

# M5 Junction 10 Improvements Scheme

## Environmental Statement Appendix 7.12 Aquatic ecology survey TR010063 – APP 6.15

Regulation 5 (2) (a)

Planning Act 2008

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

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# Infrastructure Planning Planning Act 2008

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

### M5 Junction 10 Improvements Scheme Development Consent Order 202[x]

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#### 6.15 Environmental Statement:

#### Appendix 7.12 Aquatic ecology survey

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# 1. Introduction

## 1.1. Terms of reference

- 1.1.1. Atkins, member of the SNC-Lavalin group, was commissioned by Gloucestershire County Council (GCC) to undertake aquatic ecology surveys and assessment to inform the Environmental Statement (ES) for the M5 Junction 10 Improvements Scheme (hereafter referred to as 'the Scheme').
- 1.1.2. An aquatic ecology desk study and field surveys were undertaken to determine a baseline for aquatic features and associated species (aquatic macroinvertebrates, white-clawed crayfish (*Austropotamobius pallipes*), aquatic macrophytes and fish) present within the Scheme's study area; provide recommendations to enable compliance with legislation and policy; and, if necessary, identify the need for avoidance, mitigation, compensation or enhancement measures.
- 1.1.3. This Technical Appendix summarises the results of the aquatic ecology desk study and field surveys undertaken, including the methods used, results of the surveys, and provides an evaluation of the nature conservation value of aquatic features within the study area.
- 1.1.4. This report provides factual information to support the ES, which will accompany the planning application for the Scheme.

## 1.2. Legislation and policy

- 1.2.1. Relevant legislation in relation to aquatic habitats and species is provided in Table 1-1 (excluding protected species e.g., otter and water vole, which is provided in their respective appendices). Other overarching ecological legislation e.g., the National Planning Policy Framework (NPPF) are summarised within Chapter 7 of the Environmental Statement.

Table 1-1 - Summary of relevant legislation

<b>Legislation</b>	<b>Summary</b>
<p><b>The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017</b></p>	<p>The Water Environment Regulations (2017), known as the Water Framework Directive (WFD) is the leading legislation on the duties of regulators (Environment Agency in England) in relation to environmental permitting, abstraction, and impoundment of water. Its principal aims are to protect and improve the water environment and promote the sustainable use of water, as follows:</p> <ul style="list-style-type: none"> <li>• To prevent deterioration of the status of water bodies.</li> <li>• To protect, enhance and restore all water bodies with the aim of achieving ‘good status’ by 2027 at the latest.</li> <li>• To progressively reduce or phase out the release of individual pollutants or groups of pollutants and cease or phase out emissions, discharges and losses of priority hazardous substances.</li> <li>• To prevent or limit the entry of pollutants to groundwater.</li> <li>• To comply with the requirements of all WFD Protected Areas.</li> </ul>
<p><b>Salmon and Freshwater Fisheries Act 1975</b></p>	<p>The Act dictates which methods of fishing for salmon, trout and freshwater fish are an offense and deals with offences associated with the discharge of matter or effluent that is poisonous or injurious to fish, spawn, spawning areas or food of fish. The Act also details offences associated with the wilful disturbance of any spawn or spawning fish, or any bed, bank or shallow on which any spawn or spawning fish may be.</p>
<p><b>The Eels (England and Wales) Regulations 2009</b></p>	<p>The Regulations give powers to the regulators (the Environment Agency and Natural Resources Wales) to implement recovery measures of European eel stocks in all freshwater and estuarine waters in England and Wales.</p>

## 2. Methodology

### 2.1. Desk study

#### Screening area

- 2.1.1. Screening for the presence of aquatic receptors (watercourses and standing waterbodies) was undertaken within the Scheme<sup>1</sup> plus 150 m from the Order limits<sup>2</sup> (hereafter referred to as the 'screening area').
- 2.1.2. This ensures the following:
- Aquatic habitats within the Scheme boundary that may be affected by the Scheme are identified, for example a watercourse that is crossed or a pond that is located within the works area. Effects could arise through, for example, direct/indirect habitat loss, physical modification, disturbance and/or changes to water quality/quantity.
  - Hydrologically connected receiving watercourses and any dependant standing waterbodies (i.e., pond or lakes) and designated sites which are potentially at risk due to propagation of effects from watercourses affected are included within the screening area (see Ecological Zone of Influence (EZoI)).
  - Additional aquatic habitats located not more than 150 m from the Scheme boundary that, whilst not within the works area, may still be at risk of impacts due to their proximity to the Scheme. This could be through, for example, overland pollution or mobilisation of fine sediment from the working area.
- 2.1.3. Watercourses, ponds and lakes that are not in direct hydrological connectivity with an aquatic receptor within the screening area, are considered to be sufficiently isolated as to have negligible risk of impact from a construction or operation impact source.

#### Ecological Zone of Influence

- 2.1.4. The EZoI for ponds, lakes and aquatic designated sites that are not hydrologically connected to a watercourse located within the screening area, is defined as the screening area itself. This is the extent over which these receptors could be affected by the Scheme, through mechanisms identified in Paragraph 2.1.2.
- 2.1.5. The EZoI for watercourses within the screening area (and by extension any hydrologically connected ponds, lakes or designated sites) is larger. Potential ecological impacts originate within the screening area during construction and/or operation of the Scheme. However, impacts have the potential to propagate within watercourses, beyond the screening area (for example through hydrological transport of construction pollutants). The extent to which impacts may propagate defines the EZoI for watercourses and any dependent ponds, lakes or designated sites.
- 2.1.6. In the absence of published guidance that defines the EZoI for watercourse receptors, the EZoI has been defined with reference to the design elements of the Scheme, working practices required to construct it and the author's knowledge of similar Schemes.
- 2.1.7. The Scheme does not act to fundamentally change hydromorphological processes of Main Rivers or morphologically diverse Ordinary Watercourses (i.e., through permanent abstraction or transfer of water, or extensive channel realignment), water quality (e.g., through new discharges that are unattenuated and/or carry pollutants) or aquatic species

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<sup>1</sup> The term Scheme refers to the physical extent of the permanent works including maintenance rights, together with land required temporarily to construct the works.

<sup>2</sup> The Order limits delineates the Scheme area.

movement (e.g., through construction of permanent watercourse barriers) relative to baseline conditions.

- 2.1.8. Potential impacts may arise at the point of construction due to activities required to construct individual design elements (e.g., bridges or culverts) and realignment of drainage channels. However, these are typically either localised (for example, riparian habitat loss/degradation), temporary (for example for the duration of construction) and/or subject to standard pollution prevention and control measures that serve to constrain the EZol.
- 2.1.9. In the unlikely event of an uncontrolled pollution or sediment mobilisation incident within a watercourse, effects are considered likely to be ameliorated (through deposition or dilution) and/or intercepted within 2 km of their origin.
- 2.1.10. The EZol for watercourses is therefore considered to be 2 km (measured in linear watercourse extent) from the Scheme Boundary. This is considered to be an appropriate and conservative EZol within which the assessment assumes potential for effects.

### Study areas

- 2.1.11. Study areas are defined on the basis of the EZol for aquatic receptors.
- 2.1.12. The study area for watercourses located within the screening area, and any hydrologically connected ponds, lakes and aquatic designated sites, is defined as 2 km (measured in linear watercourse extent) from the Scheme Boundary (hereafter referred to as the 2 km study area).
- 2.1.13. The study area for ponds, lakes and aquatic designated sites (falling within the screening area), which are not hydrologically connected to a watercourse within the screening area, is defined as the Scheme plus 150 m from the Scheme Boundary (hereafter referred to as the 150 m study area).
- 2.1.14. When taken together these areas are hereafter referred to as the combined study area.

### Identification of aquatic receptors

- 2.1.15. All watercourses, ponds and lakes within the combined study area were identified from geospatial analysis using contemporary Ordnance Survey (OS). The Esri World Topographic Map and OS Open Rivers Layer were used as the primary sources for identifying potentially ecologically important watercourses, ponds and lakes within the screening area. Aerial imagery was used to confirm the presence/absence of aquatic features in cases of uncertainty.
- 2.1.16. Watercourses, ponds and lakes were assigned unique identifiers (watercourse names for main rivers, drain numbers and codes for smaller ordinary watercourses and pond numbers for standing water bodies). It should be noted that since watercourses are linear features within the landscape, they may interact with the Scheme at more than one location e.g., crossed by structures at two separate locations, and falling within 150 m of the Scheme at another location. Where this occurs, specific details are provided in the reporting below.

### Watercourses

- 2.1.17. Watercourses are defined as either:
- Main River:
    - A watercourse shown on the statutory Main River map dataset. These are typically larger streams and rivers, but some of them are small watercourses of significance. They include certain structures that control or regulate the flow of water in, into or out of the channel.
    - The Environment Agency has permissive powers, but not a duty, to carry out maintenance, improvement or construction work on designated

Main Rivers. The Environment Agency has powers to regulate the activities of others affecting main rivers and their flood plains under the Environmental Permitting Regulations 2016, the Water Resources Act 1991 and land drainage bylaws.

- Canal:
  - A manmade watercourse typically characterised by artificial banks, uniform profiles and often relatively heavily used for navigational purposes.
  - The Canal & River Trust hold a number of objects and powers over the canal network, notably to preserve, protect, operate, and manage inland waterways.
- Ordinary Watercourse:
  - All other watercourses are defined as Ordinary Watercourses. The Lead Local Flood Authority (LLFA) or, if within an Internal Drainage District, the Internal Drainage Board (IDB) have similar permissive powers to maintain and improve Ordinary Watercourses.
  - The LLFA or IDB have powers to regulate works under the provisions of the Land Drainage Act 1991 and local bylaws.
  - Ordinary Watercourses include rivers, streams, land and roadside ditches, drains, cuts, culverts, dikes, sluice, sewers (other than public sewers within the meaning of the Water Industry Act 1991) and passages through which water flows.

2.1.18. Where available, the name of the watercourse is provided as it appears on OS mapping. If the watercourse is unnamed, it has been identified as such, and a unique identifier has been created. Watercourses, as named are shown in Figure 7-12A in Appendix B.

### Standing waterbodies

2.1.19. For the purposes of this assessment, standing water bodies have been classified as either:

- Ponds:
  - Artificial or natural standing water bodies less than 2 ha (20,000 m<sup>2</sup>) in size.
- Lakes:
  - Artificial or natural standing water bodies greater than 2 ha (20,000 m<sup>2</sup>) in size.

2.1.20. Ponds, as coded, are shown in Figure 7-12A in Appendix B.

### Existing background data sources

#### Publicly available data

2.1.21. Several publicly available data sources of direct relevant to aquatic receptors within the combined study area include:

- Environment Agency Severn River Basin Management Plan (RBMP)<sup>3</sup>.
- Environment Agency Catchment Data Explorer<sup>4</sup>.

<sup>3</sup>[https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment\\_data/file/718336/Severn\\_RBD\\_Part\\_1\\_river\\_basin\\_management\\_plan.pdf](https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/718336/Severn_RBD_Part_1_river_basin_management_plan.pdf) [Accessed: August 2021].

<sup>4</sup><https://environment.data.gov.uk/catchment-planning/> [Accessed: August 2021].

- Environment Agency Fish and Ecology Data Explorer for aquatic macroinvertebrates, aquatic macrophytes and fish<sup>5</sup>.
- Natural England's Multi-Agency Geographic Information for the Countryside (MAGIC) interactive map<sup>6</sup>, which delineates statutory designated sites of importance for nature conservation.
- Environment Agency River Habitat Survey monitoring data from the Government data website<sup>7</sup>.
- Contemporary OS mapping<sup>8</sup>.

#### Supplementary data requests

- 2.1.22. A data request was made to the Gloucestershire Centre for Environmental Records (GCER; local biodiversity records centre) for environmental records within 2 km of the Scheme.
- 2.1.23. Records for protected and notable species recorded in the last ten years (up to July 2022) within a 1 km and 2 km buffer were requested. Non-statutory sites within the same 1 km buffer were also requested.

#### Scheme data sources

- 2.1.24. Other data associated with the Scheme have also informed this assessment. Scheme data sources of direct relevance to aquatic receptors include:
- Scheme Habitat Suitability Index (HSI)<sup>9</sup> data for ponds and lakes (index used in the evaluation of pond habitat quality specifically for great crested newts).

#### Data screening

- 2.1.25. All background data were screened for relevance to the Scheme in terms of location, date and period of record. The following criteria were applied to determine the suitability of individual records for inclusion in the baseline:
- Data must have been collected within the combined study area.
  - Typically, data must have been collected within the past five years for aquatic macroinvertebrates, aquatic macrophytes and fish (or within 10 years for Environment Agency River Habitat Survey (RHS) data).
- 2.1.26. Aquatic species data collected over five years ago may not be representative of current community composition since changes in the aquatic environment and aquatic communities are likely to have occurred over time. The five-year cut-off reduces the potential for broad-scale habitat changes, and corresponding changes in aquatic communities, to have occurred since the data was collected.
- 2.1.27. It should be noted that through consultation with Natural England, the search period and area for fish species was extended to up to ten years and up to 10 km, respectively, due to the Severn Estuary designations and qualifying species that may be present within the River Chelt.
- 2.1.28. The cut-off for RHS data differs from the cut-off for aquatic species data (aquatic macrophytes and aquatic macroinvertebrates). Watercourse habitat structure/modification in urban settings (i.e., the Scheme environs) is generally less likely to change through time than the species it supports (e.g., aquatic assemblages may be impacted by variables

<sup>5</sup> <https://environment.data.gov.uk/ecology/explorer/> [Accessed: September 2022].

<sup>6</sup> <https://magic.defra.gov.uk/magicmap.aspx> [Accessed: September 2022].

<sup>7</sup> <https://data.gov.uk/data/search> [Accessed: September 2022].

<sup>8</sup> <https://www.bing.com/maps> [Accessed: September 2022].

<sup>9</sup> Oldham R.S., Keeble J., Swan M.J.S. and Jeffcote, M., 2000. Evaluating the suitability of habitat for the Great Crested Newt (*Triturus cristatus*). *Herpetological Journal*, 10(4), pp. 143-155.



such as water quality and temperature). As such, habitat records of up to 10 years have been included for those watercourses that have not evidently undergone significant recent modification e.g., straightening to form part of a field boundary.

## Detailed assessment and survey screening criteria

- 2.1.29. The Chartered Institute of Ecology and Environmental Management (CIEEM) (2018)<sup>10</sup> identifies the requirement for Ecological Impact Assessment (EclA) to rationalise which ecological features should be subject to detailed assessment. It is not necessary for EclA to carry out detailed assessment of features that are sufficiently widespread, unthreatened, and resilient to project impacts.
- 2.1.30. CIEEM (2018) also identifies that ecological features subject to detailed assessment will be those that are both considered to be important and potentially significantly affected by the Scheme. Features should be scoped out of detailed assessment either because they are not important enough to warrant further consideration in the Environmental Impact Assessment (EIA) process or because they will not be significantly affected.
- 2.1.31. For each aquatic feature identified within the screening area, screening criteria were applied to determine whether the receptor should be subject to detailed assessment and specific survey to inform the ecological baseline. These criteria are described in the following sections.
- 2.1.32. Details of the outcomes of this survey screening exercise for watercourses, ponds and lakes are provided in 3.1 of this report, respectively.

## 2.2. Field surveys

### Screening for surveys

#### Watercourse walkover survey

- 2.2.1. All watercourses identified within the screening area were visited as part of a walkover survey by an experienced freshwater ecologist where access was available. The aim of the walkover survey was to assist in identifying important ecological features, and support screening for detailed assessment.
- 2.2.2. Wherever possible, survey locations were aligned to key points of interaction with the Scheme (e.g., crossing points) where there is greatest potential for effects.

#### Detailed watercourse surveys (habitat and species) and assessment screening

- 2.2.3. Watercourses were screened for detailed assessment based on the developing Scheme design and the following criteria:
- The watercourse is considered a potentially important ecological feature (i.e., potentially of Local ecological importance or greater).
  - The watercourse is to be lost/crossed/diverted or potentially experience a significant change in water quality or quantity as a result of the Scheme (e.g., extension of existing culverts).
- 2.2.4. Watercourses identified for detailed assessment were screened as requiring further habitat (namely RHS, River Corridor Survey (RCS), Modular River Survey (MoRPh<sup>11</sup>),

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<sup>10</sup> CIEEM (2018) Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine version 1.1. Chartered Institute of Ecology and Environmental Management, Winchester.

<sup>11</sup> It should be noted that although geomorphological and habitat surveys (RHS and RCS) have been undertaken, MoRPh surveys and subsequent River Condition Assessments (RCA) were undertaken due to the requirement for Biodiversity Net Gain (BNG) Assessments.



and/or species survey (namely, aquatic macroinvertebrate, white-clawed crayfish, aquatic macrophyte and fish survey) based on the following criteria:

- There were no suitable existing recent background or Scheme ecological data on the watercourse within the 2 km study area.
- The watercourse exhibited suitable habitat that would justify the detailed survey type, based on the walkover survey findings.

#### Pond surveys

2.2.5. No lakes were identified within the screening area. Therefore, only ponds are discussed in the following sections.

2.2.6. Ponds were screened in for survey based on the following criteria:

- The pond is to be lost by any mechanism (drainage, land take to construction etc.) or may experience a significant change in water quality or quantity as a result of the Scheme (e.g., severance of feeder surface/groundwater pathways to the pond/lake) based on available design information.
- The pond is considered to be potentially ecologically important (i.e., potentially of Local ecological importance or greater), based on a review of physical habitat data collected during Habitat Suitability Index (HSI) survey.
- Its hydrological characteristics make it suitable for survey within the prescribed Predictive System for Multimetrics (PSYM) survey window.

#### Proportionality of survey effort

2.2.7. Surveys were undertaken only in the absence of suitable existing background data (for example Environment Agency biological monitoring data), ensuring that survey effort was proportionate to the requirement for robust ecological assessment. Existing background data were reviewed to identify the validity of its use (spatially and temporally) in place of the requirement for additional Scheme specific survey.

## Survey Methods

#### Watercourse walkover survey

2.2.8. Watercourses identified as being potentially affected were visited at the point of interaction with the Scheme (i.e., a proposed crossing point) and, where feasible, 250 m up and downstream of these interactions. During the survey, habitat characteristics were recorded following habitat descriptors outlined in RHS methodology, as listed below:

- Substrates (e.g., sand/silt, gravel, pebble, cobble, boulders).
- Vegetation type (e.g., submerged fine leaved, submerged broad leaved, marginal reeds).
- Flow type (e.g., smooth, rippled, unbroken waves).
- Approximate channel dimensions and water depths.
- Presence and extent of channel and bank re-sectioning.
- Presence of any existing crossing structures, weirs or outfalls.

2.2.9. The aquatic ecology walkover survey was designed to assess the suitability of the watercourses for fish and other aquatic species, as well as determine the requirement for further detailed surveys at later project stages.

### River Habitat Survey

- 2.2.10. For watercourses identified as requiring RHS, based on the criteria outlined in Section 2.1, RHS were undertaken alongside RCS.
- 2.2.11. Surveys were undertaken using the standard methods described in River Habitat Survey in Britain and Ireland – Field Survey Guidance Manual<sup>12</sup>.
- 2.2.12. A full 500 m RHS was undertaken for each point of interaction identified as requiring survey, where the length of accessible open channel allowed.
- 2.2.13. All RHS were undertaken in July 2020, by an RHS accredited freshwater ecologist<sup>13</sup>.
- 2.2.14. The results of RHS were used to calculate Habitat Modification Scores (HMS). The HMS provides a measure of artificial modification to the river channel morphology. To calculate the HMS for a survey site, points are allocated for the presence and extent of artificial features such as culverts/weirs and modifications such as re-profiling and reinforcement of the channel and banks.
- 2.2.15. Greater and more severe modifications result in a higher score. The cumulative points total provides the Habitat Modification Score (HMS). A Habitat Modification Class (HMC) protocol has been developed which allocates the condition of the channel in a site to one of five modification classes, based on the total score (1 = near-natural; 5 = severely modified), as shown in the coloured tables within the HMS sheets in 4.1.4.A.1. Higher HMS scores reflect more artificial intervention and modification of the river channel within a site.
- 2.2.16. HMS sheets are provided in Appendix A.1 of this report.

### River Corridor Survey (RCS)

- 2.2.17. For watercourses identified as requiring RCS (based on the criteria outlined in Section 2.1), surveys were undertaken at existing and proposed Scheme crossing points using the standard methods described in the River Corridor Surveys Methods and Procedures (Conservation Technical Handbook)<sup>14</sup>.
- 2.2.18. Where possible, RCS reaches were centred on the Scheme crossings points. Where this was not feasible (e.g., due to access constraints), surveys were undertaken as close as possible to the existing or proposed crossing point.
- 2.2.19. Where the length of accessible open channel allowed, a full 500 m RCS was undertaken for each point of interaction identified as requiring survey.
- 2.2.20. For each RCS the aquatic, marginal, bank and adjacent land zones were mapped (including the presence of any aquatic macrophytes) and at least one representative cross-section was drawn for each site. Reference photographs were also taken.
- 2.2.21. All RCS were undertaken during July 2020 by competent freshwater ecologists.
- 2.2.22. The RCS key and survey sheets are provided in Appendix A.2 of this report.

### Modular River Surveys (MoRPh)

- 2.2.23. For watercourses identified as requiring MoRPh, surveys were undertaken in accordance with the MoRPh Survey: Technical Reference Manual 2022 version (Gurnell *et al.*, 2022)<sup>15</sup> by an accredited MoRPh surveyor.

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<sup>12</sup> Environment Agency (2003) River Habitat Survey in Britain and Ireland - Field Survey Guidance Manual and National Rivers Authority (1992). River Corridor Surveys: Methods and Procedures.

