SECOND ANNUAL REPORT ON OPERATIONS OF RUSSELL COUNTY REGIONAL TREATMENT PLANT AND ASSOCIATED ENVIRONMENTAL MONITORING

Natural Resources and
Environmental Protection Cabinet
Division of Water

September 1995

Second Annual Report on Operations of Russell County Regional Wastewater Treatment Plant and Associated Environmental Monitoring

Kentucky Department for Environmental Protection
Division of Water
Water Quality Branch

This report has been approved for release:

Jack A. Wilson, Director
Division of Water

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Date

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EXECUTIVE SUMMARY

At the conclusion of the Russell County Regional Wastewater Treatment Plant's second year of discharging to the main body of Lake Cumberland, the plant had met all regulatory requirements, and no detrimental impacts to the environment had been detected. Intensive water quality, sediment quality, and biological monitoring were conducted by both Jamestown and the Division of Water. Operations at the treatment plant were rated satisfactory by the Division in several compliance inspections, and discharge monitoring data submitted by Jamestown to the Division showed that permitted constituents, including copper, chloride, and whole effluent toxicity, were always less than permit limits. This is significant because of the large number of samples taken of the final effluent at the plant: Jamestown sampled daily for chloride, weekly for copper, quarterly (with two additional monthly samples) for whole effluent toxicity, and at least weekly for all other permitted constituents, and the Division conducted semiannual compliance sampling inspections.

Sampling of the thermally stratified lake by Jamestown and the Division in late summer and early fall of 1994 indicated low pollutant concentrations and that the effluent remains well below the surface. These plume surveys detected increased conductivity and chloride in a thin vertical layer at distances of almost 5000 feet from the diffuser, but chloride concentrations were less than 15 mg/l. Near-field samples were taken for the first time by means of divers from both the Division and Jamestown. Samples were collected directly out of the pipe and at the edge of the zone of initial dilution (7 feet) to compare field results to earlier modeling predictions from which several permit limits were derived. Chloride concentrations in the 7-foot samples were highly variable, ranging from 6 to 180 mg/l, probably because of the turbulent nature of the plume at close proximity to the discharge ports. Kentucky's acute aquatic life criterion for chloride, applicable at the edge of the zone of initial dilution, is 1200 mg/l. Chloride samples taken from the edge of the mixing zone (70 feet) ranged from 9 to 34 mg/l. This compares to upstream control station concentrations of 1 to 4 mg/l and a chronic aquatic life water quality criterion applicable at the edge of the mixing zone of 600 mg/l. Total recoverable copper concentrations never exceeded 0.006 mg/l at any of the water quality monitoring sites outside the zone of initial dilution or 0.007 mg/l at the edge of the zone of initial dilution. These levels compare to background concentrations that were very low (0.001 to 0.003 mg/l) or undetectable, a chronic aquatic life criterion of about 0.008 to 0.010 mg/l, and an acute criterion of about 0.011 to 0.014 mg/l (copper criteria are dependent on water hardness).

Samples collected during unstratified conditions of February 1995 did not detect any increase in chlorides outside the mixing zone. Concentrations within the mixing zone were also much lower than during stratified conditions. These results were not unexpected because the lack of density differences in the receiving water allows more complete mixing of the effluent.

Studies by the Division did not detect any appreciable differences in nutrient levels or phytoplankton biomass downstream of the diffuser compared to an upstream control station. Fish tissue and sediment samples did not indicate any significant differences between samples collected upstream and downstream of the diffuser. Zooplankton densities downstream of the diffuser did show significant reduction in the fall 1994 samples, but species richness was not affected. Further decreases of nutrients and biomass in the Lily Creek embayment, which previously received the effluent via Lily Creek, were also found in the 1994 growing season. Division biologists surveyed Lily Creek upstream of the lake in June 1995 to assess changes since the discharge was relocated to the lake. While quantitative results are not yet available, it was evident that a greater diversity of macroinvertebrates was present.

INTRODUCTION

The Russell County Regional Wastewater Treatment Plant (RCRWWTP), operated by the City of Jamestown, was issued a Kentucky Pollutant Discharge Elimination System (KPDES) permit in October 1989 by the Kentucky Department for Environmental Protection (DEP), Division of Water (Division). The permit contained limits for typical components of sanitary wastewater and several constituents found in the large contribution from Union Underwear (Table 1). The limits applied to a discharge from a submerged multiport diffuser in the main body of Lake Cumberland. Final permit limits were to have taken effect on June 1, 1992. This date was required by Section 304(l) of the Clean Water Act following the Division's decision to place Lily Creek on the list of streams not meeting a water quality standard for a priority pollutant (copper) because of a point source discharge (RCRWWTP). Until June 1, 1992, the plant was to continue discharging to Lily Creek about three miles above the lake, the same location at which it had discharged since 1981 (Figure 1).

The change in location of the discharge was necessary because water quality criteria for chloride, copper, and several other constituents became effective after Jamestown's previous permit was issued in 1982. The RCRWWTP could not meet the revised chronic aquatic life criteria for chloride, copper, or whole effluent toxicity because no dilution was available in Lily Creek during low-flow conditions. Because of the cost and technical difficulty of removing salt from the wastewater, the RCRWWTP applied for a permit to discharge into the main body of Lake Cumberland, taking advantage of the large volume of dilution water available.

The Lake Cumberland Trust, a coalition of environmental organizations, appealed the permit, and the issue was placed before a Natural Resources and Environmental Protection Cabinet hearing officer in 1991. After lengthy testimony, the hearing officer recommended to the cabinet, Secretary that the copper limit be reevaluated by the Division. The hearing officer's final opinion also stated that no significant testimony was presented indicating that the chloride allowed in the final permit would in any way degrade the water quality of the lake. An Agreed Order was signed in January 1992 that placed the issue in the hands of a Technical Advisory Committee (TAC) made up of two members of the Lake Cumberland Trust, one member each from the Town of Jamestown and Union Underwear, and the Assistant Director of the Division. After a year of extensive work, the TAC concluded that the final permit as initially issued by the Division was the proper course of action. This decision was based on evaluations of alternative treatment technologies, engineering reliability, costs, pollution prevention measures, and environmental considerations. It was noted that progress had been made toward improving effluent quality, especially copper and color. Other recommendations were that the Division prepare at least three annual reports and that Union Underwear continue waste minimization efforts. The TAC report was accepted by the Division, and the Secretary, issued an order in February 1993 that the permit become effective with conditions as recommended by the TAC. Because of the time involved for the assessment by the TAC, the effective date of the final permit was delayed one year until June 1, 1993.

Discharge through the pipeline began on April 2, 1993, and the system operated without problems until a break in the pipeline occurred on October 22, 1993. Evidence indicated that air was drawn into the pipeline, causing the pipe to flex and eventually break. The submerged portion of the pipeline was refitted with additional weights and an air trap and 8-inch vent line to ensure that any air in the pipe would be vacated. Treated wastewater was discharged at the former discharge location on the free-flowing reaches of Lily Creek for nearly four months. Union Underwear reduced dyeing operations during this time period to minimize impact to Lily Creek. The plant resumed discharge to the main lake through the diffuser on February 15, 1994, and it has operated without problems since that time.

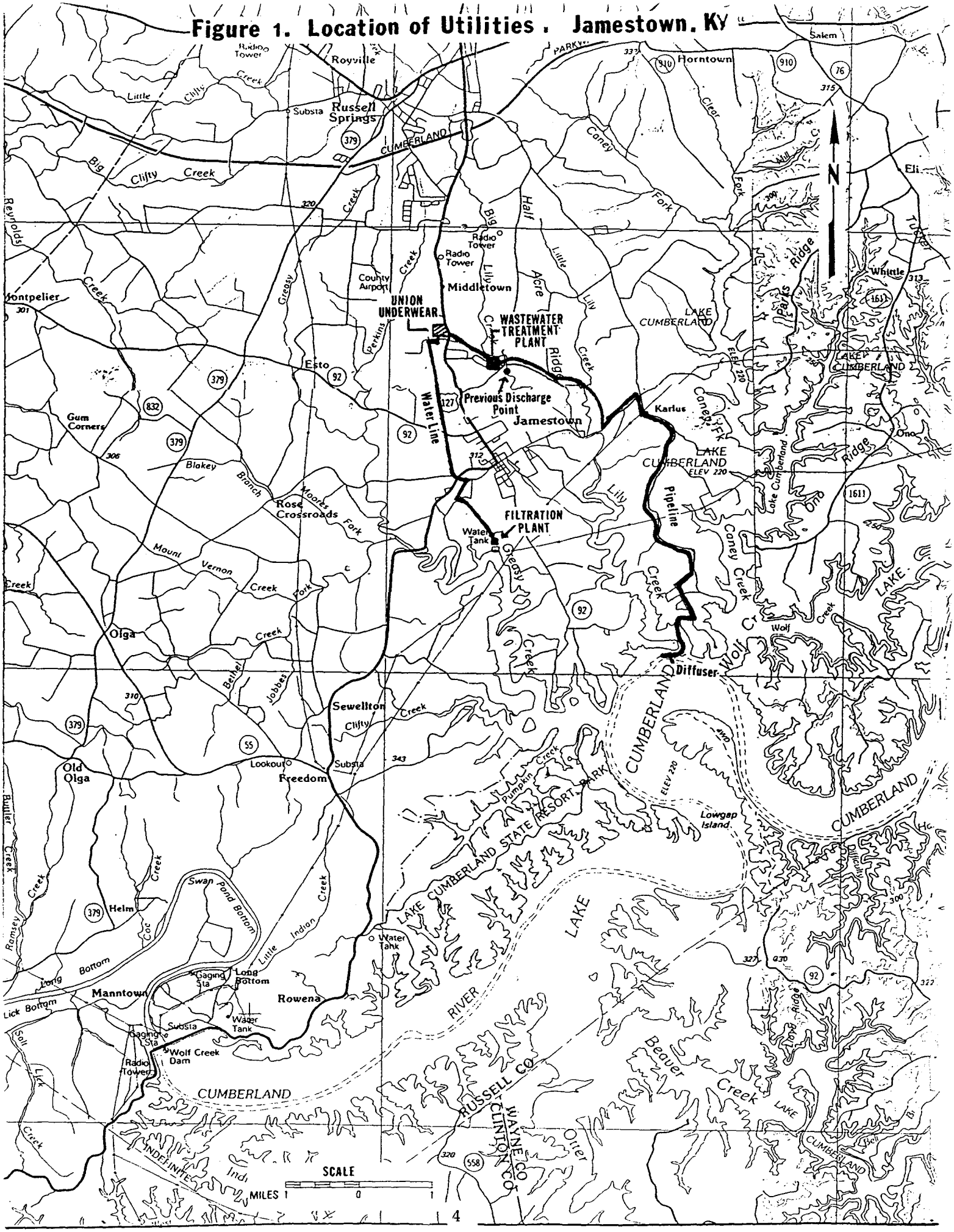
Environmental monitoring and plant operations from March 1993 through May 1994 were presented in the first annual report (Kentucky Division of Water, 1994a). The present report covers the second year of operation following the plant upgrade and relocation of the discharge to the main lake.

Table 1. Final Permit Conditions

Constituent	Concentration [a] Monthly Average	Weekly Average	Sampling Frequency
CBOD - 5[b]	30	45	Weekly
Ammonia - nitrogen	4[c]/11[d]	6[c]/16.5[d]	Weekly
Dissolved oxygen	Not less than 7	Not less than 7	Weekly
Total Suspended Solids	30	45	Weekly
Color (ADMI Units)	100	100[e]	4/Day
pH (Standard Units)	6-9	6-9	Daily
Total Residual Chlorine	0.010	0.019[e]	4/Day
Fecal Coliform bacteria (Colonies/100 ml)	200	400	Weekly
Chloride	2531	5062[e]	Daily
Copper	0.176	0.176[e]	Weekly
Toxicity (Acute Toxicity Units)		4.8	Monthly[f]

[a] mg/l unless noted otherwise
[b] Five-day carbonaceous biochemical oxygen demand
[c] May - October
[d] November - April
[e] Daily maximum
[f] First year; quarterly in subsequent years

Figure 1. Location of Utilities . Jamestown, Ky



RUSSELL COUNTY REGIONAL WASTEWATER TREATMENT PLANT

Description of Treatment Facilities and Pipeline

The RCRWWTP upgrade and expansion was completed in the summer of 1992, well before the effective date of the final permit and relocation of the discharge to the main lake. A decolorization/dechlorination basin (where chlorine is added to remove color and sulfur dioxide is then added to remove excess chlorine), a new chemical feed building, additional aeration equipment in the biological treatment (carrousel) units, floating aerators to increase dissolved oxygen in the effluent, an effluent pump station, two belt filter presses for sludge dewatering, a backup power generator, and a new operations and laboratory building were constructed (Figure 2). The new basins allowed one of the four existing biological treatment units that had been used for chlorination and decolorization to be returned to biological treatment. The effect of this construction was to increase the hydraulic capacity from 2.5 to 3.6 million gallons per day (mgd) and the retention time from 30 to 38 hours when all basins are in use.

The 24-inch pipeline was completed in the spring of 1991 but was not put into operation for two years. It follows road right-of-ways for much of its length before entering the lake near the mouth of the Lily Creek embayment (Figure 1). The pipeline then crosses the embayment and terminates in a 300-foot multiport diffuser in the main lake. The diffuser lies on the steeply sloping lake bottom and angles out slightly into the lake at an elevation of 650 feet above mean sea level (MSL) on the upstream end and 620 feet MSL on the downstream end. At normal pool elevation of 723 feet MSL, the diffuser is 73 to 103 feet deep and lies less than 100 feet horizontally from the shoreline. During the late summer and fall, the depth is usually reduced by 30 to 40 feet as the lake is gradually drawn to generate hydro-electricity. Sixteen two-inch ports spaced at 20-foot intervals distribute the wastewater in both horizontal and vertical dimensions. Following repair of the pipeline in the winter of 1994, an 8-inch vent line was added where the pipeline enters the lake to release any accumulated air (Figure 3). The underwater position of the pipeline was inspected by divers late in 1994 and found to be in excellent condition (Appendix A).

Influent from Industrial Sources

Jamestown is required to have a pretreatment program approved by the Division because industrial wastewaters are discharged into the sanitary sewer system. Union Underwear, a subsidiary of Fruit of the Loom, has a textile facility in Russell County with manufacturing, bleaching, dyeing, and sewing operations. The facility employs more than 3000 persons and supplies other Fruit of the Loom plants in the state with colored fabric. The plant has been in operation since 1981, when the RCRWWTP was constructed at its present location to handle the large volume of wastewater from Union Underwear. As in similar facilities worldwide, the dyeing operations use large amounts of salt (sodium chloride) to fix dyes in fabric. The salt then becomes a component of the wastewater, from which it is difficult and costly to remove. Copper, a component of several of the azo-dyes, is also found in the wastewater in moderately high amounts.

Figure 2. Schematic of Wastewater Flow (1993)
Russell County Regional Wastewater Treatment Plant
Jamestown, Kentucky
(Prepared by Kenvirons, Inc.)

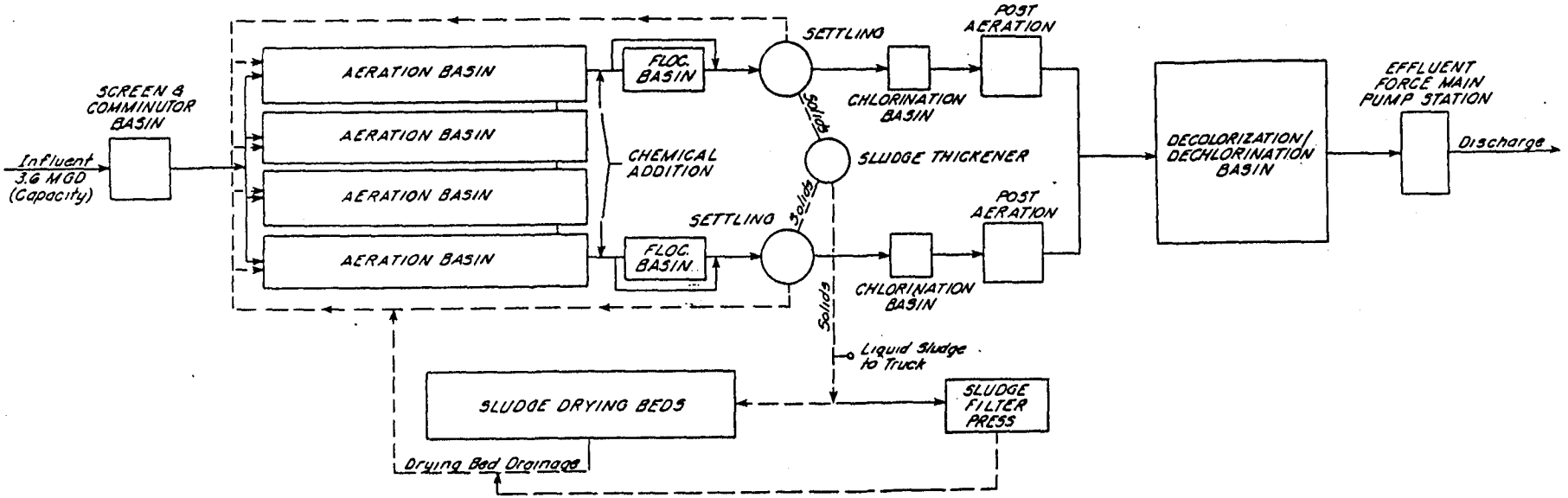
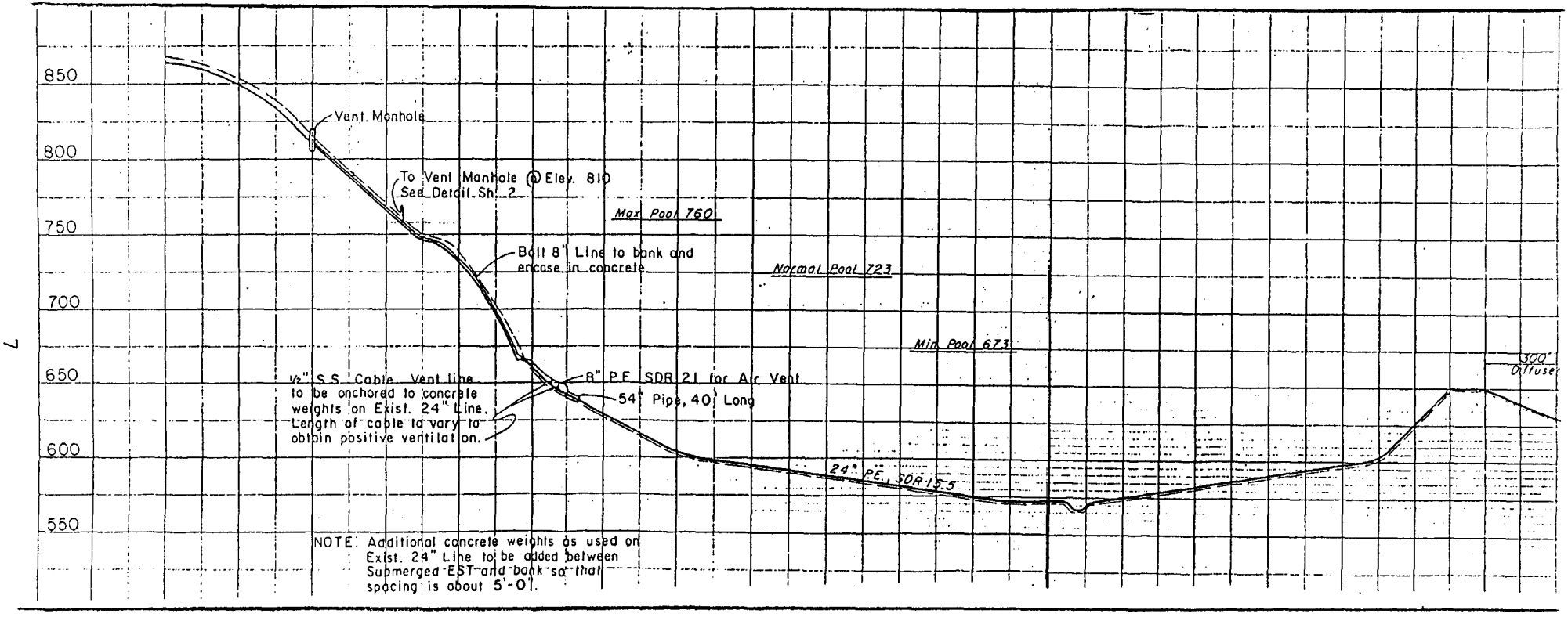


Figure 3. Jamestown Effluent Force Main Modifications
Air Vent Manhole and Pipeline Prepared by:
Kenvirons, Inc.



