

Hermitage Stream and Park Lane Stream

Aquatic Macroinvertebrate and
Habitat Investigation

Dunsbury Hill ES Technical

Appendix

July 2011

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1. Assessment details

1.1. Survey

A benthic aquatic macroinvertebrate and habitat survey of the Hermitage Stream and Park Lane Stream was undertaken in May 2011 to provide appropriate baseline data for the streams at the proposed Dunsbury Hill Scheme location. All surveys and data processing has been undertaken by Aktins' aquatic ecologists and geomorphologists in support of this Environmental Statement.

Four sites were selected for investigation (Figure 1) to allow determination of the baseline character of the streams at a scale relevant to the proposed Scheme. These sites can be broadly described as follows:

- Hermitage Stream:
 - HS01 (Concrete lined channel downstream of A3(M) road crossing)
 - HS02 (Soft banked straighten channel section below concrete section)
 - HS03 (Soft banked "natural" channel section downstream of HS02).
- Park Lane Stream
 - PL01 (adjacent to eastern Scheme boundary).

Photographic plates of these sites are provided in Table 1-3.

1.2. Invertebrate sampling methodology and processing

Aquatic macroinvertebrates were sampled at each site through the adoption of standard Environment Agency sampling protocols (Environment Agency, 1999). This included a 3 minute kick sample using a 500 um pond net and a one minute hand search of the benthic substrates. At each site a reach, approximately 7 times the channel width, was sampled; with time spent sampling in each habitat done so in proportion to its occurrence in the reach.

Material collected in the pond-net was rinsed (to remove fine sediment and detritus) before being transferred into a white plastic sorting tray containing approximately 2cm of water. Macroinvertebrates were removed into Petri-dishes for closer inspection. Taxa were then identified on the bankside using a x10 hand lens and assigned to one of the following abundance categories:

- A = 1 - 9 individuals
- B = 10 - 99
- C = 100 - 999
- D = 1000 - 9999
- E = 10 000 +

It should be noted that sampling will not guarantee an exhaustive list of the macroinvertebrates present as it is likely that some taxa may have been overlooked during the field sorting process. However, it is assumed that losses will be consistent between the sites sampled. This sampling methodology provides a semi-quantitative record of the species present allowing for the calculation of biotic indices and comparisons of community richness (number of taxa recorded) and abundance to be made between the sites sampled.

1.3. Physical habitat assessment

For each macroinvertebrate sample site an assessment of the physical habitat was also undertaken in order to describe the reach sampled. Sample site physical habitat descriptors were recorded to describe:

- Channel form
- Flow character
- Dominant habitat types
- Bed sediment characteristics
- Instream and riparian vegetation types.

1.4. Invertebrate data analysis

Aquatic benthic macroinvertebrates are a commonly used community indicator of freshwater fluvial system “health” and as such are often recorded as an integral component in the assessment of ecological status under the WFD. The following biological indices were calculated from the invertebrate community data obtained from each of the five sampling sites to provide an assessment of the quality of the ecological community at the sites sampled on the hermitage and Park Lane streams.

1.5. BMWP, ASPT and N-Taxa

Biological Monitoring Working Party (BMWP) and Average Score per Taxon (ASPT) scores for the sampling points are also provided as part of this assessment. The BMWP and ASPT scoring system provides a standard index used by the Environment Agency in assessment of water quality, primarily as an indicator of levels of organic pollution. All families of common British freshwater macroinvertebrates have been allocated a score between 1 and 10 dependent on their sensitivity to organic pollution. Taxa that are very tolerant of poor water quality score 1 and species that are very intolerant of poor water quality score 10; other species are allocated scores between these two extremes depending on their tolerances. The ASPT is the score achieved by all the scoring macroinvertebrate families and is calculated by dividing the BMWP score by the number of BMWP scoring taxa (N-Taxa). The ASPT is seen as a more reliable indicator of water quality than BMWP, in relation to organic pollution, as it is more stable and less prone to seasonal fluctuations, habitat differences and sampling effort. ASPT scores obtained can be related directly to water quality as shown below:

