CHATTANOOGA WASTE DISCHARGES

PART II

DOWNSTREAM FROM THE CITY WATER COMPANY

U. S. Environmental Protection Agency
Region IV
Surveillance and Analysis Division
Athens, Georgia

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INTRODUCTION

Chattanooga, Tennessee, was designated early in FY 1972 by the Environmental Protection Agency (EPA) as one of several "priority areas" throughout the nation where the damaging effects of pollution were widespread and especially severe. Field surveys, coupled with appropriate planning, state coordination, and enforcement actions are being concentrated in these areas in an effort to meet Federal/State water quality standards.

The specific objectives of this study were:

- Identify and characterize waste sources discharging to Chattanooga Creek.
- Determine the water quality of Chattanooga Creek.
- Determine the character of waste entering the Tennessee River from the Moccasin Bend Sewage Treatment Plant.
- To provide information for appropriate abatement actions for the entire Chattanooga area downstream from the City Water Company intakes.

Climatic conditions during the study were seasonal. Heavy rains occurred on March 2 and 9 (0.90 and 0.86 inches, respectively) which gave good runoff representations for both stream water quality and industrial discharges affected by rainfall. Chemical and microbiological data contained in this report were collected from February 27 - March 9, 1973. Sampling locations are shown in Figure 2 (foldout map at the back of this report).

The cooperation and assistance of the Tennessee Water Quality Control Board and especially the Tennessee Valley Authority (TVA) for allowing us

to use their laboratory space was greatly appreciated. Special thanks is also extended to the many industrial personnel who assisted us at the plants investigated.

FINDINGS

1. Wastes from the Rossville Development Corporation Complex -- which houses Borg Fabrics, Rossville Yarn Processing Corporation, Rossville Spinning Corporation, Rossville Carpet Dyeing and Rossville Mills, as well as the adjoining Kenyon Southern facilities and the nearby Standard Coosa Thatcher plant across Maple Street -- contribute to the pollution of McFarland's Branch even though most of the wastes are discharged to the sewer. Numerous spills and dumps occurred from the Southern Coosa Thatcher and Southern Kenyon plants. The Rossville Development Corporation has a continuous discharge reported to be cooling water and boiler soot blowdown. This discharge contained a COD concentration of 3,000 mg/l for one sample collected during the survey.

2. Chattem Drug and Chemical Company discharges part of its waste to Chattanooga Creek and part to the municipal sewer system. The portion flowing untreated to the stream is primarily cooling water, floor washings and spills. This flow of approximately 500 gpm is heavily contaminated and represents a waste load of 1,100 lbs/day BOD_5 and 770 lbs/day of nitrogen to Chattanooga Creek. The strong odor of isopropyl alcohol was evident in the waste stream on several occasions.

3. Crane Company had unusually high lead concentrations in its waste discharge. Concentration values ranged from 28.13 to 57.5 mg/l with an average discharge rate of 1,600 gpm.

4. Dixie Sand and Gravel Company is presently discharging large amounts of silt and fine sand from the land based sand washer. Total residue on two occasions was 13,209 and 6,182 mg/l with approximately 90 percent of the material being nonfilterable (suspended solids). The average daily (16 hours) waste loading was 108,736 lbs/day total residue and 98,385 lbs/day nonfilterable residue.

5. The L&N Railroad Wauhatchie Yards has five discharges to Black Creek, a tributary of Lookout Creek. Total oil and grease discharged from the facility averaged 47.2 lbs/day. Only gravity separation is provided on the oil separator at Station L&N-2 and the oil pond used to collect site drainage.

6. Modern Maid, Inc. discharges ceramic ground coat and pickling waste to a storm sewer which flows into Dobbs Branch. The ceramic base coat waste causes excessive solids concentrations and turbidity in Dobbs Branch and Chattanooga Creek.

7. Reilly Tar and Chemical Corporation stores all concentrated phenolic waste in a bio-oxidation pond. Personnel from the company reported that when phenolic concentration in the pond falls below 1 ppm, the contents of the pond are batch discharged to Chattanooga Creek. A flow averaging 10.3 gpm of additional process waste is continuously discharged through a straw filter oil trap to the creek. The BOD_5 and phenolic concentration of this stream averaged 118 and 20.5 mg/l, respectively.

8. Roper Corporation has four untreated waste streams flowing to an unnamed tributary of the Tennessee River. Two settling basins are completely filled with sediment and serve no useful purpose. The average combined waste flow was 144 gpm. BOD_5 values ranged from 2.0 to 198 mg/l and total solids from 403 to 2,006 mg/l. Based on a 12-hour workday, the BOD_5 loading is 77 lbs/day and the total solids loading is 1,140 lbs/day.

9. Swift Edible Oil Company discharges most of its process waste to the municipal sewer system; however, one concentrated waste stream was discharged directly to a tributary of Chattanooga Creek. The BOD_5 concentration of this stream ranged from 380 to 2,900 mg/l, and oil and grease ranged from 210 to 4,100 mg/l with an average of 2,170 mg/l. Based on an average flow of 25 gpm, the discharge contained 498 lbs/day of BOD_5 and 651 lbs/day of oil and grease.

10. Velsicol Chemical Corporation has four waste streams. Most of the process waste (Station VE-4) flows to the municipal waste system; while the other three streams flow into Chattanooga Creek and contain various amounts of process waste and surface runoff. The largest of these surface discharges (Station VE-1) contains plant site runoff, leaching, and process waste discharges from the plant operation. Included in the average 105 gpm flow at this station is the relatively small (approximately 10 gpm) flow from Reilly Tar and Chemical. The BOD_5 concentration at VE-1 averaged 915 mg/l, an average daily loading of 1,159 lbs/day. The flow, BOD_5, and solids loadings for all four streams were:

	BOD_5 (lbs/day)	Total Solids (lbs/day)	Average Flow (gpm)
VE-1	1,160	16,800	105
VE-2	188	2,200	44
VE-3	78	148	34
VE-4	26,900	62,200	922

* Discharged to the municipal sewer system

11. Chattanooga Coke and Chemicals (Woodward Corporation) discharges part of its waste to the municipal sewer system and the remaining portion to a tributary of Chattanooga Creek. The stronger wastes from the plant are used for coke quenching with the excess discharged to the creek. This involves waste from the ammonia still and the benzene, toluene, xylene (BTX) plant.

There are three waste streams flowing from the plant to surface streams. The major source (Station WO-2) flowing at an average rate of 52 gpm contained ammonia still and BTX plant waste as well as leachate through an old acid dump area. Values of the observed parameters were:

Parameter	Range (mg/l)	Average (mg/l)
BOD_5	86 - >600	279
COD	330 - 2,800	1,070
TOC	120 - 860	320
Phenol	25 - 465	167
TKN-N	1,240 - 7,750	4,400
NH_3-N	1,070 - 7,320	4,060
CN^-	<.01 - 9.70	4.15
Residue (total)	15,000 - 37,300	27,000

The total residue waste loading averaged 17,000 lbs/day of which 16,100 lbs/day was volatile residue. This highly polluted waste combines with the strong waste stream from Velsicol (Station VE-2) and flows through a tributary stream (Station CT-2) to Chattanooga Creek.

The other two waste streams flowing from the north side of the plant property contain some contamination which indicates leakage or drift from the quench operation.

12. The Moccasin Bend Sewage Treatment Plant (STP) receives a municipal waste composed of roughly 70 percent industrial waste. The waste is strong, highly colored and difficult to treat because of varying flow rates and concentrations. Operational difficulties and odor problems have forced municipal authorities to close the secondary sludge handling facilities (Zimpro Process). All wasted secondary sludge is discharged directly to the effluent. Waste loadings determined during the study excluding the secondary sludge discharge were:

	Max.-Min. Concentration (mg/l)	Average Concentration (mg/l)	Average Waste Load (lbs/day)
BOD_5	190 - 160	178	50,500
COD	485 - 340	409	116,000
TOC	110 - 100	102	29,000
TKN-N	21.2 - 12.4	18.2	5,180
NH_3-N	13.8 - 5.7	10.4	2,960
$NO_2 + NO_3$-N	0.03 - <0.01	<0.014	<4
T. Phos.-P	6.3 - 4.7	5.6	1,600
T. Residue	1,260 - 830	993	282,000
T. Residue Vol.	167 - 115	141	40,100
Dissolved Residue	1,190 - 640	860	245,000
T. Non-Filterable Residue	240 - 75	133	37,800
T. Non-Filterable Residue Vol.	105 - 52	70	19,900
Oil & Grease	30 - 25	28	8,000
Phenol	1.55 - 0.59	0.966	275
T. Chromium	0.335 - 0.235	0.283	81
Copper	0.060 - 0.050	0.053	15
Zinc	0.43 - 0.322	0.383	109
Iron	1.98 - 1.67	1.854	527
Manganese	0.355 - 0.29	0.311	88
Nickel	0.318 - 0.15	0.249	71
Lead	<0.1	<0.1	<28
Mercury	0.0014 - 0.0008	0.00097	0.28
Flow	27,800 - 20,700 gpm	23,700 gpm	

NOTE: These values do not reflect the secondary sludge presently being discharged from the plant.

The Moccasin Bend STP is discharging a considerable amount of oxygen demanding and toxic materials to the Tennessee River. The treated plant effluent is as strong or stronger than typical raw municipal waste, even discounting the unmeasured waste sludge discharge.

13. The combined sewerage system has a number of regulation chambers which permit overflow to the surface streams. During periods of excessive surface runoff, the regulator chambers discharge raw sewage into the Tennessee River and tributary streams. Evidence of this waste discharge was very apparent in Dobbs Branch and Chattanooga Creek during the rain of March 2, 1973.

14. The water quality in Chattanooga Creek deteriorates significantly downstream from the state line. The most significant waste sources (from Velsicol and Woodward) enter Chattanooga Creek via an unnamed stream at RM 5.3. The other major waste source entering the creek is from Dobbs Branch. This branch contains waste from Modern Maid, Inc., overflow from the municipal sewer system, and numerous unidentified discharges.

15. Unauthorized discharges to the Montague Park area storm sewer are a major source of untreated wastewater to Dobbs Branch. Although the Modern Maid, Inc. discharge was identified and traced, the source of a very fibrous constituent discharge at the mouth of the sewer was not determined.

16. Wheland Foundry has discharges containing high solids concentrations. One 2.5 gpm discharge sampled had a total solids concentration of 4,920 mg/l and a COD of 1,910 mg/l. The old dumping area for used sand and dust from air pollution control equipment has been pushed onto the flood plain of Chattanooga Creek, from where it easily washes into the creek. A new dump planned for property across the creek will result in more solids entering Chattanooga Creek if a retaining wall isn't constructed to contain the sand.

RECOMMENDATIONS

1. Improvements to the Chattanooga sewerage system should be given a very high priority by all agencies concerned.
    - A thorough treatability study of industrial waste discharges to the sewerage system should be conducted and used as background information for developing effective and enforceable pretreatment ordnances.
    - Provision for treatment of secondary waste sludge at the Moccasin Bend plant should be made as soon as possible, probably by resolving the dispute between Zimpro Corporation and the City of Chattanooga as quickly as possible.
    - A large aerated mixing and storage reservoir should be considered to store excess water in high flows during storms and to equalize the highly variable waste strength received at the Moccasin Bend plant.
2. The Chattanooga Coke and Chemicals Company should immediately install interim treatment to reduce BOD, cyanide, phenols, ammonia, oil and grease, and to neutralize the acid in its present waste discharge. A permit for this company should include the requirement for immediate interim treatment to function until such time as best practical available technology or better is installed.
3. Velsicol Chemical Corporation should immediately collect and treat all process and contaminated surface runoff discharged from its property. Interim treatment measures should be required while more adequate treatment facilities are being built.

4. Swift Edible Oil Company should install complete and adequate treatment for the wastewater currently being discharged through the storm drains to Chattanooga Creek.
5. The City of Chattanooga should make an investigation to eliminate raw waste discharges to its storm sewer system, particularly in the Montigue Park area. All discharges to the storm sewer should apply for both state and federal permits.
6. Modern Maid, Inc. should install complete and adequate treatment for the wastewater currently being discharged through the storm drains to Dobbs' Branch.
7. The L&N Railroad Wahatchie Yards should upgrade its oil removal system. Treatment should be provided for all discharges. Emulsion breakers should be added and air flotation equipment should be installed for all emulsified oil wastes.
8. Chattem Drug and Chemical Company should make a concerted effort to reduce its total waste flow by reduced water usage and recycling. The waste stream now flowing to Chattanooga Creek should be provided complete treatment before discharge.
9. The Crane Company should isolate and separately treat its individual waste streams. The waste stream containing the high lead concentration should be adequately treated or lead should be eliminated from the operation.
10. Dixie Sand and Gravel should install adequate waste treatment facilities. This would probably involve the use of cyclone separators followed by mechanical clarifiers, since adequate area is not available for settling ponds.

11. Wastes from the Roper Corporation should be given adequate treatment before discharge.
12. The Southern Coosa Thatcher Company in Rossville and the Southern Kenyon Company should immediately construct facilities to contain or prevent their frequent dye or pigment spills.
13. The Rossville Development Corporation should provide adequate treatment for the boiler soot blowdown before discharge.
14. Reilly Tar and Chemical Company should insure that its discharge meets best practical waste treatment limits.
15. Waste discharge from Wheland Foundry should be treated to remove coal fines and other pollutants before discharge into Chattanooga Creek. Retaining walls or other methods of stabilizing the dump tailings should be installed to prevent foundry sand and dust from the air control equipment from entering the creek.

STUDY AREA

This study was concentrated primarily on point source waste discharges to Chattanooga Creek and its tributaries (See fold-out map at back of report). In addition, other main industrial discharges not included in the Chattanooga . . Part I report (1) were included. The effluent from the Moccasin Bend STP was also included since most of the industries along Chattanooga Creek discharge at least a portion of their waste to the municipal system.

The headwaters of Chattanooga Creek are located approximately 12 miles south of the Tennessee-Georgia state line. The creek flows north through a long, narrow valley bounded on the east by Missionary Ridge and on the west of Lookout Mountain. Major tributaries are Dobbs Branch at mile 2.1, McFarland Branch at mile 6.1, and Dry Branch at mile 6.6. The downstream portion of the Chattanooga Creek watershed is heavily populated by the cities of Rossville, GA, and Chattanooga, TN, with a considerable amount of industrial activity ranging from carpet dyeing to drug manufacturing. One very large municipal landfill is located at 38th Street. This landfill has just recently been filled and "covered". Since the fill is located on the edge of Chattanooga Creek and is subject to partial inundation each time it rains, this will be a significant pollution source for many years. Numerous (10 to 20) industrial, public and private landfills line the banks of Chattanooga Creek throughout the lower 10 miles of the stream. Most of the dumps are uncovered and poorly maintained.

PRESENT WATER USES

Water Supply

Neither Chattanooga Creek nor its tributaries are being used for domestic or industrial water supplies.

Fish and Aquatic Life

Chattanooga Creek within Tennessee and Dobbs' and McFarland's Branches are not suitable for the propogation of a diverse aquatic life because of domestic and industrial waste discharges.

Recreation

Chattanooga Creek and its tributaries are useless for any type of recreation. In addition to pollution, the streams are so choked with litter that they are aesthetically unacceptable.

Irrigation

Irrigation is not practiced in the immediate study area.

Livestock Watering and Wildlife

The upper reaches of both Chattanooga and Dry Creek are used for livestock watering. A few cattle were seen grazing near Station CT-2.

Navigation

The Tennessee River in the vicinity of the study area is heavily used by barge traffic. Chattanooga Creek does not support barge traffic, but materials (such as rolls of fiberglass from dumps) washed from Chattanooga Creek could interfere with navigation in the River.

PREVIOUS STUDIES

A comprehensive listing of pollution sources in the Chattanooga area is included in the transcript of a public hearing held on December 2, 1971 (2). This hearing was conducted, transcribed, and published by the Tennessee Water Quality Control Board and includes a brief discussion of each pollution source.

A report by the Tennessee Stream Pollution Control Board, "Stream Pollution Survey of the Chattanooga Area - 1964" (3), identified several point sources and included a discussion of each pollution source.

A subsequent Tennessee Stream Pollution Control Board study in 1965 of interstate streams in the area (4) concluded ". . . that significant organic and bacterial pollution could be entering Tennessee through tributary streams" from Georgia.

In 1967 and 1969, the Tennessee Valley Authority collected chemical data on Chattanooga Creek and other Tennessee River tributary streams. Samples were collected at monthly intervals through calendar year 1969. No report was published.

In 1969, a biological study of the Tennessee Basin streams of northwest Georgia was conducted by the Georgia Water Quality Control Board (5). This study included Chattanooga Creek and its tributaries. A report entitled "Biological Investigation of Tennessee Basin Streams of Northwest Georgia" was later published.

STUDY METHODS

GENERAL

This survey was conducted by the Surveillance and Analysis Division personnel, EPA, Athens, Georgia, with the assistance of personnel from the Enforcement Division, Region IV, Atlanta, Georgia. Laboratory space was provided by the Tennessee Valley Authority in their old water laboratory at 10th and Lindsay Streets in Chattanooga. Field crews collected water samples and measured flow, pH, and temperature. Bacteriological, BOD_5, acidity, alkalinity, and pH determinations were made in the field laboratory. Samples for other analyses were shipped back to the Athens laboratory. Analytical methods used are listed in Appendix A.

Biological methods are included in the "BIOLOGY" discussion under "STREAM DATA AND OBSERVATIONS".

CHATTANOOGA CREEK SEDIMENT

Sediment samples were collected with a Petersen dredge at Stations C-0.6 and 8.1.

WASTE SAMPLING

EPA automatic samplers were used to collect 24-hour composite samples from some industries and the Moccasin Bend Sewage Treatment Plant while intermittent discharges or industries operated on less than a 24-hour basis were evaluated by either grab samples or manually composited samples. Grab samples were collected for any analyses requiring special preservation or collection techniques. Flows were determined from in-plant flow measuring devices, temporary weirs, bucket and stop watch, or estimates.

STREAM QUALITY

Stream samples were collected from Chattanooga Creek, Dobbs Branch, Dry Creek, and McFarland's Branch. The sampling stations are shown in Figure 1 and listed in Appendix B. Samples for chemical analyses and dissolved oxygen were taken at the one-foot depth. Bacteriological samples for coliform were collected at one-foot depth by a grab sampling technique.

MICROBIOLOGICAL METHODS

Sampling

All stream samples analyzed for coliform bacteria were collected near the surface using a grab technique. The samples were collected in sterile glass containers and placed on ice until time of analysis. Most samples were analyzed within four hours after collection and all within eight hours after collection.

All Moccasin Bend Sewage Treatment Plant samples were collected at the automatic samplers which pump water from the chlorine contact tank. Samples were collected at three-hour intervals for two 24-hour periods. Other effluent samples were collected once each morning for five days. All samples were dechlorinated using 0.2 ml of a sterile 10 percent sodium thiosulfate solution. All samples were placed on ice and were analyzed within eight hours after collection.

Stream samples collected for *Salmonella* isolation were obtained using a modification of the swab technique of Moore (6). Sanitary napkins (swabs) were folded, gauze ends tied together, and a length of heavy string attached. Prepared swabs were wrapped in kraft paper and sterilized.

Sterile swabs were suspended beneath the water surface at all Chattanooga Creek stations for five days, then retrieved and returned to the laboratory for analysis.

Examination

Total Coliform Enumeration: The standard coliform procedure outlined in Standard Methods (7) for the five-tube MPN multiple-tube dilution was used. The procedure employs lauryl tryptose broth incubated at 35 + 0.5°C for 24 and 48 ± 3 hours followed by confirmation using brilliant green lactose bile broth incubated at 35 ± 0.5°C for 24 and 48 ± 3 hours.

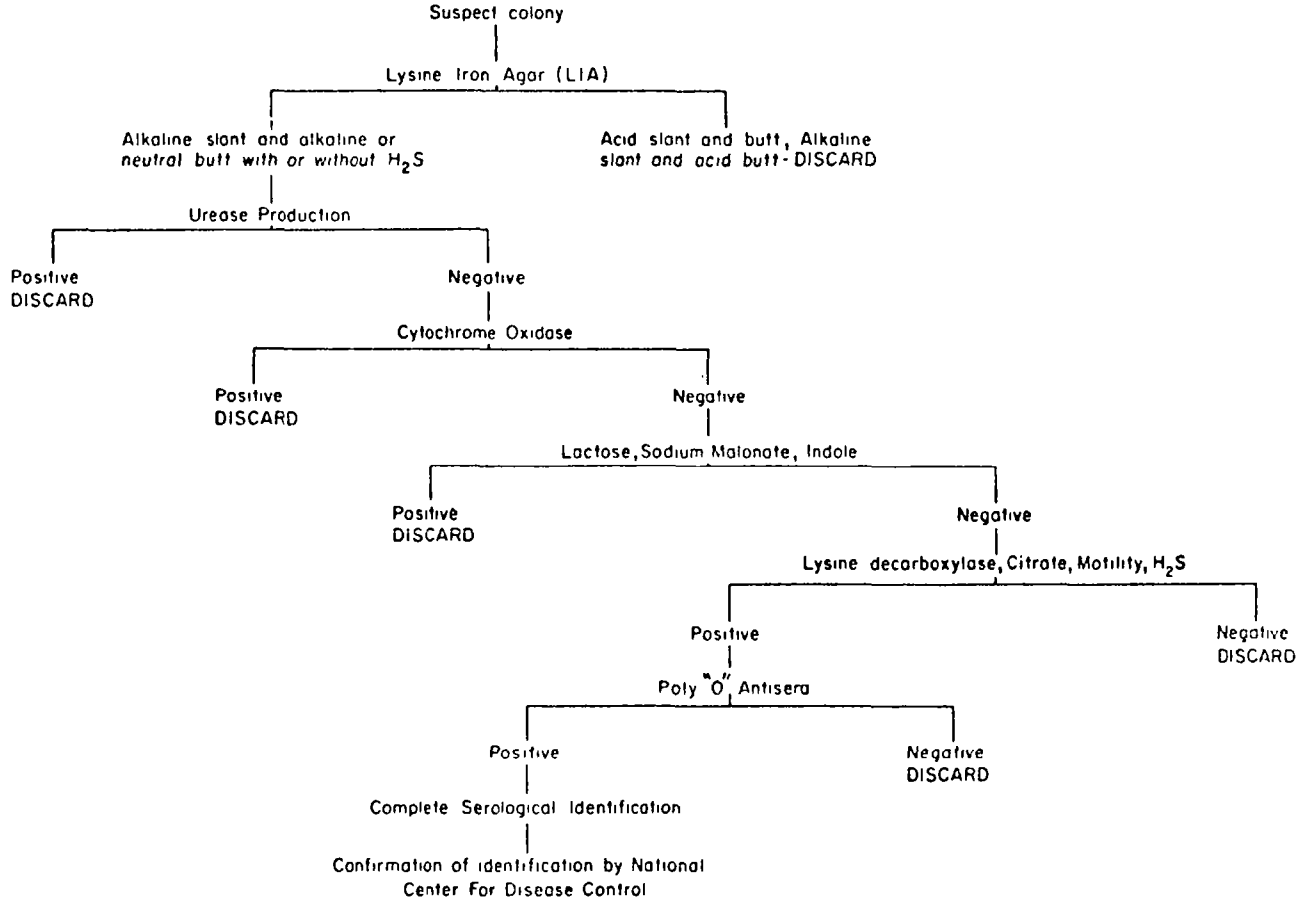
Fecal Coliform Enumeration: The fecal coliform procedure outlined in Standard Methods (7) for the five-tube MPN multiple-tube dilution was used. The procedure employs the standard presumptive test using lauryl tryptose broth followed by fecal coliform confirmation using EC medium at an elevated temperature (44.5° ± 0.2°C waterbath) for 24 ± 2 hours.

Salmonella Isolation and Identification: Swabs used for isolation purposes were placed into wide-mouth jars containing approximately 200 ml of 1-1/2 strength tetrathionate broth with brilliant green added. The inoculated enrichment was incubated from 24 to 48 hours at 41.5°C according to the procedure of Spino (8). After either primary or sub-culture enrichment, an inoculum for each enrichment was streaked onto Xylose Lysine Desoxycholate Agar (XLD) and Hektoen Enteric Agar (HE) plates and incubated at 35 ± 0.5°C for 18-24 hours. Suspected Salmonella colonies were picked from the respective plates and subjected to the identification scheme outlined in Table _____.

The methods and media outlined in Table ____ are described by Ewing (9), with the exception of the cytochrome oxidase method. Oxidase

TABLE 1.

IDENTIFICATION SCHEME FOR SALMONELLA SUSPECTS



activity was determined using Patho-Tec-CO[1/] reagent impregnated strips.

Definitive serological identification of Salmonella isolates was made at the Southeast Environmental Research Laboratory, Athens, Georgia. The methodology used was the standard serological procedures described by Edwards and Ewing (10).

AERIAL PHOTOGRAPHY

Aerial photography of the Chattanooga area was flown in January 1973 by the Environmental Surveillance Branch of the National Environmental Research Center - Las Vegas (NERC-LV). The photographs clearly confirmed the presence and extent of pollution problems (note the white color of Dobbs Branch -- left center of Figure 19). The stereoscopic coverage was particularly useful in outlining drainage basins in which to search for sources of pollution because divides between watersheds are well defined by the vertical exaggeration of the stereo-pairs.

1/ Does not imply endorsement of the product.

;ure 1A
:ttanooga Creek From Approximately Mile 1 to Mile 4

WASTE SOURCE RESULTS

GENERAL

The industrial effluent data obtained during the survey is contained in Appendix D.

INDUSTRIAL WASTES

Combustion Engineering, Inc.

Combustion Engineering employs over 5,000 people in the manufacture of boilers and pressure vessels.

The company discharges wastewater which is primarily cooling water to the Tennessee River at RM 462.1 (Figure 2).

Discussion of Analytical Data

The flow during the EPA study was estimated to be 50 gpm. Grab composite samples were collected on March 6 and 7 from the effluent pipe.

BOD_5 concentrations averaged less than 4 mg/l, while total nitrogen averaged 1.1 mg/l.

TOC concentrations ranged from 2.0 to 11.0 mg/l.

Temperature and pH of the wastewater were in the range of 17°C and 7.6-8.0 pH units, respectively.

Chattem Drug and Chemical Company

Chattem Drug plant located at 1715 West 38th Street employs a total of approximately 120 persons working three shifts per day, seven days per week. The company is divided into three production units which are housed in separate buildings. Most of the chemical process water is discharged after pretreatment for solids and oil removal to the city

Figure 2
Combustion Engineering's Cooling Water Discharge

system; however, a portion of the company's process water and cooling water is being discharged to a storm drain which enters Chattanooga Creek (Figure 3).

Chattem Drug manufactures a large number of medicinal chemicals and pharmaceutical products, many of which are derived from vegetable extracts. The major chemicals produced are aluminum isopropylate, dihydroxy aluminum carbonate, and glycine. Aluminum isopropylate is made in two different units, one for sale as a finished product, and the other as an intermediate in the production of dihydroxy aluminum sodium carbonate.

The basic raw products used at Chattem are: sodium bicarbonate, isopropyl alcohol, aluminum, ammonia and acetic acid.

Discussion of Analytical Data

The total flow (500 gpm) being discharged to the storm water sewer contained significant loads of BOD_5 (1,100 lbs/day), COD (2,340 lbs/day), and total nitrogen (770 lbs/day). The dissolved, total, and total volatile residue loadings were 4,870, 4,930, and 2,450 lbs/day, respectively.

Several times during the reconnaissance and survey, a strong odor of isopropyl alcohol was detected in the waste stream. The TOC concentrations averaged 158 mg/l and correlated well with the suspected presence of organic compounds in the wastewater. Approximately one-half of the average total residue concentration (822 mg/l) was composed of volatile matter (409 mg/l) which was 98 percent dissolved residue. The residue data clearly show that a high concentration of dissolved organic matter was in the discharge.

Figure 3
Storm Drain Carrying Waste From
Chattem Drug Company

TKN concentrations ranged from 82.5 to 185 mg/1 and averaged 127 mg/1 with an average ammonia concentration of 101 mg/1.

Chattem Drug is contributing a substantial amount of oxygen demanding pollutants to the downstream portion of Chattanooga Creek already heavily polluted by upstream waste sources.

Crane Company

The Crane Company, Chattanooga Enamelware Plant, is located at 33rd Street and Alton Park Boulevard and employs approximately 400 people on a three-shift, five-day per week basis.

The enamelware plant has a foundry operation for the melting of scrap steel and subsequent casting of bathtubs, sinks, and lavatories. After casting and cooling, the fixture is sprayed with a ground coat cover, heated to around 1600°F or higher, removed from the furnace and dusted. This step may be repeated several times to obtain an even coat. The porcelain enameling process involves the re-fusing of powdered glass on the metal surface.

The wastewater in the plant is generated in cooling the cupola in the foundry, from casting sand, air pollution scrubbing equipment, and washing operations in the mixing of cover coat materials. The wastewater discharges (Figures 4 and 5) into an old oxbow of Chattanooga Creek which was cut off when the creek was rechanneled. The water flowing into the creek had a black-grey color and an average temperature of 31°C. Water discharges into Chattanooga Creek from the old stream via two pipes which enter below the water level of the creek. During the heavy rains of March 2, a distinct plume of oil could be seen boiling into the main channel of Chattanooga Creek from this point.

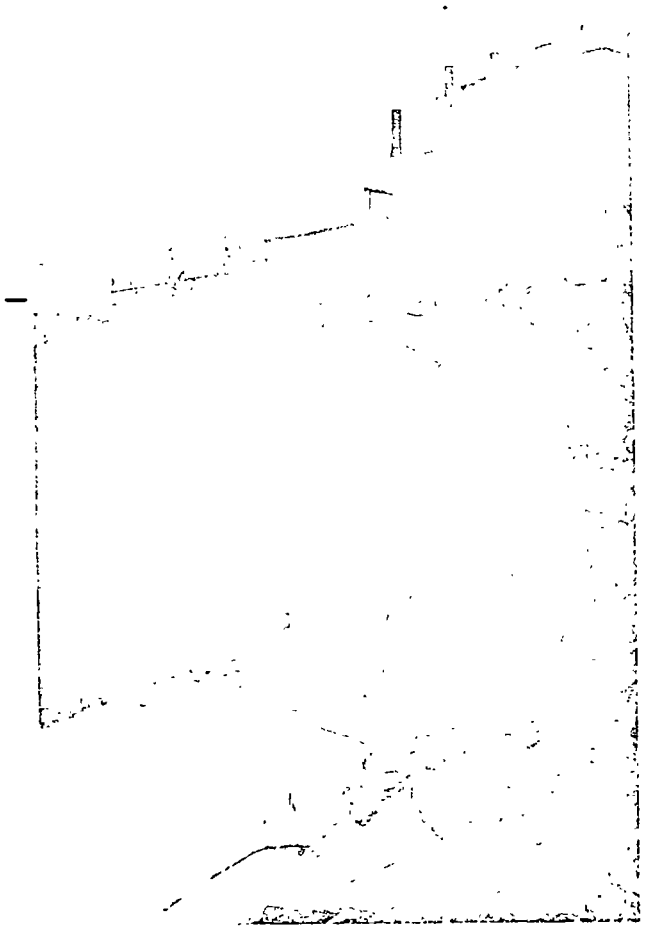


Figure 4
Discharge from Crane Company
(Station CR-1)

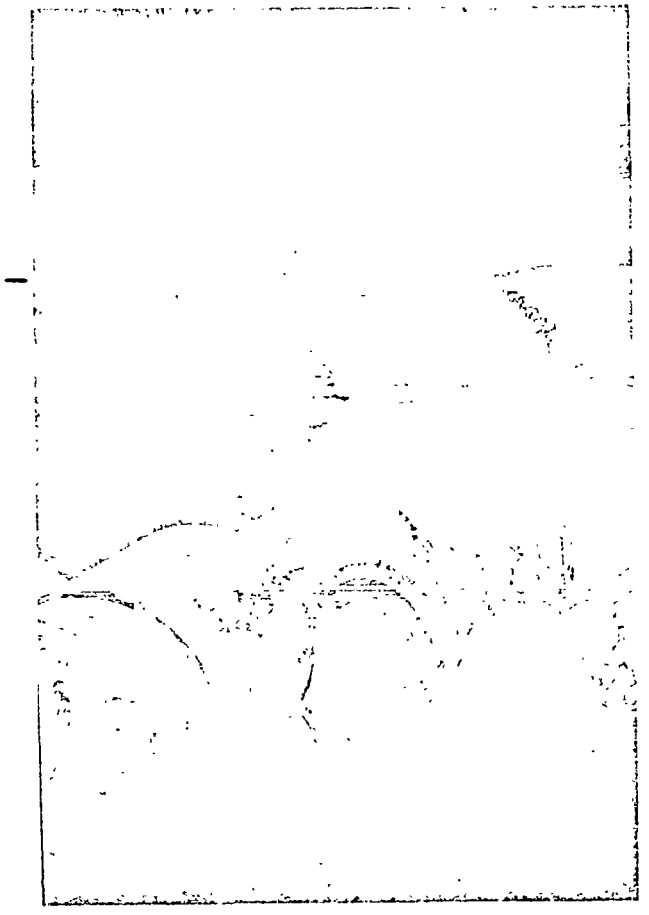


Figure 5
Discharge From Crane Company
(Station CR-1) Into Old
Chattanooga Creek Bed

Discussion of Analytical Data

The average flow was 1,600 gpm with a slightly acid pH. The pH ranged between 4.7-6.0 pH units.

The carbon content of the wastewater was relatively low as observed in the average concentrations of BOD_5, COD, and TOC which were <20, <50, and 9 mg/l, respectively. Oil and grease concentrations averaged <5 mg/l.

The average iron concentration was 23.9 mg/l (460 pounds per day). Extremely high concentrations of lead were found -- ranging from 28.13 to 57.5 mg/l with an average of 38.7 mg/l (744 pounds/day).

Total residue concentrations averaged 3,610 mg/l (69,400 pounds per day) of which 83 percent (3,000 mg/l) was total volatile residue. Four percent of the total or an average concentration of 152 mg/l (2,920 pounds/day) was nonfilterable residue.

Dixie Sand and Gravel Company

Dixie Sand and Gravel plant, located at 515 River Street, operates two 8-hour shifts per day for five days per week. The company dredges from the Tennessee River and transports the unprocessed material to its land based plant. The process includes washing and screening, followed by crushing of the larger aggregate. The discharged washwater is heavily laden with silt and fine sand and is discharged untreated to the Tennessee River.

Discussion of Analytical Data

The flow was reported by company officials to be 1,400 gpm. The high velocity of the wastewater made representative sampling for residue (solids) difficult. Results of two grab samples were:

	Concentrations in mg/l	
	March 7	March 8
Dissolved Residue	974	872
Nonfilterable (suspended) residue	12,200	5,310
Total Residue	13,200	6,180

In both cases, the nonfilterable portion made up approximately 90 percent of the total residue concentration. The waste loadings for total and nonfilterable residues were 108,700 and 98,400 pounds per 16 hours, respectively. This would represent an unusually heavy workday, since the washer is usually periodically shutdown during the day.

Gilman Paint and Varnish Company

Most of the operations involved in mixing paints are physical. The resins, oils, and pigments are first mixed, passed through grinding mills and then mixed with tinting and thinners. The liquid paint is strained into a transfer tank or into the hopper of the filling machine.

Varnishes are produced by mixing natural and synthetic resins in oils and solvents. Various types of varnish require different manufacturing techniques.

The company is discharging all process water to the city sewer but has one discharge cooling water which contains traces of paint. Company officials indicated that a sink where paint brushes containing latex paint were occasionally washed had become clogged and the maintenance department had connected the drain to the cooling water discharge.

During the EPA study, water samples collected from the cooling water effluent did not contain any evidence of water quality degrading materials.

On April 3, 1973, a letter was received from the company stating that a cooling tower is being erected and should be installed by June 30, 1973, thus eliminating the cooling water discharge to the Tennessee River.

Happy Valley Farm

This dairy farm is located off of the Rossville-Ridgeland Road in Georgia. During a visit to the farm, company officials reported that construction was almost completed on a waste pretreatment facility. The wastes were being discharged to the city sewer during the EPA study.

Prior to the installation of pretreatment equipment and discharge to the Chattanooga sewerage system, this waste constituted a major pollutional load into Dry Branch. The removal of this waste from surface streams is credited as a major cause of water quality improvement since the earlier studies cited in the Bibliography (3, 4, 5).

The Louisville & Nashville (L&N) Railroad Company

L&N operates a locomotive and car repair shop as well as fueling and car washing facilities at the Wauhatchie Yard. The wastewater consists of large quantities of oil and grease, cleaning solvents, and detergents. Five waste streams originate on the company property, four of which discharge into Black Creek and one to Lookout Creek.

The treatment facilities include a small package extended aeration plant with chlorination for domestic wastes (Station L&N-1 -- Figure 6); an oil skimmer which treats wastes from the repair shops (Station L&N-2 -- Figure 7); and a holding pond which collects yard drainage and contains a significant amount of oil (Station L&N-3 -- Figures 8, 9, and 10). The soil under the yards is saturated with oil. Station L&N-4 is located at

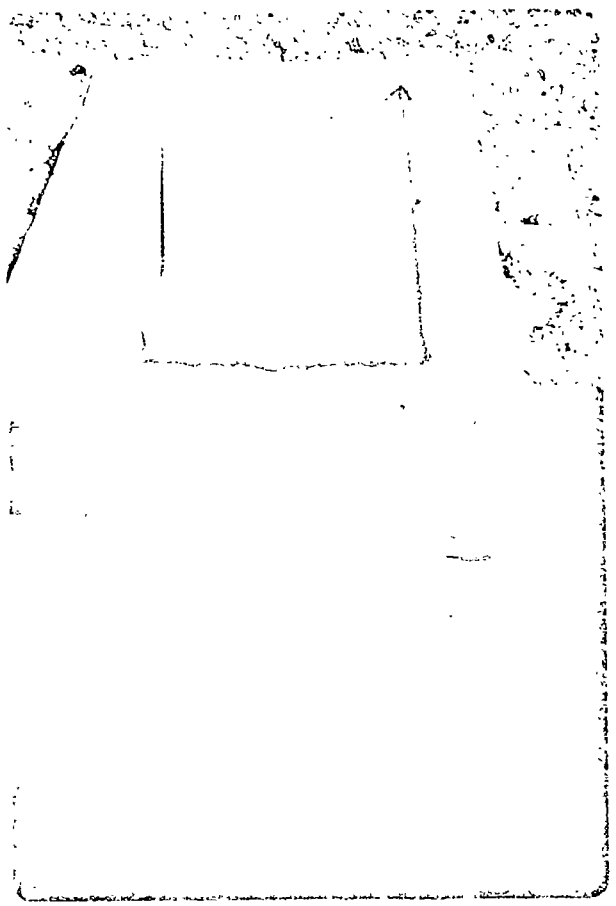


Figure 6
L&N STP Chlorine Contact Chamber (Station L&N-1)

Figure 7
Oil Skimmer (Station L&N-2)

Figure 8
L&N Holding Pond

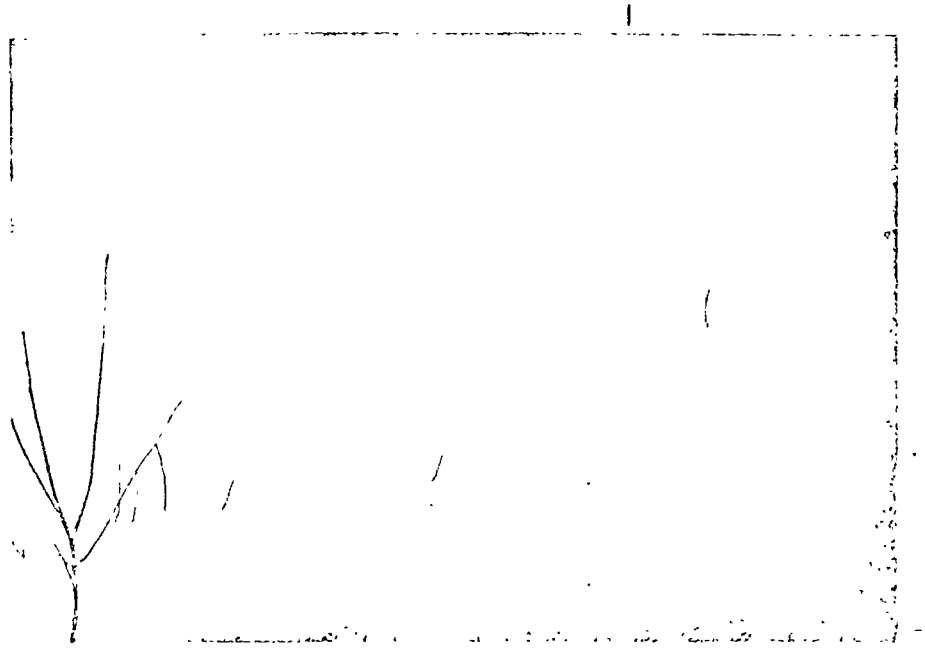


Figure 9
Floating Oil on L&N Holding Pond

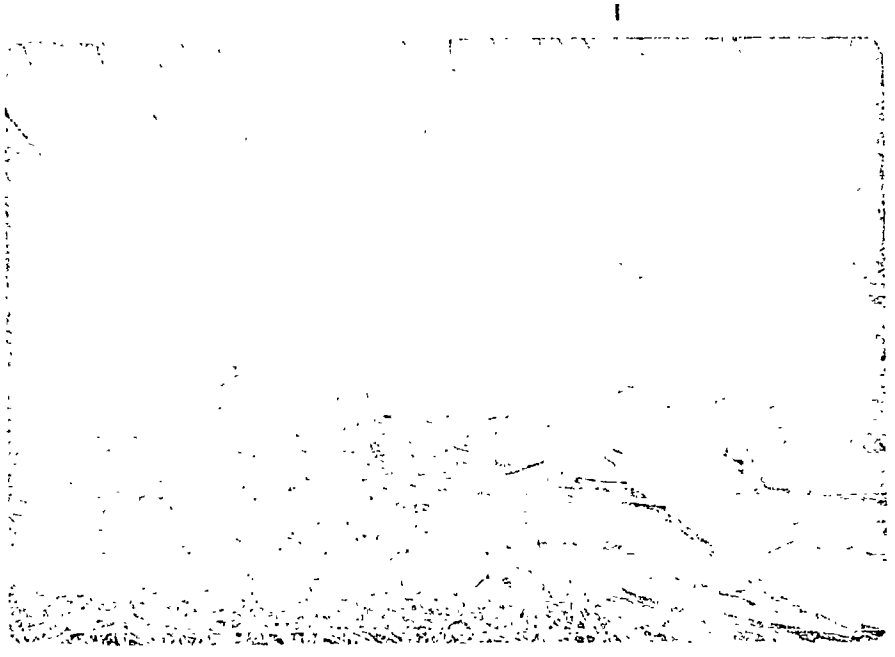


Figure 10
Overflow From Holding Pond (Station L&N-3)

a ditch carrying site drainage (Figures 11 and 12) and Station L&N-5 is located on a ditch which receives groundwater drainage (Figure 13).

Discussion of Analytical Data

Five stations were sampled during the EPA study. All five stations at the Wauhatchie Yard contributed a total average of 70 pounds per day of five-day Biochemical Oxygen Demand (BOD_5). The average BOD_5 concentrations were:

	mg/l
L&N-1	23.6
L&N-2	94.0
L&N-3	13.9
L&N-4	108.0
L&N-5	21.1

Total organic carbon (TOC) concentrations were highest in the effluent from the oil separator (L&N-2) ranging from 13 to 100 mg/l (average: 45.3 mg/l) and at the ditch crrying yard runoff (L&N-4) ranged from 18 to 133 mg/l (average: 82.7 mg/l). Total TOC waste loadings were 54 pounds per day with over half of the amount coming from L&N-2 and L&N-4.

Oil and grease concentrations were highest at L&N-2, ranging from 18 to 61 mg/l, with an average waste loading of 7 pounds per day. L&N-3 had an average loading of 6.8 pounds per day. The total waste load from all five discharges for oil and grease was 47.2 pounds per day.

Total nitrogen waste loadings averaged 26 pounds per day. Kjeldahl nitrogen and ammonia concentrations were minimal, but nitrate-nitrite (NO_3-NO_2-N) concentrations were high, with concentrations at L&N-1 averagin

Figure 11
L&N Railroad Oily Water
Draining From Spillage
and Saturated Ground
Near Fuel Pump

Figure 12
Weir at Station L&N-4 Water Drained From the Ditch
in Upper Picture

Figure 13
Groundwater Discharge at
Station L&N-5

33.8 mg/l and 17.8 mg/l at L&N-5. Total phosphorus concentrations on both L&N-1 and L&N-2 were 7.20 and 6.73 mg/l, respectively.

The residue concentrations were relatively low except for one day at L&N-2. On March 7, the total residue concentration at L&N-2 was 823 mg/l and the nonfilterable residue concentration was 229 mg/l. On the same date, the total volatile residue concentration was 227 mg/l including 64 mg/l as volatile nonfilterable residue.

Modern Maid, Inc.

The Modern Maid plant located at East 14th Street at Holtzclaw Avenue, manufactures kitchen ranges from stamped sheet steel. The steel parts are cleaned by a sequence of alkaline cleaning, hot and cold water rinses, pickling and rinse, nickel flushing and rinse, and neutralizing. After drying, the ground coat is sprayed on the metal, dried and fired. The cover coat may be applied either to the cleaned metal, or over the ground coat.

Wastewater is generated in the metal cleaning facility and contains both alkali and acid materials and dissolved iron and nickel. Another source of wastewater is in the ball-milling of the porcelain enamel frit (quenched glass). The frit is milled with clay, electrolytes, and water to form a stable suspension. The water from these mills are high in suspended material, color, and turbidity.

