WATER QUALITY DEMONSTRATION STUDY

HUNTSVILLE SPRING BRANCH
HUNTSVILLE, ALABAMA
1987 AND 1990

SPECIAL SERVICES SECTION
FIELD OPERATIONS DIVISION
ALABAMA DEPARTMENT OF ENVIRONMENTAL MANAGEMENT

WATER QUALITY DEMONSTRATION STUDY
HUNTSVILLE SPRING BRANCH AT HUNTSVILLE, ALABAMA

INTRODUCTION

The City of Huntsville, Alabama utilized Huntsville Spring Branch as a receiving stream for the treated effluent from its municipal wastewater treatment facility. During the period from April 1987 to September 1990, the City of Huntsville underwent construction to upgrade the old disposal plant. Staff members of the Special Studies Section, Field Operations Division of the Alabama Department of Environmental Management (ADEM), at the request of the Municipal Branch of the Water Division of ADEM, conducted a water quality demonstration study to assess the effects of the new treatment facility on Huntsville Spring Branch.

EPA CONSTRUCTION GRANTS PROGRAM

Since 1972, approximately $545 million dollars in EPA grant funds have been expended toward construction of municipal wastewater treatment works in Alabama. The City of Huntsville received an EPA Construction Grant for improvements to the Huntsville Spring Branch WWTP.

While the upgraded facility maintained the existing permitted hydraulic capacity of 30 milliom gallons per day (mgd), the improvements were designed to increase the reliability of the plant during periods of high flows and to insure that the required secondary treatment level was achieved. The total construction cost of the Huntsville Spring Branch facility was approximately $9.9 million. Of this total, the EPA grant funding was approximately $4.4 million. The project engineer was Proctor, Davis, Ray Engineers of Huntsville, and the construction company was T&B Scottsdale Construction of Scottsdale, Georgia. The upgrade of the plant was completed in September 1989.

The new construction included the addition of an aeration basin, one additional primary clarifier, three new final clarifiers, upgraded plant piping and control system, additional covered sludge drying beds, sludge thickeners adn chlorination facilities. Also associated with this work was the construction of a new plant outfall to convey the treated wastewater to the Tennessee River, thereby eliminating the discharge to Huntsville Spring Branch.

The upgrade of the WWTP augmented an existing activated sludge treatment system originally designed to provide 30 mgd of secondary treatment. The upgraded treatment plant was designed to meet a secondary treatment level at a flow of 30 mgd.

In the Huntsville Spring Branch WWTP, a conventional activated sludge treatment system, wastewater first goes to the bar screens and grit removal system for preliminary treatment, then to the primary clarifiers, aeration basins and then to the final clarifiers. After the treated wastewater is chlorinated, it is discharged to the Tennessee River via the new outfall, which was constructed under seperate contract in connection with this project.

NPDES permit limits for the Huntsville Spring Branch WWTP are as follows:

$cBOD_5$	25 mg/L
TSS	30 mg/L

Averge monthly performance by the WWTP for the period from May 1990 to December 1990 was as follows:

Flow	34.367 mgd
$cBOD_5$	12.6 mg/L
TSS	20.4 mg/L

FIELD OPERATIONS

During the period of April to September 1987, staff members of the Special Studies Section collected data to establish conditions and provide a comparative base of information on Huntsville Spring Branch prior to construction and implementation of the new treatment plant. During May to September 1990, data were collected to demonstrate the improvement, if any, of water quality in the receiving stream attributable to the new plant.

SAMPLING LOCATIONS AND METHODOLOGY

Two sampling locations were selected and utilized for data collection during the water quality demonstration study. The station names and locations were as follows:

STATION	LOCATION:
HSB-1 (control)	Huntsville Spring Br. approximately 1-1/4 miles upstream of WWTP at Johnson Road crossing. T4S, R1W, S14, SE1/4, NE1/4, NW1/4. Latitude: 34 41 24.4 Longitude: 086 35 46.9
HSB-2	Huntsville Spring Br. approximately 3/4 mile downstream of WWTP at Martin Road crossing. T4S, R1W, S26, SW1/4, NE1/4, SW1/4. Latitude: 34 39 31.9 Longitude: 086 36 15.9

All physical data, chemical and biological sampling, sample handling techniques, and field parameter analyses utilized in the acquisition of data for this water quality demonstration study were as described in the Field Operations Standard Operating Procedures and Quality Control Assurance Manual (Field Operations Division, ADEM, Volumes 1 and 2), as amended. Chain- of-custody was maintained by locking the samples in a Departmental vehicle when not in sight of a Field Operations employee. The samples requiring laboratory analysis were transported to the ADEM Environmental Laboratory in Montgomery, Alabama. Analysis methodologies were as specified in the Federal Register, 40 CFR Part 136, October 1984, as amended. Analysis of the samples yielded the data which are reported in Tables 1 and 2.

DISCUSSION AND RESULTS

A. PHYSICAL

Huntsville Spring Branch, at the sampling locations, is a fourth order stream that, primarily, drains residential, commercial, and industrial lands. The stream falls within the Interior Plateau Ecoregion and lies within the Tennessee River drainage basin. Due to frequent channelization, Huntsville Spring Branch has very little canopy cover, has shrubs and grasses as the dominant streamside vegetations, and has moderately stable to unstable banks. At HSB-1, bottom structure consists largely of cobble, gravel, and sand

substrates. Flows averaged approximately 30 cubic feet per second (cfs) during low flow conditions. Due to the depth of the stream at HSB-2 (greater than 4 feet), bottom structure is assumed to be similar to that at HSB-1 with siltation and solids build up being evident. As this area comes into the influence of the backwaters to the Tennessee River, flow data was indeterminate. Both sampling locations exhibited signs of erosion to varying degrees and extreme artificial channel alteration. Very few habitats existed for colonization by aquatic macroinvertebrates at both stations. The water below the WWTP discharge, before upgrade, was characterized as slightly turbid with a deep green color and a sewage odor associated. After upgrade, the effluent lines from the WWTP were rerouted directly to the Tennessee River, and subsequent observation indicated that HSB-2 was purging itself of the excess siltation and solids. There was a noticeable reduction in water color and odor.

B. CHEMICAL

The Water Use Classification for Huntsville Spring Branch is Fish and Wildlife (F&W). F&W designates the waters to be suitable for fishing, propagation of fish, aquatic life, and wildlife, and any other usage except for swimming and water contact sports or as a source of water supply for drinking or food processing purposes.

As shown in Table 1, Table 2, and Figure 1, data collected prior to and after the upgrade of the treatment plant indicated that the waters in Huntsville Spring Branch upstream were consistently meeting the dissolved oxygen (D.O.) standard for the F&W classification (5.0 mg/L). It should be noted that afternoon D.O. data were excessively elevated, as compared to morning data. Figure 3 indicates that this may have been attributable to nutrient enrichment occurring upstream and elevated Suspended Solids (TSS), thereby increasing algal productivity. Conductivity and pH data (Figure 2) collected were well within the criteria set by the F&W classification.

