M25 junction 10/A3 Wisley interchange TR010030
6.5 Environmental Statement: Appendix 7.7 Electric fishing and macro-invertebrate surveys

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M25 junction 10/A3 Wisley interchange

The M25 junction 10/A3 Wisley interchange Development Consent Order 202[x]

6.5 ENVIRONMENTAL STATEMENT:

APPENDIX 7.7 ELECTRIC FISHING AND MACRO-INVERTEBRATE SURVEYS

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Appendix 7.7 Electric fishing and marco-invertebrate surveys

7.1 Aquatic survey report – electric fishing and macro-invertebrate surveys

7.1.1 Executive summary

7.1.1.1 This report presents the findings of aquatic ecology surveys carried out by RSK Environment Ltd in May 2018.

7.1.1.2 The survey included fish and aquatic macroinvertebrate surveys at two locations on Stratford Brook, upstream and downstream of the proposed widening of the A3 near Cobham, Surrey. A single aquatic macroinvertebrate survey was also undertaken on an unnamed tributary of Stratford Brook, which flows into the Ockham and Wisley Common SSSI.

7.1.1.3 Based on macroinvertebrate data the Biological Water Quality is 'very good' for Site 1 - upstream of the A3, 'moderate' for Site 2 - downstream of the A3 and 'reduced to poor' at Site 3 - Bolder Mere Outfall.

7.1.1.4 Site 1 – upstream of the A3 has the best habitat quality, highest flow rates and lowest sedimentation. It also has the highest species diversity. The other two sites are affected to a greater or lesser extent from slower flows and higher degrees of sedimentation. They are also more heavily shaded and have reduced species diversity.

7.1.1.5 Fish surveys show low population densities at both sites within Stratford Brook with species diversity as expected.

7.1.1.6 These results provide a baseline to inform environmental assessment procedures required in support of the proposed project.

7.1.2 Introduction

Purpose of this report

7.1.2.1 This document reports on the findings of aquatic ecology surveys carried out in connection with proposed improvement works to M25 - A3 junction 10 (hereafter referred to as 'the Scheme'). The surveys focused on sections of the Stratford Brook, a tributary of the River Wey, which is due to be crossed by the development and a tributary of the brook which flows into Ockham and Wisley Common SSSI which may also be impacted by the proposed development.

7.1.2.2 The fish and aquatic macroinvertebrate surveys were requested to provide baseline information to inform required environmental assessment procedures. Furthermore, the surveys aimed to identify any fish or macroinvertebrate species of conservation interest (e.g. protected species).

Structure of this report

7.1.2.3 The remainder of the report is set out as follows:

- Section 7.1.3 describes the survey and assessment methods;
- Section 7.1.4 presents the results of the surveys;
- Section 7.1.5 provides the evaluation and conclusions;
- Section 7.1.6 includes macroinvertebrate sampling and electric fishing results.

7.1.2.4 Throughout the report normal convention is followed with respect to bank identification i.e. banks are designated Left Hand Bank (LHB) or Right Hand Bank (RHB) looking downstream.

7.1.3 Methods

General

7.1.3.1 The aquatic surveys were used to assess the diversity of fish species in both watercourses as well as the biological water quality (as determined from macroinvertebrate surveys) and macroinvertebrate species diversity.

Environmental data

7.1.3.2 Data on a range of environmental variables were collected for each site. They are required to generate RIVPACS2 community predictions. The predictions have not been calculated as part of this report; however, the data were collected to allow for the calculations to be made at a later date if required as per the instructions given in the original tender request documents.

7.1.3.3 Measurements of channel depth and width were made using a measuring pole, and observations of the substrate composition were also made. A GPS unit was used in the field to check the map referenced National Grid Reference (NGR) and elevation of each site.

Electric fishing

7.1.3.4 Electric fishing was conducted at two sites on the Stratford Brook on 30 May 2018. The site locations are given in Table 7.1.1

Table 7.1.1: Survey locations

Site / watercourse name	Macroinvertebrate survey location	Upstream limit of the electric fishing survey (NGR)	Downstream limit of the electric fishing survey (NGR)
Site 1 - Stratford Brook – US A3	TQ 06462 57344	TQ 06472 57351	TQ 06408 57381
Site 2 - Stratford Brook – DS A3	TQ 05970 57625	TQ 06039 57600	TQ 05962 57627
Site 3 - Bolder Mere Outfall	TQ 07376 58344	Macroinvertebrate survey only	Macroinvertebrate survey only

7.1.3.5 Figure 1 illustrates the locations of the survey reaches as defined by the upstream and downstream stop net locations. The figure also shows the locations for the aquatic macroinvertebrate samples.

Figure 7.1.1: Fish survey reaches and aquatic macroinvertebrate sample location

7.1.3.6 Surveys were undertaken by experienced electric fishing surveyors using battery-powered backpack equipment. Stop nets were placed in the watercourse at the up and downstream extent of the survey reach. A semi-quantitative 'triple shock' depletion method was used in which a minimum of three fishing runs are conducted within the netted survey reach. All captured fish were then placed in holding containers until the completion of surveys in that reach.

