

MICHIGAN DEPARTMENT OF NATURAL RESOURCES
SURFACE WATER QUALITY DIVISION
JULY, 1992

STAFF REPORT

A BIOLOGICAL SURVEY OF PINE CREEK
VAN BUREN COUNTY, MICHIGAN
JULY 1 AND JULY 12, 1991

As part of the biosurvey activity, staff of the Great Lakes and Environmental Assessment Section (GLEAS) conducted a qualitative biological survey to determine the impact of Du-Wel Metal Products discharge on the biological communities of Pine Creek in the vicinity of Hartford, Michigan.

The biological survey was performed according to GLEAS Procedure #51 (available upon request). Grab samples of the river water and sediment were also collected, preserved, stored at 4°C, and transported to the MDNR-Environmental Laboratory for chemical analysis (MDNR, 1981).

Pine Creek, a tributary to the Paw Paw River, ranges from a first to second order stream in the Southern Michigan Northern Indiana Till Plains Ecoregion of Van Buren County, Michigan. Pine Creek was recommended by staff of the Surface Water Quality Division for consideration as a coldwater trout stream in 1981 due to the stream temperatures (Creal, 1981).

Results of previous biological surveys indicated that periodic heavy metal concentrations in the Du-Wel Products discharge was impacting the stream quality of Pine Creek (Fetterolf and Carr, 1962; Creal, 1981 and 1982). The objective of the present biological survey was to evaluate the impact of the Du-Wel discharge on the aquatic macroinvertebrate and fish communities, physical habitat and chemical water quality of Pine Creek.

SUMMARY

1. The locations of the biological and chemical sampling stations are shown in Figure 1.
2. Fish community, aquatic macroinvertebrate community, habitat evaluation, and chemical and sediment data generated during the biological survey are presented in Tables 1 through 5, respectively.
3. The aquatic macroinvertebrate communities and habitat conditions at Stations 1, 2 and 3 ranged from "poor" (severely impaired) to "fair" (moderately impaired). The fish community was categorized as "poor" at Station 1 and

"good" (slightly impaired) at Stations 2 and 3. The overall biological integrity of Pine Creek at Station 4 immediately downstream of the Du-Wel discharge was "good" based on the qualitative assessment of fish and macroinvertebrate communities. Habitat conditions at Station 4 were categorized as "excellent" (non-impaired). The overall biological integrity at Station 5, further downstream of the Du-Wel discharge was categorized as "fair" based on aquatic macroinvertebrate and fish community structure, and habitat conditions.

4. The "poor" classification of fish and habitat and "fair" classification of macroinvertebrates at Station 1, and "fair" classification of macroinvertebrates and habitat at Stations 2 and 3 suggests that siltation and sedimentation due to agricultural related surface runoff are contributing to the biological degradation in the upstream reaches of Pine Creek. The biological communities and habitat downstream of the nonpoint source pollution impacts and the Du-Wel Metal discharge appeared to recover, as characterized by "good" community structures of fish and macroinvertebrates and "excellent" habitat conditions. However, the "fair" classification of fish and macroinvertebrate community structure, and habitat conditions at Station 5, further downstream of the Du-Wel metal discharge suggests that factors other than the periodic discharge of stormwater and noncontact cooling water are contributing to the reduced water quality of Pine Creek at this location. It appears as though the Du-Wel discharge is no longer limiting the water quality in Pine Creek as was observed in previous biological surveys (Fetterolf and Carr, 1962; Creal 1981 and 1982). The electroplating portion of the plant's processes were discontinued in 1987. Currently, the company is authorized to discharge only storm water and non-contact cooling water to Pine Creek.
5. Results of water chemistry sampling during the present survey indicated elevated levels of nitrate+nitrite at Stations 1, 2, 3 and Pine Creek tributary, and high levels of nitrites, ammonia, kjeldahl nitrogen, total phosphorus and suspended solids at Station 3. High levels of nutrients at the upstream stations indicate a source of agricultural runoff to the creek. Little buffer zone exists between Pine Creek and currently farmed agricultural areas. Elevated concentrations of zinc were found in water samples from Station 2 over those found at the other upstream stations. Elevated levels of copper were found in the Du-Wel discharge in the present survey that came close to exceeding the water quality based effluent limit of 23 ug/l of copper. However, instream copper concentrations immediately downstream of the discharge were < 1 ug/l. Previous water chemistry sampling

during the period when electroplating processes were functioning indicated periodic fluctuations in metal concentrations of the discharge (Christensen and McDonald, 1978; Boersen and Erickson, 1979; Creal, 1981; Creal, 1982). Concentrations of copper and zinc in the sediment during the present study were slightly elevated at stations 4 and 5, downstream of the Du-Wel discharge. However, concentrations of all metals found in the sediment during the present survey were greatly reduced from historical sampling results.

