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Combe Fill South Landfill
Macroinvertebrate Survey 1983

New Jersey Department of Environmental Protection
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Introduction

At the request of the Division of Fish and Game, the Monitoring and Planning Element of the Division of Water Resources collected macroinvertebrate samples from Trout Brook and the Black River. Additional samples were collected from Tanners Brook. The purpose of this study was to determine any adverse impacts to the benthic communities in nearby surface waters from leachate and runoff originating in Combe Fill South Landfill, a dump site situated in Chester and Washington Townships in Morris County.

Early in 1981, the Department of Environmental Protection and the Upper Raritan Watershed Association conducted water quality testing on surface and ground water adjacent to the landfill. The results indicated that contaminants are migrating from the dumpsite. A total of thirty-three organic chemicals were found, five of which are known carcinogens. Eight organic compounds were found in individual concentrations equal to or exceeding 100 ppb. (See report by Darryl F. Caputo for detailed information).

The facility which has been closed since September 1981 is currently on the EPA Superfund List.

Methodology

The Surber square-foot bottom sampler was used for the collection of macroinvertebrates as this is the best method available for quantitatively sampling the fauna in shallow streams having a gravel and rubble substrate. Three replicate samples were collected at each station for the purpose of obtaining more reliable data.

All macroinvertebrate samples were collected and processed according to methods detailed in the Field Procedures Manual For Data Acquisition (NJDEP, 1983, pages I-20 and I-21) and Standard Operating Procedures For Biological Laboratory Methods (NJDEP, DWR 1983, Chapter IV).

In assessing water quality, evaluation of the data was based on various pollutional indicators along with professional interpretation. Mathematical indices were calculated using the Shannon-Weaver function for the Species Diversity Indices (\bar{d}) and Lloyd and Ghelardi's formula for the Equitability Index (e).

Species Diversity (\bar{d})

In unpolluted water \bar{d} generally ranges between 3 and 4.

The Maximum Hypothetical Species Diversity ($MH\bar{d}$) is computed as though all species were equally abundant.

Equitability (e)

Equitability is sensitive to even slight levels of degradation. e is generally 0.6 to 0.8 in unpolluted waters.

Intolerant Classification

Species classified as intolerant are generally not associated with polluted waters. These species are generally intolerant of even moderate reductions in dissolved oxygen.

Description of Area

The headwaters of Trout Brook are on the tract of land where Combe Fill South Landfill is situated (see Map, Figure 1). The brook has an FW-2 Trout Production classification according to current New Jersey Surface Water Quality Standards. Trout Brook flows for approximately two miles from the landfill through wooded and low density residential areas and Hacklebarney State Park where it meets the Black River. The substrate in Trout Brook is composed primarily of sand and gravel near the headwaters gradually shifting to cobbles and rubble. Stream velocity, while slow at the headwaters, steadily increases in the downstream direction. The stream width varied from 2 to 15 feet, while the depth was less than a foot at all stations. Sampling was conducted during extreme low flow conditions. The dry stream bed precluded any sampling on the East Branch of Trout Brook.

The Black River stations are also located within the borders of Hacklebarney State Park. This stream segment is classified as FW-2 Trout Maintenance. With the exception of stream width, the physical characteristics of this stream were similar to those on the downstream segment of Trout Brook.

A site on Tanners Brook, classified as FW-2 Trout Maintenance, was chosen as a control station. This station is just downstream of Fox Hill Road in Washington Township. Abiotic factors such as proximity to headwaters, surrounding vegetation, substrate composition, stream channel dimensions and stream flow were similar to those of the West Branch of Trout Brook (Stations 1 and 2).

Station Descriptions

1. Trout Brook, near footbridge on Bostick's Property, northwest of Parker Road in Washington Township. The area is marshy and wooded. Substrate composition - sand, gravel and rubble. Stream width - 2-3 feet. Depth - <1 foot. Flow - slow.
2. Trout Brook, on Rice's Property, approximately 200 feet upstream of Parker Road in Washington Township. The area is marshy and wooded. Substrate composition - sand, gravel and rubble. Stream width - 2-3 feet. Depth - <1 foot. Flow - slow to moderate.
- 2X. Trout Brook, at Black River Estates in Chester Township, approximately 1600 feet upstream of Hacklebarney Road. Surrounding area is wooded and residential. Substrate composition - gravel and rubble. Stream width - 10 feet. Depth - < ½ foot. Flow - moderate.
3. Trout Brook, approximately 600 feet upstream of Hacklebarney Road at Black River Estates in Chester Township. Surrounding area is wooded and residential. Substrate composition - rubble. Stream width - 6 feet. Depth - ½ foot. Flow - slow to moderate.
4. Trout Brook in Hacklebarney State Park, Chester Township, approximately 50 feet upstream of its confluence with the Black River. Surrounding area is wooded. Substrate composition - rubble, cobbles and boulders. Stream width - 15 feet. Depth - ½ foot. Flow - Fast.
5. Black River in Hacklebarney State Park, Chester Township, approximately 100 feet upstream from the Trout Brook confluence. Surrounding area is wooded. Substrate composition - rubble and cobble. Stream width - 35 feet. Depth - <1 foot. Flow - moderate-fast.
6. Black River in Hacklebarney State Park, Chester Township, approximately 100 feet downstream from the Trout Brook confluence. Surrounding area is wooded. Substrate composition - rubble, cobble, and boulders. Stream width - 35 feet. Depth - <1 foot. Flow - moderate to fast.
10. Tanners Brook, approximately 100 feet downstream from Fox Hill Road in Washington Township. Surrounding land is wooded and residential. Substrate composition - sand, gravel and rubble. Stream width - 2-3 feet. Depth - ½ foot. Flow - slow.

