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MEMORANDUM

State Water Control Board

2111 North Hamilton Street P. O. Box 11143 Richmond, VA. 23230

SUBJECT: U. S. Titanium/Piney River Cursory Benthic Survey

TO: R. F. Tesh/ VRO File

FROM: R. W. Bolgiano RWB

DATE: 25 September 1984

COPIES: OERS (M. Shelor), DAT, J. Grandstaff, A. L. Willett

PLAINTIFF'S EXHIBIT 334

Piney River, Nelson County
Upper James River Basin

Abstract

A cursory benthic survey of two stations on the Piney River near the United States Titanium Corporation (UST) plant site has documented adverse effects on State waters. The qualitative/semiquantitative survey procedure led to a good water quality rating at the upstream control and a fair to poor water quality rating at the station downstream of inputs from the UST site.

Introduction

United States Titanium Corporation (UST) is the current owner of the former Virginia Chemical Corporation and American Cyanamid Corporation titanium dioxide manufacturing plant at Piney River in Nelson County. Between 1931 and 1971 ilmenite ore ($FeO(Fe_2O_3)\cdot TiO_2$) was mined adjacently to the plant site and manufactured to titanium dioxide using the sulphate process. The complete lack of waste treatment during the early years of production saw the plant discharging up to 110 tons of sulfuric acid and waste salts per day into the Piney River. The sulphate process incorporated several steps which produced waste sludges of various mineral makeup, approximately one hundred thousand tons of which were "stockpiled" in the copperas pile. Obviously, acidic discharge from the copperas pile was unnoticed during plant operation. After shutdown in June 1971, intermittent discharge from the pile has been sufficient by itself to cause numerous fish kills and other adverse effects on the Piney River. During the fall of 1980, the majority of the waste copperas was buried and an attempt at reclamation of the storage area was made. Continued fish kills resulted in further reclamation efforts. Work was completed in July 1982.

Site reclamation has apparently halted gross surface runoff from the copperas pile to the river but other unreclaimed site areas exist and monitoring well results suggest that contamination of the ground water has occurred. Undoubtedly some of this contaminated water is reaching the Piney River. Most of the approximately one mile reach of the river between Rt. 151 and the power line crossing near the downstream station established for this survey is flanked on the north by the manufacturing site and the south by the mining site and its tailing ponds.

The Piney River is designated as natural trout waters from the old American

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Cyanamid Corporation raw water intake upstream to and including the stream's headwaters.

Methods and Materials

This survey involved the qualitative examination and identification to Family of benthic macroinvertebrate organisms at two stations. Relative abundance of organisms per Family was noted allowing for an assessment of the density of organisms at each station. Thus, a diversity/density rating number is generated for pollution tolerance categories (sensitive, facultative, and tolerant) which may be compared to standard rating tables (Table 1). D-frame nets and hand picking of substrate materials were used. Every effort was made to match the stations according to stream hydraulics and substrate materials. A YSI Model 57 dissolved oxygen meter with temperature probe and an Orion Model 211 pH meter were used. No chemical analyses of water samples were performed.

Results and Discussion

The Piney River at Piney River in Nelson County drains approximately 50 square miles of the eastern slope of the Blue Ridge Mountains and has an average discharge of approximately 93 cubic feet per second.

Station 1, the control, was established at a bedrock and boulder riffle and run area approximately 100 meters upstream of the Rt. 151 bridge (see Figure 1 for locations). The benthic community at this station is characterized by high ratings in the sensitive and facultative groups and low ratings in the tolerant group (Table 2 contains the diversity and density ratings for both the control and the downstream stations). Water quality was judged to be good based on comparison of rating numbers with the standard rating tables.

