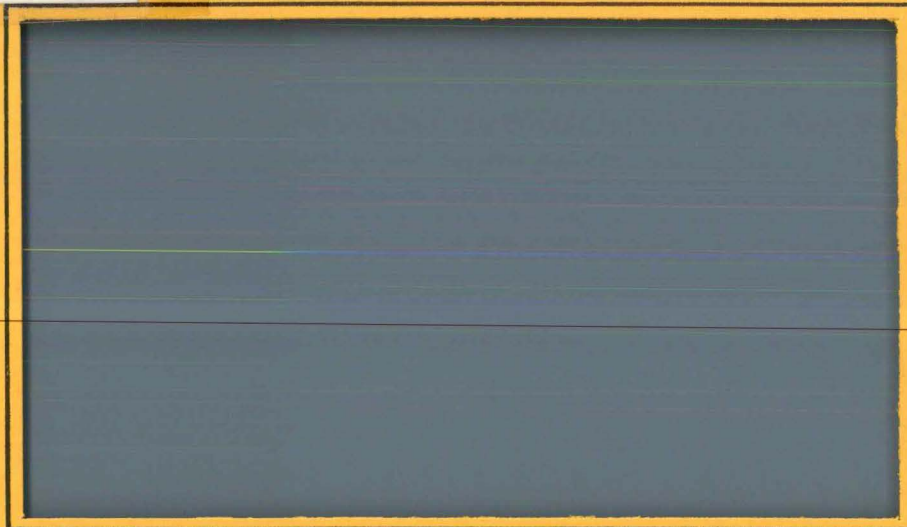


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*The State Hygienic
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WATER QUALITY SURVEY
of the
SHELLROCK RIVER

#73-19

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WATER QUALITY SURVEY
of the
SHELLROCK RIVER

Submitted to the Iowa Water Pollution Control Commission
by the
State Hygienic Laboratory on October 26, 1972

At the August 24th Water Pollution Control Commission meeting a letter was introduced from the Mayor of Northwood, Iowa, located on the Shellrock River. The Mayor was concerned with the condition of the river and requested something be done. In view of this and two water quality studies performed in 1970 showing this reach to have poor water quality, the commission requested a warm weather, low flow, water quality study of the Shellrock River.

The Shellrock River originates at Albert Lee Lake in Minnesota and after it crosses the Iowa line near Northwood, it receives wastes from the towns of Northwood, Manley, Rock Falls, Nora Springs, Rockford, Greene, Clarksville and Shellrock before it joins with the Red Cedar River near Janesville. The major Shellrock tributary, the Winnebago River, carries the wastes of Mason City and joins with the Shellrock near Rockford.

The previously mentioned towns which discharge wastes to the Shellrock River have secondary treatment of one type or another with the exceptions of Rock Falls, Rockford and Clarksville. Rockford is presently in the process of putting in lagoons. All three towns currently have some septic tank effluent discharging into the Shellrock River.

Previous water quality studies were conducted in February and June, 1970. In February, 1970, high ammonia nitrogen concentrations (4.7 mg/l), high total and soluble phosphates (5.3 and 5.1 mg/l), and low dissolved oxygens (0.2 mg/l) were found in the Shellrock River entering Iowa. The quality of water improved as it flowed downstream. Discharge rates during February were 26 CFS at Northwood and 220 CFS at the town of Shellrock.

The June study, a follow-up to the winter report, was to assess the biological condition of the Shellrock River. Discharge rates at this time were 110 CFS at Northwood and 813 CFS at Shellrock. Biological condition of the Shellrock River at Northwood was found to be very poor. Heavy algal population existed with a high organic nitrogen content and water super saturated with dissolved oxygen.

Pursuant with the Commission's request, I collected water quality samples on September 19, 1972. During September, 1972, flows in the Shellrock River were high. Provisional data from the U.S. Geological Survey for September 19th indicates discharge in the Shellrock River at Northwood averaged 86 CFS and at the town of Shellrock 545 CFS. Seven day ten year low flows are 8.2 CFS at Northwood and 57 CFS at Shellrock.

The appearance of the Shellrock River from the Iowa-Minnesota line to the confluence of the Winnebago River was dark green in color, and it appeared the river was carrying a heavy load of algae.