Discussion

Station 1 on Trout Brook, a site within close proximity of the landfill, appeared to be grossly polluted. The water was cloudy, a surface film was present, solids covered the substrate, and sewage fungus proliferated. The main inhabitants of the macroinvertebrate community were the sludgeworms Limnodrilus claparedianus and Tubifex tubifex; species which are frequently reported from grossly polluted water. Typical trout stream insects such as Trichoptera (caddisflies), Ephemeroptera (mayflies), and Plecoptera (stoneflies) were absent. Of the 22 taxa recovered, not one species was classified as intolerant to organic pollution. Individuals having a tolerant classification comprised 94.3 percent of the recovered population. A species diversity (\bar{d}) of 2.6 reflected only 58% of the Maximum Hypothetical \bar{d} (4.5). These values were the lowest of all the stations sampled, suggesting a greater degree of degradation at this location. An equitability of 0.4 was also indicative of organic pollution.

Downstream at Station 2, stream conditions appeared to be slightly improved. Although sewage fungus still covered the substrate, the water was clear and surface film was no longer present. An increase in current velocity along with more riffle areas contributed to physical reaeration of the stream, resulting in decreased stress on the benthic community. Both chironomids and sludgeworms dominated, with the clean water species Micropsectra polita comprising 19.7 percent of the community. The number of taxa (46) more than doubled and the population density increased greatly to an elevated 2856 individuals. Although species diversity (3.5) increased, equitability decreased slightly. The presence of tumors and abnormalities on many Chironomidae larvae indicated that water quality was less than favorable. The tumors were white, gray and red lumps on the abdominal segments; the antennae abnormalities were represented by various swellings, distortions or reductions of segments and flagellate. Any improvement in community composition could probably be attributed to increased dissolved oxygen levels.

At Station 2X, moderate stream velocity and numerous riffle areas provided for yet a greater degree of physical aeration. The substrate was covered with periphyton and macrophytes. Sludgeworm populations markedly declined. Micropsectra polita continued to dominate along with other clean water species of Micropsectra and Simulium larvae. Trichoptera (caddisflies), Ephemeroptera (mayflies), and Plecoptera (stoneflies), aquatic insects that had not been found at the upstream stations, began to populate the stream bed. Intolerant individuals comprised 57.9 percent of the total recovered population, reflecting an improvement in water quality. While equitability (0.4) remained low, species diversity (3.9) continued to improve. Some tumors and other abnormalities were still observed.

Silt partially covered the stream bed and periphyton growth decreased at Station 3. Housing construction immediately upstream probably contributed to these conditions. Number of taxa (50) remained fairly constant, but the population declined by more than half. The clean water midge Micropsectra polita and the sludgeworm Lumbriculus variegatus were in abundance. All pollutional indices reflected improved water quality. Species diversity was a high 4.3, comprising 77% of the MHD, and equitability was a healthy 0.6.

Surber collections at Station 4 yielded few organisms. Only 43 individuals were recovered representing 20 taxa. The population was very well balanced as indicated by high species diversity (4.0) and equitability (1.2) indices. The presence of trout stream organisms reflected good water quality.

Macroinvertebrates were collected from the Black River, both upstream and downstream of the Trout Brook confluence. Data indicated that Trout Brook had no apparent adverse impact on the benthic communities in the Black River. Macroinvertebrates recovered from Stations 5 and 6 reflected similar environmental conditions. Dominant organisms included species of Trichoptera, Diptera, and Oligochaetes. Numerous species classified as intolerant to organic pollution were common to each site. Species diversity and equitability indices did not significantly change from the upstream to the downstream site.

In the absence of pollutants, the Tanners Brook site and the West Branch of Trout Brook would be expected to support similar benthic communities. In actuality, however, the communities exhibited no similarities. Tanners Brook (Station 10) supported a diversified macroinvertebrate fauna. Numerous Taxa (77) were recovered. Mayflies, beetles, and chironomids dominated the community. More than half of the individuals (52.4%) were classified as intolerant to organic pollution. The species diversity was a high 4.9 and equitability was a healthy 0.6.

