A47 North Tuddenham to Easton Dualling

Scheme Number: TR010038

Volume 6
6.3 Environmental Statement Appendices
Appendix 8.4 - River Tud Corridor Aquatic Invertebrate Survey

APFP Regulation 5(2)(a)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

March 2021

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

The A47 North Tuddenham to Easton Development Consent Order 202[x]

ENVIRONMENTAL STATEMENT APPENDICES
Appendix 8.4 - River Tud Corridor Aquatic Invertebrate Survey

Regulation Number:	5(2)(a)
Planning Inspectorate Scheme Reference	TR010038
Application Document Reference	TR010038/APP/6.3
BIM Document Reference	HE551489-GTY-EBD-000-RP-LB-30023
Author:	A47 North Tuddenham to Easton Dualling Project Team, Highways England

Version	Date	Status of Version
Rev 0	March 2021	Application Issue

River Tud Corridor

Aquatic Invertebrate Survey

A report to
Sweco UK Limited
Grove House
Mansion Gate Drive
Leeds
West Yorkshire
LS7 4DN

By:

EMEC Ecology
The Old Ragged School
Brook Street
Nottingham
NG1 1EA

Tel: (0115) 964 4828
E-mail: mail@emec-ecology.co.uk
Website: www.emec-ecology.co.uk

December 2019

Table of Contents

1. INTRODUCTION

1.1 Project Overview

EMEC Ecology was commissioned by Sweco UK Limited to undertake a standardised repeatable aquatic invertebrate survey of designated sites of the River Tud and nearby ponds on or near the route of the A47 North Tuddenham to Easton scheme, referred to as the proposed scheme.

The main objective of the survey was to identify key taxa from pre-determined survey points along the route to assess both species richness and species abundance at each of these locations. The survey also aimed to identify any species with a conservation status.

1.2 Site Locations

Ten sites within the scoping boundary of the proposed scheme around the villages of Honingham to the east and Hockering in the west all within the 10km Ordnance Survey square TG01.

1.3 Study Aims

- To compile a detailed list of all aquatic macro-invertebrate species recorded at ten pre-determined locations. All invertebrates identified to species level except Diptera that were identified to family level.
- Record for presence of any fish species found in any sample.
- Using the Site Analysis for Freshwater Invertebrates Survey (SAFIS) analysis software and the surveyors experience determine the significance of the aquatic invertebrate assemblages present and the type and quality of the habitat and its ability to support given invertebrate assemblages.
- To highlight any invertebrates of national or regional conservation importance found during the survey that may impact on the planned development or require mitigation measures to prevent loss from the site.

2. METHOD

2.1 Survey Details

Ten sampling points both on the River Tud and on farmland ponds and ditches adjacent to the proposed scheme were sampled on the 2nd and 3rd of September 2019. Samples were collected using a standard Freshwater Biological Association net with 0.5 mm mesh. Collection consisted of three ten-second sweeps of the net at three points at each sample location. This included sweeping the benthic layer, bankside edges and amongst vegetation where present. All sample sweeps were placed into a 5 litre bucket where the sample was sieved and then placed in storage containers in 70% iso-propyl alcohol for storage and later identification. Non-destructive sampling techniques were also undertaken where appropriate to sample for the snail *Vertigo moulinisiana*. This was done by placing a white sheet at

the base of riparian vegetation. The vegetation was then shaken over the sheet and any snails identified *in-situ* before release.

Specimens were identified to species level using a stereoscopic microscope and dichotomous keys, excepting some diptera families and the Oligochaeta where specialist preparatory work is required to enable species determinations. These were on all occasions identified to family level.

A map of the sample locations is shown Appendix 1 whilst notes on each sampling location are shown in Table 1. Photographs of each sample location are shown in Appendix 2.

