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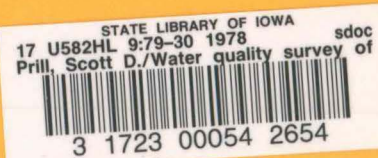
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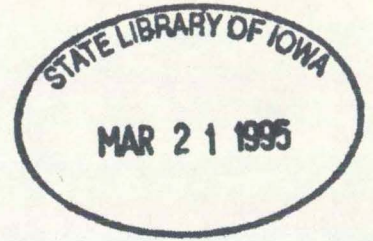
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IOWA CITY, IOWA 52242





Water Quality Survey of the
Timber Creek Basin
#79-30

Prepared for the Iowa Department of Environmental Quality by the University of Iowa, Hygienic Laboratory.

The publication of this report was financially aided through a contract between the Iowa Department of Environmental Quality and University of Iowa Hygienic Laboratory utilizing funds made available to the Iowa Department of Environmental Quality by the United States Environmental Protection Agency.

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ABSTRACT

A summer water quality survey of the Timber Creek Basin was conducted by University Hygienic Laboratory personnel on August 29 and 30, 1978. The purpose of this study was to obtain water quality information from a previously unstudied basin. A flow value determined on Timber Creek near its mouth indicated a discharge of 22 cfs, which was within the range of normal summer stream flows. Prior to the survey, rainfall totalling over two inches fell in the basin during a three day period (August 26-28). Although the major portion of the rainfall event took place before the survey, some runoff was still occurring during the sampling. The residual effect of the runoff was reflected in the bacteriological and chemical analyses which indicated elevated concentrations of most water quality parameters, especially fecal coliform concentrations. One station in the upper reaches of the basin had better water quality than found elsewhere in the basin indicating the stream was returning to ambient summer conditions. Dissolved oxygen concentrations throughout the Timber Creek Basin were considered adequate to support aquatic life. The municipalities in the Timber Creek Basin had no discernable impact on the water quality at the stream flows encountered during this survey.

INTRODUCTION

Timber Creek Basin is a relatively small watershed with a drainage area of approximately 124 square miles (1), located entirely in Marshall County (see Figure 1). The merging of North Timber and Middle Timber Creeks, south of Marshalltown, forms Timber Creek which flows in a north-easterly direction to its junction with the Iowa River. Only one major tributary, South Timber Creek, discharges into Timber Creek. The entire reach of Timber Creek, and South Timber Creek from its confluence with Timber Creek to the junction with Brush Creek, have been designated as class B warmwater streams (2).

The terrain of the drainage basin is moderately hilly. Most of the land is used primarily for pasture, with some production of row crops. There is no large point source discharge in the Timber Creek Basin, although four small municipalities (State Center, Haverhill, Gilman and Ferguson) are located within the watershed. Information regarding the existing wastewater treatment facilities in the basin, as well as the municipalities current status in the construction grants program is presented in Table 1.

This survey was conducted by University Hygienic Laboratory personnel on August 29 and 30, 1978, in order to obtain water quality data on a basin that had not previously been studied. Table 2 lists the sampling locations utilized during the present survey of the Timber Creek Basin.

A stream flow of 22 cubic feet per second (cfs) was measured by laboratory personnel at station 9 on August 30, 1978, and was approximately 170 times greater than the seven-day, ten year low flow ($7Q_{10}$) of 0.13 cfs (4). Although the stream flow was much greater than the $7Q_{10}$, it appeared to be within the average range for summer conditions (4). Rainfall occurred in the basin prior to the survey and as indicated in Table 3, affected the flow in the creek.