Summary

Trout Brook near Combe Fill South Landfill is in a grossly degraded condition. Toxic pollutants emanating from the dump site have unquestionably been detrimental to the aquatic biota. Although the entire stream has an FW-2 Trout Production classification, typical trout stream organisms were absent from the upper stream segment (Stations 1 and 2). Many of the surviving chironomid larvae have been afflicted with physical abnormalities and tumors. Stream quality underwent a continuous improvement in the downstream direction from the landfill. Oxygenation and the volatilization of organic substances were no doubt contributing factors to this improvement. Macroinvertebrates collected from Station 2X, approximately one mile downstream from the dump site, reflected favorable stream conditions. The remaining stations on Trout Brook downstream of this site also exhibited good water quality and supported diverse benthic communities with typical trout stream organisms.

References

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3. Hynes, H.B.N., The Biology of Polluted Waters, Copyright 1960 by H.B.N. Hynes, 1974 University of Toronto Press 202 pages.
4. N.J.D.E.P., Division of Water Resources, Field Procedures Manual for Water Data Acquisition. NJDEP, Trenton, N.J. 1980.
5. N.J.D.E.P., Division of Water Resources, Standard Operating Procedures for Biological Laboratory Methods, Biological Services Unit, 1983.
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Table 1
 TROUT BROOK
 Macroinvertebrate Survey 1983
 Mean Number of Individuals Per Square Foot

	1	2	2X	3	4
<u>TURBELLARIA</u>					
<i>Dugesia tigrina</i>		0.3	0.3		
<u>NEMERTEA</u>					
<i>Prostoma rubrum</i>					1.0
<u>NEMATODA</u>		7.3	0.7	0.3	1.3
<u>OLIGOCHAETA</u>					
<i>Aulodrilus pluriseta</i>	17.0		2.3	4.3	
<i>Limnodrilus claparedianus</i>	41.3		0.3		
<i>L. hoffmeisteri</i>	11.0	1.3			
<i>Lumbricidae</i>				0.3	0.7
<i>Lumbriculus variegatus</i>			13.3	22.0	2.0
<i>Nais communis</i>		0.3		1.3	
<i>N. simplex</i>	0.3		5.0	0.3	
<i>Pelosclex variegatus</i>			3.7		
<i>Tubifex tubifex</i>	40.0	106.3	3.0	0.3	
<u>COPEPODA</u>					
<i>Macrocylops albidus</i>		0.7			
<u>OSTRACODA</u>		0.3			
<u>ISOPODA</u>					
<i>Asellus communis</i>		0.3			
<u>PLECOPTERA</u>					
<i>Acroneuria</i>					0.3
<i>Leuctra truncata</i>			0.3		0.3
<u>EPHEMEROPTERA</u>					
<i>Baetis</i>			1.3	2.0	
<i>Neocoleon</i>				1.3	
<i>Paraleptophlebia</i>			0.3	0.3	
<i>Stenonema integrum</i>					0.7
<u>HEMIPTERA</u>					
<i>Microvelia borealis</i>			0.3	0.3	
<u>MEGALOPTERA</u>					
<i>Nigronia</i>			0.7	1.0	1.0
<i>Sialis</i>	0.7	2.7	3.3	1.7	
<u>TRICHOPTERA</u>					
<i>Glossosoma</i>					0.3
<i>Hydropsyche betteni</i>			0.3	3.3	
<i>H. potomacensis</i>			0.3	2.3	
<i>Ochrotrichia</i>				0.7	
<i>Rhyacophila fuscula</i>			0.3	0.3	
<i>Symphitopsyche sparna</i>			1.7	1.3	1.0

TROUT BROOK
Macroinvertebrate Survey 1983
Mean Number of Individuals Per Square Foot