Expansion of the Union Underwear facility took place in 1987-88. Influent to the RCRWWTP increased from 1.5 to 2.0 mgd. Average salt use was expected to increase to about 35 tons per day, but the installation of several high-pressure dye pads and careful selection and use of dyes that require lower amounts of salt has currently lowered average salt use to less than 20 tons per day. The first annual report (Kentucky Division of Water, 1994a) noted that average salt use for the period from April 1993 to May 1994 was 20 to 25 tons per day, so less salt was used and discharged for the period covered by this report. Union Underwear continues to explore alternative dyes and dyeing methods to further reduce the use of salt in the dyeing process and to maximize the use of the latest generation of reduced metal dyes. Also, the addition of a cationic polymer to Union Underwear's wastewater beginning early in 1993 resulted in much lower levels of total copper and suspended solids passed on to the RCRWWTP.

Monitoring and Inspections

The RCRWWTP is required to conduct regular sampling of constituents listed in Table 1. Results are submitted monthly to the Division in discharge monitoring reports (DMRs) and entered into the permit compliance system (PCS) database. Semiannual compliance sampling inspections (CSIs) and periodic compliance evaluation inspections (CEIs) are also performed by Division regional office personnel. Biomonitoring results are obtained by personnel of the Division's Bioassay Section in conjunction with the CSIs.

Pretreatment audits or inspections are performed by Division personnel on an annual basis to determine compliance with the program. Pretreatment reports are also submitted semiannually to the Division's Pretreatment Section by the permittee. Results of extensive annual influent and effluent sample analyses are reported by the permittee in one of the semiannual reports.

Results. The DMR data from May 1994 through April 1995 are shown in Table 2. In no instances were permit limits exceeded. Monthly average concentrations ranged from 1173 to 1612 mg/l for chloride and 57 to 89 ADMI units for color. Daily maximum copper concentrations ranged from 0.029 to 0.063 mg/l. Whole effluent toxicity was always less than 4.8 acute toxicity units, and total residual chlorine was always less than 0.010 mg/l. As was noted above, both chloride and copper concentrations were generally lower for the twelve-month period covered by this report compared to the previous twelve-month period.

Inspections by Division personnel have found the plant to be operating satisfactorily. CSIs were performed in November 1994 and May 1995 (Appendix B). Biomonitoring results obtained in conjunction with the latter November 1994 CSI showed toxicity well below the permit limit (Appendix B). Less detailed CEIs conducted in September 1994 and February and March 1995 also gave satisfactory ratings.

A pretreatment audit was performed in July 1993 which indicated that Jamestown was implementing its pretreatment program efficiently and effectively. At the time of the audit, it was noted that Union Underwear had begun adding polymer to its process discharge in an effort

Table 2. Discharge Monitoring Report Data
May 1994 - April 1995[a]

	Flow (mgd)	Total Residual Chlorine (mg/l)		Chloride (mg/l)		Ammonia-N (mg/l)		Copper (mg/l)		CBOD-5 (mg/l)		Fecal Coliform Bacteria (#/100 ml)		Color (ADMI Units)	Toxicity (TU_a)	Dissolved Oxygen (mg/l)	pH (Std Units)	
Date	Mo. Ave.	Mo. Ave.	Daily Max.	Mo. Ave.	Daily Max.	Mo. Ave.	Wk. Ave.	Mo. Ave.	Daily Max.	Mo. Ave.	Wk. Ave.	Mo. Ave.	Wk. Ave.	Daily Max.	Max.	Min.	Min.	Max.
5/94	2.19	<.010	<.010	1362	1650	0.025	0.1	0.034	0.042	9	11	2	7	88	<4.8	7.2	6.5	7.7
6/94	2.24	<.010	<.010	1612	2150	0.02	0.1	0.048	0.055	6	6	15	33	80	<4.8	7.0	6.2	8.3
7/94	1.78	<.010	<.010	1321	2100	0.1	0.3	0.050	0.063	7	8	94	252	75	<4.8	7.1	6.0	8.2
8/94	2.22	<.010	<.010	1212	1550	0	0	0.043	0.052	8	11	2	6	57		7.1	6.8	8.4
9/94	1.84	<.010	<.010	1278	1500	0	0	0.044	0.061	5	6	16	34	80	<4.8	7.3	6.4	8.1
10/94	1.62	<.010	<.010	1518	1800	0	0	0.034	0.036	4	5	0	1	67		7.6	6.4	7.8
11/94	1.75	<.010	<.010	1475	1600	0	0.1	0.033	0.035	6	11	12	31	70		7.3	6.8	8.0
12/94	1.57	<.010	<.010	1308	1600	0	0	0.024	0.029	7	12	4	8	67	<4.8	7.1	6.0	7.6
1/95	1.84	<.010	<.010	1173	1750	0	0	0.027	0.036	8	11	1	2	66		8.1	6.3	7.2
2/95	1.87	<.010	<.010	1280	1650	0	0	0.030	0.033	8	14	1	2	88		7.7	6.1	7.1
3/95	2.08	<.010	<.010	1376	1700	0	11	0.025	0.029	6	7	0	0	79	<4.8	7.2	6.1	7.7
4/95	1.64	<.010	<.010	1457	1950	0	0.3	0.027	0.033	7	8	24	77	89		7.1	6.2	8.0

[a] Data submitted by Town of Jamestown

to reduce the levels of copper being discharged to the RCRWWTP. The positive effect of this polymer can be seen by comparing the copper results from sampling conducted before and after polymer addition began. Influent and effluent samples taken on December 31, 1991, before polymer addition had begun, showed copper concentrations of 0.28 and 0.0466 mg/l, respectively. Influent and effluent samples taken on June 30, 1993, after polymer addition had begun, showed copper concentrations of 0.22 and 0.028 mg/l, respectively. The decrease in copper concentration in the final effluent demonstrates that the polymer is having a noticeable effect on copper removal after reaching the RCRWWTP. During the past year, Jamestown has continued its practice of adding the polymer to remove copper and copper has continued to show a gradual decline in the final effluent of the RCRWWTP. A Pretreatment Compliance Inspection conducted in November 1994 (Appendix B) and pretreatment semi-annual reports submitted to the Division in September 1994 and March 1995 have shown that Jamestown has continued to meet the requirements of all federal and state pretreatment requirements over the past year. The city performs annual inspections and semi-annual compliance monitoring of Union Underwear. The industrial user permit requires Union Underwear to perform daily self-monitoring of its effluent. Union Underwear has maintained consistent compliance with all pretreatment program requirements. This was confirmed during the most recent Pretreatment Compliance Inspection and semi-annual pretreatment reports. Currently, Jamestown and the Pretreatment Section of the Division are involved in a review of the city's local discharge limitations. This is a routine re-evaluation which must be performed at or near the time of KPDES permit reissuance. Some of the local discharge limitations may be revised as a result of this re-evaluation.

Garment Finishers, Jamestown's other industrial contributor, has also been in compliance with all pretreatment requirements. The 0.03 mgd of wastewater generated by the jean washing facility has had few problems with solids and color typical of this type of facility because of the recent innovation of using enzyme solution instead of stone washing to fade jeans.

ENVIRONMENTAL MONITORING

Lily Creek

The free-flowing portion of Lily Creek was sampled in March 1993 just before relocation of the outfall. Severe impacts to the creek were observed and discussed in the first annual report (Kentucky Division of Water, 1994a). Another survey was to have taken place in the spring of 1994 to document anticipated recovery of the creek after the outfall was relocated to the main body of the lake, but the pipeline break and discharge to Lily Creek at the old discharge location from October 1993 to February 1994 caused a postponement of that survey. The survey finally was made in June 1995 by Division biologists after two attempts were cancelled earlier in the spring because of heavy rains. Quantitative results are not yet available, but it was evident to the field investigators that a greater diversity of macroinvertebrates was present compared to the March 1993 survey. Complete results of the Lily Creek survey will be discussed in the third annual report.

Lake Cumberland

Water Quality. Monitoring of the lake environment was a condition of the final permit. A study plan was submitted by Jamestown and approved by the Division prior to relocation of the outfall. The study plan was revised in September 1994 based on the experience and findings of the first year of sampling. The original study plan called for quarterly water, sediment, and fish tissue samples to be collected by Jamestown at an upstream control station and several downstream stations and for the biological community to be assessed in the vicinity of the discharge. Background conditions prior to the discharge relocation to the lake were also assessed. The revised study plan reduced fish tissue and sediment sampling to semiannually, phytoplankton sampling was deleted because the first year's sampling turned up mostly dead cells descending from the photic zone, and water quality sampling in the near- and far-field areas was re-evaluated. It was agreed that the samples at the edge of the zone of initial dilution (ZID) can be accurately collected only by SCUBA diving and that diving is practical only in the late summer to fall when the most favorable lake conditions are present (i.e. lower lake levels and better visibility). Also, far-field plume work was to be performed quarterly by Jamestown during the second year of sampling.

The Division continued its independent assessment of environmental conditions and also obtained edge-of-ZID and far-field plume dispersion samples in late summer and early fall to determine the accuracy of the plume dispersion model that was used to derive the permit limits.

Model Verification. A preliminary diving trip was made by Division personnel in August 1994. Edge-of-ZID samples were collected at two ports on August 10, and effluent, edge-of-ZID, and edge-of-mixing-zone (MZ) samples were collected at one upstream port on August 11. Effluent samples were not collected from the diffuser ports in the August sampling, but chloride analyses from daily composites of the final effluent at the RCRWWTP were available from the city.

The first (upstream), middle, and last (downstream) ports of the 300-foot long diffuser were sampled by Jamestown in September and October and by the Division in October. Different sampling methods were employed by the Division and Jamestown. Jamestown used a water hose held in the sampling locations by a diver and pumped samples to the surface; the Division filled rigid plastic bottles underwater. Samples were obtained by the Division at the 7-ft and 70-ft locations at or near the same time as the port samples. Jamestown sampled at the 70-ft location on the day or second day following the port sampling in both September and October and at the 7-ft site at the middle port in October. Data from in-lake samples not taken on the same day as the port samples should be compared with effluent concentrations found on that day at the plant. Again, daily composite chloride sample results were obtained from the city for comparison purposes.

Results of the near-field sampling are presented in Table 3. The most interesting results are from the 7-ft (edge-of-ZID) samples. Even though samples were taken at seven feet directly out from the ports, the results are highly variable, probably because of the turbulent nature of the plume this close to the ports. The variable nature of these data complicate efforts to

Table 3. Water Quality Data (mg/l) from Diffuser and Near-Field Sampling by Town of Jamestown, September and October 1994, and by Kentucky Division of Water, August and October 1994.

Date	Port	Constituent	Effluent	7-ft	70-ft
8/10/94 (Division)	Upper	Chloride	-[a] 1000[b]	38	-[a]
		Copper	-[a]	0.011	-[a]
	Middle	Chloride	-[a]	14	-[a]
		Copper	-[a]	0.003	-[a]
8/11/94 (Division)	Upper	Chloride	926 1055[b]	11	29
		Copper	0.024	0.002	0.002
9/12/94 (Jamestown)	Upper	Chloride	970 1450[b]	37	14[c]
		Copper	0.04	<0.006	<0.006[c]
	Middle	Chloride	942	25	20[c]
		Copper	0.04	<0.006	<0.006[c]
	Lower	Chloride	940	85	11
		Copper	0.07	0.007	<0.006[c]
10/10/94 (Jamestown)	Upper	Chloride	1374 1600[b]	180[d]	9[e]
		Copper	0.02	<0.006[d]	<0.006[e]
	Middle	Chloride	1408	17[e]	9[e]
		Copper	0.03	<0.006[e]	<0.006[e]
	Lower	Chloride	1461	155[d]	13[e]
		Copper	0.02	<0.006[d]	<0.006[e]
10/11/94 (Division)	Upper	Chloride	1220 1600[b]	31	21
		Copper	0.015	0.001	0.001
	Middle	Chloride	1080	125	34
			0.016	0.001	0.001
	Lower	Chloride	-[f]	6	-[a]
		Copper	-[f]	0.001	-[a]

[a] Sample not collected
[b] 24-hr composite effluent sample by Town of Jamestown at RCRWWTP
[c] Sample collected on 9/13/94; 1300 mg/l Cl^- in RCRWWTP effluent
[d] Average of triplicate samples on 10/10/94
[e] Average of triplicate samples on 10/12/94; 1400 mg/l Cl^- in RCRWWTP effluent
[f] Sample collected but dropped and lost

calibrate the model. The samples taken directly from the ports have little variability and were usually in fairly good agreement with (although always lower than) composite samples taken by the city at the RCRWWTP. The samples taken at the edge of the mixing zone (70 ft) ranged from 9 to 34 mg/l and had moderate variability. In 1995, some samples will also be taken 15 to 20 feet from the ports in order to decrease the effects of near-field turbulence and provide more consistent data for model calibration well within the mixing zone. The number of dilutions at the edge of the mixing zone ranged from 35 to 267, corresponding to chloride concentrations at 70 feet of 34 and 9 mg/l, respectively. Model predictions used by the Division to derive certain permit limits estimated 64 dilutions at the edge of the mixing zone. However, the model estimates dilution along the center line of the effluent plume, which results in a very conservative prediction of dilution when applied to the plume as a whole. The variability of the sampling results makes comparisons to model predictions difficult, but model predictions generally appear to be consistent with the data collected in 1994 and 1995.

Plume Surveys. During the past year, Jamestown performed plume surveys in September (late summer period), October (fall), and February (winter). Complete data are presented in Appendix C. Spring 1995 sampling will be reported in the next annual report.

In September, lake elevation during the study was about 703 to 705 feet MSL (U.S. Army Corps of Engineers, 1995a), placing the diffuser at a depth of about 54 to 84 feet. Effluent chloride concentrations determined from 24-hour composite samples at the RCRWWTP were 1150 to 1450 mg/l for that period. Chloride concentrations of 20 and 22 mg/l were detected at 70 feet and 1000 feet respectively from the diffuser at depths of 53 to 61 feet (Figure 4 and Table 4). All other sampling locations at greater distances from the diffuser had chloride concentrations no greater than 15 mg/l. Trihalomethanes were not detected at any of the sites, including the 7-ft edge-of-ZID location. Except in one 7-ft sample where 0.007 mg/l was found, copper was always less than the detection limit of 0.006 mg/l (Appendix C). Trihalomethanes were always less than the detection limit of 0.005 mg/l. Mercury was always less than the detection limit of 0.001 mg/l, including samples of 100 percent effluent taken from the end of the pipe.

Besides a 34 mg/l reading from the edge of the mixing zone, the highest chloride level found in the October plume survey was 23 mg/l at the transect 400 feet downstream of the diffuser (Figure 5 and Table 4). Concentrations remained somewhat elevated at the transect located 2000 feet downstream, but the plume did not extend laterally across the lake. As in other surveys, concentrations of copper were low at all sampling locations. The lake level was about 698 feet MSL (U.S. Army Corps of Engineers, 1995a), placing the diffuser at a depth of about 48-78 feet.

Only 4 mg/l of chloride was found at the edge of the mixing zone (70 ft) during non-stratified lake conditions of February 1995 (Table 3). All other samples were at the background level of 3 mg/l (Figure 6 and Table 4). This winter study is noteworthy because it shows that the wastewater mixes even more thoroughly in non-stratified lake conditions that exist for roughly half the year.

Figure 4. Chloride Concentrations (mg/l) in Lake Cumberland at Depth of Effluent Plume (44-69 ft), Town of Jamestown Survey, September 1994

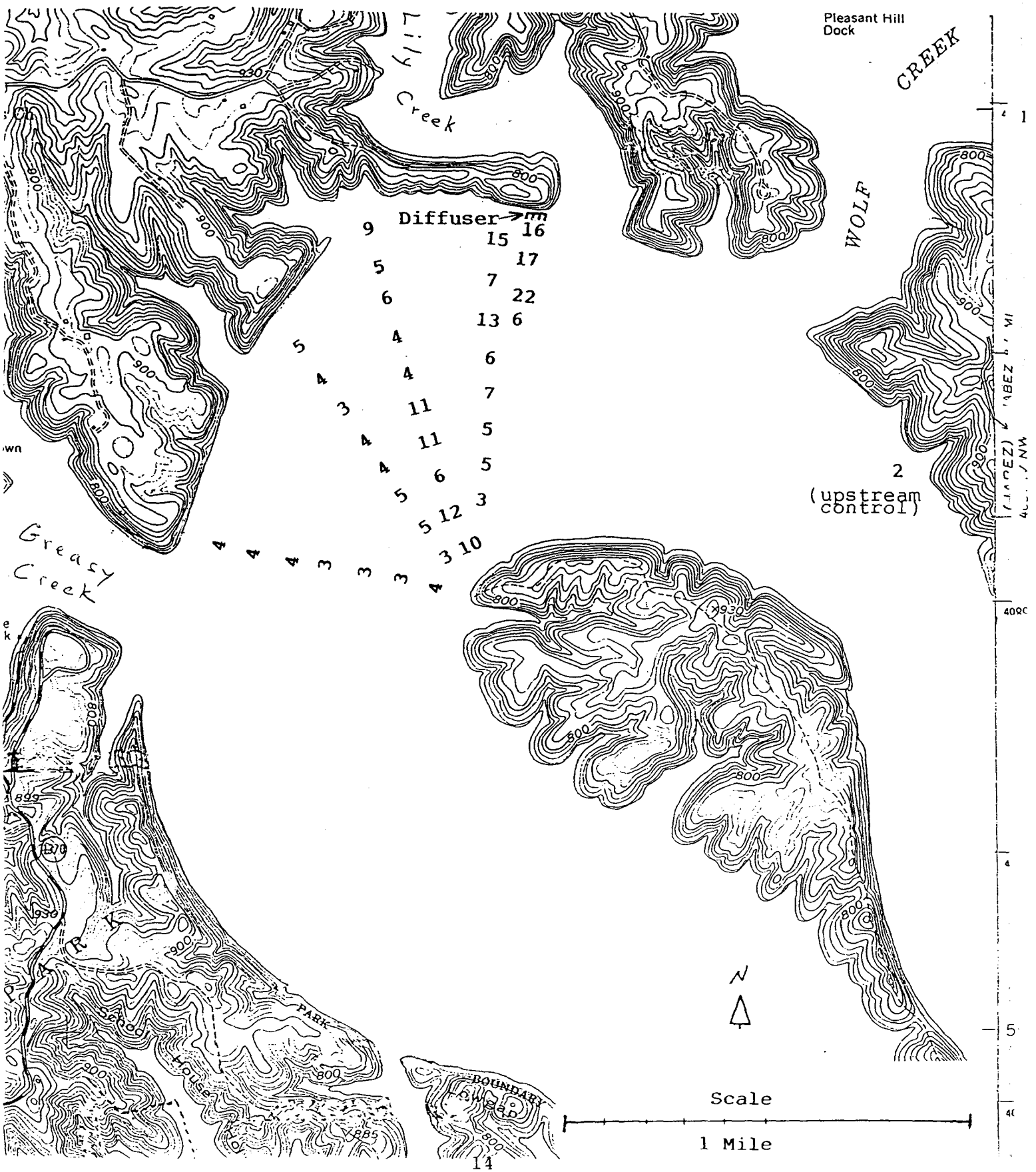


Table 4. Chloride Concentrations (mg/l) at Depth of Effluent Plume, Town of Jamestown Surveys, September 1994, October 1994, and February, 1995[a]

