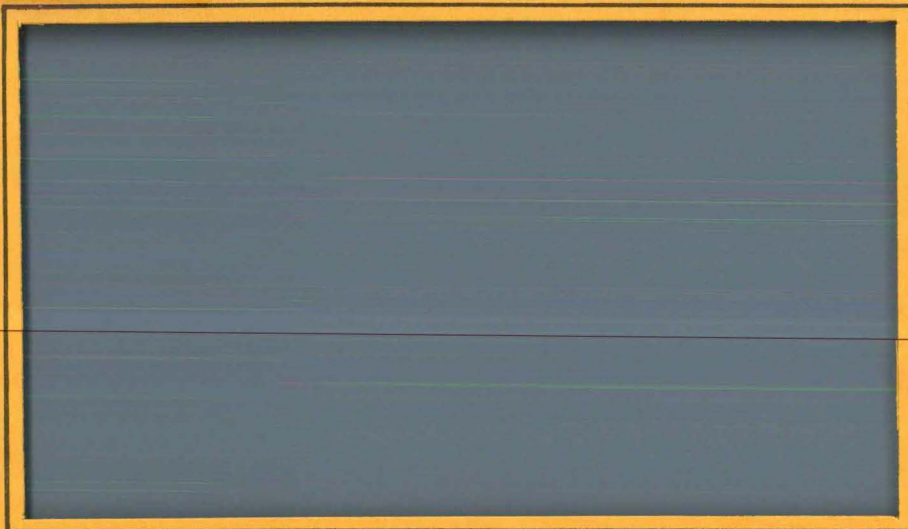


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A REPORT FROM


*The State Hygienic
Laboratory*

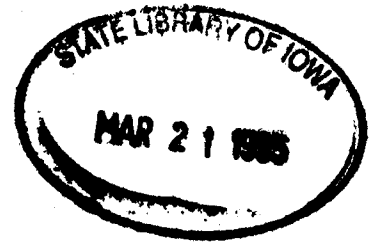


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THE UNIVERSITY OF IOWA

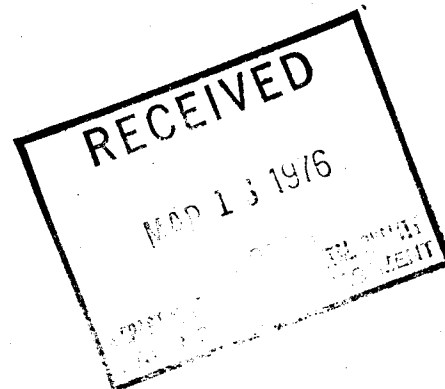
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WINTER SURVEY
OF THE
SOUTH SKUNK RIVER

#76-22



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Submitted to the Department of Environmental Quality and the
Iowa Water Quality Commission by the
State Hygienic Laboratory

INTRODUCTION

The South Skunk River originates in Hamilton County and flows in a generally southeasterly direction to its confluence with the North Skunk in Keokuk County. At this point the river has drained a total of 1840 square miles of Iowa land.

North of Ames the river flows through a narrow post-glacial valley. It is meandering with a mud and rock bottom and a repeated riffle-pool configuration. The slope of the South Skunk in this reach varies from 7.8 feet per mile in the headwaters to 5.0 feet per mile from Story City to Ames.

South of Ames the river passes through pre-glacial terrain, and it has a wider channel, a broad flood plain and a shifting sand bottom. The slope of the South Skunk in this reach is rather low as it varies from 2.9 feet per mile between Ames and Colfax to 1.4 feet per mile from Pella to Oskaloosa. Also, the stretch from Ames to Colfax has been straightened for flood control by dredging which occurred between 1893 and 1923.

Major point sources of waste in the South Skunk River Basin are the municipal sewage treatment facilities shown in Table 1.

TABLE 1

Major Sewage Discharges South Skunk River Basin

<u>Location</u>	<u>Population</u>	<u>Receiving Water</u>	<u>Average Flow (mgd)</u>
Ames	39,500	S. Skunk River	4.85
Newton	3,500	Cherry Creek	0.49
Newton	12,200	Sewer Creek	2.17
Pella	6,600	Thunder Creek	1.06
Oskaloosa	11,200	Spring Creek	0.98

In addition there are numerous smaller facilities which contribute treated waste either directly to the S. Skunk River or to its tributary streams. Thus the river receives a fairly heavy waste load relative to its assimilation capacity especially during periods of low flow.

This situation assumes added importance since the river must be protected for its intended uses. The South Skunk River is designated as a Class B, warm water stream from Story City to its confluence with the North Skunk. As such it is protected by water quality standards established to allow the

propagation of aquatic life. In addition, most of its major tributaries have been given similar classifications and must meet the same standards.

In an effort to gain more information about the impact of the waste loads, the Iowa Department of Environmental Quality requested the Limnology Division of the State Hygienic Laboratory to conduct an investigation of the water quality of the S. Skunk River basin under low flow conditions and ice cover.

This study was carried out on 2 & 3 February 1976, and samples were collected at the 23 locations shown in Figure A. Complete ice cover existed at nearly all sampling stations, and stream discharges were very low. Actual levels are indicated by the preliminary flow data obtained from the U.S. Geological Survey which is shown in Table 2.