Site	Grid Reference	Comment
A	TG 0672 1276	Tree lined section of the River Tud. Depth to 15cm. Gravels with riffles and glides.
B	TG 1054 1180	Slow flowing section of River Tud. Clay bottom, no emergent vegetation. Depth to 60cm.
C	TG 1203 1137	Open stretch of the River Tud in grazing field with aquatic and emergent vegetation. Gravel runs and clay bottomed sampling point.
D	TG 0716 1349	Dry tree lined pond. No standing water.
E	TG 0681 1346	Stagnant tree covered pond in arable field water depth to 10cm. Dense covering of *Lemna minor*.
F	TG 0987 1253	Dry tree lined pond in arable field. No standing water.
G	TG 1149 1170	Series of shallow stagnant drainage ditches in grazing field. Depth to 20 cm. Deep anoxic detritus layer.
H	TG 0947 1155	Woodland pond. No surface water but slightly damp underfoot.
I	TG 0953 1260	Dry tree lined pond in arable field. No standing water.
J	TG 1134 1088	Dry pond in field edge copse. Damp but no standing water.

Table 1. Description and position of each sample location.

2.2 SAFIS Invertebrate Analysis

Identified species assemblages from each sample point were then analysed using SAFIS (Site Analysis for Freshwater Invertebrate Surveys) Version 30. This analysis gave an indication of the conservation value of each sample location. The analysis also indicates water quality and highlights species of conservation value found during the survey. This includes water quality calculation using the Biological Monitoring Working Party (BMWP) and Average Score Per Taxon (ASPT) scoring system, the Community Conservation Index (CCI), used to provide an assessment of the conservation value of invertebrate communities at each location, a calculation of the Lincoln Quality Index (LQI), a measure used by Anglian Water to determine water quality as well as a lotic (streams and rivers)

index to calculate flow rates and a Proportion of Sediment Sensitive Invertebrates (PSI) in a sample. These last two can be used to determine the impact of works on both flow rate and effects on the sediment present at any given point in a watercourse.

2.3 Mollusc Sampling

Habitat characteristics for riparian snail sampling were also taken following methodology given in a previous study by Abrehart Ecology (2018) to primarily assess vegetational height, thatch depth, and moisture content of the sample site. Mositure content was recorded as follows:

1. Dry: no visible moisture on ground surface.
2. Damp: ground visibly damp, but water does not rise under pressure.
3. Wet: water rises under light pressure.
4. Very wet: pools of standing water, generally less than 5cm deep.
5. Site under water: entire sampling location is in standing or flowing water over 5cm deep.

Conditions numbered 3-5 are considered suitable ground moisture levels for *Vertigo moulinsiana*.

All samples were collected by William Sheppard MSc GradCIEEM and Adrian Dutton BSc (Hons). Species level determinations were performed by Adrian Dutton and William Sheppard. William Sheppard's white-clawed crayfish (*Austropotamobius pallipes*) license number 2017-32590-CLS-CLS.

2.4 Survey Limitation

No survey such as this can provide a complete picture of the invertebrate fauna of a sample location using the method employed in this survey. This survey should therefore not be considered a definitive listing of the invertebrate fauna of the area. Varying emergence periods, niche habitats and invertebrate scarcity at any given location all influence the potential to observe and discover several species of invertebrate. It is therefore probable that the number of species present at some of the locations surveyed will be higher than the number recorded on the day of visit.

3. RESULTS

3.1 General Comments on Samples.

Five of the ten sample locations did not contain water at the time of survey. These were ponds, D, F, H, I, and J. Of these it was considered that ponds F and I had not contained standing water for several months while ponds D, H and J may have contained standing water at some point during 2018/2019.

Of the other five sample locations 45 species of invertebrate were recorded ranging from a low of four species in pond E to 25 species (23 contributing to calculation of water quality) in River Tud sample location C. A full species list for each sample location is shown in Appendix 3.

Two species of fish were recorded, the bullhead (*Cottus gobio*) at sample locations A and C on the River Tud and three-spined stickleback (*Gasterosteus aculeatus*) where several were found in each of the net samples in drainage ditch sample location G.

