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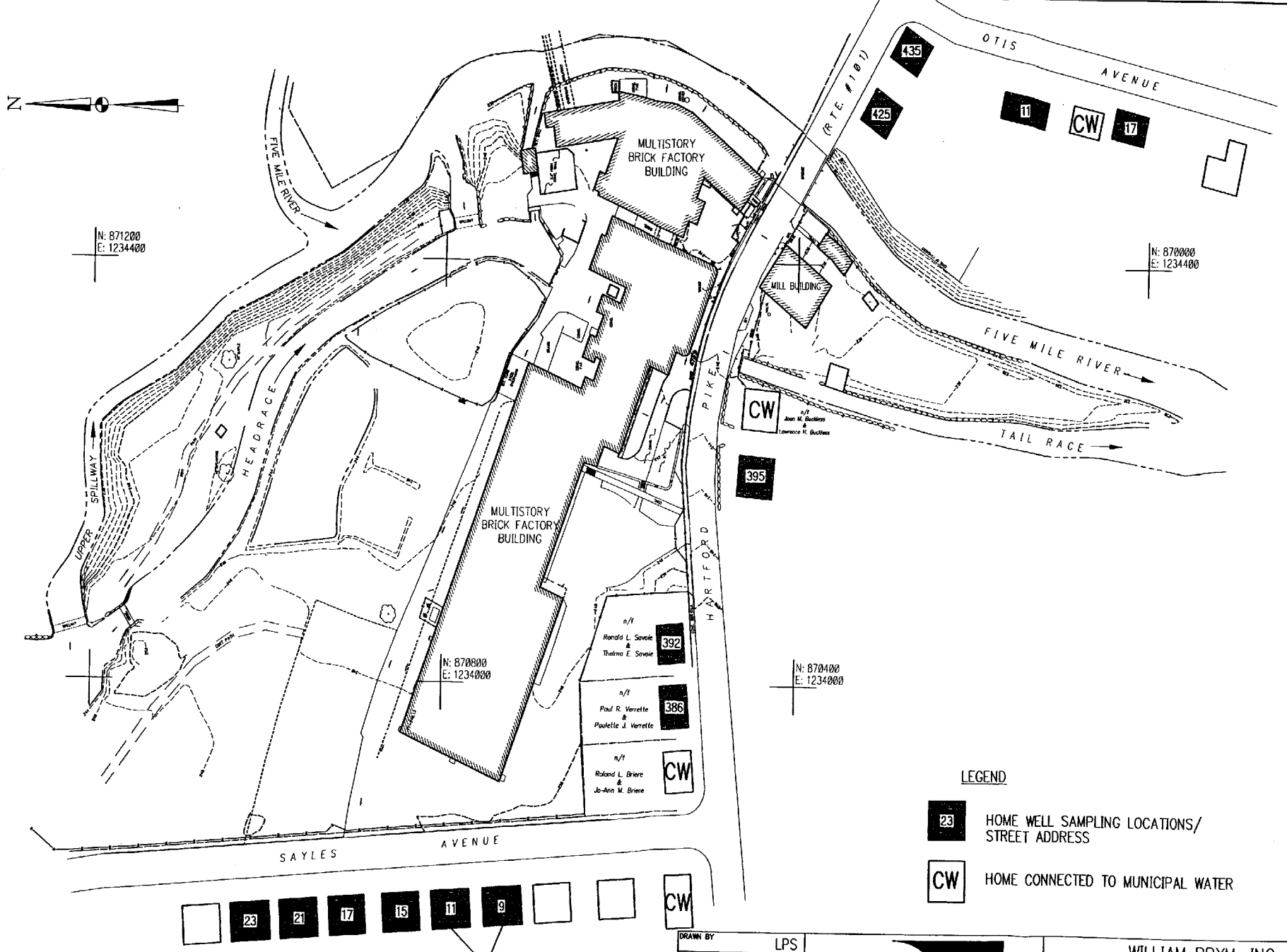
ATTACHMENT CA750-C

Home Well Sampling Data
Home Well Location Map



REFERENCE:
"TOPOGRAPHIC SURVEY PREPARED FOR PRYM MILL" BY KWP ASSOCIATES, PROMFRET CENTER, CONNECTICUT DATED 6/10/97

ELEVATIONS BASED ON NAD29; HORIZONTAL COORDINATES BASED ON CONNECTICUT GRID SYSTEM

DRAWN BY	LPS
DATE	-
CHECKED BY	RAD
SET JOB NO.	970177
SET DWG FILE	990177B01.dwg
DRAWING SCALE	1"=100'

SE TECHNOLOGIES
98 Vanadium Road Bridgeville, PA 15017 (412) 221-1188

WILLIAM PRYM, INC
DAYVILLE, CONNECTICUT
PHASE III RFI
ADJACENT RESIDENTIAL WELL SAMPLING LOCATIONS

DRAWING NAME: FIGURE 1-2
REV. Ø

Plot: env024 09/09/1999 07:13 G:\Prym\990177\990177B04.dwg

TABLE 4-14
SUMMARY OF ANALYTICAL RESULTS FOR CYANIDE AND METALS
HOME WELL WATER SAMPLES
WILLIAM PRYM, INC.
DAYVILLE SITE

Field Sample ID Date Collected	11 Sayles Ave 4/8/98	15 Sayles Ave 4/8/98	17 Sayles Ave 4/23/98	21 Sayles Ave 4/8/98	23 Sayles Ave 4/8/98	386 Hartford Trpk 4/8/98	386 Hartford Trpk (Dup) 4/8/98	392 Hartford Trpk 4/23/98	EPA RISK-BASED CONCENTRATIONS TAP WATER
Cyanide (MG/l)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.73
Metals (MG/l), total									
BARIUM	<0.01	<0.02	<0.01	<0.01	<0.01	0.012	0.012	0.016	2.6
LEAD	<0.002	<0.002	0.0023	<0.002	<0.002	0.0045	<0.0020	0.0037	
ZINC	0.022	0.03	0.02	0.018	0.016	0.021	0.024	0.035	11.0
ARSENIC	<0.002 UJ	<0.002 UJ	<0.002 UJ	<0.002 UJ	<0.002 UJ	<0.002 UJ	<0.002 UJ	<0.002 UJ	0.011
CADMIUM	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.018
COPPER	0.03	0.02	0.0065	<0.004	0.012	0.045	0.046	0.014	130.0
NICKEL	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.73

