



SUNNICA ENERGY FARM

Appendix 8D: Aquatic Scoping and Ditch Surveys

Sunnica Ltd

August 2020



Quality information

| Prepared by | Checked by | Verified by | Approved by |
|-----------------------------------------------------------------------|-----------------------------------------------|---------------------------------|---------------------------------------------|
| Louise Levins BSc (Hons) MCIWEM Consultant Aquatic Ecologist | Lauren Vickers BSc (Hons) PhD CEnv MIFM | Andy Went Associate Director | Max Wade Technical Director (Ecology) |
| Matt Harris BSc PhD MIFM Senior Aquatic Ecologist | | | |

Revision History

| Revision | Revision date | Details | Authorized | Name | Position |
|----------|---------------|-----------|------------|-----------|-----------------------|
| 1 | August 2020 | For Issue | AW | Andy Went | Associate Director |

Prepared for:

Sunnica Ltd

Prepared by:

AECOM Infrastructure & Environment UK Limited
Unit 1 Wellbrook Court
Girton
Cambridge CB3 0NA
United Kingdom

T: +44 1223 488 000
aecom.com

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1. Introduction

1.1.1 AECOM was instructed by Sunnica Ltd to undertake aquatic scoping and subsequent aquatic ecology surveys of the proposed Sunnica Energy Farm (the 'Scheme') within the Scheme boundary (the Development Consent Order (DCO) Site) (the Site).

1.1.2 This report, detailing aquatic habitats within land required for the Scheme, was commissioned following the Preliminary Ecological Appraisal (PEA). The PEA identified a number of standing and flowing waterbodies which have potential to support notable¹ and, or protected species. Aquatic scoping and required surveys were undertaken to identify whether there are known or potential aquatic receptors that may constrain or influence the design and implementation of the Scheme.

1.2 The Scheme

1.2.1 Sunnica Energy Farm is a new solar farm scheme proposal that would connect with the national electricity transmission network. Sunnica will use ground mounted solar photovoltaic (PV) panel arrays to generate electricity energy from the sun and combine these with a Battery Energy Storage System (BESS). The Scheme will be connected to the national electricity transmission network by an underground cable.

1.2.2 The BESS will consist of a compound and battery array to allow for the storage, importation and exportation of energy to the National Grid. Details of the design of the BESS elements, including their power and energy ratings, and their dimensions and appearance, are currently in development.

1.2.3 Supporting electrical infrastructure will include an on-site substation and on-site cabling between the different electrical elements of the Scheme. The generating equipment of the Scheme will be fenced and be protected via security measures such as CCTV and lighting. Inside the fenced areas, in addition to the generating equipment there will be internal access tracks, landscaping and habitat management and drainage.

1.2.4 The Scheme will be connected to the existing Burwell National Grid Substation, most likely using 132kV cables buried underground. The cables will run between Sunnica West and Sunnica East (Grid Connection Route A), and then on from Sunnica West to the Burwell National Grid Substation (Grid Connection Route B). Details of the cable route, dimensions of the cables, the depth and method of burial, and numbers of joints required are currently in development.

1.2.5 The Scheme qualifies as a Nationally Significant Infrastructure Project (NSIP) and will require a DCO from national government due to its generating capacity.

¹ A notable habitat or species has a conservation designation assigned to it, but no legal protection.

1.2.6 The Scheme therefore comprises the following key areas:

- Solar Farm Sites:
 - Sunnica East Site A;
 - Sunnica East Site B;
 - Sunnica West Site A; and
 - Sunnica West Site B.
- associated electrical infrastructure for connection to the national transmission system comprising:
 - Grid Connection Route A (connecting the Sunnica East Site A with the Sunnica East Site B and then connecting to the Sunnica West Site A);
 - Grid Connection Route B (connecting the Sunnica West Site A and Sunnica West Site B and the Burwell National Grid Substation); and
 - Burwell National Grid Substation.

1.2.7 **Figure 8D-1** shows the locations of these key areas.

1.3 Site Description

1.3.1 The extent of the Scheme is shown in **Figure 8D-1** in **Sub-Appendix A** of this report.

Sunnica East Site

1.3.2 The Sunnica East Site is split into two sub-sites, one to the north of Freckenham (referred to as Sunnica East Site A) and the other to the south of Worlington (referred to as Sunnica East Site B). These two sites are approximately 1 km apart and are separated by agricultural fields. The Sunnica East Site A encompasses an area of approximately 231.7 ha and includes land within the county of Suffolk and Cambridgeshire. Sunnica East Site B lies within Suffolk and encompasses an area of approximately 323.1 ha (**Figure 8D-1**).

1.3.3 The landscape features within the Sunnica East Site A and Sunnica East Site B consist of arable agricultural fields interspersed with individual trees, hedgerows, linear tree belts, small woodland blocks, farm access tracks and local roads.

1.3.4 The landscape features immediately surrounding the Sunnica East Site A and Sunnica East Site B comprise small rural villages, including Worlington to the north, Barton Mills to the north-east, Red Lodge and Freckenham to the south and Isleham to the west. Industrial land uses adjoin the A11 to the south of the Sunnica East Site with an industrial installation of a 7.5 MW solar farm situated adjacent to the south-eastern extent of the Sunnica East Site and an anaerobic digestion (AD) plant located to the south of the Sunnica East Site.

1.3.5 Aquatic features within the Sunnica East Site include Lee Brook, a series of connected ditches in close proximity to the River Lark, two ponds and an arable ditch south of Worlington. The River Lark lies outside of the Scheme.

Sunnica West Site

- 1.3.6 The Sunnica West Site is located within the East Cambridgeshire District Council administrative area, approximately 3 km north east of Newmarket and 6.5 km east of Burwell.
- 1.3.7 Sunnica West is split into two sub-sites, one to the south-east (referred to as Sunnica West Site A) and the other to the north-west of Snailwell (referred to as Sunnica West Site B). These two sites are approximately 1 km apart, separated by agricultural fields and Chippenham Road. The Sunnica West Site A encompasses an area of approximately 485.5 ha and includes land to the east and west of the A11, consisting of agricultural fields bounded by trees, managed hedgerows, linear tree shelter belts, small woodland and copses and farm access tracks. Sunnica West Site B encompasses an area of approximately 68.8 ha and comprise of agricultural fields, grassland, small woodland and copses, farm access tracks and irrigation ditches fed by the River Snail which runs along the western and northern boundaries of the Site (**Figure 8D-1**).
- 1.3.8 The surrounding landscape comprises regularly shaped arable fields interspersed with managed hedgerows, tall shelter belts of trees and in the Chippenham Hall area, a parkland landscape with mature individual trees. Much of the area is also characterised by grazed paddocks, horse gallops and exercise tracks.
- 1.3.9 Aquatic features within the Sunnica West Site include a number of agricultural ditches, the River Snail and two ditches connected to Chippenham Fen SSSI.

Cable Route Corridors

- 1.3.10 The Scheme will connect to the existing Burwell National Grid Substation via a cable route corridor. The cable route corridors under consideration are Grid Connection Route A, which connects the Sunnica East Site A with the Sunnica East Site B and then runs between the Sunnica West Site A and the Sunnica East Site B; and Grid Connection Route B, between the Sunnica West Site A and Sunnica West Site B and the Burwell National Grid Substation.

Grid Connection Route A

- 1.3.11 Grid Connection Route A connects the Sunnica East Site A with Sunnica East Site B and crosses two minor roads and arable farmland (**Figure 8D-1**).
- 1.3.12 Heading south from the Sunnica East Site B, the cable route corridor for Grid Connection Route A crosses the River Kennett, pastoral farmland, the Chippenham footpath 49/7 (a Public Right of Way (PRoW)) and B1085 (**Figure 8D-1**).

Grid Connection Route B

- 1.3.13 Heading east from the Burwell National Grid Substation, the cable route corridor for Grid Connection Route B crosses agricultural fields and a number of roads including the B1102 and A142. Grid Connection Route B also crosses a number of watercourses, including the Burwell Lode, New River,

and the River Snail, as well as a number of drainage ditches associated with Burwell Fen, Little Fen, the Broads, and agricultural drains (**Figure 8D-1**).

- 1.3.14 The cable route corridor for Grid Connection Route B crosses a PRow (footpath 92/19) before crossing the railway line and the A142 Newmarket / Fordham Road. The Route then runs alongside Snailwell Road and across the River Snail into Sunnica West Site B.
- 1.3.15 There are a number of aquatic features of interest within the Grid Connection Routes including the River Kennett, Burwell Lode, Catchwater Drain, New River, the River Snail and numerous ponds and ditches.

Burwell National Grid Substation Extension

- 1.3.16 The habitat within the Burwell National Grid Substation Extension (surrounding the existing substation) comprises small grassland fields to the east of the existing substation (bordered by hedgerows and mature trees) and arable land to the south and west of the existing substation (**Figure 8D-1**).

1.4 Scope of Report

- 1.4.1 A desk study was carried out to identify records of notable aquatic species within the catchment of the Scheme. Results of the desk study, PEA and aquatic scoping informed the requirement for further aquatic surveys.
- 1.4.2 Following aquatic scoping of the Scheme, aquatic macroinvertebrate and macrophyte surveys were undertaken to identify the conservation value of the communities within a watercourses and ditches and to record the presence of any notable and, or protected species. Further surveys were scoped out for ponds within the Sunnica East and Sunnica West site due to poor habitat quality. Waterbodies along the Grid Connection Routes were not surveyed as land access could not be obtained.
- 1.4.3 This baseline information can be used to inform options for impact avoidance, mitigation and, or compensation that might need to be considered.
- 1.4.4 This report is a technical appendix to accompany the Preliminary Environmental Information report, reporting on and evaluating the baseline data collected as of August 2020.

2. Methods

2.1 Desk Study

- 2.1.1 A desk study was undertaken in December 2018 through Cambridgeshire & Peterborough Environmental Records Centre (CPERC) and Suffolk Biodiversity Information Service (SBIS) as part of the PEA that identified nature conservation designations and protected or notable habitats and species potentially relevant to the Scheme. This was completed in advance of the aquatic surveys and informed aquatic scoping surveys. Desk study results of relevance to the assessment have been carried forward into this report, and where appropriate these data are presented in more detail or re-interrogated for the needs of the aquatic assessment.
- 2.1.2 Further to this, information relevant to this assessment was sought from the Environment Agency and online resources. These were accessed to identify historical fish, macroinvertebrate, macrophyte and invasive non-native species (INNS) records. Environment Agency Water Framework Directive data were requested for the relevant surface waterbodies: Burwell Lode (Waterbody ID: GB105033042720), Kennett - Lee Brook (Waterbody ID: GB105033042990), Kennett - Lee Brook (Waterbody ID: GB105033043020), New River (Waterbody ID: GB105033042780) and Lark downstream of Mill Street Bridge (Waterbody ID: GB105033043052).

2.2 Aquatic Scoping Survey

Survey conditions

- 2.2.1 Aquatic scoping surveys were carried out on the 14th and 15th August 2019 by two qualified and experienced aquatic ecologists (Louise Levins BSc Hons MCIWEM and Matt Harris BSc PhD MIFM). Scoping surveys were undertaken on each waterbody within Sunnica East Site and Sunnica West Site. Scoping was undertaken on watercourses along the Grid Connection Routes where access was possible via public rights of way.
- 2.2.2 **Table 8D-1** summarises the results of the aquatic scoping exercise. Weather conditions were poor on the afternoon of the 14th August with heavy rainfall. Weather and survey conditions were good during the rest of the scoping survey.

Survey method

- 2.2.3 Aquatic scoping surveys were conducted by walking the length of the watercourse or the circumference of ponds within the area required for the Scheme. Surveyed sites are listed below in **Table 8D-1**. Aquatic features of interest were recorded including channel dimensions, bank features, substrate composition, flow, habitat types and features, shading, artificial features and pressures, obstructions to fish passage, invasive species and surrounding land use. Survey data were collected using the interactive mapping tool Collector and uploaded directly to a predefined GIS map.

2.2.4 Aquatic habitat features were used to determine the potential of waterbodies to support protected and/or notable species and to inform further survey requirements in conjunction with desk study data.