- | | |
|--------------|---------------------------------|
| • >5.4 | = Very good biological quality |
| • 4.18 – 5.4 | = Good biological quality |
| • 4.21 – 4.8 | = Fair biological quality |
| • 3.61 – 4.2 | = Poor biological quality |
| • <3.6 | = Very poor biological quality. |

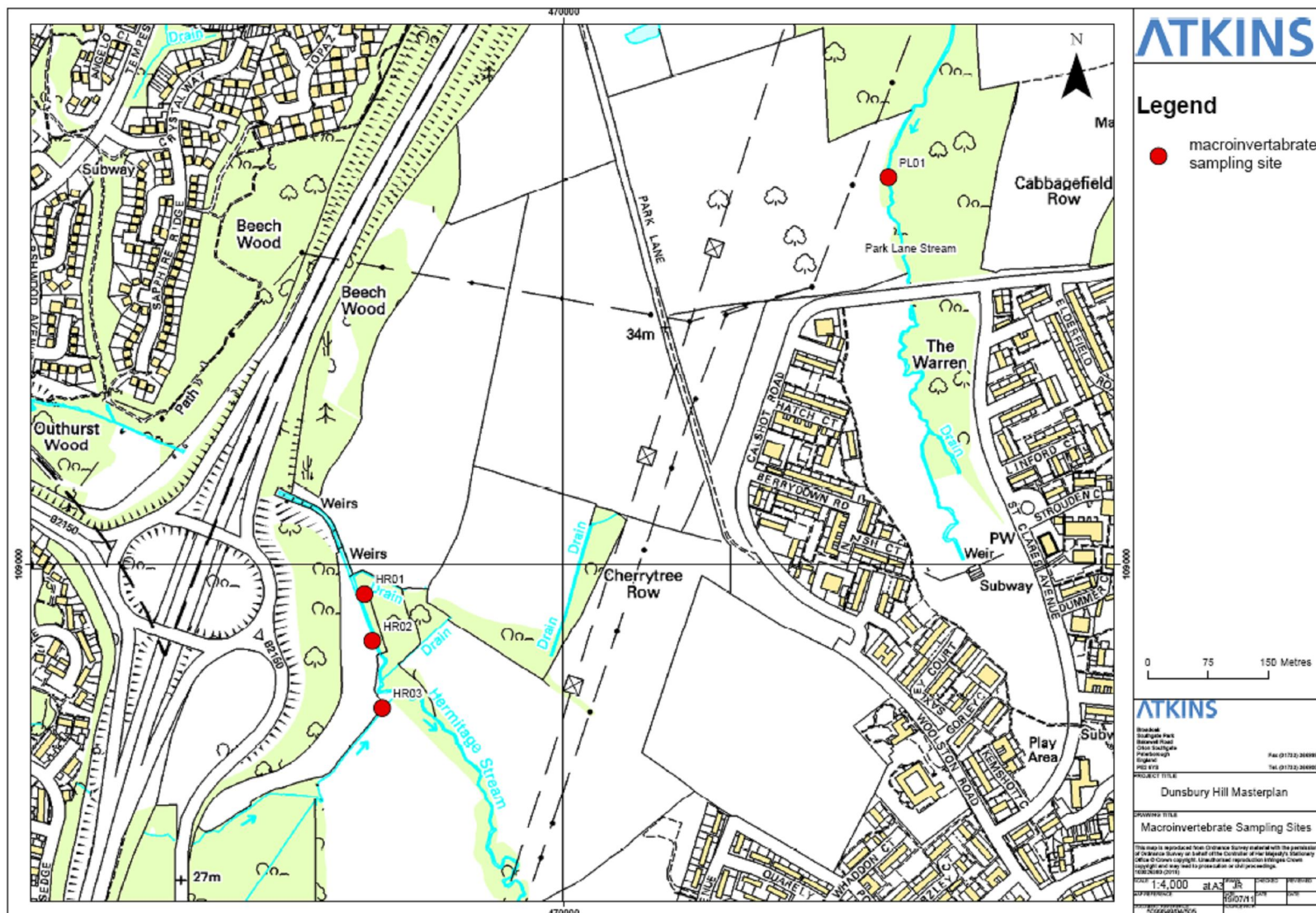


Figure 1.1 - Invertebrate sampling site locations on the Hermitage Stream and Park Lane Stream