7.1.3.7 Upon completion of surveys in each reach the fish were identified (to species level), measured (fork length or total length to the nearest mm depending on the species), and counted before being released back into the reach from which they were captured.

7.1.3.8 Site data (including physical river characteristics) were recorded on standard proformas in the field; these are summarised in the results section of this report.

7.1.3.9 Standard biosecurity practices ('check, clean, dry') were followed throughout surveys and all equipment was sterilised or thoroughly dried before arrival at the survey site and upon completion of the surveys.

Aquatic macroinvertebrate survey

7.1.3.10 Macroinvertebrate sampling was undertaken at two sites on Stratford Brook and a single site on an unnamed tributary of the brook on 30 May 2018. Survey locations are shown in Figure 7.1.1.

7.1.3.11 The method used to sample macroinvertebrates followed the standard four-minute combined kick sampling technique, adhering to EA guidelines (Environment Agency, 1999[1]). The surveys were undertaken by two people at all times for safety reasons. Briefly, the sampling methodology comprised:

- 30 seconds of netting of any surface-active insects, such as pond skaters (*Hemiptera: Gerridae*) and whirligig beetles (*Coleoptera: Gyrinidae*);
- 3 minutes of active kicking and disturbing substrates and sediment with additional sweeping of vegetation where present; and
- 30 seconds of hand searching for macroinvertebrates, such as those adhering to submerged logs, stones or other debris, for example leeches (*Hirudinea*) and caddisfly larvae (*Trichoptera*).

7.1.3.12 Care was taken to ensure that all habitats and micro-habitats, both typical and atypical, were proportionately represented in the sample, and that surface-active insects and species adhered to submerged logs and stones were included.

7.1.3.13 Samples were preserved in methylated spirits and stored at the RSK laboratory. After rigorous sorting of samples the recovered macroinvertebrates were identified to species/family level, and the relative abundance of each taxon was recorded.

[1] Environment Agency (1999). Procedures for collecting and analysing macro-invertebrate samples.

Macroinvertebrate data interpretation

General

7.1.3.14 The interpretive aquatic macroinvertebrate metric/indices described below were used to examine the datasets. Collectively, these are referred to as the biotic scores of a sample as explained below.

Biological Monitoring Working Party Score (BMWP)

7.1.3.15 The BMWP score relates to the pollution tolerance of an invertebrate assemblage and, therefore, the biological water quality of the relevant water body. This ascribes a numerical score (from 1 to 10) to a range of invertebrate families, depending on their tolerance or intolerance of organic (and other) pollution which can be related to water quality. Pollution sensitive families score more highly than pollution tolerant ones. Therefore, the cumulative score of these assigned values gives a good indication of biological water quality, with higher values indicating better water quality Table 7.1.2.

Table 7.1.2: Allows general comparisons to be drawn regarding BMWP scores and actual water quality categories, as used by the Environment Agency

Category	BMWP
Very Good	>150
Good	101 – 150
Fair	51 – 100
Poor	16 – 50
Very Poor	0 - 15

Average Score per Taxon (ASPT)

7.1.3.16 The ASPT is a derived index, which is obtained simply by dividing the BMWP score by the number of scoring families. The product is, therefore, somewhat independent of taxon richness. Using ASPT together with BMWP thus allows easier comparisons across samples and sites. Both measures are routinely used by the Environment Agency in assessing the biological water quality of rivers.

7.1.3.17 As a guide, a BMWP score of over 80 and an ASPT score of 5.0 or above indicates ‘good to very good‘ biological water quality. A BMWP score of 50 to 80 and ASPT score of 4.0 to 5.0 indicates ‘moderate to good’ water quality. BMWP scores less than 50 and ASPT scores of less than 4.0 suggest ‘reduced to poor’ water quality.

NTAXA (Taxon Richness)

7.1.3.18 This is the number of invertebrate taxa recorded, and is the most widely used measure of biodiversity. A taxon in this case is taken to mean a group of related animals, such as a species, a genus or a family.

Community Conservation Index

7.1.3.19 The Community Conservation Index (CCI) is an expression of conservation value. It accounts for community richness as well as the relative rarity of species (Chadd & Extence, 2004[2]). Each species is assigned a Conservation Score (CS) of 1 to 10 based on the parameters outlined in Table 7.1.3.

Table 7.1.3: Conservation Scores (CSs) for freshwater macroinvertebrate species in Britain

CS	Definition
10	Red Data Book 1 (RDB1 – Endangered)
9	Red Data Book 2 (RDB2 – Vulnerable)
8	Red Data Book 3 (Rare)
7	Notable (not not Red Data Book status)
6	Regionally Notable
5	Local
4	Occasional (species not in categories 10-5, which occur in up to 10% of all samples from similar habitats)
3	Frequent (species not in categories 10-5, which occur in > 10-25% of all samples from similar habitats)
2	Common (species not in categories 10-5, which occur in > 25-50% of all samples from similar habitats)
1	Very Common (species not in categories 10-5, which occur in >50-100% of all samples from similar habitats)

7.1.3.20 The sum of the CSs is then calculated and divided by the number of contributing species to give a mean measure of conservation value. This is then multiplied by a Community Score (CoS) which is derived from the rarest taxon present or the BWMP score.