Table 8D-1: Aquatic scoping survey areas

| <i>Site</i> | <i>All waterbodies</i> | <i>Waterbodies scoped in for further surveys (provide detail)</i> | <i>Central National Grid Reference</i> |
|------------------------|------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| Sunnica East Site A | Lee Brook | No – Environment Agency data for macroinvertebrates, fish and macrophytes exist within the DCO limits. | TL 66307 74309 TL 66308 73144 |
| | Ditch 01 | Yes – macrophyte and macroinvertebrate surveys. Appears to permanently hold water and potential to support protected species. No desk study data exist. | TL 66870 74700 |
| | Ditch 02 | Yes – macrophyte and macroinvertebrate surveys. Deep and wide ditch connected to River Lark with fringing reeds. Potential to support protected species. No desk study data exist. | TL 66476 74864 |
| | Ditch 03 | No – predominantly dry and choked with terrestrial vegetation. Low ecological value. | TL 67003 74680 |
| Sunnica East Site B | Ditch 04 | No – dry. | TL 69265 72715 |
| | Pond 02 | No - no access | TL 69064 72938 |
| | Pond 05 | No – agricultural pond. Filamentous algae throughout indicating eutrophication. Low ecological potential. | TL 68567 70810 |
| | Pond 08 | No – raised reservoir with no safe access point. This waterbody will be retained and therefore no further surveys are recommended. | TL 68575 70809 |
| Sunnica West Site A | Ditch 06 | No – dry. | TL 67281 68798 |
| | Ditch 07 | No – dry. | TL 68669 68194 |
| Sunnica West Site B | Pond 27 | No – dry. | TL 63769 68632 |
| | Ditch 05a | Yes – macrophyte and macroinvertebrate surveys. Located within Chippenham Fen SSSI impact risk zone. | TL 64000 68917 |
| | Ditch 05b | Yes – macrophyte and macroinvertebrate. Located within Chippenham Fen SSSI impact risk zone. | TL 64228 68909 |

| | | | |
|-------------------------|-------------------------|-----------------------------------------------------------------------------------|-------------------------------------------------------|
| | Ditch 08 | No – dry. | TL 63957 68274 |
| | Ditch 13 | No – dry. | TL 63857 68373 |
| | River Snail | No – Environment Agency data exist for macroinvertebrates adjacent to DCO limits. | TL 63905 68254 |
| Grid Connection Route A | River Kennett | No – dry. | TL 68932 70062 |
| | New River | Yes – when access to Grid Connection Route permitted. | TL 61374 68652 |
| | River Snail | No – Environment Agency data exist for macroinvertebrates adjacent to DCO limits. | TL 63450 68949 |
| | Pond 11 | No - dry | TL 67665 68092 |
| | Pond 11a | No - dry | TL 67708 68042 |
| | Pond 11b | No - dry | TL 67673 68025 |
| | Pond 11c | No - dry | TL 67644 67974 |
| | Grid Connection Route B | Burwell Lode | Yes – when access to Grid Connection Route permitted. |
| Catchwater Drain | | Yes – when access to Grid Connection Route permitted. | TL 59211 68830 |
| Pond 16 | | N/A | TL 63279 68449 |
| Pond 19 | | N/A | TL 60850 68485 |
| Ditch 09 | | No - Not accessible for surveys – overgrown and steep banks. | TL 60250 68604 |
| Ditch 10 | | No – dry. | TL 58167 68263 |
| Ditch 11 | | Yes – no access to date. macroinvertebrate survey. No desk study data exist. | TL 58355 68193 |
| Ditch 12 | | No – dry. | TL 58017 67307 |
| | 32 ditches | Yes – if access to Grid Connection Route permitted. | Multiple locations |

2.2.5 The outcome from the aquatic habitat survey and scoping was that all ponds were scoped out primarily due to their being dry and in some cases due to inaccessibility, or both. The arterial drains and rivers (Burwell Lode, New Drain and River Snail) will be surveyed for macroinvertebrates and macrophytes if permission to undertake these surveys is granted. Aquatic

habitat features were used to determine the potential of waterbodies to support protected and/or notable species and to inform further survey requirements in conjunction with desk study data. In the case of the New River, there was no need to undertake any surveys as the Environment Agency samples this watercourse on a regular basis.

2.3 Ditch Surveys

Method

- 2.3.1 Ditch surveys were conducted on the 10th and 11th September by two experienced aquatic ecologists (Matt Harris BSc PhD MIFM and Charlie Patel BSc MSc). Surveys were only conducted on ditches containing water.
- 2.3.2 The survey method was based on the method published by Buglife (2013) – A Manual for the Survey and Evaluation of the Aquatic Plant and Invertebrate Assemblages of Grazing Marsh Ditch Systems Version 6, (May 2013). A reduced version of this method was employed as it is designed for high quality grazing marsh ditch systems.
- 2.3.3 The macrophyte assemblage in each ditch was assessed by identifying all species to the lowest possible taxonomic level and recording their abundance using the DAFOR scale² along a 20 m stretch of each ditch. Once this had been completed, the rest of the ditch was assessed and the presence of any other macrophyte species was recorded. A grapnel was used to sample plants in deeper areas of the ditch and where the banks were too steep to access. Identification was carried out onsite where possible, with further identification of more complex specimens completed in the laboratory. Specimens that were taken for additional analysis were removed either by hand or grapnel, placed in a sealed plastic bag and refrigerated.
- 2.3.4 Macroinvertebrate samples were collected using a standard Freshwater Biological Association (FBA) pattern pond net (mesh size: 1 mm). Individuals were collected by netting ditch vegetation along a 50 m section of each waterbody. Macroinvertebrate samples were subsequently preserved in Industrial Methylated Spirit (IMS) and taken back to the AECOM freshwater laboratory for identification.

Ditch survey – Aquatic Plant Data Analysis

- 2.3.5 The ditch survey methodology (Buglife, 2013) provides a rarity or protected status for native plants. The assessment is based on the vascular plant Red List for Britain (Cheffings & Farrell, 2005) (updated by the Species Status Assessment Group), the New Atlas (Preston et al., 2002) and information on the JNCC website. The British Red Lists have been drawn up by applying the revised IUCN threat categories and criteria (IUCN Species Survival Commission, 2003).
- 2.3.6 Ditch survey methodology requires the calculation of four metrics to allow for ranking of aquatic plants:
- **Native Species Richness:** Native Species Richness is the number of native taxa recorded (using the list of native species provided in Buglife, 2013).
 - **Native Species Conservation Status (Species Quality Index):** Native aquatic plant taxa are given a conservation score between one and five,

² D – Dominant coverage over 75 % of survey area, A – Abundant coverage 51 – 75 % of survey area, F – Frequent coverage 26 – 50 % of survey area, O – Occasional coverage 11 -25 % of survey area, R – Rare coverage 1 – 10 % of survey area

with one associated with common species and five reserved for species listed on the Habitats Directive Annex II/IV, Schedule 8 or British Red List. The mean conservation score of all native species is calculated to provide the Plant Conservation Status Score. Non-native species are omitted from the calculation. See **Table 8D-2** below.

- **Habitat Quality:** A Plant Habitat Quality Score is calculated using the Ellenberg indicator values for nitrogen. This metric is used to give an indication of nutrient enrichment in the ditch. Aquatic plants are allocated an Ellenberg indicator value which has an associated habitat quality score. The Plant Habitat Quality Score is the mean of the scores of all the aquatic plant taxa (native and non-native) recorded in the ditch. See **Table 8D-3** below.
- **Community Naturalness:** Threat scores between 1 and 5 are allocated to non-native plant species, with a score of 5 indicating a species which poses a severe threat to native species. The Naturalness Score is the sum of threat scores for introduced species expressed as a negative value.

Table 8D-2: Aquatic plant Conservation Status Scores

| Category | Score |
|----------------------------------------------------------------------------|-------|
| Habitats Directive Annex II/IV, Schedule 8 or British Red List | 5 |
| *Near Threatened | 4 |
| Nationally Rare or Nationally Scarce (but not Red List or Near Threatened) | 3 |
| Local (in English Environment Agency Region or in Wales) | 2 |
| None of the above (Common) | 1 |

* Some of these are UK Biodiversity Action Plan priority species.

Table 8D-3: Ellenberg indicator values for nitrogen and associated scores

| Ellenberg indicator value for nitrogen | Habitat Quality Score |
|----------------------------------------------------------|-----------------------|
| 1. Species indicative of extremely infertile sites | 5 |
| 2. Between 1 and 3 | 5 |
| 3. Species indicative of more or less infertile sites | 4 |
| 4. Between 3 and 5 | 4 |
| 5. Species indicative of sites of intermediate fertility | 3 |
| 6. Between 5 and 7 | 2 |

7-9. Species of richly fertile or extremely rich conditions

1

Ditch Survey – Aquatic Macroinvertebrate Data Analysis

2.3.7 Each of the samples collected was sorted and analysed in a laboratory setting by suitably trained and experienced aquatic ecologists. Lists of the aquatic invertebrate taxa present were produced in line with Environment Agency guidance (Environment Agency, 2014). The aquatic invertebrate samples were identified to 'mixed taxon level' using stereo-microscopes. Most groups were identified to species level (where practicable), with the exception of the following:

- mites (*Hydracarina*) which were identified to order;
- worms (*Oligochaeta*) which were identified to order;
- marsh beetles (*Scirtidae*) which were identified to family;
- butterfly / moth larvae (*Lepidoptera*), which were identified to order;
- springtails (*Collembola*) which were identified to order;
- true
- fly larvae, which were identified to the maximum resolution possible; and
- immature or damaged specimens, which were identified to the maximum resolution possible on a case-by-case basis.

2.3.8 Macroinvertebrate samples were analysed using the indices set out below:

- Whalley Hawkes Paisley Trigg (WHPT) scores and Average Score Per Taxon (ASPT) values - scores are derived based on the sensitivity of particular taxa (families) of invertebrates to organic pollution;
- Community Conservation Index (CCI) method – to assess the conservation value of the macroinvertebrate populations present and identify and unusual or rare species;
- Lotic-Invertebrate Index for Flow Evaluation (LIFE) method – to assess the sensitivity of benthic macroinvertebrate communities to variable flows. Higher flows should result in higher LIFE scores; and
- Proportion of Sediment-sensitive Invertebrates (PSI) index – to assess the sensitivity of benthic macroinvertebrate communities to fine sediments.

2.3.9 Further details of the above indices can be found in Appendix B, C, D and E.

2.3.10 The survey data were then used to inform an assessment of relative nature conservation value.

2.4 Nature Conservation Evaluation Approach

2.4.1 An essential prerequisite step to allow ecological impact assessment of the Scheme is an evaluation of the relative nature conservation value of the identified ecological features (encompassing nature conservation designations, ecosystems, habitats and species).

- 2.4.2 The method of evaluation that has been utilised has been developed with reference to the Chartered Institute of Ecology and Environmental Management (CIEEM) Guidelines for Ecological Impact Assessment in the UK and Ireland – Terrestrial, Freshwater and Coastal – Second Edition. These give advice on scoping and carrying out environmental assessments and place appraisal in the context of relevant policies. Data received through consultation, desk-based studies and field-based surveys are used to allow ecological features of nature conservation value or potential value to be identified, and the main factors contributing to their value described and related to available guidance. These data can also be used to identify other relevant values e.g. socio-economic or ecosystem services values, but this is beyond the remit of this report and requires the involvement of other relevant specialists.
- 2.4.3 Aquatic macroinvertebrate communities and individual macroinvertebrate species can be of nature conservation value for a variety of reasons, and their relative value should always be determined on a case by case basis to demonstrate a robust assessment process. Value may relate, for example, to the uniqueness of the assemblage, or to the extent to which species are threatened throughout their range, or to their rate of decline. The value of the macrophyte assemblages, aquatic macroinvertebrate assemblages and species recorded by the survey has been defined with reference to the geographical level at which the feature being assessed is considered relevant (**Table 8D-4**). Relevant published national and local guidance and criteria can be used, where available, to inform the assessment of nature conservation value and to assist consistency in evaluation. Guidance and criteria of potential relevance to the aquatic macroinvertebrate features being assessed is summarised in **Table 8D-4**. The identified guidance and criteria are not definitive and other criteria have been applied as relevant and appropriate to reach a decision on relative nature conservation value. For example, the previously described CCI index has been used to inform assessment of nature conservation value.

