A12 Chelmsford to A120 widening scheme TR010060

6.3 ENVIRONMENTAL STATEMENT APPENDIX 9.1 AQUATIC ECOLOGY SURVEY REPORT

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ENVIRONMENTAL STATEMENT
APPENDIX 9.1 AQUATIC ECOLOGY SURVEY REPORT

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1 Executive Summary

1.1.1 This is an appendix of the A12 Chelmsford to A120 Widening Scheme Environmental Statement (ES). This report presents an evaluation of aquatic ecology receptors based on recent surveys. It also presents the policy and legislative context within which the Environmental Impact Assessment (EIA) process is being carried out. Likely significant effects on, and mitigation for aquatic ecology receptors has been considered in Chapter 9 of the ES.

1.1.2 The objective of the completed surveys was to describe the baseline status of aquatic ecology receptors and evaluate the population potentially affected by the proposed scheme. The surveys were undertaken between March and November in 2017 and 2020. Aquatic ecology receptors included:

a. Freshwater macro-invertebrates

b. Freshwater fish

c. Freshwater macrophytes

d. White-clawed crayfish

e. River habitat survey

f. Pond habitat survey

1.1.3 The field study identified the following species of conservation interest from the study area:

a. Brown trout *Salmo trutta*

b. Bullhead *Cottus gobio*

c. European eel *Anguilla anguilla*

d. River / brook lamprey *Lampetra fluviatilis* / *Lampetra planeri*

e. River water-dropwort *Oenanthe fluviatilis*

1.1.4 Freshwater macro-invertebrate communities from all surveyed sites have been evaluated as of **Local** importance. Macrophyte communities from the River Blackwater have been evaluated as of **County** importance. At all other sites they have been evaluated as of Local importance. Freshwater fish communities from the Boreham Brook, Domsey Brook 1, River Brain and River Ter have been evaluated as of County importance. Freshwater fish communities from the River Blackwater and Roman River have been evaluated as Local value. All ponds surveyed have been evaluated as of Local value. No white-clawed crayfish *Austropotamobius pallipes* were identified from the field study.

2 Introduction

2.1 Background

2.1.1 The A12 Chelmsford to A120 Widening Scheme (the 'proposed scheme') comprises improvements to the A12 between junction 19 (Boreham) at TL 741094, and junction 25 (Marks Tey) at TL 917238, a distance of approximately 24km, or 15 miles. The proposed scheme involves widening the A12 to three lanes throughout. It also comprises safety improvements, including closing of existing at grade accesses, and reducing access to cyclists along the dual carriageway by providing an alternative route for walkers, cyclists, and horse riders.

2.1.2 The proposed scheme would require new crossings of watercourses and potential improvements to existing culvert and bridge crossings. There are eight crossings of main rivers, six of which comprise existing crossings and two of which comprise new crossings on proposed offline sections of road. Three of the crossings would require minor realignments at the crossing points.

2.1.3 Land would be required both temporarily and permanently to construct, operate and maintain the proposed scheme. Permanent land-take requirements include the footprint of all the proposed highway infrastructure and associated earthworks, drainage works and access roads, together with environmental mitigation areas such as landscape planting and biodiversity habitat creation.

2.1.4 The proposed scheme is classed as a Nationally Significant Infrastructure Project (NSIP) under the Planning Act (2008), triggering the need to apply for a Development Consent Order (DCO).

2.1.5 The selection criteria in the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 have been used to screen the proposed scheme and identified the potential for significant effects. The proposed scheme is therefore required to be accompanied by an Environmental Statement to provide information on likely significant effects.

2.1.6 The Scoping Report Highways England (2020a) (informed by an Extended Phase 1 Habitat Survey (National Highways, 2020) identified several ecological receptors which have the potential to be impacted by construction or operation of the proposed scheme. Surveys are therefore required to establish an accurate baseline against which the impacts of the scheme could be assessed in accordance with the Chartered Institute of Ecology and Environmental Management (CIEEM) guidance for Ecological Impact Assessment (EcIA) (CIEEM, 2019) and DMRB LA 108 – Biodiversity (Highways England, 2020b). Scoping opinions received from statutory and non-statutory consultees during this process were taken into consideration (refer to Chapter 9 of the Environmental Statement (ES)).

2.1.7 The Extended Phase 1 Habitat Survey confirmed the requirement to undertake the following suite of ecological surveys for the scheme:

a. Botanical surveys of potential UK Biodiversity Action Plan (BAP) priority habitats

b. Hedgerow

c. Freshwater macro-invertebrates

d. Freshwater fish

e. Freshwater macrophytes

f. White-clawed crayfish

g. River habitat survey

h. Pond habitat survey

i. Terrestrial invertebrates

j. Birds (breeding and wintering)

k. Barn owls

l. Bats (bat activity, bat roost potential, and roost characterisation surveys)

m. Dormice

n. Water vole

o. Otter

p. Badger

2.2 Purpose of the report

2.2.1 This report is an appendix of the A12 Chelmsford to A120 Widening Scheme ES. It presents an evaluation of the status of aquatic receptors based on a desk-based review of records and field surveys.

2.2.2 The report presents the policy and legislative context within which the EIA is carried out. Likely significant effects on, and mitigation for aquatic receptors, are considered in Chapter 9 of the ES.

2.2.3 This report presents the results of the surveys undertaken between March and November in 2017 and 2020.

2.1 Survey Objectives

Freshwater macro-invertebrates, fish and macrophytes

2.1.1 The key objectives of this survey were to:

a. Identify freshwater macro-invertebrate, fish and macrophyte community composition in watercourses in the study area

b. Provide an evaluation for the freshwater macro-invertebrate, fish and macrophyte populations in watercourses in the study area through the calculation of biological metrics

c. Inform the assessment of potential impacts on the freshwater macro-invertebrate, fish and macrophyte communities associated with the proposed scheme (as detailed within the ES)

d. Provide sufficient field data for the development of appropriate mitigation if necessary (as detailed in the ES)

White-clawed crayfish

2.1.2 The key objectives of this survey were to:

a. Determine the presence or absence of white-clawed crayfish within watercourses in the study area

b. Provide an evaluation for the white-clawed crayfish population in the study area

c. Inform the assessment of potential impacts on white-clawed crayfish associated with the proposed scheme (as detailed within the ES)

d. Provide sufficient field data for the development of appropriate mitigation if necessary (as detailed in the ES)

River habitat survey

2.1.3 The key objectives of this survey were to:

a. Record habitat features of importance to wildlife from watercourses in the study area

b. Provide an assessment of habitat quality along watercourses in the study area

c. Inform the assessment of potential impacts on river habitat associated with the proposed scheme (as detailed within the ES)

d. Provide sufficient field data for the development of appropriate mitigation if necessary (as detailed in the ES).

Pond habitat survey

2.1.4 The key objectives of this survey were to:

a. Identify ponds potentially affected by the proposed scheme

b. Record the macro-invertebrate and aquatic plant communities in these ponds

c. Provide an assessment of the ecological quality of these ponds

d. Inform the assessment of potential impacts on the ecological quality of ponds associated with the proposed scheme (as detailed within the ES)

e. provide sufficient field data for the development of appropriate mitigation if necessary (as detailed in the ES)

3 Aquatic ecology

3.1.1 Freshwater environments are structurally complex, multifunctional habitats which support diverse aquatic floral and faunal assemblages.

3.1.2 Freshwater macro-invertebrates are a widespread, abundant, and diverse group of organisms which can be found in all waterbody types. They have been well studied, leading to a comprehensive understanding of community structure and function. Macro-invertebrate populations are frequently used to determine impacts for a range of pressures on waterbodies, including flow stress (abstraction, discharge, and drought), pollution (point source and diffuse), sedimentation, habitat modification, and climate change. The distribution of communities and species are determined by a wide range of factors, including in-channel habitat (substrate composition, bank structure), geomorphological process (erosion, deposition), hydrology (flow volume and diversity), water quality and connectivity of habitat between life stages.

3.1.3 Macro-invertebrate species are often specialised to a niche within the aquatic habitat and may spend some, all, or very little of their life cycle in an aquatic phase. As a result, macro-invertebrate communities may show seasonal variation, however, their relative immobility, longevity and known tolerances to pressures make them an effective indicator of wider ecosystem health.

3.1.4 Conservation value has been assigned to all major aquatic macro-invertebrate species ensuring that a conservation value accounts for community richness, as well as the conservation value of specific individuals.

3.1.5 There is potential for a diverse range of freshwater fish to be present within the study area due to a diversity of suitable habitat. The distribution of freshwater fish and diversity of the community present within a watercourse may be influenced by the position of the site within the water catchment, availability of habitat, competition and interconnectivity of habitats for different life stages, flow diversity and volume, water quality, exploitation and barriers to migration.

3.1.6 Freshwater macrophyte communities incorporate a broad range of taxa, are often found within specific aquatic habitats, are intrinsically stationary and relatively long living. Biological metrics can be calculated based on the presence of aquatic plants which can be used to effectively evaluate the ecological status of a range of different waterbodies. Where present, individual metric scores can potentially be used to help determine the reasons for any degradation.

3.1.7 White-clawed crayfish are the only native crayfish in the UK. Their populations are declining across much of their range. They are threatened by competition from invasive non-native crayfish species as well as the crayfish plague *Aphanomyces astaci,* which is carried by several introduced crayfish species of North American origin. In the UK, the distribution of white-clawed crayfish is largely determined by geology and water quality. White-clawed crayfish are of conservation interest and are protected under relevant legislation.

4 Legislation and policy

4.1 Legislation

4.1.1 The following legislation is considered relevant to the proposed scheme in relation to aquatic ecology receptors:

a. The Conservation of Habitats and Species Regulations 2017 (The Habitats Regulations)

b. Water Environment (Water Framework Directive) Regulations 2017 (WFD Regulations)Wildlife and Countryside Act 1981 (as amended)

c. The Eels (England and Wales) Regulations 2009

d. Salmon and Freshwater Fisheries Act 1975

e. Natural Environment and Rural Communities (NERC) Act 2006 (as amended)

4.1.2 The Habitats Regulations transpose the provisions of European Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (the Habitats Directive), which lists several aquatic invertebrates, macrophytes and freshwater fish. White-clawed crayfish receive full protection under Annex II and V, which means that the designation of a National Site Network (formerly Special Areas of Conservation when the UK was a member of the European Union) is required for its protection, and that taking or disturbing this species in the wild is prohibited.

4.1.3 The WFD Regulations transpose the provisions of Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive (WFD). The WFD Regulations aim to prevent the deterioration of the ecological status of watercourses from existing conditions and put in place measures to ensure waterbodies reach “good ecological status” (or “good ecological potential” in highly modified waterbodies). Aquatic macro-invertebrate, freshwater fish and macrophyte populations form part of the biological quality elements which are routinely assessed to determine the ecological status of waterbodies.

4.1.4 Several freshwater macro-invertebrates, fish and macrophyte species are listed under various schedules of the Wildlife and Countryside Act 1981. This protects the species cited against being taken, killed, or intentionally disturbed. The white-clawed crayfish receives partial protection under Schedule 5 in respect of Sections 9(1) and 9(5). This makes it an offence to intentionally take (capture), sell, offer or expose for sale, have in possession or transport for the purpose of sale, any live or dead white-clawed crayfish or part thereof. Licenses can be granted by Natural England (the licensing authority) to allow illegal activities, including development, to take place if carried out in accordance with the provisions of the license.

4.1.5 The Salmon and Freshwater Fisheries Act 1975 places protection on freshwater fish, with a focus on salmon and trout. This legislation regulates activities that could result in direct mortality, barriers to migration, increased exploitation, pollution, and degradation of habitats.

4.1.6 The Eels (England and Wales) Regulations 2009 came into force to support the UK in implementing EC Council Regulation (1100/2007) (the EC Eel Regulation). The Eel Regulations commit the competent authority to take actions to halt and reverse the decline in the European eel *Anguilla anguilla* stock, aiming to meet a target set for the number of mature adult eels leaving each river basin to return to spawn at sea.

4.1.7 The NERC places a duty on all public bodies to have regard to the conservation of biodiversity in England, when carrying out their normal functions (the biodiversity duty). Several priority species under the act are aquatic, further information is provided in Section 4.3.

4.2 National Networks National Policy Statement

4.2.1 The National Networks National Policy Statement (NNNPS) sets out the Government's policies to deliver the development of NSIP on the national road and rail networks in England. The Secretary of State (SoS) uses the NNNPS as the primary basis for making decisions on DCO applications.

4.2.2 Paragraph 5.22 of the NNNPS states that the applicant's assessment should describe any likely significant effects on internationally, nationally, and locally designated sites of ecological conservation importance; protected species; habitats (including irreplaceable habitats such as ancient woodland and veteran trees); and other species identified as being of principal importance for the conservation of biodiversity. The surveys described in this report will inform the assessment of significant effects within the ES.

4.2.3 In addition to the national policy set out in the NNNPS, the proposed scheme has also had regard to relevant legislation and local plans and policy.

4.3 Priority species

4.3.1 The NERC places a responsibility on local authorities and government departments to consider the purposes of conserving biodiversity in a manner consistent with their normal duties, such as policy and decision-making. This Act ties together wildlife legislation and planning policies.

4.3.2 Species and habitats of principal importance for the conservation of biodiversity in England are listed under Section 41 of the NERC. This list is used to guide decision-makers in public bodies, in implementing their biodiversity duty. The species and habitats listed are priorities for nature conservation action and therefore for consideration in impact assessment.

4.3.3 The UK BAP was the UK's response to the Global Convention on Biological Diversity (CBD) in 1992. It lists priority species and habitats that are identified as being the most threatened and require conservation action. In 2012, the UK Post-2010 Biodiversity Framework (2012) succeeded the UK BAP and is the UK Government's response to a new strategic plan of the CBD which was published in 2010.

4.3.4 Much of the work previously carried out under the UK BAP is now focused on a county level. However, the UK BAP lists of priority species and habitats remain important and have been used to draw up the Section 41 statutory list.

4.3.5 Local BAPs (LBAPs) integrate the conservation measures provided in the UK BAP to enhance biodiversity at the local and regional level. The Essex LBAP is pertinent to the proposed scheme and lists five aquatic species shown in Table 4.1 (Essex Biodiversity Project, 2010).

Table 4.1 Aquatic species listed on the Essex LBAP

Scientific name	Common name
Segmentina nitida	Shining ram's-horn
Vertigo moulinsiana	Desmoulins' whorl snail
Austropotamobius pallipes	White-clawed crayfish
Alosa alosa	Allis shad
Alosa fallax	Twaite shad

5 Methodology

5.1.1 The study area for the desk and field studies was defined as a 500m buffer of the Provisional Order Limits (see Figures 1 and 2, Annex C) for the following aquatic ecology receptors:

a. Freshwater macro-invertebrates

b. Freshwater fish

c. Freshwater macrophytes

d. White-clawed crayfish

e. River habitat survey

5.1.2 The study area for the pond habitat survey was limited to the Provisional Order Limits (see Figure 3, Annex C).

5.1.3 The River Chelmer was excluded from the desk and field studies because no works are planned at the existing crossing.