Discussion of Analytical Data

Three stations were sampled during the study: MM-1 (pickling waste), MM-2 (ceramic base coating waste), and MM-3 (paint shop effluent). Wastes from MM-3 are discharged to the city sewer system. Wastes at stations MM-1

and MM-2 were found to be discharging to a storm sewer (Figures 14 and 15) which drains to Dobbs Branch, verified by a dye release through the plant effluents. Travel time through the sewer system was 5½ hours and total travel time to Chattanooga Creek was about 10 hours.

The wastewater from the pickling operation had a low pH (2.3) and contained iron, lead, and nickel concentrations averaging 231, 0.64, and 7.4 mg/l, respectively.

BOD_5 and COD concentrations at all stations were low, averaging less than 20 and less than 58 mg/l, respectively, at stations MM-1 and MM-2. TKN concentration at MM-2 averaged 23.3 mg/l with a waste load of 3.27 lbs/day.

Total residue from MM-1 and MM-2 averaged 254 and 369 pounds per day, respectively. The nonfilterable residue at MM-2 averaged 238 pounds per day. The average total residue loading from the three stations was 632 pounds per day. The average nonfilterable residue total was 240 pounds per day.

Reilly Tar and Chemical Corporation

Reilly Tar and Chemical plant on Central Avenue employs seven people in the distillation of coal tar. Major products are roofing and conduit pitch. The company also collects creosote oil during the distillation and uses part of this oil to blend with the "base tar" to produce a satisfactory pitch. The remainder of the oil is sold as creosote for wood-preserving. The coal tar and the steam used for distillation are both purchased from Woodward, Inc. located adjacent to the plant.

The wastewater treatment facility has a settling pond which receives both surface and industrial water. The water then discharges through a

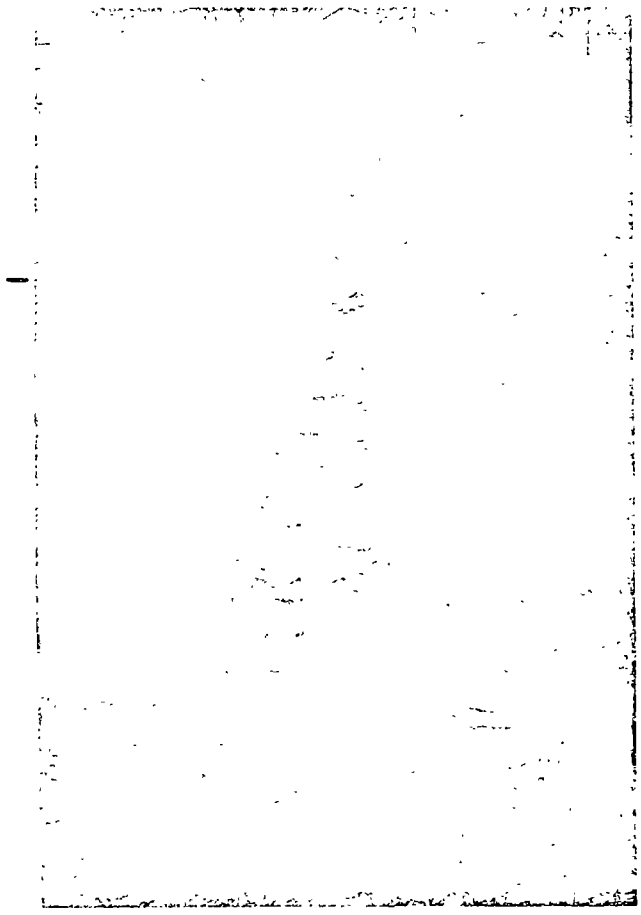


Figure 14
Station DBT-2 Sampling Point
Drainage to Dobbs Branch

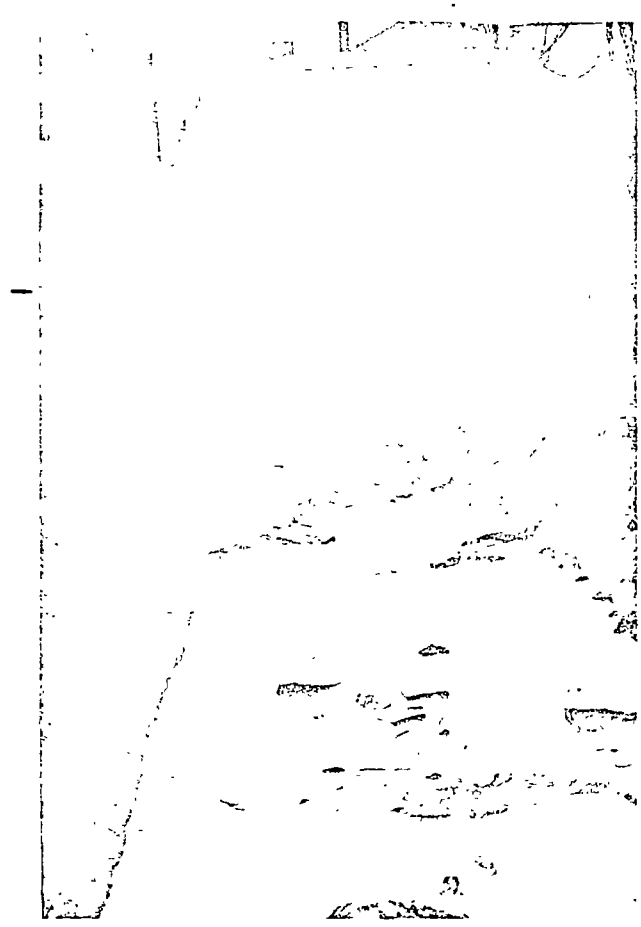


Figure 15
Turbidity Caused by Blue-White
Discharge From Modern Maid, Inc.
(Station DBT-2)

straw oil trap and via a 24-inch pipe to an unnamed tributary of Chattanooga Creek. Concentrated phenolic wastes are pumped to a bio-oxidation pond for treatment. According to company officials, the waste is held until the phenolic concentration drops below one mg/l and is then batch discharged to the creek (Figure 16).

Discussion of Analytical Data

The flow from the treatment facility during the EPA study averaged only 10.3 gpm. The concentrations for BOD_5, COD, and ammonia averaged 118, 224, and 5.0 mg/l, respectively, while the phenolic concentration averaged 20.5 mg/l. Although these concentrations were high in most cases, the waste loadings were low as a result of low flows. The bio-oxidation pond was not discharging water during the survey.

G. D. Roper Corporation

Roper Corporation is located in north Chattanooga and discharges wastewater to an unnamed branch which enters the Tennessee River at RM 464.0. The plant manufactures kitchen ranges from stamped sheet steel. After stamping operations, the parts are cleaned through a normal pickling operation of alkaline cleaning, hot and cold water rinses, pickling and rinse, nickel flushing and rinse, and neutralizing. After drying, the ground coat is sprayed on the metal, dried and fried. The cover coat may be applied either to the cleaned metal or over the ground coat.

Wastewater from the plant is discharged at four different points. Two discharges enter the branch directly while the other two streams flow through settling ponds which are completely filled with sediment.

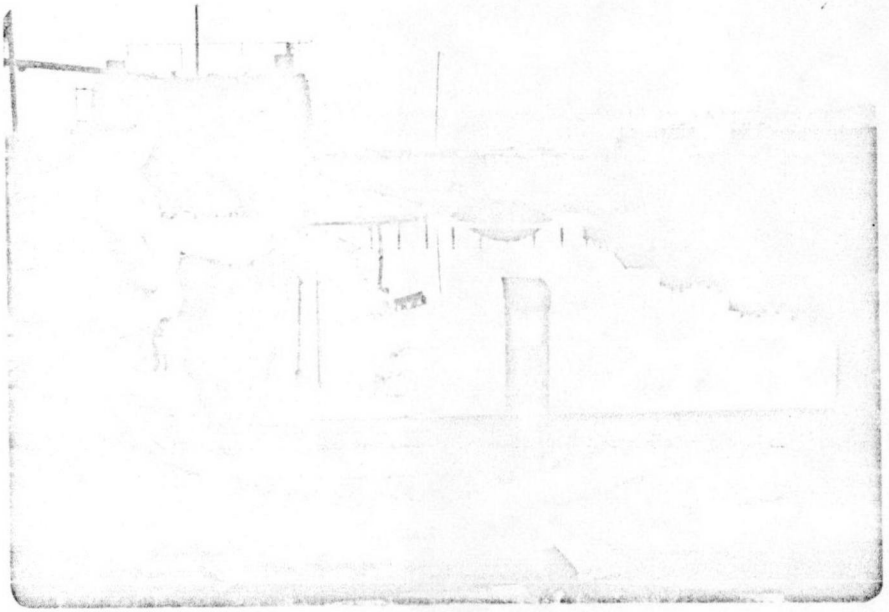


Figure 16
Reilly Tar and Chemical Corporation Bio-Oxidation Pond

Company spokesman stated that the waste at Station RO-1 was primarily welder cooling water; RO-2 consisted of cooling water and floor drains; RO-3 consisted of paint shop, pickling line and enamel mill room wastewater; RO-4 contains porcelain enamel waste. The content and color of the waste at Stations RO-2, RO-3, and RO-4 varied from hour to hour during the sampling period, while the waste at RO-1 remained clear.

Discussion of Analytical Data

The total average flow from the four discharge points was 144 gpm. The waste at Stations RO-1 and RO-3 both had excessive concentrations of BOD_5. The BOD_5 concentrations at Stations RO-1 ranged from 5.1 to 143 mg/1 with an average of 83.4 mg/1, indicating that RO-1 had more than just welding cooling water. The BOD_5 concentrations at Station RO-3 ranged from 64 to 198 with an average greater than 134.8 mg/1. The BOD_5 waste loads at Stations RO-1 and RO-3 were 37.6 and 104.1 pounds per day, respectively, and 142 pounds per day total. The waste loads measured at Stations RO-2 and RO-4 were low with only 12 pounds of BOD_5 per day.

TOC concentrations varied greatly at Stations RO-1 and RO-3 ranging from 2.0 to 43.0 mg/1 and 34 to 220 mg/1, respectively. TOC concentrations were low at Stations RO-2 and RO-4.

COD followed the same trend as BOD_5 and TOC. Wastes at Station RO-1 had an average concentration of 124 mg/1. At Station RO-3 the average concentration was 405 mg/1. The waste load discharges were 55.6 and 312.8, respectively, with a total of 368.4 pounds per day.

Solids which present a major problem at Roper were previously settled in two sedimentation basins. Since these basins are presently filled, the material is now being discharged to the receiving stream.

Due to the fact that the samples were composited grab samples of a batch discharge industry, variance was observed in some of the solids data, particularly at Station RO-2 where the range was from 388 to 1,020 mg/l with an average of 753 mg/l. Some variation was noted at Station RO-4 with a range of 1,301 to 2,279 mg/l (average 1,787). The following table lists the solids contribution based on a 24-hour workday:

SOLIDS

	Total		Total Vol.		Suspended		Vol. Suspended	
	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day
RO-1	403	182	72	32	113	51	98	44
RO-2	753	256	57	19	562	191	18	6
RO-3	2,006	1,549	178	137	899	694	76	59
RO-4	1,787	293	138	23	1,385	228	85	14
TOTALS		2,280		211		1,164		123

Phosphorus concentrations at stations RO-1 and RO-4 averaged 2.16 and 1.36 mg/l, respectively, while station RO-3 concentrations ranged from 7.50 to 23.0 mg/l with an average of 13.57 mg/l. Nitrogen concentrations were generally low, but one concentration of 16.1 mg/l of TKN was observed on March 7 at station RO-3 with a correspondingly high pH of 10.4.

Metals (zinc, manganese, and iron) were in excessive concentrations at stations RO-2, RO-3, and RO-4. The average concentrations and waste loadings are listed below:

Station	Zn		Mn		Fe	
	mg/l	lbs/day	mg/l	lbs/day	mg/l	lbs/day
RO-2	4.8	1.6	8.9	3.0	25.0	8.5
RO-3	5.7	4.4	11.4	8.8	51.6	40.0
RO-4	23.6	3.8	5.2	0.8	11.7	1.9
TOTAL LBS/DAY		9.8		12.6		50.4

Rossville Textile Mills

The Rossville Development Corporation complex (RDC) houses: Borg Fabrics, Rossville Yarn Processing Corporation, Rossville Spinning Corporation, Rossville Carpet Dyeing Corporation, Rossville Mills, and provides heating and air conditioning to the tenants. Kenyon Southern, Inc. owns and occupies the southwest corner of the complex.

Borg Fabrics dyes synthetic fibers and knits them into backing materials.

Rossville Yarn Processing Corporation processes synthetic filament yarn for carpet use. It dyes, heat sets, and performs other physical operations to produce a yarn of proper color, ply, and texture.

Rossville Spinning Corporation dyes and blends fibers for proper type and color before spinning into yarn for carpet manufacturing.

Rossville Mills purchases yarns and adds various finish coatings. The yarn is then woven into upholstery material. The company does no dyeing.

The complex is sewered by the Chattanooga system; however, several storm and cooling water drains still carry waste to McFarland's Branch. Kenyon Southern had an outside drain leading from a paved area where

empty barrels used for storing pigment are stored. These barrels often fill with rainwater and are emptied into the storm drain (Figures 17 and 18). The water contains pigment which causes Dye Branch, a small tributary to McFarland's Branch, to become highly colored. Boiler blow-down from Borg Fabrics is discharged directly to the stream.

The Standard Coosa Thatcher, National Plant, is located immediately southwest of RDC and discharges surface runoff and uncontained spills to Dye Branch. Process wastes from the yarn and pressure dyeing vats are passed through a heat exchanger before discharge to the sewer system.

These plants are subject to spills such as one witnessed at Standard Coosa Thatcher on March 1, 1972, where a pink dye was allowed to spill from the building to an outside storm drain (Figure 19). On a sampling run on March 6, 1973, a detergent-like discharge was observed and collected at Dye Branch coming from Standard Coosa Thatcher.

Several times prior to and during the EPA study, highly colored wastes were seen in McFarland's Branch, which clearly shows that all textile process wastes are not discharged to the sewers.

Discussion of Analytical Data

Samples were collected from three different point sources at the Rossville Complex. The storm drain from Kenyon Southern (Station SK-1) which discharges into Dye Branch, had the following concentrations (in addition to the strong yellow pigment) (Figure 20):

- pH - 10.9
- BOD_5 - 28 mg/1
- TOC - 37 mg/1
- TKN - 1.30 mg/1
- COD - 132 mg/1
- Total phosphorus - 1.02 mg/1
- Total residue - 1,558 mg/1
- Total volatile residue - 191 mg/1
- Total NFLT volatile residue - 160 mg/1

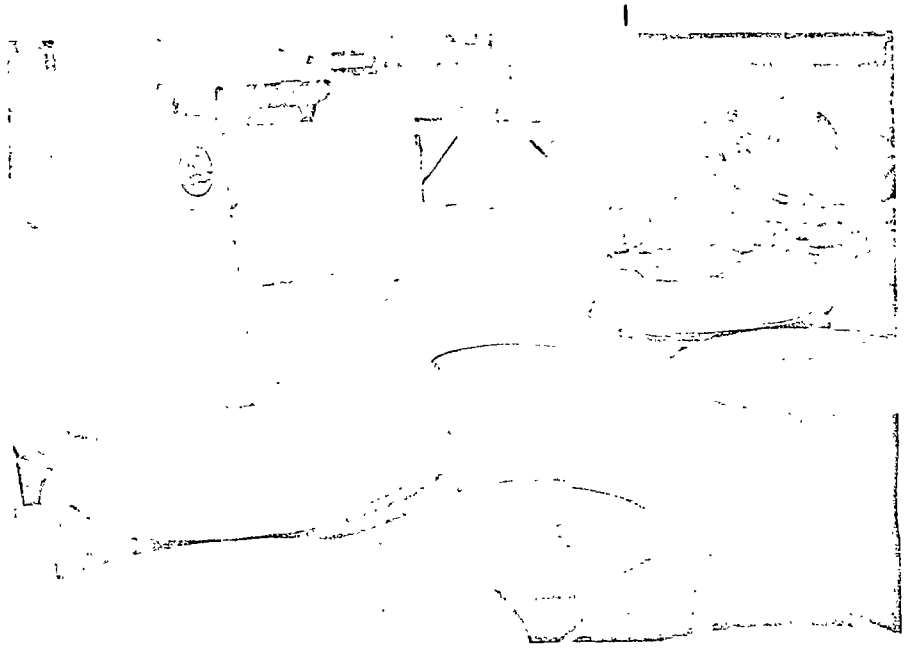


Figure 17
Storage Area at Kenyon Southern for Empty Dye and Pigment Barrels

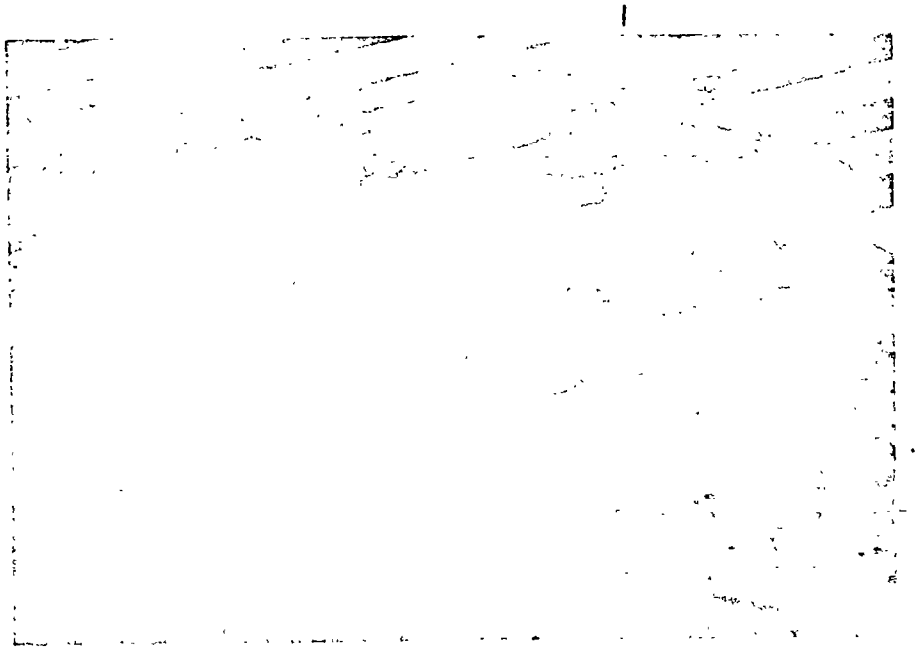


Figure 18
Multicolor Pigments at Kenyon Southern Storm Drain

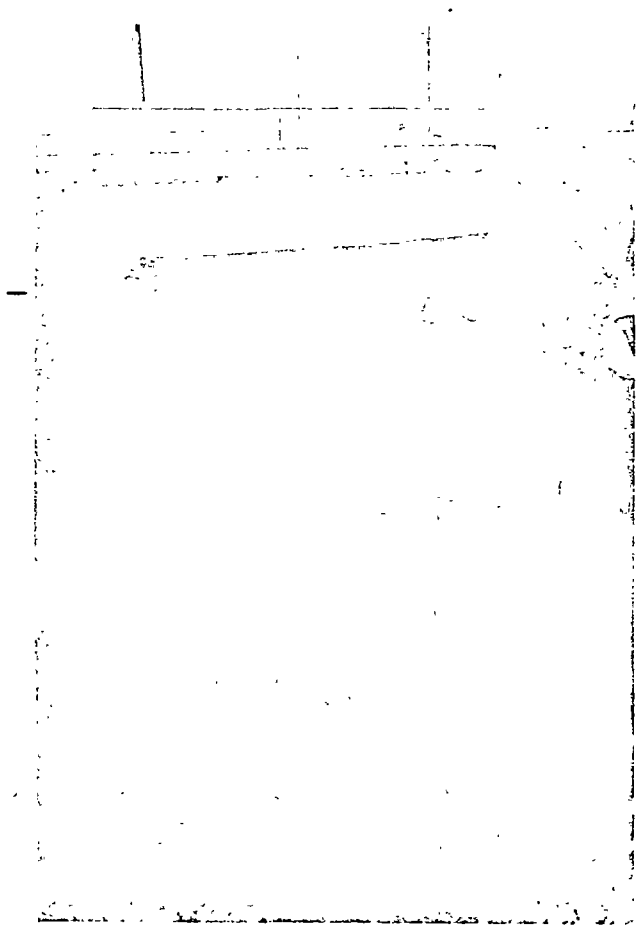


Figure 19
Pink Dye Spill From Standard Coosa Thatcher Company Entering McFarland's Branch

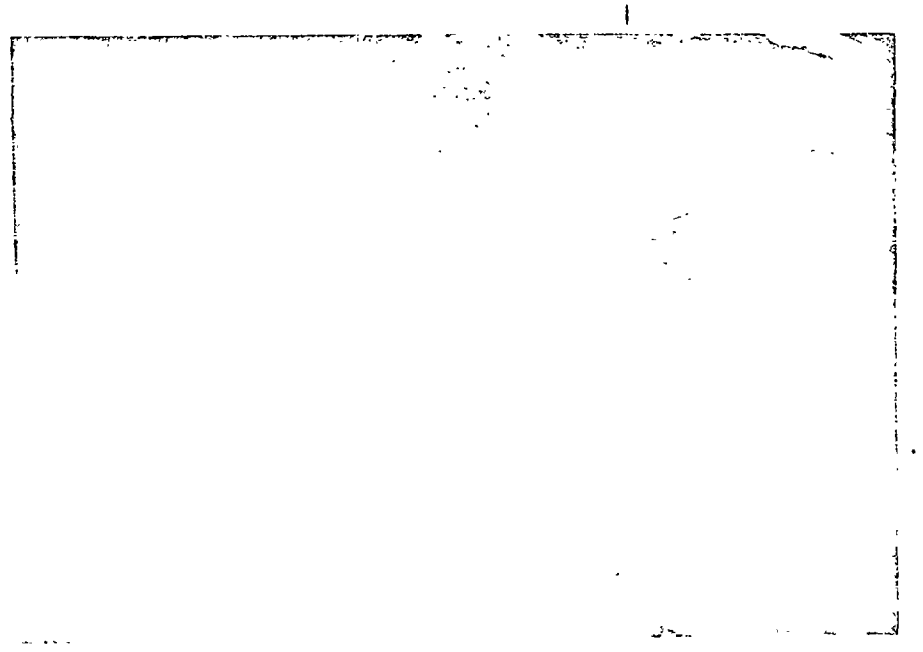


Figure 20
Yellow Pigment Flowing into Dye Branch from
Kenyon Southern

All of the above concentrations are considerably higher than those of natural drainage.

The sample at station RD-1 was collected from a ditch downstream from Standard Coosa Thatcher. The water quality was very similar to that at Station KS-1:

- pH - 10.5
- BOD_5 - 21 mg/1
- TOC - 35 mg/1
- TKN - 0.50 mg/1
- Total phosphorus - 1.12 mg/1
- Total residue - 3,605 mg/1
- Total volatile residue - 323 mg/1
- Total NFLT volatile residue - 82 mg/1

Station RDC-1 was sampled over a 3-day period, March 5-7. TOC concentrations were observed from 86 to 195 mg/1 with an average of 124 mg/1. BOD_5 concentrations were low averaging less than 6.4 mg/1, but COD concentrations ranged from 324 to 3,000 mg/1 with an average of 1,230 mg/1. One unusually high iron concentration of 85.7 mg/1 was found on March 6. The next day company officials stated that they were discharging boiler blow-down water and soot steam blasted from the combustion chamber.

Although color was not measured as a parameter, observations of various colors being discharged into Dye Branch and McFarland's Branch were noted by EPA personnel.

Total residue concentrations ranged from 825 to 4,720 mg/1 with an average of 2,247 mg/1. Total volatile residues were high with two of three values exceeding 1,000 mg/1. The average concentration was 769 mg/1. On March 6 and 7, the total nonfilterable volatile residue was 70 and 90 percent, respectively, of the total volatile residue, which is about what would be expected if this residue was, in fact, soot as claimed by company officials.

Signal Mountain Portland Cement Company

Signal Mountain Portland Cement operates quarries and a cement plant near the base of Signal Mountain. The cement is obtained by pulverizing limestone rock, calcining and grinding to a fine powder. Clay, gypsum and other additives are blended to obtain desired cements.

The waste stream consists primarily of cooling water and sediment. The wastewater treatment system is a series of lagoons with a retention time according to company reports, in excess of 10 days.

As would be expected from the type of operation, BOD_5, TOC, and nutrients were all low. The pH of the discharge was 10, and total iron concentration was 2.5 mg/l. The total iron waste loading was 31.3 pounds per day. The effluent was clear with a total residue concentration of 295 mg/l of which 64 mg/l was total nonfilterable residue.

Swift Edible Oil Company
(A Division of Swift and Company)

The Swift plant, located on Central Avenue, employs approximately 200 persons on a 7-day, 24-hour basis in the manufacturing of edible oil products such as salad oil, margarine, and shortening. The major raw products are soybean oil, cotton seed oil, and tallows. The crude vegetable oils containing fatty acids are neutralized with caustic, forming a soapy material called foots. The foots are removed by centrifuges and recovered. The oil is bleached with adsorbent clay. For salad oil, the bleached oil is deodorized and cooled, causing the stearin to crystallize. The oil is filtered and the stearin is removed. For shortening, the bleached oil is hydrogenated, rebleached, and deodorized by blowing superheated steam through the oil.

The wastewater from the plant is discharged after grease removal to the city sewer. The sewer and stormwater drains enter a common sump but are separated by a concrete partition. During the initial reconnaissance in January 1973, white colored water with considerable flow was bypassing the city sewer and going through the storm drain to an unnamed branch of Chattanooga Creek (Figure 21). To ascertain that the storm drainage did drain to Chattanooga Creek by the route described above, a slug of dye was traced from the stormwater discharge point to the unnamed tributary of Chattanooga Creek.

Discussion of Analytical Data

Composite samples were collected from the stormwater discharge from March 6 through March 8. The estimated average flow was 25 gpm with one high flow of 45 gpm reported during the initial sampling.

The BOD_5 concentrations ranged from 380 to 2,900 mg/1 with an average of 1,660 mg/1. The calculated waste loading was 498 pounds per day. Although the flow was not high, a substantial load was being discharged to the stream.

TOC concentrations ranged from 110 to 2,000 mg/1 with an average of 783 mg/1. The exceptionally high concentration of 2,000 mg/1 was found on March 6 and was indicative of a spill containing a high carbon source.

Nutrient concentrations were about normal for seed oil plants. Total phosphorus, however, was high and ranged from 18.3 to 7.4 mg/1 with an average of 13.5 mg/1.

Oil and grease content ranged from 210 to 4,100 mg/1 with an average of 2,170 mg/1. The high oil and grease content agrees with the high BOD_5

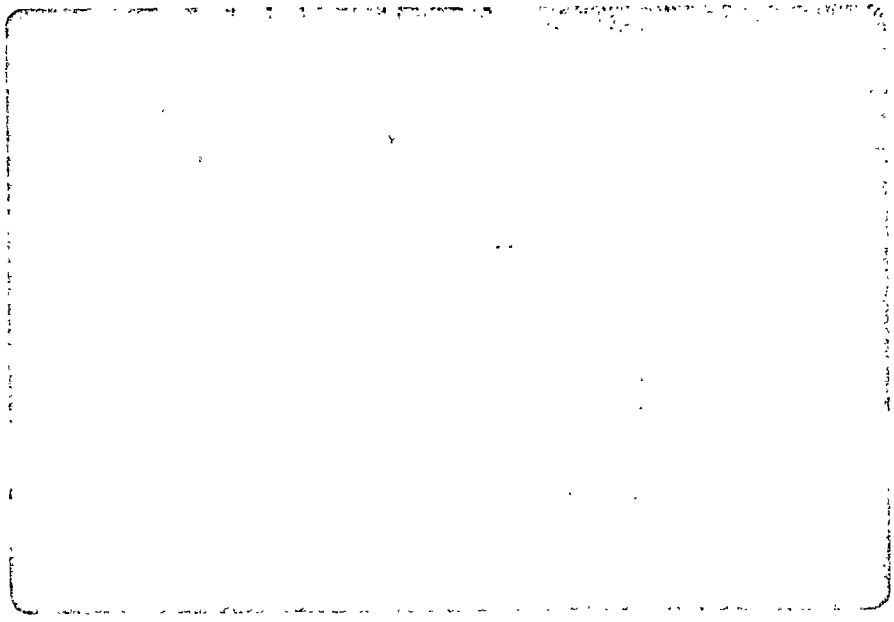


Figure 21
Storm Drain Containing Waste From Swift and Company

and TOC values found on March 6 and 8. These concentrations are the direct result of spillage and washdown from within the plant. Waste loadings for oil and grease represent a loss of 651 pounds per day. This loss is evidenced by large deposits of grease and scum-like material in the storm sewer and along the banks of the unnamed tributary flowing behind Miller Brothers warehouse.

One unusually high zinc concentration, 12.6 mg/1, was noted on March 6. This concentration was nearly 175 times greater than the lowest value of 0.075 mg/1. Chromium and copper concentrations were negligible, but an average of 6.7 mg/1 of iron was found.

pH values ranged randomly from 3.1 to 12.2. The high value, 12.2, corresponded to the high concentrations of other parameters noted on March 6.

Total dissolved residue ranged from 691 to 2,855 mg/1 with an average of 1,773 mg/1 (532 lbs/day). The average concentrations for total residue and total volatile residue were 3,646 and 4,246 mg/1, respectively. Total nonfilterable residue concentrations ranged from 6 to 4,940 mg/1 and volatile nonfilterable residue concentrations ranged from 6 to 4,800 mg/1. Volatile nonfilterable residue concentrations made up 97 percent of the total volatile concentration which indicates that the residue is almost solely organic.

Daily grab samples were also collected from the leakage around the cooling water basin. Nothing of significance was found in this discharge.

U. S. Pipe and Foundry Company
Soil Pipe Division

U. S. Pipe operations employ approximately 800 people in melting iron and scrap and casting soil pipe and fittings.

Wastewater is generated by cooling water from hydraulic presses, cupola and roof drains. Much of the turbid and oily wastewater generated by pipe drawing operations is discharged to the city sewer system.

Wastewater samples were collected at three sources, station USP-1 from a 24" pipe discharging cooling water and detergent to the Tennessee River station; USP-2 from a north storm sewer outfall; and station USP-3 from a south storm sewer outfall. All samples were manually composited.

Discussion of Analytical Data

The estimated flows during the study were:

- USP-1 - 150 gpm
- USP-2 - 40 gpm
- USP-3 - 40 gpm

BOD5 concentrations varied considerably from one day to the next and from station to station. On March 7, the BOD_5 concentrations were 80, 22, and 25 mg/l, respectively, at stations USP-1, 2, and 3. On March 8, the same stations had concentrations of 7.4, 2.8, and 8.2 mg/l, respectively. Station USP-1 had the only appreciable BOD_5 waste load: averaging 144 pounds per day.

TOC trends followed the same pattern as the BOD_5. The concentrations were 60, 36, and 97 mg/l, respectively, for stations USP-1, 2, and 3 on March 7.

Station USP-3 had a TKN concentration of 4.25 mg/l, including 1.92 mg/l of ammonia; and a total phosphorus concentration of 2.02 mg/l.

The only metal found in excessive concentrations was iron. The discharge at station USP-1 on March 7 contained 18.3 mg/l, a total waste load

of 32.9 pounds per day. On the same day, concentrations of 15.1 and 42.2 mg/l were observed at stations USP-2 and 3. On March 8, iron concentrations at the same stations were from 6 to 20 times as high as the previous day.

The discharges had a combined waste load of 1,896 pounds per day of total residue (solids). Station USP-1 had the highest average concentration of both total residue (763 mg/l) and total nonfilterable residue (527 mg/l). Total volatile and volatile nonfilterable residue average concentrations were 102 and 27 mg/l, respectively. Station USP-3 residue was also high with an average total residue concentration of 543 mg/l. The total nonfilterable residue average concentration was 123 mg/l. The volatile residue average concentrations were 129 mg/l total and 97 mg/l volatile nonfilterable.

The total nonfilterable waste loading for all three discharges was 1,111 pounds per day. The volatile nonfilterable waste loading was 111 pounds per day. The data clearly show that process wastes are being discharged to the Tennessee River along with cooling water. The company stated that this will be changed by the end of "Vacation Shut-Down" on August 6, 1973.

Velsicol Chemical Corporation

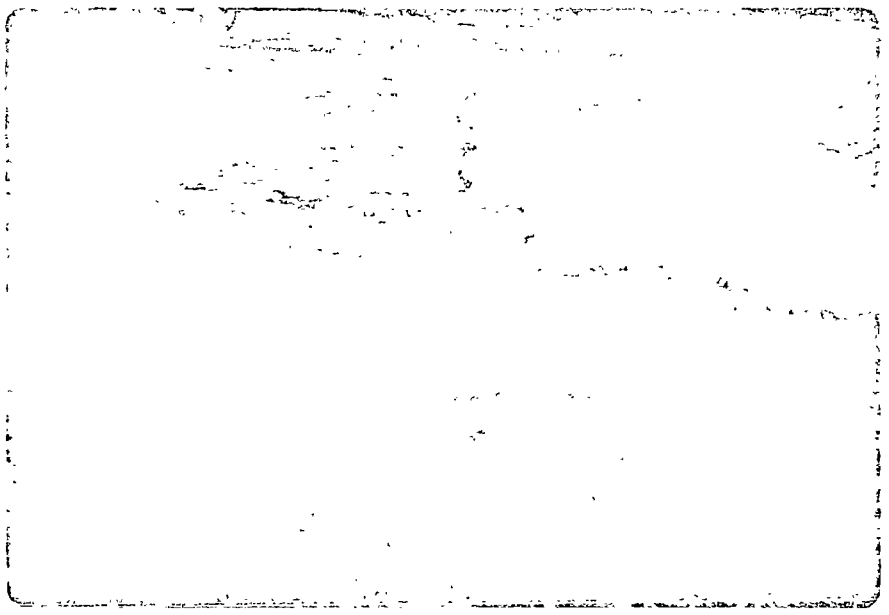
Velsicol is located at Central Avenue and employs approximately 280 employees on a 7-day, 24-hour-per-day basis. Surface drainage and process leakage discharges into Chattanooga Creek while approximately 1.4 mgd of process waters are discharged to the city sewers.

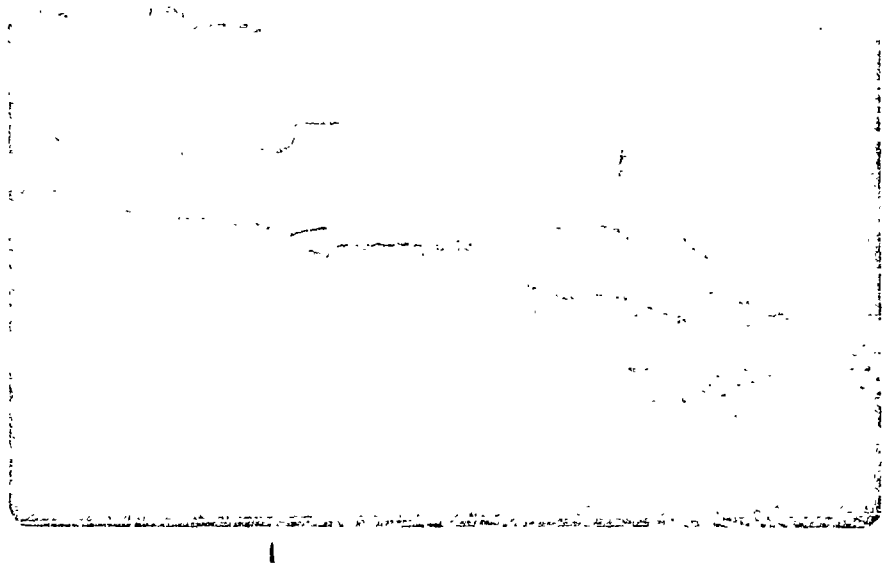
Velsicol's major building chemical is benzoic acid which is produced on site by reacting toluene with air. Other chemicals manufactured on

site are benzyl chloride, benzoyl chloride, benzyl alcohol, dibenzoate esters of glycols, benzoguanamine, sodium benzoate, and benzotrichloride. Approximately 200,000 pounds per month of dicamba, a chlorinated aryl acid herbicide is produced at the Chattanooga plant.

Benzoic acid and its derivatives are large volume products and very important to the chemical industry. They are used extensively as food additivies, medicinals, corrosion inhibitors, textile dye carriers, plasticizers, polymers, perfumes, and unlimited uses as a chemical intermediate. Due to the extensive use of these chemicals, Velsicol manufactures a wide variety of compounds and employs many raw chemicals in the process reactions. The company wastewater being discharged to the city sewer contains a large variety of these raw chemicals as well as unwanted by-products. Such compounds as benzoic acid, sodium benzoate, and the chemicals used in the production of dicamba have a high oxygen demand and/or cause taste and odor problems. As in many chemical plants, caustic and sodium chloride are used for chemical separation and then discharged. Velsicol uses large volumes of chlorine and manufactures marketable muriatic acid as a by-product.

The present wastewater collection and pretreatment system consists of a settling pond which receives a large portion of the plant surface drainage as well as process waters. A hill above the plant site is being used for acid neutralization pits and ponds for still dredges. Some of these chemicals may leach out as drainage water passes over the material (Figures 22 and 23). Another part of the wastewater disposal system is a liquid thermal oxidizer used to burn toxic or untreatable wastes. A heavy backlog of chemicals to be burned are stacked in barrels on the





Figures 22 and 23
Velsicol Chemical Corporation Industrial Chemical
Waste Disposal Areas

plant property, and these present a potential pollution hazard to Chattanooga Creek.

Discussion of Analytical Data

Three waste streams flowing from the plant property were sampled during the study. Station VE-1 is located on the stream which carries process waste and plant surface runoff. Station VE-2 is located on a stream carrying storm drainage from the southeast side of the plant property. (Prior to the EPA study, most of this drainage was diverted to the city sewer.) The waste at Station VE-3 originates in the "intermediate" building and discharges through a ditch to a tributary of Chattanooga Creek.

Station VE-1 had an average flow of 105.5 gpm which ranged in color from straw yellow to reddish yellow. The samples were grab-composited during dry weather and during one heavy rainfall.

BOD_5 concentrations averaged 915 mg/1, a waste load of 1,160 pounds per day. Both COD and TOC concentrations correspond with that of the BOD_5 with average concentrations of 1,680 mg/1 (2,130 lbs/day) and 1,160 mg/1 (1,470 lbs/day), respectively. The data from these three oxygen-demand parameters clearly show that the stream is receiving a tremendous loading of organic materials.

The stream at station VE-1 carried an extremely high load of total residue. A summary of solids loading is listed below:

RESIDUE DATA - VELSICOL CHEMICAL CORPORATION
Chattanooga Creek Study
February 27 - March 9, 1973

	Waste Loadings lbs/day				
Station	Dissolved	Total	Total Volatile	Total Nonfilterable	Volatile Nonfilterable
VE-1	16,800	17,000	523	138	34
VE-2	1,890	2,200	769	49	17
VE-3	142	148	93	6	5
VE-4*	60,800	62,000	12,000	1,430	376

* Discharge to city system.

The nutrient data did not show any significant contribution to Chattanooga Creek. The Reilly Tar and Chemical Corporation waste discharge is included in the VE-1 sample, but due to the small flow, is relatively insignificant when considering the total waste load in the stream. (Reilly Tar and Chemical is discussed in greater detail in another section in this report.)

The flow at Station VE-2 varied greatly, from 1.5 to 86.0 gpm (average 43.8 gpm). The BOD_5 loading was 188 pounds per day, while the COD and TOC loadings were 348 and 126 lbs/day, respectively.

Station VE-2 is in a swampy area and the mud is saturated with chemicals from past discharges from Velsicol. The water and mud had a distinctive chemical odor and an oily appearance. As at Station VE-1, the residue concentrations and loadings at VE-2 were high as summarized in the previous table.

Station VE-3 had a fairly constant average flow of 33.5 gpm. The water temperature was hot, ranging from 24-58°C with an average of 44.4°C.

Two BOD_5 samples measured <20 mg/l and 195 mg/l. The waste loading based on the higher concentration is 78 pounds per day. Average COD and TOC loadings were 109 and 52 pounds per day, respectively. Nitrate-nitrite concentrations were high, ranging from 0.46 to 3.06 mg/l with an average of 1.76 mg/l, but because of the small volume did not contribute a high waste load. The residue concentrations were not of significance. The residue waste loadings are listed in the above table.

Station VE-4 was a special sample collected from the discharge to the city sewer system because this stream of concentrated surface runoff and process waste contributes approximately three percent of the total flow to the Moccasin Bend Sewage Treatment Plant (more than any other single industry on the sewerage system). (The sewage treatment plant was studied and is discussed in detail elsewhere in this report.) The samples at Station VE-4 were automatically composited by EPA samplers over three 24-hour periods and flow was automatically recorded by company equipment. The flow (922 gpm) contained significant loads of BOD_5 (26,900 lbs/day), COD (37,100 lbs/day), TOC (11,500 lbs/day), and ammonia (3,580 lbs/day). The waste loadings for residue are listed in the previous table.

Wheland Foundry Division

The Wheland Foundry is located at 2800 South Broad Street and is in production 24 hours a day, five to six days per week. According to plant personnel, Wheland melts approximately 1,400 tons per day of pig iron and scrap steel in coke fired furnaces. The metal is poured into green sand molds to produce castings of which 95 percent are for automative parts, mainly brake drums. Wastes from this foundry consist of cooling water,

bentonite sand and sea coal used in casting.

During the January 1973 reconnaissance by EPA, the company had four discharges flowing into Chattanooga Creek. The pipe at Station WF-1 carried water from the melting plant and is primarily blowdown and overflow from a cooling tower. Pipes at stations WF-2 and WF-3 are primarily storm drains and pump drainage. If any malfunction should occur in the dust collection system, the overflow would enter the creek through the pipe at station WF-3. The pipe at station WF-4 discharges cooling water and surface runoff. Oil traps are situated to overflow to drains at stations WF-1 and WF-4.

Solid waste control is a major problem at the foundry. The old dumping area for used sand and dust collected from the air pollution control equipment is finding its way into Chattanooga Creek since the material has been dumped over the edges of the bank and covers the flood plain (Figure 24). Plans are being laid to start a new dump on property across the creek which will result in more solids entering Chattanooga Creek if a retaining wall isn't constructed to contain the sand. Corrective measures should be undertaken to alleviate the problem of sand being washed into the creek at the old site.

Discussion of Results

Since the plant was closed by a strike during the survey, a return trip was necessary to sample the plant discharges. One five-hour composite sample of each of three discharges was collected on May 24, 1973. The pipe at station WF-1 had no flow.

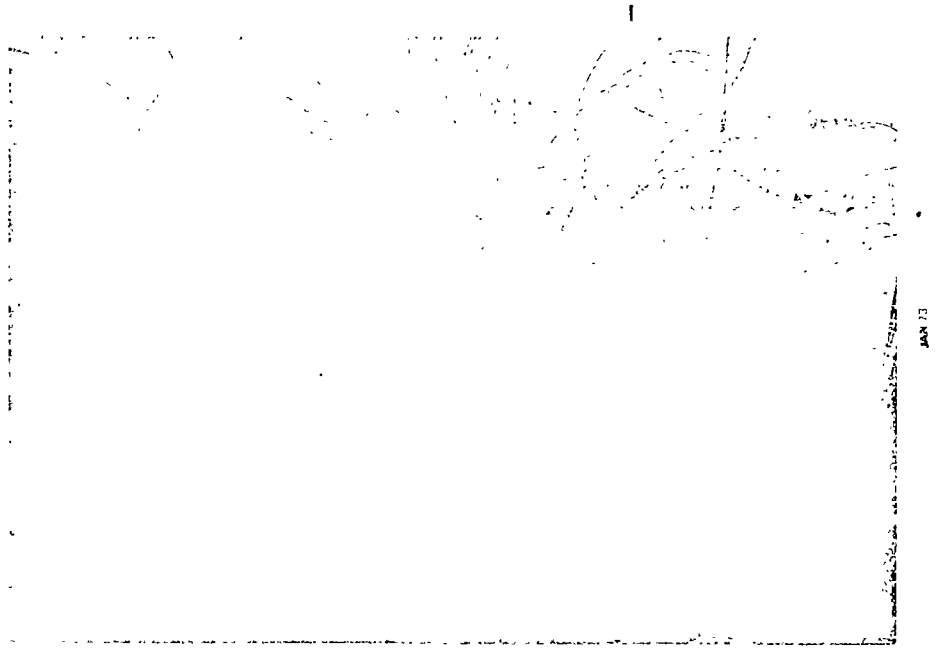


Figure 24
Landfill from Wheland Foundry

When samples were collected, only the ones at Station WF-2 contained large concentrations of waste, and this appeared to be primarily coal fines. The flow was 2.5 gpm with a total solids concentration of 4,920 mg/l and COD of 1,910 mg/l. The relatively clear flow from station WF-3 was 60 gpm, total solids was 154 mg/l, temperature was 21 to 23°F, and COD was less than 50 mg/l. The 3,000 gpm of waste from WF-4 appeared to be all cooling water. Temperatures of the three grab samples collected to make the composite sample were 37°C, 22°F, and 29°F; total solids were less than 50 mg/l, and COD was less than 124 mg/l.

Woodward Company
Chattanooga Coke and Chemicals Division

The Woodward plant located at 4800 Central Avenue has a coking capacity of 382 tons per day. Both foundry and blast furnace cokes are produced and the gases are collected and separated into benzene, toluene, and xylene in a standard BTX plant.

A part of the process wastewater from the ash rinse system is discharged to the city system after pretreatment for solids. A portion of the wastewater from the BTX unit, including the discharge from the ammonia still, is used to quench coke. The remaining portion is discharged untreated to Chattanooga Creek.

Drainage from the parking lot and roof drains is pumped into an unnamed tributary to Chattanooga Creek, while an oil removal system treats water flowing through an old plant dump area. This area was used for many years to store acid sludges and the pH of the wastewater is very low.

