phosphorus with the maximum recorded at the upstream location on Mar 18th (0.34 mg/L-P) and the minimum recorded at the downstream location on Mar 26th (0.18 mg/L-P).

Silica was generally higher site-by-site on Mar 18th compared to Mar 26th with a monthly mean of 9 mg/L as SiO_2. Total organic carbon ranged from 1.3 to 7.4 mg/L with a monthly mean of 3.4 mg/L. Total suspended solids were greatest (50 mg/L) at the upstream location on Mar 18th and lowest (14 mg/L) at the downstream location Mar 18th. Biological oxygen demand was similar at all sites on both sampling events in Mar 2005 with a monthly mean of 6.1 mg/L.

Additional ions reported for the month include chloride, sulfate, sodium and potassium (Table 3). Ion balances were outside of the recommended control limit of ± 2% for all samples in March 2005.

Table 2: Results, Mar 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Iowa River Upstream (Green Castle Avenue)																
18-Mar-05	3.9	11.3	7.90	19.5	6.1	<1	244	220	324	<0.1	0.01	3.4	2.44	5.9	0.21	0.34
26-Mar-05	6.3	12.5	7.87	6.0	6.1	6	226	114	282	0.1	0.01	5.8	2.81	8.6	0.19	0.31
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)																
18-Mar-05	7.8	11.4	7.75	13.0	8.5	<1	240	212	308	0.2	0.02	4.3	1.50	5.8	0.15	0.28
26-Mar-05	11.9	11.5	7.53	10.0	13.5	6	230	84	260	0.1	0.02	6.4	1.31	7.7	0.13	0.23
Coralville Reservoir - MID-DEPTH																
18-Mar-05	5.6	11.8	7.90	12.0	5.8	<1	234	202	300	0.1	0.02	5.3	0.94	6.3	0.16	0.24
26-Mar-05	5.7	13.0	7.97	18.5	4.9	6	230	104	266	0.1	0.02	5.0	1.13	6.1	0.12	0.21
Coralville Reservoir - BOTTOM																
18-Mar-05	8.9	12.2	7.83	5.5	7.1	<1	242	206	310	0.1	0.02	4.8	1.88	6.7	0.19	0.26
26-Mar-05	7.6	12.8	8.00	20.0	4.4	6	220	94	272	0.1	0.02	6.0	1.88	7.9	0.12	0.21
Iowa River Downstream - University Water Plant (Iowa City)																
18-Mar-05	5.6	13.0	8.16	3.0	3.2	10	238	200	304	0.1	0.03	4.8	1.13	6.0	0.13	0.20
26-Mar-05	9.3	12.0	8.11	13.0	3.6	12	236	96	270	0.1	0.02	6.4	2.25	8.7	0.10	0.18
MIN	3.9	11.3	7.53	3.0	3.2	na	220	84	260	na	0.01	3.4	0.94	5.8	0.10	0.18
MAX	11.9	13.0	8.16	20.0	13.5	na	244	220	324	0.2	0.03	6.4	2.81	8.7	0.21	0.34
MEAN	7.2	12.1	7.93	12.1	6.3	na	234	153	290	0.1	0.02	5.2	1.73	7.0	0.15	0.25

Table 3: Results, Mar 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2 mg/L	TOC mg/L	TSS mg/L	BOD_5 mg/L	Additional Anions Cl mg/L	Additional Anions SO_4 mg/L	Additional Cations Na mg/L	Additional Cations K mg/L	Ion Balance % diff.	Pigments chl *a* mg/m^3	Pigments pheo *a* mg/m^3	Pigments chl *b* mg/m^3	Pigments chl *c* mg/m^3	Indicator Org. Fecal Org. / 100 mL	Indicator Org. *E. coli* Org. / 100 mL
Iowa River Upstream (Green Castle Avenue)															
18-Mar-05	13	2.4	50	5.1	na	na	na	na	na	na	na	na	na	na	na
26-Mar-05	6	2.1	48	6.4	22.4	40.7	11.0	1.8	-11.0	na	na	na	na	na	na
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)															
18-Mar-05	12	1.3	26	6.0	na	na	na	na	na	na	na	na	na	na	na
26-Mar-05	7	3.3	34	5.6	24.3	41.7	11.0	1.7	-16.1	na	na	na	na	na	na
Coralville Reservoir - MID-DEPTH															
18-Mar-05	13	2.9	32	5.6	na	na	na	na	na	na	na	na	na	na	na
26-Mar-05	8	4.1	32	6.8	19.5	32.8	10.0	1.7	-10.8	na	na	na	na	na	na
Coralville Reservoir - BOTTOM															
18-Mar-05	13	1.8	46	6.7	na	na	na	na	na	na	na	na	na	na	na
26-Mar-05	6	7.3	36	7.0	23.7	40.3	10.0	1.8	-12.9	na	na	na	na	na	na
Iowa River Downstream - University Water Plant (Iowa City)															
18-Mar-05	6	7.4	14	7.2	na	na	na	na	na	na	na	na	na	na	na
26-Mar-05	6	1.8	30	4.9	28.2	42.8	12.0	1.7	-16.1	na	na	na	na	na	na
MIN	6	1.3	14	4.9	19.5	32.8	10.0	1.7	-16.1	na	na	na	na	na	na
MAX	13	7.4	50	7.2	28.2	42.8	12.0	1.8	-10.8	na	na	na	na	na	na
MEAN	9	3.4	35	6.1	23.6	39.7	10.8	1.7	-13.4	na	na	na	na	na	na

Table 4: Quality Assurance/Control, Mar 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Duplicate (O)																
18-Mar-05	5.74	11.01	7.92	15.5	5.9	<1	246	132	308	0.06	0.02	5.3	2.44	7.8	0.19	0.29
% diff.	na	na	na	20.5	3.8	na	-0.8	40.0	4.9	-200.0	-66.7	-54.1	0.0	-31.7	9.5	14.7
26-Mar-05	6.97	12.6	7.88	17.5	5.8	6	220	112	274	0.08	0.01	5	2.81	7.8	0.14	0.28
% diff.	na	na	na	-191.7	4.9	0.0	2.7	1.8	2.8	-14.3	44.4	13.8	0.0	9.3	26.3	9.7
Replicate (WP)																
18-Mar-05	6.03	12.57	8.18	17.5	3.1	10	238	100	300	0.12	0.02	4.8	0.94	5.8	0.12	0.2
% diff.	na	na	na	-483.3	4.6	0.0	0.0	50.0	1.3	-33.3	24.1	0.0	16.6	3.3	7.7	0.0
26-Mar-05	9.81	14.05	8.1	11.5		8	228	158	292	0.14	0.01	6.5	2.25	8.8	0.12	0.19
% diff.	na	na	na	11.5	100.0	33.3	3.4	-64.6	-8.1	-7.7	44.4	-0.9	0.0	-0.6	-20.0	-5.6
Standards (% Recovery)																
18-Mar-05	na	na	na	na	na	na	na	na	100	103	na	100	84	na	106	112
26-Mar-05	na	na	na	100	na	na	na	na	101	106	na	90	na	na	93	106
Spikes (% Recovery)																
18-Mar-05	na	na	na	125	na	na	92	na	110	99.1	na	na	na	na	107.1	108.7
Spike 2	na	na	na	100	na	na	94	na	100	94.7	na	na	na	na	106.1	11.6
Spike 3	na	na	na	83	na	na	96	na	103	94.5	na	na	na	na	100	105
26-Mar-05	na	na	na	93	na	na	100	na	100	86.3	na	na	na	na	114.1	107.2
Spike 2	na	na	na	120	na	na	104	na	95	89.4	na	na	na	na	104.2	114
Spike 3	na	na	na	95	na	na	100	na	95	91.4	na	na	na	na	111.8	98.9

Table 5: Quality Assurance/Control, Mar 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion Balance	Pigments				Indicator Org.	
					Cl	SO_4	Na	K		chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Duplicate (O)															
18-Mar-05	15.1	1.8	33	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	-15.3	25.0	34.0	na	na	na	na	na	na	na	na	na	na	na	na
26-Mar-05	5.9	1.7	33	na	18.8	33.9	10	1.6	-8.4	na	na	na	na	na	na
% diff.	-1.7	19.0	31.3	na	16.1	16.7	9.1	11.1	23.6	na	na	na	na	na	na
Replicate (WP)															
18-Mar-05	8	3.1	24	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	-19.0	58.1	-71.4	na	na	na	na	na	na	na	na	na	na	na	na
26-Mar-05	6	2.0	34	na	28.2	43.0	13.0	3.5	-10.9	na	na	na	na	na	na
% diff.	3.3	-11.1	-13.3	na	-0.2	-0.5	-8.3	-105.9	32.4	na	na	na	na	na	na
Standards (% Recovery)															
18-Mar-05	97	109	na	na	na	na	na	na	na	na	na	na	na	na	na
26-Mar-05	94	109	na	na	na	na	na	na	na	na	na	na	na	na	na
Spikes (% Recovery)															
18-Mar-05	86.5	72.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	102.5	95.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	64.8	74.0	na	na	na	na	na	na	na	na	na	na	na	na	na
26-Mar-05	85.2	180.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	81.9	149.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	70.5	101.0	na	na	na	na	na	na	na	na	na	na	na	na	na

Appendix A: Supporting Information

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp. Noon		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	18-Mar-05	5.9	11.3	7.90	19.5	<0.1	244	220	324	7.5	45.5	Clear	0
Res-Surface	18-Mar-05	7.8	11.4	7.75	13.0	<0.1	240	212	308	7.5	45.5	Clear	0
Res-Mid	18-Mar-05	5.6	11.8	7.90	12.0	<0.1	234	202	300	7.5	45.5	Clear	0
Res-Bottom	18-Mar-05	8.9	12.2	7.83	5.5	<0.1	242	206	310	7.5	45.5	Clear	0
Downstream	18-Mar-05	5.6	13.0	8.16	3.0	10	238	200	304	7.5	45.5	Clear	0

Comments:

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp. Noon		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	26-Mar-05	6.3	12.5	7.87	6.0	6	226	114	282	6.1	43.0	Partly cloudy	0.09
Res-Surface	26-Mar-05	11.9	11.5	7.53	10.0	6	230	84	260	6.1	43.0	Partly cloudy	0.09
Res-Mid	26-Mar-05	5.7	13.0	7.97	18.5	6	230	104	266	6.1	43.0	Partly cloudy	0.09
Res-Bottom	26-Mar-05	7.6	12.8	8.00	20.0	6	220	94	272	6.1	43.0	Partly cloudy	0.09
Downstream	26-Mar-05	9.3	12.0	8.11	13.0	12	236	96	270	6.1	43.0	Partly cloudy	0.09

Comments:

Department of Civil and Environmental Engineering

IIHR – Hydroscience & Engineering

Coralville Reservoir Water Quality Project

Monthly Report, April 2005

Claudia Espinosa-Villegas
Craig Just
Tatsuaki Nakato
Jerald Schnoor

General Conditions

Samples were collected on Apr 23rd and Apr 30th at all river and reservoir locations. The general conditions and hydrologic parameters for each sampling event are highlighted in Table 1. The stream flow data is taken from the USGS website and is considered provisional.

Table 1: General conditions and hydrologic parameters for each sampling event.

Date	Air Temp. Noon		Sky	Previous Day Precipitation
	°C	°F		inches
23-Apr-05	5.6	42.1	Clear	0.84
30-Apr-05	10.6	51.1	Clear	0.00

Date	Inflow, USGS05453100			Outflow, USGS05453520			Pool Level
	max	min	mean	max	min	mean	
	cfs	cfs	cfs	cfs	cfs	cfs	ft msl
23-Apr-05	2,860	2,720	2,780	3,550	3,240	3,380	679.46
30-Apr-05	2,840	2,550	2,690	3,410	3,340	3,370	679.82

Water Quality Observations

The physical, chemical and biological water quality results are shown in Table 2 and Table 3 for the reservoir and river locations. Quality assurance and quality control data are shown in Table 4 and Table 5. The field report(s) for the month are included in Appendix A.

The water temperature was between 11.7 and 16.8°C for all samples collected in Apr 2005. The dissolved oxygen concentration was lowest (9.3 mg/L) at the reservoir mid-depth on Apr 23rd and greatest (11.7 mg/L) at the upstream location on Apr 30th. The mean pH value was 7.67 for all samples collected in Apr 2005 with a minimum of 7.27 and a maximum of 7.91. The calculated values for dissolved carbon dioxide were between 5.5 and 24.7 mg/L with a mean of 11.4 mg/L for all samples in Apr 2005. Titrated values of carbon dioxide were generally twice as much as the calculated values with a mean value of 17.3 mg/L, a minimum of 9.5 mg/L and a maximum of 24.0 mg/L. Phenolphthalein alkalinity ranged from 4 to 10 mg/L for Apr 23rd but was less than 1 mg/L for the upstream location on Apr 30th. Total alkalinity was between 222 and 240 mg/L as $CaCO_3$ with a mean of 228 mg/L as $CaCO_3$ for all samples analyzed in Apr 2005. Calcium hardness was lowest (62 mg/L as $CaCO_3$) at the downstream location Apr 23rd and was greatest (238 mg/L as $CaCO_3$) at the upstream location on Apr 30th. Total hardness was between 242 and 330 mg/L as $CaCO_3$ for all samples in Apr 2005 with a mean of 302 mg/L as $CaCO_3$.

Ammonia nitrogen was between 0.1 and 0.3 mg/L-N for all samples in Apr 2005 and nitrite was between 0.01 and 0.06 mg/L-N for all samples. Nitrate was between 6.5 and 9.8 mg/L-N for all samples in Apr 2005 with a mean of 8.5 mg/L-N. Total Kjeldahl

nitrogen was between 1.31 and 7.13 mg/L-N and total nitrogen was between 8.8 and 14.0 mg/L-N for all samples in Apr 2005. Orthophosphate was between 0.17 and 0.31 mg/L-P and total phosphorus was between 0.26 and 0.69 mg/L-P for all samples in Apr 2005.

The dissolved silica concentration was lower on Apr 30th than Apr 23rd for all stations with a minimum of 11 mg/L as SiO_2 at the downstream location on Apr 30th and a maximum of 24 mg/L as SiO_2 at the reservoir mid-depth location on Apr 23rd. Total organic carbon was between 2.4 mg/L and 8.0 mg/L for all samples analyzed in Apr 2005. The total suspended solids concentrations were between less than 10 mg/L (reservoir bottom on Apr 30th) and 230 mg/L (upstream location). The biological oxygen demand was between 4.9 and 7.4 mg/L for all samples analyzed.

Ion balances were calculated for the Apr 30th sample set with resulting percent errors between -8.2 and -4.1.

Table 2: Results, Apr 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Iowa River Upstream (Green Castle Avenue)																
23-Apr-05	13.6	11.7	7.73	15.0	8.8	10	238	218	330	0.1	0.02	6.9	7.13	14.0	0.24	0.69
30-Apr-05	11.7	9.8	7.76	15.5	8.3	<1	240	238	324	0.1	0.01	9.2	1.69	10.9	0.31	0.51
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)																
23-Apr-05	13.1	10.8	7.38	20.0	18.5	4	222	186	324	0.3	0.04	7.9	3.19	11.1	0.17	0.38
30-Apr-05	13.9	9.3	7.27	9.5	24.7	4	230	236	306	0.2	0.03	9.7	1.50	11.2	0.25	0.26
Coralville Reservoir - MID-DEPTH																
23-Apr-05	12.9	11.3	7.69	18.0	9.0	6	222	112	272	0.3	0.05	8.6	2.63	11.3	0.18	0.41
30-Apr-05	11.8	9.4	7.67	14.5	9.8	10	230	218	302	0.2	0.03	9.2	2.25	11.5	0.23	0.26
Coralville Reservoir - BOTTOM																
23-Apr-05	13.0	11.5	7.66	16.5	9.7	6	222	94	316	0.3	0.04	6.5	2.25	8.8	0.19	0.40
30-Apr-05	12.0	9.6	7.63	20.0	10.6	6	228	214	308	0.2	0.03	9.2	1.31	10.5	0.24	0.27
Iowa River Downstream - University Water Plant (Iowa City)																
23-Apr-05	16.8	11.0	7.70	24.0	8.9	6	224	62	242	0.3	0.06	8.4	2.25	10.7	0.18	0.33
30-Apr-05	12.2	10.4	7.91	20.0	5.5	4	226	210	300	0.2	0.03	9.8	1.50	11.3	0.26	0.27
MIN	11.7	9.3	7.27	9.5	5.5	<1	222	62	242	0.1	0.01	6.5	1.31	8.8	0.17	0.26
MAX	16.8	11.7	7.91	24.0	24.7	na	240	238	330	0.3	0.06	9.8	7.13	14.0	0.31	0.69
MEAN	13.1	10.5	7.67	17.3	11.4	na	228	179	302	0.2	0.03	8.5	2.57	11.1	0.23	0.38