5.2 Desk Study

Water Framework Directive classifications

5.2.1 Current WFD classifications (Cycle 2, 2019) for watercourses within the study area were compiled using the Catchment Data Explorer (Environment Agency, 2020a). Classifications are developed by the Environment Agency, as the competent authority in England, and determine the status of biological quality elements including aquatic macro-invertebrates, freshwater fish and macrophytes. Only main watercourses are classified under the WFD and not all main watercourses are classified for every biological quality element.

Freshwater macro-invertebrates, fish and macrophytes

5.2.2 Environment Agency freshwater macro-invertebrates, fish and macrophyte data from 2010 to 2020 within the study area were downloaded from the Ecology and Fish Data Explorer (Environment Agency, 2020b).

River habitat survey

5.2.3 Environment Agency River Habitat Survey (RHS) data from 2010 to 2020 were downloaded from the online DEFRA file sharing resource and filtered for surveys completed within the study area (Environment Agency, 2020c).

White-clawed crayfish

5.2.4 Records of white-clawed crayfish from the study area were requested from the Environment Agency. No data were provided. White-clawed crayfish records were sought from the freshwater macro-invertebrate data downloaded from the Ecology and Fish Data Explorer (Environment Agency, 2020b).

5.2.5 Environmental records were provided by the Essex Wildlife Trust Biodiversity Records Centre in 2017 and the Essex Field Club in 2020. Data were reviewed to identify any records of white-clawed crayfish within the study area.

5.2.6 A National Biodiversity Network (NBN Atlas Partnership, 2021) data search was performed to identify any records of white-clawed crayfish from the study area.

Pond habitat survey

5.2.7 Environmental records were obtained from the Essex Wildlife Trust Biodiversity Records Centre in 2017 and the Essex Field Club in 2020. The data was reviewed for any records of freshwater macro-invertebrates or macrophytes from ponds within the study area.

5.2.8 A National Biodiversity Network (NBN Atlas Partnership, 2021) data search was performed to identify any records of freshwater macro-invertebrates or macrophytes from ponds within the study area.

Desk study limitations

5.2.9 The Environment Agency collects environmental and biological data for waterbody characterisation and may use a single monitoring point to represent the quality of an entire watercourse or catchment. As such, biological classifications within the proposed scheme footprint may not accurately reflect habitat nor community composition locally. Assessment points for classification may be located at a considerable distance, including upstream, of the proposed scheme.

5.2.10 Data obtained from the government and scientific recording schemes come with good assurances of accuracy and in most cases will have been verified, however there remains a possibility for errors in data provided.

5.2.11 The accuracy of data collected from the Essex Wildlife Trust and Essex Field Club has not been verified.

5.2.12 Species presence and distribution information is relevant to the period that information was collected, and it is acknowledged that colonisation and movement of species can occur at any time during or after this period.

5.2.13 Although the data provided by the consultees is the most complete set of species data available, the absence of records should not be taken as an indication of absence of species. Species may be present in any given area but not necessarily recorded or recognised.

5.3 Field Study

Freshwater macro-invertebrates

5.3.1 Macro-invertebrates are used to detect a range of environmental stressors, such as organic pollution, low flows, and habitat quality. All watercourses within the study area were surveyed for macro-invertebrates between March and November in both 2017 and 2020. Sample locations were chosen so that they were within the study area (or as close as possible) and in an area representative of the habitat within the reach.

5.3.2 Surveys followed standard kick and sweep-sampling methodology to obtain macro-invertebrate samples from water bodies, in addition to the collection of environmental and habitat data (Environment Agency, 2012). Samples were analysed to species level and the data were used to calculate the following macro-invertebrate indices:

a. Whalley, Hawkes, Paisley & Trigg (WHPT) metric, Average Score Per Taxon (WHPT ASPT) and Number of Taxa (WHPT NTAXA) (WFD-UKTAG, 2014a)

b. Community Conservation Index (CCI) (Chadd & Extence, 2004)

c. Proportion of Sediment sensitive Invertebrates (PSI) (Extence *et al.*, 2011)

d. Lotic Invertebrate Index for Flow Evaluation (LIFE) (Extence *et al.,* 1999)

e. River Invertebrate Classification Tool (RICT) and WFD classifications (WFD-UKTAG, 2014a)

5.3.3 The WHPT metric assesses macro-invertebrates in rivers in relation to general degradation, including organic pollution under the WFD (WFD-UKTAG, 2014a). Scores are assigned to macro-invertebrate families based on tolerance to pollution, with the final WHPT score taking into account the abundance of each of the families. WHPT ASPT scores are calculated by dividing the WHPT score by the number of scoring taxa (WHPT NTAXA) to give an average score per taxon. WHPT and WHPT ASPT scores are used as a measure of water quality; WHPT NTAXA is used as a measure of diversity. In 2014, the WHPT scoring system replaced the Biological Monitoring Working Party (BMWP) scoring system; the WHPT metric is abundance weighted and scores have been revised to be more representative of the family as a whole and reflect general pollution rather than just organic pressures. The BMWP scores are still used within the CCI.

5.3.4 The CCI (Chadd and Extence, 2004) represents the national rarity and diversity of species identified within a site and designates a conservation value to the sampled community. A conservation score based upon each species national rarity is applied to the species. The CCI is calculated from the sum of Conservation Scores divided by the number of contributing species to obtain the mean value. This is then multiplied by the Community Score, derived either from the rarest taxon present or the BMWP score, whichever is higher. The CCI

value tends to fall in a range of between 0 and 40 (see Table 5.1). Revised CCI scores used within the Environment Agency have been used, the update includes removal of non-native species scores, to reflect change in status and new species not previously included.

Table 5.1 CCI conservation classes (Chadd and Extence, 2004)

Conservation Class	Score	Description
Low	<5.0	Site supporting common species and low taxon richness
Moderate	5.0 to 10.0	Site supporting at least one species with limited distribution or moderate taxon richness
Fairly High	10.0 to 15.0	Site supporting at least one uncommon species or several of limited distribution or high taxon richness
High	15.0 to 20.0	Site supporting several uncommon species, one of which may be nationally rare or high taxon richness
Very High	>20.0	Site supporting several rare species or very high taxon richness.

5.3.5 The PSI scoring system is used to assess the impact of fine sediment accumulation on macro-invertebrate communities (Extence *et al*., 2011). Species are assigned a score based on their sensitivity to sediment. Calculation of the PSI score takes into account abundances of each scoring taxa. The resulting PSI scores indicate how sedimented the watercourse is; producing a numerical value to quantify a range from minimal sediment / unsedimented to heavily sedimented (see Table 5.2).

Table 5.2 PSI score interpretation (Extence *et al.*, 2011)

PSI	Riverbed condition
81 - 100	Minimally sedimented / unsedimented
61 - 80	Slightly sedimented
41 - 60	Moderately sedimented
21 - 40	Sedimented
0 - 20	Heavily sedimented

5.3.6 The LIFE index (Extence *et al*., 1999) is used to link macro-invertebrates to flow conditions. Freshwater macro-invertebrates have precise requirements for flow conditions and can be used to determine not only predominant flow types but also changes in flow character. Each species or family within a sample is assigned to a flow group depending on their flow/velocity preference. A high LIFE score represents a higher number of taxa with a preference for high velocity habitats and vice versa.

5.3.7 The RICT is used to classify macro-invertebrate data under the WFD. The RICT determines the ecological condition of a given location based on a comparison of macro-invertebrate communities observed at each study site, with macro-

invertebrate communities observed in a network of reference sites. Reference site selection is based on the similarity of physical attributes with the study site (for example: width, depth, substrate composition, altitude, distance from source, and alkalinity).

5.3.8 The RICT reference sites are deemed to be as close as possible to pristine and not impacted by environmental stressors such as pollution, habitat modification, or flow stress. Reference sites provide an expected (E) macro-invertebrate community score for that river type. The observed (O) macro-invertebrate community score at a given study site is divided by the expected (E) community score. Reference and bias adjustments are then applied to obtain the Ecological Quality Ratio (EQR).

5.3.9 An EQR score of one indicates that the abundance and species richness of the macro-invertebrate community at the subject site is comparable to the reference site, and therefore is not demonstrating environmental stress. The greater the variance of the EQR scores from one, the greater the environmental stress at the subject site. The EQR scores are assigned to a category from Poor to High, as set out under the WFD. The WFD uses the pollution sensitivity / general degradation (WHPT ASPT) and diversity (WHPT NTAXA) EQR scores to determine whether a watercourse meets Good Ecological Status (GES), or Good Ecological Potential (GEP) for designated heavily modified waterbodies, as required under the Directive. For WFD classification the lower scoring of the WHPT ASPT and WHPT NTAXA EQR scores determines the macro-invertebrate classification of a given site.

Freshwater fish

5.3.10 Scoping surveys carried out in 2017 identified watercourses in the study area that provided adequate habitat to be deemed appropriate for survey. Sample locations were chosen within the study area (or as close as possible) and within an area representative of the habitat within the reach.

5.3.11 Electric fishing surveys were conducted in 2017 and repeated in 2020 to identify the presence and abundance of freshwater fish. Fish surveys were conducted using a standard electric fishing technique (electric fishing backpack unit with single anode on smaller sites and single/twin anode bankside WFC4 unit for larger sites) following guidelines developed by the Environment Agency (Beaumont *et al*., 2002; Environment Agency, 2001; Environment Agency, 2007) and British Standard (BS) EN 14011:2003 (water quality – sampling of fish with electricity) (British Standards Institution, 2003). Surveys were undertaken quantitatively using a three run (minimum) catch depletion methodology.

5.3.12 At each site, all fish were speciated and measured to the nearest millimetre (fork length) and returned to the watercourse.

5.3.13 All electric fishing surveys were conducted under a FR2 license from the Environment Agency, by suitably trained members of staff.

Freshwater macrophytes

5.3.14 Macrophyte sites were selected within the study area (or as close as possible) and within an area representative of the habitat within the reach. Surveys were carried out in 2017 and in 2020.

5.3.15 Macrophyte species and taxon cover values were compiled from a 100m length of watercourse, alongside environmental and physical habitat data. Surveys followed the methods outlined by the Environment Agency (2011). Data collected were used to calculate a number of macrophyte metrics which support LEAFPACS2 analysis (WFD-UKTAG, 2014b):

a. River Macrophyte Nutrient Index (RMNI): Derived from the RMNI scores of the taxa recorded in the field survey, each species is ascribed a score based on its nutrient preferences. The RMNI score gives an indication of nutrient enrichment with scores ranging from 1 (low) to 10 (high)

b. Number of Taxa (NTAXA): A diversity metric (the number of scoring taxa recorded in the field survey), specifically only taxa which are considered truly aquatic

c. Number of Functional Groups (NFG): A diversity metric of individual taxa which are truly aquatic (i.e. hydrophytes). These are allocated to 24 ‘functional groups’

d. Cover of Green Filamentous Algae: This is the percentage cover of green filamentous algae over the whole of the surveyed section of river

5.3.16 The LEAFPACS analysis is the standard analytical tool method for the characterisation of watercourses using macrophytes and is used to indicate nutrient status of a watercourse. This classification is then reported with reference to the phytobenthos classification from DARLEQ2, and the lowest result classifies the watercourse for the overall WFD receptor ‘macrophytes and phytobenthos’.

White-clawed crayfish

5.3.17 Initial scoping surveys identified watercourses within the study area with the potential habitat to support white-clawed crayfish communities. The habitat assessment involved recording physical characteristics of the watercourse (channel width, depth, substrate, bank profile, and flow types) and the vegetation structure within the channel and along the banks. Features offering suitable refuge habitat, such as undercut banks, submerged tree roots, and cobbles were recorded. Professional judgement was used to assess the quality of the habitats for white-clawed crayfish. Specific survey locations were chosen which were as close as possible to the study area where optimal habitat was identified.

5.3.18 Manual search surveys were undertaken in 2017 and in 2020 following standard methodology (Peay, 2003) at locations identified during the habitat assessment. The method requires searching under stones for crayfish, examining undercut banks for signs of burrowing activity, sweep netting in stands of vegetation, and searching under large woody debris. These surveys were carried out by a licensed surveyor (License number: 2018-36480-CLS-CLS).

5.3.19 A trapping survey was undertaken following standard methodology in 2017 (Peay, 2003). Trapping surveys are utilised in deep water (greater than 60cm) and involved setting baited traps overnight which were recovered the following morning. Any white-clawed crayfish present in the traps were recorded and returned to the river; any non-native crayfish were humanely destroyed on site.

5.3.20 The trapping was authorized by the Environment Agency and undertaken by a licensed surveyor (Permit Number: EP/EW034-H-795/9585/01).

River habitat survey

5.3.21 Initial scoping identified watercourses within the study area which were appropriate for RHS. The RHS requires a 500m long survey reach which should be fully wetted and not choked with macrophytes at the time of survey as this can obscure physical habitat features. The RHS method quantifies the degree of artificial modification to a watercourse and habitat quality (Environment Agency, 2003). Surveys were carried out in 2017 and in 2020.

5.3.22 The RHS requires an accredited surveyor to audit a 500m reach of the physical characteristics and surrounding land use of a river. Ten spot checks were taken at 50m intervals followed by a sweep up of overall channel, bank and riparian zone characteristics, as well as features of geomorphological, hydromorphological and ecological interest.

5.3.23 Once collected, RHS data were returned to the Environment Agency (custodians of the National Database) and compared to a nationwide network of reference sites. A Habitat Quality Score (HQS) and Habitat Modification Score (HMS) was derived from the RHS.

5.3.24 Habitat Quality Score refers to the “overall habitat diversity provided by natural features in the channel and river corridor. Points are scored for the presence of features such as point, side and mid-channel bars, eroding cliffs, large woody debris, waterfalls, backwaters and floodplain wetlands” (Riverdene Consultancy, 2018).

5.3.25 The HMS is an indication of artificial modification to river channel morphology, based upon the presence and extent of artificial features such as culverts and weirs, re-profiling and reinforcement of banks, bridges and outfalls, and embankments. The HMS allocates the condition of the channel to one of five modification classes, based on the total score (1 = near-natural; 5 = severely modified) from which habitat value can be assigned (see Table 5.3).

Table 5.3 Habitat value, as determined by Habitat Modification Class

Value	Criteria
High	RHS reach classed as Pristine or Semi Natural (HMS of 0-16), or Predominantly Unmodified (HMS 17-199). No or very few channel modifications (e.g. planform alterations or bed/bank reinforcements); natural and diverse flow types; natural or semi-natural marginal and riparian vegetation.
Medium	RHS reach classed as Obviously Modified (HMS 200-499). Evidence of re-sectioning or revetment works; moderate morphological and habitat diversity.
Low	RHS reach classed as Significantly Modified (HMS 500-1399) or Severely Modified (HMS 1400+). Significant modifications limiting morphological adjustment; uniform channel characteristics and flow.