During the initial EPA visit to the Woodward plant, the oil skimmer was inoperative and appeared to have been so for some time. The motors

had been removed from the system, the basin had been filled with dark, oily sludge, and a 55-gallon drum was in the middle of the basin (Figures 25, 26, and 27).

Three sampling locations were included during the EPA study. Two sources of discharge (stations WO-1 and WO-3) originate on the north side of the plant property. The stream at station WO-1 consists of storm drainage that collects in the area of the coal yard, but may contain some drift and leakage from the quenching area (Figure 28). The stream at station WO-3 originates from a spring-like source of bubbling water of unknown source, but may also be coming from the quench tower.

The flow at station WO-1 averaged 4.33 gpm; BOD_5 averaged <8.0 mg/1; COD measured <50, <50, and 65 mg/1; TKN averaged 38.0 mg/1; ammonia averaged 37.2 mg/1; and phenolic concentrations ranged from 0.123 to 0.162 mg/1 with an average of 0.138 mg/1. More than stormwater drainage is obviously being discharged at this point. It may be contaminated groundwater. (See Table 2 for summary of loadings.)

The stream at station WO-2 is the main waste discharge and receives a large volume of leakage from within the plant (Figures 29 and 30). The flow averaged 52.3 gpm and contained high concentrations of the following parameters:

BOD_5 concentrations ranged from 86 to >600 mg/1 with an average of 279 mg/1.

Both COD and TOC concentrations were extremely high. The COD concentrations ranged from 300 to 2,800 with an average of 1,073 mg/1, while TOC concentrations ranged from 120 to 860 mg/1 with an average of 365 mg/1. The carbon levels indicate a highly concentrated

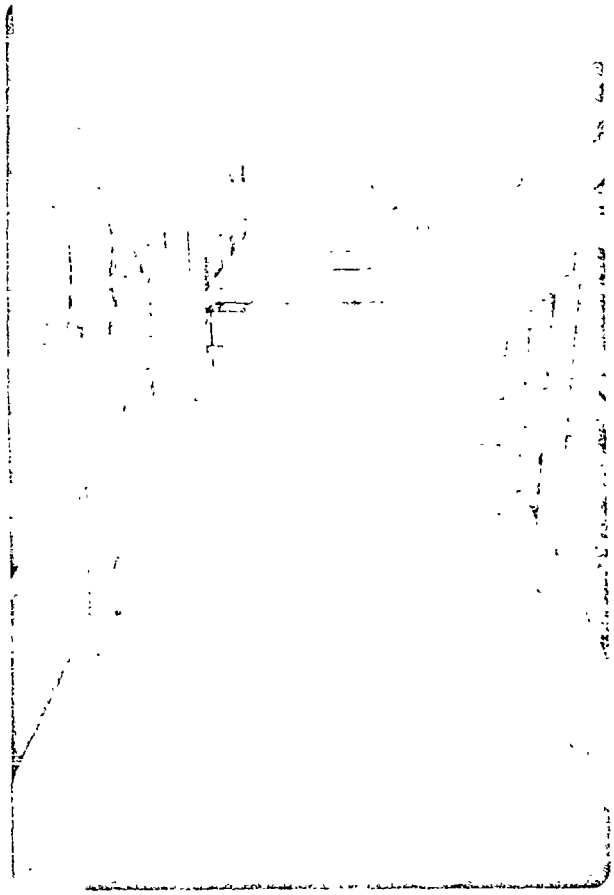


Figure 25
Woodward's Oil and Grease
Removal Facility

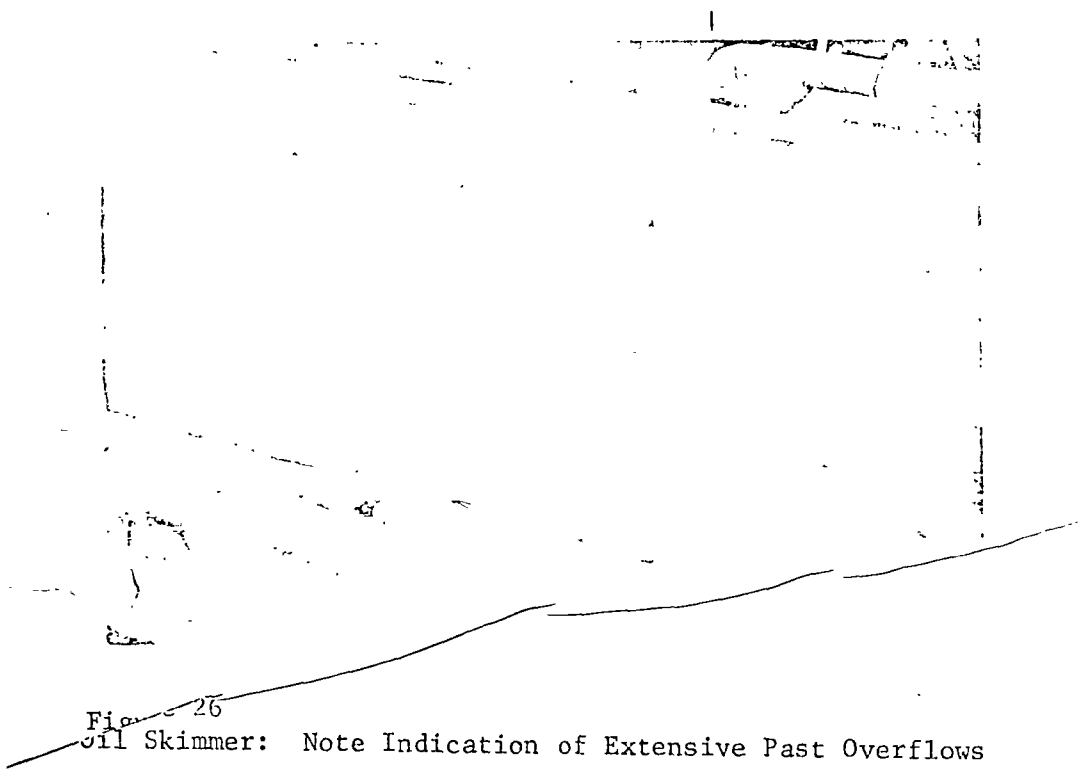


Figure 26
Oil Skimmer: Note Indication of Extensive Past Overflows

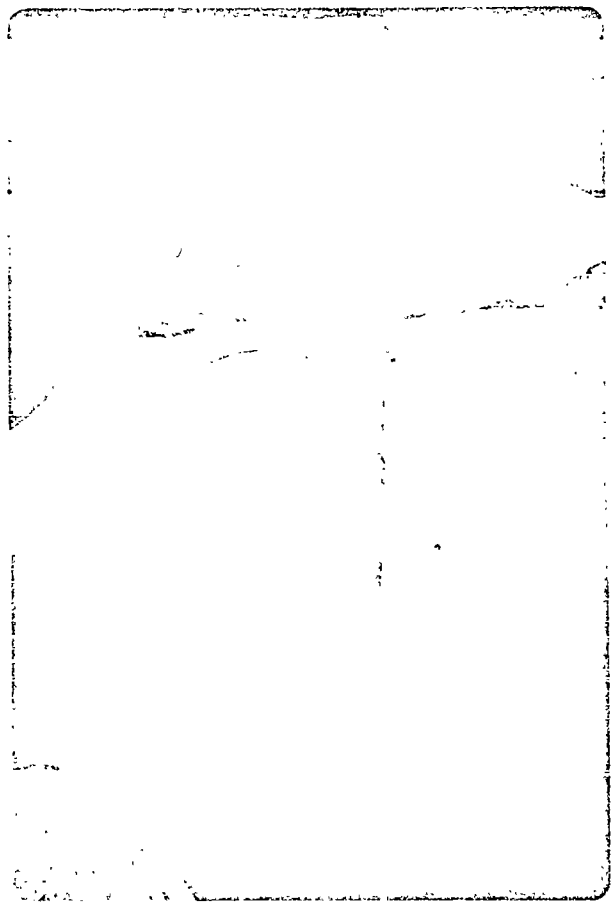


Figure 27
Bracket With Oil Pump Removed

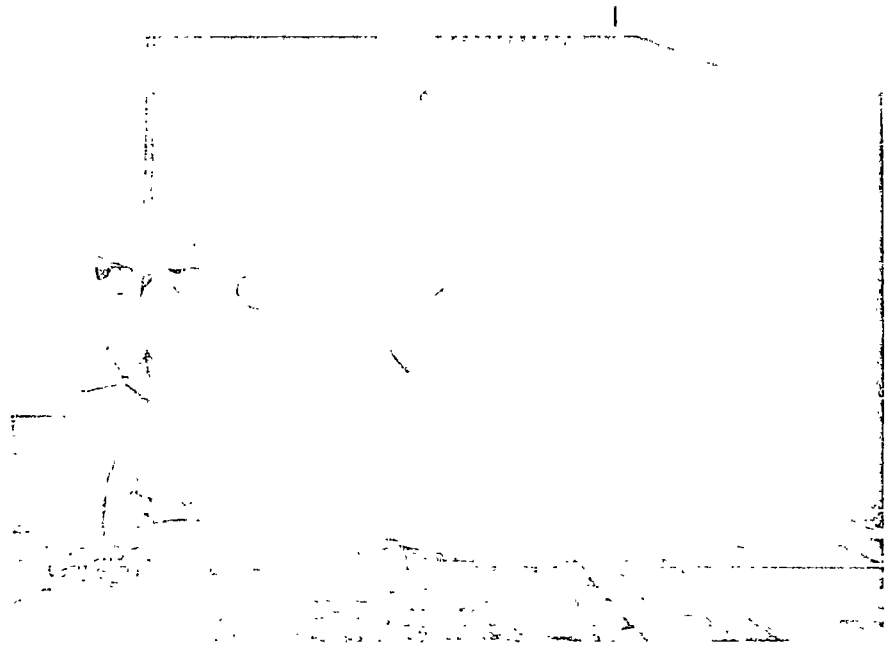


Figure 28
Woodward's Quenching Tower

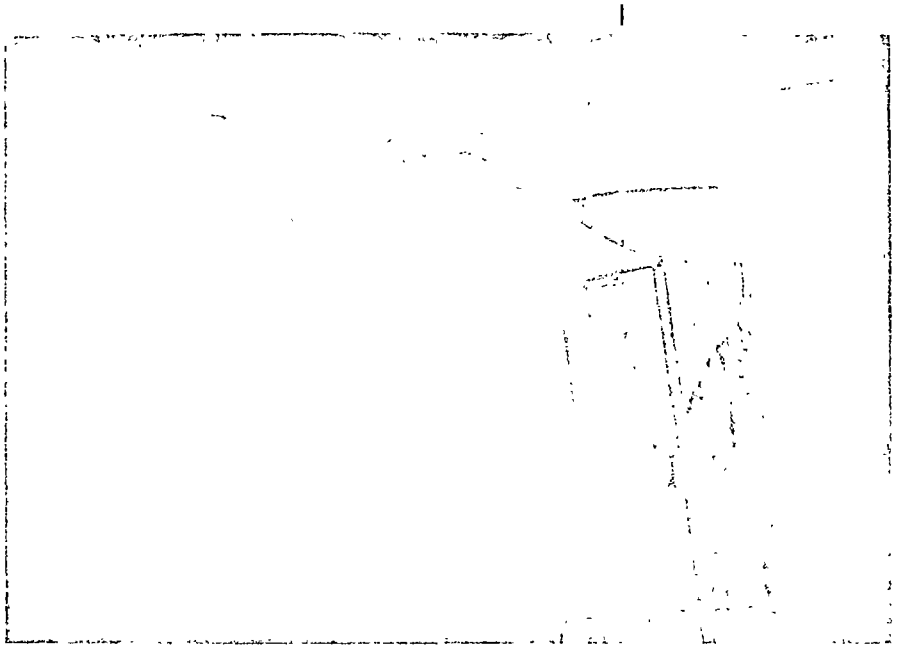


Figure 29
Process Spillage From Woodward's Ammonia Saturator.
Note Acid Spilling From Around Pipe Joint

Figure 30
Area Around Base of the Ammonia Saturator

load of organic material.

Total nitrogen concentrations in the discharge are playing a significant role in the degradation of Chattanooga Creek. The average TKN concentration was 4,400 mg/l which was almost totally ammonia nitrogen. Ammonia concentrations ranged from 1,070 to 7,320 mg/l with an average of 4,060 mg/l. Nitrate-nitrite concentrations averaged 1.9 mg/l.

Cyanide concentrations ranged from <0.01 to 9.70 mg/l with an average of 4.15 mg/l. Cyanides are toxic to aquatic life and begin to show increased toxicity as the cyanide ion forms hydrogen cyanide under acidic conditions. Since the pH at Station WO-2 was observed to vary between 1.7 and 2.1 pH units, cyanide present in station WO-2 was probably highly toxic. Temperature also caused an increase in cyanide toxicity; a $10^{o}C$ temperature rise causes a two to threefold increase in the lethal action (Reference #6). Water temperatures at station WO-2 averaged $22.8^{o}C$ with two readings of 40 and $37^{o}C$ recorded on March 7, 1973. This combination of low pH and high temperature can be expected to increase the toxicity of cyanide in the receiving stream.

Phenolic concentrations were higher than expected since much of the phenolic wastes are reportedly discharged to the city sewer system. The average concentrations for phenol ranged from 25.5 to 465 mg/l and averaged 167.4 mg/l. Theoretically it takes about 2.38 times the amount of phenol present to completely oxidize phenol to CO_2. Based on the concentration and waste loading (105 lbs/day), a substantial oxygen demand is being exerted on Chattanooga Creek.

The total residue waste loading in WO-2 averaged 17,000 lbs/day of which 16,100 pounds per day were total volatile residue. The high concentrations of total volatile residue is indicative of dissolved organic compounds. The high TKN and phenolic concentrations would account for a large part of the volatile residue content.

Total waste loadings for Station WO-2 are shown in Table 2.

MUNICIPAL WASTES

Moccasin Bend Sewage Treatment Plant

The Moccasin Bend sewage treatment plant is a secondary treatment facility designed to treat 42 million gallons of municipal waste per day (Figure 31). The plant serves the metropolitan Chattanooga area between Missionary Ridge and Lookout Mountain from Rossville, Georgia, to the area just north of the Tennessee River. This generally includes the Chattanooga Creek Basin and the downtown area of Chattanooga. The major portion of the sewer system in the older downtown area consists of combined sewers carrying both domestic waste and stormwater. During periods of heavy rainfall, much of the waste is bypassed to surface streams throughout the collection system. Flows reaching the Moccasin Bend plant in excess of 40 mgd are normally bypassed to the river to prevent plant overloading. The wide variety of industrial process wastes discharged to the sewer system comprise approximately 70 percent of the total flow to the plant. Diurnal fluctuations in the waste characteristics present difficulties in plant operations.

A schematic diagram of the plant is shown in Figure 32. The Zimpro sludge oxidation system listed as "New" on the schematic is in place and

TABLE 2

AVERAGE WASTE LOADINGS
Pounds/Day for Station WO-2
Woodward Company

BOD_5	175
COD	675
TOC	230
TKN	2,765
NH_3-N	2,550
NO_3-NO_2-N	1.2
T. Phos	0.2
Oil and Grease	10.9
Phenol	105
CN-	2.6
Dissolved Residue	16,980
Total Residue	17,030
Total Volatile Residue	16,140
Nonfilterable Residue	41
Volatile Nonfilterable Residue	30

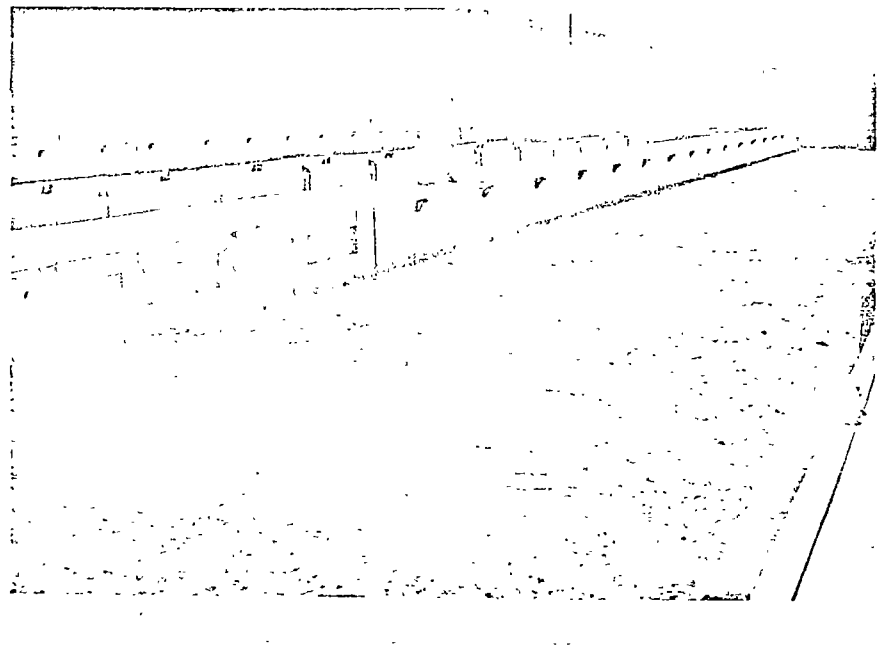
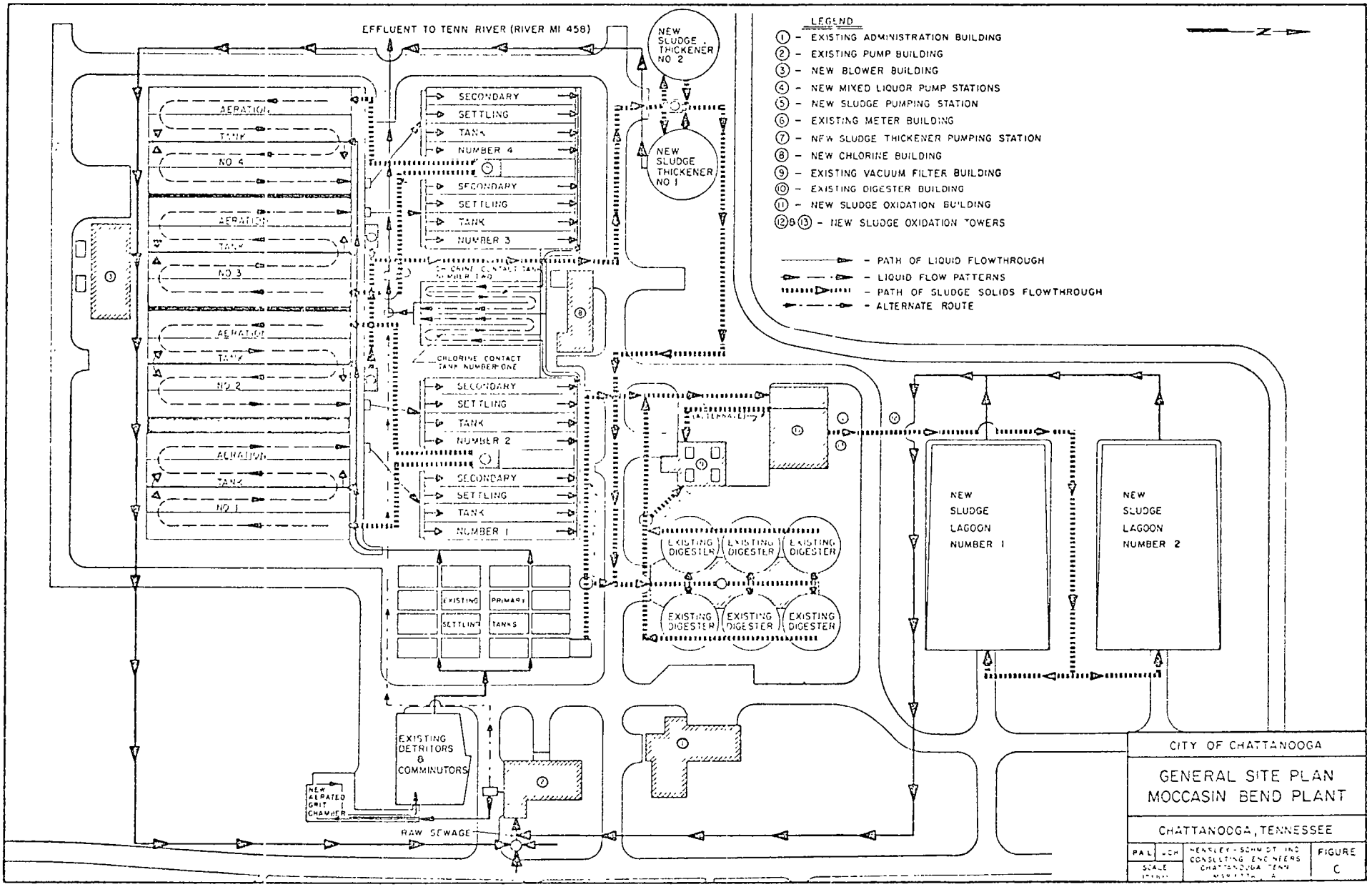


Figure 31
Activated Sludge Unit, Moccasin Bend STP


EFFLUENT TO TENN RIVER (RIVER MI 458)
NEW SLUDGE THICKENER NO 2
NEW SLUDGE THICKENER NO 1
AERATION TANK NO 4
AERATION TANK NO 3
AERATION TANK NO 2
AERATION TANK NO 1
SECONDARY SETTLING TANK NUMBER 4
SECONDARY SETTLING TANK NUMBER 3
SECONDARY SETTLING TANK NUMBER 2
SECONDARY SETTLING TANK NUMBER 1
CHLORINE CONTACT TANK NUMBER TWO
CHLORINE CONTACT TANK NUMBER ONE
EXISTING PRIMARY SETTLING TANKS
EXISTING DIGESTER
EXISTING DETRITORS & COMMINUTORS
NEW AERATED GRIT CHAMBER
RAW SEWAGE
NEW SLUDGE LAGOON NUMBER 1
NEW SLUDGE LAGOON NUMBER 2
LEGEND
(1) - EXISTING ADMINISTRATION BUILDING
(2) - EXISTING PUMP BUILDING
(3) - NEW BLOWER BUILDING
(4) - NEW MIXED LIQUOR PUMP STATIONS
(5) - NEW SLUDGE PUMPING STATION
(6) - EXISTING METER BUILDING
(7) - NEW SLUDGE THICKENER PUMPING STATION
(8) - NEW CHLORINE BUILDING
(9) - EXISTING VACUUM FILTER BUILDING
(10) - EXISTING DIGESTER BUILDING
(11) - NEW SLUDGE OXIDATION BUILDING
(12)&(13) - NEW SLUDGE OXIDATION TOWERS
- PATH OF LIQUID FLOWTHROUGH
- LIQUID FLOW PATTERNS
- PATH OF SLUDGE SOLIDS FLOWTHROUGH
- ALTERNATE ROUTE
CITY OF CHATTANOOGA
GENERAL SITE PLAN
MOCCASIN BEND PLANT
CHATTANOOGA, TENNESSEE
PAL
JCH
HENSLEY-SCHMIDT INC
CONSULTING ENGINEERS
CHATTANOOGA TENN
FIGURE
C

was previously operated, but not satisfactorily. At the present time, this section of the plant is closed, and excess secondary sludge is discharged to the plant effluent which flows directly into the Tennessee River. The plant has no secondary sludge handling capacity since the shutdown of the Zimpro system.

Samples were collected from an automatic plant sampler which pumps water from the chlorine contact chamber. This did not include the secondary sludge which was being discharged to the river. The sludge flows through an underground line from the secondary clarifiers to the plant effluent line. Since there are no access points along the line and the discharge is submerged, samples containing the waste sludge were not taken.

Daily (24-hour) composite samples were collected for chemical analysis for each of five days (See results in Table 3). Grab samples were collected for bacteriological analysis. Influent or inplant samples were not collected.

The results of chemical analysis definitely reflect the high industrial waste portion (about 70 percent) of the municipal waste. Average effluent concentrations (loadings) of BOD_5, COD, and TOC were 178 mg/l (50,500 lbs/day), 409 mg/l (116,400 lbs/day), and 102 mg/l (29,000 lbs/day), respectively. These levels are more typical of a municipal waste influent than an effluent and reflect the very strong nature of this waste. Nitrogen concentrations in the effluent were also similar to typical raw domestic waste. Total Kjeldahl nitrogen averaged 18.2 mg/l (5,180 lbs/day) with ammonia accounting for 57 percent at a concentration of 10.4 mg/l or 2,960 lbs/day. The sum of nitrate and nitrite nitrogen was very low, less than 0.014 mg/l. This plant is providing essentially no nitrification of

the ammonia either because of a short retention time, toxicity of the waste to nitrifying bacteria, or both. Phosphorus concentrations averaged 5.6 mg/l with a daily average load of 1,590 pounds per day. Oil and grease concentrations averaged 28 mg/l (8,000 lbs/day). Oil and grease concentration is unusually high and indicates a very high influent load typical of industrial waste as well as insufficient treatment within the treatment plant. Phenol concentrations were high averaging 0.966 mg/l or 275 lbs/day, again indicating the heavy industrial load.

Residue in the effluent was excessive. Total residue averaged 993 mg/l (282,500 lbs/day), filterable (dissolved) residue was 860 mg/l (244,700 lbs/day), and nonfilterable (suspended) residue was 133 mg/l (37,800 lbs/day). Total volatile residue was 141 mg/l (40,100 lbs/day) and nonfilterable volatile residue was 70 mg/l (19,900 lbs/day). These figures do not reflect the secondary sludge wasted to the effluent; final discharge amounts are greater than these reported values.

The total chromium concentration in the effluent was 0.283 mg/l (81 lbs/day). Chromium salts create particular problems in waters used for public water supplies and waters which support fish and aquatic life. The USPHS drinking water standards set a mandatory limit of 0.05 mg/l on hexavalent chromium.(11) The effect of both hexavalent and trivalent chromium salts are particularly critical to the lower forms of aquatic life.(12) The chromium discharge from this plant is excessive but not great enough to violate stream standards. Mercury in the effluent was 0.96 µg/l or 0.27 lbs/day, exceeding the EPA limit of 0.1 lb/day.

An elemental scan of a composite of effluent samples indicated the following concentrations (Table 4):

TABLE 3

WASTE SUMMARY FOR MOCCASIN BEND SEWAGE TREATMENT PLANT EFFLUENT*
STATION MB-1

	Max.-Min. Concentration (mg/l)	Average Concentration (mg/l)	Average Waste Load (lbs/day)
BOD_5	190 - 160	178	50,500
COD	485 - 340	409	116,000
TOC	110 - 100	102	29,000
TKN-N	21.2 - 12.4	18.2	5,180
NH_3-N	13.8 - 5.7	10.4	2,960
NO_2 + NO_3-N	0.03 - <0.01	<0.014	<4
T. Phos.-P	6.3 - 4.7	5.6	1,600
T. Residue	1,260 - 830	993	282,000
T. Residue Vol.	167 - 115	141	40,100
Dissolved Residue	1,190 - 640	860	245,000
T. Non-Filterable Residue	240 - 75	133	37,800
T. Non-Filterable Residue Vol.	105 - 52	70	19,900
Oil & Grease	30 - 25	28	8,000
Phenol	1.55 - 0.59	0.966	275
T. Chromium	0.335 - 0.235	0.283	81
Copper	0.060 - 0.050	0.053	15
Zinc	0.43 - 0.322	0.383	109
Iron	1.98 - 1.67	1.854	527
Manganese	0.355 - 0.29	0.311	88
Nickel	0.318 - 0.15	0.249	71
Lead	<0.1	<0.1	<28
Mercury	0.0014 - 0.0008	0.00097	0.28
Flow	27,800 - 20,700 gpm	23,700 gpm	

NOTE: These values do not reflect the secondary sludge presently being discharged from the plant.

TABLE 4

Spark Source Mass Spectrometer Scan of
Moccasin Bend STP Effluent (Station MB-1)

Element	µg/l	Element	µg/l
Bismuth	0.35	Zinc	386
Lead	42	Copper	28
Thallium	3	Nickel	219
Cerium	5	Cobalt	24
Barium	183	Iron	>175
Cesium	0.7	Manganese	>135
Iodine	20	Chromium	225
Antimony	7	Vanadium	3
Tin	21	Titanium	685
Cadmium	4	Scandium	6
Silver	7	Calcium	>5,000
Molybdenum	4	Potassium	>500
Zirconium	5	Chlorine	Acid Added
Strontium	122	Sulfur	>1,000
Rubidium	30	Phosphorus	>100
Bromine	127	Silicon	>700
Selenium	9	Aluminum	>67
Arsenic	14	Fluorine	100
Gallium	30	Boron	92

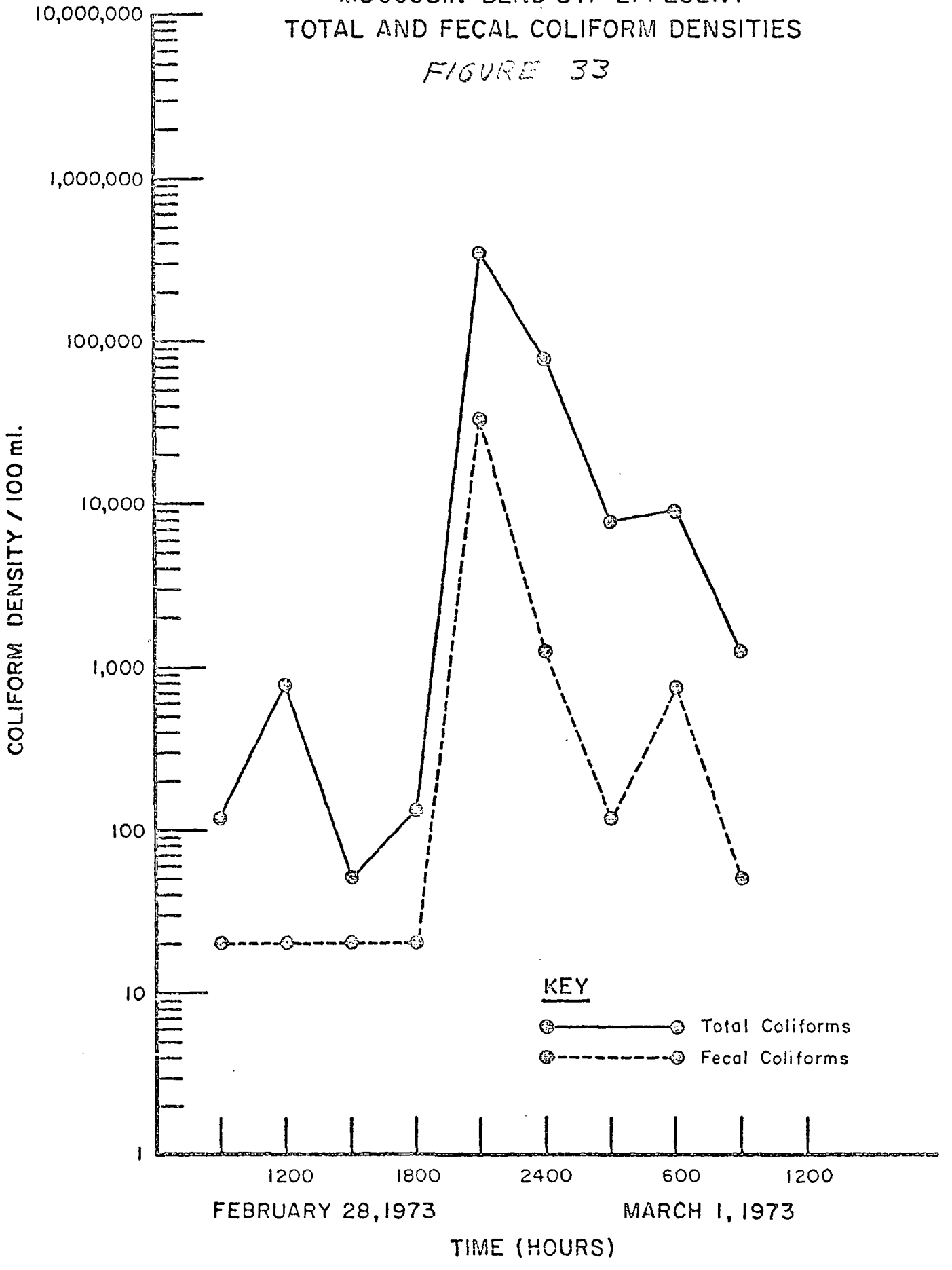
Moccasin Bend STP Bacterial Sampling

To determine the bacterial quality of the Moccasin Bend STP effluent, grab samples were collected at three-hour intervals over a 24-hour period for two days in addition to routine daily sampling. The coliform data are contained and summarized in Appendix D.

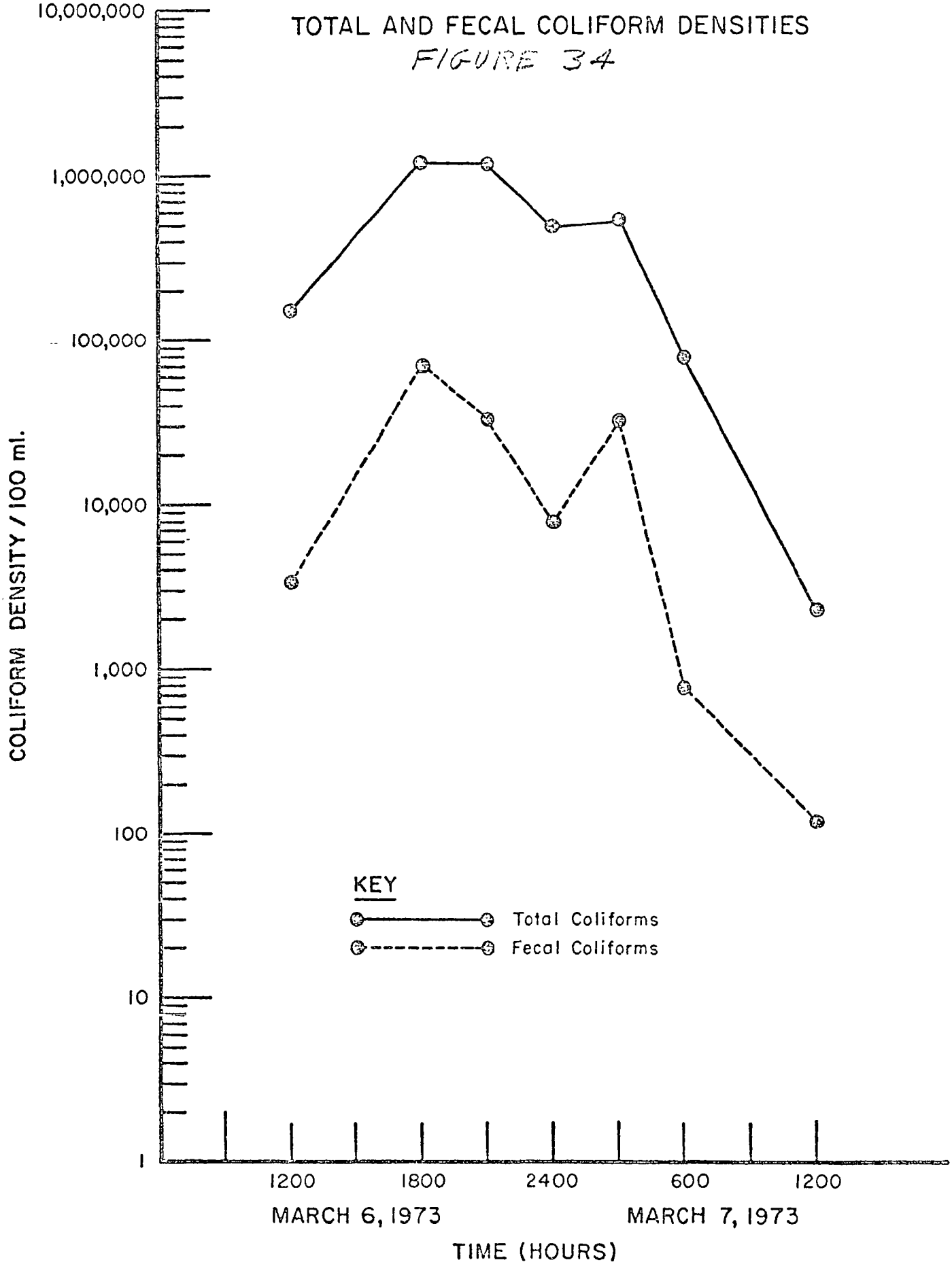
The mean effluent total and fecal coliform densities for the entire study were 8,300 and 510/100 ml, respectively. As shown in Figures 33 and 34, the bacterial quality of the effluent varied greatly during both 24-hour sampling periods. Total coliform densities during the February 28 - March 1 sampling period ranged from 50 to 350,000/100 ml, while the fecal coliform densities ranged from <20 to 33,000/100 ml. During the March 6-7 sampling period, the total coliform densities ranged from 2,200 to 1,300,000/100 ml, and the fecal coliform densities ranged from 130 to 70,000/100 ml. A comparison of Figures 33 and 34 shows the coliform densities measured during the March 6-7 sampling period were generally much higher than the February 28 - March 1 sampling period. These data indicate that effluent disinfection was inadequate much of the time, especially during late evening and early morning hours.

CHATTANOOGA WASTE DISCHARGES PART II
MOCCOSIN BEND STP EFFLUENT
TOTAL AND FECAL COLIFORM DENSITIES

FIGURE 33



CHATTANOOGA WASTE DISCHARGES PART II
MOCCOSIN BEND STP EFFLUENT
TOTAL AND FECAL COLIFORM DENSITIES
FIGURE 34



STREAM DATA AND OBSERVATIONS

GENERAL

Seven days of chemical and bacteriological samples were collected on Chattanooga Creek and its tributaries (see data in Appendix D). Time of travel through the study reach was determined using a fluorescent dye. Later during the week of May 7, 1973, a brief biological survey was conducted on the main stem of Chattanooga Creek.

Flow

Average discharge for Chattanooga Creek at the Flintstone, Georgia, USGS gage (station C-9.5) is 82.2 cfs for the past 21 years as reported by the U. S. Geological Survey. Flow during the survey averaged 110 cfs. Instantaneous discharges at the time of sample collection were:

Date	Flow (cfs)
2/27/73	59
2/28/73	54
3/1/73	49
3/2/73	47
3/5/73	159
3/6/73	143
3/7/73	259

Flows for all downstream stations were projected based upon the drainage area at each station. In the lower portion of the study area the flow is affected by fluctuation in the Nickajack Lake level. Considerable variations in lake level are caused by releases from the power generating

units at Chickamauga Dam. These fluctuations vary from one to three feet each day in the Chattanooga area and essentially control the instantaneous flow in the lower portions of Chattanooga Creek.

CHEMISTRY

Dissolved Oxygen

From upstream to downstream through the study reach, the average dissolved oxygen (D.O.) concentrations ranged from a high of 9.9 mg/l at Station C-9.5 to a low of 5.9 mg/l at Station C-0.6 (Figure 35). A significant reduction was noted downstream from the confluence of the tributary carrying waste from Velsicol and Woodward. Oxygen levels encountered during the recent survey fall within the range of earlier TVA data and are very similar to previous data collected in the late winter months. (See 1967 and 1969 TVA data in Figure 36 and Appendix D). Low oxygen concentrations generally occur during the warm summer months when stream flow is at a minimum. As evidenced by the oxygen concentration profiles in Figure 36, the lower six miles of Chattanooga Creek is an open sewer and not suitable for any other beneficial use.