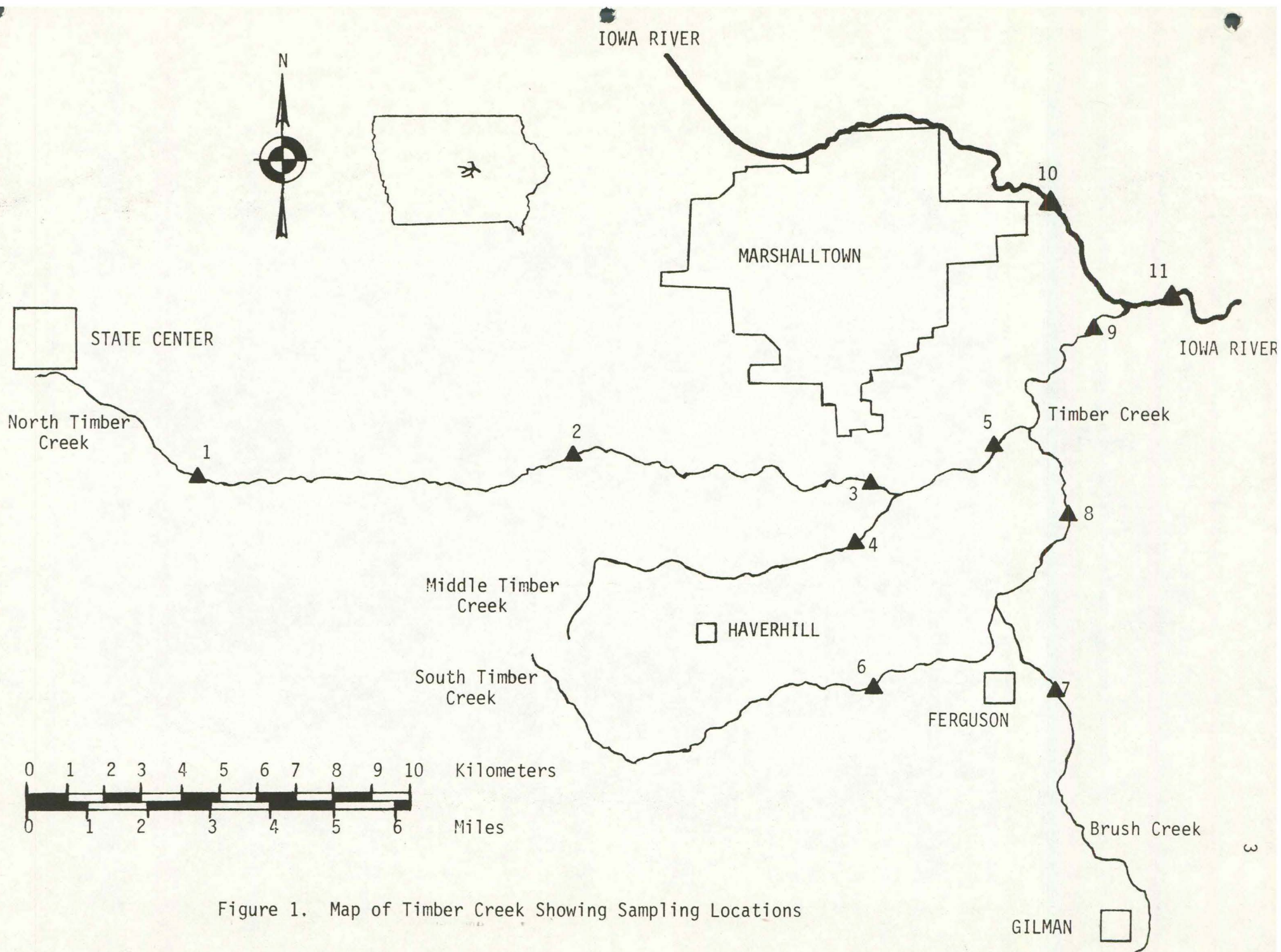


Figure 1. Map of Timber Creek Showing Sampling Locations

TABLE 1
TIMBER CREEK BASIN WASTEWATER TREATMENT FACILITIES

<u>Municipality</u>	<u>Population</u> ⁺	<u>Wastewater Plant Type</u> ⁺	<u>Flow (mgd) Average/Design</u> ⁺	<u>Construction Grants Program</u> *	<u>Receiving Stream</u>
State Center**	1,232	Trickling Filter	0.162/0.171	Step 1 Grant, Reserve Funding, Doing I/I	North Timber Creek
Haverhill	160	NEMTF	--	Step 1 Grant, Reserve Funding, have submitted facility plans	--
Gilman	513	Lagoon	0.033/0.058	Not in construction grants program	Brush Creek
Ferguson	203	NEMTF	--	Step 1 Grant, Reserve Funding, have submitted facility plans	--