LITERATURE CITED

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- Field Work by: Sylvia Heaton, Aquatic Biologist
William Creal, Aquatic Biologist
Laura Smith, Water Quality Appraisal Unit
- Report by: Sylvia Heaton, Aquatic Biologist
Water Quality Appraisal Unit
Great Lakes and Environmental Assessment Section

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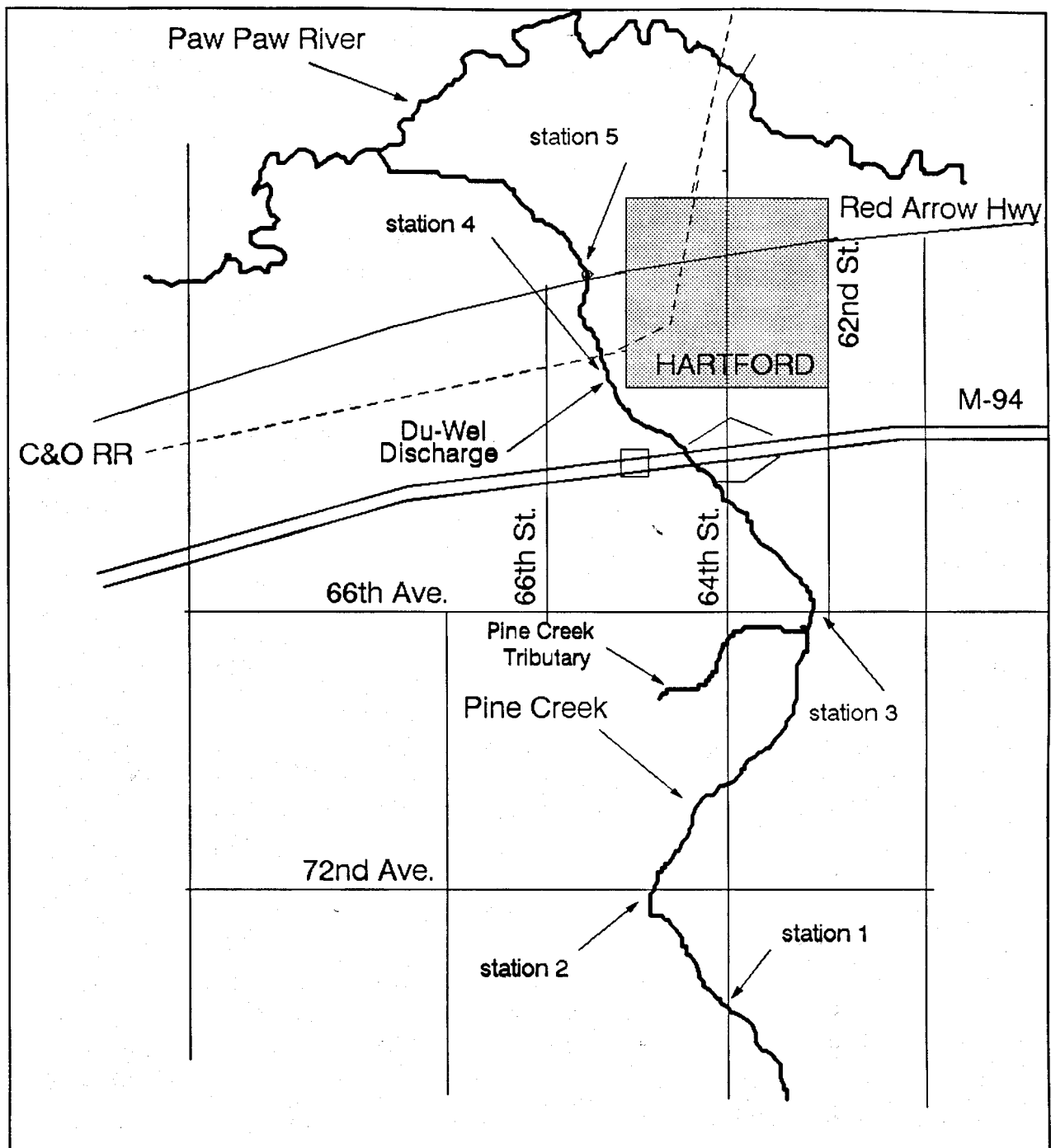