Data collected at HSB-2 before the upgrade, indicated that the the Dissolved Oxygen criterion for F&W was met during the day, but was depressed during night time hours (Figure 1). While this trend continued after upgrade, D.O. values averaged 5.0 mg/L as the daily low. It should be noted that, at HSB-2 after the upgrade, D.O. was documented as being in violation of the 5.0 mg/L F&W standard on two occassions. Conductivity and pH values again were within the preferred range (Figure 2). Chemical analysis data (Figure 4) indicated that, after the upgrade, all parameters showed a signifcant decline in concentration, with the exception of Nitrates (NO_3) and TSS.

C. BIOLOGICAL

An assessment of Huntsville Spring Branch water quality would be incomplete without considering impacts to the biological communities. The aquatic macroinvertebrate community was collected using Hester-Dendy artificial substrate samplers to substantiate the physical, and chemical data and to provide an aspect that reflects pollution response over time.

Biological metrics were used to analyze the raw macroinvertebrate data. Table 4 provides simplified interpretations of these metrics and should be referred to in the following discussion.

As demonstrated in Tables 3A through 5 and Figures 5 through 7, macroinvertebrates collected at HSB-1 before and after the upgrade, showed minimal change except for a small increase in Taxa Richness, a minor decline in the generally intolerant Ephemeroptera, Plecoptera and Trichoptera (EPT) taxa and a decline in Equitability (Figures 5 & 7). The Community Structure showed little change with Collector-Gatherers and Predators dominating the community (Figure 6). The Biotic Index, also, remained essentially the same at about 7.5, indicating a moderately pollution tolerant macroinvertebrate community.

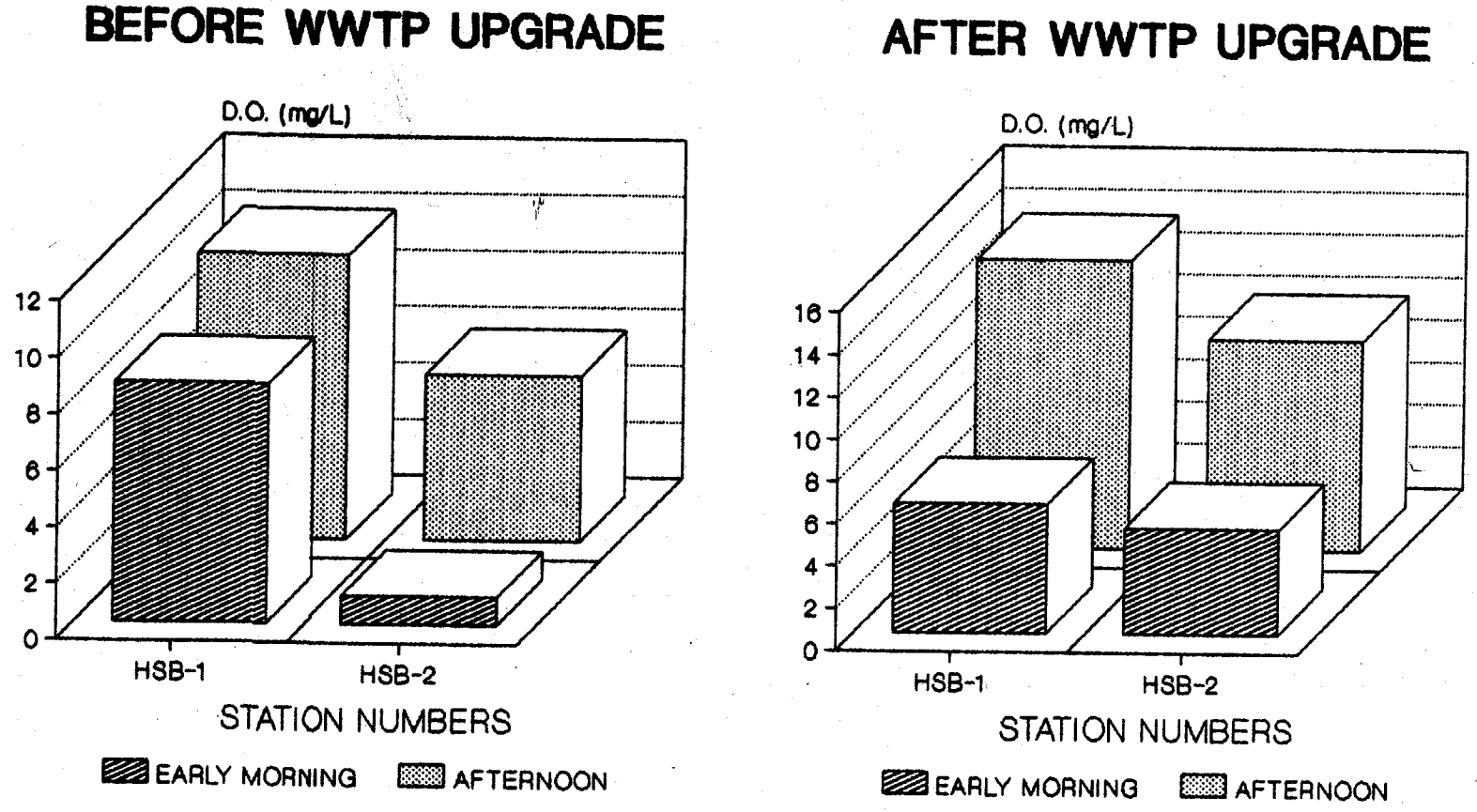
Huntsville Spring Branch below the WWTP discharge (HSB-2), showed a significant improvement upon the removal of the effluent. When compared to data collected at this station before the upgrade, Taxa Richness, EPT taxa, Species Diversity and Equitability showed a definite increase indicating improving water quality (Figures 5 and 7). The Community Structure dramatically shifted from being dominated by Collector-Gatherers to dominance by Predators (Figure 6). In additon, two more feeding groups, not previously collected at this location, were present. The Biotic Index (Figure 5) fell indicating a shift toward a more desireable macroinvertebrate community. As compared to the upstream station (HSB-1), the similarities in the relative abundance of taxa and of functional feeding groups (QSI-TAXA, QSI-FFG) present improved dramatically (Figure 8). Among the Similarity Indices, the Community Loss Index declined indicating a difference in communties. Both Jaccard's and Sorenson's Community Similarity Index also declined (Figure 8). This indicates that the samples are less similar, however, since the Community Loss Index is more sensitive to the recruitment of new taxa at HSB-2, replacement of the lost taxa demonstrates an improvement in water quality.

As shown in Table 5, the biometric indices documented little change in the background station (HSB-1). However, as compared to data collected at HSB-2 before removal of the discharge and as compared to the data collected at the background station, the biometric indices clearly demonstrate an improvement in water quality at the downstream sampling location.