+ (3)

* Data obtained from the Iowa Department of Environmental Quality

** Effluent sampled during the survey

I/I Inflow and infiltration

NEMFT - No existing municipal treatment facility

TABLE 2
 Timber Creek Sampling Locations
 August 29-30, 1978

<u>Station</u>	<u>Location</u>
WWTP effluent	State Center, Iowa
1. North Timber Creek	Marshall County Road Bridge, T83N, R19W, Sec. 19/24
2. North Timber Creek	Marshall County Road S75 Bridge, T83N, R18W, Sec. 19/24
3. North Timber Creek	Marshall Co. Rd. Br., T83N, R18W, Sec. 24/23
4. Middle Timber Creek	Marshall Co. Rd. Br., T83N, R18W, Sec. 26
5. Timber Creek	Marshall Co. Rd. Br., T83N, R17W, Sec. 17/18
6. South Timber Creek	Marshall Co. Rd. Br., T82N, R18W, Sec. 1/2
7. Brush Creek	Marshall Co. Rd. E63 Br., T82N, R17W Sec. 5/8
8. South Timber Creek	Marshall Co. Rd. Br., T83N, R17W, Sec. 21/28
9. Timber Creek	Marshall Co. Rd. Br., T83N, R17W, Sec. 4/9
10. Iowa River	Marshall Co. Rd. Br., E35 Br., T84N, R17W, Sec. 29
11. Iowa River	Marshall Co. Rd. Br., T83N, R17W, Sec. 3

TABLE 3
 PRECIPITATION AND FLOW VOLUME IN TIMBER CREEK¹
 August 25-30, 1978

<u>Date</u>	<u>Total Rainfall (inches)²</u>	<u>Average Daily Discharge (cfs)³</u>
August 25	Trace	22
August 26	0.22	28
August 27	1.69	61
August 28	0.12	34
August 29	--	26
August 30	--	23

1. Data obtained from Ivan Burmeister, U.S. Geological Survey
2. Measured at Marshalltown
3. Determined at U.S.G.S. gage near Station 9

As shown in Table 3, the major portion of the rainfall event and subsequent higher stream flows took place prior to the survey. The residual effects of the high flows affected the water quality found during the survey.

SAMPLING AND ANALYTICAL METHODOLOGY

Procedures used in sample collection, preservation and analysis are described in Standard Methods, 14th Edition (5) and Methods for Chemical Analysis for Water and Wastes (6). Grab samples were obtained using a high density polyethylene sampling bucket and a weighted stainless steel dissolved oxygen sampler. Stream flow measurements were conducted using the U.S. Geological Survey method of computing cross sectional area (7). The Price type AA current meter and top-setting wading rod were used to measure velocity and depth.

RESULTS AND DISCUSSION

Nine sampling stations were located in the Timber Creek Basin and selected water quality data at each station are presented in Table 4. All data may be found in the Appendix.

