

Appendix E: River Thames Scheme CI & FC Project Preliminary Ecological Appraisals

Appendix E Report 1: Preliminary Ecological Appraisal Report for the Flood Relief Channel (May 2016)

Appendix E Report 2: Preliminary Ecological Appraisal Report for Sunbury, Molesey, and Teddington Weirs (January 2016)

Appendix E Report 3: Broom Road Ecological Walkover Survey Report of Land at Broom Road Recreation Ground, Teddington

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River Thames Scheme

Capacity Improvements and Flood Channel Project

Preliminary Ecological Appraisal for the Flood Channel

MAY 2016



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Preliminary Ecological Appraisal

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1 Introduction

1.1 Background

- 1.1.1 The River Thames Scheme (RTS) developed in the Lower Thames Flood Risk Management Strategy (LTFRMS) comprises a flood diversion channel in three sections (refer to Figure 1.1):
- Channel Section 1 – Datchet to Hythe End
 - Channel Section 2 – Egham Hythe to Chertsey
 - Channel Section 3 – Laleham to Shepperton
- 1.1.2 The RTS also comprises capacity improvement works to the weir complexes at Sunbury, Molesey and Teddington through addition of extra weir gates as well as capacity improvement to the Desborough Cut through the widening and/or deepening of the sheet-piled right bank.
- 1.1.3 Where possible effects on existing priority habitats are identified, the Project will identify and implement measures to mitigate for these. Opportunities will also be taken to create new priority habitats (as defined by Section 41 of the Natural Environment and Rural Communities (NERC) Act) such as reedbeds, wetland or wet woodland, as enhancement rather than mitigation, as well as to provide further enhancement to access and recreation.
- 1.1.4 The RTS aims to improve the flood protection to property through a combination of the new flood channel (in three sections), the capacity improvements and the provision of community resilience measures. The standard of service provided by the scheme will vary depending on the location and current flood risk of the individual property. Currently approximately 6000 households are at very significant flood risk (at risk from a 1 in 20 flood (5%) chance of occurring in any one year). When the scheme is completed and with appropriate resilience measures in place no properties should remain at very significant risk of flooding. In total approximately 22,000 households will benefit from the scheme although the standard provided will vary from household to household.
- 1.1.5 The Environment Agency, acting as the lead authority for the RTS, has procured Galliford Black & Veatch Joint Venture Limited (here on referred to as GBV) to undertake outline design and appraisal for the capacity improvements and flood channel.
- 1.1.6 To inform the early stages of the RTS appraisal and outline design, a Preliminary Ecological Appraisal (PEA) has been undertaken.
- 1.1.7 This PEA report exclusively focuses on the proposed works for the flood channel and capacity improvement at Desborough Cut. Information on the proposed capacity improvements to the weir complexes at Sunbury, Molesey and Teddington is provided within a separate document, the *Preliminary Ecological Appraisal for the Capacity Improvements to Teddington Weir, Molesey Weir and Sunbury Weir* (Environment Agency, 2015a) ('the Weirs PEA').

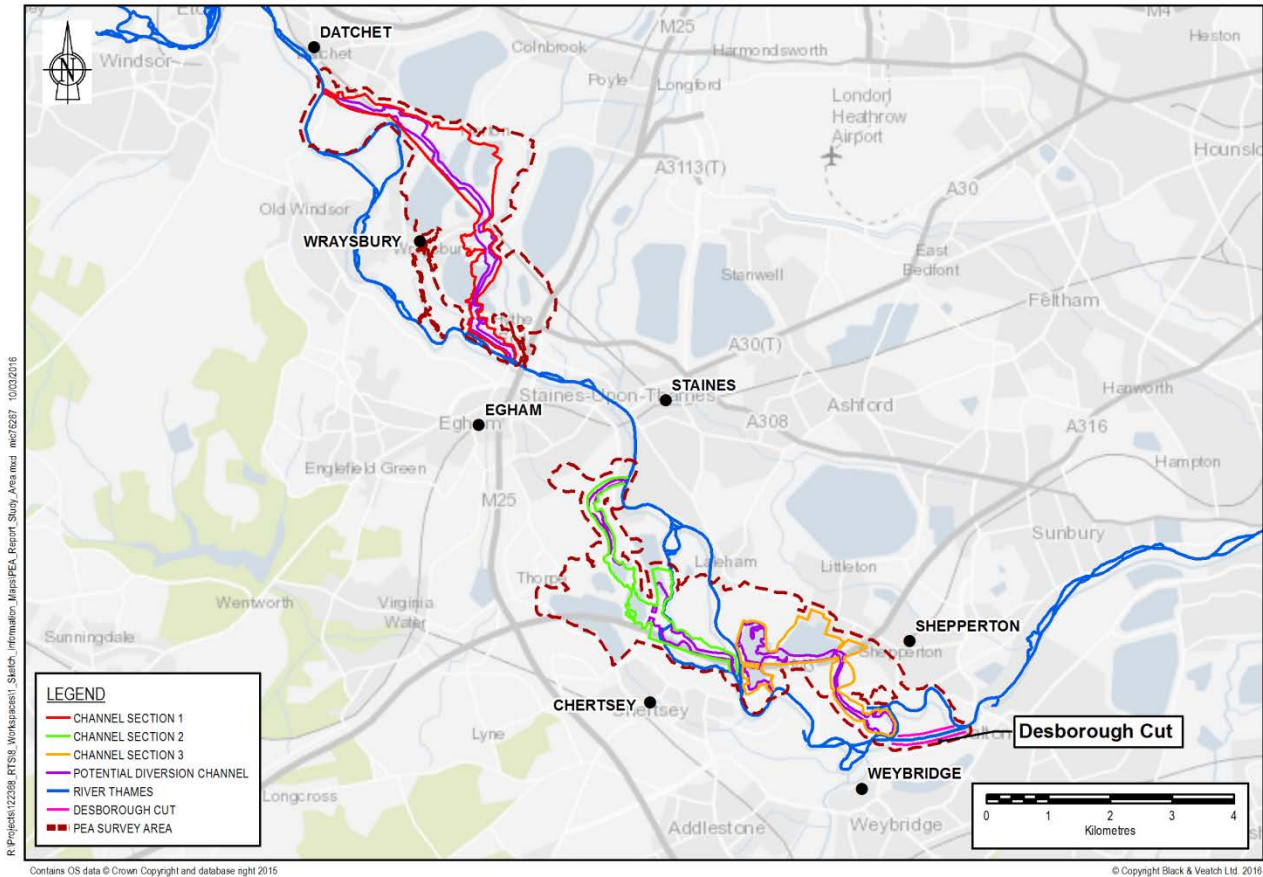


Figure 1.1: Location plan and survey area

1.2 Scope of the report

- 1.2.1 This PEA (and the Weirs PEA) will form the first of a series of assessments and reports which will be carried out for the Project. During the current stage (outline design) of the Project, a Habitats Regulations Assessment (HRA), Environmental Impact Assessment (EIA) Scoping (including Ecological Impact Assessment (EcIA) scoping) and Water Framework Directive (WFD) Assessment will also be completed. These assessments and their accompanying reports will draw upon some of information presented in this PEA (and the Weirs PEA), as well as other information specific to their individual purposes, to draw conclusions on the likelihood for significant effects to arise as a result of the Project and the Project’s level of compliance with environmental legislation.
- 1.2.2 The information provided in this report is based upon the best available information at this outline design stage of the Project. Based upon the current information, it identifies requirements for further ecological surveys and impact assessments to be carried out for the flood channel works and capacity improvement at Desborough Cut; provides information on key ecological constraints; summarises the requirements for further surveys; and makes suggestions about potential mitigation and enhancement measures that can be taken into account in the outline design process.
- 1.2.3 The aim of the PEA is to obtain information on existing ecological conditions and to conduct a preliminary assessment of the likely ecological impacts on the proposed development sites. To achieve this, the following steps were taken:

- The desk study area and field survey area (including the ‘zone of influence’ of the scheme) have been identified.
- A desk study has been undertaken, including the use and reproduction of data from the Environment Agency, Surrey Biodiversity Information Centre (SBIC) and Thames Valley Environmental Records Centre (TVERC).
- Baseline information on the three channel sections and surrounding area has been recorded through an ‘Extended Phase 1 Habitat Survey’ (referred to as ‘P1HS’) (JNCC, 2010).
- The ecological features present within the survey area(s) have been evaluated, where possible.
- Invasive non-native species (INNS) of plants and animals have been described.
- Potential constraints to the proposed development have been identified.
- Recommendations for further survey have been made.
- Potential mitigation and enhancement recommendations have been provided based on current information.

1.2.4 This PEA follows guidance published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2012).

1.2.5 P1HS maps, with supporting target notes, are included in Appendix A. Biological records of protected and notable species within the survey areas are presented in Appendix B. A description of relevant legislation, and nature conservation status’ are included in Appendix C. Appendix D contains desk study maps of designated nature conservation sites, WFD water bodies and INNS records.

1.3 Site context and status

1.3.1 The desk study and survey area (refer to Figure 1.1) is centred on a proposed flood channel and the Desborough Cut capacity improvements. The flood channel is formed of three sections consisting of: Datchet to Hythe End (Channel Section 1) approximately SU986764 to TQ017721; Egham Hythe to Chertsey (Channel Section 2) approximately TQ035701 and TQ052670; and Chertsey to upstream of Desborough Cut (Channel Section 3) approximately TQ059667 to TQ089661. Watercourses and lakes which the proposed flood channel will intersect were included within the survey area to 100m upstream and the entire watercourse downstream (of the intersection point), until these meet the River Thames, including a 10m buffer around the watercourse or waterbody. The study area is entirely within the River Thames catchment area, passing through an urban-rural fringe environment on the edge of London.

1.4 Description of the proposed Flood Channel and Desborough Cut capacity improvements

1.4.1 The following subsections provide an overview of the proposed Flood Channel.

1.4.2 In addition to the major engineering works described below, the scheme will include the creation of over 40 hectares of priority habitat. The process of identifying suitable sites for enhancement / creation is currently ongoing and is not discussed in detail as part of this report.

Flood channel route alignment

1.4.3 The alignment of each channel section is shown on Figure 1.1. Channel Section 1 has its intake structure at Datchet, passing through a series of existing lakes and gravel pits in the

Sunnymeads, Horton and Wraysbury areas. Crossing the railway line twice as well as local roads it re-enters the Thames via an outfall structure at Hythe End. From intake to outfall, Channel Section 1 would intersect seven watercourses.

1.4.4 Channel Section 2, with its intake at Egham Hythe, crosses the A320 Chertsey Lane north of Ferry Lane, turning south across Green Lane to connect into the Mead Lake Ditch. Passing through the Thorpe Park lakes and across the A320 towards Abbey Mead the channel returns through the existing Burway Ditch M3 flood culverts to re-join the Thames via an outfall structure just south of the M3. From intake to outfall, Channel Section 2 would intersect seven watercourses.

1.4.5 Channel Section 3 has its intake north of the M3. The channel then splits with the southern spur using existing M3 flood culverts to head south and return to the Thames at Chertsey Meads; whilst the northern spur heads east across existing gravel pits and local roads before using existing M3 flood culverts to re-join the Thames via an outfall structure near to Desborough Island (directly upstream of Desborough Cut). From intake to outfall, Channel Section 3 would intersect one watercourse.

Flood channel design information

1.4.6 The three flood channel sections total approximately 17km in length. The channel sections will be 20m to 45m wide, between 3.5m to 4.5m deep within areas of natural ground (between 4m to 7m deep in areas of landfill) and will convey in-bank flows of up to approximately 150m³/s. The depth of the water in the channel will be between 2.0m to 3.5m under non-flood (normal) conditions (refer to paragraph 1.4.10 for explanation of the sources of this 'non-flood' water) and will raise up to 4.5m when carrying 150m³/s.

1.4.7 Each flood channel section comprises new sections of engineered channel connecting existing lakes and gravel pits, passing through the following types of land use:

- Green field areas or agricultural land;
- Existing lakes and gravel pits;
- Landfill sites; and
- Existing river corridor.

1.4.8 The profile of the engineered channel varies according to the amount of space available and the type of land use that it passes through.

Areas of uncertainty

1.4.9 The outline design of the flood channel is ongoing and there are a number of uncertainties that will need to be resolved over the course of the Project. Information in this report will inform design decisions around these areas of uncertainty. As a result of some of the uncertainties, the channel route may change in certain locations. In particular the following require further investigation:

- The precise route of Channel Section 2 in proximity to Thorpe Hay Meadow;
- The precise location of the outfall of Channel Section 3;
- The design of the downstream section of Channel Section 2, such that opportunities to work with local businesses, particularly Thorpe Park, are maximised;
- The alignment and operation of the Chertsey Brook spill via St Ann's Lake into the flood channel, such that flood risk reduction to Chertsey is optimised; and

- Whether the LTFRMS assumption that there would be no ‘sweetening flow’¹ from the Thames into the flood channel sections in non-flood conditions is the best option.

Operating conditions

1.4.10 The operation of the flood channel can be considered as three distinct conditions, for progressively increasing flow magnitudes on the River Thames:

- **Non-flood conditions:** This is the normal non-operational condition and would occur for most of the time when the new channel is not required to relieve flooding. Flow within the Thames is fully contained within the existing Thames channel capacity. The flood channel sections are isolated from the Thames by closed gates at the intake structures. The LTFRMS assumption is that no flow enters the flood channel directly from the Thames; although it should be noted that this is one of the areas of uncertainty that needs to be resolved. In this situation water levels within the flood channel sections are controlled by water level retention structures (weirs), groundwater levels and other inflows/outflows (such as rainfall, evaporation, flow brought into the channel by the intersected tributaries etc.). Flow in the Thames is unchanged from current (no scheme) conditions.
- **Flood channel operational and within capacity:** the flows in the Thames are greater than the Thames channel capacity (and all possible control of water levels using the existing weir complexes on the Thames has been exceeded). The intake gates to the flood channel sections are progressively opened to maintain Thames water level just below bankfull and prevent flooding. Flow passes along the flood channel sections, causing water levels in the channel sections to rise above normal levels. Without the scheme flooding of the Thames would have commenced.
- **Capacity of flood channel is reached:** The flows entering the flood channel sections reach their maximum design capacity (150m³/s). The openings of the intake gates to the flood channel sections are then gradually reduced so that flow entering is limited to their design capacity. Consequently flow passing downstream in the Thames will increase, causing water levels to rise above bankfull and flooding from the Thames to commence. The severity of flooding from the Thames is reduced compared to existing (no scheme) conditions.

1.4.11 Based upon LTFRMS information, it is thought that the flood channel will operate on average once a year and that the duration of its use would be in the order of 1-3 weeks.

Design of the Desborough Cut capacity improvements

1.4.12 Desborough Cut, which runs along the south side of Desborough Island, will be widened and/or deepened to improve the flow capacity through this artificial channel (which was created in the 1930s). The LTFRMS assumed widening of approximately 3-4m would be carried out on the right bank (which is currently sheet piled).

¹ The term ‘sweetening flow’ was used during development of the LTFRMS. Although it implies a water quality benefit, it refers to the provision of a defined controlled flow from the River Thames through the flood channel.

2 Methodology

2.1 Desk study and consultation

- 2.1.1 An ecological desk study was carried out. A search for designated nature conservation sites within 2.5km (see Appendix D) of the proposed channel sections was used as part of the desk study, which represents the greatest extent of the study area.
- 2.1.2 Existing records relating to the flood channel and surrounding areas were commissioned from the relevant biological records centres; SBIC and TVERC as well as via the Environment Agency's 'Geostore' for the survey area (Figure 1.1). Information on designated nature conservation sites was gathered up to a radius of 2.5km from the proposed channel sections (see Appendix D).
- 2.1.3 Ecological records, including protected species, species included under Section 41 of NERC, and INNS, were requested for the survey area. Additional INNS data was drawn from the River Thames Scheme: Environmental Monitoring Final Interpretative Report (Environment Agency, Dec 2015b). Biological records datasets were also interrogated for the presence of species listed within Local Biodiversity Action Plans spanning the survey area.
- 2.1.4 For some aquatic macroinvertebrates which are nationally rare species, but are not included in the NERC S41 list, a Community Conservation Index (CCI) has been utilised (Chadd and Extence, 2004). This is a species-level metric measuring the conservation value of the macroinvertebrate community at a site in the national context of England and Wales, based on both the rarity of individual species and the overall diversity of the community. Each species is given an individual score based on its rarity, from 1 to 10, and all species scoring at least 7 were highlighted. Downstream effects of construction of the flood channel will also be considered as part of the wider environmental assessment for this project.
- 2.1.5 Environmental information for the survey area was also obtained from the following sources:
- 2.1.6 Key literature;
- Juvenile fish surveys on the River Thames, 2013. University of Hull International Fisheries Institute (HIFI) (Nunn and Cowx, 2014);
 - Thames Water Utilities Ltd. Lower Thames Operating Agreement: Stage 2-Completion of AMP5 Investigations (Cascade, 2013);
 - Lower Thames Flood Risk Management Strategy: Environmental Monitoring Gap Analysis (Environment Agency, 2010b); and,
 - River Thames Scheme: Environmental Monitoring Year 3 Interpretative Report (Environment Agency, 2015b).
- 2.1.7 Databases;
- MAGIC GIS database (www.magic.gov.uk);
 - ARC GIS Online Aerial Photography (www.arcgis.com);
 - Catchment Data Explorer (environment.data.gov.uk/catchment-planning);
 - Joint Nature Conservation Committee (JNCC) (www.jncc.defra.gov.uk);
 - Cladocera Interest Group Provisional Atlas (<http://www.boxvalley.co.uk/nature/cladocera/dmap.asp>);

- Global species database of fish species (www.fishbase.com);
- National Fish Population Database (NFPD); and
- Directory of UK Fishing Locations (www.live4fishing.com).

2.1.8 Three years' worth of detailed site-specific surveys have been undertaken across 20 lakes within the survey area as part of the RTS Environmental Monitoring between 2012 and 2015 (Environment Agency, 2015b). The INNS maps within Appendix D identify which of the lakes within the survey area were included in the RTS Environmental Monitoring. Surveys undertaken included:

- Water quality sampling on the 20 lakes, undertaken between July 2012 and June 2015. Samples were analysed for total phosphorus, total nitrogen, nitrate, ammonia and orthophosphate concentration, chlorophyll-a, alkalinity, metals and Biochemical Oxygen Demand (BOD). Field measurements were also undertaken of pH, temperature, salinity, conductivity and dissolved oxygen (DO) on each sampling occasion.
- Water quality surveys from two locations on the River Thames between November 2012 and May 2015. Samples were analysed for total phosphorous, total nitrogen, nitrate, ammonia and orthophosphate concentration, chlorophyll-a concentration, alkalinity, and range of metals and BOD. Field measurements of pH, temperature, salinity, conductivity and DO were taken on each sampling occasion.
- Macrophyte surveys in the summer 2012 and 2013 to determine the location of major aggregations on the lakes. In 2014 and 2015 further surveys and LEAFPACS analysis (a type of aquatic macrophyte evaluation) were undertaken. Two sites on the River Thames were also surveyed and river data were analysed following the LEAFPACS method for WFD classification.
- Benthic macroinvertebrate surveys in November 2012 and 2013 (representing autumn) and May 2013 and 2014 (representing spring) across the 20 lakes. Macroinvertebrates were collected from five sites in the River Thames in November and May each year. Further data from two extra river sites (Kingston and Laleham) were also sampled by the Environment Agency and were incorporated into the analysis.
- Where INNS were found during the monitoring at each benthic macroinvertebrate sampling site they were recorded over the same survey period.
- Zooplankton surveys were undertaken between July 2012 and May 2015 at a single site across the 20 lakes. Assessment of species assemblages were confined to Cladocera, an important food source for fish and birds.
- Phytobenthos surveys were undertaken in November (2012, 2013 and 2014) and May (2013, 2014 and 2015) each year across the 20 lakes and along five sites on the River Thames.
- Phytoplankton surveys in July, August and September 2012-2014 each year across the 20 lakes.

2.1.9 Environment Agency datasets have also been used to provide valuable information where no site specific surveys have been undertaken for certain biological elements such as macroinvertebrates and fish, these include:

- Environment Agency macroinvertebrate data for two river sites (Kingston and Laleham) which were incorporated into the analysis undertaken as part of the site specific monitoring for the RTS Environmental Monitoring (Environment Agency, 2015b).

- Environment Agency seine netting surveys for juveniles along the River Thames (2004-2015) (dataset ID 644)².
- Environment Agency boom boat survey data along the River Thames (2004-2014) (ID 644).
- Environment Agency electrofishing survey data for Colne Brook tributary (1986-2014) (ID 1800).
- Environment Agency electrofishing data for Wraysbury River (2003-2015) (ID 1800).
- Environment Agency electrofishing data for the River Colne (1986, 2002-2015) (ID 1800).
- Environment Agency fish data for one survey site on Datchet Common Brook (2015) (ID 1799).
- Environment Agency electrofishing data for three sites on the Chertsey Bourne (1989, 1991, 2003, 2006, 2008, 2011, 2012, 2015 and 2016) (ID 1799).
- Environment Agency data for Desborough Cut (1995, 2000-2015) and Desborough Loop (2005, 2009-2013) (ID 1799).

Desk based study limitations

- 2.1.10 The data coverage of the site-specific surveys undertaken across the lakes, for a variety of parameters, as part of the RTS Environmental Monitoring Programme (ID 1757), is considered to be very variable. For example, data coverage included 20 lakes which have been subject to a three year field survey, along with supplementary studies including a macrophyte WFD classification assessment. A further four lakes (Wraysbury 2 South, Hythe End Central, Hythe End East and Hythe End West) have limited data collection which mostly relates to water quality only.
- 2.1.11 There is no other freshwater ecological data relating to this programme for other lakes including Sunnymeads 4, Kingsmead 1 (North and South), Church Lake, Horton 1-4, Blenheim Lake and Lower Hythe Gravel Pits 1-5 (all in Channel Section 1); Egham Hythe Pond and Twynersh Lakes (Channel Section 2); Sheepwalk West 1 and 3, Black Ditch Pond, Manor Farm Lake and Halliford Mere (all in Channel Section 3). Refer to Figures 3.1, 5.1 and 7.1 for locations.
- 2.1.12 Survey coverage is also variable for river sections. The River Thames has an extensive series of Environment Agency monitoring points both within the survey areas and in reaches between or immediately outside. For other streams there is no regular monitoring and there appears to be no ecological data other than for some water quality, fish and INNS records for tributaries such as the Colne Brook, River Colne and Wraysbury River (Channel Section 1). Other than for fish there are no other biological data from Desborough Cut.
- 2.1.13 While there are detailed datasets on macroinvertebrates from the River Thames and across 20 of the lakes within the survey area, these were collected for a WFD assessment of habitat quality and therefore may give an incomplete indication of the presence of INNS or species of conservation importance, for which more targeted sampling would be more effective.
- 2.1.14 Information relating to fish is based on existing survey reports (see Section 2.1.6), available Environment Agency fisheries datasets (see Section 2.1.9), advice and data provided by Technical Specialists from the Environment Agency's Fisheries, Biodiversity and Geomorphology teams and various databases (see Section 2.1.7).

² From this point on in the document specific references to source datasets are provided by an ID code (in brackets) which can be looked up in Section 13.

2.1.15 As there are many challenges to surveying fish in large lowland rivers such as the River Thames, data from a range of complementary sampling techniques, both qualitative and quantitative, have been used; Catch Per Unit Effort boom boat electrofishing surveys, catch depletion electrofishing surveys, juvenile seine netting; and hydroacoustics.

2.1.16 No specific survey of lakes has been undertaken at the time of this report to inform the RTS and there is limited fish data available; which consists primarily of records of a few species within the lakes, including those that are stocked.

Consultation with technical specialists

2.1.17 Fisheries, biodiversity and geomorphology technical specialists from the Environment Agency have been consulted as part of the review process for this PEA, and their comments taken into account. They have already provided advice to the RTS Project Team on the need for further fish surveys and these recommendations have resulted in a commitment by the Environment Agency to undertaking the surveys discussed below.

Fish and macrophyte surveys that will be undertaken the Environment Agency

2.1.18 The Environment Agency has recognised the need for further surveys of the lakes likely to be affected by the flood channels. These surveys are needed in order to inform the ongoing and future environmental assessment work for the Project. In accordance with the advice of its technical specialists, the Environment Agency has already committed to undertaking a range of fish surveys including eDNA surveys (for fish), hydroacoustic surveys and seine netting surveys of the majority of lakes; as well as macrophyte surveys (as shown in Table 2.1). Refer to Figures 3.1, 5.1 and 7.1 for lake locations. The intention is for these surveys to be undertaken during 2016; although precise timescales are subject to change and landowner agreement.

Table 2.1: Surveys already committed to be undertaken by the Environment Agency

Lake	eDNA survey	Hydroacoustic survey	Seine netting	Macrophytes
Datchet 2	X	X	X	
Datchet 3 (N)	X	X		X
Datchet 3 (S)	X	X		X
Sunnymeads 1	X	X		
Sunnymeads 2	X	X	X	
Sunnymeads 3	X	X		X
Kingsmead Island Lake	X	X		X
Horton 2	X	X		X
Wraysbury II (N)	X	X		X
Wraysbury II (S)	X	X		X
Lower Hythe GP 1	X	X		X
Lower Hythe GP 2	X	X		X
Lower Hythe GP 3	X	X	X	X
Lower Hythe GP 4	X	X		X
Lower Hythe GP 5	X	X		X
Lake South of Green Lane	X	X		X
Lakes South of Norlands Lane (1)	X	X		X
Lakes South of Norlands Lane (2)	X	X		X
Fleet Lake	X	X		X

Lake	eDNA survey	Hydroacoustic survey	Seine netting	Macrophytes
Abbey Lake	X	X		X
Abbey 1	X	X		X
Abbey 2	X	X		X
Manor Lake	X	X	X	X
St Ann's Lake	X	X	X	X
Littleton North	X	X		
Littleton South	X	X		
Littleton East	X	X		X
Old Littleton Lane lake	X	X		X
Sheepwalk West 2	X	X		X
Sheepwalk East	X	X		X
Ferry Lane West 1	X	X		
Ferry lane West 2	X	X		X
Ferry Lane West 3	X	X		X
Ferry Lane	X	X		X

2.2 Extended Phase 1 Habitat Survey

- 2.2.1 The P1HS area, shown in overview in Figure 1.1, comprised accessible land within the route of the proposed flood channel, Desborough Cut, and adjacent land (not including private gardens) within 100m of the likely works areas, plus any nearby land potentially suitable for site compounds and/or access to the site. The survey area is shown in more detail on the extended P1HS maps (Appendix A).
- 2.2.2 The P1HS was undertaken between 29th May to 25th September 2015 by Chris Aylward, MCIEEM, GBV Senior Ecologist.
- 2.2.3 The survey methods were based on the Phase 1 Habitat Survey methodology (JNCC, 2010) and the Guidelines for Preliminary Ecological Appraisal (CIEEM, 2012).
- 2.2.4 All land parcels were mapped according to JNCC P1HS habitat types with target notes taken, as appropriate, to provide supplementary information on habitat conditions, features too small to map, species composition, structure and management.
- 2.2.5 During the survey, habitats were also assessed for their suitability to support protected and notable species, and field signs indicating their presence or absence recorded.
- 2.2.6 The distribution and extent of widespread, visible INNS were also noted where found. A systematic survey for INNS was not conducted as part of the PH1S.

P1HS Limitations

- 2.2.7 The majority of the survey area was accessible or could be viewed from public access points and in agreement with the landowners/managers. However, no access was obtained for the majority of private gardens or businesses. Areas which could not be surveyed are highlighted in the P1HS plans in Appendix A or referenced in target notes.
- 2.2.8 It is clearly stated where a preliminary value can be given and where further information is required.

2.2.9 This survey was undertaken within the March to September optimal survey window for P1HS.

2.3 Invasive non-native species

2.3.1 In order to establish the presence of non-native species of flora and fauna which are known to be invasive and are subject to existing legal controls, a combination of desk-based information and site survey results have been collated. The sources of information regarding INNS that have been used are:

- Datasets from SBIC (ID 1361) and TVERC (ID 1268).
- Datasets from the Environment Agency (ID 1028, 1601 and 0062).
- Environment Agency fish survey records (as listed in Section 2.1).
- Personal communications with Environment Agency Fisheries, Biodiversity and Geomorphology Technical Specialists.
- Survey data from the RTS Environmental Monitoring (Environment Agency, 2015b).
- Survey data from the Flood Channel P1HS undertaken to inform this PEA.

2.3.2 Biological records and survey observations of species present within the survey area have been compared to published lists of known INNS. The lists have been used to target species with known legal status and ecological issues (i.e. those that are most likely to be of significance to the Project). The two lists used for this PEA are:

- Schedule 9 of the Wildlife and Countryside Act (WCA) 1981 (which makes it an offence to release, plant or otherwise allow the species listed to grow in the wild).
- UK Technical Advisory Group on the Water Framework Directive (TAG WFD) working paper 'Revised classification of aquatic alien species according to their level of impact' (2015).

2.3.3 Reference to the above two recognised lists, for the purpose of targeting INNS of primary importance to the Project, does not disregard or lessen other legal obligations regarding control of INNS that may also prove to be of direct relevance to the Project. For example, as the Project moves through the design, construction and operation stages, its proponents must have due regard to the legal obligations under Section 14 of the WCA; which make the release of *any* animal not ordinarily resident in the wild an offence (subject to certain provisions).

2.3.4 At the time of writing, there are two further lists of INNS that are currently in draft format, but which are anticipated to be formally published in the near future. These two lists are the EU Species of Concern and the Environment Agency's INNS Management Plan. Drafts of these lists have been consulted and, whilst it is not anticipated that the lists will contain many species which are not already being taken into account by the Project, it is nevertheless recommended that an appraisal is made of the lists (when published) against the known INNS present within the survey area to inform subsequent stages of the Project's design and assessment.

2.4 Assessment of ecological value

2.4.1 An indication of the ecological value of habitats and features identified during the appraisal which could be affected by the development, has been provided based on the Guidelines for Ecological Impact Assessment (CIEEM, 2016).

2.4.2 Each of the identified statutory and non-statutory sites, habitat types and associated species/populations has been attributed a biodiversity value reflecting their geographic significance; examples are provided below:

- **International and European** e.g. biodiversity feature that is designated or warrants designation as an Special Area of Conservation (SAC), Special Protection Area (SPA), or Ramsar site.
- **National** e.g. biodiversity feature that is designated or warrants designation as a Site of Special Scientific Interest (SSSI) or National Nature Reserve (NNR).
- **Regional** e.g. biodiversity feature which is one of the best examples of its type within London or Surrey.
- **Borough** e.g. biodiversity feature that is designated or warrants designation as a Local Nature Reserve (LNR) or a Site of Nature Conservation Interest (SNCI³), or other feature which is one of the best examples of its type within the Borough.
- **Local** e.g. biodiversity feature which is one of the best examples of its type within a local context (i.e. within ~1km of the scheme extent).
- Biodiversity features of value within the **zone of influence** (channel alignment plus approximately a 250m buffer).
- Biodiversity features of **negligible** value.

2.4.3 Biodiversity values have also been based upon the following factors:

- Presence of sites or features designated for their nature conservation interest. Examples include internationally, nationally or locally designated sites.
- Size of habitat or species population, habitats or species which are rare, species rich assemblages, species which are endemic or on the edge of their range, large populations or concentrations of uncommon or threatened species and/or plant communities that are typical of valued natural/semi-natural vegetation types.
- Secondary and supporting value, for example, habitats or features which provide a buffer to valued features or which serve to link otherwise isolated features.
- Presence of legally protected sites or species.
- Presence of UK priority habitats and species (NERC Act S.41).

2.4.4 This report is likely to be used in support of future planning applications; therefore, relevant local planning policies relating to nature conservation have also been highlighted (Appendix C.2).

2.4.5 An Ecosystem Services assessment is not included within this PEA, but will be recommended for inclusion alongside other topics scoped-in to the EIA. There is clearly a high potential for the Project to deliver additional Ecosystem Services.

³ The term SNCI includes Local Wildlife Sites and Sites of Importance for Nature Conservation (SINC).

3 Results: Channel Section 1

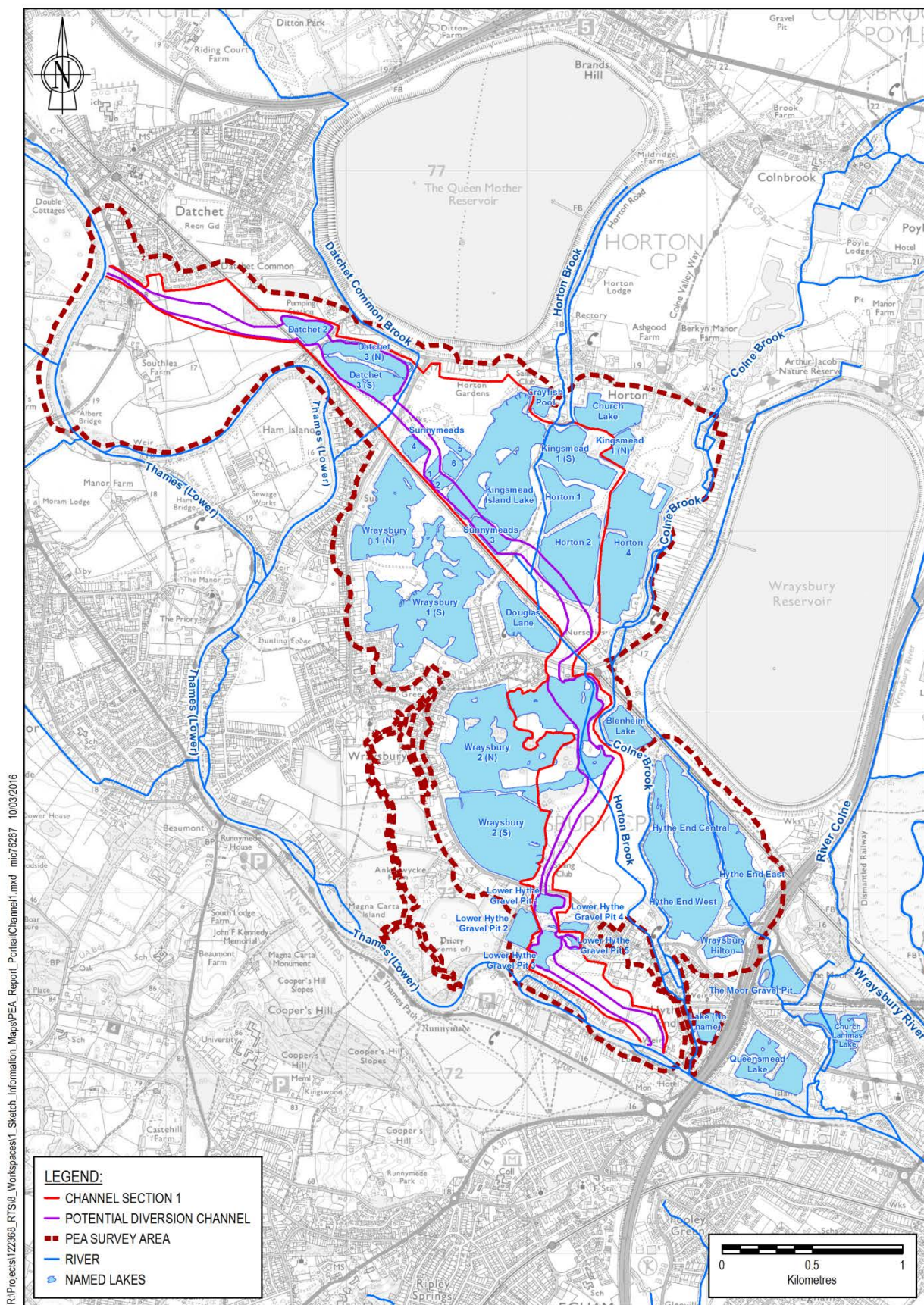


Figure 3.1: Named lakes and rivers within the PEA survey area for Channel Section 1

3.1 Introduction

3.1.1 Figure 3.1 provides an overview of the proposed route of Channel Section 1 and the Project's naming convention for the lakes and stretches of river that are within this part of the PEA survey area. A summary of the study and survey results for Channel Section 1 is provided below. Further details of species records are provided in Appendix B.

3.2 Designated sites

3.2.1 The overall study area surrounding Channel Section 1 is crossed by a matrix of gravel pits remediated to open water habitats following the end of extraction works. A number of these water bodies have been designated as part of the South West London Water bodies (SWLW) Special Protection Area (SPA), which supports internationally important numbers of overwintering gadwall *Anas strepera* and shoveler *Anas clypeata*. These species also overwinter on other lakes across the survey area that are not formally part of the SPA, but are recognised as being supporting sites.

3.2.2 The SWLW SPA covers four of seven SSSIs within 2.5km of Channel Section 1. Three lakes within the survey area are considered to be supporting sites⁴ for the SWLW SPA; Datchet 3 Lake, Sunnymeads Lake and Kingsmead Island Lake. In addition to this one Special Area of Conservation (SAC), one Local Nature Reserve (LNR), and 19 non-statutory Sites of Nature Conservation Importance (SNCI) can be found within 2.5km of Channel Section 1. Refer to the Designated Nature Conservation Sites figure (Figure 122368-BVL-Z0-SW-DR-V-00012) in Appendix D for the locations of the sites.

3.2.3 Table 3.1 provides details of the designated nature conservation sites within 2.5km of Channel Section 1, including (where available) their reasons for notification. The table also provides the ecological value assigned to the site (in accordance with the criteria explained in Section 2.4).

Table 3.1: Designated Nature Conservation Sites within 2.5 km of the Channel Section 1 site

Unless otherwise stated against a specific item, this table incorporates biodiversity data supplied by SBIC (ID1361), TVERC (ID1268) and the Environment Agency (ID1028), and is copyright to SBIC, TVERC, the Environment Agency and/or its partners.

Designated Site Name	Distance from Channel Section (m) (approx.)	Reasons for Notification and Ecological Value
Statutory Sites		
South West London Water bodies (SWLW), SPA and Ramsar site	0	A series of reservoirs and former gravel pits supporting a range of man-made and semi-natural open water habitats. These sites provide important feeding and roosting sites for wintering populations of gadwall and shoveler due to the numbers of European importance that occur. International and European value.
Windsor Forest & Great Park SAC	2375	Designated for old acidophilus oak woods in the south-eastern part of its UK range. Other qualifying features include Atlantic acidophilus beech <i>Fagus sylvatica</i> forests with common holly <i>Ilex aquifolium</i> and sometimes also yew <i>Taxus baccata</i> in the shrub layer. International and European value.
Wraysbury & Hythe	0	The site supports nationally important numbers of

⁴ Those waterbodies outside of the current SWLW SPA and Ramsar site boundary but can be identified as important supporting sites using a threshold for the identification of such waterbodies where the three year mean peak count exceeds 1% of the cited SPA population for gadwall or shoveler.