7.1.3.21 CCI calculation can be applied to specific taxa in a sample rather than mandatory identification of all taxa present in a sample. However, it should be noted that the greater the size of the species dataset obtained, the better the resolution of the final score index.

7.1.3.22 CCs can range from 0 to >40, an interpretation guide of scores is provided below:

- 0.0 to 5.0 – sites supporting at least one uncommon species and / or a community of low taxon richness – low conservation value.
- 5.0 to 10.0 – sites supporting at least one species of restricted distribution and / or a community of moderate taxon richness – moderate conservation value.
- 10.0 to 15.0 – sites supporting at least one uncommon species or several species of restricted range and / or a community of high taxon richness – fairly high conservation value.

[2] Chadd, R and Extence, C. (2004). The conservation of freshwater macro-invertebrate populations: a community-based classification scheme. Aquatic Conservation: Marine and Freshwater Ecosystems. 14: 597-624

- 15.0 to 20.0 – sites supporting several uncommon species, at least one of which may be nationally rare and / or a community of high taxon richness – high conservation value.
- >20.0 – sites supporting several rarities, including species of national importance, or at least one extreme rarity (e.g. taxa included in the British RDBs) and / or a community of very high taxon richness – very high conservation value.

LIFE

7.1.3.23 LIFE (Lotic-invertebrate Index for Flow Evaluation) is used to assess the flow regime to which the macroinvertebrate communities at the sites were adapted, ranging from fast to slow flows.

7.1.3.24 The species and families present are assigned to a particular flow group with flow-sensitivity scores based on the relevant flow group and abundance categories (Extence et al, 1999[3]). The LIFE score is then calculated as the average flow score for the invertebrates within the sample.

7.1.3.25 As a guide, LIFE scores less than 6.00 generally indicate predominantly sluggish or still water conditions. As current velocity increases, so do LIFE scores. LIFE values greater than 7.5 indicate predominantly very fast flows. LIFE scores will change throughout the seasons depending on flow conditions and care must be taken when comparing scores from samples collected in different seasons.

PSI

7.1.3.26 The PSI (Proportion of Sediment-sensitive Invertebrates) index is used to assess the preferred silt regime that the current, base-line fauna in the streams was adapted to. The amount of siltation within a watercourse is often determined by the flow regime and PSI scores can be linked to LIFE scores, with decreasing flow - reduction in the LIFE score - often leading to increased siltation and reduction in the PSI. Heavy rainfall and increased run-off from hard standing during and post construction could increase silt-loading to the nearby watercourses, a factor that would be picked up by significant decreases in the PSI scores from the established baseline.

7.1.3.27 The PSI scores are calculated based on published sediment sensitivities and abundance categories (Extence et al, 2013[4]). Each species or family of invertebrates is assigned a sensitivity to fine sediment score. The PSI score is then calculated as follows:

$$PSI = \left[\frac{\sum \text{Scores for Sediment Sensitivity Groups A \& B}}{\sum \text{Scores for all Sediment Sensitivity Groups A; B; C \& D}} \right] \times 100$$

[3] Extence, C.A., Balbi, D. M. And Chadd, R.P. (1999). River flow indexing using benthic macroinvertebrates: a framework for setting hydro-ecological objectives. Regulated Rivers: Research & Management. 15: 543-574.
[4] Extence, C.A., Chadd, R.P., England, J., Dunbar, M., Wood, P.J. and Taylor, E.D. (2013). The assessment of fine sediment accumulation in rivers using macro-invertebrate community response. River Research and Applications. 29: 7-55.

7.1.3.28 The condition of the river bed is then classified according to the criteria shown in Table 7.1.4.

Table 7.1.4: Interpretation of PSI scores

PSI	River bed conditions
81 – 100	Minimally sedimented / un-sedimented
61 – 80	Slightly sedimented
41 – 60	Moderately sedimented
21 – 40	Sedimented
0 – 20	Heavily sedimented

7.1.4 Results

7.1.4.1 The following sections of this report provide site details, fish and macroinvertebrate survey results for each of the survey sites identified in Table 7.1.5 and Figure 1.

Site descriptions

Site 1 – Stratford Brook Upstream A3

7.1.4.2 This survey reach was located on Stratford Brook upstream of the proposed development.

7.1.4.3 The electric fishing survey reach was c.100 m long with an average wetted width of 1.5 m (width range = 1.2 m to 2.2 m) and an average depth of 0.5 m (depth range = 0.05 m to 0.7 m). Water levels were considered to be moderate with some rainfall in the days preceding the survey and water clarity at the start of the survey was acceptable with the substrate clearly visible throughout most of the survey reach.