Water quality data indicates a heavy organic nitrogen load, probably algae related, coming into Iowa and decreasing as it moves downstream with a corresponding increase in nitrate levels (figure 1). A sharp decrease in organic nitrogen and a sharp increase in nitrates occurred where the Winnebago River and the Shellrock River joined. The decrease in organic nitrogen was probably due to the dilution effect of the Winnebago River and the increase in nitrates due to the higher nitrate level in the Winnebago River. The large difference between the filtered and unfiltered BOD can also be related to the heavy algae growth. The water was super saturated with dissolved oxygen because of the heavy algae load present.

The fecal coliform levels (figure 2) varied from 110-4700 organisms per 100 ml. These values are relatively low when compared to storm water runoff having values in the tens of thousand. Peak values of 4700 and 1850 organisms per 100 ml are most likely attributable to the wastes from Northwood and the Winnebago River. Other fecal coliform values are generally near expected levels.

CONCLUSIONS

The data obtained from this study is very similar to the data obtained in June, 1970. Both studies of the Shellrock River showed a heavy algal load, high organic nitrogen and super saturated dissolved oxygen.

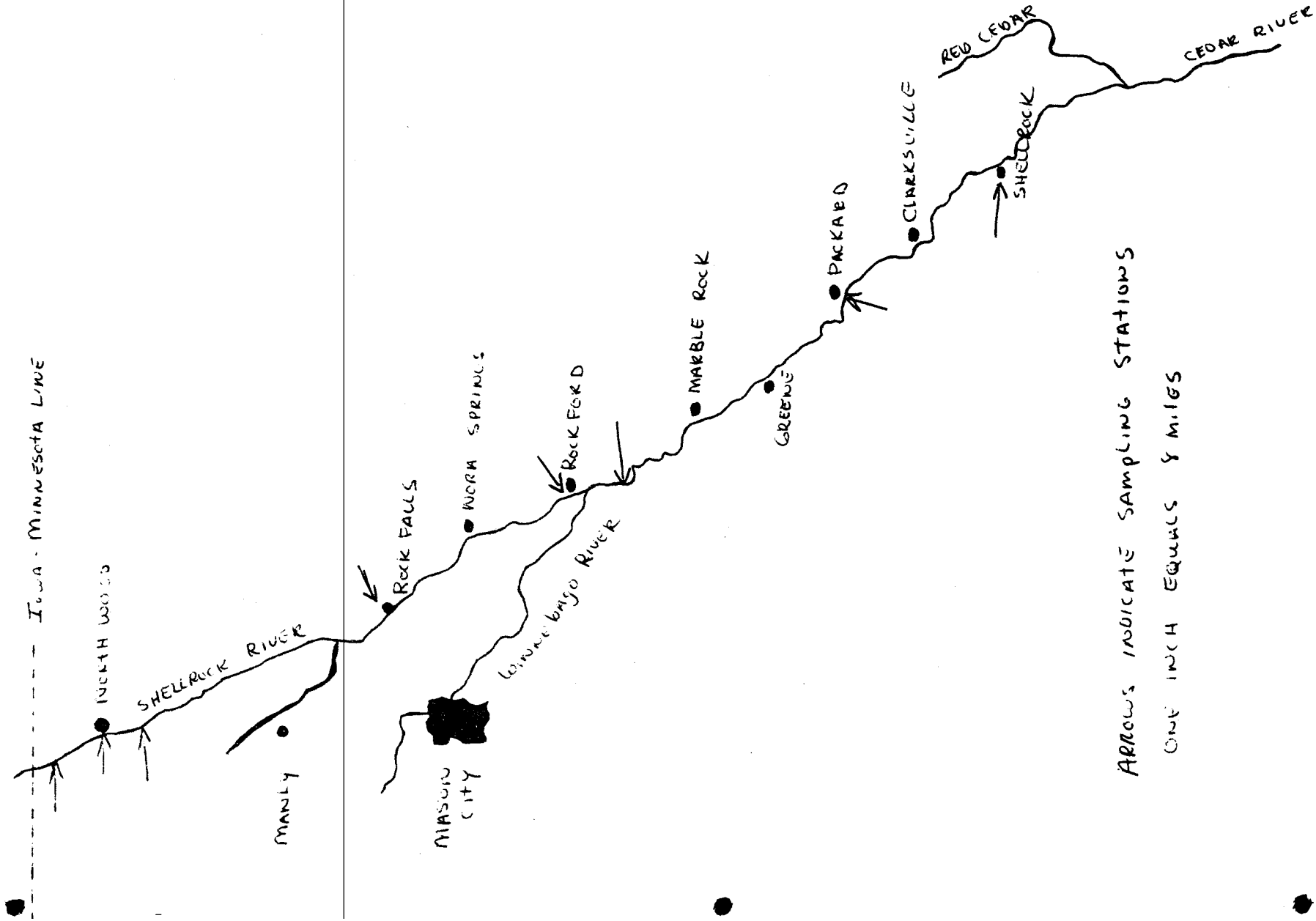
The wastes from the Iowa towns had little influence on the Shell-rock River at the time this study was made and no Iowa Water Quality Standards were violated. However, the heavy algal load which was apparently introduced into the river in Minnesota, may have adverse effects on the stream. Algae produce oxygen during periods of daylight; part of this oxygen is released into the water increasing the dissolved oxygen and part is used to carry on cell respiration. During periods of darkness, no oxygen is being produced but the algal cells still need to respire. Night respiration of a heavy algal population can therefore deplete the dissolved oxygen to almost zero. Also as this heavy algal population "dies off" it creates an increase in BOD and also releases more nutrients creating conditions for another possible "bloom".

