

**KENT AND EAST SUSSEX AREA ANALYSIS AND REPORTING TEAM  
SURVEY OF PRE-RESTORATION WORKS AT FLETCHING MILL**

<b>CATCHMENT</b>	<b>Ouse</b>	<b>REPORT DATE</b>	<b>5 February 2010</b>
<b>REQUESTED BY</b>	<b>Fisheries, Recreation and Biodiversity</b>	<b>SURVEYED BY</b>	<b>Analysis and Reporting Team</b>
<b>REPORT CODE</b>	<b>Interim</b>	<b>REPORTED BY</b>	<b>Jessica Durkota</b>

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**(1) INTRODUCTION**

The Kent and East Sussex Analysis and Reporting Team were requested to conduct an ecological survey of the River Ouse prior to the removal of the Fletching Mill Weir complex by the East Sussex Fisheries, Recreation and Biodiversity Team (FRB). The River Ouse has a long history of anthropogenic alterations and engineering which enabled the River to be used for milling and navigation; however, as the Ouse is no longer utilized in this way, a number of these relic structures have now fallen into disrepair.

The Fletching Mill weir complex, which comprises a temporary sluice and permanent weir, is one of these such structures. Impoundments can increase sedimentation, decrease flow and alter the geomorphology of a river which can result in decreased fish passage and an overall shift in the ecological structure from a lotic to a lentic community (Lessard and Hayes, 2003). Despite the installation of a fish pass (Figure 1), previous reports have suggested that coarse and salmonid fish are only able to migrate over the weir complex during times of high flow; due to this and other ecological concerns, the Environment Agency plans to remove the weir complex during 2010 and restore this section of the Ouse (Barnes, 2004).

**Figure 1.** Photograph of the Fletching Mill fish pass



This report contains information regarding the pre-restoration invertebrate, macrophyte, fish and habitat surveys taken during 2009. Subsequent ecological surveys will be undertaken following the weir complex removal to assess restoration and inform future projects.

## (2) METHODOLOGY AND RESULTS

Six sites located upstream and downstream of the weir complex were surveyed using a variety of metrics to assess the impact of the weir complex on the ecological community (Table 1). For the purposes of this study, the sluice (located on the western tributary) and weir (located on the eastern tributary) are together referred to as the weir complex. A map of all survey locations may be found in Appendix III.

**Table 1.** Locations sampled in the pre-restoration Fletching Mill survey.

Site	Location	Description	NGR
FM1	500 meters U/S Weirs	Invertebrate and RHS	TQ 4201 2321
FM2	Immediately U/S Weirs	Invertebrate, Macrophyte, Fish and RHS	TQ 4237 2305
FM3	150 meters immediately D/S Weir West Tributary	Invertebrate, Macrophyte and RHS	TQ 4237 2294
FM4	150 meters immediately D/S Weir East Tributary	Invertebrate and Fish	TQ 4244 2295
FM5	250 meters D/S Weir; D/S confluence of tributaries	Invertebrate and RHS	TQ 4242 2283
FM6	400 meters D/S Weir	RHS	TQ 4253 2274

### (2.1) Invertebrates

Invertebrate samples were taken from five sites upstream and downstream of Fletching Mill during October 2009. Samples were collected using standard Environment Agency methodology and analysed using established biotic indices (Environment Agency, 1999).<sup>1</sup> A total of sixty-one taxa were collected from the five sites and a full taxa list may be found in Appendix I. The results indicate that the sites immediately upstream of the weir complex (FM2) and immediately downstream of the sluice on the western tributary (FM3) are of poorer ecological condition than the other sites in this survey, suggesting that the weir complex has an adverse impact on the invertebrate community at Fletching Mill.

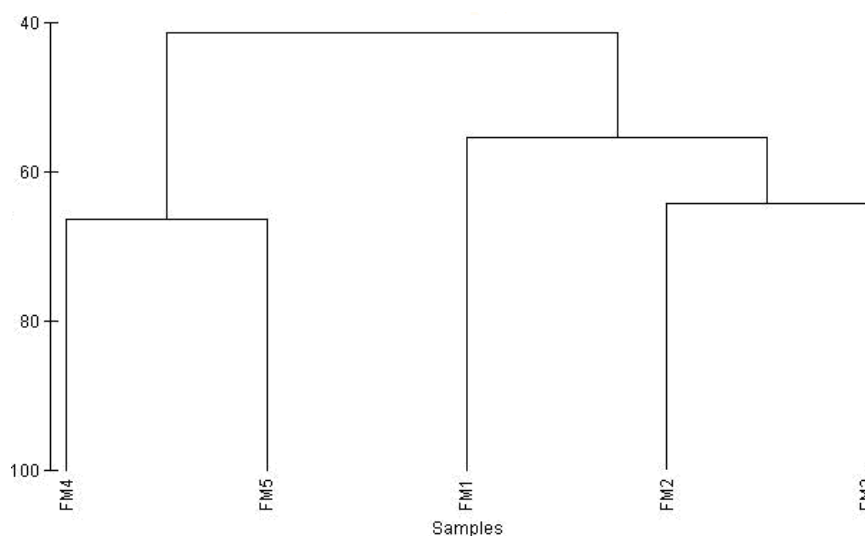
**Table 2.** Results of the pre-restoration invertebrate study at Fletching Mill