TABLE 2

Hydrological Data South Skunk River 2 February 1976					
<u>Location</u>	<u>Drainage Area</u>	<u>7Q2*</u>	<u>7Q10</u>	<u>Discharge**</u>	<u>Average</u>
Squaw Creek Near Ames	204 sq mi	n.a.	n.a.	1.9	95.9
S. Skunk River Below Squaw Cr.	556 sq mi	2.3	n.a.	2.0	239
S. Skunk River Near Oskaloosa	1,635 sq mi	40	4.8	100	849

* All discharges in cubic feet per second (cfs)

** Preliminary estimates

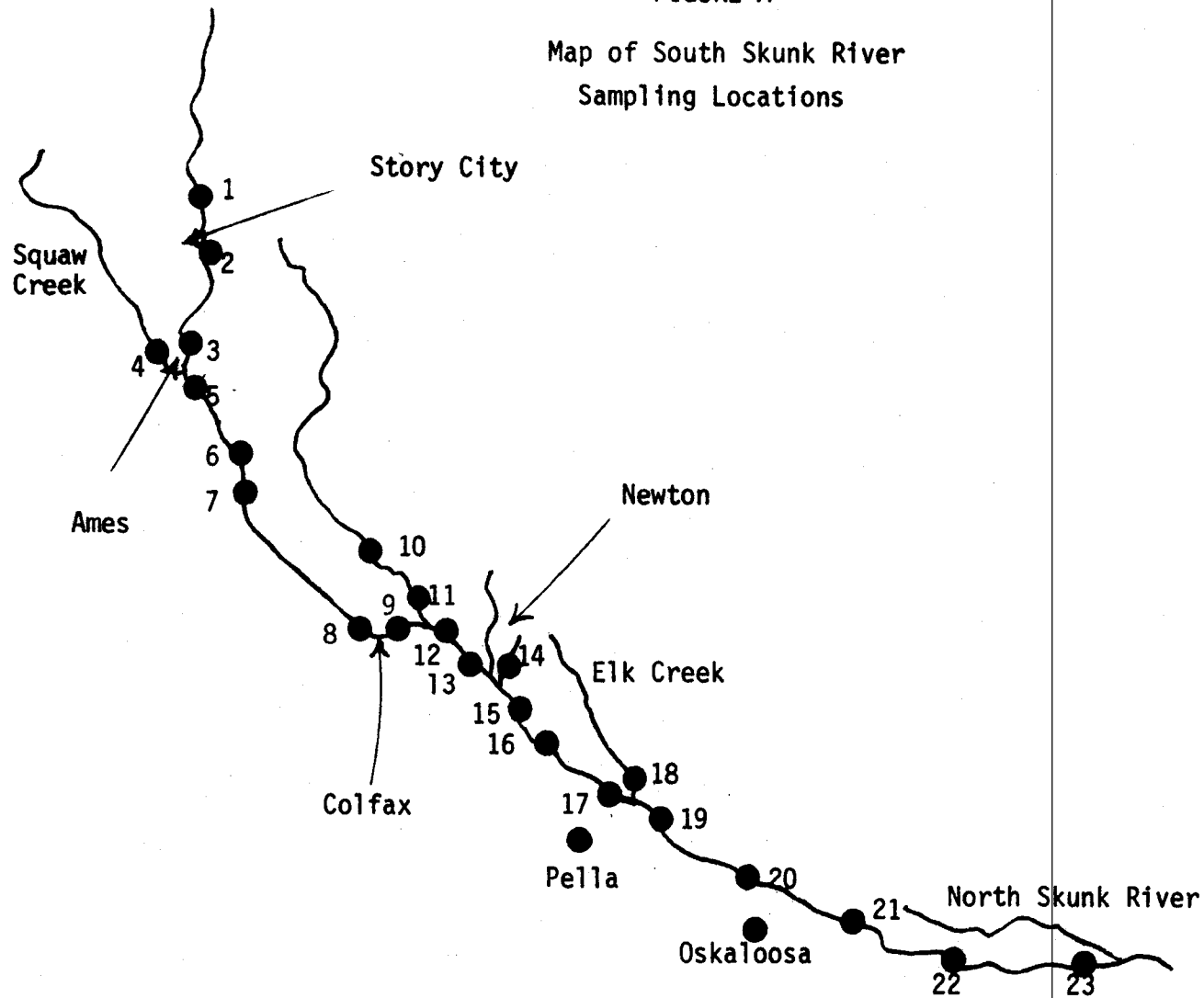
These data show that flows were extremely low especially in the upper reach of the river. The estimated flow (2.0 cfs) on the S. Skunk near Ames was below the seven-day two-year low-flow for that location. It is also apparent that most of the flow at that point was contributed by Squaw Creek (1.9 cfs), and that the flow in the South Skunk above Ames was nearly zero. Thus the flow contribution of Squaw Creek was rather large in view of its relatively small drainage basin (204 sq. mi.).

FIGURE A
South Skunk River
Sampling Locations

- Station 1: Co. Rd. Bridge at T-86N, R-24W, Sec. 36
Station 2: Highway 221 Bridge at Story City; T-85N, R23W, Sec. 18
Station 3: Old Highway 30 Bridge in Ames; T-83N, R-24W, Sec. 1 & 12
Station 4: Highway 69 Bridge over Squaw Creek in Ames; T-83N, R-24W, Sec. 11
Station 5: Co. Rd. E-57 Bridge; T-83N, R-23W, Sec. 30
Station 6: Co. Rd. E-63 Bridge near Cambridge; T-82N, R-23W, Sec. 21 & 22
~~Station 7: Co. Rd. Bridge near Cambridge; T-82N, R-23W, Sec. 22 & 27~~