Field Sample ID Date Collected	435 Hartford Trpk 4/8/98	Method Blank 4/8/98	11 Otis Ave 4/15/98	Method Blank 4/15/98	395 Hartford Trpk 4/23/98	425 Hartford Trpk 4/23/98	17 Otis Ave 4/23/98	Method Blank 4/23/98	EPA RISK-BASED CONCENTRATIONS TAP WATER
Cyanide (MG/l)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	0.73
Metals (MG/l), total									
BARIUM	0.026	<0.01	<0.01	<0.01	0.011	<0.01	<0.01	<0.01	2.6
LEAD	0.0033	<0.002	<0.002	<0.002	0.0024	<0.002	<0.002	<0.002	
ZINC	0.037	<0.05	0.14	<0.05	0.024	0.027	0.025	<0.05	11.0
ARSENIC	<0.002 UJ	<0.002 UJ	<0.002 UJ	<0.002 UJ	<0.002 UJ	<0.002 UJ	<0.002 UJ	<0.002 UJ	0.011
CADMIUM	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	0.018
COPPER	0.092	<0.004	0.021	<0.004	0.023	0.067	0.016	<0.004	130.0
NICKEL	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003	0.73

UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

EPA Region III Risk-Based Concentrations for Tap Water, October 22, 1997
DUP = Duplicate sample

TABLE 4-14
SUMMARY OF ANALYTICAL RESULTS FOR TPH AND VOCS
HOME WELL WATER SAMPLES
WILLIAM PRYM, INC.
DAYVILLE SITE

Field Sample ID Date Collected	11 Sayles Ave 4/8/98	15 Sayles Ave 4/8/98	17 Sayles Ave 4/23/98	21 Sayles Ave 4/8/98	23 Sayles Ave 4/8/98	386 Hartford Trpk 4/8/98	386 Hartford Trpk (Dup) 4/8/98	392 Hartford Trpk 4/23/98	435 Hartford Trpk 4/8/98	EPA RISK-BASED CONCENTRATIONS TAP WATER
TPH (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5[1]
Volatiles (ug/l)										
ACETONE	<20	<20	<20	<20	<20	<20	<20	<20	<20	3,700
ACRYLONITRILE	<50	<50	<50	<50	<50	<50	<50	<50	<50	0.12
BENZENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.36
BROMODICHLOROMETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.17
BROMOFORM	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.4
BROMOMETHANE	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	8.7
CARBON DISULFIDE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1,000
CARBON TETRACHLORIDE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.16
CHLOROBENZENE	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	1	<1.0	<1.0	39
CHLOROETHANE	<10 UJ	<10 UJ	<10 UJ	<10 UJ	<10 UJ	<10 UJ	<10 UJ	<10 UJ	<10 UJ	8,600
CHLOROFORM	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.15
CHLOROMETHANE	<10	<10	<10	<10	<10	<10	<10	<10	<10	1.4
DIBROMOCHLOROMETHANE	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	
DIBROMOMETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.048
DICHLORODIFLUOROMETHANE	<10	<10	<10	<10	<10	<10	<10	<10	<10	390
1,1-DICHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	810
1,2-DICHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.12
1,1-DICHLOROETHENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.044
TRANS-1,2-DICHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	120
1,2-DICHLOROPROPANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.16
CIS-1,3-DICHLOROPROPENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.077
TRANS-1,3-DICHLOROPROPENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
ETHYLBENZENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1,300
2-HEXANONE	<10	<10	<10	<10	<10	<10	<10	<10	<10	1,500
METHACRYLONITIRILE	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	3.7
4-METHYL-2-PENTANONE (MIBK)	<10	<10	<10	<10	<10	<10	<10	<10	<10	
METHYLENE CHLORIDE	<10	<10	<10	<10	<10	<10	<10	<10	<10	4.1
STYRENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1,600
1,1,1,2-TETRACHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.41
1,1,2,2-TETRACHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.052
TETRACHLOROETHENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1
TOLUENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	750
1,1,1-TRICHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	540
1,1,2-TRICHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.19
TRICHLOROETHENE (TCE)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.6
TRICHLOROFLUOROMETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1,300
VINYL ACETATE	<10	<10	<10	<10	<10	<10	<10	<10	<10	37,000
VINYL CHLORIDE	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	0.019
XYLENES (TOTAL)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	12,000

U = The analyte was analyzed for, but was not detected above the Action Level for blank contamination.

J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.

UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

1 = CTDEP Remediation Criteria
EPA Region III Risk-Based Concentrations for Tap Water, October 22, 1997
DUP = Duplicate sample