TABLE 4

SELECTED WATER QUALITY DATA FOR TIMBER CREEK AND TRIBUTARIES
(All values in mg/l unless designated otherwise)

<u>Station</u>	<u>Date Sampled</u>	<u>Fecal Coliforms per 100 ml</u>	<u>Organic</u>	<u>Nitrogen Ammonia</u>	<u>Nitrate</u>	<u>Turbidity JTU</u>	<u>DO</u>	<u>BOD</u>	<u>TOC</u>	<u>Chloride</u>
) North Timber Creek	8-30-78	610	0.24	0.01	12.0	2.6	10.9	<1	9	25
) North Timber Creek	8-30-78	11,000	0.99	0.03	8.1	55	9.1	2	10	28
) North Timber Creek	8-29-78	24,000	0.89	0.08	6.1	32	9.8	3	12	24
) Middle Timber Creek	8-29-78	12,000	1.00	0.06	6.4	29	10.9	2	9	20
) Timber Creek	8-29-78	14,000	0.80	0.07	5.0	27	9.8	2	10	22
) South Timber Creek	8-30-78	6,000	0.23	0.01	8.0	19	8.7	1	8	19
) Brush Creek	8-30-78	6,900	0.56	0.09	8.6	32	7.8	2	7	16
) South Timber Creek	8-29-78	20,000	0.56	0.05	6.3	22	10.0	3	10	17
) Timber Creek	8-29-78	12,000	0.72	0.10	5.4	29	9.5	3	10	19

In reviewing the data in Table 4, it was apparent that the generally consistent water quality found throughout the basin was influenced by residual effects of the rainfall runoff which occurred prior to the survey.

Bacteriological Conditions

Fecal coliform concentrations, with the exception of Station 1 on North Timber Creek, were high, ranging from 6000 organisms/100 ml at station 6 (South Timber Creek) to 24,000 organisms/100 ml at station 3 (North Timber Creek). Stations 5 and 9 on Timber Creek and station 8 on South Timber Creek had fecal coliform concentrations of 14,000, 12,000, and 20,000 organisms/100 ml respectively, which exceeded the limit of 2000 organisms/100 ml for a class B warmwater stream (2). The fecal coliform standard, however, does not apply "when the waters are materially affected by surface runoff" (2), as occurred during this survey.

At the farthest upstream site on North Timber Creek (station 1) the fecal coliform concentration of 610 organisms/100 ml was the lowest number found in the basin. This station with a drainage area of only eight square miles, (1) was sampled on August 30, two days after the majority of the runoff had occurred. By the time of sampling, most of the effects from the runoff had passed downstream which allowed for the stream at that site to indicate a more normal summer water quality.

Chemical Conditions

Ammonia nitrogen concentrations were low throughout the basin (0.01 to 0.10 mg/l). These concentrations were well below the warm weather standard of 2.0 mg/l established for a class B warmwater stream (2).

The greatest nitrate nitrogen concentrations were found at the sampling sites on the upper reaches of the Timber Creek Basin. Stations 1 and 2 (North Timber Creek), station 6 (South Timber Creek) and station 7 (Brush Creek) had relatively small drainage areas, but the highest nitrate nitrogen concentrations (8.0 to 12.0 mg/l) found in the basin. These elevated nitrate levels may have been caused by field tile drainage.

Nitrate nitrogen concentrations at the more downstream sampling locations decreased to 5.4 mg/l at station 9 on Timber Creek due to the diluting effect of the higher flow volumes at the downstream stations.

Organic nitrogen concentrations in the basin were variable and ranged from 0.23 to 1.00 mg/l. Station 1 (North Timber Creek) and station 6 (South Timber Creek), both located in the upper reaches of the basin, had organic nitrogen concentrations (0.24 and 0.23 mg/l respectively) that were reflective of background summer water quality. The remaining stations in the basin, especially stations 2, 3, 4, and 5 had increased concentrations of organic nitrogen (ranged from 0.80 to 1.00 mg/l) which may be attributed to the persistence of the runoff conditions.

Dissolved oxygen (DO) concentrations throughout the Timber Creek Basin were near or above saturation, ranging from 7.8 (82%) to 10.0 (124%) mg/l. At the three stations (5, 8 and 9) where the stream reach has been designated as a class B warmwater, DO concentrations were 9.8, 10.0 and 9.5 mg/l respectively, exceeding the minimum standard of 4.0 mg/l (2).