Table 3: Results, Apr 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion Balance	Pigments				Indicator Org.	
					Cl	SO_4	Na	K		chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Iowa River Upstream (Green Castle Avenue)															
23-Apr-05	22	8.0	230	7.4	na	na	na	na	na	na	na	na	na	na	na
30-Apr-05	18	7.1	150	5.2	18.1	15.0	7.3	1.7	-4.1	na	na	na	na	na	na
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)															
23-Apr-05	21	4.9	51	6.2	na	na	na	na	na	na	na	na	na	na	na
30-Apr-05	17	5.6	17	5.2	19.8	16.3	7.3	1.5	-6.8	na	na	na	na	na	na
Coralville Reservoir - MID-DEPTH															
23-Apr-05	24	3.7	60	7.0	na	na	na	na	na	na	na	na	na	na	na
30-Apr-05	15	3.4	12	4.9	18.3	13.9	7.2	1.6	-5.7	na	na	na	na	na	na
Coralville Reservoir - BOTTOM															
23-Apr-05	21	3.4	58	7.2	na	na	na	na	na	na	na	na	na	na	na
30-Apr-05	12	5.9	<10	5.2	18.3	12.5	7.3	1.5	-4.2	na	na	na	na	na	na
Iowa River Downstream - University Water Plant (Iowa City)															
23-Apr-05	16	2.4	48	6.5	na	na	na	na	na	na	na	na	na	na	na
30-Apr-05	11	3.2	11	5.2	23.6	16.7	8.1	1.5	-8.2	na	na	na	na	na	na
MIN	11	2.4	<10	4.9	18.1	12.5	7.2	1.5	-8.2	na	na	na	na	na	na
MAX	24	8.0	na	7.4	23.6	16.7	8.1	1.7	-4.1	na	na	na	na	na	na
MEAN	18	4.8	na	6.0	19.6	14.9	7.4	1.6	-5.8	na	na	na	na	na	na

Table 4: Quality Assurance/Control, Apr 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Duplicate (O)																
23-Apr-05	13.78	10.63	7.74	15.0	8.1	10	224	228	296	0.16	0.02	6.7	7.50	14.2	0.19	0.70
% diff.	na	na	na	0.0	8.0	0.0	5.9	-4.6	10.3	-14.3	-5.9	2.2	-5.3	-1.6	20.8	-1.4
30-Apr-05	11.85	9.1	7.77	16.0	7.6	2	226	220	312	0.1	0.01	9.2	1.69	10.9	0.25	0.54
% diff.	na	na	na	-3.2	8.0	na	5.8	7.6	3.7	16.7	45.5	0.0	0.0	0.0	19.4	-5.9
Replicate (WP)																
23-Apr-05	16.36	9.86	7.68	27.0	9.2	12	222	90	246	0.31	0.06	8.2	2.25	10.5	0.18	0.36
% diff.	na	na	na	-12.5	-3.8	-100.0	0.9	-45.2	-1.7	3.1	-3.3	2.4	0.0	1.8	0.0	-9.1
30-Apr-05	12.31	9.97	7.9	17.0	5.6	6	226	204	300	0.15	0.03	9.5	1.5	11.0	0.17	0.32
% diff.	na	na	na	15.0	-2.3	-50.0	0.0	2.9	0.0	6.3	-20.0	3.1	0.0	2.6	34.6	-18.5
Standards (% Recovery)																
23-Apr-05	na	na	na	100	na	na	104	na	100	103	na	106	92	na	109	106
30-Apr-05	na	na	na	na	na	na	108	na	na	100	na	na	86.95	na	na	na
Spikes (% Recovery)																
23-Apr-05	na	na	na	110	na	na	100	na	120	92.5	na	na	na	na	94.1	117.8
Spike 2	na	na	na	100	na	na	98	na	100	99.3	na	na	na	na	97.5	113.4
Spike 3	na	na	na	90	na	na	96	na	98	99.3	na	na	na	na	97.8	109.4
30-Apr-05	na	na	na	118	na	na	84	na	111	102.6	na	na	na	na	na	na
Spike 2	na	na	na	95	na	na	102	na	88	97.3	na	na	na	na	na	na
Spike 3	na	na	na	88	na	na	99	na	98	98.4	na	na	na	na	na	na

Table 5: Quality Assurance/Control, Apr 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion Balance	Pigments				Indicator Org.	
					Cl	SO_4	Na	K		chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Duplicate (O)															
23-Apr-05	26.6	8.8	118	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	-19.8	-10.0	48.7	na	na	na	na	na	na	na	na	na	na	na	na
30-Apr-05	17.6	7.6	145	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	1.3	-7.0	3.3	na	na	na	na	na	na	na	na	na	na	na	na
Replicate (WP)															
23-Apr-05	22	4.3	55	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	-38.3	-79.2	-14.6	na	na	na	na	na	na	na	na	na	na	na	na
30-Apr-05	16	2.5	10	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	-44.9	21.9	9.1	na	na	na	na	na	na	na	na	na	na	na	na
Standards (% Recovery)															
23-Apr-05	95	96	na	na	na	na	na	na	na	na	na	na	na	na	na
30-Apr-05	96	96	na	na	na	na	na	na	na	na	na	na	na	na	na
Spikes (% Recovery)															
23-Apr-05	66.2	96.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	74.3	117.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	69.9	104.0	na	na	na	na	na	na	na	na	na	na	na	na	na
30-Apr-05	na	113.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	na	122.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	na	111.0	na	na	na	na	na	na	na	na	na	na	na	na	na

Appendix A: Supporting Information

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp.		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	23-Apr-05	13.6	11.7	7.73	15.0	10	238	218	330	5.6	42.1	Clear	0.84
Res-Surface	23-Apr-05	13.1	10.8	7.38	20.0	4	222	186	324	5.6	42.1	Clear	0.84
Res-Mid	23-Apr-05	12.9	11.3	7.69	18.0	6	222	112	272	5.6	42.1	Clear	0.84
Res-Bottom	23-Apr-05	13.0	11.5	7.66	16.5	6	222	94	316	5.6	42.1	Clear	0.84
Downstream	23-Apr-05	16.8	11.0	7.70	24.0	6	224	62	242	5.6	42.1	Clear	0.84

Comments:

The reported carbon dioxide results are titrated values.

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp. Noon		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	30-Apr-05	11.7	9.8	7.76	15.5	<1	240	238	324	10.6	51.1	Clear	0
Res-Surface	30-Apr-05	13.9	9.3	7.27	9.5	4	230	236	306	10.6	51.1	Clear	0
Res-Mid	30-Apr-05	11.8	9.4	7.67	14.5	10	230	218	302	10.6	51.1	Clear	0
Res-Bottom	30-Apr-05	12.0	9.6	7.63	20.0	6	228	214	308	10.6	51.1	Clear	0
Downstream	30-Apr-05	12.2	10.4	7.91	20.0	4	226	210	300	10.6	51.1	Clear	0

Comments:

Department of Civil and Environmental Engineering

IIHR – Hydroscience & Engineering

Coralville Reservoir Water Quality Project

Monthly Report, May 2005

Claudia Espinosa-Villegas
Craig Just
Tatsuaki Nakato
Jerald Schnoor

General Conditions

Samples were collected on May 21st and May 28th at all river and reservoir locations. The general conditions and hydrologic parameters for each sampling event are highlighted in Table 1. The stream flow data is taken from the USGS website and is considered provisional.

Table 1: General conditions and hydrologic parameters for each sampling event.

Date	Air Temp. Noon		Sky	Previous Day Precipitation
	°C	°F		inches
21-May-05	20.0	68.0	Clear	0.00
28-May-05	5.0	41.0	Mostly Cloudy	0.02

Date	Inflow, USGS05453100			Outflow, USGS05453520			Pool Level
	max	min	mean	max	min	mean	
	cfs	cfs	cfs	cfs	cfs	cfs	ft msl
21-May-05	8,110	7,780	7,980	6,280	6,190	6,240	684.39
28-May-05	3,490	3,330	3,410	5,590	4,970	5,220	684.42

Water Quality Observations

The physical, chemical and biological water quality results are shown in Table 2 and Table 3 for the reservoir and river locations. Quality assurance and quality control data are shown in Table 4 and Table 5. The field report(s) for the month are included in Appendix A.

The water temperature was between 17.1 and 20.4°C at all sample locations with the minimum value recorded at the upstream location on May 21st and the maximum value recorded at the downstream location on May 28th. The dissolved oxygen concentrations were between 7.4 and 10.1 mg/L at all sample locations. The minimum pH value (6.95) was recorded at the reservoir surface May 21st and the maximum value (7.99) was recorded at the downstream location on May 28th. The mean pH value of all locations was 7.49.

Titrated carbon dioxide values ranged from <0.1 to 8.5 mg/L and calculated carbon dioxide values were between 4.5 and 45.7 mg/L. Phenolphthalein alkalinity was below 6 mg/L as $CaCO_3$ for all samples and total alkalinity was between 190 and 240 mg/L as $CaCO_3$ with a mean of 217 mg/L as $CaCO_3$. The minimum calcium hardness concentration (196 mg/L as $CaCO_3$) was at the downstream location on May 21st and the maximum (268 mg/L as $CaCO_3$) was at the upstream location on May 21st. The total hardness concentration ranged from 250 to 306 mg/L as $CaCO_3$ for the month with the mean total hardness concentration equal to 279 mg/L as $CaCO_3$.

Ammonia nitrogen concentrations for all samples were between 0.1 and 0.2 mg/L-N and nitrite concentrations were between 0.02 and 0.10 mg/L-N. The nitrate concentrations exceeded the 10 mg/L drinking water standard for all samples collected with a maximum of 13.9 mg/L-N for the upstream location on May 28th. Total Kjeldahl concentrations were between 1.50 and 3.94 mg/L-N with a mean of 2.16 mg/L-N. Total nitrogen concentrations were between 13.5 and 16.7 mg/L-N for all samples collected in May 2005 with a mean of 14.8 mg/L-N. The orthophosphate minimum concentration (0.17 mg/L-P) was recorded at the downstream location on May 28th and the maximum concentration (0.30 mg/L-P) was recorded at the upstream location on May 21st. Total phosphorus concentrations were between 0.24 and 0.47 mg/L-P for all samples collected in May 2005.

Silica concentrations were between 17 and 30 mg/L as SiO_2 with a mean of 21mg/L as SiO_2. The minimum organic carbon concentration (2.9 mg/L) was recorded at the downstream location on May 21st and the maximum value (14.3 mg/L) was at the upstream location on May 28th. The maximum total suspended solids concentration (261 mg/L) was at the upstream location on May 21st perhaps explaining the elevated organic carbon concentration at the same location and time. The minimum total suspended solids concentration (30 mg/L) was found at the reservoir mid-depth. The biological oxygen demand was between 3.5 and 6.6 mg/L for all May 2005 samples. Pigment analysis determined that chlorophyll *a* levels for May 2005 were below detection limit (1 mg/m^3) for all samples collected, while pheophytin *a* values for the month ranged from a minimum of 2.7 to 45 mg/m^3.

Ion balances and indicator organisms were not determined in May 2005.

Table 2: Results, May 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Iowa River Upstream (Green Castle Avenue)																
21-May-05	17.1	9.9	7.44	4.0	15.5	<1	214	268	284	0.2	0.08	12.4	3.94	16.4	0.30	0.41
28-May-05	17.8	10.1	7.63	<0.1	11.2	4	240	216	300	0.1	0.02	13.9	2.81	16.7	0.24	0.47
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)																
21-May-05	18.1	8.0	6.95	4.5	45.7	2	204	208	252	0.2	0.10	12.2	2.44	14.7	0.23	0.25
28-May-05	19.1	8.5	7.66	<0.1	10.0	8	230	210	296	0.2	0.06	12.6	2.06	14.7	0.24	0.26
Coralville Reservoir - MID-DEPTH																
21-May-05	18.0	8.3	7.50	10.0	12.7	6	202	242	264	0.2	0.09	12.7	2.06	14.9	0.23	0.24
28-May-05	18.7	8.0	7.92	<0.1	5.5	6	230	224	286	0.2	0.06	12.3	2.25	14.6	0.20	0.28
Coralville Reservoir - BOTTOM																
21-May-05	17.9	7.4	7.42	6.5	15.3	2	202	226	256	0.2	0.09	12.6	1.50	14.2	0.21	0.25
28-May-05	18.0	8.2	7.83	<0.1	6.9	6	234	228	306	0.1	0.06	12.5	1.50	14.1	0.18	0.27
Iowa River Downstream - University Water Plant (Iowa City)																
21-May-05	19.0	8.5	7.63	8.5	8.9	4	190	196	250	0.2	0.08	12.2	1.50	13.8	0.20	0.28
28-May-05	20.4	8.4	7.99	<0.1	4.5	6	222	224	296	0.1	0.07	11.9	1.50	13.5	0.17	0.25
MIN	17.1	7.4	6.95	<0.1	4.5	<1	190	196	250	0.1	0.02	11.9	1.50	13.5	0.17	0.24
MAX	20.4	10.1	7.99	10.0	45.7	8	240	268	306	0.2	0.10	13.9	3.94	16.7	0.30	0.47
MEAN	18.4	8.5	7.60	na	13.6	na	217	224	279	0.2	0.07	12.5	2.16	14.8	0.22	0.30

Table 3: Results, May 2005.

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Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion Balance	Pigments				Indicator Org.	
					Cl	SO_4	Na	K		chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Iowa River Upstream (Green Castle Avenue)															
21-May-05	23	5.2	92	6.6	na	na	na	na	na	<1	2.74	na	na	na	na
28-May-05	17	14.3	261	4.9	na	na	na	na	na	<1	9.57	na	na	na	na
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)															
21-May-05	30	4.4	33	4.0	na	na	na	na	na	<1	12.19	na	na	na	na
28-May-05	21	3.5	71	4.2	na	na	na	na	na	<1	36.65	na	na	na	na
Coralville Reservoir - MID-DEPTH															
21-May-05	17	5.1	30	4.3	na	na	na	na	na	<1	14.11	na	na	na	na
28-May-05	21	3.1	70	3.9	na	na	na	na	na	<1	31.89	na	na	na	na
Coralville Reservoir - BOTTOM															
21-May-05	17	3.8	32	3.5	na	na	na	na	na	<1	8.54	na	na	na	na
28-May-05	26	3.2	76	4.2	na	na	na	na	na	<1	34.12	na	na	na	na
Iowa River Downstream - University Water Plant (Iowa City)															
21-May-05	21	2.9	32	4.0	na	na	na	na	na	<1	11.58	na	na	na	na
28-May-05	22	3.5	68	3.5	na	na	na	na	na	<1	45.00	na	na	na	na
MIN	17	2.9	30	3.5	na	na	na	na	na	<1	2.7	na	na	na	na
MAX	30	14.3	261	6.6	na	na	na	na	na	na	45.0	na	na	na	na
MEAN	21	4.9	77	4.3	na	na	na	na	na	na	20.6	na	na	na	na

Table 4: Quality Assurance/Control, May 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Duplicate (O)																
21-May-05	na	na	7.45	5.0	14.6	2	206	244	280	0.17	0.08	13.2	3.94	17.2	0.18	0.38
% diff.	na	na	na	-25.0	5.9	na	3.7	9.0	1.4	-13.3	-1.3	-6.5	0.0	-4.9	40.0	7.3
28-May-05	na	na	7.66	<0.1	10.0	8	230	228	308	0.11	0.02	14.0	3.00	17.0	0.2	0.21
% diff.	na	na	na	na	10.6	-100.0	4.2	-5.6	-2.7	-37.5	0.0	-0.7	-6.6	-1.7	16.7	55.3
Replicate (WP)																
21-May-05	na	na	7.68	4.5	7.8	2	188	204	248	0.19	0.08	12.2	1.50	13.8	0.2	0.27
% diff.	na	na	-0.7	47.1	11.9	50.0	1.1	-4.1	0.8	-11.8	-1.3	0.0	0.0	0.0	0.0	3.6
28-May-05	na	na	8.01	<0.1	4.5	8	230	232	286	0.16	0.069	12.1	1.5	13.7	0.16	0.24
% diff.	na	na	na	na	1.1	-33.3	-3.6	-3.6	3.4	-23.1	-3.0	-1.7	0.0	-1.5	5.9	4.0
Standards (% Recovery)																
21-May-05	na	na	na	100	na	na	na	na	na	100	na	119.2	82.6	na	103	109
28-May-05	na	na	na	na	na	na	na	na	na	106	na	111.2	86	na	109	109
Spikes (% Recovery)																
21-May-05	na	na	na	107	na	na	104	na	100	111.9	na	na	na	na	106	95.2
Spike 2	na	na	na	80	na	na	96	na	100	101.3	na	na	na	na	102.7	105.4
Spike 3	na	na	na	104	na	na	100	na	100	106.6	na	na	na	na	102.1	102.6
28-May-05	na	na	na	na	na	na	na	na	100	100.7	na	na	na	na	102.8	97.8
Spike 2	na	na	na	na	na	na	na	na	100	96.1	na	na	na	na	97.3	96.8
Spike 3	na	na	na	na	na	na	na	na	100	na	na	na	na	na	98.8	99.5

Table 5: Quality Assurance/Control, May 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion Balance	Pigments				Indicator Org.	
					Cl	SO_4	Na	K		chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Duplicate (O)															
21-May-05	20	4.3	100	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	12.6	17.3	-8.7	na	na	na	na	na	na	na	na	na	na	na	na
28-May-05	22	3.3	166	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	-32.1	76.9	36.4	na	na	na	na	na	na	na	na	na	na	na	na
Replicate (WP)															
21-May-05	25	2.9	30	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	-19.5	0.0	6.3	na	na	na	na	na	na	na	na	na	na	na	na
28-May-05	19	4.5	74	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	9.9	-28.6	-8.8	na	na	na	na	na	na	na	na	na	na	na	na
Standards (% Recovery)															
21-May-05	110	104	na	na	na	na	na	na	na	na	na	na	na	na	na
28-May-05	130	104	na	na	na	na	na	na	na	na	na	na	na	na	na
Spikes (% Recovery)															
21-May-05	79.5	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	107.2	110.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	81.8	107.0	na	na	na	na	na	na	na	na	na	na	na	na	na
28-May-05	57.1	102.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	47.2	109.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	41.0	97.0	na	na	na	na	na	na	na	na	na	na	na	na	na

Appendix A: Supporting Information

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp. Noon		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	21-May-05	17.1	9.9	7.44	4.0	<1	214	268	284	20.0	68.0	Clear	0
Res-Surface	21-May-05	18.1	8.0	6.95	4.5	2	204	208	252	20.0	68.0	Clear	0
Res-Mid	21-May-05	18.0	8.3	7.50	10.0	6	202	242	264	20.0	68.0	Clear	0
Res-Bottom	21-May-05	17.9	7.4	7.42	6.5	2	202	226	256	20.0	68.0	Clear	0
Downstream	21-May-05	19.0	8.5	7.63	8.5	4	190	196	250	20.0	68.0	Clear	0

Comments:

The upstream location was flooded. All data is from the Marengo alternate site.