TABLE 4-14
SUMMARY OF ANALYTICAL RESULTS FOR TPH AND VOCS
HOME WELL WATER SAMPLES
WILLIAM PRYM, INC.
DAYVILLE SITE

Field Sample ID Date Collected	425 Hartford Trpk 4/23/98	17 Otis Ave 4/23/98	Method Blank 4/23/98	11 Otis Ave 4/15/98	Method Blank 4/15/98	Trip Blank 4/23/98	Method Blank 4/8/98	395 Hartford Trpk 4/23/98	EPA RISK-BASED CONCENTRATIONS TAP WATER
TPH (mg/l)	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.5[1]
Volatiles (ug/l)									
ACETONE	<20	<20	<20	<20	<20	<20	<20	<20	3,700
ACRYLONITRILE	<50	<50	<50	<50	<50	<50	<50	<50	0.12
BENZENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.36
BROMODICHLOROMETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.17
BROMOFORM	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	2.4
BROMOMETHANE	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	8.7
CARBON DISULFIDE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1,000
CARBON TETRACHLORIDE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.16
CHLOROBENZENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	39
CHLOROETHANE	<10	<10	<10	<10	<10	<10	<10	<10	8,600
CHLOROFORM	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.15
CHLOROMETHANE	<10	<10	<10	<10	<10	<10	<10	<10	1.4
DIBROMOCHLOROMETHANE	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	
DIBROMOMETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
1,2-DIBROMO-3-CHLOROPROPANE (DBCP)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.048
DICHLORODIFLUOROMETHANE	<10	<10	<10	<10	<10	<10	<10	<10	390
1,1-DICHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	810
1,2-DICHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.12
1,1-DICHLOROETHENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.044
TRANS-1,2-DICHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	120
1,2-DICHLOROPROPANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.16
CIS-1,3-DICHLOROPROPENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.077
TRANS-1,3-DICHLOROPROPENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	
ETHYLBENZENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1,300
2-HEXANONE	<10	<10	<10	<10	<10	<10	<10	<10	1,500
METHACRYLONITIRILE	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	3.7
4-METHYL-2-PENTANONE (MIBK)	<10	<10	<10	<10	<10	<10	<10	<10	
METHYLENE CHLORIDE	<10	<10	<10	<10	<10	<10	<10	<10	4.1
STYRENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1,600
1,1,1,2-TETRACHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.41
1,1,2,2-TETRACHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.052
TETRACHLOROETHENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.1
TOLUENE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	750
1,1,1-TRICHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	540
1,1,2-TRICHLOROETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	0.19
TRICHLOROETHENE (TCE)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.6
TRICHLOROFLUOROMETHANE	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1,300
VINYL ACETATE	<10	<10	<10	<10	<10	<10	<10	<10	37,000
VINYL CHLORIDE	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	0.019
XYLENES (TOTAL)	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	12,000

UJ = The analyte was not detected above the reported sample quantitation limit. However, the reported quantitation limit is approximate and may or may not represent the actual limit of quantitation necessary to accurately and precisely measure the analyte in the sample.

1 = CTDEP Remediation Criteria
EPA Region III Risk-Based Concentrations for Tap Water, October 22, 1997
DUP = Duplicate sample

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ATTACHMENT CA750-D

Five Mile River Ecological Assessment Report

ECOLOGICAL ASSESSMENT OF FIVEMILE RIVER

Prepared for

SE TECHNOLOGIES, INC.
98 Vanadium Road,
Bridgeville, PA 15017

Prepared by

NORMANDEAU ASSOCIATES INC.
25 Nashua Road
Bedford, NH 03110-5500

R-17469.000

January 1998

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1.0 INTRODUCTION

SE Technologies contracted Normandeau Associates, Inc. (Normandeau) in late October 1997 to conduct an ecological assessment of the Fivemile River aquatic biological community near the former William Prym Inc. Facility in Dayville, CT. The purpose of this ecological assessment was to determine whether groundwater in the vicinity of the facility entering the river, past discharges and/or surface runoff have had an adverse effect on the aquatic biota in Fivemile River. To observe the potential impact, the benthic macroinvertebrate community in Fivemile River was sampled using the U.S. Environmental Protection Agency (EPA) Rapid Bioassessment Protocols (RBP, Plafkin et al. 1989). RBP is an assessment methodology that is accepted by State and Federal regulatory agencies for evaluating impacts to aquatic biological communities. The RBP method is based on a comparison of metrics (parameters) characterizing the aquatic community in similar river habitats sampled at locations upstream (reference) and adjacent to (experimental) potential sources of contamination.

In addition, a search for rare, threatened, and endangered species was conducted in the river. The late time of year precluded searches for terrestrial rare, threatened, and endangered species; a search for these species is planned for spring/summer 1998.

2.0 MATERIALS AND METHODS

2.1 FIELD STUDY

The benthic macroinvertebrate survey was conducted on 7 November 1997 following procedures described in EPA's Rapid Bioassessment Protocol II (RBP II, Plafkin et al. 1989). Two stations were established in Fivemile River. The reference station was located upstream of any influence from the facility at an area immediately downstream of the railroad bridge that crosses Fivemile River east of the property (Figure 1). The experimental station was located south of the property, immediately downstream of the Route 101 bridge. At each biological sampling station, RBP habitat data were recorded as well as current velocity, temperature, pH, and conductivity.

Biological sampling at each station included qualitative kick samples and coarse particulate organic matter (CPOM) samples following RBP II guidelines. Kick samples were collected by placing a 500μm mesh dip net perpendicular to the flow and disturbing the substrate immediately upstream of the net. Animals and detritus dislodged from the substrate were carried into the net. This process was repeated at four locations at each sampling station, two in fast water and two in slow water. CPOM samples were collected by removing several handfuls of leaf litter from the substrate and placing them into a labeled sample container. CPOM samples were collected to determine the shredder component of the benthic biological community. Shredders (Cummins 1973) are benthic organisms that feed on leaf litter, bark, small branches, etc. larger than 1.0 mm; they are instrumental in the initial breakdown of this allochthonous material which falls into the stream.