	1	2	2X	3	4
<u>COLEOPTERA</u>					
Agabus	0.3	0.3			
Anacaena			0.3		
Anchyrtarsus bicolor				0.3	
Optioservus ovalis				0.3	
Stenelmis		0.3	1.0		
<u>DIPTERA</u>					
Aedes Fitchii	0.7				
Brillia flavifrons		5.3			
Calopsectra glabrescens				7.0	
C. sp.4			0.7		
Chironomus decorus	6.0	111.3		0.7	
C. riparius	0.3	155.0			
Chrysops	0.3			2.7	0.3
Cladotanytarsus sp.3				0.3	
C. van derwulpi			0.7		
Clinocera			20.7	1.3	0.7
Conchapelopia flavifrons		103.0	6.7	5.7	
Cricotopus bicinctus			0.3	2.7	
C. slossonae		0.3	0.7	5.7	
C. sp.2			1.0		
Dicranota				0.3	
Eukiefferiella brevinervis		39.0	8.3	0.3	
E. claripennis				1.3	
E. paucunca			6.0	1.0	
E. pseudomontana					0.3
Hemerodromia			0.3	1.0	
Hexatoma fultonensis			0.3		
Hydrophorus					0.3
Limnophora	1.0				
L. aequifrons		1.7			
Micropsectra brunnipes		89.3	0.7		
M. deflecta		37.0	26.3	2.3	
M. polita		187.3	91.0	35.0	
Microtendipes pedellus				0.3	
Natarsia sp.A	0.3	0.3	3.7		
Palpomyia tibialis			4.3	1.3	
Parametriocnemus lundbecki		2.0	2.3	5.3	0.3
Pentaneura sp.4		0.3			
Pentapedilum tritum		2.7		1.0	
Pericoma	1.7				
Phaenopsectra flavipes	0.7	2.0	0.3		
P. obediens		0.3			
Polypedilum convictum				5.3	
P. fallax	0.3	24.3	7.7	0.3	
Potthastia longimanus			1.0		

TROUT BROOK
Macroinvertebrate Survey 1983
Mean Number of Individuals Per Square Foot

	1	2	2X	3	4
<i>Probezzia glabra</i>	.	0.3			
<i>Prodiamesa olivacea</i>		0.3			
<i>Psectrotanypus dyari</i>		1.3			
<i>Pseudochironomus richardsoni</i>		1.0			
<i>Pseudolimnophila</i>		0.3	0.3	0.3	
<i>Psychoda alternata</i>	0.3	0.3			
<i>Rheopelopia perda</i>				2.7	
<i>Rheotanytarsus exigua</i>			1.3		0.3
<i>Simulium aureum</i>		2.7	29.7	2.3	
<i>S. jenningsi</i>		0.7			
<i>S. tuberosum</i>		0.3	10.7	1.0	0.7
<i>S. vittatum</i>		15.7	26.3	0.7	0.3
<i>Stictochironomus sp.1</i>		28.0			
<i>Stilobezzia antennalis</i>			0.7		
<i>Telopelopia okoboji</i>		0.3	0.3		
<i>Thienemanniella xena</i>			0.3		
<i>Thienemannimyia norena</i>	1.7				
<i>Tripodura halterale</i>			1.7	1.7	
<i>T. scalaenum</i>	0.3				0.3
<u>GASTROPODA</u>					
<i>Lymnaeidae</i>				0.3	
<i>Physella gyrina aurea</i>		2.3	0.7		
<i>P. heterostropha pomila</i>		3.0			
<i>P. integra integra</i>	0.3	6.3	3.7	1.3	
<i>Pseudosuccinea columella</i>		0.7			
<u>PELECYPODA</u>					
<i>Pisidium casertanum</i>	1.0	6.0	2.7		2.0
<i>Sphaerium securis</i>	0.3	0.7	1.7	2.0	
Total Number of Taxa	22	46	53	50	20
Mean Number of Ind./Sq. Ft.	126.0	952.0	302.0	137.7	14.3
Species Diversity	2.6	3.5	3.9	4.3	4.0
Equitability	0.4	0.3	0.4	0.6	1.2
% Intolerant Individuals	0	28.4	57.9	38.7	13.3

Table 1A
TROUT BROOK
Macroinvertebrate Survey 1983
Dominant Species

Station	Dominant Species	Mean Number Ind./Sq.Ft.	Percent Abundance
1	Limnodrilus claparedianus	41.3	32.8
	Tubifex tubifex	40.0	31.7
2	Micropsectra polita	187.3	19.7
	Chironomus riparius	155.0	16.3
	Chironomus decorus	111.3	11.7
	Tubifex tubifex	106.3	11.2
2X	Micropsectra polita	91.0	30.1
	Simulium aureum	29.7	9.8
	Micropsectra deflecta	26.3	8.7
	Simulium vittatum	26.3	8.7
3	Micropsectra polita	35.0	25.4
	Lumbriculus variegatus	22.0	16.0
	Calopsectra glabrescens	7.0	5.1
	Conchapelopia flavifrons	5.7	4.1
4	Lumbriculus variegatus	2.0	14.0
	Pisidium casertanum	2.0	14.0
	Nematoda	1.3	9.1
	Prostoma rubrum	1.0	7.0
	Nigronia	1.0	7.0
	Symphitopsyche sparna	1.0	7.0

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Table 2
BLACK RIVER
Macroinvertebrate Survey 1983
Mean Number of Individuals Per Square Foot