CONCLUSIONS

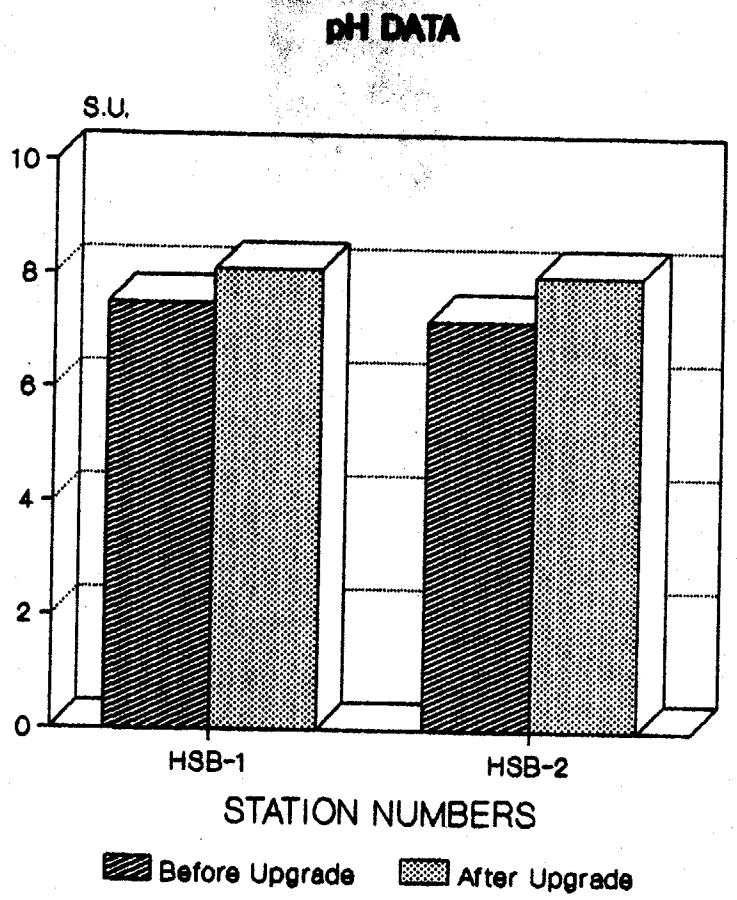
Physical, chemical, and biological data collected before and after the upgrade of the Huntsville Spring Branch wastewater treatment plant indicate that Huntsville Spring Branch has experienced an improvement in its' water quality and appears to be meeting its' Fish and Wildlife Water Use Classification. Nutrient enrichment from other sources in the watershed and channelization practices, however, continue to adversely affect the water quality of this stream.

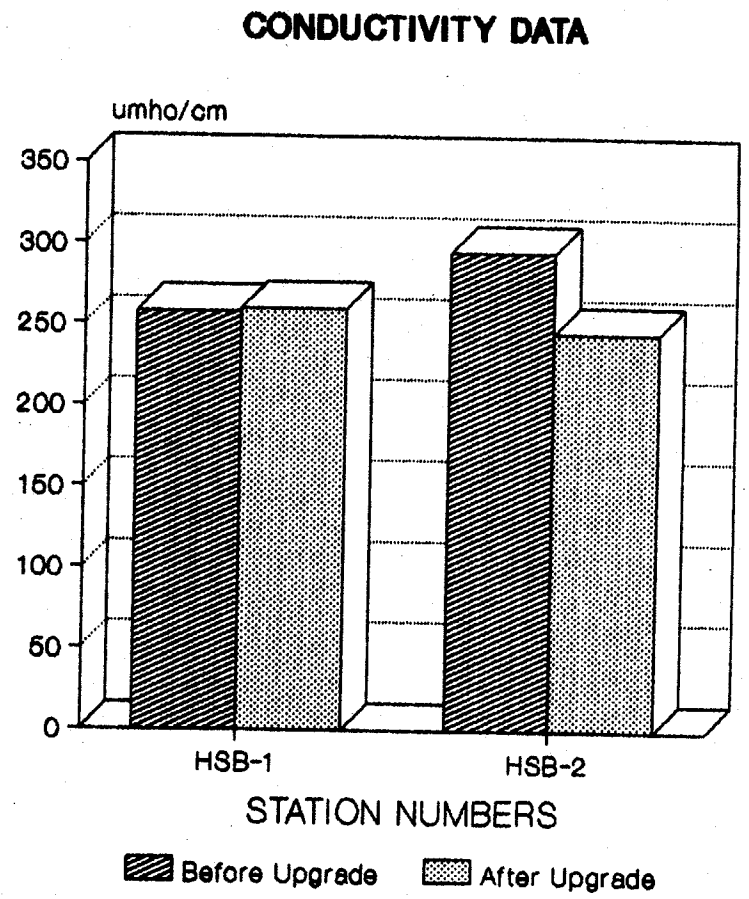
FIGURE 1
HUNTSVILLE SPRING BRANCH
DISSOLVED OXYGEN DATA



THE ABOVE NUMBERS ARE AVERAGES REPRESENTING MULTIPLE SAMPLING EVENTS.