With the exception of stations 1 and 2 on North Timber Creek, turbidity in the basin remained within a range of 19-32 JTU. Station 2 had an above average turbidity of 55 JTU. These turbidity values were much greater than that at station 1 (2.6 JTU), due most likely to the prolonged effects of the runoff.

Total organic carbon (TOC) concentrations measured during this survey were similar, ranging from 7-12 mg/l. Another determinant of the organic content of the water, Biochemical Oxygen Demand (BOD) also indicated little variation (1-3 mg/l) throughout the Timber Creek Basin. The consistent TOC and BOD concentrations found in the Timber Creek Basin suggested that any point sources discharging in to the basin had little impact on the water quality at the existing flows.

Chloride concentrations were also generally consistent throughout the basin (16-28 mg/l) and did not exhibit any trend.

A water sample was also collected at station 9 and analyzed for trace metals. The results of the analysis are listed in the Appendix. With the exception of a barium concentration of 0.2 mg/l, no detectable concentrations of metals were noted. The occurrence of barium in low concentrations frequently occurs in Iowa surface waters.

Water samples were also collected from the Iowa River, upstream (station 10) and downstream (station 11) from its juncture with Timber Creek. The results of those samples are listed in the Appendix. When comparing the data from the two Iowa River stations, the differences in water quality were very minor indicating the discharge of Timber Creek had a negligible effect on the water quality of the Iowa River. Runoff appeared to be exerting a major influence on the water quality of the Iowa River as demonstrated by a fecal coliform concentration average of 13,500 organisms per 100 ml and a turbidity average of 58 JTU at stations 10 and 11.

CONCLUSIONS AND RECOMMENDATION

During August 26-29, 1979, approximately two inches of rain fell in the Timber Creek Basin. The resultant runoff caused by the rain increased flows throughout the watershed producing a peak average daily discharge of 61 cfs near the mouth of Timber Creek on August 27. When the survey was conducted on August 29 and 30, the flow in the creek had decreased to average daily discharges of 26 and 23 cfs, respectively. Despite the decreased flows in the basin, residual effects from the runoff influenced the water quality found in the basin. Water quality parameters, especially fecal coliform concentrations, at most sampling stations were generally consistent and considered to be at greater concentrations than would be expected during normal summer conditions. One sampling station located in the upper reaches of the Timber Creek Basin, however, did indicate better water quality than elsewhere in the basin. This was due to the relatively small drainage area of the creek at that site, in addition to it being sampled on the last day of the survey (August 30). By the time of sampling, most of the effects from the runoff had passed downstream,

indicating the creek was beginning to return to a background condition.

At the existing flows encountered during this survey, no adverse impacts were noted on the water quality in the basin by the area municipalities. In order to further evaluate the potential impacts of these municipalities as well as obtain a better data base, it is recommended that an additional water quality survey be conducted on the Timber Creek Basin during non-runoff conditions.

Scott Prill

Scott Prill
Limnologist

John G. Miller III

John G. Miller III
Limnologist

LITERATURE CITED

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APPENDIX
BACTERIOLOGICAL AND CHEMICAL DATA
FROM THE TIMBER CREEK BASIN
August 29 and 30, 1978

WATER QUALITY REPORT
METALS

STATE HYGIENIC LABORATORY, Des Moines Branch
The University of Iowa
515:281-5371

Town Source Specific Location	Timber Creek Co. Rd. Br., T83N, R17W, Sec. 4/9		
Date Collected	8/29/78		
Date Received	8/30/78		
Lab Number	1485		

METALS ANALYSIS (as mg/l unless designated otherwise)

Arsenic	<0.01		
Barium	0.2		
Cadmium	<0.01		
Chromium, Total	<0.01		
Chromium, Hexavalent			
Copper	<0.01		
Lead	<0.01		
Mercury	<0.001		
Nickel	<0.1		
Selenium	<0.01		
Silver	<0.01		
Zinc	<0.01		

REMARKS:

