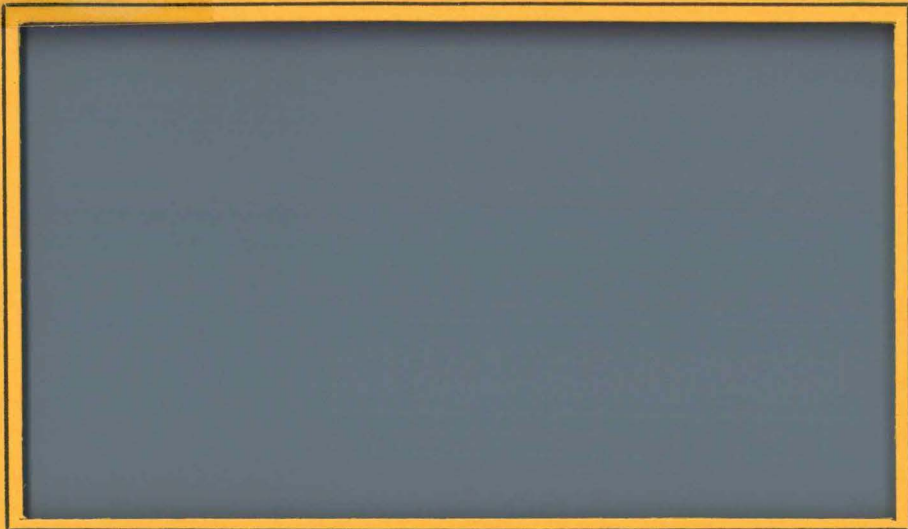


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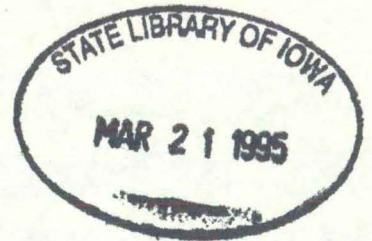


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Water Quality Survey
of the
Floyd River

#78-35

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

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28 March 1978

ABSTRACT

A water quality survey of the Floyd River was conducted on November 1 and 2, 1977. Flow was moderately high with 46 cfs at Alton (exceeded only 11% of the time) and 67 cfs at James (exceeded only 39% of the time). Data indicated that the river was contaminated with organic wastes from several municipal wastewater treatment facility discharges. Fecal coliforms ranged from 1400 to 290,000 organisms/100 ml, ammonia nitrogen from 0.04 to 5.1 mg/l, specific conductance from 630 to 1900 micromhos and total organic carbon from 3.1 to 35.5 mg/l. Water quality declined below Sheldon, LeMars, Remsen and Sioux Center most probably due to their respective wastewater treatment plant discharges.

Although the colder water temperatures experienced at the time of this survey slowed the process of assimilation, the West Branch of the Floyd recovered significantly from its loadings of organic waste to help improve the water quality of the mainstream of the Floyd River by a simple dilution effect.

Overall water quality of the Floyd River was poor, but data indicated a general improvement in water quality compared to previous reports (#77-18, #77-30, #78-16). This improvement is most probably due to the higher flows encountered during this survey.

Sheldon has completed Steps 1 and 2 of the construction grants program and is currently constructing a new facility which is to be operational in October 1978. Sanborn, Hospers, Orange City, Alton and Sioux Center are all in various phases of Step 1 of the construction grants program, while Remsen and LeMars have completed Step 1 of this program. Long term improvement in water quality is expected when these municipalities complete upgrading their wastewater treatment facilities.

INTRODUCTION

The Floyd River originates in O'Brien County and flows southwesterly for approximately 110 miles before joining the Missouri River at Sioux City, Iowa. The deep and narrow river valley with its heavily silted bottom has a total drainage area of over 920 square miles. The lower reaches have been channelized and fish habitat is sparse. Principal fishing is for channel catfish and bullheads which is regarded as poor by the Iowa Conservation Commission except for local areas in the upper reaches. Major tributaries to the Floyd River are Deep Creek, the Little Floyd River and the West Branch Floyd River. Water quality for the entire reach of the Floyd River has been considered for many years to be the poorest in the state of Iowa. Improvement in long term water quality has been observed when comparing the 1950's to the 1970's (Iowa Water Quality Management Plan - Western Iowa Basin). While some improvement has been noted, the Floyd River's water quality still falls short of being classified as unpolluted. The major cause of poor water quality may be attributed to the point source waste discharges of several municipalities located on or near the Floyd River. Many of these municipalities are updating their facilities in order to improve the quality of their effluent.

Three previous surveys conducted by the Limnology Division of the State Hygienic Laboratory (Reports #77-18, #77-30, #78-16) serve to illustrate the deteriorating effects several municipal point source wastewater discharges have on the Floyd River under low flow, early fall and winter ice cover conditions. The purpose of this survey was to assess the water quality of the Floyd River under low flow, late fall condition. Data from this and previous surveys will also be used as background information for comparison when the municipalities located on the Floyd River complete upgrading their wastewater treatment facilities.