Station 8: Co. Rd. Bridge NW of Colfax; T-79N, R-21W, Sec. 4
Station 9: Highway 117 Bridge N of Colfax; T-79N, R-21W, Sec. 1
Station 10: Co. Rd. Bridge over Indian Creek; T-81N, R-21W, Sec. 27 & 28
Station 11: Co. Rd. F-34 Bridge over Indian Creek; T-80N, R-20W, Sec. 20 & 29
Station 12: Highway 6 Bridge; T-79N, R-20W, Sec. 4
Station 13: Highway 14 Bridge S of Lambs Grove
Station 14: Co. Rd. Bridge over Sewer Creek; T-79N, R-19W, Sec. 21 & 28
Station 15: Co. Rd. F-62 Bridge NW of Reasnor
Station 16: Co. Rd. F-70 Bridge SE of Reasnor; T-78N, R-18W, Sec. 30
Station 17: Co. Rd. T-22 Bridge; T-77N, R-18W, Sec. 23
Station 18: Co. Rd. Bridge over Elk Creek; T-77N, R-17W, Sec. 7 & 8
Station 19: Co. Rd. G-5T Bridge; T-77N, R-17W, Sec. 28
Station 20: Highway 63 Bridge N of Oskaloosa
Station 21: Highway 92 Bridge E of Oskaloosa
Station 22: Co. Rd. U-33 Bridge; T-75N, R-13W, Sec. 34
Station 23: Co. Rd. Bridge near Richland; T-74N, R-10W, Sec. 6

FIGURE A
Map of South Skunk River
Sampling Locations



Scale of Miles
1 inch = 15 miles

RESULTS AND DISCUSSION

Results of all analyses are contained in the Appendix to this report. In addition selected items of data are presented for discussion in Table 3.

Station 1 is located in the non-classified upper reach of the river, but the results are of interest as points of comparison to other data. Conductance (1100 micromhos), total dissolved solids (640 mg/l), and chloride (92 mg/l) were all very high. These results indicate a significant ground water intrusion as water from the alluvial aquifers in the upstream end of the basin usually contains 500-1000 mg/l dissolved solids.

In addition fecal coliforms (2200 per 100 ml), ammonia-N (0.17 mg/l), and total-P (0.19 mg/l) were all found at slightly elevated concentrations. This is indicative of the impact of the small upstream waste inputs under these conditions of low flow and non-runoff.

Station 2 is located in the classified section of the river and just downstream of the sewage discharge from Story City. Under the stream conditions encountered, the impact of the discharge was significant at Station 2. The fecal coliform count was 44,000 per 100 ml which is more than twenty times the allowable maximum of 2000 per 100 ml. The ammonia-N concentration was 1.6 mg/l which is near the allowable 2.0 mg/l level and well above that found at Station 1. Total P and BOD were also above Station 1 concentrations, and DO was reduced from 11.2 to 9.7 mg/l.

Conditions had improved considerably by Station 3 which is located just north of Ames. Fecal coliforms had dropped to 110 per 100 ml and DO had increased to 14.0 mg/l. Most other constituents were at or near the levels found at Station 1.

Station 4 was located on Squaw Creek near its mouth on the south edge of Ames. Squaw Creek is a classified stream which drains 204 square miles and has an average flow of 90 cfs, and according to available information it receives no significant waste inputs.

Our results from this station indicate otherwise however, as the water quality of Squaw Creek at the time of sampling was severely degraded. Dissolved oxygen was absent, ammonia-N was 6.10 mg/l and the fecal coliform count was 380,000 mg/l. Table 3 shows that the other constituents measured were also highly elevated, and the overall condition of Squaw Creek was highly polluted.

Station 5 on the S. Skunk River was located just south of Ames which is below the mouth of Squaw Creek and the effluent discharge from the Ames Sewage Treatment Plant. Not surprisingly, the water quality at this station was found to be poor. 14,300 fecal coliforms per 100 ml were present and the ammonia-N was 9.50 mg/l. Both of these measurements are in violation of applicable water quality standards. Degredation was further indicated

TABLE 3

SELECTED CHEMICAL AND BACTERIOLOGICAL DATA

South Skunk River

February 1976

Station	Fecal Coliforms per 100 ml	Conductance micromhos	Ammonia- Nitrogen	TDS	Total Phosphate	DO	BOD	COD	Chloride
1	2,200	1100	0.17	640	0.19	11.2	1	21	92
2	44,000	1100	1.60	630	0.98	9.7	3	17	110
3	110	940	0.16	560	0.21	14.0	2	12	64
(Squaw Creek) 4	380,000	1400	6.10	850	2.10	0.0	65	200	240
5	14,300	840	9.50	510	2.10	9.4	9	32	40
6	210	840	5.10	530	1.00	10.0	2	19	33
7	350	850	4.10	520	1.10	8.7	4	17	32
8	10	760	1.60	460	0.95	8.2	1	8	21
9	8,800	750	1.40	480	0.95	10.0	2	12	25
(Indian Creek) 10	20	930	0.46	590	0.21	11.0	< 1	10	49
(Indian Creek) 11	450	810	0.12	510	0.20	12.0	< 1	6	29
12	2,400	770	1.50	490	0.24	11.3	1	10	24
13	360	680	1.20	400	0.22	15.9	2	6	23
(Sewer Creek) 14	150,000	860	7.10	550	2.20	11.7	12	44	69
15	190	650	1.10	400	0.26	14.8	1	8	21
16	130	660	1.20	400	0.23	14.2	1	6	25
17	30	670	1.00	410	0.23	15.3	1	6	20
(Elk Creek) 18	80	520	0.06	310	0.20	14.8	1	6	27
19	200	670	0.88	400	0.22	14.2	1	10	30
20	280	690	0.76	410	0.22	13.3	2	8	32
21	60	680	0.72	410	0.22	13.7	< 1	8	30
22	40	680	0.60	420	0.22	11.8	1	4	27
23	20	640	0.59	400	0.21	10.6	< 1	4	21

by the total-P (2.10 mg/l), BOD (9 mg/l), and COD (32 mg/l). Fortunately an adequate dissolved oxygen of 9.4 mg/l was maintained at this station.