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp.		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	28-May-05	17.8	10.1	7.63	<0.1	4	240	216	300	5.0	41.0	Mostly cloudy	0.02
Res-Surface	28-May-05	19.1	8.5	7.66	<0.1	8	230	210	296	5.0	41.0	Mostly cloudy	0.02
Res-Mid	28-May-05	18.7	8.0	7.92	<0.1	6	230	224	286	5.0	41.0	Mostly cloudy	0.02
Res-Bottom	28-May-05	18.0	8.2	7.83	<0.1	6	234	228	306	5.0	41.0	Mostly cloudy	0.02
Downstream	28-May-05	20.4	8.4	7.99	<0.1	6	222	224	296	5.0	41.0	Mostly cloudy	0.02

Comments:

Department of Civil and Environmental Engineering

IIHR – Hydroscience & Engineering

Coralville Reservoir Water Quality Project

Monthly Report, June 2005

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General Conditions

Samples were collected on June 1st, 6th and 10th at all river and reservoir locations. The general conditions and hydrologic parameters for each sampling event are highlighted in Table 1. The stream flow data is taken from the USGS website and is considered provisional.

Table 1: General conditions and hydrologic parameters for each sampling event.

Date	Air Temp. Noon		Sky	Previous Day Precipitation
	°C	°F		inches
1-Jun-05	27.2	81.0	Clear	0.00
6-Jun-05	29.4	84.9	Mostly cloudy	0.19
10-Jun-05	30.0	86.0	Clear	0.00

Date	Inflow, USGS05453100			Outflow, USGS05453520			Pool Level
	max	min	mean	max	min	mean	
	cfs	cfs	cfs	cfs	cfs	cfs	ft msl
3-Jun-04	2,730	2,560	2,650	3,380	2,960	3,130	683.38
10-Jun-04	2,830	2,290	2,630	3,080	3,010	3,040	683.57
23-Jun-04	2,350	2,170	2,220	2,788	2,420	2,570	683.32

Water Quality Observations

The physical, chemical and biological water quality results are shown in Table 2 and Table 3 for the reservoir and river locations. Quality assurance and quality control data are shown in Table 4 and Table 5. The field reports for the month are included in Appendix A. Indicator organism data supplied by the University Hygienic Laboratory for the reservoir beaches are shown in Appendix A.

Dissolved oxygen for the month of June 2005 ranged from 5.6 to 9.8 mg/L for all sampling locations. The dissolved oxygen criterion for lakes is 5.0 mg/L, and applies only to the upper layer of stratification; hence, the criterion was not exceeded during any sampling event. The values for pH at the field ranged from 7.55 to 8.60, with a monthly mean of 7.96. The pH measured in the laboratory ranged from 7.60 to 8.50, with a monthly mean of 8.27. The Phenolphthalein` alkalinity minimum (6 mg/L as $CaCO_3$) occurred at the reservoir bottom on June 1st, the maximum (14 mg/L as $CaCO_3$) occurred at the same location on June 6th, the monthly mean was 9 mg/L as $CaCO_3$. Total alkalinity was between 206 and 246 mg/L as $CaCO_3$, with a mean of 225 mg/L as $CaCO_3$. Calcium hardness ranged from 204 and 258 mg/L as $CaCO_3$ and total hardness was between 288 and 376 mg/L as $CaCO_3$.

Ammonia nitrogen never exceeded 0.3 mg/L-N; nitrite was very low (<0.07 mg/L-N for all locations) as is typical; nitrate was between 9.8 and 14.3 mg/L-N as determined by ion chromatography and total Kjeldahl nitrogen was between 1.31 and 2.63 mg/L. The drinking water standard for nitrate of 10.0 mg/L-N was exceeded at all sampling

locations, on all sampling dates, with the exception of the upstream location on June 6th (9.8 mg/L). Total nitrogen for the month of June 2005, was between 11.1 and 16.1 mg/L, with a mean of 14.4 mg/L.

Orthophosphate was between 0.17 and 0.28 mg/L-P and total phosphorus was between 0.22 and 0.87 mg/L-P. The biological oxygen demand was between 3.2 and 5.6 mg/L. Silica ranged from 12 to 37 mg/L-SiO_2, with a monthly mean of 21 mg/L-SiO_2. The mean value for total organic carbon was 4.6 mg/L, a maximum value of 12.7 mg/L was at the upstream location on June 6th, and a minimum of 2.3 mg/L was at the reservoir mid-depth also on June 6th. An unusually high value for suspended solids (372 mg/L) was determined for the upstream location on June 6th, a minimum of 22 mg/L was found on June 10th at the surface of the reservoir, and a monthly mean of 87 mg/L was determined for June 2005.

Chlorophyll *a* was generally the greatest at the reservoir, with a monthly high equal to 30.7 mg/m^3 on June 6th at the mid-depth point. Pheophytin *a* was greater than chlorophyll *a* for all sampling dates and locations, with a monthly mean of 25.2 mg/m^3. Chlorophyll *b* was below the detection limit of 1.00 mg/m^3 for all samples. Chlorophyll *c* ranged from below detection level to 3.1 mg/m^3 on June 6th at the reservoir mid-depth.

Indicator organisms were generally greatest at the upstream location with maxima of 11,000 and 9,100 organisms per 100 mL for fecal coliform and *E. coli* respectively for the Jun 6th sampling event. Sandy Beach, West Overlook Beach and Sugar Bottom Beach were sampled on June 6th, 13th, 20th and 27th. There were no exceedances in either fecal coliform or *E. Coli* levels in the water (See Appendix).

Table 2: Results, June 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Iowa River Upstream (Green Castle Avenue)																
1-Jun-05	19.8	9.1	8.48	<1	1.5	8	236	204	306	0.1	0.01	14.3	1.50	15.8	0.23	0.46
6-Jun-05	22.8	7.3	7.76	<1	7.1	8	206	246	340	0.2	0.03	9.8	1.31	11.1	0.23	0.87
10-Jun-05	25.3	7.7	8.28	<1	2.3	10	224	258	358	0.1	0.01	12.8	1.69	14.5	0.28	0.47
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)																
1-Jun-05	20.5	9.7	8.17	<1	3.1	10	230	214	294	0.2	0.04	13.6	2.44	16.1	0.21	0.26
6-Jun-05	23.9	7.8	8.60	<1	1.1	10	232	252	350	0.2	0.05	10.8	1.88	12.7	0.21	0.26
10-Jun-05	25.4	7.7	7.99	<1	4.7	10	232	244	344	0.3	0.06	12.9	2.06	15.0	0.22	0.22
Coralville Reservoir - MID-DEPTH																
1-Jun-05	21.6	8.9	8.06	<1	3.9	8	226	234	306	0.2	0.05	13.7	1.88	15.6	0.20	0.31
6-Jun-05	26.6	8.0	8.24	<1	2.6	8	232	250	366	0.2	0.05	10.9	1.69	12.6	0.23	0.25
10-Jun-05	25.4	7.2	7.96	<1	4.5	12	208	242	342	0.2	0.06	13.0	1.69	14.7	0.23	0.28
Coralville Reservoir - BOTTOM																
1-Jun-05	20.1	9.1	8.03	<1	4.1	6	222	214	292	0.1	0.04	13.6	1.69	15.4	0.17	0.31
6-Jun-05	24.2	7.8	8.13	<1	3.6	14	246	244	366	0.2	0.03	13.2	1.50	14.8	0.20	0.25
10-Jun-05	29.2	5.6	7.55	2.0	12.1	10	216	242	340	0.3	0.07	13.0	2.63	15.7	0.23	0.41
Iowa River Downstream - University Water Plant (Iowa City)																
1-Jun-05	19.8	9.8	7.82	<1	6.7	8	224	208	288	0.2	0.05	12.7	1.50	14.2	0.23	0.25
6-Jun-05	22.7	8.1	8.02	<1	4.4	8	232	256	376	0.2	0.05	11.4	2.44	13.9	0.28	0.29
10-Jun-05	24.9	8.5	7.60	<1	10.8	12	216	240	350	0.2	0.05	13.0	1.50	14.6	0.19	0.25
MIN	19.8	5.6	7.55	<1	1.1	6	206	204	288	0.1	0.01	9.8	1.31	11.1	0.17	0.22
MAX	29.2	9.8	8.60	2.0	12.1	14	246	258	376	0.3	0.07	14.3	2.63	16.1	0.28	0.87
MEAN	23.5	8.1	8.05	na	4.8	9	225	237	335	0.2	0.04	12.6	1.83	14.4	0.22	0.34

Table 3: Results, June 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion	Pigments				Indicator Org.	
	as SiO_2				Cl	SO_4	Na	K	Balance	chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Iowa River Upstream (Green Castle Avenue)															
1-Jun-05	15	5.7	164	4.9	na	na	na	na	na	4.5	14.9	<1	1.6	90	40
6-Jun-05	14	12.7	372	5.3	na	na	na	na	na	3.3	20.6	<1	<1	11000	9100
10-Jun-05	31	6.7	140	3.3	na	na	na	na	na	4.6	26.3	<1	<1	1500	1000
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)															
1-Jun-05	13	3.5	28	5.5	na	na	na	na	na	17.1	30.3	<1	2.2	20	20
6-Jun-05	27	2.5	31	5.0	na	na	na	na	na	23.1	35.8	<1	1.8	<10	<10
10-Jun-05	23	4.6	22	4.0	na	na	na	na	na	10.8	13.9	<1	<1	40	30
Coralville Reservoir - MID-DEPTH															
1-Jun-05	18	3.3	70	5.1	na	na	na	na	na	5.1	26.8	<1	<1	<10	<10
6-Jun-05	14	2.3	40	5.5	na	na	na	na	na	30.7	36.6	<1	3.1	<10	<10
10-Jun-05	33	4.0	152	3.3	na	na	na	na	na	9.1	14.4	<1	<1	45	20
Coralville Reservoir - BOTTOM															
1-Jun-05	13	2.6	45	4.8	na	na	na	na	na	5.5	26.3	<1	<1	20	20
6-Jun-05	37	5.1	38	5.0	na	na	na	na	na	29.1	35.9	<1	1.9	20	20
10-Jun-05	25	5.0	78	3.2	na	na	na	na	na	3.2	23.7	<1	<1	150	110
Iowa River Downstream - University Water Plant (Iowa City)															
1-Jun-05	12	2.7	46	5.6	na	na	na	na	na	7.0	27.8	<1	<1	63	55
6-Jun-05	18	3.8	54	4.8	na	na	na	na	na	17.2	24.6	<1	1.3	1400	1300
10-Jun-05	26	4.2	32	4.1	na	na	na	na	na	6.7	19.5	<1	<1	190	170
MIN	12	2.3	22	3.2	na	na	na	na	na	3.2	13.9	<1	<1	<10	<10
MAX	37	12.7	372	5.6	na	na	na	na	na	30.7	36.6	<1	3.1	11000	9100
MEAN	21	4.6	87	4.6	na	na	na	na	na	11.8	25.2	na	na	na	na

Table 4: Quality Assurance/Control, June 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Duplicate (O)																
1-Jun-05	na	na	8.38	<1	2.0	10	240	210	296	0.11	0.01	14.0	1.50	15.5	0.21	0.45
% diff.	na	na	na	na	-28.8	-25.0	-1.7	-2.9	3.3	8.3	0.0	1.9	0.0	1.7	8.7	2.2
6-Jun-05	na	na	na	<1	1.8	8	210	240	328	0.19	0.02	10.4	1.50	11.9	0.21	0.79
% diff.	na	na	na	na	-14.7	0.0	-1.9	2.4	3.5	9.5	25.0	-6.2	-14.2	-7.1	8.7	9.2
10-Jun-05	na	na	na	<1	1.9	14	228	240	348	0.1	0.01	13.0	1.5	14.5	0.21	0.45
% diff.	na	na	na	na	2.9	-40.0	-1.8	7.0	2.8	-11.1	61.5	-1.5	11.1	0.0	25.0	4.3
Replicate (WP)																
1-Jun-05	na	na	8.4	<1	1.9	14	250	210	282	0.18	0.05	na	1.69	na	0.22	0.29
% diff.	na	na	na	na	-14.3	-75.0	-11.6	-1.0	2.1	5.3	-13.3	na	-12.5	na	4.3	-16.0
6-Jun-05	na	na	na	<1	1.4	12	228	264	366	0.21	0.02	11.1	1.31	12.5	0.21	0.28
% diff.	na	na	na	na	-0.6	-50.0	1.7	-3.1	2.7	-5.0	48.9	2.1	46.1	10.0	25.0	3.4
10-Jun-05	na	na	na	<1	1.4	10	212	232	352	0.18	0.02	14.0	1.31		0.18	0.26
% diff.	na	na	na	na	87.1	16.7	1.9	3.3	-0.6	10.0	60.4	-7.4	12.5	100.0	5.3	-4.0
Standards (% Recovery)																
1-Jun-05	na	na	na	na	na	na	na	na	na	105	na	na	153	na	112	106
6-Jun-05	na	na	na	na	na	na	na	na	na	108	na	na	82.6	na	109	106
10-Jun-05	na	na	na	na	na	na	na	na	na	105	na	na	na	na	114.7	100
Spikes (% Recovery)																
1-Jun-05	na	na	na	na	na	na	100	na	100	104.6	77.7	na	na	na	111.7	96.7
Spike 2	na	na	na	na	na	na	104	na	104	98	100.6	na	na	na	96.4	94.2
Spike 3	na	na	na	na	na	na	100	na	100	98.7	na	na	na	na	94	91.3
6-Jun-05	na	na	na	na	na	na	104	na	100	100.4	81.4	na	na	na	104.9	96.2
Spike 2	na	na	na	na	na	na	112	na	120	98.6	103.5	na	na	na	91.2	90.9
Spike 3	na	na	na	na	na	na	107	na	113	95.7	na	na	na	na	96.6	93.1
10-Jun-05	na	na	na	85	na	na	100	na	111	105	99.5	na	na	na	na	101.9
Spike 2	na	na	na	85	na	na	102	na	110	99.8	101.4	na	na	na	na	101
Spike 3	na	na	na	83	na	na	99	na	100	99	na	na	na	na	na	101.9

Table 5: Quality Assurance/Control, June 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2 mg/L	TOC mg/L	TSS mg/L	BOD_5 mg/L	Additional Anions		Additional Cations		Ion Balance % diff.	Pigments				Indicator Org.	
					Cl mg/L	SO_4 mg/L	Na mg/L	K mg/L		chl *a* mg/m^3	pheo *a* mg/m^3	chl *b* mg/m^3	chl *c* mg/m^3	Fecal Org. / 100 mL	*E. coli* Org. / 100 mL
Duplicate (O)															
1-Jun-05	15.7	4.1	162	na	na	na	na	na	na	2.8	15.1	<1	<1	55	45
% diff.	-5.2	28.1	1.2	na	na	na	na	na	na	37.6	-1.5	na	na	38.9	-12.5
6-Jun-05	19.61	13.2	377	na	na	na	na	na	na	2.6	23.3	<1	<1	19,000	18,000
% diff.	-40.2	-3.9	-1.3	na	na	na	na	na	na	20.8	-12.8	na	na	-72.7	-97.8
10-Jun-05	20.46	5.8	175	na	na	na	na	na	na	7.1	32.4	<1	<1	1200	990
% diff.	33.8	13.4	-25.0	na	na	na	na	na	na	-53.5	-23.6	na	na	20.0	1.0
Replicate (WP)															
1-Jun-05	13	3.0	33	na	na	na	na	na	na	4.6	27.5	<1	<1	30	30
% diff.	-6.3	-11.1	28.3	na	na	na	na	na	na	34.7	1.0	na	na	52.4	45.5
6-Jun-05	17	4.1	54	na	na	na	na	na	na	15.3	25.5	<1	<1	2500	2000
% diff.	7.1	-7.9	0.0	na	na	na	na	na	na	11.0	-3.7	na	na	-78.6	-53.8
10-Jun-05	24	3.2	30	na	na	na	na	na	na	10.5	22.0	<1	<1	170	110
% diff.	8.4	23.8	6.3	na	na	na	na	na	na	-57.1	-12.7	na	na	10.5	35.3
Standards (% Recovery)															
1-Jun-05	87	95	na	na	na	na	na	na	na	na	na	na	na	na	na
6-Jun-05	102	96	na	na	na	na	na	na	na	na	na	na	na	na	na
10-Jun-05	104	105	na	na	na	na	na	na	na	na	na	na	na	na	na
Spikes (% Recovery)															
1-Jun-05	92.1	99.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	98.4	96.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	92.2	101.0	na	na	na	na	na	na	na	na	na	na	na	na	na
6-Jun-05	78.1	108.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	70.8	119.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	76.3	107.0	na	na	na	na	na	na	na	na	na	na	na	na	na
10-Jun-05	93.6	111.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	99.7	110.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	92.7	100.0	na	na	na	na	na	na	na	na	na	na	na	na	na

Appendix A: Supporting Information

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp.		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	1-Jun-05	19.8	9.1	8.48	<0.1	8	236	204	306	27.2	81.0	Clear	0
Res-Surface	1-Jun-05	20.5	9.7	8.17	<0.1	10	230	214	294	27.2	81.0	Clear	0
Res-Mid	1-Jun-05	21.6	8.9	8.06	<0.1	8	226	234	306	27.2	81.0	Clear	0
Res-Bottom	1-Jun-05	20.1	9.1	8.03	<0.1	6	222	214	292	27.2	81.0	Clear	0
Downstream	1-Jun-05	14.8	9.8	7.82	<0.1	8	224	208	288	27.2	81.0	Clear	0

Comments:

Upstream location was flooded. Sampling was done at alternate location near Marengo.