7.1.4.4 The substrate throughout the survey reach was comprised predominantly of pebble and gravel with siltation present in areas of lower flow. The dominant flow types included shallow run, shallow glide and some areas of riffle.

7.1.4.5 Throughout the reach there were various in-channel features

7.1.4.6 which may provide refuge areas for fish and other aquatic life and these included tree root systems, coarse woody material, undercut banks and overhangs.

7.1.4.7 The macroinvertebrate sampling was undertaken in an area of shallow, fast-flowing riffle and run habitat over a predominately gravel / pebble substrate.

7.1.4.8 The land adjacent to both banks was predominately deciduous woodland.

Site 2 – Stratford Brook Downstream A3

7.1.4.9 This survey reach was located on Stratford Brook downstream of the proposed development.

7.1.4.10 The electric fishing survey reach was c.80 m long with an average wetted width of 1.5 m (width range = 1.2 to 1.8 m) and an average depth of 0.5 m (depth range = 0.4 m to 0.8 m). Water levels were considered to be moderate with some rainfall in the days preceding the survey and water clarity at the start of the survey was acceptable with the substrate clearly visible throughout most of the survey reach.

7.1.4.11 The substrate throughout the survey reach was comprised predominately of silt and clay with areas of silted pebble and gravel. The dominant flow type throughout the reach was glide.

7.1.4.12 Limited in-channel features were present within the survey reach in the form of overhanging terrestrial vegetation and two large debris dams.

7.1.4.13 The macroinvertebrate sample was taken at an area of glide with a substrate comprised of cobble, gravel and pebble covered by a layer of silt and sand.

7.1.4.14 The land adjacent to the survey reach was comprised predominately of tall herbs with dense nettle growth lining both banks.

Site 3 – Bolder Mere outfall

7.1.4.15 The macroinvertebrate sample at this location was taken in an area of shallow run over a predominately sand substrate. The sample was taken downstream of the natural outfall from Bolder Mere and upstream of a culverted concrete outfall to the North in an area of mixed woodland. The A3 runs parallel to the survey ditch a short distance from the right hand bank.

Macroinvertebrate environmental data

Table 7.1.5: Environmental data for the three

Site	1 – US A3	2 – DS A3	3 – Bolermere outfall
Season	Spring	Spring	Spring
Watercourse	Stratford Brook	Stratford Brook	Unnamed watercourse
NGR	TQ 06462 57344	TQ 05970 57625	TQ 07376 58344
Average Wetted Width (m)	1.6	1.5	1.2
Average Depth (cm)	6	25	5
Substrate (% cover)			
– Silt	10	15	20
– Sand	10	30	80
– Gravel/Pebble	75	25	-
– Cobbles	5	30	-
Altitude (m)	26	16	29
Flow	Moderate	Low	Low

Site	1 – US A3	2 – DS A3	3 – Bolermere outfall
Shading	High	High	High
Macrophyte Cover (%)	0	0	0
Physico-chemical readings			
Temperature (°c)	14.3	14	16
Specific conductance (µs)	514.6	688	454.2
pH	6.6	6.67	6.51
Dissolved oxygen (%)	84	86	62.6
Dissolved oxygen (mg/l)	8.58	8.91	6.1
Salinity (ppt)	0.25	0.34	0.22

Aquatic macroinvertebrates

7.1.4.16 A full list of the macroinvertebrates recorded in the samples is presented in Section 7.1.6. Table 7.1.6 provides the biotic scores calculated for each site.

Table 7.1.6: Summary of biotic scores

Site	NTAXA	BMWP	ASPT	CCI	LIFE	PSI
1 – US A3	19	93	5.17	2.15	7.2	59.38
2 – DS A3	11	45	4.09	2.25	6.8	37.5
3 – Bolder Mere outfall	11	35	3.89	2.33	6.4	17.65

Constraints

7.1.4.17 The results presented in this report are based on surveys undertaken in late spring on a single visit. Although spring is a suitable time of year for surveying aquatic macroinvertebrates, it is likely that the assemblages are more diverse than the results suggest. Repeating surveys throughout the year (i.e. in spring, summer and autumn) would produce a more comprehensive list of macroinvertebrate species, and reduce the impact of seasonality on the results. Furthermore, seasonal fluctuations in river flow and corresponding sedimentation, PSI and LIFE scores are also likely. Any comparisons between post-construction and baseline results should take account the timing of the baseline surveys for more accurate conclusions to be drawn.

Site 1 – Upstream A3 electric fishing results

7.1.4.18 A total of 46 individual fishes comprising five different species were caught during the surveys. The species numbers, estimated density, average length and length range are all detailed in Table 7.1.7.