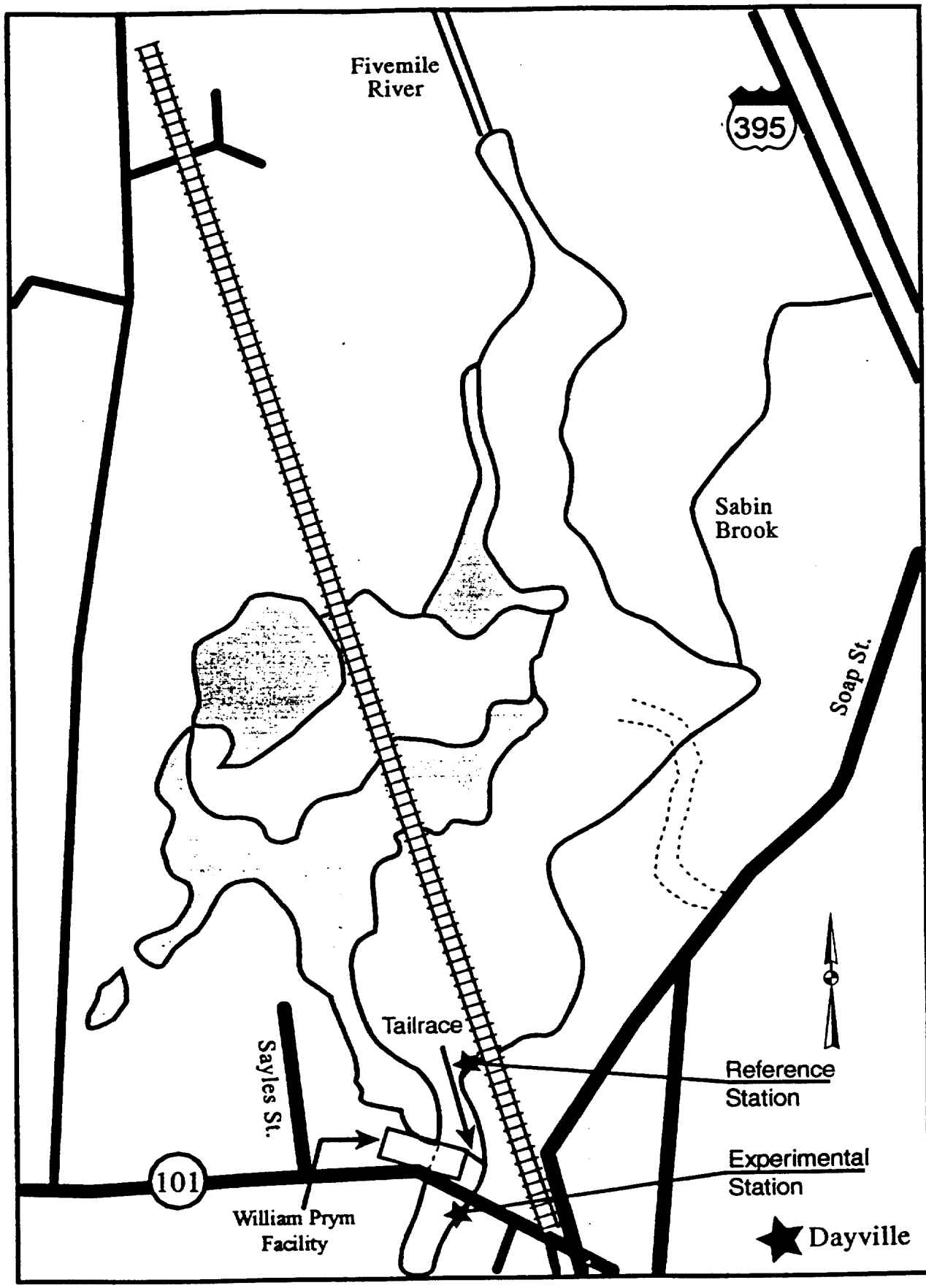

Figure 1. Location map of sampling sites for the former William Prym Inc. Facility, Dayville, Conneticut.

Each benthic and CPOM sample was placed in a container, labeled with date, station, collection time, and a unique sample identification number, then preserved with 70% ethanol.

A search for state and federally listed rare, threatened, and endangered species, primarily dwarf wedge mussel (*Alasmidonta heterodon*) and brook floater mussel (*A. varicosa*), was conducted by wading in the water and observing the substrate with a viewtube to look for mussels and other animals of interest. Areas of preferred habitat at both stations as well as an area immediately downstream of the tailrace were searched. The search area at the reference station extended from the railroad bridge to a point 100 ft downstream. The search area for the experimental station began at the Route 101 bridge and extended downstream 100 ft. The search below the tailrace began at the confluence of the tailrace and Fivemile River and extended downstream 100 ft.

2.2 LABORATORY ANALYSIS

In the laboratory, the contents of each benthic sample was individually placed in a white enamel pan (12 X 18 inches) with 50 consecutively numbered grids. The material in the pan was covered with water and gently swirled to spread it evenly over the entire bottom. Homogeneous distribution of the sample was maintained during the sorting and identification process.

After the sample was in the pan, grids were randomly selected and organisms were systematically removed (sorted using a 1.75X magnifier) from each grid until a 100 organism subsample ($\pm$ 20 organisms) was removed. Once sorting was started in a grid, all organisms were removed from that grid; each grid was only sorted once. Organisms were identified to the family taxonomic level during the sorting process and recorded.

Normally, RBP procedures require that one subsample of at least 100 organisms is analyzed from each kick sample. However for this study,three 100-organism subsamples from each station were processed and analyzed to provide an additional measure of subsampling variability. Biological metrics were calculated from mean values of the three replicate subsamples at each station. Seven grids were sorted for each subsample, and a total of 21 out of the 50 grid squares were examined for each sample.

CPOM samples were processed by first removing leaves and other large detrital material, then all organisms were removed from the sample and recorded as shredders or non-shredders.

Organisms removed from both benthic and CPOM samples were put into glass vials labeled with pertinent sample information, preserved with 70% ethanol, and archived.

2.3 HABITAT DATA ANALYSIS

Primary, secondary and tertiary habitat parameters were observed following EPA's RBP methodology, and used to describe the macrohabitat conditions found at each station. These RBP habitat

parameters were intended (by the EPA) to describe riverine conditions such as those found in Fivemile River. The RBP habitat parameters were used to describe each sampling station and the associated river habitat (reach) from about 50 feet upstream to 50 feet downstream. These data were recorded to document differences in habitat quality which may affect the benthic community compostion.