RECOMMENDATIONS

Routine monitoring of the stream will be conducted along with all our streams on a quarterly basis. It is also recommended that a follow-up low flow winter study and possibly a low flow summer study be done next year. In addition a low flow winter study of the Winnebago is also recommended.


Jack O. Kennedy
Limnologist

SHELL ROCK RIVER



ARROWS INDICATE SAMPLING STATIONS

ONE INCH EQUALS 8 MILES

FIGURE 1

SHELLROCK RIVER

MILLIGRAMS PER LITER

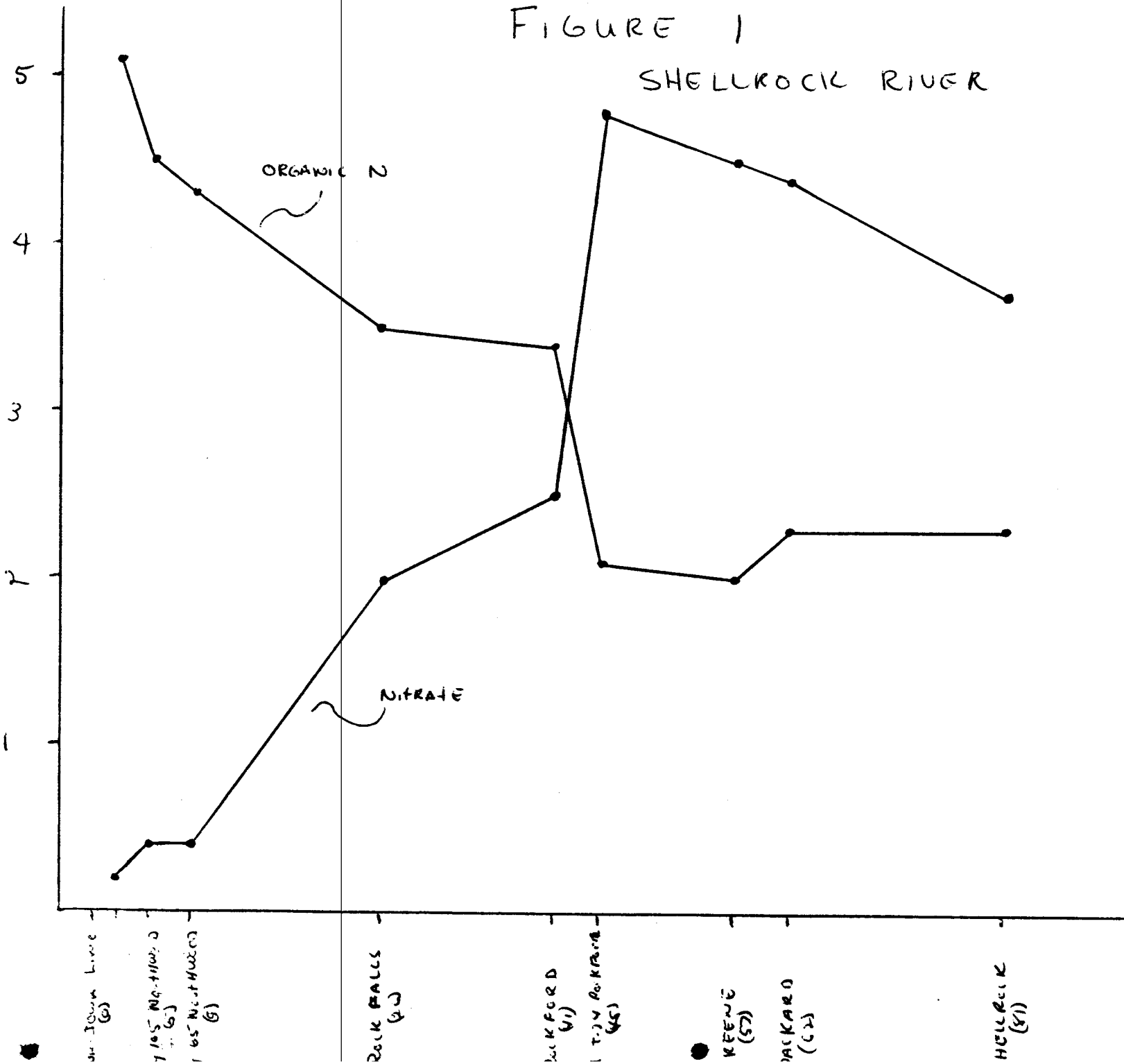
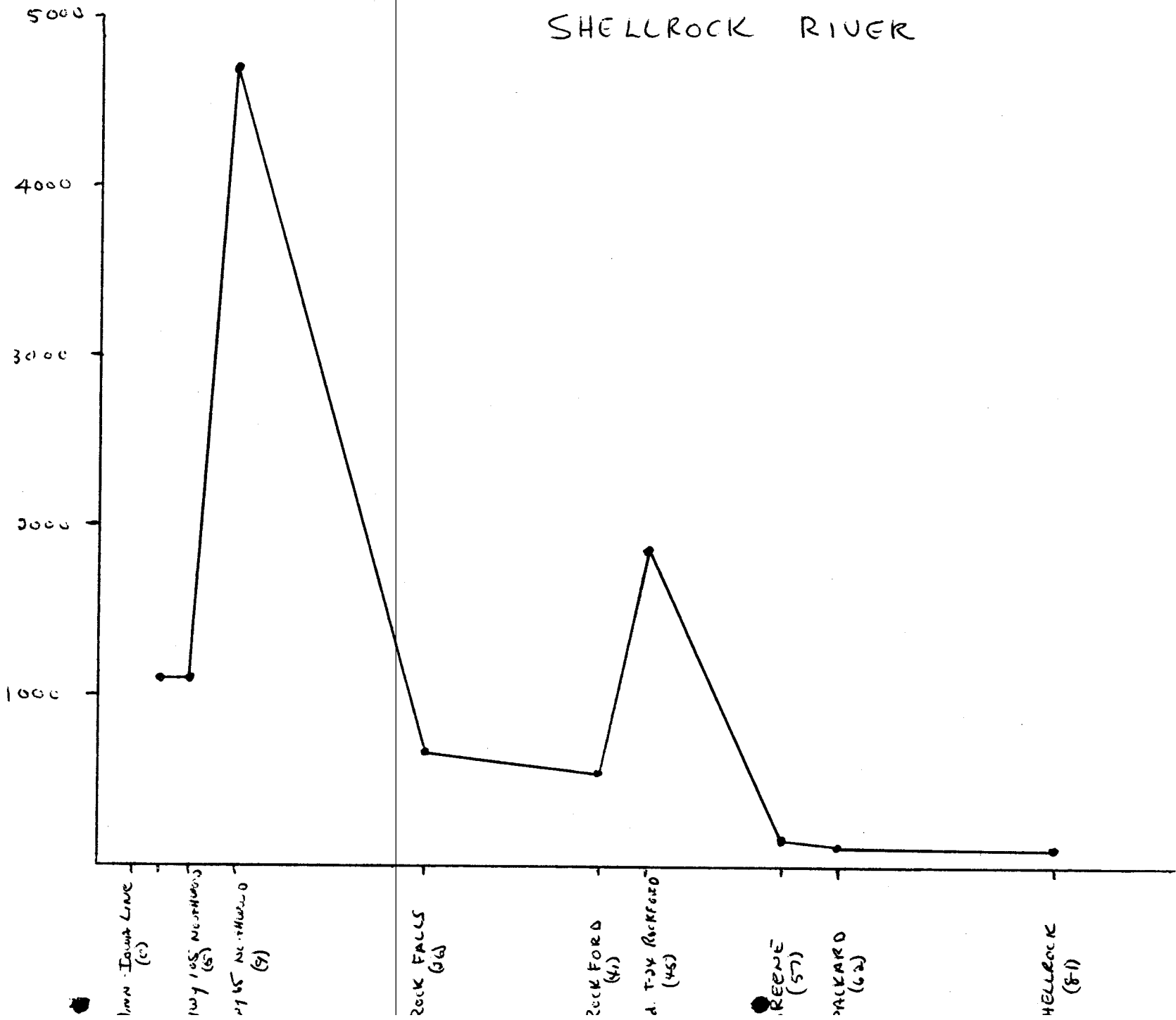