TABLE 1

Floyd River Sampling Locations
1 November 1977

<u>STATION</u>		<u>LOCATION</u>
1	Floyd River	Sioux Co. Rd. L26, T97N, R43W Sec. 25
2	Floyd River	Sioux Co. Rd. B20, T97N, R43W, Sec. 36
3	Little Floyd River	O'Brien Co. Rd., T96N, R42W, Sec. 2
4	Little Floyd River	Sioux Co. Hwy 60, T96N, R43W, Sec. 1
5	Floyd River	Sioux Co. Rd. B40, T95N, R43W, Sec. 3
6	Floyd River	Sioux Co. Hwy 10, T95N, R44W, Sec. 35
7	Floyd River	Sioux Co. Rd., T94N, R44W, Sec. 14
8	Deep Creek	Plymouth Co. Rd., T92N, R44W, Sec. 2
9	Deep Creek	Plymouth Co. Rd., T92N, R45W, Sec. 10
10	Floyd River	Plymouth Co. Hwy 75, T92N, R45W, Sec. 9
11	Floyd River	Plymouth Co. Rd. C38, T92N, R45W, Sec. 30
12	West Fork Floyd River	Sioux Co. Rd. T97N, R44W, Sec. 34
13	West Fork Floyd River	Sioux Co. Rd. B40, T95N, R45W, Sec. 1/12
14	West Fork Floyd River	Sioux Co. Rd. T95N, R45W, Sec. 22
15	West Fork Floyd River	Sioux Co. Rd., T94N, R45W, Sec. 17
16	West Fork Floyd River	Plymouth Co. Hwy 75, T91N, R46W, Sec. 2
17	Floyd River	Plymouth Co. Rd. C70, T90N, R46W, Sec. 29
18	Floyd River	Woodbury Co. Dace St. Bridge