Station 2, the downstream station was established at approximately 100 meters downstream of the power line crossing at an appropriate riffle and run area. Observations of ferric colored and gypsum-like sediments eminating from the northern bank of the river aided in choosing a station location below the mixing zone of site runoff and river water (Figure 1). Differences in right and left bank benthic communities at informal intermediate stations were also observed. The benthic community at this station is characterized by low-moderate ratings in the sensitive group, moderate ratings in the facultative group, and low (zero) ratings in the tolerant group. Water quality was judged to be fair to poor. The suppression of all three groups in contrast with a possible situation wherein more tolerant groups "take up the slack" suggests toxicity input rather than nutrient loading.

Summary

The water quality of the Piney River, as indicated by analyses of the diversity and density of its benthic community, is degraded as the stream flows past the UST plant site and ilmenite mines. Observations of sedimentation and left bank-right bank differences in benthic community suggest that the plant site (north) bank is the origin of runoff affecting the stream. Suppression of all pollution tolerance categories suggest toxicity rather than nutrient loading. The benthic community in the Piney River at the control station upstream of the U. S. Titanium site is characterized by high diversity and density ratings

for pollution sensitive and facultative organisms and low ratings for pollution tolerant organisms. These numbers indicate good water quality. The benthic community in the river downstream of the U. S. Titanium site has been suppressed to low-moderate diversity and density ratings for sensitive organisms and moderate ratings for facultative organisms. No pollution tolerant organisms were found at the downstream station. These numbers indicate fair to poor water quality.

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Table 1 - Standard Rating Tables

Diversity Rating Table for Indicator Organism Categories*

Diversity Rating	Number of Families		
	Sensitive	Facultative	Tolerant
High	7.0+	7.0+	3.5+
Moderate	2.5-6.5+	3.5-6.5	1.5-3.0
Low	0-2.0	0-3.0	0-1

Density Rating Table for Indicator Organism Categories**

Density Rating	Density Score		
	Sensitive	Facultative	Tolerant
High	18+	18+	11+
Moderate	6-17	6-17	6-10
Low	0-5	0-5	0-5

*A single organism in a Family counts 0.5, more than one organism per Family counts 1.0.

**A single organism in a Family counts one, a few count two, common organisms count six, abundant count eight, and dominant count ten. Tables and survey procedures taken from Shelor, M. H., and Ayers, R. W., May 1984. VSWCB Procedure for Conducting Qualitative Biological Surveys (Draft) personal correspondence.

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Table 2

$$\frac{\text{Diversity}}{\text{Density}}$$

		Sensitive	Facultative	Tolerant
Station 1 Upstream	Diversity / Density	9 / 26	10.5 / 29	1 / 2
Station 2 Downstream	Diversity / Density	2.5 / 7	5 / 14	0 / 0

