

**ENVIRONMENTAL PROTECTION**



National Rivers Authority  
South West Region

**BIOLOGICAL INVESTIGATION OF  
THE IMPACT OF IVYBRIDGE SEWAGE  
TREATMENT WORKS DISCHARGE  
TO THE RIVER ERME  
MAY 1991**

**SEPTEMBER 1991**

**FWI/91/017**

**Author: T.R.Geatches**

**GORDON H BIELBY BSc**  
**Regional General Manager**

**C V M Davies**  
**Environmental Protection**  
**Manager**

## SUMMARY

A biological survey was undertaken on the 8 May 1991 to assess the impact of Ivybridge Sewage Treatment Works discharge on the macroinvertebrate fauna and macroflora of the River Erme after winter operation of the storm overflow.

Upstream of the discharge a diverse macroinvertebrate fauna was detected which was typical of a moorland derived river apart from a proliferation of two groups of organic pollution tolerant taxa. A dense growth of the cyanobacterium Oscillatoria was also recorded indicating a significant nutrient source upstream.

No significant changes in organic pollution tolerant taxa or the macroflora was detected downstream of the discharge. Therefore, no evidence of an increase in organic pollution was found.

A small tributary which enters the River Erme immediately downstream of Ivybridge Sewage Treatment Works discharge was also investigated and found to be experiencing some organic and suspended solids pollution.



## 1. INTRODUCTION

There have been a number of perceived historic water quality problems associated with the discharge from Ivybridge Sewage Treatment Works (STW) to the River Erme. A macroinvertebrate survey carried out on the 17 October 1990 to assess the impact of the discharge on the River Erme (See Report FWI/90/021) concluded no detrimental impact was detected. It was recommended to resample the sites in spring 1991 to assess the impact after winter operation of Ivybridge STW storm overflow.

The four sites sampled in the original survey were resampled on the 8 May 1991.

## 2. METHODS

Aquatic macroinvertebrates were sampled using a 1.0 mm mesh Pond Net for 3 minutes duration in a riffle area of the site, using a standard kick technique, plus a further 1 minute sampling other habitats in the sample area. Details of substrate type, flow, width, depth, shade and flora were recorded on site. Samples were preserved on site with Industrial Methylated Spirit.

In the laboratory samples were sieved and placed in a shallow white tray to be sorted. Identification was to family level except for Oligocheata.

Biotic Scores were calculated using the Biological Monitoring Working Party (BMWP) score system which assigns a high score to organic pollution sensitive taxa (maximum of 10) and a low score to organic pollution tolerant taxa (minimum of 1). An average score per taxon (ASPT) was also calculated for each site. This value is considered to give a better indication of any pollution affects.

## 3. RESULTS

The macroinvertebrate fauna of the River Erme at site 1 upstream of the STW discharge was diverse with Ephemeroptera, Plecoptera and Trichoptera well represented (see Figure 1). BMWP and ASPT scores were high (see Table 1). The fauna was dominated by Oligocheata and Chironomidae. The substrate at this site was 80% covered by the cyanobacterium Oscillatoria.

At sites 3 and 4 on the River Erme downstream of the STW the macroinvertebrate fauna was less diverse than the upstream site 1 with Ephemeroptera, Plecoptera and Trichoptera reduced in diversity. There was a corresponding decline in BMWP and ASPT scores. The relative abundance of Caenidae at these sites were increased compared to site 1 and were dominant at these sites. Oligocheata and Chironomidae were in reduced relative abundance. The substrate at sites 3 and 4 was 40% and 50% covered by the cyanobacterium Oscillatoria respectively.

The macroinvertebrate fauna of the Woodland Stream at site 2 was dominated by Chironomidae and Hydrobiidae. BMWP and ASPT scores were reasonable. The substrate at this site was covered with 10% sewage fungus.

#### 4. DISCUSSION

Upstream of Ivybridge STW effluent at site 1 on the River Erme organic pollution tolerant taxa were dominant indicating some organic pollution. Downstream of Ivybridge STW effluent at sites 3 and 4 on the River Erme a reduction in organic pollution tolerant taxa was recorded compared to site 1. Therefore, no increase in organic pollution was detected as a result of Ivybridge STW effluent.