Designated Site Name	Distance from Channel Section (m) (approx.)	Reasons for Notification and Ecological Value
End Gravel Pits SSSI		wintering tufted duck <i>Aythya fuligula</i> , gadwall and goosander <i>Mergus merganser</i> together with an important assemblage of breeding birds associated with open waters and wetland habitats. In addition the site supports the nationally scarce riffle beetle <i>Oulimnius major</i> and caddisfly <i>Leptocerus lusitanicus</i> and a number of locally uncommon plants. National value. Note that large parts of this site are also part of SWLW SPA and Ramsar site.
Wraysbury No.1 Gravel Pit SSSI	20	A former gravel pit and land stretching south east to Junction 13 of the M25. Designated for nationally important numbers of wintering gadwall. The site also supports small but significant numbers of shoveler, goldeneye <i>Bucephala clangula</i> and smew <i>Mergus albellus</i> in winter. The site is also locally important for other wintering bird species including great crested grebe <i>Podiceps cristatus</i> , cormorant <i>Phalacrocorax carbo</i> , pochard <i>Aythya farina</i> , tufted duck and coot <i>Fulica atra</i> . National value. Note that large parts of this site are also part of SWLW SPA and Ramsar site.
Wraysbury Reservoir SSSI	275	An artificial reservoir supporting man-made open water habitat and cited for the nationally important numbers of wintering cormorant, great crested grebe and shoveler. National value. Note that large parts of this site are also part of SWLW SPA and Ramsar site.
Langham Pond SSSI	720	The pond and surrounding habitat of alluvial meadows is unique within the south of England, supporting rich marginal, aquatic and meadow floras. The pond supports four nationally uncommon invertebrate species; the crane fly <i>Erioptera squalida</i> , a soldier fly <i>Odontomyia tigrina</i> , an empid <i>Lonchoptera scutellana</i> , and one species of fly recorded nowhere else in Britain <i>Cerodontha ornata</i> . The scarce variable damselfly <i>Coenagrion pulchellum</i> is also present. Three nationally scarce plants are supported on site: whorled water-milfoil <i>Myriophyllum verticillatum</i> , orange foxtail grass <i>Alopecurus aequalis</i> and, in its only Surrey locality, greater water parsnip <i>Sium latifolium</i> . National value.
Staines Moor SSSI	975	The site chiefly consists of Staines Moor, a semi-natural stretch of the River Colne which flows through it, and three adjacent reservoirs. Staines Moor represents the largest area of alluvial meadows in Surrey and supports a rich flora while the reservoirs hold nationally important populations of tufted duck, pochard, goosander and shoveler. A pond at the site supports the nationally important small water-pepper <i>Polygonum minus</i> ; a plant which is extremely rare in Britain. National value. Note that large parts of this site are also part of SWLW SPA and Ramsar site.
Thorpe Hay Meadow	2230	Believed to be the last remaining Thames valley hay

Designated Site Name	Distance from Channel Section (m) (approx.)	Reasons for Notification and Ecological Value
SSSI		meadow in Surrey, this site supports a range of lime-loving plant species. From discussions with Natural England and Surrey Wildlife Trust it has become apparent that downy-fruited sedge <i>Carex filiformis</i> is the primary species of interest for this site. National value.
Windsor Forest and Great Park SSSI	2375	The largest continuous area of woodland and parkland in Berkshire providing habitat for a range of rare species of invertebrate including the internationally important violet click beetle <i>Limoniscus wolaceus</i> and stag beetle <i>Lucanus cervus</i> and a rich assemblage of other Red Data book beetles and flies. The range of provisional Red Data List fungi present includes <i>Buglossoporus pulvinus</i> , <i>Phelinus robustus</i> , <i>Boletus regius</i> and <i>Hericium coralloides</i> . In addition there are areas of unimproved acid grassland. National value.
Arthur Jacob Nature Reserve LNR	680	Formed from derelict sewage treatment lagoons the site has been managed as a wetland habitat since 1996. Borough value.
Non-statutory Sites (SNCI)		
Datchet Common and Gravel Pits	0	Grassland habitat. Borough value.
Horton & Kingsmead Lakes	0	Series of gravel pits with significant bird interest lying adjacent to internationally important area. Borough value.
Wraysbury 1 Gravel Pits	0	Primarily of broadleaved woodland and scrub habitat. Borough value.
Wraysbury 2 Gravel Pits	0	Grassland and scrub habitat. Borough value.
River Thames - Runnymede	23	Primarily riparian habitat. Regional value due in part to the importance of the River Thames to migratory fish (see Section 9).
Queen Mother Reservoir	25	Large reservoir with seeded grassland banks. Borough value.
Wraysbury Reservoir	45	The grassland surrounding the reservoir is selected as an important buffer for the Wraysbury Reservoir SSSI which is also part of the SWLW SPA Ramsar site. Borough value.
Colne Brook	55	Primarily riparian habitat. Borough value.
Runnymede (including Cooper's Hill and Cooper's Hill Slopes)	268	Unimproved and semi-improved grassland and ancient semi-natural woodland habitats. Borough value.
Hilda May Lake	508	A wetland nature reserve with two mesotrophic lakes, important for wildfowl, and a pond with associated ditch. Borough value.

Designated Site Name	Distance from Channel Section (m) (approx.)	Reasons for Notification and Ecological Value
Church Lammas	660	Selected for species rich grassland, containing at least 16 species typical of grassland of conservation interest in Surrey. The site also supports swamp and reedbed habitats and serves as Accessible Natural Greenspace within an urban area. Borough value.
Moor Lane Nature Reserve	785	Selected for its diverse wetland habitat. Species recorded on the site include small water-pepper & whorled water-milfoil <i>Myriophyllum verticillatum</i> as well as lesser water parsnip <i>Berula erecta</i> & thread-leaved water crowfoot <i>Ranunculus trichophyllus</i> (scarce in Surrey). Borough value.
River Thames (and towpath) Spelthorne	1040	Section of River Thames which falls within top 10% of UK watercourses due to macroinvertebrate diversity. Supports range of NERC Priority species including eel <i>Anguila anguila</i> , salmon <i>Salmo salar</i> , sea trout <i>Salmo trutta</i> , depressed river mussel <i>Pseudanodonta complanata</i> and otter <i>Lutra lutra</i> . Regional value.
West of Poyle Meadows	1710	The site's position is important abutting Staines Moor SSSI and therefore acts as a buffer. In addition it continues to support good emergent vegetation either side of the channel. Borough value.
Birch Green by River Ash	1730	The site was selected in 1996 for its wet grassland with ant hills. This type of grassland is uncommon and declining in the County. Following the review in 2010, it was reselected for its diverse emergent flora. Borough value.
East of Poyle Meadows	1776	Selected for its wetland habitats including reedbeds and swamp. Species present are indicative of Thames Alluvial soils supported. The site is an important buffer between the M25 & Staines Moor SSSI. Borough value.
River Colne (from county boundary to Staines Moor) Stanwell Moor	1830	Falls within the top 10% of watercourses nationally for macroinvertebrate fauna (1996). This section of river supports a diverse fish community including eel and is a spawning site for barbel <i>Barbus barbus</i> . Regional value.
Upton Court Park Wetland	2000	Wet woodland and sedge fen habitats. Borough value.
Greenham's Fishing Pond	2110	The site is selected for its wetland habitat which complements the wider mosaic of wetland habitats present in the surrounding M25 corridor area. Borough value.

3.3 Habitats and flora

- 3.3.1 The following sections detail the combined findings of the P1HS and desk based study of biological records data. The P1HS plans and target notes (TN) providing supplementary information are included in Appendix A.
- 3.3.2 A detailed list of protected and notable species for each channel section can be found in Appendix B.
- 3.3.3 The Channel Section 1 survey area can be characterised by three dominant habitat types: open water, broad-leaved semi natural woodland and cultivated/disturbed land - arable. The area, structure and composition of these habitats are described below.

Standing water habitat

- 3.3.4 Accounting for approximately forty percent of the habitat cover within the Channel Section 1 survey area, this habitat extends in a patchwork fashion from Datchet to junction 13 of the M25. The majority of these water bodies are the result of remediated gravel and sand extraction pits, an industry that is still active and continuing to shape the region. These habitats are widely utilised for a range of recreational activities including, fishing, sailing, water sports, SCUBA diving and swimming.
- 3.3.5 All of the water bodies are likely to support fish populations of varying sizes and assemblages; due to a combination of commercial fisheries, introduction by anglers, escapes during flood episodes and natural colonisation processes (see Section 9 and 10 for results and recommendations relating to fish).
- 3.3.6 The margins of many of the lakes are dominated by willow tree species *Salix spp.* forming broad-leaved semi natural woodland. Where breaks in the woodland and over shading occurs, species such as common nettle *Urtica dioica*, reedmace *Typha spp.*, branched bur-reed *Sparganium erectum*, willow herb *Epilobium spp.*, hogweed *Heracleum sphondylium* and hemlock *Conium maculatum* are dominant.
- 3.3.7 Due to the large coverage of open water (estimated to be 2.6 km² total within Channel Section 1), it is unsurprising that the area is an important habitat for overwintering waterfowl, resulting in the inclusion of four lakes (Wraysbury 1 N & S and Wraysbury 2 N & S) within the SWLW SPA. It is likely that most of the water bodies of any significant size and open structure are used by overwintering and breeding waterfowl, although it should be noted that the levels of use will vary significantly on a lake by lake and yearly basis. Other important species likely to utilise this habitat are: bats; a range of breeding bird species, widespread amphibian species such as common toad *Bufo bufo*, and possibly common frog *Rana temporaria* and common newt species where marginal habitats reduce predation by fish; otter; water vole *Arvicola amphibius*; grass snake *Natrix natrix* and possibly adder *Vipera berus* where amphibian prey and suitable adjacent habitat is abundant.

Broad-leaved semi natural woodland

- 3.3.8 Woodland has been allowed to colonise the narrow margins around and between many of the lakes within the area, forming a thin lattice across the landscape accounting for approximately seventeen percent of habitat cover within the Channel Section 1 survey area. Some of these woodlands may have originally been plantations used to screen the quarries but have since set seed and naturalised. Willow species dominate large proportions of the woodland habitats present, particularly those in close proximity to water. In places there are clusters of mature to veteran pedunculate and sessile oak *Quercus robur* and *Q. petraea* that are likely to be the remnants of field boundaries and small woodlands present in the area prior to the quarries. Other species frequently encountered within the wooded areas include common alder *Alnus*

glutinosa, hawthorn *Crataegus monogyna*, sycamore *Acer pseudoplatanus* and ash *Fraxinus excelsior*.

3.3.9 Woodland in and around the tributary running across Ankerwycke (National Trust Site) is generally much older, containing a higher proportion of veteran trees, including an ancient yew tree believed to be 2,500 years old.

3.3.10 Species likely to be supported by broadleaved semi-natural woodland include bats, Eurasian badger *Meles meles*, potentially hazel dormouse *Muscardinus avellanarius*, otter, all widespread amphibian species and great crested newt *Triturus cristatus* (where suitable breeding ponds are confirmed nearby), a range of breeding bird species and possibly reptile species along edge habitats.

Cultivated/disturbed land - arable

3.3.11 Arable land is the dominant habitat within the northern quarter of the Channel Section 1 immediately south of Datchet, with another smaller zone present to the northwest of Kingsmead Island Lake. Crop production at the time of survey appears to be mainly cereals and a small amount of root vegetables. This habitat accounts for approximately twelve percent of the habitat cover within Channel Section 1.

3.3.12 The majority of the fields are surrounded by defunct species poor hedgerows in combination with fencing, although one field is flanked by lines of trees.

3.3.13 This habitat type is generally of low habitat value for wildlife but can support a range of nesting birds both at ground level, within hedgerows and trees. Occasionally badger setts and reptiles can be found along field boundaries where there is sufficient cover available.

Other habitats

3.3.14 An additional 26 other habitat types have been identified with Channel Section 1 and are listed in Table 3.2 below.

Table 3.2: P1HS habitat types identified within Channel Section 1.

Linear features are not included within area and percentage calculations and are shown as 'negligible' in these columns.

CHANNEL SECTION 1			
P1HS Code	P1HS Habitat Type	Total Area (km ²)	Percentage of Area Covered
G1	Standing water	2.65	39.38
A1.1.1	Broadleaved woodland – semi-natural	1.13	16.84
J1.1	Cultivated/disturbed land – arable	0.81	12.01
B4	Improved grassland	0.39	5.81
G2	Running water	0.22	3.31
B6	Poor semi-improved grassland	0.18	2.72
B2.2	Neutral grassland – semi-improved	0.18	2.70
A3.1	Broadleaved parkland/scattered trees	0.18	2.61
C3.1	Other tall herb and fern – ruderal	0.16	2.32
J4	Bare ground	0.15	2.22
J1.3	Cultivated/disturbed land – ephemeral/short perennial	0.15	2.2
A1.1.2	Broadleaved woodland – plantation	0.13	2
I2.1	Quarry	0.13	1.93
J3.6	Buildings	0.12	1.73

CHANNEL SECTION 1			
P1HS Code	P1HS Habitat Type	Total Area (km ²)	Percentage of Area Covered
A2.2	Scrub – scattered	0.05	0.79
A2.1	Scrub – dense/continuous	0.04	0.54
J1.2	Cultivated/disturbed land – amenity grassland	0.03	0.43
B5	Marsh/marshy grassland	0.02	0.25
F1	Swamp	0.01	0.12
J2.8	Earth bank	0	0.05
A1.3.1	Mixed woodland – semi-natural	0	0
A3.1	Broadleaved parkland/scattered trees	Negligible	Negligible
J2.1.1	Intact hedge – species rich	Negligible	Negligible
J2.1.2	Intact hedge – species poor	Negligible	Negligible
J2.2.2	Defunct hedge – species poor	Negligible	Negligible
J2.3.1	Hedge with trees – native species rich	Negligible	Negligible
J2.4	Fence	Negligible	Negligible
J2.5	Wall	Negligible	Negligible
J2.6	Dry ditch	Negligible	Negligible
Total		6.73	100

3.3.15 The other 26 habitats are widely spread across Channel Section 1. There appears to be a greater variety of habitats around locations of constant or intense human activity, such as the fringes of urban areas, active quarries or landfill. However, this variation is usually due to an increase in the occurrence of habitats such as bare and disturbed ground, ephemeral perennials and amenity grassland (i.e. those that do not usually support a wide range of species).

3.3.16 Five NERC priority habitats were identified within the survey area as eutrophic standing water, lowland mixed deciduous woodland, rivers, wood-pasture and parkland, and hedgerows.

Evaluation

3.3.17 Outside of the designated sites or those identified as SPA supporting sites for the SWLW SPA, it is considered that the following habitats are of value within the **zone of influence**: broadleaved and mixed semi-natural woodland, scattered and dense scrub, standing water and rivers, species rich hedges (with or without trees), neutral semi-improved grassland, and areas of broadleaved parkland around Ankerwycke. These habitats have primarily been valued due to their potential to support protected or notable species or habitats and the frequency at which they occur within the wider landscape.

3.3.18 Ephemeral perennial habitat can potentially be of value to some ground nesting birds and reptile species where succession within this habitat has resulted in the correct vegetation structure or interfaces along boundaries. Valuation of this habitat type cannot be completely confirmed without further surveys to identify species supported, but is likely to be no higher than **local value**.

3.3.19 All other habitats listed in Table 3.2 are of **negligible value**; either due to the frequency in which they occur within the wider landscape, or their lack of conservation value.

3.4 Protected and notable species

Bats

- 3.4.1 All UK bat species are listed as NERC S41 species as well as being protected under the Habitats Regulations and WCA.
- 3.4.2 The riparian habitat, woodland edges and green corridors connected to the wider river valley of the River Thames have a high suitability for commuting and foraging bats and much of the survey area is likely to be regularly used by bats for these purposes. Expected species for these types of habitats include: Noctule bat *Nyctalus noctula*, Daubenton's bat *Myotis daubentonii*, Leisler's bat *Nyctalus leisleri*, soprano pipistrelle bat *Pipistrellus pygmaeus*, common pipistrelle *Pipistrellus pipistrellus* and Natterer's bat *Myotis nattereri*.
- 3.4.3 Woodland, tree lined watercourses and parkland habitats present a wide range of potential hibernation opportunities for bat species that utilise trees for roosting. In addition, the urban areas in close proximity to Channel Section 1, present a wide range of both modern and historical buildings with features suitable for bat species with preferences for these roost sites. This culmination of both building and woodland roosting opportunity has the potential to support most UK bat species within their ranges.
- 3.4.4 Despite the good supporting habitat features for bats, there are very few bat records within the Channel Section 1 survey area, recording only two pipistrelle species at the northern tip of Wraysbury 2 (N) Lake. It is highly likely that the presence of bat species is under recorded within the area.
- 3.4.5 Approximately 100 trees were provisionally identified as having some degree of bat roost potential within the Channel Section 1 survey area. However, this provisional identification does not represent a systematic search of every block of woodland; hence it is likely that additional trees with favourable roost features are present in the area.
- 3.4.6 Standing and running water combined with woodland, and the connection to the wider River Thames corridor, is likely to make these portions of the survey area of high importance for bats, but no more than **local value** relative to the county. It should be noted that this is a preliminary assessment that may alter following further surveys to assess bat usage of the survey area and the presence / likely absence of bat roosts.

Great Crested Newts

- 3.4.7 Great crested newts (GCN) are listed as NERC S41 species as well as being protected under the Habitats Regulations and WCA.
- 3.4.8 No biological records of GCN are present within the Channel Section 1 survey area; however 28 water bodies of suitable size (under 2000m²) for GCN exist within 500m of the proposed channel. It is likely that many of the 28 water bodies identified contain fish, a strong (but not absolute) excluding factor for GCN breeding. It is also likely that on a wider landscape scale, large scale habitat fragmentation from disturbance and development in the area will have had a detrimental effect upon historic GCN populations. However, it is possible that isolated GCN populations may still remain within the area; this cannot be verified without survey.
- 3.4.9 Based upon the habitats present and likely presence of fish in most water bodies the preliminary assessment of habitat for GCN concludes it is of **local value**. This valuation may change following further necessary surveys.

Reptiles

- 3.4.10 Reptiles have legal protection against killing and injury under the WCA.
- 3.4.11 The semi-improved grassland, scattered scrub, poor semi-improved grassland and some areas of disturbed ephemeral vegetation throughout the survey area provide suitable habitat for wide spread reptile species. Edge habitats, where interfaces between habitat boundaries create varied vegetative structure, are also likely to provide suitable habitat. Edge habitats include areas such as river banks, scrub, and woodland boundaries, clearings or rides, and the edge of tracks and roads.
- 3.4.12 Habitat areas of particular interest for reptiles include; the disturbed ephemeral habitat east of Welley Road (B376) (formerly gravel works); sections of the Colne Brook and grassed portions of the banks bordering the adjacent quarry; and much of the grassland within Wraysbury II Gravel Pits SSSI.
- 3.4.13 Biological records data for the Channel Section 1 survey area identify grass snake presence within the Colne Brook SSSI, Wraysbury Lake 1 (S) and Wraysbury 2 (N). Grass snakes are likely to be the most frequently encountered species within the area, which is primarily due to their strong affinity with freshwater habitats. No other historic or field records were made for reptiles within this channel section.
- 3.4.14 Although further surveys are required to evaluate the importance of different habitats, overall the survey area is considered to be of up to **local value** for reptiles.

Badgers

- 3.4.15 Badgers are protected from disturbance whilst occupying a sett, through the Protection of Badgers Act 1992.
- 3.4.16 Badgers habitat preference for sett location is that of slightly convex slopes in well-draining areas with some degree of tree or shrub cover, although where population density is high or habitat availability is limited, exposed slopes, canals and river banks close to ground water levels may be used. Free draining slopes within the edge of woodland are ideal habitat for badgers. The occurrence of sands and gravels within the survey area and the ample cover of scrub and woodland habitat mean that a healthy population of badgers could be present relative to the land available.
- 3.4.17 Two active outlier badger setts were recorded during the survey, one in the vicinity of Wraysbury 1 (S) Lake and another within Ankerwycke. Given that the range of a badger clan's territory is 20 - 100 ha (usually oval in shape), the two outliers can only be encompassed within a narrow 100 ha oval, meaning that it is possible, but unlikely, that these recorded outliers belong to the same clan.
- 3.4.18 No further definitive field signs of badgers were recorded during the survey and no biological records for badgers exist within the Channel Section 1 survey area. As there is adequate supporting habitat for badgers within the area it is highly likely that the lack of records is due to badgers being under reported.
- 3.4.19 Overall, the site is considered to have **local value** for badgers in the context of the surrounding landscape.

Birds

- 3.4.20 All birds, their nests and eggs are protected under Sections 1-8 of the WCA making it an offence to damage or destroy the nest of a wild bird whilst breeding. Certain species of bird, for example the bittern *Botaurus stellaris*, barn owl *Tyto alba* and kingfisher *Alcedo atthis* receive additional

protection under Schedule 1 of the WCA (Schedule 1 birds), which affords them protection against disturbance.

- 3.4.21 As described within Section 3.2, the Channel Section 1 survey area contains designated and supporting habitats of international importance for overwintering gadwall and shoveler and sites of national importance for overwintering gadwall, tufted duck and goosander.
- 3.4.22 Biological records data for the survey area indicate the presence of 17 species of protected birds as listed under Schedule 1 of the WCA (see Appendix B). Only four of these species (merlin *Falco columbarius*, bittern, barn owl and kingfisher) may potentially breed within the survey area.
- 3.4.23 Six records exist for the survey area that feature birds listed as NERC priority species; grasshopper warbler *Locustella naevia*, yellow wagtail *Motacilla flava*, dunnock *Prunella modularis*, brent goose *Branta bernicla*, common starling *Sturnus vulgaris* and tree pipit *Anthus trivialis*. All of these NERC bird species are likely to breed within habitats found in the survey area except for brent goose.
- 3.4.24 Considering the wide range of habitats that different bird species will utilise for nesting, most habitats within the survey area are likely to support further Schedule 1 birds, NERC birds species and/or unlisted bird species generally protected under the WCA.
- 3.4.25 It is considered that the survey areas that are not already designated, or likely to be SPA supporting sites, are of **local** ecological value for birds.

White-clawed crayfish

- 3.4.26 There are no biological records of white-clawed crayfish *Austropotamobius pallipes* available for the Channel Section 1 site. The majority of lakes have substrates composed of fine gravels and sediment, which is likely to limit potential refuge locations. Possible refuge locations are restricted to steep sided banks and root masses in areas where water levels are unlikely to significantly change and wave action removes sediment. The invasive non-native North American signal crayfish *Pacifastacus leniusculus* has been recorded within Horton Brook, Horton 1, Kingsmead Island Complex, Crayfish Pool and Church Lake. It is likely that due to flooding, and the ability of this species to cross short sections of ground, that this INNS species has also spread to adjacent water bodies but is currently unrecorded. Due to the detrimental effect of signal crayfish on white-clawed crayfish via competition and disease, it is likely that white-clawed crayfish have been excluded from the survey area and as such the habitat present is of **negligible value**.

Otters

- 3.4.27 Otters are listed as S41 species as well as being protected under the Habitats Regulations and WCA.
- 3.4.28 No evidence of otters was found during the extended P1HS and no records of otters exist within the survey area; however, there are recent records of otters along much of the River Thames corridor (published in local press, 2002-2010). As many of the lakes are within close proximity to the River Thames and are well stocked with fish, it is highly likely that otters will at least visit the survey area. Human activity in these areas is likely to be a limiting factor on the location of holts and couches, although there are sufficiently secluded areas for this to still occur. Based upon the above factors it is considered that the habitats present have value **within the zone of influence** for this species. If holts or lay-up sites are found to be present during further surveys, this will increase the value of the site for otters.

Water voles

3.4.29 Water voles are listed as NERC Section 41 Priority Species as well as afforded protection by the WCA. The water bodies within the Channel Section 1 survey area were of mixed habitat quality for water voles. Most water bodies have slow flows and sufficiently deep water; however, poor bank profiles and over shading from woodland, and the resulting decrease in riparian cover, is likely to be an excluding factor. No records exist within the area for water voles; however, it is possible that small population clusters may exist where conditions are suitable. Based upon the above factors it is considered that the habitats present have value **within the zone of influence** for this species.

Hazel dormice

3.4.30 Hazel dormice (referred from this point on as 'dormice') are listed as a NERC S41 species as well as being protected under the Habitats Regulations and WCA. There are currently no records of dormice within the Channel Section 1 survey area. It is also noted that a large region to the south west of London (including the RTS study area) lacks records of dormice (Bright and Morris, 2005). This apparent lack of dormice may be due to historical disruption of the habitats (via mineral extraction) combined with urban development. Historical disruption and loss of habitats is likely to have led to isolated and vulnerable dormice populations which ultimately were not sustainable or have dwindled to a level that is difficult to detect.

3.4.31 The habitats usually associated with dormice are woodland, scrub and hedgerows; however habitat connectivity, size, structural diversity and floral assemblages influence a habitat's suitability to support dormice. The woodland within the Channel 1 survey area does form a matrix locally, however this has mostly formed in recent decades and is bisected by linear features (such as rivers, busy roads) and urban developments that disconnect the survey area from the wider landscape, greatly limiting any chance of recolonisation. Little of the woodland possessed a well-developed or diverse shrub layer associated with good dormouse habitat, probably due to historical block tree planting of limited diversity resulting in a uniform tree canopy and shading, and a habitat less favourable for dormice.

3.4.32 Hedgerows are limited throughout the Channel Section 1 survey area and are generally species poor, hence they are unlikely to be supporting dormice populations. Much of the scrub has grown up from species poor hedges, planting schemes or natural succession after historical damage from gravel extraction has occurred. The general size, low diversity and distribution of most of the stands of scrub within the area are unlikely to support dormice.

3.4.33 Based upon the above points it is considered that the habitats within the Channel Section 1 survey area are of **negligible value** for dormice.

Terrestrial invertebrates

3.4.34 No records of protected or notable terrestrial invertebrates exist within the Channel Section 1 survey. However, given the size and range of habitats present within the survey area it is likely that some species will be present. Habitats likely to be of particular importance are lake and river margins, semi-improved grassland, veteran trees and dead wood habitats. It is considered that the species present are likely to be of **local value**.

3.5 Aquatic ecology

Zooplankton

3.5.1 All of the surveyed lakes comprise zooplankton fauna that is diverse and shows no impact of specific stressors. Two Cladocera species of interest have been recorded, these include the crustacean *Ceriodaphnia setosa* belonging to the Daphniidae family; this has previously been recorded only from East Anglia, and recently South Wales, but is present in all lakes surveyed apart from Wraysbury 2 North. *Paralona pigra* (*Chydoridae*), a species with a single previous

recorded location in south east England, has been found at Datchet 2 and Wraysbury 1 South (Environment Agency, 2015b). A conservation value of no greater than **local** is assigned.

Macroinvertebrates

- 3.5.2 All of the lakes surveyed have a macroinvertebrate community that is diverse and shows no impact of specific stressors. No macroinvertebrate species of statutory conservation status have been recorded, but several nationally rare species have been found these include:
- The beetles *Berosus lucidus*, *B. sigmaticollis*, *Hydroglyphus geminus* and *Oulimnius major* that live in vegetated drains and pools;
 - The caddisflies *Leptocerus lusitanicus* and *L. interruptus* that are confined to submerged vegetation and tree roots in larger rivers and adjacent gravel pits;
 - The leech *Glossiphonia paludosa*, typically found in vegetation-rich ponds;
 - Sunnymeads 3 contains the caddisfly *Ceraclea senilis* that lives in freshwater sponges, which themselves require clean water; and
 - The triclad (flatworm) *Bdellocephala punctata* is found in several lakes.
- 3.5.3 Most of these rare species require submerged vegetation or other structurally complex habitats. With the exception of *B. punctata* and *L. lusitanicus*, each of these species was recorded from only a single lake. Of the eight lakes surveyed, only Datchet 3 and Wraysbury 2 North did not include records of nationally rare species (Environment Agency, 2015b).
- 3.5.4 The more northerly lakes have potentially locally important populations of Odonata (dragonflies and damselflies): Datchet 2 supports high populations of the common blue damselfly *Enallagma cyathigerum*, red eyed damselfly *Erythromma najas* and blue-tailed damselfly *Ischnura elegans*; Sunnymeads 1 is the only site in the field survey in which the brown hawker dragonfly *Aeshna grandis* was recorded; Kingsmead Island Lake is similarly the only site in which the common hawker dragonfly *Aeshna juncea* was recorded. Note that all these species are of least concern, but demonstrate a high quality habitat for Odonata (Environment Agency, 2015b).
- 3.5.5 The invertebrate species highlighted above demonstrate the importance of stands of submerged and emergent vegetation in supporting a diverse species assemblage.
- 3.5.6 The invertebrate fauna of Wraysbury 1 South is particularly rich relative to other lakes surveyed, with an average taxon count per sample of 66. Wraysbury 2 North was also considered to be relatively rich comprising average taxon count of 52 taxa (Environment Agency, 2015b). Therefore these two lakes are of **regional** importance for macroinvertebrates. All other surveyed lakes are considered to be of **local** importance for macroinvertebrates.
- 3.5.7 On the River Thames, the WFD waterbody (Cookham to Egham) (ID: GB106039023231) provides a macroinvertebrate status of High for the 2014 RBMP cycle (see Appendix D for WFD waterbody ID numbers and locations). This WFD stretch includes sections at Datchet and Sunnymeads which comprise macroinvertebrates with high diversity and several notable species. The macroinvertebrate fauna at Sunnymeads is diverse, with a WFD classification of High, and includes records of small numbers of depressed river mussel *Pseudanodonta complanata*, a NERC priority species. Other nationally rare species recorded were the mayfly *Ephemera lineata* and the caddisflies *Hydropsyche fulvipes* and *Leptocerus lusitanicus*, all indicative of larger rivers. Surveys undertaken at Ham Island assessed macroinvertebrates as moderate/good for kick sampling and high for airlift sampling (Environment Agency, 2015b). A conservation value of no greater than **regional** importance is assigned for macroinvertebrates within this section of the River Thames.

Macrophytes

- 3.5.8 Among the macrophytes, the stonewort *Nitellopsis obtusa* is the only species of high nature conservation value known to be present (Environment Agency, 2015b). It has been assigned a Red Data List status of Vulnerable by JNCC, and it is a species of principal importance for nature conservation in England. This species was present only in Wraysbury 1, where there was a large bed of the species in the northwestern basin; because of the presence of an apparently healthy population of this species, Wraysbury 1 North is considered to be of **national** importance.
- 3.5.9 Otherwise, surveys of macrophyte assemblages using the LEAFPAC methodology indicate a WFD classification of moderate or poor for the eight lakes surveyed (Environment Agency, 2015b). While this may be due partially to high nutrient concentrations, other factors will influence macrophytes, including the steep sided topography of many lakes restricting the shallow water niche, shading by overhanging trees and extensive wave action (both natural and, on Datchet 3, caused by watersports activities). Further information was provided on the status of macrophytes for Datchet Common Brook (ID: GB106039023520) which provides a combined macrophyte and phytobenthos status of Moderate (see Appendix D for WFD waterbody ID numbers and locations). For macrophytes within the remaining Channel Section 1 survey area these are considered to be of **negligible** value.

3.6 Invasive non-native species

- 3.6.1 Twenty four INNS were identified within the Channel Section 1 survey area (including the WFD water bodies crossed by the proposed diversion channel) either via the survey or records data (see Section 2.3 for data sources and categorisation of 'INNS'). A species list of this data is presented in Table 3.3 and a detailed map is available in Appendix D.

Table 3.3: INNS identified within Channel Section 1 Survey Area including WFD Water bodies.

Impact levels on native species are derived from the TAG WFD working paper 'Revised classification of aquatic alien species according to their level of impact' (2015) (ID1805). Does not include 'unknown' impact species.

Common Name	Latin Name	Impact on Native Species
Northern river shrimp	<i>Crangonyx pseudogracilis</i>	Low
New Zealand mudsnail / Jenkins spire shell	<i>Potamopyrgus antipodarum</i>	Moderate
Nuttall's waterweed	<i>Elodea nuttallii</i>	High
Canadian waterweed	<i>Elodea canadensis</i>	High
Himalayan balsam	<i>Impatiens glandulifera</i>	High
Orange balsam	<i>Impatiens capensis</i>	Low
Zebra mussel	<i>Dreissena polymorpha</i>	High
Invasive mussel species	<i>Dreissna spp.</i>	High
Sweet flag	<i>Acorus calamus</i>	Low
Duck potato	<i>Sagittaria latifolia</i>	WCA Schedule 9 only
Water weed	<i>Elodea spp.</i>	High
Japanese knotweed	<i>Fallopia japonica</i>	High
Common carp	<i>Cyprinus carpio</i>	High – waiting
Water fern	<i>Azolla filiculoides</i>	High
Signal crayfish	<i>Pacifastacus leniusculus</i>	High
Grass carp	<i>Ctenopharyngodon idella</i>	Low
Rainbow trout	<i>Oncorhynchus mykiss</i>	Low
Floating pennywort	<i>Hydrocotyle ranunculoides</i>	High
Rhododendron	<i>Rhododendron ponticum</i>	High
Parrot's feather	<i>Mysiophyllum aquaticum</i>	High

Common Name	Latin Name	Impact on Native Species
Demon shrimp	<i>Dikerogammarus haemobaphes</i>	High
Mysid crustacean	<i>Hemimysis anomala</i>	High
New Zealand pygmyweed	<i>Crassula helmsii</i>	High
Bloody red shrimp	<i>Hemimysis anomala</i>	High

- 3.6.2 In addition to the above list, it should be noted that in late September 2014 the quagga mussel *Dreissena rostriformis bugensis* (High Impact, currently on waiting list) was confirmed as being present near to the River Thames. This was the first UK record of this species, which was recently identified as the INNS of most concern to UK ecosystems (APEM and URS, 2014). This species is already known to be present within the River Thames corridor and, due to its rapid ability to colonise, there is considered to be a high risk of it either being present within the study area already or it being present by the time of the Project's construction and/ or operation.
- 3.6.3 The macroinvertebrate fauna of all lakes includes a high proportion of INNS. Those considered being of high impact, as classified by UKTAG, include: the zebra mussel, which is established and common in most of the lakes surveyed, although appears to be rare in Sunnymeads 1, 2 and 3 and Kingsmead Island. The North American signal crayfish, also a high impact species has been recorded across a number of lakes which include Horton 1, Kingsmead Island complex, Crayfish Pool and Church Lake (Environment Agency, 2010b). Moderate impact species include the gastropod snail New Zealand mudsnail / Jenkins spire shell, which is present in most of the lakes surveyed. Other non-native macroinvertebrate species of the lakes which are noted as being present during surveys, which are currently all classified as 'low' or 'unknown impact' by UKTAG include: the Northern river shrimp, the gastropod *Physa acuta* and the Tricladida *Dugesia tigrina* which are also widely distributed. The gastropod *Ferrissia wautieri* was recorded in Sunnymeads 1 and 2 and Tricladida *Planaria torva* was recorded in Kingsmead Island (Environment Agency, 2015b). Unknown impact species are not included in Table 3.3 or the INNS map in Appendix D.
- 3.6.4 A high diversity of macroinvertebrate INNS have been recorded on the River Thames at Sunnymeads. These include the high impact demon shrimp, zebra mussel and the bloody red shrimp. Moderate impact species include the gastropod New Zealand mudsnail / Jenkins spire shell. Various 'low' or 'unknown impact' macroinvertebrate species include the amphipods *Chelicorophium curvispinum*, northern river shrimp, *Gammarus tigrinus* and the Tricladida *D. tigrina* and gastropod *P. acuta*.
- 3.6.5 Among the macrophyte INNS, the high impact Nuttall's waterweed has been recorded and is common across all of the surveyed lakes. The high impact Canadian waterweed has also been recorded from Kingsmead Island and Wraysbury 2 North (Environment Agency, 2015b).
- 3.6.6 A number of non-native fish species have been recorded across the lakes, which are capable of competing with native species for resources (see Sections 9 and 10). A high impact species according to UKTAG is the common carp, a species which is known to occur in most of the lakes utilised for fishing (ID 1259). Low impact species recorded include the grass carp at Church Lake and Horton 1, a species which has been introduced in many countries to control aquatic vegetation. Another low impact species includes rainbow trout *Oncorhynchus mykiss* which has been recorded at Kingsmead Island complex; this species is known to have caused some problems in relation to hybridisation with other species, thereby affecting genetic integrity and causing a decline in some native species in some countries. Unknown impact species include the European wels catfish *Silurus glanis* at Horton 1 (ID1259). There is also concern from Environment Agency fisheries experts that the topmouth gudgeon *Pseudorasbora parva* may be

present; albeit there are no records of its presence from the available fisheries data, but it is referred to in the Strategy document (Jacobs 2009 cited in Environment Agency, 2010b). On the main River Thames and in Colne Brook, the common carp has also been recorded within Channel Section 1 survey area (ID 644; ID 1800).

- 3.6.7 It was noted during the P1HS survey work that Japanese knotweed tended to be close to waste land and roads due to the tendency for it to be fly tipped or be present within landfill. Himalayan balsam tended to be in close proximity to watercourses and lakes due to habitat preferences and mechanisms of dispersal. Waterweed was widely present in most (if not all) lakes.
- 3.6.8 No systematic search was made for INNS during the P1HS. It is likely that the current data set for INNS is not a complete and reliable list of all INNS currently within the study area. Given the nature of the site (heavily disturbed, urban-rural environment, fishing and water sports), the risk of INNS being more widespread than currently recorded or additional unrecorded species being found is considered to be high.

4 Recommendations: Channel Section1

4.1 Introduction

4.1.1 The results of the desk study and P1HS have identified the following ecological features which have the potential to be affected (directly or indirectly) by the scheme proposals as they are currently known, in the absence of mitigation and reasonable avoidance measures. The likely impacts on features affected are discussed below, along with any required further survey work and /or measures to be employed to mitigate for the potential effects of the scheme on the identified ecological receptors. This assessment of impacts and recommendations should be reviewed as the design is developed.

4.2 Designated sites

4.2.1 Direct temporary construction impacts and potentially permanent operational impacts are anticipated on the SWLW SPA (and two of the supporting lakes), Wraysbury & Hythe End Gravel Pits SSSI (covered by the SWLW SPA), and four SSSI sites: Datchet Common and Gravel Pits, Horton & Kingsmead Lakes, Wraysbury 1 Gravel Pits and Wraysbury 2 Gravel Pits. A change in habitat type is likely to occur where the proposed channel crosses land at Wraysbury 2 Gravel Pits, with potential to result in permanent fragmentation and some loss of terrestrial habitat, replaced by riparian habitat. The potential for these and any other impacts to arise, as well as the significance of effects on designated sites, will be considered as part of the HRA and EIA.

4.2.2 Temporary construction impacts should be manageable via standard industry best practice measures, and are unlikely to have an effect on the medium to long term integrity of the designated sites' interest features. Particular attention will need to be given to the careful timing of works in relation to overwintering birds and the control of sedimentation within the lakes. Further input from environmental professionals should be sought at each stage of the project progression to ensure the latest best practice is integral with designs, programmes and contracts.

4.2.3 Permanent operational effects of the proposed channel on the designated sites cannot be quantified at this stage, as further studies are required prior to reaching conclusions. Further research and assessments required to inform the Project are currently ongoing or are planned for the near future. These include, but are not limited to: the consideration of hydraulic performance e.g. flow types and velocities; potential changes to water quality (including the risk of algal blooms) and associated changes to fish and other aquatic species which play a crucial role in the ecological functioning of the designated waterbodies; further targeted ecological surveys of water bodies; potential changes to pathways or habitat suitability for INNS; and, changes to the availability and suitability of habitat for protected species (see Table 2.1 and Section 12). The results of these research areas and assessments (and the findings of this Flood Channel PEA) will be used to inform the HRA, EIA and WFD Assessment (as well as specific consenting and consultation requirements for designated sites) that will be required for the Project.

4.3 Habitats and flora

4.3.1 The general implications of impacts on each notable habitat type are discussed below. Channel Section 1 falls within local authority of the Royal Borough of Windsor and Maidenhead (RBWM) and relevant policies from its Core Strategy are listed in Appendix C

Cultivated/disturbed land - arable

- 4.3.2 There is potential for fragmentation and loss of arable land within the northern most section of Channel Section 1. This habitat type is generally considered to be of low biodiversity value compared to other habitat types. Replacement habitat is generally considered unnecessary from an ecological perspective as the channel is likely to increase biodiversity within areas of agricultural land. However, agricultural land is listed as a consideration within the core strategy of RBWM for other factors.

Broad-leaved semi-natural and plantation woodland & scattered trees

- 4.3.3 Broad-leaved woodland forms a matrix across much of the Channel Section 1 survey area, particularly around the edges of many of the lakes. The proposed channel will result in the removal of a low percentage of existing, predominately semi-natural woodland and smaller amounts of broad-leaved plantation and scattered trees. Approximately three hedgerow crossings are also likely to be required within the arable land just south of Datchet.
- 4.3.4 It is recommended that when detailed design is finalised, that tree protection plans (TPP) for trees being retained within or adjacent to working areas should be put in place prior to construction commencing. TPPs should follow British Standard BS5837:2012 '*Trees in relation to design, demolition and construction – recommendations*' and be produced by an Arboricultural Association approved consultant of suitable experience. These plans are also likely to be requested by the RBWM tree officer or countryside officer.
- 4.3.5 As the hedgerows are over 20m long they do qualify for assessment under the Hedgerow Regulations 1997, however, exemptions to the regulations apply for the RTS either via planning permission (if granted) or for the purposes of flood defence.

4.4 Protected and notable species

- 4.4.1 In accordance with local planning policies and legislation, loss or disturbance of protected or notable species should be avoided. The Environment Agency is also governed by a number of statutory obligations on the conservation of biodiversity. For example, the Environment Agency has an obligation regarding conserving biodiversity and restoring or enhancing a population or habitat (NERC). Details of these statutory obligations are available in Appendix C. Channel Section 1 falls within RBWM and the relevant policies from its Core Strategy are listed in Appendix C.

Bats

- 4.4.2 Any individual trees or sections of woodland (broadleaved, mixed or coniferous and semi-natural or plantation) requiring removal or likely to be damaged or disturbed (including noise disturbance) as a result of the works, will require further survey.
- 4.4.3 Any removal of, or disturbance to, habitat likely to be important for foraging or commuting, particularly linear features such as woodland edges and hedgerows, should be assessed to determine the likely impact on bats. Further surveys may be required to confirm usage and value. The scheme should be designed to ensure no significant impact to connectivity.
- 4.4.4 Any further surveys or inspections that are required should be carried out in line with best practice survey methodologies, (Bat Conservation Trust, 2016). Preliminary roost assessment of trees is best conducted between December and March. Ground level bat activity surveys i.e. transects and static detectors, are best conducted in the optimal months of April, September and October, but can be conducted in the sub-optimal months of March to August inclusive. The need and timings for emergence / re-entry surveys would be determined by the preliminary roost assessments and the type of roost suspected, in line with Bat Conservation Trust (2016) guidance.