Table 8D-4. Geographic Scale Used to Qualify Relative Nature Conservation Value of Features

| Geographic scale of value | Definition | Example supporting guidance and assessment criteria |
|---------------------------|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| International | Europe | Guidelines for the selection of Special Areas of Conservation (SACs) (McLeod <i>et al.</i> 2005) |
| National | Great Britain/ England | Guidelines for the selection of biological Sites of Special Scientific Interest (SSSIs) for Terrestrial and Freshwater Invertebrates (Curson <i>et al.</i> 2019) |
| Regional | East Anglia | No specific guidance available, professional judgement is to be used. It will encompass features clearly of greater than county value but not of sufficient merit to demonstrate national value. |

| Geographic scale of value | Definition | Example supporting guidance and assessment criteria |
|---------------------------|--------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| County | Suffolk and Cambridgeshire | County Wildlife Site Selection Criteria (Suffolk Wildlife Trust, 2010). Cambridgeshire and Peterborough County Wildlife Sites Selection Guide (The Wildlife Trust for Bedfordshire, Cambridgeshire and Northamptonshire, 2014). |
| District | West Suffolk and East Cambridgeshire | No specific guidance available, professional judgement is to be used. |
| Local | Below district value | No specific guidance available, professional judgement is to be used. |

2.5 Assumptions and Limitations

Desk Study

- 2.5.1 The aim of the desk study was to help characterise the baseline context of the Scheme and provide valuable background information that would not be captured by a single site survey alone. Information obtained during the course of a desk study was dependent upon people and organisations having made and submitted records for the area of interest. As such, a lack of records for a particular habitat or species does not necessarily mean that the habitats or species do not occur in the study area. Likewise, the presence of records for particular habitats and species did not automatically mean that these still occurred within the area of interest or were relevant in the context of the Scheme.

Field Survey

- 2.5.2 There are no significant limitations to the work undertaken. The aquatic plant survey was undertaken within the optimal season (June – September) recommended in the ditch survey methodology (Buglife, 2013). Macroinvertebrate sampling of ditches is recommended between April – June, however, representative results can be obtained until the end of October (Buglife, 2013). The ditch surveys were undertaken during good weather and low flow conditions.
- 2.5.3 Access to waterbodies along the Grid Connection Routes was restricted to accessible public rights of way as landowner permission had not been granted along the majority of the Grid Connection Routes. Aquatic scoping surveys of these waterbodies are recommended.
- 2.5.4 Given the nature of biological survey, it is not possible to be certain that all the species present in a waterbody will be detected. Where juvenile or damaged macroinvertebrate specimens were collected, species level identification is not always possible. Not all macroinvertebrate species that use waterbodies are present at all times of year and therefore some may be overlooked when surveying. Other species that may be present at other times

of year, sporadically and/or in low numbers may not have been recorded. This is not considered a significant limitation as standard methods were applied, and the data collected is considered representative of the conditions present and appropriate for assessment of value.

3. Results

3.1 Desk Study

Designated Sites

3.1.1 There were three designated statutory sites for nature conservation relevant to aquatic ecology located within 10 km of the Site. The full list of designated statutory sites can be found in the Preliminary Ecological Appraisal (Appendix 08.A). These sites are designated for ecological reasons and summarised in **Table 8D-5** below. Site designation details are summarised in **Table 8D-5** and are taken from citation documents published online by the Joint Nature Conservation Committee (JNCC) for the individual sites.

Table 8D-5: Statutory Nature Conservation Designated sites within 10 km of the Site

| Site Name and Designation | Designation | Reason for Designation | Aquatic Features of interest | Approximate distance from the Site (km) |
|-----------------------------------------|----------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------|
| Chippenham Fen and Snailwell Poor's Fen | Fenland SAC, Chippenham Fen Ramsar / NNR, Chippenham Fen and Snailwell Poor's Fen SSSI | A spring-fed calcareous basin mire with a long history of management, which is partly reflected in the diversity of present-day vegetation. The invertebrate fauna is very rich, partly due to its transitional position between Fenland and Breckland. The site supports rich aquatic flora including Water-plantain <i>Alisma plantago-aquatica</i> , Mare's-tail <i>Hippuris vulgaris</i> and frequent Fen Pondweed <i>Potamogeton coloratus</i> . | Spined loach <i>Cobitis taenia</i> is a qualifying species of Fenland SAC. | Directly adjacent to the north of the Sunnica West Site B. |
| Red Lodge Heath | SSSI | This site supports a nationally important assemblage of terrestrial invertebrates, including nationally rare Five-banded Digger Wasp <i>Cerceris quinquefasciata</i> . | Four RDB species of coleoptera are associated with areas of wet woodland with ponds in the centre and south of the site. | Approximately 750m south east of the Sunnica East Site B and c. 740m east of the Grid Connection Route A2 |
| Wicken Fen | Wicken Fen Ramsar, Fenland SAC Wicken Fen SSSI, NNR (just outside) | The site supports diverse vegetation types, rare and scarce plants. The site supports one species of British Red Data Book plant, Fen Violet <i>Viola persicifolia</i> , which survives at only two other sites in Britain. It also | The dykes, abandoned claypits and other watercourses carry a great wealth of aquatic plants. | Approximately 2.1km north of the Grid Connection Route B and approximately 2.6km north |

| Site Name and Designation | Designation | Reason for Designation | Aquatic Features of interest | Approximate distance from the Site (km) |
|---------------------------|-----------------|----------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------|
| | 2km study area) | contains eight nationally scarce plants and 121 British RDB invertebrates. | including Greater Spearwort <i>Ranunculus flammula</i> and Lesser Water-plantain <i>Baldellia ranunculoides</i> are now uncommon elsewhere. Spined loach <i>Cobitis taenia</i> is a qualifying species of Fenland SAC. | west of the Burwell National Grid Substation Extension. |

Fish

3.1.2 Fish records were accessed via the Environment Agency National Fish Populations Database (NFPD). For this assessment, the desk study records presented below are restricted to those collated since 2009 and within 2 km of the Scheme boundary. Where there were no survey records within 2 km, the closest data have been included. These restrictions are to reflect the current, rather than historic, baseline conditions associated with the watercourses. **Table 8D-6** highlights fish records in the Lee Brook, Burwell Lode, New River and the River Kennett. There were no records of fish for any of the ditches or ponds within the Scheme boundary.

Table 8D-6: Environment Agency fish records

| Water-course | Site NGR | Distance from Site (m) | Date | Species |
|--------------|------------|------------------------|------------|---------------------------------------------------------------------------------------------------------------------------|
| Lee Brook | TL 663 731 | Within the Site | 29/04/2014 | Brown/Sea Trout <i>Salmo trutta</i> , Bullhead <i>Cottus gobio</i> , Stone Loach <i>Barbatula barbatula</i> |
| | TL 664 728 | 10m south | 24/09/2014 | 3-Spined Stickleback <i>Gasterosteus aculeatus</i> , Bullhead, Dace <i>Leuciscus leuciscus</i> |
| | TL 639 680 | 100m south | 23/05/2012 | 10-Spined Stickleback <i>Pungitius pungitius</i> , 3-Spined Stickleback, Brook Lamprey <i>Lampetra planeri</i> , Bullhead |
| | | | 14/03/2014 | Bullhead, 10-Spined Stickleback, 3-Spined Stickleback, Brook Lamprey |

| Water-course | Site NGR | Distance from Site (m) | Date | Species |
|---------------|------------|------------------------|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| | TL 665 719 | 580m south | 18/08/2011 | Dace, Pike <i>Esox lucius</i> , Bullhead, Stone Loach, Gudgeon <i>Gobio gobio</i> , Chub <i>Squalius cephalus</i> , European Eel > elvers <i>Anguilla anguilla</i> , 3-Spined Stickleback, Brook Lamprey |
| | | | 28/09/2012 | Bullhead, Dace, Minnow <i>Phoxinus phoxinus</i> , gudgeon, European Eel > elvers, 3-Spined stickleback, Brook Lamprey |
| | | | 24/09/2014 | Dace, Bullhead, Stone loach |
| | | | 02/10/2015 | Bullhead, Stone Loach, Brook lamprey ammocoetes (larval stage), Dace, 3-Spined Stickleback |
| | | | 15/11/2018 | Dace, Chub, Minnow, Bullhead, Pike, Brook Lamprey ammocoetes (larval stage) |
| Burwell Lode | TL 584 678 | 110m south-east | 05/06/2014 | Bullhead, Gudgeon, Perch <i>Perca fluviatilis</i> , Pike, Roach <i>Rutilus rutilus</i> , Spined Loach, Tench <i>Tinca tinca</i> , European Eel |
| | | | 05/07/2010 | Bleak <i>Alburnus alburnus</i> , Bullhead, Common Bream <i>Abramis brama</i> , Dace, Gudgeon, Perch, Pike, Roach, Rudd <i>Scardinius erythrophthalmus</i> , Ruffe <i>Gymnocephalus cernua</i> , Silver (White) Bream <i>Blicca bjoerkna</i> , Spined Loach, Roach x Common Bream hybrid |
| | TL 564 689 | 1830m north-west | 03/06/2014 | Roach, Perch, Common Bream, Spined Loach, Pike, European Eel elvers, Bitterling <i>Rhodeus amarus</i> |
| | | | 15/07/2010 | Common Bream, Roach, Bitterling, Bleak, Silver Bream, Common [wild] Carp <i>Cyprinus carpio</i> , Pike, Rudd, Tench, Perch, European Eel > elvers |
| New River | TL 619 668 | 1500m south | 26/02/2012 | No fish recorded |
| River Kennett | TL 702 580 | 1259m south | 04/10/2012 | Stone Loach |

- 3.1.3 There were records of three UK BAP priority fish species in the study area: Brown/Sea Trout, European Eel and Spined Loach. Records were returned of two Annex II fish species: Bullhead and Brook Lamprey.

Macroinvertebrates

- 3.1.4 Macroinvertebrate species data were requested from the Environment Agency. For this assessment, desk study records below have been restricted to those collated since 2009 and within 2 km of the Scheme boundary. Where there were no survey records within 2 km, the closest data have been included. These restrictions are to reflect the current, rather than historic, baseline conditions associated with the watercourses. Species data have been returned for:

- Lee Brook – approximately within the Sunnica East Site A;
- River Snail – on the border of Sunnica West Site B and approximately 1.4 km north of Sunnica West Site A;
- River Lark – approximately 1 km from where ditches in Sunnica East Site A enter the river;
- River Kennett – approximately 0.94 km upstream of the Grid Connection Route A;
- New River – approximately 3.9 km downstream of the Grid Connection Route B crossing point;
- Catchwater Drain – approximately 0.42 km from the Grid Connection Route B crossing point; and
- Burwell Lode – approximately 4.5 km from the Grid Connection Route B.

- 3.1.5 There were records of four macroinvertebrate species in the River Kennett and River Snail that are not RDB listed but are regarded as Nationally Scarce. The aquatic beetle *Agabus biguttatus* was recorded in the Kennett in 2015, the White-barred Soldier fly *Oxycera morrisii* in the River Kennett in 2018, the caddisfly *Limnephilus nigriceps* in River Snail in 2012 and Lister's River Snail *Viviparus contectus* recorded in the River Lark in 2014.