Distance from Shoreline	Upstream Control Site			At Diffuser			400 ft Downstream of Diffuser			2000 ft Downstream of Diffuser			4000 ft Downstream of Diffuser			Near Mouth of Greasy Creek		
	9/94	10/94	2/95	9/94	10/94	2/95	9/94	10/94	2/95	9/94	10/94	2/95	9/94	10/94	2/95	9/94	10/94	2/95
200 ft.	2	3	3	16		3												
500 ft.				17	15	3	15	23	3	9	12	3	5	4	3	4	ND[b]	3
1000 ft.				22	8		7	10	3	5	5	3	4	4	3	4	3	3
1500 ft.				6	4		13	5	3	6	6	3	3	4	3	4	6	3
2000 ft.					4		6	4		4	4		4	4		3	4	
2500 ft.							7			4			4			3	3	
3000 ft.							5			11			5			3	3	
3500 ft.							5			11			5			4	4	
4000 ft.							3			6			3					
4500 ft.										12								
5000 ft.										10								
5500 ft.										9								
5800 ft.										6								

a = See also Figures 4, 5 and 6

b = Plume not detected

Figure 5. Chloride Concentrations (mg/l) in Lake Cumberland at Depth of Effluent Plume (47-62 ft), Town of Jamestown Survey, October 1994

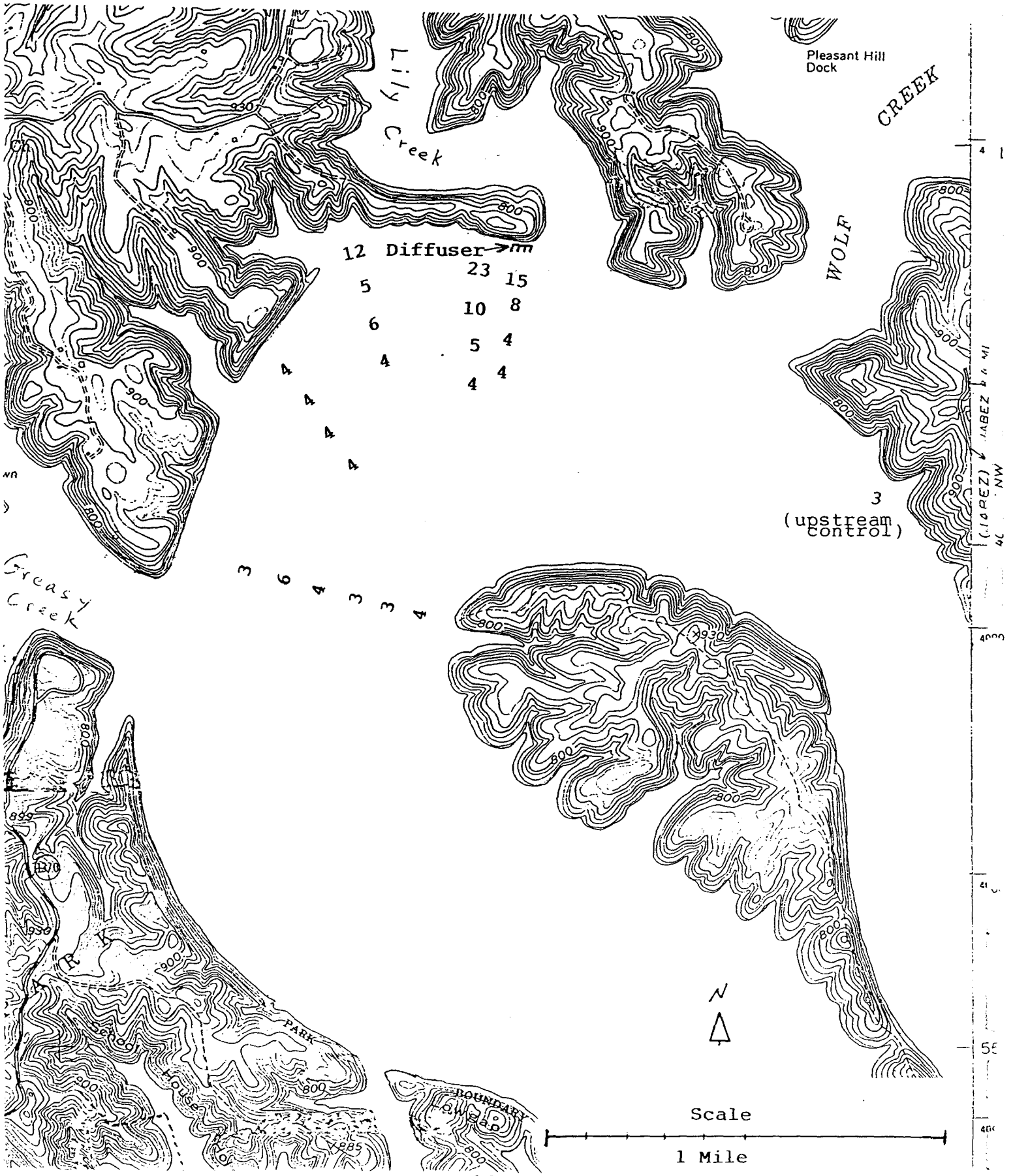
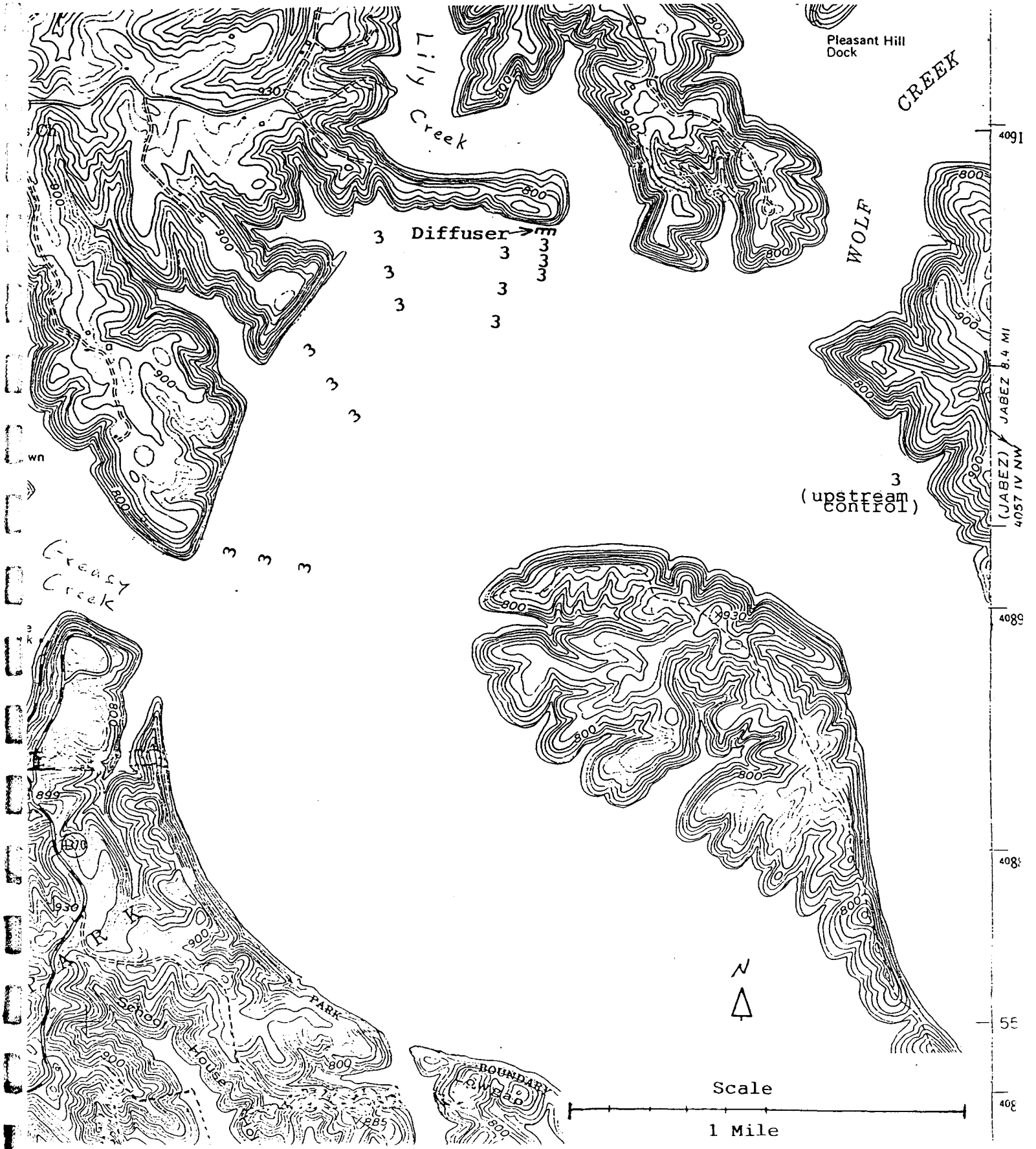


Figure 6. Chloride Concentrations (mg/l) in Lake Cumberland at Depth of Effluent Plume (50-71 ft), Town of Jamestown Survey, February 1995



The Division performed limited plume work on August 10-11, 1994. The plume was detected by specific conductivity measurements, and samples were taken for chloride and copper. The lake level during the survey was about 714 feet MSL (U.S. Army Corps of Engineers, 1995a), placing the diffuser at a depth of 64 to 94 feet. Chloride concentrations taken from 24-hour composite samples of the effluent from August 10-11 were 1000 to 1055 mg/l, and flow was in the range of 2.5 to 3.0 mgd (Town of Jamestown, 1995). Because of the large overall capacity of the treatment units, these concentrations should be relatively unchanged at any one period throughout the day.

At the upstream control station near the north shore, the chloride concentration was 10 mg/l at a depth of 69 feet, suggesting that the plume extended a short distance upstream. Evidence of the plume was not found at stations farther south along the upstream control transect (Table 5). Copper was 0.003 mg/l or less (Table 5). At a distance of 70 feet from the diffuser, at the edge of the defined mixing zone where chronic aquatic life criteria apply, the plume was found at a depth of 57 to 67 feet. The highest specific conductance measurement was 280 umhos/cm at a depth of 59 feet, with a corresponding chloride concentration of 29 mg/l and copper concentration of 0.001 mg/l. Outside the mixing zone, the highest chloride concentration was 12 mg/l at a depth of 66 feet. Copper never exceeded 0.003 mg/l at any of the stations. As was found in the previous year, there was not always a gradual decrease in chloride with increasing distance from the diffuser. While only 1 to 2 mg/l of chloride was found at distances of 500 and 1000 feet from the diffuser, about 10 mg/l was detected at a distance of 2000 feet.

Another data source confirms that the chloride plume has no overall impact to Lake Cumberland and that there is no buildup of chloride in the lake. The U.S. Army Corps of Engineers (COE) performs vertical profile surveys at several sites on the lake. From downstream to upstream, these sites are: 14 miles downstream near the Wolf Creek Dam, 5.8 miles downstream of the diffuser, 11.5 miles upstream of the diffuser, and further upstream near Somerset. Conductivity measurements taken at 5-foot intervals have revealed no discernible differences at the sites up- and downstream of the diffuser. Appendix D presents the August 1994 and June 1995 field data provided by the COE (1995b) for the lower three sites.

Sediment. Results from sediment sampling by Jamestown at three sites are presented for May and September 1994 (Tables 6 and 7). In May, Site 2 at the diffuser exhibited slightly elevated copper compared to the upstream control (Site 1). The average copper concentration of three replicates was 32.9 mg/kg at Site 2 at the diffuser, and 25.1 mg/kg at control Site 1. Nickel was also slightly elevated at Site 2 compared to the upstream sites, and mercury was slightly higher at Site 3. Other constituents including lead showed no differences between sites. In September, there was no elevated copper, nickel, mercury, or any other constituent at Site 2.

The sediment data also do not indicate a significant increase in metals in the area of the diffuser when compared to data collected the previous year or even before the discharge was moved to the main lake. In March 1993 (prior to diffuser operation), average copper concentrations were 24.5 mg/kg, while the most recent data from the spring and fall of 1994 averaged 26.9 mg/kg. Other metals also exhibited insignificant differences.

Table 5. Chloride and Copper Concentrations (mg/l) at Depth of Effluent Plume, Division of Water Survey, August 1994								
Distance from Shoreline (ft)	**Upstream Control**		**At Diffuser**		**4000 Feet Downstream of Diffuser**		**Near Mouth of Greasy Creek**	
	Chloride	**Copper**	**Chloride**	**Copper**	**Chloride**	**Copper**	**Chloride**	**Copper**
350	10	0.003					3	0.002
500			1	0.001			1	0.003
1000			2	0.002	4	0.001	<1	0.003
1500					2	0.002		
2000			10	0.001	4	0.002	4	0.002
2600							<1	0.002
3500					10	0.001		

Table 6. Sediment Quality Data, May 1994 [a]

PARAMETER	Site #1			Site #2			Site #3		
	Sample 1 SO #40943 5/17/94	Sample 2 SO #40945 5/17/94	Sample 3 SO #40947 5/17/94	Sample 1 SO #40949 5/17/94	Sample 2 SO #40951 5/17/94	Sample 3 SO #40953 5/17/94	Sample 1 SO #40955 5/17/94	Sample 2 SO #40957 5/17/94	Sample 3 SO #40959 5/17/94
Arsenic Total (mg/kg)	16.4	15.7	11.2	11.9	14.7	17.1	15.3	16	88.9
Copper - Total (mg/kg)	26.8	25.4	23.1	37.3	28.5	32.8	26.5	27.8	29.8
Lead (mg/kg)	28.1	26.6	16.6	534	19.9	24	19.7	20.8	26.5
Mercury (mg/kg)	0.12	0.097	0.112	0.112	0.097	0.134	0.138	0.152	0.173
Aroclor - 1016 (mg/kg)	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1
Aroclor - 1221 (mg/kg)	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1
Aroclor - 1232 (mg/kg)	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1
Aroclor - 1242 (mg/kg)	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1
Aroclor - 1248 (mg/kg)	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1
Aroclor - 1254 (mg/kg)	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1
Aroclor - 1260 (mg/kg)	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1
Chlordane (Technical) (mg/kg)	ND< 0.3	ND< 0.3	ND< 0.3	ND< 0.3	ND< 0.3	ND< 0.3	ND< 0.3	ND< 0.3	ND< 0.3
Nickel (mg/kg)	53.8	49.6	41.3	60.5	61.3	65.7	46.7	54.9	63.2
Solids (%) (mg/kg)	31	31.5	44	31	29	29	32	24	25
Total Organic Carbon (mg/kg)	DRY 181	DRY 193	DRY 267	DRY 298	DRY 171	DRY 154	DRY 182	DRY 283	DRY 234

[a] Site 1 located approximately one mile upstream of diffuser
Site 2 located in area of diffuser
Site 3 located approximately 4,000 ft downstream of diffuser

Table 7. Sediment Quality Data, September 1994 [a]

PARAMETER	Above Wolf Creek Site #1			Diffuser Area Site #2			Below Diffuser 4000' Site #3		
	Sample 1 SO #42393 9/16/94	Sample 2 SO #42395 9/16/94	Sample 3 SO #42397 9/16/94	Sample 1 SO #42403 9/14/94	Sample 2 SO #42404 9/15/94	Sample 3 SO #42405 9/15/94	Sample 1 SO #42399 9/15/94	Sample 2 SO #42401 9/15/94	Sample 3 SO #42402 9/15/94
Arsenic (mg/kg)	0.37	2.02	3.33	2.22	7.45	1.75	2.13	6.56	2.64
Copper - Total (mg/kg)	25.1	22.9	22.7	20.5	21.7	20.5	21.9	26.5	20.7
Lead (mg/kg)	23.3	20.3	19.9	17.6	17.7	16.6	21	22	17.3
Mercury (mg/kg)	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029	< 0.029
Aroclor - 1016 (mg/kg)	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1
Aroclor - 1221 (mg/kg)	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1
Aroclor - 1232 (mg/kg)	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1
Aroclor - 1242 (mg/kg)	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1
Aroclor - 1248 (mg/kg)	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1
Aroclor - 1254 (mg/kg)	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1
Aroclor - 1260 (mg/kg)	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1	ND< 1
Chlordane (Technical) (mg/kg)	ND< 0.3	ND< 0.3	ND< 0.3	ND< 0.3	ND< 0.3	ND< 0.3	ND< 0.3	ND< 0.3	ND< 0.3
Nickel (mg/kg)	43.3	49.9	40.8	43.1	52.1	41.8	40.4	41.3	40.8
pH (S.U.)	6.78	6.87	6.77	6.53	6.82	7.02	6.57	6.85	6.88
Solids (%) (mg/kg)	44.4	37.8	46.5	46.3	50	40.6	45.4	40.5	35.1
Total Organic Carbon (mg/kg)	DRY 427	DRY 342	DRY 607	DRY 325	DRY 780	DRY 822	DRY 512	DRY 565	DRY 495

[a] Site 1 located approximately one mile upstream of diffuser
Site 2 located in area of diffuser
Site 3 located approximately 4,000 ft downstream of diffuser

Fish Tissue. Fish tissue samples were collected by Jamestown in May and October 1994 by gill nets placed at the depth of the diffuser and at a depth mid-way between the diffuser and the surface. The upstream control station (Station 4) was located nearly five miles up the lake near the mouth of Harmon Creek. Samples were also collected on both dates from fish taken in the area of the diffuser (Station 2) and at a site located about 4000 feet downstream of the diffuser (Station 3). Whole body samples were used for forage fish such as alewives and shad, and several of these fish were composited into a single sample when the fish were of small size. Right side fillets were taken from predator fish such as bass, gar, and walleye, and the remaining portion of the fish was used for whole body sample if the fish was of adequate size.

The sites were fished until samples were obtained, but not for more than three nights. Because some types of fish were not caught on all sample dates, the number of samples is not equal between sites and dates. Low numbers of fish, including forage fish such as shad, were taken from the lower nets on all sampling dates. (Also, very few fish were observed by divers in the vicinity of the diffuser.) This information indicates that the diffuser does not attract fish.

A total of 46 samples were analyzed. Nine samples (eight forage and one small predator) were taken from Station 2 in May, and five samples (two predators with both fillet and whole body samples off each fish, and one forage fish) were taken in October. Twelve samples (six forage fish and three predators with both whole body and fillet each) came from Station 4 in May, while 13 samples came from predators in October (fillets not could be obtained from gar). Two samples were obtained from forage fish at Station 3 in May, and five samples (two from forage fish and three from predators) were obtained in October.

There were there no apparent differences in tissue concentrations in fish from the up- and downstream sites (Appendix E). The city's data show mercury was present in high concentrations (between 0.5 and 1.0 mg/kg) in several fish, and one composite sample of two alewives exceeded the FDA action level of 1.0 mg/kg. However, all tissue samples of sport fish were well below the FDA action level. Relatively high levels of mercury in fish have been detected in previous sampling in several areas of the lake (Kentucky Division of Water, 1994, 1992a), but data have shown that the RCRWWTP discharge is not the source of the mercury. The various isomers of PCBs and chlordane were usually at nondetectable levels, but low levels of chlordane were detected in several fish at concentrations well below the FDA action level of 0.3 ppm. A PCB isomer was detected occasionally, but levels were well below the FDA action level of 2 ppm.