Table 7.1.7: A summary of the fish survey results from Site 1

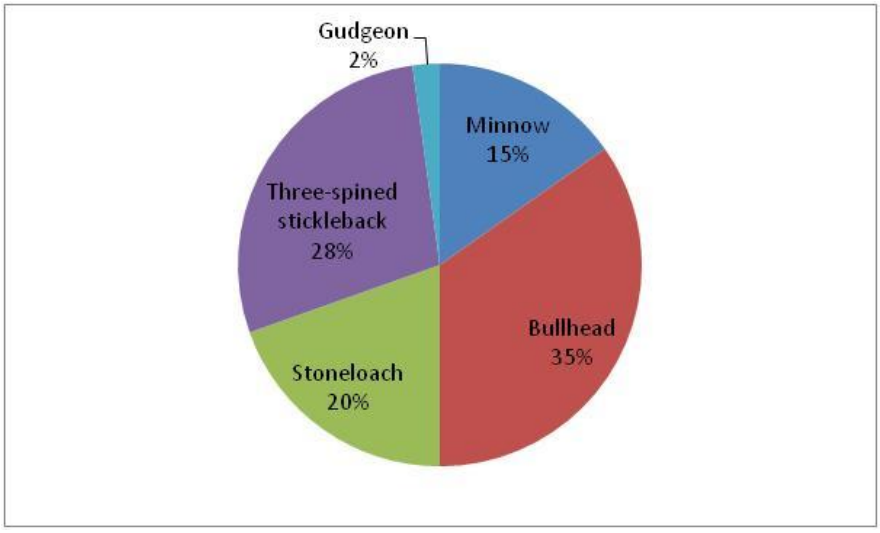
Species	Total number caught	Estimated population	Estimated density (number of individuals per m^2)*	Length range (mean) (mm)
Minnow (*Phoxinus phoxinus*)	7	n/a	0.05^	70 - 85 (76)
Bullhead (*Cottus gobio*)	16	17	0.11	44 – 86 (61)
Three-Spined Stickleback (*Gasterosteus aculeatus*)	13	14	0.09	30 – 52 (42)
Stoneloach (*Barbatula barbatula*)	9	10	0.07	65 – 105 (84)
Gudgeon (*Gobio gobio*)	1	n/a	0.01^	134

*Estimate based upon Carle & Strub[5], density calculated using population estimate.

^Density calculated using actual catch rather than Carle & Strub estimates due to insufficient sample size

7.1.4.19 According to the survey results bullhead was the most abundant fish species comprising 35% of the total catch (Figure 2). Gudgeon was the least abundant fish species with only a single individual caught comprising approximately 2% of the total catch (Figure 7.1.2).

Figure 7.1.2: Species composition based upon individuals caught at Site 1



[5] Carle, F.L. & Strub, M.R. (1978) A new method for estimating population size from removal data. Biometrics, 34, 621-830.

Site 2 – Downstream A3 electric fishing results

7.1.4.20 A total of 68 individual fishes comprising six different species were caught during the surveys. The species numbers, estimated density, average length and length range are all detailed in Table 7.1.8.

Table 7.1.8: A summary of the fish survey results from Site 2

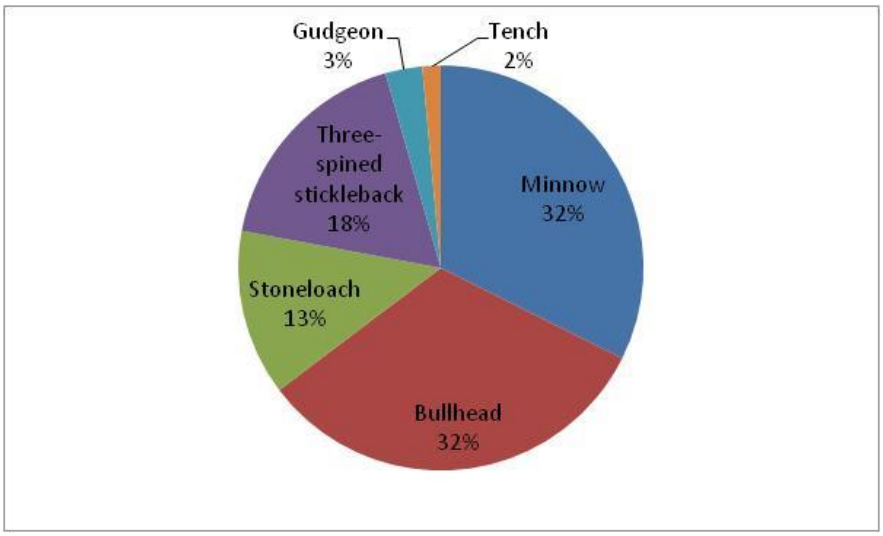
Species	Total number caught	Estimated population	Estimated density (number of individuals per m^2)*	Length range (mean) (mm)
Minnow (*Phoxinus phoxinus*)	22	25	0.21	40 – 88 (66)
Bullhead (*Cottus gobio*)	22	28	0.23	35 – 83 (59)
Three-Spined Stickleback (*Gasterosteus aculeatus*)	12	22	0.18	37 – 62 (45)
Stoneloach (*Barbatula barbatula*)	9	n/a	0.08^	67 – 134 (102)
Gudgeon (*Gobio gobio*)	2	n/a	0.02^	84 – 92 (88)
Tench (*Tinca tinca*)	1	n/a	0.01^	62

*Estimate based upon Carle & Strub, density calculated using population estimate.