3.2 Summary of Findings of Sample Locations from which Samples were Taken

Sample Location	Number of contributing Taxa.	Taxa of Conservation value	BMWP and ASPT	CCI Score	LQI Score	LIFE Score	PSI Score
A	17	White-clawed crayfish	96.7 / 6.45	33.00	A++	7.73	62.50
B	9	None	45.5 / 5.06	5.00	A	7.00	27.27
C	23	None	107.1 / 5.36	7.62	A++	7.13	41.18
E	4	None	11.9 / 3.97	1.50	E	5.33	0.00
G	10	None	36.1 / 4.01	4.33	D	5.70	0.00

Sample Location A, River Tud. White-clawed crayfish was the only invertebrate of significance found at this location. All others noted as common or very common. The invertebrate assemblage indicate that water quality is very good and excellent using BMWP/ASPT and LQI respectively. LIFE score of greater than 7.5 indicates an invertebrate assemblage favouring waters with fast flow rates. The CCI score indicates that this site supports species of national importance, namely the white-clawed crayfish.

Sample Location B, River Tud. No species of conservation found at this sample point. BMWP/ASPT indicates water of moderate quality whilst LQI indicates water and habitat of excellent quality. LIFE score and PSI score indicate water of moderate flow with the bed of the river well sedimented. The CCI scores shows that this site supports a low taxon community, the degree of shading and sedimentation at this site not being conducive to high species diversity.

Sample Location C, River Tud. All taxa recorded noted as either common or very common. CCI score indicates a site of moderate conservation value based on an assemblage of invertebrates of moderate taxon richness. BMWP/ASPT scores indicate water of very good quality whilst LQI index indicates water of excellent quality. PSI shows that the bed is moderately sedimented whilst LIFE score shows an assemblage of invertebrates requiring moderately fast flowing water.

Sample Location E, field pond. A still water body of very poor to moderate water quality BMWP/ASPT, LQI respectively. PSI indicates a water body heavily sedimented. A CCI of 1.50 indicates a pond of low conservation value.

Sample Location G, drainage ditch. All taxa noted as common or very common. BMWP/ASPT and LQI indicate water of moderate quality with a heavily sedimented bed. CCI indicates a water body of low conservation value.

Two species of terrestrial mollusc were recorded during the survey both at Sample location C. These were both common species *Succinea putris* and *Cepaea hortensis*. All sample locations surveyed had soil moisture contents scored as 1, dry soils except sample location C where a score of 2 was given.

3.3 Invertebrates of National Conservation Status Found During the Survey

The white-clawed crayfish is the United Kingdom's native crayfish and is protected under Schedule 5 of the Wildlife and Countryside Act 1981 (as amended) making it illegal to harm, disturb and take (including to handle), this species without an appropriate licence.

A single specimen was found in the River Tud at sample location A. This was found in amongst several invasive signal crayfish (*Pacifastacus leniusculus*) a species that is known to both outcompete and harbour diseases that lead to the eventual loss of white-clawed crayfish where signal crayfish are found.

3.4 Vetebrates of National Conservation Status Found During the Survey

Cottus gobio, the bullhead fish, found at both sample locations A and C is listed on Habitats Directive Annexe 2 - Non-priority Species. This indicates a species of community interest whose conservation requires the designation of Special Areas of Conservation.

4. DISCUSSION

Four out of the six pond locations on this survey were dry on the day of visit. Of these it was considered that two of these, ponds F and I had contained standing water during the summer of 2019. If so, it is considered that they would have ephemeral mobile populations of invertebrates similar to that found in pond E and in most years contain water in winter and early spring but dry out each summer. These ponds have low conservation value. The other three dry ponds D, H and J retained some moisture in the litter layer but no standing water. It is considered that these ponds are only wetted during the winter and spring. In terms of aquatic invertebrates they too are of low conservation value. However, their terrestrial fauna was not surveyed.

Drainage ditches located at sample location G were heavily sedimented and choked with sweet reed grass (*Glyceria maxima*) and common reed (*Phragmites australis*). This together with the heavy sediment layer limited the conservation value of these waterbodies.

Results from the River Tud, sample locations A, B, and C show that the river has a conservation value, most notably down to the presence of white-clawed crayfish and bullhead. However, in the case of the white-clawed crayfish the presence of signal crayfish suggests that its continued long-term survival in the watercourse is unlikely as the the latter species is both a vector for crayfish plague, to which the white-clawed is susceptible and successfully outcompetes the white-clawed in habitats where the signal crayfish enters.

Mollusc habitat suitable for *Vertigo moulinsiana* was not found at any survey location.