Biochemical Oxygen Demand

There is a continual increase in BOD_5 concentration from upstream to downstream through the study reach (Figure 37). Sharp increases occur immediately downstream from the confluence of tributaries carrying the combined waste from Woodward and Velsicol (Station CT-2) and Dobbs Branch (Station DB-0.1) which carries both industrial and domestic wastes. Figure 37A is a schematic layout of the Chattanooga sewerage system showing

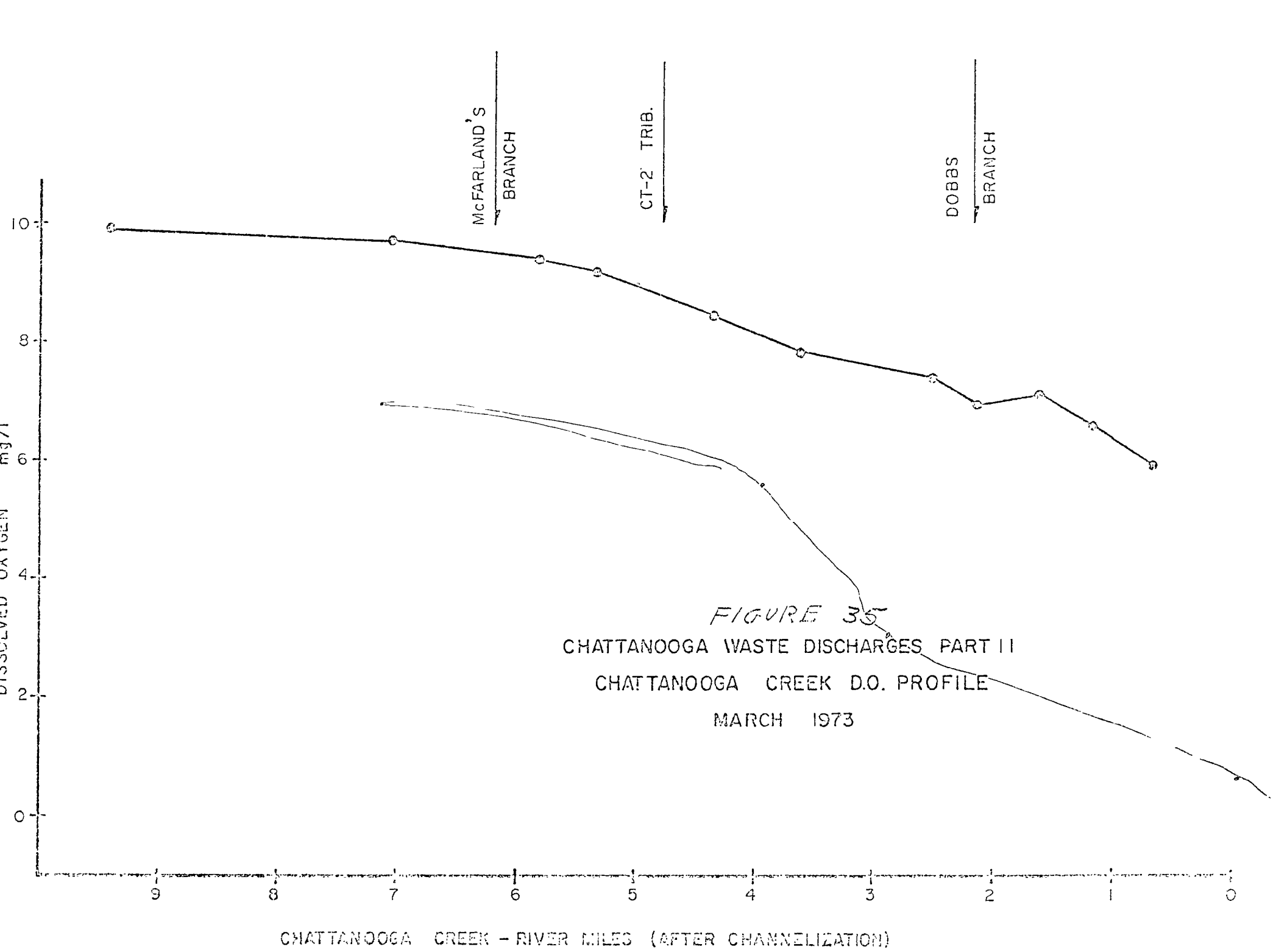


FIGURE 35

CHATTANOOGA WASTE DISCHARGES PART II

CHATTANOOGA CREEK D.O. PROFILE

MARCH 1973

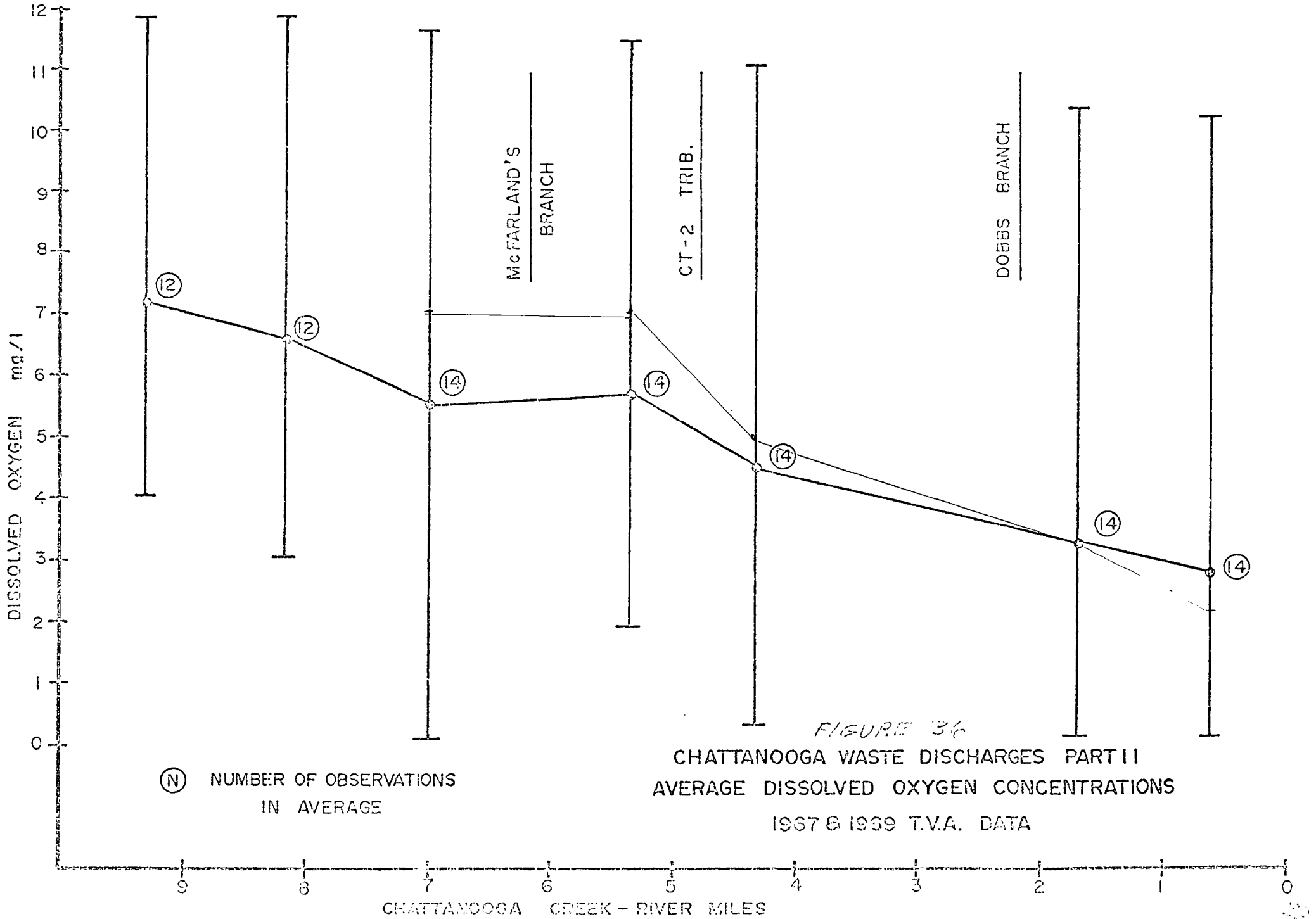


FIGURE 36

CHATTANOOGA WASTE DISCHARGES PART II

AVERAGE DISSOLVED OXYGEN CONCENTRATIONS

1967 & 1969 T.V.A. DATA

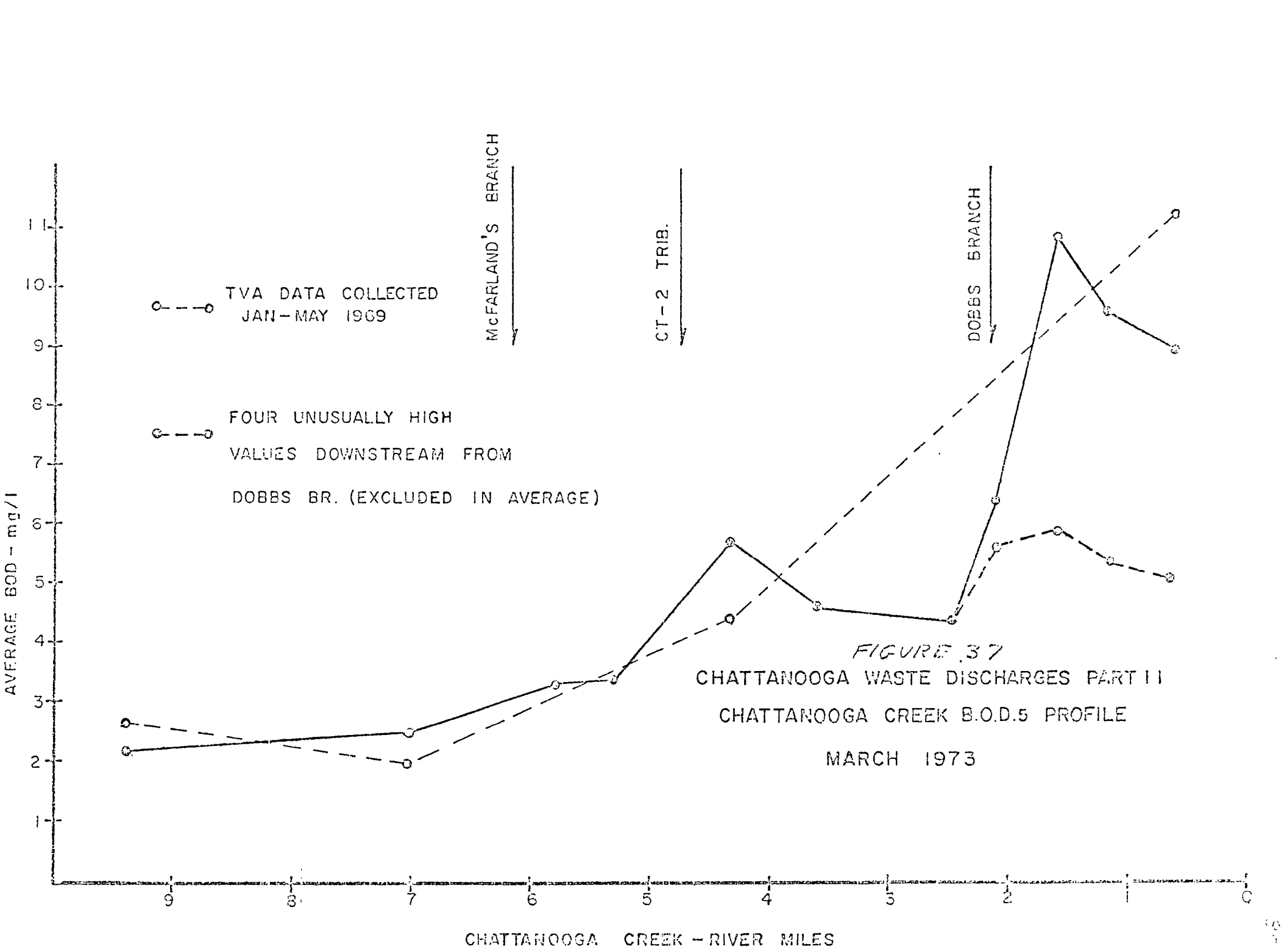


FIGURE 37

CHATTANOOGA WASTE DISCHARGES PART II

CHATTANOOGA CREEK B.O.D.5 PROFILE

MARCH 1973

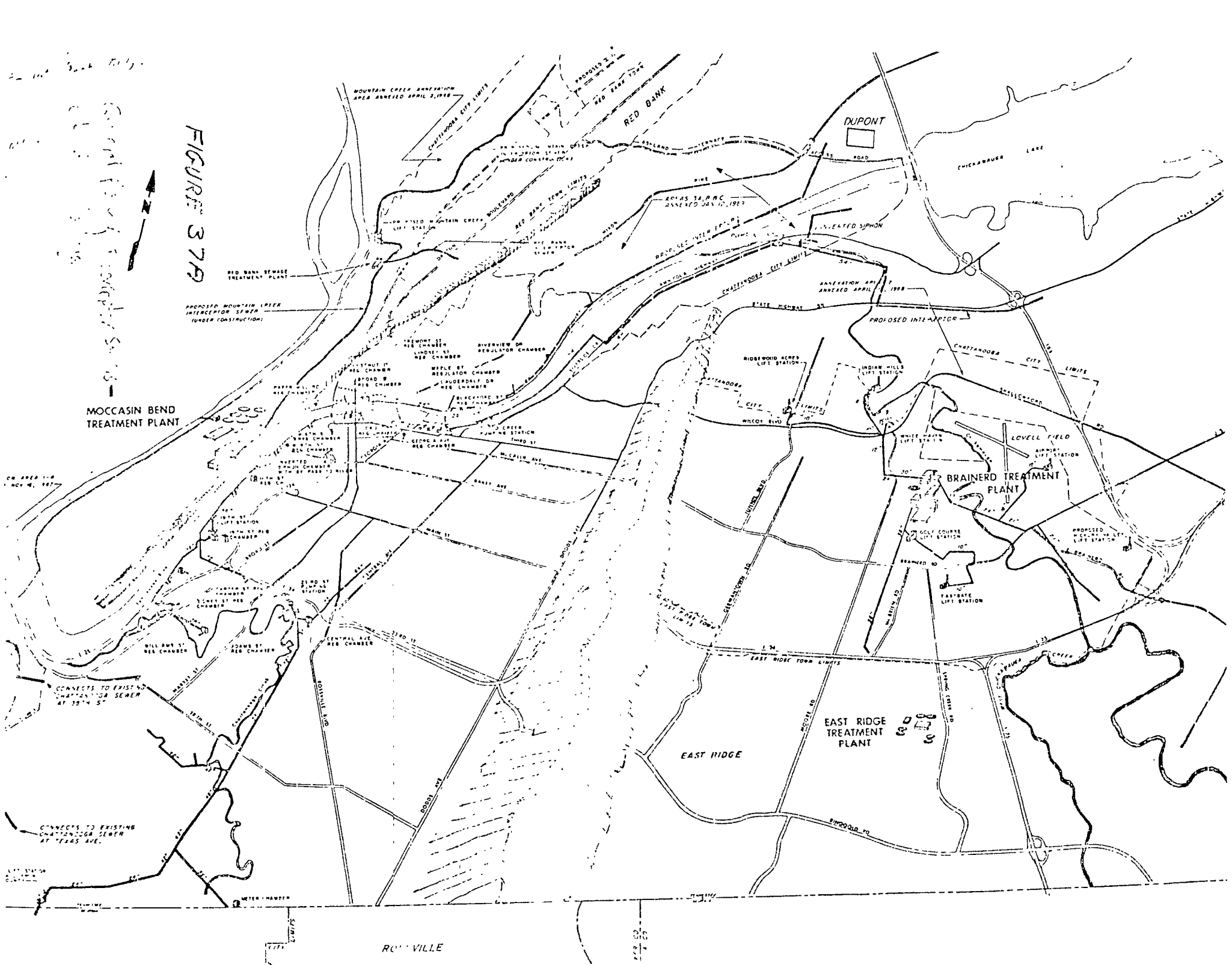


FIGURE 3.7g
MOCCASIN BEND TREATMENT PLANT
RED BANK
DUPONT
BRAINERD TREATMENT PLANT
EAST RIDGE TREATMENT PLANT
EAST RIDGE
LOVELL FIELD
CHATTANOOGA CITY LIMITS
EAST RIDGE TOWN LIMITS
PROPOSED INTERCEPTOR
CONNECTS TO EXIST'G CHATTANOOGA SEWER AT 39TH ST.
CONNECTS TO EXISTING CHATTANOOGA SEWER AT TEXAS AVE.
ROSSVILLE

numerous regulation chambers located in the trunk lines which permit excessive flow from combined sewers during rainstorms to be bypassed to the surface streams. Four such chambers designated as Central Avenue, Adams Street, Williams Street, and Sidney Street exist along the lower portion of Chattanooga Creek. Overflow from these structures contribute heavily to the polluted condition of Chattanooga Creek and are responsible for the unusually high BOD_5 concentrations such as the ones observed on March 2.

The average BOD_5 concentration at Station CT-2 was 497 mg/1 (lbs/day) with a maximum of 1,160 mg/1. The average BOD_5 concentration near the mouth of Dobbs Branch (Station DB-0.1) was 99.1 mg/1 with a maximum concentration of 370.0 mg/1 occurring on March 2, 1973. These data correspond with the exceptionally high concentrations observed in Chattanooga Creek below the confluence of Dobbs Branch. The solid line in Figure 37 reflects the effect of the waste from Dobbs Branch upon the average BOD_5 values of downstream stations. The dotted line represents average values excluding the unusually high values on March 2. The TVA data collected in 1967 and 1969 present a good basis for comparison of the more recent data. Figure 37 contains a plot of average BOD_5 values collected from January through May of 1969 representing a similar season of the year and similar flow conditions. These curves match very well and indicate that there has been no significant change in BOD_5 concentrations since 1969. Figure 38 is a plot of average, maximum and minimum values for all data collected by TVA during 1967 and 1969. Many exceptionally high values occurred (50-120 mg/1) normally during periods of low stream flow. The very high values at mile 6.26 were caused by waste entering Chattanooga

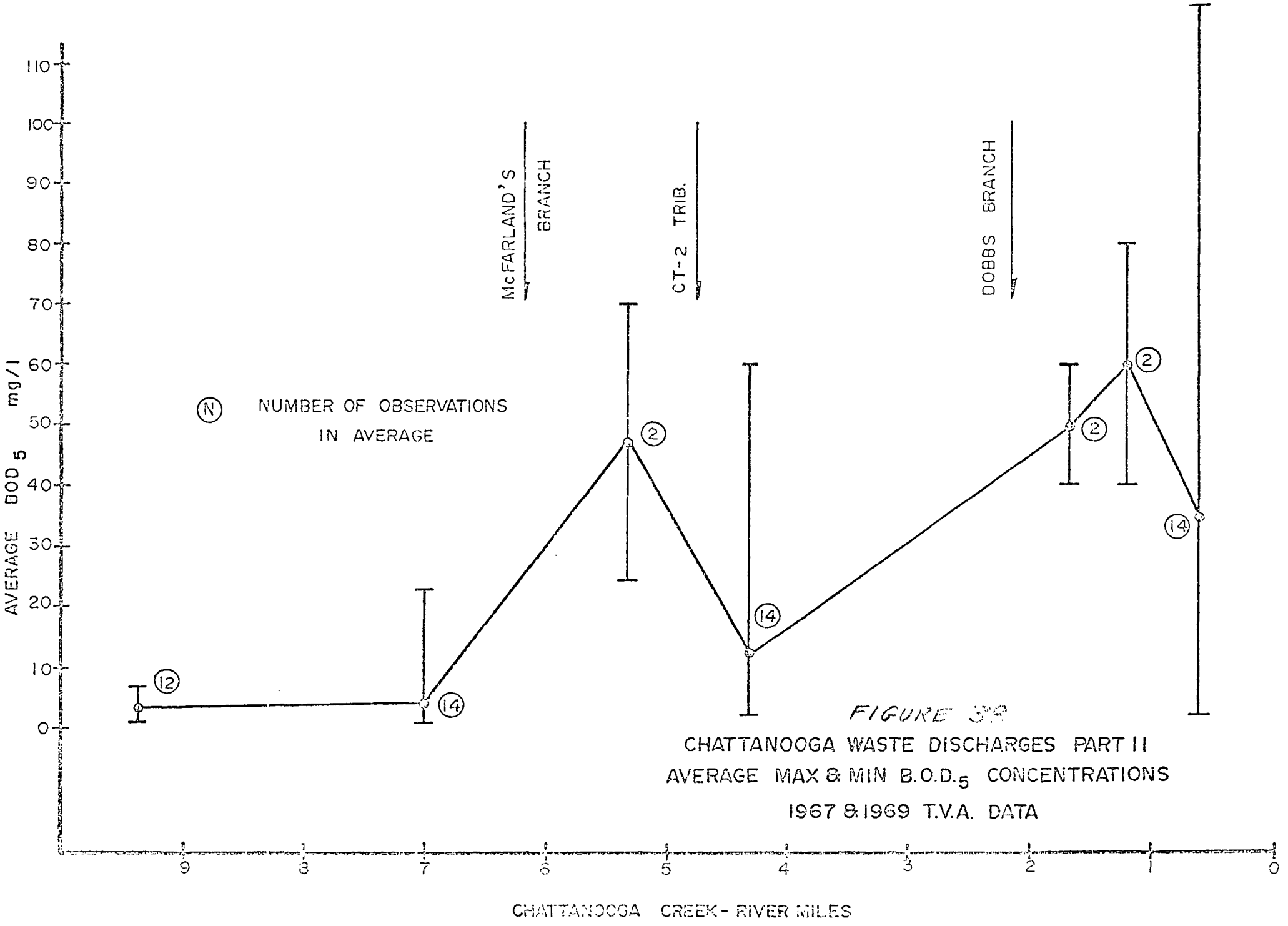


FIGURE 39

CHATTANOOGA WASTE DISCHARGES PART II

AVERAGE MAX & MIN B.O.D.$_5$ CONCENTRATIONS

1967 & 1969 T.V.A. DATA

Creek through Dry Creek and McFarland's Branch. Previously (when the TVA data were collected), Happy Valley Farms had a large discharge to Dry Creek. This waste is now discharged to the Moccasin Bend Sewerage System. McFarland's Branch drains the Rossville, GA, area and receives waste from the Rossville Industrial Complex. Both the city of Rossville and the Industrial Complex discharge to the Moccasin Bend Sewerage System; however, numerous spills and discharges from the Industrial Complex still enter McFarland's Branch.

Dobbs Branch is one of the most polluted tributaries entering Chattanooga Creek. Both Chemical Oxygen Demand (COD) and BOD_5 concentrations were very high. COD values ranged from 108 mg/1 to 3,080 mg/1, which correspond well with respective BOD_5 values of 25 mg/1 and 370 mg/1. Not all of the waste load in Dobbs Branch is caused by the overflow of the Central Avenue sewer regulation chamber; samples collected at Station DBT-1 (upstream from the regulator) had an average BOD_5 concentration of 194.6 mg/1 with a maximum of 350.0 mg/1. COD concentrations of 440 and 856 mg/1 at this same station correspond to BOD_5 values of 118 and 350 mg/1. This station was located at the discharge of an underground storm drain which drains the area around Montague and Highland Park. Dye tracers verified that low BOD_5 process wastes from Modern Maid, Inc. discharge to this drain (see following discussion under "Turbidity").

McFarland's Branch had an average BOD_5 concentration during the EPA study of 27.6 mg/1 with a maximum of 43.0 mg/1, in contrast to a 1967 and 1969 TVA average of 36 mg/1 with a maximum of 320 mg/1. COD concentrations on two days of the EPA study were 184 and 304 mg/1 with a corresponding BOD_5 concentration of 43.0 and an unreported value due to a toxic condition.

The unreported value at a one percent dilution produced a BOD_5 value of 190 mg/l; at a three percent dilution, a value of 89 mg/l; and at a 10 percent dilution, a value of 26 mg/l. These results are strong indications of toxic conditions and clearly reveal that on March 6, 1973, a strong waste concentration existed on McFarland's Branch. The following are notes taken by the field crew at Station CT-3 describing the water appearance:

2/27/73	No notes made
2/28/73	Small black suspended particles
3/1/73	Pink color
3/2/73	Red color
3/5/73	No notes made
3/6/73	Black!
3/7/73	No dye color observed

The Rossville Development Corporation discharges a waste stream containing fine carbon (black) particles above this station; Kenyon Southern has a dye drum storage area where dye pigment is washed into the stream; and Standard Coosa Thatcher also had a pink dye spill during the survey. (See the individual section on each specific industry for additional details.) There was an unconfirmed report by a resident in the area that a local septic tank cleaner dumps sludge into the creek.

Samples collected in Dry Branch at Station CT-4 had an average BOD_5 value of 4.2 mg/l with a maximum of 5.1 mg/l. This contrasts markedly with the 1967 and 1969 TVA data collected at mile 1.02 in Dry Creek when BOD_5 averaged 122.3 mg/l with a maximum of 700 mg/l. These high values were primarily caused by waste discharges from the Happy Valley Farms dairy

which is now connected to the Moccasin Bend Sewerage System. These results represent a substantial improvement in water quality over a period of three to five years.

Nitrogen

Nitrogen concentrations primarily in the form of ammonia are excessive in the lower portions of Chattanooga Creek (see Figure 39). The major contributor is Woodward, Inc., which discharges wastes including the ammonia still liquor. Upstream from Woodward's discharge, ammonia concentrations in Chattanooga Creek at Station C-5.8 averaged 0.04 mg/1, while downstream from the Woodward-Velsicol ditch at Station C-4.3 they increased to an average of 4.47 mg/1. Ammonia concentrations in Woodward's oil separator discharge averaged 4,057 mg/1 with a maximum concentration of 7,320 mg/1, and the water at station CT-2 had an average ammonia concentration of 1,430 mg/1 with a maximum of 2,260 mg/1.

Ammonia levels in other tributary streams in the study area were relatively insignificant in comparison to those at Station CT-2. At Station DB-0.1 near the mouth of Dobbs Branch, the average ammonia concentration was 3.13 mg/1 with a maximum of 5.0 mg/1. Upstream at Station DBT-1, the average concentration was 12.76 mg/1 with a maximum value of 21.8 mg/1. Farther upstream at Station DBT-2, the average concentration was only 0.77 mg/1. Ammonia concentrations in McFarland's Branch and Dry Creek averaged 0.27 mg/1 and 0.16 mg/1, respectively.

The relatively constant NO_2 plus NO_3 concentrations throughout the study reach indicate that ammonia was not being oxidized in Chattanooga Creek. The retention time within the creek is short at higher flows and does not allow time for nitrification. The average stream velocity was

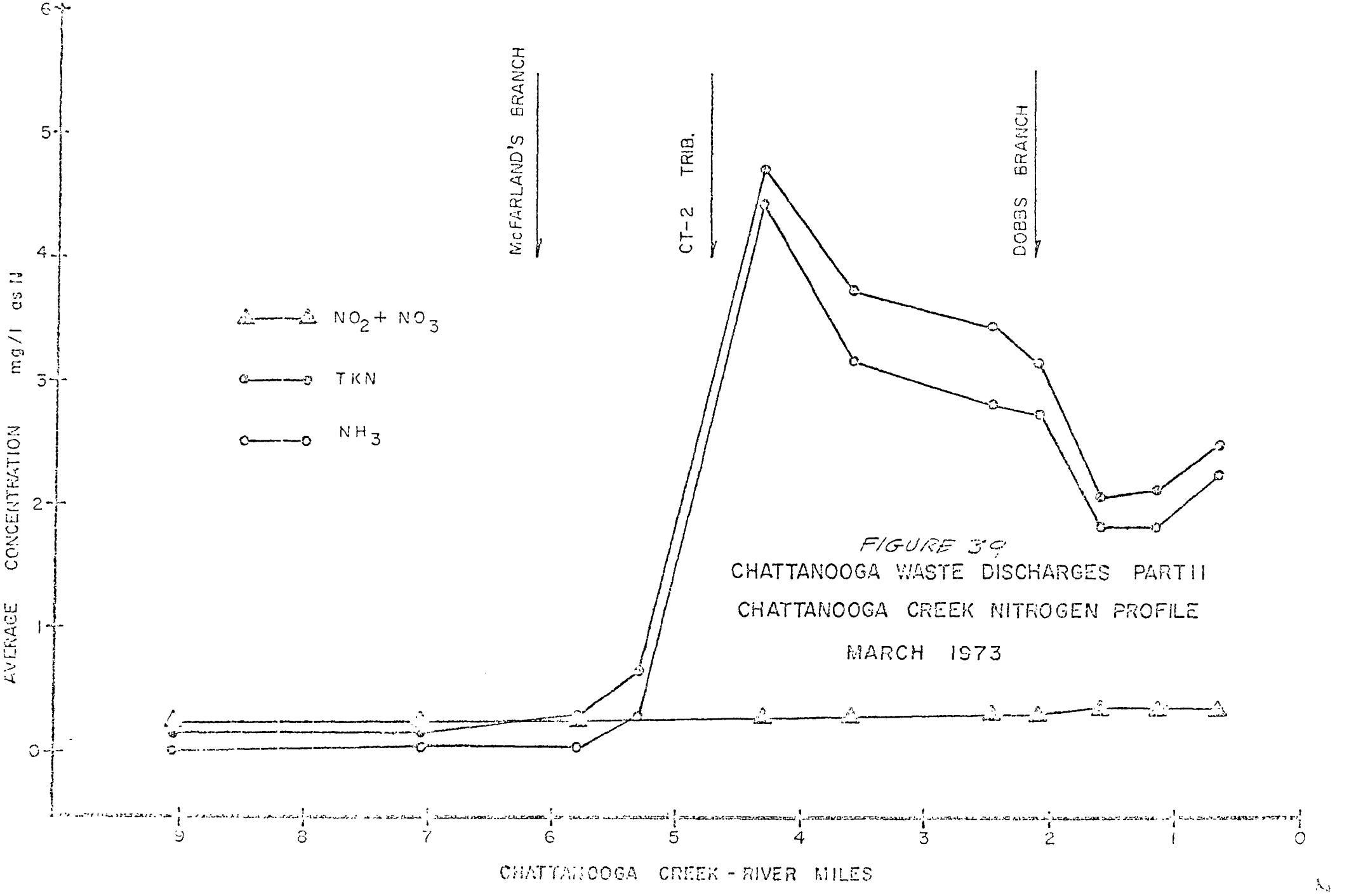


FIGURE 39

CHATTANOOGA WASTE DISCHARGES PART II

CHATTANOOGA CREEK NITROGEN PROFILE

MARCH 1973

about 0.25 mph, with a travel time of approximately 20 hours from Woodward's discharge to the mouth of Chattanooga Creek. Also, stream temperatures during the survey were in the 12 to 14°F range, which is too cool for active nitrification. With warmer temperatures and lower flows, nitrification could very rapidly deplete the dissolved oxygen in Chattanooga Creek.

Total Organic Carbon

A stream profile of Total Organic Carbon (TOC) concentrations is shown in Figure 40. Normally the TOC values of a relatively clean stream are roughly five times higher than the BOD_5, but in this case TOC is almost identical to BOD_5. The TOC concentration increases steadily through the study reach with a noticeable increase downstream from the Woodward and Velsicol discharges and a very sharp increase downstream from Dobbs Branch.

The average TOC concentration at Station DB-0.1 was 76.6 mg/l with a maximum concentration of 370 mg/l. As in the BOD_5 results, concentrations were high at Station DBT-1 (the storm sewer outfall), averaging 148.3 mg/l, and relatively low at Station DBT-2 (only stormwater and Modern Maid wastes), averaging 18.9 mg/l.

The average TOC concentration at Station CT-2 (the Woodward-Velsicol ditch) was 337.5 mg/l with a maximum of 660.0 mg/l. Individual wastes from Velsicol and Woodward both have TOC concentrations in the 300 mg/l range.

TOC levels in McFarland's Branch correspond closely to the BOD_5 concentrations. The average TOC concentration for Station CT-3 was 19.9 mg/l. The TOC value of 16.0 mg/l on March 6, 1973 (the day toxicity effected the BOD_5), did not appear to be unusually high.

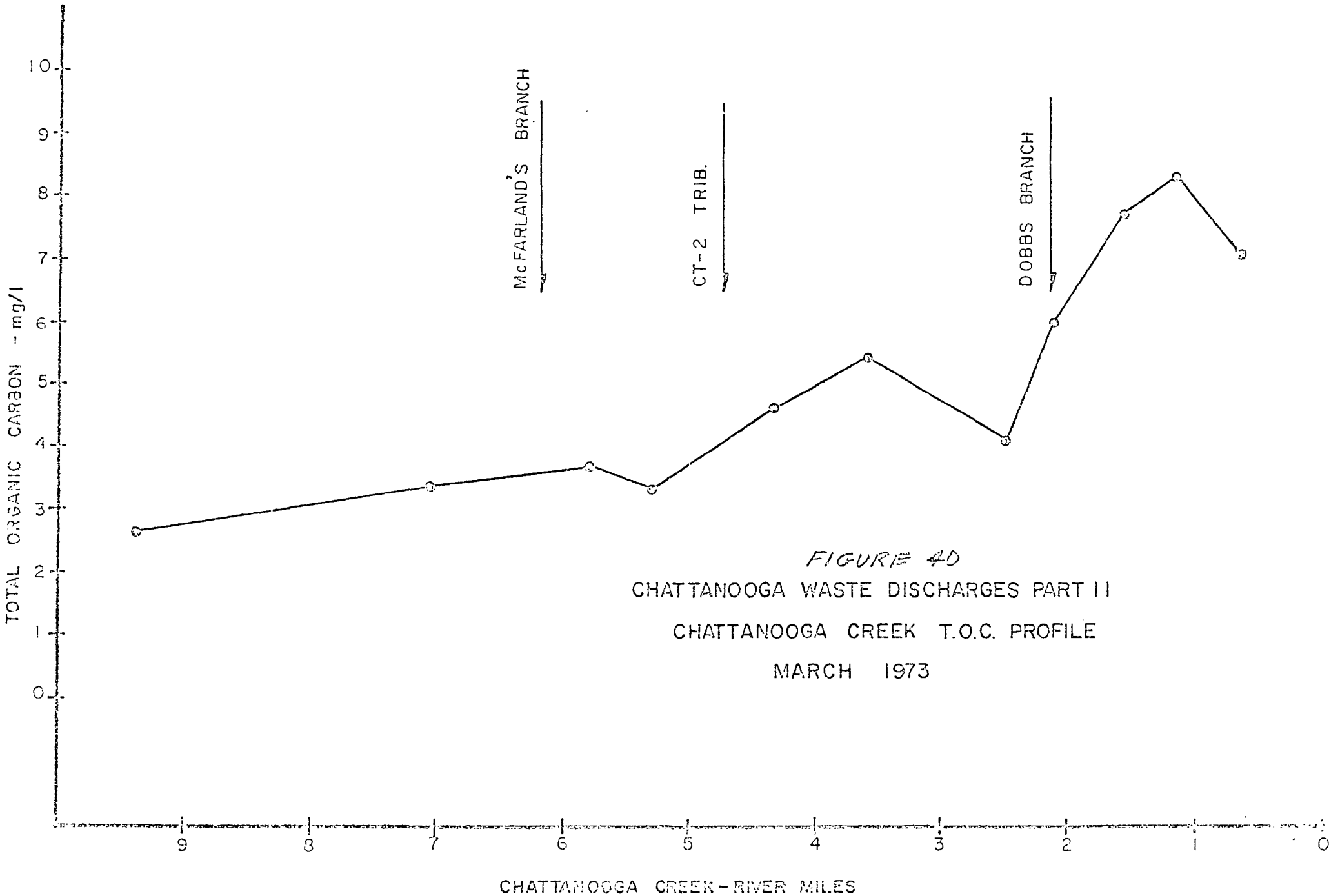


FIGURE 40

CHATTANOOGA WASTE DISCHARGES PART II

CHATTANOOGA CREEK T.O.C. PROFILE

MARCH 1973

Dry Creek TOC concentrations averaged 3.7 mg/l with a maximum of 6.0 mg/1.

Phosphorus

Total phosphorus concentrations averaged between 0.13 mg/1 and 0.21 mg/1 for all Chattanooga Creek stations. Concentrations in Dobbs Branch, McFarland's Branch, and Dry Creek averaged 1.05, 1.16, and 0.12 mg/1, respectively. The concentrations in Chattanooga Creek were nearly double those normally encountered in cleaner streams. Previous data collected by TVA at Stations C-0.6 and C-7.0 showed average values of 1.77 mg/1 and 2.33 mg/1, respectively, indicating a very large reduction in phosphorus concentrations.

Specific Conductance

Average specific conductance values are plotted in Figure 41. The same general shape profile as for BOD_5, N, TOC, and P exists with increasing values toward the mouth of Chattanooga Creek. Values averaged 132 µmhos/cm with a sharp increase to 293 µmhos/cm at Station C-4.0, which is downstream from the Woodward and Velsicol wastes. The average conductivity value at Station CT-2 were 18,285 µmhos/cm with a maximum of 32,500 µmhos/cm. Another increase was observed downstream from the confluence of Dobbs Branch where the conductivity increased from 269 at station C-2.5 to 291 µmhos/cm at Station C-2.1. The average conductivity at Station DB-0.1 near the mouth of Dobbs Branch was 611 µmhos/cm. The average reading at Station DBT-2 was 654 µmhos/cm with a maximum of 1,080 µmhos/cm, which are elevated by the industrial waste discharge from Modern Maid, Inc.

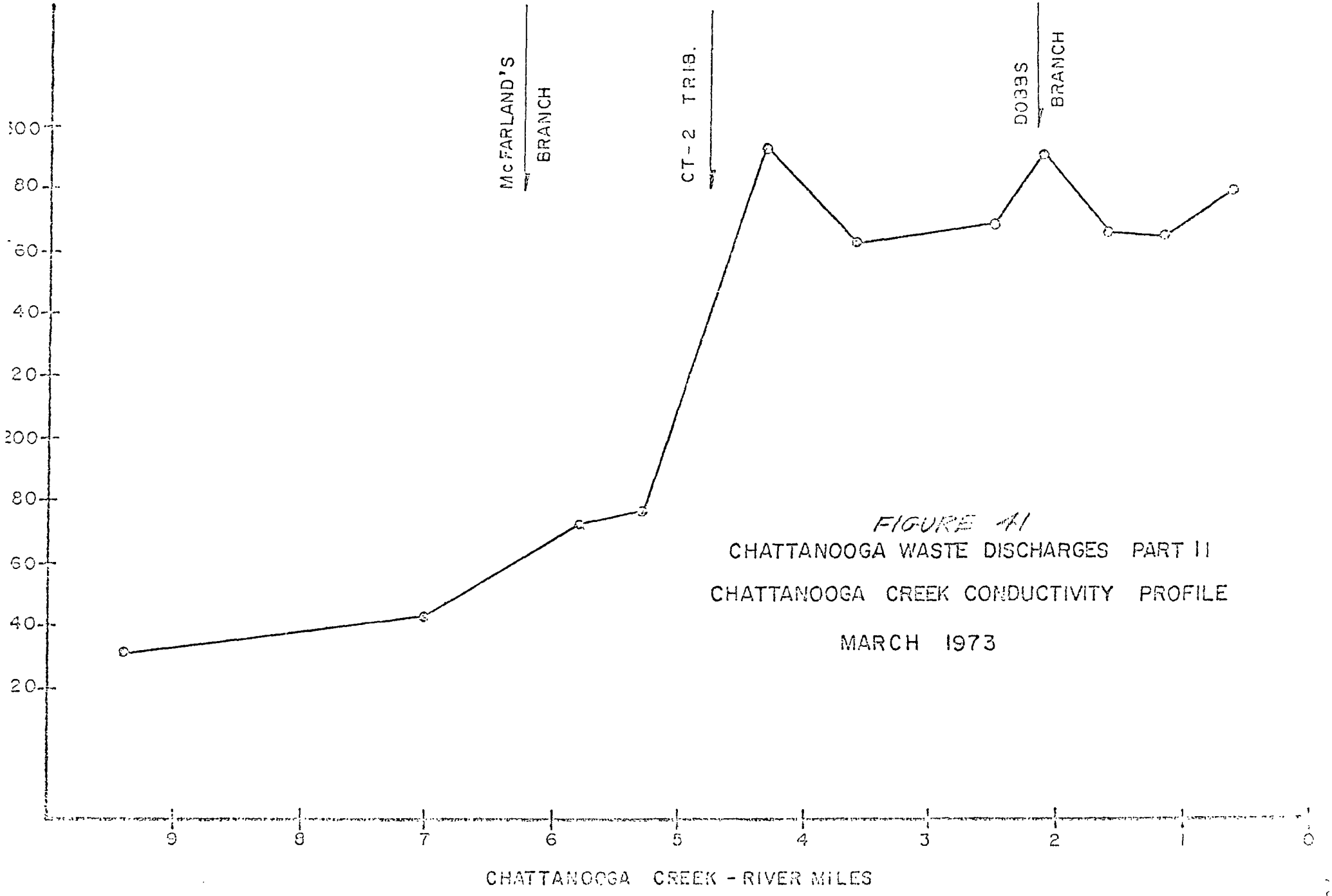


FIGURE 41

CHATTANOOGA WASTE DISCHARGES PART II

CHATTANOOGA CREEK CONDUCTIVITY PROFILE

MARCH 1973

Turbidity

The average turbidity profile in Figure 42 shows a general increase toward the mouth of Chattanooga Creek. The major increase occurred at the Dobbs Branch confluence where average turbidity levels in Chattanooga Creek increased sharply from 33 units upstream to 51 units downstream from Dobbs Branch. Turbidity in Dobbs Branch at Station DB-0.1 averaged 998.3 units with a maximum value of 6,340 units. Average readings at station DBT-2 (primarily Modern Maid's waste) averaged 757 units with a maximum of 4,000 units, reflecting the periodic discharge from Modern Maid, Inc.'s ceramic base coating operation (See Figures 14 and 15 included with Modern Maid discussion). Turbidity was not consistently high at DBT-2 because the base coat discharges were not continuous. A visit to the plant and observations of waste discharges plus subsequent dye tracer tests confirmed that the base coat material was being discharged to Dobbs Branch. The typical blue-white color of the waste observed at Station DBT-2, DBT-1, and DB-0.1, indicates that a significant portion of the turbidity in Dobbs Creek and lower Chattanooga Creek is caused by the Modern Maid, Inc., industrial waste discharge.

Somewhere between Station DBT-2 (northeast of Montague Park) and the discharge from the area's storm sewer at Station DBT-1 (Figure 43), the ceramic base coat discharge from Modern Maid is joined by a sporadic fibrous discharge from an unknown source. During previous floods, enough of this fibrous material was deposited on the banks of the ditch from DBT-1 to Dobbs Branch to leave a thick fibrous coating on the banks (Figures 44 and 45).

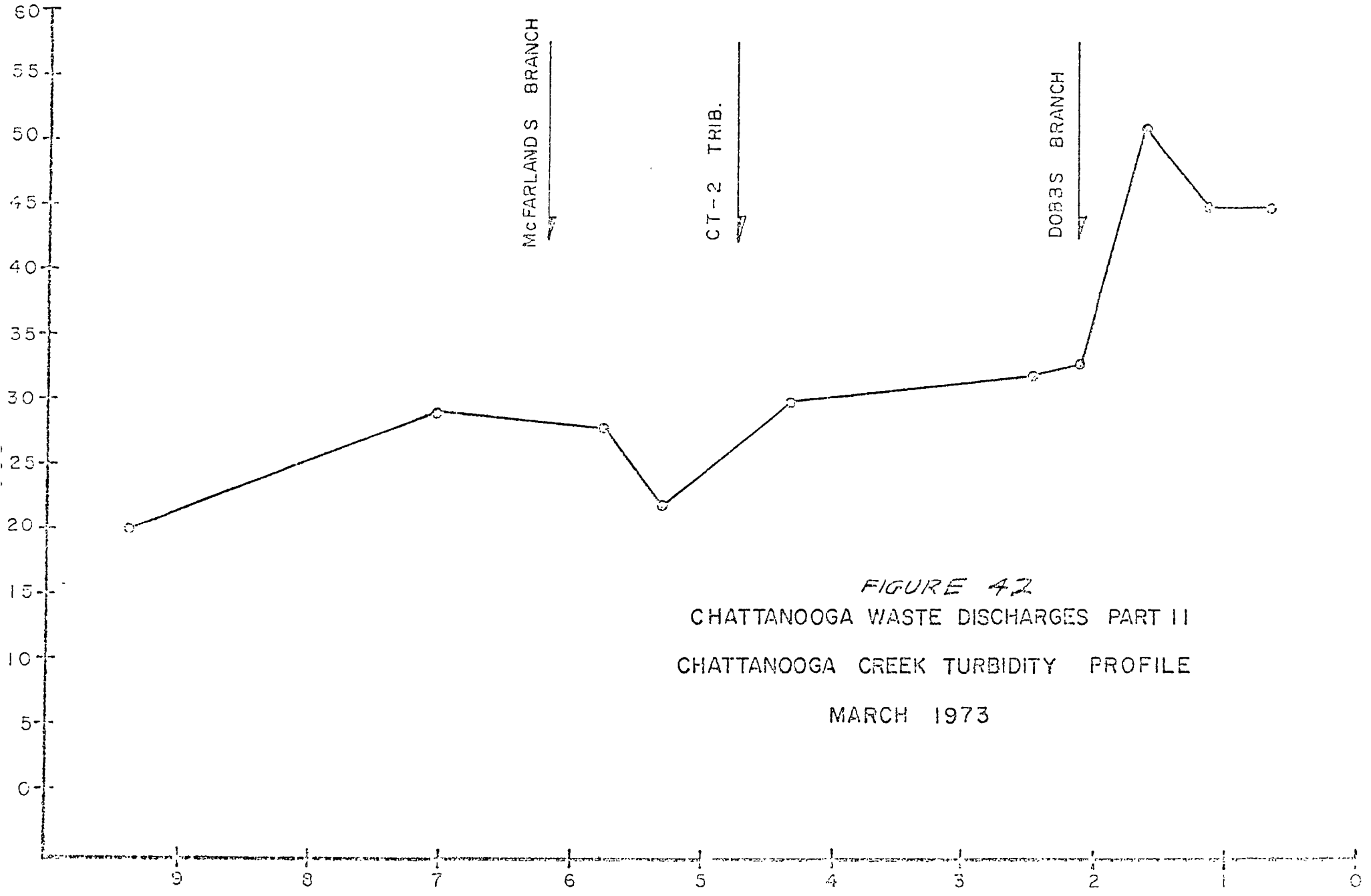


FIGURE 42

CHATTANOOGA WASTE DISCHARGES PART II

CHATTANOOGA CREEK TURBIDITY PROFILE

MARCH 1973

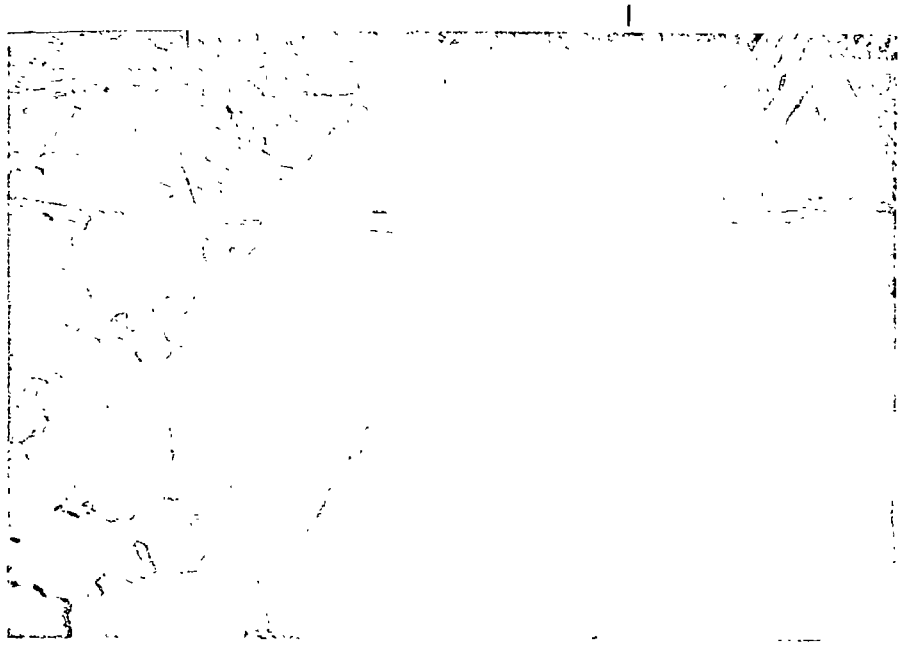


Figure 43
Station DBT-1 Showing Heavy Turbidity and Sediment

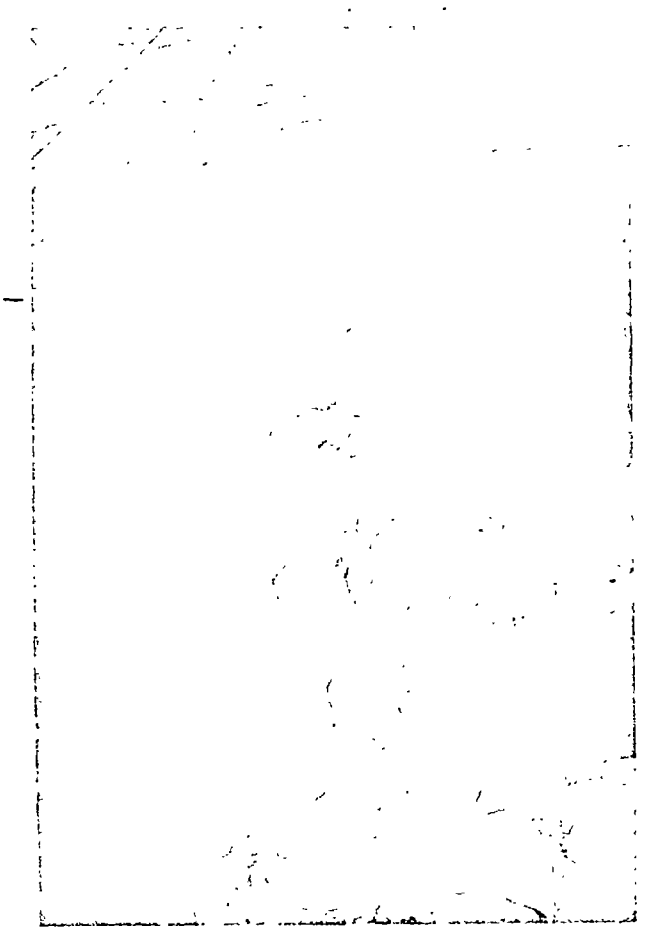


Figure 44
Fibrous Deposit at Station DBT-1 (Red Color in Stream Result of Dye Tracer)

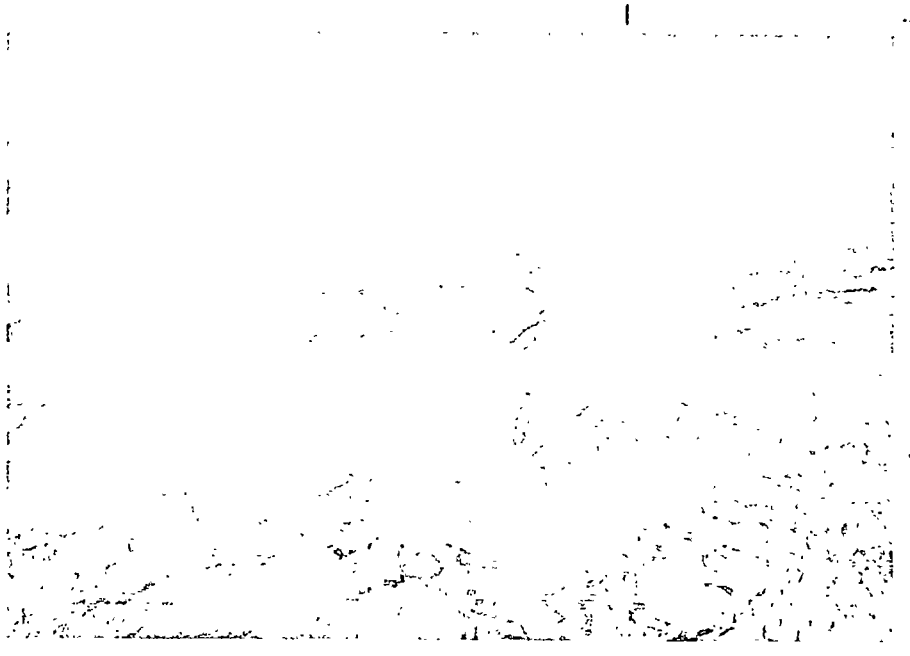


Figure 45
Close-up of Fibrous Deposit at Station DBT-1

On two occasions during the survey (during dry weather and during wet weather), dye was dumped in the wastewater discharge from Container Corporation of America's paper recycling plant located at the west corner of Montague Park. No trace of the dye was detected in the streams even though the fibrous material coating the banks of the storm sewer discharge ditch in Figure 43 has the appearance of paper fibers.