Great Crested Newt

- 4.4.5 If GCN are confirmed then the scheme could result in permanent loss of supporting terrestrial habitat and temporary impacts upon and habitats during construction. It is recommended that habitat suitability index (HSI) assessments be conducted on the 28 water bodies identified within 500m of the proposed channel in line with methodology of Oldham et al. (2000). If results are found to be favourable for GCN then further surveys will be required to establish GCN presence/likely absence and (potentially) population estimates. If confirmed, the presence of GCN will likely require a mitigation licence to be sought from the issuing authority Natural England.
- 4.4.6 HSI surveys can generally be conducted from March to September inclusive, although the optimal month is May. GCN surveys can be conducted mid-March to mid-June, with at least two to three of these visits required during mid-April to mid-May depending on survey objectives. See *Great Crested Newt Mitigation Guidelines* (English Nature, 2001) for details. eDNA survey methods for presence / likely absence can be used between 15th April to 30th June. Mitigation will need to be designed to ensure no impact to the population status of GCN that are found.

Reptiles

- 4.4.7 Due to the scale of the proposed Channel Section 1, there is potential for reptile populations to be significantly impacted at a local or zone of influence scale if adjacent habitat lacks sufficient carrying capacity. On this basis it is recommended that further reptile surveys be conducted to establish presence/likely absence in the identified habitats (as described in Section 3.4.10) directly affected by the flood channel route and related construction activities.
- 4.4.8 Reptile surveys can be conducted between March and October during suitable weather (optimal months are April/May and September), and should follow the survey methodology of Foster and Gent (1996) and Froglife Advice Sheet 10 (1999). It should be noted that reptile exclusion from an area can require between 60 and 120 suitable days (minimum figures quoted), therefore it is essential that surveys and exclusion activities are initiated well in advance of construction e.g. two seasons. If adjacent receptor habitat for exclusion is unavailable or unsuitable, then either site enhancement needs to occur, or an alternative receptor site identified well in advance of exclusion measures i.e. the reptile habitat must be well established at the receptor site.
- 4.4.9 Where works are small-scale (under 100m²) and habitat manipulation is considered likely to be effective, clearance of tall ruderal vegetation, rough grassland, or scrub should be undertaken in two stages over two consecutive days to allow reptiles to disperse. This can only be undertaken in mild weather conditions (and between April and October) when reptiles are active i.e. when the temperature does not fall below 9 degrees centigrade overnight, Langton et al (2001) and where suitable adjacent habitat is retained.

Badgers

- 4.4.10 Badger setts were not identified within 30m of the currently proposed path of the diversion channel. However, given that badgers are a widespread, common species in the Thames area and can rapidly establish new setts in relation to changes in resources and circumstances, it is recommended that further surveys be conducted before the start of construction.
- 4.4.11 Further consideration of potential impacts of the scheme upon badgers will be undertaken in during the EIA process. The habitats within 30m of works, storage and access areas should be re-assessed prior to construction to confirm the absence/presence of badger setts. Badgers are protected whilst occupying a sett and mitigation may be required if an active sett(s) is discovered. Availability of foraging habitat is unlikely to be significantly affected.

Birds

- 4.4.12 All vegetation clearance including trees should be undertaken outside of peak bird breeding season (March to September inclusive). If clearance is required during this period, nesting bird checks should be undertaken by a suitably qualified ecologist prior to clearance. If an active nest is identified, work must cease until the young have fledged.
- 4.4.13 Disturbance of important overwintering bird species should be avoided via careful programme management and timing of works outside of the overwintering period.
- 4.4.14 Permanent operational effects of the proposed channel on the bird interest features of the SWLW SPA, supporting sites and associated SSSIs cannot be quantified at this stage; as further studies and assessment (including those for the WFD Assessment and HRA) are required prior to reaching conclusions.

White-clawed crayfish

- 4.4.15 It is recommended that white-clawed crayfish surveys are not required for the water bodies within Channel Section 1 due to excluding factors making their presence unlikely.

Water voles

- 4.4.16 The scale of the proposed channel has the potential to temporarily remove significant stretches of water vole habitat if present. Permanent loss of habitat can be avoided with careful design. As such, further surveys are recommended for this species within riparian habitat and lake edges within 100m of the works areas. These should be carried out during the appropriate survey season (March to October) and follow best practice survey methods. A boat may be required where deep water prevents wading.
- 4.4.17 If impacts on water voles cannot be avoided, mitigation may comprise habitat manipulation, where appropriate, or trapping and release into a suitable receptor area nearby; under licence from Natural England as required.

Otters

- 4.4.18 Pre-construction otter surveys should be undertaken within 70m of any works required on the lakes, rivers, brooks and streams. If an otter holt or lay-up site is found within the survey area, appropriate mitigation should be implemented, this may require an EPS development license.
- 4.4.19 During construction, the watercourses or their banks should not be blocked or obstructed. Any excavations left overnight should be left with suitable egress to allow otters to escape. Harmful substances should be locked away overnight. There should be no light spill onto the watercourses.
- 4.4.20 Stringent Pollution Control Measures should be implemented and the Environment Agency's Pollution Prevention Guidance should be followed for any in-channel works.

Hazel dormice

- 4.4.21 Dormice are generally considered to be absent from all Channel Section survey areas due to abiotic factors i.e. industry, development and subsequent land remediation negatively impacting habitat and populations. Further surveys are not recommended based upon the current evidence.

4.5 Aquatic ecology

- 4.5.1 The River Thames, as well as some tributaries and lakes with connectivity to the flood channel works, are likely to be affected by the scheme to varying degrees during the construction phase. Potential impacts and effects that could be generated include a direct loss/ reduction in

submerged and emergent vegetation. Beds of vegetation are an important habitat as they provide an environment favoured by many macroinvertebrate species such as Odonata, and they act as a predation refuge for juvenile fish, macroinvertebrates and zooplankton. Thus consideration should be given where possible to replacing and/or creating conditions suitable for the growth of submerged and emergent vegetation.

- 4.5.2 During construction there is also potential for various activities (e.g. impoundment of watercourses, excavation and disturbance of sediments) to lead to an alteration in water quality and subsequently sediment quality. Potential effects may include, but are not limited to, direct toxicological effects on biota, reduction in plant growth, and smothering of benthic (bed-inhabiting) organisms; all with potential to lead to an alteration in the aquatic community composition. To minimise potential adverse effects, standard industry best practice measures should be implemented as well as developing other site specific measures as the scheme develops (see Sections 11 and 12).
- 4.5.3 There is already some connectivity between some of the lakes during flood events, but some lakes may experience increased connectivity where they do not currently flood, and, there is also the potential for increased frequency of connectivity between some lakes which are already occasionally connected during flood events. There is also potential for some lakes to experience less frequent flood water inundation (i.e. the larger portion of Wraysbury 2 N). This could have several ecological implications during operation; either if a 'sweetening flow' is required or during operation in flood events. For example currently the lakes vary in water quality from poor to high according to the WFD classification based on total phosphorus concentrations. Connecting them will enable mixing of water, that may lead to a deterioration in water quality in those lakes currently classed as high or good. Of key concern is increasing concentrations of nutrients in lakes where they are currently low. This may result in subsequent alteration of the aquatic community composition.
- 4.5.4 A similar situation could occur in the watercourses that are intercepted by the flood channel, whereby the mixing of waters and a subsequent release of water from the flood channel into a downstream stretch of an intercepted tributary could also lead to a deterioration in water quality, with subsequent effects on biota. The implications on water quality, including recommendations regarding the use of a 'sweetening flow' or having no 'sweetening flow' will need to be taken into account during the EIA and WFD Assessment before a final determination can be made on water quality and the subsequent effects on ecological receptors.
- 4.5.5 There is also potential during the construction phase for the temporary and permanent works to alter existing hydromorphological conditions (e.g. impoundment, alteration in flows and levels etc.) within the watercourses which will be intercepted by the flood channel. The subsequent effects may include, but are not limited to, an alteration in the wetted width (the cross section of the channel normally under water) and a change in aquatic biotic communities to those that may favour a new hydromorphological regime.
- 4.5.6 Various hydromorphological and associated ecological changes will arise during the operation of the scheme. The nature and extent of these changes will depend on a number of design parameters, such as flow management on the Thames and whether or not a 'sweetening flow' is required for the flood channel (with waters being taken from the River Thames and/or tributaries). Hydromorphological changes will also arise as a result of the interception of some tributaries by the new flood channel. Resulting ecological effects may include a reduction in the wetted width, exposure of edge habitats (due to lower water levels) and subsequent loss of macrophyte coverage, as well as alteration in macroinvertebrate communities.
- 4.5.7 Thus, careful consideration should be given to maintaining or even improving conditions, where possible, to support ecological communities that may be affected by alterations in

hydromorphological conditions (e.g. downstream of the channel section intakes or points of interception with tributaries). This will require further consideration as part of the ongoing Project WFD Assessment, EIA and outline design work (see Section 1.4). Furthermore, potential cumulative effects arising as a result of the flood channel acting in-combination with other extant surface water abstractions in the locality will also require careful consideration. These issues will be considered further within the WFD Assessment and EIA and any required recommendations will be made within the WFD Assessment Report.

- 4.5.8 The above impacts may, in combination, lead to further detrimental changes. Increasing nutrient concentrations can lead to increased algal growth. This in turn can be kept in check by phytoplankton grazing organisms (i.e. zooplankton and benthic filter feeders). Under a worst case scenario the absence or decline in macrophyte beds, potential increased densities of fish feeding on zooplankton and a consequent increase in high densities of algae may create problematic blooms of green algae and blue-green cyanobacteria, which in turn cause further declines in macrophytes. This could then, in turn, have subsequent impacts on the interest features of the SPA and other designated sites which rely on the macrophytes for food. Such issues will be explored in detail as part of the HRA and WFD Assessment and considered recommendations will be made following the completion of these assessments.
- 4.5.9 It is difficult at this stage of the design process to precisely determine the potential for positive changes to occur. The potential to maximise the ecological potential within existing affected areas and within the new flood channel will be considered as the scheme develops. The results of the forthcoming hydraulic, sediment and water quality modelling, as well as acquisition of further survey data (such as the surveys listed in Table 2.1) will inform this process.
- 4.5.10 Forthcoming information will be interpreted by aquatic ecologists to assess whether potential changes to biological quality elements are likely and this will also feed into the Project's WFD Assessment process (which in turn will inform the Project's HRA and EIA).
- 4.5.11 Continued dialogue should also be maintained with the Environment Agency Technical Specialists throughout the Project so as to benefit from their local knowledge and experience gained on other projects.

4.6 Invasive non-native species

- 4.6.1 There are a number of INNS species that have been identified within Channel Section 1 (Section 3.6 lists the INNS present) and there are both legal and best practice reasons why INNS are of particular importance to this Project (refer to Section 2.3).
- 4.6.2 There is strong concern regarding the spread of INNS across the lakes, as many of the lakes are usually isolated from each other during dry flow conditions, thereby reducing the opportunities for colonisation by INNS. However, during the operation of the scheme, potentially increased frequency of flooding across the lakes may serve to increase the spread of INNS. It should, however, be noted that there is already some degree of flooding across some of the lakes.
- 4.6.3 Due to the potential for INNS to be mobilised both during construction and operation of the proposed channel, a dedicated INNS study and mitigation plan will be required prior to works commencing and may need to include eradication of certain INNS species several years in advance of works where possible.
- 4.6.4 Due to the character of the area and activities occurring within, it is likely that existing INNS species will continue to spread and new INNS will become established over time. Furthermore, new or updated lists of INNS that are relevant to the Project are likely to come forward (refer to

Section 2.3). For these reasons it is important that INNS study, field surveys and records data are re-evaluated before construction.

5 Results: Channel Section 2

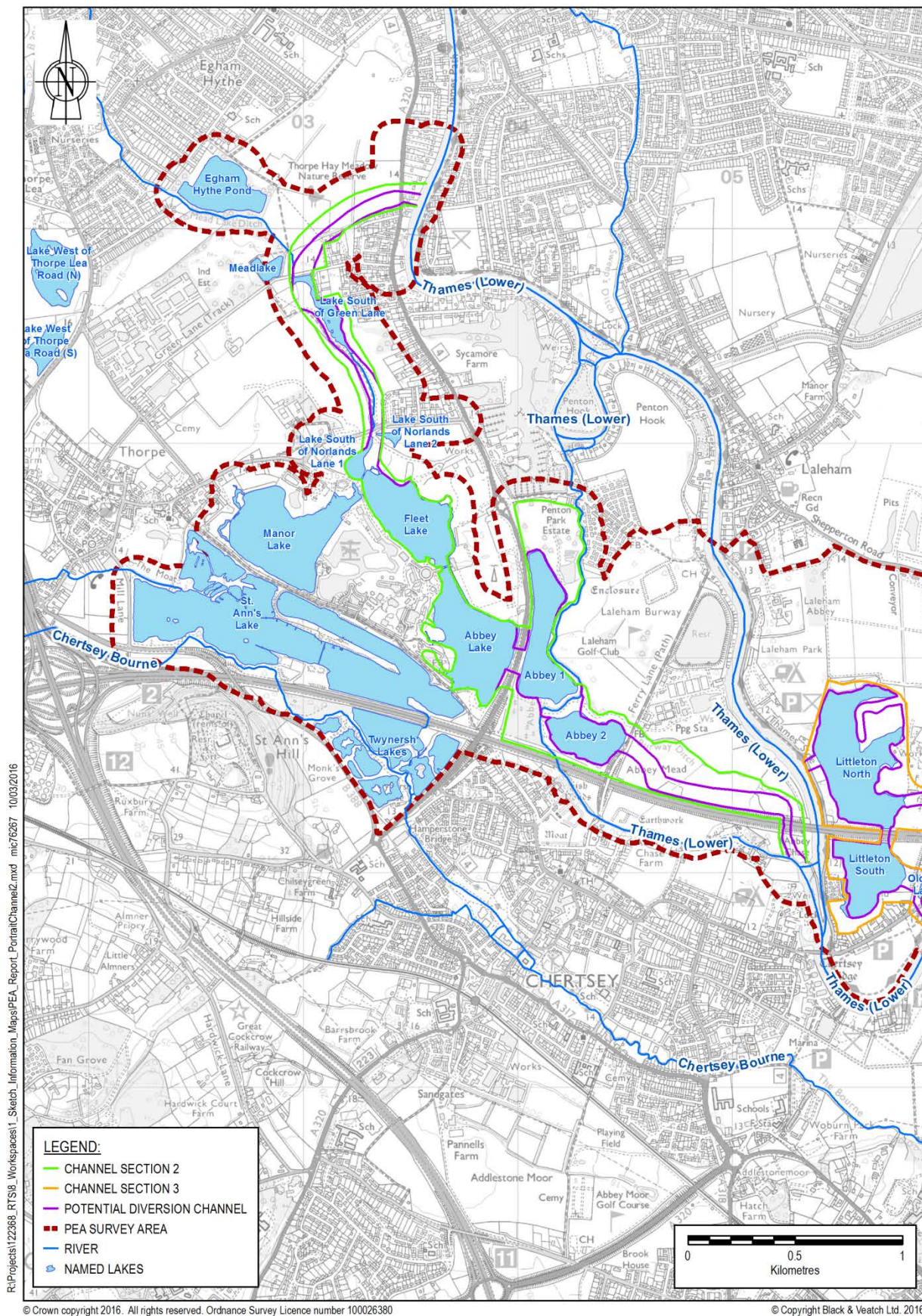


Figure 5.1: Named lakes and rivers within the PEA survey area for Channel Section 2

5.1 Introduction

5.1.1 Figure 5.1 provides an overview of the proposed route of Channel Section 2 and the Project's naming convention for the lakes and stretches of river that are within this part of the PEA survey area. A summary of the study results for Channel Section 2 is provided below. Further details of species records are provided in Appendix B.

5.2 Designated sites

5.2.1 The overall study area surrounding Channel Section 2 is crossed by a matrix of old gravel pits left as open water habitats following remediation, but to a slightly smaller extent than Channel Section 1. One of these water bodies has been designated as part of the SWLW SPA, which supports internationally important numbers of gadwall and shoveler that overwinter there. Four lakes have also been identified as supporting sites⁵ for the SWLW SPA; Fleet Lake, Abbey Lake, Manor Lake and Abbey 1 Lake. The SWLW SPA covers one of three SSSIs within 2.5km of Channel Section 2. In addition one LNR, and 26 non-statutory SNCIs can be found within 2.5km of Channel Section 2. Refer to the Designated Nature Conservation Sites figure (Figure 122368-BVL-Z0-SW-DR-V-00012) in Appendix D for the locations of the sites.

5.2.2 Table 5.1 provides details of the designated nature conservation sites within 2.5km of Channel Section 2, including (where available) their reasons for notification. The table also provides the ecological value assigned to the site (in accordance with the criteria explained in Section 2.4).

Table 5.1: Designated Nature Conservation Sites within 2.5 km of the Channel Section 2 site

Unless otherwise stated against a specific item, this table incorporates biodiversity data supplied by SBIC (ID1361), TVERC (ID1268) and the Environment Agency (ID1028), and is copyright to SBIC, TVERC, the Environment Agency and/or its partners.

Designated Site Name	Distance from Channel Section (m) (approx.)	Reasons for Notification and Ecological Value
Statutory Sites		
South West London Water bodies (SWLW), SPA and Ramsar site	7	A series of reservoirs and former gravel pits supporting a range of man-made and semi-natural open water habitats. These sites provide important feeding and roosting sites for wintering populations of gadwall and shoveler due to the numbers of European importance that occur. International and European value.
Thorpe Hay Meadow SSSI	0	Believed to be the last remaining Thames valley hay meadow in Surrey, this site supports a range of lime-loving plant species. From discussions with Natural England and Surrey Wildlife Trust it has become apparent that downy-fruited sedge is the primary species of interest for this site. National value.

⁵ Those waterbodies outside of the current SWLW SPA and Ramsar site boundary but can be identified as important supporting sites using a threshold for the identification of such waterbodies where the three year mean peak count exceeds 1% of the cited SPA population for gadwall or shoveler.

Designated Site Name	Distance from Channel Section (m) (approx.)	Reasons for Notification and Ecological Value
Thorpe Park No. 1 Gravel Pit SSSI	7	A former gravel pit now supporting open water, scrub and woodland habitats. This SSSI is designated for the nationally important numbers of gadwall it supports in winter. National value. Note that this entire site is also part of the SWLW SPA and Ramsar.
Dumsey Meadow SSSI	455	An unimproved neutral grassland habitat that is now rare in south east England. National value.
Staines Moor SSSI	1855	The site chiefly consists of Staines Moor, a semi-natural stretch of the River Colne which flows through it, and three adjacent reservoirs. Staines Moor represents the largest area of alluvial meadows in Surrey and supports a rich flora while the reservoirs hold nationally important populations of tufted duck, pochard, goosander and shoveler. A pond at the site supports the nationally important small water-pepper <i>Polygonum minus</i> ; a plant which is extremely rare in Britain. National value. Note that large parts of this site are also part of SWLW SPA and RAMSAR.
Chertsey Meads LNR	690	A remnant floodplain meadow habitat with rich floral lime-loving assemblages. Borough value.
Non-statutory Sites (SNCI)		
River Thames – Runnymede	0	Primarily riparian habitat. Regional value due in part to the importance of the River Thames to migratory fish (see Section 9).
Chertsey Bourne at Abbey Lake Complex	0	Primarily riparian and open water habitats. Borough value
Abbey Lake Complex	0	Primarily open water habitats. Borough value.
Laleham Burway Golf Course	0	Small pockets of semi-improved & unimproved grassland within an amenity grassland dominated golf course. Borough value.
River Thames (and towpath) - Spelthorne	25	This section of the River Thames is within the top 10% of UK watercourses for macroinvertebrate diversity. Supports a range of NERC Priority species including eel, salmon, sea trout, depressed river mussel and otter. Regional value.
Shepperton Quarry	90	Two large water bodies important for overwintering wildfowl. Borough value.

Designated Site Name	Distance from Channel Section (m) (approx.)	Reasons for Notification and Ecological Value
Penton Hook Island	335	Selected for the diversity of wetland habitats supporting the nationally scarce round fruited rush <i>Juncus compressus</i> & the Surrey scarce meadow crane's-bill <i>Geranium pratense</i> . Regional value.
Littleton Lake	640	An important wetland habitat supporting wintering and summer breeding birds of county level importance. Borough value.
Chertsey Meads	685	Calcareous grassland habitat. Borough value.
Chertsey Bourne at Chertsey Meads	895	Primarily riparian habitat. Borough value.
Sheepwalk Lake	970	Selected as an important wetland supporting bird assemblages of county importance for both wintering and summer breeding birds. Borough value.
The Moat Woodcock Farm	1120	Primarily riparian habitat. Borough value.
West of Queen Mary Reservoir	1510	Selected for its importance to wildfowl and visiting seabirds. The site is adjacent to Queen Mary Reservoir. Borough value.
Charlton Quarry	1535	Eutrophic lake with grass margins and numerous willows. Broadleaved tree species have been planted. Borough value.
Pannells Farm	1575	Wet grassland and pond habitats. Borough value.
Woburn Park Stream	1585	Primarily riparian habitat. Borough value.
Church Lammas	1835	Selected for species rich grassland, containing at least 16 species typical of grassland of conservation interest in Surrey. The site also supports swamp and reedbed habitats (NVC S4 & S14) and serves as Accessible Natural Greenspace within an urban area. Borough value.
Birch Green by River Ash	1870	The site was selected in 1996 for the wet grassland with ant hills. This type of grassland is uncommon and declining in the County. Following the review in 2010, it was reselected for its diverse emergent flora including NVC communities S5 and S14. Regional value.
Shortwood Common North	1910	Selected as a remnant of important alluvial grassland contiguous to Shortwood Common SSSI. It supports a Surrey rare plant species, spiny restharrow. Regional value.

Designated Site Name	Distance from Channel Section (m) (approx.)	Reasons for Notification and Ecological Value
Queen Mary Reservoir	2005	Selected for its importance to wildfowl and visiting seabirds. The site lies in an important position close to the South West London SPA/Ramsar and adjacent to the West of Queen Mary Reservoir SNCI. Regional value.
Hardwick Court Farm Fields	2010	Semi-improved grassland habitat. Borough value.
Ferris Meadows	2125	A lake created after gravel workings. Several grassland habitats surround the lake. Borough value
Simplemarsh Farm	2130	Important area for birds. Borough value.
Fan Grove	2150	Ancient semi-natural woodland habitat. Borough value.
River Thames – Elmbridge	2310	Riparian habitat. Regional value due in part to the importance of the River Thames to migratory fish (see Section 9).
Hilda May Lake	2345	A wetland nature reserve with two mesotrophic lakes, important for wildfowl, and a pond with associated ditch. Borough value.
Wey Navigation (including Addlestone Mill Pond)	2380	Primarily riparian habitat. Borough value.
River Wey – Elmbridge	2395	Primarily riparian habitat. Borough value.
Moor Lane Nature Reserve	2500	Selected for its diverse wetland habitat. Species recorded on the site include small water-pepper & whorled water-milfoil as well as lesser water parsnip & thread-leaved water crowfoot (scarce in Surrey). Regional value.

5.3 Habitats and flora

- 5.3.1 The following sections detail the combined findings of the P1HS and desk based study of biological records data. The P1HS plans and target notes (TN) providing supplementary information are included in Appendix A.
- 5.3.2 A detailed list of protected and notable species for each channel section can be found in Appendix B.
- 5.3.3 The Channel Section 2 survey area can be characterised by four dominant habitat types: Standing water, broad-leaved semi natural woodland, and low biodiversity value improved and amenity grasslands. The area, structure and composition of these habitats are described below.

Standing water habitat

- 5.3.4 Accounting for approximately 33% of the habitat cover within the Channel Section 2 survey area, this habitat appears to be concentrated in the vicinity of Thorpe Park and west of the A320 with smaller, more isolated lakes present to the north and south. The majority of these water bodies are the result of remediated gravel and sand extraction pits, an industry that is still

active and continuing to shape the region. These habitats are widely utilised for a range of recreational activities including, fishing, sailing, water sports, SCUBA diving and swimming.

- 5.3.5 All of the water bodies are likely to support fish populations of varying sizes and assemblages due to a combination of commercial fisheries, intentional introduction by anglers, accidental escapes during flood episodes and natural colonisation processes (see Section 9 and 10 for results and recommendations relating to fish).
- 5.3.6 The margins of many of the lakes are much the same for the region, dominated by willow tree species forming broad-leaved semi natural woodland. Where breaks in the woodland occurs species such as common nettle, reedmace, branched bur-reed, willow herb, hogweed and hemlock are dominant.
- 5.3.7 Due to the large coverage of open water (estimated to be 1.34 km² total within Channel Section 2), the area is an important habitat for overwintering waterfowl, resulting in the inclusion of St Ann's Lake within the SWLW SPA. It is likely that all of the water bodies of any significant size are used by overwintering and breeding waterfowl.
- 5.3.8 Other important species likely to utilise this habitat are: bats; a range of breeding bird species, widespread amphibian species such as common toad, and possibly common frog and common newt species where marginal habitats reduce predation by fish; otter; water vole; grass snake and possibly adder where amphibian prey and suitable adjacent habitat is abundant.

Broad-leaved semi natural woodland

- 5.3.9 Woodland within the Channel Section 2 area does not form the interconnected matrix as found in Channel Section 1. This habitat type still has a broad distribution across the survey area, but it is limited to strips that partially run along the edges of other habitats or landscape features such as streams, lakes and roads. The exception to this general pattern is around the Twynersh Lakes south of the M3 where woodland encompasses all of the water bodies and is the dominant habitat within that localised area. Despite being a more marginalised habitat, broad-leaved semi natural woodland accounts for approximately 10% of the habitat within this survey area. As with other woodlands in the region, a large percentage of the woodland may have originally been plantations used to screen the quarries but have since set seed and naturalised. Willow species dominate large proportions of the woodland habitats present, particularly those in close proximity to water. In places there are clusters of mature to veteran pedunculate and sessile oak that are likely to be the remnants of field boundaries and small woodlands present in the area prior to the quarries. Mature tree specimens are also found lining water bodies such as the Chertsey Bourne and Abbey River. Other species frequently encountered within the wooded areas include common alder, hawthorn, sycamore and ash.
- 5.3.10 Species likely to be supported by broadleaved semi-natural woodland include bats, Eurasian badger, potentially hazel dormouse, otter, all widespread amphibian species and great crested newt, a range of breeding bird species and possibly reptile species along edge habitats.

Amenity and improved grassland

- 5.3.11 With a combined coverage of approximately 19% of the total habitat within Channel Section 2 these species poor grassland types are indicative of the intense human usage of the area, usually found in close proximity to urban areas, facilities and recreational areas. The two largest zones of amenity grassland are found in close proximity to each other at Laleham Golf Club and Laleham Park, with all remaining amenity grassland areas being scattered widely across the survey area. There are no large individual areas of improved grassland present, rather an extensive spread of many small areas that add up to a sizable percentage of total habitat cover.

5.3.12 Although generally species poor botanically, these grasslands can still provide potential habitat for protected species within marginal habitats and landscape features such as rank grassland for reptiles and individual mature tree specimens for bats. Other species potentially supported by these habitats include badger and nesting birds.

Neutral grassland; semi-improved and unimproved

5.3.13 Both of these species rich habitats are noteworthy because of their supporting value for invertebrates, birds, reptiles and a high biodiversity value compared to other habitats within the survey area. This biodiversity value is recognised by the SSSI designation of Thorpe Hay Meadow, a rarity in the county as one of the last remaining hay meadows in Surrey, and a habitat type (unimproved neutral grassland) rarely encountered throughout the entire channel P1HS. The field immediately south of Thorpe Hay Meadow is also of particular interest, and whilst currently identified as semi-improved neutral grassland, this may well be upgraded to unimproved grassland if subject to a detailed botanical survey. Semi-improved neutral grassland within the area is found in large meadows primarily in the northern and southern most extents of Channel Section 2.

Other habitats

5.3.14 An additional 28 other habitat types have been identified with Channel Section 2 and are listed in Table 5.2 below.

Table 5.2: P1HS habitat types identified within Channel Section 2.

Some linear features are not included within area and percentage calculations as they are too small and are shown as 'negligible' in these columns.

CHANNEL SECTION 2			
P1HS Code	P1HS Habitat Type	Total Area (km ²)	Percentage of Area Covered
G1	Standing water	1.34	32.54
A1.1.1	Broadleaved woodland - semi-natural	0.47	11.54
B4	Improved grassland	0.44	10.77
J1.2	Cultivated/disturbed land - amenity grassland	0.36	8.65
B2.2	Neutral grassland - semi-improved	0.36	8.64
B6	Poor semi-improved grassland	0.24	5.85
A1.1.2	Broadleaved woodland - plantation	0.22	5.28
J3.6	Buildings	0.1	2.36
G2	Running water	0.1	2.34
A2.1	Scrub - dense/continuous	0.07	1.79
B2.1	Neutral grassland - unimproved	0.07	1.69
C3.1	Other tall herb and fern - ruderal	0.06	1.38
A2.2	Scrub - scattered	0.05	1.18
J4	Bare ground	0.04	1.06
J1.1	Cultivated/disturbed land - arable	0.04	0.97
A3.1	Broadleaved parkland/scattered trees	0.04	0.96
A1.3.2	Mixed woodland - plantation	0.03	0.83
A3.3	Mixed Parkland/scattered trees	0.03	0.65
J1.3	Cultivated/disturbed land - ephemeral/short perennial	0.03	0.63
B5	Marsh/marshy grassland	0.01	0.22
J2.6	Dry ditch	0.01	0.19

CHANNEL SECTION 2			
P1HS Code	P1HS Habitat Type	Total Area (km ²)	Percentage of Area Covered
J3.4	Caravan site	0.01	0.12
A1.2.2	Coniferous woodland - plantation	0	0.11
J5	Other habitat	0	0.08
A1.2.1	Coniferous woodland - semi-natural	0	0.05
F2.2	Marginal and inundation - inundation vegetation	0	0.05
J2.1.2	Intact hedge - species-poor	0	0.04
A1.3.1	Mixed woodland - semi-natural	0	0.01
A3.2	Coniferous Parkland/scattered trees	0	0.01
J2.1.2	Intact hedge - species poor	Negligible	Negligible
J2.2.2	Defunct hedge - species poor	Negligible	Negligible
J2.4	Fence	Negligible	Negligible
Grand Total		4.12	100

5.3.15 The 28 additional habitats listed above display a very mixed arrangement within the survey area, which is perhaps an indication of the study area spanning the rural-urban interface and the highly disturbed nature of the region. Another indication of the strong human influence on the habitat assemblage is that buildings are the eighth largest habitat type. In fact, it should be noted that not all hard standing such as roads, pavements and car parks have been recorded as this adds little value to the P1HS. However, if all hard standing and buildings were accumulated then this would most likely be the one of the dominant habitat types within the area.

5.3.16 Six NERC priority habitats were identified within the survey area as eutrophic standing water, lowland mixed deciduous woodland, rivers, wood-pasture and parkland, hedgerows and lowland meadow.

Evaluation

5.3.17 Outside of the designated sites, it is considered that the following habitats are of value within the **zone of influence**: broadleaved and mixed semi-natural woodland, scattered and dense scrub, standing water and rivers, neutral semi-improved grassland, and areas of broadleaved parkland. These habitats have primarily been valued due to their potential to support protected or notable species and/or the frequency at which they occur within the wider landscape. The exception to this is the area of neutral semi-improved grassland south of Thorpe Hay Meadow that requires further survey to assess its value but could be of at least **borough** value.

5.3.18 Ephemeral perennial habitat can potentially be of value to some ground nesting birds and reptile species where succession within this habitat has resulted in the correct vegetation structure or interfaces along boundaries. Valuation of this habitat type cannot be confirmed without further surveys to identify species supported, but is likely to be no higher than **local value**.

5.3.19 All other habitats listed above in Table 5.2 are of **negligible value** either due to the frequency in which they occur within the wider landscape or their lack of conservation value.

5.4 Protected and notable species

Bats

- 5.4.1 All UK bat species are listed as S41 species as well as being protected under the Conservation Regulations and WCA.
- 5.4.2 The riparian habitat, woodland edges and green corridors connected to the wider river valley of the River Thames have a high suitability for commuting and foraging bats, and much of the survey area is likely to be regularly used by bats for these purposes. Expected species for these types of habitats include: Noctule bat, Daubenton's bat, Leisler's bat, soprano pipistrelle bat, common pipistrelle and Natterer's bat.
- 5.4.3 The semi-natural broadleaved woodland, tree lined watercourses and parkland habitats present a wide range of potential hibernation opportunities for bat species that utilise trees for roosting. In addition, the urban areas in close proximity to Channels Section 2 provide a wide range of both modern and historical buildings with features suitable for bat species with preferences for these roost sites. This culmination of both urban and woodland roosting opportunities has the potential to support most UK bat species within their ranges.
- 5.4.4 Despite the good supporting habitat features for bats, there are very few bat records within the Channel Section 2 survey area, recording only one undefined pipistrelle species at St Ann's Lake. It is highly likely that the presence of bat species is under recorded within the area.
- 5.4.5 Approximately 90 trees were provisionally identified as having some degree of bat roost potential within the Channel Section 2 survey area. However, this provisional identification does not represent a systematic search of every block of woodland; hence it is likely that additional trees with favourable roost features are present in the area.
- 5.4.6 Standing and running water combined with woodland, and the connection to the wider River Thames corridor, is likely to make these portions of the survey area of high importance for bats, but no more than **local value** relative to the county. It should be noted that this is a preliminary assessment that may alter following further surveys to assess bat usage of the survey area and the presence / likely absence of bat roosts.

Great Crested Newts

- 5.4.7 GCN are listed as S41 species as well as being protected under the Conservation Regulations and WCA.
- 5.4.8 No biological records of GCN are present within the Channel Section 2 survey area, however 16 water bodies of suitable size (under 2000m²) for GCN exist within 500m of the proposed channel. It is likely that many of the 16 water bodies identified contain fish, a strong (but not absolute) excluding factor for GCN breeding. It is also likely that on a wider landscape scale, large scale habitat fragmentation from disturbance and development in the area will have had a detrimental effect upon historic GCN populations. However, it is possible that isolated GCN populations may still remain within the area; this cannot be verified without survey.
- 5.4.9 Based upon the habitats present and likely presence of fish in most water bodies the preliminary assessment of habitat for GCN concludes it is of **local value**. This valuation may change following further necessary surveys.

Reptiles

- 5.4.10 Reptiles have legal protection against killing and injury under the WCA.

- 5.4.11 The semi-improved grassland, scattered scrub, poor semi-improved grassland and some areas of disturbed ephemeral vegetation throughout the survey area provide suitable habitat for wide spread reptile species. Edge habitat, where interfaces between habitat boundaries create varied vegetative structure, are also likely to provide suitable habitat. Edge habitats include areas such as river banks, scrub, and woodland boundaries, clearings or rides, and the edge of tracks and roads.
- 5.4.12 Habitat areas of particular interest for reptiles include; the area of ephemeral habitat on the north west shore of Manor Lake, where a grass snake was noted basking and foraging (TN 231). This area is well known to the grounds staff of Thorpe Park for supporting grass snakes. Grass snakes are likely to be the most frequently encountered reptile species within the area, due to their strong affinity with freshwater habitats. Records of grass snakes also exist at Laleham golf course.
- 5.4.13 The semi-improved grassland east of Abbey 2 Lake is also likely to support widespread reptile species, most likely slow worm *Anguis fragilis*, grass snake and possibly viviparous lizard *Zootoca vivipara*.
- 5.4.14 Although further surveys are required to evaluate the importance of different habitats, overall the survey area is considered to be of up to **local value** for reptiles.

Badgers

- 5.4.15 Badgers are protected from disturbance whilst occupying a sett, through the Protection of Badgers Act 1992.
- 5.4.16 Badgers habitat preference for sett location is that of slightly convex slopes in well-draining areas with some degree of tree or shrub cover, although where population density is high or habitat availability is limited, exposed slopes, canals and river banks close to ground water levels may be used. Free draining slopes within the edge of woodland are ideal habitat for badgers. The occurrence of sands and gravels within the survey area and the ample cover of scrub and woodland habitat mean that a healthy population of badgers could be present relative to the land available.
- 5.4.17 No field signs of badgers were recorded during the survey and no biological records for badgers exist within the Channel Section 2 survey area. As there is adequate supporting habitat for badgers within the area it is highly likely that the lack of records is due to badgers being under reported.
- 5.4.18 Overall, the site is considered to have **local value** for badgers in the context of the surrounding landscape.

Birds

- 5.4.19 All birds, their nests and eggs are protected under Sections 1-8 of the WCA making it an offence to damage or destroy the nest of a wild bird whilst breeding. Certain species of bird, for example the barn owl, bittern and kingfisher receive additional protection under Schedule 1 of the WCA (Schedule 1 birds), which affords them protection against disturbance.
- 5.4.20 The Channel Section 2 survey area contains St Ann's Lake, part of the SWLW SPA which provides habitat of international importance for overwintering gadwall and shoveller (both Annex 2 species under the Birds Directive); see Section 5.2. Due to the spread and size of open water habitats in the Channel Section 2 survey area it is likely to support a wide range of water fowl.

- 5.4.21 Biological records data for the survey area indicate the presence of two species of protected birds as listed under Schedule 1 of the WCA; black-necked grebe *Podiceps nigricollis* and kingfisher. The black-necked grebe has the potential to breed in the UK but usually does so within the midlands and further north, using the south to overwinter. The kingfisher is a well-known resident of UK streams, rivers and lakes, breeding within burrows in steep sided embankments over water.
- 5.4.22 Only two records exist for the survey area that feature birds only listed as NERC priority species; kestrel *Falco tinnunculus* and dunnock *Prunella modularis*, both of which will breed within habitats found in the survey area.
- 5.4.23 Considering the wide range of habitats that different bird species will utilise for nesting, most habitats within the survey area are likely to support further Schedule 1 birds, NERC birds species and/or unlisted bird species generally protected under the WCA.
- 5.4.24 It is considered that those survey areas that are not already designated, or likely to be supporting features for the nearby SPA, are of **local value** for birds.

White-clawed crayfish

- 5.4.25 There are no biological records of white-clawed crayfish available for the Channel Section 2 site. The majority of lakes are composed of fine gravels and sediments, which is likely to limit potential refuge locations. Possible refuge locations are restricted to steep sided banks and root masses in areas where water levels are unlikely to significantly change, but wave action removes sediment. The invasive non-native North American signal crayfish has been recorded within the Abbey 1 and Abbey 2 lakes. Due to the detrimental effect of signal crayfish on white-clawed crayfish via competition and disease, it is likely that white-clawed crayfish have been excluded from Abbey 1 and Abbey 2 and as such the habitat present within these lakes is of **negligible value**.
- 5.4.26 It is currently unclear if signal crayfish have colonised the other lakes within the Channel Section 2 survey area. However, given the limited habitat structure present it is only of value **within the zone of influence** for native crayfish.

Otters

- 5.4.27 Otters are listed as S41 species as well as being protected under the Conservation Regulations and WCA.
- 5.4.28 No evidence of otters was found during the extended P1HS and no records of otters exist within the survey area; however, there are recent records of otters along much of the River Thames corridor (published in local press, 2002-2010). As many of the lakes are within close proximity to the River Thames and are well stocked with fish, it is highly likely that otters will at least visit the survey area. Human activity in these areas is likely to be a limiting factor on the location of holts and couches, although there are sufficiently secluded areas for this to still occur. Based upon the above factors it is considered that the habitats present have value **within the zone of influence** for this species. If holts or lay-up sites are found to be present during further surveys, this will increase the value of the site for otters.

Water voles

- 5.4.29 Water are listed as NERC Section 41 Priority Species as well as afforded protection by the WCA. The water bodies within the Channel Section 2 survey area were of much the same habitat quality for water voles as in Channel Section 1. Most water bodies have slow flows and sufficiently deep water, however, poor bank profiles and over shading from woodland, and the resulting decrease in riparian cover, is likely to be an excluding factor. Based upon the above

factors it is considered that the majority of habitats present have value **within the zone of influence** for this species.

Hazel dormice

- 5.4.30 Dormice are listed as a NERC S41 species as well as being protected under the Habitats Regulations and WCA. There are currently no records of dormice within the Channel Section 2 survey area. It is also noted that a large region to the south west of London (including the RTS study area) lacks records of dormice (Bright and Morris, 2005). This apparent lack of dormice may be due to historical disruption of the habitats (via mineral extraction) combined with urban development. Historical disruption and loss of habitats is likely to have led to isolated and vulnerable dormice populations which ultimately were not sustainable or have dwindled to a level that is difficult to detect.
- 5.4.31 The habitats usually associated with dormice are woodland, scrub and hedgerows; however habitat connectivity, size, structural diversity and floral assemblages influence a habitat's suitability to support dormice. The woodland within the Channel 2 survey area does form a matrix locally, however this has mostly formed in recent decades and is bisected by linear features (such as rivers and busy roads) and urban developments that disconnect the survey area from the wider landscape, greatly limiting any chance of recolonisation. Little of the woodland possessed a well-developed or diverse shrub layer associated with good dormouse habitat, probably due to historical block tree planting of limited diversity resulting in a uniform tree canopy and shading, and a habitat less favourable for dormice.
- 5.4.32 Hedgerows are limited throughout the Channel Section 2 survey area and are generally species poor, hence they are unlikely to be supporting dormice populations. Much of the scrub has grown up from species poor hedges, planting schemes or natural succession after historical damage from gravel extraction has occurred. The general size, low diversity and distribution of most of the stands of scrub within the area are unlikely to support dormice.
- 5.4.33 Based upon the above points it is considered that the habitats within the Channel Section 2 survey area are of **negligible value** for dormice.