	5	6
<u>NEMERTEA</u>		
Prostoma rubrum	3.3	0.3
<u>NEMATODA</u>	0.3	
<u>OLIGOCHAETA</u>		
Lumbricidae	0.7	0.3
Lumbriculus variegatus	10.7	1.3
<u>AMPHIPODA</u>		
Gammarus fasciatus	2.0	2.7
<u>PLECOPTERA</u>		
Acroneuria abnormis	0.7	
<u>EPHEMEROPTERA</u>		
Ephemerella tibialis		0.3
Isonychia	0.3	
Neocloeon	2.3	0.7
Stenonema integrum		0.3
<u>HEMIPTERA</u>		
Microvelia borealis	0.3	
Rhagovelia obesa	0.3	
<u>MEGALOPTERA</u>		
Corydalis cornutus	0.3	
<u>TRICHOPTERA</u>		
Brachycentrus	0.7	0.3
Glossosoma	7.7	1.3
Leucotrichia pictipes		5.0
Symphitopsyche morosa	7.0	5.0
S. sparna	13.7	2.3
<u>COLEOPTERA</u>		
Dineutus	0.7	
Ectopria nervosa		0.7
Macronychus glabratus	1.3	0.3
Optioservus	1.0	0.3
Oulimnius lativsculus	0.7	
Promoresia tardella		0.3
<u>DIPTERA</u>		
Antocha	1.7	3.3
Cardiocladius obscurus		0.3
Cricotopus bicinctus	0.3	0.7
Eukiefferiella discoloripes	2.0	1.7
Rheotanytarsus exigua	10.0	2.3
Simulium tuberosum	1.0	

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BLACK RIVER
Macroinvertebrate Survey 1983
Mean Number of Individuals Per Square Foot

	5	6
<u>GASTROPODA</u>		
<i>Ferrissia rivularis</i>	1.7	2.0
<i>Physella gyrina cylindrica</i>	0.3	
Total Number of Taxa	26	22
Mean Number of Ind./Sq.Ft.	71.0	32.0
Species Diversity	3.7	3.8
Equitability	0.7	0.9
% Intolerant Individuals	32.5	56.9

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Table 2A
BLACK RIVER
Macroinvertebrate Survey 1983
Dominant Species

Station	Dominant Species	Mean Number Ind./Sq.Ft.	Percent Abundanc
5	Symphitopsyche sparna	13.7	19.3
	Lumbriculus variegatus	10.7	15.1
	Rheotanytarsus exigua	10.0	14.1
	Glossosoma	7.7	10.8
6	Leucotrichia pictipes	5.0	15.6
	Symphitopsyche morosa	5.0	15.6
	Antocha	3.3	10.3
	Gammarus fasciatus	2.7	8.4
	Symphitopsyche sparna	2.3	7.2
	Rheotanytarsus exigua	2.3	7.2

Table 3
TANNERS BROOK
Macroinvertebrate Survey 1983
Mean Number of Individuals Per Square Foot

	10
<u>TURBELLARIA</u>	
Phagocata morgani morgani.	1.3
<u>NEMATODA</u>	1.0
<u>OLIGOCHAETA</u>	
Aulodrilus pluriseta	1.3
Branchiobdella americana	2.0
Limnodrilus claparedianus	0.3
Nais communis	3.7
<u>AMPHIPODA</u>	
Gammarus fasciatus	10.7
<u>DECAPODA</u>	
Cambarus bartonii bartonii	1.3
<u>HYDRACARINA</u>	
Sperchonopsis verrucosa	0.3
<u>PLECOPTERA</u>	
Acroneuria xanthenes	4.0
Hastaperla brevis	2.3
Leuctra truncata	16.3
Peltoperla	1.0
<u>EPHEMEROPTERA</u>	
Ephemerella temporalis	2.0
Neocloeon	6.3
Paraleptophlebia	12.0
Stenonema pudicum	22.7
S. rubrum	78.7
<u>ODONATA</u>	
Agrion	3.3
<u>HEMIPTERA</u>	
Rhagovelia obesa	0.7
<u>MEGALOPTERA</u>	
Nigronia	3.0
Sialis	0.3

TANNERS BROOK
Macroinvertebrate Survey 1983
Mean Number of Individuals Per Square Foot

	10
<hr/>	
<u>TRICHOPTERA</u>	
Cheumatopsyche	20.3
Chimarra aterrima	0.3
Diplectrona	1.7
Dolophilodes	4.7
Glossosoma	1.0
Goera	8.0
Hydropsyche betteni	26.0
H. potomacensis	8.0
Polycentropus	2.0
Psilotreta frontalis	0.3
Psychomyia	3.7
Pycnopsyche	4.3
Rhyacophila sp.5	1.0
Symphitopsyche sparna	59.3
 <u>COLEOPTERA</u>	
Anchytarsus bicolor	65.7
Ectopria nervosa	16.0
Optioservus ovalis	36.0
Oulimnius latiusculus	26.0
Promoresia tardella	46.7
Stenelmis crenata	38.0
 <u>DIPTERA</u>	
Antocha	3.0
Brillia falvifrons	1.7
Calopsectra sp.4	6.0
Cladotanytarsus sp.3	6.3
Clinocera	1.7
Conchapelopia flavifrons	6.0
Corynoneura taris	3.7
Diamesa nivoriunda	3.3
Dicranota	2.0
Elliptera	5.7
Eukiefferiella brevinervis	0.3
E. discoloripes	0.3
E. paucunca	4.7
E. sp.2	0.3
Hemerodromia	12.0
Micropsectra deflecta	1.0
M. polita	41.0
M. sp.E	3.7
Microtendipes tarsalis	0.3
Nanocladius rectinervis	1.7
Palpomyia pruinescens	1.3
Parametriocnemus lundbecki	6.7

