Institute of Freshwater Ecology

Natural Environment Research Council

A biological assessment of three drainage channel sites near Kings Lynn, Norfolk

Report to - Hepworths Minerals and Chemicals

J.A.B. Bass

INSTITUTE OF FRESHWATER ECOLOGY
Eastern Rivers Laboratory
Monks wood Experimental Station
Abbots Ripton
Huntingdon
Cambs PE17 2LS

Project Leader W.Davison
Report Date: July 1990
IFE Report Number: ERG/T11052b5/1
TFS Project Number: T11052b5

INTRODUCTION

The discharge of pumped groundwater via settlement lakes into a receiving water course is proposed by Hepworths Minerals and Chemicals.An assessment of the impact on two potential receiving watercourses is required.

This report describes the freshwater invertebrates (identified to Family level) and general features of three sites on small drainage channels near Kings Lynn, visited on 4 July 1990.

The analysis of corresponding water samples is recorded in a separate report (by Dr. W. Davison)

SITE LOCATIONS

1.) Gaywood River, National Grid Reference TF 664209

2.) Middleton Stop Drain, N.G.R. TF 633192

3.) Middleton Stop Drain, N.G.R. TF 641188

SITE DESCRIPTIONS

General - The three sites are on channelised streams which have been straightened and the high banks are steeply graded.

1.) Gaywood River

Site situated about 3.5 Km east of Kings Lynn and 1 Km north of Mintlyn Wood. Channel width at water surface about 3.5 m, water depth about 0.75 m. Extensive fine silt deposits, including an ochre deposit, covered the stream bed. Sparse growths of submerged Callitriche sp., Potamogeton sp. with emergent stands of Rorippa nasturtium aquaticum and Phragmites communis were also seen.

2.) Middleton Stop Drain

Site in the Hardwick Industrial Estate on the south east fringe of Kings Lynn. Channel width about 4 m, water depth about 0.5 m. Surface water drains from the industrial premises discharged from pipes at frequent intevals along the bank (the visit coincided with heavy rainfall). No water plants seen. Flocculent, highly organic, sediment deposits were of a black, anoxic, material. A surface film of oil was present.

3.) Middleton Stop Drain

At the A149 road bridge about 1.5 Km south east of Kings Lynn. Channel width about 5 m, water depth about 0.75 m. Plants were restricted to some isolated Sparganium emmersum and bankside Phragmites communis. Deep soft sediments of silt and clay covered the stream bed. Some oil was seen on the water surface.

WATER VELOCITY

Water velocity measurements were taken using an electromagetic flow meter (Armfield Technical Education Ltd) at site 1. The deep fine sediments at sites 2 and 3 prevented wading to record velocity profiles.

At site 1 a velocity profile was recorded under a bridge where the channel width was 3m, with a mean water depth of about 0.3m. Velocities were measured at ten points across the stream at 0.6 of the depth, values ranged from zero to a maximum of 0.157 m sec^{-1} . Mean velocity was 0.048 m sec^{-1} with a discharge rate of 43 litres sec^{-1} .

Lower velocities and discharges were subjectively considered to be prevailing at sites 2 and 3 on 4 July 1990.

FRESHWATER INVERTEBRATES

Identification was to Family level and a log scale of abundance in a standard collection interval of 20 secs is indicated (1-10 = "1", 10-100 = "2", 100-1000 = "3", 1000-10000 = "4").

Only aquatic fauna was recorded and the appropriate "score", as used in the Biological Monitoring Working Party (BMWP) classification system was applied (i.e. a pollution tolerant taxon rates a low score).

Total "scores" for each site and the "average score per taxon" (ASPT) (total score / number of Families recorded) are given (Table 1). These are used to assess the invertebrate community present.

1.) Gaywood River

Twenty scoring and three non-scoring Families were found, Total Score and ASPT were 81 and 4.05 respectively. The larvae of the large mayfly, Ephemera danica was the only high scoring invertebrate recorded and was confined to this site. The remaining range of invertebrates, the Total Score and the ASPT were lower than would be anticipated for an unpolluted lowland stream.

2.) Middleton Stop Drain (Industrial Estate)

Just two low scoring Familes were recorded, the Oligochaeta (worms) and larval Chironomidae (non-biting midges). The anoxic sediment would provide suitable conditions for few invertebrates.

3.) Middleton Stop Drain (A149 bridge)

Eight scoring Families were found and empty shells of two mollusc Families were present. Consequently there was a low Total Score of 32 and a similar ASPT to that found at site 1.