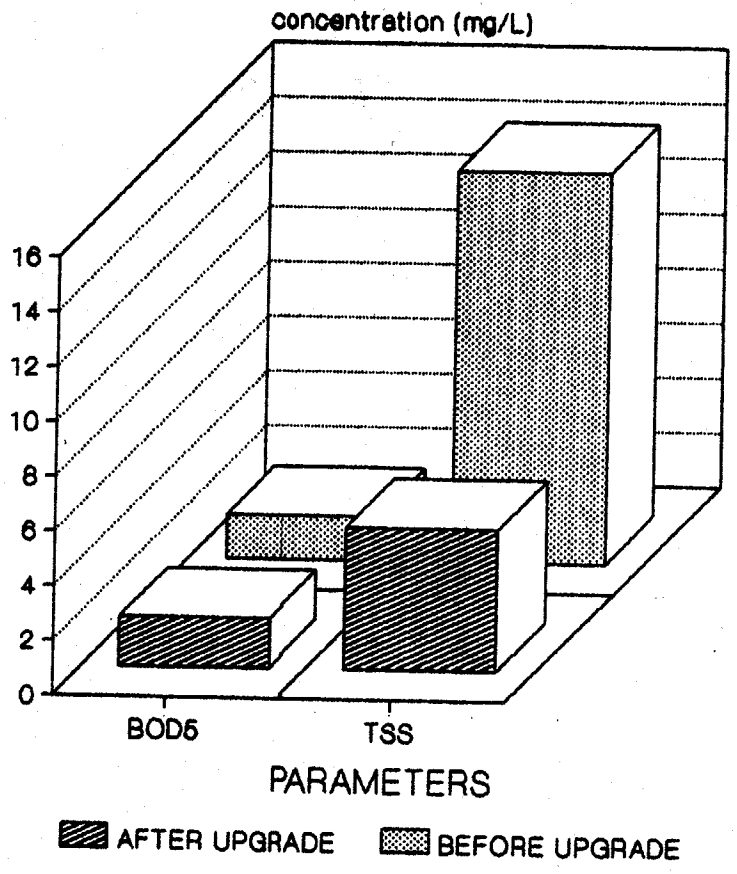
FIGURE 2
HUNTSVILLE SPRING BRANCH

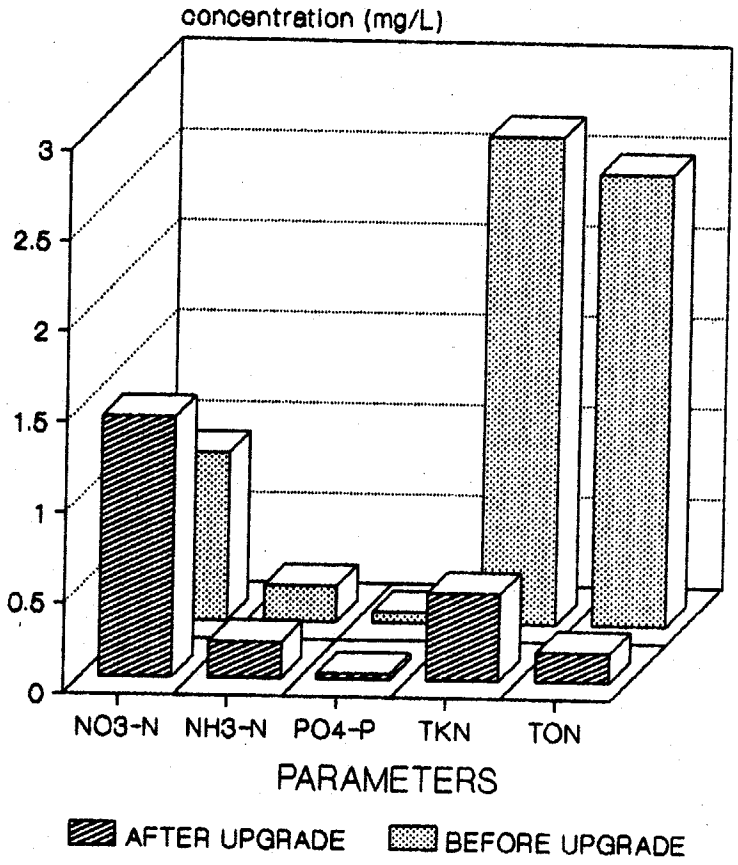




THE ABOVE NUMBERS ARE AVERAGES REPRESENTING MULTIPLE SAMPLING EVENTS.