Results from Station 6 located just upstream of Cambridge and about ten miles downstream of Ames indicated some recovery in stream quality. Fecal coliforms had decreased to 210 per 100 ml, but ammonia-N even though reduced to 5.10 mg/l was still in violation of standards. Dissolved oxygen had increased slightly to 10.0 mg/l, and BOD had decreased to 2 mg/l.

Recovery was interrupted by the small waste input from Cambridge which caused the conditions measured at Station 7. Fecal coliforms, BOD, total-P were all slightly above levels found at Station 6. Ammonia-N remained high at 4.10 mg/l, and dissolved oxygen dropped to 8.7 mg/l.

Conditions twenty miles downstream at Station 8 above Colfax were substantially improved. Fecal coliforms had decreased to 10 per 100 ml, ammonia-N was 1.6 mg/l, and BOD was 1 mg/l. The ammonia level was once again within allowable limits, but only after concentrations in violation of standards extended for nearly thirty river miles.

The sample at Station 9 was collected just downstream from Colfax and the results indicated the impact of the wastewater discharge from that town. Most constituents were essentially unchanged, but the fecal coliform count was 8800 per 100 ml which is a violation of standards.

Stations 10 and 11 were located on Indian Creek, one of the important tributaries of the S. Skunk River. Results from both stations indicated reasonably good water quality for low-flow conditions. Specific conductance and total dissolved solids were high at both locations, and indicated a substantial influx of groundwater. The small increase in fecal coliforms (20-450 per 100 ml) from Station 10 to 11 is indicative of the minor impact of the sewage discharge from Mingo.

At location 12, which was only a few more miles below Colfax, conditions were similar to those at Station 9. The major change was the reduction in fecal coliforms to 2400 per 100 ml which is still slightly above the allowable limit.

Within another five miles downstream at Station 13, slightly improved conditions were observed, and no constituents were at levels in violation of standards. Fecal coliforms were 360 per 100 ml, ammonia-N was 1.20 mg/l, and DO was 15.9 mg/l.

Sample 14 was collected near the mouth of Sewer Creek, an unclassified tributary which receives most of its flow from the main Newton Sewage Treatment Plant. Analytical results were typical of a wastewater discharge and in fact were better than those found on Squaw Creek. 150,000 fecal

coliforms per 100 ml were present and the ammonia-N, total-P, and BOD were 7.10, 2.20, and 12 mg/l respectively.

As shown by the results from Station 15, the influx of waste from Sewer Creek did not cause further degradation of the South Skunk River; although it certainly must have reduced the rate of recovery. Ammonia-N remained within limits at 1.10 mg/l and the fecal coliform count was 190 per 100 ml. BOD was only 1 mg/l, and DO remained high at 14.8 mg/l.

Significant recovery also was not observed further downstream at Station 16 as the river had received another small wastewater input from the municipal facility at Reasonor. Concentrations of all constituents were very similar to those found at Station 16.

Results from Station 17, which was nearly ten miles further downstream and above the influence of Thunder Creek, also showed only a slight improvement in stream quality. Recovery occurs very slowly under winter conditions since the rate of bacterial oxidation is very low at 0°C.

Analytical data from Station 18 located on Elk Creek, another major tributary, indicated good water quality conditions. Ammonia-N was 0.06, total-P was 0.20, DO was 14.8 mg/d, and fecal coliforms numbered 80 per 100 ml.

Station 19 which was positioned just downstream of both Thunder and Elk Creeks gave results which indicated the effect of the treated effluent from Pella and the dilutional effect of Elk Creek. All parameters were within allowable limits. Fecal coliforms were 200 per 100 ml and ammonia-N was 0.88 mg/l. Dissolved oxygen was reduced slightly to 14.2 mg/l.