It is considered that any proposed works in and around the River Tud will have little impact on the invertebrate species recorded as long as mitigatory measures are taken to maintain river flow rates and prevent possible sedimentation build up during works that may effect surface run-off or disturb the integrity of the river's bankside.

REFERENCES AND BIBLIOGRAPHY

Abrehart Ecology 2018. *Baseline Survey of Aquatic Invertebrate Diversity along the River Tud, Norfolk*. A report for Amey PLC.

Cham, S., 2012. *Field guide to the larvae and exuviae of British dragonflies*. The British Dragonfly Society, Peterborough.

Drake et al. 2007. *Surveying terrestrial and freshwater invertebrates for conservation evaluation*. Natural England Research Report NERR005.

Dobson et al. 2012. *Guide to freshwater invertebrates*. Freshwater Biological Association Scientific Publication 68. Freshwater Biological Association, Ambleside.

Edington, J. M. & Hildrew, A. G. 2005. *A revised key to the caseless caddis larvae of the British Isles.* Biological Association Scientific Publication 53. Freshwater Biological Association, Ambleside.

Elliott, J.M. & Dobson, M., 2015. *Freshwater leeches of Britain and Ireland*. Freshwater Biological Association Scientific Publication 69. Freshwater Biological Association, Ambleside.

Foster et al. 2014. *Keys to adults of the water beetles of Britain and Ireland (part 2)*. Handbooks for the identification of British insects 4(5b). Royal Entomological Society.

Friday, L.E., 1988. *A key to the adults of British water beetles*. Field Studies 7(1), 1-151

Gledhill, T. et al. 1993. *British freshwater Crustacea Malacostraca: a key with ecological notes*. Freshwater Biological Assocation, Ambleside.

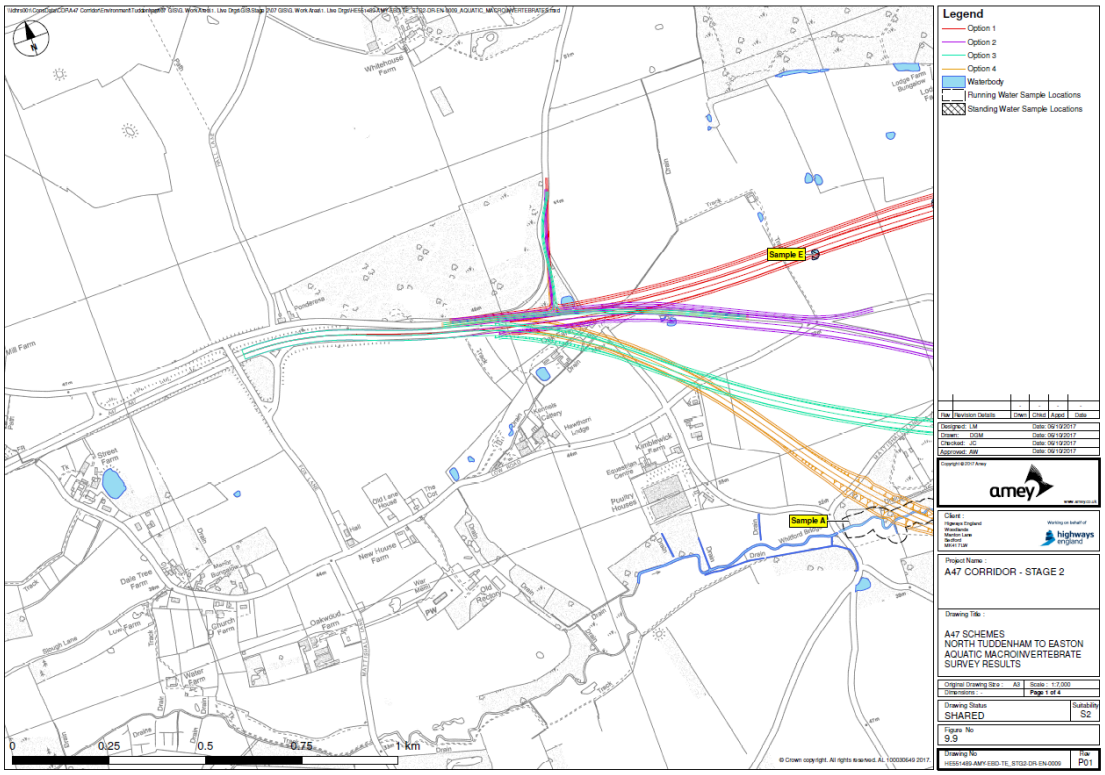
Hynes, H. B. N., 1977. *A key to the adults and nymphs of the British stoneflies (Plecoptera) with notes on their ecology and distribution.* Freshwater Biological Association Scientific Publication 17. Freshwater Biological Association, Ambleside.