Pond habitat survey

5.3.26 Still waters and ponds differ significantly in their hydrology, morphology, and ecology from riverine habitats and, as such, require specific ecological consideration. The standard method used to survey ponds is the Predictive System for Multimetrics (PSYM) assessment method, which evaluates the macro-invertebrate and freshwater macrophyte communities (Pond Action, 2002).

5.3.27 All wetland plants present within the outer edge of each pond were recorded. A pond net or grapnel was used to sample deeper areas. Where possible, plants were identified to species level in the field; where this was not possible plants were photographed or bagged and identified in the laboratory.

5.3.28 Macro-invertebrate sampling consisted of three-minute hand-net sweeps within each meso-habitat (e.g. flooded marginal grasses or gravel bottomed shallows) present. A further minute was spent searching the water surface and under stones and logs in marginal areas. Samples of macro-invertebrates were identified to family level in the field.

5.3.29 Plant species and macro-invertebrate family data was processed using the following PSYM indices.

5.3.30 Plant metrics:

a. Number of submerged and marginal species (SM) – indicates species richness of a site

b. Number of uncommon plant species (U) – measures conservation value of a community

c. Trophic Ranking Score (TRS) – indicates nutrient tolerance on a scale of 1 to 10 (10 = very tolerant)

5.3.31 Macro-invertebrate metrics:

a. Average score per taxon (ASPT) – indicates average pollution tolerance of macro-invertebrates within a community

b. Number of Odonata and Megaloptera families (OM) – indicates long-term quality of a pond as larvae have a long aquatic life stage

c. Number of Coleoptera families (CO) – indicates the habitat quality and diversity of a pond

5.3.32 Observed data was compared with predicted values and used to generate Ecological Quality Indices (EQIs) by Freshwater Habitats (formerly Pond Conservation). The EQIs determine the Index of Biological Integrity (IBI), which is interpreted as an overall percentage and quality class. Ponds that meet 'High' quality or above qualify as Habitats of Principal Importance under the UK BAP, as do those which contain Species of Principal Importance.

Field study limitations

5.3.33 Surveys which required repeat visits were completed at the same location where land access limitations allowed. Permission was not granted to all survey sites throughout the survey period.

5.3.34 The Roman River was only surveyed in 2020, as it was not within the boundary of the proposed scheme in 2017.

5.3.35 The RICT (the tool used to classify macro-invertebrate data under the WFD) does not hold reference sites for manmade, non-flowing, or ephemeral water bodies (such as winterbournes or ditches) and it is optimised for data collected in both spring and autumn.

5.3.36 The environmental parameters for the River Brain and Domsey Brook 2 sites were at the extremes of the tolerances RICT software can analyse (suitability codes of four and five respectively). The RICT could not classify with confidence the macro-invertebrate communities in both 2017 and 2020. Biological metrics have still been presented for these sites to allow for assessment of the value of the habitat.

5.3.37 Several freshwater macro-invertebrate samples were collected using the sweep sampling methodology (as opposed to kick sampling) because the watercourse was too deep to safely enter. Two were deemed not to be fully representative of the communities present at the sites because mid channel habitats could not be reached and were therefore omitted from RICT classification (River Blackwater 1 in autumn 2020, River Blackwater 2 in autumn 2020). Biological metrics have still been presented for these sites to allow for assessment of the value of the habitat.

5.3.38 Species presence and distribution information for the field study is relevant to the period the information was collected, and it is acknowledged that colonisation and movement of species can occur at any time during, or after this period. Species may be present in any given area but not necessarily recorded or recognised during surveys.

5.3.39 The limitations to the surveys do not represent a significant constraint to adequately assess the value of aquatic habitats for the purposes of undertaking an appropriate EIA, with high confidence in the outcome. Where limitations are known, they are acknowledged in the evaluation of the results.

5.3.40 The findings of this report represent the professional opinion of qualified ecologists and do not constitute professional legal advice. The client may wish to seek professional legal interpretation of the relevant wildlife legislation cited in this document.

5.3.41 This report should be read in full, and excerpts may not be representative of the findings.

5.3.42 This report has been prepared exclusively for Jacobs' client and no liability is accepted for any use or reliance on the report by third parties.

6 Results

6.1 Desk Study

The WFD classification

6.1.1 A high-level assessment of Ordnance Survey (OS) mapping identified seven main rivers in the study area. Of these, six are designated WFD waterbodies and currently achieve overall Moderate classification (Cycle 2, 2019) (see Table 6.1).

Table 6.1 WFD classifications for watercourses in the study area (Cycle 2, 2019 (Environment Agency, 2020a))

Waterbody	Boreham Tributary	Blackwater (Combined Essex)	Domsey Brook	River Brain	River Ter	Roman River
ID	GB105037033910	GB105037041160	GB105037033870	GB105037041140	GB105037033940	GB105037034150
Overall	Moderate	Moderate	Moderate	Moderate	Moderate	Moderate
Biological	Good	Moderate	Good	Moderate	Moderate	Moderate
Fish	Not assessed	High	Not assessed	Not assessed	Not assessed	Moderate
Invertebrates	Good	High	Good	Good	High	Good
Macrophytes and phytobenthos combined	Good	Moderate	High	Not assessed	Moderate	Moderate
Hydromorphological	Supports Good	Not assessed	Supports Good	Supports Good	Supports Good	Supports Good
Physico-chemical	Good	Moderate	Good	Moderate	Moderate	Moderate
Specific pollutants	Not assessed	High	Not assessed	High	High	High

Freshwater macro-invertebrates

6.1.2 Classifications for WFD waterbodies in the study area are shown in Table 6.1. The data indicates these waterbodies consistently meet or exceed Good Status for the macro-invertebrate element (Cycle 2, 2019).

6.1.3 Three macro-invertebrate monitoring sites were identified from the study area (2010-2020 data, Environment Agency, 2020b; Table 6.2).

Table 6.2 Environment Agency macro-invertebrate data from waterbodies in the study area

Data	Waterbody		
	Domsey Brook	River Blackwater	Roman River
Site ID	54570	54569	54706
Grid reference	TL87600 19000	TL86110 18210	TL93400 24100
Years	2013-2014	2011, 2015-2016	2010-2019
Number of samples	4	6	19
WHPT Total	77.7- 98.7	115.4 - 165.2	40.3-124.1
WHPT ASPT	4.57-5.4	4.97- 5.01	4.47-5.44
WHPT NTAXA	17-20	23-33	8-23

6.1.4 *Gyrinus urinator* was the only notable, but not Red Data Book status, species identified from the Environment Agency data. This beetle is found in running streams and prefers shaded areas of gravel-based streams. The species was found in the River Blackwater in 2016.

Freshwater fish

6.1.5 Two waterbodies in the study area have been classified for fish under the WFD (see Table 6.1). The Roman River and River Blackwater achieve High and Moderate status respectively for the fish element.

6.1.6 Four waterbodies in the study area were identified in the Environment Agency data, including the River Brain, River Blackwater, Domsey Brook and Roman River. The freshwater fish communities are shown in Table 6.3.

6.1.7 Fish identified in the River Brain, River Blackwater and Roman River are typical of moderate sized watercourses, with moderate to fast flowing environments, and indicate a mix of limnophilic and rheophilic species. Environment Agency data indicates lower species richness in the Domsey Brook.

6.1.8 Three fish species were identified from the Environment Agency data which are afforded legal protection as listed below:

a. Brown trout, which are protected under the Salmon and Freshwater Fisheries Act (1975) and the WFD (2000/60/EEC). They are also listed under the UK BAP and Section 41 of the NERC as a priority species

b. Bullhead, which are protected under Annex II of The Conservation of Habitats and Species Regulations 2017 (as amended).

c. European eels which are protected under the European Eel Council Regulation ((EC) No. 1100/2007) and under the WFD (2000/60/EEC). They are listed under the UK BAP and Section 41 of the NERC as a priority species. European eels are also listed as Critically Endangered under the IUCN Red List (IUCN, 2020a).

6.1.9 Brown trout are found in fast flowing, stony, and clean gravelly rivers. Bullhead occur in freshwater streams and rivers with hard stony substrates and show a preference for fast flowing, shallow watercourses. European eels are found in a variety of freshwater environments, often associated with softer sediment but also utilising rocks and woody debris to reside under. Eel are migratory, spending their adult lives in freshwater but returning to the sea to spawn. They are also known to be able to cross land in wet conditions. Their presence depends, in part, on connectivity through the catchment to allow the egress of adult eels and ingress of juveniles.

Table 6.3 Environment Agency fish monitoring data from the study area

Waterbody	Site name	Grid reference	Survey date(s)	Species recorded from watercourse (all surveys)
Domsey Brook	A12 Culvert	TL87500 19000	2014	• bullhead • minnow *Phoxinus phoxinus* • ten-spined stickleback *Pungitius pungitius* • three-spined stickleback *Gasterosteus aculeatus*
River Blackwater	Blue Mills	TL82900 12900	2010-2011, 2014, 2017	• bullhead • minnow • three-spined stickleback • European eel • chub *Leuciscus cephalus* • common bream *Abramis brama* • common carp *Cyprinus carpio* • dace *Leuciscus leuciscus* • gudgeon *Gobio gobio* • perch *Perca fluviatilis*, • pike *Esox lucius*, • roach *Rutilus rutilus*, • roach x rudd hybrid *Rutilus rutilus x Scardinius erythrophthalmus*, • rudd *Scardinius erythrophthalmus* • ruffe *Gymnocephalus cernuus* • stone loach *Barbatula barbatula* • tench *Tinca tinca*
	Braxted FGS	TL84700 16100	2010-2011, 2014, 2017	
	Greys Mill	TL85900 17900	2011, 2014, 2017	
	Saint Marys Road	TL86500 18500	2011, 2014	
	U/S Braxted Hall	TL83900 15200	2011, 2014, 2017	
River Brain	Witham Park	TL82000 14000	2011	• bullhead • minnow • three-spined stickleback • European eel • chub • dace • gudgeon • pike • roach • stone loach
Roman River	Swan Bridge	TL93417 24208	2015	• three-spined stickleback • dace • roach • stone loach • brown trout

Freshwater macrophytes

6.1.10 One macrophyte site was identified from the study area. It was located upstream of the A12 in Kelvedon, approximately 350m from the A12 road. The site is located on the River Blackwater (TL86110 18210) at Site ID 149942 (no site name provided).

6.1.11 Macrophyte surveys have been carried out at this site on four separate occasions; 2008, 2010, 2013 and 2016 and indicate the community is typical of a lowland river.

6.1.12 River water-dropwort *Oenanthe fluviatilis* was recorded in 2010, 2013 and 2016. This species is listed as Near Threatened on the IUCN Red List (IUCN, 2020b).

6.1.13 No macrophyte species of Principal Conservation Importance or UK BAP species were identified.

White-clawed crayfish

6.1.14 Records of white-clawed crayfish from watercourses within the study area were requested from the Environment Agency, but not provided.

6.1.15 The Essex Wildlife Trust and Essex Field Club data request did not identify any records of white-clawed crayfish within the study area.

6.1.16 Records from the Nation Biodiversity Network website (NBN Atlas Partnership, 2021) provided one record of white-clawed crayfish within the study area from the River Blackwater (TL85150 16850) from 2001.

River habitat survey

6.1.17 One RHS site was identified from within the study area on the Roman River at TL9344 2417. The site received a HMS score of 330 and a HMS Class of three.

Pond habitat survey

6.1.18 A data search on the NBN and data received from the Essex Wildlife Trust returned no records for freshwater macro-invertebrate or macrophytes from ponds within the study area.

6.1.19 One freshwater macrophyte record was identified within the study area from the Essex Field Club data. The record was for the invasive species Nuttall's waterweed *Elodea nuttallii* at TL83 15.

6.2 Field Study

Habitat descriptions

6.2.1 The surveyed reach of the Boreham Brook is straight, <1m wide and 0.25m – 0.5m deep. The channel flows through fields (improved pasture) and is sporadically tree lined for most of its length on the right bank. The habitat at Boreham Brook is poor with homogenous flow and substrate dominated by fine materials (silt and sand). The site has been surveyed at two locations due to land access restrictions.

6.2.2 The Domsey Brook is crossed by the proposed scheme in two locations.

6.2.3 The first site (Domsey 1) is downstream of the existing A12 in the village of Kelvedon, upstream of the confluence with the River Blackwater. The reach flows through a heavily shaded woodland area. The width is predominantly between 1m - 5m, with depths between 0.25m - 0.75m. There are localised areas of deeper water between 0.5m - 1m. The substrate is variable, comprising a mixture of cobbles, pebbles, gravel, silt, and sand.

6.2.4 The second site (Domsey Brook 2) is immediately downstream of the A12 near Easthorpe. The reach surveyed is located within a field boundary, with improved pasture surrounding the watercourse on both banks. The channel is open, between 1m - 5m wide and 0.25m - 0.75m deep. Substrates are dominated by silt deposits, with localised areas of pebbles and gravels.

6.2.5 The Rivenhall Brook is straight, between 1m - 2m wide and 0.1m - 0.4m deep. The channel flows through tilled arable fields and is tree lined for most of its length. The habitat consists of areas of riffle and glide. The substrate comprises mostly sand and gravel with some cobbles, pebbles and silt also present.

6.2.6 The River Blackwater has been surveyed at two locations due to land access restrictions.

6.2.7 River Blackwater 1 comprises a section of the river downstream of the existing A12. It represents a typical large lowland river with a predominant glide habitat type with smaller run reaches. The downstream section of the river is between 5m – 10m wide and <1m deep. The channel is not shaded by any trees on the banks, although macrophytes in-channel provide some localised shading.

6.2.8 River Blackwater 2 comprises a section of the river upstream of the A12 which has discrete areas of broken shade, with predominantly fine substrates and a habitat defined as 100% slack. The upstream river width is between 5m - 10m, whilst depth was recorded as >1m.

6.2.9 The River Brain, upstream of the A12, is heavily shaded for a large length of the reach. It has simple vegetated banks and is between 1m - 10m in width and 0.25m – 0.5m. Some deeper pools create riffle-glide-pool complexes. The substrate is diverse, comprising a mixture of coarse and fine substrates. Downstream of the existing A12, the River Brain habitat is more homogenous, and the channel is straight.

6.2.10 The River Ter downstream of the A12 flows through a wooded and heavily shaded reach, width is varied between 5m - 10m and depth is predominantly <1m with localised deep pools (>1m). Upstream of the A12, the watercourse is relatively open, between 1m - 5m in width and <1m deep. Marginal areas and banks are well vegetated.

6.2.11 The Roman River downstream of the existing A12 flows through a wooded and heavily shaded reach. The width of the watercourse ranged between 2m - 3m and depth ranged between 0.1m - 0.3m. The habitat included riffle-glide-pool complexes. The substrates were dominated by gravel with small proportions of cobbles, pebbles, sand, and silt.