Site	Site ID	BMWP	ASPT	CCI	LIFE
FM1	154344	111	5.05	17.5	6.45
FM2	154345	77	4.53	8.57	6.21
FM3	154348	73	4.87	4.64	6.69
FM4	154349	132	5.74	9.12	7.68
FM5	154347	160	5.93	12.38	8.38

Cluster analysis supports the results of the biological indices, suggesting a clear division between the more natural riffle-pool habitat at FM4 (downstream of the weir on the eastern tributary) and FM5 (furthest downstream) and the modified habitat at FM1 (furthest upstream), FM2 (immediately upstream) and FM3 (immediately downstream of the sluice on the western tributary; Figure 2). Examination of individual taxa reflects this distinction as the former cluster contains a number of rheophilic species, such as the mayfly *Heptagenia sulphurea*, which thrive in fast-flowing water; whereas the latter cluster contains a number of

<sup>1</sup> A BMWP score, ranging from 1-10 is given for each taxon and calculated for the site as a whole, this score is then divided by the total number of scoring taxa to give the ASPT. Moss (1998) suggests that a BMWP score >100 and ASPT >4.0 reflects good water quality. The CCI method suggests that sites scoring 0-5 are of low conservation value; 5-10 are of moderate conservation value; 10-15 are of fairly high conservation value; 15-20 are of high conservation value; and >20 are of very high conservation value, potentially of national significance (Chadd and Extence, 2004). The LIFE score gives each taxa a score of 1 to 6, the former being associated with rapid flows and the latter associated with drought-tolerant conditions this is calculated in a matrix against abundance to give a score in which higher scores reflect higher flows (Extence et al. 1999)

species indicative of slow-flowing or ponded water, such as the alderfly larvae *Sialis lutaria* (Wood and Petts, 1994; Wood et al.2005). A further division is illustrated within the latter cluster which suggests that the furthest upstream site (FM1) and the two sites located nearest to the sluice (FM2 and FM3), which also recorded the lowest ASPT and CCI scores of this survey, suggesting that the greatest impact from the sluice may be to its immediate surroundings which were noted to be heavily silted at the time of sampling.



**Figure 2.** Dendrogram of invertebrate community cluster analysis.

## (2.2) Macrophytes

Two macrophyte surveys were undertaken upstream and downstream of the weir complex in August 2009 using standard Environment Agency methodology (Holmes et al. 1999).<sup>2</sup> It is important to note that the surveys were taken immediately upstream of the impoundment complex and downstream of the temporary sluice on the western tributary, a survey was not undertaken on the eastern tributary (downstream of the weir) due to heavy shading. Eighteen macrophyte taxa were recorded during these two surveys and a full taxa list may be found in Appendix II. Despite the marked difference in physical habitat, the macrophyte community was very similar between the two sites, which were both dominated by *Nuphar lutea* (Yellow Water Lilly) and *Sparganium emersum* (Unbranched Bur-reed) which are typical of slow-flowing, lowland environments (Table 3; Holmes, 2009). These results suggest that the impoundment has created an area of slow-flowing water both upstream and immediately downstream of the complex which has resulted in a similar macrophyte community.

**Table 3.** Calculated macrophyte survey results.

Site	Site ID	NGR	MTR	Number of Scoring Species
Upstream Fletching Mill	134722	TQ 42367 23068	31.1	5
Downstream Fletching Mill	134721	TQ 42425 22839	25.8	4

## (2.3) Fish

Two electrofishing surveys were undertaken using standard Environment Agency methodology upstream of the weir complex and downstream of the weir on the eastern tributary during the autumn of 2009. Previous ecological surveys have suggested that the weir