CONCLUDING REMARKS

1.) Invertebrate samples, water velocities and water samples taken on one occasion provide only a single "snap-shot" of conditions pertaining at the three sites.

2.) The contrast between the range of invertebrates at site 1,2 and 3 suggest that Middleton Stop Drain, both upstream and, particuarly in the region of the Hardwick Industrial estate, receives some polluting imputs.

3.) The highly organic nature of the sediments at site 2. and absence of ochre deposits suggest that pollution is derived from sources unrelated to the discharge of groundwater via the Mintlyn River.

4.) The discharge of neutralised or moderately acidic groundwater via the Mintlyn River is unlikely to cause further deterioration in the faunal assemblage of the slow flowing Middleton Stop Drain. The effect may be the provision of greater dilution of other effluents entering Middleton Stop Drain.

5.) The Gaywood River has a higher (estimated) flow rate than Middleton Stop Drain, providing greater dilution for an effluent . An assessment of stream flow and buffering capacity in relation to the risk of increased deposition of ochre deposits would be appropriate, before the consequences for the invertebrate fauna were predicted.

TABLE 1 (A)

INVERTEBRATE FAMILY		BMWP SCORE	SITE 1	SITE 2	SITE 3
Planariidae	B43				
Dendrocoolidae	B44				
Oligochaeta	B59	1	1	3	2
Piscicolidae	B47				
Glossiphoniidae	B54	3	1		
Hirudidae	B55				
Erpobdellidae	B56	3	1		
Astacidae	A46				
Corophiidae	A66				
Gammaridae	A67	6	3		
Asellidae	B57	3	1		2
Siphlonuridae	A24				1
Heptageniidae	A25				
Leptophlebiidae	A26				
Ephemerellidae	A27				
Potamanthidae	A28				
Ephemeridae	A29	10	1		
Caenidae	A56				
Baetidae	B45	4	4		
Leptidae	A47				
Aeshnidae	A48				
Corduliidae	A49				
Cordulegasteridae	A50				
Aeschnidae	A51				
Corduliidae	A52				
Libellulidae	A53				
Platycnemididae	A68				
Coenagriidaedae	A69				
Sialidae	B46	4	2		1
Taeniopterygidae	A30				
Leuctridae	A31				
Capniidae	A32				
Perlodidae	A331				
Perlidae	A34				
Chloroperlidae	A35				
Nemouridae	A57				
Rhyacophilidae	A37				
Polycentropidae	A38				
Limnephilidae	A39				
Odontoceridae	A40				
Leptoceridae	A41				
Goeridae	A42				
Lepidostomatidae	A43				
Brachycentridae	A44				
Sericostomatidae	A45				
Hydropsychidae	A54				
Philopotamidae	A55				
Rhyacophilidae	A58				
Polycentropidae	A59				
Limnephilidae	A60				
Hydroptilidae	A64				
Hydropsychidae	B40				

TABLE 1 (B)

INVERTEBRATE FAMILY		BMWP SCORE	SITE 1	SITE 2	SITE 3
Haliplidae	B29	5	1		
Hydrobiidae	B30				
Dytiscidae	B31	5	2		1
Gyrinidae	B32				
Hydrophilidae	B33				
Clambidae	B34				
Helodidae	B35				
Dryopidae	B36				
Elminthidae	B37	5	1		
Chrysomelidae	B38				
Curculionidae	B39				
Aphelocheiridae	A36				
Mesovelidae	A70				
Hydrometridae	A71				
Gerridae	A72				
Nepidae	A73				
Naucoridae	B25				
Notonectidae	B26	5	1		
Pleidae	B27				
Corixidae	B28	5	1		2
Tipulidae	B41				
Simuliidae	B42	5	2		
Chironomidae	B58	2	4	2	3
Neritidae	A61				
Viviparidae	A62				
Ancylidae	A63				
Unionidae	A65				
Sphaeriidae	B53	3	1		dead shell
Valvatidae	B48				
Hydrobiidae	B49	3	2		
Lymnaeidae	B50	3	1		dead shell
Physidae	B51	3	1		1
Planorbidae	B52	3	1		1
Porifera					
Polyzoa					
Nematoda					
Cladocera					
Copepoda					1
Ostracoda			1		
Branchiura					
Veliidae					
Psychodidae					
Ceratopogonidae			1		
Culicidae					
Syrphidae					
Muscidae					
Empididae					
Hydrachnellidae			2		
Halacaridae					
Dreissenidae					
SCORING		TAXA	20	2	8
TOTAL SCORE			81	3	32
AVERAGE SCORE PER TAXON			4.05	1.50	4.00