The primary habitat features are intended to characterize microhabitat conditions at each station that may have the greatest direct influence on the benthic community structure. The primary characteristics evaluated by the RBP method include bottom substrate composition and available cover, substrate embeddedness, and variations in habitat as a result of depth and velocity changes. The secondary habitat characteristics evaluate channel morphology, bottom scouring and deposition, and stream sinuosity as characterized by the ratio of pool/riffle and run/bend ratio found at each station. The tertiary habitat parameters evaluate bank stability, riparian vegetation, and streamside cover (shading).

Each RBP habitat parameter was evaluated in the field at the time of sampling by completing a Habitat Assessment Field Data Sheet for each sampling station. A score was assigned for each parameter based on its similarity to "ideal" stream macrohabitat conditions for benthic macroinvertebrate communities. Each primary habitat parameter received a score of 0 to 20, secondary habitat parameters were scored from 0 to 15, and tertiary scores ranged from 0 to 10, with the highest values assigned to the best conditions. The primary, secondary and tertiary scores were summed to evaluate the habitat at each station. The maximum possible score was 135, and stations receiving a score of 100-135 were considered to have excellent macrohabitat conditions, scores of 64-99 were good conditions, scores of 36-63 were fair conditions, and macrohabitat scores less than 36 were considered poor conditions by the RBP method.

2.4 BENTHIC DATA ANALYSIS

Benthic data analysis for RBP II uses eight biological metrics (parameters) to assess the data. These metrics integrate population community and functional feeding group characteristics to produce a single evaluation of biotic integrity. Biological metric values for each station were calculated using mean data from three replicate subsamples. The eight metrics used this evaluation are listed below.

Taxa Richness. Taxonomic richness (taxa richness) is the number of different types (taxa) of benthic macroinvertebrates present in a sample, and is a measure of the diversity of different types of invertebrates in the community. For example, if two different types of mayflies, one type of caddisfly, and five different types of midges were found in a sample, the taxa richness of the sample would be 8.

Family Biotic Index. The Family Biotic Index (FBI) is a ranking based on literature-reported values of the relative sensitivity of a family to organic pollution stress caused primarily by the

presence of oxygen-demanding substances in the water. This index was developed by Hilsenhoff (1988) to summarize the tolerances of benthic macroinvertebrates at the family taxonomic level and is based on the original species- level index (Hilsenhoff 1982). Each family is assigned a value ranging from sensitive (0) to tolerant (10), the individual tolerance values are weighted by the proportion of that taxon among the total number of organisms with tolerance values in that sample, and the weighted values are summed within the sample to calculate the FBI. Samples from degraded sites will have mostly tolerant taxa and a FBI closer to 10. Pristine sites will have mostly intolerant taxa and a FBI closer to 0. Tolerance values assigned to macroinvertebrate taxa in this study were based on those used by the Connecticut Department of Environmental Protection.

Scraper/Filterer Ratio. Scrapers are benthic macroinvertebrates that feed on algae and bacteria growing on the substrate (periphyton). Filtering collectors feed on fine particulate material that is suspended in the water. The predominance of either functional feeding group reflects an abundance of their food source, and the two feeding groups are usually compared as a ratio. The more this ratio differs from a value of 1.0, the greater the imbalance in the proportion of these two food sources. A low ratio indicates either a relatively high abundance of particulate food or a low abundance of periphyton. A high ratio indicates either a high abundance of periphyton or a low abundance of particulate material. A high ratio may also indicate the presence of toxicants adsorbed to fine organic particulate material that has become available as food for filtering collectors.

Ratio of Sensitive Taxa to Tolerant Midges (EPT/C). Non-biting midges in the insect family Chironomidae are generally abundant in the benthic macroinvertebrate community and tolerant of environmental stress. The ratio of abundance of the sensitive EPT taxa to the abundance of the tolerant Chironomidae (EPT/C ratio) is a measure of community balance. Good biotic conditions are reflected in a relatively even distribution among all four groups and a relatively high ratio. Macroinvertebrate communities experiencing environmental stress may exhibit a low EPT/C ratio due to a disproportionate high number of the tolerant midges. Chironomids tend to become increasingly dominant along a gradient of increasing organic enrichment or heavy metals concentration (Ferrington 1987).

Percent Dominant Taxon. The percent contribution of the most abundant taxon to the total number of organisms found in a sample is a measure of balance in the benthic community. If the dominant taxon accounts for a large percentage of the individuals present, it is an indication of a stress because the community is dominated by one taxon whereas unstressed communities typically exhibit a more evenly balanced abundance among several taxa.

Sensitive (EPT) Taxa. Three groups of benthic insects are considered particularly sensitive to pollution, and the number of distinct taxa among them generally increases with increasing water quality. These groups (orders) are mayflies (Ephemeroptera), stoneflies (Plecoptera), and caddisflies (Trichoptera) and are collectively referred to as the EPT taxa.

Community Loss Index. The community loss index measures the loss of benthic taxa in samples from a test station compared to those found at the reference station. It is calculated as the number of taxa found at the reference station minus the number of taxa common at the two stations, divided by the number of taxa present at the test station. For example, if the reference station had three mayfly taxa, five midge taxa, and one stonefly taxon, while the test station had two of the same mayfly taxa, four of the same midge taxa, no stoneflies, and one caddisfly taxon, the community loss index for the test station would be (9 - 6)/7 = 0.43. The value of this index can range from 0 to infinity, and increases as the test station becomes increasingly dissimilar to the reference station.

Proportion of Shredders in the CPOM Sample. The abundance of shredders relative to other Functional Feeding Groups allows an evaluation of potential impairment as indicated by the CPOM-based shredder community. Shredders are sensitive to riparian zone impacts and are particularly good indicators of toxic effects when the toxicants involved are readily adsorbed to the CPOM and either affect the microbial communities colonizing the CPOM or the shredders directly.