Terrestrial invertebrates

- 5.4.34 Two records of notable terrestrial invertebrates exist within the Channel 2 survey area; the NERC butterfly species small heath *Coenonympha pamphilus* and wall *Lasiommata megera*. However, given the size and range of habitats present within the survey area it is likely that additional species will be present. Habitats likely to be of particular importance are lake and river margins, semi-improved grassland veteran trees and dead wood habitats. It is considered that the species present are likely to be of **borough Value**.

5.5 Aquatic ecology

Zooplankton

- 5.5.1 All of the lakes surveyed have a zooplankton fauna that is considered to be diverse and shows no impact of specific stressors. The same two Cladocera species of interest that have been recorded within Channel 1 are present; *C. setosa* and *P. pigra*. *C. setosa* has been found in all of the lakes surveyed apart from St Ann's and Abbey, but as these lakes are directly connected to Fleet and Manor lakes, this species is also likely to be present in these two locations. *P. pigra* has been found in Abbey (Environment Agency, 2015b). The zooplankton populations within the Channel 2 survey area are considered to be of **local** conservation value.

Macroinvertebrates

- 5.5.2 All of the lakes surveyed have a macroinvertebrate fauna that is considered diverse and shows no impact of specific stressors. No macroinvertebrate species of statutory conservation status

have been recorded in this locality, but there are several nationally rare species, including; the beetle *Oulimnius rivularis* that typically lives in fen drains; the caddisflies *L. lusitanicus* and *C. senilis* and the triclad *B. punctata*. Abbey also supports the beetle *Oulimnius troglodytes*⁶, found in a range of habitats, and the leech *G. paludosa* ⁶, typically found in vegetation-rich ponds. The lesser water boatman *Micronecta minutissima*⁶ (Hemiptera) is known from Abbey 2. With the exception of *L. lusitanicus*, each of these species has been recorded from only a single lake (Environment Agency, 2015b).

- 5.5.3 As in Channel 1, several of the invertebrate species highlighted above demonstrate the importance of stands of submerged and emergent vegetation in supporting a diverse species assemblage.
- 5.5.4 The invertebrate fauna of Abbey is the richest of the lakes surveyed in this section, with a mean of 48 taxa, and includes 4 nationally rare species. Therefore this lake is considered of **borough** ecological importance. For all other surveyed lakes, the macroinvertebrates are regarded as being of **local** importance.
- 5.5.5 There are a number of WFD water bodies within the Channel 2 survey, which provide further information on the status of macroinvertebrates, these include the River Thames ((Egham to Teddington) (ID: GB106039023232), the two WFD stretches on the Chertsey Bourne (Virginia Water to Chertsey; and Chertsey to River Thames confluence) (ID: GB106039017070 and ID: GB106039017030) and the Moat at Egham (ID: GB106039017060) (see Appendix D for WFD waterbody ID numbers and locations). The assessments for macroinvertebrates range from Good or High status, with the exception of the Moat at Egham which includes a Poor status for the 2014 RBMP cycle 2. There is an Environment Agency monitoring point at Laleham, which supports a diverse fauna but includes no records of the depressed river mussel in contrast to Channel Section 1. Among nationally rare species, the caddisfly *L. lusitanicus* has been recorded. The conservation value of macroinvertebrates within these river stretches assigned as being of **local** importance.

Macrophytes

- 5.5.6 As in Channel Section 1, the only macrophyte species of conservation value is the stonewort *N. obtusa* which occurs in Fleet, Manor, St Ann's and Abbey lakes. This species is common and apparently spreading in these lakes. Because of the presence of an apparently healthy population of this species, the four Thorpe Park lakes are considered of **national** importance (Environment Agency, 2015b).
- 5.5.7 Otherwise, macrophyte assemblages indicate WFD classification of moderate or poor for the six lakes surveyed; it is assumed that the reasons for this are similar to those cited for Channel Section 1 (Environment Agency, 2015b). Abbey 2 is particularly poor, with little macrophyte cover and only one native higher plant species (*Persicaria amphibia* – an amphibious bistort). There is one WFD water body covering the lakes within this channel, that is Thorpe Park Lakes (ID: GB30642753); which encompasses Abbey, Fleet, Manor and St Ann's lakes. The 2014 RBMP cycle assigns a status of Moderate for macrophytes and phytobenthos combined (see Appendix D for WFD waterbody ID numbers and locations). Consequently for the remaining lakes a conservation value of **negligible** is derived.
- 5.5.8 On the River Thames and tributaries, further information on the status of macrophytes is provided for the Thames (Egham to Teddington) (ID: GB106039023232) and the Moat at Egham (ID: GB 106039017060) water bodies for the RBMP 2014 cycle (see Appendix D for WFD waterbody ID numbers and locations). This includes a status of Poor and Moderate for

⁶ These species score relatively highly in the Community Conservation Index (CCI) (Chadd & Extence 2004), but have no statutory designation.

macrophytes and phytobenthos combined, respectively. Site specific surveys at Penton Hook provided a River Macrophyte Nutrient Index of 7.8 suggesting the taxa present are more typical of enriched conditions and algae coverage of 21.3%, providing an overall WFD classification of Good (Environment Agency, 2015b). Consequently, macrophytes, within the wider survey area are considered to be of **negligible** value.

5.6 Invasive non-native species

5.6.1 Twenty two INNS were identified within the Channel Section 2 survey area (including the WFD water bodies crossed by the proposed diversion channel) either via the survey or records data (see Section 2.3 for data sources and categorisation of 'INNS'). A species list of this data is presented in Table 5.3 and a detailed map is available in Appendix D.

Table 5.3: INNS identified within Channel Section 2 Survey Area including WFD Water bodies.

Impact levels on native species are derived from the TAG WFD working paper 'Revised classification of aquatic alien species according to their level of impact' (2015)(ID1805). Does not include 'unknown' impact species.

Common Name	Latin Name	Impact on Native Species
Northern river shrimp	<i>Crangonyx pseudogracilis</i>	Low
New Zealand mudsnail / Jenkins spire shell	<i>Potamopyrgus antipodarum</i>	Moderate
Nuttall's waterweed	<i>Elodea nuttallii</i>	High
Mysid crustacean	<i>Hemimysis anomala</i>	High
Himalayan balsam	<i>Impatiens glandulifera</i>	High
Rhododendron	<i>Rhododendron ponticum</i>	High
Zebra mussel	<i>Dreissena polymorpha</i>	High
Chinese mitten crab	<i>Eriocheir sinensis</i>	High
Cotoneaster	<i>Cotoneaster spp.</i>	Not rated
Sweet flag	<i>Acorus calamus</i>	Low
Pikeperch (zander)	<i>Sander lucioperca</i>	Moderate
Water weed	<i>Elodea spp.</i>	High
Japanese knotweed	<i>Fallopia japonica</i>	High
Common carp	<i>Cyprinus carpio</i>	High - waiting
Giant hogweed	<i>Heracleum mantegazzianum</i>	High
Demon shrimp	<i>Dikerogammarus haemobaphes</i>	High
Asiatic clam	<i>Corbicula fluminea</i>	High
Floating pennywort	<i>Hydrocotyle ranunculoides</i>	High
Giant hogweed	<i>Heracleum mantegazzianum</i>	High
Grass carp	<i>Ctenopharyngodon idella</i>	Low
Bloody red shrimp	<i>Hemimysis anomala</i>	High
Signal crayfish	<i>Pacifastacus leniusculus</i>	High

5.6.2 In addition to the above list, it should be noted that in late September 2014 the quagga mussel *Dreissena rostriformis bugensis* (High Impact, currently on waiting list) was confirmed as being present near to the River Thames. This was the first UK record of this species, which was recently identified as the INNS of most concern to UK ecosystems (APEM and URS, 2014). This species is already known to be present within the River Thames corridor and, due to its rapid ability to colonise, there is considered to be a high risk of it either being present within the study area already or it being present by the time of the Project's construction and/ or operation.

- 5.6.3 The macroinvertebrate fauna of all lakes include a high proportion of INNS. The zebra mussel, classed as high impact by UKTAG, is established and common in all of the lakes surveyed, although may be declining in the Fleet. The bloody red shrimp, another high impact species, has been recorded in Abbey 1 and the North American signal crayfish was also recorded from Abbey 1 and are considered to be prolific at Abbey 2.
- 5.6.4 The moderate impact gastropod snail *P. antipodarum* is present in all of the lakes surveyed. Other non-native macroinvertebrate species noted as being present during surveys, which are currently all classified as 'low' or 'unknown impact' by UKTAG, include: northern river shrimp, *P. acuta* group and *D. tigrina* which are also widely distributed. St Ann's is the only site in which the non-native oligochaete *Branchiura sowerbyi* has been recorded, while the non-native *P. torva* has been found in Manor Lake (Environment Agency, 2015b).
- 5.6.5 Along the River Thames at Laleham, a similar assemblage of INNS as described previously for Sunnymeads are present (Section 3.6); the bloody red shrimp and *D. tigrina* INNS are also thought likely to be present, although they have not been recorded (APEM, 2016, pers. comm.).
- 5.6.6 Among the macrophyte INNS, the high impact Nuttall's waterweed was again recorded and generally common in all of the surveyed lakes and has been recorded at Penton Hook on the River Thames (Environment Agency, 2015b).
- 5.6.7 Non-native fish species include the common carp which has been assigned a high impact category, but awaiting inclusion into the WFD TAG list for the next RBMP. This species has been recorded across most of the lakes which include fisheries data and on the River Thames (ID 1259 and ID 644) (see Section 9.3).
- 5.6.8 Japanese knotweed tended to be close to waste land and roads due to the tendency for it to be fly tipped or be present within landfill. Himalayan balsam tended to be in close proximity to watercourses and lakes due to habitat preferences and mechanisms of dispersal. Waterweed was widely present in most (if not all) lakes.
- 5.6.9 No systematic search was made for INNS during the P1HS. It is likely that the current data set for INNS is not a complete and reliable list of all INNS currently within the study area. Given the nature of the site (heavily disturbed, urban-rural environment, fishing and water sports), the risk of INNS being more widespread than currently recorded or additional unrecorded species being found is considered to be high.

6 Recommendations: Channel Section 2

6.1 Introduction

6.1.1 The results of the desk study and P1HS have identified the following ecological features which have the potential to be affected (directly or indirectly) by the scheme proposals as they are currently known, in the absence of mitigation and reasonable avoidance measures. The likely impacts on features affected are discussed below, along with any required further survey work and /or measures to be employed to mitigate for the potential effects of the scheme on the identified ecological receptors. This assessment of impacts and recommendations should be reviewed as the design is developed.

6.2 Designated sites

6.2.1 Direct temporary construction impacts and potentially permanent operational impacts are anticipated within Thorpe Hay Meadow SSSI and three SNCI's sites (River Thames Runnymede, Chertsey Bourne at Abbey Lake Complex, and the Abbey Lake Complex) plus some of the SPA supporting lakes⁷. The most notable habitat change caused by Channel Section 2 is likely to occur where the proposed channel crosses land at Thorpe Hay Meadow SSSI (a noted area of uncertainty for the Project, as detailed in Section 1.4). This crossing could result in permanent loss of terrestrial habitat including portions of the hay meadow interest feature. An appraisal of different options for the flood channel route near to this SSSI site is being undertaken in discussion with Natural England. Part of this work is to understand how the hydrology (groundwater and surface water) of the site supports the interest features and how the scheme may impact this. The results of this appraisal and recommendations for any further survey work (such as the need for National Vegetation Classification (NVC) or stratified floral surveys of the land adjacent to Thorpe Hay Meadow (see Section 12)) will inform the Project's design and EIA process. Further survey of Thorpe Hay Meadow itself is unlikely to be necessary due to existing NVC surveys completed in 2010 and 2013.

6.2.2 Temporary construction impacts within the SNCI sites should be manageable via standard industry best practice measures, and are unlikely to have an effect on the medium to long term integrity of the designated sites' interest features. As all of the SNCI sites affected are riparian or open water habitats, particular attention will need to be given to the careful timing of works in relation to overwintering birds and the control of sedimentation. Further input from environmental professionals should be sought at each stage of the project progression to ensure the latest best practice is integral with designs, programmes and contracts.

6.2.3 Permanent operational effects of the proposed channel on the designated sites cannot be quantified at this stage, as further studies are required prior to reaching conclusions. Further research and assessments required to inform the Project are currently ongoing or are planned for the near future. These include, but are not limited to; the consideration of hydraulic performance e.g. flow types and velocities; potential changes to water quality (including the risk of algal blooms) and associated changes to fish and other aquatic species which play a crucial role in the ecological functioning of the designated waterbodies; further targeted ecological surveys of water bodies; potential changes to pathways or habitat suitability for INNS; and, changes to the availability and suitability of habitat for protected species (see Table 2.1 and Section 12). The results of these research areas and assessments (and the findings of this Flood Channel PEA) will be used to inform the HRA, EIA and WFD Assessment (as well as specific consenting and consultation requirements for designated sites) that will be required for the Project.

⁷ Although not technically designated sites, there are also four lakes that are supporting sites to the SWLW SPA. The effects upon these sites will be taken into consideration during HRA.

6.3 Habitats and flora

6.3.1 Impacts on those habitats described in Chapter 5.3 would need to be considered in order to comply with local planning policy and the duties and policies of the Environment Agency. The precise nature of impacts on each of these habitats is unknown at this stage, but general implications of impacts on each notable habitat type affected are discussed below. Channel Section 2 falls within the local authority of Runnymede and relevant policies from its Core Strategy are listed in Appendix C.

Broad-leaved semi-natural and plantation woodland & scattered trees

6.3.2 The proposed channel will result in the removal of a low percentage of predominately semi-natural woodland and smaller amounts of broad-leaved plantation and scattered trees. Semi-natural woodland has a high biodiversity value relative to other habitat types and the project should seek to mitigate the loss of woodland wherever possible with like for like replacement quantities. However, the location of planting should consider current and future value of existing habitats.

6.3.3 It is recommended that when detailed design is finalised, that tree protection plans (TPP) for trees being retained within or adjacent to working areas should be put in place prior to construction commencing. TPPs should follow British Standard BS5837:2012 '*Trees in relation to design, demolition and construction – recommendations*' and be produced by an Arboricultural Association approved consultant of suitable experience. These plans are also likely to be requested by the Runnymede tree officer or countryside officer.

Unimproved neutral grassland

6.3.4 Proposed works within Thorpe Hay Meadow will require further feasibility studies and discussion with all stakeholders including the local authority (as discussed in Section 6.2).

6.3.5 The area of semi-improved grassland immediately south of Thorpe Hay Meadow should be subject to detailed botanical survey to ascertain if it is in fact unimproved neutral grassland. This determination is required so that any impacts upon the field can be mitigated accordingly to the habitat type and its biodiversity value.

6.4 Protected and notable species

6.4.1 In accordance with local planning policies and legislation (where applicable), loss or disturbance of protected or notable species should be avoided. The Environment Agency is also governed by a number of statutory obligations on the conservation of biodiversity. For example, the Environment Agency has an obligation regarding conserving biodiversity and restoring or enhancing a population or habitat (NERC). Details of these statutory obligations are available in Appendix C. Channel Section 2 falls within Runnymede District Council and relevant policies from its Core strategy are listed in Appendix C.

Bats

6.4.2 Any individual trees or woodland requiring removal or likely to be damaged or disturbed (including noise disturbance) as a result of the works, will require further survey.

6.4.3 Any removal of or disturbance to habitat likely to be important for foraging or commuting, such as linear woodland edges and hedgerows, should be assessed to determine the likely impact on bats. Further surveys may be required to confirm usage and value. The scheme should be designed to ensure no significant impact to connectivity.

6.4.4 Any further surveys or inspections that are required should be carried out in line with best practice survey methodologies, (Bat Conservation Trust, 2016). Preliminary roost assessment of

trees is best conducted between December and March. Ground level bat activity surveys i.e. transects and static detectors, are best conducted in the optimal months of April, September and October, but can be conducted in the sub-optimal months of March to August inclusive. The need and timings for emergence / re-entry surveys would be determined by the preliminary roost assessments and the type of roost suspected, in line with Bat Conservation Trust (2016) guidance.

Great Crested Newt

- 6.4.5 If GCN are confirmed then the scheme could result in permanent loss of supporting terrestrial habitat and temporary impacts upon and habitats during construction. It is recommended that habitat suitability index (HSI) assessments be conducted on the 16 water bodies identified within 500m of the proposed channel in line with methodology of Oldham et al. (2000). If results are found to be favourable for GCN then further surveys may be required to establish GCN presence/likely absence and (potentially) population estimates. If confirmed, the presence of GCN will likely require a mitigation licence to be sought from the issuing authority Natural England.
- 6.4.6 HSI surveys can generally be conducted from March to September inclusive, although the optimal month is May. GCN surveys can be conducted mid-March to mid-June, with at least two to three of these visits required during mid-April to mid-May depending on survey objectives. See *Great Crested Newt Mitigation Guidelines* (English Nature, 2001) for details. eDNA survey methods for presence / likely absence can be used between 15th April to 30th June. Mitigation will need to be designed to ensure no impact to the population status of GCN that are found

Reptiles

- 6.4.7 Due to the scale of the proposed Channel Section 2, there is potential for reptile populations to be significantly impacted at a local or zone of influence scale if adjacent habitat lacks sufficient carrying capacity. On this basis it is recommended that further reptile surveys be conducted to establish presence/likely absence in the identified habitats (as described in Section 5.4.9) directly affected by the channel route and related construction activities.
- 6.4.8 Reptile surveys can be conducted between March and October during suitable weather (optimal months are April/May and September), and should follow the survey methodology of Foster and Gent (1996) and Froglife Advice Sheet 10 (1999). It should be noted that reptile exclusion from an area can require between 60 and 120 suitable days (minimum figures quoted), therefore it is essential that surveys and exclusion activities are initiated well in advance of construction e.g. two seasons. If adjacent receptor habitat for exclusion is unavailable or unsuitable, then either site enhancement needs to occur, or an alternative receptor site identified well in advance of exclusion measures i.e. the reptile habitat must be well established at the receptor site.
- 6.4.9 Where works are small-scale (under 100m²) and habitat manipulation is considered likely to be effective, clearance of tall ruderal vegetation, rough grassland, or scrub should be undertaken in two stages over two consecutive days to allow reptiles to disperse. This can only be undertaken in mild weather conditions (and between April and October) when reptiles are active i.e. when the temperature does not fall below 9 degrees centigrade overnight (Langton *et al*, 2001) and where suitable adjacent habitat is retained.

Badgers

- 6.4.10 Badger setts were not identified within 30m of the currently proposed path of the diversion channel. However, given that badgers are a widespread, common species in the Thames area and can rapidly establish new setts in relation to changes in resources and circumstances, it is recommended that further surveys be conducted before the start of construction.

6.4.11 Further consideration of potential impacts of the scheme upon badgers will be undertaken during the EIA process. The habitats within 30m of works, storage and access areas should be re-assessed prior to construction to confirm the absence/presence of badger setts. Badgers are protected whilst occupying a sett and mitigation may be required if an active sett(s) is discovered. Availability of foraging habitat is unlikely to be significantly affected.

Birds

6.4.12 All vegetation clearance including trees should be undertaken outside of peak bird breeding season (March to September inclusive). If clearance is required during this period, nesting bird checks should be undertaken by a suitably qualified ecologist prior to clearance. If an active nest is identified, work must cease until the young have fledged.

6.4.13 Disturbance of important overwintering bird species should be avoided via careful programme management and timing of works outside of the overwintering period.

6.4.14 Permanent operational effects of the proposed channel on the supporting sites of the SWLW SPA and associated SSSIs and SNCIs cannot be quantified at this stage; as further studies and assessment (including those for the WFD Assessment and HRA) are required prior to reaching conclusions.

White-clawed crayfish

6.4.15 It is recommended that further crayfish surveys be conducted of the water bodies within the Channel Section 2 survey area (other than Abbey 1 and 2) that are of good to high water quality to determine the presence of white-clawed crayfish or invasive crayfish species likely to exclude white-clawed crayfish where impacts may occur. Crayfish surveys can be carried out any time between mid-July to mid-September inclusive.

Water voles

6.4.16 The scale of the proposed channel has the potential to temporarily remove significant stretches of water vole habitat if present. Permanent loss of habitat can be avoided with careful design. As such, further surveys are recommended for this species in all suitable habitat within 100m of the works areas. These should be carried out during the appropriate survey season (March to October) and follow best practice survey methods. A boat may be required where deep water prevents wading.

6.4.17 If impacts on water voles cannot be avoided, mitigation may comprise habitat manipulation, where appropriate, or trapping and release into a suitable receptor area nearby; under licence from Natural England as required.

Otters

6.4.18 Pre-construction otter surveys should be undertaken within 70m of any works required on the lakes, rivers, brooks and streams. If an otter holt or lay-up site is found within the survey area, appropriate mitigation should be implemented, this may require an EPS development license.

6.4.19 During construction, the watercourses or their banks should not be blocked or obstructed. Any excavations left overnight should be left with suitable egress to allow otters to escape. Harmful substances should be locked away overnight. There should be no light spill onto the watercourses.

6.4.20 Stringent Pollution Control Measures should be implemented and the Environment Agency's Pollution Prevention Guidance should be followed for any in-channel works.

Hazel dormice

- 6.4.21 Dormice are generally considered to be absent from all Channel Section survey areas due to abiotic factors i.e. industry, development and subsequent land remediation negatively impacting on habitat and populations. Further surveys are not recommended based upon the current evidence.

6.5 Aquatic ecology

- 6.5.1 Refer to Section 4.5 for recommendations related to aquatic ecology.

6.6 Invasive non-native species

- 6.6.1 There are a number of INNS species that have been identified within Channel Section 2 (Section 5.6 lists the INNS present).
- 6.6.2 Refer to Section 4.6 for recommendations related to INNS.

7 Results: Channel Section 3 and Desborough Cut

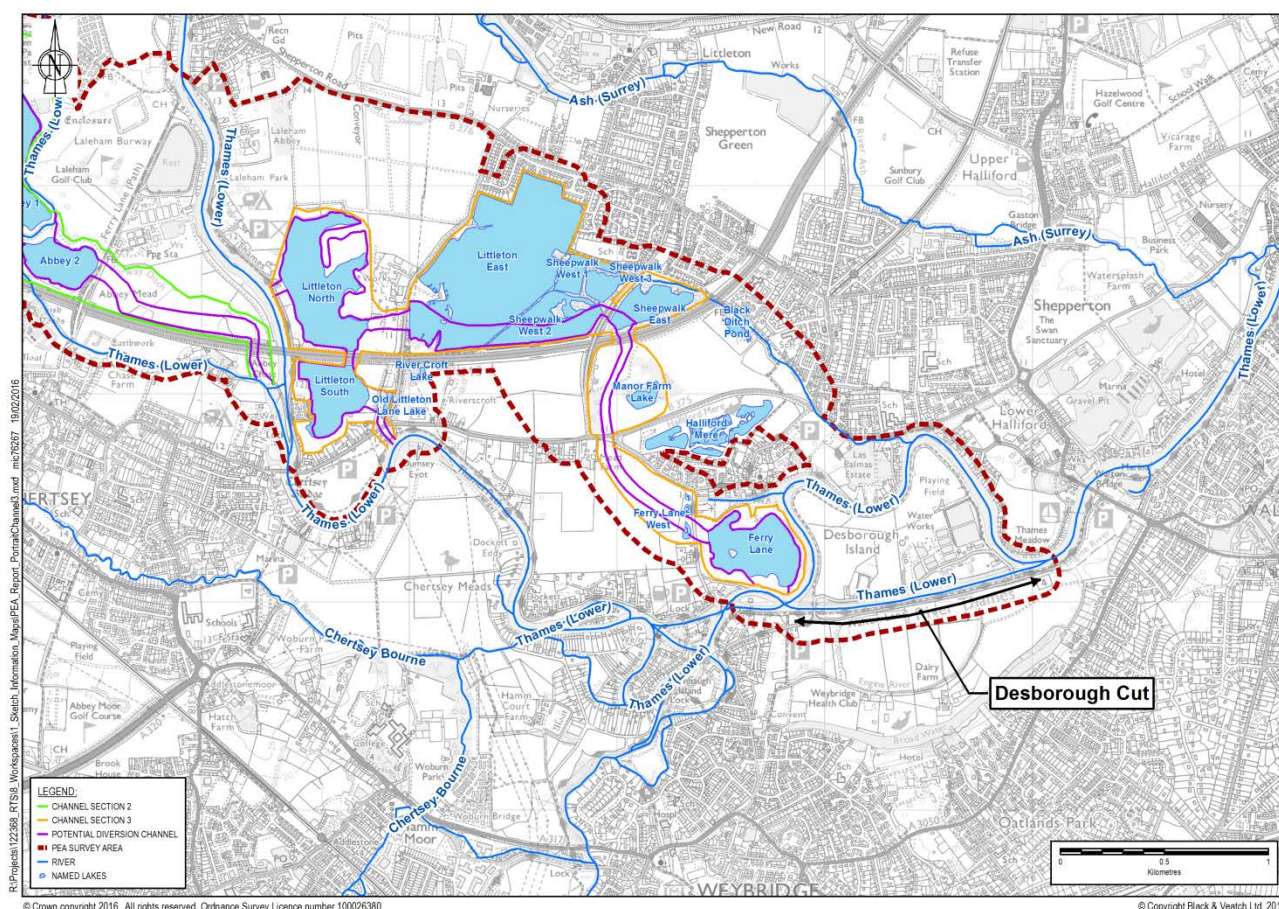


Figure 7.1: Named lakes and rivers within the PEA survey area for Channel Section 3 and Desborough Cut

7.1 Introduction

7.1.1 Figure 7.1 provides an overview of the proposed route of Channel Section 3, the location of the proposed capacity improvements to Desborough Cut and the Project’s naming convention for the lakes and stretches of river that are within this part of the PEA survey area. A summary of the study results for Channel Section 3 and Desborough Cut are provided below. Further details of species records are provided in Appendix B.

7.2 Designated sites

7.2.1 As with the other sections, the overall study area surrounding Channel Section 3 is crossed by a matrix of former gravel pits, some of which have been left as open water habitats following remediation. One of these water bodies has been designated as part of the SWLW SPA, which supports internationally important numbers of gadwall and shoveler that overwinter there. Five lakes have also been identified as supporting sites⁸ for the SWLW SPA; Little North, South and East Lakes, Sheepwalk East Lake and Ferry Lane Lake. The SWLW SPA covers one of three SSSIs within 2.5km of Channel Section 3. In addition to this one LNR, and 30 non-statutory SNCIs can be found within 2.5km of Channel Section 3 and Desborough Cut. Refer to the Designated

⁸ Those waterbodies outside of the current SWLW SPA and Ramsar site boundary but can be identified as important supporting sites using a threshold for the identification of such waterbodies where the three year mean peak count exceeds 1% of the cited SPA population for gadwall or shoveler.

Nature Conservation Sites figure (Figure 122368-BVL-Z0-SW-DR-V-00012) in Appendix D for the locations of the sites.

7.2.2 Table 7.1 provides details of the designated nature conservation sites within 2.5km of Channel Section 3 and Desborough Cut, including (where available) their reasons for notification. The table also provides the ecological value assigned to the site (in accordance with the criteria explained in Section 2.4).

Table 7.1: Designated Nature Conservation Sites within 2.5 km of the Channel Section 3 and Desborough Cut site

Unless otherwise stated against a specific item, this table incorporates biodiversity data supplied by SBIC (ID1361), TVERC (ID1268) and the Environment Agency (ID1028), and is copyright to SBIC, TVERC, the Environment Agency and/or its partners.

Designated Site Name	Distance from Channel Section (m) (approx.)	Reasons for Notification and Ecological Value
Statutory Sites		
South West London Water bodies (SWLW), SPA and Ramsar site	1580	A series of reservoirs and former gravel pits supporting a range of man-made and semi-natural open water habitats. These sites provide important feeding and roosting sites for wintering populations of gadwall and shoveler due to the numbers of European importance that occur. International and European value.
Dumsey Meadow SSSI	0	An unimproved neutral grassland habitat that is now rare in south east England. National value.
Thorpe Park No. 1 Gravel Pit SSSI	1580	A former gravel pit now supporting open water, scrub and woodland habitats. This SSSI is designated for the nationally important numbers of gadwall it supports in winter. National value. Note that this entire site is also part of the SWLW SPA and Ramsar site.
Chertsey Meads LNR	45	A remnant floodplain meadow habitat with rich floral lime-loving assemblages. Borough value.
Non-statutory Sites (SNCI)		
River Thames (and towpath) Spelthorne	0	This Section of River Thames is within the top 10% of UK watercourses for macroinvertebrate diversity. Supports a range of NERC Priority species including eel, salmon, sea trout, depressed river mussel and otter. Regional value.
Shepperton Quarry	0	Two large water bodies important for overwintering wildfowl. Borough value.
Sheepwalk Lake	0	Selected as an important wetland supporting bird assemblages of county importance for both wintering and summer breeding birds. Borough value.
Littleton Lake	0	Approximately 30 year old gravel working with mature stands of willow and scrub around lake. Borough value.

Designated Site Name	Distance from Channel Section (m) (approx.)	Reasons for Notification and Ecological Value
Ferris Meadows	0	A lake created after gravel workings. Several grassland habitats surround the lake. Borough value
Charlton Quarry	0	Eutrophic lake with grass margins and numerous willows. Broadleaved tree species have been planted. Borough value.
River Thames Elmbridge	20	Riparian habitat. Regional value
River Thames – Runnymede	25	Primarily riparian habitat. Regional value due in part to the importance of the River Thames to migratory fish (see Section 9).
Chertsey Meads	45	Calcareous grassland habitat. Borough value.
Desborough Island	45	Semi-improved neutral grassland habitat. Borough value.
Chertsey Water Works – Well Field	325	Semi-improved neutral grassland habitat. Borough value.
River Wey – Elmbridge	370	Primarily riparian habitat. Borough value.
Wey Navigation (including Addlestone Mill Pond)	405	Primarily riparian habitat. Borough value.
Chertsey Bourne at Chertsey Meads	600	Primarily riparian and open water habitats. Borough value
Laleham Burway Golf Course	690	Small pockets of semi-improved & unimproved grassland within an amenity grassland dominated golf course. Borough value.
Queen Mary Reservoir	780	Selected for its importance to wildfowl and visiting seabirds. The site lies in an important position close to the South West London SPA/Ramsar and adjacent to the West of Queen Mary Reservoir SNCI. Regional value.
River Ash SNCI: Splash Meadow to Gaston Bridge	870	This stretch of river supports the NERC Priority Species, European eel. The river is a good example of ‘natural river channel’ with a good pool and riffle system. Borough value.
River Ash: Splash Meadow	900	This stretch of river supports the NERC priority species, European eel. Extensive sedge beds are present including the NVC communities S5, S6, S7 and S14. Borough value.
Littleton Lake – Shepperton Green Reservoir	900	The lake supports diverse marginal vegetation with flat-stalked pondweed <i>Potamogeton friesii</i> recorded. It supports wetland habitats including NVC S6 and S7. It has also been reported as a refuge for wintering wildfowl including shoveler. Borough value.

Designated Site Name	Distance from Channel Section (m) (approx.)	Reasons for Notification and Ecological Value
Abbey Lake Complex	996	Primarily open water habitats. Borough value.
Woburn Park	1065	Primarily riparian habitat. Borough value.
River Ash: Shepperton Green	1085	This stretch of river supports the NERC priority species European eel and three nationally scarce species; fringed water-lily, intermediate water-starwort & yellow water-lily. Regional value.
Pannells Farm	1525	Wet grassland and pond habitats. Borough value.
West of Queen Mary Reservoir	1590	Selected for its importance to wildfowl and visiting seabirds. The site is adjacent to Queen Mary Reservoir. Borough value.
Penton Hook Island	1590	Selected for the diversity of wetland habitats supporting the nationally scarce round fruited rush & the Surrey scarce meadow crane's-bill. Regional value.
River Ash: Gaston Bridge to Watersplash Farm	1660	This stretch of river supports the NERC Priority Species, European eel. The river is a good example of a 'natural river channel' with a good pool and riffle system. Borough value.
Simplemarsh Farm	1940	Important area for birds. Borough value
The Heath	1990	Primarily semi-natural broad leaved woodland habitat. Borough value.
Ashford Plant	1995	A group of eutrophic lakes with steep sides and surrounded by willows and other broadleaved trees. Borough value.
Chertsey Bourne at Abbey Lake Complex	2410	Primarily riparian and open water habitats. Borough value.

7.3 Habitats and flora

- 7.3.1 The following sections detail the combined findings of the P1HS and desk based study of biological records data. The P1HS plans and target notes (TN) providing supplementary information are included in Appendix A.
- 7.3.2 A detailed list of protected and notable species for each channel section can be found in Appendix B.
- 7.3.3 The Channel Section 3 survey area (including Desborough Cut) can be characterised by three dominant habitat types: Standing water, broad-leaved semi natural woodland, and cultivated arable land. Another characteristic of the area to note is that this is very much a heavily disturbed landscape by quarrying activities, which are still ongoing in places. The old quarries have been used for landfill or have been remediated to lakes. The area, structure and composition of the dominant habitats are described below.

Standing water habitat

- 7.3.4 Accounting for approximately 22% of the habitat cover within the Channel Section 3 survey area, this habitat consists of four large aggregations of open water (Littleton Lakes, Sheepwalk Lakes, Halliford Mere and Ferry Lane Lake) and two significantly smaller water bodies (Manor Farm Lake and Black Ditch Pond). The majority of open water is situated north of the M3 in the Littleton and Sheepwalk Lakes (see Figure 7.1 for lake locations). As previously mentioned these water bodies are the result of remediated gravel and sand extraction pits, although it should be noted that Manor Farm Lake is the result of a land fill operation. These habitats are widely utilised for a range of recreational activities including, fishing, sailing, and water sports.
- 7.3.5 All of the water bodies are likely to support fish populations of varying sizes and assemblages due to a combination of commercial fisheries, intentional introduction by anglers, accidental escapes during flood episodes and natural colonisation processes (see Section 9 and 10 for results and recommendations relating to fish).
- 7.3.6 The margins of many of the lakes are much the same for the region, dominated by willow tree species *Salix spp.* forming broad-leaved semi natural woodland. Where breaks in the woodland occur, species such as common nettle, reedmace, branched bur-reed, willow herb, hogweed and hemlock are dominant.
- 7.3.7 The water bodies within the Channel Section 3 survey area are not included within the SWLW SPA; however, four of the lakes are supporting sites for the SWLW SPA, and the Littleton and Sheepwalk Lakes are locally designated for their assemblages of wintering and breeding waterfowl.
- 7.3.8 Other important species likely to utilise this habitat are: bats; a range of breeding bird species, widespread amphibian species such as common toad, and possibly common frog and common newt species where marginal habitats reduce predation by fish; otter; water vole; grass snake and possibly adder where amphibian prey and suitable adjacent habitat is abundant.

Broad-leaved semi natural woodland

- 7.3.9 Woodland within the Channel Section 3 area does not form the interconnected matrix like that found in Channel Section 1. This habitat type still has a broad distribution across the survey area, but it is limited to strips that partially run along the edges of other habitats or landscape features such as streams, lakes and roads. The exception is around Sheepwalk East Lake and Halliford Mere where cover is more or less continuous. As with other woodlands in the borough, a large percentage of the woodland may have originally been plantations used to screen the quarries but have since set seed and naturalised. Willow species dominate large proportions of the woodland habitats present, particularly those in close proximity to water. In places there are clusters of mature to veteran pedunculate and sessile oak that are likely to be the remnants of field boundaries and small woodlands present in the area prior to the quarries. Other species frequently encountered within the wooded areas include common alder, hawthorn, sycamore and ash and a high abundance of holm oak *Quercus ilex* around Halliford Mere.
- 7.3.10 Species likely to be supported by broadleaved semi-natural woodland include bats, Eurasian badger, potentially hazel dormouse, otter, all widespread amphibian species and great crested newt, a range of breeding bird species and possibly reptile species along edge habitats.

Cultivated/disturbed land – arable

- 7.3.11 Arable land is only present north of Littleton Lake at Laleham Farm where it is the dominant habitat type and overall represents 9% of the total habitat cover. It is believed, although not confirmed, that all of the arable land in this area is remediation for quarrying that is still occurring to the south and/or landfill.

7.3.12 This habitat type is generally of low habitat value for wildlife but can support a range of nesting birds both at ground level, within hedgerows and adjacent trees. Occasionally badger setts and reptiles can be found along field boundaries where there is sufficient cover available, although with recent remediation having recently occurred, in this instance it is considered unlikely.

Other habitats

7.3.13 An additional 26 other habitat types have been identified with Channel Section 3 and are listed in Table 7.2 below.

Table 7.2: P1HS habitat types identified within Channel Section 3 and Desborough Cut

Some linear features are not included within area and percentage calculations as they are too small and are shown as 'negligible' in these columns.

CHANNEL SECTION 3			
P1HS Code	P1HS Habitat Type	Total Area (km ²)	Percentage of Area Covered
G1	Standing water	1.04	22.32
A1.1.1	Broadleaved woodland – semi-natural	0.57	12.24
J1.1	Cultivated/disturbed land – arable	0.42	9.09
G2	Running water	0.36	7.78
J1.2	Cultivated/disturbed land – amenity grassland	0.35	7.46
B6	Poor semi-improved grassland	0.33	7.11
B2.2	Neutral grassland – semi-improved	0.3	6.35
B4	Improved grassland	0.29	6.25
I2.1	Quarry	0.18	3.83
C3.1	Other tall herb and fern – ruderal	0.13	2.67
A2.2	Scrub – scattered	0.12	2.59
A1.1.2	Broadleaved woodland – plantation	0.11	2.4
J3.6	Buildings	0.1	2.1
B2.1	Neutral grassland – unimproved	0.09	2
A2.1	Scrub – dense/continuous	0.08	1.76
A3.1	Broadleaved parkland/scattered trees	0.07	1.57
J4	Bare ground	0.06	1.34
J1.3	Cultivated/disturbed land – ephemeral/short perennial	0.04	0.81
F2.2	Marginal and inundation – inundation vegetation	0.01	0.13
A3.3	Mixed parkland/scattered trees	0	0.06
J2.6	Dry ditch	0	0.06
A1.3.2	Mixed woodland – plantation	0	0.04
A1.3.1	Mixed woodland – semi-natural	0	0.03
J3.5	Artificial sea wall	0	0.01
B5	Marsh/marshy grassland	0	0
J2.1.2	Intact hedge – species poor	Negligible	Negligible
J2.4	Fence	Negligible	Negligible
J2.8	Earth bank	Negligible	Negligible
J2.3.2	Hedge with trees – species poor	Negligible	Negligible
Total		4.68	100

- 7.3.14 The bulk of the remaining 26 additional habitats listed in Table 7.2 found within the survey area are grasslands of varying quality (approximately 27%) and running water (approximately 8%). Most grassland areas are found as large blocks, particularly neutral semi-improved grassland west of Ferry Lane Lake and on Desborough Island. Dumsey Meadows SSSI is the only location within the Channel Section 3 survey area containing unimproved grassland, the reason for its designation.
- 7.3.15 Six NERC priority habitats were identified within the survey area; eutrophic standing water, lowland mixed deciduous woodland, rivers, wood-pasture and parkland, hedgerows and lowland meadows.

Evaluation

- 7.3.16 Outside the designated sites, it is considered that the following habitats are of value **within the zone of influence**: broadleaved and mixed semi-natural woodland, scattered and dense scrub, standing water, neutral semi-improved grassland, and areas of broadleaved parkland. These habitats have primarily been valued due to their potential to support protected or notable species and/or the frequency at which they occur within the wider landscape.
- 7.3.17 Ephemeral perennial habitat can potentially be of value to some ground nesting birds and reptile species where succession within this habitat has resulted in the correct vegetation structure or interfaces along boundaries. Valuation of this habitat type cannot be completely confirmed without further surveys to identify species supported, but is likely to be no higher than **local value**.
- 7.3.18 All other habitats listed above in Table 7.2 are of **negligible value** either due to the frequency in which they occur within the wider landscape or their conservation value.

7.4 Protected and notable species

Bats

- 7.4.1 All UK bat species are listed as S41 species as well as being protected under the Habitats Regulations and WCA.
- 7.4.2 The riparian habitat, woodland edges and green corridors connected to the wider river valley of the River Thames have a high suitability for commuting and foraging bats, and much of the survey area is likely to be regularly used by bats for these purposes. Expected species for these types of habitats include: Noctule bat, Daubenton's bat, Leisler's bat, soprano pipistrelle bat, common pipistrelle and Natterer's bat.
- 7.4.3 The semi-natural broadleaved woodland, tree lined watercourses and parkland habitats present a wide range of potential hibernation opportunities for bat species that utilise trees for roosting. In addition, the urban areas in close proximity to Channel Section 3 and Desborough Cut provide a wide range of both modern and historical buildings with features suitable for bat species with preferences for these roost sites. This culmination of both urban and woodland roosting opportunities has the potential to support most UK bat species within their ranges.
- 7.4.4 Despite the good supporting habitat features for bats, there are very few bat records within the Channel Section 3 survey area, recording only one undefined pipistrelle species and one Daubenton's bat. It is highly likely that the presence of bat species is under recorded within the area.
- 7.4.5 Approximately 40 trees were provisionally identified as having some degree of bat roost potential within the Channel Section 3 survey area. However, this provisional identification does

not represent a systematic search of every block of woodland; hence it is likely that additional trees with favourable roost features are present in the area.