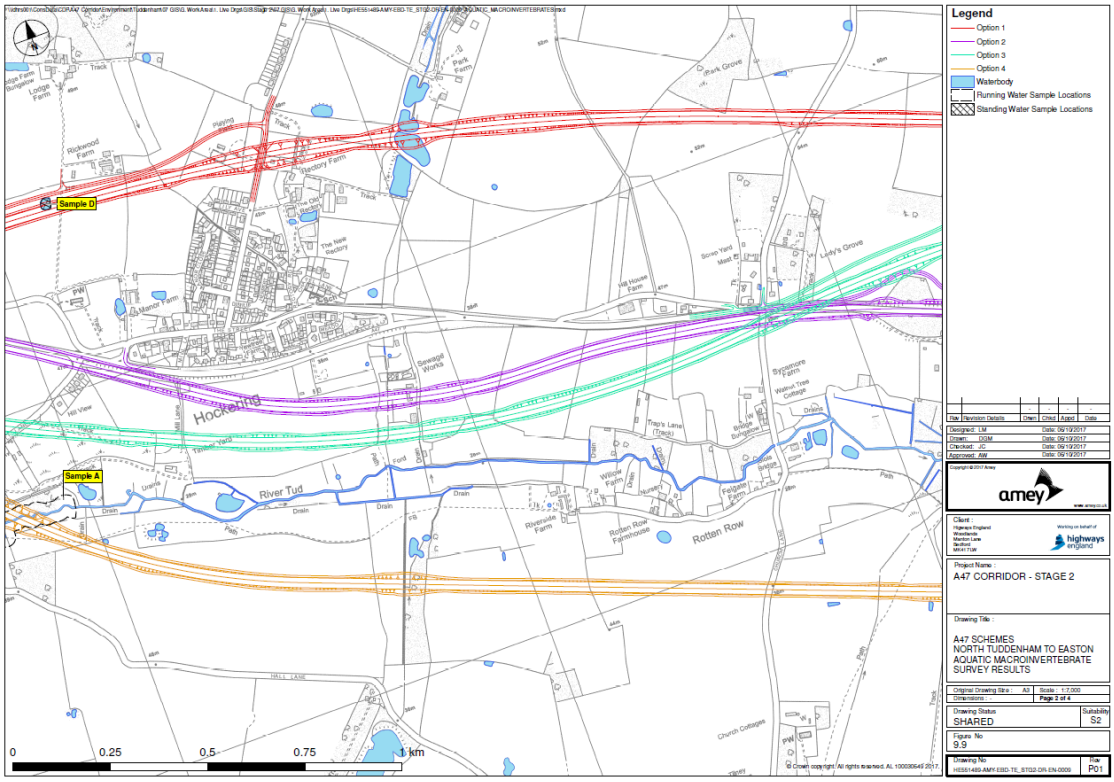
SAFIS: *Site Analysis for Freshwater Surveys*, version 30.0. Boxvalley AquaSurveys.

Savage, A. A., 1989. *Adults of the British Aquatic Hemiptera Heteroptera*. Freshwater Biological Association, Ambleside.