After biological metric values are calculated for each station (reference or experimental), the data are compared between the two stations (Figure 2). The metric values from the experimental station are compared to the reference station and each experimental station metric is assigned a score based on its percent comparability with the reference station. Metric scores for the experimental station are totaled and compared to the total metric score from the reference station. For this comparison, it is assumed that the reference station receives optimal scores (6) for each metric except for percent composition of the dominant taxon. The percent comparison between the total scores provides a final evaluation of biological condition.

3.0 RESULTS

3.1 HABITAT DATA

Habitat quality at the reference station was considered excellent, and was predominately run and pool habitat. The substrate was composed primarily of large gravel that was not embedded. Stream width at the reference station was estimated at 20 ft, depth was 0.5 ft in the run and 2.5 ft in the upstream pool (under the railroad bridge). Current velocity was 0.6 feet per second (fps) in the run and 0.3 fps in the pool. Water temperature was 9.5°C, pH was 7.4, conductivity was 82 micromhos/cm^2.

Habitat score at the reference station was 115 (Table 1). This station received excellent scores for the primary habitat parameters and two of the three secondary habitat parameters; tertiary habitat parameters ranked fair to good.

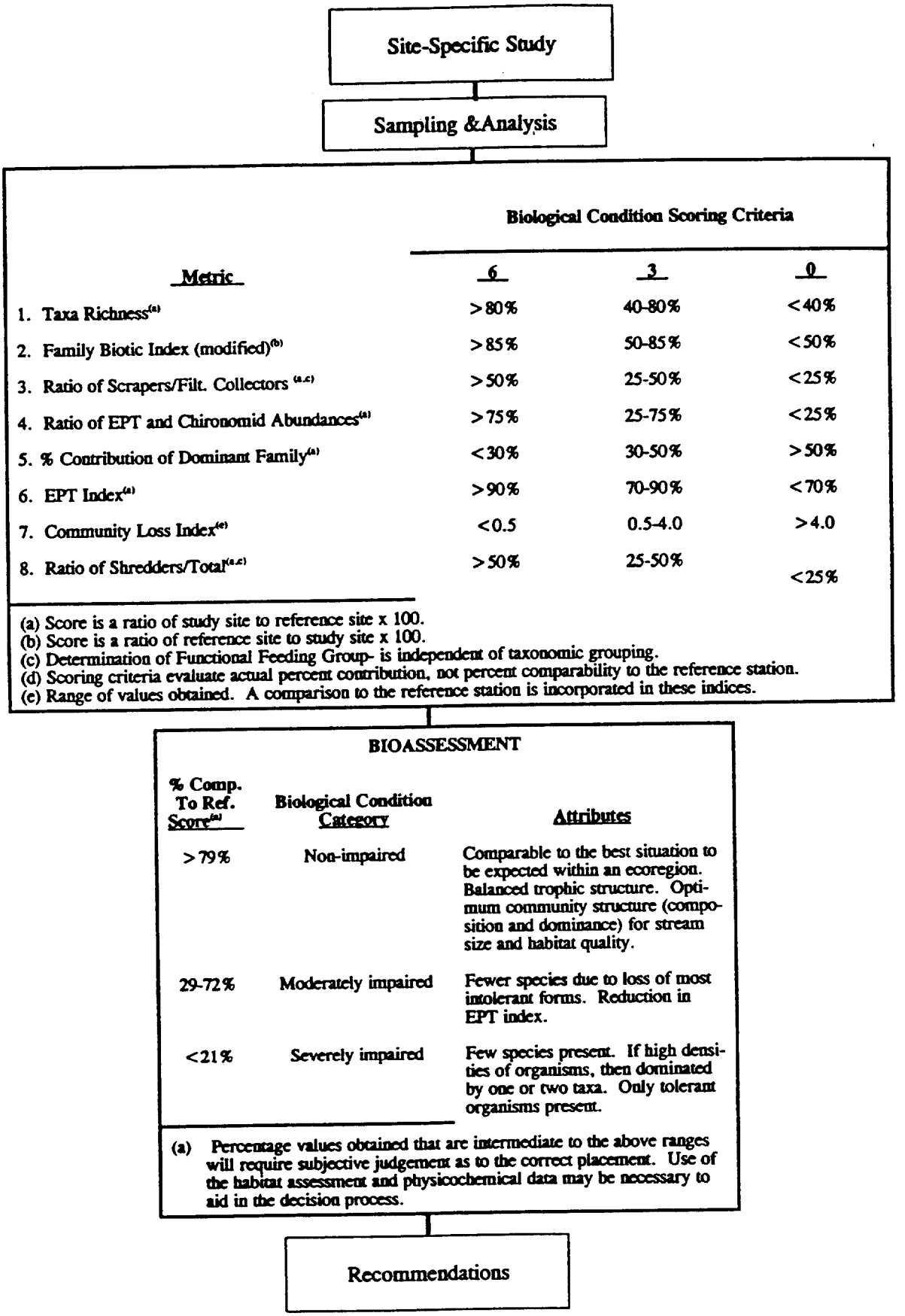

Figure 2. Flowchart of bioassessment approach advocated for Rapid Bioassessment Protocol II. (Plafkin et al. 1989)

TABLE 1. FIVE MILE RIVER RBP HABITAT SCORES.

STATION RANGE	PRIMARY* SUBSTRATE (0-20)	EMBEDDEDNESS (0-20)	AVAILABLE HABITAT (0-20)	CHANNEL ALTERATION (0-15)	SECONDARY** SCOOPING/ DEPOSITION (0-15)	POOL/ RIFFLE (0-15)	BANK STABILITY (0-10)	TERTIARY*** VEGETATIVE STABILITY (0-10)	COVER (0-10)	HABITAT SCORE
UPSTREAM	20	18	16	15	14	11	8	8	5	115
DOWNSTREAM	16	13	14	13	14	11	10	8	5	104
							Percent comparison (DS/US)			90 Comparable

* PRIMARY SCORES excellent=16-20, good=11-15, fair=6-10, poor=0-5
** SECONDARY SCORES excellent=12-15, good=8-11, fair=4-7, poor=0-3
*** TERTIARY SCORES excellent=9-10, good=6-8, fair=3-5, poor=0-2

Habitat quality at the experimental station was also considered excellent, and was exclusively run habitat. The substrate was composed of 10% cobble, 50% gravel, and 40% sand; the cobble and gravel were 25-50% embedded. Stream width was estimated at 35 ft, depth was 1.5 ft, and current velocity was 1.4 fps. Water temperature was 9.5°C, pH was 7.4, and conductivity was 75 micromhos/cm^2.