- 7.4.6 Standing and running water combined with woodland, and the connection to the wider River Thames corridor, is likely to make these portions of the survey area of high importance for bats, but no more than **local value** relative to the county. It should be noted that this is a preliminary assessment that may alter following further surveys to assess bat usage of the survey area and the presence / likely absence of bat roosts.

Great Crested Newts

- 7.4.7 GCN are listed as S41 species as well as being protected under the Habitats Regulations and WCA.
- 7.4.8 No biological records of GCN are present within the Channel Section 3 and Desborough Cut survey area, however 17 water bodies of suitable size (under 2000m²) for GCN exist within 500m of the proposed channel. It is likely that many of the 17 water bodies identified contain fish, a strong (but not absolute) excluding factor for GCN breeding. It is also likely that on a wider landscape scale, large scale habitat fragmentation from disturbance and development in the area will have had a detrimental effect upon historic GCN populations. However, it is possible that isolated GCN populations may still remain within the area; this cannot be verified without survey.
- 7.4.9 Based upon the habitats present and likely presence of fish in most water bodies the preliminary assessment of habitat for GCN concludes it is of **local value**. This valuation may change following further necessary surveys.

Reptiles

- 7.4.10 Reptiles have legal protection against killing and injury under the WCA.
- 7.4.11 The semi-improved grassland, scattered scrub, poor semi-improved grassland and some areas of disturbed ephemeral vegetation throughout the survey area provide suitable habitat for wide spread reptile species. Edge habitat, where interfaces between habitat boundaries create varied vegetative structure, are also likely to provide suitable habitat. Edge habitats include areas such as river banks, scrub, and woodland boundaries, clearings or rides, and the edge of tracks and roads.
- 7.4.12 Habitat areas of particular interest for reptiles include; the disturbed ephemeral, scrub and grassland mosaic habitat surrounding Manor Farm Lake and immediately west of Sheep Walk Road, south of the M3; the areas of semi-improved grassland west of Ferry Lane Lake; and potentially the semi-improved grassland on Desborough Island, although this site is very isolated by the River Thames, making any isolated populations vulnerable to changes in habitat management. Although there are no records of reptile within the survey area, grass snakes are likely to be the most frequently encountered reptile species within the area due to their strong affinity with freshwater habitats.
- 7.4.13 Although further surveys are required to evaluate the importance of different habitats, overall the survey area is considered to be of up to **local value** for reptiles.

Badgers

- 7.4.14 Badgers are protected from disturbance whilst occupying a sett, through the Protection of Badgers Act 1992.
- 7.4.15 Badgers habitat preference for sett location is that of slightly convex slopes in well-draining areas with some degree of tree or shrub cover, although where population density is high or

habitat availability is limited, exposed slopes, canals and river banks close to ground water levels may be used. Free draining slopes within the edge of woodland are ideal habitat for badgers. The occurrence of sands and gravels within the survey area and the ample cover of scrub and woodland habitat mean that a healthy population of badgers could be present relative to the land available.

- 7.4.16 No field signs of badgers were recorded during the survey and no biological records for badgers exist within the Channel Section 3 and Desborough Cut survey area. As there is adequate supporting habitat for badgers within the area it is highly likely that the lack of records is due to badgers being under reported.
- 7.4.17 Overall, the site is considered to have **local value** for badgers in the context of the surrounding landscape.

Birds

- 7.4.18 All birds, their nests and eggs are protected under Sections 1-8 of the WCA making it an offence to damage or destroy the nest of a wild bird whilst breeding. Certain species of bird, for example the barn owl, bittern and kingfisher receive additional protection under Schedule 1 of the WCA (Schedule 1 birds), which affords them protection against disturbance.
- 7.4.19 None of the water bodies within the Channel Section 3 survey area are designated under the SWLW SPA, however, due to the spread and size of open water habitats in the area it is likely to support a wide range of water fowl and provide supporting habitat to the SPA birds (see Section 7.2).
- 7.4.20 Biological records data for the survey area indicate the presence of nine species of protected birds as listed under Schedule 1 of the WCA; scaup, kingfisher, Slavonian grebe, fieldfare, green sandpiper, greenshank, hobby, little ringed plover and redwing. Six records exist for the survey area that feature birds only listed as NERC priority species. Details on both protected and notable bird species can be found in Appendix B.
- 7.4.21 Considering the wide range of habitats that different bird species will utilise for nesting, most habitats within the survey area have the potential to support further Schedule 1 birds, NERC bird species and unlisted bird species generally protected under the WCA.
- 7.4.22 It is considered that those survey areas that are not already designated are of **local value** for birds.

White-clawed crayfish

- 7.4.23 There are no biological records of white-clawed crayfish available for the Channel Section 3 and Desborough Cut survey area. The majority of lakes are composed of fine gravels and sediments, which is likely to limit potential refuge locations. Possible refuge locations are restricted to steep sided banks and root masses in areas where water levels are unlikely to significantly change, but wave action removes sediment. There are no records of alien crayfish species within the lakes that would otherwise be an excluding factor for white-clawed crayfish (although the presence of alien crayfish in the River Thames indicates a risk of transfer of this species to lakes which flood with River Thames water during flood events). The general habitat quality is considered to be of value within the **zone of influence** within the lakes.
- 7.4.24 North American signal crayfish have been recorded within the River Thames in the Channel Section 3 survey area, hence it is likely that they are present within Desborough Cut. Desborough Cut is considered to be of **negligible value** for white-clawed crayfish.

Otters

- 7.4.25 Otters are listed as S41 species as well as being protected under the Habitats Regulations and WCA.
- 7.4.26 No evidence of otters was found during the extended P1HS, however two otter sightings have been recorded in the vicinity of Ferry Lane Lake and the River Thames. As many of the lakes are within close proximity to the River Thames and are well stocked with fish, it is highly likely that otters will be visiting the survey area. Human activity in these areas is likely to be a limiting factor on the location of holts and couches, although there are some limited, secluded areas for this to still occur. Based upon the above factors it is considered that the habitats present have value **within the zone of influence** for this species. If holts or lay-up sites are found to be present during further surveys, this will increase the value of the site for otters.

Water voles

- 7.4.27 Water are listed as NERC Section 41 Priority Species as well as afforded protection by the WCA. The water bodies within the Channel Section 3 survey area were of much the same habitat quality for water voles as in Channel Sections 1 and 2. Most water bodies have slow flows and sufficiently deep water, however, poor bank profiles and over shading from woodland, and the resulting decrease in riparian cover, is likely to be an excluding factor. Two records for water voles exists for Pool End Ditch near Sheepwalk East Lake, hence it is possible that patchy populations may occur across the lakes and ditches in this area where conditions are suitable. Pool End Ditch is considered to be of **local value** to water voles. Based upon the above factors it is considered that the other habitats present have value **within the zone of influence** for this species. Desborough Cut is generally considered unsuitable for water voles due to hard engineered banks. The north bank is heavily shaded and while the south bank is sufficiently vegetated and receives sufficient sunlight, hard engineering may restrict water vole burrowing opportunities.

Hazel dormice

- 7.4.28 Dormice are listed as a NERC S41 species as well as being protected under the Habitats Regulations and WCA. There are currently no records of dormice within the Channel Section 3 and Desborough Cut survey area. It is also noted that a large region to the south west of London (including the RTS study area) lacks records of dormice (Bright and Morris, 2005). This apparent lack of dormice may be due to historical disruption of the habitats (via mineral extraction) combined with urban development. Historical disruption and loss of habitats is likely to have led to isolated and vulnerable dormice populations which ultimately were not sustainable or have dwindled to a level that is difficult to detect.
- 7.4.29 The habitats usually associated with dormice are woodland, scrub and hedgerows; however habitat connectivity, size, structural diversity and floral assemblages influence a habitat's suitability to support dormice. The woodland within the Channel 3 and Desborough Cut survey area does form a limited matrix locally, however this has mostly formed in recent decades and is bisected by linear features (such as rivers and busy roads) and urban developments that disconnect the survey area from the wider landscape, greatly limiting any chance of recolonisation. Little of the woodland possessed a well-developed or diverse shrub layer associated with good dormouse habitat, probably due to historical block tree planting of limited diversity resulting in a uniform tree canopy and shading, and a habitat less favourable for dormice.
- 7.4.30 Hedgerows are limited throughout the Channel Section 3 survey area and are generally species poor, hence they are unlikely to be supporting dormice populations. Much of the scrub has grown up from species poor hedges, planting schemes or natural succession after historical damage from gravel extraction has occurred. The general size, low diversity and distribution of most of the stands of scrub within the area are unlikely to support dormice.

- 7.4.31 Based upon the above points it is considered that the habitats within the Channel Section 3 and Desborough Cut survey area are of **negligible value** for dormice.

Terrestrial invertebrates

- 7.4.32 Five records of protected or notable terrestrial invertebrates exist within the Channel 3 survey area; stag beetle *Lucanus cervus*; one NERC butterfly species, small heath and three NERC moth species (shaded broad-bar *Scotopteryx chenopodiata*, cinnabar and grey dagger *Acronicta psi*). However, given the size and range of habitats present within the survey area it is likely that additional species will be present. Habitats likely to be of particular importance are lake and river margins, semi-improved grassland veteran trees and dead wood habitats. It is considered that the species present are likely to be of **local value**.

7.5 Aquatic ecology

Zooplankton

- 7.5.1 All of the lakes surveyed have a zooplankton fauna that is diverse and shows no impact of specific stressors. Only one *Cladocera* species of interest has been recorded, *C. setosa*, which was found in all lakes surveyed (Environment Agency, 2015b). Similarly to the other channel sections a conservation value of **local** is assigned to the zooplankton communities.

Macroinvertebrates

- 7.5.2 All of the lakes surveyed have a macroinvertebrate community that is diverse and shows no impact of specific stressors. No macroinvertebrate species of statutory conservation status have been recorded, but several nationally rare species are present, including the caddisfly *L. lusitanicus* and the triclad *B. punctate*. The beetles *B. luridus*, *Helochares lividus* and *O. rivularis*, all of which are typical of marsh drains and ponds, were recorded from Littleton North, while a single specimen of the beetle *Gyrinus urinator*, normally, associated with running water, has been recorded from Littleton South. A single specimen of the rarely encountered leech *Glossiphonia verrucata* was recorded from Ferry Lane. With the exception of *L. lusitanicus*, which was common in all lakes, each of these species is known from only a single lake. At Littleton North, large numbers of the blue-tailed damselfly *I. elegans* (Odonata) were recorded in May 2014 (Environment Agency, 2015b).
- 7.5.3 On the main River Thames, there is an Environment Agency monitoring point at Sunbury, downstream of the survey area, which supports a diverse fauna but includes no records of the depressed river mussel in contrast to Channel Section 1. Among nationally rare species, the caddisflies *C. senilis* and *L. lusitanicus*, the leech *G. paludosa* and the mayfly *Ephemera lineata* have been recorded. Also recorded at this site, was the beetle *Ochthebius exsculptus*⁹, which is typical of shallow running waters, and the mayfly *Heptagenia fuscogrisea*⁹, a large river species confined, in the southern England, to the lower Thames valley (Environment Agency, 2015b). Surveys at this site indicate a benthic invertebrate community of High status in 2014 for both spring and autumn samples (Environment Agency, 2015b). Sampling undertaken by the Environment Agency as part of the 2014 RBMP cycle 2 on the Thames (Egham to Teddington) WFD waterbody (ID: GB106039023232), provided an assessment of Good status for benthic invertebrates (see Appendix D for WFD waterbody ID numbers and locations).
- 7.5.4 As in Channel Sections 1 and 2, several of the invertebrate species highlighted above demonstrate the importance of stands of submerged and emergent vegetation in supporting a diverse species assemblage.

⁹ These species score relatively highly in the Community Conservation Index (CCI) (Chadd & Extence, 2004), but have no statutory designation.

7.5.5 The invertebrate fauna of Littleton North includes four nationally rare species. Therefore this lake is of **borough** importance. For the wider survey area within Channel Section 3, a conservation value of **local** is assigned.

Macrophytes

7.5.6 As in Channel Section 1, the only macrophyte species of conservation value present is the stonewort *N. ealan* which occurs in Littleton East. Because of the presence of an apparently healthy population of this species, Littleton East is considered to be of **national** importance (Environment Agency, 2015b).

7.5.7 Otherwise, macrophyte assemblages indicate WFD classification of moderate or poor for the six lakes surveyed (Environment Agency, 2015b) and on the main River Thames (Egham to Teddington) WFD water body (ID: GB106039023232) an assessment of Poor status is provided for macrophytes and phytobenthos combined as part of the 2014 RBMP cycle 2 (see Appendix D for WFD locations). Similar reasons for these classifications as cited for Channel Section 1 are assumed, and consequently these water bodies are assessed as being of **negligible** conservation value.

7.6 Invasive non-native species

7.6.1 Twenty seven invasive non-native species were identified within the Channel Section 3 survey area (including the WFD water bodies crossed by the proposed diversion channel) either via the survey or records data (see Section 2.3 for data sources and categorisation of 'INNS'). A species list of this data is presented in Table 7.3 and a detailed map is available in Appendix D.

Table 7.3: INNS identified within Channel Section 3 and Desborough Cut Survey Area including WFD Water bodies

Impact levels on native species are derived from the TAG WFD working paper 'Revised classification of aquatic alien species according to their level of impact' (2015)(ID1805). Does not include 'unknown' impact species.

Common Name	Latin Name	Impact on Native Species
Northern river shrimp	<i>Crangonyx pseudogracilis</i>	Low
New Zealand mudsnail / Jenkins spire shell	<i>Potamopyrgus antipodarum</i>	Moderate
Nuttall's waterweed	<i>Elodea nuttallii</i>	High
Mysid crustacean	<i>Hemimysis anomala</i>	High
Himalayan balsam	<i>Impatiens glandulifera</i>	High
Rhododendron	<i>Rhododendron ponticum</i>	High
Zebra mussel	<i>Dreissena polymorpha</i>	High
Chinese mitten crab	<i>Eriocheir sinensis</i>	High
Orange balsam	<i>Impatiens capensis</i>	Low
Sweet flag	<i>Acorus calamus</i>	Low
Pikeperch (zander)	<i>Sander lucioperca</i>	Moderate
Water weed	<i>Elodea spp.</i>	High
Japanese knotweed	<i>Fallopia japonica</i>	High
Common carp	<i>Cyprinus carpio</i>	High – waiting
Giant hogweed	<i>Heracleum mantegazzianum</i>	High
Demon shrimp	<i>Dikerogammarus haemobaphes</i>	High
Asiatic clam	<i>Corbicula fluminea</i>	High
Floating pennywort	<i>Hydrocotyle ranunculoides</i>	High
Grass carp	<i>Ctenopharyngodon idella</i>	Low
Canadian waterweed	<i>Elodea canadensis</i>	High
New Zealand pigmyweed	<i>Crassula helmsii</i>	High

Common Name	Latin Name	Impact on Native Species
Monbretia	<i>Crocoshmia × crocosmiflora</i>	Low
Signal crayfish	<i>Pacifastacus leniusculus</i>	High
Pink purslane	<i>Montia sibirica</i>	Low
Rainbow trout	<i>Oncorhynchus mykiss</i>	Low
Cape pondweed	<i>Aponogeton distachyos</i>	Low
Water fern	<i>Azolla filiculoides</i>	High

- 7.6.2 In addition to the above list, it should be noted that in late September 2014 the quagga mussel *Dreissena rostriformis bugensis* (High Impact, currently on waiting list) was confirmed as being present near to the River Thames. This was the first UK record of this species, which was recently identified as the INNS of most concern to UK ecosystems (APEM and URS, 2014). This species is already known to be present within the River Thames corridor and, due to its rapid ability to colonise, there is considered to be a high risk of it either being present within the study area already or it being present by the time of the Project's construction and/ or operation.
- 7.6.3 The macroinvertebrate fauna in the lakes included the zebra mussel which are established and common in most of the lakes surveyed, although may be absent from Ferry Lane. The moderate impact gastropod snail New Zealand mud snail/ Jenkins spire shell is present in all of the lakes surveyed. Other non-native macroinvertebrate species noted as being present during surveys, which are currently all classified as 'low' or 'unknown impact' by UKTAG, include: northern river shrimp, the gastropod *P. acuta* and Tricladida *D. tigrina*. Littleton North and Littleton South are the only lake sites in which the non-native amphipod *C. curvispinum* was recorded. Littleton North is one of three lake sites in which the non-native Tricladida *P. torva* has been recorded (Environment Agency, 2015b).
- 7.6.4 On the River Thames, INNS invertebrates include the polychaete *Hypania invalida* and the gastropod *Ferrissia clessiniana* (Gastropoda) which are unknown impact species. Further downstream, the semi-terrestrial amphipod *Cryptorchestia* (formerly *Orchestia*) *cavimana* has been recorded at Hampton, and the high impact Asiatic clam extends upstream to Kingston.
- 7.6.5 Among the macrophytes INNS, two high impact aquatic species are present Nuttall's waterweed, normally common in all lakes surveyed, while the New Zealand Pigmyweed has been recorded from Littleton North and Ferry Lane (Environment Agency, 2015b).
- 7.6.6 A number of non-native fish species have been recorded within Channel Section 3 and Desborough Cut survey area (see Section 9 and 10). Of particular concern is the moderate impact non-native zander *Sander lucioperca* which has been recorded at Shepperton Weirs 1 and 2 in 2008, during Environment Agency boom boat surveys (ID 644). This predator is of particular concern as it has been documented as capable of adversely affecting prey fish densities, including salmonid, smolts and especially cyprinids (Botham, 2011). Similarly to the other channels, the high impact common carp has been recorded from a number of lakes and on the main river Thames (ID 1259 and 644). The low impact non-native rainbow trout has also been recorded at Halliford Mere (ID 1259).
- 7.6.7 As with the other two Channel Section survey areas, Japanese knotweed tended to be close to waste land and roads due to the tendency for it to be fly-tipped or be present within landfill. Himalayan balsam tended to be in close proximity to watercourses and lakes due to habitat preferences and mechanisms of dispersal. Waterweed was widely present in most (if not all) lakes.

7.6.8 No systematic search was made for INNS during the P1HS. It is likely that the current data set for INNS is not a complete and reliable list of all INNS currently within the study area. Given the nature of the site (heavily disturbed, urban-rural environment, fishing and water sports), the risk of INNS being more widespread than currently recorded or additional unrecorded species being found is considered to be high.

8 Recommendations: Channel Section 3 and Desborough Cut

8.1 Introduction

8.1.1 The results of the desk study and P1HS have identified the following ecological features which have the potential to be affected (directly or indirectly) by the scheme proposals as they are currently known, in the absence of mitigation and reasonable avoidance measures. The likely impacts on features affected are discussed below, along with any required further survey work and /or measures to be employed to mitigate for the potential effects of the scheme on the identified ecological receptors. This assessment of impacts and recommendations should be reviewed as the design is developed.

8.2 Designated sites

8.2.1 Direct temporary construction impacts and potentially permanent operational impacts are anticipated within seven SNCI sites and SWLW SPA supporting sites¹⁰: Shepperton Quarry, River Thames (and towpath) Spelthorne, Littleton Lake, Sheepwalk Lake, Charlton Quarry, Ferris Meadows and River Thames Elmbridge.

8.2.2 A significant habitat change caused by Channel Section 3 is likely to occur where the proposed channel crosses land at Charlton Quarry where ephemeral / disturbed land will be replaced with a riparian habitat. It is considered that the effect of Channel Section 3 could increase connectivity to the wider landscape via creation of a green corridor and provide a wider range of habitats on site, thereby improving biodiversity. The grass borders and lake features cited within the SNCI are unlikely to be significantly altered.

8.2.3 Considerable changes are also likely to occur within Ferris Meadows and along Desborough Cut. Removal of bank (at Ferris Meadows) separating Ferry Lane Lake from the River Thames is proposed, and will result in the replacement of approximately 10% of the overall cover of semi-natural broadleaved woodland and poor semi-improved grassland with riparian habitat.

8.2.4 Temporary construction impacts within the SNCI sites should be manageable via standard industry best practice measures, and are unlikely to have an effect on the medium to long term integrity of the designated sites' interest features. As many of the SNCI sites affected are riparian or open water habitats, particular attention will need to be given to the careful timing of works in relation to overwintering birds and the control of sedimentation. Further input from environmental professionals should be sought at each stage of the project progression to ensure the latest best practice is integral with designs, programmes and contracts.

8.2.5 Permanent operational effects of the proposed channel on the designated sites cannot be quantified at this stage, as further studies are required prior to reaching conclusions. Further research and assessments required to inform the Project are currently ongoing or are planned for the near future. These include, but are not limited to; the consideration of hydraulic performance e.g. flow types and velocities; potential changes to water quality (including the risk of algal blooms) and associated changes to fish and other aquatic species which play a crucial role in the ecological functioning of the designated waterbodies; further targeted ecological surveys of water bodies; potential changes to pathways or habitat suitability for INNS; and, changes to the availability and suitability of habitat for protected species (see Table 2.1 and Section 12). The results of these research areas and assessments (and the findings of this Flood Channel PEA) will be used to inform the HRA, EIA and WFD Assessment (as well as specific

¹⁰ Although not technically designated sites, five lakes that are supporting sites to the SWLW SPA. The effects upon these sites will be taken into consideration during HRA.

consenting and consultation requirements for designated sites) that will be required for the Project.

8.3 Habitats and flora

8.3.1 The general implications of impacts on each dominant habitat type are discussed below. Channel Section 3 and Desborough Cut fall within the local authority boundaries of Elmbridge and Spelthorne and relevant policies from their Core Strategies are listed in Appendix C.

Broad-leaved semi-natural and plantation woodland & scattered trees

8.3.2 The proposed channel will result in the removal of a low percentage of predominately semi-natural woodland and smaller amounts of broad-leaved plantation and scattered trees within the survey area. Semi-natural woodland has a high biodiversity value relative to other habitat types and the project should seek to mitigate the loss of woodland wherever possible with like for like replacement quantities. However, the location of planting should consider current and future value of existing habitats.

8.3.3 It is recommended that when detailed design is finalised, that tree protection plans (TPP) for trees being retained within or adjacent to working areas should be put in place prior to construction commencing. TPPs should follow British Standard BS5837:2012 '*Trees in relation to design, demolition and construction – recommendations*' and be produced by an Arboricultural Association approved consultant of suitable experience. These plans are also likely to be requested by local authority tree officers or countryside officers.

8.4 Protected and notable species

8.4.1 In accordance with local planning policies and legislation, loss or disturbance of protected or notable species should be avoided. The Environment Agency is also governed by a number of statutory obligations on the conservation of biodiversity. For example, the Environment Agency has an obligation regarding conserving biodiversity and restoring or enhancing a population or habitat (NERC). Details of these statutory obligations are available in Appendix C. Channel Section 3 (including Desborough Cut) falls within two local authorities and relevant policies from their Core strategies are listed in Appendix C.

Bats

8.4.2 Any individual trees or woodland requiring removal or likely to be damaged or disturbed (including noise disturbance) as a result of the works, will require further survey.

8.4.3 Any removal of or disturbance to habitat likely to be important for foraging or commuting should be assessed to determine the likely impact on bats. Further surveys may be required to confirm usage and value. The scheme should be designed to ensure no significant impact to connectivity.

8.4.4 Any further surveys or inspections that are required should be carried out in line with best practice survey methodologies, (Bat Conservation Trust, 2016). Preliminary roost assessment of trees is best conducted between December and March. Ground level bat activity surveys i.e. transects and static detectors, are best conducted in the optimal months of April, September and October, but can be conducted in the sub-optimal months of March to August inclusive. The need and timings for emergence / re-entry surveys would be determined by the preliminary roost assessments and the type of roost suspected, in line with Bat Conservation Trust (2016) guidance.

Great Crested Newt

- 8.4.5 If GCN are confirmed then the scheme could result in permanent loss of supporting terrestrial habitat and temporary impacts upon and habitats during construction. It is recommended that habitat suitability index (HSI) assessments be conducted on the 17 water bodies identified within 500m of the proposed channel and Desborough Cut in line with methodology of Oldham et al. (2000). If results are found to be favourable for GCN then further surveys will be required to establish GCN presence/likely absence and (potentially) population estimates. If confirmed, the presence of GCN will likely require a mitigation licence to be sought from the issuing authority Natural England. HSI surveys can generally be conducted from March to September inclusive, although the optimal month is May. GCN surveys can be conducted mid-March to mid-June, with at least two to three of these visits required during mid-April to mid-May depending on survey objectives. See *Great Crested Newt Mitigation Guidelines* (English Nature, 2001) for details. eDNA survey methods for presence / likely absence can be used between 15th April to 30th June. Mitigation will need to be designed to ensure no impact to the population status of GCN that are found

Reptiles

- 8.4.6 Due to the scale of the proposed Channel Section 3 and Desborough Cut capacity improvements, there is potential for reptile populations to be significantly impacted at a local or zone of influence scale if adjacent habitat lacks sufficient carrying capacity. On this basis it is recommended that further reptile surveys be conducted to establish presence/likely absence in the identified habitats (as described in section 7.4.11) directly affected by the channel route and related construction activities.
- 8.4.7 Reptile surveys can be conducted between March and October during suitable weather (optimal months are April/May and September), and should follow the survey methodology of Foster and Gent (1996) and Froglife Advice Sheet 10 (1999). It should be noted that reptile exclusion from an area can require between 60 and 120 suitable days (minimum figures quoted), therefore it is essential that surveys and exclusion activities are initiated well in advance of construction e.g. two seasons. If adjacent receptor habitat for exclusion is unavailable or unsuitable, then either site enhancement needs to occur, or an alternative receptor site identified well in advance of exclusion measures i.e. the reptile habitat must be well established at the receptor site.
- 8.4.8 Where works are small-scale (under 100m²) and habitat manipulation is considered likely to be effective, clearance of tall ruderal vegetation, rough grassland, or scrub should be undertaken in two stages over two consecutive days to allow reptiles to disperse. This can only be undertaken in mild weather conditions (and between April and October) when reptiles are active i.e. when the temperature does not fall below 9 degrees centigrade overnight (Langton *et al*, 2001) and where suitable adjacent habitat is retained.

Badgers

- 8.4.9 Badgers setts were not identified within 30m of the currently proposed path of the diversion channel. However, given that badgers are a widespread, common species in the Thames area and can rapidly establish new setts in relation to changes in resources and circumstances, it is recommended that further surveys be conducted before the start of construction.
- 8.4.10 Further consideration of potential impacts of the scheme upon badgers will be undertaken in during the EIA process. The habitats within 30m of works, storage and access areas should be re-assessed prior to construction to confirm the absence/presence of badger setts. Badgers are protected whilst occupying a sett and mitigation may be required if an active sett(s) is discovered. Availability of foraging habitat is unlikely to be significantly affected.

Birds

- 8.4.11 All vegetation clearance including trees should be undertaken outside of peak bird breeding season (March to September inclusive). If clearance is required during this period, nesting bird checks should be undertaken by a suitably qualified ecologist prior to clearance. If an active nest is identified, work must cease until the young have fledged.
- 8.4.12 Disturbance of important overwintering bird species at SSCI sites designated for waterfowl species or supporting SPA bird populations should be avoided via careful programme management and timing of works outside of the overwintering period.

White-clawed crayfish

- 8.4.13 It is recommended that, where impact could occur, further crayfish surveys be conducted of the lakes within the Channel Section 3 survey area that are of good to high water quality to determine the presence of white-clawed crayfish or invasive crayfish species likely to exclude white-clawed crayfish. White-clawed crayfish surveys can be conducted any time between mid-July to mid-September inclusive under appropriate licence from Natural England as required.

Water voles

- 8.4.14 The scale of the proposed channel has the potential to temporarily remove significant stretches of water vole habitat if present. Permanent loss of habitat can be avoided with careful design. As such, further surveys are recommended for this species in all suitable habitat within 100m of the works areas. These should be carried out during the appropriate survey season (March to October) and follow best practice survey methods. A boat may be required where deep water prevents wading.
- 8.4.15 If impacts on water voles cannot be avoided, mitigation may comprise habitat manipulation, where appropriate, or trapping and release into a suitable receptor area nearby. If displacement or trapping and translocation is required, this will need to be carried out under licence from Natural England.

Otters

- 8.4.16 Pre-construction otter surveys should be undertaken within 70m of any works required on the lakes, rivers, brooks and streams. If an otter holt or lay-up site is found within the survey area, appropriate mitigation should be implemented, this may require an EPS development license.
- 8.4.17 During construction, watercourses or their banks should not be blocked or obstructed. Any excavations left overnight should be left with suitable egress to allow otters to escape. Harmful substances should be locked away overnight. There should be no light spill onto the watercourses.
- 8.4.18 Stringent Pollution Control Measures should be implemented and the Environment Agency's Pollution Prevention Guidance should be followed for any in-channel works.

Hazel dormice

- 8.4.19 Dormice are generally considered to be absent from all Channel Section survey areas due to abiotic factors i.e. industry, development and subsequent land remediation negatively impacting habitat and populations. Further surveys are not recommended based upon the current evidence.

8.5 Aquatic ecology

- 8.5.1 Refer to Section 4.5 for recommendations related to aquatic ecology.

8.6 Invasive non-native species

- 8.6.1 There are a number of INNS species that have been identified within Channel Section 3 and Desborough Cut (Section 7.6 lists the INNS present).
- 8.6.2 Refer to Section 4.6 for recommendations related to INNS.

9 Results: Fish

9.1 Introduction

9.1.1 This section describes the baseline conditions for fish and includes the following:

- Protected fish species (an overview).
- The overall fish assemblages present in each channel section.

9.1.2 Information on designated sites which may list fish as a feature or ornithological features that prey on various fish species are provided in Tables 3.1, 5.1 and 7.1.

9.2 Protected fish species (an overview)

9.2.1 Protected fish species recorded within 1km of the PEA survey area are shown in Table 9.1 below, although this distance has been extended where there is potential for protected species located elsewhere to move into the survey area. Detailed information on the relevant UK and European legislation and its impact on the development works are provided in Appendix C.

9.2.2 Fish species afforded protection under UK legislation include; the European eel *Anguilla anguilla*, Atlantic salmon *Salmo salar*, brown/sea trout *Salmo trutta* and barbel *Barbus barbus*. Atlantic salmon and barbel are listed in Schedule 4 (Regulation 43 (1) (a)) of the Conservation of Habitats and Species Regulations 2010 which is concerned with animals which may not be captured or killed in certain ways and therefore of particular relevance to the scheme where construction work has the potential to cause a direct impact on these species. The NERC Act 2006, Section 41 (England) includes the European eel, salmon and brown trout as species of principal importance for conserving biodiversity and therefore due consideration to the status of this species should also be taken into account when assessing potential impacts of the scheme.

9.2.3 Other species to be noted as present include bullhead *Cottus gobio* within all three flood channels. Also brook lamprey have been recorded within Channel Section 1 at Datchet 2, further upstream on the main River Thames at Boveney Main Reach survey site (TMFG32) (ID: 644) and within Channel Section 2 on the Chertsey Bourne. An unidentified lamprey has also been recorded at Twynersh Lakes within Channel Section 2. Bullhead and brook lamprey are listed under Annex 2 of the Habitats Directive (Council 92/43/EEC) which is concerned with designating core areas of their habitat as Sites of Community importance (SCIs), but they are not included in the Conservation of Habitats and Species Regulations 2010 and therefore not specifically protected under UK legislation.

Table 9.1 UK Protected Fish Species Records within 1 km of the PEA survey area

Unless otherwise stated in the table this table incorporates biodiversity data supplied by SBIC (ID1361) and the Environment Agency (ID1028, ID644, ID1799), and is copyright to SBIC and the Environment Agency and/or its partners.

Species Name	Location	Data Owner and Notes	Relevant Legal protection and conservation status
River Thames – Channel Section 1 and surrounding tributaries and lakes			
European eel <i>Anguilla anguilla</i>	River Thames, tributaries and surrounding lakes	Environment Agency, Surrey Biological Information Centre	NERC Act S.41, Eel (England and Wales) Regulations 2009, and IUCN Red List-Critically Endangered
Barbel <i>Barbus barbus</i>	River Thames and tributaries	Environment Agency	The Conservation of Habitats and Species Regulations (HabsRegs) 2010 Schedule 4
Atlantic salmon <i>Salmo salar</i>	River Thames, Wraysbury Reservoir and nearby lake (unnamed) near to Battle Bourne	Environment Agency, Migratory route and present in the reservoir	NERC Act S.41, HabsRegs 2010, Schedule 4 Salmon and Freshwater Fisheries Act (SAFFA)
Brown and sea trout <i>Salmo trutta</i>	River Thames and tributaries, Datchet 2	Surrey Biological Information Records, Environment Agency Migratory route	NERC Act S.41 and SAFFA
River Thames – Channel Section 2 and surrounding tributaries and lakes			
Atlantic salmon <i>Salmo salar</i>	River Thames, Abbey 1	Environment Agency Migratory route	NERC Act S.41, HabsRegs 2010 Schedule 4, SAFFA
European eel <i>Anguilla anguilla</i>	River Thames, tributaries and lakes	Environment Agency Migratory route	NERC Act S.41, Eel (England and Wales) Regulations 2009 and IUCN threat category: Critically Endangered
Brown and sea trout <i>Salmo trutta</i>	Chertsey Bourne	Environment Agency	NERC Act S.41, SAFFA
Barbel <i>Barbus barbus</i>	River Thames	Environment Agency	HabsRegs 2010 Schedule 4
River Thames – Channel Section 3 and surrounding tributaries and lakes			
Barbel <i>Barbus barbus</i>	River Thames, Desborough	Environment Agency	HabsRegs 2010 Schedule 4
European eel <i>Anguilla anguilla</i>	River Thames, tributaries and surrounding lakes, Desborough	Environment Agency. Migratory route	NERC Act S.41, Eel (England and Wales) Regulations 2009 and IUCN Red List, Critically Endangered
Atlantic salmon <i>Salmo salar</i>	River Thames, Haliford Mere, Desborough, Near Hamhaugh Island	Environment Agency. Migratory route	NERC Act S.41, HabsRegs 2010 Schedule 4, SAFFA
Brown and sea trout <i>Salmo trutta</i>	River Thames, Desborough, Near Hamhaugh Island, Ferry Lane and Haliford Mere	Environment Agency Migratory route	NERC Act S.41, and SAFFA

- 9.2.4 The European eel has been regularly recorded across the entire study area (i.e. the lakes, River Thames, surrounding tributaries and small rivers) (ID 644, ID 1799). This species is listed as critically endangered on the IUCN Red List, with a considerable decline noted in the past 20 years and over 90% across its geographical range (IUCN Red List Accessed 04/01/2016; Zoological Society of London, 2015). A host of factors have been implicated including barriers to migration, climate change, exploitation, changing hydrology, habitat loss, pollutants and predation (IUCN Red List, Accessed 04/01/2016). The eel is subject to national conservation work under the Eel (England & Wales) Regulations 2009, which affords powers to the Environment Agency to implement measures for the recovery of European eel stocks including measures to ease barriers to migration. Major investment is currently underway to implement statutory protection measures against the entrainment of eel at all major potable water intakes on the lower Thames (Environment Agency, 22nd March 2016, pers. comm.).
- 9.2.5 A European eel monitoring project has also been running within the River Thames catchment since 2005 to assess the presence of juvenile eels migrating upstream from April to October, identify restrictions to their movement and to gather long term data on trends (Zoological Society of London, 2015). The limit of the Thames eel population appears to be approximately 50-60km upstream of the tidal limit in the main channel and tributaries. The project has shown an increasing trend in elver recruitment between 2012 and 2014 and this mirrors observations of elver recruitment across Europe. However, data acquired in 2015 indicates a poor year for elver recruitment in the Thames and across Europe (Environment Agency, 22nd March 2016, pers. comm.).
- 9.2.6 Environment Agency juvenile surveys have frequently recorded bullhead on the River Thames tributaries (e.g. Chertsey Bourne) and Desborough (ID 644, ID 1799). There are also Environment Agency records of a low number of bullhead being present within the lakes, including: Datchet 2 and 3, Church Lammas lake, Horton 4, Hythe End East, Wraysbury Reservoir and West and Lake (No name); Within the Channel Section 2 study area: at Abbey 1, Lake South of Green Lane and Twynersh Lakes; Within Channel Section 3: Littleton East and South, Ferry Lane and Halliford Mere. Bullhead is considered to be widespread and common across almost the whole of England and occur on the bottom of a variety of rivers, streams and stony lakes (www.jncc.gov.uk). This species has a restricted home range. This species favours fast flowing, clear shallow water with a hard substrate (gravel, cobble, pebble) and frequently found in headwaters of upland streams as well as lowlands on softer substrates, so long as the water is well oxygenated and there is sufficient cover. It is rarely found in polluted rivers.
- 9.2.7 Barbel has been recorded fairly frequently during Environment Agency boom boat and juvenile surveys on the main River Thames and tributaries (ID 644, ID 1799). This species often occurs in medium to large rivers with fast currents and gravel bottom and occasionally in lakes, normally only when stocked. This species frequently overwinter in large groups, which may be inactive or active in slow flowing rivers habitats. Adults often form shoals and hide under overhanging trees or bridges during the day. This species migrate to spawn over distances ranging from 2-20km, which usually takes place in very shallow, fast-flowing riffles (Kottelat and Freyhof, 2007; Lucas *et al.*, 1998). Spawning has been recorded from March to July in the UK, with eggs deposited in excavations in the gravels (Kottelat and Freyhof, 2007; Lucas *et al.*, 1998). The River Colne includes an important spawning site for barbel. The weir pools and associated channels are also likely to be key recruitment areas for barbel (Environment Agency, 22nd March, 2016, pers. comm.)
- 9.2.8 Both salmon and trout have been recorded in small numbers and infrequently in the River Thames during Environment Agency surveys (ID 644), and catch returns for both species are low (Jacobs, 2009 cited in Environment Agency, 2010b). There are a few Environment Agency records for Atlantic salmon, which has been recorded within Abbey 1 within Channel Section 2 and at Haliford Mere Lakes within Channel Section 3. Brown/sea trout have also been recorded

within Channel Section 1 at Datchet 2, as well as within Channel Section 3 at Ferry Lane and Haliford Mere. Although, salmon have been recorded in the lakes, their presence is likely to be rare and an outcome of flooding events in the past (Environment Agency, 17th May, 2016, pers. comm.). Salmon are anadromous (i.e. adults migrate from the sea to breed in freshwater) and spawn in the upper reaches of the River Thames, upstream of the study area. They are a widespread species in the UK, which are found in many rivers, many of which have adult runs in excess of 1000. The latest estimates of the UK spawning population size are, however, about 50% down on the ten-year average (jncc.defra.gov.uk). Threats include pollution, physical barriers to migration, exploitation from netting and angling and degradation of spawning and nursery habitats. Several of the Thames tributaries are designated as salmonid waters (Environment Agency, 2010b).