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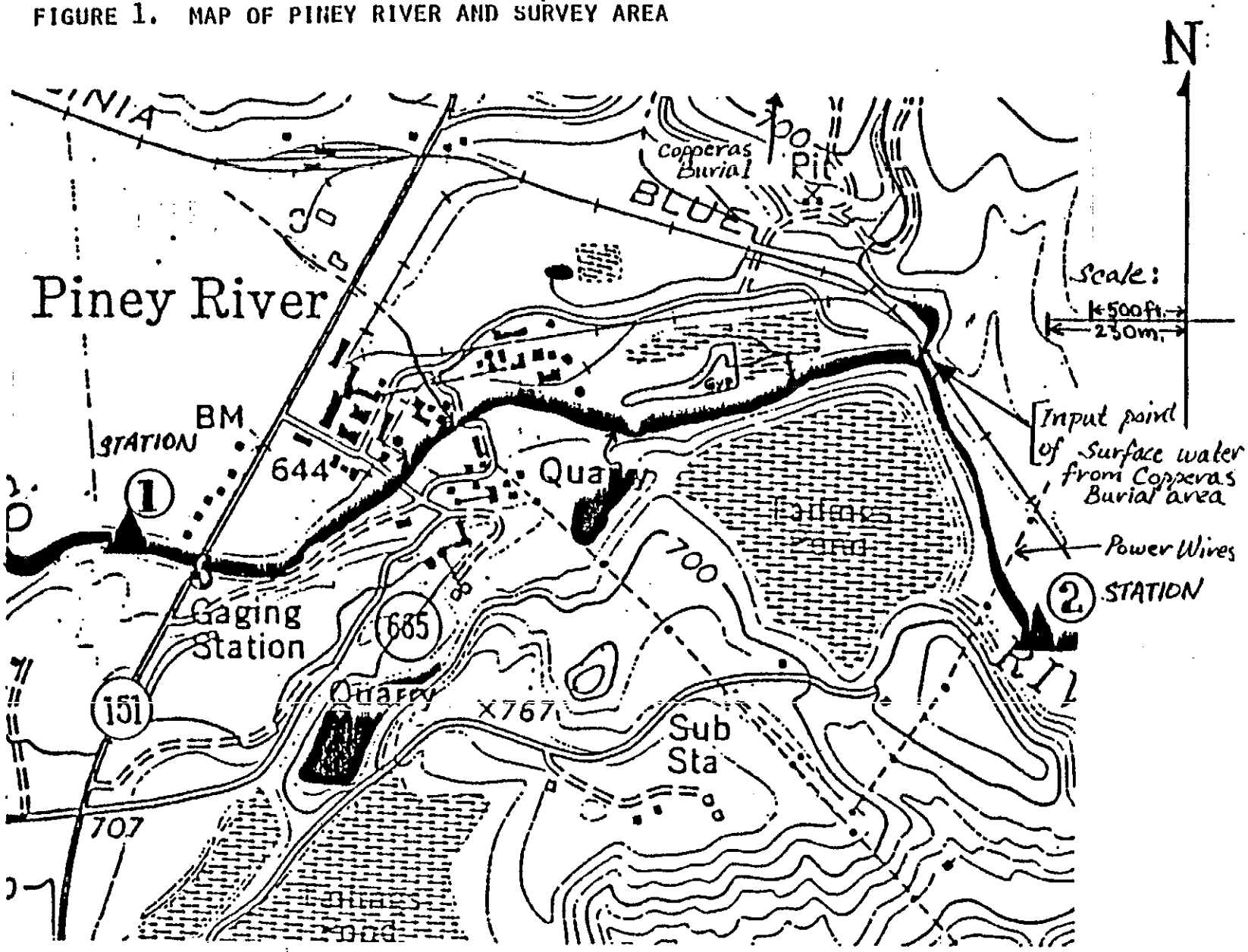
FIGURE 1. MAP OF PINEY RIVER AND SURVEY AREA



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FIELD DATA

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SENSITIVE GROUP		STATIONS						
Piney River	8-23-84	1	2					
Stoneflies	Capniidae							
	Chloroperlidae							
	Leuctridae							
	Nemouridae							
	Peltoperlidae		X					
	Perlidae	F						
	Perlodidae							
	Pteronarcidae							
	Taeniopterygidae							
Beetles	Dryopidae	F						
	Elmidae	C						
	Psephenidae							
Mayflies	Baetiscidae							
	Caenidae							
	Ephemerellidae							
	Ephemeridae							
	Heptageniidae	C	F					
	Leptophlebiidae	X						
	Oligoneuridae	C	C					
	Siphlonuridae							
	Tricorythidae							
Caddisflies	Brachycentridae							
	Calamoceratidae							
	Glossosomatidae							
	Helicopsychidae							
	Hydroptilidae	F						
	Lepidostomatidae							
	Leptoceridae							
	Limnephilidae	F						
	Odontoceridae							
	Philopotamidae							
	Phryganeidae							
	Polycentropodidae							
	Psychomyiidae							
	Rhyacophilidae							
Sponge	Spongillidae							
Operculate snail	Pleuroceridae							
	Viviparidae							
Oligochaetes	Branchiobdellidae							
Mussels	Unionidae							
Crayfish	Astacidae	C						
Watermite	Diplodontidae							
	Hydrachnidae	X						
	Libertiidae							
	Sperchonidae							
Diptera	Blephariceridae							
RATING:	DIVERSITY / DENSITY	9 / 26	25 / 7					