Habitat score at the experimental station was 104 and had a percent comparability with the reference station of 90%, indicating that the two habitats were comparable (Plafkin et al. 1989) and should support similar benthic communities. This station received good to excellent scores for primary and secondary habitat parameters and fair to excellent scores for tertiary habitat parameter scores.

3.2 BENTHIC DATA

The Fivemile River reference station benthic community was comprised of organisms typical of the aquatic habitat located there. This station had a mean of 21 taxa including 13 EPT taxa (Table 2). The dominant taxon found at the reference station was the mayfly Ephemerellidae, a pollution sensitive organism found in clean-swept cobble and large gravel habitats with moderate current velocity. Low values were found for the biotic index value and percent shredders from the CPOM sample. High values were found for EPT/Chironomidae ratio and for percent domination by a single taxon.

The experimental station also had a benthic community that was typical of the type of habitat found there. This station had a mean of 20 taxa including 10 EPT taxa. The dominant taxon at this station was the midge Chironomidae, a moderately pollution-tolerant organism found in substrates consisting of fine-grained material such as sand, mud, and silt. Values for taxa richness, scraper/filterer ratio, EPT/Chironomidae ratio, and percent contribution of the dominant taxon were lower than at the reference station. Conversely, values for biotic index and percent shredders from the CPOM sample were higher than at the reference station.

Benthic data comparisons between the reference station and the experimental station indicated that Fivemile River was considered by the RBP method to fall between non-impaired and moderately impaired conditions at the experimental station (Table 3). The experimental station received optimal metric comparison scores (6) for taxa richness, scraper/ filterer ratio, percent contribution by the dominant taxon, community loss index, and percent shredders in the CPOM sample. EPT richness received a moderate score (3). Biotic index and EPT/Chironomidae abundance ratio received low scores (0).

TABLE 2. REPLICATE AND MEAN NUMBER OF BENTHIC MACROINVERTEBRATES FOUND IN KICK SAMPLES COLLECTED FROM TWO STATIONS ON FIVEMILE RIVER.
DATA COLLECTED ON 7 NOVEMBER 1997.

TAXON	FUNCTIONAL GROUP	FBI	REFERENCE STATION REP A	REP B	REP C	MEAN	EXPERIMENTAL STATION REP A	REP B	REP C	MEAN
OLIGOCHAETA (worms)	CG	8					9	2	3	4.67
MOLLUSCA										
Planorbidae (snails)	SC	6	1	0	0	0.33				
Sphaeriidae (clams)	CF	8	0	0	1	0.33	20	16	13	16.33
ARACNIDA (mites)	PR	4					1	0	0	0.33
AMPHIPODA (scuds)										
Gammaridae	CG	6	0	1	0	0.33				
Talitridae	CG	8					0	1	0	0.33
INSECTA										
EPHEMEROPTERA (mayflies)										
Baetidae	CG	4	1	0	0	0.33	1	0	1	0.67
Ephemerellidae	CG	1	40	47	43	43.33	5	7	4	5.33
Heptageniidae	CG	4	7	6	3	5.33	11	4	3	6.00
Siphlonuridae	CG	7	0	1	1	0.67	3	0	1	1.33
PLECOPTERA (stoneflies)										
Perlidae	PR	1	2	2	1	1.67	0	1	0	0.33
Taeniopterygidae	SH	2	6	7	7	6.67	0	9	7	5.33
ODONATA (dragonflies)										
Aeshnidae	PR	3	1	0	0	0.33	1	0	0	0.33
Coenagrionidae	PR	9	2	2	2	2.00	9	5	5	6.33
Gomphidae	PR	1					2	0	0	0.67
COLEOPTERA (beetles)										
Elmidae	SC	4	14	9	6	9.67	9	12	17	12.67
Psephenidae	SC	4					1	1	1	1.00
TRICHOPTERA (caddisflies)										
Brachycentridae	SH	1	1	2	3	2.00	3	2	7	4.00
Hydropsychidae	CF	4	18	14	8	13.33	11	11	5	9.00
Hydroptilidae	CG	4	0	0	1	0.33				
[illegible]nephilidae	SH	4	0	1	0	0.33				
[illegible]ilopotamidae	CF	3	2	4	0	2.00	1	1	2	1.33
Phryganeidae	SH	6	0	0	1	0.33				
Polycentropodidae	CF	6	2	2	1	1.67	0	2	0	0.67
DIPTERA (true flies)										
Chironomidae	CG	6	1	7	5	4.33	20	28	26	24.67
Tipulidae	SH	3	0	0	1	0.33				
TOTAL			98	105	84	95.67	107	102	95	101.33

	MEAN	MEAN
Taxa Richness =	21	20
Family Biotic Index =	2.64	5.27
Scraper/Filterer Ratio =	0.58	0.52
EPT/Chironomidae Ratio =	18.00	1.38
% Dominant Taxon =	45.30	24.34
EPT Richness =	13	10
Community Loss Index =		0.35
% Shredders (from CPOM) =	0.36	0.55

Functional Feeding Group Classification:

	N	% Comp.	N	% Comp.
Collector/Gatherers (CG)	55	57.14	43	42.57
Collector/Filterers (CF)	17	18.12	27	26.73
Predators (PR)	4	4.18	8	7.92
Scrapers (SC)	10	10.45	14	13.86
Shredders (SH)	10	10.10	9	8.91
	96	100	101	100

TABLE 3. COMPARISON OF BENTHIC METRIC DATA FROM SITES ON FIVEMILE RIVER DURING NOVEMBER 1997.