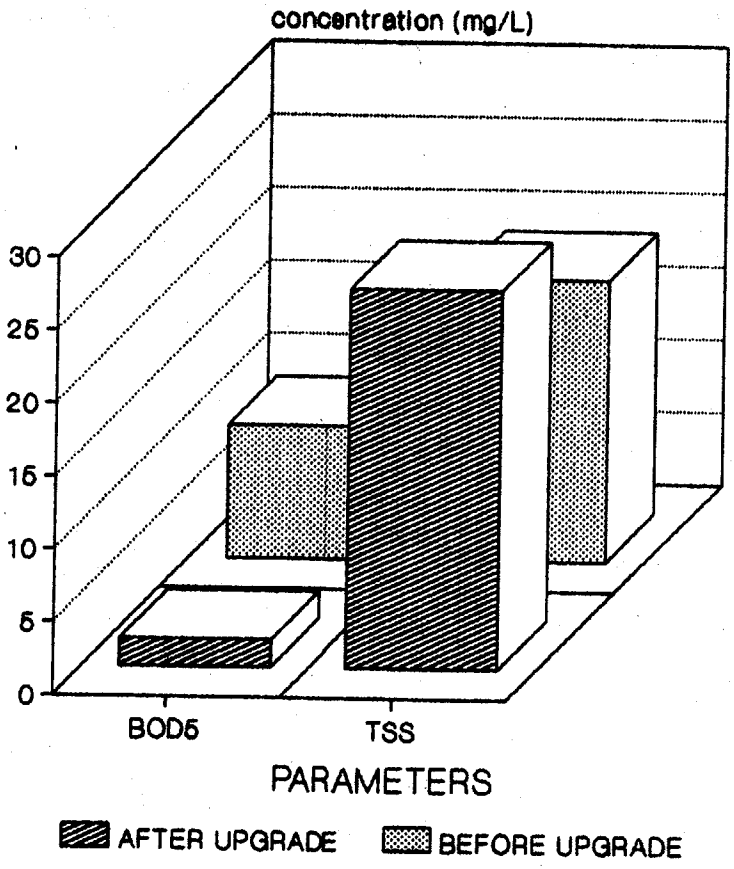
FIGURE 3
HUNTSVILLE SPRING BRANCH (HSB-1)
CHEMICAL ANALYSIS DATA

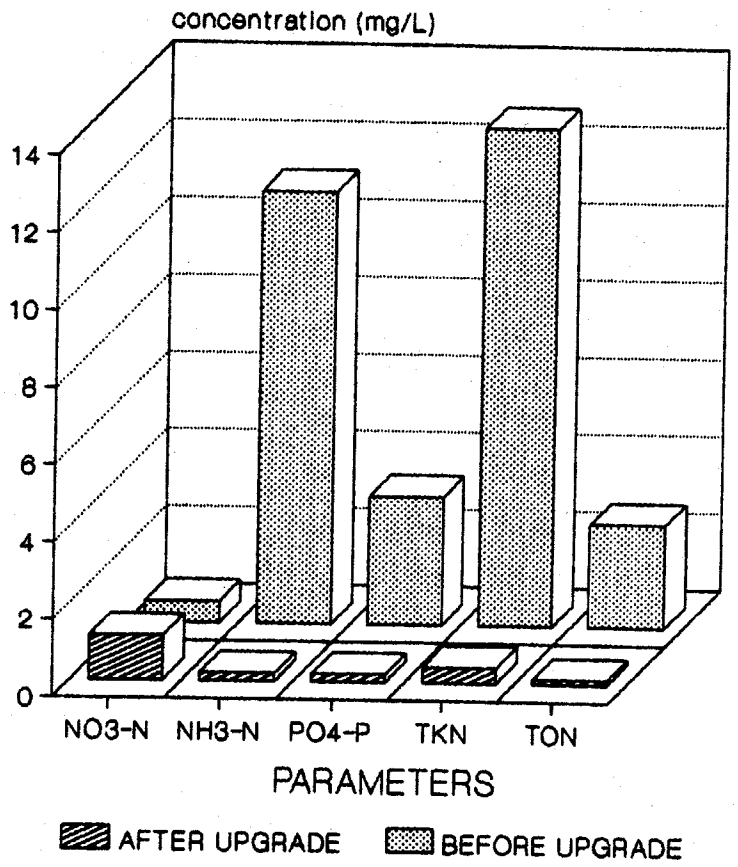




THE ABOVE NUMBERS ARE AVERAGES REPRESENTING MULTIPLE SAMPLING EVENTS

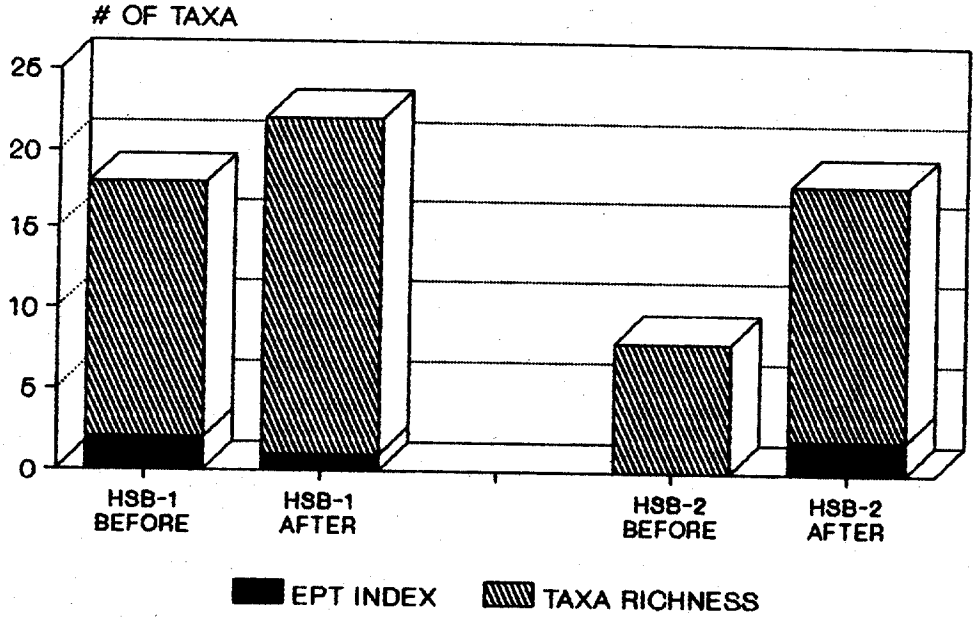
FIGURE 4
HUNTSVILLE SPRING BRANCH (HSB-2)
CHEMICAL ANALYSIS DATA

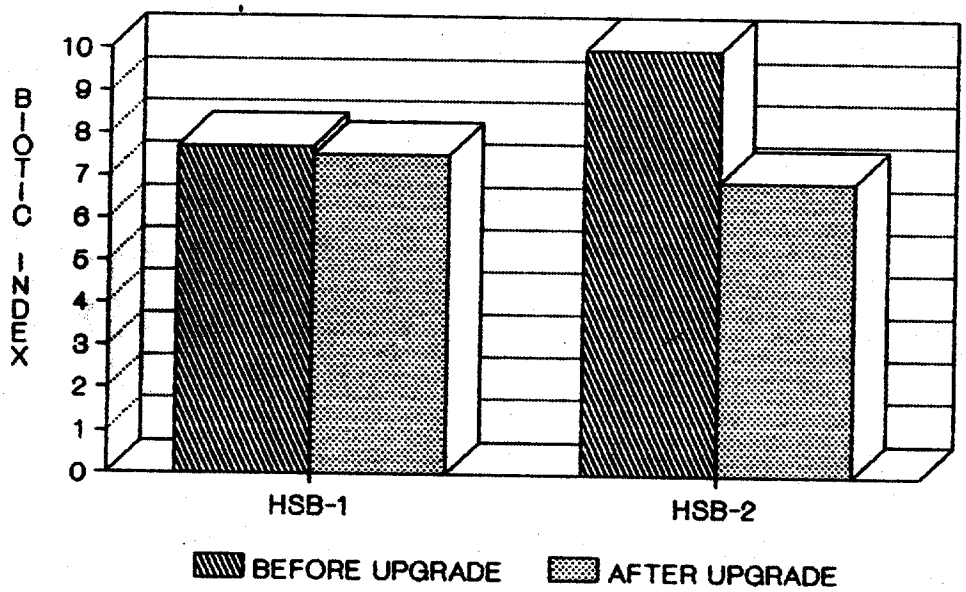


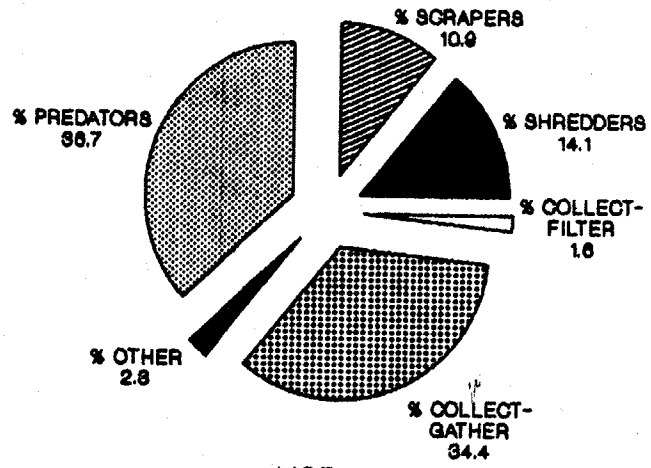


THE ABOVE NUMBERS ARE AVERAGES REPRESENTING MULTIPLE SAMPLING EVENTS

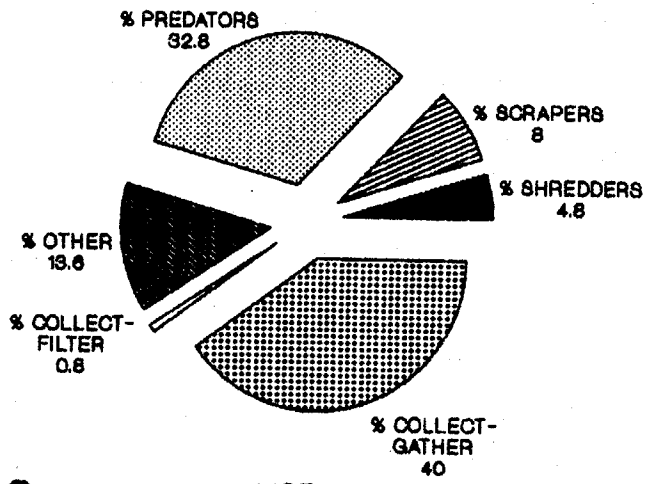