1.6. Interpretation and assessment of invertebrate community data

Benthic invertebrate sampling conducted on the Hermitage Stream and Park Lane Stream yielded a total of 20 taxa representing 18 macroinvertebrate family groups (Table 1-1). Almost all of the taxa recorded are considered as ubiquitous, occurring commonly in most flowing water systems and no notable or protected macroinvertebrate species e.g. white-clawed crayfish (*Austropotamobius pallipes*) were recorded at survey.

Three taxa were common to all of the sites sampled, namely *Baetis* sp. (mayfly), *Gammarus pulex* (freshwater shrimp) and Chironomidae (non-biting midge larvae) and with the exception of the Elmidae (riffle beetles), Glossomatidae and *Tipula* sp. all of the species recorded in the Park Lane Stream were also recorded in the Hermitage Stream indicating a number of shared community traits between the water courses.

Table 1-1- Sample site invertebrate data and biotic scores

			Sampling Site Details			
Site Code			HR01	HR02	HR03	PL01
Stream			Hermitage	Hermitage	Hermitage	Park Lane
Date			06/05/2011	06/05/2011	06/05/2011	06/05/2011
NGR			SU 69752 08962	SU 69762 08904	SU 69774 08870	SU 70404 09481
Macroinvertebrates						
Family	Species	BMWP score				
Baetidae	<i>Baetis</i> sp.	4	B	B	C	A
Leptoceridae	<i>Mystacides</i> sp.	10			A	
Glossomitidae		7				A
Calopterygidae		8		B		
Asselidae	<i>Asellus aquaticus</i>	3	A	B		
Gammaridae	<i>Gammarus pulex</i>	6	C	B	D	D
Glossiphoniidae	<i>Glossiphonia complanata</i>	3	A		A	
Velilidae						A
Elmidae	<i>Elmis aenea</i>	5				B
	<i>Limnius</i> sp.	5				A
Ancylidae	<i>Ancylus fluviatilis</i>	6			A	
Hydrobiidae	<i>Potamopyrgus antipodarum</i>	3		B	A	
Tipulidae	<i>Tipula</i> sp.	5				A
Pediciidae	<i>Dicranota</i> sp.	5		A	A	
Chironomidae		2	B	B	B	B
Ceratopogonidae					A	A
Simuliidae	Simuliidae	5			A	
Lumbriculidae		1			B	
Naididae		1		A	B	A
Hydracarina				B		
Species richness			5	9	12	10
BMWP			18	32	45	30
N-Taxa			5	8	10	8
ASPT			3.60	4.00	4.50	3.75

The biotic index values indicate the presence of a depauperate macroinvertebrate community in both stream systems. The species poor community structure is reflected in the BMWP scores obtained at each sampling site (BMWP range = 45 to 18) and the resultant low ASPT scores (ASPT range 3.6 to 4.5) indicate a community structure affected by fair to poor biological water quality.

The poor community structure is further reflected by the absence of certain orders of aquatic insect such as the Plecoptera (stoneflies) and the poor numerical representation of family groups belonging to the mayfly and caddisfly orders. This stated, the presence of low numbers of pollution intolerant taxa in the samples obtained from the Hermitage Stream e.g. larvae of the caddisfly *Mystacides* sp. and damselfly nymphs belonging to the Calopterygidae family indicate that poor water quality is likely to be a sporadic event and that additional factors are likely to also account for the low community richness observed. These factors are include, but are not necessarily limited to:-

- Limited macroinvertebrate habitat availability due to small stream size.
- Heavy shading from the riparian corridor resulting in an absence of aquatic macrophytes and associated macroinvertebrate taxa. Although this is a characteristic of most wooded

headwater catchments the range of taxa recorded in the Hermitage Stream are Park Lane Stream is considered to be relatively low.