<sup>13</sup> EA Accredited RHS Surveyor Number: FA022

<sup>14</sup> National Rivers Authority (1992). River Corridor Surveys. Methods and Procedures. Conservation Technical Handbook No. 1.

<sup>15</sup> Gurnell, A., England, J., Shuker, L. and Wharton, G. (2022) The MoRPh Survey: Technical Reference Manual 2022 version.

- 2.2.24. MoRPh surveys were undertaken on the Leigh Brook on 12 May 2022 and on the River Chelt on 07 June 2022.
- 2.2.25. The MoRPh survey method collects a range of physical habitat data across four broad areas:
- General information - records general survey details such as date, location, channel cross-section measurements and module length.
  - Bank-top floodplain - records artificial ground cover, bank-top vegetation (including invasive non-native species) and floodplain water related features e.g., side channels.
  - Bank face and channel margin measurements - records bank-face profile, bank-face material, any bank reinforcements (and associated materials), vegetation types (including non-native invasive species) and abundances, and bank and marginal features e.g., side bars.
  - Channel bed measurements - records channel bed substrates, water surface flow patterns, natural and artificial channel features (such as mid-channel bars and bridge piers) and vegetation types (including non-native invasive species) and abundances.
- 2.2.26. Most features are recorded using abundance categories of:
- Absent.
  - Trace (<5% of the module area).
  - Present (5% - <33% of the module area).
  - Extensive (>33% of the module area).
- 2.2.27. Where possible, MoRPh surveys were undertaken at existing and proposed Scheme crossing points and at sub-reaches that were representative of the watercourse's overall character and condition.
- 2.2.28. As per the guidance, a minimum of 20% of the length of watercourse screened in for MoRPh surveys within the Order limits were surveyed.
- 2.2.29. A River Condition Score<sup>16</sup> was calculated to determine condition relative to the watercourse typology and to generate the required information to feed into the Scheme's Biodiversity Net Gain (BNG) assessment using the DEFRA Biodiversity Metric 3.0<sup>17</sup>.
- 2.2.30. The BNG assessment is provided in Appendix 7.18 – TR010063 – APP 6.15. Appendix 7.18 also includes the MoRPh survey data and condition assessment calculations.

#### Ditch Condition Assessment

- 2.2.31. Ditch condition assessment were undertaken, retrospectively using the watercourse walkover survey information, using the Biodiversity Metric 3.0 ditch condition assessment approach, which assigns a condition based on how many of the following eight criteria are met along the ditch length:
1. The ditch is of good water quality, with clear water (low turbidity) indicating no obvious signs of pollution.
  2. A range of emergent, submerged and floating leaved plants are present. As a guide >10 species of emergent, floating or submerged plants in a 20 m ditch length.

<sup>16</sup> Gurnell, A.M., England, J., Scott, S.J. and Shuker, L.J. (2021) A guide to assessing river condition. Part of the Rivers and Streams Component of the Biodiversity Net Gain Metric. Beta test version: March 2021.

<sup>17</sup> Natural England Joint Publication JP 039 (2021). The Biodiversity Metric 3.0 Auditing and Accounting for Biodiversity: User Guide. Accessible from: <http://nepubprod.appspot.com/publication/6049804846366720>.

3. There is less than 10% cover of filamentous algae and/or duckweed (these are signs of eutrophication).
  4. A fringe of marginal vegetation is present along more than 75% of the ditch.
  5. Physical damage evident along less than 5% of the ditch, such as excessive poaching, damage from machinery use or storage, or any other damaging management activities.
  6. Sufficient water levels are maintained; as a guide a minimum summer depth of approximately 50 cm in minor ditches and 1 m in main drains.
  7. Less than 10% of the ditch is heavily shaded.
  8. There is an absence of non-native plant and animal species.
- 2.2.32. Ditches that meet all eight criteria are classified as having 'Good' condition, six to seven criteria as having 'Moderate' condition, and zero to five as having 'Poor' condition.
- 2.2.33. Ditch condition assessment sheets are provided in the BNG assessment, Appendix 7.18 – TR010063 – APP 6.15.

#### Aquatic macroinvertebrates

- 2.2.34. Aquatic macroinvertebrate surveys were undertaken at representative locations within each of the watercourses screened as requiring survey. Samples were collected downstream of the Scheme interface with the watercourse so that the location is in the direction in which most effects will propagate. Where access allowed and habitat was suitable, samples were also collected upstream to further characterise the community and provide a control site to support future construction monitoring.
- 2.2.35. Aquatic macroinvertebrate samples were collected using a standard three-minute kick-sampling technique in accordance with RIVPACS<sup>18</sup> standard sampling protocols<sup>19</sup>.
- 2.2.36. Samples were preserved in the field in 99% Industrial Denatured Alcohol (IDA) and returned to the laboratory for sorting and species/mixed taxon level analysis.
- 2.2.37. Environmental variables<sup>20</sup> required to generate RIVPACS community predictions were recorded, thus ensuring that should a full suite of WFD classification be required in the future, the data collected was fit for purpose. For each sample, the following biological metrics were calculated:

#### Whalley Hawkes Paisley Trigg (WHPT)<sup>21</sup>

- The WHPT metric was developed by the statistical analysis of a large and comprehensive database of field samples, as an update to the Biological Monitoring Working Party (BMWP<sup>22</sup>) scoring system.
- Much like the former BMWP scoring system, WHPT was developed primarily as a means of assessing water quality and does not necessarily correlate intimately with conservation importance. The method has been designed to detect the impact of organic enrichment on aquatic macroinvertebrates. It is also known to be sensitive to toxic pollution. It may also detect the impact of other pressures or combinations of pressures.
- The list of scoring taxa for WHPT is more extensive than the BMWP list, due both to the inclusion of additional taxa and splitting of some BMWP species

<sup>18</sup> RIVPACS is the River Invertebrate Prediction & Classification Systems model implemented within the RICT (River Invertebrate Classification Tool) used by the Environment Agency to determine WFD invertebrate classifications.

<sup>19</sup> EU Star UK (2006) RIVPACS Macroinvertebrate Sampling Protocol. Available at: <http://www.eu-star.at/pdf/RivpacsMacroinvertebrateSamplingProtocol.pdf> [Accessed: September 2021].

<sup>20</sup> Environmental variables recorded as part of the RIVPACS method are available on request.

<sup>21</sup> WFD-UKTAG (2014), River Assessment Method. Benthic Invertebrate Fauna. Invertebrates (General Degradation): Whalley, Hawkes, Paisley & Trigg metric in River Invertebrate Classification Tool (RICT) UKTAG Method Statement. ISBN: 978-1-906934-62-0.

<sup>22</sup> Biological Monitoring Working Party (1978). Final report: assessment and presentation of the quality of rivers in Great Britain. Unpublished report, Department of the Environment, Water Data Unit.

aggregates. WHPT scoring utilises abundance data rather than just presence/absence as in BMWP.

- The metric is underpinned by sensitivity scores, based on tolerance to organic pollutants. Theoretically, a site with good water quality should result in a higher WHPT than a site with poor water quality.
- The number of scoring aquatic macroinvertebrate taxa (NTAXA) is simply the number of scoring taxa recorded in the site sample and the average score per taxon (ASPT) is the WHPT divided by NTAXA.
- ASPT tends to be less influenced by seasonal community changes and is the most appropriate index of the three by which to monitor a site over time. In general, ASPT scores above 5 represent macroinvertebrate communities living in good water quality. Lower scores are indicative of macroinvertebrate communities suffering from stress due to reduced water quality.
- In combination, the scores can also be used to infer watercourse condition in terms of habitat complexity.

#### *Proportion of Sediment-sensitive Invertebrates (PSI)<sup>23</sup>*

- The PSI is based on the known ecological responses of different aquatic macroinvertebrate species or family groups to the accumulation of sediment on riverine substrata.
- Those taxa that are known to benefit from, or that are largely unaffected by sedimentation, are given a high score, known as a Sediment Sensitivity Rating (SSR). Those taxa that are known to suffer from the accumulation of sediment are given a low SSR. The metric also depends on the relative abundance of different taxa and so is not just dependent on “presence-absence”, but also on the numbers of different taxa recorded.
- The PSI score describes the percentage of sediment-sensitive taxa present in a sample with high values indicating a greater proportion (percentage) of silt intolerant macroinvertebrate species present within the aquatic macroinvertebrate community sampled i.e., the less a site is affected by silt the greater the PSI score. Scores range from 0 to 100 with categories from naturally sedimented/un-sedimented to heavily sedimented.

#### *Lotic invertebrate Index for Flow Evaluation (LIFE)<sup>24</sup>*

- This metric was developed as a means of assessing flow as a stressor on the aquatic macroinvertebrate community. Macroinvertebrate taxa (family and species levels) are assigned to a flow group depending on their documented flow preferences (current velocity) ranging from I (Rapid) to VI (Drought Resistant).
- The calculation of a community LIFE score is underpinned by flow scores. These are derived with reference to an abundance/flow group matrix such that both the abundance and flow preference of recorded taxa is taken into account. Abundance categories are defined by standard Environment Agency categories.
- LIFE score categories identify the community as having a low, moderate or high sensitivity to flow reduction. With a lower score indicating a community made up of proportionally more taxa with a preference for low flows.

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<sup>23</sup> Extence, C.A., Chadd, R.P., England, J., Dunbar, M.J., Wood, P.J. and Taylor, E.D. (2013). The assessment of fine sediment accumulation in rivers using macro-invertebrate community response. *River Research and Applications*, 29, pp. 17-55.

<sup>24</sup> Extence, C.A., Balbi, D.M. and Chadd, R.P. (1999). River flow indexing using British benthic macroinvertebrates: A framework for setting hydroecological objectives. *Regulated Rivers: Research and Management* 15, pp. 543-574.



### Community Conservation Index (CCI)<sup>25</sup>

- The CCI is used to assess community conservation value and highlights specific species of conservation importance based on the Joint Nature Conservation Committee (JNCC) threat categories (after Wallace, 1991<sup>26</sup>).
  - Community score categories range from low (i.e., a site that supports only common species and/or a community of low taxon richness) to very high (a community potentially of national significance and may merit statutory protection) conservation value. It should be noted that the CCI does not directly align with nature conservation value.
- 2.2.38. Following identification, the macroinvertebrate species list for each survey site was checked against known conservation designations using the sources below:
- JNCC Conservation Designations for UK Taxa<sup>27</sup>.
  - Natural History Museum UK Species Data<sup>28</sup>.
  - National Biodiversity Network (NBN) Atlas<sup>29</sup>.
- 2.2.39. Biotic indices and full taxa lists are provided in Appendix A.3 of this report.

### White-clawed crayfish survey

- 2.2.40. White-clawed crayfish (*Austropotamobius pallipes*) surveys were undertaken following standard survey methodology<sup>30</sup>. All white-clawed crayfish surveys were led by surveyors holding a Natural England Class Survey Licence (CL11). During the surveys, information was recorded on the site length, channel width, flow, water clarity, water temperature, water quality, and shading, as well as information on the types of refuges present for searching and the presence of any crayfish burrows.
- 2.2.41. White-clawed crayfish survey sheets are provided in Appendix A.4 of this report.

### Aquatic macrophytes

- 2.2.42. Aquatic macrophyte surveys were undertaken along reaches screened as requiring survey in accordance with:
- Water Quality Guidance Standards for the Surveying of Aquatic Macrophytes in Running Waters<sup>31</sup>
- 2.2.43. Aquatic macrophyte surveys were conducted along a 100 m reach screened as requiring survey. Surveys were typically conducted downstream of the of the Scheme interface with the watercourse so that the location is in the direction in which most effects will propagate. In addition, predictor variables as described in LEAFACS<sup>32</sup> were collected for each 100 m survey, thus ensuring that should a full site WFD classification be required in future, the data collected was fit for this purpose.

<sup>25</sup> Chadd, R.P. and Extence, C.A. (2004). *The conservation of freshwater macroinvertebrate populations: a community-based classification Project*. Aquatic Conservation: Marine and Freshwater Ecosystems, 14, pp. 597–624.

<sup>26</sup> Wallace, I.D. (1991). A review of the Trichoptera of Great Britain. Research and Survey in Nature Conservation No. 32. Nature Conservancy Council: Peterborough.

<sup>27</sup> JNCC (2020) Conservation designations for UK taxa [online] Available at: <https://hub.jncc.gov.uk/assets/478f7160-967b-4366-acdf-8941fd33850b> [Accessed: September 2022].

<sup>28</sup> Natural History Museum (2021) UK Species Data [online] Available at: <https://www.nhm.ac.uk/our-science/data.html> [Accessed: September 2022].

<sup>29</sup> National Biodiversity Network (2021) NBN Atlas [online] Available at: <https://nbnatlas.org/> [Accessed: September 2022].

<sup>30</sup> Peay S (2003). Monitoring the White-clawed Crayfish *Austropotamobius pallipes*. Conserving Natura 2000 Rivers Monitoring Series No. 1, English Nature, Peterborough.

<sup>31</sup> CEN - EN 14184. Water Quality Guidance Standards for the Surveying of Aquatic Macrophytes in Running Waters.

<sup>32</sup> UKTAG, 2014. Guide to Macrophytes in Rivers River LEAFACS2. [pdf] Available at: <http://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Biological%20Method%20Statements/River%20Macrophytes%20UKTAG%20Method%20Statement.pdf> [Accessed: September 2022].

- 2.2.44. An estimate was made of the percentage cover of each species recorded and a corresponding cover value assigned. Species list and species cover values were then used to calculate the following biological metrics using the LEAFPACS2<sup>33</sup> survey metric calculator:
- River Macrophyte Nutrient Index (RMNI): The RMNI is designed to categorise a macrophyte community's preference to nutrient levels. Scores range from 1 to 10 with scores of 1 representing plant communities with preference for very low levels of nutrients and 10 representing communities with a preference for (or tolerance of) enriched conditions.
  - Total number of taxa recorded (TTAXA): A diversity score based on the total number of macrophyte taxa recorded from the field survey.
  - Number of aquatic taxa (NTAXA): A diversity score indicating the number of truly aquatic macrophyte taxa recorded from the field survey.
  - Number of aquatic plant functional groups (NFG): A diversity score indicating the number of functional macrophyte groups within the plant community, from a predefined list of 24 different functional groups. Only truly aquatic taxa are included.
  - Cover of green filamentous algae (ALG): The percentage cover of green filamentous algae over the whole of the surveyed section of the river.
- 2.2.45. Aquatic macrophyte survey data including species records, abundance and biological metrics are provided in Appendix A.5 of this report.

#### Fish

- 2.2.46. Electric fishing surveys were undertaken along reaches screened as requiring survey in accordance with current industry standards:
- BS EN 14962:2006 / BS 6068-5.40:2006 Water quality – Guidance on the scope and selection of fish sampling methods.
  - BS EN 14011:2003 / BS 6068-5.32:2003 Water quality – Sampling of fish with electricity.
  - Environment Agency (2010) Electric fishing in rivers. Operational Instruction 144\_03.
  - CEH (2002) Guidelines for Electric Fishing Best Practice R&D Technical Report W2-054/TR.
- 2.2.47. The upstream and downstream extent of each survey reach (100 m) was defined and isolated using stop-nets. A minimum of one electric fishing run, working in an upstream direction was undertaken at each survey reach, thus aligning the survey with the requirements for determining WFD fish status using the Fisheries Classification Scheme 2<sup>34</sup> (FCS2) model.
- 2.2.48. The use of stop-nets allowed for a catch depletion methodology to be applied where three catch depletion runs were undertaken along each survey reach. Stunned fish were removed using hand nets and stored in aerated fish holding tanks before being returned to the watercourse following recovery.
- 2.2.49. Fish captured were identified to species, counted and either fork length or total length measured to the nearest mm (depending on species caught).

<sup>33</sup> Environment Agency, 2014. River LEAFPACS2 Survey Metric calculator. [online] Available at: <https://www.wfduk.org/resources/riversmacrophytes> [Accessed: September 2022].

<sup>34</sup> WFD-UKTAG, 2008. UKTAG Rivers Assessment Methods. Fish Fauna (Fisheries Classification Scheme 2 (FCS2)).

- 2.2.50. Certain species have been classified as minor<sup>35</sup> species, these are defined as small-bodied fish that often occur in high abundance, including stone loach (*Barbatula barbatula*), bullhead (*Cottus gobio*), minnow (*Phoxinus phoxinus*) and three-spined stickleback (*Gasterosteus aculeatus*). Where these occur in high abundance, they are generally noted as either present or absent at the survey site.
- 2.2.51. Fish survey data including species and counts by electric fishing run number are provided in Appendix A.6 of this report.

#### Pond surveys

- 2.2.52. No ponds were screened as requiring survey based on no impact pathways being identified, therefore a detailed methodology of PSYM pond survey has not been provided within this appendix.

#### Priority Habitat Assessment

- 2.2.53. Based on available desk study and supporting survey information obtained for watercourses, an assessment has been made against the priority habitat criteria outlined in the UK Biodiversity Action Plan priority habitat descriptions for Rivers<sup>36</sup>.
- 2.2.54. Where the published criteria have been met for definition of priority habitat, these are described in the relevant baseline descriptor tables in Section 3.2.

#### Assessment

- 2.2.55. The aquatic receptors have been valued in a geographical context following the framework provided in Design Manual for Roads and Bridges (DMRB) guidance note LA 108 - Biodiversity<sup>37</sup>. The evaluation is based on the information gathered from the desk study and field surveys, using a combination of professional judgement and accepted criteria<sup>38</sup> (e.g., diversity, rarity and naturalness).

#### Limitations

- 2.2.56. During the watercourse walkover survey, there was limited access upstream on the Leigh Brook due to dense vegetation (hedgerow) along the watercourse obscuring views. As such, detailed surveys were undertaken downstream of the M5 where access was better and the various survey methods could be applied.
- 2.2.57. Not all watercourses were visited during the walkover survey. This was partly due to access restrictions and partly due to developing Scheme design following the walkover survey, which brought additional watercourses into the study area. All Main Rivers within the 2 km study area were visited and of the Ordinary Watercourses only Drain 9, 11, 21 and 22 were not visited. Through thorough review of aerial photographs, it is assumed that the drains which were not visited are of similar character to the other agricultural and roadside drainage features within the Scheme area. All drains observed during the walkover had similar profiles (typically <1-2 m wide), were heavily managed and typically overgrown with terrestrial vegetation, they had straightened planforms and remain dry for

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<sup>35</sup> Environment Agency, 2014. Flow and Level Criteria for Coarse Fish and Conservation Species. Science Report SC020112/SR.

<sup>36</sup> Maddock, A. (ed) (December 2011). *UK Biodiversity Action Plan Priority Habitat Descriptions – Rivers*. Online: [Rivers \(UK BAP Priority Habitat description\) \(jncc.gov.uk\)](https://www.jncc.gov.uk/information-and-publications/biodiversity-action-plan/priority-habitat-descriptions-rivers)

<sup>37</sup> Highways England (2020). Design Manual for Roads and Bridges. LA 108 Biodiversity (formerly Volume 11, Section 3, Part 4 Ecology and Nature Conservation and IAN 130/10). (March 2020, version 1). Online: [https://www.standardsforhighways.co.uk/dmrb/search?discipline=SUSTAINABILITY\\_AND\\_ENVIRONMENT\\_](https://www.standardsforhighways.co.uk/dmrb/search?discipline=SUSTAINABILITY_AND_ENVIRONMENT_)

<sup>38</sup> Set out in Ratcliffe, D.A (1977). *A Nature Conservation Review*. Cambridge University Press.



at least part of the year. As such, it is considered reasonable to assume that the additional drain features which were unable to be visited are of a similar value.

2.2.58. On both the River Chelt and Leigh Brook within the Order limits, limited access and visibility constrained MoRPh surveys at the following locations:

- Upstream of the existing River Chelt Crossing (SO 90128 24770 - SO 90043 24791).
- Upstream, downstream and at the point of the new Link Road Bridge on the River Chelt (SO 90618 24617 – SO 90843 24588).
- Leigh Brook upstream (SO 90801 25981 – SO 90920 25908) and downstream of the Leigh Brook Culvert (SO 90687 26076 – SO 90658 26189).

2.2.59. Subsequently, the reaches of the River Chelt and Leigh Brook described above have either not been visited or MoRPh surveyed. As such, and where appropriate, river condition has been applied to unvisited reaches of both the River Chelt and Leigh Brook, by using river condition that has been calculated on representative reaches on each watercourse. Habitat characteristics, watercourse typology, review of aerial imagery and professional judgement has been applied to ensure that river condition that has been applied to unvisited reaches is representative of the habitats likely to be present in both the riparian and in-channel habitat.

## 3. Baseline

### 3.1. Desk study

#### Watercourse screening outcomes

- 3.1.1. A total of 24 watercourses were identified within the combined study area during the initial screening exercise. These include four Main Rivers, and 20 Ordinary Watercourses. No canals were identified within the screening area.
- 3.1.2. Watercourses identified within the study area are provided in Table 3-1. Since watercourses are linear features within the landscape, they may interact with the Scheme at more than one location e.g., crossed by the Scheme in separate locations, and falling within the screening area of the Scheme or another location.
- 3.1.3. Of these watercourses, 14 were taken forward for baseline data collation and detailed assessment, based on application of screening criteria outlined in Section 2.1. Screening criteria and outcomes are summarised in Table 3-1.