FIGURE 5
BIOMETRIC INDICES





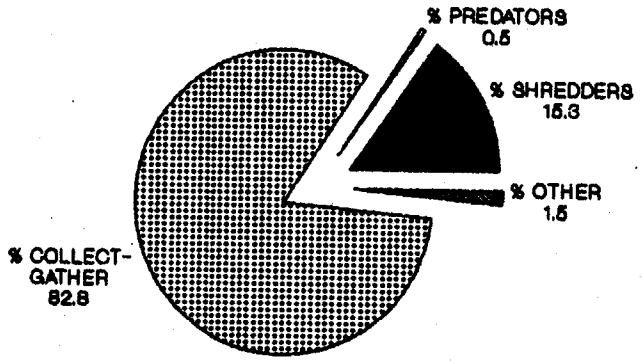


HSB-1
BEFORE UPGRADE

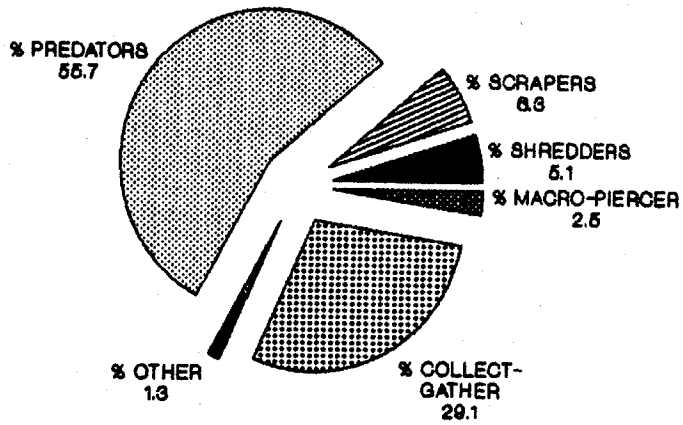


HSB-1
AFTER UPGRADE

FIGURE 6
COMMUNITY STRUCTURE
HUNTSVILLE SPRING BRANCH



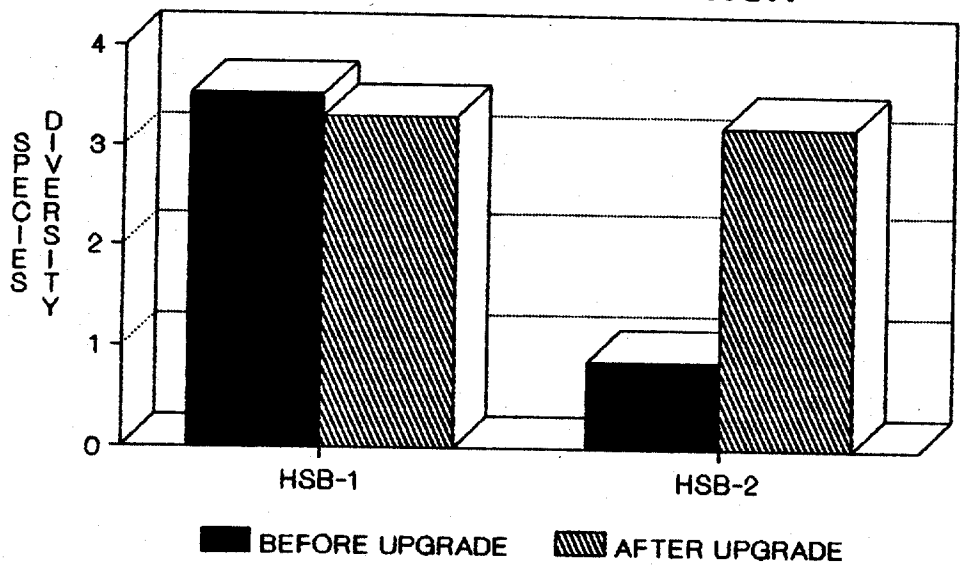
HSB-2
BEFORE UPGRADE



HSB-2
AFTER UPGRADE

% OTHER ARE ORGANISMS WITHOUT FUNCTIONAL FEEDING GROUP DESIGNATION.

FIGURE 7
BIOMETRIC INDICES
HUNTSVILLE SPRING BRANCH



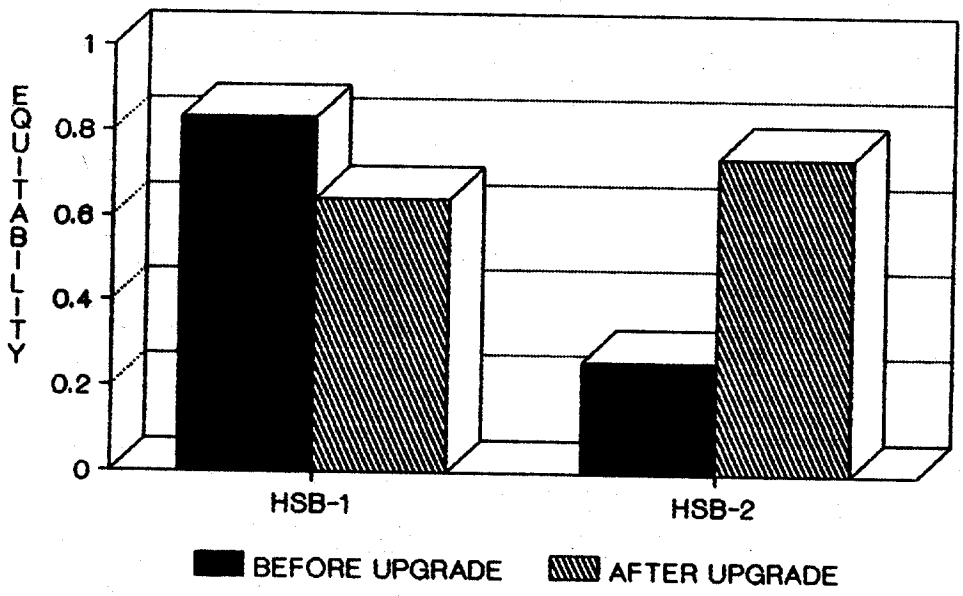
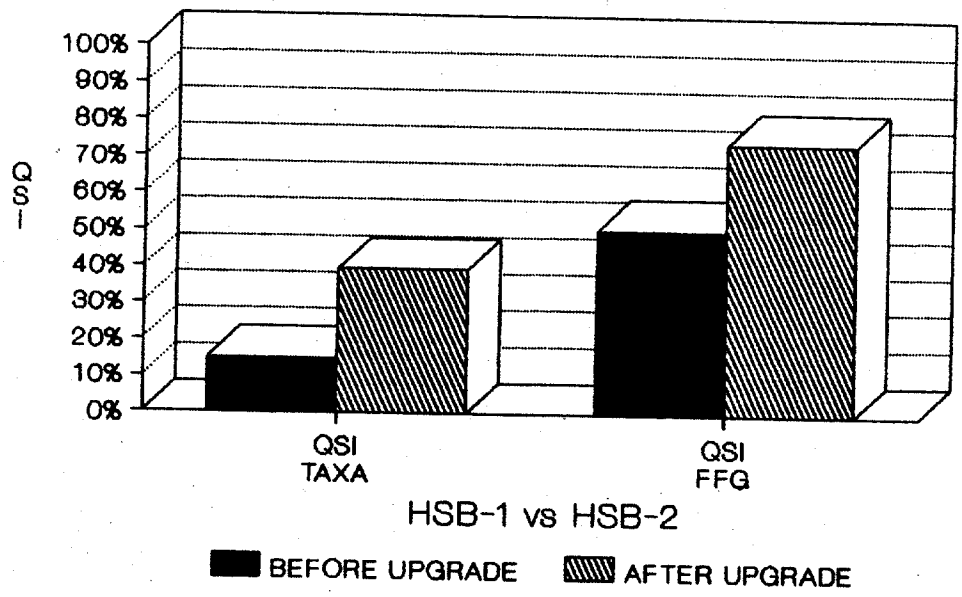