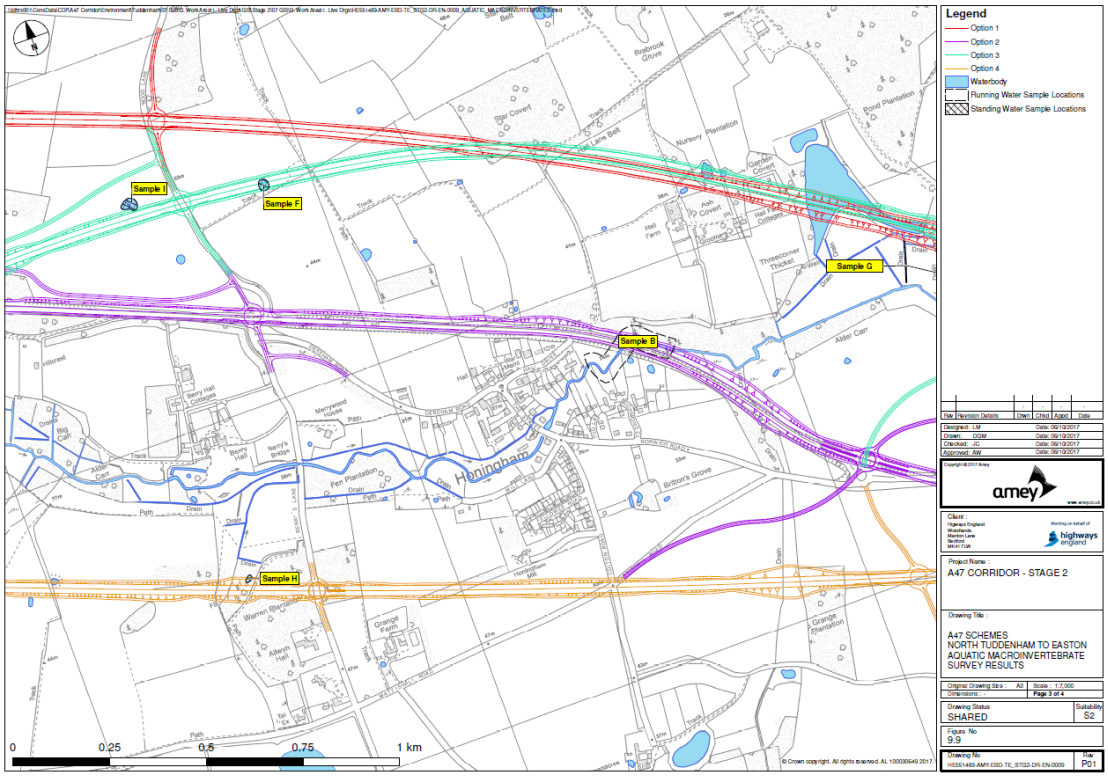
Wallace, I.D., Wallace, B., & Philipson, G.N., 1990. *Keys to the case-bearing caddis larvae of Britain and Ireland.* Freshwater Biological Association Scientific Publication 61. Freshwater Biological Association, Ambleside.

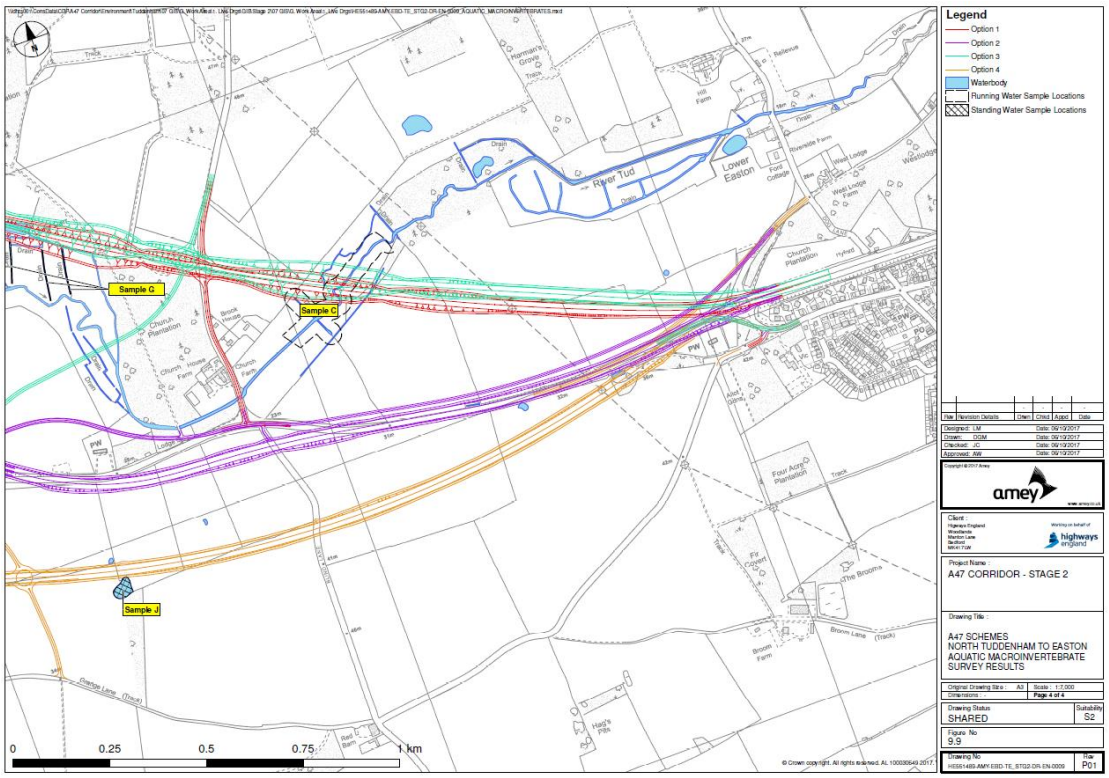
Appendix 1 - Site Map Showing Locations of each of the Ten Sample Locations.