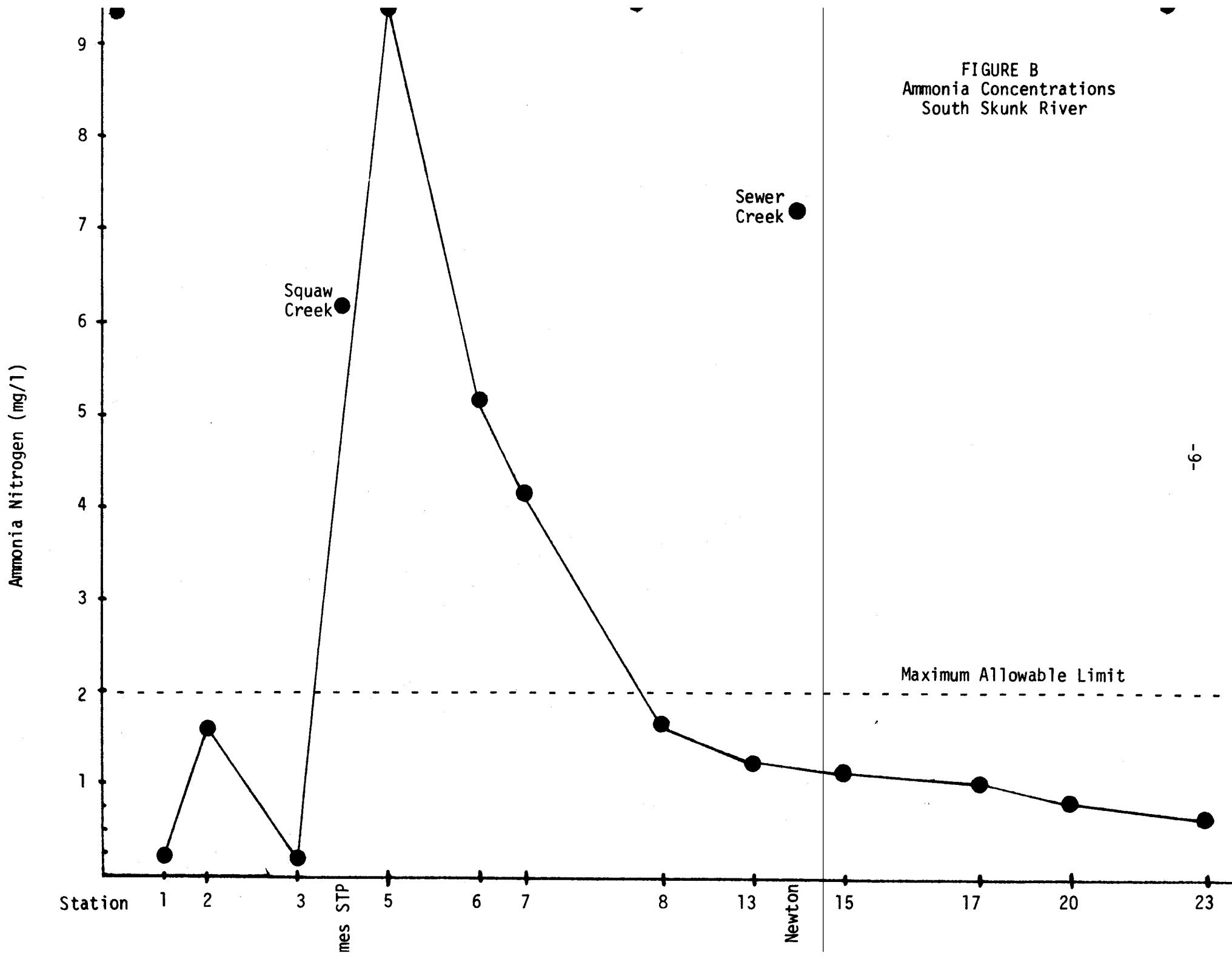
Results from the remaining four locations show little variation and indicate the slow rate of recovery of the river. Fecal coliform numbers were reduced to 20 per 100 ml at Station 23 as the organisms slowly died off and settled out. Ammonia-N, BOD, and dissolved oxygen all decreased gradually as the slow rate of oxidation continued under the ice cover.

Insights into the condition of the entire reach of the South Skunk River can be gained by an examination of Figure B. This graph which shows ammonia-N concentrations along the river is indicative of the overall condition of the river.

Upstream of Ames, conditions were slightly degraded due to the effluent from Story City, but no violations of standards were observed. Below Ames to near Colfax the river is severely degraded and the ammonia-N standard is violated throughout. This situation is due to the wastewater discharge from Ames and the inputs from Squaw Creek which is seriously polluted from an unknown source.

From Colfax downstream to the river's confluence with the North Fork, the ammonia-N concentrations are below the 2.0 mg/l standard and exhibit a gradual reduction to 0.59 mg/l. This slow rate of recovery is not

FIGURE B
Ammonia Concentrations
South Skunk River



unexpected as the rate of bacterial nitrification at 0°C is extremely low. Furthermore, recovery was repeatedly inhibited by the influx of additional wastes from Newton, Pella and other towns within the basin. Finally at low winter flows, the dilutional effect of tributary streams is not great.


CONCLUSIONS

Under the stream conditions observed, our analytical results from the South Skunk River Basin led to the following conclusions:


1. At a single sampling site near Ames, Squaw Creek was severely polluted. Concentrations of fecal coliforms, ammonia-nitrogen, and dissolved oxygen were in violation of standards for Class B waters. The source of this pollution is unknown.
2. The South Skunk River contained ammonia-nitrogen violations throughout a 30-mile reach of river from Ames to near Colfax. This situation can be attributed to the impact of Squaw Creek and the wastewater discharge from the Ames Sewage Treatment Plant.
3. Violations of the water quality standard for fecal coliform organisms were discovered at six locations in the S. Skunk River Basin. Some of these can be attributed specifically to wastewater discharges from Ames, Colfax, Story City, and the unknown source into Squaw Creek.
4. The persistence of slightly elevated ammonia levels downstream of Colfax can be attributed to several factors. The frequent sources of low levels of ammonia along the entire reach of the river are additive in effect and inhibit recovery. The rate of bacterial nitrification at 0°C is extremely low and ammonia is not rapidly oxidized to nitrate. And finally, the dilutional effect of good quality tributary streams is relatively small at low winter flows.

RECOMMENDATIONS

It is recommended that the Limnology Division of the State Hygienic Laboratory do further field sampling on Squaw Creek near Ames. The purposes of the work would be to determine whether the pollution in Squaw Creek has persisted and if so, to determine the source or sources of the pollutants.