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp. Noon		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	6-Jun-05	22.8	7.3	7.76	<0.1	8	206	246	340	29.4	84.9	Mostly cloudy	0.19
Res-Surface	6-Jun-05	23.9	7.8	8.60	<0.1	10	232	252	350	29.4	84.9	Mostly cloudy	0.19
Res-Mid	6-Jun-05	26.6	8.0	8.24	<0.1	8	232	250	366	29.4	84.9	Mostly cloudy	0.19
Res-Bottom	6-Jun-05	24.2	7.8	8.13	<0.1	14	246	244	366	29.4	84.9	Mostly cloudy	0.19
Downstream	6-Jun-05	22.7	8.1	8.02	<0.1	8	232	256	376	29.4	84.9	Mostly cloudy	0.19

Comments:

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp. Noon		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	10-Jun-05	25.3	7.7	8.28	<0.1	10	224	258	358	30.0	86.0	Clear	0
Res-Surface	10-Jun-05	25.4	7.7	7.99	<0.1	10	232	244	344	30.0	86.0	Clear	0
Res-Mid	10-Jun-05	29.2	7.2	7.96	<0.1	12	208	242	342	30.0	86.0	Clear	0
Res-Bottom	10-Jun-05	24.9	5.6	7.55	0.4	10	216	242	340	30.0	86.0	Clear	0
Downstream	10-Jun-05	23.8	8.5	7.60	<0.1	12	216	240	350	30.0	86.0	Clear	0

Comments:

Department of Civil and Environmental Engineering

IIHR – Hydroscience & Engineering

Coralville Reservoir Water Quality Project

Monthly Report, July 2005

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General Conditions

Samples were collected on July 15th, 22nd and 10th at all river and reservoir locations. The general conditions and hydrologic parameters for each sampling event are highlighted in Table 1. The stream flow data is taken from the USGS website and is considered provisional.

Table 1: General conditions and hydrologic parameters for each sampling event.

Date	Air Temp. Noon		Sky	Previous Day Precipitation
	°C	°F		inches
15-Jul-05	32.2	90.0	Partly Cloudy	0.00
22-Jul-05	31.1	88.0	Clear	0.05
28-Jul-05	24.4	75.9	Partly Cloudy	0.00

Date	Inflow, USGS05453100			Outflow, USGS05453520			Pool Level
	max	min	mean	max	min	mean	
	cfs	cfs	cfs	cfs	cfs	cfs	ft msl
15-Jul-05	1,780	1,650	1,710	na*	na*	na*	683.41
22-Jul-05	1,260	1,230	1,240	1,280	1,250	1,270	683.45
28-Jul-05	1,320	1,270	1,300	1,260	1,240	1,250	683.37

na* = not available

Water Quality Observations

The physical, chemical and biological water quality results are shown in Table 2 and Table 3 for the reservoir and river locations. Quality assurance and quality control data are shown in Table 4 and Table 5. The field reports for the month are included in Appendix A. Indicator organism data supplied by the University Hygienic Laboratory for the reservoir beaches are shown in Appendix A. Dissolved oxygen for the month of July 2005 ranged from 3.7 to 7.6 mg/L for all sampling locations. The dissolved oxygen criterion for lakes is 5.0 mg/L, and applies only to the upper layer of stratification; the criterion was violated on July 22nd at the bottom reservoir location. The values for pH ranged from 7.96 to 8.45, with a monthly mean of 8.23. The phenolphthalein alkalinity minimum (<1 mg/L as $CaCO_3$) occurred on July 22nd at the mid-depth and reservoir bottom locations, and on July 28th at both the surface and mid-depth reservoir locations. The maximum (22 mg/L as $CaCO_3$) occurred at the upstream and reservoir surface location on July 15th. Total alkalinity was between 200 and 248 mg/L as $CaCO_3$, with a mean of 228 mg/L as $CaCO_3$. Calcium hardness ranged from 160 and 218 mg/L as $CaCO_3$ and total hardness was between 258 and 312 mg/L as $CaCO_3$.

Ammonia nitrogen was below 0.5 mg/L-N for all samples; nitrite ranged from 0.01 to 0.24 mg/L-N with a mean of 0.11 mg/L-N; nitrate was between 4.3 and 12.6 mg/L-N as determined by ion chromatography and total Kjeldahl nitrogen was between 1.88 and 5.81 mg/L. The drinking water standard for nitrate is 10.0 mg/L-N which was exceeded at the upstream location on July 22nd. Total nitrogen for the month of July 2005, was between 6.7 and 14.9 mg/L, with a mean of 10.9 mg/L.

Orthophosphate was between 0.15 and 0.38 mg/L-P and total phosphorus was between 0.27 and 0.64 mg/L-P. The biological oxygen demand was between 3.1 and 6.7 mg/L. The silica minima was below detection level (<1 mg/L-SiO_2) for all locations on July 28th, the maximum occurred on July 22nd at the downstream location (31 mg/L-SiO_2). The mean value for total organic carbon was 4.3 mg/L; the maximum value of 12.7 mg/L was measured at the upstream location on July 15th, and a minimum of 1.2 mg/L was measured for the downstream location on July 22nd. The maximum suspended solids value was found at the upstream location on July 28th (221 mg/L); a minimum of 19 mg/L was found at the reservoir surface on both July 15th and July 22nd, and a monthly mean of 79 mg/L was determined for July 2005.

Chlorophyll *a* had a minimum of 6 mg/m^3 on July 28th at the reservoir bottom, a maximum of 98 mg/m^3 on July 22nd at the downstream location, and a monthly mean of 31 mg/m^3. Pheophytin *a* was between 23 and 96 mg/m^3, with a monthly mean of 38 mg/m^3. Chlorophyll *b* ranged from below the detection limit of 1 mg/m^3 to a high of 17 mg/m^3 on July 15th at the reservoir surface. Chlorophyll *c* ranged from below detection level to 20 mg/m^3 also on July 15th at the reservoir surface.

Indicator organisms ranged from below detection level (<10 organisms per 100 mL) for both F. Coliform and *E. Coli* to a high on July 28th of 410 organisms per 100 mL of F. Coliform (downstream location) and 200 organisms per 100 mL of *E. Coli* (upstream location). Sandy Beach, West Overlook Beach and Sugar Bottom Beach were sampled on July 5th, 11th, 18th and 25th. There were no exceedances in either F. Coliform or *E. Coli* levels in the water (See Appendix).

Ion balances were performed for all locations on July 15th and were between -8.0 and -3.7 percent difference.

Table 2: Results, July 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Iowa River Upstream (Green Castle Avenue)																
15-Jul-05	29.1	6.7	8.20	<1	2.9	22	236	210	304	0.3	0.02	7.2	5.63	12.9	0.34	0.47
22-Jul-05	28.9	7.4	8.31	<1	2.2	8	224	190	290	<0.1	0.01	12.6	2.25	14.9	0.29	0.64
28-Jul-05	25.4	7.4	8.29	<1	2.1	10	212	160	262	0.1	0.15	4.3	2.25	6.7	0.15	0.41
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)																
15-Jul-05	28.2	7.0	8.33	<1	2.3	22	248	212	312	0.1	0.06	9.2	4.13	13.4	0.32	0.34
22-Jul-05	29.1	7.3	8.45	<1	1.7	8	242	210	312	0.1	0.06	9.3	2.63	12.0	0.32	0.35
28-Jul-05	26.7	6.2	8.19	1.5	2.6	<1	202	170	258	0.5	0.23	4.8	2.25	7.3	0.23	0.35
Coralville Reservoir - MID-DEPTH																
15-Jul-05	28.8	6.7	8.34	<1	2.1	16	234	218	306	0.2	0.06	7.2	2.44	9.7	0.37	0.46
22-Jul-05	28.9	7.3	8.18	<1	3.1	<1	240	212	308	<1	0.05	9.1	4.13	13.2	0.38	0.30
28-Jul-05	26.6	6.3	8.24	2.0	2.3	<1	204	178	272	0.5	0.24	4.4	3.00	7.6	0.24	0.33
Coralville Reservoir - BOTTOM																
15-Jul-05	27.8	5.6	7.96	<1	5.3	18	242	216	302	0.3	0.09	6.7	1.88	8.6	0.36	0.42
22-Jul-05	28.3	3.7	8.07	4.5	4.1	<1	244	204	300	0.1	0.08	8.3	2.81	11.2	0.35	0.40
28-Jul-05	26.4	7.3	8.30	<1	2.0	6	200	184	258	0.5	0.23	4.7	3.00	7.9	0.23	0.33
Iowa River Downstream - University Water Plant (Iowa City)																
15-Jul-05	27.2	7.2	8.17	<1	3.0	20	224	204	290	0.2	0.05	8.5	3.19	11.7	0.32	0.37
22-Jul-05	27.1	7.3	8.44	<1	1.7	8	236	208	308	<0.1	0.04	8.8	5.81	14.7	0.37	0.27
28-Jul-05	25.9	7.6	8.24	<1	2.6	10	226	200	286	0.2	0.24	7.7	4.13	12.1	0.24	0.27
MIN	25.4	3.7	7.96	<1	1.7	<1	200	160	258	<0.1	0.01	4.3	1.88	6.7	0.15	0.27
MAX	29.1	7.6	8.45	4.5	5.3	22	248	218	312	0.5	0.24	12.6	5.81	14.9	0.38	0.64
MEAN	27.6	6.7	8.23	na	2.7	na	228	198	291	na	0.11	7.5	3.30	10.9	0.30	0.38

Table 3: Results, July 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion Balance	Pigments				Indicator Org.	
					Cl	SO_4	Na	K		chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Iowa River Upstream (Green Castle Avenue)															
15-Jul-05	16	12.7	201	4.3	21.4	8.6	7.8	1.9	-3.7	8	25	<1	<1	130	110
22-Jul-05	29	4.5	169	5.3	na	na	na	na	na	35	96	<1	2	<10	<10
28-Jul-05	<1	4.6	221	6.3	na	na	na	na	na	12	76	1	2	200	200
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)															
15-Jul-05	13	2.4	19	3.9	25.6	10.1	7.3	2.2	-8.0	55	36	17	20	<10	<10
22-Jul-05	23	2.6	19	4.6	na	na	na	na	na	71	33	4	6	<10	<10
28-Jul-05	<1	6.3	39	3.2	na	na	na	na	na	20	28	1	2	<10	<10
Coralville Reservoir - MID-DEPTH															
15-Jul-05	14	7.8	32	3.8	21.9	9.5	7.5	2.2	-3.7	31	27	3	4	<10	<10
22-Jul-05	22	3.2	24	5.3	na	na	na	na	na	37	25	2	4	<10	<10
28-Jul-05	<1	2.2	56	3.6	na	na	na	na	na	9	29	2	2	<10	<10
Coralville Reservoir - BOTTOM															
15-Jul-05	13	4.7	137	4.8	21.3	8.9	7.4	2.3	-4.5	12	47	<1	<1	10	10
22-Jul-05	21	4.8	126	3.1	na	na	na	na	na	16	41	1	1	130	110
28-Jul-05	<1	1.8	58	6.7	na	na	na	na	na	6	27	<1	<1	<10	<10
Iowa River Downstream - University Water Plant (Iowa City)															
15-Jul-05	14	2.5	31	4.3	21.4	10.1	7.1	2.8	-5.9	42	23	3	4	40	40
22-Jul-05	31	3.6	25	4.8	na	na	na	na	na	98	39	4	10	60	60
28-Jul-05	<1	1.2	26	5.2	na	na	na	na	na	16	24	2	3	410	150
MIN	<1	1.2	19	3.1	21.3	8.6	7.1	1.9	-8.0	6	23	<1	<1	<10	<10
MAX	31	12.7	221	6.7	25.6	10.1	7.8	2.8	-3.7	98	96	17	20	410	200
MEAN	na	4.3	79	4.6	22.3	9.4	7.4	2.3	-5.2	31	38	na	na	na	na

Table 4: Quality Assurance/Control, July 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Duplicate (O)																
15-Jul-05	28.74	6.19	8.17	<1	3.1	14	230	204	300	0.15	0.02	5.8	5.25	11.1	0.34	0.56
% diff.	na	na	na	na	-4.5	36	2.5	2.9	1.3	42.3	4.8	19.5	6.7	13.9	0.0	-19.1
22-Jul-05	28.93	7	8.31	<1	2.1	6	220	202	300	<0.1	0.02	9.6	2.25	11.8	0.35	0.66
% diff.	na	na	na	na	1.8	25	1.8	-6.3	-3.4	na	-66.7	24.1	0.0	20.4	-20.7	-3.1
28-Jul-05	25.74	7.28	8.33	<1	1.8	4	194	164	254	0.06	0.15	na	2.063	na	0.15	0.36
% diff.	na	na	na	na	16.7	60	8.5	-2.5	3.1	40.0	0.0	na	8.3	na	0.0	12.2
Replicate (WP)																
15-Jul-05	27.18	7.37	8.21	<1	2.8	18	232	210	294	0.19	0.05	8.5	3.00	11.5	0.26	0.3
% diff.	na	na	na	na	5.7	10	-3.6	-2.9	-1.4	0.0	-2.2	0.4	5.9	1.9	18.8	18.9
22-Jul-05	27.81	7.45	8.45	<1	1.6	6	226	194	294	<0.1	0.0	9.2	6	15.3	0.35	0.31
% diff.	na	na	na	na	6.5	25	4.2	6.7	4.5	na	-9.1	-4.4	-3.2	-4.0	5.4	-14.8
28-Jul-05	26.51	7.29	8.38	<1	1.9	8	234	210	296	0.22	0.27	5.5	4.1	9.9	0.27	0.32
% diff.	na	na	na	na	25.5	20	-3.5	-5.0	-3.5	-4.8	-12.5	28.8	0.0	18.2	-12.5	-18.5
Standards (% Recovery)																
15-Jul-05	na	na	na	na	na	na	104	na	na	100	na	108	84	na	115	118
22-Jul-05	na	na	na	na	na	na	104	na	na	86	na	118	76	na	109	109
28-Jul-05	na	na	na	na	na	na	na	na	98	101	na	100	100	na	109	104
Spikes (% Recovery)																
15-Jul-05	na	na	na	na	na	na	104	na	100	95	na	89	na	na	113.6	95.2
Spike 2	na	na	na	na	na	na	106	na	100	99	na	108	na	na	95.5	96.2
Spike 3	na	na	na	na	na	na	97	na	100	116	na	148	na	na	101.7	101.8
22-Jul-05	na	na	na	na	na	na	100	na	50	122	na	101	na	na	97.3	116.3
Spike 2	na	na	na	na	na	na	104	na	100	104	na	96	na	na	91.4	108.5
Spike 3	na	na	na	na	na	na	101	na	100	113	na	107	na	na	79.2	61.4
28-Jul-05	na	na	na	na	na	na	104	na	100	103	na	111	na	na	95.5	69.1
Spike 2	na	na	na	na	na	na	96	na	110	106	na	95	na	na	96	72.1
Spike 3	na	na	na	na	na	na	101	na	90	96	na	102	na	na	93	75.5

Table 5: Quality Assurance/Control, July 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2 mg/L	TOC mg/L	TSS mg/L	BOD_5 mg/L	Additional Anions		Additional Cations		Ion Balance % diff.	Pigments				Indicator Org.	
					Cl mg/L	SO_4 mg/L	Na mg/L	K mg/L		chl *a* mg/m^3	pheo *a* mg/m^3	chl *b* mg/m^3	chl *c* mg/m^3	Fecal Org. / 100 mL	*E. coli* Org. / 100 mL
Duplicate (O)															
15-Jul-05	10	5.4	203	na	20.4	8.4	7.8	1.9	-1.6	14	34	<1	<1	110	91
% diff.	37.4	57.5	-1.0	na	4.6	2.3	0.0	0.0	na	-75	-37	na	na	15.4	17.3
22-Jul-05	23.15	4.7	311	na	na	na	na	na	na	51	103	<1	4	130	80
% diff.	20.2	-4.4	-84.0	na	na	na	na	na	na	-45	-7	na	-55	na	na
28-Jul-05	<1	3.9	158	na	na	na	na	na	na	16	72	2	2	150	140
% diff.	na	15.2	28.5	na	na	na	na	na	na	-35	5	-64	-57	25.0	30.0
Replicate (WP)															
15-Jul-05	12	2.5	20	na	22.0	9.9	7.2	2.9	-6.3	44	24	2	3	45	45
% diff.	13.3	0.0	35.5	na	-2.7	na	-1.4	-3.6	na	-6	-6	18	22	-12.5	-12.5
22-Jul-05	24	2.6	20	na	na	na	na	na	na	56	41	2	5	100	60
% diff.	22.3	27.8	20.0	na	na	na	na	na	na	43	-7	48	45	-66.7	0.0
28-Jul-05	<1	1.7	33	na	na	na	na	na	na	18	21	2	3	450	210
% diff.	na	-41.7	-26.9	na	na	na	na	na	na	-14	13	-5	-17	-9.8	-40.0
Standards (% Recovery)															
15-Jul-05	110	101	na	na	na	na	na	na	na	na	na	na	na	na	na
22-Jul-05	102	101	na	na	na	na	na	na	na	na	na	na	na	na	na
28-Jul-05	97	101	na	na	na	na	na	na	na	na	na	na	na	na	na
Spikes (% Recovery)															
15-Jul-05	94	129	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	50	80	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	53	102	na	na	na	na	na	na	na	na	na	na	na	na	na
22-Jul-05	102	100	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	99	94	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	88	113	na	na	na	na	na	na	na	na	na	na	na	na	na
28-Jul-05	na	119	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	na	121	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	na	109	na	na	na	na	na	na	na	na	na	na	na	na	na