Table 3-1 - Watercourse screening outcomes

Watercourse name	Watercourse type	Potentially important ecological feature for EIA	Potential impact pathway identified?	Assessment screening outcome
River Chelt	Main River	Yes	Yes	In
Leigh Brook	Ordinary Watercourse <sup>39</sup>	Yes	Yes	In
River Swilgate	Main River	Yes	No	Out
Hatherley Brook	Main River	Yes	No	Out
Dean Brook	Main River	Yes	No	Out
MW3	Ordinary Watercourse	Yes	Yes	In
MW4	Ordinary Watercourse	Yes	No	Out
Drain 4	Ordinary Watercourse	Yes	No	Out
Drain 5	Ordinary Watercourse	Yes	No	Out
Drain 6	Ordinary Watercourse	Yes	No	Out
Drain 7	Ordinary Watercourse	Yes	No	Out
Drain 8	Ordinary Watercourse	Yes	Yes	In

<sup>39</sup> Designated as Main River approximately 2.25 km downstream from the Order limits (outside of the combined study area).

Watercourse name	Watercourse type	Potentially important ecological feature for EIA	Potential impact pathway identified?	Assessment screening outcome
Drain 9	Ordinary Watercourse	Yes	Yes	In
Drain 10	Ordinary Watercourse	Yes	Yes	In
Drain 11	Ordinary Watercourse	Yes	Yes	In
Drain 12	Ordinary Watercourse	Yes	Yes	In
Drain 13	Ordinary Watercourse	Yes	No	Out
Drain 14	Ordinary Watercourse	Yes	Yes	In
Drain 15	Ordinary Watercourse	Yes	Yes	In
Drain 16	Ordinary Watercourse	Yes	Yes	In
Drain 17	Ordinary Watercourse	Yes	No	Out
Drain 20	Ordinary Watercourse	Yes	Yes	In
Drain 21	Ordinary Watercourse	Yes	Yes	In
Drain 22	Ordinary Watercourse	Yes	Yes	In

3.1.4. Further details of those watercourses taken forward for detailed assessment are provided in Table 3-2 along with details of the key Scheme interaction points identified for each watercourse. Those features screened out were either outside of the Order limits for the Scheme and do not have any hydrological connectivity to the works or were on the edge of the Order limits, but not under any footprint of the works, and also having no hydrological connectivity to likely Scheme impacts.

Table 3-2 - Scheme interaction points for watercourses taken forward to assessment

Watercourse name	Type of interaction	Interaction location	Scheme component/impact
River Chelt	Crossed by the Scheme	SO 90743 24593	New proposed bridge crossing associated with the Link Road
	Crossed by the Scheme	SO 90020 24812	No change to existing river crossing (River Chelt Culvert)
Leigh Brook	Crossed by the Scheme	SO 90759 26016	Existing M5 culvert extension (Leigh Brook Culvert)
	Drainage	SO 91283 25787	Adjacent to an attenuation basin with new drainage outfall (open cut channel)
MW3	Drainage	SO 90090 25186	Adjacent to an attenuation basin with new drainage outfall
Drain 8	Crossed by the Scheme	SO 90130 25883	Existing culvert extension and realignment due to Scheme footprint
Drain 9	Underneath Scheme footprint	SO 90011 25881	Realignment due to Scheme footprint
Drain 10	Crossed by the Scheme	SO 90710 25443	Existing culvert extension and realignment due to Scheme footprint
Drain 11	Crossed by the Scheme	SO 90813 25311	Realignment due to Scheme footprint
Drain 12	Crossed by the Scheme	SO 90870 24886	Existing culvert extension and new proposed crossing associated with the Link Road
Drain 14	Crossed by the Scheme	SO 90359 23855	Riparian disturbance
Drain 15	Crossed by the Scheme	SO 90458 23904	Existing culvert extension and new B4634 flood culverts
Drain 16	Underneath Scheme footprint	SO 90366 23844	Realignment due to Scheme footprint
Drain 20	Underneath Scheme footprint	SO 90616 23905	Realignment due to the Scheme footprint
Drain 21	Within Order Limits	SO 91893 24520	Channel regrading and new drainage outfall (open cut channel)
Drain 22	Crossed by Scheme	SO 90379 25481	Existing culvert extension (Piffs Elm Culvert)

### Standing waterbody screening outcomes

- 3.1.5. A total of 17 ponds (waterbodies <2 ha in size) were identified within the combined study area, presented in Table 3-3.
- 3.1.6. On a precautionary basis, these ponds have been assessed as being potentially important ecological features that may provide valuable aquatic habitat and support a range of aquatic species, even if habitat quality is poor or if they only occasionally hold standing water.

Table 3-3 - Standing water body screening outcomes

Water body ID	Location	Potentially important ecological feature for EIA	Potential impact pathway identified?	Assessment screening outcome
Pond 1	SO 91418 28338	Yes	No	Out
Pond 11	SO 91545 27023	Yes	No	Out
Pond 12	SO 91389 26983	Yes	No	Out
Pond 13	SO 91376 26961	Yes	No	Out
Pond 14	SO 91430 26925	Yes	No	Out
Pond 14a	SO 91398 26859	Yes	No	Out
Pond 15	SO 91411 26826	Yes	No	Out
Pond 22	SO 91425 24843	Yes	No	Out
Pond 23	SO 91454 24830	Yes	No	Out
Pond 24	SO 91504 24742	Yes	No	Out
Pond 25	SO 91572 24648	Yes	No	Out
Pond 28	SO 92807 24616	Yes	No	Out
Pond 31	SO 90281 24169	Yes	No	Out
Pond 37	SO 89576 23129	Yes	No	Out
Pond 38	SO 89594 23139	Yes	No	Out
Pond 39	SO 89932 26139	Yes	No	Out
Pond 40	SO 89946 26079	Yes	No	Out

3.1.7. No impact pathways have been identified for ponds identified within the study area taking account of embedded mitigation, therefore no ponds have been taken forward for baseline data collation or assessment.

### Existing background data

#### Designated sites

3.1.8. No statutory or non-statutory designated watercourses, ponds or lakes were identified within 2 km of the Scheme.

3.1.9. However, it should be noted that the River Chelt and Leigh Brook are tributaries of the River Severn, which is designated as the Severn Estuary Special Area of Conservation (SAC), Ramsar Site and Site of Special Scientific Interest (SSSI) over 40 km downstream from the closest Scheme interaction. The River Chelt may therefore provide functionally linked habitat for the qualifying fish species of the designated sites.

#### Biological records search

3.1.10. GCER returned no records for protected or notable aquatic macroinvertebrates, aquatic macrophytes or fish species within 2 km of the Scheme.

#### Environment Agency monitoring data

3.1.11. No temporally (< 5 years old) or spatially (within 2 km) suitable Environment Agency data was available for watercourses identified within the 2 km study area. Some data > 5 years

old is available for the River Chelt and has briefly been summarised within the baseline section for additional context for fish species only.

## Survey screening outcomes

### Watercourses

- 3.1.12. All watercourses taken forward for assessment were screened as requiring a walkover survey as per the approach outlined in Paragraph 2.2.1.
- 3.1.13. Additionally, the River Chelt and Leigh Brook met the survey screening criteria for detailed surveys as outlined in Table 3-4. Survey locations were focused on the Scheme crossing points outlined in Table 3-4. Unique survey ID codes have been assigned to each survey e.g., WCID09\_FH (fish surveys).
- 3.1.14. It should be noted that the Leigh Brook did not meet the screening criteria for fish survey, given that the habitat within the site was not deemed suitable for the survey methodology.
- 3.1.15. Furthermore, no other watercourses (drains and minor watercourses) met the screening criteria for detailed aquatic ecology surveys, principally due to the features not exhibiting suitable habitat for the detailed survey type as reviewed during the walkover. Walkover data is considered sufficient to characterise these watercourses to inform a robust assessment.
- 3.1.16. Watercourse survey locations are shown on Figure 7-12B within Appendix B.
- 3.1.17. For spatial context:
- WCID09 – indicates surveys in proximity to/at the existing M5 crossing of the River Chelt.
  - WCID10 - indicates surveys in proximity to/at the proposed new crossing of the River Chelt (Link Road Bridge).
  - WCID02 – indicates surveys in proximity to/at the existing M5 crossing of the Leigh Brook.

Table 3-4 - Survey locations, survey type<sup>40</sup> and date

Survey ID	Survey reach NGR	Survey type	Date of survey
<b>River Chelt</b>			
WCID09_RHS	SO 90182 24760 – SO 89869 25052	River Habitat Survey	27/07/2020
WCID10_RHS	SO 90963 24606 – SO 90490 24660	River Habitat Survey	27/07/2020
WCID09_RCS	SO 90260 24783 – SO 89891 24979	River Corridor Survey	29/07/2020
WCID10_RCS	SO 90867 24558 - SO 90497 24654	River Corridor Survey	29/07/2020
WCID09_MRS_LR	SO 90882 24553 - SO 90839 24585	Modular River Survey	07/06/2022
WCID10_MRS_J10_US	SO 90043 24791 – SO 90011 24823	Modular River Survey	07/06/2022

<sup>40</sup> Each survey type has been given a unique survey ID, which is as follows: RHS – River Habitat Survey, RCS – River Corridor Survey, MRS – Modular River Survey (MoRPH), aquatic macroinvertebrate (MI), white-clawed crayfish (WWC), aquatic macrophyte (MP) and fish (FH).

Survey ID	Survey reach NGR	Survey type	Date of survey
WCID10_MRS_J10_DS	SO 89987 24841 - SO 89949 24855	Modular River Survey	07/06/2022
WCID09_MI_A	SO 90184 24781	Macroinvertebrate	13/10/2020
WCID09_MI_B	SO 89915 24885	Macroinvertebrate	13/10/2020
WCID10_MI_A	SO 90859 24556	Macroinvertebrate	13/10/2020
WCID10_MI_B	SO 90605 24615	Macroinvertebrate	13/10/2020
WCID09_WWC	SO 90232 24783 – SO 89939 24867	White-clawed crayfish	28/07/2020
WCID10_WCC	SO 90876 24578 – SO 90568 24620	White-clawed crayfish	29/07/2022
WCID09_MP	SO 90096 24787 - SO 90042 24796	Macrophyte	29/07/2020
WCID10_MP	SO 90714 24607 – SO 90625 2461	Macrophyte	29/07/2020
WCID09_FH	SO 90140 24760 – SO 90053 24787	Fish	29/07/2020
WCID10_FH	SO 90645 24606 – SO 90518 24634	Fish	28/07/2020
<b>Leigh Brook</b>			
WCID02_RHS	SO 90737 26057 – SO 90546 26433	River Habitat Survey	27/07/2020
WCID02_RCS	SO 90745 26051 – SO 90560 26407	River Corridor Survey	28/07/2020
WCID02_MRS	SO 90731 26052 - SO 90699 26074	Modular River Survey	12/05/2022
WCID02_MI	SO 90667 26090	Macroinvertebrate	13/10/2020
WCID02_WWC	SO 90634 26100 – SO 90647 26192	White-clawed crayfish	27/07/2020
WCID02_MP	SO 90742 26044 – SO 90642 26106	Macrophyte	28/07/2020

### Ponds

- 3.1.18. Existing ponds were screened out of requiring both detailed assessment and survey (specifically PSYM survey), as no ponds lie directly underneath the footprint and/or are otherwise impacted by the Scheme. This assumes the embedded construction mitigation is followed, principally around pollution prevention.

## 3.2. Baseline watercourse conditions

- 3.2.1. Table 3-5 and Table 3-6 outline baseline characterisation of the River Chelt (Main River) and Leigh Brook (Ordinary Watercourse) as supported by existing background records and survey data.
- 3.2.2. Baseline characterisation for other Ordinary Watercourses taken forward for detailed assessment, are presented under the corresponding heading within this section, with photographs presented in Table 3-7.



- 3.2.3. Existing baseline conditions are considered in relation to each watercourse receptor to determine its overall ecological valuation for the purpose of impact assessment.
- 3.2.4. Original data from survey undertaken in support of the ecological valuations are presented in the corresponding appendices.

Table 3-5 - River Chelt

Watercourse: River Chelt (Main River)



Photo 1: River Chelt upstream of M5 crossing (SO 90816 24584) (left)  
Photo 2: River Chelt downstream of M5 crossing (SO 89914 24887) (right)

**WFD Characterisation**

Where the Scheme interacts with the River Chelt, it is designated as two different WFD water bodies, as presented below:

**Chelt – source to M5 (GB109054032820)**

Classified WFD Water Body – Yes

Hydromorphological designation – heavily modified

Overall Ecological Status – Moderate (2019 Classification)

- Overall Biological Quality Elements – Good
  - Fish – High
  - Invertebrates – Good
  - Macrophytes and Phytobenthos combined – Good

Hydromorphological supporting elements – Supports Good

Reasons for Not Achieving Good – Physical modification associated with flood protection and urbanisation.

**Chelt – M5 to confluence River Severn (GB109054032810)**

Classified WFD Water Body – Yes

Hydromorphological designation – not designated artificial or heavily modified

Overall Ecological Status – Poor (2019 Classification)

- Overall Biological Quality Elements – Poor
  - Fish – Not classified for 2019. Poor in 2014.
  - Invertebrates – Good
  - Macrophytes and Phytobenthos combined – Poor

Hydromorphological supporting elements – Supports Good

Reasons for Not Achieving Good – Mixture of poor livestock and nutrient management resulting in diffuse pollution, sewage discharge, septic tanks and transport drainage.



## Watercourse: River Chelt (Main River)

### Background records

**Existing background data:** Desk study returned no temporally (< 5 years old) or spatially (within 2 km) suitable Environment Agency data for aquatic macrophytes, macroinvertebrates or fish. Moreover, no records for RHS were identified.

Historical Environment Agency Fisheries data

Environment Agency fish survey records (>5 years old) indicate that the populations of the Chelt in proximity to the Scheme (records from monitoring sites located within 2.5 km of the M5 crossing) are predominately composed of minor coarse fish species e.g., bullhead (*Cottus gobio*), gudgeon (*Gobio gobio*) and 3-spined stickleback (*Gasterosteus aculeatus*). Of note are records of brown/sea trout (*Salmo trutta*) and European eel (*Anguilla anguilla*). European eel is a Critically Endangered species on the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (2020), and is a species of Principal Importance under section 41 of the Natural Environment and Rural Communities (NERC) Act 2006, and a UK Biodiversity Action Plan (BAP; 2007) priority fish species. Brown/sea trout are also a species of Principal Importance under section 41 of the NERC Act 2006 and a UK BAP (2007) priority fish species.

Atlantic salmon (*Salmo salar*) as well as major coarse fish species such as barbel (*Barbus barbus*), roach (*Rutilus rutilus*) and dace (*Leuciscus leuciscus*) are also present in the River Chelt, but typically in its lower reaches nearer to the confluence with the River Severn. Atlantic salmon have been recorded on one occasion in low numbers (4 recorded at survey) in 2014, approximately 8.1 km downstream from the Scheme. Atlantic salmon is a European Commission Habitats Directive Annex II and V species, a species of Principal Importance under section 41 of the NERC Act 2006 and a UK BAP (2007) priority fish species.

No designated sites were identified within 2 km of the Scheme. However, the River Chelt is a tributary of the River Severn, and therefore may support the migratory fish species that are qualifying features/interest features of the Severn Estuary SAC, Ramsar and SSSI, which can all migrate over 40 km upstream where there are no barriers, such as weirs or waterfalls<sup>41,42</sup>. European eel, Atlantic salmon and sea/brown trout are qualifying features/interest features of the Severn Estuary Ramsar and SSSI.

No protected or priority aquatic species (aquatic macroinvertebrates, macrophytes, fish, white-clawed crayfish (*Austropotamobius pallipes*)) were returned from GCER within 2 km of the Scheme.

### River Habitat Survey

Both reaches of the River Chelt exhibited modifications due to channel realignment and over-deepening. In-channel habitat was homogenous across the reaches with low substrate variability and flow types, in particular at the location of the existing M5 crossing. Within the reach in which the new River Chelt Bridge is proposed (WCID10), there was greater in-channel habitat complexity due to the presence of un-vegetated side bars, large woody debris and greater variability in flow types. Both reaches had a lack of trees along their riparian zones.

#### Survey code: WCID09\_RHS

Representative Channel Dimensions: Water depth: 0.1 m; water width: 2.2 m; bankfull width: 4.5 m

Habitat Modification Score (HMS): 3,605

Habitat Modification Class (HMC): 5 (severely modified)

**Summary:** A lowland river flowing through predominantly agricultural land characterised by tilled land and broadleaved plantation. There is evidence of historical channel realignment and over deepening associated with the surrounding land-use. Channel substrate was uniform (gravel-pebble and sand), with low energy flow types, bank profiles (including eroding cliff habitats), however channel features are absent. Few aquatic macrophyte functional groups (indicators of

<sup>41</sup> Maitland, P.S. (2003). Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.

<sup>42</sup> Maitland, P.S. & Hatton-Ellis, T.W. (2003). Ecology of the Allis and Twaite Shad. Conserving Natura 2000 Rivers Ecology Series No. 3. English Nature, Peterborough.

### Watercourse: River Chelt (Main River)

vegetative river habitat diversity) were recorded. Tree cover (and therefore channel shading and other wooded habitat features) is relatively sparse.

#### Survey Code: WCID10\_RHS

Representative Channel Dimensions: Water depth: 0.15 m; water width: 2.4 m; bankfull width: 5.1 m

Habitat Modification Score (HMS): 2,120

Habitat Modification Class (HMC): 5 (severely modified)

**Summary:** A lowland river flowing through predominantly tilled, rough pasture and suburban land use. There is evidence of historical channel realignment and over deepening associated with the surrounding land-use, in addition to impoundment facilitated by a weir. Channel substrate was uniform (gravel-pebble and sand), with low and high energy flow types, bank profiles (including eroding cliff habitats), and channel features such as un-vegetated side bars and a mature island, with large woody debris contributing to habitat complexity. Few aquatic macrophyte functional groups (indicators of vegetative river habitat diversity) were recorded. Tree cover (and therefore channel shading and other wooded habitat features) is relatively sparse.

### River Corridor Survey

#### Survey code: WCID09\_RCS

**Summary:** The River Chelt flows through an area of arable farmland (both banks) with a series of farm buildings predominantly on the right bank towards the upstream end of the reach. A farm access bridge and associated weir is present across the channel in line with these buildings. The channel within this reach also flows under the M5 motorway carriageway and there is a footpath running along the left bank. Channel incision along the survey reach is evidenced through steep banks and a few sections of eroding cliffs. No pipes, outfalls or tributaries were identified at survey. Around the M5 motorway culvert and the farm access bridge there is some artificial bank protection. In-channel macrophytes were limited to a few patches of water crowfoot (*Ranunculus* Sect. *Batrachium* sp.) and water starwort (*Callitriche* sp.). Patches of marginal vegetation were relatively common on both banks mainly comprised of branched bur-reed (*Sparganium erectum*) and scattered reed canary-grass (*Phalaris arundinacea*) along the margins. Less frequent patches of fool's watercress (*Helosciadium nodiflorum*), brooklime (*Veronica beccabunga*), soft rush (*Juncus effusus*), hard rush (*J. inflexus*), water figwort (*Scrophularia auriculata*) and pendulous sedge (*Carex pendula*) were also present.

Bank vegetation was dominated by grasses and ruderal communities such as creeping bent grass (*Agrostis stolonifera*), great willowherb (*Epilobium hirsutum*) and gypsywort (*Lycopus europaeus*). The invasive non-native species Himalayan balsam (*Impatiens glandulifera*) was also recorded within the reach.

Individual bankside trees were occasionally present, with patches of broadleaved woodland on both banks adjacent to the M5 motorway. Trees comprised a mix of ash (*Fraxinus excelsior*), Scots pine (*Pinus sylvestris*), beech (*Fagus sylvatica*), sycamore (*Acer pseudoplatanus*), crack-willow (*Salix fragilis*) and hawthorn (*Crataegus monogyna*). Brambles (*Rubus fruticosus* agg.) were also present within and adjacent to the broadleaf woodland.

In-channel habitat was relatively homogenous, with no features such as mid-channel bars or islands and only one riffle associated with the weir structure.

#### Survey code: WCID10\_RCS

**Summary:** The River Chelt runs through an area of residential housing (right bank) and farmland (left bank). Channel incision along the survey reach is evidenced through sequences of stable and unstable cliffs. The banks are fenced throughout, where they are artificially reinforced with man-made stone wall revetment. No pipes, outfalls or tributaries were identified at survey. There is also a footpath on the left bank, with a road along 200 m of its course. In-channel macrophytes were limited to a few patches of water crowfoot. Filamentous algae (mainly *Cladophora glomerata*) was frequent, with small stones supporting the encrusting alga *Gongrosira encrustans*. Little marginal vegetation was recorded, mainly with scattered reed canary-grass or branched bur-reed along the margins and a few locations where deposition of silt has enabled species such as great willowherb, hybrid watercress (*Nasturtium × sterilis*), redshank (*Persicaria*

### Watercourse: River Chelt (Main River)

*maculosa*), water figwort and brooklime to colonise. Bank vegetation was dominated by tall ruderal communities such as great burdock (*Arctium lappa*), false oat-grass (*Arrhenatherum elatius*), large bindweed (*Calystegia sylvatica*), spear thistle (*Cirsium vulgare*), bristly ox-tongue (*Helinthis echioides*), hogweed (*Heracleum sphondylium*) and the invasive non-native species Himalayan balsam. These communities were present between stands of trees that included hazel (*Corylus avellana*), ash (*Fraxinus excelsior*) and crack willow, as well as a line of planted balsam poplars (*Populus cf. trichocarpa*) and a single crab apple (*Mauls sylvestris*). Where erosion has occurred, the banks were limited to complexes of bryophytes mainly *Pohlia melanodon* and *Lunularia cruciata* and a small stand of *Marchantia polymorpha subsp. ruderalis*. In-channel habitat was homogenous, with no features such as mid-channel bars, islands or pools/riffles present.