Macrophytes

- 3.1.6 Macrophyte species data were requested from the Environment Agency and as with other desk study data, the records below have been restricted to those collated since 2009 and within 2 km of the Scheme boundary. Where there were no survey records within 2 km, the closest data have been included. These restrictions are to reflect the current, rather than historic, baseline conditions associated with the watercourses. Species data has been returned for: Desk study records were returned from the Environment Agency for macrophyte species at the:

- Lee Brook – approximately 10 m west of Sunnica East Site A;
- River Snail – on the border of Sunnica West Site B;
- River Lark – approximately 1 km from where ditches in the Sunnica East A site enter the river;

- River Kennett – approximately 0.94 km upstream of the Grid Connection Route A crossing point; and
 - New River – approximately 3.9 km downstream of the Grid Connection Route B crossing point.
- 3.1.7 No notable or protected macrophyte species records exist within the past ten years at the above sites.
- 3.1.8 Cambridgeshire and Peterborough Environmental Records Centre returned one RDB species classed as Vulnerable: Water Violet *Hottonia palustris*. Water Violet was recorded in Chippenham Fen in 2009, approximately 1 km from the Sunnica West Site B boundary and in 2011 in New River, approximately 1.1 km from the Grid Connection Route B.
- 3.1.9 The Suffolk Biodiversity Information Service returned records of the Near Threatened Scarce Chaser dragonfly *Libellula fulva* approximately 70 m from the Sunnica East Site A in 2011. Records were also returned for Perfoliate Pondweed *Potamogeton perfoliatus*, a Suffolk rare plant, approximately 700 m from the Sunnica East Site A in the River Lark in 2013. No other protected or notable aquatic invertebrate species were reported.

Invasive Non-Native Species

- 3.1.10 Desk study records of invasive non-native species are listed in **Table 8D-7**. The table highlights the most recent records of these species at each site.
- 3.1.11 Cambridgeshire and Peterborough Environmental Records Centre and Suffolk Biodiversity Information Service returned records of four invasive species of macrophyte; Nuttall’s Waterweed *Elodea nuttallii* and Canadian Pondweed *Elodea canadensis*. Results are listed below in **Table 8D-7**.
- 3.1.12 A freshwater shrimp, either Northern River Crangonyctid *Crangonyx pseudogracilis* or Florida *Crangonyx floricranus* has been recorded in both Catchwater Drain in 2009 and Burwell Lode in 2015 by the Environment Agency (**Table 8D-7**). *Crangonyx pseudogracilis* is a long-established non-native species, whereas *Crangonyx floricranus* is a highly invasive non-native species, which has only recently been recorded in the UK (Mauvisseau et al., 2018). Taxonomic distinction between *Crangonyx floricranus* and *Crangonyx pseudogracilis* is extremely difficult (Mauvisseau et al., 2018) so the records in **Table 8D-7** do not specify which species.
- 3.1.13 Records of Signal Crayfish *Pacifastacus leniusculus* exist from the River Lark in 2005, Lee Brook in 2012 and the River Kennett in 2016.

Table 8D-7: Desk study records of invasive non-native species

| Watercourse | Grid Reference | Distance and Orientation from Site | Date | Species |
|-------------|----------------|------------------------------------|------------|-----------------|
| Lee Brook | TL 662 733 | 0.04 km from Sunnica East Site A | 20/10/2016 | Signal Crayfish |

| | | | | |
|------------------------------|------------|--------------------------------------|------------|--------------------------------------------------|
| Catchwater Drain | TL 587 681 | 0.42 km from Grid Connection Route B | 26/10/2009 | Northern River Crangonyctid or Florida Crangonyx |
| River Lark | TL 677 747 | 1.1 km from Sunnica East Site A | 25/08/2004 | Nuttall's Waterweed |
| New River and Monks Lode CWS | TL 581 698 | 1.21 km from Grid Connection Route B | 17/08/2011 | Canadian Pondweed |
| Burwell Lode | TL 565 690 | 1.70 km from Grid Connection Route B | 03/07/2017 | Nuttall's Waterweed |
| Wicken Fen | TL 574 699 | 1.85 km from Grid Connection Route B | 03/07/2010 | Canadian Pondweed |

3.2 Aquatic Scoping Surveys

3.2.1 The results of aquatic scoping at Sunnica East Sites A and B, Sunnica West Sites A and B and along the Grid Connection Routes are detailed below.

Sunnica East Site A

Lee Brook (Waterbody ID: GB105033043020)

- 3.2.2 Lee Brook is a heavily modified 'Main River' and is currently classified by the Environment Agency as having 'Poor' ecological potential. The waterbody fails to meet 'Good' ecological potential due to water abstraction, barriers to fish passage, agricultural and rural land management and the presence of invasive non-native Signal Crayfish³.
- 3.2.3 Lee Brook flows through Sunnica East Site A before flowing into the River Lark to the north. Land use in the area is predominantly arable. This section of Lee Brook is heavily modified with a straightened planform and managed riparian vegetation to the north. Beck Bridge Gauging Station is located on the site boundary and the associated weir is a barrier to fish movement during low flows (see Plate 8D-1). The water level was significantly lower upstream of the gauging station (10 – 30 cm) compared to downstream (approximately 80 – 100 cm). Water passing over the weir was 2 – 3 cm deep. Macrophytes were present in the brook and would provide suitable habitat for fish and macroinvertebrates. The substrate consisted predominantly of silt and glide was the only habitat type present, typical of a straightened lowland channel (see Plate 8D-2).
- 3.2.4 Up to date macrophyte (2015), macroinvertebrate (2019) and fish (2014) data exist at the Environment Agency monitoring site Beck Bridge Gauging Station on the Site boundary.

³ <https://environment.data.gov.uk/catchment-planning/WaterBody/GB105033043020>



Plate 8D-1: Lee Brook at Beck Bridge gauging station



Plate 8D-2: Lee Brook downstream of gauging station

Ditch 01

- 3.2.5 Ditch 01 is part of a series of interconnected ditches in the northern section of Sunnica East Site A at Lee Farm (see Plate 8D-3 and Plate 8D-4). The vegetation structure was not well developed relative to other ditches in the land parcel, with some areas of open standing water dominated by filamentous algae. Some emergent reeds and overhanging vegetation were present in the ditch but the overall community lacked complexity. The surrounding land is used for arable crops and the riparian area consists of scrub/shrub vegetation types.
- 3.2.6 There is no desk study data for the site.



Plate 8D-3: Ditch 01 at Lee Farm



Plate 8D-4: Ditch 01 at Lee Farm

Ditch 02

- 3.2.7 Ditch 02 is connected to Ditch 01 in the northern section of Sunnica East Site A. There is broadleaved woodland to the north and arable land to the south. The ditch was well developed in terms of vegetation structure with White Water Lily *Nymphaea alba* (see Plate 8D-5), several pondweed species and reeds, and does not appear to have been managed recently. An open area of standing water was present in the corner of the field and contained litter (see Plate 8D-6). The east-west section of Ditch 02 was wide (up to 6 m), deep (1.2 m) and heavily shaded by broadleaved woodland. The north-south section was shallower (2 m) and unshaded.
- 3.2.8 There are no desk study data for the site.

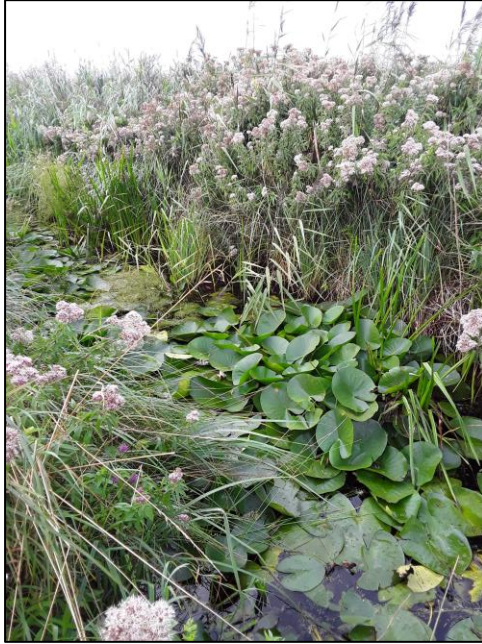


Plate 8D-5: Ditch 02 at Lee Farm



Plate 8D-6: Ditch 02 at Lee Farm

Ditch 03

- 3.2.9 Ditch 03 is connected to the River Lark to the north and Ditch 02 via a culvert. The southern section of the ditch was dry at the time of survey and the wetted area was heavily vegetated (see Plate 8D-7 and Plate 8D-8). The average wetted width was 1 m and scrub/shrub dominated the local land area.
- 3.2.10 There are no desk study data for the site. Due to the ephemeral nature of the waterbody and the culvert connection, it is of little ecological value.



Plate 8D-7: Ditch 03 at Lee Farm



Plate 8D-8: Ditch 03 at Lee Farm

Sunnica East Site B

Pond 08

- 3.2.11 Pond 08 is an artificially lined pond which is raised above ground level. It is approximately 15,540 m² and is used for irrigation purposes. It was not possible to safely access the site for scoping.
- 3.2.12 There are no desk study data for the site.

Sunnica West Site A

Ditch 06

- 3.2.13 Ditch 06 is located east of the A11 and was dry during scoping (see Plate 8D-9).
- 3.2.14 Ditch 07 is located to the west of the A11 and was dry during scoping (see Plate 8D-9).



Plate 8D-9: Ditch 07 at La Hogue land.

Sunnica West Site B

- 3.2.15 Two ditches in the Sunnica West Site B were not accessible during scoping due to the presence of livestock. Further surveys were undertaken on both ditches due to their close proximity to Chippenham Fen SSSI and potential to support protected and/or notable species.

River Snail (GB105033042860)

- 3.2.16 The River Snail is a heavily modified 'Main River' and is currently classified by the Environment Agency as having 'Moderate' ecological potential. The waterbody fails to meet 'Good' ecological potential due to physical modifications and sewage discharges⁴.
- 3.2.17 The River Snail flows along the western boundary of Sunnica West Site B. Land use on the left bank is predominantly broadleaved woodland and grazing pasture on the right bank. There was evidence of poaching by livestock on the right bank (see Plate 8D-11). There is a gauging weir where the river meets the site boundary which appears to be a barrier to the upstream movement of fish (see Plate 8D-10). The river was relatively shallow with an average depth of 15 cm. Silt was the predominant substrate type with a small amount of gravel. Macrophytes were present in the channel including filamentous algae, Fool's Watercress *Apium nodiflorum* and a water-crowfoot *Ranunculus* species which would provide suitable habitat for fish and macroinvertebrates.
- 3.2.18 Macroinvertebrate data exist at two locations on the River Snail approximately 0.1 km upstream of Sunnica West Site B (data from 2013) and approximately 1.43 km downstream of this site (data from 2019).

⁴ <https://environment.data.gov.uk/catchment-planning/WaterBody/GB105033042860> accessed 28/11/2019



Plate 8D-10: River Snail at Chippenham Park



Plate 8D-11: River Snail at Chippenham Park

Ditch 08

- 3.2.19 Ditch 08 is located at Chippenham Park. The ditch was dry during scoping (see Plate 8D-12).



Plate 8D-12: Ditch 08 at Chippenham Park

Ditch 13

- 3.2.20 Ditch 13 is also located at Chippenham Park. The ditch was dry during scoping.

Grid Connection Routes

- 3.2.21 There was no access to private land in the Grid Connection Routes so aquatic scoping was only carried out on waterbodies and watercourses where access was possible from a public right of way.

River Kennett (Waterbody ID: GB105033042990)

- 3.2.22 The River Kennett is a heavily modified 'Main River' and is currently classed by the Environment Agency as having 'Moderate' ecological potential. The waterbody fails to meet 'Good' ecological potential due to sewage discharges, groundwater abstraction, physical modifications (ecological discontinuity), poor nutrient management and the presence of invasive non-native Signal Crayfish⁵.
- 3.2.23 The River Kennett joins the Lee Brook south of Freckenham. Due to limited access, scoping of the river was only possible outside of the Grid Connection Routes. Two areas were assessed, one upstream (see Plate 8D-13) and one downstream (see Plate 8D-14) of the Grid Connection Route A. The upstream section was heavily modified with a major bridge crossing (A11) and reinforced banks. There was no flowing water in the channel and only a few puddles of stagnant water were present following heavy rain the previous day. The substrate consisted primarily of silt. Macrophytes were growing in the channel which suggests the watercourse was not permanently dry. The invasive Himalayan Balsam *Impatiens glandulifera* was present on the banks and in the channel. The downstream section was completely dry with a visible cobble/gravel substrate. Bankside vegetation was more developed with broadleaved woodland and scrub.
- 3.2.24 Environment Agency macroinvertebrate data exist 0.94 km upstream of the Grid Connection Route crossing from 2018, suggesting the site is not permanently dry.