9.3 Channel Section 1 (overall fish assemblage)

- 9.3.1 In addition to the protected fish species mentioned previously it is also important to give due consideration to the overall fish assemblages across the study area, as they are an important component of aquatic ecosystems and can be sensitive indicators of habitat degradation, environmental contamination and overall ecosystem productivity. They may also provide a prey source for other species in the food chain, including some birds (e.g. cormorants) and mammals (e.g. otters) and provide a valuable recreational resource for many anglers. It is also important to consider the River Thames, its tributaries and in particular the associated floodplain together (encompassing the lakes), as these can represent important areas of refuge, as well as major spawning and nursery areas for some fish (Nunn *et al.*, 2007, cited in Nunn and Cowx, 2014).
- 9.3.2 The Channel Section 1 study area encompasses 39 lakes (refer to Figure 3.1 in Section 3.1), with at least 24 known to provide an important recreational fishing resource; Datchet 2, Sunnymeads 4, Kingsmead Island Lake, Crayfish Pool, Horton 1, Kingsmead 1 (N), Kingsmead 1 (S), Church Lake, Wraysbury 1 (N), Wraysbury 1 (S), Wraysbury 2 (N), Wraysbury 2 (S), Blenheim Lake, Hythe End West, Hythe End Central, Hythe End East, Wraysbury Hilton, Lower Hythe Gravel Pit 1, Lower Hythe Gravel Pit 2, Lower Hythe Gravel Pit 3, Lower Hythe Gravel Pit 4, The Moor Gravel Pit (Lake), Queensmead Lake and Church Lammas Lake (ID 1259).
- 9.3.3 Species information is available for 19 of the lakes. Overall at least 21 species are known to be present which include the protected European eel and Atlantic salmon. Other notable species include bullhead and brook lamprey. The remaining fish assemblage comprises common bream *Abramis brama*, chub *Leuciscus cephalus*, crucian carp *Carassius carassius*, common carp *Cyprinus carpio*, mirror carp (a variant of the *Cyprinus carpio*), perch *Perca fluviatilis*, pike *Esox lucius*, rudd *Scardinius erythrophthalmus*, roach *Rutilus rutilus* (and hybrids), gudgeon *Gobio gobio*, goldfish *Carassius auratus* and tench *Tinca tinca*. Other notable non-native species such as Koi carp *Cyprinus carpio* have also been recorded from Queensmead Lake, grass carp at Church Lake and the European wels catfish at Horton 1 (ID 1259; ID 1028; ID 644; ID 1799) (see Section 3.6). Rainbow trout and the brown trout have also been recorded within the Kingsmead Complex (Environment Agency, 2010b). There is little fish data on the remaining five lakes (i.e. Sunnymeads 4 and Lower Hythe Gravel Pit 1-4) but carp is possibly present (ID 1259). However, these are planned to be surveyed by the Environment Agency as detailed in Table 2.1.
- 9.3.4 Environment Agency annual adult boom boat survey data (2004-2014) for the main River Thames has been utilised across the study area (ID 644). Analysis of data from 2010 to 2014 shows an overall downward trend in the number of individuals and numbers caught per minute, although in 2014 there appears to be a slight increase in numbers from 2013. For the Channel Section 1 survey area, Environment Agency survey sites extending from upstream of Datchet Intake (TMFH40) to Bell Weir (TMFJ45) on the main River Thames have been utilised, albeit the lower survey reaches have sometimes extended into the Channel Section 2 survey area. At least 18 species have been recorded which include the protected European eel (including elvers),

Atlantic salmon, barbel and brown/sea trout. Other species include bleak *Alburnus alburnus*, chub, common carp, common bream, dace *Leuciscus leuciscus*, gudgeon, Koi carp, perch, pike, roach (and hybrids), rudd, ruffe *Gymnocephalus cernuus*, silver bream *Blicca bjoerkna* and tench.

- 9.3.5 Within the Channel Section 1 survey area, on the main River Thames, roach were the most abundant species in terms of number of individuals in 2006, 2008-2013 (ID 644). Roach, a eurytopic¹¹ cyprinid is ubiquitous in the lower River Thames. The dominance of this species reflects habitat suitability and availability in the study area and its ability to occupy a range of habitat types (Cascade, 2013). This species has a varied diet, feeding on benthic invertebrates, zooplankton, plant material and detritus. This species can undertake short or long spawning migrations (e.g. ranging from 100m to 10km), with diel movement up to 1.3km (Lucas *et al.*, 1998; Peirson and Sumner 2013). Roach breed among dense submerged vegetation in backwaters or lakes, flooded meadows or in shallow, fast flowing river habitats on plant or gravel bottoms around March to June (Kottelat and Freyhof, 2007; Lucas *et al.*, 1998).
- 9.3.6 Bleak was the most abundant species in 2004, 2005, 2008 and 2014 on the main River Thames (ID 644). This eurytopic species is also able to occupy a range of habitat types within the study area and inhabit open waters of large lakes and medium to large rivers. Adults can occur in shoals near the surface. This species carries out potamodromous spawning migrations usually around April to July (Juradjda *et al.*, 1996 and Prignon *et al.*, 1996 all cited in Lucas *et al.*, 1998). The substrate is not important to this species although it spawns in shallow riffles or along stony shores of lakes and occasionally above submerged vegetation (www.iucnredlist.org accessed on 02/01/2016; Kottelat and Freyhof, 2007). As such it is not ecologically sensitive to changes in flow patterns or substrate.
- 9.3.7 Environment Agency juvenile monitoring survey data (2003-2015) for the Old Windsor Survey reach on the main River Thames and other studies have also been utilised for the Channel 1 Section area (Cascade, 2013; Nunn and Cowx, 2014; ID 644). These studies have identified a range of spawning habitats to be present along with self-sustaining populations of a number of eurytopic and rheophilic¹² fish species, with localised spawning of species of strictly rheophilic and limnophilic¹³ species (Nunn and Cowx, 2014). During these surveys, at least 16 species of fish have been captured, many of which were the same as those recorded during the adult boom boat surveys, including the protected barbel. Bullhead were again recorded, as well as other species including the three spined stickleback *Gasterosteus aculeatus*, ten spined stickleback *Pungitius pungitius*, minnow *Phoxinus phoxinus* and stone loach *Barbatula barbatula* (Cascade, 2014). The data show the annual top characterising species has varied between chub, gudgeon, roach, dace and minnow *Phoxinus phoxinus*. In more recent years, minnow dominated samples in 2012 to 2014 and roach in 2015. Monthly comparisons of juveniles present at different sites showed some degree of variation in their preferred habitats (Cascade, 2013). Surveys undertaken in 2011 (May to September) found dace to be the most recorded species in May; roach in June and August; and minnow in July and September. In 2012 (May to September), bullhead was the top characterizing species in May, dace in June, and minnow in July, August and September. Old Windsor also recorded the highest mean juvenile densities of all the juvenile survey reaches in May (0.16 fish m⁻²), August (5 fish m⁻²) and September (22 fish m⁻²) in 2012. It should also be noted that most catches were considered to be substantially smaller than average in 2012 (e.g. August catch = 4,701 compared to August 2007-2011 mean = 19,488) which was attributed to the cool and extremely wet summer of 2012 (Cascade, 2013).

¹¹ Definition: An organism able to tolerate a wide range of habitats or ecological conditions.

¹² Definition: An organism preferring to live in fast flowing water.

¹³ Definition: An organism which prefers to live in lakes, ponds, marshes, pools or other slow moving or still waters.

- 9.3.8 In terms of the WFD and data extracted from the Environment Agency Catchment Planning System on 15th February 2016, no current biological assessment is provided for fish as part of the 2015 RBMP cycle for the Thames (Cookham to Egham) riverine water body. An earlier assessment of High was however provided as part of the 2009 RBMP cycle.
- 9.3.9 Environment Agency electrofishing data for the Colne Brook tributary has been utilised as it is one of the most comprehensive datasets available and covers a number of years (1986-2014). Furthermore, this tributary runs fairly closely to the current proposed flood channel alignment and meets the River Thames at a confluence approximately 50m downstream of the Channel Section 1 outfall. At least 17 species are present, with many of those already listed for the main River Thames, including the protected barbel and European eel (various life stages elvers and glass eels). At least 1926 individuals have been captured over this 29 year time frame, with roach accounting for largest number of individuals caught (26%), followed by perch (18%), dace (11%) and chub (10%). Bullhead has also been recorded within this tributary (ID 1800).
- 9.3.10 Environment Agency fish data are also available for the River Colne and Wraysbury River, which have no direct connectivity to the proposed flood channel alignment, but converge with each other and meet the main River Thames at a confluence approximately 1.7km downstream of the Channel Section 1 outfall. In terms of protected species, Environment Agency surveys have recorded barbel, brown/sea trout and European eel as present in Wraysbury River (ID 1800).
- 9.3.11 For the River Colne, which includes the River Colne (from county boundary to Staines Moor) Stanwell Moor SNCI, this area is recognised as supporting a diverse fish community including the European eel and containing a spawning site for barbel (ID 1028). These two protected species were also recorded during the Environment Agency surveys and there is an SBIC record for brown trout (ID 1800 and ID 1361).
- 9.3.12 There is very limited survey data for Datchet Common Brook which will be intercepted by the proposed flood channel. Species recorded in the one year of sampling and at only one site included minnow, bullhead, stone loach and perch (ID 1799).
- 9.3.13 In terms of the WFD, biological assessments of fish based on the 2015 RBMP cycle provides an assessment of Bad for Colne Brook riverine WFD water body. The species driving this failure include chub, dace, roach, minnow and bullhead which are recording lower than expected numbers (Environment Agency, 25th April 2016, pers. comm.).
- 9.3.14 The conservation value of the waterbodies in relation to fish within the Channel Section 1 is as follows:
- The main River Thames is considered to be of **regional** importance, as it provides a migratory route for a number of protected species which include Atlantic salmon, European eel, barbel and brown/sea trout. The weir pools also provide important areas for barbel recruitment. Furthermore, Environment Agency adult boom boat and juvenile surveys have identified a range of species to be present which form an important component of the overall fish assemblage within this large riverine stretch.
 - Some of the tributaries within the study area are considered important for fish, although they are not on the main migratory route for Atlantic salmon. There is a paucity of information for these watercourses and those that directly intercept with the proposed flood channel alignment, therefore it is difficult to assign a conservation value to these. Nevertheless, the data show protected species such as barbel and European eel to be present on the Colne Brook. The Colne Brook is also designated as a WFD water body which is currently failing on the fish WFD element. The River Colne is also noted as supporting a spawning site for barbel as well as being designated a SNCI. Consequently, on the basis of the data provided it is likely the conservation value for the tributaries will

range from being of **local** to **borough** importance, with the River Colne assigned a conservation value of **borough**.

- For the lakes, again it is difficult to assign a conservation value to fish due to the paucity of information. However, there are a few individual records of the presence of some protected species, including the European eel and Atlantic salmon. However, as discussed previously the latter species is likely to be rare in the lakes and present due to past flooding events across the area. As these lakes are not considered to be a main migratory route for protected species they are assigned a conservation value primarily of **local**. Lakes such as Wraysbury No.1 Gravel Pit, Wraysbury and Hythe End Gravel Pits and Wraysbury Reservoir (which are designated as SSSIs and form part of SWLW SPA and Ramsar) which include ornithological features such as cormorant, great crested grebe and goosander which prey on fish, these lakes are assigned a higher conservation value of **borough** importance for fish.
- For the all of the waterbodies within the Channel Section 1 study area, an overall conservation value of **regional** is assigned for the combined River Thames, tributaries and the associated flood area complex (including the lakes), which can represent important areas for refuge, feeding, spawning and nursery areas for some fish species.

9.4 Channel Section 2 (overall fish assemblage)

- 9.4.1 The Channel Section 2 study area encompasses 16 lakes (refer to Figure 5.1 in Section 5), with at least eight known to provide an important recreational resource for fishing; Egham Hythe Pond, Lakes West of Thorpe Lea Road (N), Lakes West of Thorpe Lea Road (S), St Ann's Lake, Abbey 1 aka Beomonds Lake, Abbey 2 (aka Abbey Lake), Twynersh Lakes (x2) (ID 1259).
- 9.4.2 Species information is available for six of these lakes which are known to contain at least 13 species including the protected European eel and Atlantic salmon. Other species include the bullhead, common bream, common carp, mirror carp, perch, pike, rudd, roach, bleak, gudgeon and tench (ID 1259; ID 1028; ID 644; ID 1799). For the remaining two lakes, Abbey 1 aka Beomonds Lake and Abbey 2 (aka Abbey Lake), there is limited information with American signal crayfish recorded as present within both lakes, along with carp and eels present at the latter (ID 1259).
- 9.4.3 Environment Agency boom boat survey data (2004-2014) for the main River Thames has been utilised for three sites at Penton Hook (TMFK46, TMFK47, TMFK47a) which are located within the Channel Section 2 study area. Surveys recorded 16 species, with roach consistently the most abundant species in terms of the number of individuals in most years (i.e. 2004-2007 and 2010-2013) as well as gudgeon (2008 and 2009) and dace (2014) in other years (ID 644).
- 9.4.4 Gudgeon was also the most abundant species in 2008 and 2009 on the main River Thames. It occurs in nearly all types of riverine and lacustrine habitats, fast flowing rivers with sand or gravel bottoms and also occurs in some still waters (Cascade, 2013; Peirson and Sumner, 2013; Kottelat and Freyhof, 2007). This species form schools and is known to breed in shallow water over stones, sand or plant material (Kottelat and Freyhof, 2007). Gudgeon usually spawn between April to August, as temperatures rise above 13°C. Its diet consists of a wide variety of large benthic invertebrates (IUCN Red List Accessed on 29/01/2016).
- 9.4.5 Dace recorded the most number of individuals on the main River Thames in 2014. This species inhabit moderate to fast-flowing large streams to large rivers with rock or gravel bottom. Adults aggregate in dense swarms in winter in the lower reaches of rivers or backwaters and often migrate to spawning streams in autumn and overwinter there. Dace usually breed between March to April and spawn in fast-flowing water on shallow gravel beds, often in small tributaries (Kottelat and Freyhof, 2007).

- 9.4.6 Environment Agency juvenile monitoring data (2003-2015) for Staines and Laleham Abbey survey reaches on the main River Thames, has shown the top characterising species in terms of the number of individuals has varied. At Laleham Abbey, roach dominated samples taken in 2008-2012 and in 2015, gudgeon and dace in 2013 and minnow in 2014 (Cascade, 2013; Nunn and Cowx, 2014; ID 644). Monthly sampling at this site also recorded roach as the dominant species in May to August, and chub in September 2011. In contrast, from June to September 2012, this varied between dace, gudgeon and chub. In June 2012, Laleham Abbey also recorded the highest diversity ($H'=1.20$) of all the sites surveyed (Cascade, 2013; ID 1654).
- 9.4.7 At Staines the top characterising species varied between roach in May; gudgeon in June; minnow in July and September; and dace in August 2011. In 2012, dace dominated samples in June-August; and gudgeon in September. Staines recorded the highest diversity of all sites surveyed in May 2012 (Cascade, 2013).
- 9.4.8 With regard to the tributaries, there is limited Environment Agency survey data for the Chertsey Bourne which has some connectivity with the scheme via St Ann's Lake. Across the three surveyed sites on this river only the protected European eel has been recorded (ID 1799).
- 9.4.9 Data extracted from the Environment Agency Catchment Planning System on 10 February, 2016 for biological assessments of fish, provided a WFD assessment of Good for Chertsey Bourne (Chertsey to River Thames confluence) and Bad for Chertsey Bourne (Virginia Water to Chertsey) riverine water bodies. No assessments are provided for fish as part of the 2015 RBMP cycle for the Thames (Egham to Teddington) riverine water body.
- 9.4.10 The conservation value of the waterbodies within the Channel Section 2 is as follows:
- The main River Thames is considered to be of **regional** importance, as it provides a migratory route for a number of protected species such as Atlantic salmon, European eel and barbel. The River Thames (and Towpath)-Spelthorne SNCI designation is also present within this Channel Section 2 study area, which is considered to be in the top 10% of UK watercourses for macroinvertebrate diversity but also cites European eel, salmon and sea trout as present. The riverine stretch also comprises important fish assemblages.
 - Similarly, some of the tributaries are considered important for fish but as there is a paucity of information for these watercourses and those that directly intercept with the proposed flood channel alignment, it is difficult to assign a conservation value. Nevertheless, the data show protected species such as European eel and brown/sea trout as present on the Chertsey Bourne. Based on the limited available data, the conservation value for these watercourses are considered to be of **local to borough** importance.
 - For the lakes, these are assessed as being primarily of **local** importance for fish due to the presence of the European eel and a few individual records of Atlantic salmon, although the latter is likely to be present due to past flooding events. The lakes are clearly important in terms of providing important habitat within the floodplain complex.
 - For the all of the waterbodies within the Channel Section 2 study area, an overall conservation value of **regional** is assigned for the combined River Thames, tributaries and the associated floodplain areas including the lakes, which can represent important areas for refuge and feeding as well as spawning and nursery areas for some fish species.

9.5 Channel Section 3 (overall fish assemblage)

- 9.5.1 There are 16 lakes that fall within the Channel Section 3 (including Desborough Cut) study area (refer to Figure 7.1 in Section 7.1). Nine are known to provide an important recreational resource for fishing; Littleton North, Littleton South, Littleton East, Sheepwalk West 1, Sheepwalk West 2, Sheepwalk West 3, Sheepwalk East, Ferry Lane BRPS and Haliford Mere (ID

1259). At least 15 fish species are known to occur in these lakes; including the protected European eel and Atlantic salmon. The remaining fish assemblage comprises bullhead, brown trout, common bream, silver bream, common carp, crucian carp, mirror carp, perch, pike, rudd, roach, tench and rainbow trout (ID 1259; ID 1042; ID 1028; ID 644; ID 1799). INNS fish species are discussed in more detail in Section 7.6.

- 9.5.2 Environment Agency adult boom boat survey data (2004-2014) extending from Chertsey Main to Shepperton Weir stream survey sites on the River Thames (i.e. TMFL48, TMFL48a, TMFM53, TMFM54, TMFM55, TMFM55a, MFM55b) has been utilised for this survey area (ID 644). During the boom boat surveys, at least 20 species have been recorded across this survey stretch, which include many of the same species as described for the other channels, along with the protected Atlantic salmon, barbel, brown/sea trout and European eel (including elvers). Roach consistently recorded the most number of individuals in all years (2004-2014). Additional species include the non-native zander at Shepperton Weirs 1 and 2 in 2008, as well as the ghost carp *Cyprinus carpio*. INNS fish species are discussed in more detail in Section 7.6.
- 9.5.3 Environment Agency juvenile monitoring survey data (2003-2015) for Desborough Island survey reach and other studies has been utilised for the Channel Section 3 survey area (Cascade, 2013; Nunn and Cowx, 2014; ID-644). At least 13 species including the protected barbel as well as other species including the bullhead, bleak, chub, common bream, perch, roach, dace, gudgeon, roach, minnow, ruffe and pike have been recorded. The top characterising species has varied between chub (in 2013), gudgeon (2012 and 2014) and roach (2015) (Cascade, 2013; ID 644). Monthly juvenile sampling in 2011, also varied with roach dominating in May and June; gudgeon, roach, chub and perch in July; chub and roach in August; and chub and dace in September 2011. In the following year, dace was the most abundant species in June and July; gudgeon in August; and chub in September.
- 9.5.4 There is limited data for the tributaries of the River Thames in Channel Section 3. Environment Agency fisheries data available for the River Ash, which connects to the Thames approximately 3.2km downstream of the Channel Section 3 outfall, shows the European eel to be present. The River Ash also includes a number of SNCI stretches which cite the rivers importance for European eel.
- 9.5.5 The conservation value of the waterbodies within the Channel Section 3 includes:
- For the main River Thames, this is considered to be of **regional** importance, as it provides a migratory route for protected species such as Atlantic salmon. The River Thames (and Towpath)-Spelthorne SNCI designation is also present within this Channel Section 3 study area, which cites European eel, salmon and sea trout as present.
 - Similarly, some of the tributaries are considered important for fish but as there is a paucity of information for these watercourses and those that directly intercept with the proposed flood channel alignment, it is difficult to assign a conservation value. In light of the limited available data a conservation value ranging from **local to borough** importance is assigned. The River Ash is assigned a conservation value of **borough** due to the importance of eel within the SNCI stretches.
 - For the lakes, these are assessed as being of **local** conservation importance for fish, with protected species present including a number of records for European eel and a few records for Atlantic salmon, with the latter species likely to be present due to past flooding events. These lakes are clearly important in terms of providing important habitat within the floodplain complex.
 - For the all of the waterbodies within the Channel Section 3 study area, an overall conservation value of **regional** is assigned for the combined River Thames, tributaries

and the associated floodplain areas, which can represent important spawning and nursery areas for some fish species.

10 Recommendations: Fish

10.1 Channel Section 1, 2, 3 and Desborough Cut

- 10.1.1 The desk study has identified that fish will be affected (directly or indirectly) by the scheme proposals as they are currently known, in the absence of mitigation and reasonable avoidance measures. Possible effects are discussed below, along with any required further survey work and /or measures to be employed to mitigate the potential effects of the scheme. This preliminary assessment of potential impacts and recommendations should be reviewed as the design is developed through the Project's environmental assessment process.
- 10.1.2 Fish surveys that are currently planned to be undertaken by the Environment Agency for the lakes that are likely to be affected by the works are shown in Table 2.1. A summary of all recommendations for surveys and other proposed measures are shown in Table 12.1.
- 10.1.3 During the construction and operational phases of the Project, there are a number of key potential impacts which require careful consideration.
- 10.1.4 The Project has the potential to lead to some direct loss of aquatic habitats, which may provide an important resource for fish (e.g. macrophytes providing refuge areas, food source and suitable spawning habitat). If construction is primarily confined to the periphery of the lakes, it is anticipated there would only be some small scale loss of existing aquatic habitats, especially as most of the surveyed lakes were noted as being steep sided, with heavy shading by trees, which has limited the development of marginal vegetation (Environment Agency, 2015b). If construction has the potential to remove larger areas of aquatic vegetation, then opportunities for habitat enhancement measures to support fish populations should be sought as mitigation. Furthermore, due consideration should also be given to maintaining and developing any current habitat enhancement measures that have been implemented within the study area to support fish species (e.g. along the Abbey River).
- 10.1.5 There is potential for the passage of fish to be impeded, including protected species, via a number of potential barriers (e.g. physical presence, hydrological). For example, during the construction phase this may occur due to the installation of the intake structures, flood channels and weirs, along with the presence of coarse trash screens potentially required on the minor structures controlling inflows and outflows of watercourses intersecting the new flood channel sections. All of these works have the potential to cause some barrier effects to the movement of some fish species and further subsequent effects including increased predation. Thus, all construction works should facilitate the continued passage of fish species, including migratory species, where possible. During the operation of the scheme there is also potential for similar effects on fish as those described during construction, and consequently measures are required to facilitate continued movement of fish species (e.g. provision of suitable fish passes and installation of low lying weirs along the new flood channels).
- 10.1.6 During the construction phase there is potential for an increase in noise levels from various activities including piling which may occur as part of the temporary and permanent works (e.g. for the road bridges with abutments and piers, for the vertical sided sections of the channel etc.). The subsequent effects on fish will vary according to the sensitivity of the fish present, but the effects will vary from behavioural (e.g. barrier and avoidance) to injury and mortality. The construction methodology has still to be confirmed, but nevertheless a noise assessment should be undertaken, as part of the EIA, on the potential levels that could be generated and mitigated accordingly.

10.1.7 During the operation of the scheme, the diversion of some flood water into the flood channels also has the potential to lead to the subsequent intake of fish of various life stages into the flood channel. This has the potential to lead to the establishment of new fish populations, derived from the River Thames as well as the lakes and possibly the intersected small watercourses, within the flood channels. Consequently, there are a number of potential options which require careful consideration dependent on location specific conservation objectives (e.g. free passage, isolating stocked lakes and management of INNS etc.), some of these include:

- Installation of suitable intake structures, along with an adequate fish return system, if feasible and desirable, to try and maintain some degree of separation of fish populations occurring on the main River Thames with those occurring within the lakes, as well as minimising the mixing of stocks between the lakes;
- Installation of suitable fish passes, as discussed previously, along the flood channels, so as to facilitate the safe passage of migratory species; and/or
- Consideration to providing a weir design which is passable to fish without the need for a fish pass.

10.1.8 During construction and operation there is potential for hydromorphological changes in a number of watercourses, which may lead to direct and indirect effects on fish. For example, an alteration in water levels, flows, connectivity between surface watercourses and frequency of flooding events especially across some of the lakes may lead to a change in the wetted area, extent of habitats, subsequent level of competition for resources between fish species, increased predation on fish, mixing of fish stocks and a change in fish community structure etc. To minimise the potential for significant adverse effects, careful consideration should be given to maintaining existing hydrological connectivity wherever possible, creating suitable hydrological conditions wherever feasible in existing watercourses that may be affected and newly created flood channels to support new fish populations. Construction methodologies for the flood channel embankments should seek to minimise disturbance and stress to fish (e.g. consideration to the use of cofferdams or partial drainage rather than the complete draining out of water from the lakes).

10.1.9 The scheme has potential to lead to water quality changes during construction from the following sources:

- Direct disturbance of potential contaminated sediments (e.g. in the landfill areas) and the leaching of contaminants into the various water bodies;
- Direct disturbance of sediments within the lakes and the mobilisation of sediments into the water column potentially increasing suspended sediments and contaminants levels, leading to a subsequent reduction in the water quality;
- Where the flood channel intersects other watercourses, there is potential for impoundment and alterations in connectivity to affect various water quality parameters (e.g. temperature); and
- Accidental spillage from machinery etc.

10.1.10 During the operation of the scheme, diverted flood water from the main River Thames into the new flood channels, comprising elevated suspended sediments and nutrients (especially phosphates), also has the potential to lead to a deterioration in water quality, especially across the lakes, in the intersected watercourses and potentially at the discharge points on the main River Thames where flooding occurs to new areas or in greater frequency than under baseline conditions.

10.1.11 These water quality changes may have direct adverse effects on fish, including physiological and behavioural responses (e.g. mortality in fish from the clogging effects of suspended sediments, avoidance behaviour in adults to suspended sediments, reduction in the ability of fish to locate prey due to reduced visibility etc.). There is also potential for indirect adverse effects on fish populations, whereby other biological elements (e.g. change in phytoplankton, zooplankton and benthic invertebrate communities) on which fish may rely, are adversely affected. Consequently, suitable measures to minimise the water quality impacts will be required (see Section 11 and 12).

10.1.12 At this stage it is difficult to precisely quantify the scale of potential impacts; however, the forthcoming hydraulic, sediment and water quality modelling will provide more detail to inform future environmental assessments (e.g. EIA and WFD Assessment).

10.1.13 The potential positive effects of the scheme are also currently being explored as part of an ongoing stakeholder engagement process. Potential enhancement measures could include:

- The opening up of the backwaters to provide additional habitat which may be utilised to varying degrees by various species, if designed appropriately and within the constraints of the scheme;
- Providing additional refuges in affected watercourses (e.g. sinking any trees that are removed as part of the scheme or designing custom built refuges);
- Improving marginal habitats, encouraging macrophyte growth;
- Consideration to the deposition of gravels in some margins;
- Creation of some shallow areas; and
- Consideration to some short length naturalised bypass channels.

10.1.14 The above, and other measures that may be developed, have the potential to minimise the effects of predation, provide shelter during flood events and for some species there is the potential to provide further spawning and nursery areas. Consequently, the potential to maximise the ecological potential within existing affected areas and within the flood channel (e.g. habitat enhancement opportunities) will be considered as the scheme develops and following further surveys (e.g. fish and hydromorphology) (see Section 11 and 12 and Table 2.1).

10.1.15 Continued dialogue should also be maintained with Environment Agency fisheries specialists throughout the Project in order to continue to benefit from their local knowledge, survey data and to establish suitable mitigation measures (for example determining any consenting requirements and/or time constraints that should be adhered to for all aspects of the work).

11 Conclusions

- 11.1.1 The size and the scale of all the works required for the RTS Flood Channel (in three sections) and Desborough Cut capacity improvements mean that outline design, detailed design and construction will extend over several years. Currently it is anticipated that the Flood Channels will not be ready for use at least until 2024.
- 11.1.2 In light of the Project timeframes, habitat features, status and population dynamics of species may alter prior to the completion of the works. This report summarises the dominant habitat types and suitability for protected and notable species at the time of the survey, and provides a preliminary assessment of the impacts based on current design where possible.
- 11.1.3 Further detailed planning and assessment of potential changes across the whole study area are required to enable the proposed works. Of particular importance is the need to identify any potentially significant effects on designated conservation sites, particularly the SWLW SPA (comprising a number of SSSIs) and Thorpe Hay Meadow SSSI. It will also be important to consider effects that may arise from changes in the non-designated areas that are recognised as supporting sites to the SWLW SPA. Assessment of such likely changes and the need for any further mitigation and compensation will be carried out as part of the Project's HRA, EIA and WFD Assessment processes.
- 11.1.4 The dominant habitat types are consistent throughout all three channel section survey areas, these are: open standing water, semi-natural broadleaved woodland and then arable land. Slight variations exist between each channel section, but the regional influences of gravel extraction and urban encroachment upon a formerly rural environment have forced widespread habitat conformity.
- 11.1.5 Some of the protected species most likely to be encountered within the area are considered to be bats, reptiles and nesting birds. Otter and badger are believed to be present within all three channel sections, but are unlikely to be as frequently encountered as other species. Water voles are likely to be present in small, very localised, population clusters on lakes and rivers, with the highest likelihood of encountering this species occurring within Channel Section 3. GCN are considered possible but there are no existing records. White-clawed crayfish are considered to be unlikely within the Channels Section 1 survey area, but with low potential within a small number of lakes in Channel Section 2 and 3. Further detailed Phase 2 studies are recommended for bats, reptiles, nesting birds, white-clawed crayfish, badgers and GCN which, if conducted with adequate time before the start of construction, should ensure that impacts can be managed via best practices and licensing. Refer to Section 12 for further detail on survey recommendations.
- 11.1.6 For all three channel sections, an overall biodiversity value of 'regional' has been assigned for the combined River Thames, tributaries, smaller rivers and lakes which are connected by river flooding; primarily due to the presence of a number of protected fish and migratory species. Although the lakes may not contain as many migratory protected fish species as the main River Thames, they are nevertheless important as they form part of the floodplain area which often represent major spawning and nursery areas for fluvial fish (Nunn and Cowx, 2014).
- 11.1.7 Further surveys and assessments that may be required, mitigation that could be applied and habitat improvements that could be designed-in to the Project, have been described throughout Sections 4, 6, 8 and 10. The detail of these recommendations will need to be further refined during outline and detailed design as the proposed programme and design evolves.
- 11.1.8 Section 12 summarises the recommendations that have been made.

12 Summary of Recommendations

Table 12.1: Summary of recommendations made in sections 4, 6, 8 and 10

Locations	Feature(s)	Recommendations
All three channels and Desborough Cut	All biota along the route of the proposed channel	Continued dialogue should be maintained with the Environment Agency Technical Specialists throughout the Project so as to benefit from their local knowledge and experience of developing enhancement opportunities and mitigation measures for other projects.
		Designs should seek to maintain and improve habitat conditions that support healthy and diverse ecological communities wherever possible across the whole channel ecosystem. For example consideration should be given to designing-in measures such as the creation of two-stage channels, braided channels, berms, sheltered embayments, gravel areas, suitable and varying depths within the flood channels, active planting and/or encouraging new macrophyte and emergent plant beds to develop. Whilst of primary benefit to aquatic species, such measures would in-turn be of wider benefit to the whole ecosystem.
		Develop site-specific measures (based upon industry best practice, such as Environment Agency PPGs) to minimise the footprint and magnitude of construction stage effects upon water quality (e.g. suspended sediments, nutrients, temperature etc.) and aquatic species. Consider incorporating sustainable pollution control systems (e.g. creation of reed beds) as potential filtering mechanisms. The nature of these effects and the measures required to address them will depend upon design evolution and the recommendations of ongoing water quality modelling, survey and WFD Assessment. See Section 4.5 for further discussion.
All three channels and Desborough Cut	Aquatic ecology	Minimise the likely footprint of disturbance and damage to existing macrophyte beds and emergent vegetation stands through careful design based upon known locations of these habitats. Where damage is likely to occur, seek to replace or create suitable habitat conditions for the growth of submerged and emergent vegetation. See Section 4.5 for further details.
		Collect macrophyte and macroinvertebrate field survey data from Desborough Cut and in the smaller rivers crossing the survey area: Datchet Common Brook, Horton Brook, Midridge Green Drain, Colne Brook, County Ditch, Wraysbury Stream (Channel Section 1); Mead Lake Ditch, Chertsey Bourne, The Moat, Abbey River, Burway Ditch (Channel Section 2); Pool End Ditch and The Chap (Channel Section 3). WFD compliant spring and autumn sampling is recommended for macroinvertebrates and summer sampling for macrophytes. Hydromorphological (and geomorphological) data is also required, with some targeted surveys already planned to inform the WFD Assessment.

Locations	Feature(s)	Recommendations
		<p>Collect macroinvertebrate and macrophyte field survey data from lakes that are on the line of the proposed channel but have not been formally surveyed to date: Horton Lakes, Sunnymeads 4, Lower Hythe Gravel Pits (Channel Section 1). Summer sampling is recommended for macroinvertebrates. For determining species of conservation importance, more specific methods are recommended such as the Natural England Common Standards Monitoring procedure for pond netting. Some macrophyte surveys are currently planned to be undertaken by the Environment Agency (see Table 2.1), including for the Lower Hythe Gravel Pits and Horton 2.</p>
<p>All three channels and Desborough Cut</p>	<p>Fish</p>	<p>Further habitat enhancement measures to those described previously for all biota should be considered where lakes and/or other watercourses may be adversely affected. For example: creation of shallower inclines and planting of macrophyte communities is preferable to support fish populations; consideration of gravel deposition in some margins; short stretches of naturalized bypass channels; and, providing additional refuges in affected watercourses (e.g. sinking any trees that are removed as part of the scheme or designing custom built refuges). See Section 10.1 for further details.</p> <p>Construction methodologies for the flood channel embankments should seek to minimise disturbance and stress to fish (e.g. consideration to the use of cofferdams or partial drainage rather than the complete draining out of water from the lakes).</p> <p>A noise assessment, including determination of the potential noise levels that could occur alongside an assessment of potential impacts on the surrounding fish, will be required as part of the EIA process. Potential mitigation measures will be determined as the scheme develops.</p>
<p>Channels 1,2 and 3</p>	<p>Fish</p>	<p>Careful consideration should be given to the optimum level of connectivity required between various waterbodies along the different sections of the flood channel (e.g. continuous connectivity, intermittent or infrequent) with regards to minimising the mixing of fish stocks and associated effects, such as fish predation; notwithstanding the requirement to ensure passage of protected migrating species. See Section 10.1 for further details.</p> <p>Measures should be included to facilitate safe fish passage (e.g. provision of suitable fish passes and consideration of weir design methods that are passable to fish without the need for fish passes) to reduce potential effects where potential barriers to fish movement are likely to occur. See Section 10.1 for further details.</p> <p>Consideration should be given to the design of suitable intake structures with an adequate fish return system, if feasible, to minimise the potential intake of fish species into the flood channels. See Section 10.1 for further details.</p>

Locations	Feature(s)	Recommendations
		Carry out surveys for fish within the potentially affected lakes (refer to Table 2.1 for a list of surveys which are currently planned to be undertaken by the Environment Agency to address this requirement).
		Carry out surveys of fish passage in the smaller rivers crossing the survey area: Datchet Common Brook, Horton Brook, Midridge Green Drain, Colne Brook, County Ditch, Wraysbury Stream (Channel Section 1); Mead Lake Ditch, Chertsey Bourne, The Moat, Abbey River, Burway Ditch (Channel Section 2); Pool End Ditch and The Chap (Channel Section 3).
All three channels and Desborough Cut	Bat species	Detailed preliminary bat roost assessments on any areas of woodland or singular trees to be removed or in close proximity (20m) of the proposed channel route and the right bank of the Desborough Cut. Some of these will likely lead to further surveys. If confirmed, bat presence will likely require mitigation under licence from Natural England. See recommendations in Sections 4, 6 & 8 for more details including survey timings.
		Bat activity surveys of linear features (such as woodland and lake edges, lines of trees and hedgerows) that will be severed by the proposed works, in order to assess potential impact on commuting and foraging bats. See recommendations in Sections 4, 6 & 8 for more details including survey timings.
All three channels and Desborough Cut	Great crested newt	Habitat Suitability Index (HSI) assessments should be conducted on the 61 water bodies identified within 500m of the proposed channel and Desborough Cut. If results are found to be favourable for GCN then further surveys (such as eDNA surveys or 'bottle trapping') will be required to establish GCN presence/likely absence and (potentially) population estimates. If confirmed, the presence of GCN will likely require a mitigation license to be sought from Natural England. See recommendations in Sections 4, 6 & 8 for more details including survey timings.
All three channels and Desborough Cut	Widespread reptile species	Reptile surveys where the proposed channel or associated works impact upon semi-improved grassland, scattered scrub, poor semi-improved grassland and some areas of disturbed ephemeral vegetation or suitable edge habitats. Further mitigation will be required where reptiles are present. Reptile surveys should be conducted at least two seasons prior to any ground works commencing. See recommendations in Sections 4, 6 & 8 for more details including survey timings.
All three channels and Desborough Cut	Badger	A pre-construction walkover between six months to a year prior to any ground works commencing to a distance of approximately 30m from any construction related activity. Any setts found will need to be assessed to determine a mitigation strategy and licensing requirements.
All three channels and Desborough Cut	Nesting birds	All vegetation clearance should be programmed outside of the nesting bird season of March to September where possible. If vegetation suitable for nesting has to be cleared within this period then it will require survey by a suitably qualified

Locations	Feature(s)	Recommendations
		ecologist before works can proceed.
All three channels and Desborough Cut	Water vole	Surveys within riparian habitat and lake edges within 100m of the works areas. If confirmed, water vole presence will likely require mitigation under licence from Natural England. See recommendations in Sections 4, 6 & 8 for more details including survey timings.
All three channels and Desborough Cut	Otter	Pre-construction otter surveys within 70m of any works required on the lakes, rivers, brooks and streams. If an otter holt or lay-up site is found appropriate mitigation should be implemented; this may require a mitigation license from Natural England. See recommendations in Sections 4, 6 & 8 for further recommendations relating to the construction stage.
All three channels and Desborough Cut	Trees	Tree protection plans (TPP) for trees being retained within or adjacent to working areas should be put in place prior to construction commencing. TPPs should follow British Standard BS5837:2012 ' <i>Trees in relation to design, demolition and construction – recommendations</i> ' and be produced by an Arboricultural Association approved consultant of suitable experience.
All three channels and Desborough Cut	INNS	The INNS data for the survey area should be re-evaluated when the documents on EU Species of Concern and the Environment Agency's INNS Management Plan are published. Undertake a comprehensive INNS study in order to establish the need for any further surveys, make recommendations to inform the design and identify methods that may be required to prevent, contain or eradicate the spread of INNS during the construction and operation of the Project.
Channels 1, 2 and 3	Overwintering birds	Works within lakes and areas of land identified as supporting habitat for overwintering birds should be carefully timed to avoid disturbance during peak overwintering periods. The findings of the HRA will inform any further recommendations specific to the SPA qualifying features (overwintering gadwall and shoveler).
Channels 2 and 3	White-clawed crayfish	Surveys for white-clawed crayfish and invasive crayfish should be undertaken on those lakes of good to high water quality that have not already been confirmed as having invasive crayfish species present in Channel Sections 2 and 3. See recommendations in Sections 6 & 8 for recommended survey timings and locations.
Channel 2	Flora	A more detailed botanical survey of the meadow in land south of Thorpe Hay Meadow is required to fully ascertain its biodiversity value. It is currently identified as semi-improved neutral grassland but it is suspected that this may be unimproved grassland. Further survey of Thorpe Hay Meadow itself is unlikely to be necessary due to existing NVC surveys completed in 2010 and 2013.

13 References

Name of document	GBV dataset ID number
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13.1 Datasets

Name of dataset	GBV dataset ID number
• Local Records Centre protected species and site records. Environment Agency.	1028
• Non-native invasive species by waterbody. Environment Agency.	1601
• River Thames fish catch records - 2004 to 2014. Environment Agency.	644
• Sites of Special Scientific Interest (SSSI's). Natural England.	133
• Special Protection Areas. Natural England.	135
• Species Surveys - Non-Native Species. Environment Agency (Geostore).	62
• Surrey Biological Information Centre (SBIC) species and site records.	1361
• Thames Valley Environmental Records Centre (TVERC) species and site records.	1268
• Electrofishing data for Chertsey Bourne , Datchet Common Brook, Desborough Cut and Desborough Loop. Environment Agency.	1799
• Electrofishing data for Wraysbury River (2003 to 2015). Environment Agency.	1800
• Electrofishing survey data for Colne Brook tributary (1986 to 2014). Environment Agency.	1800
• Environment Agency electrofishing data for the River Colne (1986, 2002-2015). Environment Agency.	1800

14 Appendices

Appendix A: Extended Phase 1 Habitat Maps and Target Notes

Please see Figure W-DR-V-00052 (Sheets 1-21) in Pack 3 within Appendix A: 'Maps & Figures' in the EIA Scoping Report.

Appendix B: Desk Study Results for Protected and Notable Species

Protected & NERC species records within the survey area of Channel Section 1

Unless otherwise stated against a specific item, this table incorporates data supplied by SBIC (ID1361), TVERC (ID1268) and the Environment Agency (ID1028), and is copyright to SBIC, TVERC and the Environment Agency and/or its partners.