The abundance of Oscillatoria in the River Erme at all sites sampled was an indication of poor water quality, as proliferation of Oscillatoria is normally associated with nutrient concentrations atypical of moorland streams such as the River Erme. However, the presence of several macroinvertebrate taxa associated with good water quality suggests the source of nutrients was non-toxic.

The macroinvertebrate fauna of the River Erme at sites 3 and 4 downstream of Ivybridge STW discharge was dominated by Caenidae, which is normally associated with silted habitats. It was possible that the entry of the Woodland Stream, which has been known episodically to discharge high levels of silt into the River Erme, was responsible. It was also possible that the reduction in Oscillatoria cover in the River Erme downstream of Ivybridge STW discharge may have been partially responsible for the increase in relative abundance of Caenidae by an increase in available habitat.

The macroinvertebrate fauna of the Woodland Stream at site 2 was dominated by organic pollution tolerant taxa and 10% sewage fungus cover was recorded indicating chronic organic pollution. However, several organic pollution sensitive taxa were recorded indicating organic pollution to have been slight. Suspended solids pollution and siltation was also evident at this site which may have been responsible for the absence and scarcity of some organic pollution sensitive taxa. Caenidae were scarce at this site probably as a result of the chronic organic pollution.

Data from previous surveys (see Figure 2) indicated little change in water quality has occurred from 1986 to date (BMWP  $\approx$ 100, ASPT  $\approx$ 5.5). A discussion of the results of surveys up to 1990 is presented in FWI/90/021.

A routine biological sample taken at site 4 during April 1991 (not included in Figure 2 as taken at about the same time as this survey) recorded BMWP and ASPT scores of 135 and 6.75 respectively. The difference in these scores compared to results from this study (see table 1) was probably a result of difficulties of sampling the River Erme (because of the predominance of boulders in the substrate) and the different sampling strategies.

## 5. CONCLUSIONS

1. The condition of the River Erme upstream of Ivybridge STW discharge was indicative of a substantial non-toxic nutrient source entering the River Erme upstream.
2. No significant impact was detected on aquatic macroinvertebrates as a result of the entry of Ivybridge STW discharge to the River Erme. There was no indication that operation of Ivybridge storm overflow during the winter period had caused any detrimental effect on the aquatic macroinvertebrate fauna of the River Erme.
3. The aquatic macroinvertebrate fauna of the Woodland Stream was indicative of slight organic and silt pollution.

## 6. RECOMMENDATIONS

1. Further investigations of the River Erme upstream of Ivybridge STW discharge should be carried out to determine the source of organic pollution and nutrients.

Action - Freshwater Officer

2. Further investigations of the Woodland Stream should be carried out to determine the source of organic pollution and suspended solids.

Action - Pollution Controller

## 7. REFERENCES

- FWI/90/021      Biological investigation of Ivybridge Sewage Treatment Works - October 1990

FIGURE 1. MACROINVERTEBRATE SAMPLING SITES, DISCHARGES AND RELATIVE ABUNDANCE CHANGES OF MACROINVERTEBRATES IN THE RIVER ERME AND WOODLAND STREAM - 08/05/1991