Oil and Grease

The highest stream concentrations of oil and grease were measured at Station CT-2 on the Woodward-Velsicol ditch. Oil (primarily from Woodward) was visible with a layer on the surface and a distinct coating on the banks of the tributary. The average concentration was 12.8 mg/l with a maximum of 18.0 mg/l. Concentrations near the mouth of Chattanooga Creek at Stations C-1.2 and C-0.6 were mostly less than 5 mg/l. Oil films were frequently visible on the water at Stations C-1.6, C-1.2, C-0.6, and at the mouth of Chattanooga Creek. The only recorded value on Dobbs Branch at Station DB-0.1 was less than 5 mg/l.

Phenol

Phenolic concentrations in Chattanooga Creek, particularly in the lower portion, are higher than those normally found in natural streams. The concentration at the USGS Flintstone gage (Station C-9.5) averaged 18 µg/l with a maximum value of 25 µg/l. "Analysis of water from streams draining non-industrial watersheds has shown 'phenol' concentrations in the range of 3 to 20 ppb."(13) Since phenolic compounds are released in the decay of natural organic materials and in domestic waste, the values at Station C-9.5 are not unusually high.

The phenolic concentration in Dobbs Branch at Station DB-0.1 averaged 45 µg/l with a maximum value of 100 µg/l, which are typical of the concentrations in domestic wastes.

The phenolic concentration in Chattanooga Creek increased significantly downstream to an average value of 140 µg/l at Station C-3.6, downstream from the waste discharged from Woodward (Figure 46). The average concentration at Station CT-2 (the Woodward-Velsicol ditch) averaged 83,300 µg/l with a maximum of 360,000 µg/l. Average and maximum concentrations at Stations C-2.5 and C-0.6 were 98 and 260 µg/l and 113 and 257 µg/l, respectively. For maintenance of a well-balanced fish population, the total phenolic concentration should not exceed 0.05 mg/l (50 µg/l).(14)

Metals and Cyanide

Listed below are the averages of the metal analyses expressed in µg/l:

Sta.	Cr	Cu	Fe	Pb	Mn	Ni	Zn	Cn
C-0.6	<24	<12	2,177	<118	294	<80	111	<.012
CT-2	150	188	61,750	175	10,000	80	2,000	.24
C-5.8	<20	<11	1,678	<100	115	<80	20	<.01
C-9.5	<20	<11	1,104	<100	71	<80	17	--

All values with the exception of nickel were elevated at Station CT-2. At the flow rates existing in Chattanooga Creek during this study, the high metal concentrations from this tributary were significantly diluted before reaching Station C-0.6. When comparing data at Stations C-5.8 and C-0.6, iron, manganese, and zinc show a sizeable increase.

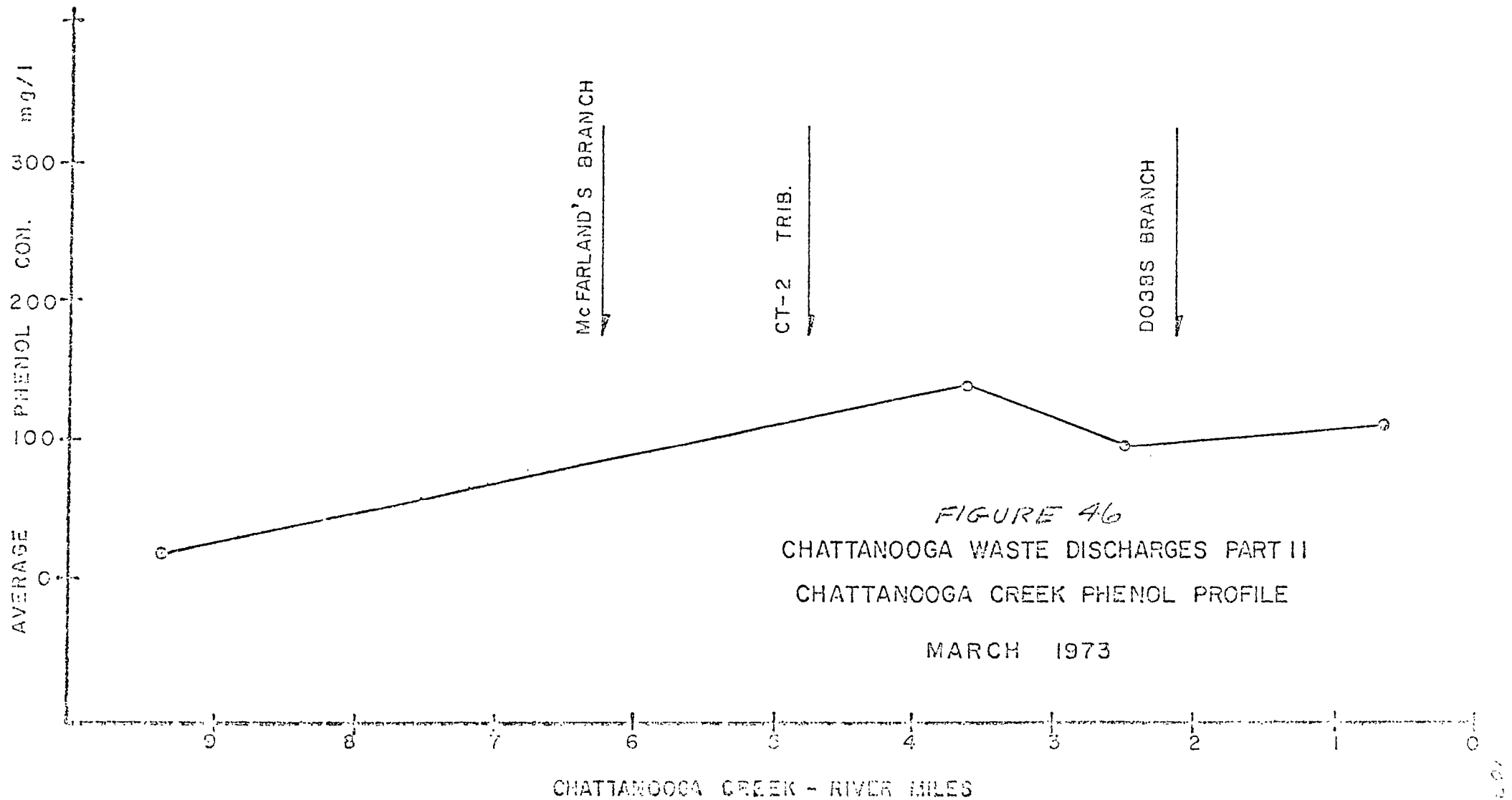


FIGURE 46

CHATTANOOGA WASTE DISCHARGES PART II

CHATTANOOGA CREEK PHENOL PROFILE

MARCH 1973

Cyanide concentrations at Station CT-2 were 0.48 mg/1 and <0.01 mg/1 in the two days the station was sampled. There was no appreciable increase in concentration between Stations C-5.8 and C-0.6.

Sediment

Sediment samples were collected at Stations C-0.6 and C-8.1. The stream bottom at Station C-0.6 consists of a very black fine particle material as contrasted with the primarily sand and gravel bottom at Station C-8.1. The results of the chemical analyses in mg/kg are:

Station	Ni	As	Hg	Cr	Cu	Zn	Mn
C-0.6	29	7.4	<.0	82	56	363	2,445
C-8.1	14	4.2	.1	18	5.2	50	268

Station	Fe	Pb	COD	Phos	Org. N	% Moisture	% Volatile
C-0.6	18,408	230	378,000	640	1,940	43	14
C-8.1	9,935	40	199,000	410	2,450	34	14

These data show higher concentrations of metals near the mouth (Station C-0.6) of Chattanooga Creek than upstream from the major waste sources. Waste from Velsicol and Woodward measured at Station CT-2 contributed rather large quantities of metals. Another probable significant source is the overflow of domestic waste from the regulation chambers on the municipal sewer system into the lower portion of Chattanooga Creek. This waste is a combination of domestic, industrial, and stormwater runoff.

MICROBIOLOGY

Coliform Results

Bacterial samples were collected on seven different days at eleven Chattanooga Creek and six tributary stations. The coliform data are

contained in Appendix D and summarized in Table 5 and Figure 47.

The background station (C-9.5) on Chattanooga Creek had mean[1/] total and fecal coliform densities of 4,700 and 1,100/100 ml, respectively (Table 5). These coliform densities indicate that Chattanooga Creek was receiving some fecal waste upstream from the study area.

Downstream from the background station the mean total coliform densities generally increased as illustrated in Figure 47. The mean fecal coliform density of 17,000/100 ml at Station C-3.6 was approximately four times greater than the background station density. These increased coliform densities resulted from wastes contributed by several tributaries (McFarland's Branch, Dry Creek, an unnamed tributary) which flow into Chattanooga Creek.

The mean fecal coliform density after an initial increase to 2,900/100 ml (station C-7.0) decreased at Station C-5.8 to background levels (Table 5 and Figure 47). This station was downstream from the confluence of several tributaries to Chattanooga Creek; however, the reason for the decreased fecal coliform density was not apparent. Downstream from Station C-5.8, the mean fecal coliform density gradually increased to 2,500/100 ml as measured at Station C-3.6 (Table 5).

Immediately upstream from Station C-2.1, Dobbs Branch flows into Chattanooga Creek. Dobbs Branch contributed mean total and fecal coliform densities of 860,000 and 37,000/100 ml, respectively, as measured at Station DB-1 (Table 5). The impact of Dobbs Branch on the bacterial quality of Chattanooga Creek was partially seen at Station C-2.1 which

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1/ All means reported are geometric means.

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TABLE 5

TOTAL AND FECAL COLIFORM DATA SUMMARY
CHATTANOOGA CREEK AND TRIBUTARY STATIONS

Station	Total Coliform/100 ml				Fecal Coliform/100 ml				No. Samples
	Maximum	Minimum	Average	Log Mean	Maximum	Minimum	Average	Log Mean	
C-0.6	1,600,000	13,000	270,000	57,000	350,000	1,300	57,000	6,900	7
C-1.2	920,000	23,000	210,000	100,000	920,000	1,700	140,000	12,000	7
C-1.6	1,600,000	13,000	270,000	61,000	540,000	2,200	81,000	7,400	7
C-2.1	130,000	11,000	43,000	29,000	7,900	200	3,000	2,000	7
C-2.5	33,000	490	11,000	6,300	17,000	140	3,600	1,400	7
C-3.6	49,000	3,100	24,000	17,000	13,000	790	4,000	2,500	7
C-4.3	70,000	7,000	20,000	15,000	4,900	700	2,300	1,700	7
C-5.3	81,000	2,800	15,000	6,400	10,000	490	2,500	1,400	7
C-5.8	24,000	3,300	14,000	11,000	2,300	490	1,300	1,100	7
C-7.0	33,000	3,300	13,000	9,400	17,000	460	5,100	2,900	7
C-9.5	54,000	1,300	11,000	4,700	7,000	170	2,300	1,200	7
DB-0.1	5,400,000	280,000	1,400,000	860,000	1,300,000	4,900	210,000	37,000	7
DBT-1	9,200,000	790,000	4,200,000	2,900,000	790,000	23,000	210,000	100,000	7
DBT-2	35,000	20	12,000	2,500	35,000	20	8,400	920	7
CT-2	7,900	<20	2,000	510	7,900	<20	1,800	320	7
CT-3	49,000	1,900	19,000	11,000	24,000	270	6,400	2,800	7
CT-4	130,000	330	29,000	9,700	33,000	20	8,800	3,200	7

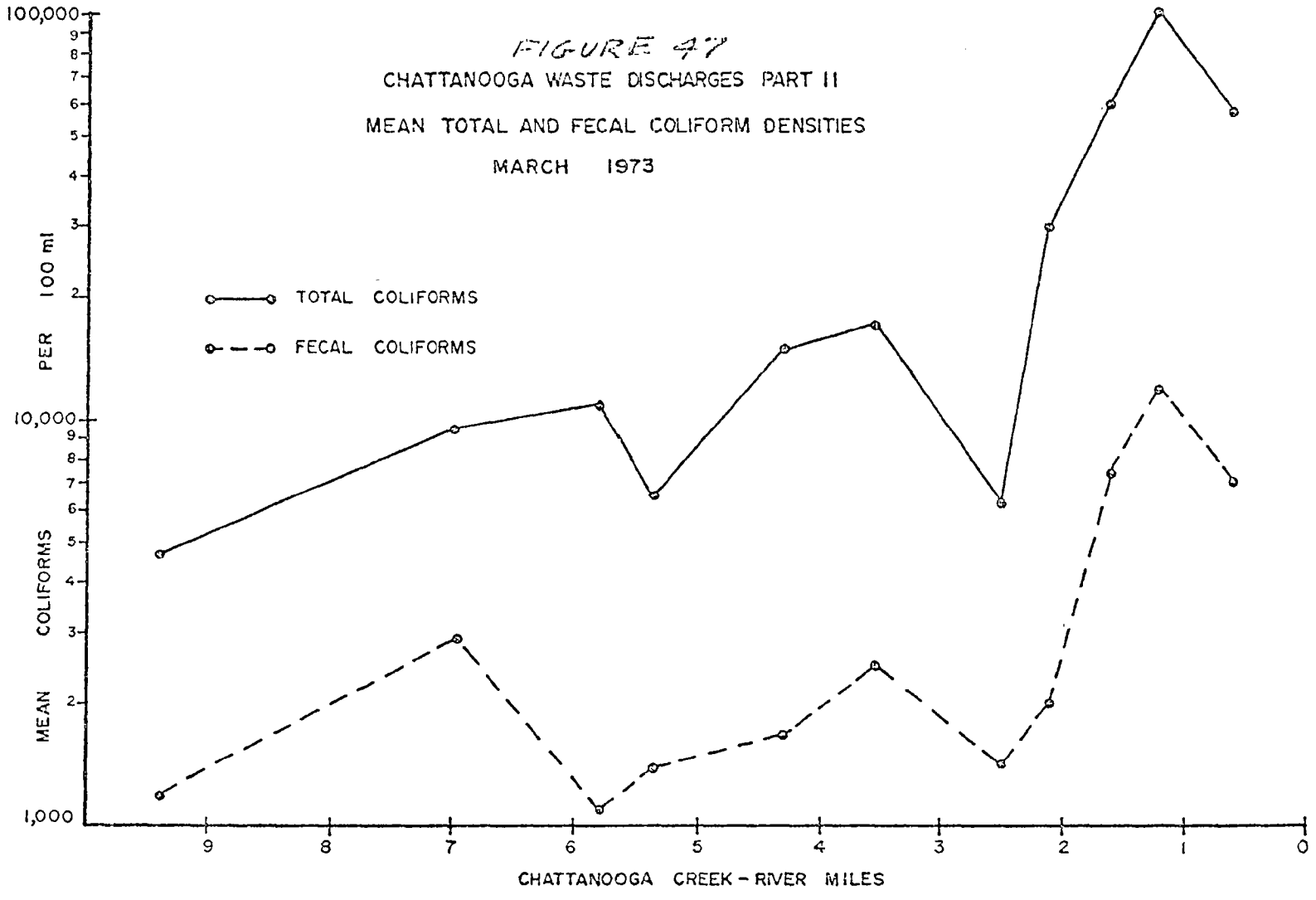


FIGURE 47
CHATTANOOGA WASTE DISCHARGES PART II
MEAN TOTAL AND FECAL COLIFORM DENSITIES
MARCH 1973
TOTAL COLIFORMS
FECAL COLIFORMS
MEAN COLIFORMS PER 100 ml
100,000
10,000
1,000
9
8
7
6
5
4
3
2
1
0
CHATTANOOGA CREEK - RIVER MILES

had mean total and fecal coliform densities of 29,000 and 2,000/100 ml, respectively. After complete mixing, the full impact of Dobbs Branch was seen at Station C-1.2 which had mean total and fecal coliform densities of 100,000 and 12,000/100 ml (Table 5 and Figure 47).

Station C-0.6, the most downstream station within the study area, had mean total and fecal coliform densities of 57,000 and 6,900/100 ml, respectively. A comparison of these coliform densities with the background densities (Table 5) indicates considerable degradation of the bacterial quality of Chattanooga Creek within the study area.

Salmonella Results

In addition to total and fecal coliform determinations, attempts were made to isolate members of the genus Salmonella at the Chattanooga Creek stations. Isolation and identification procedures used are described in the Study Methods section of this report.

Sampling swabs were placed at each Chattanooga Creek station and were suspended for a five-day sampling period. Swabs were torn away at four stations during the sampling period. Swabs were retrieved from seven stations and Salmonella isolation was attempted.

One or more Salmonella enteriditis serotypes were isolated from each of the seven Chattanooga Creek stations (Table 6). A total of five different serotypes were isolated with one serotype (S. give) being isolated at each station. Isolation of Salmonella from these stations furnishes further evidence of fecal pollution and of the disease-producing potential of portions of Chattanooga Creek.

TABLE

SALMONELLA ENTERIDITIS SEROTYPES ISOLATED FROM THE CHATTANOOGA CREEK STATIONS

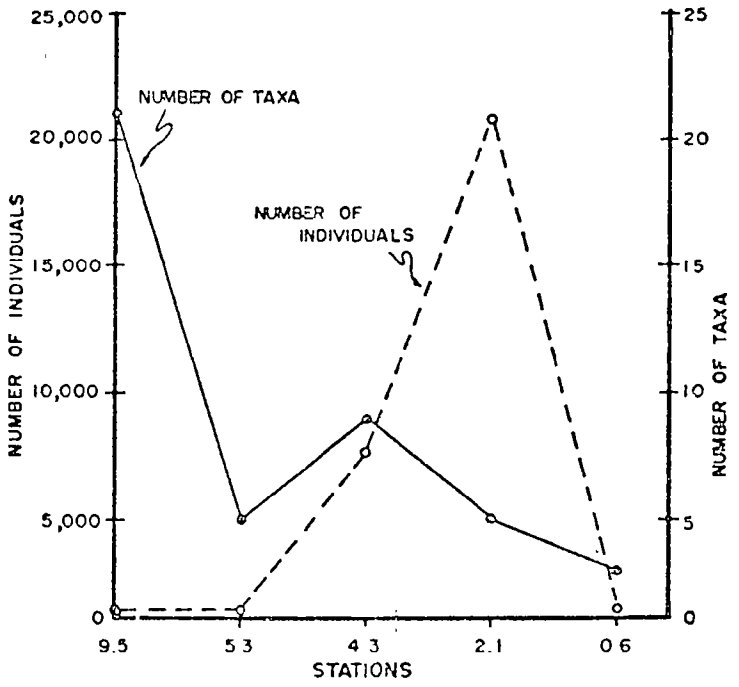
Station	Salmonella enteriditis Serotype Isolated
C-0.6	S. give, S. panama
C-1.2	Swab lost
C-1.6	Swab lost
C-2.1	Swab lost
C-2.5	S. give, S. derby
C-3.4	S. give
C-4.0	S. give, S. typhimurium
C-4.8	S. give
C-5.3	S. give
C-6.5	Swab lost
C-8.8	S. give, S. typhimurium, S. eimsbuettel

BIOLOGY

The biological study consisted of a series of three quantitative samples collected with an Ekman grab sampler and qualitative samples consisting of half-hour concentrated efforts with dip nets and hand-picking from five stations on Chattanooga Creek. The five sampling stations are located at miles 0.6, 2.1, 4.3, 5.3, and 9.5. The Ekman grab samples were collected from representative areas of the stream bottom, and the qualitative samples were collected by sweeping submerged vegetation, logs, and other debris with a dip net; hand-picking of logs and other substrates; and extensive dredging of the side and stream bottom with heavy-framed dip nets. The material collected from these sampling efforts was sifted through a No. 30 mesh sieve, and the material remaining in the sieve was placed into white enamel pans. The organisms were then sorted from this debris, identified, and enumerated. Those organisms not readily identifiable were placed in 70-percent alcohol and returned to the laboratory for identification. The results of this sampling are recorded in Tables 7 and 8 and Figures 48 and 49.

This biological data indicate a steady decline in the quality of the benthic community from the upstream Station 8.8 through Station 0.6 near the mouth of the Creek. Figure 48 is very similar to the classical curves described by Bartsch and Ingram (1959) for benthic communities exposed to enrichment and toxicity (1). Station 9.5, located upstream from the major sources of pollution, has a relatively diverse community of organisms, consisting of 26 taxonomic groups ranging in tolerance to pollution from highly intolerant to tolerant (2). This reflects the relatively good water quality reported in the chemical section of this study for this station.

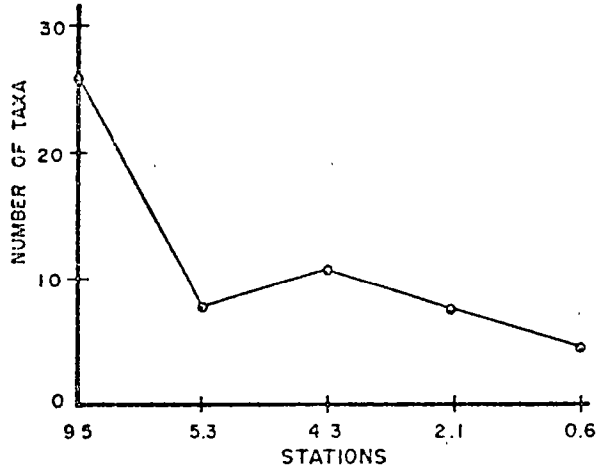
FIGURE 48



NUMBER OF TAXA AND INDIVIDUALS PER SQUARE FOOT COLLECTED WITH AN EKMAN GRAB SAMPLER FROM FIVE STATIONS ON CHATTANOOGA CREEK, CHATTANOOGA, TENN. MAY 1973

FIGURE 49

CHATTANOOGA WASTE DISCHARGES PART II



NUMBER OF TAXA COLLECTED QUALITATIVELY FROM FIVE STATIONS ON CHATTANOOGA CREEK, CHATTANOOGA, TENN. MAY 1973

TABLE 7

A QUALITATIVE LIST OF ORGANISMS COLLECTED FROM FIVE STATIONS
ON CHATTANOOGA CREEK, CHATTANOOGA, TENNESSEE
May 1973

Organisms	Stations 9.5	5.3	4.3	2.1	0.6
Annelida					
Oligochaeta					
Pleisiopora					
Naididae					
Nais, sp.		X			
Tubificidae					
Limnodrilus hoffmeisteri	X	X	X		
L. cervix		X			
Unid. sp.	X	X	X	X	X
Lumbriculidae					
Lumbriculus variegatus			X	X	X
Arthropoda					
Arthropoda					
Isopoda					
Asellidae					
Asellus sp.	X				
Lirceus sp.	X	X			
Amphipoda					
Talitridae					
Hyalella azteca				X	
Arachnoidea					
Hydracarina					
Unid. sp.					
Insecta					
Pleeoptera					
Nemouridae					
Nemoura venosa					
Perlidae					
Perlesta sp.					
Perlodidae					
Isoperla sp.					
Ephemeroptera					
Baetidae					
Ephemerella temporalis	X	X	X	X	X
Paraleptophlebia sp.	X				
Baetis sp.	X				
Heptageniidae					
Stenonema exiguum	X				
Heptagenia sp.	X				

TABLE 7 (CONT'D)

A QUALITATIVE LIST OF ORGANISMS COLLECTED FROM FIVE STATIONS ON CHATTANOOGA CREEK, CHATTANOOGA, TENNESSEE
May 1973

Organisms	Stations 9.5	5.3	4.3	2.1	0.6
Odonata					
Calopterygidae					
Calopteryx sp.					
Coenagrionidae					
Argia sp.					
Aeschnidae					
Boyeria sp.					
Tricoptera					
Hydropsychidae					
Hydropsyche sp.					
Cheumatopsyche sp.	X				
Psychomiidae					
Polycentropus placidus	X				
Coleoptera					
Elmidae					
Dubiraphia vittata	X				
Haliplidae					
Peltodytes sp.		X			
Diptera					
Ceratopogonidae					
Palpomyia sp.	X				
Stilobezzia pos. *antenalis*	X				
Chironomidae					
Ablabesmyia janta					
A. ornata	X				
Conchapelopia sp.	X				
Corynoneura taris	X				
Thienemanniella sp. 2 Roback	X				
Cricotopus prob. *slossonae*			X	X	X
C. ceris anatus			X		
C. prob. *ceris*			X		
C. bicinctus			X	X	
C. nr. *trifasciatus*			X		
Trichocladius robacki	X				
Potthastia longimanus					
Chironomus crassicaudatus				X	X
Cryptochironomus nr. *fulvus*	X				
Paracladopelma undine	X				
Tribelos poss. *jucunda*	X				
Phaenopsectra flavipes			X		

TABLE 7 (CONT'D)

A QUALITATIVE LIST OF ORGANISMS COLLECTED FROM FIVE STATIONS
ON CHATTANOOGA CREEK, CHATTANOOGA, TENNESSEE
May 1973

Organisms	Stations				
	9.5	5.3	4.3	2.1	0.6
Polypedilum halterale	X				
P. illinoense					
Tanytarsus guerlus	X				
Rheotanytarsus exiguus	X				
Atanytarsus sp.	X				
Mollusca					
Gastropoda					
Pulmonata					
Physidae					
Physa sp.	X	X	X	X	X
Planorbidae					
Helisoma sp.		X	X	X	
Total Number of Taxa	26	8	11	8	5

TABLE 8

A LIST OF ORGANISMS COLLECTED WITH AN EKMAN GRAB SAMPLER FROM FIVE STATIONS ON CHATTANOOGA CREEK, CHATTANOOGA, TENNESSEE
May 1973

Organisms	Stations																			
	9.5 Sample				5.3 Sample				4.3 Sample				2.1 Sample				0.6 Sample			
	1	2	3	Total	1	2	3	Total	1	2	3	Total	1	2	3	Total	1	2	3	Total
*Tubificidae																				
Limnodrilus hoffmeisteri			2	2	7			7	40	4	2,000	2,044								
L. cervix					6	25	25	56												
Unid. sp.	1	1	5	7	12			12	20	4	3,000	3,024	10,000	600	5,000	15,600	125	175		300
Naididae																				
Nais sp.						25		25												
Lumbriculidae																				
Lumbriculus variegatus																		1		1
Asellidae																				
Asellus sp.			1	1																
Talitridae																				
Hyalella azteca															6	6				
Hydracarina																				
Unid. sp.			1	1																
Baetidae																				
Baetis sp.		1		1																
Ephemerella temporalis															2	2				
Phycomiidae																				
Eurycentropus placidus		1		1																
Elmidae																				
Dubiraphia vittata		1		1																
Ceratopogonidae																				
Palpomyia sp.	1			1																
Stilobezzia pos. antenalis			1	1																
Chironomidae																				
Ablabesmyia ornata			1	1																
Conchapelopia sp.		3		3																
Corynoneura taris		3		3																
Thienemanniella sp. 2 Roback		7		7																

TABLE 8 (CONT'D)

A LIST OF ORGANISMS COLLECTED WITH AN EKMAN GRAB SAMPLER FROM FIVE STATIONS ON CHATTANOOGA CREEK, CHATTANOOGA, TENNESSEE
May 1973

Organisms	Stations																			
	9.5 Sample				5.3 Sample				4.1 Sample				2.1 Sample				0.6 Sample			
	1	2	3	Total	1	2	3	Total	1	2	3	Total	1	2	3	Total	1	2	3	Total
Cricotopus prob. slossonae									7			7								
C. cerio-aratus									2			2								
C. prob. cerio									2	1	1	4								
C. bicinctus									1			1								
Cricotopus nr. trifasciatus									1			1								
Trilocladius robacki		1		1																
Chironomus crassicaudatus															2	2	2			2
Cryptochironomus nr. fulvus			1	1																
Paracladopelma undine			1	1																
Tribelos poss. jucundus	2	3		5																
Phaenopsectra flavipes									1			1								
Polypedilum halterale			2	2																
Tanytarsus guerlus	1		6	7																
Rheotanytarsus exiguus		1		1																
Atanytarsus sp.			1	1																
Physidae																				
Physa sp.									1		1	2	3	4	7	14				
Number of taxa	5	10	11	21	3	2	1	4	9	3	4		2	2	5	5	2	2	-	2
Number of Individuals	5	22	21	49	25	50	25	95	75	9	5,002	5,086	10,003	604	5,017	15,624	127	176	-	301

*Numbers of tubifids above 100 were estimated

The benthic fauna at Station 5.3 reflects a reduction in water quality. The diversity has been reduced to eight taxonomic groups; however, there has not been a significant increase in the numbers of individuals, as one might expect if the reduction in diversity was caused by excessive enrichment. This reduction in diversity was probably caused by the introduction of toxic substances. McFarland's Branch empties into Chattanooga Creek upstream from Station 4.8. During the March 1973 sampling period, water collected from this branch for BOD analysis gave strong indications of toxic conditions (Page of this report). This or perhaps leaching from an old garbage pit adjacent to Station 5.3 was probably responsible for the reduction in community diversity.

Station 4.3 is located downstream from the outfall from the major industrial complex. Vegetation, debris, and other substrates were covered with copius amounts of Sphaerotilus. Several species of chironomids (four species of Cricotopus and one species of Phaenopsectra) were found in intimate relationship with the masses of Sphaerotilus and were not found anywhere else in the creek. The great increase in numbers of individuals at this station is a good indication of excessive enrichment. Sludge usually blankets the bottom of such reaches of a stream, limiting the use of the area to only a few species that can survive in such a substrate. These surviving species are isolated from competitors and predators with an abundance of food and as a result, form huge populations (Table 7).

A further reduction in water quality at Station 2.1 is illustrated in Figures 47 and 48. This station is located immediately downstream from the confluence of Dobbs Branch, which carries an extremely heavy BOD load (Figure 37). Numbers of organisms per square foot have risen to an

estimated 21,000, and taxonomic groups have been reduced to five. The five groups represented were: Tubificid worms, the amphipod Hgalella azteca, the mayfly Ephemeroptera temporalis, the midge Chrionomus crassicaudatus and the pulmonate snail Physa (Table 8).

Station 0.6, the most downstream station, illustrates a still further reduction in water quality. Only two species were collected in the quantitative sampling, and only five species were collected in total (Table 7). That this station is grossly polluted is apparent from outward appearance alone. Anaerobic activity is apparent, floating debris is coated with oily substances, and everything has a greasy appearance. In fact, after completion of sampling at this station, the sampling gear had the appearance of pots and pans washed in greasy dishwater. The fact that there was a great reduction in total individuals collected is interesting. Water quality data do not denote the presence of toxic materials, yet the lack of large numbers of sludge worms would indicate such a presence. It is possible that the extreme flooding prior to the survey scoured the bottom of the creek at this station, thus removing the sludge deposits which harbir the great masses of sludge worms usually found in such areas. While the only organisms collected were worms (Tubificidae and Lumbriculidae), only relatively small numbers of individuals were collected. Qualitatively, again, the ubiquitous mayfly Ephemerella temporalis was collected, plus the midges Cricotopus slossonae and Chironomus crassicaudatus and a physid snail.

In conclusion, the biological data collected from the five stations on Chattanooga Creek illustrated a steady decline in the quality of the benthic community in Chattanooga Creek, from the relatively unpolluted upstream station 9.5 to the highly polluted area at station 0.6.

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APPENDIX A

ANALYTICAL METHODS

ANALYTICAL METHODS

Parameter	Method	Reference
Biochemical Oxygen Demand	Winkler DO, 5-Day	1, 2
Total Organic Carbon	Carbon Analyzer	2
Nonfilterable Solids	Gravimetric	1
Volatile Solids	Gravimetric, 550°C	1
Total Solids	Gravimetric, 105°C	1
Filterable Solids	Difference Between Total and Suspended Solids	-
Total Kjeldahl Nitrogen	Automated Phenolate Method	2
Ammonia	Automated Phenolate Method	2
Nitrate-Nitrite	Copper-Cadmium Reduction, Automated	2
Phosphorus	Ascorbic Acid Method	2
pH	Electrometric	1
Acidity and Alkalinity	Volumetric	1
Dissolved Oxygen	Winkler	1
Oil and Grease	Solvent Extraction	1
Phenols	4-Aminoantipyrine	1
Metals (Less Hg & As)	Atomic Absorption	2
Mercury	Cold Vapor Atomic Absorption	4
Arsenic	Silverdiethyldithiocarbonate	1
Cyanide	Pyrazolene	3
Turbidity	Hach 2100	2
Conductivity	Wheatstone Bridge	1
Total Coliform	MPN	1
Salmonella	Method of Spino	-
Fecal Coliform	MPN	1

All procedures
for organic chem

ANALYTICAL METHODS (Cont'd)

Parameter	Method	Reference
Organic Scan	SEWL	1

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1. Standard Methods for Examination of Water and Wastewater, 13th Edition, 1971

2. EPA Manual of Methods for Chemical Analyses of Water and Wastes, 1971

3. ASTM Book of Standards, Part 23, 1971

4. EPA, April 1972

APPENDIX B

STATION LOCATIONS

INDUSTRIAL WASTE STATION LOCATIONS

CH-1 Chattem Drug & Chemical Company industrial waste discharge to the storm drain. Sample collected from manhole near the southwest corner of building #2.

COMB-1 Combustion Engineering concrete pipe carrying water to Tennessee River.

CR-1 Crane Company industrial waste discharge to the ox-bow cutoff of Chattanooga Creek. Sample taken from 42" diameter concrete pipe at edge of creek.

DI-1 Dixie Sand & Gravel washer effluent flume before it flows into the Tennessee River.

GIL-1 Gilman Paint Company. Sample collected at sump prior to discharge to the Tennessee River.

L&N-1 Louisville & Nashville Railroad sample collected at effluent from sewage treatment plant.

L&N-2 Louisville & Nashville Railroad sample collected form oil skimmer effluent.

L&N-3 Louisville & Nashville Railroad sample collected from holding pond overflow.

L&N-4 Louisville & Nashville Railroad sample collected at entrance to yard. Ditch carrying runoff.

L&N-5 Louisville & Nashville Railroad sample collected from underdrain effluent at rear of yard.

MB-1 Mocassin Bend Sewage Treatment Plant. Automatic sampler set up at plant effluent in digester room.

MM-1 Modern Maid, Inc. industrial waste discharge from the pickling operation. The sample was collected in a sump adjacent to the pickling vats.

MM-2 Modern Maid, Inc. industrial waste discharge from the ceramic base coat operation. The sample was collected at sump at the southeast end of the building.

MM-3 Modern Maid, Inc. industrial waste discharge from base coat operation. Sample taken from paint shop effluent.

RD-1 Standard Coosa Thatcher waste discharge to McFarland Branch. Stream runs under part of plant, and parallel to Williams Road.

RDC-1 Southern Kenyon taken from concrete pipe waste drain approximately 40 yards upstream from confluence of two branches of McFarland Branch.

RE-1 Reilly Tar & Chemical Corporation combined industrial waste discharge from the oil separator.

RO-1 Roper Corporation discharge from uppermost of four discharges. Located near retaining wall.

RO-2 Roper Corporation discharge located approximately 150' downstream from RO-1.

RO-3 Roper Corporation discharge from settling pond downstream from RO-2.

RO-4 Roper Corporation discharge from settling pond downstream from RO-3.

SI-1 Signal Mountain Portland Cement. Sample collected from the settling pond effluent on the north bank of the Tennessee River.

SK-1 Southern Kenyon discharges dye waste to a tributary (McFarland Branch) of Chattanooga Creek. The plant is located in an industrial complex southeast of Rossville High School.

SW-1 Swift Edible Oil Division. Storm water discharge to a tributary of Chattanooga Creek. Sample collected from a manhole near cooling tower.

SW-2 Swift Edible Oil Division. Leakage from the engine room cooling water basin. Sample collected near the southeast corner of the basin.

USP-1 United States Pipe & Foundry - Soil Pipe Division. Sample collected from 24" corrugated pipe discharging to the Tennessee River.

USP-2 United States Pipe & Foundry - Soil Pipe Division. North storm sewer.

USP-3 United States Pipe & Foundry - Soil Pipe Division. Outfall from south storm sewer.

VE-1 Velsicol Chemical Corporation. Station set up approximately 75 yards from Wilson Road beside railroad track, effluent flows through a swamp.

VE-2 Velsicol Chemical Corporation. Site drainage flowing across Wilson Road to tributary of Chattanooga.

VE-3 Velsicol Chemical Corporation. Sample collected at fence from building across road from main plant.

VE-4 Velsicol Chemical Corporation effluent to city sewer system.

WO-1 Woodward Company storm water ditch on north side of property.

WO-2 Woodward Company waste discharge from oil separator unit on east side of the main plant.

WO-3 Woodward Company drainage on north side of plant property, bubbling up from ground, east of WO-1.

TABLE 1

Stream Station Sample Locations

C-0.6	Chattanooga Creek, Hamilton County, Tennessee, at L&N Railroad bridge approximately 0.6 miles from the mouth.
C-1.2	Chattanooga Creek, Hamilton County, Tennessee, at Broad Street bridge.
C-1.6	Chattanooga Creek, Hamilton County, Tennessee, at Market Street bridge.
C-2.1	Chattanooga Creek, Hamilton County, Tennessee, at Southern Railroad Shipps Yard Bridge immediately downstream from the confluence of Dobbs Branch.
DB-0.1	Dobbs Branch, Hamilton County, Tennessee, at the Central of Georgia Railroad Bridge approximately 0.1 miles from mouth.
DBT-1	Unnamed tributary to Dobbs Branch (primarily a storm-water and waste drain) entering Dobbs Branch near I-24 behind the Art Cinema Theater. The stream enters Dobbs Branch near mile 0.3.
DBT-2	Unnamed tributary to Dobbs Branch (upstream from DBT-1) above Jorges Carpet at a culvert under Holtzclaw Avenue near 16th Street.
C-2.5	Chattanooga Creek, Hamilton County, Tennessee, at the end of railroad spur adjacent to the northern edge of Southern Piedmont Wood Preserving.
3.6 C-~~3.4~~	Chattanooga Creek, Hamilton County, Tennessee, immediately upstream from Southern Piedmont Wood Preserving and adjacent to Clifton Hills subdivision.
4.3 C-~~4.0~~	Chattanooga Creek, Hamilton County, Tennessee, at the 38th Street bridge.
CT-2	Unnamed tributary to Chattanooga Creek draining the area around Velsicol, Reilly Tar and Chemicals and Woodward. Sample from culvert under Hammill Road near the intersection of Wilson Road.
5.3 C-~~4.8~~	Chattanooga Creek, Hamilton County, Tennessee, at Hammill Road bridge.
5.8 C-~~5.3~~	Chattanooga Creek, Hamilton County, Tennessee, at Hooker Road bridge.

TABLE 1 (Continued)

CT-3	McFarland Branch tributary to Chattanooga Creek near mile 5.6. Stream flows past Rossville High School. Sample to be taken from bridge on Tennessee-Georgia state-line.
CT-4	Dry Creek, tributary to Chattanooga Creek, near mile 6.1. Sample to be collected from highway bridge 0.5 miles from mouth of creek in Walker County, Georgia.
C-~~6~~ 7.0	Chattanooga Creek, Hamilton County, Tennessee, at Wilson Road Bridge near the Tennessee-Georgia state-line.
C-~~8~~ 9.5	Chattanooga Creek, Walker County, Georgia, at the USGS gaging station off of Burnt Mill Road.