Plankton. Phytoplankton sampling was deleted from the monitoring program beginning in the summer of 1994 based on the first year's results. There was no indication of any effects of the discharge of effluent on the algal community, and sampling at depth resulted mostly in dead cells descending from the photic zone. May 1994 results showed no difference in dominant species between the three sites, and mean cell density was low (< 10 cells/ml) at all three sites.

Zooplankton data from four quarterly collections from spring of 1994 through winter of 1995 at three stations are presented in Appendix F. Station 1 is the upstream control station, Station 2 is in the vicinity of the diffuser, and Station 3 is about 4000 feet downstream of the diffuser. The data indicate that there has been no detrimental influence on the zooplankton community from diffuser operation. Data from the September sampling showed no significant difference between stations in the density of organisms per cubic meter but did show a difference at the 0.01 level between the taxa. A mean number of 9.6 taxa were present at Station 3, while stations 1 and 2 had means of 17 and 17.7, respectively. The difference occurred primarily in the rotifers, which showed a decrease in mean numbers from 11 at Station 1 to 4.3 at Station 3. One possible explanation is that Station 3 was sampled late in the day and underwater light levels may have triggered some vertical movement in this group of organisms. Another possible explanation is the general patchiness of zooplankton distribution. The lack of significant difference in the density data was largely because of greater variability between replicates.

October data showed a significant difference at the 0.05 level between stations in the density of organisms. Station 1 had more than three times as many individuals as either Station 2 or 3. There was very close agreement between all stations in species richness, however. The mean number of taxa per station was 7.0, 7.0, and 6.7 for stations 1,2, and 3, respectively. The reduction in species richness from September to October is very likely a natural seasonal decline since it occurred at all stations.

Trophic State. The Division's Water Quality Branch has monitored the Lily Creek embayment of Lake Cumberland since 1985. Monitoring was initiated to assess trophic state and the impacts to water quality from the RCRWWTP.

A comparison of chemical, physical, and biological data collected in the two years prior to the construction of the pipeline to data collected in 1993 and 1994, after the discharge had been relocated to the main lake, indicates a trend of improved water quality and overall aesthetics associated with the removal of the discharge from Lily Creek. For the past several years, the Division (1994, 1992b, 1990, 1988, 1986) has classified the Lily Creek embayment as eutrophic, and the Kentucky Department of Fish and Wildlife Resources (KDFWR) has recognized the embayment as supporting one of the better fisheries on Lake Cumberland. However, once the nutrient input ceased, chlorophyll-a, total phosphorus, and soluble reactive phosphorus decreased in 1993 and 1994 when compared to 1991 and 1992 (Table 8). Secchi disk transparency and euphotic zone depths also increased, indicating that the embayment is less eutrophic.

In May, August, and October 1994, three stations below the diffuser and a control station above the diffuser were sampled to monitor the effects on phytoplankton biomass of the diffuser discharge. These stations were located at River Mile (RM) 475.9 (control), RM 475.6 (600 feet below the diffuser), RM 475.0, and RM 474.4 of Lake Cumberland.

No significant differences were found in chlorophyll-a concentrations in seasonal samples collected in May, August, and October at three stations downstream of the diffuser when

TABLE 8. Growing Season (April - October) Averages of Chemical, Physical and Biological Parameters at Milepoint 3.8 of the Lily Creek Embayment

	1991	1992	1993[a]	1994
Chlorophyll-a (ug/l)	19.8	25.8	13.5	10.4
Total Phosphorus (mg/l)	0.17	0.08	0.05	<0.041
Soluble Reactive Phosphorus (mg/l)	0.117	0.021	<.005	<0.021
Euphotic Zone (feet)	13.1	13.5	16.4	15.1
Secchi Disk Transparency (feet)	3.0	3.1	4.2	4.3

[a] Discharge relocated to main lake prior to 1993 growing season.

compared to the control station (RM 475.9). Little or no difference in 1993 and 1994 was found in the concentrations of nutrients and other selected parameters sampled below the diffuser when compared to the control station. Thus, after two years of trophic state and physical-chemical monitoring, there appears to be very little effect on the biomass in the main lake as a result of the discharge. This is because the concentrations of nutrients are rapidly diluted and remain below the photic zone. This was also demonstrated by higher conductivity measurements downstream of the diffuser at the depth of the diffuser throughout the growing season, indicating that the effluent remains mostly below the photic zone.

Creel Survey. The Kentucky Department of Fish and Wildlife Resources (KDFWR) conducts creel surveys in the Lily Creek area of the lake in even-numbered years. At the request of the Division of Water, data from the Lily Creek embayment were separated from other survey areas in 1994 and submitted to the Division (KDFWR, 1995). The purpose of the request was to monitor the impact on the sport fishery of the Lily Creek embayment once the discharge was relocated to the main body of the lake. The embayment had once been one of the better fisheries on Lake Cumberland, but it is expected that the loss of nutrient input from the RCRWWTP discharge will decrease productivity (see discussion above on trophic state) and eventually adversely affect the sport fishery. The information presented below is a baseline against which future data will be compared.

Lily Creek anglers fished a total of 15,249 man-hours (105.9 hours per acre) and made 5083 trips (Table 9). Anglers caught 10,489 fish, of which 1878 fish totalling 1757 pounds were harvested. The overall catch rate for all fish species was about one fish per 1.4 hours of fishing (0.69 fish per hour). The overall harvest rate was about one fish per 8.3 hours of fishing (0.12 fish per hour). Striped bass comprised more than 93 percent of the weight harvested (1643 pounds), followed by black bass (5 percent) and panfish (2 percent). Panfish, mostly bluegill and longear sunfish, accounted for more than one half of the numbers harvested, followed by striped bass and black bass.

Table 9. Fish harvest statistics for the Lily Creek embayment (144 acres) derived from a creel survey in Lake Cumberland from 8 February - 31 December 1994.

Fishing trips		
Number of fishing trips (per acre)	5,083	(35.3)
Fishing pressure		
Total man-hours (R.S.E.)	15,249	(11.3)
Man hours/acre	105.9	
Catch/harvest		
Number of fish caught (S.E.)	10,489	(3,873)
Number of fish harvested (S.E.)	1,878	(965)
Pounds of fish harvested	1,757	
Harvest rates		
Fish/hour	0.12	
Pounds/hour	0.12	
Fish/acre	13.0	
Pounds/acre	12.2	
Catch rates		
Fish/hour	0.69	
Fish/acre	72.8	
Miscellaneous characteristics (%)		
Male	92	
Female	8	
Resident	80	
Non-resident	20	
Method (%)		
Still fishing	20	
Casting	49	
Trolling	1	
Live bait (Striped bass fishermen)	30	

Source: Kentucky Department of Fish and Wildlife Resources (1995)

CONCLUSIONS

The second year of operation at the Russell County Regional Wastewater Treatment Plant following an expansion and upgrade of treatment facilities and relocation of the discharge to Lake Cumberland in April 1993 was marked by compliance with all regulatory requirements and no demonstrable impacts to Lake Cumberland as observed through environmental monitoring by both Jamestown and the Division of Water. Data submitted by Jamestown and inspections conducted by the Division indicated that the facility operated satisfactorily. Monitoring in the lake of water quality, fish tissue, sediment quality, and plankton indicated no environmental problems associated with the discharge. Studies conducted by Jamestown and the Division of Water showed chloride concentrations in the lake were less than 200 mg/l at the edge of the zone of initial dilution (7 feet from the end of the nozzles) and less than 40 mg/l at the edge of the mixing zone (70 feet from the nozzles). Other constituents of the wastewater, including metals and trihalomethanes, were again found in very low or undetectable concentrations in the lake. As has been found in all previous environmental monitoring, the highest concentrations were found in a thin vertical layer during stratified lake conditions. During winter when the waters of the lake are not stratified by temperature and density differences, the plume was barely detectable outside the mixing zone.

REFERENCES

Kentucky Department of Fish and Wildlife Resources. 1995. Unpublished creel survey data provided to Kentucky Division of Water, July 21, 1995.

Kentucky Division of Water. 1994a. Annual Report on Operations of Russell County Regional Wastewater Treatment Plant and Associated Environmental Monitoring.

_____1994b. 1994 Report to Congress on Water Quality.

_____1992a. Lake Cumberland/Lily Creek Sediment and Fish Tissue Investigation. Technical Report No. 49.

_____1992b. 1992 Kentucky Report to Congress on Water Quality.

_____1990. 1990 Kentucky Report to Congress on Water Quality.

_____1988. 1988 Kentucky Report to Congress on Water Quality.

_____1986. 1986 Kentucky Report to Congress on Water Quality.

Town of Jamestown. 1995. Personal communication, January 11, 1995.

U.S. Army Corps of Engineers. 1995a. Personal communication, August 11, 1995.

_____1995b. Unpublished profile data provided to Kentucky Division of Water, July 27, 1995.

APPENDIX A
PIPELINE INSPECTION

Williams & Schultheiss Diving
Route 3, Box 480
Rockport, IN. 47635
Phone: (812)649-5071 Fax: (812)649-5072

FAX

DATE 12/28/94 # PGS 1

TO Harold Snodgrass

CO Kenvirons, Inc. FAX#

FROM Derek Bivins

CO WS Diving PH/FAX#

MESSAGE Report

AVERY FX-15

December 28, 1994

Kenvirons, Inc.
Attn: Harold Snodgrass
452 Versailles Rd.
Frankfort, KY. 40601

Re: Report/Inspection of 24 Inch Pipeline.

Diver enters water at flange between pipe and diffuser; diver inspects bolts at flange, bolts in satisfactory condition. Diver reports pipeline has not moved.

Throughout the total of all dives, this pipeline is in satisfactory condition and also pipeline has not moved since the installation of the weights. Diver took pneumo shots every (5) five feet on top of the vent pipe. The vent pipe has a positive flow from the 54 inch to surface. The 54 inch pipe has not moved.

Overall, the pipeline is in excellent condition.

Reported By:

Derek D. Bivins

DB/db

APPENDIX B
DIVISION OF WATER COMPLIANCE
SAMPLING INSPECTIONS AND BIOMONITORING RESULTS

PHILLIP J. SHEPHERD
SECRETARY

BRERETON C. JONES
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION

January 23, 1995

Honorable Donnie Wilkerson
Mayor City of Jamestown
Monument Square Box 587
Jamestown, Kentucky 42629

RE: Russell County Regional WWTP
KY0062995

Dear Mayor Wilkerson:

Please find enclosed your copy of the Compliance Sampling Inspection Report (including appropriate laboratory reports) conducted by James S. Woody of the Kentucky Division of Water at the Russell County Regional Wastewater Treatment Plant in Russell County, Kentucky on November 30, 1995. At the time of inspection your facility received a rating of Satisfactory. The analytical data from this inspection indicates compliance with your facility's KPDES permit.

If you have any questions regarding this report, please feel free to contact this office.

Sincerely,

Sara E. Gold, Supervisor
Division of Water
Columbia Regional Office
P. O. Box 335
Columbia, Kentucky 42728
Phone: (502) 384-4734

SEG/bjb

Enclosure

cc: KPDES Branch, Division of Water
Frankfort Central Office files
Columbia Regional Office files

PHILLIP J. SHEPHERD
SECRETARY

BREATHITT C. JONES
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF ENVIRONMENTAL SERVICES
SUITE 104
100 SOWER BOULEVARD
FRANKFORT, KY 40601

January 19, 1995

Division of Environmental Services
Report Number: A02-15240
Sample Number: 9404755

TO: Division of Water
Frankfort Office Park
Frankfort, Kentucky 40601

RE: Russell County Regional WWTP

ATTN: Sam Lester

County: Russell

Facility: KY0062995

Collected by: James S. Woody

Date: 11/30/94 **Time:** 0915

Delivered by: James S. Woody

Date: 11/30/94 **Time:** 1300

Received by: Polly Baker

Date: 11/30/94 **Time:** 1300

Sample Matrix: Water

Collection Method: Composite

Sample Identification: JI1 Influent

REPORT OF ANALYSIS

TOTAL CONSTITUENTS	CONCENTRATION
BOD-5	278 mg/L
Chloride	1,210 mg/L
Color, Filtered @ ambient pH	996 ADMI Color Units
Color, Filtered @ pH = 7.6	1,110 ADMI Color Units
pH	7.4 S.U.
Total Suspended Solids	320 mg/L
Ammonia-Nitrogen	4.7 mg/L
Copper	0.113 mg/L

This report has been prepared and reviewed by personnel within the Division of Environmental Services. It has been approved for release.

William E. Davis

William E. Davis, Director
Division of Environmental Services

PHILLIP J. SHEPHERD
SECRETARY

BREATHITT C. JONES
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF ENVIRONMENTAL SERVICES
SUITE 104
100 SOWER BOULEVARD
FRANKFORT, KY 40601

January 19, 1995

Division of Environmental Services
Report Number: A02-15239
Sample Number: 9404754

TO: Division of Water
Frankfort Office Park
Frankfort, Kentucky 40601

RE: Russell County Regional WWTP

ATTN: Sam Lester

County: Russell

Facility: KY0062995

Collected by: James S. Woody

Date: 11/30/94 **Time:** 0920

Delivered by: James S. Woody

Date: 11/30/94 **Time:** 1300

Received by: Polly Baker

Date: 11/30/94 **Time:** 1300

Sample Matrix: Water

Collection Method: Composite

Sample Identification: JE1 Effluent to pipeline

REPORT OF ANALYSIS

TOTAL CONSTITUENTS	CONCENTRATION
BOD-5	8.3 mg/L
Chloride	822 mg/L
Color, Filtered @ ambient pH	37.9 ADMI Color Units
Color, Filtered @ pH = 7.6	27.9 ADMI Color Units
pH	7.0 S.U.
Total Suspended Solids	22 mg/L
Ammonia-Nitrogen	0.2 mg/L
Copper	0.018 mg/L

This report has been prepared and reviewed by personnel within the Division of Environmental Services. It has been approved for release.

William E. Davis

William E. Davis, Director

PHILLIP J. SHEPHERD
SECRETARY

BRERETON C. JONES
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF ENVIRONMENTAL SERVICES
SUITE 104
100 SOWER BOULEVARD
FRANKFORT, KY 40601

January 19, 1995

Division of Environmental Services
Report Number: A02-15239
Sample Number: 9404754

TO: Division of Water
Frankfort Office Park
Frankfort, Kentucky 40601

RE: Russell County Regional WWTP

ATTN: Sam Lester

County: Russell

Facility: KY0062995

Collected by: James S. Woody **Date:** 11/30/94 **Time:** 0920

Delivered by: James S. Woody **Date:** 11/30/94 **Time:** 1300

Received by: Polly Baker **Date:** 11/30/94 **Time:** 1300

Sample Matrix: Water **Collection Method:** Composite

Sample Identification: JE1 Effluent to pipeline

REPORT OF ANALYSIS

TOTAL CONSTITUENTS	CONCENTRATION
BOD-5	8.3 mg/L
Chloride	822 mg/L
Color, Filtered @ ambient pH	37.9 ADMI Color Units
Color, Filtered @ pH = 7.6	27.9 ADMI Color Units
pH	7.0 S.U.
Total Suspended Solids	22 mg/L
Ammonia-Nitrogen	0.2 mg/L
Copper	0.018 mg/L

This report has been prepared and reviewed by personnel within the Division of Environmental Services. It has been approved for release.

William E. Davis

William E. Davis, Director
Division of Environmental Services

PHILLIP J. SHEPHERD
SECRETARY

BRERETON C. JONES
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION

February 10, 1995

Honorable Donnie Wilkerson
Mayor, City of Jamestown
Monument Square Box 587
Jamestown, Kentucky 42629

RE: Russell County Regional STP
KPDES NO. KY0062995
Russell County

Dear Mayor Wilkerson:

Please find enclosed your copy of a Compliance Evaluation Inspection conducted by James S. Woody of the Kentucky Division of Water at the above referenced treatment plant on February 1, 1995. At the time of inspection your facility received a rating of Satisfactory.

If you have any questions regarding this report, please feel free to contact this office.

Sincerely,

Sara E. Gold, Supervisor
Division of Water
P. O. Box 335
Columbia, Kentucky 42728
Phone: (502) 384-4734

SEG:bjb

Enclosure

cc: KPDES Branch, Division of Water
Frankfort Central Office files
Columbia Regional Office files

PHILLIP J. SHEPHERD
SECRETARY

BRERETON C. JONES
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION

March 29, 1995

Honorable Donnie Wilkerson
Mayor, City of Jamestown
Monument Square Box 587
Jamestown, Kentucky 42629

RE: Russell County Regional WWTP
KPDES NO. KY0062995
Russell County

Dear Mayor Wilkerson:

Please find enclosed your copy of a Compliance Evaluation Inspection conducted by James S. Woody of the Kentucky Division of Water at the above referenced treatment plant on March 10, 1995. At the time of inspection your facility received a rating of Satisfactory.

If you have any questions regarding this report, please feel free to contact this office.

Sincerely,

Sara Gold

Sara E. Gold, Supervisor
Division of Water
P. O. Box 335
Columbia, Kentucky 42728
Phone: (502) 384-4734

SEG:bjb

Enclosure

cc: KPDES Branch, Division of Water
Frankfort Central Office files
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PHILLIP J. SHEPHERD
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GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
FRANKFORT OFFICE PARK
14 REILLY ROAD
FRANKFORT, KENTUCKY 40601

June 5, 1995

Mr. Terry Lawless, Supervisor
Public Works
City of Jamestown
P. O. Box 99
Jamestown, KY 42629

RE: Jamestown/Russell County WWTP (KY 0062995) Biomonitoring Tests Performed by the Kentucky Division of Water, Bioassay Section

Dear Mr. Lawless:

Enclosed please find biomonitoring data for your facility, as determined by the Kentucky Division of Water, Bioassay Section.

The enclosed data is the summary of the acute toxicity tests completed on May 26, 1995 using the fathead minnow (Pimephales promelas) and the Daphnid (Ceriodaphnia dubia). Samples were four grabs collected on May 23 and 24, 1995. The results indicate no acute toxicity in any grab sample with both test species, LC_5 >21% (TU_a < 4.8). Samples were also tested at 100% effluent which again showed no toxicity to either species.

Please call if you have any questions regarding this report.