Freshwater macro-invertebrates

6.2.12 Freshwater macro-invertebrates were sampled in spring and autumn in 2017 and in 2020. In 2017, the Boreham Brook, River Ter, River Brian, River Blackwater, Domsey Brook and Rivenhall Brook were surveyed. In 2020, the same watercourses were surveyed with the addition of the Roman River. Land access prevented some sites from being sampled, with representative alternative locations sampled where possible.

6.2.13 The RICT was performed on the macro-invertebrate data; Table 6.4 provides the EQRs and WFD classifications.

6.2.14 In autumn 2017, all sites except for Boreham Brook achieve Good status or above for macro-invertebrate communities indicating minor variation from reference conditions.

6.2.15 The Boreham Brook achieved Moderate status in autumn 2017, driven by poor species richness (WHPT NTAXA). The remaining samples collected achieved Good or above.

6.2.16 The EQRs and associated WFD classifications have not been provided for each sample collected (see Table 6.4). Several freshwater macro-invertebrate samples were collected using the sweep sampling methodology because the watercourse was too deep to safely enter. Two were deemed not to be representative of the communities present at the sites because mid channel habitats could not be reached and were therefore omitted from RICT classification (River Blackwater 1 in autumn 2020, River Blackwater 2 in autumn 2020).

6.2.17 The environmental parameters for the River Brain and Domsey Brook 2 sites were at the extremes of the tolerances RICT software can analyse (suitability codes of 4 and 5 respectively). The RICT could not classify with confidence the macro-invertebrate communities in both 2017 and 2020 and as such, the results have not been included in Table 6.4.

Table 6.4 EQR scores and WFD classifications for macro-invertebrate communities in watercourses surveyed in 2017 and in 2020

Site	Grid reference	Survey date	Index	EQR	Class	Confidence of class	Overall Classification
Boreham Brook 1	TL74662 09586	Spring 2017	WHPT ASPT	0.94	Good	52.79	Good
			WHPT NTAXA	0.76	Good	38.83	
		Autumn 2017	WHPT ASPT	0.94	Good	47.51	Moderate
			WHPT NTAXA	0.58	Moderate	38.00	
		Autumn 2020	WHPT ASPT	0.97	High	49.71	High
			WHPT NTAXA	1.05	High	97.45	
Boreham Brook 2	TL75120 09331	Spring 2020	WHPT ASPT	0.92	Good	54.31	Good
			WHPT NTAXA	0.88	High	72.39	

Site	Grid reference	Survey date	Index	EQR	Class	Confidence of class	Overall Classification
Domsey Brook 1	TL87527 19000	Spring 2017	WHPT ASPT	0.93	Good	52.46	Good
			WHPT NTAXA	0.82	High	56.33	
		Autumn 2017	WHPT ASPT	0.92	Good	51.15	Good
			WHPT NTAXA	0.74	Good	39.22	
		Spring 2020	WHPT ASPT	0.93	Good	53.49	Good
			WHPT NTAXA	1.05	High	97.54	
		Autumn 2020	WHPT ASPT	0.99	High	58.62	High
			WHPT NTAXA	0.85	High	66.24	
Rivenhall Brook	TL84533 16488	Spring 2017	WHPT ASPT	1.04	High	83.57	High
			WHPT NTAXA	1.20	High	99.94	
		Autumn 2020	WHPT ASPT	1.01	High	71.63	High
			WHPT NTAXA	1.07	High	98.31	
River Blackwater 1	TL85562 17647	Spring 2017	WHPT ASPT	1.02	High	72.46	High
			WHPT NTAXA	1.11	High	98.97	
		Autumn 2017	WHPT ASPT	1.03	High	74.56	High
			WHPT NTAXA	0.84	High	60.27	
		Spring 2020	WHPT ASPT	1.15	High	98.02	High
			WHPT NTAXA	1.07	High	97.64	
River Blackwater 2	TL84392 15798	Spring 2020	WHPT ASPT	1.04	High	79.64	High
			WHPT NTAXA	1.36	High	100.00	
River Ter	TL78355 11358	Spring 2017	WHPT ASPT	1.18	High	99.8	High
			WHPT NTAXA	0.95	High	88.21	
		Autumn 2017	WHPT ASPT	1.25	High	99.95	High
			WHPT NTAXA	0.80	High	48.14	
		Autumn 2020	WHPT ASPT	1.07	High	88.07	High
			WHPT NTAXA	1.02	High	95.79	
Roman River	TL93284 24400	Spring 2020	WHPT ASPT	0.94	Good	51.74	Good
			WHPT NTAXA	0.97	High	90.51	
		Autumn 2020	WHPT ASPT	1.02	High	72.54	High
			WHPT NTAXA	0.86	High	65.96	

6.2.18 Biological metrics have been calculated for each sample and are provided in Table 6.5. Across the study area WHPT scores ranged between 37.2-166.2. The scores fluctuate between survey seasons for most sites, which is not

unexpected due to the different life-stages of macro-invertebrate species. One exception was the community at Domsey Brook 2 which received consistently low WHPT scores, suggesting species more tolerant of poor water quality were prevalent.

6.2.19 The WHPT ASPT scores at Domsey Brook 2 were low in comparison to the other sites sampled (3.53 and 3.95). The community present was likely influenced by modified habitat, low summer flow, and adjacent agricultural land drainage. The WHPT ASPT scores across the remaining sites were higher (ranging between 4.10 and 6.05) indicating the macro-invertebrate community contains a number of species more sensitive to environmental changes.

6.2.20 The WHPT NTAXA scores across the study area ranged between 9 and 32. The WHPT NTAXA scores recorded from the River Blackwater and River Brain in autumn 2020 were lower than previous survey scores as sweep samples were taken. As discussed above these samples were omitted from WFD classification as they were not deemed to be representative of the environment present.

6.2.21 The macro-invertebrate communities sampled in 2017 and 2020 have LIFE scores which ranged from 6.0 to 8.38. Higher LIFE scores indicate a higher number of taxa with a preference for faster flows.

6.2.22 The PSI scores across the study area indicate that watercourses ranged from minimally sedimented to heavily sedimented. Domsey Brook 2 was the only site that received consistently low PSI scores (1.14 and 1.0), indicating a macro-invertebrate community typical of a fine sediment dominated habitat.

6.2.23 The CCI scores ranged from low to moderate for the Boreham Brook, Domsey Brook, River Blackwater 1, River Brain, River Ter, Roman River and Rivenhall Brook (autumn 2020). The macro-invertebrate communities within the Rivenhall Brook (spring 2017) and River Blackwater 2 have a Fairly High conservation value.

6.2.24 No species of conservation interest (CCI score of seven or above), or species listed on the Essex LBAP were recorded.

6.2.25 Full macro-invertebrate taxa lists are presented in Annex A.

Table 6.5 Biological metrics for aquatic macro-invertebrates sampled in 2017 and 2020

Site	Grid reference	Survey date	WHPT	WHPT NTAXA	WHPT ASPT	LIFE (sp)	PSI (sp)	CCI
Boreham Brook 1	TL74662 09586	Spring 2017	90.0	18	5.00	8.38	76.92	8.33
		Autumn 2017	60.1	13	4.62	8.00	64.71	4.67
		Autumn 2020	120.6	25	4.82	7.52	41.51	7.65
Boreham Brook 2	TL75120 09331	Spring 2020	102.8	21	4.90	7.59	45.65	4.33
Domsey Brook 1	TL87527 19000	Spring 2017	97.6	20	4.88	7.38	46.03	4.63
		Autumn 2017	81.2	18	4.51	7.77	57.50	4.09

Site	Grid reference	Survey date	WHPT	WHPT NTAXA	WHPT ASPT	LIFE (sp)	PSI (sp)	CCI
		Spring 2020	127.3	26	4.90	7.04	41.18	8.41
		Autumn 2020	102.6	21	4.89	7.11	32.50	3.80
Domsey Brook 2	TL 89882 21631	Spring 2017	59.3	15	3.95	6.44	16.67	1.14
		Spring 2020	56.5	16	3.53	6.00	9.52	1.00
Rivenhall Brook	TL84533 16488	Spring 2017	166.2	30	5.54	7.46	52.46	10.92
		Autumn 2020	137.0	27	5.07	7.45	56.10	6.33
River Blackwater 1	TL85562 17647	Spring 2017	120.1	26	4.62	6.80	22.22	9.33
		Autumn 2017	88.0	20	4.40	6.18	13.95	9.67
		Spring 2020	130.4	25	5.22	7.58	46.03	8.64
		Autumn 2020	37.2	9	4.13	7.00	25.00	4.00
River Blackwater 2	TL84392 15798	Autumn 2017	77.9	19	4.10	6.56	9.38	11.00
		Spring 2020	153.1	32	4.78	6.71	23.88	10.50
		Autumn 2020	59.5	12	4.96	6.83	15.38	11.25
River Brain	TL 82897 13713	Spring 2017	99.3	23	4.32	6.78	31.71	4.31
		Autumn 2017	105.7	21	5.03	7.07	43.18	5.36
		Spring 2020	120.7	26	4.64	7.00	26.83	7.89
		Autumn 2020	67.9	16	4.24	6.50	6.67	6.00
River Ter	TL 78355 11358	Spring 2017	137.5	23	5.98	8.18	77.59	7.14
		Autumn 2017	120.9	20	6.05	8.13	73.13	9.55
		Autumn 2020	133.3	26	5.13	6.79	26.47	7.50
Roman River	TL93284 24400	Spring 2020	120.3	24	5.01	7.62	54.76	7.06
		Autumn 2020	106.8	21	5.09	7.26	40.00	3.94

Freshwater fish

6.2.26 Freshwater fish were surveyed at five sites in 2017 and six sites in 2020. In both years, sites were surveyed using a 3-run catch depletion method, except for Boreham Brook and the River Blackwater in 2020. Low water levels and heavy channel choking restricted access and only allowed spot checking on Boreham Brook. The River Blackwater was dominated by submerged and emergent macrophytes that significantly reduced the efficiency of observing and catching fish using electric fishing. To prevent damage to fish this site was fished with a single run, semi quantitatively method.

6.2.27 Table 6.6 provides the abundance of fish and range of fish lengths recorded during both survey years.

Table 6.6 Freshwater fish abundance and length range (mm) at each survey site from 2017 and 2020

Survey year	Species	Freshwater fish abundance (length range length (mm))					
		Boreham Brook	Domsey Brook 1	River Blackwater 1	River Brain	River Ter	Roman River
		TL74630 09787	TL87518 18978	TL 85562 17647	TL 82903 13721	TL 78355 11358	TL93284 24400
2017	Chub	-	-	3 (230-440)	8 (315-400)	11 (90-280)	-
	Gudgeon	-	-	4 (100-115)	107 (90-130)	-	-
	Bullhead	12 (35-80)	23 (30-95)	18 (35-80)	83 (35-80)	59 (25-70)	-
	Roach	-	-	12 (60-210)	63 (60-265)	-	-
	European eel	1 (90)	-	-	4 (110-470)	1 (280)	-
	Minnow	-	77 (20-90)	67 (20-80)	95 (20-70)	-	-
	Perch	-	-	1 (95)	6 (40-190)	1 (155)	-
	Dace	-	6 (55-110)	3 (75-170)	17 (75-245)	21 (75-255)	-
	Stone loach	-	6 (30-90)	12 (80-110)	18 (75-120)	1 (45)	-
	Pike	-	-	1 (270)	2 (220-260)	1 (295)	-
	Lamprey (ammocoete)	-	-	-	-	2 (90-180)	-
	Three-spined stickleback	5 (15-60)	4 (25-50)	10 (20-35)	-	2 (20-30)	-
	Brown trout	-	3 (65-100)	-	-	6 (65-300)	-
2020	Chub	-	-	1 (170)	51 (95-324)	24 (104-220)	-
	Gudgeon	-	2 (105-106)	6 (105-138)	66 (85-135)	3 (11-123)	-
	Bullhead	8 (31-80)	27 (26-73)	7 (27-65)	87 (30-133)	28 (25-65)	-
	Roach	-	-	6 (161-205)	1(185)	12 (85-146)	5 (48-124)
	European eel	2 (length unknown)	1 (length unknown)	-	-	2 (200-300)	-
	Minnow	-	430 (23-249)	34 (32-65)	41 (21-56)	1 (82)	-
	Perch	-	-	-	-	1 (131)	-

Survey year	Species	Freshwater fish abundance (length range length (mm))					
		Boreham Brook	Domsey Brook 1	River Blackwater 1	River Brain	River Ter	Roman River
		TL74630 09787	TL87518 18978	TL 85562 17647	TL 82903 13721	TL 78355 11358	TL93284 24400
	Dace	-	2 (775)	-	23 (35-195)	13 (120-175)	-
	Stone loach	-	-	4 (86-111)	37 (10-105)	-	-
	Pike	-	-	1 (585)	11 (117-230)	2 (135-190)	-
	Lamprey	-	-	-	-	1 (148)	-
	Three-spined stickleback	3 (30-68)	18 (17-47)	1 (30)	-	3 (35-41)	13 (26-55)
	Brown trout	-	-	1 (length unknown)	-	19 (80-320)	57 (67-109)

6.2.28 In total, 13 different species were recorded from a range of surveyed habitats in the study area.

6.2.29 Three species were recorded from the Boreham Brook (bullhead, European eel and three-spined stickleback). The lack of habitat, flow, and substrate diversity in the survey reach is reflected in the poor species richness of the fish community.

6.2.30 Minnow were dominant at Domsey Brook 1. Seven other species were recorded including bullhead, brown trout, and European eel, as well as a range of other species typical of smaller watercourses with moderate to fast flowing environments.

6.2.31 Eleven species were identified from the River Blackwater indicating a greater species richness at this site despite the homogenous habitat that was present. Minnow were dominant, rheophilic species such as brown trout, chub and dace were also prevalent as well as benthic species such as bullhead, gudgeon and stone loach.

6.2.32 Ten species were found in the River Brain. Minnow were dominant and high numbers of bullhead, gudgeon and roach were recorded. Overall, the species composition from the river was typical of moderately size lowland watercourses.

6.2.33 The greatest number of species were recorded from the River Ter. Rheophilic species such as brown trout, chub and dace were prevalent in areas of faster flow. Benthic species such as (bullhead, gudgeon and stone loach) were also present.

6.2.34 Despite diverse substrate, flow, and habitat in the Roman River, only three fish species were recorded. The highest abundance of brown trout was recorded in this river. Fish were found primarily in two pools along the survey reach which was otherwise very shallow in 2017.

6.2.35 Across all survey sites in 2017 and in 2020, four species of conservation interest were found (brown trout, bullhead, European eels, and river / brook lamprey). Brown trout, bullhead, and European eels are afforded legal protection as listed in Section 6.1.8. River / brook lamprey are both listed under Annex II of the Habitats Directive (river lamprey are also listed under Annex V of the Habitats Directive and is a species listed in accordance with the requirements of Section 41 of the NERC – however species was not confirmed).