Species Name	Relevant Legal protection and conservation status
Stag Beetle	Wildlife & Countryside Act 1981 – Schedule 5. (WCA-Sch5)_sect9.5a, 9.5b. NERC S41.
Slavonian Grebe <i>Podiceps auritus</i>	Wildlife & Countryside Act 1981 – Schedule 1. (WCA-Sch1) part1.
Black-necked Grebe <i>Podiceps nigricollis</i>	WCA-Sch1_part1.
Northern Pintail <i>Anas acuta</i>	WCA-Sch1_part2.
Merlin	WCA-Sch1_part1.
Lapland Bunting <i>Calcarius lapponicus</i>	WCA-Sch1_part1.
Black-throated Diver <i>Gavia arctica</i>	WCA-Sch1_part1.
Greater Scaup <i>Aythya marila</i>	WCA-Sch1_part1. NERC S.41.
Black Tern <i>Chlidonias niger</i>	WCA-Sch1_part1.
Black-tailed Godwit <i>Limosa limosa</i>	WCA-Sch1_part1. NERC S.41.
Yellow Wagtail <i>Motacilla flava</i>	NERC S.41.
Mediterranean Gull <i>Larus melanocephalus</i>	WCA-Sch1_part1.
Common Greenshank <i>Tringa nebularia</i>	WCA-Sch1_part1.
Bewick's Swan <i>Cygnus columbianus</i>	WCA-Sch1_part1. NERC S.41.
Dunnock <i>Prunella modularis</i>	NERC S.41.
Brent Goose <i>Branta bernicla</i>	NERC S.41.
Little Tern <i>Sternula albifrons</i>	WCA-Sch1_part1. NERC S.41.
Common Starling <i>Sturnus vulgaris</i>	NERC S.41.
Goldeneye <i>Bucephala clangula</i>	WCA-Sch1_part2.
Slavonian Grebe	WCA-Sch1_part1.
Black-necked Grebe	WCA-Sch1_part1.
Black-throated Diver	WCA-Sch1_part1.
Bewick's swan <i>Cygnus columbianus</i>	WCA-Sch1_part1. NERC S.41.
Green Sandpiper <i>Tringa ochropus</i>	WCA-Sch1_part1.

Species Name	Relevant Legal protection and conservation status
Common Scoter <i>Melanitta nigra</i>	WCA-Sch1_part1. NERC S.41.
Tree Pipit <i>Anthus trivialis</i>	NERC S.41.
Northern Pintail	WCA-Sch1_part2.
Greater Scaup <i>Aythya marila</i>	WCA-Sch1_part1. NERC S.41.
Bittern	WCA-Sch1_part1. NERC S.41.
Yellow Wagtail	NERC S.41.
European Water vole <i>Arvicola amphibious</i>	WCA-Sch5_sect9.1(kill/injuring & taking), sect9.2, 9.4a, 9.4b, 9.5a, 9.5b, 9.4c. NERC S41.
Grass Snake <i>Natrix natrix</i>	WCA-Sch5_sect9.1(kill/injuring), sect9.5a, 9.5b. NERC S41.
Grass Snake	WCA-Sch5_sect9.1(kill/injuring), sect9.5a, 9.5b. NERC S41.
Barn Owl <i>Tyto alba</i>	WCA-Sch1_part1.
Grass Snake	WCA-Sch5_sect9.1(kill/injuring), sect9.5a, 9.5b. NERC S41.
Pipistrelle Bat species <i>Pipistrellus</i>	The conservation of Habitats and Species Regulations 2010 - Schedule 2 (HabReg Sch 2). WCA Sch5.
Stag Beetle	WCA-Sch5_sect9.5a, 9.5b. NERC S41.
Pipistrelle Bat species	HabReg Sch 2. WCA Sch5.
Cinnabar Moth <i>Tyria jacobaeae</i>	NERC S.41.
Kingfisher <i>Alcedo atthis</i>	WCA-Sch1_part1.
Common Goldeneye	WCA-Sch1_part2.
Grasshopper Warbler <i>Locustella naevia</i>	NERC S.41.

Protected & NERC species records within the survey area of Channel Section 2

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Species Name	Relevant Legal protection and conservation status
Black-Necked Grebe	WCA-Sch1_part1.
Bluebell <i>Hyacinthoides non-scripta</i>	WCA-Sch8.
Common Toad <i>Bufo bufo</i>	NERC S41.
Duncock	NERC S.41.
Grass Snake	WCA-Sch5_sect9.1(kill/injuring), sect9.5a, 9.5b. NERC S41.
Kestrel <i>Falco tinnunculus</i>	NERC S41.
Kingfisher	WCA-Sch1_part1.
Pipistrelle Bat Species	HabReg Sch 2. WCA Sch5.
Common Toad	NERC S41.

Species Name	Relevant Legal protection and conservation status
Small Heath <i>Coenonympha pamphilus</i>	NERC S41.
Wall <i>Lasiommata megera</i>	NERC S41.

Protected & NERC species records within the survey area of Channel Section 3 and Desborough Cut

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Species Name	Relevant Legal protection and conservation status
Bluebell	WCA-Sch8.
Kingfisher	WCA-Sch1_part1.
Common Toad	NERC S41.
Daubenton's Bat <i>Myotis daubentonii</i>	HabReg Sch 2. WCA Sch5.
Dunnock	NERC S41.
European Otter	HabReg Sch 2. WCA Sch5.
Fieldfare <i>Turdus pilaris</i>	WCA_Sch1_Part1.
Green Sandpiper <i>Tringa ochropus</i>	WCA_Sch1_Part1.
Greenshank	WCA_Sch1_Part1.
Hobby <i>Falco Subbuteo</i>	WCA_Sch1_Part1.
Kestrel	NERC S41.
Little Ringed Plover <i>Charadrius dubius</i>	WCA_Sch1_Part1.
Pipistrelle	HabReg Sch 2. WCA Sch5.
Redwing <i>Turdus iliacus</i>	WCA_Sch1_Part1.
Reed Bunting <i>Emberiza schoeniclus</i>	NERC S41.
Scaup	WCA-Sch1_part1. NERC S41.
Slavonian Grebe	WCA_Sch1_Part1.
Water Vole <i>Arvicola amphibious</i>	WCA-Sch5_sect9.4a, 9.4b, 9.4c.
Yellow Wagtail	NERC S41.
Yellowhammer <i>Emberiza citronella</i>	NERC S41.
Stag Beetle	Wildlife & Countryside Act 1981 – Schedule 5 (WCA-Sch5)_sect9.5a, 9.5b. NERC S41.
Cinnabar Moth	NERC S.41.
Great Water-Parsnip	NERC S.41.
Grey Dagger <i>Acronicta psi</i>	NERC S41.
House Sparrow <i>Passer domesticus</i>	NERC S41.
Shaded Broad-Bar	NERC S41.

Species Name	Relevant Legal protection and conservation status
<i>Scotopteryx chenopodiata</i>	
Small Heath	NERC S41.

Notable species records within the survey area of Channel Sections 1,2, 3 and Desborough Cut

Unless otherwise stated against a specific item, this table incorporates data supplied by SBIC (ID1361), TVERC (ID1268) and the Environment Agency (ID1028), and is copyright to SBIC, TVERC and the Environment Agency and/or its partners.

Channel Section	Common Name	Latin Name	Designation
CHANNEL SECTION 1	Common Sandpiper	<i>Actitis hypoleucos</i>	Bird Population Status - amber
	Northern Shoveler	<i>Anas clypeata</i>	Bird Population Status - amber
	Eurasian Teal	<i>Anas crecca</i>	Bird Population Status - amber
	Mallard	<i>Anas platyrhynchos</i>	Bird Population Status - amber
	Gadwall	<i>Anas strepera</i>	Bird Population Status - amber
	Ruddy Turnstone	<i>Arenaria interpres</i>	Bird Population Status - amber
	Common Pochard	<i>Aythya ferina</i>	Bird Population Status - amber
	Tufted Duck	<i>Aythya fuligula</i>	Bird Population Status - amber
	Brent Goose	<i>Branta bernicla</i>	Bird Population Status - amber
	Red Knot	<i>Calidris canutus</i>	Bird Population Status - amber
	Good-King-Henry	<i>Chenopodium bonus-henricus</i>	Vulnerable
	Black-headed Gull	<i>Chroicocephalus ridibundus</i>	Bird Population Status - amber
	Galingale	<i>Cyperus longus</i>	Nationally scarce
	Eurasian Oystercatcher	<i>Haematopus ostralegus</i>	Bird Population Status - amber
	Frogbit	<i>Hydrocharis morsus-ranae</i>	Vulnerable
	Brown Ant	<i>Lasius brunneus</i>	Nationally Notable A
	Dittander	<i>Lepidium latifolium</i>	Nationally scarce
	a Caddis Fly	<i>Leptocerus lusitanicus</i>	Vulnerable
	Bar-tailed Godwit	<i>Limosa lapponica</i>	Bird Population Status - amber
	Jack Snipe	<i>Lymnocyptes minimus</i>	Bird Population Status - amber
	Smew	<i>Mergellus albellus</i>	Bird Population Status - amber
	Grey Wagtail	<i>Motacilla cinerea</i>	Bird Population Status - amber
	Yellow Wagtail	<i>Motacilla flava</i>	Bird Population Status - red
	Threatened bryophyte record	<i>Octodicerias fontanum</i>	Nationally scarce
	a Beetle	<i>Oulimnius major</i>	Nationally scarce
	Willow Warbler	<i>Phylloscopus trochilus</i>	Bird Population Status - amber
	Green Woodpecker	<i>Picus viridis</i>	Bird Population Status - amber
	Grey Plover	<i>Pluvialis squatarola</i>	Bird Population Status - amber
	Red-necked Grebe	<i>Podiceps grisegena</i>	Bird Population Status - amber
	Dunnock	<i>Prunella modularis</i>	Bird Population Status - amber
	Black-legged Kittiwake	<i>Rissa tridactyla</i>	Bird Population Status - amber
	Common Eider	<i>Somateria mollissima</i>	Bird Population Status - amber
	Common Tern	<i>Sterna hirundo</i>	Bird Population Status - amber

Channel Section	Common Name	Latin Name	Designation
	Arctic Tern	<i>Sterna paradisaea</i>	Bird Population Status - amber
	Common Starling	<i>Sturnus vulgaris</i>	Bird Population Status - red
	Little Grebe	<i>Tachybaptus ruficollis</i>	Bird Population Status - amber
	Common Redshank	<i>Tringa totanus</i>	Bird Population Status - amber
CHANNEL SECTION 2	Mallard	<i>Anas platyrhynchos</i>	Bird Population Status - amber
	Gadwall	<i>Anas strepera</i>	Bird Population Status - amber
	<i>Auplopus carbonarius</i>	<i>Auplopus carbonarius</i>	Nationally Notable B
	Tufted Duck	<i>Aythya fuligula</i>	Bird Population Status - amber
	Downy-fruited Sedge	<i>Carex filiformis</i>	Nationally rare
	Downy-Fruited Sedge	<i>Carex filiformis</i>	Nationally rare
	Greater Dodder	<i>Cuscuta europaea</i>	Nationally scarce
	Galingale	<i>Cyperus longus</i>	Nationally scarce
	Kestrel	<i>Falco tinnunculus</i>	Bird Population Status - amber
	Corn Marigold	<i>Glebionis segetum</i>	Vulnerable
	Yellow Vetchling	<i>Lathyrus aphaca</i>	Nationally scarce, Vulnerable
	Dittander	<i>Lepidium latifolium</i>	Nationally scarce
	<i>Lestiphorus bicinctus</i>	<i>Lestiphorus bicinctus</i>	Nationally Notable B
	<i>Macropis europaea</i>	<i>Macropis europaea</i>	Nationally Notable A
	Round-Leaved Mint	<i>Mentha suaveolens</i>	Nationally scarce
	Smew	<i>Mergellus albellus</i>	Bird Population Status - amber
	<i>Nomada ferruginata</i>	<i>Nomada ferruginata</i>	Endangered
	<i>Nomada xanthosticta</i>	<i>Nomada ferruginata</i>	Endangered
	Fringed Water-lily	<i>Nymphoides peltata</i>	Nationally scarce
	Green Woodpecker	<i>Picus viridis</i>	Bird Population Status - amber
	Dunnock	<i>Prunella modularis</i>	Bird Population Status - amber
	Creeping Spearwort	<i>Ranunculus reptans</i>	Nationally rare, Vulnerable
	Drab Wood-soldierfly	<i>Solva marginata</i>	Nationally Notable, Vulnerable
	Corn Spurrey	<i>Spergula arvensis</i>	Vulnerable
Whitethroat	<i>Sylvia communis</i>	Bird Population Status - amber	
<i>Volucella inanis</i>	<i>Volucella inanis</i>	Nationally Notable	
Purple Fescue	<i>Vulpia ciliata subsp. ambigua</i>	Nationally scarce	
CHANNEL SECTION 3	Common Sandpiper	<i>Actitis hypoleucos</i>	Bird Population Status - amber
	Skylark	<i>Alauda arvensis</i>	Bird Population Status - red
	Shoveler	<i>Anas clypeata</i>	Bird Population Status - amber
	Teal	<i>Anas crecca</i>	Bird Population Status - amber
	Mallard	<i>Anas platyrhynchos</i>	Bird Population Status - amber
	Gadwall	<i>Anas strepera</i>	Bird Population Status - amber
	Corn Chamomile	<i>Anthemis arvensis</i>	Endangered
	Meadow Pipit	<i>Anthus pratensis</i>	Bird Population Status - amber
	Swift	<i>Apus apus</i>	Bird Population Status - amber
	<i>Auplopus carbonarius</i>	<i>Auplopus carbonarius</i>	Nationally Notable B

Channel Section	Common Name	Latin Name	Designation
	Pochard	<i>Aythya ferina</i>	Bird Population Status - amber
	Tufted Duck	<i>Aythya fuligula</i>	Bird Population Status - amber
	<i>Blaesoxipha plumicornis</i>	<i>Blaesoxipha plumicornis</i>	Nationally Notable
	Box	<i>Buxus sempervirens</i>	Nationally rare
	Dunlin	<i>Calidris alpina</i>	Bird Population Status - red
	Ringed Plover	<i>Charadrius hiaticula</i>	Bird Population Status - amber
	<i>Cheilosia soror</i>	<i>Cheilosia soror</i>	Nationally Notable
	Good King Henry	<i>Chenopodium bonus-henricus</i>	Vulnerable
	Black-Headed Gull	<i>Chroicocephalus ridibundus</i>	Bird Population Status - amber
	<i>Cistogaster globose</i>	<i>Cistogaster globosa</i>	Endangered
	House Martin	<i>Delichon urbicum</i>	Bird Population Status - amber
	Corn Bunting	<i>Emberiza calandra</i>	Bird Population Status - red
	Kestrel	<i>Falco tinnunculus</i>	Bird Population Status - amber
	Snipe	<i>Gallinago gallinago</i>	Bird Population Status - amber
	Great Northern Diver	<i>Gavia immer</i>	Bird Population Status - amber
	Box Bug	<i>Gonocerus acuteangulatus</i>	Endangered
	Swallow	<i>Hirundo rustica</i>	Bird Population Status - amber
	Herring Gull	<i>Larus argentatus</i>	Bird Population Status - red
	Common Gull	<i>Larus canus</i>	Bird Population Status - amber
	Lesser Black-Backed Gull	<i>Larus fuscus</i>	Bird Population Status - amber
	Great Black-Backed Gull	<i>Larus marinus</i>	Bird Population Status - amber
	Summer Snowflake	<i>Leucojum aestivum subsp. aestivum</i>	Nationally scarce
	Smew	<i>Mergellus albellus</i>	Bird Population Status - amber
	Grey Wagtail	<i>Motacilla cinerea</i>	Bird Population Status - amber
	Yellow Wagtail	<i>Motacilla flava</i>	Bird Population Status - red
	Fringed Water-Lily	<i>Nymphoides peltata</i>	Nationally scarce
	Wheatear	<i>Oenanthe oenanthe</i>	Bird Population Status - amber
	Willow Warbler	<i>Phylloscopus trochilus</i>	Bird Population Status - amber
	Bulbous Meadow-grass	<i>Poa bulbosa</i>	Nationally scarce
	Bulbous Meadow-Grass	<i>Poa bulbosa</i>	Nationally scarce
	Mallow Flea Beetle	<i>Podagrica fuscicornis</i>	Nationally Notable B
	Dunnock	<i>Prunella modularis</i>	Bird Population Status - amber
	Bullfinch	<i>Pyrrhula pyrrhula</i>	Bird Population Status - amber
	Sand Martin	<i>Riparia riparia</i>	Bird Population Status - amber
	<i>Sphecodes crassus</i>	<i>Sphecodes crassus</i>	Nationally Notable B
	Common Tern	<i>Sterna hirundo</i>	Bird Population Status - amber
	Starling	<i>Sturnus vulgaris</i>	Bird Population Status - red
	Whitethroat	<i>Sylvia communis</i>	Bird Population Status - amber
	Little Grebe	<i>Tachybaptus ruficollis</i>	Bird Population Status - amber
	Redshank	<i>Tringa totanus</i>	Bird Population Status - amber
	Song Thrush	<i>Turdus philomelos</i>	Bird Population Status - red

Channel Section	Common Name	Latin Name	Designation
	Mistle Thrush	<i>Turdus viscivorus</i>	Bird Population Status - amber
	Hoary Mullein	<i>Verbascum pulverulentum</i>	Nationally scarce

Appendix C: Legislation, planning policy, Environment Agency policy & conservation status

Note that the details provided in this appendix are for general guidance only, and should not be relied upon as a definitive statement of the law. The legislation is only applicable in Britain only (i.e. not the Isle of Man, Northern Island, the Republic of Ireland or the Channel Islands.) Only legislation relevant to the RTS scheme is included.

C.1 Relevant Legislation

National and European Legislation Afforded to Habitats

International Statutory Designations

Special Areas of Conservation (SACs) and **Special Protection Areas (SPAs)** are sites of European importance and are designated under the EC Habitats Directive 92/43/EEC on the Conservation of natural habitats and of wild fauna and flora (the Habitats Directive) and the EC Birds Directive 2009/147/EC on the conservation of wild birds respectively. Both form part of the wider Natura 2000 network across Europe.

Under the Habitats Directive the, Article 3 requires the establishment of a network of important conservation sites (SACs) across Europe in order to conserve the 189 habitats and 788 species (non-bird) identified in Annexes I and II of the Directive (as amended).

SPAs are classified under Article 2 of the EC Birds Directive both for rare bird species (as listed on Annex I) and for important migratory species.

SACs and SPAs up to 12 nautical miles (nm) from the coast are afforded protection in the UK under the Conservation of Habitats and Species Regulations 2010 which consolidate all amendments made to the Conservation (Natural Habitats, &c.) Regulations 1994. In Scotland, the requirements of Habitats Directive are implemented through a combination of the 1994 and the 2010 (reserved matters) Regulations. The Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended) provide a means for designating and protecting SACs in UK offshore waters (from 12-200 nm).

Ramsar sites are designated under the Convention on Wetlands of International Importance, agreed in Ramsar, Iran, in 1971. The Convention covers all aspects of wetland conservation and recognises the importance of wetland ecosystems in relation to global biodiversity conservation. The Convention refers to wetlands as “*areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres*” however they may also include riparian and coastal zones. Ramsar sites are statutorily protected under the Wildlife & Countryside Act 1981 (as amended) with further protection provided by the Countryside and Rights of Way (CRoW) Act 2000. Policy statements have been issued by the Government in England and Wales highlighting the special status of Ramsar sites. The Government in England and Wales has issued policy statements which ensure that Ramsar sites are afforded the same protection as areas designated under the EC Birds and Habitats Directives as part of the Natura 2000 network (e.g. SACs & SPAs).

National Statutory Designations

Sites of Special Scientific Interest (SSSI) are designated by nature conservation agencies in order to conserve key flora, fauna, geological or physio-geographical features within the UK. The original designations were under the National Parks and Access to the Countryside Act 1949 but SSSIs were then re-designated under the Wildlife & Countryside Act 1981 (as amended). As well as reinforcing other national designations (including National Nature Reserves), the system also provides statutory protection for terrestrial and coastal sites which are important within the European Natura 2000 network and globally. Further provisions for the protection and management of SSSIs have been introduced by the Countryside and Rights of Way Act 2000 (in England and Wales) and the Nature Conservation (Scotland) Act 2004.

Local Statutory Designations

Local authorities in consultation with the relevant nature conservation agency can declare *Local Nature Reserves (LNRs)* under the National Parks and Access to the Countryside Act 1949. LNRs are designated for flora, fauna or geological interest and are managed locally to retain these features and provide research, education and recreational opportunities.

Non- Statutory Designations

All non-statutorily designated sites are referred to as *Local Wildlife Sites (LWS) or Sites of Interest for Nature Conservation (SINC)*, and can be designated by the local authority for supporting local conservation interest. Combined with statutory designation, these sites are considered within Local Development Frameworks under the Town and Country Planning system and are a material consideration during the determination of planning applications. The protection afforded to these sites varies depending on the local authority involved.

National and European Legislation Afforded to Species

The Habitats Directive

The EC Habitats Directive aims to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore wild species listed on the Annexes to the Directive at a favourable conservation status, introducing robust protection for those species of European importance. The Directive is transposed into UK law by **The Conservation of Habitats and Species Regulations (amended) 2011** (the Habitat Regulations) and the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended). The following notes are relevant for all species protected under the EC Habitats Directive:

In the Directive, the term 'deliberate' is interpreted as being somewhat wider than intentional and may be thought of as including an element of recklessness.

The Habitats Regulations do not define the act of 'migration' and, therefore, as a precaution, it is recommended that short distance movement of animals for e.g. foraging, breeding or dispersal purposes are also considered.

In order to obtain a European Protected Species Mitigation licence, the application must demonstrate that it meets all of the following three 'tests':

- the action(s) are necessary for the purpose of preserving public health or safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequence of primary importance for the environment;
- there is no satisfactory alternative; and
- the action authorised will not be detrimental to the maintenance of the species concerned at a favourable conservation status in their natural range.

The Wildlife and Countryside Act 1981 (as amended) is the principle mechanism for the legislative protection of wildlife in Great Britain. It does not extend to Northern Ireland, the Channel Islands or the Isle of Man. This legislation is the means by which the Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention') and the European Union Directives on the Conservation of Wild Birds (79/409/EEC).

The WCA 1981 has been subject to a number of amendments, the most important of which are through the Countryside and Rights of Way (CRoW) Act (2000) and Nature Conservation (Scotland) Act 2004.

Other legislative Acts affording protection to wildlife and their habitats include:

- Deer Act 1991
- Natural Environment & Rural Communities (NERC) Act 2006
- Protection of Badgers Act 1992
- Wild Mammals (Protection) Act 1996
- Eel (England and Wales) Regulations 2009
- Salmon and Freshwater Fisheries Act 1975
- Water Environment (WFD) Regulations

Badgers

Badgers *Meles meles* are protected under The Protection of Badgers Act 1992 which makes it an offence to:

- Wilfully kill, injure, take, or attempt to kill, injure or take a badger
- Cruelly ill-treat a badger, including use of tongs and digging
- Possess or control a dead badger or any part thereof
- Intentionally or recklessly damage, destroy or obstruct access to a badger sett¹⁴ or any part thereof
- Intentionally or recklessly disturb a badger when it is occupying a badger sett
- Intentionally or recklessly cause a dog to enter a badger sett
- Sell or offers for sale, possesses or has under his control, a live badger

Impacts of legislation on development works

A development licence will be required from the relevant countryside agency for any development works liable to affect an active badger sett, or to disturb badgers whilst they occupy a sett. Guidance has

¹⁴ A badger sett is defined in the legislation as "any structure or place which displays signs indicating current use by a badger". This includes seasonally used setts. Natural England (2009) have issued guidance on what is likely to constitute current use of a badger sett: www.naturalengland.org.uk/Images/WMLG17_tcm6-11815.pdf

been issued by the countryside agency's to define what would constitute a licensable activity¹⁵. It is not possible to obtain a licence to translocate badgers.

Birds

With certain exceptions, all birds, their nests and eggs are protected under Sections 1-8 of the WCA. Among other things, this makes it an offence to:

- Intentionally (or recklessly in Scotland) kill, injure or take any wild bird
- Intentionally (or recklessly in Scotland) take, damage or destroy (or, in Scotland, otherwise interfere with) the nest of any wild bird while it is in use or being built
- Intentionally take or destroy an egg of any wild bird
- Sell, offer or expose for sale, have in his possession or transport for the purpose of sale any wild bird (dead or alive) or bird egg or part thereof

Certain species of bird, for example the barn owl, bittern and kingfisher receive additional protection under Schedule 1 of the WCA and Annex 1 of the European Community Directive on the Conservation of Wild Birds (2009/147/EC) and are commonly referred to as "Schedule 1" birds. This affords them protection against:

- Intentional or reckless disturbance while it is building a nest or is in, on or near a nest containing eggs or young
- Intentional or reckless disturbance of dependent young of such a bird

Impacts of legislation on development works

Works should be planned to avoid the possibility of killing or injuring any wild bird, or damaging or destroying their nests. The most effective way to reduce the likelihood of nest destruction in particular is to undertake work outside the main bird nesting season which typically runs from March to August. Where this is not feasible, it will be necessary to have any areas of suitable habitat thoroughly checked for nests prior to vegetation clearance.

Schedule 1 birds are additionally protected against disturbance during the nesting season. Thus, it will be necessary to ensure that no potentially disturbing works are undertaken in the vicinity of the nest. The most effective way to avoid disturbance is to postpone works until the young have fledged. If this is not feasible, it may be possible to maintain an appropriate buffer zone or standoff around the nest.

Herpetofauna (amphibians and reptiles)

The great crested newt *Triturus cristatus* receives full protection under the Habitats Regulations through their inclusion on Schedule 2. Regulation 41 prohibits:

- Deliberate killing, injuring or capturing of Schedule 2 species

¹⁵ For guidance on what constitutes disturbance and other licensing queries, see Natural England (2007) Badgers & Development: A Guide to Best Practice and Licensing. www.naturalengland.org.uk/Images/badgers-dev-guidance_tcm6-4057.pdf, Natural England (2009) Interpretation of 'Disturbance' in relation to badgers occupying a sett www.naturalengland.org.uk/Images/WMLG16_tcm6-11814.pdf,

With the exception of the pool frog, these species are also listed on Schedule 5 of the WCA and they are additionally protected from:

- Intentional or reckless disturbance (at any level)
- Intentional or reckless obstruction of access to any place of shelter or protection
- Selling, offering or exposing for sale, possession or transporting for purpose of sale.

Other native species of herpetofauna are protected solely under Schedule 5 of the WCA. Species such as the adder *Vipera berus*, grass snake *Natrix natrix*, common lizard *Zootoca vivipara* and slow-worm *Anguis fragilis* are listed in respect to Section 9(1) & (5). For these species, it is prohibited to intentionally (or recklessly in Scotland) kill or injure these species

Impacts of legislation on development works

A European Protected Species Mitigation (EPSM) Licence issued by the relevant countryside agency (e.g. Natural England) will be required for works liable to affect the breeding sites or resting places amphibian and reptile species protected under Habitats Regulations. A licence will also be required for operations liable to result in a level of disturbance which might impair their ability to undertake those activities mentioned above (e.g. survive, breed, rear young and hibernate). The licences are to allow derogation from the relevant legislation, but also to enable appropriate mitigation measures to be put in place and their efficacy to be monitored.

Although not licensable, appropriate mitigation measures may also be required to prevent the intentional killing or injury of adder, grass snake, common lizard and slow worm, thus avoiding contravention of the WCA.

Water voles

The water vole *Arvicola amphibius* fully protected under Schedule 5 of the WCA. This makes it an offence to:

- Intentionally kill, injure or take (capture) water voles
- Intentionally or recklessly damage, destroy or obstruct access to any structure or place used for shelter or protection
- Intentionally or recklessly disturb water voles while they are occupying a structure or place used for shelter or protection

Impacts of legislation on development works

If development works are liable to affect habitats known to support water voles, the relevant countryside agency must be consulted. It must be shown that means by which the proposal can be re-designed to avoid contravening the legislation have been fully explored e.g. the use of alternative sites, appropriate timing of works to avoid times of the year in which water voles are most vulnerable, and measures to ensure minimal habitat loss. Conservation licences for the capture and translocation of water voles may be issued by the relevant countryside agency (e.g. Natural England) for the purpose of development activities if it can be shown that the activity has been properly planned and executed and thereby contributes to the conservation of the population. The licence will then only be granted to a suitably experienced person if it can be shown that adequate surveys have been undertaken to inform appropriate mitigation measures. Identification and preparation of a suitable receptor site will be necessary prior to the commencement of works.

Otters

Otters *Lutra lutra* are fully protected under the Habitats Regulations through their inclusion on Schedule 2. Regulation 41 prohibits:

- Deliberate killing, injuring or capturing of Schedule 2 species
- Damage or destruction of a breeding site or resting place
- Otters are also currently protected under the WCA through their inclusion on Schedule 5. Under this Act, they are additionally protected from
- Intentional or reckless disturbance (at any level)
- Intentional or reckless obstruction of access to any place of shelter or protection

Impacts of legislation on development works

An EPSM Licence issued by the relevant countryside agency (e.g. Natural England) will be required for works liable to affect otter breeding or resting places (often referred to as holts, couches or dens) or for operations likely to result in a level of disturbance which might impair their ability to undertake those activities mentioned above (e.g. survive, breed, and rear young). The licence is to allow derogation from the relevant legislation but also to enable appropriate mitigation measures to be put in place and their efficacy to be monitored

Bats

All species are fully protected by Habitats Regulations 2010 as they are listed on Schedule 2. Regulation 41 prohibits:

- Deliberate killing, injuring or capturing of Schedule 2 species (e.g. all bats)
- Deliberate disturbance of bat species as:
 - to impair their ability:
 - to survive, breed, or reproduce, or to rear or nurture young;
 - to hibernate or migrate
 - to affect significantly the local distribution or abundance of the species
- Damage or destruction of a breeding site or resting place

Bats are afforded the following additional protection via the WCA as they are included on Schedule 5:

- Intentional or reckless disturbance (at any level)
 - Intentional or reckless obstruction of access to any place of shelter or protection
- Impacts of legislation on development works

Impacts of legislation on development works

Works which are liable to affect a bat roost or an operation which are likely to result in an illegal level of disturbance to the species will require an EPSM licence. The licence is to allow derogation from the legislation through the application of appropriate mitigation measures and monitoring.

White clawed crayfish

The white clawed crayfish *Austropotamobius pallipes* receives protection under Schedule 5 of the WCA in respect of Sections 9(1) and 9(5). This makes it an offence to intentionally take (capture) or buy or sell white-clawed crayfish.

Impacts of legislation on development works

The relevant countryside agency will need to be consulted about development which could impact on a watercourse or wetland known to support white clawed crayfish. Conservation licences for the capture and translocation of crayfish can be issued if it can be shown that the activity has been properly planned and executed and thereby contributes to the conservation of the population. The licence will only be granted to a suitably experienced person if it can be shown that adequate surveys have been undertaken to inform appropriate mitigation measures. Identification and preparation of a suitable receptor site will be necessary prior to the commencement of the works.

Wild Mammals (Protection Act) 1996

All wild mammals are protected against intentional acts of cruelty under the above legislation. This makes it an offence to mutilate, kick, beat, nail or otherwise impale, stab, burn, stone, crush, drown, drag or asphyxiate any wild mammal with intent to inflict unnecessary suffering.

To avoid possible contravention, due care and attention should be taken when carrying out works (for example operations near burrows or nests) with the potential to affect any wild mammal in this way, regardless of whether they are legally protected through other conservation legislation or not.

Legislation Afforded To Plants

With certain exceptions, all wild plants are protected under the WCA. This makes it an offence for an 'unauthorised' person to intentionally (or recklessly in Scotland) uproot wild plants. An authorised person can be the owner of the land on which the action is taken, or anybody authorised by them.

Certain rare species of plant, for example some species of orchid, are also fully protected under Schedule 8 of the Wildlife and Countryside Act 1981 (as amended).

In addition to the UK legislation outlined above, several plant species are fully protected under Schedule 5 of The Conservation of Habitats and Species Regulations 2010. These are species of European importance.

Invasive non-native species

Part II of Schedule 9 of the WCA lists invasive non-native plant species for which it is a criminal offence in England and Wales to plant or cause to grow in the wild due to their impact on native wildlife. Species include Japanese Knotweed *Fallopia japonica*, Giant Hogweed *Heracleum mantegazzianum* and Himalayan Balsam *Impatiens glandulifera*.

Impacts of legislation on development works

It is not an offence for plants listed in Part II of Schedule 9 of the WCA 1981 to be present on the development site however it is an offence to cause them to spread. Therefore, if any of the species are present on site and construction activities may result in further spread (e.g. earthworks, vehicle movements) then it will be necessary to design and implement appropriate mitigation prior to construction commencing.

Injurious weeds

Under the Weeds Act 1959 any land owner or occupier may be required prevent the spread of certain 'injurious weeds' such as Spear Thistle *Cirsium vulgare*, Creeping Thistle *Cirsium arvense*, Curled Dock

Rumex crispus, Broad-leaved Dock *Rumex obtusifolius*, and Common Ragwort *Senecio jacobaea*. It is a criminal offence to fail to comply with a notice requiring such action to be taken. The Ragwort Control Act 2003 establishes a ragwort control code of practice as common ragwort is poisonous to horses and other livestock. This code provides best practice guidelines and is not legally binding.

Fish

Key UK legislation relevant to those fish recorded within the flood channel study area includes the Habitats Regulations, NERC Act, Salmon and Freshwater Fisheries Act 1975 and Eels (England and Wales) Regulations 2009 (SI 2009/3344) as amended by SI 2011/2976.

Schedule 4 (Regulation 43 (1) (a)) of the Habitats Regulations includes Atlantic salmon and barbel which is concerned with animals which may not be captured or killed in certain ways. Within the Habitats Directive Atlantic salmon (in freshwater only) are listed within Annexes 2 and 5, and barbel spp. within Annex 5. Annex 5 is concerned with the exploitation of certain species, including fish and ensuring their taking in the wild is compatible with maintaining them in a favourable conservation status. Bullhead and brook lamprey are only included in Annex 2 of the Habitats Directive, they are not included in the Habitats Regulations; this annex is concerned with designating core areas of their habitat as Sites of Community Importance (SCIs) which are subsequently included in the Natura 2000 network. Consequently, species only listed in Annex 2 can only be considered to be protected if areas are designated for their protection. Therefore bullhead and brook lamprey are not afforded the same UK legal protection as some other fish species.

The NERC Act S.41 includes the European eel, salmon and brown trout as species of principal importance for the purpose of conserving biodiversity and therefore these species need to be taken into consideration by a public body when performing its functions.

The Salmon and Freshwater Fisheries Act is concerned with prohibition of certain modes of taking or destroying fish, obstructions to fish passage, times of fishing, selling and exporting fish, fishing licences as well as administrations and enforcement. Of particular relevance to the scheme is that the Act states it is an offence to pollute waters containing fish so as to cause the waters to be poisonous or injurious to fish, their food or spawning grounds. It also includes provisions to prevent the obstruction to salmon or migratory trout, with duties to make, maintain and alter fish passes in waters frequented by these species. The Act also states with regard to spawning grounds that it is an offence, except in exercise of a legal right to take materials from any waters, wilfully disturb any spawn or spawning fish, or any bed, bank or shallow on which any spawn or spawning fish may be. However, a person is not guilty of an offence, if they are acting for the purposes of the artificial propagation of salmon, trout or freshwater fish or for some scientific purpose or for the purpose of the preservation or development of a private fishery and has obtained the previous permission in writing from the water authority.

The Eels Regulations are applicable to rivers in England and Wales. It implements Council Regulation (EC 1100/2007) of 18 September 2007 to provide the Environment Agency with powers to implement measures necessary to meet the obligations to establish measures for the recovery of the stock of European eel. The Regulation requires Member States to implement a number of short-term and long-term measures to achieve a target of ensuring that at least 40% of the potential productions of adult eels return to the sea to spawn on an annual basis. This Directive is based on advice from the International Council for the Exploration of the Sea (ICES) in 2006, which indicated the stock of the European eel (*Anguilla anguilla*) was outside safe biological limits across European waters. Populations have declined significantly, with recruitment of glass eel reducing to 5% of the original 1980s stock

levels in some Member States (around 70% decline in the UK). In response to this advice, 11 Eel Management Plans have been prepared, one for each River Basin District within England and Wales. The plans outline the current situation and how these targets are to be achieved. Such measures include a reduction in fishing pressure, improving access and habitat quality, and reducing the impacts of entrainment.

The Water Environment (Water Framework Directive (WFD)) Regulations (SI 3242/2003) transposes the European WFD (Directive 2000/60/EC) into England and Wales. These regulations aim to protect and enhance water bodies (e.g. rivers, lakes and ground waters etc.) within Europe. Within each water body, the WFD sets overall, ecological and chemical objectives. The overall objective for all natural water bodies is to attain a current status of 'Good', which can comprise 'Good Ecological Status (GES)' and 'Chemical Status' and for all Artificial or Heavily Modified Water Bodies (A/HMWB) there is a requirement to meet Good Ecological Potential (GEP). Consequently, Member States are required to either maintain and improve, and thus prevent deterioration in the overall status of water bodies. In order to determine the potential effects of a scheme on the WFD status, it is necessary for Member States to have assessed the status of their waterbodies using appropriate classification tools.

Impacts of legislation on development works

Development should give due regard to fish species afforded protection under the relevant conservation legislation. For example, with regard to Atlantic salmon and barbel which are included in the Habitats Regulations, all works should aim to prevent mortality in these species.

In terms of those fish species of principal importance under the NERC Act it is necessary to consider the potential impacts of the scheme that may arise throughout the life time of the project and the requirements necessary to preserve these species in terms of biodiversity. This is a material planning consideration.

The Environment Agency regulates structures, sluices and dams that control the movement of freshwater fish, salmon, trout and eels along a river. Consequently, any scheme that involves the installation of new structures, and potentially alter or refurbish existing ones, there may be a requirement to install a fish pass or screen in accordance with the Salmon and Freshwater Fisheries Act, or an eel pass or screen in accordance with the Eels Regulations. In accordance with the Salmon and Freshwater Fisheries Act due consideration should be given to ensuring the works do not pollute waters so that adverse effects occur which are poisonous or injurious to fish, their food or spawning grounds as well as causing disturbance to spawning areas or spawning fish (e.g. excavation works and piling noise etc.).

In accordance with the Water Environment (WFD) Regulations a WFD assessment will need to be undertaken.

C.2 PLANNING POLICY

Table C2.1: Relevant Core Strategy Planning Policies for Channel Section 1

Local Authority	Planning Policy (Core Strategy)
Royal Borough of Windsor and Maidenhead (ID1846)	<p>N2 Setting of the Thames: The borough council will conserve and enhance the setting of the Thames, as defined on the proposals maps and will not permit development which would adversely affect the character and setting of the river in both urban and rural locations. Proposed development will be required to meet the following criteria:</p> <p>...4) The retention of tree-cover and the conservation of the ecological value of the area, particularly the retention of vulnerable meadow-land.</p>
	<p>N4 Common Land, Village Greens and Ponds: The council will not approve development proposals which would adversely affect the amenity or ecological value of registered common land and village greens, allotments, ponds and watercourses, or would adversely affect their setting.</p>
	<p>N6 Trees & Development: The borough council will, where appropriate, require applications for new development to;</p> <ol style="list-style-type: none"> 1) Submit a detailed tree survey as part of a planning application wherever existing trees are a feature of the site. Plans for new development should, wherever practicable, allow for the site retention of existing suitable trees; 2) Carry out any protection measures considered necessary to protect trees during site clearance and building operations; 3) Include an appropriate tree planting and landscaping scheme where the amenity value of trees outweighs the justification for development, planning permission may be refused.
	<p>N7 Hedgerows: The borough council will require the retention of hedgerows and will not permit development which would result in the loss of or threat to an important hedgerow, such as a boundary hedge. Where hedgerow removal is unavoidable, replacement and improved planting will be required.</p>
	<p>N9 Wildlife Heritage Sites: In considering development proposals affecting local nature reserves and wildlife heritage sites, the council will have particular regard to the need to protect natural features and the availability of mitigation measures. Measures will be required to safeguard and enhance wildlife heritage sites included within any development proposal.</p>

Table C2.2: Relevant Core Strategy Planning Policies for Channel Section 2

Local Authority	Planning Policy (Core Strategy)
Runnymede District Council (ID1847)	<p>NE3 Fragmentation of Agricultural Holdings: In considering proposals for development which would result in the fragmentation of agricultural holdings, the Council will have regard to the following: (1) the agricultural quality of the land. (2) the scale of the development and its impact on the open character of the countryside environment....(4) the economic viability of the remaining holding.</p>
	<p>NE12 Protection of Trees: The Council will continue to protect significant trees, hedgerows and woodlands and make provision for new planting, through the use of development control powers, tree preservation orders and through countryside management.</p>

Table C2.3: Relevant Core Strategy Planning Policies for Channel Section 3 and Desborough Cut

Local Authority	Planning Policy (Core Strategy)
Elmbridge Borough Council (ID1751)	CS15 Biodiversity: The Council will seek to avoid loss and contribute to a net gain in biodiversity across the region and the objectives of the Surrey Biodiversity Action Plan.
	CS14 Green infrastructure: The River Thames corridor is classed as green/blue infrastructure. The Council will protect, enhance and manage a diverse network of accessible multi-functional green infrastructure.
Spelthorne Borough Council (ID1750)	EN7 Tree Protection: The Council will promote tree preservation orders wherever appropriate to safeguard healthy trees of amenity value, giving priority to the protection of those known to be under threat. Permission will not normally be granted to fell preserved trees, but where such trees are felled replacement planting will be required.
	EN8 Protecting and improving the landscape and biodiversity: The Council will seek to protect and improve the landscape and biodiversity of the Borough...
	EN9 River Thames and its tributaries: The Council will seek to maintain and look for opportunities to enhance the setting of the River Thames and its tributaries.