TANNERS BROOK
Macroinvertebrate Survey 1983
Mean Number of Individuals Per Square Foot

	10
Pentaneura falcigera	0.3
Polypedilum fallax	0.3
P. illinoense	14.3
Rheotanytarsus exigua	39.3
Simulium tuberosum	2.0
Thienemanniella xena	15.0
Tripodura halterale	57.0
Zavrelia johannseni	0.3
<u>GASTROPODA</u>	
Physella gyrina auera	0.3
P. heterostropha pomila	0.3
Pseudosuccinea columella	0.3
<u>PELECYPODA</u>	
Pisidium casertanum	1.0
Sphaerium	0.7
Total Number of Taxa	77
Mean Number of Ind./Sq.Ft.	787.7
Species Diversity	4.9
Equitability	0.6
% Intolerant Individuals	52.4

300103

Table 3A
TANNERS BROOK
Macroinvertebrate Survey 1983
Dominant Species

Station	Dominant Species	Mean Number Ind./Sq.Ft.	Percent Abundance
10	Stenonema rubrum	78.7	10.0
	Anchytarsus bicolor	65.7	8.3
	Symphitopsyche sparna	59.3	7.5
	Tripodura halterale	57.0	7.2
	Promoresia tardella	46.7	5.9
	Micropsectra polita	41.0	5.2
	Rheotanytarsus exigua	39.3	5.0
	Stenelmis crenata	38.0	4.8