Prepared by EMEC Ecology
Tel: (0115) 9644 828





Prepared by EMEC Ecology
Tel: (0115) 9644 828

Appendix 2 - Photographs of Each of the Ten Sample Locations.

Photographs aim to show the habitat type at each of the sample locations.

Sample Location A, River Tud, (TG 0672 11276).

Sample Location B, River Tud. (TG 1054 1180).

Sample Location C, River Tud. (TG 1203 1137).

Sample Location D, dry pond in arable farmland. (TG 0716 1349).

Sample Location E, stagnant pond in arable farmland. (TG 0681 1346).

Sample Location F, dry pond in arable farmland. (TG 0987 1253).

Sample Location G, drainage ditch in grazing farmland. (TG 1149 1170).

Sample Location H, dry pond in woodland. (TG 0953 1260).

Sample Location I, dry pond in arable field. (TG 0953 1260).

Sample Location J, dry pond in arable field. (TG 1134 1088).

Appendix 3 - List of Recorded Species Found During the Survey.

Species Name	***Other Name***	***Order***	***Family***	***A***	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***
Crangonyx pseudogracilis	Freshwater shrimp	Amphipoda	Crangonyctidae					✓					
Gamarus pulex	Freshwater shrimp	Amphipoda	Gammaridae	✓	✓	✓							
Elmidae larvae	Riffle beetle	Coleoptera	Elmidae		✓	✓							
Elmis aenea	Riffle beetle	Coleoptera	Elmidae	✓		✓							
Limnius volckmari	Riffle beetle	Coleoptera	Elmidae	✓		✓							
Oulimnius tuberculatus	Riffle beetle	Coleoptera	Elmidae	✓		✓							
Octhebius minimus	Hydraenid beetle	Coleoptera	Hydraenidae							✓			
Anacaena limbata	Hydrophilid beetle	Coleoptera	Hydrophilidae							✓			
Austropotamobius pallipes	White-clawed crayfish	Decapoda	Astracidae	✓									
Pacifastacus leniusculus	Signal crayfish	Decapoda	Astracidae	✓									
Chaoboridae sp.	Phantom midage	Diptera	Chaoboridae					✓					
Chironomidae sp.	Non-biting midge	Diptera	Chironimade	✓		✓		✓					
Pediciidae sp.	Hairy-eyed cranefly	Diptera	Pediciidae	✓									
Simulium sp.	Blackfly larvae	Diptera	Simuliidae			✓							
Serratella ignata	Blue-winged olive	Emphemeroptera	Ephemerelidae			✓							
Ephemera danica	Green drake	Emphemeroptera	Ephemeridae	✓		✓							
Baetis rhodani	Large dark olive	Ephemeroptera	Baetidae	✓		✓							
Paraleptophlebia submarginata	Turkey-brown mayfly	Ephemeroptera	Leptophlebiidae	✓									
Valvata piscinalis	Valve snail	Gastropoda	Valvatidae			✓							
Corixa punctata	Waterboatman	Hemiptera	Corixidae			✓							
Corixa sp nymph.	Waterboatman	Hemiptera	Corixidae							✓			
Hesperocorixa sahlbergi	Lesser waterboatman	Hemiptera	Corixidae					✓					
Gerris lacustris	Pondskater	Hemiptera	Gerridae							✓			
Nepa cinerea	Water scorpion	Hemiptera	Nepidae							✓			