Freshwater macrophytes

6.2.36 Macrophytes were surveyed in 2017 and in 2020. The locations of the surveys are listed in Table 6.7.

Table 6.7 Macrophyte surveys undertaken by Jacobs for the A12 project

Site name	Waterbody	Grid reference	Date surveyed
Boreham Brook (downstream)	GB105037033910	TL74662 09586 TL74615 09865	2017 2020
River Ter (upstream)	GB105037033940	TL78097 11745	2017
River Ter (downstream)		TL78355 11358	2017, 2020
River Brain (upstream)	GB105037041140	TL82714 13804*	2017, 2020
River Brain (downstream)		TL82895 13717	2017 2020
River Blackwater (upstream)	GB105037041160	TL85589 17735	2017
River Blackwater (downstream)		TL85566 17654	2017, 2020
Domsey Brook 1 (downstream)	GB105037033870	TL87534 19009	2017, 2020
Domsey Brook 2 (downstream)		TL89884 21635	2017
*The macrophyte survey reach in 2017 was approximately 50m upstream compared with 2020 survey reach			

6.2.37 Characterisation of the macrophyte communities is provided below for each watercourse. Observed LEAFPACS metrics and associated WFD Classifications are provided in Table 6.8.

Boreham Brook

6.2.38 A number of marginal species were identified including bittersweet nightshade (*Solanum dulcamara*), willowherb (*Epilobium hirsutum*) and great water dock (*Rumex hydrolapathum*), each with cover values of <1%.

6.2.39 The NFG score which gives an indication of truly aquatic species within the community achieves 2 in both 2017 and 2020. Species identified were fool's watercress (*A. nodiflorum*) in 2017 and 2020, water hemlock (*Oenanthe crocata*) in 2017 and filamentous green algae in 2020.

6.2.40 Filamentous algae was observed in 2020 as 0.05%. None was recorded in 2017.

6.2.41 The River Macrophyte Nutrient Index (RMNI) scored above eight on both sampling occasions which gives an indication that the watercourse at this location comprises a species more tolerant of nutrient enrichment.

6.2.42 Boreham Brook achieves Poor WFD classification, indicating a watercourse suffering environmental stress.

River Ter

6.2.43 The RMNI scores were above 7.5 in both 2017 and 2020 upstream and downstream of the A12 road, suggesting some species within the community were more sensitive to poor water quality.

6.2.44 Six scoring taxa were observed downstream in 2020, five of which were aquatic species and with 1.7% cover of filamentous algae. Species observed include water mint (*Mentha aquatica*) (<1%), water forget-me-not (*Myosotis scorpiodes*) (2.5% - 5%) and duckweed (*Lemna minor* and *Lemna minuta*), (each <1%). The community downstream in 2020 achieves WFD Good status.

6.2.45 In 2017, the macrophyte community was classed as Moderate both upstream and downstream of the A12 road. Although a number of species were observed including those submerged taxa such as water starwort (*Callitriche* spp.) the liverwort (*Pellia endiviifolia*) and duckweed (*L. minor*), species diversity using WFD metrics was poor with only two scoring taxa observed upstream and downstream both of which were truly aquatic, water starwort and fool's watercress.

River Brain

6.2.46 Although the habitats were considerably different upstream and downstream of the A12, the LEAFPACS2 metrics suggest similar sensitivities to nutrient enrichment with RMNI scores between 7.76 and 8.37.

6.2.47 The number of truly aquatic species observed was marginally higher upstream of the A12, with five recorded in 2017 compared to downstream where four were recorded in 2017 and five in 2020.

6.2.48 Species which were identified were typical of a permanently wetted river system, including the branched bur-reed (*Sparganium erectum*) (upstream and downstream), submerged bur-reed (*Sparganium emersum*) (upstream and downstream) duckweed, (*L. minor* and *L. minuta)* (downstream), water starwort (downstream) and fool's watercress (upstream and downstream).

6.2.49 Other species which were observed that are less ubiquitous are two types of pondweed (*Potamogeton trichoides* and *Potamogeton pectinatus*) (upstream).

6.2.50 No filamentous algae has been recorded at the sites upstream and downstream of the A12.

6.2.51 The WFD classification indicates in 2017, the macrophyte community upstream of the A12 achieved Good, whilst in 2020, the macrophyte community achieves Moderate. The sampling site in 2020 was approximately 50m upstream compared to the 2017 site which may account for the difference in community abundance (60% total cover in 2017 and 6% in 2020). Downstream of the A12 in 2017 and 2020, the community achieves Moderate.

River Blackwater

6.2.52 The macrophyte community upstream and downstream of the A12 was diverse, with 15 species recorded upstream, and 18 and 23 downstream (2017 and 2020 respectively).

6.2.53 Downstream of the A12, pondweed (*P. pectinatus*), reed canary grass (*P. arundinacea*) and branched bur-reed were the most prevalent. A number of other submerged and emergent species were identified including arrowhead (*Sagittaria sagittifolia*), common clubrush (*Schoenoplectus lacustris*), duckweed (*Spirodella polyrhiza*) and amphibious bistort (*Persicaria amphibia*).

6.2.54 A similar macrophyte community was identified upstream with slightly less truly aquatic species (four) than downstream (seven in 2017 and nine in 2020).

6.2.55 Water dropwort was recorded upstream and downstream of the A12 in 2017 and 2020, with cover values of 2.5% - 5%. This species was considered Near Threatened (IUCN, 2020b).

6.2.56 In 2017, both upstream and downstream sites achieved WFD Good status indicating the community shows minor deviation from pristine conditions for a watercourse of this nature. Downstream in 2020, the watercourse achieved Moderate for macrophytes.

6.2.57 The invasive non-native species Himalayan balsam (*Impatiens glandulifera*) was identified upstream (2017) and downstream (2017 and 2020) of the A12 in the River Blackwater.

Domsey Brook 1

6.2.58 Species diversity was low totalling four species in 2017 and five species in 2020. In 2017, the most prevalent species observed was the liverwort (1% - 2.5% cover) and in 2020 fool's watercress was most dominant (2.5% - 5% cover). No filamentous algae was observed.

6.2.59 In 2017, the site was unable to be classified for the purposes of WFD as no truly aquatic species were present. In 2020, the community achieves Moderate.

Domsey Brook 2

6.2.60 Fools watercress, reed canary grass, duckweed (*L. minor*) and bur-reed were most prevalent throughout the survey area (with cover values ranging between 10% - 50%). The remaining five species identified covered <0.1% of the survey area.

6.2.61 The RMNI scores gives an indication of nutrient enrichment from low (one) to high (ten). Domsey Brook 2 achieves 8.19. No filamentous algae was recorded.

6.2.62 WFD classification was Poor, suggesting deviation from reference conditions of a site of this nature.

Table 6.8 Macrophyte indices (River Macrophyte Nutrient Index (RMNI), Number of Taxa (NTAXA), NTAXA including non-scoring taxa, Number of Functional Groups (NFG) and Percentage algal cover (ALG)) and WFD Classification (Ecological Quality Ratio (EQR) and Confidence of Class).

Site	Year	Observed RMNI	Observed NTAXA (scoring species)	Observed NTAXA (inc. non-scoring species)	Observed NFG	Observed ALG	EQR	Class	Confidence in Class
Boreham Brook (downstream)	2017 2020	8.22 8.05	2 2	11 9	1 2	0 0.05	0.27 0.34	Poor Poor	71.1 72.3
River Ter (upstream)	2017	7.87	2	12	2	0	0.56	Moderate	66.6
River Ter (downstream)	2017 2020	7.52 7.57	2 6	7 10	2 5	0 1.7	0.59 0.78	Moderate Good	53.1 67.3
River Brain (upstream)	2017 2020	7.76 8.37	6 6	11 7	4 5	0 0	0.72 0.48	Good Moderate	89.4 75.7
River Brain (downstream)	2017 2020	8.15 8.25	4 5	9 11	4 4	0 0	0.50 0.52	Moderate Moderate	78.3 77.2
River Blackwater (upstream)	2017	8.23	7	15	4	0	0.60	Good	51.4
River Blackwater (downstream)	2017 2020	8.11 8.31	9 13	18 23	7 9	0 0.05	0.68 0.58	Good Moderate	86.8 59.2
Domsey Brook 1 (downstream)	2017 2020	6.81 7.75	0 2	4 5	0 2	0 0	- 0.53	- Moderate	- 76.3
Domsey Brook 2 (downstream)	2017	8.19	3	10	3	0	0.37	Poor	62.3

White-clawed crayfish

6.2.63 No white-clawed crayfish, nor evidence of their presence, were recorded at any of sites surveyed in 2017 (River Ter, River Brain or River Blackwater) or 2020 (River Ter, River Brain, River Blackwater, Domsey Brook or Roman River). No crayfish, including non-natives were recorded.

River Habitat Survey (RHS)

6.2.64 The RHS were undertaken on five watercourses, the survey results are presented in Table 6.9.

6.2.65 The River Ter, River Brain and River Blackwater achieved a habitat modification class of Severely Modified predominantly due to extensive artificial modification and re-sectioning. In all cases the survey reach included the existing A12 crossing whilst the historic effects of previous physical habitat intervention (for example embankments, resectioning and planting) maintain an effect on riverine functioning.

6.2.66 Recording less historic modification along its planform the Domsey Brook achieved a HMS of Significantly Modified. The RHS survey encompassed significant modification from the existing A12 crossing and minor road crossing, but downstream was well buffered from the agricultural landscape by woodland and scrub.

6.2.67 The Roman River received a HMS of Predominantly Unmodified. Due to access constraints this site did not fully encompass the realigned section of the Roman River immediately below the existing A12 crossing. Downstream of the crossing, the river runs relatively unmodified through woodland and pasture, and other than some isolated section of bank modification to protect bank top industry, the river functions naturally.

Table 6.9 RHS survey results*The RHS survey reaches in 2017 and 2020 were completed at different locations due to land access constraints.

Watercourse	Grid reference	Year	Habitat Modification Score (HMS)	Habitat Modification Score (Class)	Habitat Quality Assessment (HQA)
River Ter	TL78368 11313	2017	1570	5 - Severely Modified	49
	TL78367 11312	2020	1615	5 - Severely Modified	50
River Brain	TL82942 13710	2017	2695	5 - Severely Modified	36
River Blackwater*	TL85590 17719	2017	3340	5 - Severely Modified	38
	TL85451 17544	2020	2830	5 - Severely Modified	36
Domsey Brook	TL87521 18984	2020	1235	4 – Significantly Modified	41

Watercourse	Grid reference	Year	Habitat Modification Score (HMS)	Habitat Modification Score (Class)	Habitat Quality Assessment (HQA)
Roman River	TL93281 24402	2020	155	2 - Predominantly Unmodified	50

Pond biodiversity (PSYM)

6.2.68 The PSYM surveys were undertaken on 10 ponds within the study area.

6.2.69 The PSYM classification and key outputs are summarised in Table 6.10. Full PSYM output data is presented in Annex B.

Table 6.10 Summary of PSYM pond habitat quality classifications.

Pond	Grid reference	Survey date	Index of Biotic Integrity (%)	PSYM quality category
Pond 14	TL91080 22795	26/06/2017	39%	Poor
Pond 43	TL86840 17867	28/06/2017	11%	Very Poor
Pond 43	TL86840 17867	13/08/2020	33%	Poor
Pond 76	TL83015 14854	12/08/2020	50%	Poor
Pond 39	TL87838 19174	13/08/2020	39%	Poor
Pond 77	TL83113 15003	12/08/2020	50%	Poor
Pond 91	TL81436 12909	12/08/2020	22%	Very Poor
Pond 91	TL81436 12909	27/06/2017	22%	Very Poor
Pond 99	TL79901 12675	11/08/2020	67%	Moderate
Pond 101	TL80081 11936	11/08/2020	72%	Moderate
Pond 120	TL74046 09142	29/06/2017	11%	Very Poor
Pond 154	TL81053 12069	11/08/2020	56%	Moderate

6.2.70 The overall IBI was low for the majority of the ponds surveyed, and these ponds demonstrated a lack of Odonata and Megaloptera (OM) (alderfly and dragonfly families), and the number of beetle families observed was generally much lower than expected than reference conditions.

6.2.71 The PSYM classification for all ponds was Moderate, therefore no ponds qualify as BAP priority habitat based on their PSYM category. No species of conservation importance were identified.

7 Discussion

7.1 Summary

Freshwater macro-invertebrates

7.1.1 Macro-invertebrate communities identified from surveyed sites were typical of small streams and moderately sized lowland rivers.

7.1.2 All sites, with the exception of the Boreham Brook in autumn 2017 achieved Good or above WFD status for macro-invertebrates indicating only minor deviation from reference conditions. The Boreham Brook achieved Moderate status in autumn 2017, driven by poor species richness (WHPT NTAXA), potentially linked to poor habitat.

Freshwater fish

7.1.3 Freshwater fish communities identified from surveyed sites were typical of smaller/medium watercourses with moderate to fast flowing environments.

7.1.4 Four species of conservation interest were identified from surveyed sites in 2017 and 2020. Each of these species is afforded the following legal protection:

a. Brown trout which are protected under the Salmon and Freshwater Fisheries Act (1975) and the WFD (2000/60/EEC). They are also listed under the UK BAP and Section 41 of the NERC as a priority species.

b. Bullhead which are protected under Annex II of the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.

c. European eels which are protected under the European Eel Council Regulation ((EC) No. 1100/2007) and under the WFD (2000/60/EEC). They are listed under the UK BAP and Section 41 of the NERC as a priority species. European eels are also listed as critically endangered under the IUCN Red List (IUCN, 2020a).

d. River/brook lamprey which are listed under Annex II of the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019 (river lamprey are also listed under Annex V of the Regulations and are priority species under the UK BAP as well as Section 41 of the NERC but species was not confirmed).

Freshwater macrophytes

7.1.5 The sites surveyed in 2017 and 2020 were typical of small streams and lowland rivers in a semi-rural environment. Macrophyte communities were broadly ubiquitous to these habitat types, reasonably sensitive to nutrient enrichment, with species richness and abundances that vary between sites/habitats.

7.1.6 Boreham Brook and Domsey Brook were considered much smaller watercourses in comparison to the rivers sampled for this proposed scheme and likened to small streams running along field boundaries and relatively straight in nature. Less than three scoring taxa were identified, and it is considered likely the nature of the habitat is the underlying reason for failure to meet WFD Good status.

7.1.7 The Rivers Ter and Brain were considered larger lowland rivers than the Boreham Brook and Domsey Brook; the channel was wider (<10m) with glide-pool-riffle complexes and sinuous characteristics in localised areas. Although a greater number of taxa were identified, the number of truly aquatic species was still relatively low, indicating a greater proportion of those species with a preference for marginal areas where the channel may not be wetted 100% of the year. The River Ter downstream (2020) and River Brain upstream (2017) achieved Good for WFD classification. All other sampling occasions achieved Moderate suggesting slight deviation from reference conditions with no anthropogenic stressors.