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FACULTATIVE GROUP		STATIONS						
Piney River	8-23-84	1	2					
Freshwater shrimp	Palaemonidae							
Scuds	Gammaridae							
Caddisfly	Hydropsychdae	C	C					
Mayfly	Baetidae							
Limpet	Ancylidae	F						
Megaloptera	Corydalidae	F	F					
	Sialidae	X						
Dragonflies	Aeshnidae	F						
	Cordulegastridae							
	Corduliidae							
	Gomphidae	F						
	Libellulidae							
	Macromiidae							
Damselflies	Calopterygidae							
	Coenagrionidae							
	Lestidae							
	Protoneuridae							
Aquatic Sowbugs	Asellidae							
Diptera	Chironomidae	F	X					
	Simuliidae	C						
	Tipulidae		X					
Beetles	Chrysomelidae							
	Curculionidae							
	Ditiseidae							
	Gyrinidae	C						
	Haliplidae							
	Helodidae							
	Hydrophilidae							
	Noteridae							
	Ptilodactylidae							
Hemiptera	Belostomatidae							
	Corixidae							
	Gelastocoridae							
	Gerridae	F	F					
	Hebridae							
	Hydrometridae							
	Mesoveliidae							
	Naucoridae							
	Nepidae							
	Notonectidae							
	Veliidae	C	C					
RATING: DIVERSITY / DENSITY		10.5 / 29	5 / 14					

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TOLERANT GROUP		STATIONS						
Piney River	8-23-84	1	2					
i ra	Atherricidae							
	Canaceidae							
	Ceratopogonidae							
	Chaoboridae							
	Chironomidae (bloodworm midge)							
	Dixidae							
	Dolichopodidae							
	Empididae							
	Ephydridae							
	Muscidae							
	Psychodidae							
	Sciomyzidae							
	Stratiomyidae							
	Syrphidae							
	Tabanidae							
	Tanyderidae							
Oligochaetes	Enchytraeidae							
	Lumbriculidae							
	Naididae							
	Tubificidae							
Non-operculate snails	Lymnaeidae							
	Physidae							
	Planorbidae							
F worms	Dendrocoelidae							
	Planariidae	F						
Clams	Corbiculidae							
	Sphaeriidae							
RATING:	DIVERSITY	1/2	0/0					
	DENSITY							

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BIOLOGICAL MONITORING REPORT

Basin: James (02) Lake or Stream: Piney River

Sub-Basin: Upper James USGS Quad: Piney River, VA

Station No. _____ Lat: 37°42'07" Long: 79°01'40" Sample Control No. _____

Date: 8/23/84 Time: 1100 County: Nelson State: VA

Collector: R. W. Bolgiano, L. M. Carpenter, R. E. Miller Nearest Town: _____

Location: riffle approximately 100 m upstream of Rt. 151 bridge

SAMPLER: Surber _____ Ekman _____ 6x6 Ponar _____ Peterson _____ D Frame Net x

Artificial Substrate _____ Qualitative x Areal _____ Other _____

STREAM: DO 9.0 pH 6.7 Temp. 18.0 Cl² 0.0 Other weather 1-2

Average Depth 0.3m Average Width 12 m Color clear Odor none Flow 3

Bottom Materials: boulders, cobbles, bedrock, gravel, sand Bottom Type: riffle/run

PLANT AND FISH LIFE: Macrophytes: water willow, emergent grass, tree roots

Periphyton: diatom slight, green algae moderate

Fish: shiners, dace, darters

Pollution Sources: quarries

Purpose of Station: control U. S. Titanium

SURVEY RESULTS: (D - Dominant A - Abundant C - Common F - Few X - Present)