⁵ <https://environment.data.gov.uk/catchment-planning/WaterBody/GB105033042990>



Plate 8D-13: River Kennett upstream of Grid Connection Route A

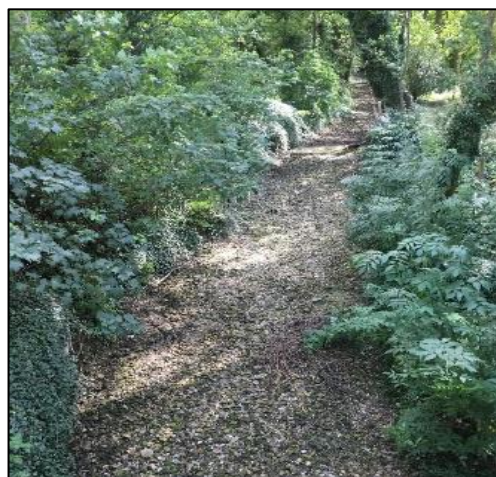


Plate 8D-14: River Kennett downstream of Grid Connection Route A

[Burwell Lode \(Waterbody ID: GB105033042720\)](#)

- 3.2.25 Burwell Lode is a heavily modified 'Main River' and is currently classed by the Environment Agency as having 'Moderate' ecological potential. The waterbody fails to meet 'Good' ecological potential due to physical modifications, sewage discharges, poor livestock management, poor nutrient management, transport drainage and atmospheric deposition of mercury and its compounds⁶.
- 3.2.26 The Grid Connection Route B crosses Burwell Lode north of Burwell, through arable land. This section is navigable by boat. There are public footpaths along both bank tops and riparian vegetation comprises reeds, grasses and scrub. There is little flow and glide is the only habitat type present. The channel is relatively wide (approximately 12 m) and deep. Macrophytes and overhanging vegetation would provide suitable habitat for fish and macroinvertebrates. See Plate 8D-15.
- 3.2.27 Fish survey data exist from 2014 at two Environment Agency monitoring sites on Burwell Lode approximately 110 m and 600 m from the site boundary. Macroinvertebrate data from 2015 exist 4.5 km from the cable route crossing.

⁶ <https://environment.data.gov.uk/catchment-planning/WaterBody/GB105033042720> accessed 28/11/2019



Plate 8D-15: Burwell Lode at the Grid Connection Route B crossing

Catchwater Drain

- 3.2.28 Catchwater Drain is a 'Main River' which eventually joins another drain and becomes Burwell Lode, north of Burwell. The surveyed section sits partially within the Burwell Lode catchment and is therefore classed as having 'Moderate' ecological potential.
- 3.2.29 The Grid Connection Route B passes over Catchwater Drain north-east of Burwell. The watercourse is an artificial drainage channel, with a straightened planform and homogeneous flow (see Plate 8D-16). The surveyed reach had an average width of 4 m and depth of 0.3 m. Several habitat features of interest were noted including underwater tree roots, submerged and emergent macrophytes, detritus, overhanging vegetation and large woody debris. A short section was culverted beneath a single-track road. A small shoal of coarse fish was observed during the survey.
- 3.2.30 Macroinvertebrate data from 2009 exist 0.42 km from the Site boundary.



Plate 8D-16: Catchwater drain at the Grid Connection Route B crossing point

Ditch 09

- 3.2.31 Ditch 09 is located parallel to Ness Road in the Grid Connection Route B. Vegetation was obscuring view of the ditch and there were no safe access points to assess possible habitats (see Plate 8D-17).



Plate 8D-17: Ditch 09 on Ness Road

Ditch 10

- 3.2.32 Ditch 10 is a complex of dry roadside ditches within the Grid Connection Route B, running parallel to Factory Road. See Plate 8D-18.



Plate 8D-18: Ditch 10 on Factory Road

Ditch 11

3.2.33 Ditch 11 is located within the Grid Connection Route B, south of Factory Road. Access was restricted due to overgrown vegetation and private land.

Ditch 12

3.2.34 Ditch 12 is a series of dry ditches within the Grid Connection Route B, running along Newnham Drive. See Plate 8D-19.



Plate 8D-19: Ditch 12 on Newnham Drive

3.3 Ditch Vegetation Surveys

- 3.3.1 No macrophyte species were recorded that receive specific protection via Schedule 5 of the Wildlife and Countryside Act 1981 (as amended), or that are listed on Section 41 of the NERC Act as being of Principal Importance for nature conservation in England. This does not remove the need to further assess the species assemblage and species recorded for their nature conservation importance. There are other criteria for nature conservation value (see **Table 8D-4** for example) and legal protections do not always provide a true or current reflection of all species of nature conservation concern.
- 3.3.2 Ditches 01 and 02 located in the Sunnica East Site A were identified as requiring further investigation during the scoping survey, with an additional two ditches at Chippenham Park in Sunnica West Site B also requiring surveys. Due to its length and variable habitat, Ditch 01 on Sunnica East Site A was surveyed as two separate entities during the ditch surveys; Ditch 01A (north-south section) and Ditch 01B (east-west section).

Sunnica East Site A: Ditch 01A at Lee Farm

- 3.3.3 Ditch 01A had a native species richness score of 9, with nine native macrophyte taxa recorded in the survey area; Narrow-leaved Water Plantain *Alisma lanceolatum*, Broad-leaved Pondweed *Potamogeton natans*, Fennel-leaved Pondweed *Potamogeton pectinatus*, Filamentous Algae, Ivy-leaved Duckweed *Lemna trisulca*, Common Reed *Phragmites australis*, Reedmace *Typha latifolia*, Common Duckweed *Lemna minor* and a sedge *Carex* species. Water Mint *Mentha aquatica* and Soft Rush *Juncus effusus* were also recorded in the ditch, but are not target species in the native species richness metric (Buglife, 2013).
- 3.3.4 All of the species present had a conservation status score of 1 and as a result, the overall native species conservation status score was 1. A score of 1 indicates all species recorded are common throughout the UK and are not awarded any special protection.
- 3.3.5 Ditch 01A achieved a habitat quality score of 1.72 which indicates the macrophyte community is adapted to richly fertile or extremely rich conditions. Broadleaved pondweed and ivy-leaved duckweed had the highest habitat quality scores and are both indicators of moderate water quality.
- 3.3.6 All species recorded in Ditch 01A were native, therefore the plant community naturalness score was 0. A negative naturalness score would indicate the presence of invasive non-native species.

Sunnica East Site A: Ditch 01B at Lee Farm

- 3.3.7 Ditch 01B had a native species richness score of 6, with 6 native macrophyte taxa recorded in the survey area; Narrow-leaved Water Plantain, Ivy-leaved Duckweed, Common Reed, Reedmace, a stonewort *Chara* species and a sedge *Carex* species. The non-native Nuttall's Waterweed was also recorded in this ditch.

- 3.3.8 All native species present had a conservation status score of 1 and as a result, the overall native species conservation status score was 1. A score of 1 indicates all species recorded are common throughout the UK and are not awarded any special protection.
- 3.3.9 Ditch 01B achieved a habitat quality score of 1.79 which indicates the macrophyte community is adapted to richly fertile or extremely fertile conditions. A sedge, a stonewort and Ivy-leaved Duckweed had the highest habitat quality scores and are indicators of moderate water quality.
- 3.3.10 Nuttall's Waterweed was recorded in Ditch 01B, which resulted in a plant community naturalness score of -3. A negative score indicates the presence of invasive non-native species. A score of 0 would indicate invasive non-native species were not recorded.

Sunnica East Site A: Ditch 02 at Lee Farm

- 3.3.11 Ditch 02 had a native species richness score of 9, with nine native macrophyte taxa present in the survey area; Narrow-leaved Water-plantain, Ivy-leaved Duckweed, Common Reed, Reedmace, Spiked Water-milfoil *Myriophyllum spicatum*, European White-water Lily, Broad-leaved Pondweed, Branched Bur Reed *Sparganium erectum* and Common Duckweed. Nuttall's Waterweed, Canadian Pondweed and Least Duckweed *Lemna minuta* were also recorded but are not scoring species in the native species richness metric.
- 3.3.12 All species present had a conservation status score of 1 and as a result, the overall native species conservation status score was 1. A score of 1 indicates all species recorded are common throughout the UK and are not awarded any species protection.
- 3.3.13 Ditch 02 achieved a habitat quality score of 1.87 which indicates the macrophyte community is adapted to richly fertile or extremely fertile conditions. European White-water Lily and Broadleaved Pondweed had the highest habitat quality scores, indicative of moderate water quality.
- 3.3.14 Three non-native macrophyte species were recorded in Ditch 02; Canadian pondweed, Nuttall's Waterweed and Least Duckweed, which resulted in Ditch 02 scoring -6 for plant community naturalness.

Sunnica West Site B: Ditch 01 at Chippenham Park

- 3.3.15 Ditch 04 was found to be dry when access was obtained. Based upon terrestrial succession, the ditch appeared to have been dry for a prolonged period.

Sunnica West Site B: Ditch 02 at Chippenham Park

- 3.3.16 Ditch 02 had a native species richness of 3, with 3 native macrophyte taxa recorded in the survey area; Fool's Water Cress, Common Duckweed and Common Reed. Other non-scoring taxa were also recorded in the survey; Field Horsetail *Equisetum arvense*, Least Duckweed, Soft Rush and Hard Rush *Juncus inflexus*.

- 3.3.17 All species present had native species conservation status scores of 1 and as a result, the overall plant conservation status score was 1. A score of 1 indicates all species recorded are common throughout the UK and are not awarded any species protection.
- 3.3.18 Ditch 02 achieved a habitat quality score of 1.38 which indicates the macrophyte community is adapted to richly fertile or extremely fertile conditions. Fool's water Cress and Common Duckweed had the highest habitat quality scores, indicative of poor water quality.
- 3.3.19 The non-native Least Duckweed was present in Ditch 02, resulting in a plant community naturalness of -3.

3.4 Aquatic Invertebrates

- 3.4.1 No macroinvertebrate species were recorded that receive specific protection via Schedule 5 of the Wildlife and Countryside Act 1981 (as amended), or that are listed on Section 41 of the NERC Act as being of principal importance for nature conservation in England. This does not remove the need to further assess the species assemblage and species recorded for their nature conservation importance. There are other criteria for nature conservation value (see **Table 8D-4** for example), and legal protections do not always provide a true or current reflection of all species of nature conservation concern.

Sunnica East Site A: Ditch 01A at Lee Farm

- 3.4.2 A moderate diversity of macroinvertebrate species was recorded (17 species), however, the community was dominated by several species of snails. The CCI score was 8.4 indicating the ditch has a moderate conservation value in terms of the CCI index. The site supported one species of Local7 distribution, the Hairy Dragonfly *Brachytron pratense*. The majority of species recorded at the site were very common.
- 3.4.3 The biological water quality of the site was moderate, indicating the site is impacted by moderate water quality or habitat (WHPT score 71.8; ASPT 3.8). A number of pollution tolerant species were recorded in high numbers including true flies (*Orthocladiinae* and *Tanytarsini*), Water Hoglouse *Asellus aquaticus* and molluscs (*Lymnaeidae*, *Bithyniidae*, *Physidae*, *Planorbidae* and *Sphaeriidae*). A single pollution sensitive species of caddisfly was recorded *Agrypnia pagetana* or *Agrypnia picta*.
- 3.4.4 The community was composed predominantly of taxa that are adapted to slow and/or standing waters (LIFE: 5.5) and the species present are tolerant of heavily sedimented conditions (PSI: 2.4).

⁷ Those species not uncommon enough to fall within any of the preceding categories (Regionally Notable to Endangered (RDB1)), but which are nonetheless of some interest. A species may qualify, for example, by being very widely distributed but nowhere common, by being restricted to a specialised habitat such as brackish pools but being a common component of this habitat, or simply by being uncommon but not uncommon enough to be Notable. Species with few records but which are suspected of being badly under-recorded are likely to be placed in the Local category. Local species may also be Regionally Notable (Chadd & Extence, 2004).