Appendix A: Supporting Information

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp.		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	15-Jul-05	29.1	6.7	8.20	<1	22	236	210	304	32.2	90.0	Partly cloudy	0
Res-Surface	15-Jul-05	28.2	7.0	8.33	<1	22	248	212	312	32.2	90.0	Partly cloudy	0
Res-Mid	15-Jul-05	28.8	6.7	8.34	<1	16	234	218	306	32.2	90.0	Partly cloudy	0
Res-Bottom	15-Jul-05	27.8	5.6	7.96	<1	18	242	216	302	32.2	90.0	Partly cloudy	0
Downstream	15-Jul-05	27.2	7.2	8.17	<1	20	224	204	290	32.2	90.0	Partly cloudy	0

Comments:

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp. Noon		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	22-Jul-05	28.9	7.4	8.31	<1	8	224	190	290	31.1	88.0	Clear	0.05
Res-Surface	22-Jul-05	29.1	7.3	8.45	<1	8	242	210	312	31.1	88.0	Clear	0.05
Res-Mid	22-Jul-05	28.9	7.3	8.18	0.4	<1	240	212	308	31.1	88.0	Clear	0.05
Res-Bottom	22-Jul-05	28.5	3.7	8.07	4.5	<1	244	204	300	31.1	88.0	Clear	0.05
Downstream	22-Jul-05	27.1	7.3	8.44	<1	8	236	208	308	31.1	88.0	Clear	0.05

Comments:

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp. Noon		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	28-Jul-05	25.4	7.4	8.29	<1	10	212	160	262	24.4	75.9	Partly Cloudy	0
Res-Surface	28-Jul-05	26.7	6.2	8.19	1.5	<1	202	170	258	24.4	75.9	Partly Cloudy	0
Res-Mid	28-Jul-05	26.6	6.3	8.24	2.0	<1	204	178	272	24.4	75.9	Partly Cloudy	0
Res-Bottom	28-Jul-05	26.4	7.3	8.30	<1	6	200	184	258	24.4	75.9	Partly Cloudy	0
Downstream	28-Jul-05	25.9	7.6	8.24	<1	10	226	200	286	24.4	75.9	Partly Cloudy	0

Comments:

Department of Civil and Environmental Engineering

IIHR – Hydroscience & Engineering

Coralville Reservoir Water Quality Project

Monthly Report, August 2005

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General Conditions

Samples were collected on August 10th, 17th and 25th at all river and reservoir locations. The general conditions and hydrologic parameters for each sampling event are highlighted in Table 1. The stream flow data is taken from the USGS website and is considered provisional.

Table 1: General conditions and hydrologic parameters for each sampling event.

Date	Air Temp. Noon		Sky	Previous Day Precipitation
	°C	°F		inches
10-Aug-05	32.8	91.0	Clear	0
17-Aug-05	27.8	82.0	Scattered clouds	0.01
25-Aug-05	27.8	82.0	Clear	0.01

	max cfs	min cfs	mean cfs	max cfs	min cfs	mean cfs	ft msl
10-Aug-05	714	677	694	756	549	639	683.34
17-Aug-05	672	649	659	890	765	822	683.44
25-Aug-05	640	576	610	589	529	564	683.37

Water Quality Observations

The physical, chemical and biological water quality results are shown in Table 2 and Table 3 for the reservoir and river locations. Quality assurance and quality control data are shown in Table 4 and Table 5. The field reports for the month are included in Appendix A. Indicator organism data supplied by the University Hygienic Laboratory for the reservoir beaches are shown in Appendix A. Dissolved oxygen for the month of August 2005 ranged from 2.5 to 8.4 mg/L for all sampling locations. The dissolved oxygen criterion for lakes is 5.0 mg/L, and applies only to the upper layer of stratification; the criterion was violated on August 17th at the mid-depth reservoir location, and on all sampling dates for the bottom reservoir. The values for pH ranged from 7.66 to 9.21, with a monthly mean of 8.22. Carbon dioxide values ranged from <1 to 7.5 mg/L for titrated values, and <1 to 5.4 mg/L for calculated values during the month of August, 2005. The phenolphthalein alkalinity minimum (<1 mg/L as $CaCO_3$) occurred on August 10th at the reservoir bottom location and on August 17th and 25th at both the mid-depth and reservoir bottom locations. The maximum (12 mg/L as $CaCO_3$) occurred at the upstream location on both August 10th and 17th. Total alkalinity was between 102 and 240 mg/L as $CaCO_3$, with a mean of 159 mg/L as $CaCO_3$. Calcium hardness ranged from 54 to 200 mg/L as $CaCO_3$ and total hardness was between 136 to 300 mg/L as $CaCO_3$.

Ammonia nitrogen was below 1 mg/L-N for all samples; nitrite ranged from 0.01 to 0.09 mg/L-N with a mean of 0.05 mg/L-N; nitrate was between 0.1 and 4.1 mg/L-N as determined by ion chromatography and total Kjeldahl nitrogen was between 1.31 and

6.56 mg/L. Total nitrogen for the month of August 2005, was between 2.6 and 9.7 mg/L, with a mean of 5 mg/L.

Orthophosphate was between 0.06 and 0.36 mg/L-P and total phosphorus was between 0.20 and 0.74 mg/L-P. The biological oxygen demand was between 1.8 and 7.6 mg/L. The silica minima was 3 mg/L as SiO_2 on August 17th at the upstream location, the maximum occurred on August 28thnd at the reservoir bottom location (27 mg/L-SiO_2). The mean value for total organic carbon was 6.0 mg/L; the maximum value of 15.4 mg/L was measured at the upstream location on August 28th, and a minimum of 1.8 mg/L was measured for the downstream location on August 10th. The maximum suspended solids value was found at the upstream location on August 25th (239 mg/L); a minimum of <10 mg/L was found at the reservoir surface August 17th.

Chlorophyll *a* had a minimum of 4 mg/m^3 on August 10th at the reservoir bottom, a maximum of 85 mg/m^3 on August 10th at the upstream location, and a monthly mean of 31 mg/m^3. Pheophytin *a* was between 15 and 697 mg/m^3, with a monthly mean of 151 mg/m^3. Chlorophyll *b* ranged from below the detection limit of 1 mg/m^3 to a high of 6 mg/m^3 on August 10th at the reservoir surface. Chlorophyll *c* ranged from below detection level to 9 mg/m^3 on August 10th at the upstream location and on August 25th at the downstream location.

Indicator organisms ranged from below detection level (<10 organisms per 100 mL) for both F. Coliform and *E. Coli* to a high on August 25th of 280 organisms per 100 mL of F. Coliform (downstream location) and 200 organisms per 100 mL of *E. Coli* (downstream location). Sandy Beach, West Overlook Beach and Sugar Bottom Beach were sampled on August 1st, 8th, 22nd and 29th. There were no exceedances in either F. Coliform or *E. Coli* levels in the water (See Appendix).

Table 2: Results, August 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Iowa River Upstream (Green Castle Avenue)																
10-Aug-05	28.1	7.9	9.21	<1	<1	12	104	72	176	0.1	0.03	2.9	2.44	5.4	0.08	0.41
17-Aug-05	25.8	8.4	9.11	<1	<1	12	108	64	144	0.1	0.01	0.1	4.13	4.2	0.06	0.38
25-Aug-05	23.0	6.8	9.20	<1	<1	10	102	54	136	0.4	0.01	0.6	2.63	3.3	0.25	0.74
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)																
10-Aug-05	28.3	7.8	8.50	<1	1.3	10	214	170	296	0.2	0.06	4.1	1.88	6.0	0.21	0.22
17-Aug-05	26.4	8.2	8.54	<1	<1	8	150	114	200	0.2	0.07	1.6	1.69	3.4	0.15	0.20
25-Aug-05	24.7	5.1	8.51	<1	<1	4	136	106	184	0.4	0.03	0.5	2.06	2.6	0.25	0.26
Coralville Reservoir - MID-DEPTH																
10-Aug-05	27.6	5.7	8.43	<1	1.7	4	230	190	280	0.4	0.09	4.1	3.94	8.1	0.36	0.38
17-Aug-05	26.1	4.7	8.02	6.5	2.3	<1	124	98	176	0.7	0.06	1.2	3.75	5.1	0.16	0.27
25-Aug-05	24.9	7.0	7.91	2.5	3.4	<1	138	104	170	0.4	0.02	0.2	2.44	2.6	0.25	0.26
Coralville Reservoir - BOTTOM																
10-Aug-05	27.1	2.7	8.02	6.0	4.5	<1	240	200	300	0.5	0.09	3.9	2.63	6.6	0.36	0.44
17-Aug-05	25.3	3.5	7.66	7.5	5.4	<1	124	100	176	0.9	0.05	1.0	3.38	4.4	0.24	0.51
25-Aug-05	25.4	2.5	8.07	3.0	2.3	<1	136	120	170	0.4	0.01	0.3	4.31	4.6	0.25	0.29
Iowa River Downstream - University Water Plant (Iowa City)																
10-Aug-05	26.7	7.6	8.42	<1	1.6	8	216	180	280	0.2	0.07	3.1	6.56	9.7	0.29	0.28
17-Aug-05	25.3	7.5	8.30	1.9	1.9	6	194	172	250	0.2	0.06	2.4	1.31	3.8	0.25	0.24
25-Aug-05	24.3	7.5	8.34	<1	1.5	2	164	134	220	0.2	0.06	2.5	2.25	4.8	0.24	0.24
MIN	23.0	2.5	7.66	<1	<1	<1	102	54	136	0.1	0.01	0.1	1.31	2.6	0.06	0.20
MAX	28.3	8.4	9.21	7.5	5.4	12	240	200	300	0.9	0.09	4.1	6.56	9.7	0.36	0.74
MEAN	25.9	6.2	8.22	na	na	na	159	125	211	0.3	0.05	1.9	3.03	5.0	0.23	0.34

Table 3: Results, August 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion Balance	Pigments				Indicator Org.	
					Cl	SO_4	Na	K		chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Iowa River Upstream (Green Castle Avenue)															
10-Aug-05	4	13.6	87	6.9	na	na	na	na	na	85	697	<1	9	55	50
17-Aug-05	3	11.4	124	7.6	na	na	na	na	na	45	552	<1	6	30	30
25-Aug-05	6	15.4	239	6.4	na	na	na	na	na	16	601	<1	2	55	40
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)															
10-Aug-05	18	2.9	13	5.4	na	na	na	na	na	81	49	6	6	<10	<10
17-Aug-05	9	4.0	<10	5.8	na	na	na	na	na	30	62	<1	3	10	10
25-Aug-05	26	4.1	34	4.2	na	na	na	na	na	20	36	<1	2	<10	<10
Coralville Reservoir - MID-DEPTH															
10-Aug-05	19	4.3	32	5.0	na	na	na	na	na	12	32	1	1	<10	<10
17-Aug-05	7	5.2	28	3.8	na	na	na	na	na	15	30	<1	2	<10	<10
25-Aug-05	27	4.0	50	6.2	na	na	na	na	na	14	32	<1	2	<10	<10
Coralville Reservoir - BOTTOM															
10-Aug-05	20	3.9	69	2.2	na	na	na	na	na	4	45	<1	<1	<10	<10
17-Aug-05	8	5.8	76	2.7	na	na	na	na	na	5	37	<1	<1	10	<10
25-Aug-05	27	4.5	43	1.8	na	na	na	na	na	43	15	4	8	<10	<10
Iowa River Downstream - University Water Plant (Iowa City)															
10-Aug-05	15	1.8	19	6.0	na	na	na	na	na	21	29	1	2	36	10
17-Aug-05	16	4.8	31	5.4	na	na	na	na	na	10	27	<1	1	82	64
25-Aug-05	21	4.4	35	5.6	na	na	na	na	na	58	27	4	9	280	200
MIN	3	1.8	13	1.8	na	na	na	na	na	4	15	<1	<1	<10	<10
MAX	27	15.4	239	7.6	na	na	na	na	na	85	697	6	9	280	200
MEAN	15	6.0	63	5.0	na	na	na	na	na	31	151	na	na	na	na

Table 4: Quality Assurance/Control, August 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Duplicate (O)																
10-Aug-05	na	na	9.25	<1	0.1	8	106	70	160	0.11	0.02	0.1	2.63	2.7	0.07	0.30
% diff.	na	na	na	na	na	33.3	-1.9	2.8	9.1	0.0	55.9	1.2	-7.7	49.8	12.5	26.8
17-Aug-05	na	na	9.09	<1	0.1	10	102	76	144	0.21	0.01	na	3.94	na	0.06	0.34
% diff.	na	na	na	na	na	16.7	5.6	-18.8	0.0	-61.5	-40.0	na	4.5	na	0.0	10.5
25-Aug-05	na	na	9.23	<1	0.1	6	98	64	134	0.07	0.01	0.1	2.25	2.3	0.05	0.7
% diff.	na	na	na	na	na	40.0	3.9	-18.5	1.5	84.1	11.1	91.8	14.3	29.6	80.0	5.4
Replicate (WP)																
10-Aug-05	na	na	8.32	<1	2.0	6	210	210	276	0.19	0.07	3.1	6.56	9.8	0.29	0.3
% diff.	na	na	na	na	-23.0	25.0	2.8	-16.7	1.4	0.0	-10.6	-1.8	0.0	-0.7	0.0	-7.1
17-Aug-05	na	na	8.34	<1	1.8	4	198	154	244	0.2	0.06	2.8	1.88	4.8	0.21	0.25
% diff.	na	na	na	na	7.1	33.3	-2.1	10.5	2.4	-11.1	1.6	-16.0	-42.8	-24.9	16.0	-4.2
25-Aug-05	na	na	8.49	<1	1.1	4	168	130	218	0.2	0.06	na	2.06	na	0.2	0.25
% diff.	na	na	na	na	28.1	-100.0	-2.4	3.0	0.9	-25.0	4.8	na	8.3	na	16.7	-4.2
Standards (% Recovery)																
10-Aug-05	na	na	na	na	na	na	na	na	94	102	na	116	92	na	133	106
17-Aug-05	na	na	na	na	na	na	na	108	100	104	na	116	87	na	111	103
25-Aug-05	na	na	na	na	na	na	na	104	96	101	na	102	83	na	121	106
Spikes (% Recovery)																
10-Aug-05	na	na	na	80	na	na	100	na	100	95	na	80	na	na	106	99
Spike 2	na	na	na	105	na	na	104	na	100	95	na	72	na	na	93	97
Spike 3	na	na	na	97	na	na	103	na	100	100	na	85	na	na	87	92
17-Aug-05	na	na	na	100	na	na	100	na	100	103	na	92	na	na	84	102
Spike 2	na	na	na	85	na	na	98	na	103	96	na	79	na	na	96	100
Spike 3	na	na	na	103	na	na	97	na	98	100	na	96	na	na	102	na
25-Aug-05	na	na	na	100	na	na	100	na	100	110	na	86	na	na	87	na
Spike 2	na	na	na	105	na	na	96	na	110	109	na	na	na	na	91	103
Spike 3	na	na	na	100	na	na	99	na	93	101	na	93	na	na	98	100

Table 5: Quality Assurance/Control, August 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion Balance	Pigments				Indicator Org.	
					Cl	SO_4	Na	K		chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Duplicate (O)															
10-Aug-05	4.99	13.3	136	na	na	na	na	na	na	49	570	<1	6	<10	<10
% diff.	-23.5	2.2	-56.3	na	na	na	na	na	na	42.2	18.3	na	41.0	na	na
17-Aug-05	3	10.3	129	na	na	na	na	na	na	115	509	<1	14	27	18
% diff.	0.0	9.6	-4.0	na	na	na	na	na	na	-156.1	7.9	na	-145.1	10.0	40.0
25-Aug-05	7	15.8	194	na	na	na	na	na	na	31	686	<1	4	91	91
% diff.	-16.7	-2.6	18.8	na	na	na	na	na	na	-99.5	-14.3	na	-80.2	-65.5	-127.5
Replicate (WP)															
10-Aug-05	18	1.7	25	na	na	na	na	na	na	25	36	2	3	100	64
% diff.	-16.5	5.6	-31.6	na	na	na	na	na	na	-17	-23.9	-40.0	-52.9	-177.8	-540.0
17-Aug-05	13	4.4	16	na	na	na	na	na	na	28	31	1	4	80	70
% diff.	18.8	8.3	48.4	na	na	na	na	na	na	-188.7	-14.5	na	-213.9	2.4	-9.4
25-Aug-05	25	6.1	24	na	na	na	na	na	na	16	33	<1	2	300	<10
% diff.	-19.0	-38.6	31.4	na	na	na	na	na	na	71.9	-23.1	na	78.6	-7.1	na
Standards (% Recovery)															
10-Aug-05	na	101	na	na	na	na	na	na	na	na	na	na	na	na	na
17-Aug-05	na	114	na	na	na	na	na	na	na	na	na	na	na	na	na
25-Aug-05	na	112	na	na	na	na	na	na	na	na	na	na	na	na	na
Spikes (% Recovery)															
10-Aug-05	45	106	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	78	104	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	88	104	na	na	na	na	na	na	na	na	na	na	na	na	na
17-Aug-05	102	99	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	89	102	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	110	89	na	na	na	na	na	na	na	na	na	na	na	na	na
25-Aug-05	50	108	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	92	101	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	107	na	na	na	na	na	na	na	na	na	na	na	na	na	na