	REFERENCE STATION	EXPERIMENTAL STATION	PERCENT COMPARISON	REF. METRIC SCORE	EXP. METRIC SCORE
TAXA RICHNESS	21.00	20.00	95.24	6	6
BIOTIC INDEX	2.64	5.27	50.09	6	0
SCRAPER/FILTERER	0.58	0.52	89.66	6	6
EPT/CHIRONOMIDAE	18.08	1.38	7.63	6	0
% DOMINANT TAXON	40.82	24.34	—	3	6
EPT RICHNESS	13.00	10.00	76.92	6	3
COMMUNITY LOSS INDEX	---	0.25		6	6
% SHREDDERS FROM CPOM	0.36	0.55	100.00	6	6
				45	33
			% SCORE COMPARISON=		73.33
			BIOASSESSMENT=	NON-IMPAIRED/ MODERATELY IMPAIRED	

3.3 RARE, THREATENED, AND ENDANGERED SPECIES SEARCH

No mussels or other rare, threatened, or endangered species were found in the substrate or along the shore of Fivemile River during this survey. In addition, prior to conducting the field study, Normandeau was in contact with the Connecticut Natural Diversity Data Base and the town of Killingly to obtain information on known habitats or locations of rare, threatened, or endangered species in the vicinity of the study area. Both sources stated that no records of rare, threatened, or endangered species were known from the study area.

4.0 DISCUSSION

The percent comparability between the experimental station and reference stations was 73.3 percent (Table 3). The RBP biological condition category for experimental stations with a percent comparability of 73 percent falls between the upper and lower limits of moderate impairment and non-impairment respectively (Figure 2), though 73 percent comparability is just slightly above the moderately impaired category. In situations when the biological condition category is not clearly defined, best professional judgement of the investigator is required to determine whether impairment is indicated. The abundance of midges and fingernail clams at the experimental station compared to the reference station may be due to degraded water quality and/or substrate conditions, or differences in substrate composition. Several pollution intolerant organisms were collected at the downstream station. These organisms would not be expected from an area with degraded water quality or substrate conditions. Also, taxa richness and the percentage of shredders in the CPOM sample were higher at the experimental station than at the reference station. Degraded environmental conditions usually reduce these values relative to the reference station.

A low value for EPT/Chironomidae ratio and a high biotic index value resulted in low percent comparability with the reference station, and therefore low biological condition scores for those metrics. The low value for EPT/Chironomidae ratio is due to the presence of more Chironomidae (midges) at the experimental station compared to the reference station. A mean of only 4 individuals of this family of mostly tolerant organisms was found in the subsample from the reference station, however midges were among the dominant taxa at the experimental station (24.7%). The higher biotic index value at the experimental station (indicating a community of pollution tolerant organisms) was primarily due to the abundance of two taxa, midges and Sphaeriidae (fingernail clams), having high biotic index values. The biotic index values for these two families are 6 and 8 respectively and represented 41 of the 101 individuals found at the experimental station. Ephemerellidae, the dominant family at the reference station also represented 43 of the 96 individuals, yet it has a biotic index value of 1, indicating it is a pollution sensitive group. Therefore, midges and fingernail clams at the experimental station were the pollution tolerant organisms contributing most of the increased biotic index value at the experimental station.

Habitat characteristics at both stations were considered comparable based on the RBP II habitat evaluation, however, subtle habitat differences between the stations may exist. The RBP habitat assessment procedures state that if two sites have habitat percent comparability greater than 90 percent, then those two sites are comparable and should support similar benthic communities. The percent comparability between the reference station and the experimental station in Fivemile River had a percent comparability of 90, the lower end of the comparable habitat range. If the experimental station had received a score two points less (i.e., a score of 102 instead of 104) the percent comparability would have been 89 percent, too low to be considered comparable. Every effort was made to find two sampling stations with similar habitat conditions, and the two locations chosen for the sampling stations were as similar as possible within the confines of the study area.

The reference station had a substrate that was almost exclusively clean- swept large gravel (0.75-1.5 in), whereas the experimental station had a substrate that contained interstitial sand between cobble and gravel. Primary habitat characteristics, which include substrate composition, embeddedness, and variety of habitat types are the most important factors affecting benthic community composition. Habitats with coarse, clean- swept cobble and large gravel substrates are often dominated by Ephemeroptera (mayflies) and Trichopera (caddisflies), whereas habitats with fine grained substrates (sand, mud, silt) are usually dominated by midges, Oligochaeta (worms), and sometimes fingernail clams. Organisms that are found in sandy habitats also typically have moderate to high biotic index values, even if the habitat is pristine. This is because habitats with fine grained sediments usually have low dissolved oxygen levels, so organisms living in these habitats must be able to survive in a wide range of dissolved oxygen concentrations. The presence of organisms with high biotic index (pollution tolerant) values does not necessarily indicate impaired conditions, however the presence of these organisms at the exclusion of organisms with low biotic index (pollution intolerant) values does indicate impairment. The benthic community at the experimental station had both pollution tolerant and pollution intolerant organisms.

The RBP analysis of benthic data collected from Fivemile River did not clearly show whether the experimental station was impaired. The data tend to indicate that some impairment has occurred; however, the difference in the biological community between the two stations may be due to degraded substrate or water quality conditions, or other conditions at the time of sampling. The low percent comparability of biological conditions between the two stations indicates that there probably was some impairment at the experimental station. However, benthic macroinvertebrate communities of flowing waters typically peak in abundance and diversity during the late summer (August-September); therefore, the observed differences between reference and experimental stations that were seen in this study may also have been influenced by sampling only part of the community that remained present during the ice-free period considered to be late in the growing season for stream benthic macroinvertebrates.

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