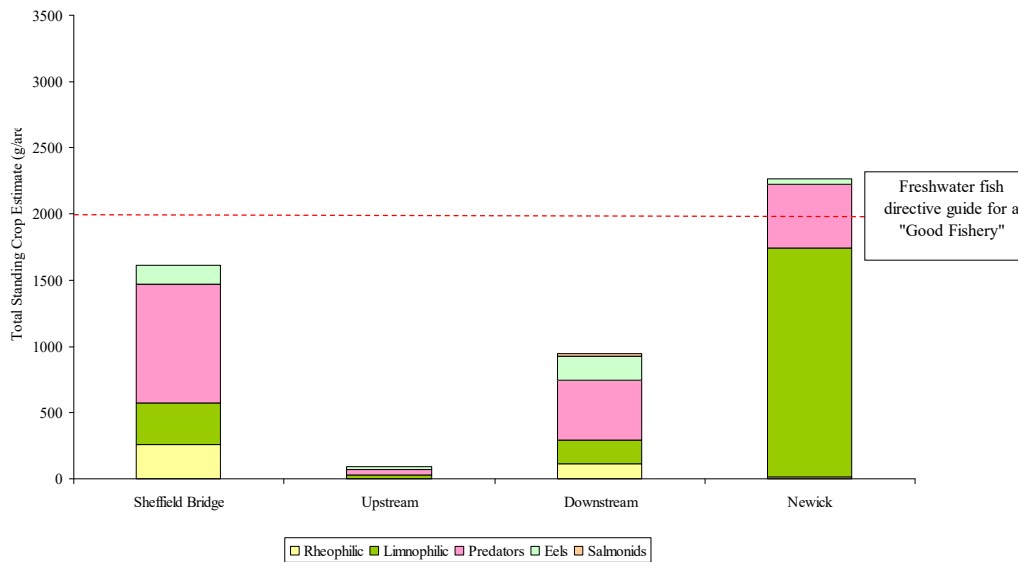
<sup>2</sup> The MTR methodology associates higher scores with plants that are intolerant of high levels of nutrients and lower scores with those that are cosmopolitan or are tolerant of nutrients; score of <45 suggest that a site is impacted by eutrophication and a difference of >5 between sites indicates a significant difference between sites.

is only passable by fish during high flow events and continues to present a significant obstruction to fish passage on the Ouse (Barnes, 2004). A total of ninety-nine fish of eight taxa were recorded from the two surveys (Table 4). Both sites recorded a low species richness (national average = 8 species) and standing crop, which was well below the threshold for a 'good fishery' and of the two routinely monitored sites upstream (Sheffield Bridge) and downstream (Newick) of Fletching Mill (Figure 3).

**Table 4.** Taxa list and associated abundance from two Fletching Mill fisheries surveys.

	<b>Fletching Mill Upstream (121078)</b>	<b>Fletching Mill Downstream (121074)</b>
Dace	1	26
Eel	1	7
Gudgeon	0	8
Perch	10	8
Pike	4	2
Roach	3	24
Rudd	4	0
Sea Trout	0	1

Despite the similar community composition between the sites, records from two species are of particular importance. Primarily, the single Eel caught at the upstream site was very large at 500 millimeters whereas the Eels caught at the downstream site had a much more even size distribution (575, 490, 300, 290, 240, 220, 150); in addition, one Sea Trout was captured at the downstream site. It is important to note the reduced catch efficiency at the upstream site due to the depth, which may influence the results; however, these records reflect the importance of enabling passage for migratory species not just to the upstream site, but also to the headwaters beyond.



**Figure 3.** Total Standing Crop Estimate (Carle and Strub) by guild >99mm (g/are)

#### (2.4) River Habitat Survey

Two River Habitat Surveys (RHS) were undertaken upstream and downstream of the weir complex in June 2009. RHS is a method which has been developed by the Environment Agency to assess the character and habitat quality of rivers based upon their physical structure

(Raven et al. 2000). Each survey comprises ten semi-objective assessments of the morphological character of the river over a 500 meter section accounting for both natural and artificial features (Environment Agency, 2003). These features are then assessed against the results of one-hundred and fifty baseline RHS from nearby locations to provide a number of comparable scores (Raven et al. 2000).

The Flechting Mill surveys indicate that the downstream site, located from immediately to downstream of the sluice on the western tributary, provides a much more diverse range of physical habitat than the upstream site, which was located immediately upstream of the weir complex (Table 5). The downstream survey was characterised by a number of riffle-pool sequences whilst the upstream site reflected the impoundment created by the weir complex, characterised by a deep, slow-flowing, lentic habitat (Figure 4).



**Figure 4.** Flechting Mill immediately upstream of the weir complex

The Habitat Quality Assessment score (HQA) is a broad measure of the diversity and ‘naturalness’ of physical habitat structure in the river corridor in which higher scores suggest greater quality (Raven et al. 1998). The Habitat Modification Score (HMS) is a measure of artificial modification to the physical structure of the channel in which higher scores suggest greater modification. The results from these surveys suggest that the downstream site offers a more diverse habitat but that both the upstream and downstream sites are significantly modified.<sup>3</sup>

**Table 5.** Results of the two pre-restoration RHS at Flechting Mill.

Location	Site ID	Survey ID	HMS Class	HQA Score	HMS Score
U/S Weir Complex	24929	38007	4	36	930
D/S Weir Complex	24930	38008	4	45	1260

### (3) CONCLUSIONS

The results of this study suggest that sites upstream of the weir complex provide a deep, slow-flowing, heavily modified habitat for a largely lentic community whilst the community downstream reflects a more shallow, faster-flowing area with natural riffle-pool sequences and greater diversity.