Figure 1. Biological sampling locations on Pine Creek, Van Buren Co., July 1 and July 12, 1991.

Table 1A. Qualitative fish sampling results for Pine Creek, Van Buren, Co., July 1 and July 12, 1991.

TAXA	STATION 1	STATION 2	STATION 3	STATION 4	STATION 5
Petromyzontidae (Lampreys)			2		
Clupeidae (Herrings)					
Salmonidae (Trouts)					
Salvelinus fontinalis (Brook tr.)				7	
Umbriidae (Mudminnows)					
Umbra limi (Central mudminnow)		5	8	6	4
Esocidae (Pikes)					
Esox americanus ver. (Grass Pike)			2	1	3
Cyprinidae (Minnows and Carps)					
Nocomis biguttatus (Horneyhead)					4
Semotilus atromaculatus (Creek)			1	3	14
Notemigonus crysoleucas (Golden)				2	3
N. spilopterus (Spotfin shiner)		2			
P. notatus (Bluntnose minnow)	3			4	
Rhinichthys atratulus (Blacknose)		2		17	
Cottidae (Sculpins)					
Cottus bairdi (Mottled sculpin)			3	29	1
Catostomidae (Suckers)					
Catostomus commersoni (W. sucker)	2		18	10	23
Ictaluridae (Bullhead, Catfish)					
Ictalurus melas (Black bullhead)			1		
Aphredoderidae (Pirate perch)					
Cyprinodontidae (Killifish)					
Gasterosteidae (Sticklebacks)					
Percichthyidae (Serranidae)					
Centrarchidae (Sunfish)					
Lepomis cyanellus (Green sunfish)			1	3	10
L. macrochirus (Bluegill)			6		
Micropterus salmoides (Lm. bass)			1	5	1
Percidae (Perches)					
E. nigrum (Johnny darter)		1		1	5
Percina maculata (Blackside dar.)			2		
TOTAL INDIVIDUALS	5	10	45	88	68
NUMBER OF ANOMALIES				1	1
SQUARE FOOT SAMPLED	75	225	1200	3750	3750
DENSITY OF INDIVIDUALS (#/SF)	0.067	0.044	0.038	0.023	0.018

Table 1B. Fish metric evaluation of Pine Creek, Van Buren Co., July 1 and July 12, 1991.

METRIC	STATION 1		STATION 2		STATION 3		STATION 4		STATION 5	
	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	2	1	4	3	11	5	12	5	10	5
NUMBER OF DARTER SPECIES	0	1	1	3	1	3	1	3	1	3
NUMBER OF SUNFISH SPECIES	0	1	0	1	2	3	1	3	1	3
NUMBER OF SUCKER SPECIES	1	3	0	1	1	3	1	3	1	3
PERCENT CARP, G.SUNFISH, W.SUCKER	40.0	1	0.0	5	42.2	1	14.8	3	48.5	1
PERCENT OMNIVORES	100.0	1	0.0	5	40.0	3	18.2	5	38.2	3
PERCENT INSECTIVO. CYPRINIDS	0.0	1	20.0	3	0.0	1	0.0	1	5.9	1
PERCENT PISCIVORES	0.0	1	0.0	1	6.7	5	6.8	5	5.9	5

Table 2. Continued...