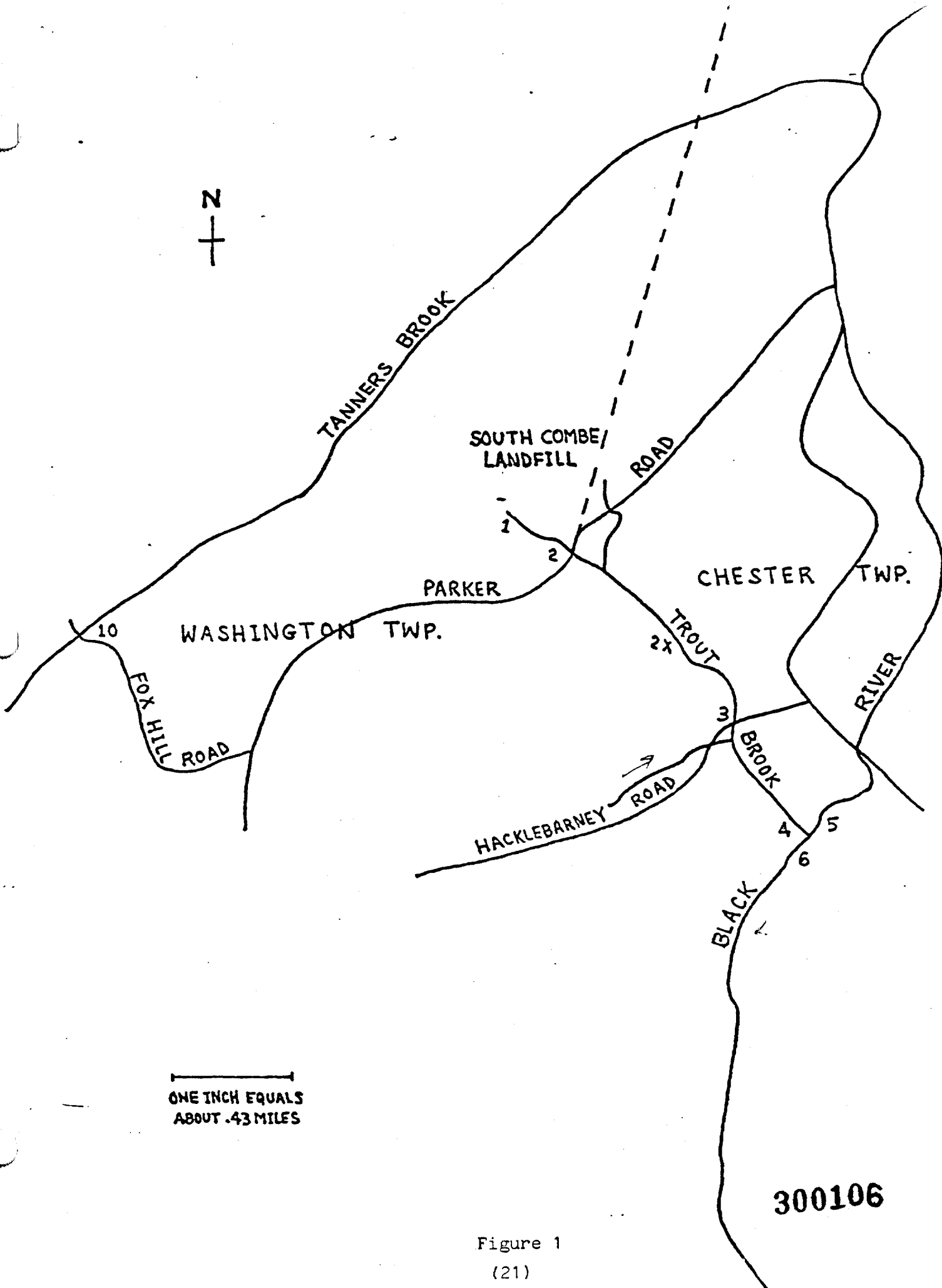
300104

Table 4

COMBE FILL SOUTH LANDFILL
Macroinvertebrate Survey 1983
Diversity Indices

<u>Station</u>	<u>\bar{d}</u>	<u>$MH\bar{d}$</u>	<u>%$MH\bar{d}$ attained</u>
1	2.6	4.5	58
2	3.5	5.5	64
2X	3.9	5.7	68
3	4.3	5.6	77
4	4.0	4.3	93
5	3.7	4.7	79
6	3.8	4.5	84
10	4.9	6.3	78

BK:Y:MP3



300106

Figure 1
(21)