<sup>3</sup> A Habitat Modification score of 0-16 reflects pristine/semi-natural conditions; 17-199 reflects predominantly unmodified conditions; 200-499 reflects obviously modified conditions; 500-1399 significantly modified; and 1400+ severely modified; an HMS Class of 1 is pristine/semi-natural, 2 is unmodified; 3 is modified; 4 is significantly modified and 5 is severely modified.

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## APPENDICES

**Appendix I.** List of invertebrate taxa recorded from the five Fletching Mill samples

	FM1	FM2	FM3	FM4	FM5
Valvatidae			1		1
<i>Bithynia tentaculata</i>	21	7	5	11	2
<i>Physa fontinalis</i>		1			
Lymnaeidae					1
<i>Lymnaea peregra</i>			1		
<i>Lymnaea stagnalis</i>				1	
Planorbidae		1			1
<i>Ancylus fluviatilis</i>				3	10
<i>Sphaerium</i>	10	3		50	50
<i>Oligochaeta</i>	3	25	2	2	50
<i>Pisicola geometra</i>				1	
<i>Glossiphonia complanata</i>		2			
<i>Helobdella stagnalis</i>		2			
Erpobdellidae	3	15		2	1
Hydracarina	1		1		
Cladocera	10				
Ostracoda	1	2	5		
<i>Asellus aquaticus</i>	50	18	2		
<i>Crangonyx pseudogracilis</i>	18				
<i>Gammarus pulex</i>	1	10	3	50	25
Collembola	1				
<i>Baetis rhodani</i>	5		1	4	3
<i>Heptagenia sulphurea</i>				1	3
<i>Ephemera danica</i>				3	4
Caenidae					7
Coenagriidae	2	2			
<i>Calopteryx splendens</i>	2	2	2	5	1
Corixidae	2				
<i>Gyrinus urinator</i>	2				
<i>Helophorus</i>	1				
<i>Hydraena</i>	1				
<i>Elmis aenea</i>			1	11	10
<i>Limnius volckmari</i>			1	13	10
<i>Oulimnius</i>	2		1	10	10
<i>Sialis lutaria</i>	3	13	7		
<i>Rhyacophila dorsalis</i>			1	2	5
<i>Glossosoma</i>				1	
Hydroptila	1				2
<i>Lype reducta</i>	12			2	3
<i>Cyrnus trimaculatus</i>	6	4	7	13	
<i>Polycentropus flavomaculatus</i>				20	14

	FM1	FM2	FM3	FM4	FM5
Hydropsyche angustipennis				25	101
Hydropsyche siltalai		2			
Lepidostoma hirtum				12	83
Limnephilidae				7	
Limnephilus rhombicus	20	11	1	6	
Goera pilosa					2
Sericostoma personatum					2
Molanna angustata	1	6			
Leptoceridae					13
Athripsodes				3	
Mystacides			10	1	
Pyralidae		1			
Tipula				1	
Dicranota				1	2
Ceratopogonidae				3	7
Chironomidae	10	8	30	20	10
Stratiomyidae					1
Muscidae					1
Polycelis	1			1	1
Dugesiiidae	3				
Dendrocoelum lacteum	3				
BMWP	111	77	73	132	160
ASPT	5.05	4.53	4.87	5.74	5.93
No Of Taxa	22	17	15	23	27
CCI	17.5	8.57	4.64	9.12	12.38
SPECIES LIFE	6.45	6.21	6.69	7.68	8.38



**Appendix II.** Macrophyte Taxa List in which the number reflects the percentage cover of a given species over the 100 meter survey and \* indicates a species which is present in the riparian area but not within the wetted perimeter.

Site/Station Name	U/S FLETCHING MILL	D/S FLETCHING MILL
Site/Station ID	134722	134721
Site/Station Location	TQ-42367-23068	TQ-42425-22839
Sample Date	06-Aug-09	06-Aug-09
Cladophora	*	*
Callitriche	2	1
Epilobium hirsutum	*	
Impatiens glandulifera	*	*
Lycopus europaeus	*	*
Lythrum salicaria	*	*
Myosotis scorpioides	1	4
Nuphar lutea	3	4
Oenanthe crocata	1	*
Pulicaria dysenterica	*	
Rorippa palustris	1	
Alisma plantago-aquatica		*
Iris pseudacorus		*
Lemna minor	2	1
Phalaris arundinacea	2	2
Sagittaria sagittifolia	3	
Sparganium emersum	7	4
Persicaria hydropiper	*	*
MTR Score	31.1	25.8
MFR Score	2	1.75
Number of Scoring Species	5	4

APPENDIX III. Map of sample and survey locations.