### Modular River Survey

#### Survey Code: WCID09\_MRS\_LR

The River Chelt at this location is a lowland river flowing predominantly through agricultural land characterised by arable fields (right bank) and permanently vegetated agriculture (left bank), with occasional clumps of trees present on both banks. There is evidence of historical realignment and over-deepening associated with the riparian land-use, however, areas of active erosion suggest that the system is beginning to naturally recover and return to its historical alignment. The channel bed was predominantly composed with softer substrates such as sand and clay, with some areas of gravel/pebble. Low energy flow types, which were predominantly smooth, were extensively present throughout the survey sub-reach, with some areas of rippled flow associated with a riffle. Organic accumulations (wood, twigs and leaves) were present within the channel, which has facilitated the establishment of a mid-channel bar. Marginal features included berms/benches on the right bank, with animal nest holes present on the left bank. The left bank had greater rates of erosion, with an eroded cliff present. Marginal macrophyte groups included emergent linear and broad-leaved macrophytes in areas where channel shading was absent. The invasive non-native species Himalayan balsam was also recorded within the reach.

#### Survey Code: WCID10\_MRS\_J10\_US

Approximately 40 m of the River Chelt at this location is culverted, which conveys flow underneath the M5 carriageway. The 10 m of the River Chelt upstream of the River Chelt culvert flows through predominantly agricultural land, characterised by permanently vegetated agriculture on both banks, with a pedestrianised footpath on the left bank. The footpath is vegetated with a fence and wiring present. There is a jetty like structure through the River Chelt Culvert that conveys a concrete walkway. There are deciduous tree species such as willow present on the right bank at the upstream end of the River Chelt culvert. Marginal features were limited to a vegetated side bar present on the right bank. The channel bed was predominately composed of harder substrates such as gravel and pebble, with some areas of sand present. Low energy flow types, which were predominantly smooth, were extensively present throughout the survey sub-reach, with rippled flow present in some areas. Marginal vegetation was limited to emergent linear-leaved macrophyte species.

#### Survey Code: WCID10\_MRS\_J10\_DS

The River Chelt at this location flows predominantly through agricultural land characterised by arable fields on the right bank, with deciduous woodland and a pedestrianised footpath on the left bank. There is a footbridge that crosses the River Chelt at SO 89954 24853, where whole bank reinforcement is present on the left and right bank, primarily composed of brick. Both banks are reinforced at the same extent and with the same material immediately downstream, which is associated with one large outfall, assumed to be from a sewage treatment works in the area. Concrete channel bed reinforcement is also present, associated with the outfall previously described. A total of 12 outfalls were present on the left bank, assumed to be associated with land drainage, with another two outfalls present on the right bank, directly beneath the footbridge. High energy flow types, generated by the large volumes of water discharging from the large outfall, included broken and unbroken standing waves, in addition to some areas of rippled flow. Immediately downstream, a large pool has formed, facilitated by the scour of the channel bed and banks of the River Chelt associated with the large outfall. Macrophyte assemblages were limited to the channel margin, with mosses and bryophytes recorded.

## Watercourse: River Chelt (Main River)

### River Condition Assessment

#### WCID09\_MRS\_LR

The River Condition Assessment determined that this reach surveyed on the River Chelt has a River Condition Score of 0.6, which equates to a river Condition Class of 'Moderate'. The overall condition score is driven by lack of features present that would increase values for positive indicator scores across the bank-top, bank-face and within the channel. There does not appear to be an indicator value that is driving the overall condition score, however, particularly positive values were recorded for 'C3 – Bank Face Natural Bank Profile Extent' (3), 'C4 – Bank Face Natural Bank Profile Richness' (3) and 'D4 – Channel Margin Physical Feature Extent' (3). The most negative indicator values were recorded for 'B4 – Bank Top NNIPS Cover' (-3) and 'B5 – Bank Top Managed Ground Cover' (-3).

#### WCID10\_MRS\_J10\_US

The River Condition Assessment determined that this reach on the River Chelt has a River Condition Score of -0.54, which equates to a River Condition Class of 'Fairly Poor'. The overall condition score is driven by lack of features present that would increase values for positive indicator scores across the bank-top, bank-face and within the channel. There does not appear to be an indicator value that is driving the overall condition score, however, particularly positive values were recorded for 'E4 – Channel bed Natural Features Extent' (3) only. The most negative indicator values were recorded for 'B5 – Bank Top Managed Ground Cover' (-4), 'C7 – Bank Face Artificial Bank Profile Extent' (-4), 'C9 – Bank Face Reinforcement Material Severity' (-4) and 'E10 – Channel Bed Artificial Features Severity' (-4).

#### WCID10\_MRS\_J10\_DS

The River Condition Assessment determined that this reach on the River Chelt has a River Condition Score of -0.28, which equates to a River Condition Class of 'Fairly Poor'. The overall condition score is driven by lack of features present that would increase values for positive indicator scores across the bank-top, bank-face and within the channel. There does not appear to be an indicator value that is driving the overall condition score, however, particularly positive values were recorded for 'D3 – Channel Margin Physical Feature Extent' (3) and 'E3 – Channel Bed Hydraulic Features Richness' (3). The most negative indicator values were recorded for 'B4 – Bank Top NNIPS Cover' (-3) and 'B5 – Bank Top Managed Ground Cover' (-3) and 'D5 – Channel Margin Artificial Features' (-3).

### Aquatic Macroinvertebrates

There was commonality across the four sites on the River Chelt in terms of the range of macroinvertebrate families supported and the assemblage's high sensitivity to flow reduction. The River Chelt at the existing M5 crossing (WCID09\_MI\_A) was the only site to support macroinvertebrate communities of 'Fairly High' conservation value, with all other sites being of 'Low' conservation value. The non-native New Zealand mud snail (*Potamopygrus antipodarum*) was recorded at all of the survey sites.

Specific details are provided under the corresponding survey site headings.

#### Survey Code: WCID09\_MI\_A

The community is species rich with 37 taxa, representing 23 families recorded.

Key community biological metrics (refer to Section 2.2 for descriptions of biological metrics): WHPT (NTAXA): 21; WHPT ASPT: 5.43; LIFE (Species) 7.54; PSI (Species): 59.3.

Biological metrics are indicative of good habitat (moderately sedimented channel) and water quality, with the macroinvertebrate assemblages highly sensitive to reduced flows.

This site had the highest CCI score (10.21), identifying the community as being of 'Fairly High' conservation value. This is due primarily to the high taxon richness and the presence of a notable aquatic beetle which is scarce within the UK (*Gyrinus urinator*).

#### Survey Code: WCID09\_MI\_B

The community is species rich with 38 taxa, representing 23 families recorded.

Key community biological metrics: WHPT (NTAXA): 22; WHPT ASPT: 4.73; LIFE (Species): 7.61; PSI (Species): 55.6.



### Watercourse: River Chelt (Main River)

Biological metrics are indicative of moderate habitat and water quality, with the macroinvertebrate assemblages highly sensitive to reduced flows and indicated a moderately sedimented channel.

The CCI score of 4.41 identifies the community as being of 'Low' conservation value, supporting only commonly occurring taxa.

#### Survey Code: WCID10\_MI\_A

The community is moderately species rich with 29 taxa, representing 21 families recorded.

Key community biological metrics: WHPT (NTAXA): 19; WHPT ASPT: 5.33; LIFE (Species): 7.76; PSI (Species): 62.5.

Biological metrics are indicative of good habitat and water quality, with the macroinvertebrate assemblages highly sensitive to reduced flows and indicated a slightly sedimented channel.

The CCI score of 4.07 identifies the community as being of 'Low' conservation value, supporting only commonly occurring taxa.

#### Survey Code: WCID10\_MI\_B

The community is comparatively species poor with 22 taxa, representing 16 families recorded.

Key community biological metrics: WHPT (NTAXA): 15; WHPT ASPT: 5.20; LIFE (Species): 8.33; PSI (Species): 79.4.

Biological metrics are indicative of good habitat and water quality, with the macroinvertebrate assemblages highly sensitive to reduced flows and indicated a slightly sedimented channel.

The CCI score of 8.89 identifies the community as being of 'Moderate' conservation value due primarily to the presence of a leech species of restricted distribution (*Trocheta pseudodina*).

### White-clawed crayfish

WCID09\_WWC and WCID10\_WWC

Surveys conducted in July 2020 of potentially suitable habitat in the River Chelt returned no records for white-clawed crayfish. A juvenile signal crayfish (*Pacifastacus leniusculus*), an invasive non-native species, was recorded at WCID10\_WWC.

White-clawed crayfish assumed absent.

### Aquatic Macrophytes

A limited number of species (10) with low percentage cover were recorded at survey across the two surveyed reaches. Survey WCID09 yielded the greatest number of species (nine), with survey WCID10 yielding only one species. The species recorded are typical of a lowland river with no uncommon or protected species recorded. See below for detailed survey results.

#### Survey code: WCID09\_MP

Survey yielded a total of nine species. Green algae (*Enteromorpha intestinalis*, *Ulva flexuosa/intestinalis*), fool's watercress, floating sweet-grass (*Glyceria fluitans* agg), amphibious bistort (*Persicaria amphibia*), watercress (*Rorippa nasturtium-aquaticum* agg) and brooklime all had a percentage cover of <1% at survey. Reed canary grass had a percentage cover of 1-2.5 %, with blanket weed agg. (*Cladophora glomerata*, *Rhizoclonium hierglyphicum*) and crowfoot species (*Ranunculus* sp. (r. sect batrachian sp or hybrid indet)) having the greatest percentage cover at 2.5-5 %.

#### Survey code: WCID10\_MP

The macrophyte assemblage here was species poor, with one emergent species recorded: branched bur-reed, which had a percentage cover of <1%.

### Fish

There was commonality in habitat availability for fish species across the survey reaches with both reaches exhibiting similar width and depth character and being predominately composed of glide habitat, although riffles were also present. The upper survey reach (WCID10\_FH) was slightly more complex in that it also supported run habitat, but also a higher percentage of finer substrate. Both reaches are therefore considered to provided appropriate habitat for lithophilic species. Such species were yielded at survey e.g., stone loach (*Barbatula barbatula*), bullhead and chub (*Squalius cephalus*), with the downstream reach immediately upstream of the existing

#### Watercourse: River Chelt (Main River)

M5 crossing supporting a higher abundance and range of species (see below). No salmonids were recorded despite the habitat observed being likely suitable for brown trout (*Salmo trutta*).

##### Survey code WCID09\_FH

**Summary:** Fish survey at this site yielded seven species. Minor species were dominant with stone loach, bullhead and minnow recorded in high numbers. Three-spined stickleback were also recorded but in low numbers. Chub, brook/river lamprey (*Lampetra* spp.) ammocoetes (juvenile life-stage) and European eel were also recorded. Habitat records for the fish survey reach identified the dominance of riffle and glide habitat.

##### Survey code: WCID10\_FH

**Summary:** Only three species were recorded at survey, namely, bullhead, three-spined stickleback and European eel, which with the exception of bullhead, were recorded in low numbers.

European eel, lamprey (*Lampetra* spp.) and bullhead are all notable fish species. European eel is a Critically Endangered species on the IUCN red list of Threatened Species, a species of Principal Importance under section 41 of the NERC Act 2006 and a UK BAP priority species. European eel is a qualifying feature/interest feature of the downstream Severn Estuary Ramsar and SSSI. River lamprey (*Lampetra fluviatilis*) is a UK BAP priority species and a species of Principal Importance under section 41 of the NERC Act 2006 and a European Commission Habitats Directive Annex II<sup>43</sup> and Annex V<sup>44</sup> species. It is a qualifying feature/interest feature of the downstream Severn Estuary Ramsar, SAC and SSSI. Brook lamprey and bullhead are also European Commission Habitats Directive Annex II species (but not a qualifying feature of the downstream Severn Estuary designations).

#### Priority Habitat Assessment

The River Chelt supports five criterion B fish species which together with records of otter, results in classification of the watercourse as a priority habitat (based on the total number of criterion B species (6No.)).

<sup>43</sup> Animal and plant species of Community interest (i.e., endangered, vulnerable, rare or endemic in the European Community) whose conservation requires the designation of special areas of conservation.

<sup>44</sup> Animal and plant species of Community interest whose taking in the wild and exploitation may be subject to management measures.

Table 3-6 - Leigh Brook

Watercourse: Leigh Brook (Ordinary Watercourse)



Photo 3 and Photo 4: Downstream of the M5 (SO 90579 26345 and SO 90650 26140)

**WFD Characterisation**

The Leigh Brook within the 2 km study area is classified as the Leigh Bk – source to conf. R. Chelt WFD water body (GB 109054039770).

**Leigh Bk – source to conf. R. Chelt WFD (GB109054039770)**

Classified WFD Water Body – Yes

Hydromorphological designation - not designated artificial or heavily modified

Overall Ecological Status – Moderate (2019 Classification)

- Overall Biological Quality Elements of WFD Waterbody – Moderate
  - Fish – Not assessed
  - Invertebrates – Good
  - Macrophytes and Phytobenthos combined – Moderate

Hydromorphological supporting elements – Supports Good

Reasons for Not Achieving Good – Diffuse pollution associated with poor nutrient and livestock management, sewage discharge and urban development.

**River Habitat Survey (Survey code: WCID02\_RHS)**

Representative Channel Dimensions: Water depth: 0.8 m; water width: 0.8 m; bankfull width: 3.2 m

Habitat Modification Score (HMS): 2,120

Habitat Modification Class (HMC): 5 (Severely Modified)

**Summary:** A lowland stream flowing through predominantly agricultural land characterised by improved grasslands and broadleaved plantations. The Leigh Brook discharges to the River Chelt, which is itself a direct tributary of the River Severn. There is evidence of historical channel modifications associated with realignment and over deepening. Limited bed substrates (gravel- pebble and silt), low energy flow types, and re-sectioned bank profiles. Few macrophyte functional groups (indicators of vegetative river habitat diversity) were recorded. Tree cover (and therefore channel shading and other wooded habitat features) is relatively sparse.

**Background records**

No protected or priority aquatic species (aquatic macroinvertebrates, macrophytes, fish, white-clawed crayfish (*Austropotamobius pallipes*)) were returned from GCER or the environment Agency within 2 km of the Scheme.

**River Corridor Survey (Survey code: WCID02\_RCS)**

**Summary:** The Leigh Brook corridor runs through an area of improved pasture, with abundant barley (*Hordeum secalinum*) and some wall barley (*H. murinum*), particularly on the right bank. In

### Watercourse: Leigh Brook (Ordinary Watercourse)

the downstream section of the survey the watercourse flows alongside a small part of a barley field with a diverse arable weed flora, including broad-leaved spurge (*Euphorbia platyphyllos*) which is rare and declining in Gloucestershire. No pipes, outfalls or tributaries were identified at survey. In-channel vegetation was limited to a few isolated patches of fool's-watercress (*Helosciadium nodiflorum*) and some bittersweet (*Solanum dulcamara*). No marginal vegetation was recorded due to heavy shading. Bank vegetation was dominated by trees throughout, composed of hawthorn (*Crataegus monogyna*), crack willow (*Salix × fragilis*) and ash (*Fraxinus excelsior*), including some mature pollards. In-channel habitat was homogenous, with no features (such as mid-channel bars and islands) or pools/riffles present. One access track bridge was recorded.

### Modular River Survey

#### WCID02\_MRS

The Leigh Brook at this location flows predominantly through agricultural land, characterised by permanently vegetated agriculture associated with grazing for livestock, which is evident by the poaching present on the left bank. There is extensive tree line at the bank top, composed of scrub and tree species. There is evidence of historical channel realignment due to a straightened planform and riparian land-use. The channel bed was predominantly composed of earth with some areas of gravel/pebble. Low flow energy flow types were extensively present, which included smooth and no perceptible flow. Marginal features were limited to berms. No in-channel or marginal vegetation was recorded, likely constrained by the extensive tree and shrub line on both bank faces of the Leigh Brook.

### River Condition Assessment

The River Condition Assessment determined that the reach surveyed on the Leigh Brook has an Overall Condition Score of 0.43, which equates to a River Condition Class of 'Fairly Poor'. There does not appear to be an indicator value that is driven the overall condition score, however, particularly positive values were recorded for 'C3 – Bank Face Natural Bank Profile Extent' (2), 'C4 – Bank Face Natural Bank Profile Richness' (2) and 'E6 – Channel Bed Material Richness' (2). The most negative recorded is 'B5 – Bank Top Managed Ground Cover' (-2).

### Aquatic Macroinvertebrate Survey (Survey Code: WCID02\_MI)

The community is comparatively species poor with 19 taxa, representing 17 families.

Key community biological metrics for the sampling site (refer to Section 2.2 for descriptions of biological metrics): WHPT (NTAXA): 15; WHPT ASPT: 3.96; LIFE (Species): 6.30; PSI (Species): 10.3.

Biological metrics are indicative of poor habitat and water quality, with a community that has a low sensitivity to reduced flow velocity conditions and indicative of a channel that is heavily sedimented.

The CCI score of 4.20 identifies the community as being of 'Low' conservation value, supporting only commonly occurring taxa.

The non-native New Zealand mud snail (*Potamopygrus antipodarum*) is a dominant component of the species assemblage.

### White-clawed crayfish

#### WCID02\_WWC

Surveys conducted in 2020 did not identify any suitable habitat for targeted white-clawed crayfish surveys.

Assumed absent.

### Aquatic Macrophyte Survey (Survey code: WCID02\_MP)

The macrophyte community was species poor, with one species, fool's watercress, recorded with <1% cover in the survey reach.

### Fish Survey



#### Watercourse: Leigh Brook (Ordinary Watercourse)

The Leigh Brook was not screened in for detailed fish survey due to the channel not exhibiting suitable habitat for the survey type within the site and the fact the watercourse experiences intermittent flow periods. It should be noted that the watercourse may support minor fish species such as three-spined stickleback and minnow during periods when the channel conveys flow/holds water. During such periods the watercourse may act as a suitable resource for migrating European eel (*Anguilla anguilla*) within the wider catchment, however, the brook is not considered in itself to be a viable resource for adult European eel development.

#### Priority Habitat Assessment

The Leigh Brook within the Scheme is over 2.5 km from its source, and therefore does not qualify as 'headwater' under the Priority Habitat definition, nor does it meet any of the other qualifying criteria for definition as Priority Habitat. The watercourse has been observed as not conveying flow by the Scheme's drainage team, and during site visits by ecologists whilst conducting extended Phase I habitat surveys.

#### Other watercourses

- 3.2.5. Other Ordinary Watercourses taken forward for assessment as presented in Table 3-1, were characterised as minor tributary systems and heavily managed drainage ditches with limited habitat complexity, typically choked with terrestrial herbs and scrub (indicating their ephemeral nature) and/or shaded by trees. Their straightened planforms exhibited a limited range of habitat typologies for aquatic species. They are considered likely to provide only limited value for aquatic species when temporarily acting to convey surface water flows.
- 3.2.6. Information collected during the watercourse walkover survey and review of site photographs was used to retrospectively to inform the ditch condition assessment. All other watercourses taken forward for assessment achieved <5 of the criteria described in Section 2.2.31. As such, all other watercourses have been assigned a condition of 'Poor'.
- 3.2.7. Drain 9, 11, 21 and 22 were unable to be visited during walkover survey but are assumed to be of similar character and condition to other ditches on site which were visited given the similarities between the other drains across the Scheme.

Table 3-7 - Photographs of Ordinary Watercourses (excluding Leigh Brook as unable to be visited during watercourse walkover survey)



Photo 5: Drain 8 (SO 90279 25796)



Photo 6: Drain 10 (SO 90773 25383)



Photo 7: Drain 10 (SO 90773 25383)



Photo 8: Drain 12 (SO 90817 24898)



Photo 9: Drain 12 (SO 90817 24898)



Photo 10: view looking north towards Drain 14 and the B4634 (SO 90284 23728)





Photo 9: Drain 15 (SO 90407 23646)



Photo 10: Drain 15 along field boundary  
(SO 90416 23664)



Photo 11: Drain 16 at confluence with Drain 20.  
Drain 16 is culverted under a farm access track at  
this location, but runs parallel to the Old Gloucester  
Road B4634 acting as road drainage  
(SO 90620 23925)



Photo 12: Looking south towards Drain 20 from the  
Old Gloucester Road B4634 and Drian 16  
(SO 90620 23925)



Photo 13: MW3 looking cross stream  
(SO 89964 25217)



Photo 14: MW3 looking downstream  
(SO 90089 25184)

## 4. Evaluation

- 4.1.1. The valuations applied to aquatic receptors consider the receptor importance in the context of both intrinsic habitat quality and the species it has been identified to support.
- 4.1.2. Consequently, aquatic receptors (habitats) supporting notable species are afforded an ecological valuation which is, at a minimum, commensurate with the conservation value of the habitat and/or species which they support. In this way, mitigation requirements (for example, control of construction works) are associated with the receptor supporting the notable species (e.g., a watercourse), rather than the species itself (e.g., an aquatic macrophyte or aquatic macroinvertebrate). This reduces the potential for uncertainty in mitigation application for future phases, with named receptors (e.g., watercourse X) requiring prescribed mitigation.
- 4.1.3. Features that have been identified to be of less than local importance are not considered to be important ecological features and as such have not been considered within the impact assessment within the ES.
- 4.1.4. Table 3-8 shows the receptor evaluation results and a justification for the ascribed value. The justification draws on the baseline information concerning the presence and composition of the aquatic habitat and supported aquatic species within the 2 km study area and the importance of the feature for the maintenance of wider catchment function.