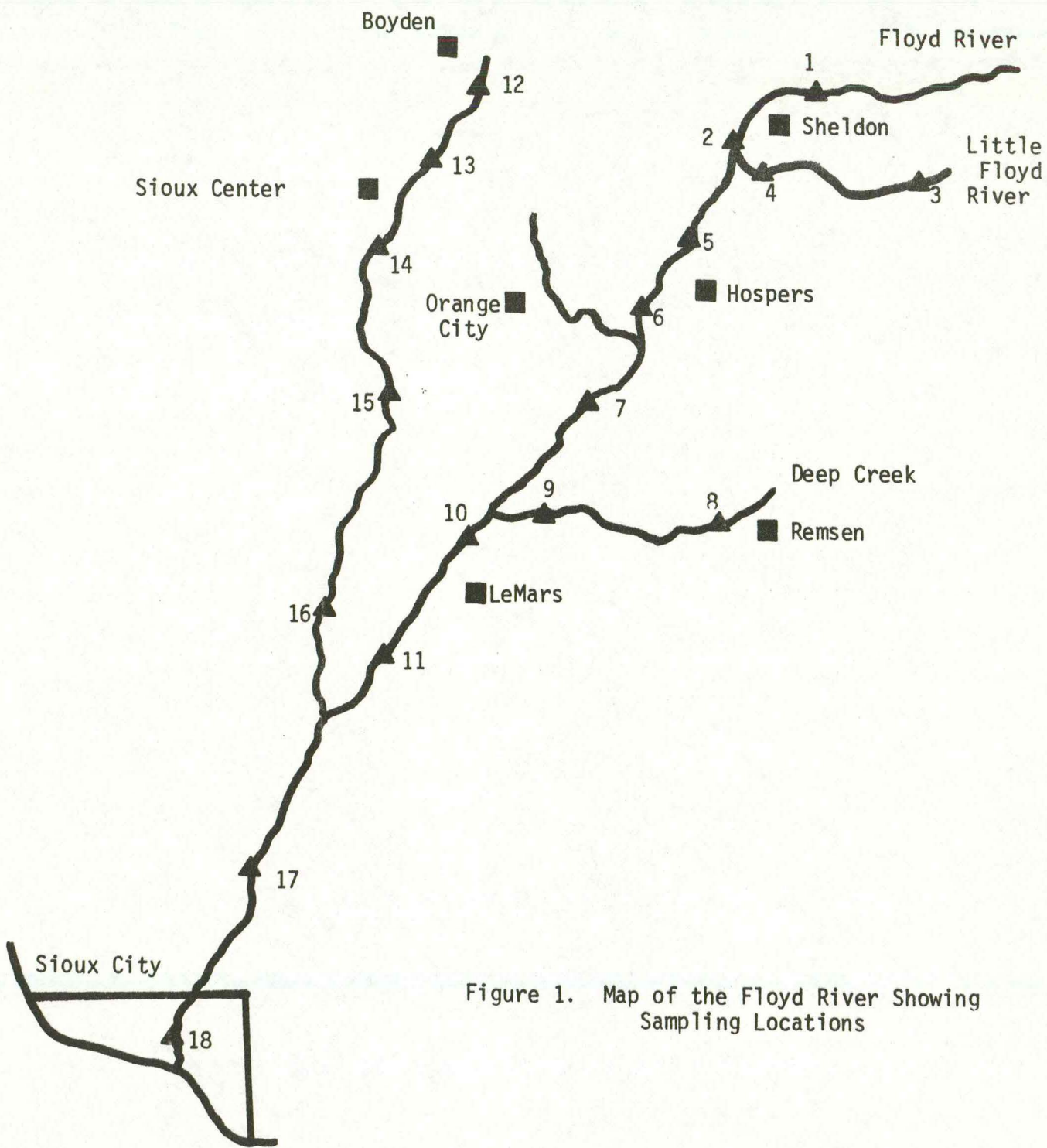


Figure 1. Map of the Floyd River Showing Sampling Locations

The Floyd River is currently classified as a class B warmwater stream from its mouth to Highway 10 in Sioux County. As such, the Iowa Water Quality Stream Standards for aquatic life propagation apply to this reach.

Figure 1 is a map of the sampling area while Table 1 is a list of the sampling locations used for this survey. Gage height readings were obtained from two United States Geological Survey gage stations located on the Floyd River and converted to flow:

	<u>7 day Q₁₀</u>	<u>2 Nov. 1977</u>	<u>% time 2 Nov. flow equalled or exceeded</u>
Floyd River at Alton	0.45 cfs*	46 cfs	11
Floyd River at James	2.5 cfs *7 day Q ₂	67	39

Stream flow was considerably above the calculated 7 day Q₁₀.

RESULTS AND DISCUSSION

To facilitate the discussion of this report, each tributary will be discussed first followed by the Floyd River itself. Selected data will be tabulated in the text. All of the data collected during this study will be found in the Appendix.

Little Floyd River

This small tributary flows southwesterly, joining the Floyd River below Sheldon and has a total drainage area of approximately 60 square miles. Station 3 was located just downstream from Sanborn, Iowa, the only continuous wastewater discharger on the Little Floyd River. Station 4 was located just before the juncture of the Floyd River with the Little Floyd River. Selected data are tabulated below.

Little Floyd River

(all values in mg/l unless designated otherwise)

Station	Fecal Coliforms per 100 ml	Specific Conductance*	Ammonia Nitrogen	Dissolved Oxygen	Filtrable Phosphate	Chloride	TOC
3	22,000	910	0.26	8.6	0.97	32	5.9
4	23,000	830	0.06	9.0	0.90	26	6.3

*micromhos

Water quality at station 3 was below average as was evidenced by the high fecal coliforms (22,000 organisms/100 ml), specific conductance (910 micromhos) and filtrable phosphate (0.97 mg/l) levels. A very small amount of assimilation had occurred by station 4 as can be seen in the slight declines in specific conductance, ammonia nitrogen, filtrable phosphate and chloride. The process of assimilation was slowed, however, due to the colder water temperatures experienced during the time of year that this survey was performed. The high values at station 3 and 4 (fecal coliforms, specific conductance) are most probably due to the organic waste discharge from Sanborn, Iowa. Sanborn is in Step 1 of the construction grants program and is nearing completion of a wastewater treatment facility plan.

Deep Creek

This tributary to the Floyd River has a total drainage area of 156 square miles and junctions with the Floyd River in Plymouth County just upstream from LeMars, Iowa. Station 8 was located just downstream from the only continuous wastewater discharger (Remsen, Iowa) located on Deep Creek. The only other wastewater treatment facility on this stream is maintained by the small town of Oyens which has a single cell lagoon. Station 9 was located near the mouth of Deep Creek and the Floyd River. Selected data for each station are presented below.

Deep Creek

(all values in mg/l unless designated otherwise)

<u>Station</u>	<u>Fecal Coliforms per 100 ml</u>	<u>Specific Conductance*</u>	<u>Ammonia Nitrogen</u>	<u>Filtrable Phosphate</u>	<u>DO</u>	<u>BOD</u>	<u>TOC</u>	<u>Chloride</u>
8	130,000	1,200	2.8	1.9	5.8	11	13.9	130
9	230,000	630	1.8	2.3	6.5	22	35.5	62

*micromhos

Station 8 reflected water quality indicative of a stream loaded with organic wastes. Fecal coliforms (130,000 organisms/100 ml), ammonia nitrogen (2.8 mg/l), BOD (11 mg/l) and chloride (130 mg/l) values were all elevated. The poor water quality at station 8 can probably be attributed to the wastewater discharge from Remsen, Iowa. Data at station 9 is contradictory; while fecal coliforms (230,000 organisms/100 ml), filtrable phosphate (2.3 mg/l) and BOD (22 mg/l) and TOC (35.5) increase even more, there is a decline in specific conductance (630 micromhos) and chloride (62 mg/l) values. The small town of Oyens, located between stations #8 and #9 was discharging from their lagoon wastewater treatment facility at the time this survey was conducted and thus may have been responsible for the unusual values found at station 9. Water quality of Deep Creek at station 9 can at best be considered poor and contaminated with organic wastes. Remsen is in Step 2 of the construction grants program while Oyens is in Step 1 of this program.