- Habitat severance and degradation resulting from channel modifications (culverting and straightening) and poor connectivity throughout system. This will act to interrupt and limit natural colonisation in the system and potentially make them vulnerable to species loss.
- Interspecific competition i.e. the effects of over abundance of competitive species such as *Gammarus pulex* on the wider invertebrate community. *Gammarus* are likely to be favoured due to their ability to tolerate moderate levels of organic pollution and the fact that they are able to quickly exploit resources as a result of their multivoltine lifecycle strategy.
- High fine sediment load shown to be present within the gravel and pebble bed substrate interstices acts to limit stream bed habitat quality to a wide range of macroinvertebrate fauna and may therefore be acting to limit species richness.

Of note are the records of *Cottus gobio* (Bullhead) which were coincidental captures from the macroinvertebrate sampling conducted in both the concrete and soft banked channel sections of the Hermitage Stream. The presence of juvenile bullhead indicated that the site is suitable for spawning and that successful recruitment to the population had occurred. No other fish species were recorded or observed during stream sampling. Bullhead are a European - Annex 2 non-priority species, although they are not considered as a Priority Species under the UK Biodiversity Action Plan. No fish were observed or recorded in the Park Lane Stream and neither stream is considered to provide any angling value at the proposed Scheme site.

1.7. Rapid habitat assessment

An walkover survey and an appraisal of the Hermitage Stream and Park Lane Stream habitat quality was also undertaken in May 2011 to assess the diversity of hydromorphological features supported by each system and to provide detail on the riparian habitat character of the streams. Habitat assessment records are provided in Table 1-2.

Common to both systems was the presence of predominantly clay stream banks and stream bed substrates characterised by a high proportion of pebble and gravel substrates. The clay banks throughout the reaches investigated showed evidence of on-going bank erosion and sediment transportation through the reach i.e. assessments were undertaken in a sediment transport zone. In “natural” sections the high degree of channel complexity observed results from the presence of mature trees within the riparian zone acting to deflect flows and provided a sinuous planform and deliver large woody debris to the system creating a range of hydromorphological conditions.

For the Hermitage Stream three broad habitat areas were described during the site walkover survey, each coinciding with the macroinvertebrate monitoring site locations. These are:

- Concrete channel section:
 - This 125m section of concrete lined channel to the south of the A3(M) culvert exhibits very low habitat diversity. The concrete channel contains a series of weirs designed, it is thought, to act as velocity breaks. These are currently ineffective as velocity breaks due to coarse and fine sediment accretion between the weir sections to weir invert level. Sediment accumulation within the concrete line channel indicates that the Hermitage Stream within, and adjacent to, the scheme boundary is in.
- Soft bank (straightened) section:
 - Immediately downstream of the concrete lined channel is soft banked, tree lined channel which has been realigned along a straight course for approximately 85m. The bed is composed predominantly of pebble sized substrate and there is little variation in bed level resulting in a homogenous channel form. Channel complexity increases where roots from mature riparian tree protrude into the channel. The channel is slightly incised and has low vertical clay banks indicating that they are subject to on-going erosion and sediment transport. Banks are, however, relatively stable as a result of the presence of riparian trees and associated root binding.
- Soft banked (natural) section:

- Downstream of the straighten channel the channel form becomes more characteristic of a low order wooded stream section with an occasional tortuous planform between mature tree stands. The clay banks are high and often vertical indicating that they are subject to on-going erosion with rapid removal of collapsed bank material occurring within bayed areas. Gravel bars and deep pools alternate within the channel and the bed sediment is dominated by pebble and gravel substrates.

The habitat quality of the Park Lane Stream was investigated along its boundary with the Scheme. Park Lane Stream exhibits a tortuous planform with deep pools (up to 1.3m deep) and shallower gravel sections. Of particular note is the presence of numerous large woody debris jams which act to provide a diverse set hydromorphological features. Bed substrates in faster flowing sections are dominated by pebble and gravel although within the bed interstices a high proportion of fine sediment was evident.