7.1.8 The river water dropwort was identified upstream and downstream of the A12 in the River Blackwater in 2017 and 2020. The IUCN Red Data Book classes this species as Near Threatened (IUCN, 2020b).

White-clawed crayfish

7.1.9 No white-clawed crayfish, or signs of their presence, were found during the field study.

River Habitat Survey (RHS)

7.1.10 Surveys indicated that watercourses across the study area ranged from Predominantly Unmodified to Severely Modified, and all have been affected by historic alteration or intervention that affects natural riverine function.

Pond biodiversity (PSYM)

7.1.11 The PSYM classification for all ponds achieved Moderate or below. The aquatic macro-invertebrates and macrophytes observed were mostly indicative of agriculturally influenced still-waters.

7.2 Evaluation

Freshwater macro-invertebrates

7.2.1 Many of the observed species were ubiquitous to aquatic habitats with indistinct habitat preferences. General aquatic macro-invertebrate analysis indicates some watercourses in the study area support high species diversity. There were no species of conservation interest reported from the surveyed sites.

7.2.2 Using the DMRB LA 108 – Biodiversity (Highways England, 2020b) the macro-invertebrate communities at all surveyed sites (Boreham Brook, River Blackwater, River Ter, Roman River, River Brain, Rivenhall Brook and Domsey Brook) have been evaluated as of **Local** importance.

Freshwater fish

7.2.3 Freshwater fish were recorded from all the sites surveyed, the species observed were typical of lowland rivers and streams. At least one of the following species which are afforded legal protection were recorded from each surveyed watercourse:

a. Brown trout

b. Bullhead

c. European eel

d. River/brook lamprey.

7.2.4 The European eel is listed as Critically Endangered (IUCN, 2020a). This species was found from the Boreham Brook, Domsey Brook 1, River Brain and River Ter. As a result, using the DMRB LA 108 – Biodiversity (Highways England, 2020) freshwater fish communities from these rivers have been evaluated as of **County** importance.

7.2.5 Freshwater fish communities have been evaluated as **Local** value on the River Blackwater and Roman River.

Freshwater macrophytes

7.2.6 Each species of macrophyte have specific habitat preferences for establishment and prevalence within a community. Factors such as light (shading), flow, substrate and water quality all impact the presence or absence of species within the community.

7.2.7 Using the DMRB LA 108 – Biodiversity (Highways England, 2020) macrophyte communities from the sites surveyed in the **Boreham Brook, River Ter, River Brain and Domsey Brook** have been evaluated as of **Local** importance for biodiversity. The habitats and species present were typical of watercourses of their nature.

7.2.8 The macrophyte community within the River Blackwater was noticeably more diverse and abundant than the others surveyed; the survey reaches were typical of a large lowland river, wide, with diverse substrate, habitat and flow-types.

7.2.9 Water dropwort was identified in the River Blackwater both upstream and downstream of the A12 in 2017 and 2020. This species was also identified from Environment Agency data at another location near Kelvedon in the River Blackwater on several monitoring occasions (2008, 2010, 2013, 2016).

7.2.10 The IUCN Red Data Book lists this species as Near Threatened (IUCN, 2020). As such, using the DMRB LA 108 – Biodiversity (Highways England, 2020) the macrophyte communities from the sites surveyed on the **River Blackwater** have been evaluated as of **County** importance.

White-clawed crayfish

7.2.11 No white-clawed crayfish were identified in the study area.

Pond biodiversity (PSYM)

7.2.12 All ponds surveyed using the PSYM methodology were classified as Moderate or below and no species of conservation interest were found. Using the DMRB LA 108 – Biodiversity (Highways England, 2020) all surveyed ponds have been evaluated as of **Local** importance.

8 Acronyms and abbreviations

Chartered Institute of Ecology and Environmental Management (CIEEM)

Community Conservation Index (CCI)

Convention on Biological Diversity (CBD)

Development Consent Order (DCO)

Ecological Quality Indices (EQIs)

Ecological Quality Ratio (EQR)

Environmental Statement (ES)

Filamentous algae (ALG)

Good Ecological Potential (GEP)

Good Ecological Status (GES),

Habitat Modification Score (HMS)

Habitat Quality Score (HQS)

Index of Biological Integrity (IBI)

Local BAPs (LBAPs)

Lotic Invertebrate Index for Flow Evaluation (LIFE)

Nationally Significant Infrastructure Project (NSIP)

Natural Environment and Rural Communities (NERC)

Number of Coleoptera families (CO)

Number of Functional Groups (NFG)

Number of Odonata and Megaloptera families (OM)

Number of submerged and marginal (not floating) species (SM)

Number of Taxa (WHPT NTAXA)

Number of uncommon plant species (U)

Ordnance Survey (OS)

Pond habitat survey (Predictive System for Multimetrics (PSYM)

Proportion of Sediment sensitive Invertebrates (PSI)

River Habitat Survey (RHS)

River Invertebrate Classification Tool (RICT)

River Macrophyte Nutrient Index (RMNI)

Trophic Ranking Score (TRS)

UK Biodiversity Action Plan (UK BAP)

Water Framework Directive (WFD)

Whalley, Hawkes, Paisley & Trigg (WHPT)

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10 Glossary

Coleoptera	Insect order, consisting of the beetles and weevils.
Kick and Sweep Sampling	Technique which involves agitating the stones or sediment of a river or stream by foot and catching the sample in a sturdy hand net that is held downstream.
Limnophilic	Organisms which prefer to live in lakes, ponds, marshes, pools or other slow moving, still or stagnant water.
Megaloptera	Insect order, consisting of alderflies, dobsonflies and fishflies
Odonata	Insect order, consisting of dragonflies and damselflies
Rheophilic	Organisms which prefer to live in fast flowing water

Annex A – Macro-invertebrate field survey data

Table A.1 Macro-invertebrate species records for sites sampled in 2017

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2	River Brain		River Ter DS	
	23/05/2017	03/10/2017	24/05/2017	03/10/2017	24/05/2017	25/05/2017	24/05/2017	04/10/2017	04/10/2017	23/05/2017	03/10/2017	23/05/2017	03/10/2017
Adicella reducta	0	0	0	0	0	2	0	0	0	0	0	0	0
Agapetus fuscipes	172	11	49	205	0	11	0	0	0	0	0	110	146
Agapetus sp.	10	47	0	5	0	0	0	0	0	0	0	0	39
Alboglossiphonia heteroclita	0	0	0	0	0	0	0	0	0	0	1	0	0
Anacaena bipustulata	0	0	0	0	0	0	0	0	1	0	0	0	0
Anacaena lutescens	0	0	0	0	0	0	0	1	0	0	0	0	0
Ancylus fluviatilis	0	0	0	0	0	0	0	0	0	0	0	1	0
Anisus vortex	0	0	0	0	0	0	0	16	2	0	0	0	0
ASELLIDAE	0	0	0	3	7	0	0	0	0	0	0	0	0
Asellus aquaticus	3	1	10	7	111	27	2	18	11	84	127	0	0
Athripsodes albifrons	0	0	1	0	0	0	0	0	0	0	0	0	10

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2	River Brain		River Ter DS	
	23/05/2017	03/10/2017	24/05/2017	03/10/2017	24/05/2017	25/05/2017	24/05/2017	04/10/2017	04/10/2017	23/05/2017	03/10/2017	23/05/2017	03/10/2017
Athripsodes albifrons group	0	0	0	0	0	13	0	0	0	0	0	0	0
Athripsodes bilineatus	1	0	0	0	0	0	0	0	0	0	0	0	3
Athripsodes cinereus	1	0	3	0	0	0	0	0	0	0	0	30	0
Athripsodes sp.	5	0	84	1	0	0	0	0	0	0	0	14	0
BAETIDAE	0	0	2	0	0	0	0	0	0	0	3	0	19
Baetis rhodani	1	0	8	5	0	10	0	0	0	0	1	6	34
Baetis scambus/fuscatus	0	7	0	0	0	0	0	0	0	1	1	31	10
Baetis sp.	2	1	8	2	0	4	0	0	0	2	14	57	180
Baetis vernus	0	0	0	0	0	0	0	0	2	0	0	0	0
Bathyomphalus contortus	0	0	7	0	0	0	0	1	0	1	0	0	0
Bithynia leachii	0	0	0	0	0	0	3	21	1	0	0	0	0
Bithynia tentaculata	0	0	0	0	0	0	0	3	4	2	4	0	0
Caenis luctuosa	0	0	0	0	0	0	0	0	0	79	2	0	0
Caenis luctuosa/macrura	0	0	0	0	0	1	10	0	0	0	0	0	0

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2	River Brain		River Ter DS	
	23/05/2017	03/10/2017	24/05/2017	03/10/2017	24/05/2017	25/05/2017	24/05/2017	04/10/2017	04/10/2017	23/05/2017	03/10/2017	23/05/2017	03/10/2017
Caenis sp.	0	0	0	0	0	0	0	0	0	0	4	0	0
Calopteryx sp.	0	0	0	2	0	0	0	0	43	0	6	0	0
Calopteryx splendens	0	0	3	0	0	1	0	26	10	0	12	0	0
Centroptilum luteolum	0	0	0	0	0	1	6	0	7	0	0	0	0
CERATOPOGONIDAE	3	0	0	0	9	0	1	0	0	8	0	0	0
Chironomidae	32	17	52	6	412	165	336	9	1	101	51	38	208
COENAGRIONIDAE	0	0	0	0	0	0	1	2	0	0	0	0	0
Collembola	0	0	0	0	0	0	0	5	0	1	0	0	0
Crangonyx pseudogracilis	0	0	0	0	0	27	0	11	3	0	0	0	0
Dendrocoelum lacteum	0	0	0	0	0	1	0	0	0	0	0	0	0
Dicranota sp.	13	0	4	0	0	12	0	0	0	0	0	3	0
Dixa nebulosa	0	0	0	0	0	0	0	0	2	0	0	0	0
Dixa sp.	0	0	0	0	0	0	0	32	0	0	6	0	0
Dugesia sp.	0	0	0	0	0	0	0	0	0	1	0	0	0

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2	River Brain		River Ter DS	
	23/05/2017	03/10/2017	24/05/2017	03/10/2017	24/05/2017	25/05/2017	24/05/2017	04/10/2017	04/10/2017	23/05/2017	03/10/2017	23/05/2017	03/10/2017
Dugesia tigrina	0	0	0	0	0	0	0	0	3	2	0	0	0
DYTISCIDAE	0	0	0	0	0	0	6	0	0	0	0	0	0
Elmis aenea	206	44	49	44	0	123	6	0	0	17	10	51	140
Elodes sp.	0	0	0	1	0	0	0	0	0	0	0	0	0
Eloeophila sp.	0	0	0	0	0	0	0	0	0	1	0	0	0
EMPIDIDAE	0	0	0	0	0	2	0	1	0	0	0	0	0
Ephemera vulgata	0	0	0	0	0	0	1	0	0	0	0	0	0
Erpobdella octoculata	0	0	0	0	3	0	0	0	0	0	0	0	2
Erpobdella sp.	0	0	0	0	0	0	0	0	0	0	0	0	1
Erpobdella testacea	1	0	0	0	0	0	0	0	0	0	0	0	1
GAMMARIDAE	0	0	0	3	25	0	0	0	0	0	16	0	0
Gammarus pulex	691	282	155	151	359	634	13	18	21	1	15	283	637
Gammarus sp.	0	0	0	0	0	0	0	2	0	8	0	0	35
Gastropoda	0	0	0	0	0	0	0	0	1	0	0	0	0

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2	River Brain		River Ter DS	
	23/05/2017	03/10/2017	24/05/2017	03/10/2017	24/05/2017	25/05/2017	24/05/2017	04/10/2017	04/10/2017	23/05/2017	03/10/2017	23/05/2017	03/10/2017
GERRIDAE	0	0	0	0	0	0	0	0	1	0	0	0	0
Gerris sp.	0	0	0	0	0	0	0	0	0	0	1	0	0
Glossiphonia complanata	0	8	0	15	11	5	1	0	0	3	0	1	2
GLOSSOSOMATIDAE	0	0	0	0	0	0	0	0	0	0	0	0	28
Goera pilosa	0	0	0	0	0	0	0	0	0	0	0	2	2
Gyraulus albus	0	0	0	0	0	0	1	0	1	0	0	0	0
Halesus radiatus	1	0	2	0	0	3	0	0	0	0	0	0	0
Haliplus ruficollis group	0	0	0	0	0	0	0	0	5	0	0	0	0
Helobdella stagnalis	0	0	0	0	1	0	0	0	0	8	0	0	0
Hydracarina	0	0	3	0	0	4	1	0	0	0	0	5	0
Hydropsyche pellucidula	0	0	0	0	0	0	0	0	0	0	11	1	84
Hydropsyche siltalai	138	26	97	3	0	3	0	0	0	0	0	61	292
Hydropsyche sp.	0	2	2	0	0	0	0	0	0	0	3	0	0
HYDROPSYCHIDAE	0	0	0	0	0	0	0	0	0	0	0	0	19

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2	River Brain		River Ter DS	
	23/05/2017	03/10/2017	24/05/2017	03/10/2017	24/05/2017	25/05/2017	24/05/2017	04/10/2017	04/10/2017	23/05/2017	03/10/2017	23/05/2017	03/10/2017
Hydroptila sp.	6	1	0	0	0	7	57	0	0	4	0	5	1
Ischnura elegans	0	0	0	0	0	0	0	2	0	0	0	0	0
Lepidostoma hirtum	0	0	0	0	0	45	0	0	0	1	0	42	0
LEPIDOSTOMATIDAE	0	0	0	0	0	0	0	0	0	0	0	0	2
LIMNEPHILIDAE	0	0	0	0	3	0	0	0	0	0	1	0	0
Limnephilus lunatus	0	0	73	0	34	10	8	0	3	0	0	1	0
Limnephilus sp.	0	0	0	0	0	0	0	32	0	0	0	0	0
Limnius volckmari	37	18	30	12	0	35	2	1	0	1	0	45	197
LUMBRICIDAE	0	0	1	0	0	0	0	0	0	0	0	0	0
Lymnaea stagnalis	0	0	0	0	0	0	0	0	1	0	0	0	0
LYMNAEIDAE	0	0	0	0	0	0	0	0	2	0	0	0	0
Lype reducta	2	0	0	0	0	1	0	0	0	0	0	0	0
Lype sp.	0	0	0	0	3	0	0	0	0	0	0	0	0
Micropterna sequax	0	0	2	0	0	0	0	0	0	0	0	0	0