West Fork Floyd River

The West Fork Floyd River with a total drainage area of 281 square miles is the largest tributary to the Floyd River. Five stations were located on this segment to aid in assessing water quality. Selected data are tabulated below. All data collected will be found in the Appendix.

West Fork Floyd River

(all values in mg/l unless designated otherwise)

Station	Fecal Coliforms per 100 ml	Specific Conductance*	Ammonia Nitrogen	Filtrable Phosphate	DO	BOD	TOC	Chloride
12	4,800	1,200	0.14	0.80	9.5	3	7.9	95
13	10,000	1,300	0.04	0.27	10.0	3	5.8	100
(Sioux Center)								
14	210,000	1,900	5.1	4.4	11.3	23	17.4	280
15	1,400	850	0.05	0.34	11.3	2	6.2	29
16	5,800	730	0.20	0.25	10.4	3	3.1	16

*micromhos

Because of some unusual data obtained in the previous survey on the Floyd River (Report #78-16), a new station was added to the West Fork Floyd River. This station (#12) was located just downstream of the town of Boyden to provide background water quality data for the upper portion of this tributary. Boyden has a lagoon wastewater treatment system and visual inspection confirmed that there was no discharge at the time of this survey.

Overall water quality was poor at station 12 (specific conductance - 1200 micromhos, fecal coliforms - 4800 organisms/100 ml, chloride - 95 mg/l) and had changed very little by station 13 except for an increase in both fecal coliforms (10,000 organisms/100 ml) and specific conductance (1300 micromhos).

Station 14 showed a sharp decline in water quality (fecal coliforms - 210,000 organisms/100 ml, specific conductance - 1900 micromhos, ammonia nitrogen - 5.1 mg/l, filtrable phosphate - 4.4 mg/l, BOD - 23 mg/l, and chloride - 280 mg/l). This decline in water quality may be attributed to the discharge from the Sioux Center wastewater treatment plant. Part of the decline in water quality also might possibly be attributed to several cattle and swine feedlot operations located between stations 13 and 14.

Additional work is needed to determine how much if any of the decline in water quality can be attributed to these feedlot operations. Sioux Center is in Step 1 of the construction grants program, and is in the process of completing the facility plan for its new wastewater treatment system. By station 15, a significant improvement in water quality was observed (fecal coliforms - 1400 organisms/100 ml, specific conductance - 850 micromhos ammonia nitrogen - 0.05 mg/l, filtrable phosphate - 0.34 mg/l, BOD - 2 mg/l and chloride - 29 mg/l) and by station 16, water quality was beginning to approach more normal levels, although the fecal coliforms were still elevated at 5800 organisms/100 ml.

Floyd River

Selected data for the Floyd River are presented below. All data collected may be found in the Appendix.

Floyd River

(all values in mg/l unless designated otherwise)

<u>Station</u>	<u>Fecal Coliforms per 100 ml</u>	<u>Specific Conductance*</u>	<u>Ammonia Nitrogen</u>	<u>Filtrable Phosphate</u>	<u>DO</u>	<u>BOD</u>	<u>TOC</u>	<u>Chl</u>
1 (Sheldon)	160,000	800	0.19	0.45	9.0	5	9.0	
2	290,000	880	0.80	0.64	8.0	11	12.4	
5 (Hospers)	43,000	840	0.38	0.98	8.0	7	8.0	
6 (Orange City)	5,800	1,100	0.20	0.63	8.6	4	8.5	1
7	6,000	1,100	0.47	0.57	9.0	8	5.9	1
10 (LeMars)	100,000	1,100	1.4	1.1	9.7	14	16.7	1
11	200,000	1,100	0.81	1.1	9.0	10	11.8	1
17	14,000	920	0.06	0.57	10.8	4	5.7	
18	12,000	940	0.15	0.55	11.7	4	4.8	

*micromhos

At station 10 the increases in fecal coliforms (100,000 organisms/100 ml), filtrable phosphate (1.1 mg/l), ammonia nitrogen (1.4 mg/l), TOC (16.7 mg/l) and BOD (14 mg/l) may be attributed to the flow from Deep Creek which enters the Floyd River one half mile upstream from this station.