Sincerely,

Charles A. Roth, Supervisor
Bioassay Section
Water Quality Branch

Enclosure

CAR:dh
c: Sara Gold, Columbia Regional Office
Bob Rogers, Pretreatment Section
[redacted], Water Quality Branch
DOW Files

Acute 96 Hour Toxicity Test

Start Date:	24 May-95 14:00	Test ID:	285FE	Sample ID:	KY0062995
End Date:	26 May-95 14:00	Protocol ID:	EPAF 91	Sample Type:	EFF1 POTW
Sample Date:	24 May-95	Analyst Name:	CAR,LAC,SLC,B	Test Species:	CD Ceriodaphnia dubia
Comments:	JAMESTOWN/RUSSELL CO. STP			Response:	Survival

Group ID	1	2
N Control	1.000	0.890
G1 5/23/15:00	0.900	0.860
G2 5/23/21:02	1.000	1.000
G3 5/24/03:08	0.900	0.800
G4 5/24/09:00	1.000	1.000
G1	1.000	1.000
G2	1.000	0.900
G3	1.000	0.900
G4	0.890	1.000

			Untransformed Data									
Group ID	Mean	N-Mean	Mean	Min	Max	CV%	N	Sum	Critical	MSD	NRESP	NDOSE
N Control	0.945	1.000	0.945	0.890	1.000	8.23	2					
G1 5/23/15:00	0.880	0.931	0.880	0.860	0.900	3.21	2					
G2 5/23/21:02	1.000	1.058	1.000	1.000	1.000	0.00	2					
G3 5/24/03:08	0.850	0.899	0.850	0.800	0.900	8.32	2					
G4 5/24/09:00	1.000	1.058	1.000	1.000	1.000	0.00	2					
G1	1.000	1.058	1.000	1.000	1.000	0.00	2					
G2	0.950	1.005	0.950	0.900	1.000	7.44	2					
G3	0.950	1.005	0.950	0.900	1.000	7.44	2					
G4	0.945	1.000	0.945	0.890	1.000	8.23	2					

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Normality of the data set cannot be confirmed				
Equality of variances cannnot be confirmed				

Test: Acute 96 Hour Toxicity Test													
Species: CD Ceriodaphnia dubia													
Test ID: 285FE RTest ID: REFCD950516 Analyst(s): CAR,LAC,SLC,BSB													
Sample ID: KY0062995 Sample Type: EFF1 POTW													
Start Date/Time: 24 May-95 End Date/Time: 26 May-95													
			Test	Proportion	Start	Number Survived at Day							
Pos	ID	Rep	Groups	Survived	Count	1	2	3	4	5	6	End	Notes
	1	1	N Control	1.000	9	9	9						
	2	2	N Control	0.890	9	9	8						
	3	1	G1 5/23/15:00	0.900	10	9	9						21%FE
	4	2	G1 5/23/15:00	0.860	7	6	6						21%FE
	5	1	G2 5/23/21:02	1.000	10	10	10						21%FE
	6	2	G2 5/23/21:02	1.000	10	10	10						21%FE
	7	1	G3 5/24/03:08	0.900	10	9	9						21%FE
	8	2	G3 5/24/03:08	0.800	10	9	8						21%FE
	9	1	G4 5/24/09:00	1.000	10	10	10						21%FE
	10	2	G4 5/24/09:00	1.000	10	10	10						21%FE
	11	1	G1	1.000	10	10	10						100%FE
	12	2	G1	1.000	10	10	10						100%FE
	13	1	G2	1.000	10	10	10						100%FE
	14	2	G2	0.900	10	9	9						100%FE
	15	1	G3	1.000	10	10	10						100%FE
	16	2	G3	0.900	10	9	9						100%FE
	17	1	G4	0.890	9	8	8						100%FE
	18	2	G4	1.000	10	10	10						100%FE

Acute 48 Hour Toxicity Test

Start Date:	24 May-95 14:00	Test ID:	285FE	Sample ID:	KY0062995
End Date:	26 May-95 14:00	Protocol ID:	EPAF 91	Sample Type:	EFF1 POTW
Sample Date:	24 May-95	Analyst Name:	CAR,LAC,SLC,B	Test Species:	PP Pimephales promelas
Comments:	JAMESTOWN/RUSSELL CO. STP			Response:	Survival

Group ID	1	2
N Control	1.000	1.000
G1 5/23/15:00	1.000	1.000
G2 5/23/21:02	1.000	1.000
G3 5/24/03:08	1.000	1.000
G4 5/24/09:00	1.000	1.000
G1	1.000	1.000
G2	1.000	0.910
G3	1.000	1.000
G4	1.000	1.000

			Untransformed Data								
Group ID	Mean	N-Mean	Mean	Min	Max	CV%	N	Critical	MSD	NRESP	NDOSE
N Control	1.000	1.000	1.000	1.000	1.000	0.00	2				
G1 5/23/15:00	1.000	1.000	1.000	1.000	1.000	0.00	2				
G2 5/23/21:02	1.000	1.000	1.000	1.000	1.000	0.00	2				
G3 5/24/03:08	1.000	1.000	1.000	1.000	1.000	0.00	2				
G4 5/24/09:00	1.000	1.000	1.000	1.000	1.000	0.00	2				
G1	1.000	1.000	1.000	1.000	1.000	0.00	2				
G2	0.955	0.955	0.955	0.910	1.000	6.66	2				
G3	1.000	1.000	1.000	1.000	1.000	0.00	2				
G4	1.000	1.000	1.000	1.000	1.000	0.00	2				

Auxiliary Tests	Statistic	Critical	Skew	Kurt
Normality of the data set cannot be confirmed				
Equality of variances cannnot be confirmed				

Test: Acute 48 Hour Toxicity Test													
Species: PP Pimephales promelas													
Test ID: 285FE RTest ID: REFFM950503 Analyst(s): CAR,LAC,SLC,BSB													
Sample ID: KY0062995 Sample Type: EFF1 POTW													
Start Date/Time: 24 May-95 End Date/Time: 26 May-95													
			Test	Proportion	Start	Number Survived at Day							
Pos	ID	Rep	Groups	Survived	Count	1	2	3	4	5	6	End	Notes
	1	1	N Control	1.000	10	10	10						
	2	2	N Control	1.000	10	10	10						
	3	1	G1 5/23/15:00	1.000	10	10	10						21%FE
	4	2	G1 5/23/15:00	1.000	10	10	10						21%FE
	5	1	G2 5/23/21:02	1.000	10	10	10						21%FE
	6	2	G2 5/23/21:02	1.000	10	10	10						21%FE
	7	1	G3 5/24/03:08	1.000	10	10	10						21%FE
	8	2	G3 5/24/03:08	1.000	10	10	10						21%FE
	9	1	G4 5/24/09:00	1.000	10	10	10						21%FE
	10	2	G4 5/24/09:00	1.000	10	10	10						21%FE
	11	1	G1	1.000	11	11	11						100%FE
	12	2	G1	1.000	10	10	10						100%FE
	13	1	G2	1.000	10	10	10						100%FE
	14	2	G2	0.910	11	11	10						100%FE
	15	1	G3	1.000	10	10	10						100%FE
	16	2	G3	1.000	10	10	10						100%FE
	17	1	G4	1.000	10	10	10						100%FE
	18	2	G4	1.000	10	10	10						100%FE

PHILLIP J. SHEPHERD
SECRETARY

BRERETON C. JONES
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION

July 25, 1995

Honorable Donnie Wilkerson
Mayor City of Jamestown
Monument Square Box 587
Jamestown, Kentucky 42629

RE: Russell County Regional WWTP
KY0062995

Dear Mayor Wilkerson:

Please find enclosed your copy of the Compliance Sampling Inspection Report (including appropriate laboratory reports) conducted by James S. Woody of the Kentucky Division of Water at the Russell County Regional Wastewater Treatment Plant in Russell County, Kentucky on May 24, 1995. At the time of inspection your facility received a rating of Satisfactory. The analytical data from this inspection indicates compliance with your facility's KPDES permit.

If you have any questions regarding this report, please feel free to contact this office.

Sincerely,

Sara E. Gold, Supervisor
Division of Water
Columbia Regional Office
P. O. Box 335
Columbia, Kentucky 42728
Phone: (502) 384-4734

SEG/bjb

Enclosure

cc: KPDES Branch, Division of Water
Frankfort Central Office files
Columbia Regional Office files

NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DIVISION OF WATER

WASTEWATER TREATMENT PLANT INSPECTION REPORT

Facility Name Russell Co Reg WWTP County Russell

TRANS CODE		KPDES #	YR	MO	DA	TYPE	INSPECTOR	FAC TYPE
N	5	KY0062995	95	05	24	S	S	1

RATING: S

REMARKS:

Reserved	DMR RELIABILITY	BI	QA	Reserved	EMPLOYEE NO
	5				0611

RATING CODES: S = Satisfactory; U = Unsatisfactory; M = Marginal; OUT = Out of Operation

	CONDITION / APPEARANCE	RATING	COMMENTS
PRELIMINARY	Bar Screen	S	
	Disposal of Screenings	S	
	Comminutor	/	
	Grit Chamber	/	
	Disposal of Grit	/	
PRIMARY/ SECONDARY	Settling Tanks	S	
	Scum Removal / return	S	
	Sludge Removal / return	S	
	Effluent	S	
	Hydroseive	/	
SECONDARY/ TERTIARY	Trickling Filter / or RBC(s)	/	
	Aeration Tank(s)	S	
	Lagoon(s)	/	
	Filter(s)	/	
SLUDGE DISPOSAL	Digesters	S	
	Temperature & pH	/	
	Heating Equipment	/	
	Sludge Pumps	/	
	Drying Beds	/	
	Vacuum Filter	/	
	Incineration	/	
	Disposal of Sludge	S	
	Belt Press	S	
OTHER	Flowmeter and Recorder	S	
	Records	S	
	Laboratory Controls	S	
	Weir(s)	S	
	Pretreatment	S	
	Self-Monitoring Program	S	
CHLORINE	Effluent	S	pipeline to Lake
	Chlorinators	S	
	Effective Dosage	S	
	Contact Time	S	
	Contact Tank	S	
	De chlor	S	
GENERAL	Grounds	S	
	Buildings	S	
	Stream		

SUMMARY OF FINDINGS / GENERAL COMMENTS

24 Hr CSI & Bio monitoring effluent to pipeline

ph 7.6 D.O. 7.7 temp 25°
fecal coliform <2/100 ml
See attached results

IDENTIFICATION SECTION

On-Site Representative / Title: Otis Skaggs Calvin Johnson

Owner or Responsible Party / Title: City of Jamestown

Person(s) Contacted: Same

Inspector's Signature: James L Hoody

PHILLIP J. SHEPHERD
SECRETARY

BRERETON C. JONES
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF ENVIRONMENTAL SERVICES
100 SOWER BOULEVARD
SUITE 104
FRANKFORT, KY 40601

June 27, 1995

Division of Environmental Services
Report Number: A02-15520
Sample Number: 9501652

To: Division of Water
Frankfort Office Park
Frankfort, Kentucky 40601

Re: Russell County Regional WWTP

Attn: Sam Lester

County: Russell

Facility: KY0062995

Collected by: James Woody **Date:** 05/24/95 **Time:** 0930

Delivered by: Betty Beshoar **Date:** 05/24/95 **Time:** 1340

Received by: Polly Baker **Date:** 05/24/95 **Time:** 1340

Sample Matrix: Water **Collection Method:** Composite

Sample Identification: Jamestown 24 hour composite effluent to pipeline

REPORT OF ANALYSIS

TOTAL CONSTITUENTS	CONCENTRATION
BOD-5	4.85 mg/L
Chloride	856 mg/L
Color, Filtered @ ambient pH	31.1 ADMI Color Units
Color, Filtered @ pH = 7.6	34.7 ADMI Color Units
pH	8.0 S.U.
Total Suspended Solids	12 mg/L
Ammonia-Nitrogen	ND @ 0.1 mg/L
Copper	0.014 mg/L

ND = Not Detected

This report has been prepared and reviewed by personnel within the Division of Environmental Services. It has been approved for release.

William E. Davis, Director
Division of Environmental Services

PHILLIP J. SHEPHERD
SECRETARY

BRERETON C. JONES
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
DIVISION OF ENVIRONMENTAL SERVICES
100 SOWER BOULEVARD
SUITE 104
FRANKFORT, KY 40601

June 27, 1995

Division of Environmental Services
Report Number: A02-15519
Sample Number: 9501651

To: Division of Water
Frankfort Office Park
Frankfort, Kentucky 40601

Re: Russell County Regional WWTP

Attn: Sam Lester

County: Russell

Facility: KY0062995

Collected by: James Woody **Date:** 05/24/95 **Time:** 0930

Delivered by: Betty Beshoar **Date:** 05/24/95 **Time:** 1340

Received by: Polly Baker **Date:** 05/24/95 **Time:** 1340

Sample Matrix: Water **Collection Method:** Composite

Sample Identification: Jamestown Influent 24 Hour Composite CSI

REPORT OF ANALYSIS

TOTAL CONSTITUENTS	CONCENTRATION
BOD-5	244 mg/L
Chloride	1,000 mg/L
Color, Filtered @ ambient pH	961 ADMI Color Units
Color, Filtered @ pH = 7.6	856 ADMI Color Units
pH	8.2 S.U.
Total Suspended Solids	190 mg/L
Ammonia-Nitrogen	4.44 mg/L
Copper	0.047 mg/L

This report has been prepared and reviewed by personnel within the Division of Environmental Services. It has been approved for release.

William E. Davis

William E. Davis, Director
Division of Environmental Services

PHILLIP J. SHEPHERD
SECRETARY

BRERETON C. JONES
GOVERNOR

COMMONWEALTH OF KENTUCKY
NATURAL RESOURCES AND ENVIRONMENTAL PROTECTION CABINET
DEPARTMENT FOR ENVIRONMENTAL PROTECTION
FRANKFORT OFFICE PARK
14 REILLY ROAD
FRANKFORT, KENTUCKY 40601

November 17, 1994

Terry Lawless, Public Works Director
City of Jamestown
P.O. Box 99
Jamestown, Kentucky 42629

Re: Pretreatment Compliance Inspection (PCI)
City of Jamestown
KPDES No.: KY0062995
Russell County

Dear Mr. Lawless:

This is to inform you of the findings of the PCI conducted in Jamestown on November 15, 1994. The inspection indicated that your Pretreatment Program is being implemented efficiently. Both significant industrial users (SIUs) are operating under adequate permits, and have been sampled and inspected. Also, the Enforcement Response Plan (ERP) is being implemented when necessary.

I commend you and the city of Jamestown for your diligence in implementing an exemplary pretreatment program. Your thorough monitoring program has resulted in effective pretreatment on the part of your industries.

Attached is a general summary describing the findings of the PCI. Thank you for your cooperation and patience during this inspection and should you have any questions regarding this matter, please contact me at (502) 564-2225, extension 459.

Sincerely,

Sandra Gruzesky

Sandra Gruzesky, P.E
Environmental Engineer
Pretreatment Section
KPDES Branch
Division of Water

SG:mm

Attachment

c: Cynthia Brumfield, Hall & Associates, Inc.
Columbia Regional Office
Municipal Compliance Section
Division of Water Files

APPENDIX C
WATER QUALITY DATA

CITY OF JAMESTOWN
SAMPLING RESULTS

WATER

PARAMETER	UNITS	Above Wolf Creek Site #1				Out of Nozzle Site #2			7' From End of Nozzle Site #2		
		Background #42391 09/14/94	Sample 1 SW #42392 9/16/94	Sample 2 SW #42394 9/16/94	Sample 3 SW #42396 9/16/94	D-1 SW #42385 9/12/94	D-2 SW #42386 9/12/94	D-3 SW #42387 9/12/94	D-1 SW #42388 9/12/94	D-2 SW #42389 9/12/94	D-3 SW #42390 9/12/94
Arsenic	mg/l	< 0.001	< 0.001	< 0.001	< 0.01	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Chloride	mg/l	2.39	2.01	2.3	2.3	970	942	940	37.2	25.5	84.8
Copper-Total	mg/l	< 0.006	< 0.006	< 0.006	< 0.006	0.04	0.04	0.07	< 0.006	< 0.006	0.007
Lead	mg/l	0.009	0.009	0.01	< 0.006	0.01	< 0.006	< 0.006	< 0.006	0.007	0.008
Mercury	mg/l	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Nickel	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	0.02	0.02	0.03	0.01	0.01	< 0.01
pH	su	7.18	6.96	6.96	7.09	7.96	7.85	7.64	7.06	7.05	7.14
Specific Conductivity	UMHO/cm	127	127	129	128	3080	2880	2940	230	191	411
Bromodichloromethane	ug/l	ND< 5			ND< 5				ND< 5	ND< 5	
Bromoform	ug/l	ND< 5			ND< 5				ND< 5	ND< 5	
Chlorodibromomethane	ug/l	ND< 5			ND< 5				ND< 5	ND< 5	
Chloroform	ug/l	ND< 5			ND< 5				ND< 5	ND< 5	
FIELD											
pH	S.U.	8.49			7.87				7.66	7.85	6.67
Temp.	Deg. C	23.4			22				18.4	16.8	15.3
D.O.	mg/l	3.5			0.74				1.78	2.23	2.95
Cond.	MHO/cm	0.198			0.192				0.25	0.21	0.26
Chlorides	mg/l	5			11.5				70	50	45
Depth	ft.	40			40				56	61	

CITY OF JAMESTOWN
SAMPLING RESULTS

WATER

PARAMETER	UNITS	70' From End of Nozzle Site #2			200' From End of Nozzle Site #2			1500' Lake C	1500' Lake C	1500' Lake C	1500' Lake C
		D-1 SW #42380 9/13/94	D-2 SW #42382 9/13/94	D-3 SW #42384 9/13/94	D-1 SW #42379 9/13/94	D-2 SW #42381 9/13/94	D-3 SW #42383 9/13/94	Transect 2 #42966 9/20/94	Transect 3 #42967 9/20/94	Transect 4 #42968 9/21/94	Transect 5 #42969 9/21/94
Arsenic	mg/l	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Chloride	mg/l	14.2	19.8	11.1	16.4	11.5	20.4				
Copper-Total	mg/l	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
Lead	mg/l	0.01	0.009	0.03	0.007	0.008	< 0.006	0.03	0.02	0.02	0.03
Mercury	mg/l	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Nickel	mg/l	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01
pH	su	7.25	7.25	7.49	7.31	7.38	7.47				
Specific Conductivity	UMHO/cm	153	175	146	169	151	179				
Bromodichloromethane	ug/l	ND< 5	ND< 5	ND< 5	ND< 5	ND< 5	ND< 5				
Bromoform	ug/l	ND< 5	ND< 5	ND< 5	ND< 5	ND< 5	ND< 5				
Chlorodibromomethane	ug/l	ND< 5	ND< 5	ND< 5	ND< 5	ND< 5	ND< 5				
Chloroform	ug/l	ND< 5	ND< 5	ND< 5	ND< 5	ND< 5	ND< 5				
FIELD											
pH	S.U.	7.7	7.53	6.98	7.19			7.55	7.86	7.68	7.82
Temp.	Deg. C	17.6	17.5	14	15.2			14.2	20	19.8	20.3
D.O.	mg/l	0.84	1.04	2.8	2.18			1.64	0.62	0.78	0.51
Cond.	MHO/cm	0.242	0.274	0.248	0.258			0.19	0.182	0.184	0.184
Chlorides	mg/l	45	65	53	40			12.5	2.5	4	6
Depth	ft.	50	53	67.8	61			69	49	60	50

CITY OF JAMESTOWN
SAMPLING RESULTS

WATER

PARAMETER	UNITS	Site #3	
		Sample 1 SW #42398 9/14/94	Sample 2 SW #42400 9/15/94
Arsenic	mg/l	< 0.001	< 0.001
Chloride	mg/l	2.62	3.57
Copper–Total	mg/l	< 0.006	< 0.006
Lead	mg/l	< 0.006	0.009
Mercury	mg/l	< 0.001	< 0.001
Nickel	mg/l	< 0.01	< 0.01
pH	su	6.94	6.85
Specific Conductivity	UMHO/cm	119	130
Bromodichloromethane	ug/l	ND< 5	
Bromoform	ug/l	ND< 5	
Chlorodibromomethane	ug/l	ND< 5	
Chloroform	ug/l	ND< 5	
FIELD			
pH	S.U.		
Temp.	Deg. C		
D.O.	mg/l		
Cond.	MHO/cm		
Chlorides	mg/l		
Depth	ft.		