Sunnica East Site A: Ditch 01B at Lee Farm

- 3.4.5 A moderate diversity of macroinvertebrate species was recorded (15 species) in the ditch. The macroinvertebrate assemblage was dominated by crustaceans (Water Hoglouse and a crangonid a Crangonyx species) which comprised 67% of individuals in the sample. The CCI score was 10 indicating the ditch has a moderate conservation value in terms of CCI index. The site supported one species of Local distribution, the snail Leach's Bithynia Bithynia leachi.
- 3.4.6 The biological water quality of the site was moderate, indicating the site is moderately impacted by water quality or habitat (WHPT 78.5; APST; 3.7). The macroinvertebrate assemblage contained largely pollution tolerant taxa, with a single pollution sensitive caddisfly recorded (Phryganeidae sp.).
- 3.4.7 The community was composed of taxa that are adapted to slow and/or standing waters (LIFE: 5.6) and the species present are tolerant of heavily sedimented conditions (PSI: 0).

Sunnica East Site A: Ditch 02 at Lee Farm

- 3.4.8 A moderate diversity of macroinvertebrate species was recorded (19 species) in the ditch. Molluscs dominated the macroinvertebrate community with high numbers of crangonids and Water Hoglouse. The CCI score was 9.4 indicating the ditch has a moderate conservation value in terms of CCI index. Two species of Local distribution were recorded, the Hairy Dragonfly and caddisfly Agrypnia pagetana.
- 3.4.9 The biological water quality of the site was moderate, indicating the site is moderately impacted by water quality or habitat (WHPT 69.4; APST; 3.7). A high number of pollution tolerant taxa were recorded, with only two pollution sensitive species of caddisfly present Phryganea bipunctata and Agrypnia pagetana.
- 3.4.10 The community was composed of taxa that are adapted to slow and/or standing waters (LIFE: 5.4) and the species present are tolerant of heavy levels of sedimentation (PSI: 0).

Sunnica West Site B: Ditch 02 at Chippenham Park

- 3.4.11 A low diversity of macroinvertebrate species was recorded (12 species). The Whirlpool Ram's Horn Snail Anisus vortex and Water Hoglouse comprised 51 % of individuals in the sample. The CCI score was 7.9 indicating the ditch has a moderate conservation value in terms of CCI index. The site supported one species of Local distribution, the diving beetle Ilybius quadriguttatus.
- 3.4.12 The biological water quality of the site was poor/moderate indicating the site was impacted/moderately impacted by water quality or habitat (WHPT 59.9; APST; 3.7).
- 3.4.13 The community was dominated by taxa that are adapted to slow and/or standing waters (LIFE: 5.8) and the species present are tolerant of heavy levels of sedimentation (PSI: 6.7).

4. Nature Conservation Evaluation

4.1.1 This section contains an assessment of the aquatic plants, fish and macroinvertebrates likely to be impacted by the development of the Scheme to determine their relative nature conservation value using the approach detailed in Section 8.7 of this report. There is no reasonable likelihood of the features present being of international nature conservation importance, so this can be discounted. This is on the basis that the site does not support any species considered notable in an international context (e.g. species for which Great Britain holds a substantial part of the international population, or species which are restricted to Great Britain).

4.2 Aquatic survey results

Macrophytes

4.2.1 During the ditch surveys, no macrophyte species of conservation importance were recorded, with the community sampled typical of nutrient rich waterbodies. Narrow-leaved Water Plantain was present at all three ditches in the Sunnica East Site A and is considered a Suffolk rarity, however, it is not a priority species and is common throughout England. A similar macrophyte assemblage is expected to be common in the wider landscape. Therefore, none of the ditches can be considered to support macrophyte assemblages of any more than Local value.

Macroinvertebrates

4.2.2 During surveys at Sunnica East Site A, three species with a local distribution were recorded; the Hairy Dragonfly, the snail *Bithynia leachi*. and caddisfly *Agrypnia pagetana*. One species with a local distribution was recorded at the Sunnica West Site B; the diving beetle. None of these are Red Data Book species or species of conservation importance.

4.2.3 The community composition across all the surveyed sites is considered to be of moderate conservation value under the CCI index, with similar macroinvertebrate assemblages expected to be common across the wider landscape. There were no local BAP species recorded during any of the surveys. Therefore, none of the ditches can be considered to support macroinvertebrate communities of any more than Local value.

5. Conclusions

5.1.1 This section presents the conclusions of the survey work. Where recommendations are made, these will be taken forward as part of the EIA process and presented in the Environmental Statement supporting the DCO application.

Solar Sites: Sunnica East Sites A and B; and Sunnica West Sites A and B

5.1.2 No rare, notable or protected macrophyte species were recorded during field surveys in the vicinity of the Site. The community structure in the surveyed ditches are typical of those adapted to richly fertile or extremely fertile conditions, which may be due to runoff from the adjacent arable and grazing land. A change in surrounding land use from farming practices to solar generation may allow species composition in the associated watercourses to return to a more natural state due to a reduction in nutrient input. A change in surrounding land use is not likely to result in any deleterious effects upon the plant or macroinvertebrate ecology of the ditch systems during operation of the site assuming the solar panels do not cause shading of the waterbodies.

5.1.3 No rare, notable or protected macroinvertebrate species were recorded during the aquatic field surveys. Several species with a Local distribution were recorded, however, the ditches surveyed were only found to be of moderate conservation importance under the CCI index. A number of Nationally Scarce macroinvertebrate species were recorded in the River Kennett and River Snail during the desk study, however, it is considered unlikely that operation of the Scheme will have an impact on these species assuming the solar panels do not cause shading of the waterbody. Macroinvertebrate sampling at all sites indicate the community assemblages are common throughout the wider landscape and water or habitat quality are impacting the waterbodies.

5.1.4 Brook Lamprey (Annex II species), Bullhead (Annex II species), European Eel (UK BAP) and Brown Trout (UK BAP) have all been recorded by the Environment Agency in Lee Brook, which is located within the Sunnica East Site A. It should also be noted that as ditches 01A, 01B and 02 in the Sunnica East Site A are connected to Lee Brook via the River Lark, they have potential to be used by these species for foraging, as a refuge from predators and in times of high flows. No records of protected fish species exist from the River Snail, which runs adjacent to the Sunnica West Site B, so this has not been considered. Construction of the Sunnica East Site A, located on Lee farm, has the potential to impact protected fish species that may be utilising the ditch system.

5.1.5 There are records of invasive species in close proximity to both of the Sunnica East and Sunnica West site boundaries, with Nuttall's Waterweed and Canadian Pondweed recorded during field surveys. The interconnected nature of watercourses in the local area suggest it is unlikely construction activity would result in the spread of invasive species to new locations,

however it could accelerate their distribution. Therefore, biosecurity measures should be in place and working in or adjacent to watercourses should be avoided where possible. No further invasive aquatic species surveys are required at this stage.

- 5.1.6 It is recommended that construction of the Scheme does not take place within 10 m of Lee Brook, the River Snail or the surveyed ditches. It is also suggested that construction activities that have potential to result in water contamination are conducted at a safe distance from waterbodies. Spoil should be not stored within the vicinity of waterbodies in order to reduce the chance of sediment run-off. Pollution prevention measures such as temporary silt fencing, Sustainable Drainage System (SuDS) features and attenuation ponds are recommended for construction works. Further mitigation measures to limit and/or prevent any potential impacts during construction and operation will be provided in the impact assessment.
- 5.1.7 No further surveys are recommended at this time. Additional surveys may be required when the final design and working methods are confirmed.

Grid Connection Routes

- 5.1.8 Access to Burwell Lode, Catchwater Drain, New River, the River Kennett, the River Snail and numerous ditches was limited along the Grid Connection Routes.
- 5.1.9 Bullhead (Annex II species), European Eel (UK BAP) and Spined Loach (UK BAP) have all been recorded during Environment Agency surveys undertaken in Burwell Lode. It is likely they inhabit connected waterbodies, including Catchwater Drain and local ditches.
- 5.1.10 Construction activity has the potential to negatively impact the ecology of these waterbodies. The most appropriate methodology should be utilised to prevent any potential negative impacts. It is recommended laying of the cable avoids crossing waterbodies where possible and utilises Horizontal Directional Drilling (HDD) where it is unavoidable. This will reduce the level of disturbance to waterbodies and potential impacts on fish and other species. It should be noted when utilising HDD, the cable break-out points should not be within the aquatic environment and should be a suitable distance on land away from the bank.
- 5.1.11 It is suggested that activities that have potential to result in water contamination are conducted at a safe distance from waterbodies. Spoil should be not stored within the vicinity of waterbodies in order to reduce the chances of increased sedimentation. Pollution prevention measures such as temporary silt fencing, Sustainable Drainage System (SuDS) features and attenuation ponds are recommended for construction works. Further mitigation measures to limit and/or prevent any potential impacts during construction and operation will be provided in the impact assessment.
- 5.1.12 No additional fish surveys are required at this time. However, if more intrusive construction methods are employed or the Grid Connection Routes change then further surveys may be required in addition to fish rescues where needed.

- 5.1.13 There are records of aquatic invasive species within and in close proximity to the proposed Grid Connection Routes. Although there is high connectivity between watercourses in the local area, mitigation methods should be employed to prevent further spread of these species. Biosecurity measures should be in place during the construction phase to prevent any further spread. Based on the available data and current Grid Connection Routes no further INNS surveys are required.

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Sub-Appendix A. Figures

Figure 8D-1 – Aquatic Ecology Survey Areas

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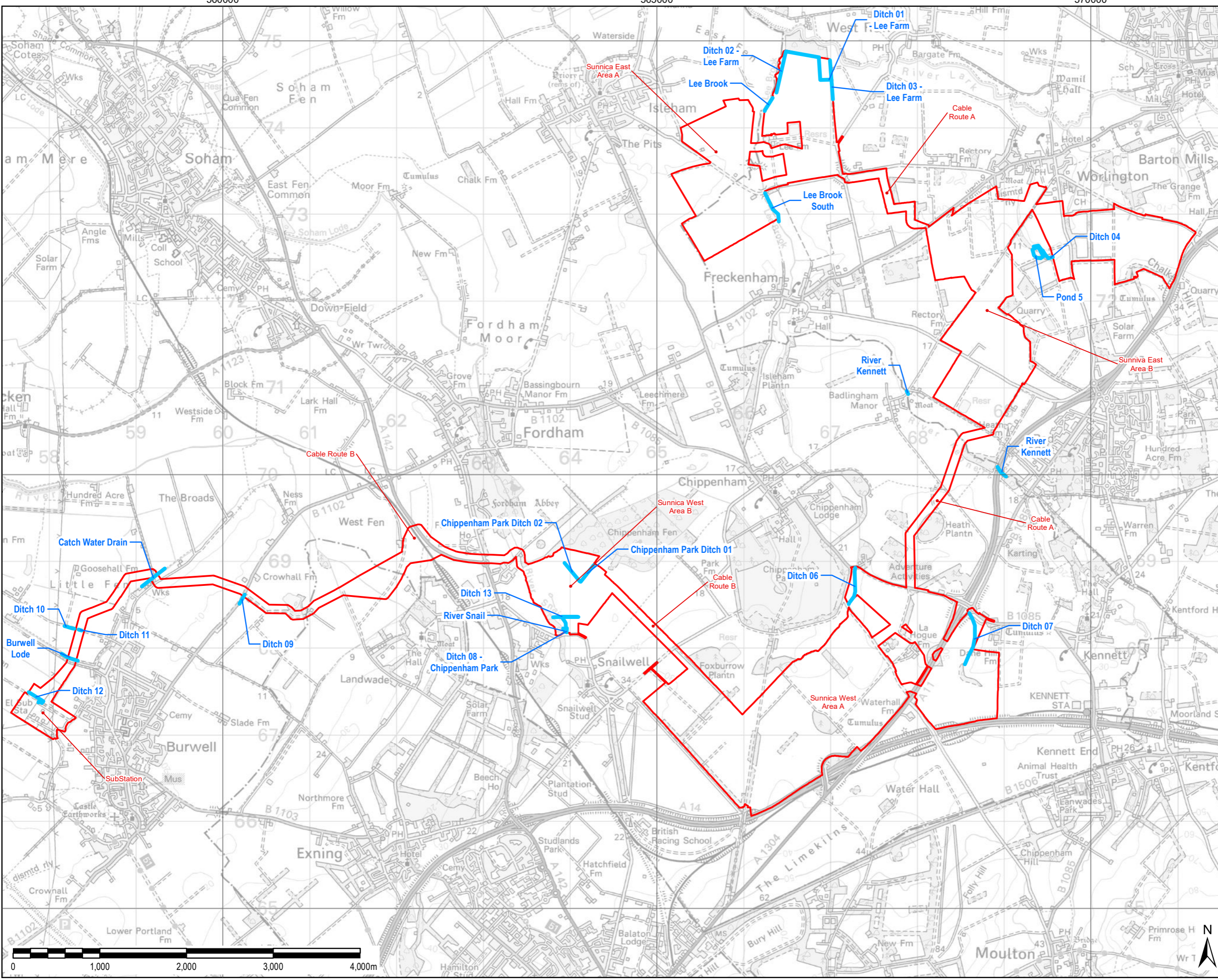
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THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT

- LEGEND**
- DCO Boundary
 - Aquatic Ecology Survey Area



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Purpose of Issue: **FOR INFORMATION**

Client: **SUNNICA LTD**



Drawing Title: **FIGURE 8D-1
 AQUATIC ECOLOGY
 SURVEY AREAS**

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| Drawn AD | Checked LL | Approved NC | Date 28/08/2020 |
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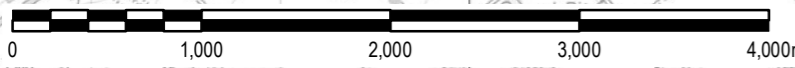


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Sub-Appendix B. Whalley, Hawkes, Paisley and Trigg (WHPT) Metric

There are approximately 4,000 species of aquatic macroinvertebrates in the British Isles. To simplify the analysis of the samples and the data we do not identify individual species but only the major types (taxa), mostly at the family taxonomic level. A key piece of information is the number of different taxa at a site. A fall in the number of taxa indicates ecological damage, including pollution (organic, toxic and physical pollution such as siltation, and damage to habitats or the river channel).

The WHPT scoring system (WFD-UKTAG, 2014) is based upon the sensitivity of macroinvertebrate families to organic pollution. It replaces the Biological Monitoring Working Party (BMWP) system (Hawkes, 1997) previously used in the UK.

The WHPT system assigns a numerical value to about 100 different taxa (known as the WHPT-scoring taxa) according to their sensitivity to organic pollution. In addition to the presence of macroinvertebrate taxa at a sampling site, as in the BMWP scoring system, the WHPT system also uses another type of information, this being the abundances of different scoring taxa.

Taxa abundances are classified in four categories (Class 1: 1 to 10 individuals, Class 2: 11 to 100 individuals, Class 3: 101 to 1,000 individuals, and Class 4: > 1,000 individuals). A score (Pressure Sensitivity Scores (PSs)) is then assigned to each taxa, depending of the taxa sensitivity and abundances recorded.

The total WHPT score for a sample corresponds to the sum of PSs of scoring taxa recorded. The Average Score Per Taxon (ASPT) values are calculated as the Sum PSs divided by the number of scoring taxa (NTAXA). As such, three metrics are calculated:

- *WHPT score*
- *NTAXA*
- *ASPT*

Some animals are more susceptible to organic pollution than others, and the presence of sensitive species indicates good water quality. This fact is taken into account by the WHPT metrics.

The most useful way of summarising the biological data was found to be one that combined the number of taxa and the ASPT. The best quality is indicated by a diverse variety of taxa, especially those that are sensitive to pollution. Poorer quality is indicated by a smaller than expected number of taxa, particularly those that are sensitive to pollution. Organic pollution sometimes encourages an increased abundance of the few taxa that can tolerate it. However, maximum achievable values will vary between geological regions. For example, pristine lowland streams in East Anglia will always score lower than pristine Welsh mountain streams because they are unable to support many of the high-scoring taxa associated with fast flowing habitat. WHPT scores and ASPT for different types watercourse are dependent on the quality and diversity of habitat, natural water chemistry (associated with geology, distance

from source etc.), altitude, gradient, time of year the sample was taken and other factors.

Sub-Appendix C. Community Conservation Index (CCI)

The Community Conservation Index (Chadd & Extence, 2004) allows a classification of the nature conservation value associated with a macroinvertebrate community. The CCI score for one sample is derived from individual Conservation Scores (CS), assigned to some species of aquatic macroinvertebrates and relating closely to the available published Red Data Books (Bratton, 1991a, 1991b; Shirt, 1987). Conservation Scores assigned to individual species vary from 1 to 10, as detailed on the **Table 8D- A1** below. The derived CCI scores generally vary from 0 to > 20, as detailed in the **Table 8D- A1** below. The Table B3 below provides a guide to interpreting CCI scores.

Table 8D- A1: Conservation Scores from the Community Conservation Index (from Chadd & Extence, 2004)

| Conservation Score | Relation to Red Data Books |
|--------------------|-------------------------------------------------------------------------------------------------------------------|
| 10 | RDB1 (Endangered) |
| 9 | RDB2 (Vulnerable) |
| 8 | RDB3 (Rare) |
| 7 | Notable (but not RDB status) |
| 6 | Regionally notable |
| 5 | Local |
| 4 | Occasional (species not in categories 10-5, which occur in up to 10% of all samples from similar habitats) |
| 3 | Frequent (species not in categories 10-5, which occur in up to >10-25% of all samples from similar habitats) |
| 2 | Common (species not in categories 10-5, which occur in up to >25-50% of all samples from similar habitats) |
| 1 | Very common (species not in categories 10-5, which occur in up to >50-100 % of all samples from similar habitats) |

Table 8D- A2: General guide to CCI scores (from Chadd & Extence, 2004)

| CCI Score | Description | Interpretation |
|----------------|-----------------------------------------------------------------------------------------------------------------------------------------|--------------------------------|
| 0 to 5.0 | Sites supporting only common species and/or community of low taxon richness | Low conservation value |
| > 5.0 to 10.0 | Sites supporting at least one species of restricted distribution and/or a community of moderate taxon richness | Moderate conservation value |
| > 10.0 to 15.0 | Sites supporting at least one uncommon species, or several species of restricted distribution and/or a community of high taxon richness | Fairly high conservation value |
| > 15.0 to 20.0 | Sites supporting several uncommon species, at least one of which may be nationally rare and/or a community of high taxon richness | High conservation value |

| | | |
|--------|----------------------------------------------------------------------------------------------------------------------------|------------------------------|
| > 20.0 | Sites supporting several rarities, including species of national importance and/or a community of very high taxon richness | Very high conservation value |
|--------|----------------------------------------------------------------------------------------------------------------------------|------------------------------|

Sub-Appendix D. Lotic-Invertebrate Index for Flow Evaluation (LIFE)

The Lotic-Invertebrate Index for Flow Evaluation (LIFE) provides an assessment of the impact of variable flows on benthic macroinvertebrate communities. Under the assessment, individual species of aquatic macroinvertebrates are assigned to a flow group varying from I to VI, as detailed on the **Table 8D-A3** below. The LIFE score for a macroinvertebrate sample is then derived (mean of individual scores) from individual species scores and abundances, as detailed on the **Table 8D-A3** below. LIFE scores for a macroinvertebrate sample ranges from 1 to 12, where highest scores describe communities adapted to rapid flows.

Table 8D-A3: Flow groups used to derive LIFE scores (from Extence, Balbi and Chadd, 1999)

| LIFE score Group | Description | Mean current velocity |
|------------------|-------------------------------------------------------------------|----------------------------------------|
| I | Taxa primarily associated with rapid flows | Typically > 100 cm.s ⁻¹ |
| II | Taxa primarily associated with moderate to fast flows | Typically 20 to 100 cm.s ⁻¹ |
| III | Taxa primarily associated with slow or sluggish flows | Typically < 20 cm.s ⁻¹ |
| IV | Taxa primarily associated with (usually slow) and standing waters | |
| V | Taxa primarily associated with standing waters | |
| VI | Taxa frequently associated with drying or drought impacted sites | |

Table 8D-A4: Abundance categories used to derive LIFE scores (from Extence, Balbi and Chadd, 1999)

| Abundance category | Description |
|--------------------|--------------|
| A | 1 to 9 |
| B | 10 to 99 |
| C | 100 to 999 |
| D | 1000 to 9999 |
| E | > 10000 |

Table 8D-A5: A guide to interpreting LIFE scores (from Extence, Balbi and Chadd, 1999)

| Flow groups | Abundance categories | | | |
|-------------|----------------------|----|----|-----|
| | A | B | C | D/E |
| I | 9 | 10 | 11 | 12 |
| II | 8 | 9 | 10 | 11 |
| III | 7 | 7 | 7 | 7 |
| IV | 6 | 5 | 4 | 3 |

| | | | | |
|----|---|---|---|---|
| V | 5 | 4 | 3 | 2 |
| VI | 4 | 3 | 2 | 1 |

Sub-Appendix E. Proportion of sediment-sensitive invertebrates (PSI)

The Proportion of Sediment-sensitive Invertebrates (PSI) index (Extence et. Al, 2013) provides an assessment of the extent to which the river bed is composed of, or covered by, fine sediments.

Under the assessment, individual species of aquatic macroinvertebrates are assigned a Fine Sediment Sensitivity Rating (FSSR) ranging from A to B, as detailed in the Table D1 below. The PSI score for a macroinvertebrate sample is then derived from individual species scores and abundances, as detailed on the **Table 8D-A6** below. The PSI score corresponds to the percentage of fine sediment-sensitive taxa present in a sample. PSI score for a sample ranges from 0 to 100 where lowest scores correspond to watercourses with high fine sediment cover.

Table 8D-A6 Fine Sediment Sensitivity Rating (FSSR) groups used to derive PSI scores (from Extence et al., 2013)

| FSSR group | Description |
|------------|------------------------|
| A | Highly sensitive |
| B | Moderately insensitive |
| C | Moderately insensitive |
| D | Highly insensitive |

Table 8D-A7 Abundance categories used to derive PSI scores (from Extence, et al., 2013)

| FSSR group | Abundance | | | |
|------------|-----------|-------|---------|------|
| | 1-9 | 10-99 | 100-999 | >999 |
| A | 2 | 3 | 4 | 5 |
| B | 1 | 2 | 3 | 4 |
| C | 1 | 2 | 3 | 4 |
| D | 2 | 3 | 4 | 5 |

Table 8D-A8 Interpretation of PSI scores (from Extence et al., 2013)

| PSI | Description |
|--------|-----------------------|
| 81-100 | Minimally sedimented |
| 61-80 | Slightly sedimented |
| 41-60 | Moderately sedimented |
| 21-40 | Sedimented |
| 0-20 | Heavily sedimented |