APPENDIX C

TENNESSEE WATER QUALITY CRITERIA

APPENDIX D

WASTE AND STREAM QUALITY DATA

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
(DOWNSTREAM FROM CITY WATER COMPANY INTAKES) FEB.-MARCH, 1973

AGENCY - 1113S000

STATION	DATE	TIME	DEPTH	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00310 BOD 5 DAY MG/L	00400 PH SU	00403 LAB PH SU	00410 T ALK CACO3 MG/L	00435 T ACDITY CACO3 MG/L
C-0.6	730227	0900	0001	10.5	24	238	5.8	4.3	7.0	7.1	75	3
C-0.6	730228	1650	0001	11.5	19	320	5.7	5.3	7.0	7.1	83	3
C-0.6	730301	0810	0001	10.0	17	320	4.8	6.4	6.9	7.3	82	4
C-0.6	730302	1520		10.0	130	420	5.7	32.0	6.9	7.2	97	7
C-0.6	730305	1410	0001	14.0	30	205	7.1	2.8	7.2	7.6	70	2
C-0.6	730306	1440	0001	14.0	16	210	6.5	4.7	7.2	7.3	59	2
C-0.6	730307	0900	0001	14.5	78	240	6.0	7.0	7.1	7.6	62	2
C-1.2	730227	0940	0001	10.0	23	265	6.7	4.9	7.1	7.2	71	3
C-1.2	730228	1620	0001	11.5	14	330	6.1	5.4	7.1	7.5	75	3
C-1.2	730301	0850	0001	10.0	17	320	5.6	5.4	6.9	7.2	78	5
C-1.2	730302	1450		10.0	145	330	6.9	35.0	7.1	7.4	87	3
C-1.2	730305	1425	0001	14.0	31	200	7.5	3.2	7.3	7.6	55	2
C-1.2	730306	1510	0001	14.0	20	220	6.7	7.5	7.2	7.5	66	2
C-1.2	730307	0920	0001	14.0	66	190	6.4	5.5	7.2	7.6	61	2
C-1.6	730227	1010	0001	10.0	30	324	8.0	6.5	7.0	7.3	73	4
C-1.6	730228	1555	0001	12.0	11	330	6.6	3.7	7.1	7.5	77	3
C-1.6	730301	0915	0001	10.0	14	305	6.3	6.9	7.0	7.5	81	4
C-1.6	730302	1400		10.0	145	295	7.3	40.0	7.1	7.4	71	3
C-1.6	730305	1440	0001	14.5	34	205	7.7	4.0	7.3	7.3	54	2
C-1.6	730306	1415	0001	14.0	16	235	7.0	8.0	7.1	7.3	75	2
C-1.6	730307	0940	0001	14.0	105	175	6.6	6.2	7.2	7.5	61	1K
C-2.1	730227	1055	0001	10.5	29	328	7.0	6.1	6.9	7.2	72	5
C-2.1	730228	1500	0001	12.0	12	365	6.6	4.7	7.1	7.5	78	3
C-2.1	730301	0935	0001	10.5	10	300	6.8	3.6	7.0	7.4	75	4
C-2.1	730302	1120	0001	10.0	18	430	6.5	11.0	7.0	7.0	157	13
C-2.1	730305	1500	0001	16.0	33	220	7.8	4.8	7.3	7.5	59	3
C-2.1	730306	1330	0001	15.0	18	220	7.1	7.9	7.3	7.4	65	3
C-2.1	730307	1000	0001	14.5	110	175	6.7	6.4	7.1	7.5	59	2

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
(DOWNSTREAM FROM CITY WATER COMPANY INTAKES) FEB.-MARCH, 1973

AGENCY - 1113S000

STATION	DATE	TIME	DEPTH	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00310 BOD 5 DAY MG/L	00400 PH SU	00403 LAB PH SU	00410 T ALK CACO3 MG/L	00435 T ACDITY CACO3 MG/L
C-2.5	730227	1320	0001	11.0	13	275	6.9	7.5	6.2	7.1	54	5
C-2.5	730228	1420	0001	10.5	11	320	6.8	3.6	7.1	7.6	83	4
C-2.5	730301	1040	0000	10.0	11	330	7.5	3.1	7.0	7.5	68	3
C-2.5	730302	1055	0001	9.5	19	385	7.1	3.7	7.0	7.4	84	5
C-2.5	730305	1540	0001	14.0	32	195	8.1	2.4	7.3	7.6	56	2
C-2.5	730306	1200	0001	13.5	23	195	7.5	4.0	7.0	7.4	48	3
C-2.5	730307	1045	0001	14.0	115	185	7.1	6.0	7.1	7.4	56	2
C-3.6	730227	1530	0001	11.5	16	287	7.6	5.7	6.9	7.1	75	3
C-3.6	730228	1150	0001	10.0	16	306	8.0	4.6	7.1	7.5	82	3
C-3.6	730301	1105	0001	9.5	11	310	8.0	4.2	6.9	7.5	71	3
C-3.6	730302	1030	0001	9.5	13	395	7.3	4.3	7.1	7.4	71	4
C-3.6	730305	1605	0001	13.5	32	185	8.2	2.1	7.3	7.6	55	2
C-3.6	730306	1120	0001	13.5	24	180	7.9	4.8	7.0	7.4	55	2
C-3.6	730307	1110	0001	14.0	105	175	7.6	6.2	7.1	7.4	53	3
C-4.3	730227	1355	0001	11.0	15	297	8.3	7.2	6.7	7.3	67	2
C-4.3	730228	1010	0001	10.0	21	442	8.5	8.2	7.2	7.5	74	3
C-4.3	730301	1130	0001	9.5	14	310	8.7	6.5		7.4	71	3
C-4.3	730302	1010	0001	10.0	12	405	8.2	4.5	7.0	7.4	67	4
C-4.3	730305	1655	0001	13.5	34	230	8.7	2.1	7.3	7.5	60	4
C-4.3	730306	1140	0001	12.5	28	195	8.3	5.3	7.1	7.4	57	2
C-4.3	730307	1135	0001	13.5	84	175	8.1	5.7	7.2	7.5	55	1
C-5.3	730227	1440	0001	13.0	18	216	9.4	5.0	7.4	7.6	77	2
C-5.3	730228	1020	0001	9.5	19	185	9.4	4.1	7.3	7.7	73	2
C-5.3	730301	1350	0001	11.0	10	200	10.1	3.4	7.4	7.5	72	7
C-5.3	730302	0940	0001	10.0	11	190	8.7	2.8	7.1	7.6	74	3
C-5.3	730305	1730	0001	14.0	26	145	9.4	1.8	7.4	7.7	54	2
C-5.3	730306	1040	0001	12.5	25	155	8.7	2.7	7.1	7.5	57	1
C-5.3	730307	1155	0001	13.5	45	150	8.3	3.5	7.2	7.6	55	1K

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
(DOWNSTREAM FROM CITY WATER COMPANY INTAKES) FEB.-MARCH, 1973

AGENCY - 1113S000

STATION	DATE	TIME	DEPTH	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00310 BOD 5 DAY MG/L	00400 PH SU	00403 LAB PH SU	00410 T ALK CACO3 MG/L	00435 T ACDITY CACO3 MG/L
C-5.8	730227	1515	0001	12.5	16	185	9.7	4.2	7.4	7.7	71	1
C-5.8	730228	1000	0001	9.5	20	189	9.4	3.5	7.3	7.8	74	1
C-5.8	730301	1420	0001	11.0	10	220	10.4	3.8	7.6	7.7	69	3
C-5.8	730302	0920	0001	10.0	11	210	8.6	3.2	7.3	7.4	75	3
C-5.8	730305	1745	0001	13.5	25	135	9.5	1.9	7.4	7.6	56	2
C-5.8	730306	1025	0001	13.0	22	135	9.0	2.7	7.2	7.6	58	1K
C-5.8	730307	1340	0001	14.0	90	135	8.6	3.6	7.3	7.7	53	1K
C-7.0	730227	1635	0001	11.5	12	159	10.5	3.4	7.5	7.6	62	2
C-7.0	730228	0905	0001	9.5	12	162	9.6	2.7	7.2	7.6	64	1
C-7.0	730301	1640	0001	10.0	6	155	11.6	1.6	7.4	7.4	66	4
C-7.0	730302	0845	0001	10.0	8	190	8.8	3.3	7.2	7.2	76	4
C-7.0	730305	1545		14.0	19	115	9.6	1.4	7.4	7.7	41	2
C-7.0	730306	0945	0001	12.5	17	115	9.1	2.0	7.2	7.6	52	1K
C-7.0	730307	1430	0001	14.0	125	105	8.7	2.8	7.2	7.5	47	1
C-9.5	730227	1700	0001	11.5	8	132	10.5	2.3	7.4	7.4	56	1
C-9.5	730228	0830	0001	8.5	8	162	10.0	3.3	7.2	7.6	63	1
C-9.5	730301	1610	0001	10.0	6	150	11.4	1.1	7.2	7.5	56	4
C-9.5	730302	0825	0001	9.0	7	155	9.0	2.6	7.1	7.5	66	3
C-9.5	730305	1515		14.0	18	115	9.8	1.4	7.3	7.6	47	2
C-9.5	730306	0925	0001	12.0	13	105	9.5	1.9	7.2	7.6	42	1K
C-9.5	730307	1450	0001	13.5	84	105	9.0	2.6	7.2	7.6	49	2
DR-0.1	730227	1125	0001	14.0	260	555	4.3	25.0	6.8	7.3	204	24
DR-0.1	730228	1520	0001	15.0	175	620	4.4	67.0	7.3	7.6	208	10
DR-0.1	730301	0955	0001	12.5	100	610	2.0	49.0	6.8	7.1	162	22
DR-0.1	730302	1150	0001	12.0	6340	625		370.0	6.8	7.0	226	40
DR-0.1	730305	1515	0001	17.5	28	940	4.4	103.0	7.9	7.9	202	4
DR-0.1	730306	1345	0001	16.0	40	620	4.5	52.0	7.1	7.4	173	6
DR-0.1	730307	1015	0001	15.0	45	310	5.9	28.0	7.2	7.7	104	3

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
(DOWNSTREAM FROM CITY WATER COMPANY INTAKES) FEB.-MARCH, 1973

AGENCY - 11135000

STATION	DATE	TIME	DEPTH	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00310 BOD 5 DAY MG/L	00400 PH SU	00403 LAB PH SU	00410 T ALK CACO3 MG/L	00435 T ACDITY CACO3 MG/L
DBT-1	730227	1415		19.0	2500	740	5.8	118.0	7.0	7.1	285	23
DBT-1	730228	1525		23.0	2100	680		260.0	6.6	7.1	213	49
DBT-1	730301	1635		22.0	160	950		193.0	6.6	6.7	104	55
DBT-1	730302	1020		19.0	1470	935		350.0	5.9	6.5	61	70
DBT-1	730305	1750		22.0	15	685		156.0	6.7	7.1	210	29
DBT-1	730306	0830	0000	12.0	130	770		229.0	6.8	7.2	176	9
DBT-1	730307	0825	0001	16.5	110	395	6.5	56.0	6.9	7.3	133	11
DBT-2	730227	1440		16.0	230	675	6.8	20.0K	6.0	5.5	3	155
DBT-2	730228	1540		18.0	330	1080		20.0K	4.4	4.0	0	268
DBT-2	730301	1640		16.0	235	920		20.0K	6.5	6.3	11	87
DBT-2	730302	1135		12.0	145	220		39.0	6.4	7.5	36	4
DBT-2	730305	1735		21.0	4000	575		50.0K	7.5	7.9	112	5
DBT-2	730306	0845	0000	15.0	225	440		10.0	8.8	9.5	139	0
DBT-2	730307	0835	0000	15.5	135	670		45.0	9.1	9.6	225	0
CT-2	730227	1420	0000	21.5	17	15100	5.9	100.0L	8.5	8.8	1000	0
CT-2	730228	1035	0000	13.5	175	23300	7.6	360.0	4.0	3.8	0	816
CT-2	730301	1150	0000	15.0	10	32500		610.0	2.1	2.1	0	1550
CT-2	730302	0955	0000	12.0	110	25000		630.0	5.8	5.8	267	570
CT-2	730302	1200			210	11700		290.0		2.3	0	1070
CT-2	730305	1710	0000	21.0	65	19400		495.0	5.5	5.4	82	870
CT-2	730306	1055	0000	25.0	180	14600		1160.0	5.0	4.9	17	620
CT-2	730307	1145	0000	17.0	100	4680		310.0	6.3	6.5	123	123
CT-3	730227	1540	0000	19.5	21	1220	7.8	43.0	9.7	9.8	186	0
CT-3	730228	0935	0000	14.0	10	740		26.0	9.5	9.8	181	0
CT-3	730301	1445	0000	19.0	34	840		28.0	9.8			
CT-3	730302	0905	0000	16.0	17	2440		38.0	9.8	9.8	213	0
CT-3	730305	1615		22.0	12	600	6.7	21.0	9.0	9.3	149	0
CT-3	730306	1010	0000	18.0	7	6050			8.7	9.2	158	0
CT-3	730307	1350	0000	17.5	32	595		9.8	10.1	11.1	232	0

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
(DOWNSTREAM FROM CITY WATER COMPANY INTAKES) FEB.-MARCH, 1973

AGENCY - 1113S000

STATION	DATE	TIME	DEPTH	00010 WATER TEMP CENT	00070 TURB JKSN JTU	00095 CNDUCTVY AT 25C MICROMHO	00300 DO MG/L	00310 BOD 5 DAY MG/L	00400 PH SU	00403 LAB PH SU	00410 T ALK CACO3 MG/L	00435 T ACDITY CACO3 MG/L
CT-4	730227	1620	0001	15.5	12	216	13.2	3.1	8.9	9.2	100	0
CT-4	730228	0925	0001	8.0	11	270	11.1	2.2	7.6	8.0	116	1
CT-4	730301	1520	0001	12.0	32	210	12.6	8.0K	8.0			
CT-4	730302	0855	0001	9.5	14	275	8.9	2.0	7.4	8.0	133	3
CT-4	730305	1600		16.0	36	270	9.1	5.1	7.2	7.8	103	3
CT-4	730306	0955	0001	12.0	20	260	10.9	4.9	7.3	7.9	104	1K
CT-4	730307	1420	0001	14.0	38	190	9.0	4.2	7.3	7.6	78	2

STATION	DATE	TIME	DEPTH	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00665 PHOS-T P-WET MG/L	00680 T ORG C C MG/L	31505 TOT COLI MPN CONF /100ML	31615 FEC COLI MPNECMED /100ML	00060 STREAM FLOW CFS	00500 RESIDUE TOTAL MG/L
C-0.6	730227	0900	0001	0.46	0.90	0.37	0.08	4.0	13000	1300	85.0	177
C-0.6	730228	1650	0001	2.38	2.80	0.32	0.18	5.0	54000	2300	78.0	205
C-0.6	730301	0810	0001	3.59	4.02	0.32	0.14	5.0	24000	1700	71.0	257
C-0.6	730302	1520		1.90	2.47	0.54	0.41	20.0	1600000	350000	68.0	373
C-0.6	730305	1410	0001	1.39	1.12	0.34	0.10	4.0	160000	35000	229.0	231
C-0.6	730306	1440	0001	2.82	2.90	0.28	0.13	4.0	13000	1700	206.0	175
C-0.6	730307	0900	0001	3.20	3.20	0.34	0.28	8.0	33000	7000	374.0	252
C-1.2	730227	0940	0001	0.46	0.70	0.29	0.07	4.0	130000	7900	84.0	
C-1.2	730228	1620	0001	3.50	3.72	0.31	0.10	4.0	23000	1700	77.0	
C-1.2	730301	0850	0001	1.38	1.70	0.37	0.19	4.0	170000	33000	70.0	
C-1.2	730302	1450		2.23	3.35	0.65	0.48	30.0	920000	920000	67.0	
C-1.2	730305	1425	0001	1.46	1.12	0.32	0.09	4.0	49000	2200	227.0	
C-1.2	730306	1510	0001	2.62	2.97	0.26	0.15	5.0	170000	2300		
C-1.2	730307	0920	0001	1.19	1.30	0.31	0.23	7.0	33000	13000	370.0	
C-1.6	730227	1010	0001	0.64	0.95	0.31	0.06	4.0	17000	3300		
C-1.6	730228	1555	0001	3.12	3.72	0.31	0.13	3.0	13000	2200	77.0	
C-1.6	730301	0915	0001	1.33	1.65	0.34	0.14	5.0	49000	3100	70.0	
C-1.6	730302	1400		2.28	2.85	0.65	0.52	25.0	1600000	540000	67.0	
C-1.6	730305	1440	0001	1.60	1.20	0.34	0.10	4.0	79000	3300	226.0	
C-1.6	730306	1415	0001	2.60	2.80	0.26	0.17	5.0	51000	2400	203.0	
C-1.6	730307	0940	0001	1.29	1.30	0.34	0.23	8.0	46000	13000	369.0	

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
(DOWNSTREAM FROM CITY WATER COMPANY INTAKES) FEB.-MARCH, 1973

AGENCY - 1113S000

STATION	DATE	TIME	DEPTH	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00665 PHOS-T P-WET MG/L	00680 T ORG C C MG/L	31505 TOT COLI MPN CONF /100ML	31615 FEC COLI MPNECMED /100ML	00060 STREAM FLOW CFS	00500 RESIDUE TOTAL MG/L
C-2.1	730227	1055	0001	5.30	6.10	0.33	0.08	5.0	23000	4900		
C-2.1	730228	1500	0001	3.17	3.50	0.31	0.12	4.0	11000	1700		
C-2.1	730301	0935	0001	2.20	2.90	0.28	0.13	5.0	23000	200K		
C-2.1	730302	1120	0001	2.51	3.45	0.32	0.13	10.0	23000	2300		
C-2.1	730305	1500	0001	1.57	1.32	0.32	0.13	5.0	130000	1700		
C-2.1	730306	1330	0001	2.66	2.97	0.25	0.16	4.0	13000	2300		
C-2.1	730307	1000	0001	1.77	1.70	0.32	0.22	9.0	79000	7900		
C-2.5	730227	1320	0001	3.70	5.00	0.33	0.60	5.0	4900	3300		
C-2.5	730228	1420	0001	3.56	4.00	0.30	0.14	3.0	490	140		
C-2.5	730301	1040	0000	2.38	2.90	0.29	0.17	3.0	3300	790		
C-2.5	730302	1055	0001	4.70	6.20	0.28	0.13	4.0	17000	790		
C-2.5	730305	1540	0001	0.86	0.95	0.30	0.12	4.0	7900	1700		
C-2.5	730306	1200	0001	2.78	2.90	0.26	0.13	3.0	11000	1300		
C-2.5	730307	1045	0001	1.88	2.30	0.34	0.20	7.0	33000	17000		
C-3.6	730227	1530	0001	2.58	2.96	0.31	0.40	4.0	7900	4900		
C-3.6	730228	1150	0001	3.32	5.35	0.30	0.14	4.0	3100	790		
C-3.6	730301	1105	0001	4.56	4.65	0.28	0.08	5.0	24000	2300		
C-3.6	730302	1030	0001	5.50	6.30	0.28	0.08	11.0	49000	1100		
C-3.6	730305	1605	0001	1.00	1.17	0.23	0.13	4.0	35000	4900		
C-3.6	730306	1120	0001	2.86	3.00	0.25	0.14	3.0	13000	1100		
C-3.6	730307	1110	0001	2.34	2.60	0.30	0.23	7.0	33000	13000		
C-4.3	730227	1355	0001	2.62	3.15	0.31	0.40	5.0	7900	4900	76.0	
C-4.3	730228	1010	0001	7.30	8.00	0.30	0.17	5.0	17000	1300	70.0	
C-4.3	730301	1130	0001	4.41	4.51	0.27	0.19	4.0	17000	940	63.0	
C-4.3	730302	1010	0001	6.50	6.60	0.26	0.10	4.0	13000	700	61.0	
C-4.3	730305	1655	0001	4.48	4.25	0.29	0.07	3.0	11000	2300	205.0	
C-4.3	730306	1140	0001	3.84	4.05	0.26	0.14	4.0	7000	790	184.0	
C-4.3	730307	1135	0001	2.12	2.55	0.30	0.29	7.0	70000	4900	334.0	

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
(DOWNSTREAM FROM CITY WATER COMPANY INTAKES) FEB.-MARCH, 1973

AGENCY - 1113S000

STATION	DATE	TIME	DEPTH	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00665 PHOS-T P-WET MG/L	00680 T ORG C C MG/L	31505 TOT COLI MPN CONF /100ML	31615 FEC COLI MPNECMED /100ML	00060 STREAM FLOW CFS	00500 RESIDUE TOTAL MG/L
C-5.3	730227	1440	0001	1.16	1.35	0.29	0.21	4.0	4900	2300	75.0	457
C-5.3	730228	1020	0001	0.13	0.72	0.26	0.22	3.0	4900	2300	66.0	165
C-5.3	730301	1350	0001	0.12	0.40	0.26	0.18	3.0	2800	1000	62.0	170
C-5.3	730302	0940	0001	0.19	0.30	0.25	0.19	3.0	3300	490	59.0	164
C-5.3	730305	1730	0001	0.26	0.25	0.26	0.08	3.0	4900	790	201.0	133
C-5.3	730306	1040	0001	0.23	1.27	0.25	0.17	4.0	4900	490	181.0	196
C-5.3	730307	1155	0001	0.08	0.20	0.26	0.18	3.0	81000	10000	327.0	161
C-5.8	730227	1515	0001	0.04	0.12	0.28	0.22	4.0	3300	1700		
C-5.8	730228	1000	0001	0.02	0.45	0.28	0.21	4.0	7000	1300		
C-5.8	730301	1420	0001	0.09	0.15	0.26	0.30	3.0	4900	490		
C-5.8	730302	0920	0001	0.04	0.30	0.25	0.17	3.0	13000	790		
C-5.8	730305	1745	0001	0.01	0.15	0.26	0.06	3.0	22000	1700		
C-5.8	730306	1025	0001	0.03	0.21	0.24	0.14	4.0	24000	490		
C-5.8	730307	1340	0001	0.08	0.57	0.29	0.17	5.0	23000	2300		
C-7.0	730227	1635	0001	0.07	0.20	0.27	0.20	3.0	10000	7600	64.0	144
C-7.0	730228	0905	0001	0.04	0.22	0.25	0.20	3.0	3300	3300	59.0	137
C-7.0	730301	1640	0001	0.04	0.05	0.23	0.07	2.0	3300	460	53.0	166
C-7.0	730302	0845	0001	0.04	0.10	0.20	0.27	5.0	17000	3300	51.0	145
C-7.0	730305	1545		0.26	0.12	0.26	0.04	2.0	7900	3300	173.0	148
C-7.0	730306	0945	0001	0.02	0.10	0.20	0.11	2.0	13000	790	156.0	148
C-7.0	730307	1430	0001	0.01	0.32	0.22	0.17	6.0	33000	17000	283.0	205
C-9.5	730227	1700	0001	0.04	0.17	0.27	0.05	2.0	2300	490	59.0	
C-9.5	730228	0830	0001	0.04	0.17	0.25	0.22	3.0	13000	3300	54.0	
C-9.5	730301	1610	0001	0.04	0.15	0.23	0.08	1.0	1300	170	49.0	
C-9.5	730302	0825	0001	0.02	0.05	0.23	0.16	3.0	4900	3300	47.0	
C-9.5	730305	1515		0.01	0.17	0.23	0.14	2.0	2300	790	159.0	
C-9.5	730306	0925	0001	0.01	0.12	0.19	0.10	2.0	2300	790	143.0	
C-9.5	730307	1450	0001	0.01	0.20	0.20	0.14	5.0	54000	7000	259.0	

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CHATTANOOGA FIELD STUDY
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AGENCY - 1113S000

STATION	DATE	TIME	DEPTH	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00665 PHOS-T P-WET MG/L	00680 T ORG C C MG/L	31505 TOT COLI MPN CONF /100ML	31615 FEC COLI MPNECMED /100ML	00060 STREAM FLOW CFS	00500 RESIDUE TOTAL MG/L
DB-0.1	730227	1125	0001	3.10	4.15	0.65	0.23	19.0	1100000	46000		185
DB-0.1	730228	1520	0001	2.00	3.50	0.77	0.31	26.0	330000	27000		532
DB-0.1	730301	0955	0001	2.40	3.07	0.52	0.26	34.0	280000	4900		508
DB-0.1	730302	1150	0001	0.85	2.20	0.64	4.40	370.0	5400000	1300000		3213
DB-0.1	730305	1515	0001	1.90	5.00	0.90	1.47	47.0	790000	11000		662
DB-0.1	730306	1345	0001	2.00	2.90	0.75	0.43	24.0	1700000	33000		480
DB-0.1	730307	1015	0001	0.78	1.10	0.62	0.23	16.0	490000	33000		266
DBT-1	730227	1415		11.70	21.80	0.96	0.68	140.0	3500000	330000		1137
DBT-1	730228	1525		4.78	6.55	1.64	0.46	260.0	9200000	790000		1442
DBT-1	730301	1635		7.90	12.60	2.23	0.60	120.0	790000	50000		1174
DBT-1	730302	1020		9.90	14.50	2.00	0.82	200.0	790000	170000		1740
DBT-1	730305	1750		10.60	15.50	0.25	0.31	130.0	2400000L	46000		623
DBT-1	730306	0830	0000	8.90	13.50	1.22	0.18	140.0	3500000	23000		738
DBT-1	730307	0825	0001	4.22	4.85	0.66	0.38	48.0	9200000	49000		349
DBT-2	730227	1440		0.50	6.00	0.75	0.43	7.0	230	20		
DBT-2	730228	1540		1.23	2.17	0.79	1.40	8.0	1700	230		
DBT-2	730301	1640		0.73	3.38	0.70	0.73	14.0	20K	20K		
DBT-2	730302	1135		1.00	2.75	1.58	0.92	36.0	9400	4600		
DBT-2	730305	1735		1.20	1.57	0.18	2.15	12.0	35000	35000		
DBT-2	730306	0845	0000	0.57	7.35	0.66	1.72	7.0	33000	17000		
DBT-2	730307	0835	0000	0.17	6.25	1.14	9.70	48.0	7900	2200		
CT-2	730227	1420	0000	845.00	850.00	1.74	0.10	240.0	790	490	0.4	10130
CT-2	730228	1035	0000	2260.00	2375.00	1.48	0.41	270.0	20	20	0.6	18870
CT-2	730301	1150	0000	1835.00	1800.00	1.78	0.50	390.0	20K	20K	0.3	27210
CT-2	730302	0955	0000	1110.00	1235.00	2.06	0.34	470.0	3300	3300	0.4	20590
CT-2	730302	1200		855.00	975.00	1.10	1.00	210.0			1.9	7642
CT-2	730305	1710	0000	1790.00	1800.00	2.60	0.19	290.0	1300	790	0.5	12500
CT-2	730306	1055	0000	2380.00	2650.00	1.80	0.26	660.0	790	80	0.4	11070
CT-2	730307	1145	0000	374.00	390.00	1.58	0.12	170.0	7900	7900	0.7	2604

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AGENCY - 1113S000

STATION	DATE	TIME	DEPTH	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L	00665 PHOS-T P-WET MG/L	00680 T ORG C C MG/L	31505 TOT COLI MPN CONF /100ML	31615 FEC COLI MPNECMED /100ML	00060 STREAM FLOW CFS	00500 RESIDUE TOTAL MG/L
CT-3	730227	1540	0000	0.26	1.05	0.83	1.66	35.0	4900	490		
CT-3	730228	0935	0000	0.24	1.17	0.90	1.57	22.0	7900	2200		
CT-3	730301	1445	0000	0.24	0.70	0.70	2.47	23.0	4900	3300		
CT-3	730302	0905	0000	0.67	1.10	0.72	0.59	18.0	1900	270		
CT-3	730305	1615		0.10	0.52	0.60	0.78	15.0	35000	24000		
CT-3	730306	1010	0000	0.18	0.90	0.67	0.50	16.0	28000	7000		
CT-3	730307	1350	0000	0.18	0.42	0.69	0.52	10.0	49000	7900		
CT-4	730227	1620	0001	0.04	0.30	0.65	0.08	3.0	4900	3300		
CT-4	730228	0925	0001	0.05	0.30	0.82	0.07	2.0	6400	5100		
CT-4	730301	1520	0001	0.22	0.45	0.88	0.08	4.0	330	20		
CT-4	730302	0855	0001	0.12	0.25	0.84	0.14	3.0	11000	4600		
CT-4	730305	1600		0.47	0.60	0.65	0.27	5.0	24000	7900		
CT-4	730306	0955	0001	0.12	0.25	0.66	0.07	3.0	130000	33000		
CT-4	730307	1420	0001	0.13	0.42	0.55	0.15	6.0	23000	7900		

STATION	DATE	TIME	DEPTH	00505 RESIDUE TOT VOL MG/L	00515 RESIDUE DISS-105 C MG/L	00530 RESIDUE TOT NFLT MG/L	00535 RESIDUE VOL NFLT MG/L	01002 ARSENIC AS,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L	32730 PHENOLS UG/L
C-0.6	730227	0900	0001	24	163	14	5	29K	20K	10K	
C-0.6	730228	1650	0001	24	189	16	0	29K	20K	10K	28
C-0.6	730301	0810	0001	47	210	21	14	29K	20K	10K	
C-0.6	730302	1520		90	293	80	40	29K	48	27	35
C-0.6	730305	1410	0001	57	185	46	13	29K	20K	10K	18
C-0.6	730306	1440	0001	46	147	28	8	29K	20K	10K	225
C-0.6	730307	0900	0001	56	157	95	16	29K	20K	10K	257
C-2.1	730228	1500	0001								13
C-2.1	730305	1500	0001								20

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STATION	DATE	TIME	DEPTH	00505 RESIDUE TOT VOL MG/L	00515 RESIDUE DISS-105 C MG/L	00530 RESIDUE TOT NFLT MG/L	00535 RESIDUE VOL NFLT MG/L	01002 ARSENIC AS,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L	32730 PHENOLS UG/L
C-2.5	730227	1320	0001								62
C-2.5	730228	1420	0001								31
C-2.5	730301	1040	0000								22
C-2.5	730302	1055	0001								55
C-2.5	730305	1540	0001								22
C-2.5	730306	1200	0001								260
C-2.5	730307	1045	0001								237
C-3.6	730227	1530	0001								69
C-3.6	730228	1150	0001								26
C-3.6	730301	1105	0001								38
C-3.6	730302	1030	0001								73
C-3.6	730305	1605	0001								35
C-3.6	730306	1120	0001								375
C-3.6	730307	1110	0001								367
C-5.3	730227	1440	0001	82	422	35	7				
C-5.3	730228	1020	0001	36	133	32	1				
C-5.3	730301	1350	0001	52	156	14	12				
C-5.3	730302	0940	0001	53	139	25	6				
C-5.3	730305	1730	0001	19	79	54	12				
C-5.3	730306	1040	0001	60	151	45	3				
C-5.3	730307	1155	0001	31	89	72	11				
C-5.8	730227	1515	0001					29K	20K	20	
C-5.8	730228	1000	0001					29K	20K	10K	
C-5.8	730301	1420	0001					29K	20K	10K	
C-5.8	730302	0920	0001					29K	20K	10K	
C-5.8	730305	1745	0001					29K	20K	10K	
C-5.8	730306	1025	0001					29K	20K	10K	
C-5.8	730307	1340	0001					81	20K	10K	

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STATION	DATE	TIME	DEPTH	00505 RESIDUE TOT VOL MG/L	00515 RESIDUE DISS-105 C MG/L	00530 RESIDUE TOT NFLT MG/L	00535 RESIDUE VOL NFLT MG/L	01002 ARSENIC AS,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L	32730 PHENOLS UG/L
C-7.0	730227	1635	0001	22	114	30	8				
C-7.0	730228	0905	0001	21	107	30	2				
C-7.0	730301	1640	0001	12	156	8	8				
C-7.0	730302	0845	0001		128	17	7				
C-7.0	730305	1545		38	120	28	6				
C-7.0	730306	0945	0001	29	124	24	4				
C-7.0	730307	1430	0001	43	81	124	14				
C-9.5	730227	1700	0001					60	20K	20K	12
C-9.5	730228	0830	0001					29K	20K	10K	21
C-9.5	730301	1610	0001					29K	20K	10	25
C-9.5	730302	0825	0001					29K	20K	10K	20
C-9.5	730305	1515						29K	20K	10K	15
C-9.5	730306	0925	0001					29K	20K	10K	10
C-9.5	730307	1450	0001					29K	20K	10K	25
DB-0.1	730227	1125	0001	38	142	43	15				20
DB-0.1	730228	1520	0001	53	485	47	12				34
DB-0.1	730301	0955	0001	69	386	122	40				62
DB-0.1	730302	1150	0001	1624	1523	1890	1000				100
DB-0.1	730305	1515	0001	67	618	44	26				
DB-0.1	730306	1345	0001	93	430	50	30				35
DB-0.1	730307	1015	0001	51	206	60	18				17
DBT-1	730227	1415		526	611	526	250				
DBT-1	730228	1525		645	858	584	264				
DBT-1	730301	1635		466	912	262	174				
DBT-1	730302	1020		629	1205	535	215				
DBT-1	730305	1750		215	418	205	135				
DBT-1	730306	0930	0000	164	668	70	63				
DBT-1	730307	0825	0001	89	219	130	62				

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STATION	DATE	TIME	DEPTH	00505 RESIDUE TOT VOL MG/L	00515 RESIDUE DISS-105 C MG/L	00530 RESIDUE TOT NFLT MG/L	00535 RESIDUE VOL NFLT MG/L	01002 ARSENIC AS,TOT UG/L	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L	32730 PHENOLS UG/L
CT-2	730227	1420	0000	2739	10090	46	14				29200
CT-2	730228	1035	0000	11260	18760	110	37				59000
CT-2	730301	1150	0000	8369	27160	45	23				15500
CT-2	730302	0955	0000	1817	20450	138	55				39500
CT-2	730302	1200		3272	7307	375	143		150	188	23500
CT-2	730305	1710	0000	1679	12310	190	72				64500
CT-2	730306	1055	0000	8963	10760	310	80				360000
CT-2	730307	1145	0000	993	2514	90	30				75000
CT-3	730227	1540	0000								25
CT-3	730301	1445	0000								50
CT-3	730302	0905	0000								40
CT-3	730305	1615									20
CT-3	730306	1010	0000								17
CT-3	730307	1350	0000								18

STATION	DATE	TIME	DEPTH	01045 IRON TOTAL UG/L	01051 LEAD PB,TOT UG/L	01055 MANGNESE MN UG/L	01067 NICKEL NI,TOTAL UG/L	01092 ZINC ZN,TOT UG/L	00339 COD MUD DRY WGT MG/KG	00495 % MOIST. SEDIMENT SAMPLE	00626 ORGAN. N MUD D WT MG/KG-N
C-0.6	730227	0900	0001	990	100K	260	80K	130			
C-0.6	730228	1650	0001	990	100	300	80K	132			
C-0.6	730301	0810	0001	1110	200	390	80K	157			
C-0.6	730302	1520		4320	137	497	80K	213			
C-0.6	730305	1410	0001	2090	100K	158	80K	28			
C-0.6	730306	1440	0001	1040	100K	158	80K	26			
C-0.6	730307	0900	0001	4700	90	298	80K	94			
C-0.6	730308	0900	BOT						378000	43.00	1940.00
C-5.8	730227	1515	0001	1070	100K	122	80K	15			
C-5.8	730228	1000	0001	1135	100K	150	80K	20			
C-5.8	730301	1420	0001	710	100K	100	80K	20			
C-5.8	730302	0920	0001	790	100K	122	80K	20			
C-5.8	730305	1745	0001	1700	100K	88	80K	26			
C-5.8	730306	1025	0001	1400	100K	80	80K	11			
C-5.8	730307	1340	0001	4940	100K	143	80K	26			

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STATION	DATE	TIME	DEPTH	01045 IRON TOTAL UG/L	01051 LEAD PB,TOT UG/L	01055 MANGNESE MN UG/L	01067 NICKEL NI,TOTAL UG/L	01092 ZINC ZN,TOT UG/L	00339 COD MUD DRY WGT MG/KG	00495 % MOIST. SEDIMENT SAMPLE	00626 ORGAN. N MUD D WT MG/KG-N
C-8.1	730308		BOT						236500	30.00	2800.00
C-9.5	730227	1700	0001	350	100K	62	80K	15			
C-9.5	730228	0930	0001	400	100K	85	80K	20			
C-9.5	730301	1610	0001	270	100K	62	80K	10			
C-9.5	730302	0825	0001	350	100K	75	80K	15			
C-9.5	730305	1515		1150	100K	58	80K	17			
C-9.5	730306	0925	0001	710	100K	45	80K	15			
C-9.5	730307	1450	0001	4500	100K	109	80K	28			
CT-2	730302	1200		61750	175	10000	80	2000			

STATION	DATE	TIME	DEPTH	00668 PHOS MUD DRY WGT MG/KG	01003 AS MUD DRY WGT MG/KG-AS	01029 CR MUD DRY WGT MG/KG-CR	01043 CU MUD DRY WGT MG/KG-CU	01052 PB MUD DRY WGT MG/KG-PB	01053 MN MUD DRY WGT MG/KG-MN	01068 NI MUD DRY WGT MG/KG-NI	01093 ZN MUD DRY WGT MG/KG-ZN
C-0.6	730308	0900	BOT	640.0	7.40	82.00	56.00	230.00	2445.00	29.00	363.00
C-8.1	730308		BOT	570.0	7.60	35.00	8.00	74.00	363.00	26.00	81.00

STATION	DATE	TIME	DEPTH	01170 FE MUD DRY WGT MG/KG-FE	70322 RESIDUE TOT VOL PERCENT	71920 MERCURY SED-PULP MG/KG WT	00340 COD HI LEVEL MG/L	00550 OIL-GRSE TOT-SXLT MG/L	00720 CYANIDE CN MG/L	00058 FLOW RATE GPM	00059 FLOW RATE INST-GPM
C-0.6	730227	0900	0001				50K				
C-0.6	730228	1650	0001						0.010K		
C-0.6	730301	0810	0001					5.0K	0.020		
C-0.6	730302	1520					92				
C-0.6	730306	1440	0001					9.0	0.010K		
C-0.6	730307	0900	0001					5.0K	0.010K		
C-0.6	730308	0900	BOT	18410	19.3	0.0K					

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STATION	DATE	TIME	DEPTH	01170 FE MOD DRY WGT MG/KG-FE	70322 RESIDUE TOT VOL PERCENT	71920 MERCURY SED-PULP MG/KG WT	00340 COD HI LEVEL MG/L	00550 OIL-GRSE TOT-SXLT MG/L	00720 CYANIDE CN MG/L	00058 FLOW RATE GPM	00059 FLOW RATE INST-GPM
C-1.2	730228	1620	0001					5.0K			
C-1.2	730306	1510	0001					5.0			
C-1.2	730307	0920	0001					5.0K			
C-5.8	730228	1000	0001						0.010K		
C-5.8	730301	1420	0001						0.010K		
C-5.8	730302	0920	0001						0.010		
C-5.8	730306	1025	0001						0.010K		
C-8.1	730308		BOT	11700	18.0	1.4					
C-9.5	730227	1700	0001				50K				
C-9.5	730302	0825	0001				50K				
DB-0.1	730227	1125	0001				108				
DB-0.1	730302	1150	0001				3080				
DB-0.1	730307	1015	0001					5.0K			
DBT-1	730227	1415					440				
DBT-1	730302	1020					856				
DBT-2	730227	1440					50K				
DBT-2	730302	1135					132				
CT-2	730227	1420	0000				764				
CT-2	730228	1035	0000					16.0			
CT-2	730301	1150	0000					8.0			
CT-2	730302	0955	0000				1760	18.0			
CT-2	730302	1200							0.480		
CT-2	730305	1710	0000						0.010K		
CT-2	730306	1055	0000					12.0			
CT-2	730307	1145	0000					10.0			

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STATION	DATE	TIME	DEPTH	01170 FE MUD DRY WGT MG/KG-FE	70322 RESIDUE TOT VOL PERCENT	71920 MERCURY SED-PULP MG/KG WT	00340 COD HI LEVEL MG/L	00550 OIL-GRSE TOT-SXLT MG/L	00720 CYANIDE CN MG/L	00058 FLOW RATE GPM	00059 FLOW RATE INST-GPM
CT-3	730227	1540	0000				184				
CT-3	730306	1010	0000				04				

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STATION	DATE	TIME	DATE	TIME	DEPTH	00500 RESIDUE TOTAL MG/L	00505 RESIDUE TOT VOL MG/L	00515 RESIDUE DISS-105 C MG/L	00530 RESIDUE TOT NFLT MG/L	00535 RESIDUE VOL. NFLT MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L
SI-1	730308	0930				295	80	231	64	8	0.03	0.50	0.34
USP-1	730307	0910	(C) 730307	1655		833	151	117	716	40	0.61	0.85	0.71
USP-1	730308	0910	(C) 730308	1255		693	53	355	338	14	0.23	0.32	0.52
USP-2	730307	1015	(C) 730307	1715		902	141	776	126	48	0.32	1.30	0.53
USP-2	730308	1020	(C) 730308	1315		190	44	152	38	13	0.01	0.15	1.07
USP-3	730307	1030	(C) 730307	1720		862	191	159	703	163	1.92	4.25	0.57
USP-3	730308	1030	(C) 730308	1325		224	66	131	93	31	0.71	0.70	0.53
COMB-1	730307	0925	(C) 730307	1705		194	21	148	46	17	0.21	0.95	0.64
COMB-1	730308	0850	(C) 730308	1240		150	37	147	3	3	0.03	0.10	0.51
GIL-1	730307	1615	(C) 730308	1630		101	39	101	1K	1K	0.05	0.20	0.45
DI-1	730307	1030				13210	521	974	12240	520	0.35	1.30	0.48
DI-1	730308	1000				6182	318	872	5310	210	0.40	1.20	0.53
RO-1	730306	0940	(C) 730306	1350							0.05	0.15	0.82
RO-1	730307	0920	(C) 730307	1550		392	102	305	87	57	0.01K	0.20	0.90
RO-1	730308	0915	(C) 730308	1550		414	124	306	108	86	0.01K	0.25	0.84
RO-2	730306	0945	(C) 730306	1355		1020	68	2	1018	41	0.14	2.10	0.86
RO-2	730307	0925	(C) 730307	1555		388	60	210	178	10	0.05	0.47	0.70
RO-2	730308	0920	(C) 730308	1555		851	42	361	490	2	0.03	0.55	0.65

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SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
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AGENCY - 11135000

STATION	DATE	TIME	DATE	TIME	DEPTH	00500 RESIDUE TOTAL MG/L	00505 RESIDUE TOT VOL MG/L	00515 RESIDUE DISS-105 C MG/L	00530 PESIDUE TOT NFLT MG/L	00535 RESIDUE VOL NFLT MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L
RO-3	730306	1000(C)	730306	1405		1165	39	749	436	56	0.03	0.90	0.92
RO-3	730307	0940(C)	730307	1600		2193	99	1217	976	88	0.14	0.62	0.98
RO-3	730307	1615				2407	372	1339	1068	56	0.26	16.10	0.92
RO-3	730308	0915(C)	730308	1555		2237	200	1120	1117	105	0.03	0.42	1.02
RO-4	730306	1010(C)	730306	1410		1301	117	361	920	60	0.16	1.10	1.52
RO-4	730307	0945(C)	730307	1605		1780	132	544	1236	56	0.51	2.85	2.20
RO-4	730308	0920(C)	730308	1600		2279	164	279	2000	140	0.10	0.95	3.64
SK-1	730306	1737				1558	191	1398	160	65	0.47	1.30	0.79
RD-1	730306	1740				3605	323	3523	82	38	0.14	0.50	0.79
RDC-1	730305	1725(C)	730306	1800		4720	1130	1358	3362	792	0.31	0.45	0.26
RDC-1	730306	1800(C)	730307	1440		1195	1034	599	596	152	0.13	0.50	0.82
RDC-1	730307	1440(C)	730308	1530		825	142	265	560	130	0.04	0.40	0.98
MB-1	730227	0930(C)	730228	0930							13.80	21.20	0.03
MB-1	730228	0930(C)	730301	0930							10.50		0.01K
MB-1	730301	1000(C)	730302	1045		1261	142	1126	75	52	5.70	12.40	0.01K
MB-1	730306	1110				833	115	749	84	52			
MB-1	730305	1315(C)	730306	1110							10.40	19.50	0.01K
MB-1	730306	1110(C)	730307	1140		884	167	644	240	105	11.50	19.50	0.01K
WF-2	730524	0935(C)	730524	1450		4916	785	216	4700	782	2.62		0.57
WF-3	730524	0825(C)	730524	1400		154	46	130	24	8	0.09		0.52

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AGENCY - 1113S000

STATION	DATE	TIME	DATE	TIME	DEPTH	00500 RESIDUE TOTAL MG/L	00505 RESIDUE TOT VOL MG/L	00515 RESIDUE DISS-105 C MG/L	00530 RESIDUE TOT NFLT MG/L	00535 RESIDUE VOL NFLT MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L
WF-4	730524	0810(C)	730524	1350		124	35	118	6	2	0.01K		0.46
CR-1	730227	1645									0.19	0.85	0.77
CR-1	730228	0825(C)	730228	1600		3418	2728	3213	205	26	0.38	1.10	0.66
CR-1	730301	0910(C)	730301	1500		3800	3268	3701	99	16	0.17	0.60	0.59
MM-1	730227	1500(C)	730228	1615							0.01	0.80	0.61
MM-1	730228	1615(C)	730301	1635		1077	453	1067	10	1	0.01K	0.40	0.52
MM-1	730301	1635(C)	730302	0910		1034	135	1032	2	2	0.12	0.40	0.55
MM-2	730227	1430(C)	730228	1605							0.39	27.00	0.91
MM-2	730228	1605(C)	730301	1625		2255	69	972	1283	42	0.86	17.00	0.79
MM-2	730301	1625(C)	730302	0845		3019	175	899	2120	80	0.34	26.00	0.79
MM-3	730227	1520(C)	730228	1620							0.09	1.42	0.63
MM-3	730228	1620(C)	730301	1645		145	54	140	5	2	0.11	0.25	0.57
SW-1	730227	1540									1.87	7.34	0.61
SW-1	730228	0900(C)	730228	1500		2861	2294	2855	6	6	0.01	3.32	0.28
SW-1	730301	1015(C)	730301	1530		5631	4998	691	4940	4800	0.03	1.12	0.28
SW-2	730227	1120									0.05	0.35	0.38
SW-2	730228	0915				174	60	172	2	1	0.07	0.12	0.55
SW-2	730301	1025				172	93	164	8	5	0.05	0.26	0.41
VE-1	730301	1130(C)	730301	1615		26440	591	26310	128	22	0.05	3.00	0.01
VE-1	730302	0900(C)	730302	1430		353	235	263	90	31	1.73	2.67	0.31

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AGENCY - 11135000

STATION	DATE	TIME	DATE	TIME	DEPTH	00500 RESIDUE TOTAL MG/L	00505 RESIDUE TOT VOL MG/L	00515 RESIDUE DISS-105 C MG/L	00530 RESIDUE TOT NFLT MG/L	00535 RESIDUE VOL NFLT MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L
VE-2	730301	1115(C)	730301	1600		5671	2184	5636	45	17	0.79	1.12	0.02
VE-2	730302	0845(C)	730302	1410		2667	744	1545	142	46	0.65	1.45	0.34
VE-3	730301	0745(C)	730301	1545		170	94	168	2	1K	0.01	0.22	0.46
VE-3	730302	0915(C)	730302	1540		567	370	541	26	24	0.57	1.85	3.06
VE-4	730305	1445(C)	730306	1530		5970	974	5909	61	21	325.00	300.00	0.71
VE-4	730306	1530(C)	730307	1430		5667	954	5467	200	40	314.00	300.00	0.57
VE-4	730307	1430(C)	730308	1345		5217	1320	5092	125	41	332.00	315.00	0.57
WO-1	730228	0955(C)	730228	1630							37.60	37.50	0.26
WO-1	730301	1010(C)	730301	1530		3619	2241	3579	40	10	36.60	38.20	0.21
WO-1	730302	0930(C)	730302	1400		1833	743	1756	77	19	37.40	38.20	0.28
WO-2	730228	1425(C)	730228	1645							1068.00	1240.00	2.88
WO-2	730301	1100				37310	35620	37250	54	52	7320.00	7750.00	1.19
WO-2	730302	1000(C)	730302	1415		28860	26980	28770	92	59	5460.00	5850.00	1.88
WO-2	730307	0900(C)	730307	1500		15060	14410	15010	50	34	2380.00	2750.00	1.80
WO-3	730228	1000(C)	730228	1625							105.00	147.00	10.40
WO-3	730301	1015(C)	730301	1530		3620	2952	3597	23	9	88.00	117.00	4.50
WO-3	730302	0930(C)	730302	1405		937	318	684	253	177	81.00	87.50	3.50
L&N-1	730306	1030(C)	730306	1600		563	207	548	15	15		2.45	39.00
L&N-1	730307	0900(C)	730307	1300		504	150	487	17	6	0.01K	1.57	31.00
L&N-1	730308	0900(C)	730308	1300		414	132	399	15	15	0.30	1.20	31.40
L&N-2	730306	1030(C)	730306	1600		251	53	186	65	13	0.12	0.17	0.41
L&N-2	730307	0900(C)	730307	1300		823	227	594	229	64	0.55	1.45	1.24
L&N-2	730308	0900(C)	730308	1300		245	48	188	51	15	0.23	0.45	0.46

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SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
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AGENCY - 1113S000

STATION	DATE	TIME	DATE	TIME	DEPTH	00500 RESIDUE TOTAL MG/L	00505 RESIDUE TOT VOL MG/L	00515 RESIDUE DISS-105 C MG/L	00530 RESIDUE TOT NFLT MG/L	00535 RESIDUE VOL NFLT MG/L	00610 NH3-N TOTAL MG/L	00625 TOT KJEL N MG/L	00630 NO2&NO3 N-TOTAL MG/L
L&N-3	730306	1030(C)	730306	1600		240	61	206	34	10	0.01K	0.45	0.09
L&N-3	730307	0900(C)	730307	1300		230	64	182	48	9	0.01	0.52	0.04
L&N-3	730308	0900(C)	730308	1315		288	86	219	69	12	0.01K	0.70	0.26
L&N-4	730306	1100(C)	730306	1630		336	88	322	14	4	0.01	0.40	0.16
L&N-4	730307	0850(C)	730307	1300		509	267	367	142	45	0.01	0.32	0.15
L&N-4	730308	0930(C)	730308	1330		401	143	374	27	9	0.03	0.10	0.13
L&N-5	730306	1100(C)	730306	1630		515	182	514	1	1K	0.56	1.35	17.50
L&N-5	730307	0900(C)	730307	1315		496	182	490	6	2	1.25	2.15	17.00
L&N-5	730308	0930(C)	730308	1330		519	198	513	6	4	1.02	1.77	19.00
CH-1	730227	1000(C)	730228	0930							93.00	114.00	1.46
CH-1	730228	0930(C)	730301	0930		747	313	745	2	2	68.00	82.50	1.30
CH-1	730301	0930(C)	730302	0945		896	505	879	17	15	143.00	185.00	1.27
RE-1	730228	1055(C)	730228	1700							4.35	4.50	0.03
RE-1	730301	1050(C)	730301	1505		2982	487	2977	5	4	4.68	6.20	0.05
RE-1	730302	0940(C)	730302	1430		1116	235	1035	81	44	6.10	7.50	0.62

STATION	DATE	TIME	DATE	TIME	DEPTH	00665 PHOS-T P-WET MG/L	00340 COD HI LEVEL MG/L	00403 LAB PH SU	00310 BOD 5 DAY MG/L	00668 PHOS MUD DRY WGT MG/KG	00058 FLOW RATE GPM	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
SI-1	730308	0930				0.05	50K	10.0	1.8		1042.00	70	10K
USP-1	730307	0910(C)	730307	1655		0.08	240	7.9	80.0		150.00	32	50
USP-1	730308	0910(C)	730308	1255		0.02	50K	8.0	7.4		150.00	20K	15