CITY OF JAMESTOWN
SAMPLING RESULTS

WATER

PARAMETER	Site #1			From Nozzle Site #2			D1 7' Site #2			D2 7' Site #2		
	Sample 1 #42664 10/12/94	Sample 2 #42665 10/12/94	Sample 3 #42666 10/12/94	D1 #42688 10/10/94	D2 #42689 10/10/94	D3 #42690 10/10/94	Sample 1 #42676 10/10/94	Sample 2 #42677 10/10/94	Sample 3 #42678 10/10/94	Sample 1 #42670 10/12/94	Sample 2 #42671 10/12/94	Sample 3 #42672 10/12/94
Arsenic (mg/L)	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025
Chloride (mg/L)	3.26	3.32	3.26	1374	1408	1461	166	171	203	32	9.57	9.59
Copper-Total (mg/L)	< 0.006	< 0.006	< 0.006	0.02	0.03	0.02	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
Lead (mg/L)	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	0.06	< 0.006	< 0.006
Mercury (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Nickel (mg/L)	< 0.01	0.01	0.01	0.04	0.03	0.03	0.01	0.01	0.01	0.01	< 0.01	< 0.01
FIELD												
pH (S.U.) 2.0	7.60	7.53	7.45				8.29				7.59	
Temp. (degrees C)	16.3	16.5	16.4				21.7				18.1	
D.O. (mg/l)	0.75	0.67	0.66				5.58				.21	
Cond. (MHO/cm)	0.172	0.170	0.172				1.116				1.01	
Chlorides (mg/l)	3.5	3.5	3.5				170				70	
Depth (ft.)	60	60	60				47				63	

CITY OF JAMESTOWN
SAMPLING RESULTS

WATER

PARAMETER	D3 7' Site #2			D1 70' Site #2			D2 70' Site #2			D3 70' Site #2		
	Sample 1 #42685 10/10/94	Sample 2 #42686 10/10/94	Sample 3 #42687 10/10/94	Sample 1 #42679 10/12/94	Sample 2 #42680 10/12/94	Sample 3 42681 10/12/94	Sample 1 42673 10/12/94	Sample 2 #42674 10/12/94	Sample 3 #42675 10/12/94	Sample 1 #42682 10/12/94	Sample 2 #42683 10/12/94	Sample 3 #42684 10/12/94
Arsenic (mg/L)	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025	< 0.025
Chloride (mg/L)	151	175	140	8.38	8.38	9.06	9.44	8.65	8.93	16	8.21	13.8
Copper-Total (mg/L)	0.007	0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
Lead (mg/L)	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
Mercury (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Nickel (mg/L)	< 0.01	< 0.01	0.01	< 0.01	< 0.01	0.01	0.01	< 0.01	0.01	< 0.01	0.01	0.01
FIELD												
pH (S.U.) 2.0	7.53				7.65		7.87			7.41		
Temp. (degrees C)	15.1				15.9		15.9			16.1		
D.O. (mg/l)	2.33				.69		0.80			0.70		
Cond. (MHO/cm)	.824				.196		0.20			.216		
Chlorides (mg/l)	175				10		9.5			16.5		
Depth (ft.)	70				50		60			60		

CITY OF JAMESTOWN
SAMPLING RESULTS

WATER

PARAMETER	500' 55' Deep Transect 1 #42974 10/18/94	500' 55' Deep Transect 2 #42973 10/18/94	1000' 60' Deep Transect 3 #42971 10/18/94	1000' Lake C Transect 4 #42970 10/18/94	1000' 60' Deep Transect 5 #42972 10/18/94	500' Site #3 Sample 1 #42667 10/12/94	500' Site #3 Sample 2 #42668 10/12/94	500' Site #3 Sample 3 #42669 10/12/94
Arsenic (mg/L)	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.025	< 0.025	< 0.025
Chloride (mg/L)						3.61	3.52	3.31
Copper-Total (mg/L)	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
Lead (mg/L)	0.008	0.01	0.01	0.02	0.02	< 0.006	< 0.006	< 0.006
Mercury (mg/L)	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Nickel (mg/L)	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
FIELD								
pH (S.U.) 2.0	7.33	7.67	7.74	7.85	7.47	7.35	7.30	7.45
Temp. (degrees C)	15.7	20.3	17.1	17.1	15.8	16.4	16.2	15.7
D.O. (mg/l)	0.66	5.82	0.66	0.65	0.68	1.1	1.1	1.58
Cond. (MHO/cm)	0.228	.276	0.172	0.182	0.186	.170	.170	0.170
Chlorides (mg/l)	15	23	3.5	3.0	4.5	6.5	6.5	5.5
Depth (ft.)	55	55	60	62	60	60	60	60

CITY OF JAMESTOWN
SAMPLING RESULTS

WATER

PARAMETER	UNITS	Above Wolf Creek Site #1			7' From End of Nozzle Site #2								
		Sample 1 #45759 02/22/95	Sample 2 #45760 02/22/95	Sample 3 #45761 02/22/95	D-1 Sample 1 #45762 02/22/95	D-1 Sample 2 #45763 02/22/95	D-1 Sample 3 #45764 02/22/95	D-2 Sample 1 # 45771 02/22/95	D-2 Sample 2 # 45772 02/22/95	D-2 Sample 3 # 45773 02/22/95	D-3 Sample 1 #45780 02/22/95	D-3 Sample 2 # 45781 02/22/95	D-3 Sample 3 # 45782 02/22/95
Arsenic - Total	mg/l	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Copper-Total	mg/l	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
Lead - Total	mg/l	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
Mercury - Total	mg/l	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Nickel - Total	mg/l	0.0100	0.0100	0.0100	0.0100	0.0200	0.0100	0.00700	0.0100	0.0100	0.0100	0.00700	< 0.006
FIELD													
pH	S.U.	8.36	8.36	8.36	8.22	8.22	8.22	8.18	8.18	8.18	8.12	8.12	8.12
Temp.	Deg. C	5.7 Deg. C	5.7 Deg. C	5.7 Deg. C	5.7 Deg. C	5.7 Deg. C	5.7 Deg. C	6.0 Deg. C	6.0 Deg. C	6.0 Deg. C	6.0 Deg. C.	6.0 Deg. C.	6.0 Deg. C.
D.O.	mg/l	11.36	11.36	11.36	11.15	11.15	11.15	10.09	10.09	10.09	8.83	8.83	8.83
Cond.	MHO/cm	0.176	0.176	0.176	0.24	0.24	0.24	0.286	0.286	0.286	0.28	0.28	0.28
Chlorides	mg/l	2.5	2.5	2.5	4.0	18.0	9.0	11	14	5	8	4	8.5
Depth	ft.	70'	70'	70'	57'	57'	57'	61'	61'	61'	71'	71'	71'

CITY OF JAMESTOWN
SAMPLING RESULTS

WATER

PARAMETER	UNITS	70' From End of Nozzle Site #2									Site #3		
		D-1 Sample 1 #45765 02/20/95	D-1 Sample 2 #45766 02/22/95	D-1 Sample 3 #45767 02/22/95	D-2 Sample 1 # 45774 02/22/95	D-2 Sample 2 # 45775 02/22/95	D-2 Sample 3 # 45776 02/22/95	D-3 Sample 1 #45783 02/22/95	D-3 Sample 2 # 45784 02/22/95	D-3 Sample 3 # 45785 02/22/95	Sample 1 #45789 02/22/95	Sample 2 #45790 02/22/95	Sample 3 # 45791 02/22/95
Arsenic - Total	mg/l	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Copper-Total	mg/l	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
Lead - Total	mg/l	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
Mercury - Total	mg/l	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Nickel - Total	mg/l	0.0100	0.0100	0.0100	0.0100	0.0100	0.00900	0.0100	0.00900	0.0100	0.0100	0.00900	0.00800
FIELD													
pH	S.U.	8.08	8.08	8.08	7.98	7.98	7.98	7.96	7.96	7.96	8.16	8.16	8.16
Temp.	Deg. C	5.7 Deg. C	5.7 Deg. C	5.7 Deg. C	5.7 Deg. C.	5.7 Deg. C.	5.7 Deg. C.	5.7 Deg. C.	5.7 Deg. C.	5.7 Deg. C.	5.7 Deg. C.	5.7 Deg. C.	5.7 Deg. C.
D.O.	mg/l	9.66	9.66	9.66	9.82	9.82	9.82	9.14	9.14	9.14	9.31	9.31	9.31
Cond.	MHO/cm	0.186	0.186	0.186	0.198	0.198	0.198	0.204	0.204	0.204	0.196	0.196	0.196
Chlorides	mg/l	3.0	3.0	3.0	3	2.5	2.5	3.5	3.5	3.5	3.5	2.5	2.5
Depth	ft.	80'	80'	80'	100'	100'	100'	100'	100'	100'	100'	100'	100'

CITY OF JAMESTOWN
SAMPLING RESULTS

WATER

PARAMETER	UNITS	400' From Shore	1,000' From Shore				
		Transect 1 # 45753 02/14/95	Transect 2 # 45754 02/14/95	Transect 3 # 45755 02/14/95	Transect 4 # 45756 02/14/95	Transect 5 # 45757 02/14/95	Transect 6 # 45758 02/14/95
Arsenic - Total	mg/l	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005	< 0.005
Copper-Total	mg/l	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
Lead - Total	mg/l	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006	< 0.006
Mercury - Total	mg/l	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Nickel - Total	mg/l	0.0100	0.0100	0.0100	0.0100	0.0100	0.0100
FIELD							
pH	S.U.	7.87	7.93	7.95	7.97	7.98	7.98
Temp.	Deg. C	6.0	6.0	6.0	6.1	6.1	6.0
D.O.	mg/l	12.4	14.5	12.99	11.49	10.57	11.01
Cond.	MHO/cm	0.222	0.218	0.220	0.220	0.222	0.218
Chlorides	mg/l	3.0	3.0	3.0	3.0	3.0	2.5
Depth	ft.	53.5	53.5	60	50	50	50

APPENDIX D
VERTICAL PROFILE DATA FROM THE U.S. ARMY CORPS OF ENGINEERS AT THREE SITES IN LAKE CUMBERLAND
August 1994
June 1995

Site at River Mile 487.0, approximately 11 miles upstream of RCRWWTP discharge, 8/30/94

401SUM AURAS WATER QUALITY DATA NASHVILLE DISTRICT CORPS OF ENGINEERS

CUMBERLAND RIVER BASIN LAKE CUMBERLAND 052000 CUMBERLAND RIVER, MILE 487.0 KENTUCKY STAT 3WOL20004

DATE: 30 AUG 94 TIME: 1330NOMINAL 00078 SECCHI : 3.7 72020 ELEV AB.MSL : 708.1
72025 MAX DEPTH: 141

RESULTS OF LABORATORY ANALYSES

SAMPLE DEPTH FEET	000	035	070	100	130
00410 T.ALK	42	50	36	36	38
00415 P.ALK	0	0	0	0	0
00500 T.SOLID	134	164	136	128	80
00505 V.SOLID	18	40	26	36	28
00515 D.SOLID	133	164	135	126	78
00520 DVSOLID	17	40	25	35	27
00530 S.SOLID	1	0	1	2	2
00535 SVSOLID	1	0	1	1	1
00610 T-NH3-N	L 0.1	L 0.1	L 0.1	L 0.1	L 0.1
00625 TKN	0.6	0.7	0.6	0.3	0.6
00630 TNO3+NO2	0.1	0.4	0.5	0.7	0.6
00665 T. Phos	L 10	L 10	L 10	L 10	L 10
00900 T.HARD	72	86	66	62	62
00915 Ca Diss.	18.4	21.6	16.8	16.9	16.5
00916 Ca Tot.	18.3	20.7	16.6	16.6	15.6
00925 Mg Diss.	6.2	7.4	5.8	5.5	5.5
00927 Mg Tot.	6.7	7.6	6.0	5.7	5.6
00929 Na Tot.	5.7	7.5	4.0	3.4	3.4
00930 Na Diss.	4.8	7.3	3.8	3.8	3.3
00935 K Diss.	1.3	1.8	1.4	1.4	1.3
00937 K Tot.	1.6	1.9	1.5	1.4	1.4
00945 SULFATE	33	38	30	26	26
01005 Ba Diss.	18	25	20	17	16
01007 Ba Tot.	21	27	20	18	17
01010 Be Diss.	3	1	1	2	1
01012 Be Tot.	1	1	1	1	1
01045 Fe Tot.	15	59	109	127	97
01046 Fe Diss.	10	21	9	9	6
01055 Mn Tot.	L 4	9	14	72	63
01056 Mn Diss.	L 4	L 4	11	9 L	4
01090 Zn Diss.	11	17	18	30	32
01092 Zn Tot.	10	123	93	160	39
01095 An Diss.	8	6 L	6	8 L	6
01097 An Tot.	13 L	6	9 L	6 L	6
01105 Al Tot.	75	46	109	108	126
01106 Al Diss.	L 24	L 24	L 24	L 24	L 24

PROFILES

DEP FT	00010 TEMP C.	00094 SP.COND	00299 O2 Diss.	00301 O2 Satd.	00400 PH	32210 CHLOR
000	28.7	203	8.2	106.	8.5	1
005	27.5	202	8.3	105.	8.6	1
010	27.4	202	8.3	105.	8.6	1
015	27.3	201	8.3	104.	8.6	2
020	27.3	203	8.1	102.	8.5	2
025	27.2	202	8.0	101.	8.5	2
030	26.5	229	5.2	65.	7.8	
035	23.1	236	0.4	5.	7.4	
040	20.6	216	0.6	7.	7.2	
045	18.6	204	1.5	16.	7.1	
050	17.1	193	1.6	17.	7.1	
055	15.9	186	2.1	21.	7.1	
060	14.9	181	2.8	28.	7.1	
065	13.5	174	3.7	36.	7.1	
070	13.0	171	4.0	38.	7.1	
075	12.0	166	4.0	37.	7.1	
080	11.3	164	3.7	34.	7.0	
085	11.0	164	3.6	33.	7.0	
090	10.4	162	3.4	31.	7.0	
095	10.1	162	3.2	29.	7.0	
100	9.8	163	3.1	27.	7.0	
105	9.6	162	3.1	27.	7.0	
110	9.5	162	3.2	28.	7.0	
115	9.2	162	3.4	30.	7.0	
120	9.0	162	3.6	31.	7.0	
125	8.8	162	3.9	34.	7.0	
130	8.7	162	4.0	34.	7.0	
135	8.6	162	3.7	32.	7.0	

Site at River Mile 487,0, approximately 11 miles upstream of RCRWWTP discharge, 6/20/95

401SUM AURAS WATER QUALITY DATA NASHVILLE DISTRICT CORPS OF ENGINEERS

CUMBERLAND RIVER BASIN LAKE CUMBERLAND 052000 CUMBERLAND RIVER, MILE 487.0 KENTUCKY STAT 3WOL20004

DATE: 20 JUN 95 TIME: 0930NOMINAL 00078 SECCHI : 3.3 72020 ELEV AB.MSL : 723.1
72025 MAX DEPTH: 161

RESULTS OF LABORATORY ANALYSES

SAMPLE DEPTH FEET	000	040	090	150
00410 T.ALK	50	40	42	40
00415 P.ALK	6	0	0	0

PROFILES

DEP FT	00010 TEMP C.	00094 SP.COND	00299 O2 Diss.	00301 O2 Satd.	00400 PH
000	25.9	184	9.1	112.	9.0
005	25.9	182	9.2	113.	9.0
010	25.8	182	9.2	113.	9.0
015	24.7	182	10.5	126.	9.0
020	21.8	188	6.8	78.	8.1
025	20.1	175	5.6	62.	7.8
030	18.4	156	5.6	60.	7.7
035	17.4	148	5.6	59.	7.6
040	16.5	144	5.9	61.	7.6
045	16.0	142	6.3	64.	7.5
050	15.7	143	6.2	63.	7.4
055	15.4	143	6.4	64.	7.4
060	15.1	146	6.7	67.	7.4
065	14.7	157	6.8	67.	7.4
070	14.2	165	6.8	67.	7.3
075	13.7	167	6.9	67.	7.3
080	13.1	174	7.1	68.	7.3
085	12.1	170	7.4	69.	7.3
090	11.0	165	7.5	68.	7.3
095	8.4	161	7.3	62.	7.3
100	8.2	159	7.3	62.	7.2
105	8.1	159	7.3	62.	7.2
110	7.9	159	7.4	62.	7.2
115	7.7	160	7.5	63.	7.2
120	7.5	161	7.7	64.	7.2
125	7.4	162	7.8	65.	7.1
130	7.4	162	7.8	65.	7.1
135	7.3	161	7.8	65.	7.1
140	7.3	161	7.8	65.	7.1
145	7.3	161	7.7	64.	7.1
150	7.2	162	7.7	64.	7.1
155	7.2	163	7.6	63.	7.1
160	7.2	162	7.6	63.	7.1

Site at River Mile 469.7, six miles downsteam of RCRWWTP discharge, 8/30/94

401SUM AURAS WATER QUALITY DATA NASHVILLE DISTRICT CORPS OF ENGINEERS

CUMBERLAND RIVER BASIN LAKE CUMBERLAND 052000 CUMBERLAND RIVER, MILE 469.7 KENTUCKY STAT 3WOL20003

DATE: 30 AUG 94 TIME: 1130 00078 SECCHI : 4.0 72020 ELEV AB.MSL : 708.1
72025 MAX DEPTH: 156

RESULTS OF LABORATORY ANALYSES

PROFILES

SAMPLE DEPTH FEET	** DEP FT	00010 TEMP C.	00094 SP.COND	00299 O2 Diss.	00301 O2 Satd.	00400 PH
	** 000	27.6	182	8.1	102.	8.4
	** 005	27.4	183	8.0	101.	8.4
	** 010	27.2	182	8.1	102.	8.4
	** 015	27.2	182	8.2	103.	8.5
	** 020	27.1	183	8.1	102.	8.4
	** 025	26.8	189	6.5	81.	7.9
	** 030	25.1	216	3.8	46.	7.5
	** 035	23.2	223	1.4	16.	7.2
	** 040	21.0	199	2.2	25.	7.2
	** 045	19.3	184	1.9	21.	7.1
	** 050	17.3	171	1.5	16.	7.0
	** 055	15.6	165	2.2	22.	7.0
	** 060	14.6	171	3.2	32.	7.0
	** 065	13.6	176	4.1	40.	7.0
	** 070	12.9	166	4.5	43.	7.0
	** 075	12.4	161	4.8	45.	7.0
	** 080	12.0	157	5.0	47.	7.0
	** 085	11.0	156	5.1	46.	7.0
	** 090	10.5	158	5.3	48.	7.0
	** 095	10.0	160	5.2	46.	7.0
	** 100	9.6	157	4.6	40.	7.0
	** 105	9.5	159	4.6	40.	7.0
	** 110	9.4	159	4.5	39.	7.0
	** 115	9.3	160	4.5	39.	7.0
	** 120	9.2	160	4.4	38.	7.0
	** 125	8.9	161	4.3	37.	7.0
	** 130	8.8	162	4.2	36.	7.0
	** 135	8.6	162	3.9	34.	7.0
	** 140	8.5	164	3.7	32.	7.0
	** 145	8.4	164	3.3	28.	6.9
	** 150	8.3	165	3.2	27.	6.9
	** 155	8.2	166	3.2	27.	6.9
	**					