^Density calculated using actual catch rather than Carle & Strub estimates due to insufficient sample size

7.1.4.21 According to the survey results minnow and bullhead were the most abundant species each comprising 32% of the total catch. Tench was the least abundant fish species with only a single individual caught comprising 2% of the total catch (Figure 7.1.3).

Figure 7.1.3: Species composition based upon individuals caught at Site 2



7.1.5 Discussion

Aquatic macroinvertebrate assemblages

7.1.5.1 The biotic scores for water quality are ‘very good’ for Site 1 - upstream of the A3, ‘moderate’ for Site 2 - downstream of the A3 and ‘reduced to poor’ at Site 3 - Bolder Mere Outfall.

7.1.5.2 This indicates deterioration in water quality with progression downstream of the A3. The reduction in species diversity may also, in part, be due to the increased shading at sites 2 and 3 when compared to the more open habitat present at Site 1.

7.1.5.3 The baseline results for the Community Conservation Index assessment shows all three sites have macroinvertebrate assemblages of low conservation value containing predominantly very common species.

7.1.5.4 The LIFE scores indicates that all three sites have moderate flow speeds with the site upstream of the A3 having the highest flow rate of the three sites.

7.1.5.5 The baseline results for PSI scores show Site 1 - upstream of the A3 is ‘moderately sedimented’, Site 2 - Downstream of the A3 is ‘sedimented’ and Site 3 - Bolder Mere Outfall is ‘heavily sedimented’.

7.1.5.6 Comparisons between the sites are not required for the purposes of this assessment. Instead, these results should be used as a baseline against which changes in flow and sedimentation as a result of the proposed works, can be assessed.

7.1.5.7 Site 1 – upstream of the A3, has the best habitat quality, highest flow velocities and lowest sedimentation. These physical habitat attributes are likely to be contributing to the highest species diversity observed at this site. The other two sites suffer to a greater or lesser extent from slightly slower velocities and higher degrees of sedimentation. They are also more heavily shaded and consequently, compared to Site 1 - Upstream of the A3, they have reduced species diversity.

Fish communities

7.1.5.8 The majority of the species captured within Stratford Brook are typical of those found in small, silted watercourses, with the exception of bullhead, which can be found in a range of habitats. The most abundant species were bullhead, minnow, three-spined stickleback and stoneloach respectively.

7.1.5.9 The size ranges observed for some of the species indicates that they are likely to be recruiting within the reach (i.e. several size cohorts observed). This is particularly true for bullhead, minnow and three-spined stickleback. Bullhead is cited under Annex II of the EU Habitats Directive.

7.1.5.10 Juvenile gudgeon and a single juvenile tench were also captured during the surveys. Gudgeon are more commonly found in larger lowland rivers and tench favour slow flowing or stillwater environments. Given the small size of the tench captured and lack of suitable spawning or adult habitat in the brook it is considered likely that this individual has been stocked in ponds upstream and washed into the reach; the same may also be true for the gudgeon.

7.1.5.11 In general fish population densities were low within the survey reaches, and this is likely to be a reflection of habitat and water quality. Land-use upstream of the survey areas is predominately arable or pasture with diffuse runoff of sediment, chemicals and nutrients likely contributing to reduced habitat and water quality.

7.1.5.12 Of the two survey sites, habitat was considerably more varied at Site 1 with areas of glide interspersed with riffle, run and small pools. The in-stream habitat at Site 2 was more homogenous being comprised mainly of glide with siltation of the substrate evident throughout. Despite the variance in habitat between the two sites no major change in fish species composition was evident.

7.1.5.13 It should be noted that a formal habitat survey and assessment was not requested as part of this survey and the comments relating to habitat are based on brief observations made by surveyors during the macroinvertebrate and electric fishing surveys. A formal habitat assessment and water quality survey would provide more accurate information regarding the quality of the river habitat with respect to fish and macroinvertebrates.

Recommendations

7.1.5.14 Post-construction fish and aquatic surveys, if required, should be aligned with survey locations defined in this report. upon completion of the works to assess changes to species compositions.

7.1.5.15 An ecologist with suitable knowledge of aquatic ecology should be present on site during the proposed works to advise on any issues arising.