FIGURE 2

SHELLROCK RIVER

-7-
FECAL COLIFORMS PER 100 M.L., LITERS



WATER QUALITY REPORT

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

own ource pecific Location	Northwood Shellrock 2 mi NW of North- wood Co.Rd. T-100N R-20W Sec.18	Highway 105 bridge West of Northwood	Highway 65 South of Northwood
ate Collected ate Received	19 September 1972 20 September 1972		
ib Number	1572	1573	1574
ollection Time	1:30	FIELD DATA 1:50	2:30
emperature	19.0°C	19.0°C	19.0°C
issolved Oxygen	11.3	11.6	12.7
BACTERIOLOGICAL EXAMINATION			
ecal Coliform/100 ml	1100	1100	4700
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
onductance (micromhos)	640	600	600
BAS (as LAS)			
H(units)	8.3	8.4	8.05
alkalinity: P	6.0	32.0	None
T	244	236	256
ITROGEN: Organic N	5.1	4.5	4.3
Ammonia N	0.005	0.04	0.07
Nitrite N	0.020	0.025	0.024
Nitrate N	0.2	0.4	0.4
Nitrate as NO ₃			
ESIDUE: Total	454	440	477
Fixed	309	285	311
Volatile	145	155	166
Filtrable Residue T	358	347	336
F	251	233	220
V	107	114	116
Nonfiltrable Residue T	96	93	141
F	58	52	91
V	38	41	50
ettleable Matter (ml/l)			
HOSPDATE: Filtrable P	0.14	0.12	0.12
Total P	0.40	0.37	0.37
issolved Oxygen			
OD	18	15	15
OD filtered	3	3	3
OD	89	85	81
rease or Oil			
urbidity (JTU)	96	68	64
otal Hardness (as CaCO ₃)			
alcium (Ca ⁺⁺)			
agnesium (Mg ⁺⁺)			
hloride (Cl ⁻)			
ulfate (SO ₄ ⁻)			
OD filtered	39	35	31

REMARKS:

COLLECTOR Kennedy
REPORT TO Limnology Division
State Hygienic Laboratory
Des Moines, Iowa