Site at River Mile 469.7, six miles downstream of RCRWWTP discharge, 6/20/95

401SUM AURAS WATER QUALITY DATA NASHVILLE DISTRICT CORPS OF ENGINEERS

CUMBERLAND RIVER BASIN LAKE CUMBERLAND 052000 CUMBERLAND RIVER, MILE 469.7 KENTUCKY STAT 3WOL20003

DATE: 20 JUN 95 TIME: 1145NOMINAL 00078 SECCHI : 5.1 72020 ELEV AB.MSL : 723.1
72025 MAX DEPTH: 183

RESULTS OF LABORATORY ANALYSES

PROFILES

SAMPLE DEPTH FEET	DEP FT	00010 TEMP C.	00094 SP.COND	00299 O2 Diss.	00301 O2 Satd.	00400 PH
	000	25.7	180	8.7	107.	8.8
	005	25.4	180	8.7	106.	8.7
	010	25.3	180	8.6	105.	8.7
	015	25.3	181	8.6	105.	8.7
	020	21.5	177	9.2	104.	8.3
	025	19.8	168	7.0	77.	7.8
	030	18.2	170	5.6	60.	7.6
	035	17.2	161	5.3	55.	7.5
	040	16.6	152	5.5	57.	7.5
	045	16.1	150	5.7	58.	7.5
	050	15.7	147	6.2	63.	7.4
	055	15.4	155	6.4	64.	7.3
	060	15.1	163	6.5	65.	7.3
	065	14.8	166	6.7	66.	7.3
	070	14.6	170	6.7	66.	7.3
	075	13.7	180	6.8	66.	7.3
	080	12.6	180	7.0	66.	7.3
	085	11.8	178	7.1	66.	7.2
	090	10.3	174	7.5	67.	7.2
	095	8.8	166	7.9	68.	7.2
	100	8.0	164	8.0	68.	7.2
	105	7.8	164	8.0	67.	7.2
	110	7.4	167	8.0	67.	7.2
	115	7.2	169	8.0	66.	7.2
	120	7.2	169	7.9	65.	7.2
	130	7.1	171	7.8	65.	7.1
	140	7.1	173	7.7	64.	7.1
	150	7.0	174	7.6	63.	7.1
	160	7.0	175	7.6	63.	7.1
	170	7.0	175	7.5	62.	7.1
	180	7.0	175	7.5	62.	7.1

Site at River Mile 461.4 at dam, 14 miles downstream of RCRWWTP discharge, 6/20/95

401SUM AURAS WATER QUALITY DATA NASHVILLE DISTRICT CORPS OF ENGINEERS

CUMBERLAND RIVER BASIN LAKE CUMBERLAND 052000 CUMBERLAND RIVER, MILE 461.4 KENTUCKY STAT 3WOL20002

DATE: 20 JUN 95 TIME: 1300NOMINAL 00078 SECCHI : 5.4 72020 ELEV AB.MSL : 723.1
72025 MAX DEPTH: 182

RESULTS OF LABORATORY ANALYSES

SAMPLE DEPTH FEET	000	040	100	170
00410 T.ALK	46	46	44	46
00415 P.ALK	2	0	0	0

PROFILES

DEP FT	00010 TEMP C.	00094 SP.COND	00299 O2 Diss.	00301 O2 Satd.	00400 PH
000	26.5	181	8.2	102.	8.7
005	25.9	180	8.3	102.	8.7
010	25.7	180	8.3	102.	8.6
015	25.6	180	8.3	101.	8.6
020	23.1	182	10.2	119.	8.8
025	20.1	182	9.5	105.	8.4
030	18.9	184	8.7	94.	8.1
035	17.3	181	6.2	65.	7.8
040	16.7	172	5.9	61.	7.7
045	16.2	165	6.0	61.	7.6
050	15.8	171	6.1	62.	7.5
055	15.6	172	6.3	64.	7.5
060	15.3	173	6.4	64.	7.4
065	15.0	177	6.5	65.	7.4
070	14.4	182	6.6	65.	7.4
075	13.3	184	6.9	66.	7.4
080	12.7	181	7.1	67.	7.4
085	11.6	178	7.3	67.	7.3
090	10.6	177	7.5	68.	7.3
095	9.3	175	7.8	68.	7.3
100	8.7	172	8.0	69.	7.3
105	8.0	180	8.1	69.	7.3
110	7.5	179	8.2	69.	7.3
115	7.3	178	8.0	66.	7.2
120	7.2	178	8.0	66.	7.2
125	7.2	178	8.0	66.	7.2
130	7.2	179	8.0	66.	7.2
135	7.2	179	7.9	65.	7.2
140	7.1	179	7.9	65.	7.2
145	7.1	179	7.9	65.	7.2
150	7.1	179	7.8	65.	7.2
155	7.1	180	7.8	65.	7.1
160	7.1	180	7.8	65.	7.1
165	7.1	181	7.8	65.	7.1
170	7.1	181	7.8	65.	7.1
175	7.1	181	7.8	65.	7.1
180	7.1	180	7.7	64.	7.1

APPENDIX E
FISH TISSUE DATA

FISH TISSUE ANALYSIS - SAMPLING PERIOD
STATION 2

		May 17 - 19, 1994								
		Station 2 2 Alewives 17 - 19.5 cm	Station 2 20 Alewives Avg. 9 cm	Station 2 20 Alewives Avg. 9 cm	Station 2 20 Alewives Avg. 9 cm.	Station 2 1 Alewive 18.5 cm	Station 2 Striped Bass 26.5 cm	Station 2 20 Alewives Avg. 9 cm	Station 2 20 Alewives Average 9 cm	Station 2 2 Alewives 17, 18.5 cm
Chlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Oxychlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Trans-chlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Cis-chlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Trans-nonachlor	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Alpha-chlordene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chlordene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Gamma-chlordene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Cis-nonachlor	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
PCB, Aroclor-1016/1242	mg/kg	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250
PCB, Aroclor	mg/kg	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250
PCB, Aroclor-1232	mg/kg	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250
PCB, Aroclor-1248	mg/kg	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250
PCB, Aroclor-1254	mg/kg	<0.250	<0.250	<0.250	<0.440	<0.250	<0.250	<0.250	<0.250	<0.250
PCB, Aroclor-1260	mg/kg	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250
Lipids, Total	% Total Wt.	4.000	8.000	6.000	7.000	5.000	10.000	6.000	7.000	7.000
Total Arsenic (Furnace)	mg/kg	<0.100	<0.100	<0.100	<0.100	<0.100	0.140	0.240	<0.100	<0.100
Total Copper (ICP)	mg/kg	1.000	<1.000	1.000	1.000	1.000	<1.000	<1.000	<1.000	<1.000
Total Mercury (Cold Vapor)	mg/kg	0.280	<0.270	0.280	0.270	0.990	0.280	0.400	0.220	2.400
Total Nickel (ICP)	mg/kg	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	2.000	<2.000
Total Lead (ICP)	mg/kg	<10.000	<10.000	<10.000	<10.000	10.000	<10.000	<10.000	<10.000	<10.000

FISH TISSUE ANALYSIS - SAMPLING PERIOD
STATION 4

		May 17 - 19, 1994											
		Station 4 20 Alewives Avg. 9.5 cm	Station 4 20 Alewives Avg. 9.5 cm	Station 4 20 Alewives Avg. 9 cm	Station 4 3 Alewives 18 cm	Station 4 20 Alewives 9 cm	Station 4 2 Alewives 18, 19.5 cm	Station 4 Walleye Fillet	Station 4 Walleye, Whole Body, 3 lb	Station 4 Catfish Fillet, 3.75	Station 4 Catfish, Whole Body, 3.75 lb	Station 4 Catfish Fillet, 3 lb	Station 4 Catfish, Whole Body, 3 lb
Chlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Oxychlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Trans-chlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Cis-chlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Trans-nonachlor	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Alpha-chlordene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chlordene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Gamma-chlordene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Cis-nonachlor	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
PCB, Arodor-1016/1242	mg/kg	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250
PCB, Arodor	mg/kg	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250
PCB, Arodor-1232	mg/kg	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250
PCB, Arodor-1248	mg/kg	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250
PCB, Arodor-1254	mg/kg	<0.250	<0.290	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250
PCB, Arodor-1260	mg/kg	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250
Lipids, Total	% Total Wt.	8.000	8.000	5.000	8.000	7.000	7.000	3.000	11.000	3.000	6.000	8.000	10.000
Total Arsenic (Furnace)	mg/kg	<0.100	0.810	<0.100	0.100	0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Total Copper (ICP)	mg/kg	<1.000	1.000	<1.000	<1.000	<1.000	1.000	<1.000	1.000	<1.000	1.000	1.000	1.000
Total Mercury (Cold Vapor)	mg/kg	0.310	0.210	<0.270	0.310	0.260	0.300	0.250	0.310	0.390	0.220	0.220	0.260
Total Nickel (ICP)	mg/kg	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000	<2.000
Total Lead (ICP)	mg/kg	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000	<10.000

FISH TISSUE ANALYSIS - SAMPLING PERIOD
STATION 2

		October 19 - 20, 1994				
		Station 2 3 lb Catfish Fillet	Station 2 3 lb Catfish Whole Body	Station 2 3 lb 12 oz. Catfish Whole Body	Station 2 3 lb 12 oz. Catfish Fillet	Station 2 30 cm Shad Whole Body
Chlordane	mg/kg	<0.050	<0.050	0.215	<0.100	<0.050
Oxychlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
Trans-chlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
Cis-chlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
Trans-nonachlor	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
Alpha-chlordene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
Chlordene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
Gamma-chlordene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
Cis-nonachlor	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050
PCB, Aroclor-1016/1242	mg/kg	<0.500	<0.500	<0.750	<0.250	<0.250
PCB, Aroclor	mg/kg	<0.500	<0.500	<0.750	<0.250	<0.250
PCB, Aroclor-1232	mg/kg	<0.500	<0.500	<0.750	<0.250	<0.250
PCB, Aroclor-1248	mg/kg	<0.500	<0.500	<0.750	<0.250	<0.250
PCB, Aroclor-1254	mg/kg	<0.500	<0.500	<0.750	<0.250	<0.250
PCB, Aroclor-1260	mg/kg	<0.500	<0.500	<0.750	<0.250	<0.250
Lipids, Total	% Total Wt.	6.000	16.000	14.000	12.000	5.000
Total Arsenic (Furnace)	mg/kg	<0.100	<0.100	<0.100	<0.100	<0.100
Total Copper (ICP)	mg/kg	<1.000	<1.000	<0.850	<1.000	<1.000
Total Mercury (Cold Vapor)	mg/kg	<0.290	0.030	0.070	0.030	<0.270
Total Nickel (ICP)	mg/kg	<2.000	<2.000	<1.700	<2.000	<2.000
Total Lead (ICP)	mg/kg	<5.000	<5.000	<4.200	<5.000	<5.000

FISH TISSUE ANALYSIS - SAMPLING PERIOD
STATION 3

		May 17 - 19, 1994		October 19 - 20, 1994				
		Station 3 3 Alewives 16, 17, 17.5	Station 3 20 Alewives Avg. 9 cm	Station 3 7 Alewives Whole Body	Station 3 68 cm Garr Whole Body	Station 3 41 cm Walleye Whole Body	Station 3 41 cm Walleye Fillet	Station 3 32.5 cm Shad Whole Body
Chlordane	mg/kg	<0.050	<0.050	<0.050	0.087	0.160	<0.050	<0.050
Oxychlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.100	<0.050	<0.100
Trans-chlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Cis-chlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Trans-nonachlor	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Alpha-chlordene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chlordene	mg/kg	<0.050	<0.050	<0.100	<0.050	<0.050	<0.050	<0.050
Gamma-chlordene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Cis-nonachlor	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
PCB, Aroclor-1016/1242	mg/kg	<0.250	<0.250	<0.500	<0.500	<0.750	<0.250	<0.250
PCB, Aroclor	mg/kg	<0.250	<0.250	<0.500	<0.500	<0.750	<0.250	<0.250
PCB, Aroclor-1232	mg/kg	<0.250	<0.250	<0.500	<0.500	<0.750	<0.250	<0.250
PCB, Aroclor-1248	mg/kg	<0.250	<0.250	<0.500	<0.500	<0.750	<0.250	<0.250
PCB, Aroclor-1254	mg/kg	0.380	<0.250	<0.500	<0.500	<0.750	<0.250	<0.250
PCB, Aroclor-1260	mg/kg	<0.250	<0.250	<0.500	<0.500	<0.750	<0.250	<0.250
Lipids, Total	% Total Wt.	7.000	7.000	7.000	11.000	9.000	1.000	5.000
Total Arsenic (Furnace)	mg/kg	0.120	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Total Copper (ICP)	mg/kg	1.000	<1.000	<0.790	1.000	<1.000	<0.930	<0.960
Total Mercury (Cold Vapor)	mg/kg	0.310	0.890	<0.260	0.600	0.360	0.560	<0.270
Total Nickel (ICP)	mg/kg	<2.000	<2.000	<1.600	4.000	<2.000	<1.900	<1.900
Total Lead (ICP)	mg/kg	<10.000	<10.000	<4.000	<5.000	<5.000	<4.700	<4.800

FISH TISSUE ANALYSIS - SAMPLING PERIOD
STATION 4

		October 19 - 20, 1994												
		Station 4 2 lbs. 12 oz. Catfish Fillet	Station 4 2 lbs. 12 oz. Catfish Whole	Station 4 81 cm Garr Whole Body	Station 4 3 lb Walleye Fillet	Station 4 3 lb Walleye Whole Body	Station 4 56 cm Garr Whole Body	Station 4 57 cm Garr Whole Body	Station 4 1 lb. 12 oz. Catfish Fillet	Station 4 34.5 Striper Fillet	Station 4 82 cm Garr Whole Body	Station 4 1 lb 12 oz. Catfish Whole Body	Station 4 34.5 cm Striper Whole Body	Station 4 67 cm Garr Whole Body
Chlordane	mg/kg	<0.100	0.107	<0.050	<0.050	<0.050	<0.100	<0.050	<0.050	<0.050	0.080	<0.100	<0.050	0.190
Oxychlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Trans-chlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Cis-chlordane	mg/kg	<0.050	<0.050	<0.050	<0.050	0.065	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Trans-nonachlor	mg/kg	<0.050	<0.050	<0.050	<0.050	0.096	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Alpha-chlordene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Chlordene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Gamma-chlordene	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Cis-nonachlor	mg/kg	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
PCB, Aroclor-1016/1242	mg/kg	<0.250	<0.500	<0.250	<0.250	<0.750	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.500
PCB, Aroclor	mg/kg	<0.250	<0.500	<0.250	<0.250	<0.750	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.500
PCB, Aroclor-1232	mg/kg	<0.250	<0.500	<0.250	<0.250	<0.750	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.500
PCB, Aroclor-1248	mg/kg	<0.250	<0.500	<0.250	<0.250	<0.750	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.500
PCB, Aroclor-1254	mg/kg	<0.250	<0.500	<0.250	<0.250	<0.750	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.500
PCB, Aroclor-1260	mg/kg	<0.250	<0.500	<0.250	<0.250	<0.750	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.250	<0.500
Lipids, Total	% Total Wt.	8.000	18.000	11.000	2.000	11.000	12.000	12.000	8.000	4.000	48.000	16.000	11.000	15.000
Total Arsenic (Furnace)	mg/kg	<0.100	<0.100	0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100	<0.100
Total Copper (ICP)	mg/kg	1.000	0.840	1.400	<0.910	<1.000	1.500	1.300	<0.810	<0.960	1.400	<0.880	<0.810	1.100
Total Mercury (Cold Vapor)	ug/kg	0.280	0.290	0.070	0.130	0.460	<0.300	<0.330	<0.310	0.320	0.330	<0.290	0.330	0.600
Total Nickel (ICP)	mg/kg	<2.000	<1.700	2.900	<1.800	<2.000	2.700	3.700	<1.600	<2.000	5.000	<1.800	<1.600	3.400
Total Lead (ICP)	mg/kg	<5.000	<4.200	<4.000	<2.500	<5.000	<4.700	<3.500	<4.000	<4.900	<4.100	<4.400	<4.000	<4.000

APPENDIX F
PLANKTON DATA

KENVIRON LAKE CUMBERLAND PHYTOPLANKTON SAMPLES FOR 17 MAY
VALUES EXPRESSED IN CELLS PER LITER

	SAMPLE	SITE 1	SITE 1	SITE 2	SITE 2-2	SITE 2-3	SITE 3	SITE 3	SITE 3
	DATE	051794	051794	051794	051794	051794	051794	051794	051794
CODE	TAXON								
G	OOCYSTI	260	0	0	0	0	0	0	0
G	SCQUAD	260	0	0	0	0	0	0	0
C	DINOBYR	0	66	0	0	0	0	0	64
DI	PERIDINI	0	0	0	0	0	65	65	0
E	TRACHLE	0	0	0	0	0	0	65	0
D	ACDEFLE	130	0	0	0	0	0	0	64
D	ACMINUT	0	66	65	196	66	0	0	0
D	ACLANC	0	0	0	0	0	0	0	64
D	AMVENE	0	0	0	0	132	0	0	0
D	ASFORM	0	328	194	0	529	516	583	254
D	AUDISTA	0	0	65	0	0	0	0	127
D	AUITALIC	584	459	0	196	0	452	0	0
D	CBCYMBI	0	0	129	65	0	129	0	64
D	CYBODA	0	0	0	0	0	0	130	0
D	CYSPP	0	197	65	261	0	194	130	191
D	EPSPP	0	0	0	0	0	0	0	64
D	FRCROT	8177	1574	194	2745	4562	3292	15490	3053
D	GOANGU	0	0	0	65	0	65	0	0
D	GOINTRV	0	66	0	0	264	0	0	0
D	MASMITH	0	66	0	0	66	0	0	0
D	NAVENET	65	0	0	0	0	0	65	0
D	NIDISSIP	130	0	0	0	0	0	0	0
D	NIFILIFO	0	0	65	0	0	0	0	0
D	NIPALEA	130	66	65	0	66	129	0	64
D	RESINUA	0	66	0	0	0	0	0	0
D	STNIAGA	65	0	0	0	66	0	65	0
D	SUANGU	0	66	0	0	0	0	0	0
D	SYACUS	260	197	129	131	0	129	259	127
	TOTCELL	10059	3213	969	3660	5752	4970	16851	4135

TAXONOMIC LISTING FOR LAKE CUMBERLAND PHYTOPLANKTON SAMPLES FOR 17 MAY 1994

CLASS CODE

G = GREEN ALGAE (CHLOROPHYCEAE)
E = EUGLENOIDS (EUGLENOPHYCEAE)
D = DIATOMS (BACILLARIOPHYCEAE)
DI = DINOFLAGELLATES (DINOPHYCEAE)
C = CHRYSOPHYTES (CHRYSOPHYCEAE)

CODE	TAXON CODE	GENUS	SPECIES	AUTHORITY
G	OOCYSTIS	Oocystis		
G	SCQUADRI	Scenedesmus	quadricauda (Chod.) G. M. Sm.	
C	DINOBRYO	Dinobryon		
E	TRACHLEM	Trachlemonas		
DI	PERIDINI	Peridinium		
D	ACDEFLEX	Achnanthes	deflexa Reim.	
D	ACMINUTI	Achnanthes	minutissima Kutz.	
D	ACLANCEL	Achnanthes	lancelota Breb. ex Kutz.	
D	AMVENETA	Amphora	veneta Kutz.	
D	ASFORMO	Asterionella	formosa Hass.	
D	AUDISTAN	Aulacosira	distans (Ehr.) Simon.	
D	AUITALIC	Aulacosira	italica (Ehr.) Simon.	
D	CBCYMBIF	Cymbella	cymbiformis Agrdh.	
D	CYBODANI	Cyclotella	bodanica Grun.	
D	CYSPP	Cyclotella	spp.	
D	EPSPP	Epithemia	spp.	
D	FRCROTEN	Fragilaria	crotonensis Kitt.	
D	GOANGUS	Gomphonema	angustatum (Kutz.) Rabh.	
D	GOINTRVV	Gomphonema	intricatum v. vibrio (Erh.) Cl.	
D	MASMITHI	Mastigloia	smithii Thwaites ex W. Sm.	
D	NAVENETA	Navicula	veneta	
D	NIDISSIP	Nitzschia	dissipata (Kutz.) Grun.	
D	NIFILIFO	Nitzschia	filiformis (W. Sm.) Schutt	
D	NIPALEA	Nitzschia	palea (Kutz.) W. Sm.	
D	RESINUAT	Reimeria	sinuata	
D	STNIAGAR	Stephanodiscus	niagarae Ehr.	
D	SUANGUST	Surirella	angusta Kutz.	
D	SYACUS	Synedra	acus Kutz.	