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CHATTANOOGA FIELD STUDY
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STATION	DATE	TIME	DATE	TIME	DEPTH	00665 PHOS-T P-WET MG/L	00340 COD HI LEVEL MG/L	00403 LAB PH SU	00310 BOD 5 DAY MG/L	00668 PHOS MUD DRY WGT MG/KG	00058 FLOW RATE GPM	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
USP-2	730307	1015(C)	730307	1715		0.80	140	8.4	22.0		30.00	40	67
USP-2	730308	1020(C)	730308	1315		0.11	50K	8.0	2.8		50.00	20K	15
USP-3	730307	1030(C)	730307	1720		2.02	380	7.7	25.0		50.00	53	78
USP-3	730308	1030(C)	730308	1325		0.06	61	7.8	8.2		30.00	26	10K
COMB-1	730307	0925(C)	730307	1705		0.08	50K	7.6	4.0			20K	38
COMB-1	730308	0850(C)	730308	1240		0.45	50K	8.0	4.0K			20K	10K
GIL-1	730307	1615(C)	730308	1630		0.01K	50K	8.0	28.0			20K	10K
DI-1	730307	1030				7.70	50K	8.1	2.8		1400.00		
DI-1	730308	1000				2.47	95	8.2	5.0		1400.00		
RO-1	730306	0940(C)	730306	1350		0.10	50K	8.1	5.1		29.00	20K	10K
RO-1	730307	0920(C)	730307	1550		3.90	165	9.1	102.0		39.00	20K	15
RO-1	730308	0915(C)	730308	1550		2.48	158	9.3	143.0		44.00	20K	10
RO-2	730306	0945(C)	730306	1355		1.00	100	9.5	8.0K		26.00	120	158
RO-2	730307	0925(C)	730307	1555		0.37	50K	8.1	8.0K		34.00	20K	14
RO-2	730308	0920(C)	730308	1555		0.65	50K	8.1	8.0K		25.00	95	129
RO-3	730306	1000(C)	730306	1405		7.50	168	7.4	110.0		65.00	33	112
RO-3	730307	0940(C)	730307	1600		13.20	232	8.9	64.0		61.00	40	122
RO-3	730307	1615				23.00	800	10.4	167.0L			170	345
RO-3	730308	0915(C)	730308	1555		10.60	420	7.5	198.0		67.00	45	445
RO-4	730306	1010(C)	730306	1410		1.88	50K	9.3	8.0K		8.00	100	106
RO-4	730307	0945(C)	730307	1605		1.24	50K	9.3	8.0K		17.00	140	64
RO-4	730308	0920(C)	730308	1600		0.96	50K	9.4	8.0K		16.00	329	136

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STATION	DATE	TIME	DATE	TIME	DEPTH	00665 PHOS-T P-WET MG/L	00340 COD HI LEVEL MG/L	00403 LAB PH SU	00310 BOD 5 DAY MG/L	00668 PHOS MUD DRY WGT MG/KG	00058 FLOW RATE GPM	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
SK-1	730306	1737				1.02	132	10.9	28.0			20K	103
RD-1	730306	1740				1.12		10.5	21.0			20K	139
RDC-1	730305	1725	(C) 730306	1800		2.55	3000	6.2	5.0K				
RDC-1	730306	1800	(C) 730307	1440		1.65	324	10.5	3.2			40	100
RDC-1	730307	1440	(C) 730308	1530		2.77	366	11.0	6.4		10.00	47	117
MB-1	730227	0930	(C) 730228	0930		6.30	450	7.3	161.0		.207E+05	281	50
MB-1	730228	0930	(C) 730301	0930		5.50	380	7.3	159.0		.208E+05	292	57
MB-1	730301	1000	(C) 730302	1045		5.10	485	7.0	192.0		.215E+05	335	60
MB-1	730305	1315	(C) 730306	1110		6.20	340	7.2	185.0		.278E+05	270	50
MB-1	730306	1110	(C) 730307	1140		4.70	388	7.4	191.0		.277E+05	235	50
WF-2	730524	0935	(C) 730524	1450		0.49						100	120
WF-3	730524	0825	(C) 730524	1400		0.07						100K	20K
WF-4	730524	0810	(C) 730524	1350		0.06						100K	20K
CR-1	730227	1845				0.21	50K	5.3	20.0K		1600.00	174	177
CR-1	730228	0825	(C) 730228	1600		0.50	50K	6.4	20.0K		1600.00	140	368
CR-1	730301	0910	(C) 730301	1600		0.34	50K	4.8	20.0K		1600.00	215	185
MM-1	730227	1500	(C) 730228	1615		0.09	50K	2.3	8.0K		20.00	105	88
MM-1	730228	1615	(C) 730301	1635		0.70	50K		16.0		20.00	65	64
MM-1	730301	1635	(C) 730302	0910		0.19	50K	2.3	8.0K		20.00		

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STATION	DATE	TIME	DATE	TIME	DEPTH	00665 PHOS-T P-WET MG/L	00340 COD HI LEVEL MG/L	00403 LAB PH SU	00310 BOD 5 DAY MG/L	00668 PHOS MUD DRY WGT MG/KG	00058 FLOW RATE GPM	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
MM-2	730227	1430(C)	730228	1605		0.63	58	9.5	8.0K		10.00		
MM-2	730228	1605(C)	730301	1625		0.90	50K		20.0K		15.00		
MM-2	730301	1625(C)	730302	0845		0.57	50K	9.3	20.0K		10.00		
MM-3	730227	1520(C)	730228	1620		3.50	50K	7.6	8.0K		5.00		
MM-3	730228	1620(C)	730301	1645		5.10	50K	7.5	8.0K		5.00		
SW-1	730227	1540				18.30	5610	12.8	1700.0		45.00	20	94
SW-1	730228	0900(C)	730228	1500		14.70	1010	3.2	380.0		15.00	20K	50
SW-1	730301	1015(C)	730301	1530		7.40	2400	7.8	2900.0		15.00	20K	55
SW-2	730227	1120				0.04	50K	7.6	5.2				
SW-2	730228	0915				0.04	50K	7.3	2.6				
SW-2	730301	1025				0.01K	50K	7.4	2.6				
VE-1	730301	1130(C)	730301	1615		0.17	2240	9.8	1270.0		53.00		
VE-1	730302	0900(C)	730302	1430		0.13	1125	8.1	560.0		158.00		
VE-2	730301	1115(C)	730301	1600		0.04	930	7.3	520.0		1.50		
VE-2	730302	0845(C)	730302	1410		0.18	395	7.6	196.0		86.00		
VE-3	730301	0745(C)	730301	1545		0.01	60	8.3	20.0K		35.00		
VE-3	730302	0915(C)	730302	1540		0.07	480	7.2	195.0		32.00		
VE-4	730305	1445(C)	730306	1530		0.32	3260	10.0	2100.0		922.00		
VE-4	730306	1530(C)	730307	1430		0.19	3260	10.3	2900.0		922.00		
VE-4	730307	1430(C)	730308	1345		0.19	3520	9.9	2300.0		922.00		

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AGENCY - 11135000

STATION	DATE	TIME	DATE	TIME	DEPTH	00665 PHOS-T P-WET MG/L	00340 COD HI LEVEL MG/L	00403 LAB PH SU	00310 BOD 5 DAY MG/L	00668 PHOS MUD DRY WGT MG/KG	00058 FLOW RATE GPM	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
WO-1	730228	0955(C)	730228	1630		0.05	65	6.5	8.0K		4.00		
WO-1	730301	1010(C)	730301	1530		0.16	50K	6.5	8.0K		4.00		
WO-1	730302	0930(C)	730302	1400		0.05	50K	6.5	8.0K		5.00		
WO-2	730228	1425(C)	730228	1645		0.15	345	8.9	190.0		41.00		
WO-2	730301	1100				0.36	330	1.6	86.0				
WO-2	730302	1000(C)	730302	1415		0.50	736	1.6	240.0		71.00		
WO-2	730307	0900(C)	730307	1500		0.23	2880	1.0	600.0L		45.00		
WO-3	730228	1000(C)	730228	1625		0.02	50K	6.6	6.0		2.70		
WO-3	730301	1015(C)	730301	1530		0.06	136	6.5	99.0		0.70		
WO-3	730302	0930(C)	730302	1405		0.11	380	6.3	24.0		20.00		
L&N-1	730306	1030(C)	730306	1600			52	6.9	25.0		1.80		
L&N-1	730307	0900(C)	730307	1300		7.70	50K	7.0	40.0		5.40		
L&N-1	730308	0900(C)	730308	1300		6.70	50K	6.8	5.8		2.70		
L&N-2	730306	1030(C)	730306	1600		0.17	50K	6.9	24.0		13.00		
L&N-2	730307	0900(C)	730307	1300		19.50	492	10.8	218.0		19.00		
L&N-2	730308	0900(C)	730308	1300		0.53	51	7.5	40.0		13.00		
L&N-3	730306	1030(C)	730306	1600		0.10	68	7.6	14.0				
L&N-3	730307	0900(C)	730307	1300		0.12	76	7.6	21.0		26.00		
L&N-3	730308	0900(C)	730308	1315		0.16	63	7.8	6.6		57.00		
L&N-4	730306	1100(C)	730306	1630		0.05	50K	7.8	32.0		13.00		
L&N-4	730307	0830(C)	730307	1300		0.11	300	7.6	184.0		7.00		
L&N-4	730308	0930(C)	730308	1330		0.06	1870	7.9			28.00		

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SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
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AGENCY - 1113S000

STATION	DATE	TIME	DATE	TIME	DEPTH	00665 PHOS-T P-WET MG/L	00340 COD HI LEVEL MG/L	00403 LAB Ph SU	00310 BOD 5 DAY MG/L	00668 PHOS MUD DRY WGT MG/KG	00058 FLOW RATE GPM	01034 CHROMIUM CR,TOT UG/L	01042 COPPER CU,TOT UG/L
L&N-5	730306	1100(C)	730306	1630		0.12	50K	8.4			60.00		
L&N-5	730307	0900(C)	730307	1315		0.15	50K	8.5	38.0		95.00		
L&N-5	730308	0930(C)	730308	1330		0.12	50K	8.4	4.1		135.00		
CH-1	730227	1000(C)	730228	0930		0.01	278	7.1	150.0		500.00		
CH-1	730228	0930(C)	730301	0930		0.03	336	6.9	200.0		500.00		
CH-1	730301	0930(C)	730302	0945		0.13	555	6.6	198.0		500.00		
RE-1	730228	1055(C)	730228	1700		0.31	225	7.0	120.0		1.50		
RE-1	730301	1050(C)	730301	1505		0.18	208	6.9	150.0		2.40		
RE-1	730302	0940(C)	730302	1430		0.20	180	6.5	83.0		27.00		

STATION	DATE	TIME	DATE	TIME	DEPTH	01045 IRON TOTAL UG/L	01051 LEAD PB,TOT UG/L	01055 MANGNESE MN UG/L	01067 NICKEL NI,TOTAL UG/L	01092 ZINC ZN,TOT UG/L	00010 WATER TEMP CENT	00400 PH SU
SI-1	730308	0930				2500	100K	132	80K	18		
USP-1	730307	0910(C)	730307	1655		18300	450	1100	80K	1140		
USP-1	730308	0910									25.0	
USP-1	730308	1255									26.0	
USP-1	730308	0910(C)	730308	1255		3240	90	754	80K	124		
USP-2	730307	1225									16.0	
USP-2	730307	1715									16.0	
USP-2	730307	1015(C)	730307	1715		15100	220	235	80K	810		
USP-2	730308	1020									15.0	
USP-2	730308	1315									16.0	
USP-2	730308	1020(C)	730308	1315		1830	100K	25	80K	92		

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SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
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STATION	DATE	TIME		DATE	TIME	DEPTH	01045 IRON TOTAL UG/L	01051 LEAD PB,TOT UG/L	01055 MANGNESE MN UG/L	01067 NICKEL NI,TOTAL UG/L	01092 ZINC ZN,TOT UG/L	00010 WATER TEMP CENT	00400 PH SU
USP-3	730307	1230										13.0	
USP-3	730307	1720										13.0	
USP-3	730307	1030	(C)	730307	1720		42200	195	412	80K	671		
USP-3	730308	1030										13.0	
USP-3	730308	1325										13.0	
USP-3	730306	1030	(C)	730308	1325		2050	100K	25	80K	42		
COMB-1	730307	1705										17.0	
COMB-1	730307	0925	(C)	730307	1705		4370	375	248	80K	910		
COMB-1	730308	0850	(C)	730308	1240		175	100K	25	80K	195		
GIL-1	730307	1615	(C)	730308	1630		195	100K	30	80K	359		
RO-1	730306	0940										20.0	7.7
RO-1	730306	1030										21.0	7.5
RO-1	730306	1130										20.0	7.1
RO-1	730306	1300										20.0	7.5
RO-1	730306	1350										19.0	7.5
RO-1	730306	0940	(C)	730306	1350		65	100K	29	80K	760		
RO-1	730307	0920										21.0	8.3
RO-1	730307	1040										21.0	8.3
RO-1	730307	1145										21.0	8.3
RO-1	730307	1325										22.0	7.6
RO-1	730307	1445										23.0	8.2
RO-1	730307	1550										22.0	7.1
RO-1	730307	0920	(C)	730307	1550		250	100K	146	80K	150		
RO-1	730308	0915										23.0	8.6
RO-1	730308	1105										23.0	8.1
RO-1	730308	1235										23.0	7.9
RO-1	730308	1430										21.0	7.6
RO-1	730308	1550										21.0	7.9
RO-1	730308	0915	(C)	730308	1550		200	100K	100	80K	42		

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AGENCY - 1113S000

STATION	DATE	TIME		DATE	TIME	DEPTH	01045 IRON TOTAL UG/L	01051 LEAD Pb,TOT UG/L	01055 MANGNESE MN UG/L	01067 NICKEL NI,TOTAL UG/L	01092 /INC ZN,TOT UG/L	00010 WATER TEMP CENT	00400 PH SU
RO-2	730306	0945										20.0	8.7
RO-2	730306	1040										22.0	7.2
RO-2	730306	1135										20.0	7.2
RO-2	730306	1305										22.0	7.2
RO-2	730306	1355										22.0	7.3
RO-2	730306	0945	(C)	730306	1355		33100	4540	10700	650	7700		
RO-2	730307	0925										20.0	7.9
RO-2	730307	1045										21.0	7.9
RO-2	730307	1150										21.0	7.7
RO-2	730307	1330										20.0	7.4
RO-2	730307	1450										22.0	7.4
RO-2	730307	1555										22.0	7.2
RO-2	730307	0925	(C)	730307	1555		5920	1350	2100	200	1960		
RO-2	730308	0920										22.0	7.9
RO-2	730308	1110										21.0	7.4
RO-2	730308	1230										23.0	7.7
RO-2	730308	1435										22.0	7.3
RO-2	730308	1555										22.0	7.8
RO-2	730308	0920	(C)	730308	1555		38400	2075	14000	580	4825		
RO-3	730306	1000										22.0	6.5
RO-3	730306	1105										24.0	5.9
RO-3	730306	1145										24.0	8.3
RO-3	730306	1320										26.0	7.5
RO-3	730306	1405										26.0	6.8
RO-3	730306	1000	(C)	730306	1405		23800	2180	4090	2180	3820		
RO-3	730307	0940										22.0	6.4
RO-3	730307	1105										25.0	7.6
RO-3	730307	1305										23.0	9.1
RO-3	730307	1355										24.0	8.0
RO-3	730307	1500										23.0	8.0
RO-3	730307	1600										22.0	7.2
RO-3	730307	0940	(C)	730307	1600		33300	2500	5350	2710	6750		
RO-3	730307	1615					90900	680	27800	2200	2800	22.0	9.1
RO-3	730308	0915										23.0	6.8
RO-3	730308	1110										25.0	6.6
RO-3	730308	1230										26.0	6.8
RO-3	730308	1425										27.0	4.6
RO-3	730308	1555										26.0	7.3
RO-3	730308	0915	(C)	730308	1555		58500	1090	8700	4140	9400		

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STATION	DATE	TIME	DATE	TIME	DEPTH	01045 IRON TOTAL UG/L	01051 LEAD PB,TOT UG/L	01055 MANGNESE MN UG/L	01067 NICKEL NI,TOTAL UG/L	01092 ZINC ZN,TOT UG/L	00010 WATER TEMP CENT	00400 PH SU
RO-4	730306	1010									16.0	8.3
RO-4	730306	1110									14.0	8.4
RO-4	730306	1150									16.0	6.9
RO-4	730306	1325									18.0	8.1
RO-4	730306	1410									17.0	8.0
RO-4	730306	1010	(C)730306	1410		8900	6380	5280	1900	16440		
RO-4	730307	0945									17.0	8.6
RO-4	730307	1110									14.0	8.5
RO-4	730307	1310									15.0	8.6
RO-4	730307	1400									15.0	8.2
RO-4	730307	1505									14.0	8.1
RO-4	730307	1605									16.0	8.3
RO-4	730307	0945	(C)730307	1605		13900	27100	3800	1210	13500		
RO-4	730308	0920									16.0	8.6
RO-4	730308	1115									17.0	8.4
RO-4	730308	1235									19.0	8.5
RO-4	730308	1430									18.0	8.4
RO-4	730308	1600									21.0	8.8
RO-4	730308	0920	(C)730308	1600		12200	2000	6500	2320	41000		
SK-1	730306	1737				1220	120	109	80K	131		
RD-1	730306	1740				710	90	70	80K	103		
RDC-1	730306	1800	(C)730307	1440		85700	100K	350	80K	910		
RDC-1	730307	1440	(C)730308	1530		20400	100K	132	80K	80		
MB-1	730228	0930									20.0	6.7
MB-1	730227	0930	(C)730228	0930		1980	90	298	318	410		
MB-1	730228	0930	(C)730301	0930		1900	100K	300	300	430		
MB-1	730301	1000	(C)730302	1045		1890	100K	290	250	384		
MB-1	730305	1315									18.0	
MB-1	730306	1110									20.0	
MB-1	730305	1315	(C)730306	1110		1830	100K	355	150	370		
MB-1	730307	1140									20.0	
MB-1	730306	1110	(C)730307	1140		1670	100K	310	226	322		

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AGENCY - 1113S000

STATION	DATE	TIME	DATE	TIME	DEPTH	01045 IRON TOTAL UG/L	01051 LEAD Pb,TOT UG/L	01055 MANGNESE MN UG/L	01067 NICKEL NI,TOTAL UG/L	01092 ZINC ZN,TOT UG/L	00010 WATER TEMP CENT	00400 PH SU
WF-2	730524	0935(C)	730524	1450		110000	263	604	90	440		
WF-3	730524	0825(C)	730524	1400		2400	100K	44	20K	301		
WF-4	730524	0810(C)	730524	1350		290	100K	12	20K	39		
CR-1	730227	1605									33.0	
CR-1	730227	1845				20000	28130	6250	80K	7250	33.0	
CR-1	730228	0825									25.0	
CR-1	730228	1333									24.0	
CR-1	730228	1600									32.0	
CR-1	730228	0825(C)	730228	1600		28380	57500	9200	80K	9875		
CR-1	730301	0910									32.0	6.0
CR-1	730301	1155									34.0	5.5
CR-1	730301	1500									34.0	4.7
CR-1	730301	0910(C)	730301	1500		23500	30500	6375	80K	7400		
MM-1	730227	1500(C)	730228	1615		259000	400	1145	9800	138		
MM-1	730228	1615(C)	730301	1635		203500	885	945	5040	100		
SW-1	730227	1115									31.0	12.2
SW-1	730227	1330									28.0	9.9
SW-1	730227	1540				8650	260	300	150	12630	30.0	6.6
SW-1	730228	0900									27.0	3.6
SW-1	730228	1145									28.0	3.1
SW-1	730228	1500									29.0	6.5
SW-1	730228	0900(C)	730228	1500		8400	100K	460	80	158		
SW-1	730301	1020									30.0	6.0
SW-1	730301	1315									30.0	8.8
SW-1	730301	1530									32.0	7.3
SW-1	730301	1015(C)	730301	1530		3090	100K	290	80	75		

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STATION	DATE	TIME	DATE	TIME	DEPTH	01045 IRON TOTAL UG/L	01051 LEAD PB.TOT UG/L	01055 MANGNESE MN UG/L	01067 NICKEL NI.TOTAL UG/L	01092 ZINC ZN.TOT UG/L	00010 WATER TEMP CENT	00400 PH SU
SW-2	730227	1120									25.0	7.5
SW-2	730228	0915									21.0	6.8
SW-2	730301	1025									22.0	6.6
VE-1	730301	1130									17.0	8.0
VE-1	730301	1430									21.0	10.0
VE-1	730301	1615									20.0	9.4
VE-1	730302	0900									14.0	8.0
VE-1	730302	1150									12.0	7.9
VE-1	730302	1430									12.0	7.6
VE-2	730301	1115									10.0	7.2
VE-2	730301	1420									17.0	6.9
VE-2	730301	1600									16.0	7.1
VE-2	730302	0845									7.0	6.7
VE-2	730302	1105									10.0	7.2
VE-2	730302	1410									12.0	8.6
VE-3	730301	0745									110.0L	7.2
VE-3	730301	1330									58.0	7.1
VE-3	730301	1545									53.0	7.0
VE-3	730302	0915									44.0	6.9
VE-3	730302	1200									43.0	6.9
VE-3	730302	1540									24.0	7.3
VE-4	730307	1430									29.0	
VE-4	730306	1345									33.5	
WO-1	730228	0955									13.0	
WO-1	730228	1300									14.0	
WO-1	730228	1630									13.0	
WO-1	730301	1010									14.0	6.2
WO-1	730301	1325									14.0	5.9
WO-1	730301	1530									14.0	
WO-1	730302	0930									13.0	
WO-1	730302	1115									13.0	
WO-1	730302	1400									13.0	

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STATION	DATE	TIME	DATE	TIME DEPTH	01045 IRON TOTAL UG/L	01051 LEAD PB,TOT UG/L	01055 MANGNESE MN UG/L	01067 NICKEL NI,TOTAL UG/L	01092 ZINC ZN,TOT UG/L	00010 WATER TEMP CENT	00400 PH SU
WO-2	730228	1425								18.0	
WO-2	730228	1645								19.0	
WO-2	730301	1100								17.0	1.7
WO-2	730302	1000								18.0	
WO-2	730302	1130								18.0	
WO-2	730302	1415								15.0	
WO-2	730307	0900								40.0	2.1
WO-2	730307	1500								37.0	
WO-3	730228	1000								13.0	
WO-3	730228	1400								16.0	
WO-3	730228	1645								15.0	
WO-3	730301	1015								15.0	6.5
WO-3	730301	1330								18.0	5.9
WO-3	730301	1530								16.0	5.9
WO-3	730302	0930								14.0	
WO-3	730302	1120								11.0	
WO-3	730302	1405								10.0	
L&N-1	730306	1030								12.0	
L&N-1	730306	1330								12.0	
L&N-1	730306	1600								12.0	
L&N-1	730307	0900								11.0	
L&N-1	730307	1100								12.0	
L&N-1	730307	1300								14.0	
L&N-1	730308	0900								13.0	
L&N-1	730308	1100								14.0	
L&N-1	730308	1300								13.0	
L&N-2	730306	1030								10.0	
L&N-2	730306	1330								10.0	
L&N-2	730306	1600								11.0	
L&N-2	730307	0900								11.0	
L&N-2	730307	1100								12.0	
L&N-2	730307	1300								12.0	
L&N-2	730308	0900								14.0	
L&N-2	730308	1100								14.0	
L&N-2	730308	1300								12.0	

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AGENCY - 11135000

STATION	DATE	TIME	DATE	TIME	DEPTH	01045 IRON TOTAL UG/L	01051 LEAD PB,TOT UG/L	01055 MANGNESE MN UG/L	01067 NICKEL NI,TOTAL UG/L	01092 ZINC ZN,TOT UG/L	00010 WATER TEMP CENT	00400 PH SU
L&N-3	730306	1030									11.0	
L&N-3	730306	1400									11.0	
L&N-3	730306	1600									12.0	
L&N-3	730307	0900									16.0	
L&N-3	730307	1100									16.0	
L&N-3	730307	1300									16.0	
L&N-3	730308	0930									12.0	
L&N-3	730308	1100									16.0	
L&N-3	730308	1315									16.0	
L&N-4	730306	1100									14.0	
L&N-4	730306	1330									14.0	
L&N-4	730306	1630									16.0	
L&N-4	730307	0930									14.0	
L&N-4	730307	1030									14.0	
L&N-4	730307	1300									13.0	
L&N-4	730308	0930									16.0	
L&N-4	730308	1130									16.0	
L&N-4	730308	1330									21.0	
L&N-5	730306	1100									10.0	
L&N-5	730306	1400									10.0	
L&N-5	730306	1630									11.0	
L&N-5	730307	0900									10.0	
L&N-5	730307	1100									12.0	
L&N-5	730307	1315									12.0	
L&N-5	730308	0930									13.0	
L&N-5	730308	1130									13.0	
L&N-5	730308	1330									12.0	
CH-1	730228	0945									21.0	7.2
CH-1	730301	0930									21.0	6.7
CH-1	730302	0945										6.7

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STATION	DATE	TIME	DATE	TIME	DEPTH	01045 IRON TOTAL UG/L	01051 LEAD Pb,TOT UG/L	01055 MANGNESE MN UG/L	01067 NICKEL NI,TOTAL UG/L	01092 ZINC ZN,TOT UG/L	00010 WATER TEMP CENT	00400 PH SU
RE-1	730228	1055									16.0	
RE-1	730228	1510									16.0	
RE-1	730228	1700									17.0	
RE-1	730301	1050									14.0	6.7
RE-1	730301	1310									15.0	6.5
RE-1	730301	1505									15.0	6.6
RE-1	730302	0940									14.0	
RE-1	730302	1150									14.0	
RE-1	730302	1430									13.0	

STATION	DATE	TIME	DATE	TIME	DEPTH	31505 TOT COLI MPN CONF /100ML	31615 FEC COLI MPNECMED /100ML	00550 OIL-GRSE TOT-SXLT MG/L	32730 PHENOLS UG/L	00520 RESIDUE VOL FLT MG/L	00059 FLOW RATE INST-GPM	00680 T ORG C C MG/L
SI-1	730308	0930										3.0
USP-1	730307	0910(C)	730307	1655								60.0
USP-1	730308	0910(C)	730308	1255								4.0
USP-2	730307	1015(C)	730307	1715								36.0
USP-2	730308	1020(C)	730308	1315								4.0
USP-3	730307	1030(C)	730307	1720								97.0
USP-3	730308	1030(C)	730308	1325								13.0
COMB-1	730307	0925(C)	730307	1705							50.00	11.0
COMB-1	730308	0850(C)	730308	1240							50.00	2.0
GIL-1	730307	1615(C)	730308	1630							10.00	10.0

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
(DOWNSTREAM FROM CITY WATER COMPANY INTAKES) FEB.-MARCH, 1973

AGENCY - 11135000

STATION	DATE	TIME	DATE	TIME	DEPTH	31505 TOT COLI MPN CONF /100ML	31615 FEC COLI MPNECMED /100ML	00550 OIL-GRSE TOT-SXLT MG/L	32730 PHENOLS UG/L	00520 RESIDUE VOL FLT MG/L	00059 FLOW RATE INST-GPM	00680 T ORG C C MG/L
DI-1	730307	1030										3.0
DI-1	730308	1000										28.0
RO-1	730306	0940	(C)730306	1350								2.0
RO-1	730307	0920	(C)730307	1550								43.0
RO-1	730308	0915	(C)730308	1550								40.0
RO-2	730306	0945	(C)730306	1355								18.0
RO-2	730307	0925	(C)730307	1555								7.0
RO-2	730308	0920	(C)730308	1555								8.0
RO-3	730306	1000	(C)730306	1405								34.0
RO-3	730307	0940	(C)730307	1600								58.0
RO-3	730307	1615									60.00	220.0
RO-3	730308	0915	(C)730308	1555								100.0
RO-4	730306	1010	(C)730306	1410								5.0
RO-4	730307	0945	(C)730307	1605								10.0
RO-4	730308	0920	(C)730308	1600								4.0
SK-1	730306	1737									5.00	37.0
RD-1	730306	1740										35.0
RDC-1	730305	1725	(C)730306	1800								95.0
RDC-1	730306	1800	(C)730307	1440								92.0
RDC-1	730307	1440	(C)730308	1530								86.0

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
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AGENCY - 11135000

STATION	DATE	TIME		DATE	TIME	DEPTH	31505 TOT COLI MPN CONF /100ML	31615 FEC COLI MPNECMED /100ML	00550 OIL-GRSE TOT-SXLT MG/L	32730 PHENOLS UG/L	00520 RESIDUE VOL FLT MG/L	00059 FLOW RATE INST-GPM	T 00680 ORG C C MG/L
MB-1	730227	0930					81000	2000K					
MB-1	730227	1030					5000	2000					
MB-1	730227	1600					2000K	2000K					
MB-1	730228	0840					20	20K					
MB-1	730228	0930					110	20K					
MB-1	730227	0930	(C)	730228	0930				25.0	820			100.0
MB-1	730228	1200					790	20					
MB-1	730228	1500					50	20K					
MB-1	730228	1800					130	20					
MB-1	730228	2100					350000	33000					
MB-1	730228	2400					79000	1300					
MB-1	730301	0300					7900	110					
MB-1	730301	0600					9000	740					
MB-1	730301	0900					1300	50					
MB-1	730228	0930	(C)	730301	0930				30.0	1200			100.0
MB-1	730302	1045					230	20K		1550			
MB-1	730301	1000	(C)	730302	1045								110.0
MB-1	730305	1315					2200	20K					
MB-1	730306	1110					160000	3300					
MB-1	730305	1315	(C)	730306	1110					670			100.0
MB-1	730306	1600					1300000	70000					
MB-1	730306	2100					1300000	33000					
MB-1	730306	2400					490000	8000					
MB-1	730307	0300					540000	33000			0		
MB-1	730307	0600					79000	790					
MB-1	730307	1140					2200	130					
MB-1	730306	1110	(C)	730307	1140					590			100.0
WF-2	730524	0935	(C)	730524	1450				13.0	46	3		
WF-3	730524	0825	(C)	730524	1400				5.0K	10K	38		4.0
WF-4	730524	0810	(C)	730524	1350				5.0K	16	33		3.0

ENVIRONMENTAL PROTECTION AGENCY REGION IV
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CHATTANOOGA FIELD STUDY
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AGENCY - 11135000

STATION	DATE	TIME	DATE	TIME	DEPTH	31505 TOT COLI MPN CONF /100ML	31615 FEC COLI MPNECMED /100ML	00550 OIL-GRSE TOT-SXLT MG/L	32730 PHENOLS UG/L	00520 RESIDUE VOL FLT MG/L	00059 FLOW RATE INST-GPM	00680 T ORG C MG/L
CR-1	730227	1845						5.0K				7.0
CR-1	730228	0825(C)	730228	1600				5.0K				11.0
CR-1	730301	0910(C)	730301	1500								9.0
MM-1	730227	1500(C)	730228	1615								3.0
MM-1	730228	1615(C)	730301	1635								3.0
MM-1	730301	1635(C)	730302	0910								2.0
MM-2	730227	1430(C)	730228	1605								20.0
MM-2	730228	1605(C)	730301	1625								12.0
MM-2	730301	1625(C)	730302	0845								20.0
MM-3	730227	1520(C)	730228	1620								3.0
MM-3	730228	1620(C)	730301	1645								4.0
SW-1	730227	1115						2200.0				
SW-1	730227	1540										2000.0
SW-1	730228	0900						210.0				
SW-1	730228	0900(C)	730228	1500								110.0
SW-1	730301	1020						4100.0				
SW-1	730301	1015(C)	730301	1530								240.0
SW-2	730227	1120									7.00	4.0
SW-2	730228	0915									15.00	15.0
SW-2	730301	1025									10.00	2.0
VE-1	730301	1130(C)	730301	1615								2000.0
VE-1	730302	0900(C)	730302	1430								320.0

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
(DOWNSTREAM FROM CITY WATER COMPANY INTAKES) FEB.-MARCH, 1973

AGENCY - 1113S000

STATION	DATE	TIME	DATE	TIME	DEPTH	31505 TOT COLI MPN CONF /100ML	31615 FEC COLI MPNECMED /100ML	00550 OIL-GRSE TOT-SALT MG/L	32730 PHENOLS UG/L	00520 RESIDUE VOL FLT MG/L	00059 FLOW RATE INST-GPM	00680 T ORG C C MG/L
VE-2	730301	1115(C)	730301	1600								330.0
VE-2	730302	0845(C)	730302	1410								190.0
VE-3	730301	0745(C)	730301	1545								20.0
VE-3	730302	0915						150.0				
VE-3	730302	0915(C)	730302	1540								240.0
VE-4	730305	1445(C)	730306	1530								900.0
VE-4	730306	1530(C)	730307	1430								1120.0
VE-4	730307	1430(C)	730308	1345								1060.0
WO-1	730228	0955(C)	730228	1630					123			3.0
WO-1	730301	1010(C)	730301	1530					162			4.0
WO-1	730302	0930(C)	730302	1400					130			3.0
WO-2	730228	1425(C)	730228	1645				6.0	64000			120.0
WO-2	730301	1100						5.0K	25500		20.00	160.0
WO-2	730302	1000(C)	730302	1415					119000			320.0
WO-2	730307	0900(C)	730307	1500				41.0	465000			860.0
WO-3	730228	1000(C)	730228	1625								4.0
WO-3	730301	1015(C)	730301	1530					42000			98.0
WO-3	730302	0930(C)	730302	1405					4500			65.0
L&N-1	730306	1030(C)	730306	1600								15.0
L&N-1	730307	0900(C)	730307	1300								13.0
L&N-1	730308	0900(C)	730308	1300								9.0
L&N-2	730306	1030(C)	730306	1600				18.0				23.0
L&N-2	730307	0900(C)	730307	1300								100.0
L&N-2	730308	0900(C)	730308	1300				61.0				13.0

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
(DOWNSTREAM FROM CITY WATER COMPANY INTAKES) FEB.-MARCH, 1973

AGENCY - 11135000

STATION	DATE	TIME	DATE	TIME	DEPTH	31505 TOT COLI MPN CONF /100ML	31615 FEC COLI MPNECMED /100ML	00550 OIL-GRSE TOT-SALT MG/L	32730 PHENOLS UG/L	00520 RESIDUE VOL FLT MG/L	00059 FLOW RATE INST-GPM	00680 T ORG C MG/L
LAN-3	730306	1030(C)	730306	1600				7.0				18.0
LAN-3	730307	0900(C)	730307	1300				30.0				25.0
LAN-3	730308	0900(C)	730308	1315				5.0				16.0
LAN-4	730306	1100(C)	730306	1650				110.0				18.0
LAN-4	730307	0830(C)	730307	1300								97.0
LAN-4	730308	0930(C)	730308	1330				32.0				133.0
LAN-5	730306	1100(C)	730306	1630				9.0				6.0
LAN-5	730307	0900(C)	730307	1315				25.0				8.0
LAN-5	730308	0930(C)	730308	1330								8.0
CH-1	730227	1000(C)	730228	0930								100.0
CH-1	730228	0930(C)	730301	0930								135.0
CH-1	730301	0930(C)	730302	0945								240.0
RE-1	730228	1055(C)	730228	1700				5.0<	27000			60.0
RE-1	730301	1050(C)	730301	1605				5.0<	24000			80.0
RE-1	730302	0940(C)	730302	1430					10500			30.0

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
(DOWNSTREAM FROM CITY WATER COMPANY INTAKES) FEB.-MARCH, 1973

PAGE	PARAMETER	DESCRIPTION
1	00500	RESIDUE, TOTAL (MG/L)
1	00505	RESIDUE, TOTAL VOLATILE (MG/L)
1	00515	RESIDUE, TOTAL FILTRABLE (DRIED AT 105C),MG/L
1	00530	RESIDUE, TOTAL NONFILTRABLE (MG/L)
1	00535	RESIDUE, VOLATILE NONFILTRABLE (MG/L)
1	00610	NITROGEN, AMMONIA, TOTAL (MG/L AS N)
1	00625	NITROGEN, KJELDAHL, TOTAL, (MG/L AS N)
1	00630	NITRITE PLUS NITRATE, TOTAL 1 DET. (MG/L AS N)
5	00665	PHOSPHORUS, TOTAL, WET METHOD (MG/L AS P)
5	00340	CHEMICAL OXYGEN DEMAND, .25N K2CR2O7 (MG/L)
5	00403	PH (STANDARD UNITS) LAB
5	00310	BIOCHEMICAL OXYGEN DEMAND (MG/L, 5 DAY - 20DEG C)
5	00668	PHOSPHORUS,TOTAL, BOTTOM DEPOSIT (MG/KG DRY WGT)
5	00056	FLOW RATE (GALLONS PER MINUTE)
5	01034	CHROMIUM, TOTAL (UG/L AS CR)
5	01042	COPPER, TOTAL (UG/L AS CU)
10	01045	IRON, TOTAL (UG/L AS FE)
10	01051	LEAD, TOTAL (UG/L AS PB)
10	01055	MANGANESE, TOTAL (UG/L AS MN)
10	01067	NICKEL, TOTAL (UG/L AS NI)
10	01092	ZINC, TOTAL (UG/L AS ZN)
10	00010	TEMPERATURE, WATER (DEGREES CENTIGRADE)
10	00400	PH (STANDARD UNITS)
15	31505	COLIFORM,TOT,MPN,CONFIRMED TEST,35C (TUBE 31506)
18	31615	FECAL COLIFORM,MPN,FC MED,44.5C (TUBE 31614)
15	00550	OIL & GREASE (SOXHLET EXTRACTION) TOTAL,REC.,MG/L
15	32730	PHENOLS (UG/L)
18	00520	RESIDUE, VOLATILE FILTRABLE (MG/L)
18	00059	FLOW RATE, INSTANTANEOUS (GALLONS PER MINUTE)
18	00680	CARBON, TOTAL ORGANIC (MG/L AS C)

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
(DOWNSTREAM FROM CITY WATER COMPANY INTAKES) FEB.-MARCH, 1973

PAGE	PARAMETER	DESCRIPTION
1	00010	TEMPERATURE, WATER (DEGREES CENTIGRADE)
1	00070	TURBIDITY, (JACKSON CANDLE UNITS)
1	00095	SPECIFIC CONDUCTANCE (UMHOS/CM @ 25C)
1	00300	OXYGEN, DISSOLVED (MG/L)
1	00310	BIOCHEMICAL OXYGEN DEMAND (MG/L, 5 DAY - 20DEG C)
1	00400	PH (STANDARD UNITS)
1	00403	PH (STANDARD UNITS) LAB
1	00410	ALKALINITY, TOTAL (MG/L AS CACO3)
1	00435	ACIDITY, TOTAL (MG/L AS CACO3)
5	00610	NITROGEN, AMMONIA, TOTAL (MG/L AS N)
5	00625	NITROGEN, KJELDAHL, TOTAL, (MG/L AS N)
5	00630	NITRITE PLUS NITRATE, TOTAL 1 DET. (MG/L AS N)
5	00665	PHOSPHORUS, TOTAL, WET METHOD (MG/L AS P)
5	00680	CARBON, TOTAL ORGANIC (MG/L AS C)
5	31505	COLIFORM,TOT,MPN,CONFIRMED TEST,35C (TUBE 31506)
5	31615	FECAL COLIFORM,MPN,EC MED,44.5C (TUBE 31614)
5	00060	FLOW, STREAM, MEAN DAILY (CUBIC FEET PER SEC.)
5	00500	RESIDUE, TOTAL (MG/L)
9	00505	RESIDUE, TOTAL VOLATILE (MG/L)
9	00515	RESIDUE, TOTAL FILTRABLE (DRIED AT 105C),MG/L
9	00530	RESIDUE, TOTAL NONFILTRABLE (MG/L)
9	00535	RESIDUE, VOLATILE NONFILTRABLE (MG/L)
9	01002	ARSENIC, TOTAL (UG/L AS AS)
9	01034	CHROMIUM, TOTAL (UG/L AS CR)
9	01042	COPPER, TOTAL (UG/L AS CU)
9	32730	PHENOLS (UG/L)
12	01045	IRON, TOTAL (UG/L AS FE)
12	01051	LEAD, TOTAL (UG/L AS PB)
12	01055	MANGANESE, TOTAL (UG/L AS MN)
12	01067	NICKEL, TOTAL (UG/L AS NI)
12	01092	ZINC, TOTAL (UG/L AS ZN)
12	00339	CHEMICAL OXYGEN DEMAND, BOT. DEP. (MG/KG DRY WGT)
12	00495	MOISTURE CONTENT (PERCENT OF TOTAL DRY WEIGHT)
12	00626	NITROGEN,ORG. KJEL.,BOT. DEPOS. (MG/KG-N DRY WGT)
13	00668	PHOSPHORUS,TOTAL, BOTTOM DEPOSIT (MG/KG DRY WGT)
13	01003	ARSENIC IN BOTTOM DEPOSITS (MG/KG AS AS DRY WGT)
13	01029	CHROMIUM,TOTAL IN BOTTOM DEPOSITS (MG/KG,DRY WGT)
13	01043	COPPER IN BOTTOM DEPOSITS (MG/KG AS CU DRY WGT)
13	01052	LEAD IN BOTTOM DEPOSITS (MG/KG AS PB DRY WGT)
13	01053	MANGANESE IN BOTTOM DEPOSITS (MG/KG AS MN DRY WGT
13	01068	NICKEL, TOTAL IN BOTTOM DEPOSITS (MG/KG,DRY WGT)
13	01093	ZINC IN BOTTOM DEPOSITS (MG/KG AS ZN DRY WGT)
13	01170	IRON IN BOTTOM DEPOSITS (MG/KG AS FE DRY WGT)
13	70322	SOLIDS, VOLATILE, PERCENT OF TOTAL SOLIDS
13	71920	MERCURY,TOT IN BOT DEPOS OR PULP(MG/KG,WET WGT)
13	00340	CHEMICAL OXYGEN DEMAND, .25N K2CR207 (MG/L)
13	00550	OIL & GREASE (SOXHLET EXTRACTION) TOTAL,REC.,MG/L
13	00720	CYANIDE (MG/L AS CN)
13	00058	FLOW RATE (GALLONS PER MINUTE)
13	00059	FLOW RATE, INSTANTANEOUS (GALLONS PER MINUTE)

ENVIRONMENTAL PROTECTION AGENCY REGION IV
SOUTHEAST ENVIRONMENTAL RESEARCH LABORATORY

CHATTANOOGA FIELD STUDY
(DOWNSTREAM FROM CITY WATER COMPANY INTAKES) FEB.-MARCH, 1973

AGENCY	PRIMARY STATION	SECONDARY	STATION LOCATION	STATE	MINOR BASIN	
11135000	130228	CT-4	DRY CK AT 0.5 MI FROM MOUTH	GEORGIA	TENNESSEE RIVER	CHATTANOOG
	130234	C-9.5	CHATT CK OFF BURNT MILL RD-M 8.8	GEORGIA	TENNESSEE RIVER	CHATTANOOG
	470200	C-0.6	CHATT CK AT LAN RR BRIDGE-MI. .6	TENNESSEE	TENNESSEE RIVER	CHATTANOOG
	470202	C-1.2	CHATT CK AT BROAD STREET BRIDGE	TENNESSEE	TENNESSEE RIVER	CHATTANOOG
	470204	C-1.6	CHATT CK AT MARKET STREET BRIDGE	TENNESSEE	TENNESSEE RIVER	CHATTANOOG
	470206	C-2.1	CHATT CK AT SOU RR SHIPPS YARD	TENNESSEE	TENNESSEE RIVER	CHATTANOOG
	470208	DB-0.1	DOBBS BR AT CENTRAL OF GA RR BRD	TENNESSEE	TENNESSEE RIVER	CHATTANOOG
	470210	DBT-1	UNNAMED TRIB TO DOBBS BRANCH 0.1	TENNESSEE	TENNESSEE RIVER	CHATTANOOG
	470212	DBT-2	UNNAMED TRIB TO DOBBS BRANCH 0.9	TENNESSEE	TENNESSEE RIVER	CHATTANOOG
	470214	C-2.5	CHATT CK-END OF RR SPUR AT M 2.5	TENNESSEE	TENNESSEE RIVER	CHATTANOOG
	470216	C-3.6	CHATT CK AT CLIFTON HILLS SUBDIV	TENNESSEE	TENNESSEE RIVER	CHATTANOOG
	470218	C-4.3	CHATT CK AT 38TH STREET BRIDGE	TENNESSEE	TENNESSEE RIVER	CHATTANOOG
	470220	CT-2	UNNAMED TRIB TO CHATT CREEK 0.2	TENNESSEE	TENNESSEE RIVER	CHATTANOOG
	470222	C-5.3	CHATT CK AT HAMMILL ROAD BRIDGE	TENNESSEE	TENNESSEE RIVER	CHATTANOOG
	470224	C-5.6	CHATT CK AT HOOKER ROAD BRIDGE	TENNESSEE	TENNESSEE RIVER	CHATTANOOG
	470226	CT-3	MCFARLAND BR AT THE TENN-GA LINE	TENNESSEE	TENNESSEE RIVER	CHATTANOOG
	470230	C-7.0	CHATT CK AT WILSON ROAD BRIDGE	TENNESSEE	TENNESSEE RIVER	CHATTANOOG
	470232	C-8.1	CHATT CK AT BURNT MILL ROAD	TENNESSEE	TENNESSEE RIVER	CHATTANOOG

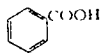
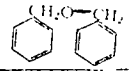
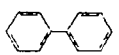
APPENDIX E