Appendix A: Supporting Information

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp.		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	10-Aug-05	28.1	7.9	9.21	<1	12	104	72	176	32.8	91.0	Clear	0
Res-Surface	10-Aug-05	28.3	7.8	8.50	<1	10	214	170	296	32.8	91.0	Clear	0
Res-Mid	10-Aug-05	27.6	5.7	8.43	<1	4	230	190	280	32.8	91.0	Clear	0
Res-Bottom	10-Aug-05	27.1	2.7	8.02	6.0	<1	240	200	300	32.8	91.0	Clear	0
Downstream	10-Aug-05	26.7	7.6	8.42	<1	8	216	180	280	32.8	91.0	Clear	0

Comments:

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp. Noon		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	17-Aug-05	25.8	8.4	9.11	<1	12	108	64	144	27.8	82.0	Scattered clouds	0.01
Res-Surface	17-Aug-05	26.4	8.2	8.54	<1	8	150	114	200	27.8	82.0	Scattered clouds	0.01
Res-Mid	17-Aug-05	26.1	4.7	8.02	6.5	<1	124	98	176	27.8	82.0	Scattered clouds	0.01
Res-Bottom	17-Aug-05	25.3	3.5	7.66	7.5	<1	124	100	176	27.8	82.0	Scattered clouds	0.01
Downstream	17-Aug-05	25.3	7.5	8.30	<1	6	194	172	250	27.8	82.0	Scattered clouds	0.01

Comments:

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp. Noon		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	25-Aug-05	23.0	6.8	9.20	<1	10	102	54	136	27.8	82.0	Clear	0.01
Res-Surface	25-Aug-05	24.7	5.1	8.51	<1	4	136	106	184	27.8	82.0	Clear	0.01
Res-Mid	25-Aug-05	24.9	7.0	7.91	2.5	<1	138	104	170	27.8	82.0	Clear	0.01
Res-Bottom	25-Aug-05	25.4	2.5	8.07	3.0	<1	136	120	170	27.8	82.0	Clear	0.01
Downstream	25-Aug-05	24.3	7.5	8.34	<1	2	164	134	220	27.8	82.0	Clear	0.01

Comments:

Department of Civil and Environmental Engineering

IIHR – Hydroscience & Engineering

Coralville Reservoir Water Quality Project

Monthly Report, September 2005

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General Conditions

Samples were collected on September 8th and 15th at all river and reservoir locations. The general conditions and hydrologic parameters for each sampling event are highlighted in Table 1. The stream flow data is taken from the USGS website and is considered provisional.

Table 1: General conditions and hydrologic parameters for each sampling event.

Date	Air Temp. Noon		Sky	Previous Day Precipitation
	°C	°F		inches
8-Sep-05	27.2	81.0	Clear	0
15-Sep-05	19.4	66.9	Clear	0

Date	Inflow, USGS05453100			Outflow, USGS05453520			Pool Level
	max	min	mean	max	min	mean	
	cfs	cfs	cfs	cfs	cfs	cfs	ft msl
8-Sep-05	361	322	335	549	433	470	683.55
15-Sep-05	326	310	316	249	188	222	683.91

Water Quality Observations

The physical, chemical and biological water quality results are shown in Table 2 and Table 3 for the reservoir and river locations. Quality assurance and quality control data are shown in Table 4 and Table 5. The field reports for the month are included in Appendix A. Indicator organism data supplied by the University Hygienic Laboratory for the reservoir beaches are shown in Appendix A. Dissolved oxygen for the month of Sep 2005 ranged from 5.8 to 9.4 mg/L for all sampling locations. The dissolved oxygen criterion for lakes is 5.0 mg/L, and applies only to the upper layer of stratification; the criterion was not violated during the month of Sep 2005. The values for pH ranged from 7.45 to 8.93, with a monthly mean of 8.03. The phenolphthalein alkalinity minima (<1 mg/L as $CaCO_3$) occurred on Sep 8th at the mid-depth and reservoir bottom locations, and on Sep 15th at the bottom reservoir location. The maximum alkalinity (8 mg/L as $CaCO_3$) occurred at the upstream location on Sep 8th and 15th, and at the reservoir surface location on Sep 15th. Total alkalinity was between 124 and 136 mg/L as $CaCO_3$, with a mean of 130 mg/L as $CaCO_3$. Calcium hardness ranged from 72 to 112 mg/L as $CaCO_3$ and total hardness was between 160 to 184 mg/L as $CaCO_3$.

Ammonia nitrogen was below 1 mg/L-N for all samples; nitrite ranged from <0.01 to 0.22 mg/L-N; nitrate was below detection level (<0.05 mg/L-N) at the upstream and reservoir surface locations on Sep 8th and for all river and reservoir locations on Sep 15th, as determined by ion chromatography. Total Kjeldahl nitrogen was between 1.88 and

6.19 mg/L. Total nitrogen for the month of Sep 2005 was between 1.9 and 6.2 mg/L, with a mean of 3.4 mg/L.

Orthophosphate was between 0.06 and 0.22 mg/L-P and total phosphorus was between 0.24 and 0.50 mg/L-P. The biological oxygen demand was between 4.6 to 8.6 mg/L Silica values ranged from 4 to 16 mg/L as SiO_2, with a mean of 8 mg/L as SiO_2. The mean value for total organic carbon was 7.9 mg/L; the maximum value of 18.5 mg/L was measured at the upstream location on Sep 8th, and a minimum of 4.3 mg/L was measured for the mid-depth reservoir location on Sep 15th. The maximum suspended solids value was found at the upstream location on Sep 15th (114 mg/L); a minimum of 10 mg/L was found at the reservoir surface on Sep 8th and the monthly mean was 36 mg/L.

Chlorophyll *a* had a minimum of 4 mg/m^3 on Sep 8th at the reservoir mid-depth location, a maximum of 31 mg/m^3 on Sep 8th at the reservoir surface, and a monthly mean of 18 mg/m^3. Pheophytin *a* was between 18 and 329 mg/m^3 with a monthly mean of 97 mg/m^3. Chlorophyll *b* ranged from below the detection limit of 1 mg/m^3 to 1 mg/m^3. Chlorophyll *c* ranged from below detection level to 3 mg/m^3.

Beach water indicator organisms were measured on the 6th, 12th and 20th with most samples reporting below the 10 organism per 100 mL detection level. The greatest values for *E. coli* were on Sep 6th with values of 50, 20 and 20 cfu/100 mL for the Sandy Beach, Sugar Bottom and West Overlook locations respectively.

Table 2: Results, September, 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Iowa River Upstream (Green Castle Avenue)																
8-Sep-05	25.3	7.3	8.90	<1	<1	8	126	72	170	0.1	<0.01	<0.1	6.19	6.2	0.06	0.50
15-Sep-05	20.7	9.4	8.65	<1	0.5	8	124	98	162	0.1	<0.01	<0.1	4.31	4.3	0.11	0.42
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)																
8-Sep-05	26.2	8.5	8.93	<1	<1	8	126	94	160	0.1	0.01	<0.1	2.81	2.8	0.13	0.25
15-Sep-05	23.7	6.9	8.37	<1	1.1	2	130	100	176	0.4	0.03	<0.1	2.25	2.3	0.17	0.24
Coralville Reservoir - MID-DEPTH																
8-Sep-05	24.4	6.1	7.45	6.5	8.9	<1	126	94	174	0.7	0.02	0.1	2.44	2.6	0.21	0.31
15-Sep-05	23.8	5.8	8.18	1.5	1.7	<1	134	100	172	0.5	0.03	<0.1	2.25	2.3	0.19	0.25
Coralville Reservoir - BOTTOM																
8-Sep-05	24.2	5.9	7.78	7.5	4.4	<1	132	94	176	0.8	0.02	0.2	3.19	3.4	0.22	0.29
15-Sep-05	23.7	6.0	7.76	1.5	4.5	2	130	100	172	0.4	0.03	<0.1	1.88	1.9	0.16	0.29
Iowa River Downstream - University Water Plant (Iowa City)																
8-Sep-05	25.9	7.7	8.22	<1	1.6	2	132	110	180	0.1	0.22	0.1	5.06	5.4	0.14	0.24
15-Sep-05	22.3	8.6	8.66	<1	0.6	2	136	112	184	0.1	0.01	<0.1	2.81	2.8	0.22	0.26
MIN	20.7	5.8	7.45	<1	<1	<1	124	72	160	0.1	<0.01	<0.1	1.88	1.9	0.06	0.24
MAX	26.2	9.4	8.93	7.5	8.9	8.0	136	112	184	0.8	0.22	0.2	6.19	6.2	0.22	0.50
MEAN	24.0	7.2	8.03	na	na	na	130	97	173	0.3	na	na	3.32	3.4	0.16	0.31

Table 3: Results, September 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2 mg/L	TOC mg/L	TSS mg/L	BOD_5 mg/L	Additional Anions Cl mg/L	Additional Anions SO_4 mg/L	Additional Cations Na mg/L	Additional Cations K mg/L	Ion Balance % diff.	Pigments chl *a* mg/m^3	Pigments pheo *a* mg/m^3	Pigments chl *b* mg/m^3	Pigments chl *c* mg/m^3	Indicator Org. Fecal Org. / 100 mL	Indicator Org. *E. coli* Org. / 100 mL
Iowa River Upstream (Green Castle Avenue)															
8-Sep-05	5	18.5	80	6.4	na	na	na	na	na	25	237	<1	3	na	na
15-Sep-05	4	17.1	114	8.6	na	na	na	na	na	17	329	<1	2	na	na
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)															
8-Sep-05	8	4.8	10	7.8	na	na	na	na	na	31	110	1	2	na	na
15-Sep-05	7	6.4	27	6.0	na	na	na	na	na	24	38	<1	2	na	na
Coralville Reservoir - MID-DEPTH															
8-Sep-05	8	4.3	13	5.3	na	na	na	na	na	4	33	<1	<1	na	na
15-Sep-05	5	6.9	17	4.6	na	na	na	na	na	14	32	<1	<1	na	na
Coralville Reservoir - BOTTOM															
8-Sep-05	16	4.7	26	5.2	na	na	na	na	na	10	18	<1	<1	na	na
15-Sep-05	8	6.1	28	5.1	na	na	na	na	na	11	30	<1	<1	na	na
Iowa River Downstream - University Water Plant (Iowa City)															
8-Sep-05	16	5.4	23	5.1	na	na	na	na	na	19	99	1	1	na	na
15-Sep-05	7	4.9	17	6.1	na	na	na	na	na	28	39	1	1	na	na
MIN	4	4.3	10	4.6	na	na	na	na	na	4	18	<1	<1	na	na
MAX	16	18.5	114	8.6	na	na	na	na	na	31	329	1	3	na	na
MEAN	8	7.9	36	6.0	na	na	na	na	na	18	97	na	na	na	na

Table 4: Quality Assurance/Control, September 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Duplicate (O)																
8-Sep-05	na	na	7.75	<1	4.2	4	118	80	174	0.08	<0.01	<0.1	6.19	6.2	0.05	1.17
% diff.	na	na	12.9	na	na	50.0	6.3	-11.1	-2.4	-14.3	na	na	0.0	0.0	16.7	-134.0
15-Sep-05	na	na	8.99	<1	0.2	6	118	90	154	0.14	<0.01	<0.1	4.50	4.5	0.09	0.32
% diff.	na	na	-3.9	na	58.6	25.0	4.8	8.2	4.9	-27.3	na	na	-4.3	-4.3	18.2	23.8
Replicate (WP)																
8-Sep-05	na	na	7.43	<1	10.1	4	136	112	180	0.05	0.23	<0.1	5.06	5.3	0.15	0.17
% diff.	na	na	na	na	-543.9	-100.0	-3.0	-1.8	0.0	16.7	-3.7	na	0.0	1.5	-7.1	29.2
15-Sep-05	na	na	8.33	<1	1.3	2	140	116	178	0.16	0.02	<0.1	1.88	1.9	0.34	0.27
% diff.	na	na	na	na	-125.2	0.0	-2.9	-3.6	3.3	-77.8	-45.5	na	33.3	33.0	-54.5	-3.8
Standards (% Recovery)																
8-Sep-05	na	na	na	na	na	na	na	104	96	97	na	115	87	na	112	112
15-Sep-05	na	na	na	na	na	na	na	104	98	103	na	120	88	na	112	106
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Spikes (% Recovery)																
8-Sep-05	na	na	na	100	na	na	100	na	100	107	na	95	na	na	97	116
Spike 2	na	na	na	105	na	na	104	na	100	115	na	103	na	na	93	105
Spike 3	na	na	na	100	na	na	108	na	97	101	na	99	na	na	92	98
15-Sep-05	na	na	na	100	na	na	96	na	120	102	na	84	na	na	105	112
Spike 2	na	na	na	103	na	na	96	na	93	101	na	99	na	na	98	103
Spike 3	na	na	na	102	na	na	97	na	98	106	na	99	na	na	95	106

Table 5: Quality Assurance/Control, September 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion Balance	Pigments				Indicator Org.	
					Cl	SO_4	Na	K		chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Duplicate (O)															
8-Sep-05	6	21.5	502	na	na	na	na	na	na	7	315	<1	<1	na	na
% diff.	-14.2	-16.2	-527.5	na	na	na	na	na	na	72.7	-33.2	na	na	na	na
15-Sep-05	5	15.8	104	na	na	na	na	na	na	65	286	<1	6	na	na
% diff.	-29.4	7.6	8.8	na	na	na	na	na	na	-106.2	-159.1	na	-184.3	na	na
Replicate (WP)															
8-Sep-05	12	5.7	38	na	na	na	na	na	na	12	60	<1	<1	na	na
% diff.	22.9	-5.6	-65.2	na	na	na	na	na	na	39.5	39.3	na	na	na	na
15-Sep-05	7	5.7	20	na	na	na	na	na	na	21	42	1	2	na	na
% diff.	0.0	-16.3	-17.6	na	na	na	na	na	na	24.8	-6.5	5.3	-78.9	na	na
Standards (% Recovery)															
8-Sep-05	135	93	na	na	na	na	na	na	na	na	na	na	na	na	na
15-Sep-05	123	93	na	na	na	na	na	na	na	na	na	na	na	na	na
	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Spikes (% Recovery)															
8-Sep-05	103	106	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	108	111	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	112	101	na	na	na	na	na	na	na	na	na	na	na	na	na
15-Sep-05	49	85	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	67	111	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	57	72	na	na	na	na	na	na	na	na	na	na	na	na	na

Appendix A: Supporting Information

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp.		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	8-Sep-05	25.3	7.3	8.90	<1	8	126	72	170	27.2	81.0	Clear	0
Res-Surface	8-Sep-05	26.2	8.5	8.93	<1	8	126	94	160	27.2	81.0	Clear	0
Res-Mid	8-Sep-05	24.4	6.1	7.45	6.5	<1	126	94	174	27.2	81.0	Clear	0
Res-Bottom	8-Sep-05	24.2	5.9	7.78	7.5	<1	132	94	176	27.2	81.0	Clear	0
Downstream	8-Sep-05	25.9	7.7	8.22	<1	2	132	110	180	27.2	81.0	Clear	0

Comments:

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp. Noon		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	15-Sep-05	20.7	9.4	8.65	<1	8	124	98	162	19.4	66.9	Clear	0
Res-Surface	15-Sep-05	23.7	6.9	8.37	<1	2	130	100	176	19.4	66.9	Clear	0
Res-Mid	15-Sep-05	23.8	5.8	8.18	1.5	<1	134	100	172	19.4	66.9	Clear	0
Res-Bottom	15-Sep-05	23.7	6.0	7.76	1.5	2	130	100	172	19.4	66.9	Clear	0
Downstream	15-Sep-05	22.3	8.6	8.66	<1	2	136	112	184	19.4	66.9	Clear	0

Comments:

Department of Civil and Environmental Engineering

IIHR – Hydroscience & Engineering

Coralville Reservoir Water Quality Project

Monthly Report, October 2005

Claudia Espinosa-Villegas
Craig Just
Tatsuaki Nakato
Jerald Schnoor

General Conditions

Samples were collected on Oct 13th at all river and reservoir locations. The general conditions and hydrologic parameters for each sampling event are highlighted in Table 1. The stream flow data is taken from the USGS website and is considered provisional.

Table 1: General conditions and hydrologic parameters for each sampling event.

Date	Air Temp. Noon		Sky	Previous Day Precipitation
	°C	°F		inches
13-Oct-05	13.0	55.4	Overcast	0.01

Date	Inflow, USGS05453100			Outflow, USGS05453520			Pool Level
	max	min	mean	max	min	mean	
	cfs	cfs	cfs	cfs	cfs	cfs	ft msl
13-Oct-05	528	510	520	351	333	344	685.29

Water Quality Observations

The physical, chemical and biological water quality results are shown in Table 2 and Table 3 for the reservoir and river locations. Quality assurance and quality control data are shown in Table 4 and Table 5. The field report(s) for the month are included in Appendix A.