DENSITY OF INDIVIDUALS	0.067	3	0.044	1	0.038	5	0.023	3	0.018	3
PERCENT ANOMALIES	0.0	5	0.0	5	0.0	5	1.1	3	1.5	0
TOTAL SCORE		18		28		34		34		27
FISH COMMUNITY CATEGORY		POOR (SEVERELY IMPAIRED)		GOOD (SLIGHTLY IMPAIRED)		GOOD (SLIGHTLY IMPAIRED)		GOOD (SLIGHTLY IMPAIRED)		FAIR (MODERATELY IMPAIRED)

Table 2A. Qualitative macroinvertebrate sampling results for Pine Creek, Van Buren, Co., July 1, and July 12, 1991.

TAXA	STATION 1	STATION 2	STATION 3	STATION 4	STATION 5
PORIFERA (sponges)	6	2			
PLATYHELMINTHES (flatworms)					
ANNELIDA (segmented worms)				4	
Oligochaeta (worms)		1	5		
ARTHROPODA					
Amphipoda (scuds)	50	50	5		
Decapoda (crayfish)	3	3	3	5	10
Arachnoidea					
Insecta					
Ephemeroptera (mayflies)					
Baetidae		4	3	25	20
Heptageniidae				11	
Caenidae				1	
Odonata					
Calopterygidae		2		2	2
Coenagrionidae			1		
Aeshnidae		5	3		1
Gomphidae				1	
Plecoptera (stoneflies)					
Hemiptera (true bugs)					
Belostomatidae					
Notonectidae			1		
Gerridae	3	10	50		10
Mesoveliidae		2	20		
Megaloptera					
Chauliodes			1		
Neuroptera (spongilla flies)					
Trichoptera (caddisflies)					
Hydropsychidae	20	6		63	20
Cheumatopsyche				3	
Hydroptilidae				4	
Limnephilidae	50	1		1	
Lepidoptera (moths)					
Coleoptera (beetles)					
Dytiscidae (total)			3		1
Hydrophilidae (total)	1	11	2		
Elmidae		10	10	9	10
Diptera (flies)					
Tipulidae		4			1
Simuliidae	6	11		5	20
Chironomidae			40	1	
Rheotanytarsus				2	
MOLLUSCA					
Gastropoda (snails)					
Campeloma				1	
Ferrissia (limpet)					10
Lymnaea				4	
Physa			2	3	
Pelecypoda (clams)					
TOTAL INDIVIDUALS	139	122	149	145	105

Table 2B. Macroinvertebrate metric evaluation of Pine Creek, Van Buren, Co., July 1 and July 12, 1991.

METRIC	STATION 1		STATION 2		STATION 3		STATION 4		STATION 5	
	Value	Score	Value	Score	Value	Score	Value	Score	Value	Score
TOTAL NUMBER OF TAXA	8	0	15.0	2	15.0	4	18.0	4	12.0	2
NUMBER OF MAYFLY TAXA	0	0	1.0	0	1.0	2	3.0	6	1.0	2
NUMBER OF CADDISFLY TAXA	2	0	2	3	0	0	4	2	1	0
NUMBER OF STONEFLY TAXA	0	0	0	0	0	0	0	0	0	0
PERCENT MAYFLY COMP.	0.0	0	3.3	0	2.0	0	25.5	6	19.0	6
PERCENT CADDISFLY COMP.	50.4	6	5.7	0	0.0	0	49.0	6	19.0	2
PERCENT CONTR. DOM. TAXON	36.0	2	41.0	0	33.6	2	43.4	0	19.0	6
PERCENT ISOPOD, SNAIL, LEECH	0.0	6	0.0	6	1.3	4	5.5	2	9.5	0
PERCENT SURFACE AIR BREATHERS	2.9	6	18.9	4	51.0	0	0.0	6	10.5	4
TOTAL SCORE		20		15		12		32		22
MACROINVERTEBRATE COMMUNITY CATEGORY		FAIR (MODERATELY IMPAIRED)		FAIR (MODERATELY IMPAIRED)		FAIR (MODERATELY IMPAIRED)		GOOD (SLIGHTLY IMPAIRED)		FAIR (MODERATE IMPAIRED)

Table 3. Habitat evaluation for Pine Creek, Van Buren Co., July 1 and July 12, 1991.