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2	River Brain		River Ter DS	
	23/05/2017	03/10/2017	24/05/2017	03/10/2017	24/05/2017	25/05/2017	24/05/2017	04/10/2017	04/10/2017	23/05/2017	03/10/2017	23/05/2017	03/10/2017
Mystacides azurea	0	0	2	0	0	2	0	0	0	0	9	3	1
Mystacides longicornis	0	0	2	0	0	0	0	0	0	0	0	0	0
Mystacides longicornis/nigra	0	0	0	0	0	2	1	0	0	0	0	0	0
Mystacides sp.	0	0	1	0	0	0	0	0	0	0	1	0	0
Nebrioporus elegans	0	0	1	0	0	0	0	0	0	0	0	0	0
Neolimnophila sp.	0	0	0	1	0	0	0	0	0	0	0	0	0
Notonecta viridis	0	0	0	0	0	0	0	0	1	0	0	0	0
Oligochaeta	1105	84	100	295	251	11	66	3	0	196	36	36	212
Orectochilus villosus	0	0	0	0	0	1	0	0	0	0	0	0	5
Ostracoda	0	0	0	0	0	0	1	0	0	0	0	0	0
Oulimnius sp.	0	2	0	3	0	3	14	1	0	6	10	2	122
Oulimnius tuberculatus	0	0	0	0	0	4	0	0	0	0	0	0	9
Paracorixa concinna	0	0	0	0	0	0	0	1	0	0	0	0	0
Physa fontinalis	0	0	0	0	0	0	0	0	1	0	0	0	0

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2	River Brain		River Ter DS	
	23/05/2017	03/10/2017	24/05/2017	03/10/2017	24/05/2017	25/05/2017	24/05/2017	04/10/2017	04/10/2017	23/05/2017	03/10/2017	23/05/2017	03/10/2017
Pilaria sp.	0	0	0	0	0	0	1	0	0	0	0	0	0
Piscicola geometra	0	0	0	0	0	0	0	0	0	0	1	0	0
Pisidium sp.	25	50	50	87	92	11	21	0	0	69	4	40	22
Planorbarius corneus	0	0	0	0	0	0	0	1	0	0	0	0	0
PLANORBIDAE	0	0	1	1	0	0	0	0	0	0	0	0	0
Planorbis planorbis	0	0	0	0	0	0	0	1	0	0	0	0	0
Platambus maculatus	0	0	1	0	0	5	0	0	0	0	0	1	0
Platambus sp.	0	1	0	0	0	0	0	0	0	0	0	0	0
Polycelis felina	0	0	8	0	0	3	0	0	0	2	0	0	0
Polycelis sp.	0	0	1	0	0	0	0	0	0	1	0	0	0
POLYCENTROPODIDAE	0	0	0	0	0	1	0	0	0	0	2	0	0
Polycentropus flavomaculatus	0	0	0	0	0	0	0	0	0	0	0	1	9
Potamopyrgus antipodarum	14	174	1500	1248	79	4	1	2	1	6	3	126	579

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2	River Brain		River Ter DS	
	23/05/2017	03/10/2017	24/05/2017	03/10/2017	24/05/2017	25/05/2017	24/05/2017	04/10/2017	04/10/2017	23/05/2017	03/10/2017	23/05/2017	03/10/2017
Proasellus meridianus	0	1	5	0	0	0	0	1	0	0	0	0	0
PSYCHODIDAE	0	0	0	0	5	0	3	17	0	6	0	0	0
Radix balthica	0	0	0	0	0	1	40	0	0	1	0	0	0
SCIRTIDAE	0	0	0	0	0	1	0	0	0	0	0	0	0
Sericostoma personatum	0	0	0	0	0	0	0	0	0	0	0	3	1
Serratella ignita	0	0	0	0	0	6	19	0	0	4	0	105	1
Sialis lutaria	0	0	0	0	0	0	0	0	0	0	1	0	0
Sigara distincta	0	0	0	0	0	0	0	1	0	0	0	0	0
SIMULIIDAE	12	0	2	1	0	0	0	0	0	0	0	0	46
Simulium sp.	0	0	1	5	0	10	2	0	0	0	3	117	95
Sphaerium corneum	0	0	18	52	0	0	0	0	0	0	0	1	3
Stictotarsus duodecimpustulatus	0	0	0	1	0	0	0	0	0	0	0	0	0
SUCCINEIDAE	0	0	0	0	0	0	0	89	2	0	0	0	0
TABANIDAE	0	0	0	0	1	0	0	0	0	0	0	0	0

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2	River Brain		River Ter DS	
	23/05/2017	03/10/2017	24/05/2017	03/10/2017	24/05/2017	25/05/2017	24/05/2017	04/10/2017	04/10/2017	23/05/2017	03/10/2017	23/05/2017	03/10/2017
Theodoxus fluviatilis	0	0	1	0	0	0	0	0	0	0	0	0	0
TIPULIDAE	0	0	0	0	1	0	0	4	1	7	0	0	0
Valvata cristata	0	0	3	0	0	0	0	0	0	15	0	0	0
Valvata piscinalis	0	0	0	0	0	0	3	2	0	7	0	0	0
Velia caprai	0	0	0	0	1	0	0	0	0	0	0	0	0
Velia sp.	0	0	0	0	0	0	1	2	0	1	0	2	0

Table A.2 Macro-invertebrate species records for sites sampled in 2020

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2		River Brain		River Ter	Roman River	
	16/11/2020	20/05/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	16/11/2020	16/11/2020	20/05/2020	17/11/2020
Agabus sp.	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Agapetus fuscipes	9	4	5	17	0	1	0	0	0	0	0	0	0	27	4
Agapetus sp.	147	0	0	1	0	1	0	0	0	0	0	0	0	0	6
Anacaena limbata	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0
Ancylus fluviatilis	0	0	0	0	0	1	1	0	2	0	3	0	0	0	0
Anisoptera Gen. sp.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Anisus vortex	1	0	1	0	7	0	0	0	0	0	0	0	0	0	1
ASELLIDAE	3	0	15	0	0	0	0	0	39	0	0	0	0	0	1
Asellus aquaticus	61	12	26	4	110	26	5	1	125	2	19	2	13	58	32
Athripsodes albifrons	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Athripsodes aterrimus	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Athripsodes bilineatus	0	0	1	0	0	0	0	0	0	0	0	0	0	3	0

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2		River Brain		River Ter	Roman River	
	16/11/2020	20/05/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	16/11/2020	16/11/2020	20/05/2020	17/11/2020
Athripsodes cinereus	2	2	0	0	0	0	4	0	0	0	0	0	0	0	0
Athripsodes sp.	3	0	0	0	0	1	2	0	3	0	0	0	1	1	0
BAETIDAE	1	0	0	0	0	0	3	1	4	0	0	2	4	0	0
Baetis rhodani	0	8	1	0	0	0	0	0	0	0	0	0	0	0	0
Baetis rhodani/atlanticus	16	47	8	0	0	4	0	0	0	0	0	0	0	4	0
Baetis scambus/fuscatus	0	0	0	0	0	0	12	0	0	0	0	0	0	0	0
Baetis sp.	0	1	7	0	0	0	15	0	0	0	0	0	0	0	0
Baetis vernus	0	26	0	0	0	0	0	0	0	0	4	0	0	0	0
Baetis vernus/buceratus	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0
Bathyomphalus contortus	0	0	0	0	0	9	0	0	5	0	0	0	0	0	0
Bithynia leachii	0	0	0	0	0	0	2	0	3	0	0	0	0	0	0
Bithynia sp.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Bithynia tentaculata	0	0	0	0	0	0	11	0	21	0	1	1	3	1	0

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2		River Brain		River Ter	Roman River	
	16/11/2020	20/05/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	16/11/2020	16/11/2020	20/05/2020	17/11/2020
Caenis luctuosa/macrura	0	0	0	0	0	0	140	0	205	0	43	1	0	0	0
Calopteryx sp.	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Calopteryx splendens	0	2	0	0	0	0	0	8	6	2	15	0	0	0	0
Cataclysta lemnata	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0
Centroptilum luteolum	0	0	0	0	0	0	8	0	0	0	7	2	0	0	0
CERATOPOGONIDAE	0	8	4	1	1	1	7	0	10	0	5	0	12	14	3
CHAOBORIDAE	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Chironomidae	56	265	495	212	769	224	326	16	840	2	1183	17	46	128	44
Cloeon dipterum	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0
COENAGRIONIDAE	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0
Coleoptera Gen. sp.	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Collembola	0	0	0	0	1	0	0	2	0	17	0	0	2	0	0
Crangonyx pseudogracilis/floridanus	0	0	0	0	0	0	0	0	3	0	0	1	1	0	6

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2		River Brain		River Ter	Roman River	
	16/11/2020	20/05/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	16/11/2020	16/11/2020	20/05/2020	17/11/2020
Cyrnus trimaculatus	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Dendrocoelum lacteum	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dicranota sp.	2	22	6	0	0	4	25	0	0	0	1	0	1	4	0
Diptera	0	0	0	3	0	0	0	0	0	6	0	24	11	0	0
Dixa nebulosa	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Dryops sp.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Dugesia lugubris/polychroa	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Dugesia tigrina	3	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Elmis aenea	48	86	32	20	0	17	21	1	30	1	4	0	4	57	8
Elodes sp.	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
EMPIDIDAE	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Ephemera danica	0	0	0	0	0	0	0	0	0	0	0	0	0	6	7
Ephemera sp.	0	0	0	1	0	0	3	0	4	0	0	0	0	2	2

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2		River Brain		River Ter	Roman River	
	16/11/2020	20/05/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	16/11/2020	16/11/2020	20/05/2020	17/11/2020
Ephemera vulgata	0	0	0	0	0	0	9	0	1	0	0	0	0	0	0
Erpobdella octoculata	0	2	3	1	5	0	0	0	4	0	2	0	0	5	3
Erpobdella sp.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
ERPOBDELLIDAE	1	0	0	0	6	1	0	0	0	0	0	0	2	6	3
Galba truncatula	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0
Gammarus fossarum/pulex agg	187	231	170	22	59	105	61	2	67	0	20	4	7	107	52
Gammarus pulex	201	295	220	17	96	170	28	3	11	7	8	1	3	379	32
Gastropoda	0	0	0	1	0	0	24	1	0	0	0	5	0	0	0
Glossiphonia complanata	2	2	1	1	6	3	0	0	5	0	0	0	0	1	1
GLOSSIPHONIIDAE	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0
GLOSSOSOMATIDAE	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Glyphotaelius pellucidus	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Goera pilosa	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2		River Brain		River Ter	Roman River	
	16/11/2020	20/05/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	16/11/2020	16/11/2020	20/05/2020	17/11/2020
Gyraulus albus	0	0	0	0	0	0	1	0	14	0	1	0	0	0	0
Gyraulus crista	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Gyrinus caspius	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0
Habrophlebia fusca	1	0	3	0	0	0	0	0	0	0	0	0	0	0	0
Halesus radiatus	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0
Haliplus sp.	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Helius sp.	5	0	0	0	0	0	0	0	0	0	0	0	0	0	3
Helobdella stagnalis	0	0	0	0	0	0	0	0	0	0	21	0	0	0	0
Helophorus flavipes	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Hydracarina	0	11	2	1	0	0	30	0	2	0	4	0	0	16	3
Hydraena testacea	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0
HYDROPHILIDAE	0	0	0	0	0	0	0	0	0	2	0	1	0	0	0
HYDROPORINAE	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
Hydroporus sp.	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2		River Brain		River Ter	Roman River	
	16/11/2020	20/05/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	16/11/2020	16/11/2020	20/05/2020	17/11/2020
Hydropsyche pellucidula	0	0	0	0	0	0	0	0	2	0	1	0	0	0	0
Hydropsyche siltalai	135	13	4	0	0	1	3	0	0	0	0	0	0	16	4
Hydropsyche sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0
Hydroptila sp.	2	0	0	0	0	0	18	0	23	0	2	0	0	0	0
Ischnura elegans	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Laccobius sp.	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0
Lepidostoma hirtum	0	0	0	0	0	0	0	0	10	0	0	0	0	0	0
Lepidostoma hirtum/basale	0	0	0	0	0	1	5	0	0	0	0	0	1	0	0
LIMNEPHILIDAE	12	1	0	16	1	1	0	6	0	4	0	0	9	1	20
Limnephilus extricatus	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Limnephilus lunatus	0	6	1	1	9	0	5	0	27	0	6	0	9	7	0
Limnephilus sp.	0	0	0	1	0	0	0	1	0	0	0	0	0	0	1
Limnius volckmari	65	44	10	4	0	37	12	0	0	0	0	0	4	87	48

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2		River Brain		River Ter	Roman River	
	16/11/2020	20/05/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	16/11/2020	16/11/2020	20/05/2020	17/11/2020
LIMONIIDAE	0	0	1	1	1	0	0	0	0	0	0	0	3	0	0
LYMNAEIDAE	0	0	1	0	0	0	0	0	10	0	0	0	0	0	0
Lype reducta	0	1	0	0	0	1	0	0	0	0	0	1	0	1	3
Mesovelia furcata	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
Micropterna sequax	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
MUSCIDAE	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mystacides azurea	0	0	0	0	0	0	0	0	0	0	0	0	3	0	0
Mystacides longicornis	0	0	4	0	0	0	1	0	2	0	0	0	0	0	0
Mystacides longicornis/nigra	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0
Mystacides sp.	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0
Nebrioporus elegans	0	0	0	0	0	0	1	0	2	0	0	0	0	0	0
NEMOURIDAE	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Notonecta viridis	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2		River Brain		River Ter	Roman River	
	16/11/2020	20/05/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	16/11/2020	16/11/2020	20/05/2020	17/11/2020
Ochthebius minimus	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Oligochaeta	90	93	53	100	181	9	49	7	145	11	277	11	268	40	35
Orectochilus sp.	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
Oribati	0	0	1	0	0	0	0	0	0	2	0	0	2	1	0
Orthetrum cancellatum	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ostracoda	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0
Oulimnius sp.	10	2	7	9	0	0	4	0	22	0	3	0	9	5	1
Oulimnius tuberculatus	0	0	0	1	0	0	4	0	6	0	0	0	0	0	0
PEDICIIDAE	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Physa fontinalis	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
Pilaria sp.	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pisidium sp.	131	53	40	15	68	12	14	0	10	0	22	0	16	7	2
Planorbarius corneus	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0
PLANORBIDAE	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2		River Brain		River Ter	Roman River	
	16/11/2020	20/05/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	16/11/2020	16/11/2020	20/05/2020	17/11/2020
Platambus maculatus	1	0	1	6	0	18	0	0	0	0	0	0	3	0	0
Plectrocnemia conspersa	0	0	0	0	0	0	0	0	0	0	0	0	0	4	4
Polycelis felina	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0
Polycelis nigra/tenuis	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Polycelis sp.	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0
Polycentropus flavomaculatus	0	0	0	0	0	0	0	0	2	0	0	0	0	2	1
Potamopyrgus antipodarum	83	10	326	67	83	112	38	0	86	0	69	0	1	3	1
Proasellus meridianus	5	5	7	2	0	0	0	0	0	0	0	0	0	0	2
Procloeon bifidum	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0
PSYCHODIDAE	0	0	1	0	1	0	0	0	0	0	0	11	38	0	0
Radix balthica	0	0	1	0	0	1	1	0	0	0	7	0	0	0	0
RHAGIONIDAE	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2		River Brain		River Ter	Roman River	
	16/11/2020	20/05/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	16/11/2020	16/11/2020	20/05/2020	17/11/2020
Sericostoma personatum	0	0	0	0	0	0	0	0	0	0	0	0	1	4	6
Serratella ignita	0	0	0	0	0	0	104	0	15	0	7	0	0	0	0
SIALIDAE	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Sialis lutaria	0	0	5	2	17	4	0	0	2	0	2	0	2	0	4
Silo sp.	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0
SIMULIIDAE	23	112	12	0	0	0	1037	0	1	0	5	0	1	2	0
Simulium ornatum-Gr.	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
SPHAERIIDAE	0	0	9	0	0	6	0	0	0	0	0	0	0	0	0
Sphaerium sp.	0	102	0	4	0	0	68	0	8	0	10	0	0	1	0
Stagnicola palustris	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Stictotarsus duodecimpustulatus	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
STRATIOMYIIDAE	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Succinea sp.	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0