Table 3-8 - Watercourse importance valuation

Watercourse name	Importance value	Justification
River Chelt (Main River)	County	<p>Main River and Priority Habitat, shown to support fish that are qualifying/interest features of the Severn Estuary SAC/Ramsar/SSSI site downstream (European eel, river lamprey (assumed presence), Atlantic salmon and sea/brown trout).</p> <p>Despite being modified throughout much of its length within the study area, the River Chelt supports an aquatic macroinvertebrate assemblage that is of a 'Fairly High' conservation value (including a notable aquatic beetle species and species of restricted distribution) and supports a well-established aquatic macrophyte community.</p> <p>As such, the River Chelt has been valued to be of County importance.</p> <p>LA 108 advises that UK BAP priority habitats and habitats of principal importance should be considered to be of National nature conservation value. The importance level ascribed to the River Chelt deviates from LA 108. This is because, despite the River Chelt supporting a species rich aquatic macroinvertebrate assemblage, a range of fish species and meeting the criteria for a priority habitat, the watercourse is modified throughout much of its length and supports a species poor aquatic macrophyte assemblage. Furthermore, the Severn Estuary designates are a considerable distance downstream (40 km) from the point of interaction with the Scheme. On this basis, a valuation of County is considered appropriate for the River Chelt resource within the study area.</p>
Leigh Brook (Ordinary Watercourse)	Local	<p>An intermittently following watercourse within the Scheme Boundary that has been identified as being 'significantly altered from its natural state'. Its intermittent nature combined with limited marginal and in-channel habitat complexity means it supports a species poor aquatic ecological assemblages. Despite this is it noted as providing value as an aquatic resource providing connectivity with the wider catchment. As a result, the Leigh Brook has been valued to be of Local importance.</p>
Other Ordinary Watercourses (MW3, Drain 8, Drain 9, Drain 10, Drain 11, Drain 12, Drain 14, Drain 15, Drain 16, Drain 20, Drain 21 and Drain 22)	Local	<p>These watercourses are likely to provide temporary habitat for opportunistic aquatic macroinvertebrate and macrophyte species when flow is conveyed. Their presence within the predominantly agricultural setting means that they provide valuable wildlife corridors for aquatic species. As a result, all have been assigned a value of Local importance.</p>

# Appendices





# Appendix A. Field survey data

## A.1. River Habitat Survey Habitat Modification Score (HMS) Sheets

River Chelt (WCID09\_RHS)

**Survey: WCID09\_RHS**  
**RHS Habitat Modification Score & Habitat Modification Class Scoring System**

A	Spot check channel modification - Culverts	0
B	Sweep-up artificial features - Culverts	400
<b>HMS: Culverts sub-score</b>		<b>400</b>
C	Spot check bank material	80
D	Spot check bank modification - RI	0
E	Sweep-up bank profiles - RI	0
F	Sweep-up artificial features - revetments	0
G	Spot check channel substrate	0
H	Spot check channel modification - RI	200
<b>HMS: Bank &amp; bed reinforcement sub-score</b>		<b>280</b>
I	Spot check bank modification - RS	800
J	Sweep-up bank profiles - RS	0
K	Spot check channel modification - RS	2000
L	Sweep-up channel modification - over deepened	0
<b>HMS: Bank &amp; bed resectioning sub-score</b>		<b>2800</b>
M	Spot check bank modification - Berms (BM)	0
N	Spot check bank modification - EM	0
O	Sweep-up bank profiles - Artificial two-stage	0
P	Sweep-up bank profiles - Embanked	0
Q	Sweep-up bank profiles - set back embankment	0
<b>HMS: Berms &amp; embankments sub-score</b>		<b>0</b>
R	Sweep-up artificial features - weirs/dams/sluices	0
<b>HMS: Weirs/dams/sluices sub-score</b>		<b>0</b>
S	Sweep-up artificial features - bridges	100
<b>HMS: Bridges sub-score</b>		<b>100</b>
T	Spot check bank modification - poaching (PC or PC(B))	0
U	Sweep-up bank profiles - poached	0
<b>HMS: Poaching sub-score</b>		<b>0</b>
V	Sweep-up artificial features - fords	0
<b>HMS: Fords sub-score</b>		<b>0</b>
W	Sweep-up artificial features - outfall	25
X	Sweep-up artificial features - deflectors	0
<b>HMS: Outfall/deflectors sub-score</b>		<b>25</b>
<b>Total HMS</b>		<b>3605</b>

HMC	HMC Description	HMS Score
1	Pristine/semi-natural	0 - 16
2	Predominantly unmodified	17 - 199
3	Obviously modified	200 - 499
4	Significantly modified	500 - 1399
5	Severely modified	1400 +

River Chelt (WCID10\_RHS)

**Survey: WCID10\_RHS**  
**RHS Habitat Modification Score & Habitat Modification Class Scoring System**

A	Spot check channel modification - Culverts	0
B	Sweep-up artificial features - Culverts	400
<b>HMS: Culverts sub-score</b>		<b>400</b>
C	Spot check bank material	80
D	Spot check bank modification - RI	40
E	Sweep-up bank profiles - RI	0
F	Sweep-up artificial features - revetments	0
G	Spot check channel substrate	0
H	Spot check channel modification - RI	200
<b>HMS: Bank &amp; bed reinforcement sub-score</b>		<b>320</b>
I	Spot check bank modification - RS	800
J	Sweep-up bank profiles - RS	0
K	Spot check channel modification - RS	400
L	Sweep-up channel modification - over deepened	0
<b>HMS: Bank &amp; bed resectioning sub-score</b>		<b>1200</b>
M	Spot check bank modification - Berms (BM)	0
N	Spot check bank modification - EM	0
O	Sweep-up bank profiles - Artificial two-stage	0
P	Sweep-up bank profiles - Embanked	0
Q	Sweep-up bank profiles - set back embankment	0
<b>HMS: Berms &amp; embankments sub-score</b>		<b>0</b>
R	Sweep-up artificial features - weirs/dams/sluices	0
<b>HMS: Weirs/dams/sluices sub-score</b>		<b>0</b>
S	Sweep-up artificial features - bridges	200
<b>HMS: Bridges sub-score</b>		<b>200</b>
T	Spot check bank modification - poaching (PC or PC(B))	0
U	Sweep-up bank profiles - poached	0
<b>HMS: Poaching sub-score</b>		<b>0</b>
V	Sweep-up artificial features - fords	0
<b>HMS: Fords sub-score</b>		<b>0</b>
W	Sweep-up artificial features - outfall	0
X	Sweep-up artificial features - deflectors	0
<b>HMS: Outfall/deflectors sub-score</b>		<b>0</b>
<b>Total HMS</b>		<b>2120</b>

HMC	HMC Description	HMS Score
1	Pristine/semi-natural	0 - 16
2	Predominantly unmodified	17 - 199
3	Obviously modified	200 - 499
4	Significantly modified	500 - 1399
5	Severely modified	1400 +

Leigh Brook (WCID02\_RHS)

**Survey: WCID02\_RHS**  
**RHS Habitat Modification Score & Habitat Modification Class Scoring System**

A	Spot check channel modification - Culverts	0
B	Sweep-up artificial features - Culverts	0
<b>HMS: Culverts sub-score</b>		<b>0</b>
C	Spot check bank material	0
D	Spot check bank modification - RI	0
E	Sweep-up bank profiles - RI	0
F	Sweep-up artificial features - revetments	0
G	Spot check channel substrate	0
H	Spot check channel modification - RI	0
<b>HMS: Bank &amp; bed reinforcement sub-score</b>		<b>0</b>
I	Spot check bank modification - RS	320
J	Sweep-up bank profiles - RS	0
K	Spot check channel modification - RS	1600
L	Sweep-up channel modification - over deepened	0
<b>HMS: Bank &amp; bed resectioning sub-score</b>		<b>1920</b>
M	Spot check bank modification - Berms (BM)	0
N	Spot check bank modification - EM	0
O	Sweep-up bank profiles - Artificial two-stage	0
P	Sweep-up bank profiles - Embanked	0
Q	Sweep-up bank profiles - set back embankment	0
<b>HMS: Berms &amp; embankments sub-score</b>		<b>0</b>
R	Sweep-up artificial features - weirs/dams/sluices	0
<b>HMS: Weirs/dams/sluices sub-score</b>		<b>0</b>
S	Sweep-up artificial features - bridges	200
<b>HMS: Bridges sub-score</b>		<b>200</b>
T	Spot check bank modification - poaching (PC or PC(B))	0
U	Sweep-up bank profiles - poached	0
<b>HMS: Poaching sub-score</b>		<b>0</b>
V	Sweep-up artificial features - fords	0
<b>HMS: Fords sub-score</b>		<b>0</b>
W	Sweep-up artificial features - outfall	0
X	Sweep-up artificial features - deflectors	0
<b>HMS: Outfall/deflectors sub-score</b>		<b>0</b>
<b>Total HMS</b>		<b>2120</b>

HMC	HMC Description	HMS Score
1	Pristine/semi-natural	0 - 16
2	Predominantly unmodified	17 - 199
3	Obviously modified	200 - 499
4	Significantly modified	500 - 1399
5	Severely modified	1400 +

## A.2. River Corridor Survey

### A.2.1. RCS key

Standard RCS symbols, as provided in the River Corridor Surveys Methods and Procedures (Conservation Technical Handbook), were used for RCS mapping. A key to these symbols, extracted from the handbook, is shown below.

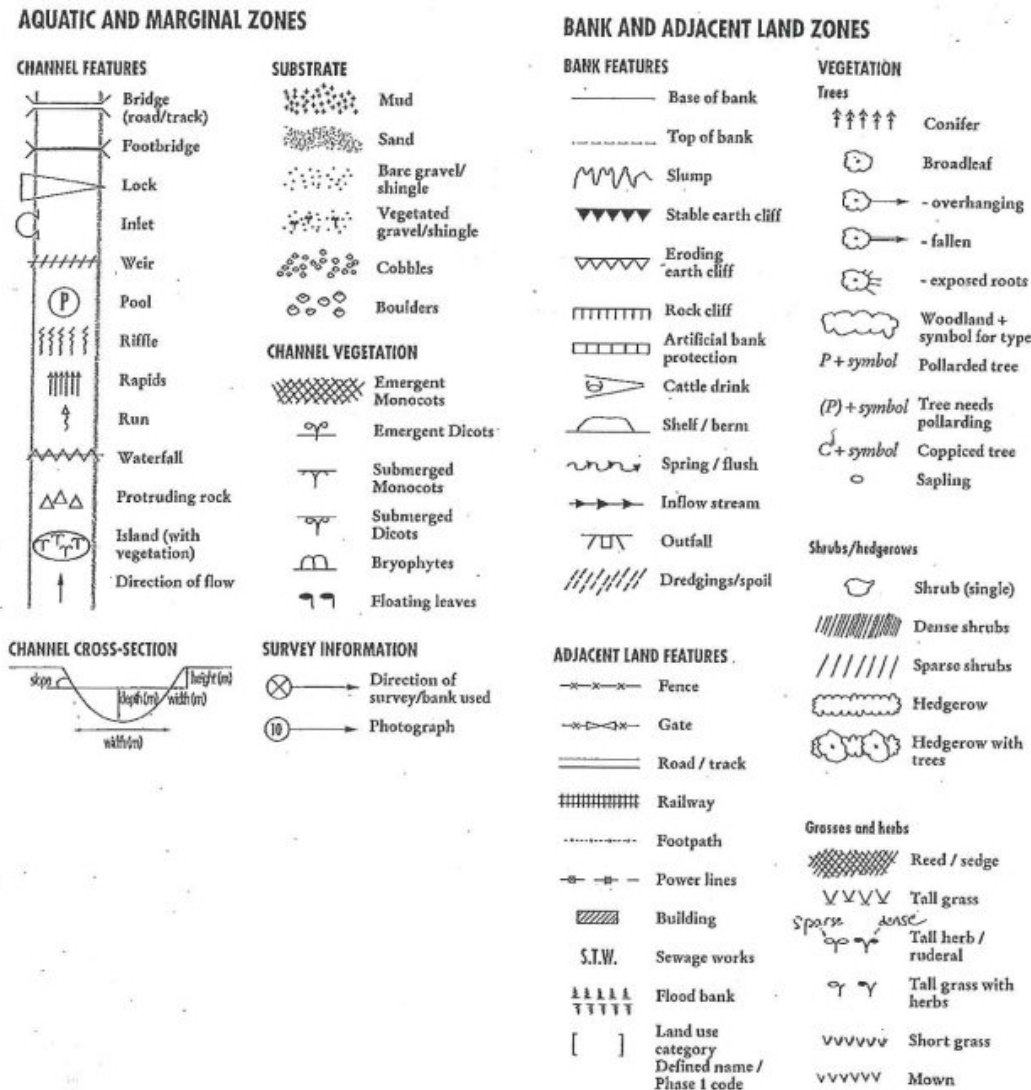


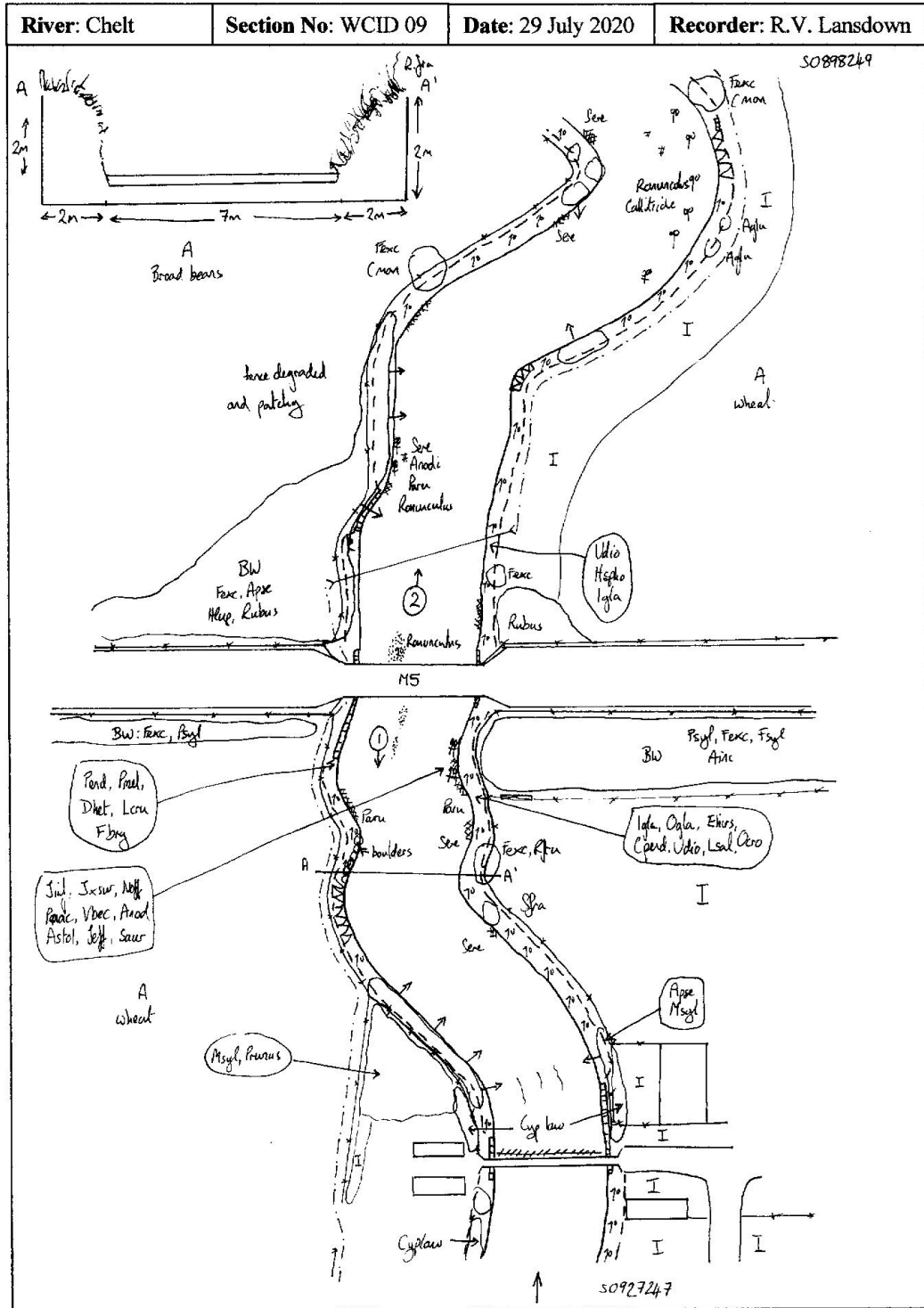
Photo locations shown on the RCS maps do not correspond with the photographs presented in this report. Additional photographs of each survey reach are available and can be provided on request.

Plant species are recorded using an abbreviated version of their scientific name, using the following convention: first letter of the generic name followed by the first three letters of the species name.

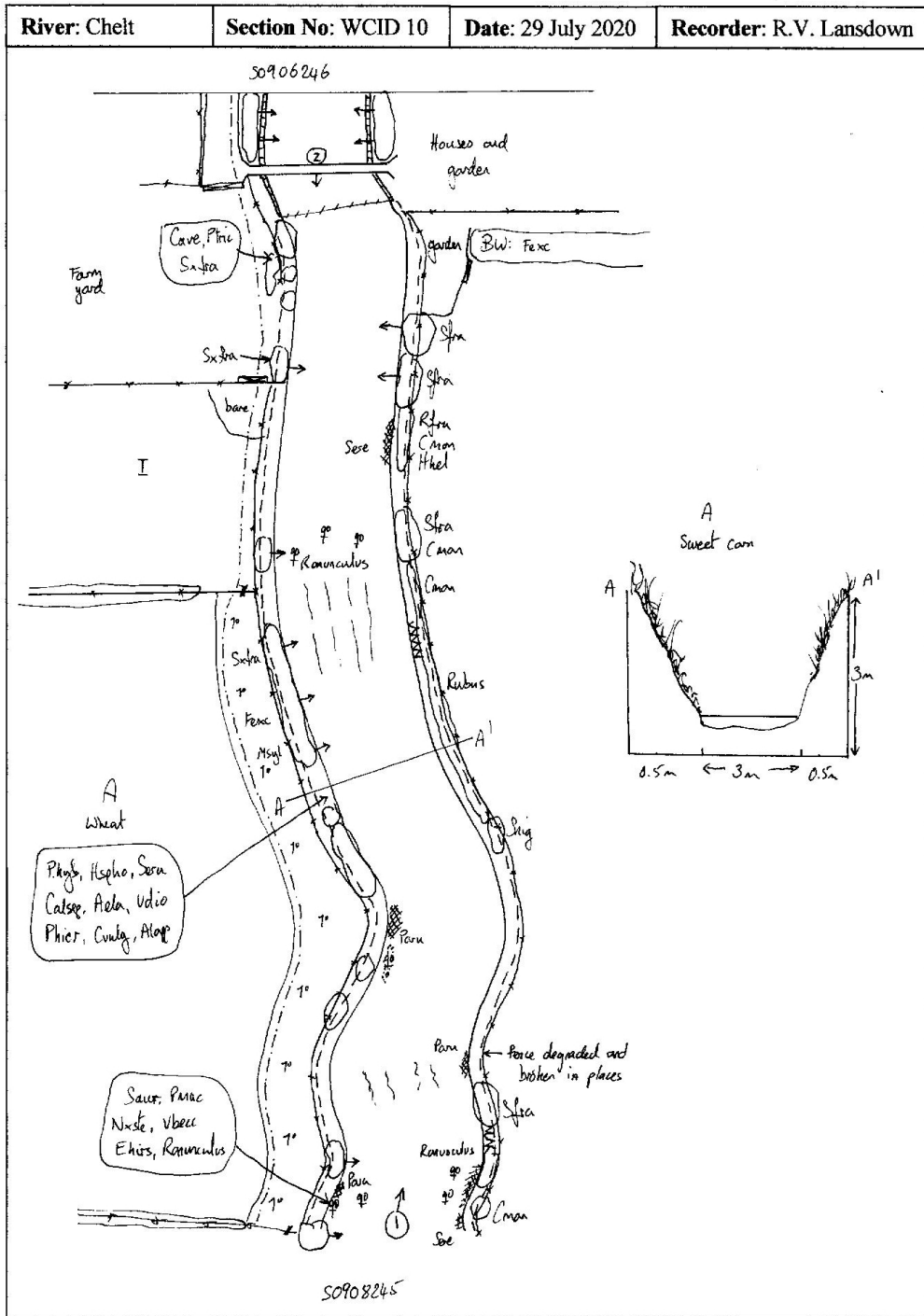
Plants not identified to species are recorded using the genus name followed by sp.