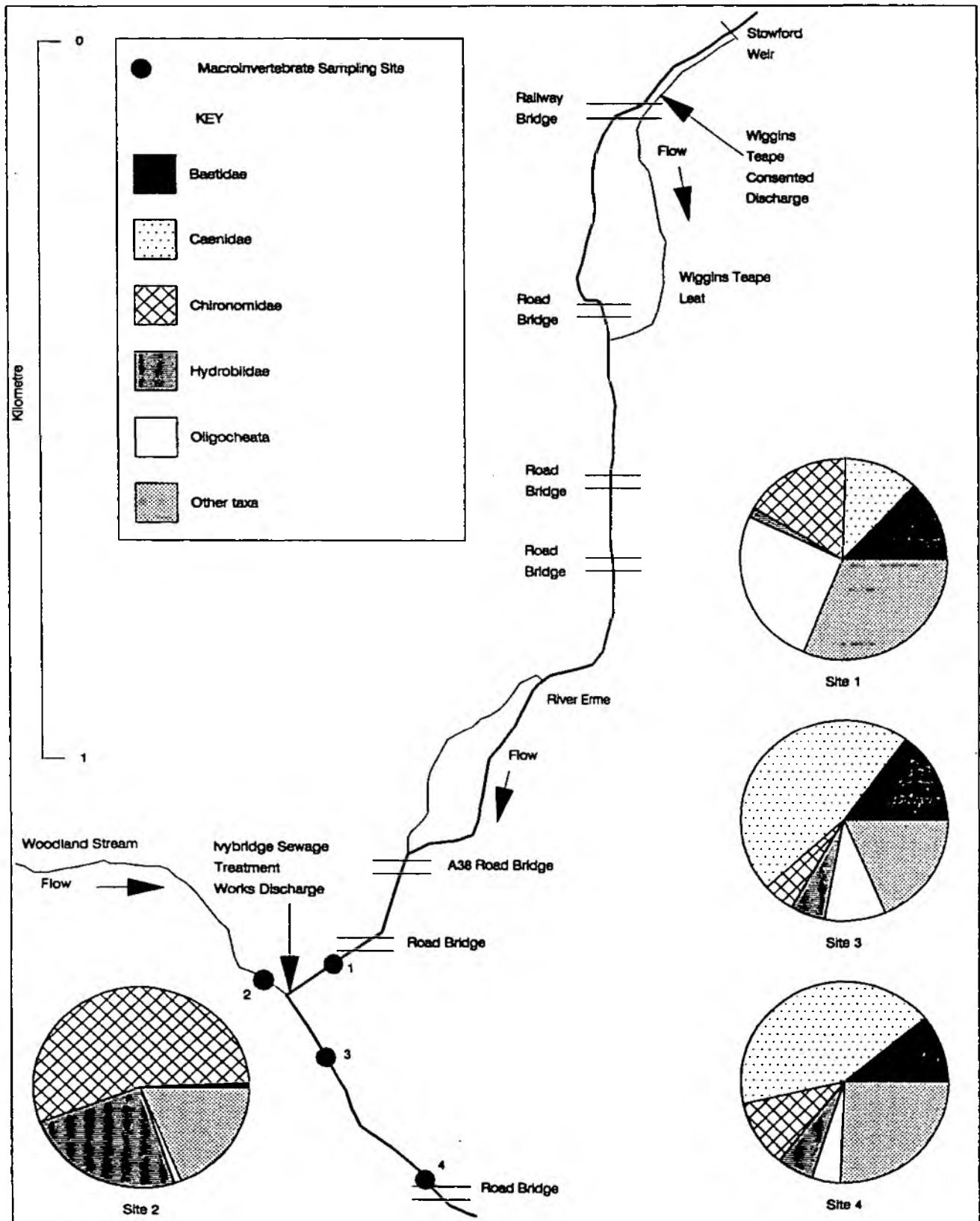


TABLE 1. OCCURRENCE AND ABUNDANCE OF MACROINVERTEBRATE  
TAXA IN THE RIVER ERME AND WOODLAND STREAM - 08/05/91

SITE NUMBER (SEE MAP)	1	2	3	4
DATE SAMPLED	08/05/91	08/05/91	08/05/91	08/05/91
SAMPLING OFFICER	TRG	TRG	TRG	TRG
IDENTIFYING OFFICER	DJ	DJ	DJ	DJ
<hr/>				
EPHEMEROPTERA	-	-	-	-
BAETIDAE	96	8	120	120
CAENIDAE	84	4	376	468
EPHEMERELLIDAE	-	80	-	-
HEPTAGENIIDAE	4	4	4	-
PLECOPTERA	-	-	-	-
CHLOROPERLIDAE	28	-	8	12
NEMOURIDAE	16	-	8	20
PERLODIDAE	1	-	-	-
TAENIOPTERYGIDAE	-	-	-	4
HEMIPTERA	-	-	-	-
VELIIDAE	-	4	-	-
TRICHOPTERA	-	-	-	-
HYDROPSYCHIDAE	56	4	56	128
LEPIDOSTOMATIDAE	1	-	-	-
LEPTOCERIDAE	1	-	-	-
LIMNEPHILIDAE	-	1	-	-
POLYCENTROPODIDAE	1	-	4	-
PSYCHOMIDAE	4	4	8	-
RHYACOPHILIDAE	16	20	8	8
SERICOSTOMATIDAE	8	8	12	20
DIPTERA	-	-	-	-
ATHERICIDAE	8	-	2	1
CERATOPOGONIDAE	12	4	-	1
CHIRONOMIDAE	124	784	40	116
EMPIDIDAE	36	48	8	48
MUSCIDAE	1	-	-	-
PSYCHODIDAE	12	-	-	-
SIMULIIDAE	1	-	20	12
TIPULIDAE	4	-	4	-
COLEOPTERA	-	-	-	-
ELMIDAE	16	-	4	6
GYRINIDAE	1	-	-	4