SPECIES LIST FOR LAKE CUMBERLAND ZOOPLANKTON SAMPLES

GROUP
R = ROTIFERS
CL = CLADOCERN
CO= COPEPODS

GROUP	CODE	GENUS SPECIES
R	ASPLSPP	Asplanchna spp.
	CEPHSPP	Cephalodella spp.
	EOTHSPP	Eothinia spp.
	FILIOPOL	Filinia opolensis
	KELLLONG	Kellicottia longispina
	KERACOCH	Keratella cochlearis
	KERAHIEM	Keratella hiemalis
	LECASPP	Lecane spp.
	MONOSPP	Monostyla spp.
	POLYSPP	Polyarthra spp.
	SYNCSPP	Synchaeta spp.
	TRICSPP	Trichocera spp.
CL	BOSMLON	Bosmina longirostris
	DAPHGAME	Daphnia galeata mendotae
	DIAPIMMA	Daphnia immatures
CO	CYCLCOPE	Cyclopoid copepods
	COPEPODI	copepodites
	NAUPSP1	nauplii sp. 1

KENVIRON LAKE CUMBERLAND ZOOPLANKTON SAMPLES FOR 17 MAY 1994
VALUES EXPRESSED AS ORGANISMS PER CUBIC METER

	SITE	SITE 1	SITE 1	SITE 1	STA 2	STA 2	STA 2
	DATE	051794	051794	051794	051794	051794	051794
R	ASPLSPP	62	324	237	168	125	80
	CEPHSPP	0	46	0	0	0	0
	EOTHSPP	0	93	0	0	0	0
	FILIOPOL	0	0	47	0	0	0
	KELLLONG	339	463	475	201	250	361
	KERACOCH	833	2315	1898	302	542	1043
	KERAHIEM	0	0	0	0	0	80
	LECASPP	0	0	0	0	0	0
	MOMOSPP	31	0	47	0	0	40
	PHILSPP	0	0	0	0	0	0
	POLYSPP	463	1759	1234	806	792	1123
	SCARSPP	31	0	142	101	42	0
	SYNCSPP	833	880	380	571	625	682
	TRICSPP	0	93	0	0	0	0
CL	BOSMLONG	0	0	0	0	0	80
	DAPHGAME	2839	3843	3701	3558	5000	4895
	DIAPIMMA	247	278	285	436	375	441
CO	CYCLCOPE	370	417	380	537	1208	602
	COPEPODI	339	185	237	67	125	80
	NAUPSP1	1697	2361	2040	1477	1917	2207
	TOTAL	8086	13056	11104	8223	11000	11716

KENVIRON LAKE CUMBERLAND ZOOPLANKTON SAMPLES FOR 17 MAY 1994
VALUES EXPRESSED AS ORGANISMS PER CUBIC METER

	SITE	STA 3	STA 3	STA 3	STA 4	STA 4	STA 4
	DATE	051794	051794	051794	051794	051794	051794
R	ASPLSPP	0	0	0	46	37	108
	CEPHSPP	0	0	0	0	37	0
	EOTHSPP	0	0	0	46	111	0
	FILIOPOL	0	0	0	0	0	0
	KELLLONG	370	389	463	231	333	173
	KERACOCH	630	632	1071	509	1037	627
	KERAHIEM	19	0	58	46	37	22
	LECASPP	0	0	0	0	0	22
	MOMOSPP	0	0	0	0	74	0
	PHILSPP	0	0	0	0	0	0
	POLYSPP	759	535	926	625	963	713
	SCARSPP	0	0	0	0	0	0
	SYNCSPP	259	259	637	139	407	346
	TRICSPP	0	0	0	0	0	0
CL	BOSMLONG	0	0	0	0	0	0
	DAPHGAME	1926	1199	2373	3403	5296	2874
	DIAPIMMA	167	81	550	301	333	173
CO	CYCLCOPE	426	438	405	208	333	389
	COPEPODI	74	32	58	93	148	108
	NAUPSP1	1093	859	1476	1042	1111	1253
	TOTAL	5722	4424	8015	6690	10259	6806

DENSITY DATA
FOR
LAKE CUMBERLAND ZOOPLANKTON SAMPLES

SEPTEMBER, 1994

Density in Organisms per Cubic Meter

Code	Genus	Sta. 1A	Sta. 1B	Sta. 1C	Sta. 2A	Sta. 2B	Sta. 2C	Sta. 3A	Sta. 3B	Sta. 3C
R	ASPLSPP	1173	1349	1709	336	111	360	0	0	0
	FILILONG	293	0	0	0	0	0	0	0	0
	FILIPOL	880	0	244	0	667	601	0	80	0
	FILISPP	0	0	1465	0	0	0	0	0	0
	LEPASPP	587	1499	733	336	0	0	0	0	0
	KELLLONG	587	0	0	0	0	0	0	0	214
	KERACOC	5279	1798	4151	840	667	1442	1527	1603	2244
	LECASPP	587	1349	733	1176	111	120	0	0	0
	MONOSPP	5572	450	244	1176	222	240	0	0	0
	NOTHACU	293	0	0	0	222	240	0	0	0
	PHILSPP	0	0	977	336	0	0	0	0	0
	POLYSPP	22876	13039	16605	8061	3778	4926	7226	2405	4382
	SYNCSPP	0	0	0	0	0	0	0	80	0
	COLUSPP	880	0	244	0	778	1081	0	0	0
	ROTISPP 2	2346	1199	1709	168	222	120	0	321	0
	BRACSPP	0	450	1221	0	0	0	0	0	0
	CEPHMUC	0	0	244	0	0	0	0	0	0
	LEPAOVAL	0	0	0	0	889	360	0	0	0
	ROTISPP 1	0	0	0	0	0	0	1120	1443	2565
CL	BOSMLON	2346	1349	1953	2015	667	240	0	0	534
	BOSMIMM	0	749	488	504	0	360	407	160	0
	DAPHDUBI	880	150	733	2687	778	1081	4987	2004	4168
	DAPHSIMIL	0	0	0	672	222	240	0	0	0
	DAPHPULE	0	0	0	1008	0	360	0	0	0
	DAPHSPP	587	0	0	0	222	0	0	0	0
	DAPHIMMA	0	749	0	0	0	0	509	240	107
	DIAPSPP	0	0	0	0	111	120	0	0	0
CO	CALOCOP	0	300	977	0	222	0	102	0	0
	CYCLCOP	6452	4646	2198	8229	7444	7209	6412	5611	4809
	NAUPSP1	7625	3897	2686	8397	2778	3244	4580	3046	5023
N	NEMATA	0	0	0	0	111	360	0	0	0
TOTALS		59243	32972	39314	35939	20222	22709	26870	16992	24046
NO. OF SPECIES		17	15	19	15	19	19	9	11	9

DENSITY DATA
FOR
LAKE CUMBERLAND ZOOPLANKTON SAMPLES

OCTOBER, 1994

Density in Organisms per Cubic Meter

Code	Genus	Sta. 1A	Sta. 1B	Sta. 1C	Sta. 2A	Sta. 2B	Sta. 2C	Sta. 3A	Sta. 3B	Sta. 3C
R	ASPLSPP	0	0	0	56	0	0	0	0	0
	FILILONG	0	0	0	0	0	0	0	0	0
	FILIPOL	0	0	0	0	0	0	0	0	0
	FILISPP	0	0	0	0	0	0	0	0	0
	LEPASPP	0	0	0	0	0	0	0	0	0
	392	1425	1366	2559	392	305	475	129	122	124
	KERACOC	11684	15216	16816	9852	8779	8372	9025	12092	14550
	LECASPP	0	0	0	0	0	0	0	0	0
	MONOSPP	0	0	0	0	0	0	0	0	62
	NOTHACU	0	0	0	0	0	0	0	0	0
	PHILSPP	0	0	0	0	0	0	0	0	0
	POLYSPP	1852	2146	2559	672	458	475	516	550	805
	SYNCSPP	0	0	0	0	0	0	64	183	0
	COLUSPP	0	0	0	0	0	0	0	0	0
	ROTISPP 2	0	0	0	112	0	0	0	0	0
	BRACSPP	0	0	0	0	0	0	0	0	0
	CEPHMUC	0	0	0	0	0	0	0	0	0
	LEPAOVAL	0	0	0	0	0	0	0	0	0
	ROTISPP 1	285	390	0	0	0	237	0	0	0
CL	BOSMLON	427	390	0	448	992	237	64	0	1053
	BOSMIMM	285	0	0	0	0	0	0	0	0
	DAPHDUBI	0	0	0	0	0	0	0	0	0
	DAPHSIMIL	0	0	0	0	0	0	0	0	0
	DAPHPULE	0	0	0	0	0	0	0	0	0
	DAPHSPP	0	0	0	0	0	0	0	0	0
	DAPHIMMA	0	0	0	0	0	0	0	0	0
	DIAPSPP	0	0	0	0	0	0	0	0	0
CO	CALOCOP	142	0	0	0	0	0	0	0	0
	CYCLCOP	12397	18728	48986	1791	4885	1900	3481	794	1176
	NAUPSP1	5130	6438	10601	672	1145	712	451	2931	2291
N	NEMATA	0	0	0	0	0	0	0	0	0
TOTALS		**33628**	**44673**	**81521**	**13995**	**16565**	**12409**	**13730**	**16672**	**20061**
NO. OF SPECIES		9	7	5	8	6	7	7	6	7

/92012/DENSITY.DAT/ 01-04-95

Zooplankton--Lake Cumberland 1/11/95 Sample Site 1A

Sample volume 200 ml Subsample number Subsample volume/ml	1A-1 1	1A-2 1	1A-3 1	1A-4 1	1A-5 1	Total 5	Organisms Per Cubic Meter
Rotifers							
Asplanchna spp.	49	74	61	60	53	297	7920
Filinia longiseta						0	0
Filinia opolensis						0	0
Filinia spp.						0	0
Kellicottia longispina					2	2	53
Keratella cochlearis	52	60	54	61	57	284	7573
Keratella hiemalis						0	0
Lecane spp.						0	0
Monostyla spp						0	0
Notholca accuminata						0	0
Philodina spp.			1			1	27
Polyarthra spp.	12	4	13	12	9	50	1333
Synchaeta spp.	141	77	97	85	68	468	12480
Tricocerca spp.			1	1	2	4	107
Cladocerans							
Bosmina longirostris	4	4	2	2	5	17	453
Daphnia galeata mendotae						0	0
Copepods							
Calanoid copepods	1			1	1	3	80
Cyclopoid copepods						0	0
Copepodites	28	14	20	18	15	95	2533
Nauplii	49	66	51	55	47	268	7147
Total	336	299	300	295	259	1489	39707
Organisms/Cubic Meter	44800	39867	40000	39333	34533	39707	

Zooplankton--Lake Cumberland 1/11/95 Sample Site 1B

Sample volume 200 ml Subsample number Subsample volume/ml	1B-1 1	1B-2 1	1B-3 1	1B-4 1	1B-5 1	Total 5	Organisms Per Cubic Meter
Rotifers							
Asplanchna spp.	60	46	70	35	51	262	6987
Filinia longiseta						0	0
Filinia opolensis						0	0
Filinia spp.						0	0
Kellicottia longispina			1	2		3	80
Keratella cochlearis	57	46	38	28	49	218	5813
Keratella hiemalis						0	0
Lecane spp.						0	0
Monostyla spp						0	0
Notholca accuminata						0	0
Philodina spp.						0	0
Polyarthra spp.	5	10	12	16	19	62	1653
Synchaeta spp.	87	94	100	43	56	380	10133
Tricocerca spp.						0	0
Cladocerans							
Bosmina longirostris	2	8	8	3	3	24	640
Daphnia galeata mendotae						0	0
Copepods							
Calanoid copepods	1	2				3	80
Cyclopoid copepods						0	0
Copepodites	13	27	17	18	13	88	2347
Nauplii	32	51	72	41	53	249	6640
Total	257	284	318	186	244	1289	34373
Organisms/Cubic Meter	6853	7573	8480	4960	6507	34373	

Zooplankton--Lake Cumberland 1/11/95 Sample Site 1C

Sample volume 200 ml Subsample number	1C-1	1C-2	1C-3	1C-4	1C-5	Total	Organisms Per Cubic Meter
Subsample volume/ml	1	1	1	1	1	5	
Rotifers							
Asplanchna spp.	55	56	52	43	56	262	6987
Filinia longiseta						0	0
Filinia opolensis						0	0
Filinia spp.						0	0
Kellicottia longispina	1				1	2	53
Keratella cochlearis	42	47	49	37	41	216	5760
Keratella hiemalis						0	0
Lecane spp.						0	0
Monostyla spp						0	0
Notholca accuminata						0	0
Philodina spp.		2				2	53
Polyarthra spp.	11	11	12	20	16	70	1867
Synchaeta spp.	117	117	100	47	47	428	11413
Tricocerca spp.						0	0
Cladocerans							
Bosmina longirostris	6	3	2	5	4	20	533
Daphnia galeata mendotae						0	0
Copepods							
Calanoid copepods						0	0
Cyclopoid copepods						0	0
Copepodites	11	13	12	20	13	69	1840
Nauplii	38	53	40	30	53	214	5707
Total	281	302	267	202	231	1283	34213
Organisms/Cubic Meter	7493	8053	7120	5387	6160	34213	

Zooplankton--Lake Cumberland 1/11/95 Sample Site 2A

Sample Site

Sample volume 200 ml							Organisms Per Cubic Meter
Subsample number	2A-1	2A-2	2A-3	2A-4	2A-5	Total	
Subsample volume/ml	1	1	1	1	1	5	
Rotifers							
Asplanchna spp. *	88	82	73	75	69	387	10320
Filinia longiseta						0	0
Filinia opolensis						0	0
Filinia spp.					1	1	27
Kellicottia longispina		1				1	27
Keratella cochlearis	101	88	94	103	86	472	12587
Keratella hiemalis						0	0
Lecane spp.						0	0
Monostyla spp			2			2	53
Notholca accuminata						0	0
Philodina spp.	3	1		2	2	8	213
Polyarthra spp.	33	28	25	31	25	142	3787
Synchaeta spp.	98	78	123	115	103	517	13787
Tricocerca spp.		1		2	2	5	133
Cladocerans							
Bosmina longirostris	12	11	8	6	4	41	1093
Daphnia galeata mendotae				1		1	27
Copepods							
Calanoid copepods	2	3	1	1		7	187
Cyclopoid copepods					1	1	27
Copepodites	28	24	20	16	18	106	2827
Nauplii	45	46	39	42	53	225	6000
Total	410	363	385	394	364	1916	51093
Organisms/Cubic Meter	10933	9680	10267	10507	9707	51093	

Zooplankton--Lake Cumberland 1/11/95 Sample Site 2B
Sample Site

Sample volume 200 ml Subsample number	2B-1	2B-2	2B-3	2B-4	2B-5	Total	Organisms Per Cubic Meter
Subsample volume/ml	1	1	1	1	1	5	
Rotifers							
Asplanchna spp.	41	39	33	58	36	207	5520
Filinia longiseta						0	0
Filinia opolensis						0	0
Filinia spp.						0	0
Kellicottia longispina				1	1	2	53
Keratella cochlearis	35	55	49	51	32	222	5920
Keratella hiemalis						0	0
Lecane spp.						0	0
Monostyla spp						0	0
Notholca accuminata						0	0
Philodina spp.				1		1	27
Polyarthra spp.	20	22	19	14	17	92	2453
Synchaeta spp.	90	83	72	64	39	348	9280
Tricocerca spp.		1	1			2	53
Cladocerans							
Bosmina longirostris	3	3	7	3	3	19	507
Daphnia galeata mendotae						0	0
Copepods							
Calanoid copepods						0	0
Cyclopoid copepods						0	0
Copepodites	7	21	6	13	9	56	1493
Nauplii	12	15	21	15	20	83	2213
Total	208	239	208	220	157	1032	27520
Organisms/Cubic Meter	5547	6373	5547	5867	4187	27520	

Zooplankton--Lake Cumberland 1/11/95 Sample Site 2C

Sample volume 200 ml							Organisms Per Cubic Meter
Subsample number	2C-1	2C-2	2C-3	2C-4	2C-5	Total	
Subsample volume/ml	1	1	1	1	1	5	
Rotifers							
Asplanchna spp.	49	52	46	60	51	258	6880
Filinia longiseta						0	0
Filinia opolensis						0	0
Filinia spp.						0	0
Kellicottia longispina						0	0
Keratella cochlearis	81	64	66	73	83	367	9787
Keratella hiemalis						0	0
Lecane spp.						0	0
Monostyla spp						0	0
Notholca accuminata						0	0
Philodina spp.				1	1	2	53
Polyarthra spp.	12	5	9	18	22	66	1760
Synchaeta spp.	93	83	114	44	80	414	11040
Tricocerca spp.				1	2	3	80
Cladocerans							
Bosmina longirostris	13	6	11	6	8	44	1173
Daphnia galeata mendotae						0	0
Copepods							
Calanoid copepods	1	2				3	80
Cyclopoid copepods						0	0
Copepodites	33	24	20	29	31	137	3653
Nauplii	38	29	40	35	28	170	4533
Total	320	265	306	267	306	1464	39040
Organisms/Cubic Meter	8533	7067	8160	7120	8160	39040	

Zooplankton--Lake Cumberland 1/11/95 Sample Site 3A

Sample volume 200 ml							Organisms Per Cubic Meter
Subsample number	3A-1	3A-2	3A-3	3A-4	3A-5	Total	
Subsample volume/ml	1	1	1	1	1	5	
Rotifers							
Asplanchna spp.	50	53	63	48	40	254	6773
Filinia longiseta						0	0
Filinia opolensis						0	0
Filinia spp.				1	1	2	53
Kellicottia longispina	3	1	1		2	7	187
Keratella cochlearis	52	64	71	70	85	342	9120
Keratella hiemalis						0	0
Lecane spp.						0	0
Monostyla spp						0	0
Notholca accuminata						0	0
Philodina spp.	1					1	27
Polyarthra spp.	3	8	13	3	6	33	880
Synchaeta spp.	71	73	69	65	64	342	9120
Tricocerca spp.					3	3	80
Cladocerans							
Bosmina longirostris	8	12	14	10	16	60	1600
Daphnia galeata mendotae				1	2	3	80
Copepods							
Calanoid copepods	7	3	7		1	18	480
Cyclopoid copepods				1		1	27
Copepodites	23	34	27	20	31	135	3600
Nauplii	18	13	27	26	28	112	2987
Total	236	261	292	245	279	1313	35013
Organisms/Cubic Meter	6293	6960	7787	6533	7440	35013	

Zooplankton--Lake Cumberland 1/11/95 Sample Site 3C

Sample volume 200 ml Subsample number	3C-1	3C-2	3C-3	3C-4	3C-5	Total	Organisms Per Cubic Meter
Subsample volume/ml	1	1	1	1	1	5	
Rotifers							
Asplanchna spp.	28	28	20	24	19	119	3173
Filinia longiseta						0	0
Filinia opolensis						0	0
Filinia spp.						0	0
Kellicottia longispina		1		1	1	3	80
Keratella cochlearis	83	56	67	67	69	342	9120
Keratella hiemalis						0	0
Lecane spp.						0	0
Monostyla spp						0	0
Notholca accuminata						0	0
Philodina spp.			1	1	1	3	80
Polyarthra spp.	12	14	16	12	22	76	2027
Synchaeta spp.	57	51	53	49	47	257	6853
Tricocerca spp.	3	1	2		3	9	240
Cladocerans							
Bosmina longirostris	15	8		6	13	42	1120
Daphnia galeata mendotae						0	0
Copepods							
Calanoid copepods	4	1	1	1		7	187
Cyclopoid copepods						0	0
Copepodites	44	36	25	30	33	168	4480
Nauplii	31	23	26	24	32	136	3627
Total	277	219	211	215	240	1162	30987
Organisms/Cubic Meter	7387	5840	5627	5733	6400	30987	