Table 1-2 - Habitat assessment data for the Hermitage Stream and Park Lane Stream

		Sampling Site Details			
Site Code		HR01	HR02	HR03	PL01
Stream		Hermitage	Hermitage	Hermitage	Park Lane
Date		06/05/2011	06/05/2011	06/05/2011	06/05/2011
Descriptor		NGR	SU 69752 08962	SU 69774 08870	SU 70404 09481
Channel dimensions	Average width (m)	3.2	1.8	1.5	1.9
	Depth range (m)	0.05 - 0.5	0.15 - 0.3	0.12 - 0.3	0.05 - 1.3
	Surface velocity (cm/sec)	<10	<10	<10	<10
	Channel notes	Concrete lined channel with verticle concrete walls containing a series of velocity check weirs. Between weirs significant gravel accumultaion.	Soft banked re-aligned channel following straight path. Exposed tree roots providing increased habitat complexity.	Soft banked meandering planform with short wavelength. Well formed gravel bars interspaced with deeper pools. Continuous vegetation both banks with a number of mature trees. Steep incised banks, predominately exposed clay.	Highly sinuous channel containing shallow bars, deep pools, large amount of large woody debris creating debris jams and diversity of flow habitat conditions. Stream incised indicating variable flow events, banks composed predominately of clay.
Substrate (by pecent)	Cobble		5		10
	Pebble	50	80	80	40
	Gravel	30	5	10	15
	Sand	5		5	5
	Silt	15	10	5	30
	Notes	Concrete lined bed exposed in places, gravel accretion between weirs. Fine silt covering throughout. High fine sediment load within bed matrix.	Fine silt covering over larger bedload substrates due to low flow velocity. High fine sediment load within bed matrix.	Fine silt covering over larger bedload substrates due to low flow velocity. High fine sediment load within bed matrix.	Fine silt covering over larger bedload substrates due to low flow velocity. Very high fine sediment load within bed matrix.
Aquatic macrophytes		None (Cladophora filamentous green algae covering all bed substate)	None	None	None
Bankside wetland macrophytes		None due to verticle concrete walls.	Pendulous sedge (<i>Carex pendula</i>), woodsedge, greater pond sedge (<i>Carex riparia</i>) , freshwater lichen (<i>Dermatocarpon</i>).	Pendulous sedge (<i>Carex pendula</i>), woodsedge, greater pond sedge (<i>Carex riparia</i>) , freshwater lichen (<i>Dermatocarpon</i>).	Pendulous sedge (<i>Carex pendula</i>), woodsedge, greater pond sedge (<i>Carex riparia</i>) , freshwater lichen (<i>Dermatocarpon</i>).
Invasive species		None	None	Himalayan balsam (<i>Impatiens glandulifera</i>) present.	None
Fish		Bullhead (<i>Cottus gobio</i>) present.	Bullhead (<i>Cottus gobio</i>) present. Juvenile specimens indictie recruitment in the reach.	Bullhead (<i>Cottus gobio</i>) present. Juvenile specimens indictie recruitment in the reach.	None observed.

1.8. Photographic plates

Table 1-3 – Photographic plates of the Hermitage Stream and Park Lane Stream

Site	Image	Description
Hermitage Stream HS01		Aquatic macroinvertebrate sampling site and center point of habitat assessment location. Viewed looking upstream.
Hermitage Stream HS02		Aquatic macroinvertebrate sampling site and center point of habitat assessment location. Viewed looking upstream.
Hermitage Stream HS03		Aquatic macroinvertebrate sampling site and center point of habitat assessment location. Viewed looking upstream.
Park Lane Stream PL01		Aquatic macroinvertebrate sampling site and center point of habitat assessment location. Viewed looking downstream.

1.9. References

Environment Agency, 1999. Procedures for Collecting and Analysis Macroinvertebrate Samples (issue 2.0)
Environment Agency BT001.



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