CRUSTACEA	-	-	-	-
ASELLIDAE	-	8	-	-
GAMMARIDAE	-	56	-	-
MOLLUSCA	-	-	-	-
ANCYLIDAE	1	20	-	4
HYDROBIIDAE	12	348	44	64
LYMNAEIDAE	-	3	-	-
PLANORBIDAE	1	-	1	-
OLIGOCHETA	188	16	76	48
HIRUDINEA	-	-	-	-
ERPODELLIDAE	1	-	2	12
GLOSSIPHONIIDAE	-	4	-	1

SITE NUMBER (SEE MAP)	1	2	3	4
DATE SAMPLED	08/05/91	08/05/91	08/05/91	08/05/91
SAMPLING OFFICER	TRG	TRG	TRG	TRG
IDENTIFYING OFFICER	DJ	DJ	DJ	DJ

---

**BIOTIC SCORES**

BMWP	143	95	102	93
ASPT	6.22	5.94	5.67	5.47
NUMBER OF SCORING TAXA	23	16	18	17
TOTAL NUMBER OF TAXA	28	20	20	20
TOTAL NUMBER OF INDIVIDUALS	734	1428	805	1097

**PHYSICAL PARAMETERS**

WIDTH (METRES)	10.4	2.1	7.4	13.8
MEAN DEPTH (METRES)	0.45	0.15	0.28	0.32
FLOW (METRES/SECOND)	1	0.33	1	0.33
TURBIDITY	NONE	SLIGHT/CLEAR	NONE	NONE
WATER COLOUR	CLEAR	BROWN	CLEAR	CLEAR
SHADE (%)	25	50	30	10

**SUBSTRATE (%)**

ROCK PAVEMENT	-	-	-	-
BOULDERS (>256mm)	60	30	50	40
COBBLES (64-256mm)	10	30	40	40
PEBBLES (16-64mm)	10	-	8	10
GRAVEL (2-16mm)	10	30	2	5
SAND	10	-	-	-
SILT	-	10	-	5
CLAY	-	-	-	-