Stonefly		Hellgrammite		Diptera	
Water penny	SEE OTHER SHEET	Dragonfly	SEE OTHER SHEET	Oligochaetes	SEE OTHER SHEET
Riffle beetle		Damselfly		Non-operculate snail	
Limpet		Aquatic sowbug		Leeches	
Mayfly		Cranefly		Flatworms	
Caddisfly		Water Boatman		Fingernail clams	
Fr. water sponge		Whirligig beetle		Bloodworm midges	
Operculate snail		Other water beetle		Asiatic clam	
Scuds		Alderfly		Rat-tailed maggots	
Mussel		Blackfly		Other	
Crayfish		Midges			
Water mite		Water Strider			

REMARKS AND EVALUATION:

DENSITY	DIVERSITY	INDICATOR ORGANISMS	OVERALL RATING	COMPARED WITH LAST YEAR
☐ Good	☐ Good	Tolerant N/A	☐ Good	☐ Better
☐ Fair NA	☐ Fair NA	Facultative N/A	☐ Fair NA	☐ Same NA
☐ Poor	☐ Poor	Sensitive N/A	☐ Poor	☐ Worse

COMPARED WITH UPSTREAM	COMPARED WITH DOWNSTREAM
☐ Better	☐ Better
☐ Same NA	☐ Same NA
☐ Worse	☐ Worse

OTHER REMARKS:

Flow falling from recent high water.

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BIOLOGICAL MONITORING REPORT

Basin: James (02) | Lake or Stream: Piney River
S. Basin: Upper James | USGS Quad: Piney River, VA
Station No. ____ Lat. -- Long: -- | Sample Control No. ____
Date: 8/23/84 Time: 1300 | County: Nelson State: VA
Collector: R. W. Bolgiano, L. M. Carpenter, R. E. Miller | Nearest Town: Piney River
Location: ≈100 m below power wires (downstream of former biological monitoring station)

SAMPLER: Surber ____ Ekman ____ 6x6 Ponar ____ Peterson ____ D Frame Net X
Artificial Substrate ____ Qualitative X Areal ____ Other ____
STREAM: DO 9.5 pH 6.8 Temp. 20.0 Cl^2 0.0 Other weather 1-2-3
Average Depth 0.30 Average Width 15 m Color clear Odor none Flow 3
Bottom Materials boulder, cobble, gravel, sand Bottom Type riffle/run

PLANT AND FISH LIFE: Macrophytes emergent grasses, sedges
Periphyton diatom moderate/ filamentous green slight/ *
Fish shiner, dace, darter, bluegill
Pollution Sources U. S. Titanium
Purpose of Station monitor effects of U. S. Titanium
*ferric colored slime and gypsum sediment

CURSORY RESULTS: (D - Dominant A - Abundant C - Common F - Few X - Present)

Stonefly		Hellgrammite		Diptera			
Water penny		Dragonfly		Oligochaetes			
Riffle beetle		Damselfly		Non-operculate snail			
Limpet		Aquatic sowbug		Leeches			
Mayfly		Cranefly		Flatworms			
Caddisfly		Water Boatman		Fingernail clams			
Fr. water sponge		Whirlegig beetle		Bloodworm midges			
Operculate snail		Other water beetle		Asiatic clam			
Scuds		Alderfly		Rat-tailed maggots			
Mussel		Blackfly		Other			
Crayfish		Midges					
Water mite		Water Strider					

SEE OTHER SHEET

REMARKS AND EVALUATION:

DENSITY	DIVERSITY	INDICATOR ORGANISMS	OVERALL RATING	COMPARED WITH LAST YEAR
☐ Good	☐ Good	Tolerant ____	☐ Good	☐ Better
☐ Fair	☐ Fair	Facultative ____	☐ Fair	☐ Same
☐ Poor	☐ Poor	Sensitive ____	☐ Poor	☐ Worse

COMPARED WITH UPSTREAM	COMPARED WITH DOWNSTREAM
☐ Better	☐ Better
☐ Same	☐ Same
☐ Worse	☐ Worse

OTHER REMARKS:
Ferric colored slime and gypsum sediment.

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