### A.2.2. RCS field survey sheets

#### River Chelt (WCID09\_RCS)

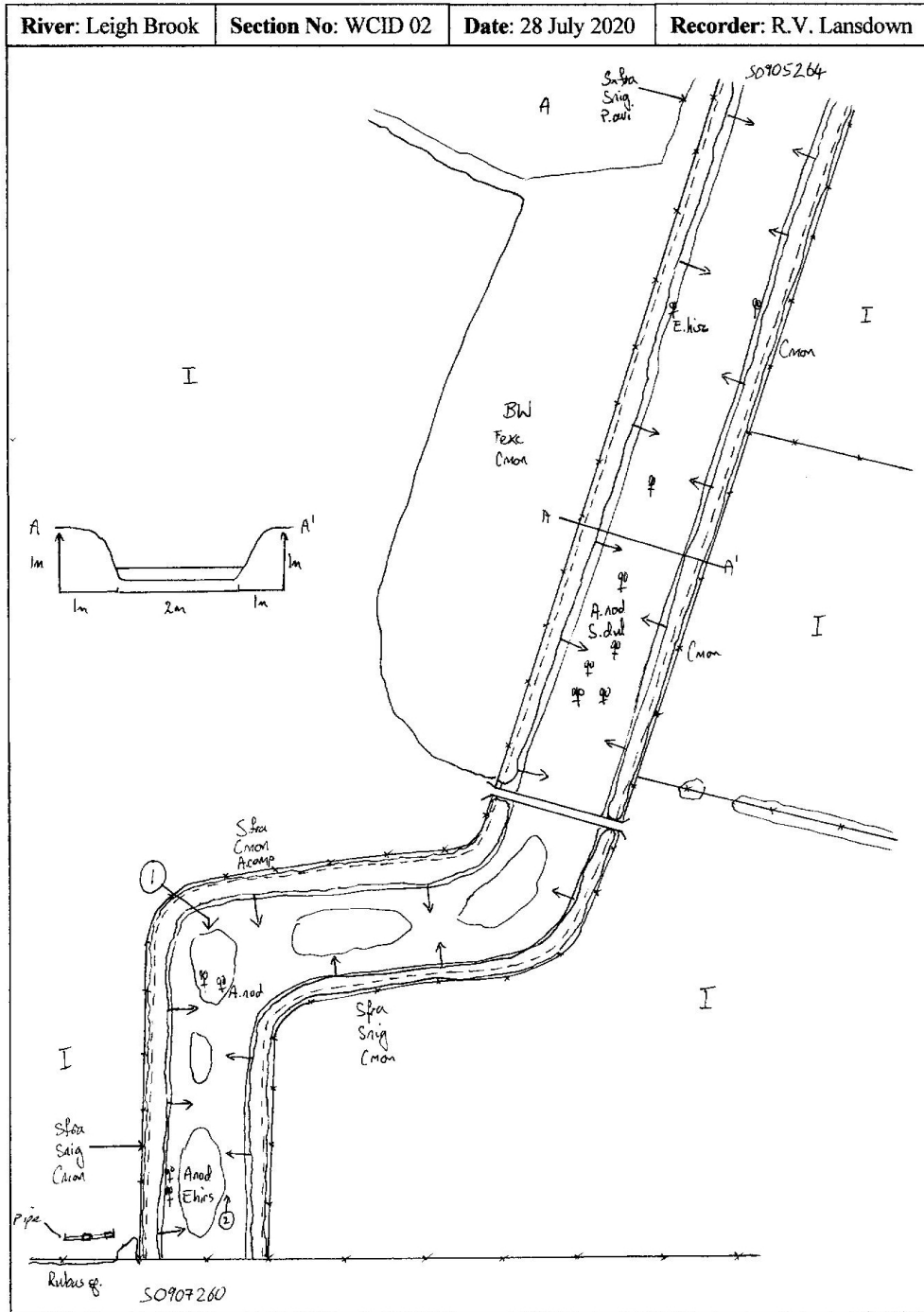


**River Chelt (WCID10\_RCS)**





**Leigh Brook (WCID02\_RCS)**



## A.3. Aquatic macroinvertebrates

### A.3.1. Biotic indices

Watercourse	Sample Date and Survey Code	WHPT ASPT	WHPT N-Taxa	LIFE score (Family)	LIFE Score (Species)	CCI Score	CCI Interpretation	PSI Species Score	Species PSI Interpretation	PSI Family Score	Family PSI Interpretation
River Chelt	13/10/2020 WCID09_MI_A	5.43	21	7.17	7.54	10.21	Fairly High	59.3	Moderately Sedimented	54.3	Moderately Sedimented
River Chelt	13/10/2020 WCID09_MI_B	4.73	22	6.95	7.61	4.41	Low	55.6	Moderately Sedimented	43.6	Moderately Sedimented
River Chelt	13/10/2020 WCID10_MI_A	5.33	19	7.06	7.76	4.07	Low	62.5	Slightly Sedimented	54.3	Moderately Sedimented
River Chelt	13/10/2020 WCID10_MI_B	5.20	15	7.82	8.33	8.89	Moderate	79.4	Slightly Sedimented	76.0	Slightly Sedimented
Leigh Brook	13/10/2020 WCID02_MI	3.96	15	5.75	6.30	4.20	Low	10.3	Heavily Sedimented	7.4	Heavily Sedimented

### A.3.2. Taxa list

Watercourse	River Chelt	River Chelt	River Chelt	River Chelt	Leigh Brook
Survey Code	WCID10_MI_A	WCID10_MI_B	WCID09_MI_A	WCID09_MI_B	WCID02_MI
Sample Date	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020
Sample Method	Kick/Sweep 3 mins	Kick/Sweep 3 mins	Kick/Sweep 3 mins	Kick/Sweep 3 mins	Kick/Sweep 3 mins
Analysis	Species	Species	Species	Species	Species
Taxa Name					
<i>Polycelis nigra/tenuis</i>				1	38
<i>Dugesia lugubris/polychroa</i>				3	
<i>Dugesia tigrina</i>				4	
<i>Dendrocoelum lacteum</i>					1
<i>Potamopyrgus antipodarum</i>	12	4	4	12	628
<i>Radix balthica</i>	56		53	4	
<i>Bathyomphalus contortus</i>			1		
<i>Pisidium sp.</i>	1	1		1	56
<i>Oligochaeta</i>	6	2	83	76	6
<i>Glossiphonia complanata</i>					3
<i>Helobdella stagnalis</i>				2	
<i>Erpobdella octoculata</i>	1				1
<i>Trocheta pseudodina (bykowskii)</i>		1			
<i>Trocheta subviridis</i>					1
<i>Hydracarina</i>	1		3	3	1
<i>Oribatei</i>					2

Watercourse	River Chelt	River Chelt	River Chelt	River Chelt	Leigh Brook
Survey Code	WCID10_MI_A	WCID10_MI_B	WCID09_MI_A	WCID09_MI_B	WCID02_MI
Sample Date	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020
Sample Method	Kick/Sweep 3 mins	Kick/Sweep 3 mins	Kick/Sweep 3 mins	Kick/Sweep 3 mins	Kick/Sweep 3 mins
Analysis	Species	Species	Species	Species	Species
Taxa Name					
<i>Asellus aquaticus</i>	1			48	68
<i>Proasellus meridianus</i>			8		
<i>Crangonyx pseudogracilis</i>					3
<i>Gammarus pulex</i>	1			1	1
<i>Gammarus pulex/fossarum</i>	78	50	29	67	8
<i>Gammarus fossarum</i>	6	2	1		
<i>Baetis sp.</i>			1		
<i>Baetis rhodani</i>	4	1	1	4	
<i>Baetis atlanticus/rhodani</i>	80	77	5	22	
<i>Baetis scambus/fuscatus</i>	4	1	11	2	
<i>Baetis vernus</i>			2	4	
<i>Serratella ignita</i>		1	3		
<i>Caenis luctuosa/macrura</i>	2		4		
<i>Pyrrhosoma nymphula</i>			1		
<i>Calopteryx splendens</i>			3	1	
<i>Calopteryx virgo</i>			1		
<i>Haliphus sp.</i>				1	
<i>Nebrioporus elegans</i>			1		

Watercourse	River Chelt	River Chelt	River Chelt	River Chelt	Leigh Brook
Survey Code	WCID10_MI_A	WCID10_MI_B	WCID09_MI_A	WCID09_MI_B	WCID02_MI
Sample Date	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020
Sample Method	Kick/Sweep 3 mins	Kick/Sweep 3 mins	Kick/Sweep 3 mins	Kick/Sweep 3 mins	Kick/Sweep 3 mins
Analysis	Species	Species	Species	Species	Species
Taxa Name					
<i>Stictotarsus duodecimpustulatus</i>	1		1		
<i>Platambus maculatus</i>			2	1	
<i>Agabus group (Agabus sp., Ilybius chalconatus &amp; Ilybius melanocornis)</i>					2
<i>Gyrinus urinator</i>			1		
<i>Hydrophilidae</i>					1
<i>Elmis aenea</i>	24	19	66	21	
<i>Limnius volckmari</i>	24	39	26	12	
<i>Oulimnius sp.</i>	9	1	38	21	
<i>Oulimnius tuberculatus</i>			15		
<i>Rhyacophila sp.</i>	2	3	4	1	
<i>Rhyacophila dorsalis</i>		2	3		
<i>Hydroptila sp.</i>				2	
<i>Polycentropus flavomaculatus</i>	1		2		
<i>Polycentropus irroratus</i>			1		
<i>Hydropsyche pellucidula</i>	1		3	5	
<i>Hydropsyche siltalai</i>	6	7	14	13	

Watercourse	River Chelt	River Chelt	River Chelt	River Chelt	Leigh Brook
Survey Code	WCID10_MI_A	WCID10_MI_B	WCID09_MI_A	WCID09_MI_B	WCID02_MI
Sample Date	13/10/2020	13/10/2020	13/10/2020	13/10/2020	13/10/2020
Sample Method	Kick/Sweep 3 mins	Kick/Sweep 3 mins	Kick/Sweep 3 mins	Kick/Sweep 3 mins	Kick/Sweep 3 mins
Analysis	Species	Species	Species	Species	Species
Taxa Name					
<i>Micropterna sequax</i>					2
<i>Sericostoma personatum</i>	1				
<i>Athripsodes albifrons group (bilineatus &amp; commutatus)</i>	2			2	
<i>Mystacides sp.</i>	1				
<i>Mystacides azurea</i>			1		
<i>Diptera (indet.)</i>			1		
<i>Tipula sp.</i>		1			
<i>Antocha vitripennis</i>	1				
<i>Dicranota sp.</i>	8	4		3	
<i>Psychodidae</i>					3
<i>Ceratopogonidae</i>		1	1		
<i>Simuliidae</i>	212	148	18	636	
<i>Chironomidae</i>	20	4	37	66	17
<i>Dolichopodidae</i>		2			
<i>Limnophora sp.</i>				2	



## A.4. White-clawed crayfish survey sheets

### A.4.1. River Chelt WCID09\_WCC

<b>Aquatic Feature Name</b>	River Chelt	<b>Aquatic Feature ID</b>	WCID009
<b>Site (PIL ID/BK ref.)</b>	-	<b>Date (dd/mm/yy)</b>	28/07/2020
<b>Surveyors</b>	Names removed on purpose	<b>Photo ref. &amp; location</b>	Photos provided separately
<b>OS Grid ref. (u/s end)</b>	SO9023224783	<b>OS Grid ref. (d/s end)</b>	SO8993924867
<b>Start time</b>	10:00	<b>Finish time</b>	14:00
<b>Channel Inaccessibility (%)</b>	Could only access 350m of the 500m required for survey (i.e., 70%). Access to this 350m was largely good.	<b>RCS map ref.</b>	-
<b>Site length (m)</b>	350m	<b>Width channel (m)</b>	4
<b>Weather (good 1, moderate 2, poor 3)</b>	2	<b>Water temp. (°C)</b>	15.1
<b>Flow (normal 1, low 2, fall 3, rise 4)</b>	1	<b>Clarity (good 1, moderate 2, poor 3)</b>	1
<b>Description (channel features, land use)</b>	Surrounded land use is arable.		

Sample	Patch 1		Patch 2		Patch 3		Patch 4		Patch 5	
OS Grid Reference	Start	End	Start	End	Start	End	Start	End	Start	End
	SO 8998 0 2485 3	SO 8998 5 2484 9	SO 9014 1 2476 2	SO 9014 5 2476 0	SO 9015 3 2475 6	SO 9015 5 2475 6	SO 9019 5 2476 7	SO 9019 9 2477 3	SO 9021 4 2478 4	SO 9021 7 2478 5
<b>Survey method, std 1, quad 2, net/kick 3, trap 4, view 5, HSI 6</b>	Net/kick		Std (stone turning)		Std (stone turning)		Std (stone turning, net/kick)		Std (stone turning, net/kick)	
<b>Details (if not standard)</b>										
<b>Extent (l x w patch)</b>	7x2		5x2		3x2		5x3		4x1.5	

Sample	Patch 1	Patch 2	Patch 3	Patch 4	Patch 5
<b>Channel (1 margins, 2 mid, 3 both,</b>	1	2	2	3	3
<b>other specify)</b>	0.3	0.2	0.35	0.4	0.25
<b>Depth (metres)</b>	3	4	3	3	3
<b>Feature (1 marg. d'water, 2 pool,</b>					
<b>3 glide, 4 run, 5 riffle)</b>		Y		Y	
<b>Refuges in channel (tick all present in patch, ring main type(s) searched)</b>		Y		Y (searched)	Y (searched)
<b>Cobble (6.5–15cm)</b>	Y (searched)	Y (main searched)		Y (main searched)	Y (main searched)
<b>Cobble (15–25.6 cm)</b>	Y (searched)	Y (main searched)			
<b>Boulder (25.6-40 cm)</b>		Y (20cm)	Y (30-60cm, main searched)		Y (bricks, 30cm)
<b>Boulder (&gt;40cm)</b>	Y			Y	
<b>Rubble (give size)</b>	Net/kick	Std (stone turning)	Std (stone turning)	Std (stone turning, net/kick)	Std (stone turning, net/kick)
<b>Woody debris</b>					
<b>Other urban debris</b>					
<b>Tree roots, fine</b>	Y (main habitat searched)				Y (small amount)
<b>Moss</b>					
<b>Filamentous algae</b>	Y				
<b>Other submerged vegetation</b>					
<b>Emergents</b>					
<b>Main substrate beneath</b>					
<b>Bedrock</b>					

Sample	Patch 1	Patch 2	Patch 3	Patch 4	Patch 5
<b>Cobble (6.5-15 cm)</b>		Y	Y		
<b>Pebble (&lt;6.5 cm)</b>		Y	Y		
<b>Gravel (&lt;1.6cm)</b>		Y	Y		Y
<b>Sand (&lt;2mm)</b>	Y			Y	
<b>Clay</b>					
<b>Silt</b>					
<b>Siltation</b>					
<b>None</b>		Y	Y		
<b>Low</b>	Y			Y	
<b>Moderate</b>					Y
<b>High</b>					
<b>Refuges in bank</b>					
<b>None</b>					
<b>Cobble/boulder</b>					
<b>Tree roots, large</b>					
<b>Vertical or undercut bank</b>	Y (slight)			Y (slight)	Y (slight)
<b>Dry stone wall</b>					
<b>Other reinforced</b>					
<b>Crayfish burrows</b>					
<b>Shading above</b>	Y (light)			Y (heavy)	Y (moderate)
<b>Whole Site</b>					
<b>Surveyability (0-3)</b>	1 – mostly good with some limitations due to deep/fast flowing water		<b>Problems</b> pollution 1, erosion 2, (E if >33% affected), aliens 3.	Some litter in the channel	
<b>Other Limitations</b>	Beyond 100m d/s of mid-point too deep for manual survey. Also, CSO discharging into river at about 100m d/s of mid-point, making water v. fast flowing, green tinged and with lots of filamentous algae.				

### A.4.2. River Chelt WCID10\_WCC

<b>Aquatic Feature Name</b>	River Chelt	<b>Aquatic Feature ID</b>	WCID10
<b>Site (PIL ID/BK ref.)</b>	-	<b>Date (dd/mm/yy)</b>	29/07/2020
<b>Surveyors</b>		<b>Photo ref. &amp; location</b>	Photos provided separately
<b>OS Grid ref. (u/s end)</b>	SO9087624578	<b>OS Grid ref. (d/s end)</b>	SO9056824620
<b>Start time</b>	09:45	<b>Finish time</b>	16:00 (with a 1 hour break in survey)
<b>Channel Inaccessibility (%)</b>	Could only access 350m of the 400m required for survey (i.e., 80%). Access to this 400m was largely good.	<b>RCS map ref.</b>	-
<b>Site length (m)</b>	400m	<b>Width channel (m)</b>	5.5
<b>Weather (good 1, moderate 2, poor 3)</b>	1	<b>Water temp. (°C)</b>	14.8
<b>Flow (normal 1, low 2, fall 3, rise 4)</b>	1	<b>Clarity (good 1, moderate 2, poor 3)</b>	1
<b>Description (channel features, land use)</b>	Surrounded land use is arable.		

Sample	Patch 1		Patch 2		Patch 3		Patch 4		Patch 5	
OS Grid Reference	Start	End	Start	End	Start	End	Start	End	Start	End
	SO		SO		SO		SO		SO	
<b>Survey method, std 1, quad 2, net/kick 3, trap 4, view 5, HSI 6</b>	Net/kick		Net/kick		Net/kick		Net/kick		Std (stone turning, net/kick)	
<b>Details (if not standard)</b>										
<b>Extent (l x w patch)</b>	3x1.5		3x1.5		2x1.5		5x1		2x1.5	
<b>Channel (1 margins, 2 mid, 3 both,</b>	1		1		1		1		1	

Sample	Patch 1	Patch 2	Patch 3	Patch 4	Patch 5
<b>other specify)</b>	0.35	0.5	0.45	0.35	0.25
<b>Depth (metres)</b>	3	2	2	4/3	4
<b>Feature (1 marg. d'water, 2 pool,</b>					
<b>3 glide, 4 run, 5 riffle)</b>					
<b>Refuges in channel (tick all present in patch, ring main type(s) searched)</b>					Y (clods of clay from bank erosion – main searched)
<b>Cobble (6.5–15cm)</b>					
<b>Cobble (15–25.6 cm)</b>					
<b>Boulder (25.6-40 cm)</b>					
<b>Boulder (&gt;40cm)</b>					
<b>Rubble (give size)</b>					
<b>Woody debris</b>	Y (main habitat searched, in the margins)	Y (main habitat searched)	Y (main habitat searched)	Y (main habitat searched)	
<b>Other urban debris</b>					
<b>Tree roots, fine</b>					
<b>Moss</b>					
<b>Filamentous algae</b>					
<b>Other submerged vegetation</b>					
<b>Emergents</b>					
<b>Main substrate beneath</b>					
<b>Bedrock</b>					
<b>Cobble (6.5-15 cm)</b>	Y	Y	Y	Y	
<b>Pebble (&lt;6.5 cm)</b>					
<b>Gravel (&lt;1.6cm)</b>					Y



Sample	Patch 1	Patch 2	Patch 3	Patch 4	Patch 5
<b>Sand (&lt;2mm)</b>	Y	Y	Y	Y	
<b>Clay</b>					
<b>Silt</b>					
<b>Siltation</b>				Y	Y
<b>None</b>	Y	Y	Y		
<b>Low</b>					
<b>Moderate</b>					
<b>High</b>					
<b>Refuges in bank</b>					
<b>None</b>	Y (fine)	Y (but not significant)	Y (fine)	Y (small)	
<b>Cobble/boulder</b>					
<b>Tree roots, large</b>					
<b>Vertical or undercut bank</b>					
<b>Dry stone wall</b>					
<b>Other reinforced</b>	Y (light)	Y (light)	Y (light)	Y (moderate)	Y (heavy)
<b>Crayfish burrows</b>	Net/kick	Net/kick	Net/kick	Net/kick	Std (stone turning, net/kick)
<b>Shading above</b>					
Whole Site					
<b>Surveyability (0-3)</b>	1 – mostly good with some limitations due to deep water		<b>Problems</b> pollution 1, erosion 2, (E if >33% affected), aliens 3.	Some large litter caught in/around tree roots.	
<b>Other Limitations</b>	Beyond 100m d/s of mid-point too deep for manual survey. Also, CSO discharging into river at about 100m d/s of mid-point, making water v. fast flowing, green tinged and with lots of filamentous algae.				

### A.4.3. Leigh Brook – WCID02\_WCC

<b>Aquatic Feature Name</b>	Leigh Brook	<b>Aquatic Feature ID</b>	WCID02
<b>Site (PIL ID/BK ref.)</b>	-	<b>Date (dd/mm/yy)</b>	27/07/2020
<b>Surveyors</b>		<b>Photo ref. &amp; location</b>	Photos provided separately
<b>OS Grid ref. (u/s end)</b>	SO9063426100	<b>OS Grid ref. (d/s end)</b>	SO9064726192
<b>Start time</b>	11:45	<b>Finish time</b>	13:00
<b>Channel Inaccessibility (%)</b>	Could only access 100m of the 500m required for survey (i.e., 20%). Access to this 100m was largely good.	<b>RCS map ref.</b>	-
<b>Site length (m)</b>	100m	<b>Width channel (m)</b>	4.5
<b>Weather (good 1, moderate 2, poor 3)</b>	2	<b>Water temp. (°C)</b>	15.5
<b>Flow (normal 1, low 2, fall 3, rise 4)</b>	2 (hardly any)	<b>Clarity (good 1, moderate 2, poor 3)</b>	2
<b>Description (channel features, land use)</b>	Surrounded by agricultural pastureland (cattle grazing in adjacent field).		

<b>Sample</b>	<b>Patch 1</b>		<b>Patch 2</b>		<b>Patch 3</b>		<b>Patch 4</b>		<b>Patch 5</b>	
<b>OS Grid Reference</b>	Start	End	Start	End	Start	End	Start	End	Start	End
<b>Survey method, std 1, quad 2, net/kick 3, trap 4, view 5, HSI 6</b>	Very few suitable crayfish habitats were identified and so this part of the assessment could not be completed (see below for more information on overall suitability for crayfish).									