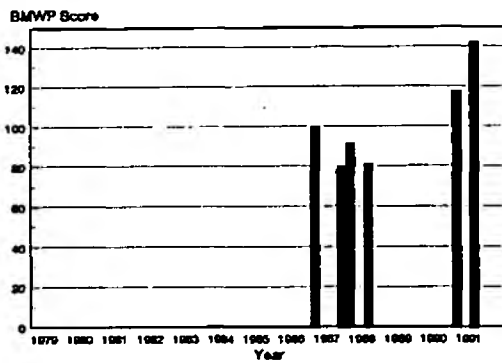
**FLORA**

MACROPHYTE COVER (%)	-	-	-	20
BRYOPHYTE COVER (%)	40	90	50	30
ALGAE COVER (%)	80	10	40	50
SEWAGE FUNGUS (%)	-	10	-	-

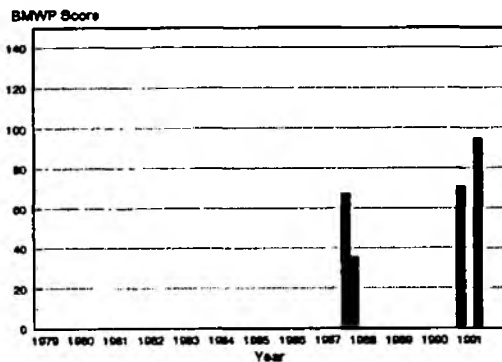
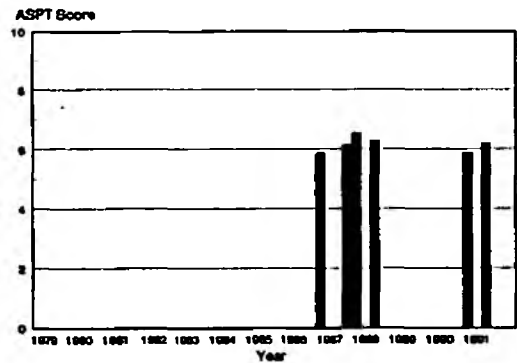
---



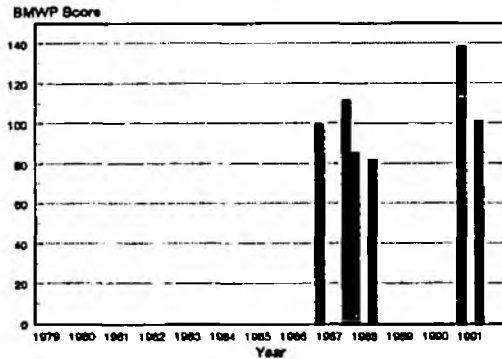
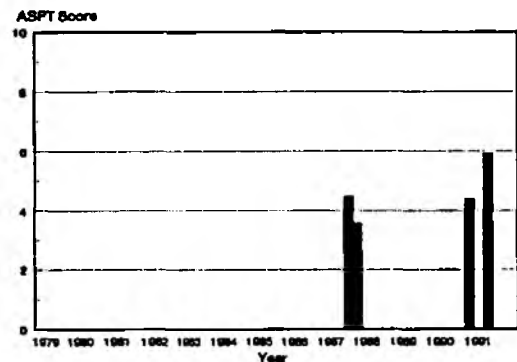
**FIGURE 2. SUMMARY OF BIOTIC SCORES - 1979 TO 1991**



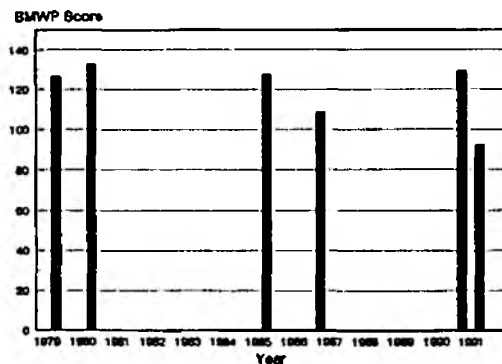
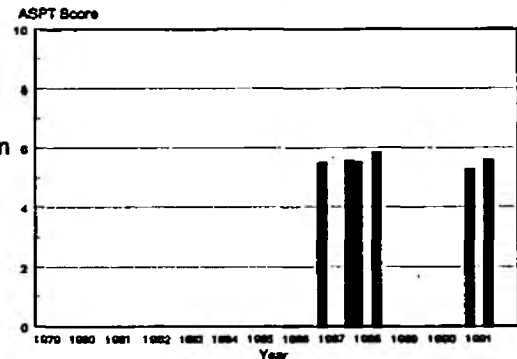
Site 1 - River Erme  
100 metres upstream  
of hybrid STW  
discharge



Site 2 - Woodland  
Stream prior to  
River Erme  
confluence



Site 3 - River Erme  
150 metres downstream  
of hybrid STW  
discharge



Site 4 - River Erme  
400 metres downstream  
of hybrid STW  
discharge