Sub-Appendix F. Aquatic Macroinvertebrate Data

| Family | Species | BMWP score | WHPT score (presence only) | Conservation Score | Flow group | FSSR Score | Lee Farm Ditch 01A | Lee Farm Ditch 01B | Lee Farm Ditch 2 | Chippenham park Ditch 2 |
|------------------|-----------------------------------|------------|----------------------------|--------------------|------------|------------|--------------------|--------------------|------------------|-------------------------|
| Flatworms | | | | | | | | 2 | | |
| Dendrocoelidae | <i>Dendrocoelum lacteum</i> | 5 | 3.0 | 2 | IV | | 1 | 9 | | |
| Planariidae | <i>Polycelis sp.</i> | 5 | 4.9 | | | D | | 1 | | |
| Dugesidae | <i>Dugesia lugubris/polychroa</i> | 5 | 2.9 | 2 | IV | D | | 1 | | |
| Snails | | | | | | | | | | |
| Lymnaeidae | <i>Stagnicola sp.</i> | 3 | 3.3 | | VI | D | 4 | 3 | | 4 |
| Lymnaeidae | <i>Lymnaea stagnalis</i> | 3 | 3.3 | 1 | IV | D | 55 | 3 | | 60 |
| Lymnaeidae | <i>Radix balthica</i> | 3 | 3.3 | 1 | IV | D | 189 | | | 70 |
| Lymnaeidae | <i>Radix peregra</i> | | | | | | | 61 | | |
| Bithyniidae | <i>Bithynia tentaculata</i> | 3 | 3.7 | 1 | IV | D | 3 | 23 | | 80 |
| Bithyniidae | <i>Bithynia leachi</i> | 3 | 3.7 | 5 | IV | D | | 4 | | |
| Physidae | Physidae (juvenile / damaged) | 3 | 2.4 | | IV | D | 7 | | | |
| Physidae | <i>Physa sp.</i> | 3 | 2.4 | | | D | | | | 2 |
| Physidae | <i>Physa fontinalis</i> | 3 | 2.4 | 1 | III | D | | 9 | | 4 |
| Physidae | <i>Physella sp.</i> | 3 | 2.4 | | | D | 14 | | | |

| Family | Species | BMWP score | WHPT score (presence only) | Conservation Score | Flow group | FSSR Score | Lee Farm Ditch 01A | Lee Farm Ditch 01B | Lee Farm Ditch 2 | Chippenham park Ditch 2 |
|----------------------------|--------------------------------------|------------|----------------------------|--------------------|------------|------------|--------------------|--------------------|------------------|-------------------------|
| Succineidae | <i>Succinea sp.</i> | - | - | | | | | | | 70 |
| Planorbidae | <i>Planorbarius corneus</i> | 3 | 3.1 | 4 | IV | D | 15 | | | |
| Planorbidae | <i>Planorbis sp.</i> | 3 | 3.1 | | | D | 21 | 4 | | |
| Planorbidae | <i>Planorbis carinatus</i> | 3 | 3.1 | 1 | IV | D | | 4 | 30 | |
| Planorbidae | <i>Planorbis planorbis</i> | 3 | 3.1 | 1 | IV | D | 31 | | | |
| Planorbidae | <i>Anisus vortex</i> | 3 | 3.1 | 1 | IV | D | 1 | 2 | 50 | 205 |
| Planorbidae | <i>Bathyomphalus contortus</i> | 3 | 3.1 | 2 | IV | D | | | | 5 |
| Limpets and mussels | | | | | | | | | | |
| Acroloxidae | <i>Acroloxus lacustris</i> | 6 | 3.6 | 2 | IV | | | | 2 | |
| Sphaeriidae | <i>Pisidium sp.</i> | 3 | 3.9 | | | D | 1 | 30 | 15 | 10 |
| Worms | | | | | | | | | | |
| Oligochaeta | | 1 | 2.7 | | | D | | 13 | | |
| Leeches | | | | | | | | | | |
| Glossiphoniidae | Glossiphoniidae (juvenile / damaged) | 3 | 3.2 | | IV | C | | | | 1 |
| Glossiphoniidae | <i>Glossiphonia complanata</i> | 3 | 3.2 | 1 | IV | C | | | | 2 |
| Glossiphoniidae | <i>Helobdella stagnalis</i> | 3 | 3.2 | 1 | IV | C | | | 2 | |

| <i>Family</i> | <i>Species</i> | <i>BMWP score</i> | <i>WHPT score (presence only)</i> | <i>Conservation Score</i> | <i>Flow group</i> | <i>FSSR Score</i> | <i>Lee Farm Ditch 01A</i> | <i>Lee Farm Ditch 01B</i> | <i>Lee Farm Ditch 2</i> | <i>Chippenham park Ditch 2</i> |
|--------------------|-------------------------------------|-------------------|-----------------------------------|---------------------------|-------------------|-------------------|---------------------------|---------------------------|-------------------------|--------------------------------|
| Erpobdellidae | Erpobdellidae (juvenile / damaged) | 3 | 3.1 | | IV | C | | | | 1 |
| Mites | | | | | | | | | | |
| Hydracarina | | - | - | | | | 1 | | | |
| Crustaceans | | | | | | | | | | |
| Cladocera | | - | - | | | | | 9 | | |
| Gammaridae | Gammaridae | 6 | 4.4 | | II | B | 1 | | | |
| Gammaridae | <i>Gammarus sp.</i> | 6 | 4.4 | | | B | | | | 9 |
| Gammaridae | <i>Gammarus pulex</i> | 6 | 4.4 | 1 | II | B | 6 | | | 5 |
| Crangonyctidae | <i>Crangonyx sp.</i> | 6 | 3.9 | | | | 24 | 207 | 100 | |
| Asellidae | <i>Asellus sp.</i> | 3 | 2.8 | | | D | | | | 10 |
| Asellidae | <i>Asellus aquaticus</i> | 3 | 2.8 | 1 | IV | D | 33 | 270 | 40 | 110 |
| Mayflies | | | | | | | | | | |
| Baetidae | <i>Cloeon dipterum</i> | 4 | 5.5 | 1 | IV | D | | | 1 | |
| Damselflies | | | | | | | | | | |
| Coenagrionidae | Coenagrionidae (juvenile / damaged) | 6 | 3.5 | | IV | D | 26 | 1 | 50 | 25 |
| Coenagrionidae | <i>Pyrrhosoma nymphula</i> | 6 | 3.5 | 3 | | | | | | 10 |
| Dragonflies | | | | | | | | | | |
| Aeshnidae | <i>Brachytron pratense</i> | 8 | 4.7 | 5 | IV | C | 2 | | 1 | |

| Family | Species | BMWP score | WHPT score (presence only) | Conservation Score | Flow group | FSSR Score | Lee Farm Ditch 01A | Lee Farm Ditch 01B | Lee Farm Ditch 2 | Chippenham park Ditch 2 |
|-------------------|----------------------------------|------------|----------------------------|--------------------|------------|------------|--------------------|--------------------|------------------|-------------------------|
| Aeshnidae | <i>Aeshna grandis</i> | 8 | 4.7 | 2 | V | C | 1 | | 2 | |
| True bugs | | | | | | | | | | |
| Nepidae | <i>Nepa cinerea</i> | 5 | 2.9 | 3 | V | D | 1 | | | |
| Corixidae | <i>Sigara fossarum</i> | 5 | 3.8 | 4 | IV | D | | 1 | | |
| Notonectidae | <i>Notonecta glauca</i> | 5 | 3.4 | 1 | IV | | 3 | | 4 | |
| Beetles | | | | | | | | | | |
| Haliplidae | <i>Halipus obliquus</i> | 5 | 3.6 | 4 | IV | | | 4 | | |
| Dytiscidae | Dytiscidae (larvae / damaged) | 5 | 4.5 | | IV | D | | | 2 | |
| Dytiscidae | <i>Hydroporus ovatus</i> | 5 | 4.5 | | | D | | | 5 | |
| Dytiscidae | <i>Agabus didymus</i> | 5 | 4.5 | 1 | III | C | 1 | | | |
| Dytiscidae | <i>Agabus paludosus</i> | 5 | 4.5 | 1 | II | C | | | | 1 |
| Dytiscidae | <i>Ilybius quadriguttatus</i> | 5 | 4.5 | 5 | V | D | | | | 1 |
| Noteridae | <i>Noterus clavicornis</i> | 5 | 3.2 | 2 | | D | | | 7 | |
| Hydrophilidae | Hydrophilidae (larvae / damaged) | 5 | 6.2 | | IV | D | | | | 1 |
| Hydrophilidae | <i>Anacaena globulus</i> | 5 | 6.2 | 1 | IV | C | | 1 | | 1 |
| Hydrophilidae | <i>Anacaena limbata</i> | 5 | 6.2 | 1 | IV | D | | 3 | | |
| Scirtidae | Scirtidae (larvae / damaged) | 5 | 6.9 | | IV | B | | | | 3 |
| Alderflies | | | | | | | | | | |
| Sialidae | Sialidae (juvenile / damaged) | 4 | 4.3 | | IV | D | | | | |

| Family | Species | BMWP score | WHPT score (presence only) | Conservation Score | Flow group | FSSR Score | Lee Farm Ditch 01A | Lee Farm Ditch 01B | Lee Farm Ditch 2 | Chippenham park Ditch 2 |
|--------------------------------------|------------------------------------|------------|----------------------------|--------------------|------------|------------|--------------------|--------------------|------------------|-------------------------|
| Sialidae | <i>Sialis lutaria</i> | 4 | 4.3 | 1 | IV | D | 2 | | 1 | 6 |
| Caddisflies | | | | | | | | | | |
| Polycentropodidae | <i>Holocentropus dubius</i> | 7 | 8.1 | 4 | V | | | | 15 | |
| Phryganeidae | <i>Phryganea bipunctata</i> | 10 | 5.5 | 2 | IV | D | | | 1 | |
| Phryganeidae | <i>Agrypnia sp.</i> | 10 | 5.5 | | V | D | | 3 | | |
| Phryganeidae | <i>Agrypnia pagetana</i> | 10 | 5.5 | 5 | V | D | | | 3 | |
| Phryganeidae | <i>Agrypnia pagetana/picta</i> | 10 | 5.5 | | V | D | 5 | | | |
| Limnephilidae | Limnephilidae (juvenile / damaged) | 7 | 6.2 | | IV | B | | 1 | | |
| Limnephilidae | <i>Limnephilus marmoratus</i> | 7 | 6.9 | 2 | V | C | | 16 | | |
| Limnephilidae | <i>Limnephilus lunatus</i> | 7 | 6.9 | 1 | IV | C | 13 | 8 | | 2 |
| Trichoptera pupae/Trichoptera non ID | | - | - | | | | | 2 | | 1 |
| Trueflies | | | | | | | | | | |
| Chironomidae | Chironomidae (damaged / pupa) | 2 | 1.1 | | | | | 1 | 20 | |
| Chironomidae | Tanypodinae | 2 | 1.1 | | | | | 4 | | 40 |
| Chironomidae | Orthoclaadiinae | 2 | 1.1 | | | | 1 | | | 20 |
| Chironomidae | Chironomini | 2 | 1.1 | | | | | 6 | | 10 |

| <i>Family</i> | <i>Species</i> | <i>BMWP score</i> | <i>WHPT score (presence only)</i> | <i>Conservation Score</i> | <i>Flow group</i> | <i>FSSR Score</i> | <i>Lee Farm Ditch 01A</i> | <i>Lee Farm Ditch 01B</i> | <i>Lee Farm Ditch 2</i> | <i>Chippenham park Ditch 2</i> |
|--------------------------------------|--------------------|-------------------|-----------------------------------|---------------------------|-------------------|-------------------|---------------------------|---------------------------|-------------------------|--------------------------------|
| Chironomidae | Tanytarsini | 2 | 1.1 | | | | 2 | 1 | | 20 |
| Limoniidae | Limoniidae | 5 | 5.9 | | | B | | 1 | | |
| Dixidae | <i>Dixella</i> sp. | - | 7.0 | | | | 2 | 13 | | |
| Psychodidae | | - | 4.4 | | | D | | | | 35 |
| Chaoboridae | | - | 3.0 | | V | | | 2 | | |
| Other Taxa | | | | | | | | | | |
| Lepidoptera | | - | - | | | | | | 20 | 1 |
| Collembola | | - | - | | | | | | | 2 |
| Diptera | Longchopteridae | - | - | | | | | | | 1 |
| WHPT score | | | | | | | 71.8 | 78.5 | 69.4 | 59.9 |
| ASPT (WHPT) | | | | | | | 3.8 | 3.7 | 3.7 | 3.7 |
| PSI Score (species) | | | | | | | 2.4 | 0.0 | 0.0 | 6.7 |
| LIFE Score (species) | | | | | | | 5.5 | 5.6 | 5.4 | 5.8 |
| CCI Score | | | | | | | 8.4 | 10.0 | 9.4 | 7.9 |
| Total number of taxa | | | | | | | 29 | 33 | 25 | 31 |
| Total Number of species | | | | | | | 17 | 15 | 19 | 12 |
| Total Number of genus / above | | | | | | | 12 | 18 | 6 | 19 |