Dennis M Geary, MS
Limnologist

2 March 1976


R L Morris, PhD
Associate Director &
Principal Chemist

A P P E N D I X

WATER QUALITY REPORT

Town			Ames
Source	S. Skunk River	S. Skunk River	S. Skunk River
Specific Location	Co.Rd. bridge, T86N, R24W, Sec.36	Hwy 221 bridge, T85N, R24 ₃ W, Sec.18	Old hwy 30 bridge, T83N, R24W, Sec. 1 & 1
Date Collected	2 February 1976	2 February 1976	2 February 1976
Date Received	2 February 1976	2 February 1976	2 February 1976
Lab Number	3002	3003	3004
Collection Time	10:05	FIELD DATA	
pH		10:35	11:20
Temperature	-1°C	-1°C	-1°C
Disolved Oxyren			
BACTERIOLOGICAL EXAMINATION			
Fecal Coliform/100 ml	2200 (<8 hrs.)	44,000 (<8 hrs.)	110 (<8 hrs.)
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
Conductance (micromhos)	1100	1100	940
MBAS (as LAS)			
pH (units)	7.65	7.75	7.9
Alkalinity: P	None	None	None
T	352	344	308
NITROGEN: Organic N	0.58	1.0	0.72
Ammonia N	0.17	1.6	0.16
Nitrite N	0.041	0.089	0.057
Nitrate N	2.6	2.6	2.1
Nitrate as NO ₃			
RESIDUE: Total	680	660	600
Fixed	540	540	470
Volatile	140	120	130
Filtrable Residue T	640	630	560
F	520	530	460
V	120	100	100
Nonfiltrable Residue T	8	9	11
F	6	4	8
V	2	5	3
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.19	0.24	0.21
Total P	0.19	0.98	0.21
Dissolved Oxygen	11.2	9.7	14.0
BOD	1*	3	2
COD	21	17	12
Grease or Oil			
Turbidity (JTU)	3.1	3.2	4.3
Total Hardness (as CaCO ₃)	478	426	424
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	92	110	64
Sulfate (SO ₄ ⁻)			
	*Comprehensive note for lab #'s 3002-3008: Sample held for 36 hours at 4°C before analysis.		

REMARKS: 100% ice cover. 90% ice cover. 100% ice cover.

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

R. L. Morris, Ph.D.
Associate Director & Principal Chemist
FEB 12 1976
LIMNOLOGY SURVEY

WATER QUALITY REPORT

-13-

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

Town	Ames	S. Skunk River	Cambridge
Source	Squaw Creek	S. Skunk River	S. Skunk River
Specific Location	Hwy 69 bridge, T83N, R24W, Sec. 11	Co.Rd. E-57 bridge T83N, R24W, Sec.30	Co.Rd. E-63 bridge, T82N, R23W, Sec.21 & 2
Date Collected	2 February 1976	2 February 1976	2 February 1976
Date Received	2 February 1976	2 February 1976	2 February 1976
Lab Number	3005	3006	3007
Collection Time	11:45	FIELD DATA	
pH		1:15	1:30
Temperature	-1°C	0°C	-1°C
Dissolved Oxygen			
BACTERIOLOGICAL EXAMINATION			
Fecal Coliform/100 ml	380,000 (<8 hrs.)	14,300 (<8 hrs.)	210 (<8 hrs.)
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
Conductance (micromhos)	1400	840	840
MBAS (as LAS)			
pH (units)	6.8	7.55	7.6
Alkalinity: P	None	None	None
T	181	252	283
NITROGEN: Organic N	4.2	1.6	2.2
Ammonia N	6.1	9.5	5.1
Nitrite N	0.025	0.29	0.16
Nitrate N	<0.1	2.1	1.6
Nitrate as NO ₃			
RESIDUE: Total	960	550	560
Fixed	710	430	450
Volatile	250	120	110
Filtrable Residue T	850	510	530
F	680	420	440
V	170	90	90
Nonfiltrable Residue T	56	18	7
F	26	11	6
V	30	7	1
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	2.1	2.1	0.31
Total P	2.1	2.1	1.0
Dissolved Oxygen	0.0	9.4	10
BOD	65	9	2
COD	200	32	19
Grease or Oil			
Turbidity (JTU)	44	17	6.2
Total Hardness (as CaCO ₃)	444	336	388
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	240	40	33
Sulfate (SO ₄ ⁻)			

REMARKS: 100% ice cover. 30% ice cover. 95% ice cover.

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

FEB 12 1976

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

LIMNOLOGY SURV...

WATER QUALITY REPORT

-14-

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

Town	Cambridge	S. Skunk River	Colfax
Source	S. Skunk River	S. Skunk River	S. Skunk River
Specific Location	Co.Rd. bridge, T82N, R23W, Sec. 22 & 27	Co.Rd. bridge T79N, R21W, Sec. 4	Hwy 117 bridge, T79N, R21W, Sec. 1
Date Collected	2 February 1976	3 February 1976	3 February 1976
Date Received	2 February 1976	3 February 1976	3 February 1976
Lab Number	3008	3020	3021
Collection Time	1:45	9:15	11:30
pH			
Temperature	-1°C	-1°C	-1°C
Dissolved Oxygen			
	FIELD DATA		
	BACTERIOLOGICAL EXAMINATION		
Fecal Coliform/100 ml	350 (<8 hrs.)	10 (<8 hrs.)	8800 (<8 hrs.)
	CHEMICAL ANALYSIS (as mg/l unless designated otherwise)		
Conductance (micromhos)	850	760	750
MBAS (as LAS)			
pH (units)	7.5	7.6	7.6
Alkalinity: P	None	None	None
T	281	275	272
NITROGEN: Organic N	0.95	2.2	2.1
Ammonia N	4.1	1.6	1.4
Nitrite N	0.14	0.050	0.056
Nitrate N	1.4	1.3	1.5
Nitrate as NO ₃			
RESIDUE: Total	550	500	500
Fixed	440	400	400
Volatile	110	100	100
Filtrable Residue T	520	460	480
F	430	390	390
V	90	70	90
Nonfiltrable Residue T	8	4	7
F	5	3	7
V	3	1	0
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.31	0.26	0.26
Total P	1.1	0.95	0.95
Dissolved Oxygen	8.7	8.2	10.0
BOD	4	1	2
COD	17	8	12
Grease or Oil			
Turbidity (JTU)	6.4	3.4	3.3
Total Hardness (as CaCO ₃)	382	364	360
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	32	21	25
Sulfate (SO ₄ ⁻)			
		Comprehensive note for lab #'s 3020-3024: Samples held at 40°C for 16 hours before analysis.	

REMARKS: 60% ice cover. 95% ice cover. 80% ice cover.