HABITAT METRIC	STATION 1 SCORE	STATION 2 SCORE	STATION 3 SCORE	STATION 4 SCORE	STATION 5 SCORE
Bottom Substrate Available Cover:	6	11	16	17	6
Embeddedness:	6	11	11	11	10
Velocity:Depth:	11	13	5	18	11
Flow Stability:	10	9	10	11	12
Bottom Deposition:	7	8	5	12	8
Pools-Riffles-Runs-Bends:	4	8	9	14	5
Bank Stability:	9	4	8	7	6
Bank Vegetative Stability:	10	10	10	9	6
Streamside Cover:	10	10	10	7	7
TOTAL SCORE	73	84	84	106	71
HABITAT CONDITION CATEGORY	POOR (SEVERELY IMPAIRED)	FAIR (MODERATELY IMPAIRED)	FAIR (MODERATELY IMPAIRED)	EXCELLENT (NON-IMPAIRED)	FAIR (MODERATELY IMPAIRED)

Date:	7-01-91	7-01-91	7-01-91	7-12-91	7-12-91
Stream Type:	Coldwater	Coldwater	Coldwater	Coldwater	Coldwater
Weather:	Sunny	Sunny	Sunny	Partly Cloudy	Partly Cloudy
Stream Order:	First	First	Second	Second	Second
Air Temperature:	90 Deg. F.	90 Deg. F.	90 Deg. F.	90 Deg. F.	90 Deg. F.
Water Temperature:	65 Deg. F.	63 Deg. F.	67 Deg. F.	67 Deg. F.	67 Deg. F.
Ave. Stream Width:	3 Feet	3 Feet	4 Feet	15 Feet	15 Feet
Ave. Stream Depth:	0.25 Feet	0.5 Feet	0.5 Feet	2 Feet	2 Feet
Surface Velocity:	1 Ft./Sec.	1 Ft./Sec.	0.5 Ft./Sec.	0.5 Ft./Sec.	0.5 Ft./Sec.
Estimated Flow:	0.75 CFS	1.5 CFS	1 CFS	15 CFS	15 CFS

Table 4a. Water chemistry data for the biological sampling stations on Pine Creek,
July 1 and July 12, 1991.

Station:		#1	#2	#3	#4	#5	Pine Ck. Tributary	Du-Wel Products Discharge
Parameter:	Unit							
Alkalinity of Water	mg CaCO ₃ /l	190	190	170	220	220		
Chloride in Water	mg/l	11	9.0	9.0	14	14		
COD	mg/l	19	17	18	12	6.0	4.0	
Conductivity of Water	umho/cm	630	470	460	530	530		
Hardness	mg/l	220	220	210	240	240		
Nitrite	mgN/l	.02 HT	.01 HT	.07 HT	.02 HT	.02 HT		
Nitrate+Nitrite	mgN/l	1.9	1.4	3.6	.97	.91	1.7	
Ammonia	mgN/l	.02	.02	.130	.030	.030	.030	
Kjeldahl Nitrogen	mgN/l	.49	.67	1.10	.41	.26	.49	
pH of Water	pH	8.0	8.3	8.0	8.10	8.20		
Ortho Phosphate	mgP/l	.02 HT	.02 HT	.05 HT	.02 HT	.02 HT		
Total Phosphorus	mgP/l	.04	.06	.15	.03	.050		
Suspended Solids	mg/l	7.0	16	110	21	K 4		
Total Dissolved Solids	mg/l	310	310	330	360	360		

Table 4a. continued

Station:		#1	#2	#3	#4	#5	Pine Ck. Tributary	Du-Wel Products Discharge
Parameter:	Unit							
Total Dissolved Solids	mg/l	307	314	330	360	360		
Sulfate in Water	mg/l	23	28	30	35	35		
TOC	mg/l	5.1	5.1	6.6	3.0	2.9	1.6	
Total Silver	ug/l	K 0.5	K 0.5	K 0.5	K 0.5	K 0.5		K 0.5
Total Chromium	ug/l	K 1	1.3	K 1.0	K 1.0	K 1.0		16
Total Copper	ug/l	K 1	1.1	K 1.0	K 1.0	K 1.0		20
Total Cadmium	ug/l	K 0.2	K 0.2	K 0.2	K 0.2	K 0.2		K 0.2
Total Iron	ug/l	220	390	430	750	400		1080
Potassium	mg/l	2.80	2.40	1.4	1.8	1.7		
Magnesium	mg/l	24	23	24	24	24		
Sodium	mg/l	4.1	4.4	4.2	8.1	7.9		
Nickel	ug/l	K 2.0	K 2.0	K 2.0	K 2.0	K 2.0		8.8
Lead	ug/l	K 1.0	K 1.0	K 1.0	K 1.0	K 1.0		K 1.0
Zinc	ug/l	4.0	57	4.0	14	8.0		48

HT = The recommended maximum laboratory holding time was exceeded before analysis.