TROUT BROOK
Macroinvertebrate Survey 1983
Species Diversity Index

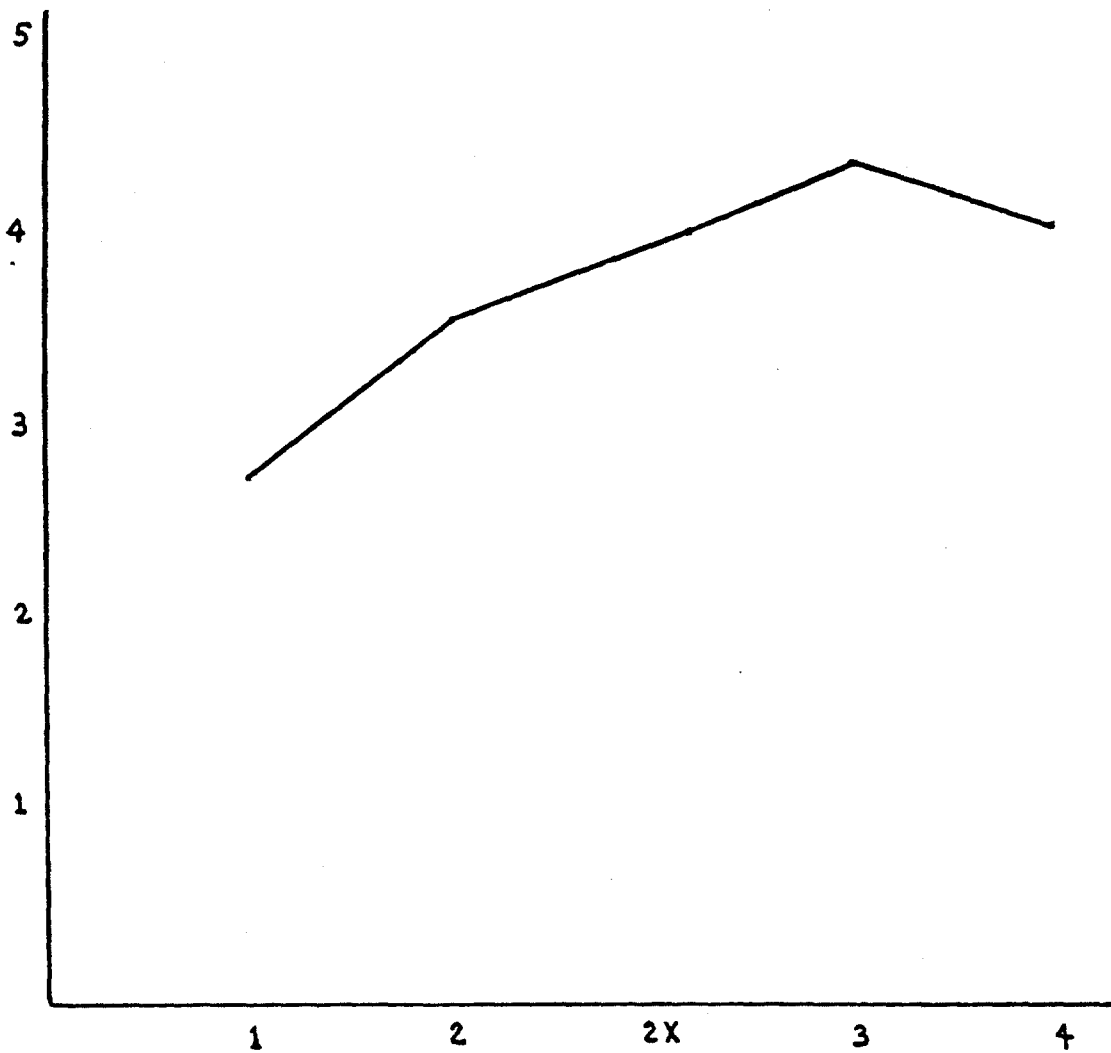


Figure 2

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TROUT BROOK
Macroinvertebrate Survey 1983
Percent MHT Attained

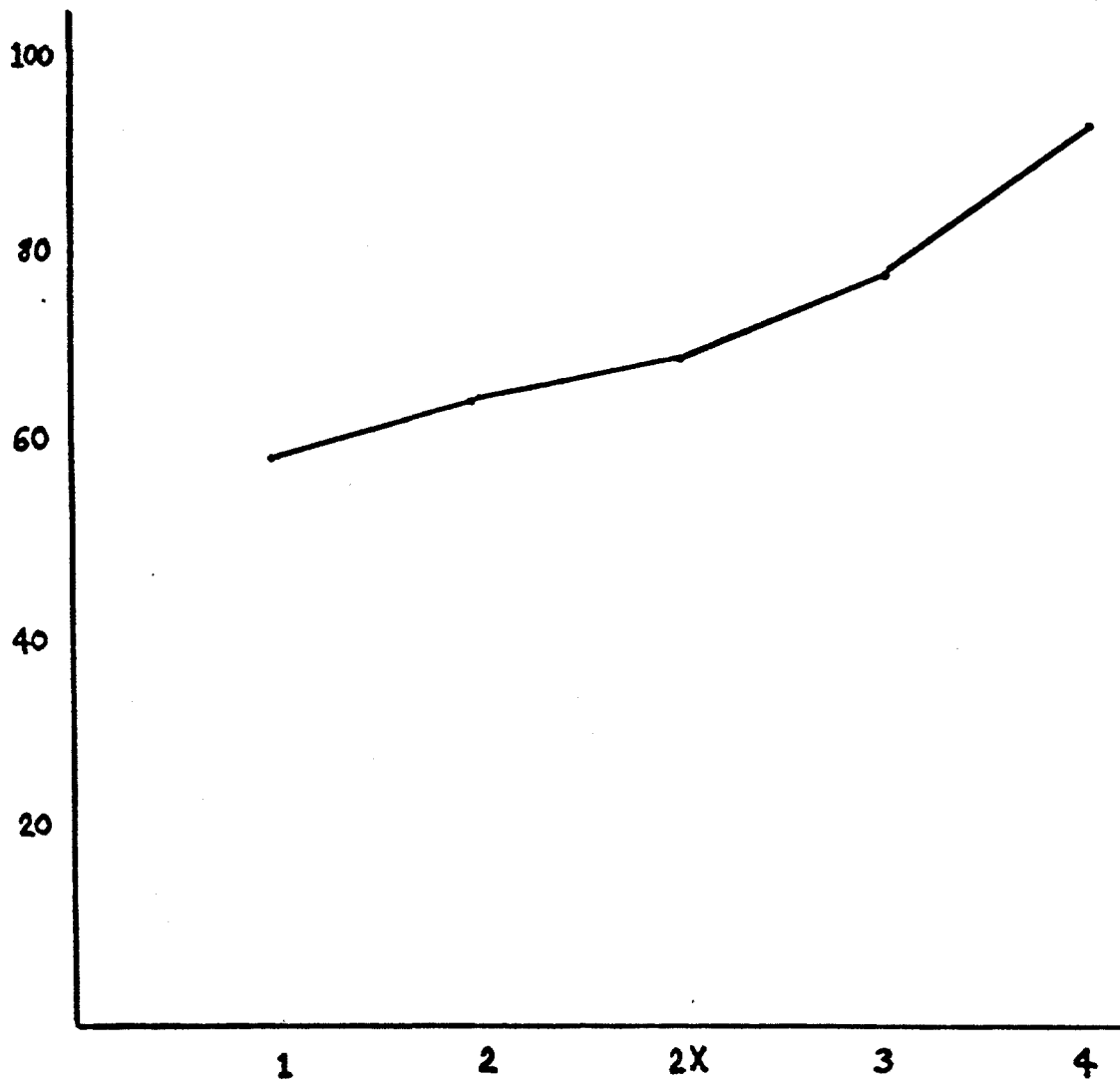


Figure 3