The water temperature was between 15.5 and 17.7°C at all locations with a mean of 16.5°C. The dissolved oxygen concentration was lowest at the reservoir bottom location (6.4 mg/L) and greatest at the reservoir surface (9.1 mg/L). The pH was between 7.98 and 8.72 for all sample locations with a mean of 8.27. The titrated carbon dioxide concentrations were between <1 mg/L and 5 mg/L with the minima occurring at the upstream and reservoir surface locations and the maximum occurring at the reservoir bottom. Phenolphthalein alkalinity was below detection level (<1 mg/L as $CaCO_3$) for the reservoir mid-depth, reservoir bottom and the downstream locations; values of 10 mg/L as $CaCO_3$ were measured at the upstream and reservoir surface. Total alkalinity was between 134 and 270 mg/L as $CaCO_3$ for all samples with a mean of 172 mg/L as $CaCO_3$. Calcium hardness was lowest (96 mg/L as $CaCO_3$) at the reservoir surface and greatest (260 mg/L as $CaCO_3$) at the upstream location. Total hardness was between 180 and 350 mg/L as $CaCO_3$ for all samples with a mean of 222 mg/L as $CaCO_3$.

Ammonia nitrogen concentrations ranged from 0.1 to 0.6 mg/L-N for all samples with a mean of 0.3 mg/L-N. Nitrite nitrogen concentrations were 0.01 mg/L-N for all samples collected. The nitrate concentration was lowest (0.2 mg/L-N) at the reservoir surface location and greatest (2.5 mg/L-N) at the upstream location. Total Kjeldahl nitrogen was

between 1.69 and 5.63 mg/L-N for all samples with a mean of 2.78 mg/L-N. Total nitrogen was lowest (2.3 mg/L-N) at downstream location and greatest (8.1 mg/L-N) at the upstream location. Reactive (ortho) phosphate was between 0.06 and 0.55 mg/L-P for all locations and total phosphorus was lowest at downstream location (0.10 mg/L-P) and greatest (0.58 mg/L-P) at the upstream location.

The silica concentration was between 4 mg/L and 20 mg/L as SiO_2 for all samples and total organic carbon was lowest (5.1 mg/L) at the upstream location and greatest (9.7 mg/L) at the reservoir bottom. Total suspended solids ranged from 11 mg/L for the reservoir surface to 115 mg/L for the upstream location. The biological oxygen demand was between 4.9 and 7.2 mg/L for all samples with a mean of 6.0 mg/L.

No other parameters were measured in Oct 2005.

Table 2: Results, Oct 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Iowa River Upstream (Green Castle Avenue)																
13-Oct-05	15.9	8.9	8.50	<1	1.7	10	270	260	350	0.1	0.01	2.5	5.63	8.1	0.55	0.58
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)																
13-Oct-05	17.5	9.1	8.72	<1	0.5	10	144	96	180	0.1	0.01	0.2	3.00	3.2	0.06	0.14
Coralville Reservoir - MID-DEPTH																
13-Oct-05	16.0	6.7	7.98	4.0	3.1	<1	150	98	190	0.5	0.01	0.6	1.88	2.5	0.08	0.20
Coralville Reservoir - BOTTOM																
13-Oct-05	15.5	6.4	7.99	5.0	3.2	<1	160	120	204	0.6	0.01	1.2	1.69	2.9	0.08	0.30
Iowa River Downstream - University Water Plant (Iowa City)																
13-Oct-05	17.7	8.7	8.18	1.0	1.7	<1	134	102	184	0.1	0.01	0.6	1.69	2.3	0.08	0.10
MIN	15.5	6.4	7.98	<1	0.5	<1	134	96	180	0.1	0.01	0.2	1.69	2.3	0.06	0.10
MAX	17.7	9.1	8.72	5.0	3.2	10	270	260	350	0.6	0.01	2.5	5.63	8.1	0.55	0.58
MEAN	16.5	6.9	8.27	na	2.1	na	172	135	222	0.3	0.01	1.0	2.78	3.8	0.17	0.26

Table 3: Results, Oct 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2 mg/L	TOC mg/L	TSS mg/L	BOD_5 mg/L	Additional Anions Cl mg/L	Additional Anions SO_4 mg/L	Additional Cations Na mg/L	Additional Cations K mg/L	Ion Balance % diff.	Pigments chl *a* mg/m^3	Pigments pheo *a* mg/m^3	Pigments chl *b* mg/m^3	Pigments chl *c* mg/m^3	Indicator Org. Fecal Org. / 100 mL	Indicator Org. *E. coli* Org. / 100 mL
Iowa River Upstream (Green Castle Avenue)															
13-Oct-05	20	5.1	115	5.3	na	na	na	na	na	na	na	na	na	na	na
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)															
13-Oct-05	4	5.5	11	7.2	na	na	na	na	na	na	na	na	na	na	na
Coralville Reservoir - MID-DEPTH															
13-Oct-05	4	6.4	20	6.5	na	na	na	na	na	na	na	na	na	na	na
Coralville Reservoir - BOTTOM															
13-Oct-05	6	9.7	48	5.9	na	na	na	na	na	na	na	na	na	na	na
Iowa River Downstream - University Water Plant (Iowa City)															
13-Oct-05	6	5.3	16	4.9	na	na	na	na	na	na	na	na	na	na	na
MIN	4	5.1	11	4.9	na	na	na	na	na	na	na	na	na	na	na
MAX	20	9.7	115	7.2	na	na	na	na	na	na	na	na	na	na	na
MEAN	8	6.4	42	6.0	na	na	na	na	na	na	na	na	na	na	na

Table 4: Quality Assurance/Control, Oct 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Duplicate (O)																
13-Oct-05	na	na	8.46	<1	1.7	10	256	228	334	0.02	0.01	4.9	5.81	10.7	0.29	0.29
% diff.	na	na	na	na	-4.2	0.0	5.2	12.3	4.6	66.7	18.2	-96.0	-3.3	-31.8	47.3	50.0
Replicate (WP)																
13-Oct-05	na	na	8.08	1.0	2.2	<1	134	108	184	0.16	0.00	<0.1	1.88	1.9	0.14	0.19
% diff.	na	na	na	0.0	-26.3	na	0.0	-5.9	0.0	-60.0	57.1	na	-11.1	19.2	-75.0	-90.0
Standards (% Recovery)																
13-Oct-05	na	na	na	na	na	na	na	na	104	98	na	106.4	86.95	na	112	115
Spikes (% Recovery)																
13-Oct-05	na	na	na	na	na	na	96	na	90	84.9	na	na	na	na	100.1	113.7
Spike 2	na	na	na	na	na	na	92	na	95	104.9	na	na	na	na	94.9	102.4
Spike 3	na	na	na	na	na	na	100	na	100	95	na	na	na	na	105	98.9

Table 5: Quality Assurance/Control, Oct 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion Balance	Pigments				Indicator Org.	
					Cl	SO_4	Na	K		chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Duplicate (O)															
13-Oct-05	19.2	5.0	38	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	3.5	2.0	67.0	na	na	na	na	na	na	na	na	na	na	na	na
Replicate (WP)															
13-Oct-05	4	4.8	11	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	33.3	9.4	31.3	na	na	na	na	na	na	na	na	na	na	na	na
Standards (% Recovery)															
13-Oct-05	115	101	na	na	na	na	na	na	na	na	na	na	na	na	na
Spikes (% Recovery)															
13-Oct-05	86.5	114.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	115.5	109.0	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	63.3	97.0	na	na	na	na	na	na	na	na	na	na	na	na	na

Appendix A: Supporting Information

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp.		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	13-Oct-05	15.9	8.9	8.50	<1	10	270	260	350	13.0	55.4	Overcast	0.01
Res-Surface	13-Oct-05	17.5	9.1	8.72	<1	10	144	96	180	13.0	55.4	Overcast	0.01
Res-Mid	13-Oct-05	16.0	6.7	7.98	4.0	<1	150	98	190	13.0	55.4	Overcast	0.01
Res-Bottom	13-Oct-05	15.5	6.4	7.99	5.0	<1	160	120	204	13.0	55.4	Overcast	0.01
Downstream	13-Oct-05	17.7	8.7	8.18	1.0	<1	134	102	184	13.0	55.4	Overcast	0.01

Comments:

Department of Civil and Environmental Engineering

IIHR – Hydroscience & Engineering

Coralville Reservoir Water Quality Project

Monthly Report, November 2005

Claudia Espinosa-Villegas
Craig Just
Tatsuaki Nakato
Jerald Schnoor

General Conditions

Samples were collected on Nov 3rd at all river and reservoir locations. The general conditions and hydrologic parameters for each sampling event are highlighted in Table 1. The stream flow data is taken from the USGS website and is considered provisional.

Table 1: General conditions and hydrologic parameters for each sampling event.

Date	Air Temp. Noon		Sky	Previous Day Precipitation
	°C	°F		inches
3-Nov-05	21.0	69.8	Clear	0

Date	Inflow, USGS05453100			Outflow, USGS05453520			Pool Level
	max	min	mean	max	min	mean	
	cfs	cfs	cfs	cfs	cfs	cfs	ft msl
3-Nov-05	365	345	351	157	133	145	686.35

Water Quality Observations

The physical, chemical and biological water quality results are shown in Table 2 and Table 3 for the reservoir and river locations. Quality assurance and quality control data are shown in Table 4 and Table 5. The field report(s) for the month are included in Appendix A.

The water temperature was between 11.3 and 15.4°C at all locations with a mean of 13.6°C. The dissolved oxygen concentration was lowest at the reservoir bottom location (8.6 mg/L) and greatest at the upstream location (13 mg/L). The pH was between 8.28 and 8.73 for all sample locations with a mean of 8.41. The titrated carbon dioxide concentrations were all below the detection level (<1 mg/L). Phenolphthalein alkalinity was between 0.8 and 2.0 mg/L as $CaCO_3$ with a mean of 1.4 mg/L as $CaCO_3$. Total alkalinity was between 148 and 238 mg/L as $CaCO_3$ for all samples with a mean of 191 mg/L as $CaCO_3$. Calcium hardness was lowest (116 mg/L as $CaCO_3$) at the downstream location and greatest (186 mg/L as $CaCO_3$) at the upstream location. Total hardness was between 196 and 300 mg/L as $CaCO_3$ for all samples with a mean of 244 mg/L as $CaCO_3$.

Ammonia nitrogen concentrations were 0.1 mg/L-N for all samples. Nitrite nitrogen concentrations were between 0.01 and 0.11 mg/L-N with a mean of 0.07 mg/L-N. The nitrate concentration was lowest (0.2 mg/L-N) at the downstream location and greatest (3.1 mg/L-N) at the upstream location; there was no nitrate nitrogen measurement for the reservoir mid-depth location due to an analytical error. Total Kjeldahl nitrogen was between 1.31 and 2.63 mg/L-N for all samples with a mean of 1.99 mg/L-N. Total

nitrogen was lowest (1.5 mg/L-N) at downstream location and greatest (4.8 mg/L-N) at the upstream location. Reactive (ortho) phosphate was between 0.06 and 0.12 mg/L-P for all locations and total phosphorus was lowest at reservoir bottom location (0.17 mg/L-P) and greatest (0.35 mg/L-P) at the upstream location.

The silica concentration was between 6 mg/L and 13 mg/L as SiO_2 for all samples. Total organic carbon was lowest (3.1 mg/L) at the downstream location and greatest (6.3 mg/L) at the reservoir surface. Total suspended solids ranged from 11 mg/L for the downstream location to 25 mg/L for the upstream location. The biological oxygen demand was between 7.2 and 10.3 mg/L for all samples with a mean of 8.2 mg/L.

No other parameters were measured in November 2005.

Table 2: Results, Nov 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Iowa River Upstream (Green Castle Avenue)																
3-Nov-05	11.3	13.0	8.73	<1	0.8	16	238	186	300	0.1	0.03	3.1	1.69	4.8	0.12	0.35
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)																
3-Nov-05	15.3	8.8	8.44	<1	1.3	6	186	140	236	0.1	0.11	1.7	2.25	4.1	0.06	0.20
Coralville Reservoir - MID-DEPTH																
3-Nov-05	12.5	9.7	8.28	<1	2.0	4	190	150	240	0.1	0.09	na	2.63	na	0.07	0.34
Coralville Reservoir - BOTTOM																
3-Nov-05	15.4	8.6	8.30	<1	1.9	6	194	144	246	0.1	0.09	2.0	2.06	4.1	0.06	0.17
Iowa River Downstream - University Water Plant (Iowa City)																
3-Nov-05	13.6	10.1	8.42	<1	1.1	6	148	116	196	0.1	0.01	0.2	1.31	1.5	0.08	0.18
MIN	11.3	8.6	8.28	<1	0.8	4	148	116	196	0.1	0.01	0.2	1.31	1.5	0.06	0.17
MAX	15.4	13.0	8.73	<1	2.0	16	238	186	300	0.1	0.11	3.1	2.63	4.8	0.12	0.35
MEAN	13.6	10.0	8.41	na	1.4	8	191	147	244	0.1	0.07	1.7	1.99	3.6	0.08	0.25

Table 3: Results, Nov 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion Balance	Pigments				Indicator Org.	
					Cl	SO_4	Na	K		chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Iowa River Upstream (Green Castle Avenue)															
3-Nov-05	12	4.1	25	10.3	na	na	na	na	na	na	na	na	na	na	na
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)															
3-Nov-05	13	6.3	15	7.6	na	na	na	na	na	na	na	na	na	na	na
Coralville Reservoir - MID-DEPTH															
3-Nov-05	8	4.0	15	8.2	na	na	na	na	na	na	na	na	na	na	na
Coralville Reservoir - BOTTOM															
3-Nov-05	11	3.3	20	7.6	na	na	na	na	na	na	na	na	na	na	na
Iowa River Downstream - University Water Plant (Iowa City)															
3-Nov-05	6	3.1	11	7.2	na	na	na	na	na	na	na	na	na	na	na
MIN	6	3.1	11	7.2	na	na	na	na	na	na	na	na	na	na	na
MAX	13	6.3	25	10.3	na	na	na	na	na	na	na	na	na	na	na
MEAN	10	4.2	17	8.2	na	na	na	na	na	na	na	na	na	na	na

Table 4: Quality Assurance/Control, Nov 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Duplicate (O)																
3-Nov-05	na	na	na	na	na	16	230	182	300	0.08	0.02	2.6	1.69	4.3	0.08	0.29
% diff.	na	na	na	na	na	0.0	3.4	2.2	0.0	-14.3	29.0	16.1	0.0	10.6	33.3	17.1
Replicate (WP)																
3-Nov-05	na	na	na	na	na	6	150	110	194	0.1	0.01	0.2	1.50	1.7	0.1	0.09
% diff.	na	na	na	na	na	0.0	-1.4	5.2	1.0	-25.0	50.0	-17.6	-14.2	-14.2	-25.0	50.0
Standards (% Recovery)																
3-Nov-05	na	na	na	na	na	na	na	104	104	103	na	121.6	82	na	115	103
Spikes (% Recovery)																
3-Nov-05	na	na	na	na	na	na	108	na	100	111	na	na	na	na	92	99
Spike 2	na	na	na	na	na	na	104	na	113	106	na	na	na	na	93	107
Spike 3	na	na	na	na	na	na	106	na	103	101	na	na	na	na	101	111

Table 5: Quality Assurance/Control, Nov 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion Balance	Pigments				Indicator Org.	
					Cl	SO_4	Na	K		chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Duplicate (O)															
3-Nov-05	10.91	3.2	22	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	6.0	22.0	12.0	na	na	na	na	na	na	na	na	na	na	na	na
Replicate (WP)															
3-Nov-05	5	3.0	<10	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	22.3	3.2	na	na	na	na	na	na	na	na	na	na	na	na	na
Standards (% Recovery)															
3-Nov-05	114	104	na	na	na	na	na	na	na	na	na	na	na	na	na
Spikes (% Recovery)															
3-Nov-05	153	105	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	197	127	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	200	115	na	na	na	na	na	na	na	na	na	na	na	na	na

Appendix A: Supporting Information

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp.		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	3-Nov-05	11.3	13.0	8.73	<1	16	2238	186	300	21.0	69.8	Clear	0
Res-Surface	3-Nov-05	15.3	8.8	8.44	<1	6	186	140	236	21.0	69.8	Clear	0
Res-Mid	3-Nov-05	12.5	9.7	8.28	<1	4	190	150	240	21.0	69.8	Clear	0
Res-Bottom	3-Nov-05	15.4	8.6	8.30	<1	6	194	144	246	21.0	69.8	Clear	0
Downstream	3-Nov-05	13.6	10.1	8.42	<1	6	148	116	196	21.0	69.8	Clear	0

Comments:

Department of Civil and Environmental Engineering

IIHR – Hydroscience & Engineering

Coralville Reservoir Water Quality Project

Monthly Report, December 2005

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General Conditions

Samples were collected on Dec 9th at all river and reservoir locations. The general conditions and hydrologic parameters for each sampling event are highlighted in Table 1. The stream flow data is taken from the USGS website and is considered provisional.

Table 1: General conditions and hydrologic parameters for each sampling event.

Date	Air Temp. Noon		Sky	Previous Day Precipitation
	°C	°F		inches
9-Dec-05	-13.9	7.0	Clear	0

Date	Inflow, USGS05453100			Outflow, USGS05453520			Pool Level
	max	min	mean	max	min	mean	
	cfs	cfs	cfs	cfs	cfs	cfs	ft msl
9-Dec-05	528	455	492	908	881	896	684.17

Water Quality Observations

The physical, chemical and biological water quality results are shown in Table 2 and Table 3 for the reservoir and river locations. Quality assurance and quality control data are shown in Table 4 and Table 5. The field report(s) for the month are included in Appendix A. Dangerous ice conditions prevented sample collection at the reservoir mid-depth and bottom locations.