K = Attached value is less than the value given.

Table 5. Sediment chemistry data for the biological sampling stations on Pine Creek, July 1 and July 12, 1991.

Station: Parameter:	Unit	#2	#3	#4	#5
Cadmium	mg/kg	K 2	K 2	K 2	K 2
Chromium	mg/kg	4.6	5.7	5.6	8.5
Copper	mg/kg	5.1	6.6	12	12
Mercury	mg/kg	K 0.1	K 0.1	K 0.1	K 0.1
Nickel	mg/kg	7.7	9.6	6.6	9.1
Lead	mg/kg	K 5	K 5	K 5	6.1
Zinc	mg/kg	29	28	34	43
Total Inorganic Solids	%	47	61	75	61

K = Attached value is less than the value given.

Water PINE CREEK

County VAN BUREN

Summary of () All sites () Coll. site No. 1

T. _____ R. _____ Sec. _____

I.D. 64th Ave. (CR 607)

() Index site No. _____

FISH COLLECTION

Date 7-1-91

Sheet _____ of _____

Species	<u>WHT SUCK</u>													
Gear														
Lengths														
Total	No.	N ₁	No.	N ₂	No.	N ₃	No.	N ₄	No.	N ₅	No.	N ₆	No.	N ₇
CPE														

LENGTH-FREQUENCY & LENGTH-BIOMASS SAMPLE

Inches														
1														
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38														

Sample total 2

Water PINE CREEK

T. _____ R. _____ Sec. _____

Date 7-1-91

County VAN BUREN

ID 66th Ave.

Sheet _____ of _____

Summary of: () All sites () Coll. site No. 3 () Index site No. _____ () All gear () Gear _____

Species	CRK CHUB	WHT SACK	BLK BULLHD	GRN SUN	BLUE GILL	LG MOUTH								
Gear														
Lengths														
Total	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
CPE														
Inches														
1														
2	1				1	1								
3				1	2									
4					2									
5			1		1									
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Sample total	1	18	1	1	6	1								

LENGTH-FREQUENCY & LENGTH-BIOMASS SAMPLE

Water PINE CREEK
 County VAN BUREN

FISH COLLECTION

T. _____ R. _____ Sec. _____

Date 7-12-91

ID RAILROAD TRACKS - U/S Du-We! Discharge Sheet _____ of _____

Summary of: () All sites () Coll. site No. 4 () Index site No. _____ () All gear () Gear _____

Species	BRK TRT	CRK CHUB	LGM BASS	GRN SUN	WHT SUCK										
Gear															
Length															
Total	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
CPE															
inches ↓															
1			4												
2	2		1	2	4										
3	4				4										
4	1				1										
5		1		1	1										
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Sample total	7	3	5	3	10										

LENGTH-FREQUENCY & LENGTH-BIOMASS SAMPLE

Water PINE CREEK
 County VAN BUREN

FISH COLLECTION

Date 7-12-91

T. _____ R. _____ Sec. _____

ID RAILROAD TRACKS - D/S Du-wel Discharge

Sheet _____ of _____

Summary of: () All sites () Coll. site No. 5 () Index site No. _____ () All gear () Gear _____

Species	WHT SUCK	HORN CRAB	GRASS PICK	CRK CRAB	GLD SHIN	GRN SUN	LGM BASS							
Gear														
Length														
Total	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
CPE														
Inches														
1	7						1							
2						6								
3	3	1				4								
4	2			1	2									
5		3		2	1									
6	2		1	5										
7	1		1	6										
8			1											
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10	2													
11	4													
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38														
Sample total	2	4	3	14	3	10	1							

LENGTH-FREQUENCY & LENGTH-BIOMASS SAMPLE