At the next station downstream (station 12) fecal coliforms (200,000 organism per 100 ml) and chloride (130 mg/l) values rose even more, due to the discharge from the LeMars wastewater treatment plant. LeMars has completed Step 1 of the construction grants program and is completing the plans and specifications for a new wastewater treatment facility.

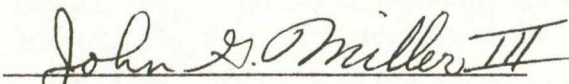
Although the stream still contained organic wastes, there was a noticeable improvement in water quality by station 17, as compared to the previous station. Again, this is in part due to stream assimilation and in part due to the dilutional effect that the largest tributary of the Floyd (the West Branch of the Floyd River) has on water quality. It should be noted that most of the improvement in water quality can probably be attributed more to the dilution effect of the West Branch of the Floyd rather than to stream assimilation, owing to the colder temperatures experienced at the time of year this survey was conducted.

The last station (station 18) located on the Floyd River was just before the juncture of the Floyd River with the Missouri River. Water quality was basically unchanged from the previous station. There was only a slight decline in fecal coliforms (12,000 organisms/100 ml) and a slight increase in dissolved oxygen (11.7 mg/l). Water quality of the stream was still below average when it junctioned with the Missouri River.

SUMMARY AND CONCLUSIONS

A water quality survey of the Floyd River was conducted on November 1 and 2, 1977. Data indicated a decline in water quality below the municipalities of Sheldon, Remsen, LeMars and Sioux Center, most probably due to their respective wastewater treatment plant discharges. Although the colder water temperatures experienced at the time of this survey slowed the process of assimilation, the West Branch of the Floyd River recovered significantly from its loading of organic wastes to help improve the water quality of the mainstream of the Floyd River by a simple dilution effect.

Although overall water quality of the Floyd River was still poor, data found during this survey indicated a general improvement in water quality compared to previous reports (#77-18, #77-30, #78-16). The improvement in water quality was most probably due to the higher flows encountered during this survey and not due to an improvement in point source wastewater discharges. Most of the towns along the Floyd River reach are in or have completed Step 1 of the construction grants program. Sheldon is presently constructing a new wastewater treatment plant that is scheduled to be operational in October 1978. The water quality of the Floyd River is expected to improve when all of the municipalities along its reach finish upgrading their wastewater treatment plant facilities.


John G. Miller III
Limnologist

APPENDIX

WATER QUALITY REPORT

STATE HYGIENIC LABORATORY, Des Moines Branch
The University of Iowa
E 7th & Court, Rm 405, Des Moines, Iowa 50309

Town	Sheldon	Sheldon	Sheldon
Source	Floyd River	Sheldon STP effluent	Floyd River
Specific Location	Sioux Co. Rd. L26, T97N R43W, Sec. 25		Sioux Co. Rd. B20, T97N, R43W, Sec. 36
Date Collected	1 Nov. 1977	1 Nov. 1977	1 Nov. 1977
Date Received	2 Nov. 1977	2 Nov. 1977	2 Nov. 1977
Lab Number	1968	1972	1969
Collection Time	8:30	FIELD DATA	10:35
pH		8:45	
Temperature	9.5°C	20.5°C	10°C
Dissolved Oxygen			
Fecal Coliform/100 ml	160,000	BACTERIOLOGICAL EXAMINATION	290,000
		2,600,000	
Conductance (micromhos)	800	CHEMICAL ANALYSIS (as mg/l unless designated otherwise)	880
MBAS (as LAS)		3600	
pH (units)	8.1	7.85	8.0
Alkalinity: P	none	none	none
T	284	383	281
NITROGEN: Organic N	0.65	1.6	1.0
Ammonia N	0.19	13	0.80
Nitrite N			
Nitrate N	7.3	1.4	6.4
Nitrate as NO ₃			
RESIDUE: Total	668	2250	738
Fixed	512	2060	592
Volatile	156	186	146
Filtrable Residue T	542	2180	568
F	410	2030	452
V	132	150	116
Nonfiltrable Residue T	126	66	170
F	102	30	140
V	24	36	30
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.45	2.8	0.64
Total P	0.91	7.2	1.1
Dissolved Oxygen	9.0		8.0
BOD	5	45	11
COD	38	250	46
Grease or Oil			
Turbidity (JTU)	32	20	46
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	27	800	54
Sulfate (SO ₄ ⁻)			
Chlorophyll a	27 µg/L		54 µg/L
Total Organic Carbon	9.0	25.8	12.4

REMARKS:

COLLECTOR
REPORT TO

Miller
State Hygienic Lab
Limnology Division
Des Moines Branch

WJ Hausler, Jr PhD
Director

JAN 5 1978

WATER QUALITY REPORT

The University of Iowa
E 7th & Court, Rm 405, Des Moines, Iowa 50309

Town	Sheldon	Sheldon	Hospers
Source	Little Floyd River	Little Floyd River	Floyd River
Specific Location	O'Brien Co. Rd. T96N R42W, Sec. 2	Sioux Co. Hwy 60 T96N, R43W, Sec. 1	Sioux Co. Rd. B40, T95N R43W, Sec. 3
Date Collected	1 Nov. 1977	1 Nov. 1977	1 Nov. 1977
Date Received	2 Nov. 1977	2 Nov. 1977	2 Nov. 1977
Lab Number	1970	1971	1973
Collection Time	8:05	10:50	11:05
pH		FIELD DATA	
Temperature	9 ^o C	9.5 ^o C	9.5 ^o C
Dissolved Oxygen			
Fecal Coliform/100 ml	22,000	BACTERIOLOGICAL EXAMINATION 23,000	43,000
Conductance (micromhos)	910	CHEMICAL ANALYSIS (as mg/l unless designated otherwise)	
MBAS (as LAS)		830	840
pH (units)	7.95	8.1	8.0
Alkalinity: P	none	none	none
T	318	299	274
NITROGEN: Organic N	0.43	0.41	0.64
Ammonia N	0.26	0.06	0.38
Nitrite N			
Nitrate N	12	9.4	5.7
Nitrate as NO ₃			
RESIDUE: Total	682	586	614
Fixed	510	452	492
Volatile	172	134	122
Filtrable Residue T	604	550	542
F	446	424	430
V	158	126	112
Nonfiltrable Residue T	78	36	72
F	64	28	62
V	14	8	10
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.97	0.90	0.98
Total P	2.0	2.5	2.5
Dissolved Oxygen	8.6	9.0	8.0
BOD	3	4	7
COD	16	20	23
Grease or Oil			
Turbidity (JTU)	20	15	23
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	32	26	42
Sulfate (SO ₄ ⁻)			
Chlorophyll a	6 µg/L	13 µg/L	28 µg/L
Total organic carbon	5.9	6.3	8.0

REMARKS:

COLLECTOR
REPORT TO

Miller
State Hygienic Lab
Limnology Division
Des Moines Branch

WJ Hausler, Jr PhD
Director
JAN 5 1978

WATER QUALITY REPORT

STATE HYGIENIC LABORATORY, Des Moines Branch
The University of Iowa
E 7th & Court, Rm 405, Des Moines, Iowa 50309

Town	Orange City	Orange City STP	Floyd River
Source	Floyd River		Sioux Co. Rd. T94N, R44W
Specific Location	Sioux Co. Hwy 10 T95N, R44W, Sec. 35		Sec. 14
Date Collected	1 Nov. 1977	1 Nov. 1977	1 Nov. 1977
Date Received	2 Nov. 1977	2 Nov. 1977	2 Nov. 1977
Lab Number	1974	1975	1976
Collection Time	12:00	FIELD DATA	12:35
pH		11:30	
Temperature	10.5°C	13.5°C	10.5°C
Dissolved Oxygen			
	BACTERIOLOGICAL EXAMINATION		
Fecal Coliform/100 ml	5,800	950,000	6000
	CHEMICAL ANALYSIS (as mg/l unless designated otherwise)		
Conductance (micromhos)	1100	3100	1100
MBAS (as LAS)			
pH (units)	8.3	7.85	8.25
Alkalinity: P	none	none	none
T	285	412	296
NITROGEN: Organic N	0.54	6.8	0.30
Ammonia N	0.21	24	0.47
Nitrite N			
Nitrate N	2.6	5.9	2.0
Nitrate as NO ₃			
RESIDUE: Total	712	1970	716
Fixed	602	1700	588
Volatile	110	274	128
Filtrable Residue T	672	1850	668
F	570	1660	550
V	102	190	118
Nonfiltrable Residue T	40	120	48
F	32	36	38
V	8	84	10
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.63	9.5	0.56
Total P	0.82	11	0.65
Dissolved Oxygen	8.6		9.0
BOD	4	85	8
COD	12	267	19
Grease or Oil			
Turbidity (JTU)	17	30	17
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	110	680	110
Sulfate (SO ₄ ⁻)			
Chlorophyll a	24 µg/L		50 µg/L
total Organic Carbon	8.5	38.6	5.9

REMARKS: Gage 6.58

COLLECTOR
REPORT TO

Miller
Limnology Division
State Hygienic Lab
Des Moines Branch

WJ Hausler, Jr PhD
Director

JAN 5 1978

WATER QUALITY REPORT

STATE HYGIENIC LABORATORY, Des Moines Branch
The University of Iowa
E 7th & Court, Rm 405, Des Moines, Iowa 50309