FIGURE 8



BIOMETRIC INDICES
HUNTSVILLE SPRING BRANCH

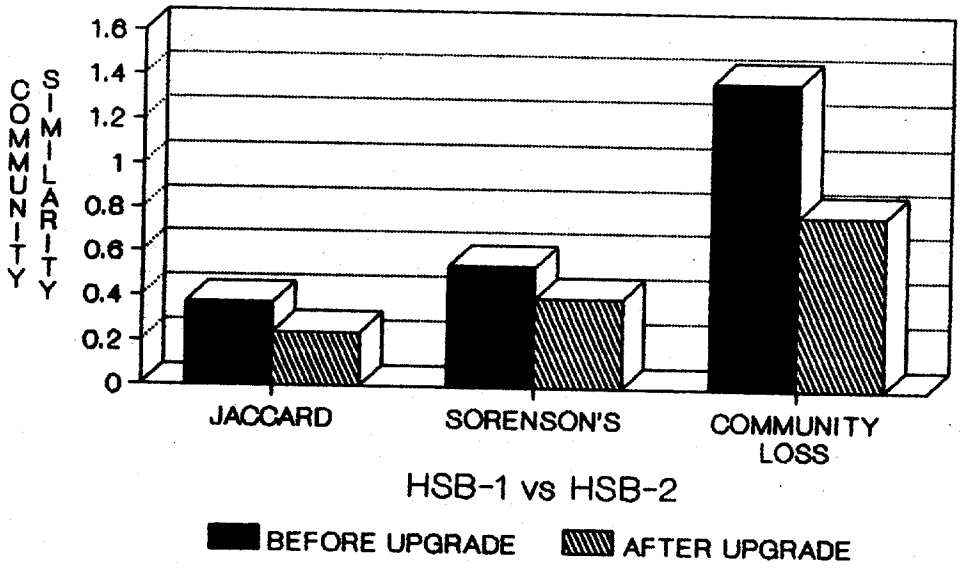


TABLE 1

WATER QUALITY DEMONSTRATION STUDY
HUNTSVILLE SPRING BRANCH AT HUNTSVILLE, ALABAMA
DATA COLLECTED PRIOR TO UPGRADE OF WWTP

DATE	LOCATION	TIME	AIR TEMP	WATER TEMP	A.M. DO	P.M. DO	pH	SPECIFIC COND	BOD 5	TSS	NO -N 3	NH -N 3	TKN	TON	PO -P 4	FLOW	BACTERI
04/29/87	HSB-1	15:47	28.5	25		11.5	7.9	----	1.8	15	1.32	0.2	3.4	3.2	<0.02		
05/20/87		15:05	33	32.5		10.1	7.9	----	1.2	13	1.12	0.3	1.6	1.3	0.04		<1
05/21/87		08:50	26.5	25	8.5		7.4	----									
06/24/87		14:12	30.5	32		8.4	7.7	----	0.9	2	0.62	0.3	2.2	1.9	<0.02		
07/22/87		14:10	24.5	30.5		10.3	7.1	279	1.4	3	0.92	0.1	2.4	2.3	0.09		
07/23/87		07:45	25	24.5	6.4		7.1	270	2.3	5	0.86	0.2	2.2	2	0.15		81
08/31/87		11:25	31	25	9.7		7.7	249	2.5	59	0.86	<0.2	4.2	4.2	0.06		
09/01/87		08:35	27	21	9.5		7.4	235	1.4	3	0.8	0.2	3.1	2.9	0.06		54
AVERAGE			28.3	26.9	8.5	10.1	7.5	258	1.6	14.3	0.93	----	2.7	2.5	----		----
04/29/87	HSB-2	15:15	27.5	25.5		8.8	7.3	----	3	26	1.74	7.3	8.2	0.9	1.75		
05/20/87		15:35	31	30.5		4.9	7.5	----	10.4	20	0.47	10.3	13.2	2.9	1.65		<2
05/21/87		08:35	26	24	1.8		6.9	----									
06/24/87		14:29	30	32		6.4	7.3	----	5.8	24	0.62	8.7	14.4	5.7	1.39		
07/22/87		15:00	31.5	30.5		6.7	7.2	560	8.1	10	0.6	11.2	15.2	4	3.2		
07/23/87		07:20	27	25	0.7		6.9	500	10	13	0.18	12.1	12.6	0.5	6.4		6567
08/31/87		12:05	30	28		2.9	7.3	700	14	32	0.12	15	16.2	1.2	3.6		
09/01/87		08:55	25	24	0.6		7.2	620	12.5	10	0.16	13.8	10.6	<2	5.3		>20000
AVERAGE			28.5 C	27.4 C	1.0 mg/L	5.9 mg/L	7.2 SU	595 umho/cm	9.1 mg/L	19.3 mg/L	0.56 mg/L	11.2 mg/L	12.9 mg/L	---- mg/L	3.33 mg/L	cfs	---- org/100 ml

TABLE 2

WATER QUALITY DEMONSTRATION STUDY
HUNTSVILLE SPRING BRANCH AT HUNTSVILLE, ALABAMA
DATA COLLECTED AFTER UPGRADE OF WWTP

DATE	LOCATION	TIME	AIR TEMP	WATER TEMP	A.M. DO	P.M. DO	pH	SPECIFIC COND	BOD 5	TSS	NO -N 3	NH -N 3	TKN	TON	PO -P 4	FLOW	BACTERI
05/15/90	HSB-1	15:00	27	28		14.5	8.3	250	1.6	1	1.38	<0.20	<0.40	0	<0.02	44.52	----
05/16/90		06:00	21	20	7.1		8.1	290	0.8	2	1.78	<0.20	<0.40	0	<0.02		>850
07/24/90		06:14	20	22	5.7		7.7	280	0.8	<1	1.38	<0.20	<0.40	0	0.04	28.05	----
07/25/90		06:13	19	22	5.6		7.8	270	0.8	2	1.46	<0.20	<0.40	0	<0.02		667
09/12/90		14:45	30.5	30		12.8	8.7	210	4.9	20	1.18	<0.20	0.8	0.8	0.05	16.22	----
AVERAGE			23.5	24.4	6.1	13.7	8.1	260	1.8	---	1.44	-----	----	0.16	----	29.60	----
05/15/90	HSB-2	14:45	25	28		10.7	8	290	1.4	15	1.46	<0.20	<0.40	0	<0.02	---	----
05/16/90		06:15	21	20	5.9		8.1	265	1	51	1.48	<0.20	<0.40	0	<0.02	---	143
07/24/90		06:00	20	23	4.7		7.6	240	1	5	0.81	<0.20	<0.40	0	0.04	---	----
07/25/90		05:55	19	22	4.5		7.7	245	1	22	1.03	<0.20	0.6	0.6	<0.02	---	90
09/12/90		13:40	30.5	28.5		9.2	8.5	185	5.2	36	0.97	<0.20	<0.40	0	0.05	---	----
AVERAGE			23.1 C	24.3 C	5.0 mg/L	10.0 mg/L	8.0 SU	245 umho/cm	1.9 mg/L	26 mg/L	1.15 mg/L	---- mg/L	---- mg/L	0.12 mg/L	---- mg/L	--- cfs	117 org/100 ml

TABLE 3A
MACROINVERTEBRATE
DATA SUMMARY SHEET

Waterbody Name: Huntsville Spring Branch Aq. Ecoregion: 71
Location/ City: Huntsville County: Madison State: AL
Investigators: Bertolotti, Diggs Date: 08-31-87

Habitat Assess.	---	---
Station Number	HSB-1	HSB-2
Total No. Org.	80	1458
Taxa Richness	18	8
EPT Index	2	0
Biotic Index	7.7	10.0
% Dom. Taxa	31.3%	83.1%
Dominant Taxa	Dicrotendipes	Chironomus
Tol. Value of Dom. Taxa	8	10
% Shredders	14.1%	15.3%
% Scrapers	10.9%	0%
% Predators	36.7%	0.5%
% Collect-Gath.	34.4%	82.8%
% Collect-Fil.	1.6%	0%
% Macro-Piercer	0%	0%
% Other	2.3%	1.5%
Scrap/Scrap+C-F	---	---
Shredder/Total	---	---
EPT/EPT+Chiro.	0.04	0
Hydrop/Trichop	0	0
S.W. Diversity	3.53	0.86
Equitability	0.83	0.26