7.1.6 Raw survey results

Macroinvertebrate survey results

Species	Description	BMWP Score	Conservation Status/CS Score	PSI Group	Flow Group	Sample Site											
						Site 1 - U/S A3				Site 2 - D/S A3				Site 3 - Bolder Mere Outfall			
						Abundance	Abundance Category	Sediment Sensitivity Score	LIFE Flow Score (fs)	Abundance	Abundance Category	Sediment Sensitivity Score	LIFE Flow Score (fs)	Abundance	Abundance Category	Sediment Sensitivity Score	LIFE Flow Score (fs)
COLEOPTERA																	
Noteridae		5															
Noterus larvae	Diving Beetle		-	D	4									1	A	2	6
Elmidae		5															
Elmis aenea	Riffle Beetle		Very Common (1)	B	2	1	A	1	8								
Helodidae		5															
Helodidae larvae	Water Beetle		-	D	4	1	A	2	6								
EPHEMERIDAE																	
Baetiae		4								1	A	2	8				
Baetis rhodani	Swimming Mayfly		Very Common (1)	A	2	1	A	2	8								
Ephemerellidae		10															
Ephemerella ignita	Mayfly		Very Common (1)	A	2	1	A	2	8								
PLECOPERA																	
Leuctridae		10															
Leuctra fusca	Stonefly		Very Common (1)	A	2	50	B	3	9								
TRICHOPTERA																	
Glossosomatidae		7															
Agapetus sp	Cased Caddisfly		-	A	2	1	A	2	8								
Hydropsychiidae		5															
Hydropsyche angustipennis	Caseless Caddisfly		Very Common (1)	B	2	5	A	1	8								
Polycentropodidae		7															
Polycentropus flavomaculatus	Caseless Caddisfly		Common (2)	B	2	10	B	2	9	1	A	1	8				
Limnephilidae		7															
Limnephilus lunatus	Cased Caddisfly		Very Common (1)	C	4	25	B	2	4	50	B	2	5	50	B	2	5
CRUSTACEA																	
Gammaridae		6															
Gammarus pulex	Freshwater Shrimp		Very Common (1)	B	2	750	C	3	10	5	A	1	8	150	C	3	10
Asellidae		3															
Asellus aquaticus	Hoglouse		Very Common (1)	D	4	10	B	3	5	25	B	3	5	50	B	3	5
NEUROPTERA																	
Sialidae		4															
Sialis lutaria	Alderfly		Very Common (1)	D	4	1	A	2	6								
DIPTERA																	

Species	Description	BMWP Score	Conservation Status/CS Score	PSI Group	Flow Group	Sample Site											
						Site 1 - U/S A3				Site 2 - D/S A3				Site 3 - Bolder Mere Outfall			
						Abundance	Abundance Category	Sediment Sensitivity Score	LIFE Flow Score (fs)	Abundance	Abundance Category	Sediment Sensitivity Score	LIFE Flow Score (fs)	Abundance	Abundance Category	Sediment Sensitivity Score	LIFE Flow Score (fs)
Chironomidae	Non-biting Midge	**2**	-	**-**	**-**	10	B	-	-	50	B	-	-	25	B	-	-
Ceratopogonidae	Biting Midge	**NS**	-	**-**	**-**	1	A	-	-								
Ptychopteridae	Phantom Cranefly	**NS**	-	**-**	**2**									1	A	-	8
Tipulidae	Cranefly	**5**	-	**B**	**4**	1	A	1	6								
MOLLUSCA																	
Ancylidae		**6**															
Ancylus fluviatilis	River Limpet		Very Common (1)	**A**	**2**	1	A	2	8	1	A	2	8				
Sphaeriidae		**3**															
Pisidium sp	Pea Mussel		Very Common (1)	**D**	**4**	10	B	3	5	5	A	2	6	150	C	4	4
Hydrobiidae		**3**															
Potamopyrgus antipodarum	Jenkins Spire Shell		Very Common (1)	**C**	**3**	5	A	1	7	1	A	1	7	5	A	1	7
Lymnaeidae		**3**															
Radix balthica	Wandering Pond Snail		Very Common (1)	**D**	**4**					1	A	2	6				
PLANARIA																	
Dugesiidae		**5**															
Dugesia sp	Flatworm		Common (2)	**D**	**4**									1	A	2	6
OLIGOCHAETE																	
Oligochaete	Worm	**1**	-	**-**	**-**	25	B	-	-	5	A	-	-	75	B	-	-
Eiseniella tetraedra	Square-tailed Worm	**1**	-	**-**	**-**									1	A	-	-
Taxon Richness						19				11				11			
BMWP Score						93				45				35			
Number of Scoring Families						18				11				9			
ASPT						5.17				4.09				3.89			
CS Sum						14				9				7			
CCI						2.15				2.25				2.33			
PSI Score						59.38				37.50				17.65			
LIFE Score						7.2				6.8				6.4			

Fish survey results

Upstream A3 electric fishing results

Fish #	Run	Species	Length (mm)	Fish #	Run	Species	Length (mm)
1	1	MN	72	35	2	3-STB	38
2	1	BH	68	36	2	3-STB	44
3	1	MN	73	37	2	MN	48
4	1	3-STB	44	38	2	MN	88
5	1	3-STB	62	39	2	BH	42
6	1	3-STB	44	40	2	MN	56
7	1	3-STB	38	41	2	STL	84
8	1	MN	40	42	2	MN	62
9	1	MN	68	43	2	BH	58
10	1	MN	60	44	2	MN	82
11	1	BH	55	45	2	BH	76
12	1	MN	48	46	2	3-STB	37
13	1	BH	62	47	2	GU	92
14	1	BH	58	48	2	BH	58
15	1	MN	58	49	2	GU	84
16	1	BH	56	50	2	STL	125
17	1	BH	62	51	2	TE	62
18	1	BH	60	52	2	BH	66
19	1	BH	51	53	2	BH	78
20	1	MN	54	54	2	STL	134
21	1	STL	83	55	2	MN	82
22	1	MN	79	56	2	BH	35
23	1	MN	54	57	2	STL	106
24	1	STL	87	58	3	MN	83
25	2	3-STB	42	59	3	MN	82
26	2	BH	62	60	3	STL	124
27	2	BH	55	61	3	MN	58
28	2	3-STB	46	62	3	STL	67
29	2	3-STB	50	63	3	BH	62
30	2	3-STB	55	64	3	BH	58
31	2	MN	78	65	3	STL	112
32	2	MN	56	66	3	BH	83
33	2	BH	44	67	3	MN	61
34	2	3-STB	40	68	3	BH	50