Town Source Specific Location	Floyd River Plymouth Co. Hwy 75 T92N, R45W, Sec. 9	Oyens Deep Creek Plymouth Co. Rd. T92N R44W Sec. 2	Le Mars Deep Creek Plymouth Co. Rd. T92N R45W, Sec. 10
Date Collected	2 Nov. 1977	2 Nov. 1977	2 Nov. 1977
Date Received	2 Nov. 1977	2 Nov. 1977	2 Nov. 1977
Lab Number	1977	1978	1979
Collection Time	8:30	FIELD DATA	8:10
pH		7:45	
Temperature	7°C	5°C	5.5°C
Dissolved Oxygen			
Fecal Coliform/100 ml	100,000	130,000	230,000
Conductance (micromhos)	1100	CHEMICAL ANALYSIS (as mg/l unless designated otherwise)	
MBAS (as LAS)		1200	630
pH (units)	8.1	7.7	7.7
Alkalinity: P	none	none	none
T	271	220	139
NITROGEN: Organic N	0.91	0.17	1.7
Ammonia N	1.4	2.8	1.8
Nitrite N			
Nitrate N	2.2	4.5	3.2
Nitrate as NO ₃			
RESIDUE: Total	738	854	622
Fixed	596	696	464
Volatile	142	158	158
Filtrable Residue T	686	772	486
F	564	628	360
V	122	144	126
Nonfiltrable Residue T	52	82	136
F	32	68	104
V	20	14	32
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	1.1	1.9	2.3
Total P	1.8	2.3	2.6
Dissolved Oxygen	9.7	5.8	6.5
BOD	14	11	22
COD	65	60	120
Grease or Oil			
Turbidity (JTU)	39	54	130
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	110	130	62
Sulfate (SO ₄ ⁻²)			
Chlorophyll a	96 µg/L	15 µg/L	40 µg/L
Total Organic Carbon	16.7	13.9	35.5

REMARKS:

COLLECTOR
REPORT TO

Miller
Limnology Division
State Hygienic Lab
Des Moines Branch

WJ Hausler, Jr PhD
Director

JAN 5 1978

WATER QUALITY REPORT

STATE HYGIENIC LABORATORY, Des Moines Branch
The University of Iowa
E 7th & Court, Rm 405, Des Moines, Iowa 50309

Town	Le Mars	Floyd River	Boyden
Source	Le Mars STP	Plymouth Co. T92N, R45W	West Fork Floyd River
Specific Location		Sec. 30	T97N, R44W, Sec. 34
Date Collected	2 Nov. 1977	2 Nov. 1977	1 Nov. 1977
Date Received	2 Nov. 1977	2 Nov. 1977	2 Nov. 1977
Lab Number	1980	1981	1982
Collection Time	8:45	9:05	9:45
pH		FIELD DATA	
Temperature	14°C	7°C	9°C
Dissolved Oxygen			
BACTERIOLOGICAL EXAMINATION			
Fecal Coliform/100 ml	2,400,000	200,000	4800
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
Conductance (micromhos)	2800	1100	1200
MBAS (as LAS)			
pH (units)	7.8	8.1	8.0
Alkalinity: P	none	none	none
T	430	277	347
NITROGEN: Organic N	6.0	0.63	0.37
Ammonia N	7.0	0.81	0.14
Nitrite N			
Nitrate N	1.1	2.4	9.6
Nitrate as NO ₃			
RESIDUE: Total	1830	830	806
Fixed	1670	660	642
Volatile	158	170	164
Filtrable Residue T	1800	738	804
F	1670	622	640
V	130	116	164
Nonfiltrable Residue T	28	92	2
F	2	38	2
V	26	54	0
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	11	1.1	0.80
Total P	12	1.9	1.6
Dissolved Oxygen		9.0	9.5
BOD	45	10	3
COD	141	50	22
Grease or Oil			
Turbidity (JTU)	15	24	5
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	420	130	95
Sulfate (SO ₄ ⁻)			
Chlorophyll a		67 µg/L	14 µg/L
Total Organic Carbon	29.3	11.8	7.9

REMARKS:

COLLECTOR
REPORT TO

John Miller
Limnology Division
State Hygienic Lab
Des Moines Branch

WJ Hausler, Jr PhD
Director

JAN 5 1978

WATER QUALITY REPORT

STATE HYGIENIC LABORATORY, Des Moines Branch
The University of Iowa
E 7th & Court, Rm 405, Des Moines, Iowa 50309