## A.5. Aquatic macrophytes

### A.5.1. Aquatic macrophyte survey data

Watercourse		River Chelt	River Chelt	Leigh Brook	
Survey code		WCID09_MP	WCID10_MP	WCID02_MP	
scoring taxa	Apium nodiflorum	1		1	
	Cladophora glomerata/Rhizoclonium hieroglyphicum	4			
	Glyceria fluitans agg	1			
	Persicaria amphibia	1			
	Phalaris arundinacea	3			
	Ranunculus (sect Batrachian) sp or hybrid indet1	4			
	Rorippa nasturtium-aquaticum agg.	1			
	Sparganium erectum		1		
	Ulva flexuosa	1			
	Veronica beccabunga	1			
additional taxa recorded	Use this space to enter records of additional species				
	Agrostis stolonifera	✓			
	Epilobium hirsutum	✓		✓	
	Lunularia cruciata		✓		
	Pohlia melanodon		✓		
	Scrophularia auriculata		✓		
	Marchantia polymorpha subsp. <i>ruderalis</i>		✓		
	Equisetum arvense	✓			
	Gongrosira encrustans	✓			
	Juncus effusus	✓			
	Persicaria maculosa	✓			
	Metrics	<b>RMNI</b>	<b>7.91</b>	<b>8.34</b>	<b>8.64</b>
<b>NTAXA</b>		<b>5.00</b>	<b>1.00</b>	<b>1.00</b>	
<b>NFG</b>		<b>4.00</b>	<b>0.00</b>	<b>1.00</b>	
<b>ALG</b>		<b>3.85</b>	<b>0.00</b>	<b>0.00</b>	
General info	Date	29.7.20	29.7.20	28.7.20	
	Site name	WCID09	WCID10	WCID02	
	Start time	11:00	10:00	15:30	
	NGR start (u/s)	SO 90042 24796	SO 90714 24607	SO 90742	
	NGR middle	SO 90087 24783	SO 90670 24606	SO 90682	
	NGR end (d/s)	SO 90096 24787	SO 90625 24617	SO 90642	
	% Wadeable	80	50	100	
	Environmental variables	<b>Total % cover of macrophytes</b>	3	1	<1
<b>% cover of filamentous algae</b>		3	3	0	
Width (m) %		<1	0	0	0
		1 - 5	100	100	100
		5 -10	0	0	0
		10-20	0	0	0
		> 20	0	0	0
Depth (m) %		< 0.25	80	40	100
		0.25 - 0.5	15	10	0
		0.5 - 1	5	50	0
		> 1	0	0	0
Substrate %		Peat	0	0	0
		Silt/clay	19	60	100
		Sand	1	0	0
		Pebbles/gravel	80	40	0
		Boulder/cobbles	0	0	0
		Bedrock	0	0	0
Habitat %		Pool	0	0	0
		Riffle	0	0	0
		Run	0	0	0
		Slack	100	100	100
Shading %		LB	100	30	0
			0	0	0
			0	70	100
		RB	100	30	0
			0	0	0
Clarity %		Clear	0	0	100
	Turbid	0	0	0	
	Cloudy	100	100	0	
Bed stability %	Solid/firm	0	40	0	
	Unstable	0	0	0	
	Stable	100	0	0	
	Soft/sinking	0	60	100	
<b>Typicality</b> A=data not affected or effects limited to<25% of site B=records form 25-50% of site affected C=records from 50% of site affected)		<b>A</b>	<b>A</b>	<b>A</b>	

## A.6. Fish

### A.6.1. Electric fishing survey data

#### River Chelt (WCID09\_FH)

##### Total numbers caught per species per run

	Species						
	Minnow (MN)	Stone loach (STL)	Bullhead (BH)	Three-spined stickleback (SB3)	Chub (CH)	Brook/river lamprey ammocoetes (B/RL AMM)	Eel (EEL)
<b>Run 1</b>	151	25	111	1	2	2	2
<b>Run 2</b>	82	5	32	2	0	0	4
<b>Run 3</b>	75	10	21	0	0	0	0

##### Average lengths in mm caught per species per run

	Species						
	Minnow (MN)	Stone loach (STL)	Bullhead (BH)	Three-spined stickleback (SB3)	Chub (CH)	Brook/river lamprey ammocoetes (B/RL AMM)	Eel (EEL)
<b>Run 1</b>	55.28	55.08	30.4	36	58	77.5	200
<b>Run 2</b>	N/A*	78.6	N/A*	36.5	N/A**	N/A**	128.75
<b>Run 3</b>	N/A*	82.4	N/A*	N/A**	N/A**	N/A**	N/A**

\* no lengths recorded

\*\* none recorded in run

#### River Chelt (WCID10\_FH)

##### Total numbers caught per species per run

	Species						
	Minnow (MN)	Stone loach (STL)	Bullhead (BH)	Three-spined stickleback (SB3)	Chub (CH)	Brook/river lamprey ammocoetes (B/RL AMM)	Eel (EEL)
<b>Run 1</b>	0	0	86	0	0	0	1
<b>Run 2</b>	0	0	34.18	0	0	0	0
<b>Run 3</b>	0	0	173	16	0	0	1

**Average lengths in mm caught per species per run**

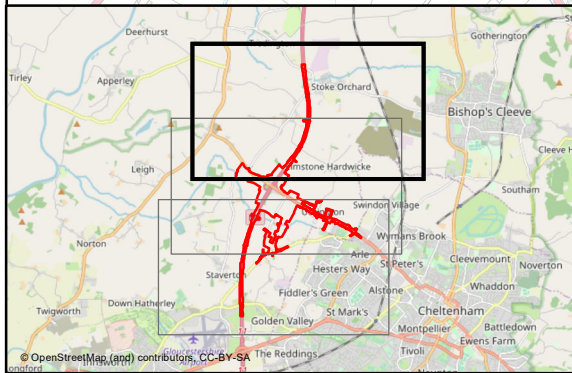
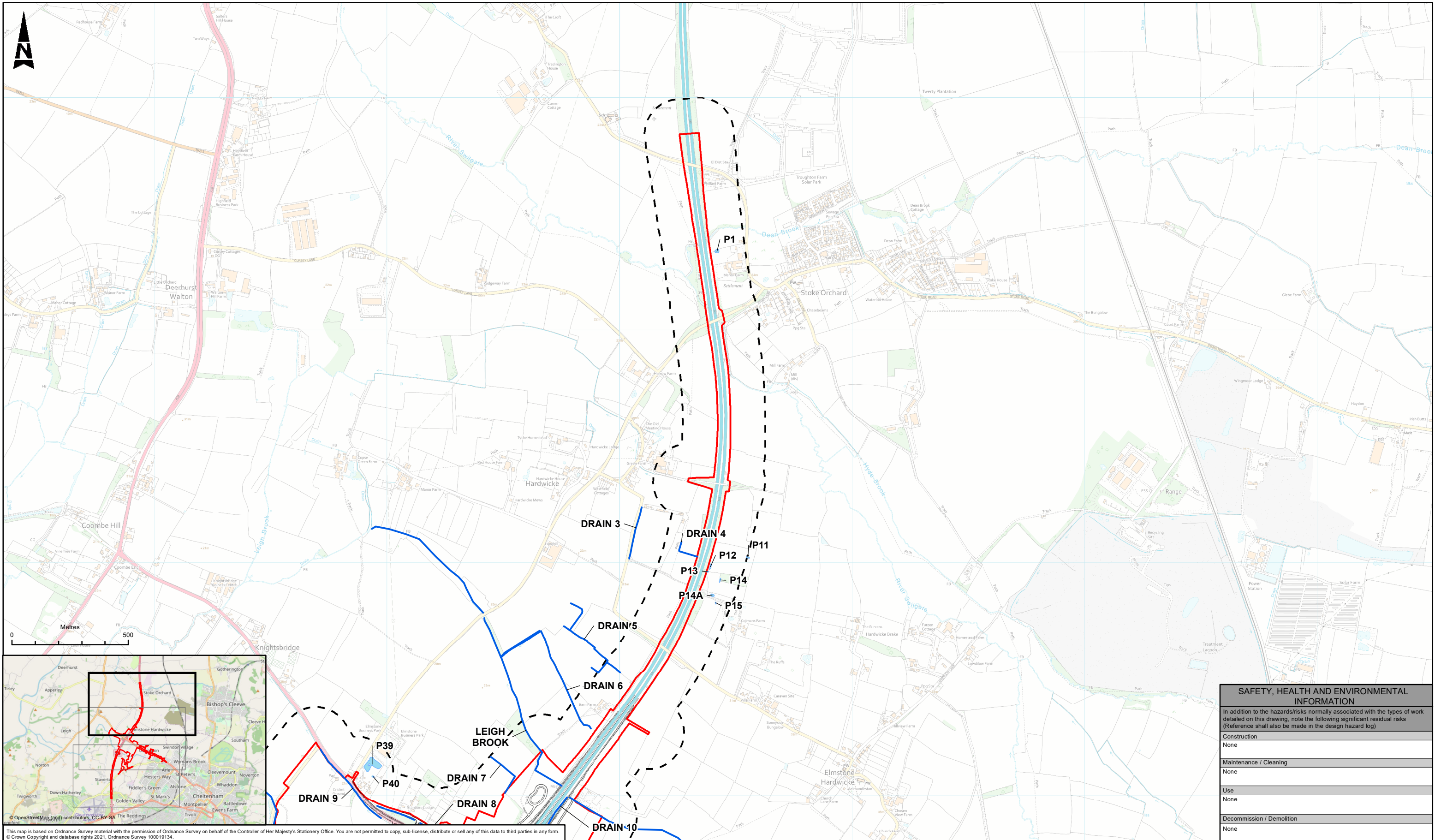
	<b>Species</b>						
	Minnow (MN)	Stone loach (STL)	Bullhead (BH)	Three-spined stickleback (SB3)	Chub (CH)	Brook/river lamprey ammocoetes (B/RL AMM)	Eel (EEL)
<b>Run 1</b>	N/A**	N/A**	35.9	N/A**	N/A**	N/A**	125
<b>Run 2</b>	N/A**	N/A**	57	N/A**	N/A**	N/A**	N/A**
<b>Run 3</b>	N/A**	N/A**	37.95	40.69	N/A**	N/A**	300

\*\* none recorded in run



## Appendix B. Schedule of figures included in this application document

Figure reference	Document title	Sheet	Document number	Revision
7-12A	Aquatic features within the screening area	1 of 3	GCCM5J10-ATK-EBD-ZZ-GS-GI-000082	0
7-12A	Aquatic features within the screening area	2 of 3	GCCM5J10-ATK-EBD-ZZ-GS-GI-000082	0
7-12A	Aquatic features within the screening area	3 of 3	GCCM5J10-ATK-EBD-ZZ-GS-GI-000082	0
7-12B	Aquatic ecology survey locations	1 of 4	GCCM5J10-ATK-EBD-ZZ-GS-GI-000083	0
7-12B	Aquatic ecology survey locations	2 of 4	GCCM5J10-ATK-EBD-ZZ-GS-GI-000083	0
7-12B	Aquatic ecology survey locations	3 of 4	GCCM5J10-ATK-EBD-ZZ-GS-GI-000083	0
7-12B	Aquatic ecology survey locations	4 of 4	GCCM5J10-ATK-EBD-ZZ-GS-GI-000083	0



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Construction	None
Maintenance / Cleaning	None
Use	None
Decommission / Demolition	None

LEGEND	
	ORDER LIMITS
	SCHEME ALIGNMENT
	PONDS
	150M STUDY AREA
	WATERCOURSES

Description						
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
PUBLISHED						

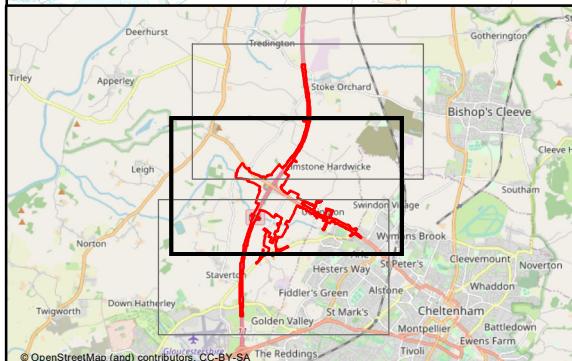
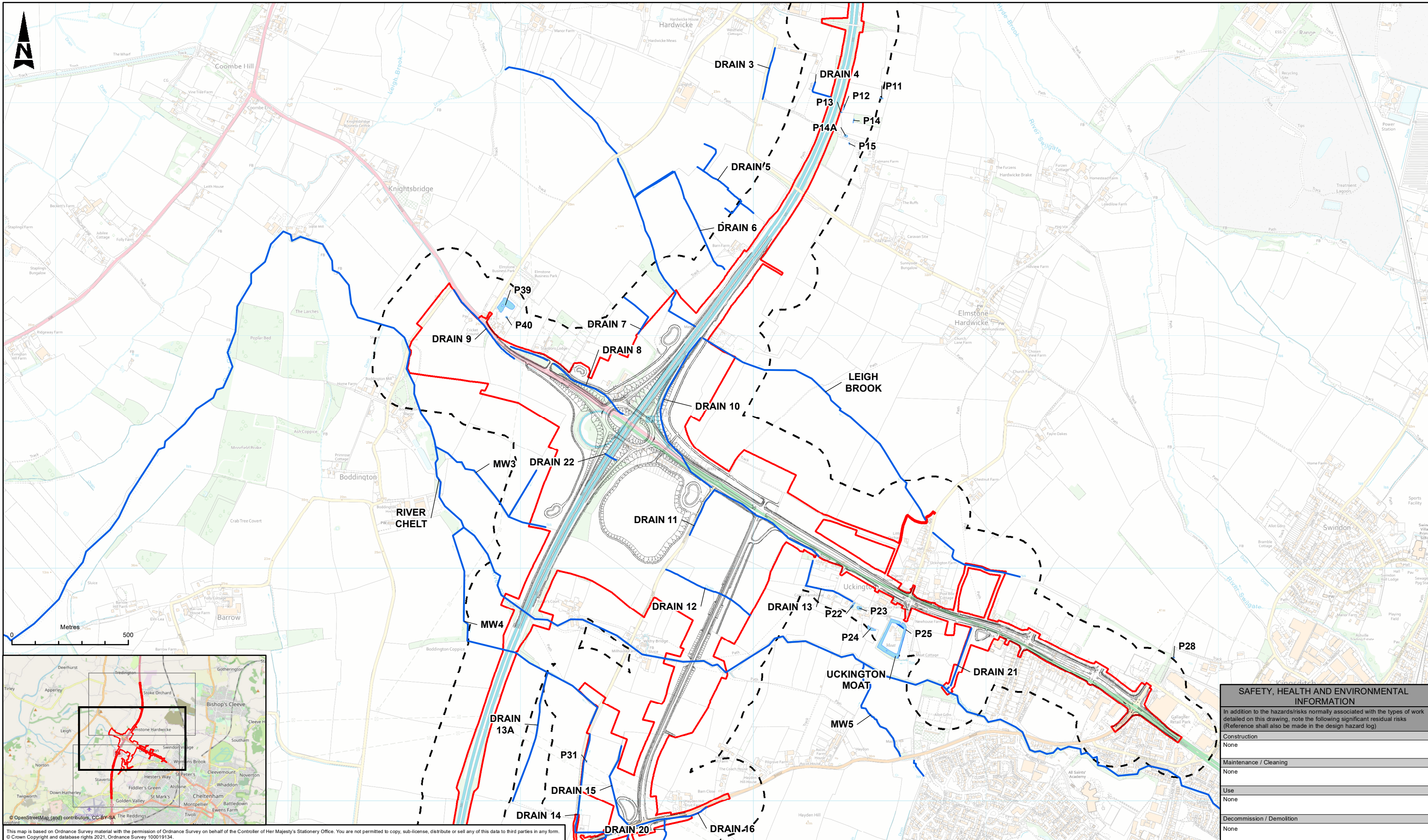
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Project Title		M5 Junction 10 Improvements Scheme	
Drawing Title		FIGURE 7-12A AQUATIC FEATURES WITHIN THE SCREENING AREA	
Drawing Number		Project: GCCM5J10 - ATK - EBD Originator: ZZ - GS - GI - 00082 Volume: 1 of 3	
Original Size: A3	Scale: 1:15,000	Project Ref: 5206696	Sheet: 1 of 3 Rev: P02

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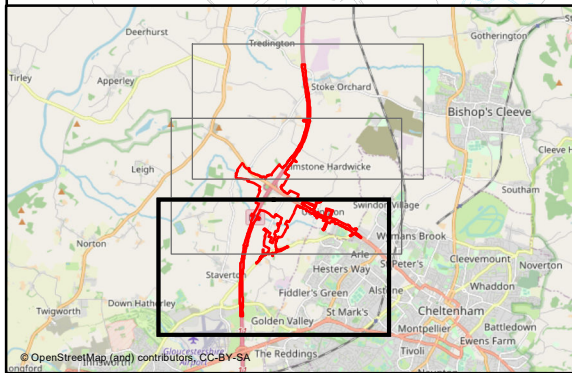
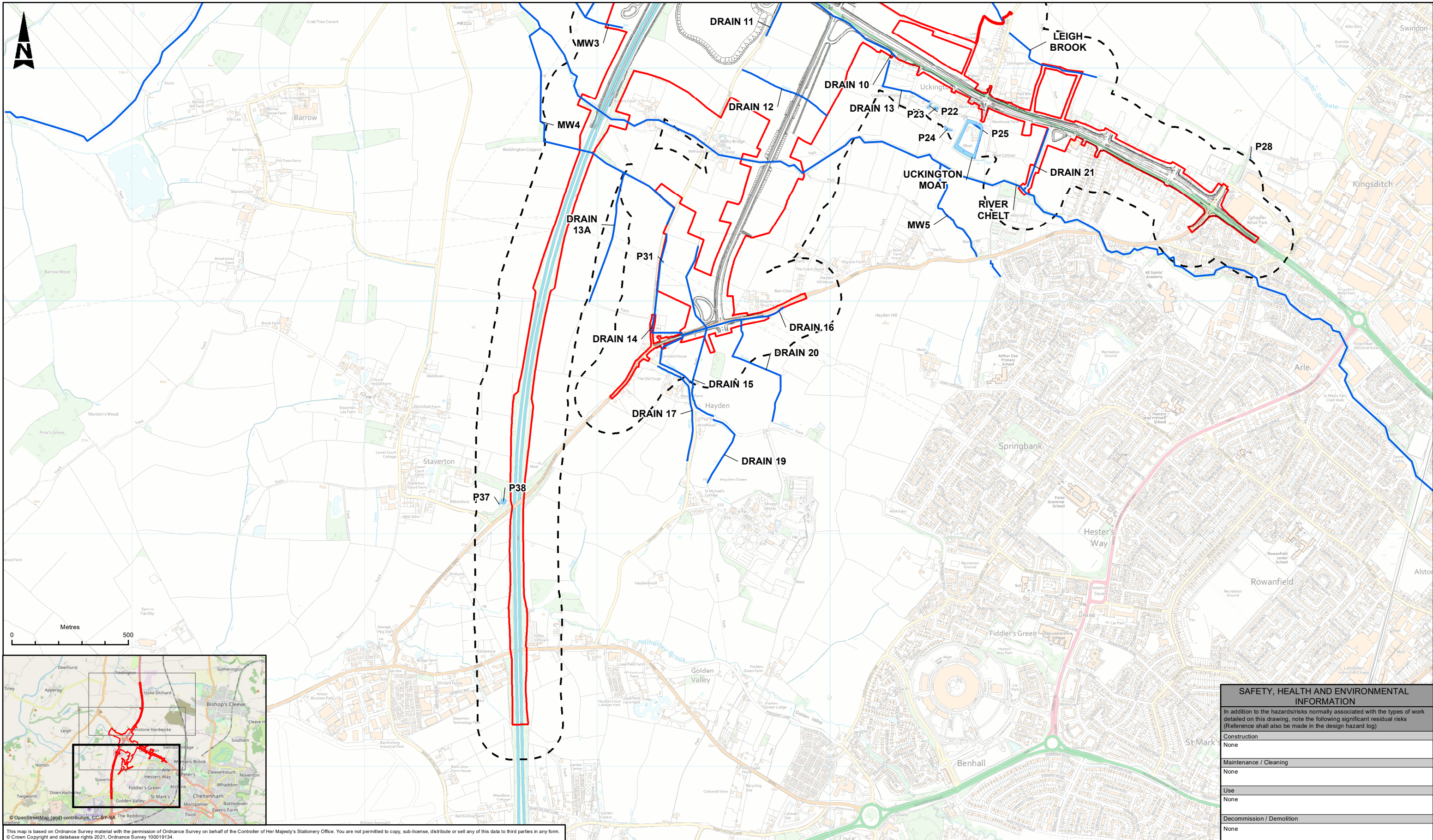


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Decommission / Demolition	None

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	Drawing Number Project: <b>GCCM5J10 - ATK - EBD</b> Originator: <b>ZZ - GS - GI - 000082</b> Volume: <b>2 of 3</b>		Drawing Number Project: <b>GCCM5J10 - ATK - EBD</b> Originator: <b>ZZ - GS - GI - 000082</b> Volume: <b>2 of 3</b>
	Client: <b>Gloucestershire COUNTY COUNCIL</b>		Drawing Number Project: <b>GCCM5J10 - ATK - EBD</b> Originator: <b>ZZ - GS - GI - 000082</b> Volume: <b>2 of 3</b>
	Description <b>PUBLISHED</b> Status: <b>A1</b>   Revision: <b>P02</b>   Drawn: <b>EM</b>   Checked: <b>LH</b>   Reviewed: <b>CC</b>   Authorised: <b>LJ</b>   Issue Date: <b>25/08/23</b>		Drawing Number Project: <b>GCCM5J10 - ATK - EBD</b> Originator: <b>ZZ - GS - GI - 000082</b> Volume: <b>2 of 3</b>
	Description <b>PUBLISHED</b> Status: <b>A1</b>   Revision: <b>P02</b>   Drawn: <b>EM</b>   Checked: <b>LH</b>   Reviewed: <b>CC</b>   Authorised: <b>LJ</b>   Issue Date: <b>25/08/23</b>		Drawing Number Project: <b>GCCM5J10 - ATK - EBD</b> Originator: <b>ZZ - GS - GI - 000082</b> Volume: <b>2 of 3</b>