R. L. Morris, Ph.D.
Associate Director & Principal Chemist

5 October 1972 jb

WATER QUALITY REPORT

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

own urce pecific Location	Rockfalls Shellrock Bridge in Rockfalls	Rockford Main street bridge in Rockford	Rockford Co.Rd. T-24 3 miles SE of rockford
ate Collected ite Received b Number	19 September 1972 20 September 1972 1575	1576	1577
ollection Time i	3:25	FIELD DATA 4:00	4:15
emperature ssolved Oxygen	19.5°C 11.5	19.5°C 13.9	20.0°C 10.8
BACTERIOLOGICAL EXAMINATION			
ical Coliform/100 ml	670	530	1850
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
onductance (micromhos)	610	580	730
BAS (as LAS)			
H(units)	8.2	8.4	8.2
alkalinity: P	None	6.0	None
T	248	242	280
TROGEN: Organic N	3.5	3.4	2.1
Ammonia N	0.07	0.07	< 0.01
Nitrite N	0.026	0.021	0.024
Nitrate N	2.0	2.5	4.8
Nitrate as NO ₃			
ESIDUE: Total	406	375	484
Fixed	269	232	360
Volatile	137	143	124
Filtrable Residue T	340	318	440
F	214	210	316
V	126	108	124
Nonfiltrable Residue T	66	57	44
F	55	22	44
V	11	35	0
ntleable Matter (ml/l)			
OSPHATE: Filtrable P	0.06	0.04	0.29
Total P	0.25	0.22	0.42
issolved Oxygen			
OD	12	11	7
OD filtered	3	2	5
OD	69	60	60
rease or Oil urbidty (JTU)	40	40	46
otal Hardness (as CaCO ₃)			
alcium (Ca ⁺⁺)			
agnesium (Mg ⁺⁺)			
hloride (Cl ⁻)			
ulfate (SO ₄ ⁻)			
OD filtered	31	27	27

EMARKS:

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WATER QUALITY REPORT

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

Town	Greene	Packard	Shellrock
Source	Shellrock		
Specific Location	Highway 14 bridge	Co. Rd. T-47	Highway 3
Date Collected	19 September 1972		
Date Received	20 September 1972		
Lab Number	1578	1579	1580
Collection Time	4:55	FIELD DATA 5:20	5:50
pH			
Temperature	20.0°C	20.0°C	20.0°C
Dissolved Oxygen	11.3	13.5	14.1
BACTERIOLOGICAL EXAMINATION			
Fecal Coliform/100 ml	160	110	120
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
Conductance (micromhos)	670	630	630
ABAS (as LAS)			
pH (units)	8.2	8.3	8.3
Alkalinity: P	None	16.0	14.0
T	264	266	236
NITROGEN: Organic N	2.0	2.3	2.3
Ammonia N	0.03	< 0.01	0.01
Nitrite N	0.023	0.021	0.021
Nitrate N	4.5	4.4	3.7
Nitrate as NO ₃			
RESIDUE: Total	439	420	423
Fixed	298	312	299
Volatile	141	108	124
Filtrable Residue T	380	384	352
F	277	278	256
V	103	106	96
Nonfiltrable Residue T	59	36	71
F	21	34	43
V	38	2	28
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.17	0.14	0.11
Total P	0.28	0.29	0.29
Dissolved Oxygen			
BOD	6	8	8
BOD filtered	2	2	2
COD	44	44	48
Grease or Oil			
Turbidity (JTU)	30	46	44
Total Hardness (as CaCO ₃)			
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)			
Sulfate (SO ₄ ⁻)			
COD filtered	23	27	19

REMARKS:

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5 October 1972 j b

WATER QUALITY REPORT

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

own ource pecific Location	Mason City Winnebago River Bridge on Co.Rd. S-34		
ate Collected ate Received ab Number	19 September 1972 20 September 1972 1581		
ollection Time H emperature issolved Oxygen	12:30 18.5°C 8.4	FIELD DATA	
BACTERIOLOGICAL EXAMINATION			
ecal Coliform/100 ml	1700		
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
onductance (micromhos) BAS (as LAS)	760		
H (units)	7.95		
alkalinity: P T	None 308		
NITROGEN: Organic N Ammonia N Nitrite N Nitrate N	1.2 < 0.01 0.023 6.2		
Nitrate as NO ₃			
RESIDUE: Total Fixed Volatile	600 468 132		
Filtrable Residue T F V	548 427 121		
Nonfiltrable Residue T F V	52 41 11		
ettleable Matter (ml/l)			
HOSPHATE: Filtrable P Total P	0.18 0.24		
issolved Oxygen DOD BOD filtered DOD	 2 2 27		
rease or Oil urbidity (JTU)	 42		
otal Hardness (as CaCO ₃) alcium (Ca ⁺⁺) agnesium (Mg ⁺⁺)			
hloride (Cl ⁻) ulfate (SO ₄ ⁻)			
COD filtered	19		

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