Species	Boreham Brook		Domsey Brook 1		Domsey Brook 2	Rivenhall Brook	River Blackwater 1		River Blackwater 2		River Brain		River Ter	Roman River	
	16/11/2020	20/05/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	17/11/2020	20/05/2020	16/11/2020	16/11/2020	20/05/2020	17/11/2020
SUCCINEIDAE	0	0	0	0	0	0	0	8	2	0	0	5	0	0	0
TIPULIDAE	1	0	0	0	0	0	0	0	0	0	0	4	0	0	0
Tricladida	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0
Trocheta sp.	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
Trocheta subviridis	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
Valvata cristata	0	0	0	0	0	1	0	0	1	0	0	0	1	0	0
Valvata piscinalis	0	0	0	0	0	0	0	0	7	0	0	0	0	0	0
Valvata sp.	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0

Annex B – Pond biodiversity (PSYM) survey results

Table B.1 PSYM metrics and results for surveys in 2017 and 2020

Site Name	Pond 14	Pond 39	Pond 43	Pond 43	Pond 76	Pond 77	Pond 91	Pond 91	Pond 99	Pond 101	Pond 120	Pond 154
Survey date	**26/06/2017**	**13/08/2020**	**28/06/2017**	**13/08/2020**	**12/08/2020**	**12/08/2020**	**27/06/2017**	**12/08/2020**	**11/08/2020**	**11/08/2020**	**29/06/2017**	**11/08/2020**
Grid reference	TL 91080 22795	TL87838 19174	TL 86840 17867	TL86840 17867	TL83015 14854	TL83113 15003	TL81436 12909	TL81436 12909	TL79901 12675	TL80081 11936	TL 74046 09142	TL81053 12069
No. of submerged + marginal plant species (not including floating leaved)	4	8	1	4	9	8	1	1	8	11	4	1
Number of uncommon plant species (U)	0	1	0	0	1	0	0	0	2	2	0	1
Trophic Ranking Score (TRS)	8.83	8.31	0	9.67	8.8	8.27	9.00	0	8.72	8.68	9.67	9.5
ASPT	3.63	3.25	3.14	3.67	5.13	4.71	3.00	4.5	4.22	4.89	3.27	4.94
Odonata + Megaloptera (OM) families	0	0	1	0	1	0	0	1	1	3	0	3

Site Name	Pond 14	Pond 39	Pond 43	Pond 43	Pond 76	Pond 77	Pond 91	Pond 91	Pond 99	Pond 101	Pond 120	Pond 154
Survey date	**26/06/2017**	**13/08/2020**	**28/06/2017**	**13/08/2020**	**12/08/2020**	**12/08/2020**	**27/06/2017**	**12/08/2020**	**11/08/2020**	**11/08/2020**	**29/06/2017**	**11/08/2020**
Coleoptera families	1	0	0	2	0	1	0	0	1	2	0	2
Altitude (m)	31	33	35	24	60	63	25	31	40	82	29	45
Easting	5910	5878	5868	5868	5830	5831	5814	5814	5799	5800	5740	5810
Northing	2227	2191	2178	2178	2148	2150	2129	2129	2126	2119	2091	2120
Shade (%)	40	1	15	80	1	1	15	3	10	0	15	2
Inflow (0/1)	0	0	0	0	0	0	1	0	0	0	1	0
Grazing (%)	0	0	0	0	0	0	5	0	0	0	0	0
pH	8.03	7.3	7.68	7.5	7.5	6.9	8.37	8.4	7.8	8.2	7.54	8.1
Emergent plant cover (%)	1	5	0	0	1	1	0	0	60	2	95	1
Base clay (1-3)	3	3	3	3	1	1	2	3	3	3	3	2
Base sand, gravel, cobbles (1-3)	1	1	1	1	3	3	2	1	1	1	1	2
Base peat (1-3)	1	1	1	1	1	1	1	1	1	1	1	1
Base rock (1-3)	1	1	1	1	1	1	1	1	1	1	1	1
Area (m2)	40	140	300	36	2000	2000	300	180	105	10000	500	8000
Predicted (SM)	11.6	14.5	16.9	11.2	23.4	23.4	16.9	15.1	13.8	31.6	18.6	30.0
Actual (SM)	4	8.0	1	4.0	9.0	8.0	1	1.0	8.0	11.0	4	1.0

Site Name	Pond 14	Pond 39	Pond 43	Pond 43	Pond 76	Pond 77	Pond 91	Pond 91	Pond 99	Pond 101	Pond 120	Pond 154
Survey date	26/06/2017	13/08/2020	28/06/2017	13/08/2020	12/08/2020	12/08/2020	27/06/2017	12/08/2020	11/08/2020	11/08/2020	29/06/2017	11/08/2020
EQI (SM)	0.34	0.5	0.06	0.4	0.4	0.3	0.06	0.1	0.6	0.3	0.22	0.0
IBI (SM)	1	2	0	1	1	1	0	0	2	1	0	0
Predicted (U)	2.0	2.4	2.9	2.0	3.8	3.9	2.8	2.5	2.3	5.1	3.1	4.9
Actual (U)	0	1.0	0	0.0	1.0	0.0	0	0.0	2.0	2.0	0	1.0
EQI (U)	0.00	0.4	0.00	0.0	0.3	0.0	0.00	0.0	0.9	0.4	0.00	0.2
IBI (U)	0	1	0	0	1	0	0	0	3	1	0	0
Predicted (TRS)	8.76	8.75	8.77	8.79	8.67	8.62	8.73	8.79	8.77	8.80	8.77	8.76
Actual (TRS)	8.83	8.31	0.00	9.67	8.80	8.27	9.00	0.00	8.72	8.68	9.67	9.50
EQI (TRS)	1.01	0.95	0.00	1.10	1.01	0.96	1.03	0.00	0.99	0.99	1.10	1.08
IBI (TRS)	3	3	0	1	3	3	3	0	3	3	1	2
Predicted (ASPT)	5.10	5.06	5.07	5.10	5.03	5.02	5.15	5.06	5.10	5.11	5.12	5.10
Actual (ASPT)	3.63	3.25	3.14	3.67	5.13	4.71	3.00	4.50	4.22	4.89	3.27	4.94
EQI (ASPT)	0.71	0.64	0.62	0.72	1.02	0.94	0.58	0.89	0.83	0.96	0.64	0.97
IBI (ASPT)	2	1	1	2	3	3	1	3	2	3	1	3
Predicted (OM)	3.46	3.11	3.14	3.50	2.88	2.87	3.24	3.05	3.39	3.08	3.38	3.06
Actual (OM)	0	0.00	1	0.00	1.00	1.00	0	1.00	1.00	3.00	0	3.00
EQI (OM)	0.00	0.00	0.32	0.00	0.35	0.35	0.00	0.33	0.30	0.97	0.00	0.98

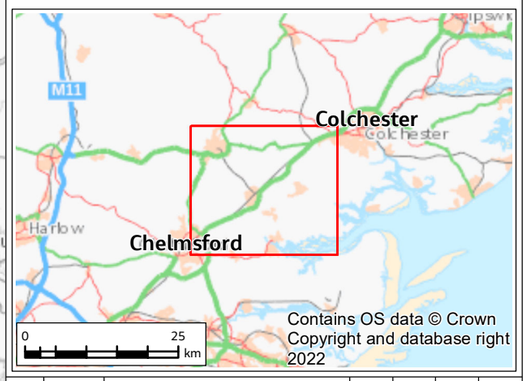
Site Name	Pond 14	Pond 39	Pond 43	Pond 43	Pond 76	Pond 77	Pond 91	Pond 91	Pond 99	Pond 101	Pond 120	Pond 154
Survey date	**26/06/2017**	**13/08/2020**	**28/06/2017**	**13/08/2020**	**12/08/2020**	**12/08/2020**	**27/06/2017**	**12/08/2020**	**11/08/2020**	**11/08/2020**	**29/06/2017**	**11/08/2020**
IBI (OM)	0	0	1	0	1	1	0	1	1	3	0	3
Predicted (CO)	3.75	3.71	3.73	3.75	3.69	3.69	3.81	3.72	3.74	3.76	3.78	3.76
Actual (CO)	1	0.00	0	2.00	0.00	1.00	0	0.00	1.00	2.00	0	2.00
EQI (CO)	0.27	0.00	0.00	0.53	0.00	0.27	0.00	0.00	0.27	0.53	0.00	0.53
IBI (CO)	1	0	0	2	0	1	0	0	1	2	0	2
Sum of Individual Metrics	**7**	**7**	**2**	**6**	**9**	**9**	**4**	**4**	**12**	**13**	**2**	**10**
Index of Biotic Integrity (%)	**39%**	**39%**	**11%**	**33%**	**50%**	**50%**	**22%**	**22%**	**67%**	**72%**	**11%**	**56%**
PSYM quality category (IBI >75%=Good, 51-75%= Moderate, 25-50%=Poor, <25%=V Poor)	**Poor**	**Poor**	**Poor**	**Poor**	**Poor**	**Poor**	**Very Poor**	**Very Poor**	**Moderate**	**Moderate**	**Poor**	**Moderate**
Is this a Priority Pond? (Good quality category)	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**	**No**

Annex C – Aquatic ecology survey maps

APPENDIX 9.1 - FIGURE 1

Legend

- Provisional Order Limits
- Study Area
- Detailed River Network
- Environment Agency River Habitat Survey (RHS) location
- Environment Agency freshwater fish survey location
- Environment Agency freshwater macro-invertebrate survey location
- Environment Agency freshwater macrophyte survey location
- Environment Agency white-clawed crayfish record location



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Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P01	31/05/22	For DCO application	AD	LW	NP	SG

Development Consent Order Drawing Number: TR010060/APP/6.3

APFP Regulation: Regulation 5(2)(l)

Client: national highways

Project: REGIONAL DELIVERY PARTNERSHIP
A12 CHELMSFORD TO A120 WIDENING SCHEME

Drawing Title: ENVIRONMENTAL STATEMENT
ENVIRONMENT AGENCY SURVEY
LOCATIONS WITHIN THE STUDY AREA

Drawing Status: S4 – SUITABLE FOR STAGE APPROVAL

Scale @ A3	1:75000	DO NOT SCALE
Jacobs No.	B36601D1	
Client No.	HE551497	Rev P01

Drawing Number: HE551497-JAC-LDC-SCHW-SK-GI-0491

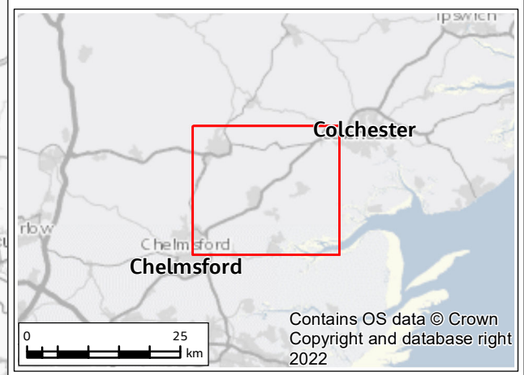
APPENDIX 9.1 - FIGURE 2

Legend

- Provisional Order Limits
- Study Area
- Detailed River Network

Watercourse Survey Types

- Freshwater fish survey location
- Freshwater macro-invertebrate survey location
- Freshwater macrophyte survey location
- River Habitat Survey (RHS) location
- White-clawed crayfish survey location



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0 5 Kilometres

Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd
P01	31/05/22	For DCO application	AD	LW	NP	SG

Development Consent Order Drawing Number: TR010060/APP/6.3

APFP Regulation: Regulation 5(2)(l)

Client: national highways

Project: REGIONAL DELIVERY PARTNERSHIP
A12 CHELMSFORD TO A120 WIDENING SCHEME

Drawing Title: ENVIRONMENTAL STATEMENT
FIELD AQUATIC ECOLOGY
WATERCOURSE SURVEY LOCATIONS

Drawing Status: S4 – SUITABLE FOR STAGE APPROVAL

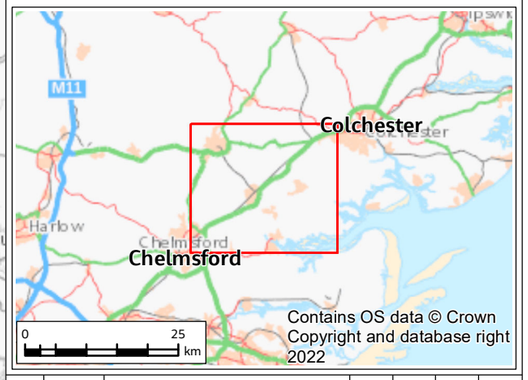
Scale @ A3	1:75000	DO NOT SCALE
Jacobs No.	B36601D1	
Client No.	HE551497	Rev P01

Drawing Number: HE551497-JAC-LDC-SCHW-SK-GI-0492

APPENDIX 9.1 - FIGURE 3

Legend

- Provisional Order Limits
- PSYM Quality - Moderate
- PSYM Quality - Poor
- PSYM Quality - Very Poor



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P01	31/05/22	For DCO application	AD	LW	NP	SG
Rev.	Rev. Date	Purpose of revision	Drawn	Check'd	Rev'd	Appr'd

Development Consent Order Drawing Number: TR010060/APP/6.3

APFP Regulation: Regulation 5(2)(l)

Client: national highways

Project: REGIONAL DELIVERY PARTNERSHIP
A12 CHELMSFORD TO A120 WIDENING SCHEME

Drawing Title: ENVIRONMENTAL STATEMENT
POND HABITAT SURVEY
(PSYM) SURVEY LOCTIONS

Drawing Status: S4 – SUITABLE FOR STAGE APPROVAL

Scale @ A3	1:75000	DO NOT SCALE
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Client No.	HE551497	Rev P01

Drawing Number: HE551497-JAC-LDC-SCHW-SK-GI-0493

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