Town			
Source			
Specific Location	West Fork Floyd River Sioux Co. Rd. B40 T95N, R45W, Sec. 1/12	West Fork Floyd River Sioux Co. Rd. T95N R45W, Sec. 22	West Fork Floyd River Sioux Co. T94N, R45W Sec. 17
Date Collected	1 Nov. 1977	1 Nov. 1977	1 Nov. 1977
Date Received	2 Nov. 1977	2 Nov. 1977	2 Nov. 1977
Lab Number	1983	1984	1985
Collection Time	1:40	FIELD DATA	2:15
pH		1:10	
Temperature	10 ⁰ C	10 ⁰ C	10.5 ⁰ C
Dissolved Oxygen			
	BACTERIOLOGICAL EXAMINATION		
Fecal Coliform/100 ml	10,000	210,000	1400
	CHEMICAL ANALYSIS (as mg/l unless designated otherwise)		
Conductance (micromhos)	1300	1900	850
MBAS (as LAS)			
pH (units)	8.25	8.0	8.1
Alkalinity: P	none	none	none
T	332	289	219
NITROGEN: Organic N	0.37	0.86	0.12
Ammonia N	0.04	5.1	0.05
Nitrite N			
Nitrate N	1.0	9.4	0.4
Nitrate as NO ₃			
RESIDUE: Total	890	1280	590
Fixed	714	1120	492
Volatile	176	160	98
Filtrable Residue T	882	1240	582
F	712	1090	490
V	170	150	92
Nonfiltrable Residue T	8	42	8
F	2	32	2
V	6	10	6
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.27	4.4	0.34
Total P	0.94	6.0	3.0
Dissolved Oxygen	10.0	11.3	11.3
BOD	3	23	2
COD	26	62	5
Grease or Oil			
Turbidity (JTU)	6	30	5
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	100	280	29
Sulfate (SO ₄ ⁻²)			
Chlorophyll a	9 µg/L	47 µg/L	7 µg/L
Total Organic Carbon	5.8	17.4	6.2

REMARKS:

Station moved due to feedlot.

COLLECTOR
REPORT TO

Miller
Limnology Division
State Hygienic Lab
Des Moines Branch

WJ Hausler, Jr PhD
Director

JAN 5 1978

WATER QUALITY REPORT

STATE HYGIENIC LABORATORY, Des Moines Branch
The University of Iowa
E 7th & Court, Rm 405, Des Moines, Iowa 50309

Town Source Specific Location	West Fork Floyd River Plymouth Co. T91N R46W Sec. 2	Floyd River Plymouth Co. Rd. C70 T90N, R46W, Sec. 29	Sioux City Floyd River Dace St. Bridge
Date Collected	2 Nov. 1977	2 Nov. 1977	2 Nov. 1977
Date Received	2 Nov. 1977	2 Nov. 1977	2 Nov. 1977
Lab Number	1986	1987	1988
Collection Time	9:25	FIELD DATA	11:00
pH		10:25	
Temperature	6°C	7°C	8°C
Dissolved Oxygen			
	BACTERIOLOGICAL EXAMINATION		
Fecal Coliform/100 ml	5800	14,000	12,000
	CHEMICAL ANALYSIS (as mg/l unless designated otherwise)		
Conductance (micromhos)	730	920	940
MBAS (as LAS)			
pH (units)	8.0	8.2	8.2
Alkalinity: P	none	none	none
T	228	263	261
NITROGEN: Organic N	0.16	0.47	0.23
Ammonia N	0.20	0.06	0.15
Nitrite N			
Nitrate N	0.3	1.2	1.6
Nitrate as NO ₃			
RESIDUE: Total	556	674	664
Fixed	472	562	568
Volatile	84	112	96
Filtrable Residue T	498	592	618
F	426	496	530
V	72	96	88
Nonfiltrable Residue T	58	82	46
F	46	66	38
V	12	16	8
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.25	0.57	0.55
Total P	2.5	1.3	1.1
Dissolved Oxygen	10.4	10.8	11.7
BOD	3	4	4
COD	8	20	12
Grease or Oil			
Turbidity (JTU)	15	25	22
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	16	69	75
Sulfate (SO ₄ ⁻)			
Chlorophyll a	5 µg/L	48 µg/L	40 µg/L
Total Organic Carbon	3.1	5.7	4.8

REMARKS:

Gage 10.24

COLLECTOR
REPORT TO

John Miller
Limnology Division
State Hygienic Lab
Des Moines Branch

WJ Hausler, Jr PhD
Director

JAN 5 1978

**WATER QUALITY REPORT
METALS**

The University of Iowa
515:281-5371

Town Source Specific Location	Floyd River Plymouth Co. Rd. C70 T90N, R46W Sec. 29	Sioux City Floyd River Dace St. Bridge	
Date Collected	2 Nov. 1977	2 Nov. 1977	
Date Received	2 Nov. 1977	2 Nov. 1977	
Lab Number	1987	1988	
METALS ANALYSIS (as mg/l unless designated otherwise)			
Arsenic	<0.01	<0.01	
Barium	<0.1	0.1	
Cadmium	<0.01	<0.01	
Chromium, Total	<0.01	<0.01	
Chromium, Hexavalent			
Copper	<0.01	<0.01	
Lead	<0.01	<0.01	
Mercury	<0.001	<0.001	
Nickel	<0.1	<0.1	
Selenium	<0.01	<0.01	
Silver	<0.01	<0.01	
Zinc	<0.01	<0.01	

REMARKS:

COLLECTOR
REPORT TO

John Miller
Limnology Division
State Hygienic Lab
Des Moines Branch

Date Reported JAN 5 1978

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