COLLECTOR
REPORT TO

Limnology Division
UHL, Des Moines Branch

Date Reported OCT 17 1978

W.J. Hausler Jr., Ph.D.
Director

WATER QUALITY REPORT

STATE HYGIENIC LABORATORY, Des Moines Branch
H.A. WALLACE BUILDING
DES MOINES, IOWA 50309

Town			
Source			
Specific Location	North Timber Creek Co. Rd. S75 bridge T83N, R18W, Sec. 19/24	North Timber Creek Co. Rd. Br. T83M, R18W, Sec. 24/23	Middle Timber Creek Co. Rd. Br. T83N, R18W, Sec. 26
Date Collected	8/30/78	8/29/78	8/29/78
Date Received	8/30/78	8/30/78	8/30/78
Lab Number	1478	1479	1480
Collection Time	0920	1350	1415
pH		FIELD DATA	
Temperature	Air 20°C, Water 16°C	Air 32°C, Water 22°C	Air 31°C, Water 22°C
Dissolved Oxygen			
	BACTERIOLOGICAL EXAMINATION		
Fecal Coliform/100 ml	11,000	24,000	12,000
	CHEMICAL ANALYSIS (as mg/l unless designated otherwise)		
Conductance (micromhos)	770	720	700
MBAS (as LAS)			
pH (units)	8.1	8.2	8.2
Alkalinity: P	none	none	none
T	272	257	269
NITROGEN: Organic N	0.99	0.89	1.0
Ammonia N	0.03	0.08	0.06
Nitrite N			
Nitrate N	8.1	6.1	6.4
Nitrate as NO ₃			
RESIDUE: Total	594	534	470
Fixed	398	344	332
Volatile	196	190	138
Filtrable Residue T	478	484	414
F	314	300	300
V	164	184	114
Nonfiltrable Residue T	116	50	56
F	84	44	32
V	32	6	24
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.36	0.30	0.15
Total P	0.43	0.33	0.20
Dissolved Oxygen	9.1	9.8	10.9
BOD	2	3	2
COD	36	33	27
Grease or Oil			
Turbidity (JTU)	55	32	29
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	28	24	20
Sulfate (SO ₄ ⁻)			
Total Organic Carbon	10	12	9

REMARKS:

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UHL, Des Moines Branch

W.J. HAUSLER, JR., Ph.D.
DIRECTOR

WATER QUALITY REPORT

 STATE HYGIENIC LABORATORY, Des Moines Branch
 H.A. WALLACE BUILDING
 DES MOINES, IOWA 50309

Town Source Specific Location	Timber Creek Co. Rd. Br., T83N R17W, Sec. 17/18	S. Timber Creek Co. Rd. Br., T82N, R17W, Sec. 1/2	Brush Creek Co. Rd. E63 Bridge T82N, R17W, Sec. 5/8
Date Collected Date Received Lab Number	8/29/78 8/30/78 1482	8/30/78 8/30/78 1481	8/30/78 8/30/78 1483
Collection Time pH Temperature Dissolved Oxygen	1300 Air 30°C Water 21°C	0800 FIELD DATA air 16°C, Water 17°C	0730 air 19°C water 18°C
Fecal Coliform/100 ml	14,000	BACTERIOLOGICAL EXAMINATION	
		6000	6,900
Conductance (micromhos) MBAS (as LAS)	650	CHEMICAL ANALYSIS (as mg/l unless designated otherwise)	
		640	600
pH (units) Alkalinity: P T	8.2 none 240	8.0 none 246	8.0 none 243
NITROGEN: Organic N Ammonia N Nitrite N Nitrate N	0.80 0.07 5.0	0.23 0.01 8.0	0.56 0.09 8.6
Nitrate as NO ₃			
RESIDUE: Total Fixed Volatile	464 300 164	454 262 192	474 312 162
Filtrable Residue T F V	412 274 138	422 254 168	404 270 134
Nonfiltrable Residue T F V	52 26 26	32 8 24	70 42 28
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P Total P	0.22 0.31	0.09 0.13	0.09 0.18
Dissolved Oxygen BOD	9.8 2	8.7 1	7.8 2
COD	33	26	31
Grease or Oil Turbidity (JTU)	27	19	32
Total Hardness (as CaCO ₃) Calcium (Ca ⁺⁺) Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻) Sulfate (SO ₄ ⁻)	22	19	16
Total organic carbon	10	8	7