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Construction	None
Maintenance / Cleaning	None
Use	None
Decommission / Demolition	None

LEGEND							
	ORDER LIMITS						
	SCHEME ALIGNMENT						
	PONDS						
	150M STUDY AREA						
	WATERCOURSES						

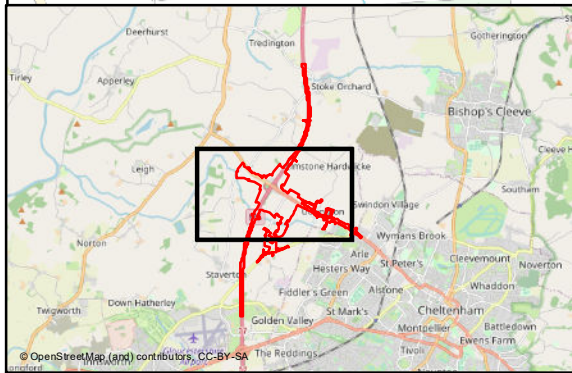
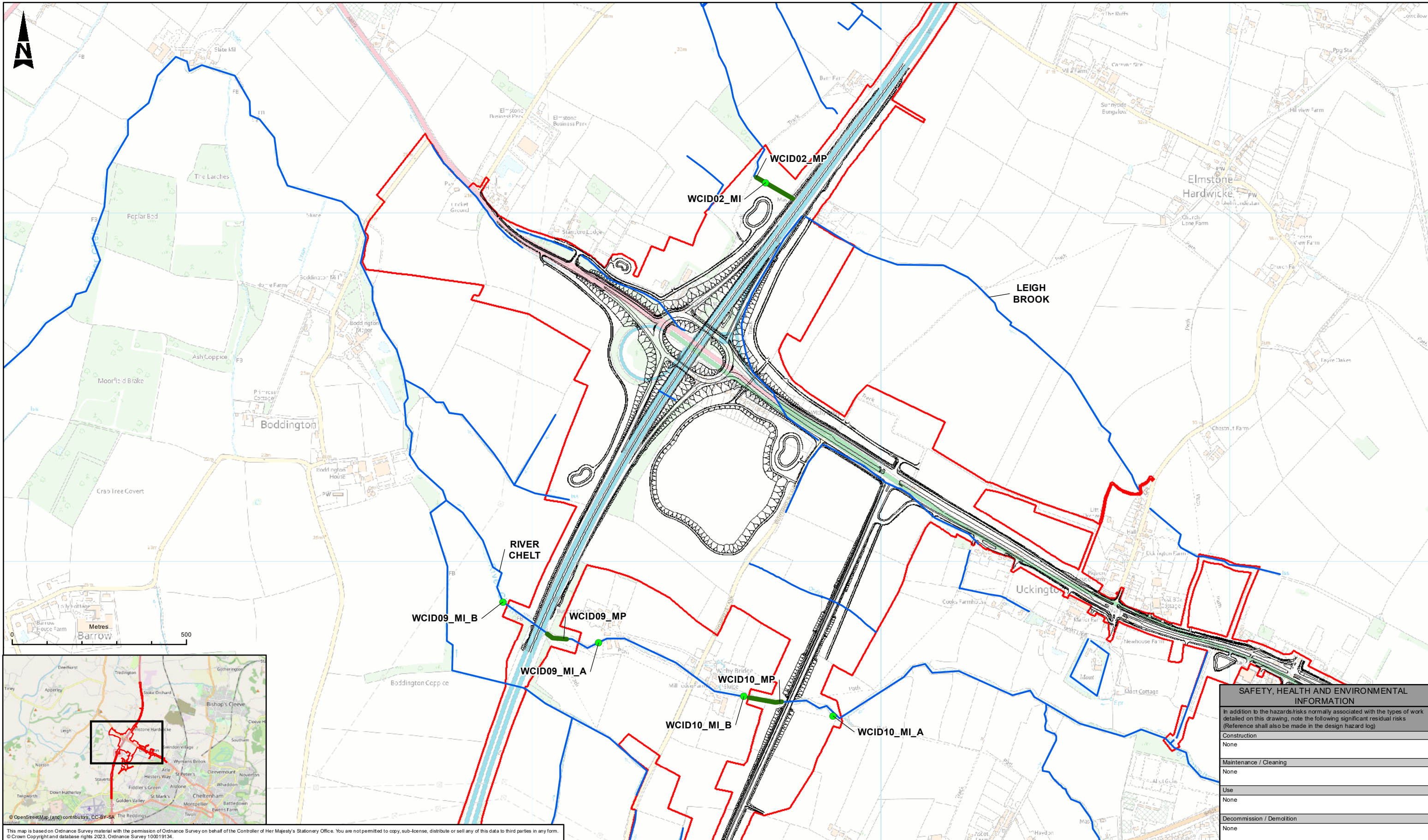
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Project Title		M5 Junction 10 Improvements Scheme	
Drawing Title		FIGURE 7-12A AQUATIC FEATURES WITHIN THE SCREENING AREA	
Project	Originator	Volume	
GCCM5J10 - ATK - EBD	ZZ - GS - GI - 00082		
Location	Type	Role	Number
A3	1:15,000	5206696	3 of 3
Original Size	Scale	Project Ref.	Sheet
A3	1:15,000	5206696	3 of 3
Rev.			
P02			





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Maintenance / Cleaning	None
Use	None
Decommission / Demolition	None

LEGEND							
	ORDER LIMITS						
	SCHEME ALIGNMENT						
	WATERCOURSES						
	AQUATIC MACROPHYTE SURVEY LOCATIONS						
	AQUATIC MACROINVERTEBRATE SURVEY LOCATIONS						

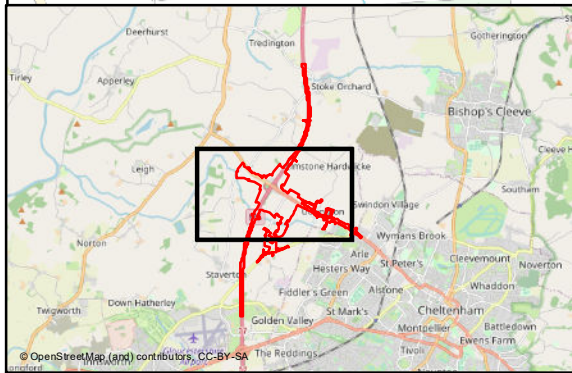
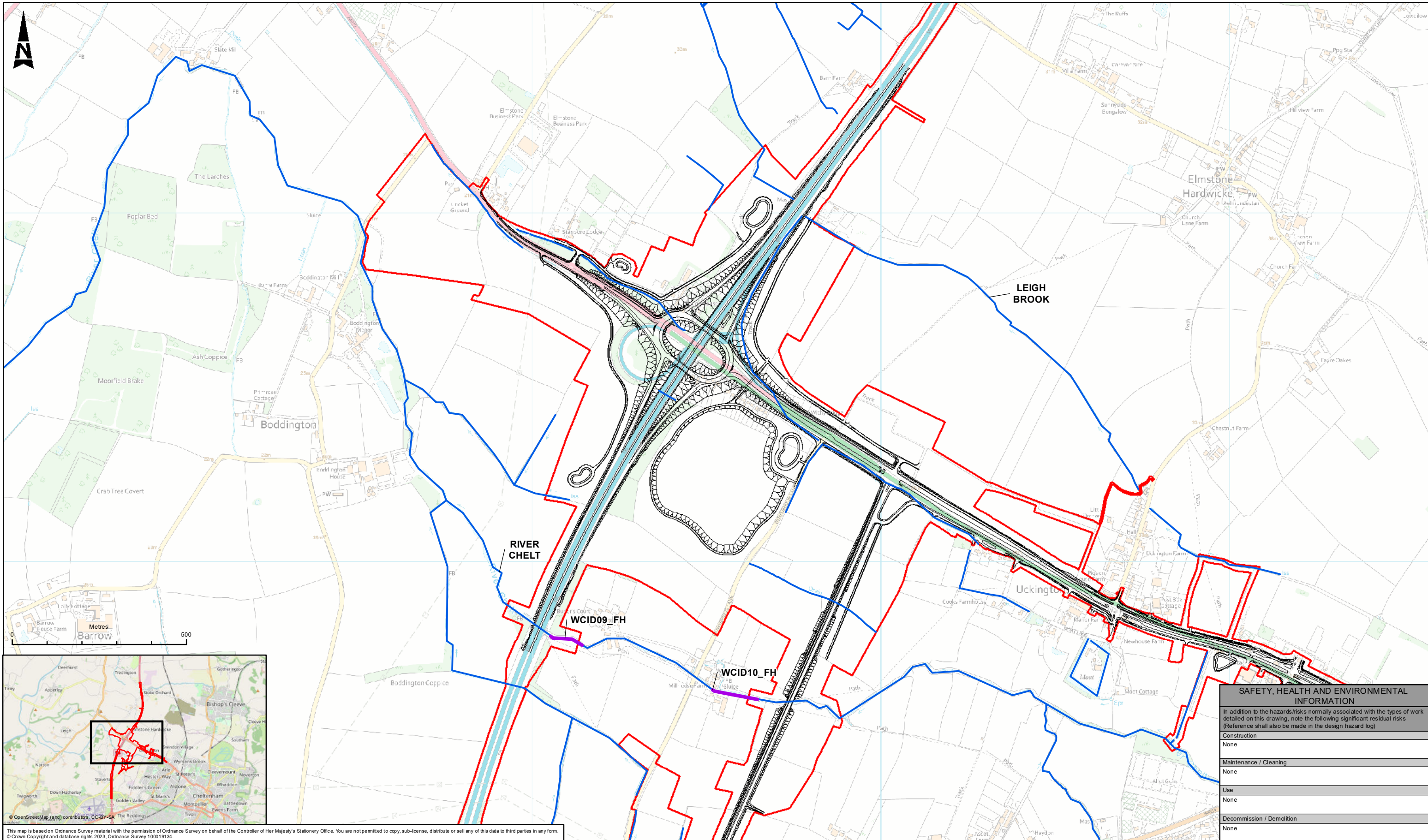
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Project Title		M5 Junction 10 Improvements Scheme	
Drawing Title		FIGURE 7-12B AQUATIC ECOLOGY SURVEY LOCATIONS	
Drawing Number		GCCM5J10 - ATK - EBD ZZ - GS - GI - 000083	
Original Size: A3	Scale: 1:10,000	Project Ref: 5214106	Sheet: 1 of 4 Rev: P02





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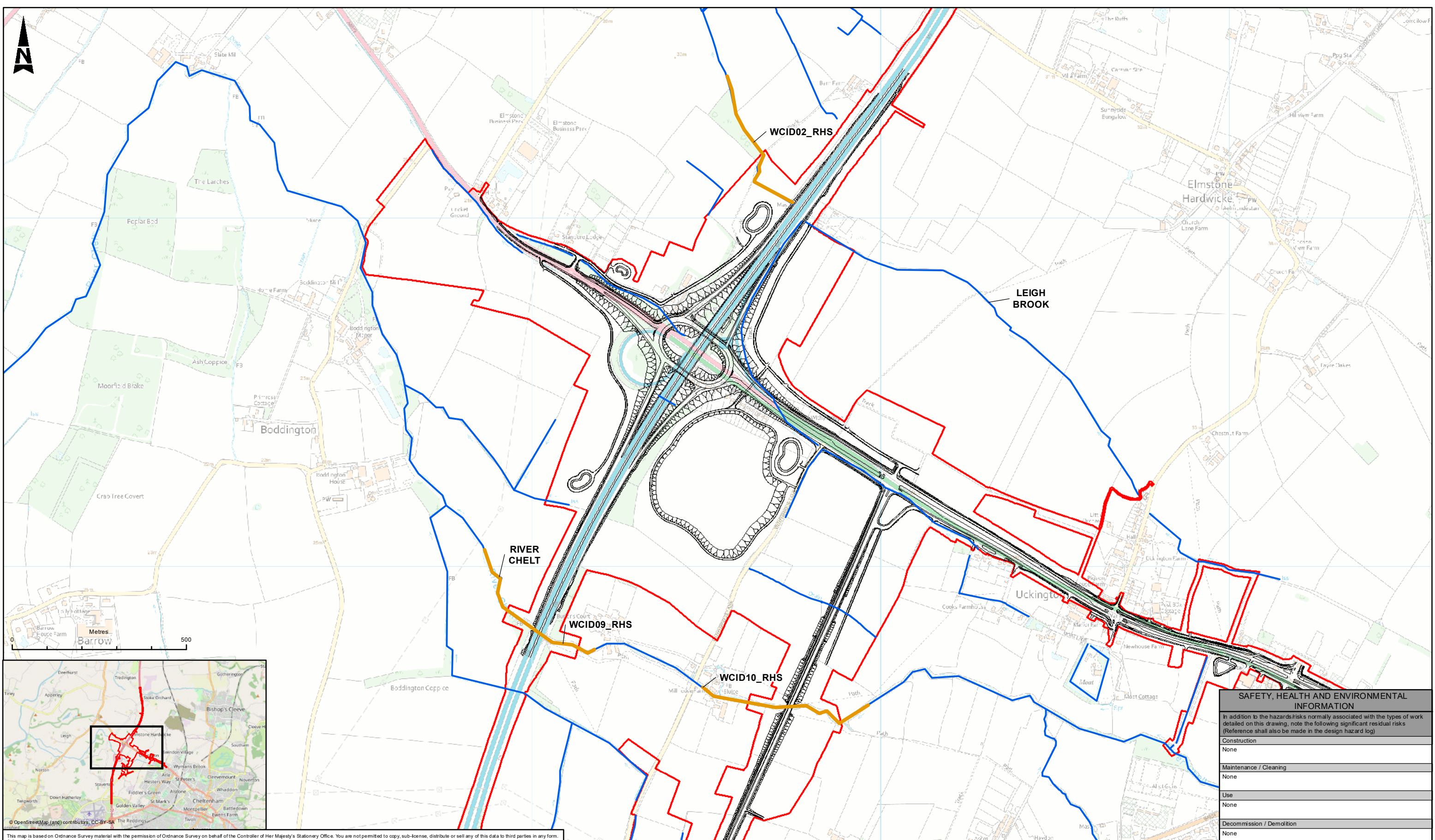
SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION	
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Construction	None
Maintenance / Cleaning	None
Use	None
Decommission / Demolition	None

LEGEND	
	ORDER LIMITS
	SCHEME ALIGNMENT
	WATERCOURSES
	FISH SURVEY LOCATIONS

Description							Drawing Suitability	Status	Project Title
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date	<b>PUBLISHED</b>	<b>A1</b>	M5 Junction 10 Improvements Scheme
Description									
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date			
Description									
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date	 Member of the SNC-Lavalin Group 5th Floor, Block 5 Shire Hall Bearland Gloucester GL1 2TH Tel: 08000 514 514 Copyright © Atkins Limited (2023) www.atkinsglobal.com	 Gloucestershire COUNTY COUNCIL	Drawing Title <b>FIGURE 7-12B</b> <b>AQUATIC ECOLOGY SURVEY</b> <b>LOCATIONS</b>
Description									
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date			
Description									
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date	Drawing Number Project   Originator   Volume <b>GCCM5J10 - ATK - EBD</b> <b>ZZ - GS - GI - 000083</b>	Original Size: A3   Scale: 1:10,000   Project Ref: 5214106   Sheet: 2 of 4   Rev: P02	
Description									
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date			
Description									

Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
Description						
Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
Description						





SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION	
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Construction	None
Maintenance / Cleaning	None
Use	None
Decommission / Demolition	None

LEGEND	
	ORDER LIMITS
	SCHEME ALIGNMENT
	WATERCOURSES
	RIVER HABITAT SURVEY LOCATIONS

Description	Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
PUBLISHED	A1	R02	EM	LH	CC	LJ	29/08/23

Description	Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
PUBLISHED	A1	R02	EM	LH	CC	LJ	29/08/23

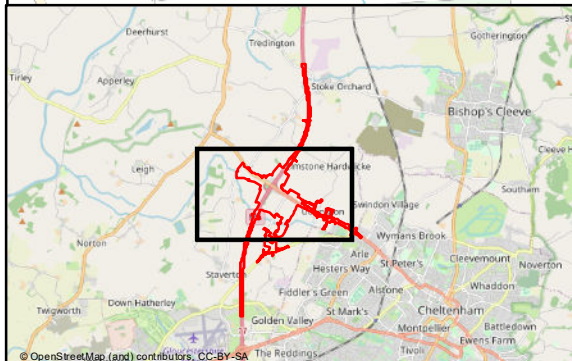
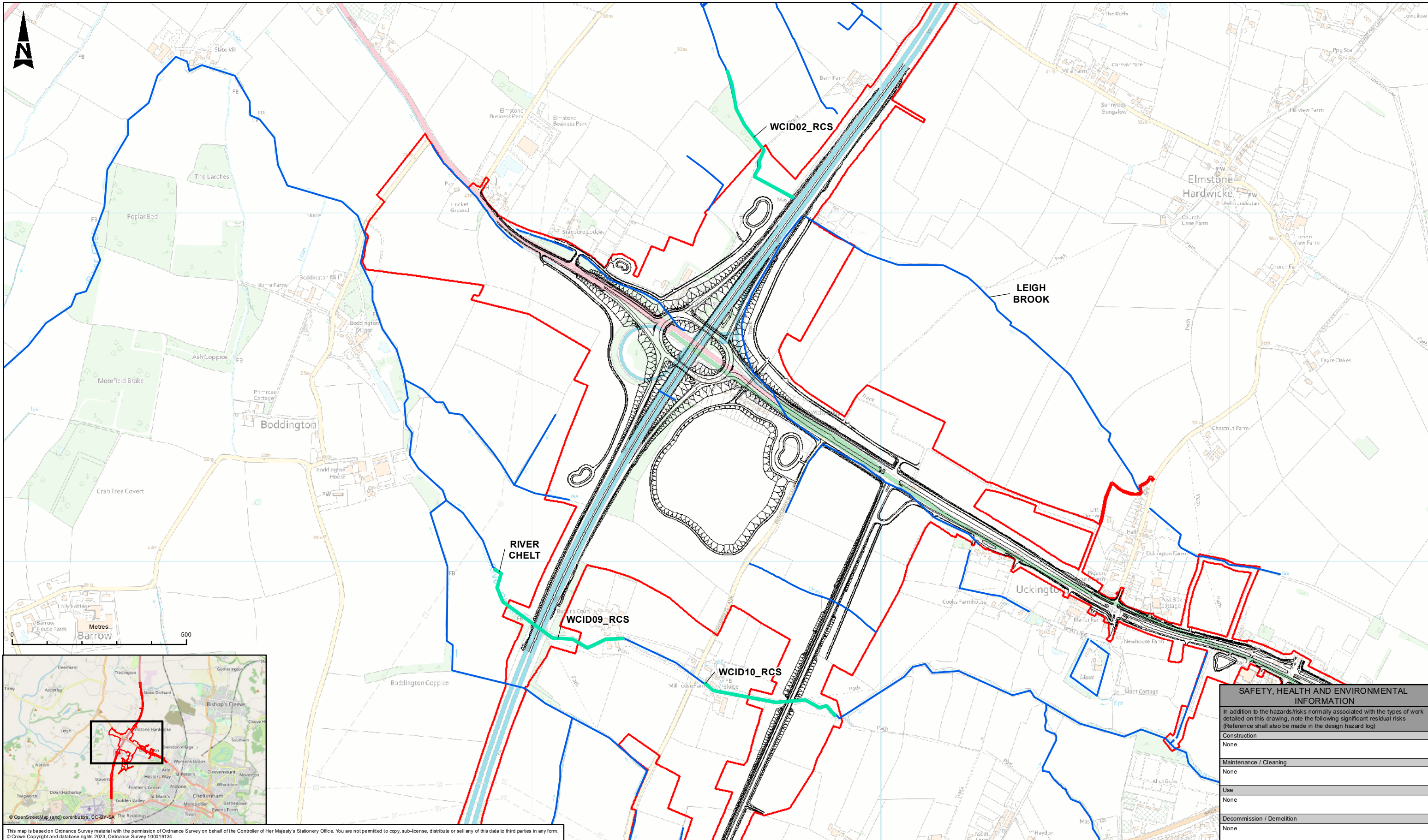
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Project Title		M5 Junction 10 Improvements Scheme	
Drawing Title		FIGURE 7-12B AQUATIC ECOLOGY SURVEY LOCATIONS	
Drawing Number		Project: GCCM5J10 - ATK - EBD Originator: ZZ - GS - GI - 000083 Volume: 3 of 4	
Original Size: A3	Scale: 1:10,000	Project Ref: 5214106	Rev: P02

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SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION	
In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made in the design hazard log)	
Construction	None
Maintenance / Cleaning	None
Use	None
Decommission / Demolition	None

LEGEND							
	ORDER LIMITS						
	SCHEME ALIGNMENT						
	WATERCOURSES						
	RIVER CORRIDOR SURVEY LOCATIONS						

Description	Status	Revision	Drawn	Checked	Reviewed	Authorised	Issue Date
PUBLISHED	A1						29/08/23

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Project Title		M5 Junction 10 Improvements Scheme	
Drawing Title		FIGURE 7-12B AQUATIC ECOLOGY SURVEY LOCATIONS	
Drawing Number		GCCM5J10 - ATK - EBD ZZ - GS - GI - 000083	
Original Size: A3	Scale: 1:10,000	Project Ref: 5214106	Sheet: 4 of 4 Rev: P02

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