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

FEB 12 1976

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

LIMNOLOGY SURVEY

WATER QUALITY REPORT

Town			
Source	Indian Creek	Indian Creek	S. Skunk River
Specific Location	Co.Rd. bridge, T81N, R21W, Sec. 27 & 28	Co.Rd. F-34 bridge, T80N, R20W, Sec. 20 & 29	Hwy 6 bridge, T79N, R20W, Sec. 4
Date Collected	3 February 1976	3 February 1976	3 February 1976
Date Received	3 February 1976	3 February 1976	3 February 1976
Lab Number	3022	3023	3024
Collection Time	9:40	10:05	10:25
pH			
Temperature	-1°C	-1°C	-1°C
Disolved Oxygen			
BACTERIOLOGICAL EXAMINATION			
Fecal Coliform/100 ml	20 (<8 hrs.)	450 (<8 hrs.)	2400 (<8 hrs.)
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
Conductance (micromhos)	930	810	770
MBAS (as LAS)			
pH (units)	7.6	7.65	7.65
Alkalinity: P	None	None	None
T	346	288	322
NITROGEN: Organic N	0.51	0.38	0.49
Ammonia N	0.46	0.12	1.5
Nitrite N	0.093	0.059	0.057
Nitrate N	2.4	1.7	1.5
Nitrate as NO ₃			
RESIDUE: Total	620	530	520
Fixed	500	410	410
Volatile	120	120	110
Filtrable Residue T	590	510	490
F	500	410	410
V	90	100	80
Nonfiltrable Residue T	6	8	6
F	5	7	4
V	1	1	2
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.21	0.20	0.24
Total P	0.21	0.20	0.24
Dissolved Oxygen	11.0	12.0	11.3
BOD	<1	<1	1
COD	10	6	10
Grease or Oil			
Turbidity (JTU)	3.0	2.5	2.9
Total Hardness (as CaCO ₃)	436	400	376
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	49	29	24
Sulfate (SO ₄ ⁻)			

REMARKS: 100% ice cover. 100% ice cover. 80% ice cover.

COLLECTOR
REPORT TO

Cramer & Kennedy
Limnology Division
State Hygienic Laboratory
Des Moines, Iowa

R. L. Morris, Ph.D.
Associate Director & Principal Investigator
LIMNOLOGY SURVEY

FEB 12 1976

WATER QUALITY REPORT

Town	Lambs Grove	Reasnor	S. Skunk River
Source	S. Skunk River	S. Skunk River	S. Skunk River
Specific Location	Hwy 14 bridge S of Lamb's Grove	Co. Rd. F-62 bridge W of Reasnor	Co. Rd. F-70 bridge, T78N, R18W, Sec. 30
Date Collected	2 February 1976	2 February 1976	2 February 1976
Date Received	3 February 1976	3 February 1976	3 February 1976
Lab Number	3009	3010	3011
Collection Time	14:50	FIELD DATA	
pH		14:30	1400
Temperature	0°C	0°C	0°C
Dissolved Oxygen			
Fecal Coliform/100 ml	360 (>8 hrs.)	190 (>8 hrs.)	130 (>8 hrs.)
BACTERIOLOGICAL EXAMINATION			
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
Conductance (micromhos)	680	650	660
MBAS (as LAS)			
pH (units)	7.9	7.8	7.8
Alkalinity: P	None	None	None
T	251	239	241
NITROGEN: Organic N	0.59	0.56	0.56
Ammonia N	1.2	1.1	1.2
Nitrite N	0.060	0.069	0.072
Nitrate N	1.5	1.4	1.5
Nitrate as NO ₃			
RESIDUE: Total	540	430	420
Fixed	340	350	340
Volatile	200	80	80
Filtrable Residue T	400	400	400
F	340	330	340
V	60	70	60
Nonfiltrable Residue T	6	18	6
F	4	11	1
V	2	7	5
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.22	0.23	0.23
Total P	0.22	0.26	0.23
Dissolved Oxygen	15.9	14.8	14.2
BOD	2*	1	1
COD	6	8	6
Grease or Oil			
Turbidity (JTU)	2.4	5.4	2.7
Total Hardness (as CaCO ₃)	324	316	314
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	23	21	25
Sulfate (SO ₄ ⁻)			
*Comprehensive note for lab #'s 3009-3019--Sample held at 4°C for 16 hours before analysis.			

REMARKS: Complete ice cover. Total ice cover. Complete ice cover.

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

FEB 12 1976

R. L. Morris, Ph.D.
 Associate Professor, Principal Chemist

LIMNOLOGY SURVEY

WATER QUALITY REPORT

Town Source	Pella	Peoria	Oskaloosa
Specific Location	S. Skunk River Co.Rd. T-22 bridge T77N, R18W, Sec.23	S. Skunk River Co.Rd. G-5T bridge T77N, R17W, Sec.28	S. Skunk River Hwy 63 bridge N of of Oskaloosa
Date Collected	2 February 1976	2 February 1976	2 February 1976
Date Received	3 February 1976	3 February 1976	3 February 1976
Lab Number	3012	3013	3014
Collection Time	1330	FIELD DATA	
pH		12:40	12:00
Temperature	0°C	0°C	0°C
Dissolved Oxygen			
BACTERIOLOGICAL EXAMINATION			
Fecal Coliform/100 ml	30 (>8 hrs.)	200 (>8 hrs.)	280 (>8 hrs.)
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
Conductance (micromhos)	670	670	690
MBAS (as LAS)			
pH (units)	7.85	7.8	7.95
Alkalinity: P	None	None	None
T	239	235	237
NITROGEN: Organic N	0.62	0.55	0.59
Ammonia N	1.0	0.88	0.76
Nitrite N	0.072	0.068	0.076
Nitrate N	1.4	1.6	1.9
Nitrate as NO₃			
RESIDUE: Total	440	430	440
Fixed	350	350	370
Volatile	90	80	70
Filtrable Residue T	410	400	410
F	340	340	350
V	70	60	60
Nonfiltrable Residue T	8	10	10
F	5	5	7
V	3	5	3
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.22	0.22	0.21
Total P	0.23	0.22	0.22
Dissolved Oxygen	15.3	14.2	13.3
BOD	1	1	2
COD	6	10	8
Grease or Oil			
Turbidity (JTU)	3.0	2.9	3.7
Total Hardness (as CaCO₃)	312	308	308
Calcium (Ca⁺⁺)			
Magnesium (Mg⁺⁺)			
Chloride (Cl⁻)	26	30	32
Sulfate (SO₄⁻)			

REMARKS: 95% ice cover. 90% ice cover. Complete ice cover.