REMARKS:

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 Des Moines Branch

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WATER QUALITY REPORT

STATE HYGIENIC LABORATORY, Des Moines Branch
H.A. WALLACE BUILDING
DES MOINES, IOWA 50309

Town			Marshalltown
Source	South Timber Creek	Timber Creek	Iowa River
Specific Location	Co. Rd. Br., T83N, R17W, Sec. 21/28	Co. Rd. Br., T83N, R17W, Sec. 4/9	Rd. E35 bridge, T84N, R17 Sec. 29/32
Date Collected	8/29/78	8/29/78	8/29/78
Date Received	8/30/78	8/30/78	8/30/78
Lab Number	1484	1485	1486
Collection Time	1320	FIELD DATA	1130
pH		1225	
Temperature	Air 32°C, Water 22°C	Air 30°C, Water 21°C	Air 29°C, Water 21°C
Dissolved Oxygen			
BACTERIOLOGICAL EXAMINATION			
Fecal Coliform/100 ml	20,000	12,000	15,000
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
Conductance (micromhos)	650	630	610
MBAS (as LAS)			
pH (units)	8.2	8.1	8.1
Alkalinity: P	none	none	none
T	241	229	229
NITROGEN: Organic N	0.56	0.72	1.3
Ammonia N	0.05	0.10	0.06
Nitrite N			
Nitrate N	6.3	5.4	7.5
Nitrate as NO ₃			
RESIDUE: Total	492	438	600
Fixed	282	312	430
Volatile	210	126	170
Filtrable Residue T	446	374	410
F	262	276	288
V	184	98	122
Nonfiltrable Residue T	46	64	190
F	20	36	142
V	26	28	48
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.13	0.20	0.36
Total P	0.19	0.28	0.50
Dissolved Oxygen	10.0	9.5	9.2
BOD	3	3	4
COD	35	30	46
Grease or Oil			
Turbidity (JTU)	22	29	55
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	17	19	19
Sulfate (SO ₄ ⁻)			
Total Organic Carbon	10	10	17

REMARKS:

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Limnology Division
UHL, Des Moines Branch

W.J. HAUSLER, JR., Ph.D.
DIRECTOR

AUG 31 1978

WATER QUALITY REPORT

STATE HYGIENIC LABORATORY, Des Moines Branch
H.A. WALLACE BUILDING
DES MOINES, IOWA 50309

Town	Marshalltown		
Source	Iowa River		
Specific Location	Co. Rd. Br., T83N, R17W, Sec. 3		
Date Collected	8/29/78		
Date Received	8/30/78		
Lab Number	1487		
Collection Time	1200	FIELD DATA	
pH			
Temperature	Air 30°C, Water 21°C		
Dissolved Oxygen			
		BACTERIOLOGICAL EXAMINATION	
Fecal Coliform/100 ml	12,000		
		CHEMICAL ANALYSIS (as mg/l unless designated otherwise)	
Conductance (micromhos)	610		
MBAS (as LAS)			
pH (units)	8.05		
Alkalinity: P	none		
T	225		
NITROGEN: Organic N	1.4		
Ammonia N	0.08		
Nitrite N			
Nitrate N	7.6		
Nitrate as NO ₃			
RESIDUE: Total	594		
Fixed	442		
Volatile	152		
Filtrable Residue T	382		
F	272		
V	110		
Nonfiltrable Residue T	212		
F	170		
V	42		
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.37		
Total P	0.52		
Dissolved Oxygen	8.7		
BOD	4		
COD	52		
Grease or Oil			
Turbidity (JTU)	60		
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	20		
Sulfate (SO ₄ ⁻)			
tal Organic Carbon	15		

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