The water temperature was between 2.2 and 3.5°C at all locations with a mean of 2.6°C. The dissolved oxygen concentration was lowest at the upstream location (14.2 mg/L) and greatest at the reservoir surface (17.0 mg/L). The pH was between 7.78 and 8.36 with a mean of 8.06. The titrated carbon dioxide concentrations were less than the detection limit (<1 mg/L) for the reservoir surface and downstream locations and 7.5 mg/L at the upstream location. Phenolphthalein alkalinity was below detection level (<1 mg/L as $CaCO_3$) for the upstream location; values of 6 and 8 mg/L as $CaCO_3$ were measured at the reservoir surface and downstream locations respectively. Total alkalinity was between 176 and 272 mg/L as $CaCO_3$ for all samples with a mean of 211 mg/L as $CaCO_3$. Calcium hardness was lowest (122 mg/L as $CaCO_3$) at the reservoir surface and greatest (220 mg/L as $CaCO_3$) at the upstream location. Total hardness was between 228 and 340 mg/L as $CaCO_3$ for all samples with a mean of 266 mg/L as $CaCO_3$.

Ammonia nitrogen concentrations ranged from 0.2 to 0.3 mg/L-N for all samples with a mean of 0.2 mg/L-N. Nitrite nitrogen concentrations were less than 0.03 mg/L-N for all samples collected. The nitrate concentration was lowest (0.6 mg/L-N) at the downstream location and greatest (4.0 mg/L-N) at the upstream location. Total Kjeldahl nitrogen was

between 2.06 and 3.00 mg/L-N for all samples with a mean of 2.56 mg/L-N. Total nitrogen was lowest (2.9 mg/L-N) at reservoir surface and greatest (7.0 mg/L-N) at the upstream location. Reactive (ortho) phosphate was between 0.03 and 0.30 mg/L-P for all locations and total phosphorus was lowest at the reservoir surface (0.56 mg/L-P) and greatest (2.07 mg/L-P) at the upstream location.

The silica concentration was below detection limit (<1 mg/L as SiO_2) for the reservoir surface and 2 and 4 mg/L as SiO_2 for the downstream and upstream locations respectively. Total organic carbon was lowest (6.8 mg/L) at the upstream location and greatest (8.2 mg/L) at reservoir surface. Total suspended solids ranged from 11 mg/L for the reservoir surface to 16 mg/L for the upstream location. The biological oxygen demand was between 10.8 and 13.8 mg/L for all samples with a mean of 12.3 mg/L.

No other parameters were measured in December 2005.

Table 2: Results, Dec 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Iowa River Upstream (Green Castle Avenue)																
9-Dec-05	2.2	14.2	7.78	7.5	9.0	<1	272	220	340	0.2	0.01	4.0	3.00	7.0	0.30	2.07
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)																
9-Dec-05	3.5	17.0	8.28	<1	1.8	6	176	122	228	0.2	0.01	0.8	2.06	2.9	0.03	0.56
Coralville Reservoir - MID-DEPTH																
9-Dec-05	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Coralville Reservoir - BOTTOM																
9-Dec-05	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Iowa River Downstream - University Water Plant (Iowa City)																
9-Dec-05	2.2	15.4	8.36	<1	1.6	8	184	126	230	0.3	0.03	0.6	2.63	3.3	0.08	0.65
MIN	2.2	14.2	7.78	<1	1.6	<1	176	122	228	0.2	0.01	0.6	2.06	2.9	0.03	0.56
MAX	3.5	17.0	8.36	7.5	9.0	8	272	220	340	0.3	0.03	4.0	3.00	7.0	0.30	2.07
MEAN	2.6	15.5	8.06	na	4.1	na	211	156	266	0.2	0.02	1.8	2.56	4.4	0.14	1.09

Table 3: Results, Dec 2005.

Coralville Reservoir Water Quality

Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2 mg/L	TOC mg/L	TSS mg/L	BOD_5 mg/L	Additional Anions Cl mg/L	Additional Anions SO_4 mg/L	Additional Cations Na mg/L	Additional Cations K mg/L	Ion Balance % diff.	Pigments chl *a* mg/m^3	Pigments pheo *a* mg/m^3	Pigments chl *b* mg/m^3	Pigments chl *c* mg/m^3	Indicator Org. Fecal Org. / 100 mL	Indicator Org. *E. coli* Org. / 100 mL
Iowa River Upstream (Green Castle Avenue)															
9-Dec-05	4	6.8	16	10.8	na	na	16.0	3.5	na	na	na	na	na	na	na
Coralville Reservoir - SURFACE (Downstream from Lake McBride at Mehaffey Bridge)															
9-Dec-05	<1	8.2	11	13.8	na	na	13.0	2.8	na	na	na	na	na	na	na
Coralville Reservoir - MID-DEPTH															
9-Dec-05	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Coralville Reservoir - BOTTOM															
9-Dec-05	na	na	na	na	na	na	na	na	na	na	na	na	na	na	na
Iowa River Downstream - University Water Plant (Iowa City)															
9-Dec-05	2	7.9	16	12.4	na	na	12.0	3.1	na	na	na	na	na	na	na
MIN	<1	6.8	11	10.8	na	na	12.0	2.8	na	na	na	na	na	na	na
MAX	4	8.2	16	13.8	na	na	16.0	3.5	na	na	na	na	na	na	na
MEAN	na	7.6	14	12.3	na	na	13.7	3.1	na	na	na	na	na	na	na

Table 4: Quality Assurance/Control, Dec 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 1 of 2

Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide		Alkalinity		Hardness		Nitrogen as N					Phosphorus as P	
				Titr. mg/L	Calc. mg/L	Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	NH_3-N mg/L	NO_2-N mg/L	NO_3-N mg/L	TKN mg/L	Total mg/L	Ortho-P mg/L	Total-P mg/L
Duplicate (O)																
9-Dec-05	na	na	na	na	na	na	268	218	342	0.16	0.01	4.7	2.81	7.5	0.38	0.82
% diff.	na	na	na	na	na	na	1.5	0.9	-0.6	30.4	7.7	-17.5	6.2	-7.3	-26.7	60.4
Replicate (WP)																
9-Dec-05	na	na	na	na	na	na	176	124	232	0.17	0.02	0.9	2.44	3.4	0.02	0.81
% diff.	na	na	na	na	na	na	4.3	1.6	-0.9	32.0	12.0	-50.0	7.1	-3.4	75.0	-24.6
Standards (% Recovery)																
9-Dec-05	na	na	na	na	na	na	104	104	102	102	na	111.2	82.6	na	118	109
Spikes (% Recovery)																
9-Dec-05	na	na	na	na	na	na	112	na	100	110	na	na	na	na	106	112
Spike 2	na	na	na	na	na	na	98	na	75	116	na	na	na	na	100	67
Spike 3	na	na	na	na	na	na	95	na	40	114	na	na	na	na	94	85

Table 5: Quality Assurance/Control, Dec 2005.

Coralville Reservoir Water Quality

QA/QC: Physical, Chemical and Biological Analysis - Table 2 of 2

Date	Silica as SiO_2	TOC	TSS	BOD_5	Additional Anions		Additional Cations		Ion Balance	Pigments				Indicator Org.	
					Cl	SO_4	Na	K		chl *a*	pheo *a*	chl *b*	chl *c*	Fecal	*E. coli*
	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% diff.	mg/m^3	mg/m^3	mg/m^3	mg/m^3	Org. / 100 mL	
Duplicate (O)															
9-Dec-05	4.67	6.4	10	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	-9.6	5.9	37.5	na	na	na	na	na	na	na	na	na	na	na	na
Replicate (WP)															
9-Dec-05	2	5.8	11	na	na	na	na	na	na	na	na	na	na	na	na
% diff.	-49.7	26.6	31.3	na	na	na	na	na	na	na	na	na	na	na	na
Standards (% Recovery)															
9-Dec-05	96	96	na	na	na	na	na	na	na	na	na	na	na	na	na
Spikes (% Recovery)															
9-Dec-05	79	121	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 2	102	114	na	na	na	na	na	na	na	na	na	na	na	na	na
Spike 3	96	97	na	na	na	na	na	na	na	na	na	na	na	na	na

Appendix A: Supporting Information

Coralville Reservoir Water Quality - Field Report

Physical and Chemical Analysis

Location	Date	Water Temp. °C	Diss. Oxygen mg/L	pH	Carbon Dioxide mg/L	Alkalinity		Hardness		Air Temp.		Sky	Previous Day Precipitation inches
						Phenolth. mg/L	Total mg/L	Calcium mg/L	Total mg/L	°C	°F		
Upstream	9-Dec-05	2.2	14.2	7.87	7.5	<1	272	220	340	-13.9	7.0	Clear	0
Res-Surface	9-Dec-05	3.5	16.9	8.71	<1	6	176	122	228	-13.9	7.0	Clear	0
Res-Mid													
Res-Bottom													
Downstream	9-Dec-05	2.2	15.4	8.48	<1	8	184	126	230	-13.9	7.0	Clear	0

Comments:

Ice cover was found at both the reservoir and upstream locations. Due to dangerous ice cover at the reservoir location sampling was terminated early. Neither the reservoir mid-depth or reservoir bottom location were sampled.

Beach Water Results – May 16th.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
May 16th, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	590	350	510
E. coli	590	300	340

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: May 16th, 2005							
Location	Transpe rency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	7.5	0	0	0/0/0	2	SE	0.0
Sugar Bottom	13.0	0	0	0/0/0	2	3.5	
West Overlook	13.5	0	0	0/0/0	0		

Comments:

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – May 18th.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
May 18th, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	170	160	230
E. coli	130	150	130

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: May 18th, 2005

Location	Transparency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	10.0	0	0	0/0/0	5	SSE	0.0
Sugar Bottom	14.0	0	0	1/0/0	2	8.1	
West Overlook	17.0	0	0	0/0/5	2		

Comments:

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – May 23rd.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
May 23rd, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	130	91	50
E. coli	130	91	50

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: May 23rd, 2005

Location	Transparency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	15.0	0	0	0/5/0	2	NW	0.07
Sugar Bottom	21.0	0	0	12/0/0	0	9.2	
West Overlook	23.0	0	0	0/0/0	2		

Comments:

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – May 31st.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
May 31st, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	30	10	10
E. coli	30	10	10

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: May 31st, 2005							
Location	Transpe rency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	7.1	0	1	0/0/0	10	SE	0.04
Sugar Bottom	13.1	0	5	0/0/0	2	8.1	
West Overlook	21.2	0	0	0/0/0	5		

Comments:
Pontoon boat near SW side of swimming area at Sandy Beach
Brown froth on the water by shoreline at Sugar Bottom

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – Jun 6th.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
June 6th, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	70	100	20
E. coli	70	90	20

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: June 6th, 2005							
Location	Transparency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	6.4	0	5	0/0/0	4	SSW	1.32
Sugar Bottom	12.6	0	0	0/0/0	2	6.9	
West Overlook	30.8	0	0	2/0/0	0		

Comments:

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – Jun 13th.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
June 13th, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	30	60	< 10
E. coli	30	50	< 10

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: June 13th, 2005

Location	Transparency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	10.6	0	0	0/0/2	2	SSW	0.01
Sugar Bottom	22.4	0	0	0/0/0	4	6.9	
West Overlook	47.0	0	0	5/0/3	0		

Comments:
Some trash on the beach on Sandy Beach and West Overlook

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – Jun 20th.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
June 20th, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	30	<10	<10
E. coli	30	<10	<10

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: June 20th, 2005							
Location	Transpe rency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	37.4	0	0	0/0/0	0	SW	0.0
Sugar Bottom	20.0	1	0	0/0/0	2	4.6	
West Overlook	10.0	0	0	7/0/0	0		

Comments:

[1]Estimated
[2]As reported by weatherunderground.com at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for the cumulative 48 hours preceding sampling.

Beach Water Results – Jul 27th.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
June 27th, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	120	40	<10
E. coli	73	30	<10

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: June 27th, 2005							
Location	Transpe rency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	9.2	0	0	0/0/0	8	SSE	0.0
Sugar Bottom	19.5	0	0	0/0/0	3	6.9	
West Overlook	20.4	0	1	0/0/0	2		

Comments:
Dead, somewhat decomposed fish found on Sandy Beach near one of near-shore sampling points.

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – Jul 5th.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
July 5th, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	140	100	91
E. coli	91	100	82

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: July 5th, 2005							
Location	Transpe rency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	10.5	0	1	0/0/0	4	CALM	0.65
Sugar Bottom	10.9	0	1	0/0/0	1	0.0	
West Overlook	12.8	3	3	0/0/0	2		

Comments:

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – Jul 11th.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
July 11th, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	45	140	30
E. coli	45	130	30

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: July 11th, 2005							
Location	Transpe rency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	8.7	0	0	0/0/0	1	SE	0.0
Sugar Bottom	20.3	0	0	0/0/0	0	5.8	
West Overlook	25.6	0	0	4/0/1	0		
Comments:							

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – Jul 18th.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
July 18th, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	10	<10	10
E. coli	10	<10	10

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: July 18th, 2005							
Location	Transparency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	11.8	0	0	0/0/0	3	SSW	0.0
Sugar Bottom	21.9	0	0	0/0/0	1	15.0	
West Overlook	41.3	0	0	4/0/0	2		
Comments:							

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – Jul 25th.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
July 25th, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	10	<10	<10
E. coli	<10	<10	<10

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: July 25th, 2005							
Location	Transpe rency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	15.9	0	0	0/0/0	0	SE	0.0
Sugar Bottom	26.8	0	0	0/0/0	0	3.5	
West Overlook	42.0	0	0	0/0/0	0		

Comments:

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – Aug 1st.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
August 1st, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	20	20	10
E. coli	<10	20	10

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: August 1st, 2005							
Location	Transpe rency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	21.8	0	2	0/0/0	5	S	0.0
Sugar Bottom	18.5	0	0	0/0/0	4	5.8	
West Overlook	23.1	0	0	0/2/0	2		

Comments:

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – Aug 8th.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
August 8th, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	<10	<10	<10
E. coli	<10	<10	<10

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: August 8th, 2005							
Location	Transpe rency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	21.6	0	3	0/0/0	0	Variable 3.5	0.0
Sugar Bottom	30.2	0	0	0/2/0	1		
West Overlook	45.1	2	0	0/0/2	0		

Comments: Brown froth on shoreline at all three beaches.

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – Aug 15th.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
August 15th, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	55	<10	40
E. coli	36	<10	40

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: August 15th, 2005							
Location	Transpe rency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	9.6	2	3	0/0/0	2	NE	0.02
Sugar Bottom	20.9	0	0	0/0/0	0	3.5	
West Overlook	31.4	3	3	0/0/0	1		

Comments: Brown froth on shoreline of Sandy Beach.

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – Aug 22nd.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
August 22nd, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	40	<10	<10
E. coli	40	<10	<10

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: August 22nd, 2005							
Location	Transpe rency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	11.0	0	0	0/0/0	3	ENE	0.12
Sugar Bottom	21.2	0	0	0/3/0	3	5.8	
West Overlook	34.7	0	1	0/0/0	3		

Comments:

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – Aug 29th.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
August 29th, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	10	40	10
E. coli	10	40	10

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: August 29th, 2005							
Location	Transpe rency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	--	0	0	0/0/0	0	CALM	0.01
Sugar Bottom	23.0	0	2	0/0/0	2	0.0	
West Overlook	34.5	1	0	0/0/0	0		

Comments:
Sampler failed to remember to record Sandy Beach transparency level.

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – Sep 6th.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
September 6th, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	80	30	20
E. coli	50	20	20

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: September 6th, 2005							
Location	Transpe rency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	12.0	0	0	0/0/0	2	SSE	0.60
Sugar Bottom	21.2	0	0	1/0/0	3	3.5	
West Overlook	34.0	0	2	0/0/0	3		

Comments:

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – Sep 12th.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
September 12th, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	<10	20	<10
E. coli	<10	20	<10

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: September 12th, 2005							
Location	Transpe rency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	15.9	0	0	0/0/0	3	S	0.0
Sugar Bottom	26.5	0	0	0/0/0	3	4.6	
West Overlook	49.8	0	1	0/1/0	1		

Comments:

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.

Beach Water Results – Sep 20th.

Beach water indicator organism results for Sandy Beach, West Overlook Beach and Sugar Bottom Beach are shown in Table 1:

Table 1: Indicator organism concentrations in beach waters of the Coralville Reservoir.

Date and Parameter	Result (cfu per 100 mL)		
September 20th, 2005	Sandy Beach	Sugar Bottom Beach	West Overlook Beach
Fecal Coliform	<10	<10	<10
E. coli	<10	<10	<10

The analysis was performed by The University of Iowa Hygienic Laboratory using methods SM18 9222D and EPA 1603. The detection limit was 10 cfu/100 mL.

The overall sampling conditions and other notes are shown in Table 2.

Date: September 20th, 2005							
Location	Transpe rency (cm)	# of People In Water	# of People On Shore	# of Water Fowl/Shore Birds/Gulls	Wave Height[1] (cm)	Wind[2] (mph)	Precipitation[3] (48 hours prior to sampling, inches)
Sandy Beach	12.7	0	0	0/0/0	0	WNW	0.07
Sugar Bottom	22.3	0	0	0/0/0	0	3.5	
West Overlook	27.1	0	0	0/0/0	1		

Comments:

[1]Estimated
[2]As reported by weatherunderground.com for North Liberty, IA at approximately 9:00 a.m. on the day of sampling.
[3]As reported by weatherunderground.com for North Liberty, IA for the cumulative 48 hours preceding sampling.