	HSB-1 vs HSB-2
IAI	0.41
DIC (>5%)	2
QSI-Taxa	15%
QSI-FFG	50.4%
Comm. Loss Index	1.38
Jaccard Comm. Sim.	0.37
Sorenson's CSI	0.54

TABLE 3B
MACROINVERTEBRATE
DATA SUMMARY SHEET

Waterbody Name: Huntsville Spring Branch
Location/ City: Huntsville County: Madison
Investigators: Bauer, Leslie Date: 09-12-90

Aq. Ecoregion: 71
State: AL

Habitat Assess.	---	---
Station Number	HSB-1	HSB-2
Total No. Org.	125	79
Taxa Richness	22	18
EPT Index	1	2
Biotic Index	7.5	6.9
% Dom. Taxa	38%	33%
Dominant Taxa	Dicrotendipes	Ablabesmyia
Tol. Value of Dom. Taxa	10	8
% Shredders	4.8%	5.1%
% Scrapers	8.0%	6.3%
% Predators	32.8%	55.7%
% Collect-Gath.	40.0%	29.1%
% Collect-Fil.	0.8%	0%
% Macro-Piercer	0%	2.5%
% Other	13.6%	1.3%
Scrap/Scrap+C-F	---	---
Shredder/Total	---	---
EPT/EPT+Chiro.	0.02	0.07
Hydrop/Trichop	0	0
S.W. Diversity	3.31	3.22
Equitability	0.64	0.74

	HSB-1 vs HSB-2
IAI	2.44
DIC (>5%)	3
QSI-Taxa	39.5%
QSI-FFG	74.3%
Comm. Loss Index	0.78
Jaccard Comm. Sim.	0.24
Sorenson's CSI	0.40

TABLE 4
BIOMETRIC INTERPRETATION

METRIC	RANGE	INTERPRETATION
HABITAT ASSESSMENT	104-135	EXCELLENT
	71-103	GOOD
	35-70	FAIR
	0-34	POOR
a). TAXA RICHNESS b). EPT INDEX c). SHANNON-WEAVER SPECIES DIVERSITY d). EQUITABILITY		GENERALLY INCREASES WITH INCREASING WATER QUALITY.
a). BIOTIC INDEX b). % DOMINANT TAXA c). TOLERANCE VALUE OF DOM TAXA		GENERALLY INCREASES WITH DECREASING WATER QUALITY.
a). % SHREDDERS b). % SCRAPERS c). % PREDATORS d). % COLLECTOR-GATHERERS e). % COLLECTOR-FILTERERS f). % MACROPHYTE PIERCERS g). % OTHERS		PERCENTAGES AND COMPOSITION SHOULD BE SIMILAR TO BACKGROUND STATION FOR SIMILAR STREAM SIZES AND HABITAT COMPOSITION.
a). SCRAPERS/SCRAPERS+C-F b). SHREDDERS/TOTAL c). HYDROPTILIDAE/TRICHOPTERA		NO SIGNIFICANT CHANGE AS COMPARED TO BACKGROUND.
a). EPT/EPT+CHIRONOMIDAE		GENERALLY INCREASING WATER QUALITY AS APPROACHES 1.0.
SIMILARITY INDICES		
a). INDICATOR ASSEMBLAGE INDEX (IAI) b). JACCARD COMMUNITY SIMILARITY c). SORENSON'S CSI		INCREASING SIMILARITY AS APPROACHES 1.0.
a). DOMINANTS IN COMMON b). QUANTITATIVE SIMILARITY INDEX (QSI)-TAXA c). QSI-FUNCTIONAL FEEDING GROUP (FFG)		GENERALLY INCREASING WITH INCREASING SIMILARITY.
a). COMMUNITY LOSS INDEX		GENERALLY INCREASING WITH INCREASING DISSIMILARITY.

TABLE 5
MACROINVERTEBRATE
METRIC SUMMARY SHEET

Waterbody Name: Huntsville Spring Branch Aq. Ecoregion: 71
Location/ City: Huntsville County: Madison State: AL
Investigators: Bertolotti, Diggs Date: Before 08-23-90
Bauer Leslie After 09-12-90

+....improvement
0....no change
-....deterioration
*....see comments below

Habitat Assess.	*	*
Station Number	HSB-1	HSB-2
Taxa Richness	+	+
EPT Index	-	+
Biotic Index	0	+
% Dom. Taxa	0	+
Tol. Value of Dom. Taxa	0	+
Scrap/Scrap+C-F	*	*
Shredder/Total	*	*
EPT/EPT+Chiro.	0	+
Hydrop/Trichop	0	0
S.W. Diversity	0	+
Equitability	-	+

Station Comparisons	HSB-1 vs HSB-2
IAI	-
DIC	+
QSI-Taxa	+
QSI-FFG	+
Comm. Loss Index	+
Jaccard Comm. Sim.	-
Sorenson's CSI	-

* - Habitat Assessments were not performed during this WQDS.
- Scrapers/ Scrapers+C-F is evaluated on Riffle communities ONLY.
- Shredders/ Total is evaluated on CPOM communities ONLY.

TAXA LIST

HUNTSVILLE SPRING BRANCH
MACROINVERTEBRATE DATA

MACROINVERTEBRATE	HSB-1 BEFORE	HSB-2 BEFORE	HSB-1 AFTER	HSB-2 AFTER
ANNELIDA				
HIRUDINEA				
Placobdella		3		
OLIGOCHAETA	2	21	11	1
INSECTA				
COLEOPTERA				
Berosus				2
Enochrus			1	
DIPTERA				
Atrichpogon				1
Bezzia			1	
Culex			1	
Culicoides	1			
CHIRONOMIDAE				
Ablabesmyia	15	3	14	26
Chironomus	1	1192		
Cricotopus				1
Cryptochironomus			2	
Dicrotendipes	25	2	48	12
Endochironomus	1			
Glyptotendipes	9	221	2	1
Goeldichironomus	1	15		
Labrundinia				1
Larsia			1	1
Nanocladius			1	
Parachironomus			5	
Phaenopsectra				5
Polypedilum	1	1	4	2
Procladius	1			
Stenochironomus				1
Tanytarsus	1			
Thienemannimyia Grp	7		8	12
Tribelos				4
CHIRONOMIDAE UNID			1	
CHIRONOMIDAE UNID DIF			1	
EPHEMEROPTERA				
Baetis	1			2
Caenis				3
Stenacron	1			
ODONATA				
Amphiagrion			6	
Chromagrion	3		1	3
Erythemis				1
Lestes	2			
Pachydiplax			1	
TRICHOPTERA				
Cyrnellus			2	

TAXA LIST

HUNTSVILLE SPRING BRANCH
MACROINVERTEBRATE DATA

MACROINVERTEBRATE	HSB-1 BEFORE	HSB-2 BEFORE	HSB-1 AFTER	HSB-2 AFTER
MOLLUSCA				
GASTROPODA				
Elimia	2		5	
Ferrissia	6			
Physella			4	
Somatogyrus			1	
MISCELLANEOUS				
Planaria			4	