ORGANIC COMPOUND IDENTIFICATION

CHEMICAL SERVICES BRANCH
SAD, EPA, REGION IV
ATHENS, GEORGIA 30601

ORGANIC COMPOUNDS IDENTIFIED

PROJECT Chattanooga Creek Study SAMPLING DATE March, 1973

SAD Number	Industry or Source	Organic Compound	Conc. Found mg/L	Chemical Formula	Chemical Class	Water Solubility	Sources or Uses
0899	Velsicol (VE-1)	xylene	Est. at 0.03		aromatic	insoluble	solvent and synthesis of organic chem
0899	VE-1	benzaldehyde	Est. at 0.18		aromatic aldehyde	slightly soluble	product of Velsicol
0899	VE-1	an isomer of chlorotoluene	0.14		chlorinated aromatic	slightly soluble	product of Velsicol
0899	VE-1	napthalene	0.078		aromatic	insoluble	chemical intermediate
0899	VE-1	benzyl alcohol	Est. at 23.		aromatic alcohol	somewhat soluble	product of Velsicol
0899	VE-1	benzoic acid	28.		aromatic acid	slightly soluble	product of Velsicol
0899	VE-1	acetone	----		ketone	miscible	solvent
0899	VE-1	dibenzyl ether	1.6		aromatic ether	insoluble	product of Velsicol
0899	VE-1	biphenyl	Est. at 0.17		aromatic	insoluble	Organic synthesis
0900	Velsicol (VE-2)	acetophenone	Est. at 2.5		aromatic ketone	slightly soluble	Perfumery & Pharmaceuticals

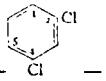
ORGANIC COMPOUNDS IDENTIFIED AND ENVIRONMENTAL EFFECTS OF EACH

SAD Number	Organic Compound	Conc. Found mg/L	Toxicity Data mg/kg of Body Weight	Fish Toxicity mg/L	Taste & Odor
0899	xylene	Est. at 0.03	very toxic: probable lethal dose for man 50-500 mg/kg [2]	10-90 mg/L toxic depending on fish species [3]	0.3-1.0 mg/L causes detectable taste or odor [3]
0899	benzaldehyde	Est. at 0.18	moderately toxic: probable lethal dose for man 500 mg-50 gm/kg [2]	unknown	Threshold odor in water 0.004 [4]
0899	An isomer of chlorotoluene	0.14	toxic by inhalation [1]	unknown	unknown
0899	napthalene	0.078	moderately toxic [1]	96 hr TLM for mosquito fish 150 mg/L [3]	Threshold odor in water 6.8 mg/L [4]
0899	benzyl alcohol	Est. at 23.	moderately toxic: probable lethal dose for man 500 mg - 50 gm/kg [2]	Median threshold effect on Daphnia for 48 hr exposure occurred at 360mg/L [3]	Threshold taste in water 5.5 mg/L [4]
0899	benzoic acid	28.	moderately toxic: probable lethal dose for man 500 mg - 50 gm/kg [2]	48 hr TLM for mosquito fish is 225 mg/L [3]	Threshold taste in water 85 mg/L [4]
0899	acetone		moderately toxic: probable lethal dose for man 500 - 50 gm/kg [2]	48 hr TLM for mosquito fish is 13,000 mg/L [3]	Threshold odor in water 100 mg/L [4]
0899	dibenzyl ether	1.6	unknown	unknown	unknown
0899	biphenyl	Est. at 0.17	highly toxic [1]	unknown	unknown
0900	acetophenone	Est. at 2.5	low toxicity [1]	unknown	Threshold odor in water 65 mg/L [4]

CHEMICAL SERVICES BRANCH
SAD, EPA, REGION IV
ATHENS, GEORGIA 30601

ORGANIC COMPOUNDS IDENTIFIED

PROJECT Chattanooga Creek Study SAMPLING DATE March, 1973

SAD Number	Industry or Source	Organic Compound	Conc. Found mg/L	Chemical Formula	Chemical Class	Water Solubility	Sources or Uses
0900	VE-2	1,2,4 trichlorobenzene	Est. at 0.5		chlorinated aromatic	insoluble	organic intermediate
0900	VE-2	an isomer of dichloroanisole appears to be present at an est. conc. of 0.4					
0900	VE-2	3,5 dichlorophenol	Est. at 0.5		chlorinated phenol	slightly soluble	Organic synthesis
0900	VE-2	2,4 dichlorophenol	1.		chlorinated phenol	slightly soluble	Organic synthesis
0900	VE-2	dibenzyl ether	0.68		aromatic ether	insoluble	Perfumery & flavors
0900	VE-2	An isomer of chlorotoluene	0.02	Same as for VE-1			
0900	VE-2	benzyl alcohol	Est. at 0.15	Same as for VE-1			
0900	VE-2	benzoic acid	11.	Same as for VE-1			
0900	VE-2	acetone	- - - -	Same as for VE-1			
0900	VE-2	2,4 dichlorobenzoic acid	0.37		chlorinated aromatic acid	insoluble	Probably by-products

ORGANIC COMPOUNDS IDENTIFIED AND ENVIRONMENTAL EFFECTS OF EACH

SAD Number	Organic Compound	Conc. Found mg/L	Toxicity Data mg/kg of Body Weight	Fish Toxicity mg/L	Taste & Odor
0900	1,2,4 trichlorobenzene	Est. at 0.5	moderately toxic [1]	unknwon	unknown
0900	An isomer of dichloroanisole	Est. at 0.4	unknown	unknown	unknown
0900	3,5 dichlorophenol	Est. at 0.5	moderately toxic [1]	unknown	See 2,4 dichlorophenol on page 2
0900	2,4 dichlorophenol	1.	moderately toxic [1]	unknown	Threshold odor in water [4] 0.21 mg/L
0900	dibenzyl ether	0.68		Same as for 0899	
0900	An isomer of chlorotoluene	0.02		Same as for 0899	
0900	benzyl alcohol	Est. at 0.15		Same as for 0899	
0900	benzoic acid	11.		Same as for 0899	
0900	acetone			Same as for 0899	
0900	2,4 dichlorobenzoic acid	0.37	unknown	unknown	unknown

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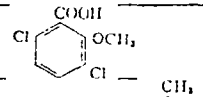
SAD Number	Industry or Source	Organic Compound	Conc. Found mg/L	Chemical Formula	Chemical Class	Water Solubility	Sources or Uses
0900	VE-2	Another isomer of dichlorobenzoic acid	Est. at 0.2		chlorinated aromatic acid	insoluble	Probably by-products of their processes
0900	VE-2	Two isomers of trichlorobenzoic acid	Both Est. at 0.4		chlorinated aromatic acid	insoluble	"
0900	VE-2	Two isomers of tetrachlorobenzoic acid	Est. at 0.6-0.7		chlorinated aromatic acid	insoluble	"
0900	VE-2	dicamba	<0.05		chlorinated aromatic acid	slightly soluble	Produced by Velsicol
0901	Velsicol (VE-4)	toluene	— — —		aromatic	insoluble	Production of medicines and perfumes
0901	VE-4	xylene	0.20		Same as for VE-1		
0901	VE-4	benzaldehyde	Est. at 19.		Same as for VE-1		
0901	VE-4	An isomer of chlorotoluene	2.2		Same as for VE-1		
0901	VE-4	benzyl alcohol	Est. at 11.		Same as for VE-1		
0901	VE-4	acetophenone	Est. at 1.2		Same as for VE-2		

ORGANIC COMPOUNDS IDENTIFIED AND ENVIRONMENTAL EFFECTS OF EACH

SAD Number	Organic Compound	Conc. Found mg/L	Toxicity Data mg/kg of Body Weight	Fish Toxicity mg/L	Taste & Odor
0900	Another isomer of dichlorobenzoic acid	Est. at 0.2	unknown	unknown	unknown
0900	Two isomers of trichlorobenzoic acid	Both Est. at 0.4	Moderately toxic: probable lethal dose to man 500 mg - 50 gm/kg [2/]	unknown	unknown
0900	Two isomers of tetrachlorobenzoic acid	Est. at 0.6-0.7	unknown	unknown	unknown
0900	dicamba	<0.05	moderately toxic: probable lethal dose to man 500 mg - 50 gm/kg [2/]	35 mg/L is the 48 hr TLM for rainbow trout [3/]	unknown
0901	toluene		very toxic: probable lethal dose to man 50 - 500 mg/kg [2/]	48 hr TLM for mosquito fish is 1260 mg/L [3/]	unknown
0901	xylene	0.20		Same as for 0899	
0901	benzaldehyde	Est. at 19.		Same as for 0899	
0901	An isomer of chlorotoluene	2.2		Same as for 0899	
0901	benzyl alcohol	Est. at 11.		Same as for 0899	
0901	acetophenone	Est. at 1.2		Same as for 0899	

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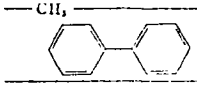
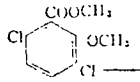
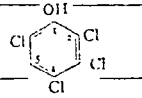
SAD Number	Industry or Source	Organic Compound	Conc. Found mg/L	Chemical Formula	Chemical Class	Water Solubility	Sources or Uses
0901	VE-4	1,2,4 trichlorobenzene	Est. at 40.		Same as for VE-2		
0901	VE-4	Appears to be two isomers of dichloroanisole	Est. at 20 mg/l				
0901	VE-4	An isomer of methyl biphenyl	Est. at 0.2		aromatic	insoluble	unknown
0901	VE-4	methyl ester of dicamba	4.3		chlorinated aromatic ester	insoluble	Produced by Velsicol
0901	VE-4	dibenzyl ether	3.6	Same as for VE-2			
0901	VE-4	benzonitrile	Est. at 5.3		aromatic cyanide	slightly soluble	Produced by Velsicol
0901	VE-4	2,4 dichlorophenol	11.	Same as for VE-2			
0901	VE-4	benzoic acid	140.	Same as for VE-1			
0901	VE-4	2,3,4,6 tetrachlorophenol	3.		chlorinated phenol	insoluble	Probably a by-product
0901	VE-4	o-chlorobenzoic acid	Est. at 1.		chlorinated aromatic acid	insoluble	Produced by Velsicol

ORGANIC COMPOUNDS IDENTIFIED AND ENVIRONMENTAL EFFECTS OF EACH

SAD Number	Organic Compound	Conc. Found mg/L	Toxicity Data mg/kg of Body Weight	Fish Toxicity mg/L	Taste & Odor
0901	1,2,4 trichlorobenzene	Est. at 40.		Same as for 0900	
0901	Appears to be two isomers of dichloroanisole	Est. at 20 mg/L		Same as for 0900	
0901	An isomer of methyl biphenyl	Est. at 0.2	unknown	unknown	unknown
0901	methyl ester of dicamba	4.3		Same as for 0900	unknown
0901	dibenzyl ether	3.6		Same as for 0899	unknown
0901	benzonitrile	Est. at 5.3		48 hr TLM for bluegills is 78 mg/L [3/]	unknown
0901	2,4 dichlorophenol	11.		Same as for 0900	
0901	benzoic acid	140.		Same as for 0899	
0901	2,3,4,6 tetrachlorophenol	3.	unknown	unknown	unknown
0901	o-chlorobenzoic acid	Est. at 1.	unknown	unknown	unknown

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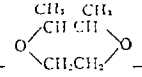
SAD Number	Industry or Source	Organic Compound	Conc. Found ng/L	Chemical Formula	Chemical Class	Water Solubility	Sources or Uses
0901	VE-4	2,4 dichlorobenzoic acid	Est. at 2.		chlorinated aromatic acid	insoluble	Probably a by-product
0901	Velsicol (VE-4)	dicamba	73.	Same as for VE-2			
0901	VE-4	acetone	— — —	Same as for VE-1			
0901	VE-4	n-butanol	— — —	$CH_3CH_2CH_2CH_2OH$	alcohol	soluble	solvent
0901	VE-4	Two isomers of dimethyl dioxane	— — —		dioxone	soluble	solvent
0901	VE-4	methylene chloride	— — —	CH_2Cl_2	chlorinated alkone	slightly soluble	solvent & pharmaceutical extractant
0902	Moccasin Bend STP (MB-1)	An isomer of chlorotoluene	0.062	Same as VE-1			
0902	MB-1	2,4 dichlorophenol	1.6	Same as VE-2			
0902	MB-1	Another isomer of dichlorophenol	Est. at 0.4				
0902	MB-1	Appears to be two isomers of dichloroanisole	Est. at 0.4				Found also in VE-2

ORGANIC COMPOUNDS IDENTIFIED AND ENVIRONMENTAL EFFECTS OF EACH

SAD Number	Organic Compound	Conc. Found mg/L	Toxicity Data mg/kg of Body Weight	Fish Toxicity mg/L	Taste & Odor
0901	2,4 dichlorobenzoic acid	Est. at 2.0	unknown	unknown	unknown
0901	dicamba	73.		Same as for 0900	
0901	acetone			Same as for 0899	
0901	n-butanol		moderately toxic: probable lethal dose to man 500 mg - 50 gm/kg [2]	20 mg/L killed goldfish in 15 to 96 hours	Threshold odor in water 2.5 mg/L [4]
0901	Two isomers of dimethyl dioxane		moderately toxic [1]	unknown	Threshold odor in water 2.5 mg/L [4]
0901	methylene chloride		moderately toxic: probable lethal dose to man 500 mg - 50 gm/kg [2]	unknown	unknown
0902	An isomer of chlorotoluene	0.062		Same as for 0899	
0902	2,4 dichlorophenol	1.6		Same as for 0900	
0902	Another isomer of dichlorophenol	Est. at 0.4		Same as for 0900	
0902	Appears to be two isomers of dichloroanisole	Est. at 0.4		Same as for 0900	

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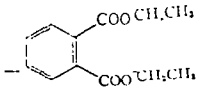
SAD Number	Industry or Source	Organic Compound	Conc. Found mg/L	Chemical Formula	Chemical Class	Water Solubility	Sources or Uses
0902	MB-1	3,5-dichlorophenol	0.28	Same as VE-2			
0902	MB-1	biphenyl	Est. at 0.08	Same as VE-1			
0902	MB-1	Two isomers of methyl biphenyl	Est. at 0.02-0.08	Same as VE-4			
0902	MB-1	diethyl phthalate	Est. at 0.05		aromatic ester	insoluble	Solvent and plasticizer
0902	MB-1	dibenzyl ether	0.26	Same as for VE-2			
0902	MB-1	methyl ester of dicamba	0.14	Same as for VE-4			
0902	MB-1	Two isomers of trichlorophenol	Est. at 0.02-0.16		chlorinated phenol	unknown	Fungicide and bactericide
0902	MB-1	2,3,4,6 tetrachlorophenol	0.34	Same as for VE-4			
0902	MB-1	o-chlorobenzoic acid	Est. at 0.04	Same as for VE-4			
0902	MB-1	2,4-dichlorobenzoic acid	0.09	Same as for VE-2			

ORGANIC COMPOUNDS IDENTIFIED AND ENVIRONMENTAL EFFECTS OF EACH

SAD Number	Organic Compound	Conc. Found mg/L	Toxicity Data mg/kg of Body Weight	Fish Toxicity mg/L	Taste & Odor
0902	3,5-dichlorophenol	0.28		Same as for 0900	
0902	biphenyl	Est. at 0.08		Same as for 0899	
0902	Two isomers of methyl byphenyl	Est. at 0.02-0.08	2/	Same as for 0901	
0902	diethyl phthalate	Est. at 0.05	moderately toxic: probable lethal dose for man 500 mg - 50 gm/kg	unknown	unknown
0902	dibenzyl ether	0.26		Same as for 0899	
0902	methyl ester of dicamba	0.14		Same as for 0900	
0902	Two isomers of trichlorophenol	0.02-0.16	1/ highly toxic	unknown	unknown
0902	2,3,4,6 tetrachlorophenol	0.34		Same as for 0901	
0902	o-chlorobenzoic acid	Est. at 0.04		Same as for 0901	
0902	2,4-dichlorobenzic acid	0.09		Same as for 0900	

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SAD Number	Industry or Source	Organic Compound	Conc. Found mg/L	Chemical Formula	Chemical Class	Water Solubility	Sources or Uses
0902	MB-1	dicamba	2.4	Same as for VE-2			
0902	MB-1	acetone	— — —	Same as for VE-1			
0902	MB-1	ethyl hexanol	— — —	$CH_3CH_2CH_2CH_2CHCH_2OH$ C_2H_5	alcohol	insoluble	plasticizer
0903	Moccasin Bend STP (MB-2)	An isomer of chlorotoluene	0.05	Same as for VE-1			
0903	MB-2	1,2,4 trichlorobenzene	— — —	Same as for VE-2			
0903	MB-2	2,4 dichlorophenol	0.42	Same as for VE-2			
0903	MB-2	Appears to be two isomers of dichloroanisole	Est. at 0.05	Same as for VE-2			
0903	MB-2	3,5 dichlorophenol	0.18	Same as for VE-2			
0903	MB-2	biphenyl	Est. at 0.04	Same as for VE-1			
0903	MB-2	Two isomers of methyl biphenyl	Est. at 0.02-0.07	Same as for VE-2			

ORGANIC COMPOUNDS IDENTIFIED AND ENVIRONMENTAL EFFECTS OF EACH

SAD Number	Organic Compound	Conc. Found mg/L	Toxicity Data mg/kg of Body Weight	Fish Toxicity mg/L	Taste & Odor
0902	dicamba	2.4		Same as for 0900	
0902	acetone			Same as for 0899	
0902	ethyl hexanol		low toxicity 1/	unknown	unknown
0903	An isomer of chlorotoluene	0.05		Same as for 0899	
0903	trichlorobenzene			Same as for 0900	
0903	2,4 dichlorophenol	0.42		Same as for 0900	
0903	Appears to be two isomers of dichloroanisole	Est. at 0.05		Same as for 0900	
0903	3,5 dichlorophenol	0.18		Same as for 0900	
0903	biphenyl	Est. at 0.04		Same as for 0899	
0903	Two isomers of methyl biphenyl	Est. at 0.07-0.07		Same as for 0901	

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SAD Number	Industry or Source	Organic Compound	Conc. Found mg/L	Chemical Formula	Chemical Class	Solubility	Uses
0903	MB-2	methyl ester of dicamba	0.26	Same as for VE-4			
0903	MB-2	diethyl phthlate	Est. at 0.05	Same as for MB-1			
0903	MB-2	dibenzyl ether	0.12	Same as for VE-2			
0903	MB-2	Two isomers of cresol	<0.02		phenol	soluble in hot water	disinfectant
0903	MB-2	2,4 dichlorophenol	0.40	Same as for VE-2			
0903	MB-2	Another isomer of dichlorophenol	Est. at 0.3	Same as for VE-2			
0903	MB-2	Two isomers of trichlorophenol	Est. at 0.12	Same as for MB-1			
0903	MB-2	2,3,4,6 tetrachlorophenol	0.25	Same as for VE-4			
0903	MB-2	o-chlorobenzoic acid	0.04	Same as for VE-4			
0903	MB-2	2,4 dichlorobenzoic acid	0.18	Same as for VE-2			

ORGANIC COMPOUNDS IDENTIFIED AND ENVIRONMENTAL EFFECTS OF EACH

SAD Number	Organic Compound	Conc. Found mg/L	Toxicity Data mg/kg of Body Weight	Fish Toxicity mg/L	Taste & Odor
0903	methyl ester of dicamba	0.26		Same as for 0900	
0903	diethyl phthalte	Est. at 0.05		Same as for 0902	
0903	dibenzyl ether	0.12		Same as for 0899	
0903	Two isomers of cresol	<0.02	very toxic: probable lethal dose to man 50 - 500 mg/kg [27]	48 hr TLM for fathead minnows is 24 mg/L [3]	Threshold odor in water 0.68 mg/L [4]
0903	2,4 dichlorophenol	0.40		Same as for 0900	
0903	Another isomer of dichlorophenol	Est. at 0.3		Same as for 0900	
0903	Two isomers of trichlorophenol	Est. at 0.12		Same as for 0902	
0903	2,3,4,6 tetrachlorophenol	0.25		Same as for 0901	
0903	o-chlorobenzoic acid	Est. at 0.04		Same as for 0901	
0903	2,4 dichlorobenzoic acid	0.18		Same as for 0900	

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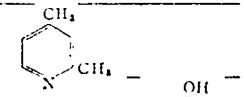
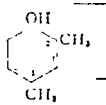
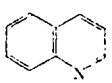
0903	MB-2	dicamba	1.7	Same as for VE-2			
0903	MB-2	acetone	— — —	Same as for VE-1			
0904	Chattanooga Tributary (CT-2)	An isomer of xylene	Est. at 0.5	Same as for VE-1			
0904	CT-2	Two isomers of dimethyl pyridine	Est. at 0.3-0.8		pyridine	soluble	Coal tar derivative
0904	CT-2	phenol	Est. at 6.		phenol	soluble	Found in Woodward WO-2
0904	CT-2	benzyl alcohol	Est. at 4.	Same as for VE-1			
0904	CT-2	An isomer of cresol	0.76	Same as for MB-2			
0904	CT-2	Three isomers of xylenol	All Est. at 0.5		phenol	slightly soluble	Coal tar derivative
0904	CT-2	napthalene	2.0	Same as for VE-1			
0904	CT-2	quinoline	Est. at 0.33		aromatic nitrogen	soluble	Coal tar derivative

ORGANIC COMPOUNDS IDENTIFIED AND ENVIRONMENTAL EFFECTS OF EACH

AD mber	Organic Compound	Conc. Found mg/L	Toxicity Data mg/kg of Body Weight	Fish Toxicity mg/L	Taste & Odor
03	dicamba	1.7		Same as for 0900	
03	acetone			Same as for 0899	
04	An isomer of xylene	Est. at 0.5		Same as for 0899	
04	Two isomers of dimethyl pyridine	Est. at 0.3-0.8		unknown	unknown
04	phenol	Est. at 6.	very toxic: probable lethal dose for man is 50-500 mg/kg [2/]	96 hr TLM for bluegills is 13.6 mg/L [3/]	Threshold odor in water 5.9 mg/L [4/]
04	benzyl alcohol	Est. at 4.		Same as for 0899	
04	An isomer of cresol	0.76		Same as for 0903	
04	Three isomers of xylenol	All est. at 0.5	very toxic [1/]	24 hr TLM for carp is 30 mg/L [3/]	unknown
04	napthalene	2.0		Same as for 0899	
04	quinoline	Est. at 0.33	highly toxic [1/]	5 mg/L is lethal in 4 hrs to bluegill [3/]	Threshold odor in water 71 mg/L [4/]

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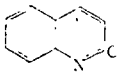
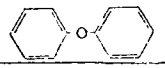
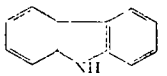
0904	CT-2	Two isomers of methyl quinoline	<0.1		aromatic nitrogen	slightly soluble	Coal tar derivative
0904	CT-2	biphenyl	Est. at 0.07	Same as for VE-1			
0904	CT-2	diphenyl ether	Est. at 2.		aromatic ether	insoluble	Organic synthesis & perfumery
0904	CT-2	dibenzyl ether	0.81	Same as for VE-2			
0904	CT-2	carbazole	<0.5			insoluble	Coal tar derivative
0904	CT-2	benzoic acid	13.	Same as for VE-2			
0904	CT-2	Three isomers of xylenol	Est. at 1.5-3.0		phenol	slightly soluble	Found in Woodward effluent
0904	CT-2	acetone	— — —	Same as for VE-1			
0904	CT-2	pyridine	— — —		pyridine	soluble	Solvent and synthesis of drugs
0905	Chattem Drug (CH-1)	acetone	— — —	Same as for VE-1			

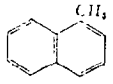
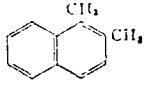
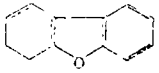
ORGANIC COMPOUNDS IDENTIFIED AND ENVIRONMENTAL EFFECTS OF EACH

SAD Number	Organic Compound	Conc. Found mg/L	Toxicity Data mg/kg of Body Weight	Fish Toxicity mg/L	Taste & Odor
0904	Two isomers of methyl quinoline	<0.1	highly toxic [1]	unknown	unknown
0904	biphenyl	Est. at 0.07		Same as for 0899	
0904	diphenyl ether	Est. at 2.	low toxicity [1]	unknown	Detectable in water by odor at 0.013 mg/L [3]
0904	dibenzyl ether	0.81		Same as for 0899	
0904	carbazole	<0.5	low toxicity [1]	unknown	unknown
0904	benzoic acid	13.		Same as for 0900	
0904	Three isomers of xylenol	Est. at 1.5-3.0		Same as for 0904	
0904	acetone			Same as for 0899	
0904	pyridine		moderately toxic: probable lethal dose for man 500 mg - 50 gm/kg [2]	96 hr TLM for mosquito fish is 1300 mg/L [3]	Threshold odor in water 82 mg/L [4]
0904	acetone			Same as for 0899	

CHEMICAL SERVICES BRANCH
SAD, EPA, REGION IV
ATHENS, GEORGIA 30601

ORGANIC COMPOUNDS IDENTIFIED

PROJECT Chattanooga Creek Survey SAMPLING DATE March, 1973

SAD Number	Industry or Source	Organic Compound	Conc. Found mg/L	Chemical Formula	Chemical Class	Water Solubility	Sources or Uses
0906	Woodward Co. (WO-2)	Two isomers of xylene	.100-.200	Same as for VE-1			Coal tar derivative
0906	WO-2	phenol	Est. at 25	Same as for CT-2			Coal tar derivative
0906	WO-2	Two isomers of cresol	13-22	Same as for MB-2			Coal tar derivative
0906	WO-2	Three isomers of xylenol	10-22	Same as for CT-2			
0906	WO-2	napthalene	18	Same as for VE-1			Coal tar derivative
0906	WO-2	Two isomers of methyl napthalene	Est. at 0.6-1.3		aromatic	insoluble	Coal tar derivative
0906	WO-2	biphenyl	0.35	Same as for VE-1			Coal tar derivative
0906	WO-2	An isomer of dimethyl napthalene	Est. at 0.2		aromatic	insoluble	Coal tar derivative
0906	WO-2	An isomer of methyl biphenyl	Est. at 0.2		aromatic	insoluble	Coal tar derivative
0906	WO-2	dibenzofuran	Est. at 0.4		tricyclic hydrocarbon oxide	insoluble	Coal tar derivative

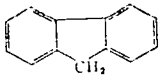
ORGANIC COMPOUNDS IDENTIFIED AND ENVIRONMENTAL EFFECTS OF EACH

SAD Number	Organic Compound	Conc. Found mg/L	Toxicity Data mg/kg of Body Weight	Fish Toxicity mg/L	Taste & Odor
0906	Two isomers of xylene	.100-.200		Same as for 0899	
0906	phenol	Est. at 25		Same as for 0904	
0906	Two isomers of cresol	13-22		Same as for 0903	
0906	Three isomers of xylenol	10-22		Same as for 0904	
0906	napthalene	18		Same as for 0899	
0906	Two isomers of methyl napthalene	Est. at 0.6-1.3	Probably toxic 1/	unknown	unknown
0906	biphenyl	0.35		Same as for 0899	
0906	An isomer of dimethyl napthalene	Est. at 0.2	Probably toxic 1/	unknown	unknown
0906	An isomer of methyl biphenyl	Est. at 0.2		Same as for 0901	
0906	dibenzofuran	Est. at 0.4	Probably toxic 1/	unknown	unknown

CHEMICAL SERVICES BRANCH
SAD, EPA, REGION IV
ATHENS, GEORGIA 30601

ORGANIC COMPOUNDS IDENTIFIED

PROJECT Chattanooga Creek Survey SAMPLING DATE March, 1973

SAD Number	Industry or Source	Organic Compound	Conc. Found mg/L	Chemical Formula	Chemical Class	Water Solubility	Sources or Uses
0906	WO-2	fluorene	Est. at 0.55		tricyclic hydrocarbon	insoluble	Coal tar derivative
0906	WO-2	methylene chloride	— — —	Same as for VE-4			
	The concentrations qualified by Est. at should be considered a rough estimation of concentration.						
	The other concentrations were determined by quantitating duplicate extracts and reporting the average.						
	The soluble and/or volatile solvents were not quantitated because the efficiency of the technique is unknown.						

ORGANIC COMPOUNDS IDENTIFIED AND ENVIRONMENTAL EFFECTS OF EACH

SAD Number	Organic Compound	Conc. Found mg/L	Toxicity Data mg/kg of Body Weight	Fish Toxicity mg/L	Taste & Odor
0906	fluorene	Est. at 0.55	unknown	unknown	unknown
0906	methylene-chloride			Same as for 0901	

1/ The Condensed Chemical Dictionary, Van Nostrand Reinhold Co., New York, New York 8th Ed., 1971.

2/ Gleason, Gosselin, Hodge & Smith, Clinical Toxicology of Commercial Products, The Williams & Wilkins Co., Baltimore, Maryland., 3rd Ed., 1969.

3/ California Water Quality Criteria, California Water Resources Control Board, Publ. 3-A, 2nd Ed. 1963.

4/ Compilation of Odor and Taste Threshold Values Data, American Society For Testing and Materials, Philadelphia, PA, 1973.

APPENDIX F

PROJECT PERSONNEL

PROJECT PERSONNEL

Study Director - David W. Hill

Project Engineer - Charles A. Sweatt

Project Chemist - Wade R. Knight

Project Microbiologist - Ralph E. Gentry

Chemist - William R. (Rod) Davis

Chemist Aide - Thomas J. Sack

Microbiologist - Herbert C. Barden

Engineering Aide - Edward E. Shollenberger

Physical Science Tech. - Robert M. (Mike) McCreery

Co-Op Student - Eddie P. Minchew

Worker Trainee - Michael D. Cronic

Data Logging - Jerry W. Burger

Environmental Specialist - Alfred L. Cherry, Jr.

Mechanical Engineer - Thomas P. Lyttle

Sanitary Engineer - Richard E. Newsome

Sanitary Engineer - David M. Parks

APPENDIX G

MATHEMATICAL MODEL OF CHATTANOOGA CREEK

APPENDIX G

INTRODUCTION

Chattanooga Creek was modeled using the dosag computer code develop ed by the Texas Water Development Board (1). This model has received wide use and has been specified in the recent series of river basin modeling contracts let by EPA. Essentially, the model is a conventional first-order dissolved oxygen model. The model allows biochemical oxygen demand to be stated in terms of both the carbonaceous and nitrogeneous components, with each component having a seperate rate coefficient. Depth and velocity versus flow relationships are stated by an equation having the form:

$$Y = A(X)^B$$

The reaeration relationship may either be input directly into the program, computed from the method of Thackston and Krenkle(1), or from a relationship of the form:

$$K_2 = \frac{A(V)^B}{D^C}$$

Where V is the stream velocity, D is the depth, and A, B, and C are empirical coefficients whose values have been reported by various authors (1).

MODEL SEGMENTATION

The model segmentation is schematized in figure I (attached). The section of Chattanooga Creek modeled begins at the USGS gage at Franklin Georgia and ends at it's confluence with the Tennessee River. For the purpose of this model, it was assumed that the river is free-flowing for it's entire length. Major tributaries included in the model are Dry

Creek, McFarland Branch, Dobbs Branch, and the un-named tributary draining Woodward-Velsicol. Each tributary was modeled as two reaches, one of which is a dummy reach (see model reference 1 for explanation) and the other has a length of 0.2 miles.

DEPTH AND VELOCITY VERSUS FLOW RELATIONSHIPS

Depth and velocity versus flow relationships for the program were developed from data obtained at the USGS stream gage near Franklin, Ga. on Chattanooga Creek. Selected field observations were plotted on logrimithic graph paper and the coefficients of the previously mentioned equations were determined. The velocity versus flow relationship was furthur refined with data from a dye study conducted during the field study. It should be noted that the data from the USGS gage is only representative of a single point on the stream while the dye study is representative of the entire reach.

DEOXYGENATION AND REAERATION COEFFICIENTS

The deoxygenation coefficient, K1, was determined from a laboratory BOD time series analysis. A value of 0.12/day (base E, 20 degrees centigrade) was determined from an analysis of this data. This value was used to convert 5-day BOD values for use in model calibration. Note that this value of K1 is only representative of conditions in a BOD bottle and not the natural environment. Several instream values for K1 were tried in the model and a value of 0.60/day (base E, 20 degrees centigrade) was found to represent the degration of waste satisfactorily. Relatively high values of K1 such as this are typical of polluted rivers like Chattanooga Creek and can be attributed to an abundant, acclimitized biological community.

The reaeration coefficient, K2, was estimated by the method proposed by Churchill, et al (3). Comparative estimates were made with the method of Langbien and Duram (4) and virtually identical values resulted.

FLOWS, LOADINGS, AND MODEL CALIBRATION

Tributary flows for use in the program were approximated from tributary drianage areas as tributry flows could not be measured during the study. Consequently, inflow BOD5 may not correspond to values obtained during the study. Inflow BOD5 was determined by estimating the value needed to raise the BOD5 of Chattanooga Creek to the value observed during the study.

With these values for BOD5 and the 0.60 value for K1, the observed dissolved oxygen profile was adequately represented by the model. The data used for model calibration consisted of the samples taken during the period from 27 Feb. to 1 March. In this period the river was at approximately steady state with respect to flow. A plot of predicted and observed dissolved oxygen and BOD5 profiles is shown in figure 2. Also attached is a copy of the calibration run.

SUMMARY

A computer model for Chattanooga Creek has been developed which adequately reproduce an observed dissolved oxygen profile. For additional information concerning access to and use of this model, contact

Monitoring and Data Support Branch
Surviellance and Analysis Division
Region IV, EPA
Athens, Ga. 30601
Attn: Thomas O. Barnwell, Jr.

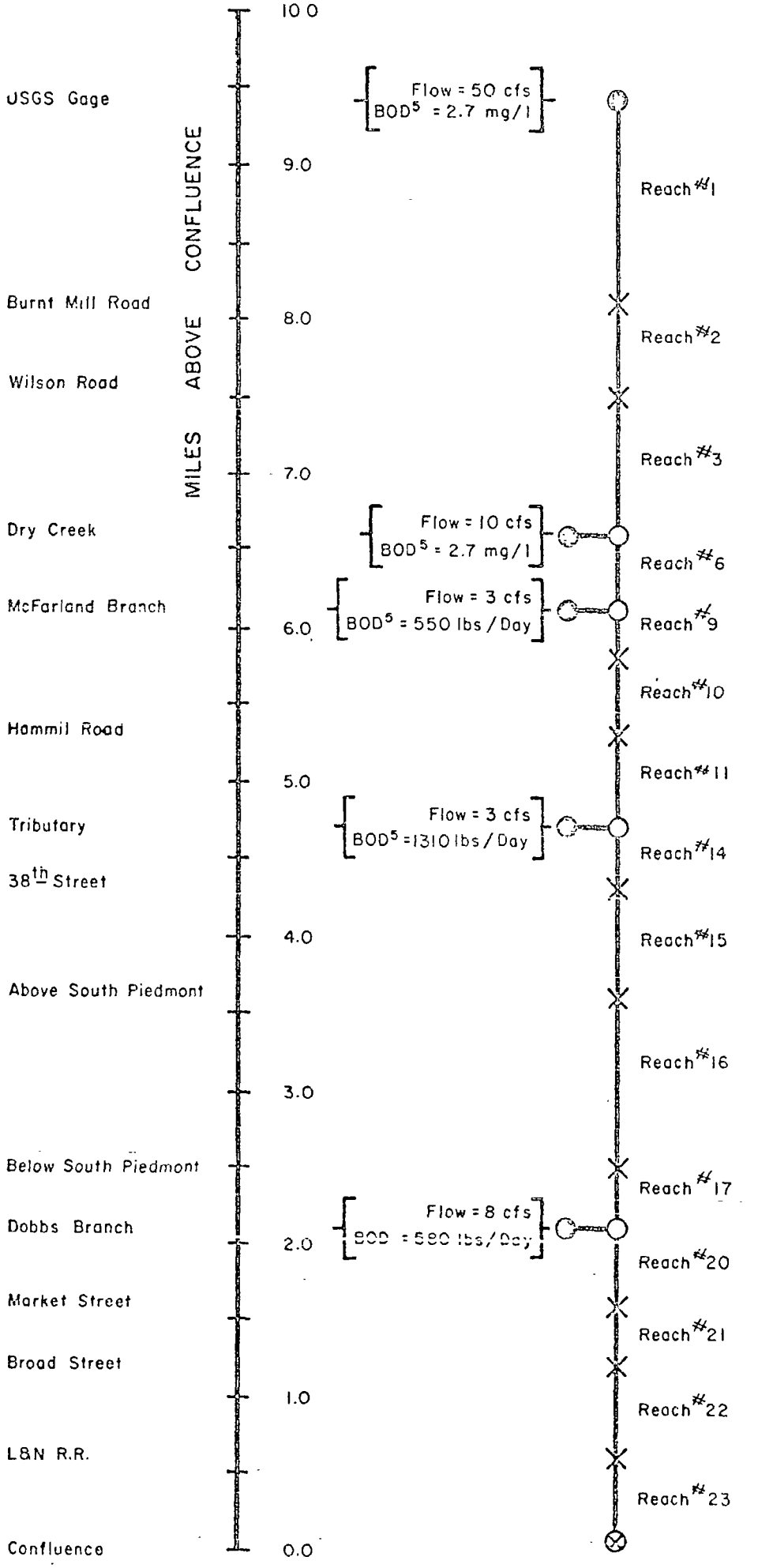
REFERENCES

1. Dosag-I, Program Documentation and User's Manual, Texas Water Development Board, Sept. 1970.

2. Churchill, et. al., The Prediction of Stream Aeration Rates, Journal Sanitary Engineering Division, ASCE, Vol 7, 1962.

3. Langbien and Durum, The Aeration Capacity of Streams, USGS Circular No. 542, U. S Dept. of Interior, Wash., D. C., 1967.

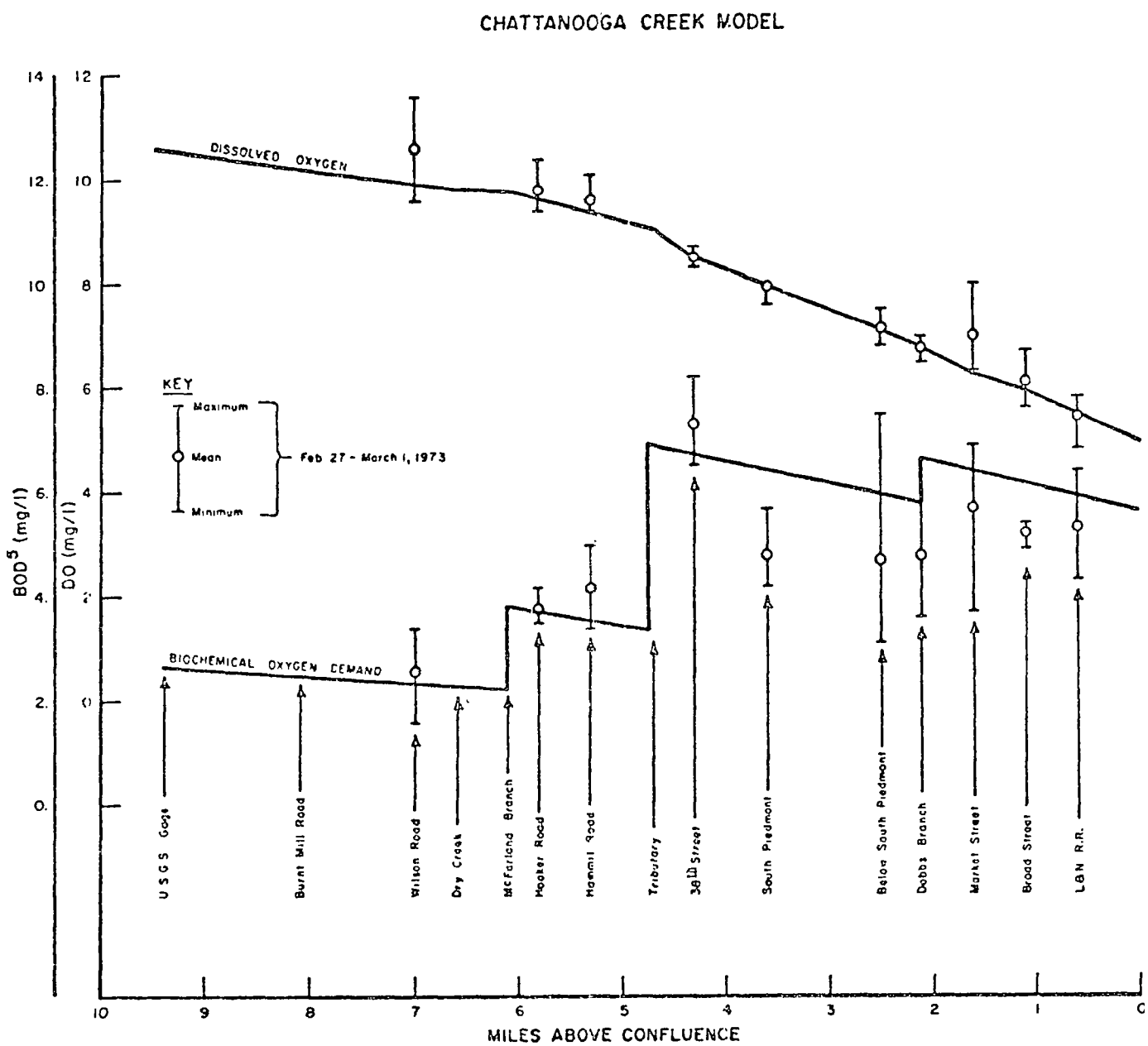
CHATTANOOGA CREEK MODEL SEGMENTATION



KEY

- Headwater
- Junction
- Reach Divider
- End of Model

NOTE Each Tributary Consists o
Dummy Reach and a Reach 0 2 Mi
Long


CHATTANOOGA CREEK MODEL
DISSOLVED OXYGEN
BIOCHEMICAL OXYGEN DEMAND
KEY
Maximum
Mean
Minimum
Feb 27 - March 1, 1973
BOD5 (mg/l)
DO (mg/l)
14
12.
10
8.
6.
4.
2.
0.
12
10
8
6
4
2
0
USGS Gage
Burnt Mill Road
Wilson Road
Dry Creek
McFarland Branch
Hooker Road
Mammil Road
Tributary
38th Street
South Piedmont
Below South Piedmont
Dobbs Branch
Market Street
Broad Street
L&N R.R.
10
9
8
7
6
5
4
3
2
1
0
MILES ABOVE CONFLUENCE

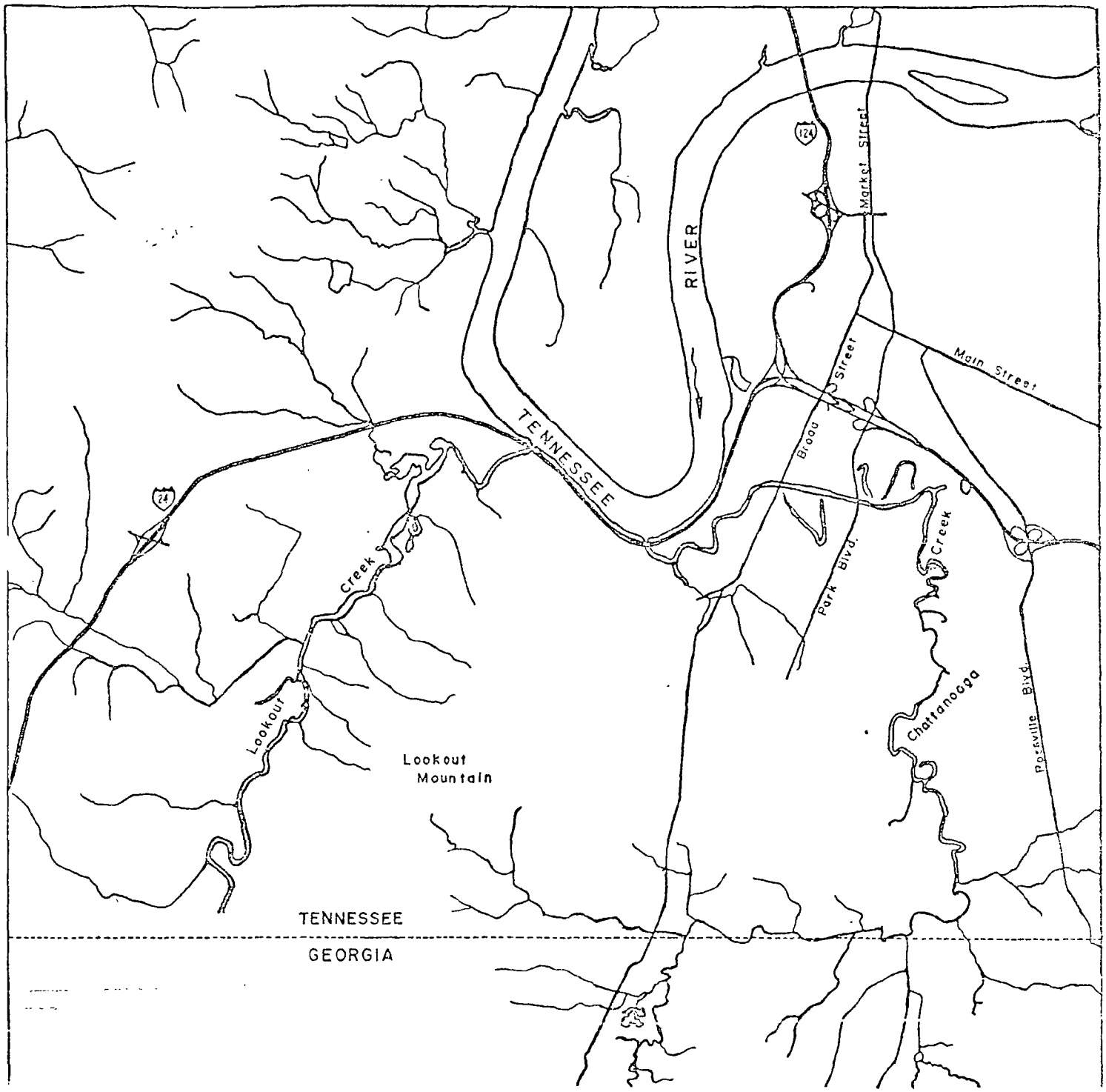


Figure 1 Study Area

(To be improved and included as a fold-out in the back of the final report.)