Species Name	***Other Name***	***Order***	***Family***	***A***	***B***	***C***	***D***	***E***	***F***	***G***	***H***	***I***	***J***
Lymnaea stagnalis	Great pond snail	Hygrophila	Lymnaeidae							✓			
Radix balthica	Wandering snail	Hygrophila	Lymnaeidae			✓							
Planorbis planorbis	Margined ramshorn snail	Hygrophila	Planorbidae			✓				✓			
Asellus aquaticus	Water hog louse	Isopoda	Asellidae		✓	✓							
Bithynia tentaculata	Common bithynia	Littorinimorpha	Bithyniidae			✓				✓			
Potamopyrgus antipodarum	New Zealand mud snail	Littorinimorpha	Tateidae	✓	✓	✓							
Oligochaeta sp.	Segmented worm	Lumbriculida		✓									
Calopteryx splendens	Banded demoiselle	Odonata	Calopterygodae	✓	✓	✓							
Pyrrhosoma nymphula	Large red damselfly	Odonata	Coenagrionidae							✓			
Sympetrum striolatum	Common darter	Odonata	Libellulidae							✓			
Leuctra hippopus	Stonefly	Plecoptera	Leuctridae	✓									
Ostracoda sp.		Podocopida	-		✓								
Succinea putris	Amber snail	Pulmonata	Succineidae			✓							
Cepaea hortensis	White-lipped snail	Pulmonata	Helicidae			✓							
Glossiphonia complanata	Leech	Rhynchobdellida	Glossiphoniidae		✓	✓							
Musculium lacustre	Pea mussel	Sphaeriida	Sphaeriidae	✓	✓	✓							
Goera pilosa	Caddis fly	Trichoptera	Georidae			✓							
Hydropsyche angustipennis	Caddis fly	Trichoptera	Hydropsychidae	✓									
Hydroptila sp.	Caddis fly	Trichoptera	Hydroptilidae			✓							
Lepidostoma hirtum	Caddis fly	Trichoptera	Lepidostomatidae	✓									
Drusus annulatus	Caddis fly	Trichoptera	Limnephilidae	✓									
Halesus radiatus	Caddis fly	Trichoptera	Limnephilidae		✓	✓							
Molanna angustata	Caddis fly	Trichoptera	Molannidae			✓							
Polycentropus flavomaculatus	Caddis fly	Trichoptera	Polycentropopidae		✓	✓							

Prepared by EMEC Ecology
Tel: (0115) 9644 828

QUALITY ASSURANCE:

TITLE: River Tud Corridor: Aquatic Invertebrate Survey

SUBMITTED TO: Sweco UK Limited

ISSUE AND REVISION RECORD:

Contract Number: AD/19/10747/02

Revision Number: 1

Description: Final Report

Date: 9th December 2019

Disclosure: the information, data, evidence, advice and opinions which have been prepared and provided are true, and have been prepared and provided in accordance with the Chartered Institute of Ecology and Environmental Management's Code of Professional Conduct. I confirm that the opinions expressed are my true and professional bona fide opinions.

AUTHOR

Name: Adrian Dutton BSc (Hons) **Signed:** [redacted]

INTERNAL REVIEWER

Name: Steve Ralph MSc MCIEEM AIEMA **Signed:** [redacted]

East Midlands Environmental Consultants Ltd (trading as EMEC Ecology), Registered in England and Wales, no. 2623590. Registered offices: The Old Ragged School, Brook Street, Nottingham, NG1 1EA.