Downstream A3 electric fishing results

Fish #	Run	Species	Length (mm)	Fish #	Run	Species	Length (mm)
1	1	GU	134	24	1	BH	86
2	1	3-STB	38	25	1	STL	98
3	1	BH	65	26	2	BH	60
4	1	STL	72	27	2	BH	62
5	1	MN	70	28	2	BH	66
6	1	BH	56	29	2	BH	55
7	1	3-STB	46	30	2	3-STB	33
8	1	3-STB	52	31	2	MN	72
9	1	3-STB	50	32	2	BH	70
10	1	3-STB	39	33	2	BH	46
11	1	MN	85	34	2	MN	82
12	1	BH	44	35	2	STL	84
13	1	BH	80	36	2	STL	83
14	1	STL	76	37	2	MN	72
15	1	3-STB	38	38	2	3-STB	44
16	1	BH	72	39	2	3-STB	38
17	1	BH	60	40	3	MN	84
18	1	STL	65	41	3	3-STB	50
19	1	3-STB	30	42	3	MN	70
20	1	BH	52	43	3	STL	73
21	1	STL	100	44	3	BH	52
22	1	STL	105	45	3	3-STB	40
23	1	BH	48	46	3	3-STB	44

Survey images

Plate 1 - Site 1 Aquatic Invert Site Looking US - TQ 06462 57344

Plate 2 - Site 1 Aquatic Invert Site Looking DS – TQ 06462 57344

Plate 3 - Site 1 EF Reach Habitat – TQ 06387 57399

Plate 4 - Site 1 DS Stop net – TQ 06408 57381

Plate 5 - Site 2 Aquatic Invert Site Looking US - TQ 05970 57625

Plate 6 - Site 2 Aquatic Invert Site Looking DS - TQ 05970 57625

Plate 7 - Site 2 EF Reach Habitat – TQ 05987 57615

Plate 8 - Site 2 EF Reach Habitat – TQ 06049 57586

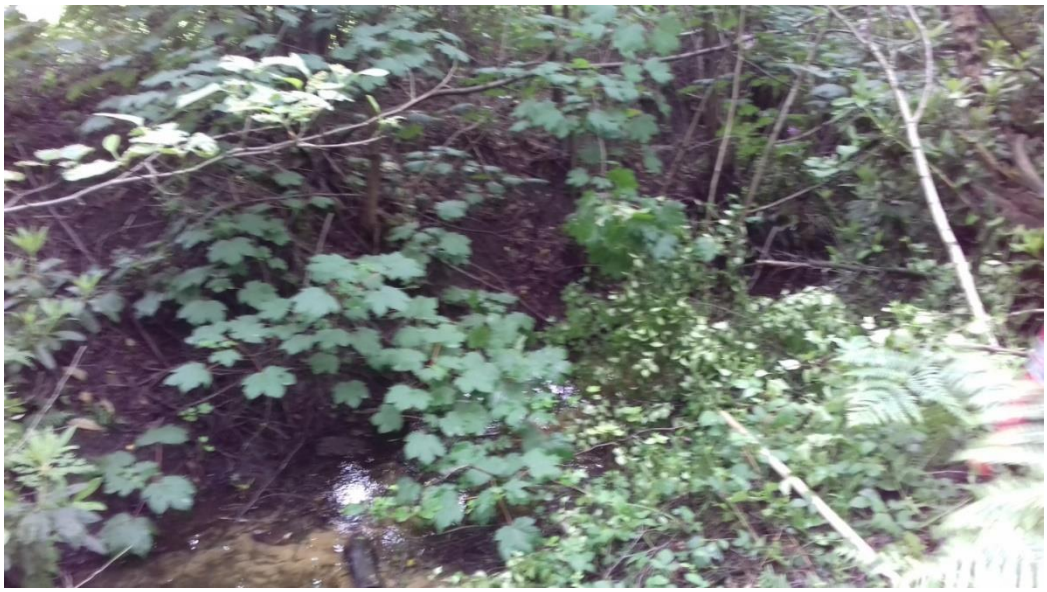


Plate 9 - Site 3 Aquatic Invert Site Looking US - TQ 07376 58344

Plate 10 - Site 3 Aquatic Invert Site Looking DS - TQ 07376 58344

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