COLLECTOR
REPORT TO

Geary
 Limnology Division
 State Hygienic Laboratory
 Des Moines, Iowa

R. L. Morris, Ph.D.

Associate Director & Principal Chemist

FEB 14 1976

LIMNOLOGY SURVEY

WATER QUALITY REPORT

Location	Oskaloosa	Delta	Richland
Source	S. Skunk River	S. Skunk River	S. Skunk River
Specific Location	Hwy 92 bridge E of Oskaloosa	Co.Rd. U-33 bridge T75N, R13W, Sec.34	Co.Rd. bridge, T74N, R10W, Sec. 6
Date Collected	2 February 1976	2 February 1976	2 February 1976
Date Received	3 February 1976	3 February 1976	3 February 1976
Lab Number	3015	3016	3017
Collection Time	1130	FIELD DATA 11:00	1010
PH			
Temperature	0°C	0°C	0°C
Dissolved Oxygen			
Fecal Coliform/100 ml	60 (>8 hrs.)	40 (>8 hrs.)	20 (>8 hrs.)
BACTERIOLOGICAL EXAMINATION			
CHEMICAL ANALYSIS (as mg/l unless designated otherwise)			
Conductance (micromhos)	680	680	640
MBAS (as LAS)			
pH (units)	7.75	7.75	7.65
Alkalinity: P	None	None	None
T	239	246	240
NITROGEN: Organic N	0.60	0.72	0.76
Ammonia N	0.72	0.60	0.59
Nitrite N	0.068	0.066	0.060
Nitrate N	1.8	1.7	1.7
Nitrate as NO ₃			
RESIDUE: Total	440	450	420
Fixed	360	360	340
Volatile	80	90	80
Filtrable Residue T	410	420	400
F	350	360	330
V	60	60	70
Nonfiltrable Residue T	8	7	9
F	6	5	5
V	2	2	4
Settleable Matter (ml/l)			
PHOSPHATE: Filtrable P	0.22	0.21	0.21
Total P	0.22	0.22	0.21
Dissolved Oxygen	13.7	11.8	10.6
BOD	<1	1	<1
COD	8	4	4
Grease or Oil			
Turbidity (JTU)	3.4	3.5	3.8
Total Hardness (as CaCO ₃)	316	328	312
Calcium (Ca ⁺⁺)			
Magnesium (Mg ⁺⁺)			
Chloride (Cl ⁻)	30	27	21
Sulfate (SO ₄ ⁻)			

REMARKS: Complete ice cover. Complete ice cover. Complete ice cover.

COLLECTOR
REPORT TO

Geary
Limnology Division
State Hygienic Laboratory
Des Moines, Iowa

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

FEB 12 1976

LIMNOLOGY SURVEY

WATER QUALITY REPORT

Town	Peoria	Newton
Source	Elk Creek	Sewer Creek
Specific Location	Co.Rd. bridge, T77N, R17W, Sec. 7 & 8	Co.Rd. bridge, T79N, R19W, Sec. 21 & 28
Date Collected	2 February 1976	2 February 1976
Date Received	3 February 1976	3 February 1976
Lab Number	3018	3019
Collection Time	1305	FIELD DATA 15:15
pH		
Temperature	0°C	4°C
Dissolved Oxygen		
Fecal Coliform/100 ml	80 (≥ 8 hrs.)	150,000 (≥ 8 hrs.)
	BACTERIOLOGICAL EXAMINATION	
	CHEMICAL ANALYSIS (as mg/l unless designated otherwise)	
Conductance (micromhos)	520	860
MBAS (as LAS)		
pH (units)	7.75	7.75
Alkalinity: P	None	None
T	185	160
NITROGEN: Organic N	0.54	1.9
Ammonia N	0.06	7.1
Nitrite N	0.042	0.15
Nitrate N	1.9	5.1
Nitrate as NO ₃		
RESIDUE: Total	340	610
Fixed	270	510
Volatile	70	100
Filtrable Residue T	310	550
F	250	490
V	60	60
Nonfiltrable Residue T	34	44
F	31	35
V	3	9
Settleable Matter (ml/l)		
PHOSPHATE: Filtrable P	0.20	1.8
Total P	0.20	2.2
Dissolved Oxygen	14.8	11.7
BOD	1	12
COD	6	44
Grease or Oil		
Turbidity (JTU)	7.5	22
Total Hardness (as CaCO ₃)	236	214
Calcium (Ca ⁺⁺)		
Magnesium (Mg ⁺⁺)		
Chloride (Cl ⁻)	27	69
Sulfate (SO ₄ ⁻)		
	STATE LIBRARY COMMISSION OF IOWA	
	Historical	
	DES MOINES, IOWA 50319	

REMARKS: 95% ice cover. Open--no ice cover.

FEB 12 1976

COLLECTOR
REPORT TO

Geary
Limnology Division
State Hygienic Laboratory
Des Moines, Iowa

R. L. Morris, Ph.D.

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LIMNOLOGY SUBDIVISION