C.3 ENVIRONMENT AGENCY STATUTORY OBLIGATIONS FOR BIODIVERSITY

The Environment Agency's has a number of statutory obligations for biodiversity which have been extracted from the Environment Agency Position Statement *Flood and Coastal Risk Management – conserving, enhancing and restoring biodiversity* (2013), these include:

1. We have as our principal aim, in discharging our functions so as to protect or enhance the environment, taken as a whole, to contribute towards attaining the objective of achieving sustainable development (subject to and in line with other legal provisions and taking into account any likely costs) (Section 4(1) of the Environment Act 1995).
2. We have a general duty to promote the conservation of flora and fauna which depends on an aquatic environment, to such extent as we consider desirable (Section 6(1)(b) of the Environment Act 1995).
3. When formulating or considering any Flood and Coastal Erosion Risk Management (FCRM) proposals, we must exercise our powers to conserve and enhance natural beauty and conserve flora, fauna and geological or physiographical features of special interest so far as they may be consistent with the purposes of our FCRM functions (Section 7(1)(a) of the Environment Act 1995).
4. We have a general duty to promote the conservation and enhancement of amenity and natural beauty of inland and coastal waters and their use for recreational purposes to such extent as we consider desirable (Section 6(1)(a) & (c) of the Environment Act 1995) as well as, when considering FCRM proposals, to have regard to desirability of protecting and conserving buildings, sites and objects of archaeological, historic and heritage interest (Section 7(1)(c)(i) of the Environment Act 1995) and to take account effect of proposals on amenity and fauna and flora (Section 7(1)(c)(ii) of the Environment Act 1995) and of

preserving public access (Section 7(2) of the Environment Act 1995). These duties are very much linked to our biodiversity duties.

5. We must, in exercising our functions, have regard to conserving biodiversity (so far as it is consistent with the proper exercise of those functions) (Section 40(1) of the Natural Environment & Rural Communities Act 2006). Conserving biodiversity includes restoring or enhancing a population or habitat (Section 40(3)). In doing so, we must have regard to the list of living organisms and types of habitat which in the Secretary of State's opinion are of principal importance for conserving biodiversity.
6. We have a duty in exercising our functions (so far as their exercise is likely to affect an SSSI), to take reasonable steps, consistent with the proper execution of our functions, to conserve and enhance the flora, fauna or geological or physiographical features which are the reason for the site's special scientific interest (Section 28G of the Wildlife & Countryside Act 1981).
7. We have a duty to exercise our functions having regard to the purpose of conserving and enhancing the natural beauty of Areas of Outstanding Natural Beauty (AONBs) (Section 85(1) of the Countryside & Rights of Way Act 2000).
8. We have a duty to exercise our functions relating to any land, having regard to the desirability of conserving the natural beauty and amenity of the countryside. This includes wildlife (Section 11 of the Countryside Act 1968).
9. In exercising our functions in relation to land in a National Park, we must have regard to the purposes of conserving and enhancing the natural beauty, wildlife and cultural heritage of the areas, and of promoting opportunities for the understanding and enjoyment of National Parks by the public (Section 11A and Section 5(1) of the National Parks and Access to the Countryside Act 1949).
10. When exercising any of our functions, we must have regard to both the Birds Directive and the Habitats Directive (Regulation 9(3) of the Conservation of Habitats & Species Regulations 2010). This includes taking steps to avoid, in the special areas of conservation, the deterioration of natural habitats and the habitats of species as well as disturbance of the species for which the areas have been designated (Article 6(2) of the Habitats Directive 92/43/EEC).
11. When exercising our functions, we must take such steps as we consider appropriate to contribute to the preservation, maintenance and re-establishment of a sufficient diversity and area of habitat for wild birds in the UK. This includes the upkeep, management and creation of such habitat, taking account as appropriate of economic and recreational requirements, and having regard to the Birds Directive (Regulation 9A(2) & (3) of the Conservation of Habitats & Species Regulations 2010).
12. Furthermore, so far as lies within our powers, we must when exercising our functions use all reasonable endeavours to avoid any pollution or deterioration of habitats of wild birds (Regulation 9A(8) of the Conservation of Habitats & Species Regulations 2010).
13. We have a general duty to exercise our relevant functions to secure compliance with the requirements of the Water Framework Directive (Regulation 3(1) Water Environment

(Water Framework Directive) (England and Wales) Regulations 2003). We're also required to have regard to the River Basin Management Plans and to any advice given by the Secretary of State on this directive.

14. We should take steps to remove barriers to eel passage and to avoid creating new ones. This includes installing screens on water diversion structures (Regulation 17 of the Eels (England and Wales) Regulations 2009) and constructing eel passes around obstructions (Regulation 14).

Appendix D: Desk study maps

Figure number	Description of figure
122368-BVL-Z0-SW-DR-V-00012	Designated Nature Conservation Sites within 2.5km of Channel Sections 1, 2 and 3.
122368-BVL-Z0-C1-DR-V-00002	Invasive Non-Native Species Map Channel Section 1.
122368-BVL-Z0-C2-DR-V-00002	Invasive Non-Native Species Map Channel Section 2.
122368-BVL-Z0-C3-DR-V-00002	Invasive Non-Native Species Map Channel Section 3 and Desborough Cut.
122368-BVL-Z0-SW-DR-V-00011	Water Framework Directive Lakes and Rivers.

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- LEGEND:**
- CHANNEL SECTION 1
 - CHANNEL SECTION 2
 - CHANNEL SECTION 3
 - POTENTIAL DIVERSION CHANNEL
 - - - PEA SURVEY AREA
 - - - CHANNELS 2.5 KM BUFFER
 - LOCAL NATURE RESERVE
 - SITE OF NATURE CONSERVATION INTEREST
 - SOUTH WEST LONDON WATERBODIES SPECIAL PROTECTION AREA AND RAMSAR SITE
 - SPA SUPPORTING SITES*
 - SPECIAL AREA OF CONSERVATION
 - SITE OF SPECIAL SCIENTIFIC INTEREST
 - ~ RIVER THAMES

NOTE: *PRELIMINARY ANALYSIS OF RTS ENVIRONMENTAL MONITORING (RTSEM) BIRD COUNT DATA HAS SOUGHT TO IDENTIFY THOSE WATERBODIES OUTSIDE OF THE CURRENT SWLW SPA AND RAMSAR SITE BOUNDARY WHICH CAN BE IDENTIFIED AS IMPORTANT SUPPORTING SITES. THIS ANALYSIS HAS USED A PRECAUTIONARY THRESHOLD FOR THE IDENTIFICATION OF SUCH WATERBODIES WHERE THE RTSEM 3 YEAR MEAN PEAK COUNT EXCEEDS 1% OF THE CITED SPA POPULATION FOR GADWALL OR SHOVELER.

SITE OF NATURE CONSERVATION INTEREST DATA INCLUDES LOCAL WILDLIFE SITES AND SITES OF IMPORTANCE FOR NATURE CONSERVATION.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

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CONSTRUCTION :
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MAINTENANCE, CLEANING AND OPERATION :
NOT APPLICABLE

DECOMMISSIONING OR DEMOLITION :
NOT APPLICABLE

POI	MMG	CA	EF	ES	08/03/2016	SUITABLE FOR INFORMATION
Rev	Drawn	Chkd	Rvwd	Apprvd	Date	Description

Designed by: MMG Date: MARCH 2016

Client: **River Thames Scheme**

PROTECTING our communities
SECURING our economy
ENHANCING our Thames

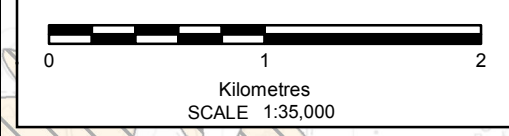
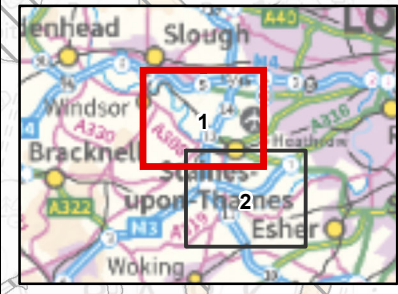
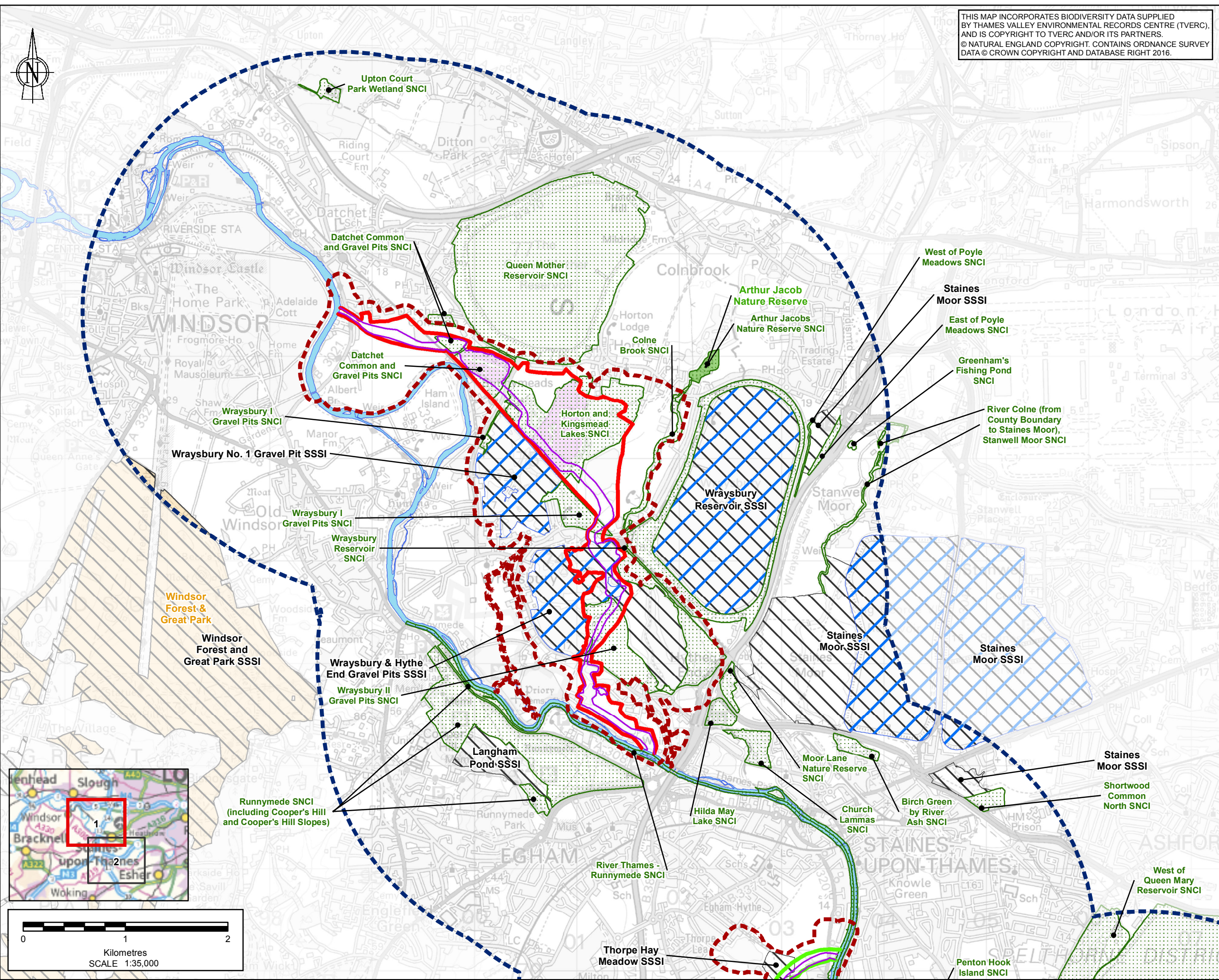
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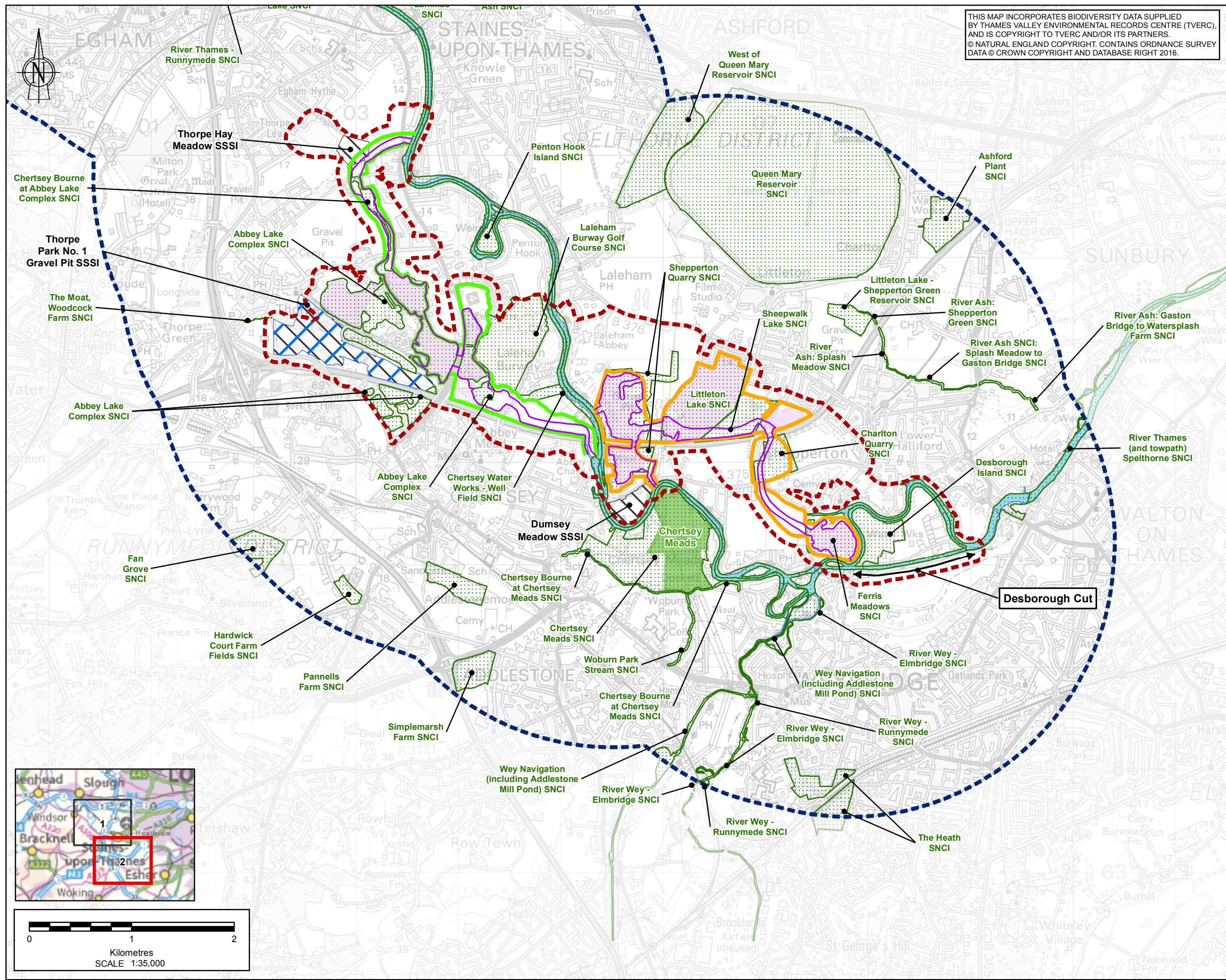
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Project: RIVER THAMES SCHEME (DATCHET TO TEDDINGTON) (RTS) CAPACITY IMPROVEMENTS AND FLOOD CHANNEL (CI&FC)

DESIGNATED NATURE CONSERVATION SITES SHEET 1 OF 2

Drawing scale: 1:35,000 @ A3 Sheet size: A3
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- LEGEND:**
- CHANNEL SECTION 1
 - CHANNEL SECTION 2
 - CHANNEL SECTION 3
 - POTENTIAL DIVERSION CHANNEL
 - - - PEA SURVEY AREA
 - - - CHANNELS 2.5 KM BUFFER
 - LOCAL NATURE RESERVE
 - SITE OF NATURE CONSERVATION INTEREST
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SITE OF NATURE CONSERVATION INTEREST DATA INCLUDES LOCAL WILDLIFE SITES AND SITES OF IMPORTANCE FOR NATURE CONSERVATION.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION	
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MAINTENANCE, CLEANING AND OPERATION:	NOT APPLICABLE
DECOMMISSIONING OR DEMOLITION:	NOT APPLICABLE

Rev	Drawn	Chkd	Rvwd	Apprvd	Date	Description
P01	MMG	CA	EF	ES	08/03/2016	SUITABLE FOR INFORMATION

Designed by: MMG Date: MARCH 2016

Client: **River Thames Scheme**

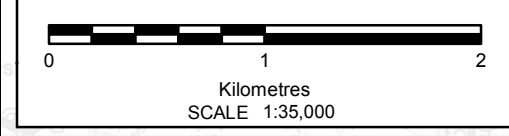
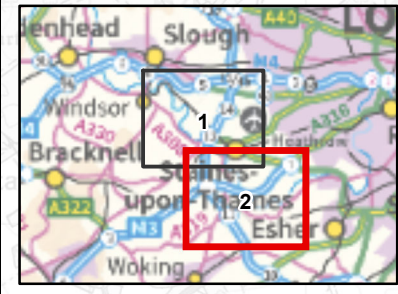
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 SECURING our economy
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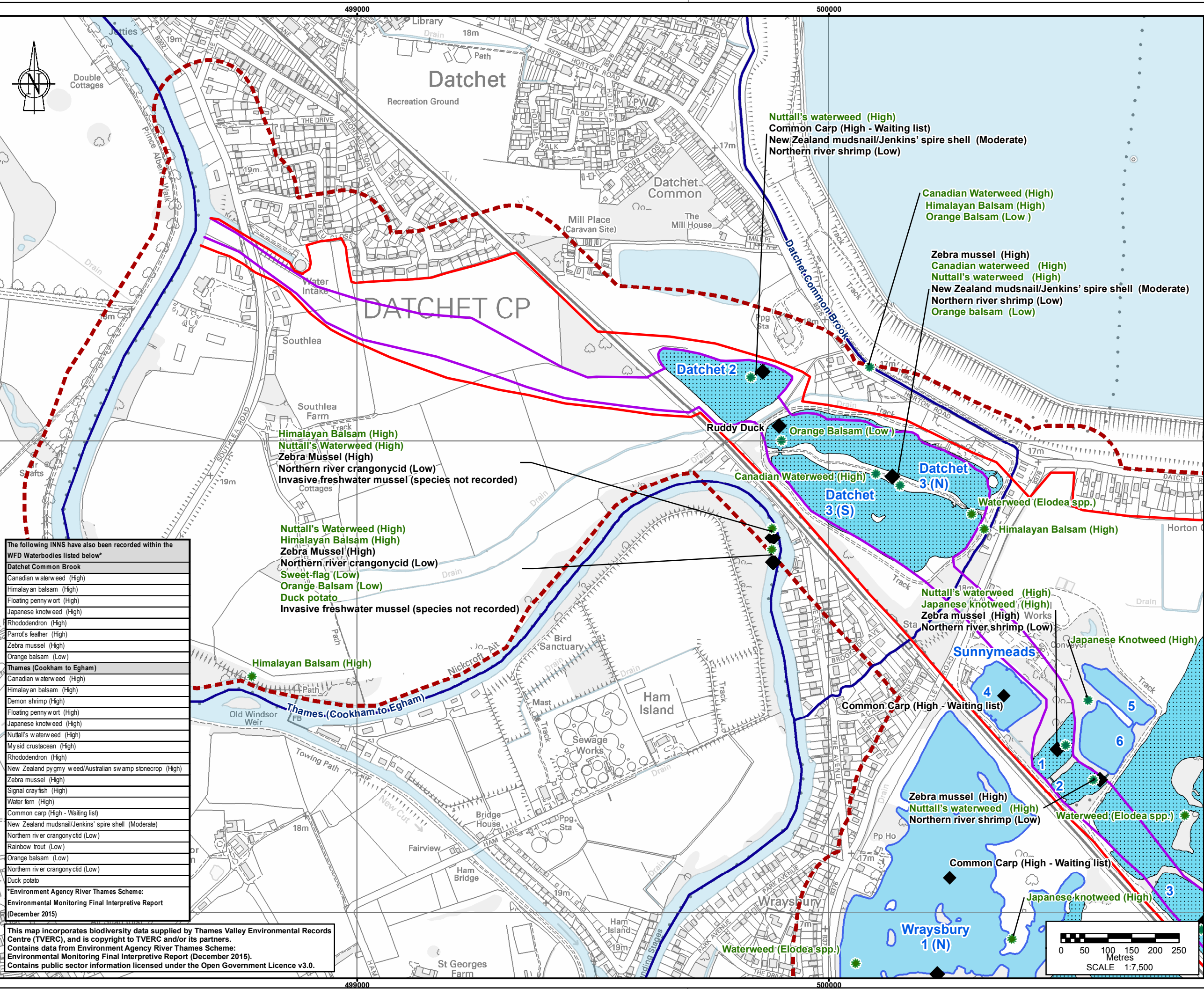
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 Drawing title:

DESIGNATED NATURE CONSERVATION SITES SHEET 2 OF 2

Drawing scale: 1:35,000 @ A3 Sheet size: A3
 Drawing no. 122368-BVL-Z0-SW-DR-V-00012 Revision: P01





The following INNS have also been recorded within the WFD Waterbodies listed below*

Datchet Common Brook
Canadian waterweed (High)
Himalayan balsam (High)
Floating pennywort (High)
Japanese knotweed (High)
Rhododendron (High)
Parrot's feather (High)
Zebra mussel (High)
Orange balsam (Low)
Thames (Cookham to Egham)
Canadian waterweed (High)
Himalayan balsam (High)
Demon shrimp (High)
Floating pennywort (High)
Japanese knotweed (High)
Nuttall's waterweed (High)
Mysid crustacean (High)
Rhododendron (High)
New Zealand pygmy weed/Australian swamp stonecrop (High)
Zebra mussel (High)
Signal crayfish (High)
Water fern (High)
Common carp (High - Waiting list)
New Zealand mudsnail/Jenkins' spire shell (Moderate)
Northern river crayonycid (Low)
Rainbow trout (Low)
Orange balsam (Low)
Northern river crayonycid (Low)
Duck potato

*Environment Agency River Thames Scheme: Environmental Monitoring Final Interpretive Report (December 2015)

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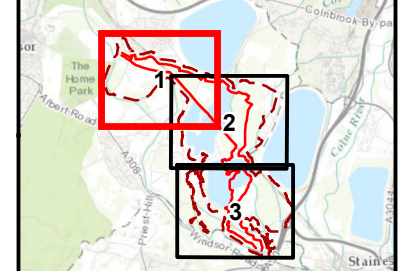
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LEGEND:

- CHANNEL SECTION 1
- POTENTIAL DIVERSION CHANNEL
- PEA SURVEY AREA
- PLANT
- ANIMAL
- WFD WATERBODIES
- NAMED LAKES
- LAKE MONITORED AS PART OF THE RTS ENVIRONMENTAL MONITORING PROJECT
- INLAND WATER

(High) LEVEL OF IMPACT ON NATIVE HABITATS AND BIOTA*
 (Moderate)
 (Low) SPECIES WAITING TO BE ADDED TO THE UKTAG LIST IN PREPARATION FOR THE NEXT RBMP CYCLE
 (High - Waiting list)

Note: *As classified by the Revised Classification of Aquatic Alien Species, Working Paper Version 7.6 of the UK Technical Advisory Group on the Water Framework Directive, 22 July 2015.



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P01	MMG	CA	EF	ES	08/03/2016	SUITABLE FOR INFORMATION
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Rev	Drawn	Chkd	Rvwd	Apprvd	Date	Description

Designed by: MMG Date: MARCH 2016

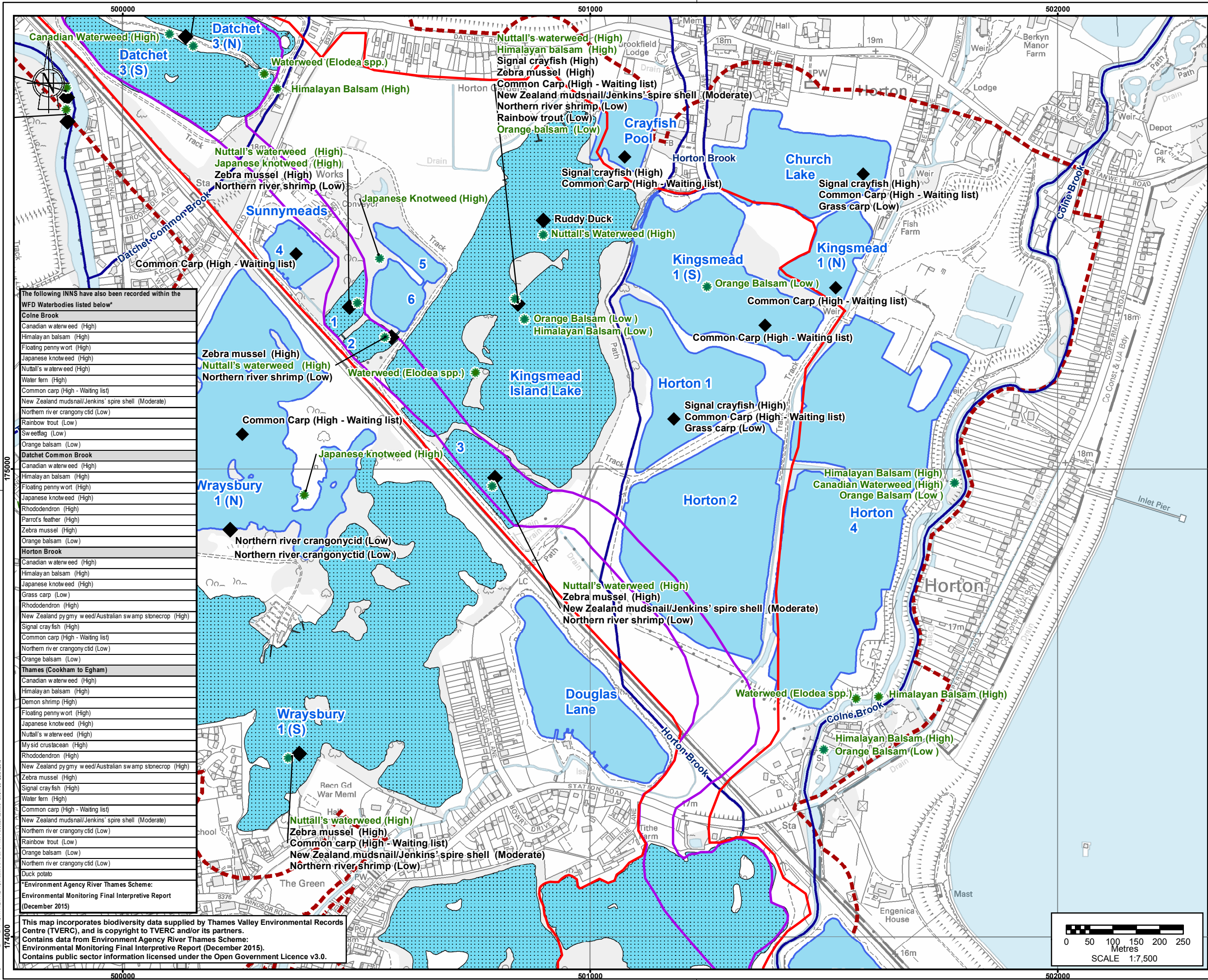
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Project: RIVER THAMES SCHEME (DATCHET TO TEDDINGTON) (RTS) CAPACITY IMPROVEMENTS AND FLOOD CHANNEL (CI&FC)

Drawing title: INVASIVE NON-NATIVE SPECIES CHANNEL SECTION 1 1 OF 3

Drawing scale: 1:7,500 @ A3 Sheet size: A3
 Drawing no. 122368-BVL-Z0-C1-DR-V-00002 Revision P02



The following INNS have also been recorded within the WFD Waterbodies listed below*

Colne Brook	
Canadian waterweed (High)	
Himalayan balsam (High)	
Floating penny wort (High)	
Japanese knotweed (High)	
Nuttall's waterweed (High)	
Water fern (High)	
Common carp (High - Waiting list)	
New Zealand mudsnail/Jenkins' spire shell (Moderate)	
Northern river crayfish (Low)	
Rainbow trout (Low)	
Sweetflag (Low)	
Orange balsam (Low)	
Datchet Common Brook	
Canadian waterweed (High)	
Himalayan balsam (High)	
Floating penny wort (High)	
Japanese knotweed (High)	
Rhododendron (High)	
Parrot's feather (High)	
Zebra mussel (High)	
Orange balsam (Low)	
Horton Brook	
Canadian waterweed (High)	
Himalayan balsam (High)	
Japanese knotweed (High)	
Grass carp (Low)	
Rhododendron (High)	
New Zealand pygmy weed/Australian swamp stonecrop (High)	
Signal crayfish (High)	
Common carp (High - Waiting list)	
Northern river crayfish (Low)	
Orange balsam (Low)	
Thames (Cookham to Egham)	
Canadian waterweed (High)	
Himalayan balsam (High)	
Demon shrimp (High)	
Floating penny wort (High)	
Japanese knotweed (High)	
Nuttall's waterweed (High)	
Myxid crustacean (High)	
Rhododendron (High)	
New Zealand pygmy weed/Australian swamp stonecrop (High)	
Zebra mussel (High)	
Signal crayfish (High)	
Water fern (High)	
Common carp (High - Waiting list)	
New Zealand mudsnail/Jenkins' spire shell (Moderate)	
Northern river crayfish (Low)	
Rainbow trout (Low)	
Orange balsam (Low)	
Northern river crayfish (Low)	
Duck potato	

*Environment Agency River Thames Scheme: Environmental Monitoring Final Interpretive Report (December 2015)

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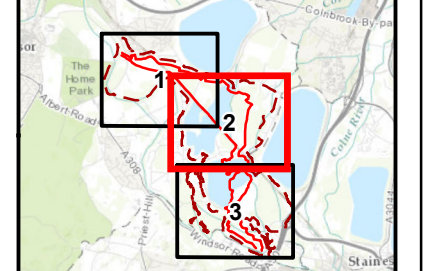
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LEGEND:

- CHANNEL SECTION 1
- POTENTIAL DIVERSION CHANNEL
- PEA SURVEY AREA
- PLANT
- ANIMAL
- WFD WATERBODIES
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(High) LEVEL OF IMPACT ON NATIVE HABITATS AND BIOTA*
(Moderate)
(Low) SPECIES WAITING TO BE ADDED TO THE UKTAG LIST IN PREPARATION FOR THE NEXT RBMP CYCLE
(High - Waiting list)

Note: *As classified by the Revised Classification of Aquatic Alien Species, Working Paper Version 7.6 of the UK Technical Advisory Group on the Water Framework Directive, 22 July 2015.



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CONSTRUCTION:						
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MAINTENANCE, CLEANING AND OPERATION:						
NOT APPLICABLE						
DECOMMISSIONING OR DEMOLITION:						
NOT APPLICABLE						
P01	MMG	CA	EF	ES	06/03/2016	SUITABLE FOR INFORMATION
P02	ZO	CA	EF	ES	06/05/2016	SUITABLE FOR INFORMATION
Rev	Drawn	Chkd	Rvwd	Apprvd	Date	Description

Designed by: MMG Date: MARCH 2016

Client: **River Thames Scheme**

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SECURING our economy
ENHANCING our Thames

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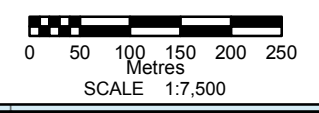
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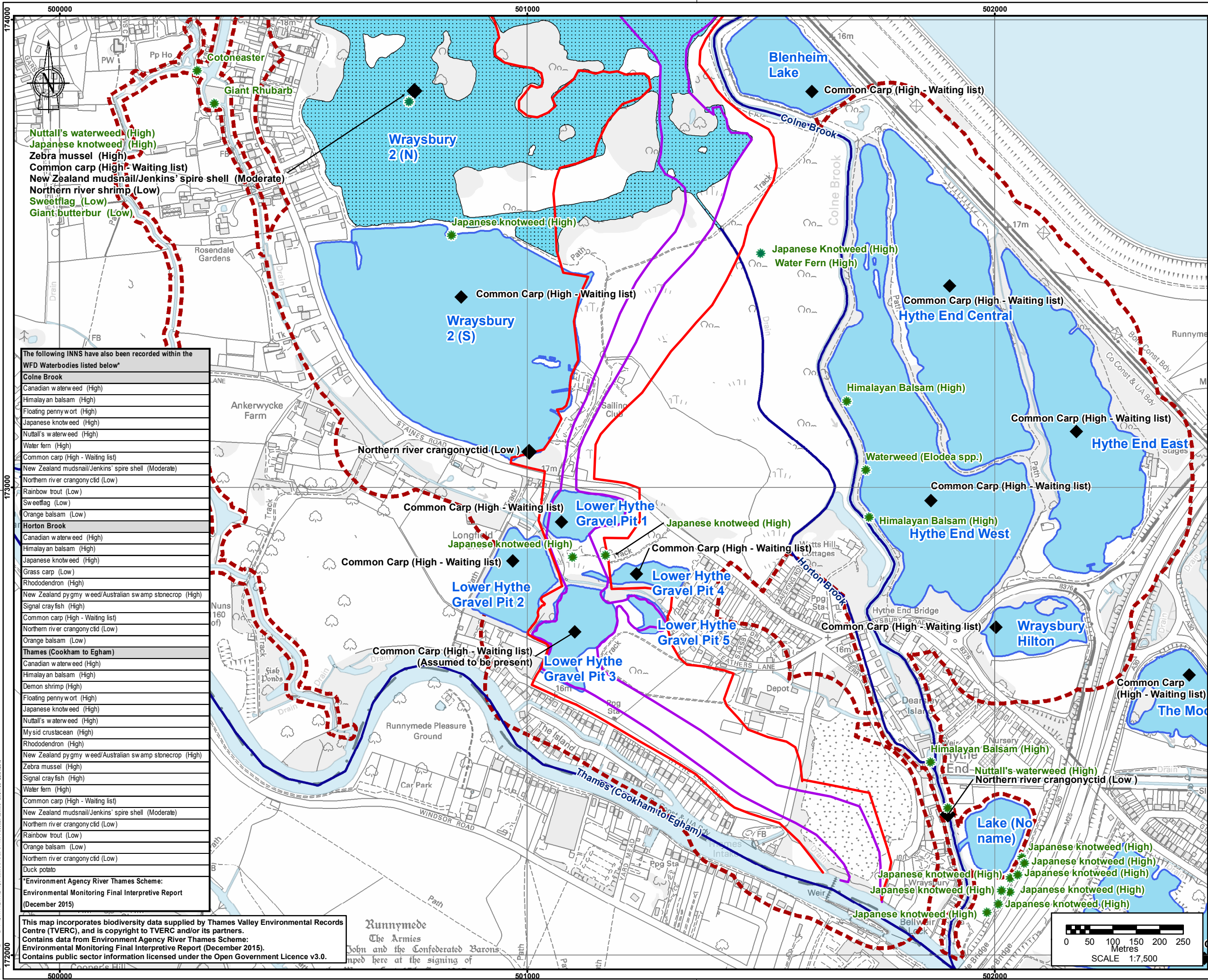
Project: **RIVER THAMES SCHEME (DATCHET TO TEDDINGTON) (RTS) CAPACITY IMPROVEMENTS AND FLOOD CHANNEL (CI&FC)**

Drawing title: **INVASIVE NON-NATIVE SPECIES CHANNEL SECTION 1 2 OF 3**

Drawing scale: 1:7,500 @ A3 Sheet size: A3

Drawing no. 122368-BVL-Z0-C1-DR-V-00002 Revision: P02





The following INNS have also been recorded within the WFD Waterbodies listed below*

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Canadian waterweed (High)
Himalayan balsam (High)
Floating pennywort (High)
Japanese knotweed (High)
Nuttall's waterweed (High)
Water fern (High)
Common carp (High - Waiting list)
New Zealand mudsnail/Jenkins' spire shell (Moderate)
Northern river crayngonyctid (Low)
Rainbow trout (Low)
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Duck potato
*Environment Agency River Thames Scheme: Environmental Monitoring Final Interpretive Report (December 2015)

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- INLAND WATER

(High) LEVEL OF IMPACT ON NATIVE HABITATS AND BIOTA*
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 (Low) SPECIES WAITING TO BE ADDED TO THE UK TAG LIST IN PREPARATION FOR THE NEXT RBMP CYCLE
 (High - Waiting list)

Note: *As classified by the Revised Classification of Aquatic Alien Species, Working Paper Version 7.6 of the UK Technical Advisory Group on the Water Framework Directive, 22 July 2015.

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MAINTENANCE, CLEANING AND OPERATION: NOT APPLICABLE

DECOMMISSIONING OR DEMOLITION: NOT APPLICABLE

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P02	ZO	CA	EF	ES	06/05/2016	SUITABLE FOR INFORMATION
Rev	Drawn	Chkd	Rvwd	Apprvd	Date	Description

Designed by: MMG Date: MARCH 2016

Client: **River Thames Scheme**

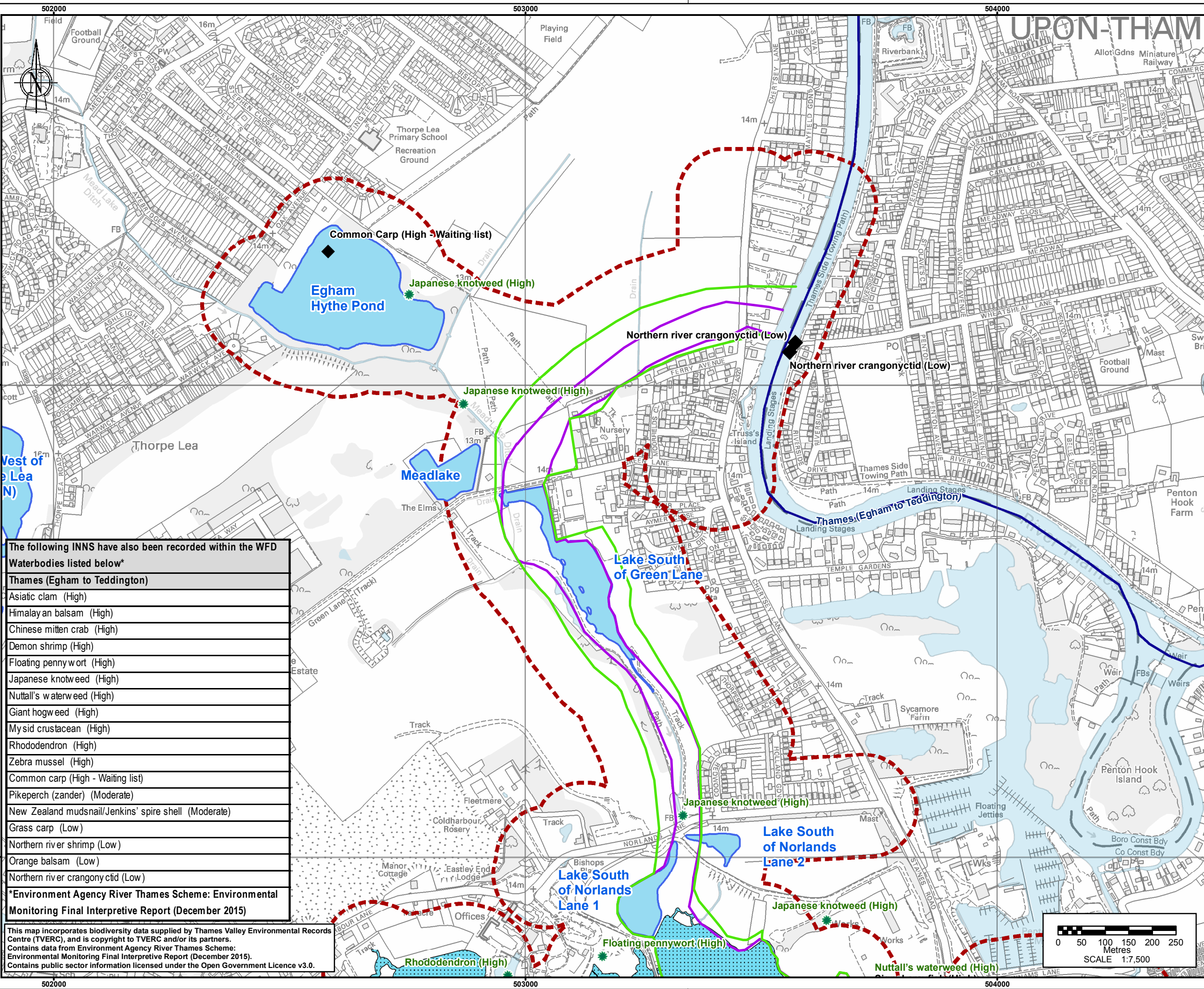
Client Drawing No. | Revision

gbv A GALLIFORD TRY, BLACK & VEATCH JOINT VENTURE
 Registered office: Cowley Business Park, Cowley, UnbrIDGE, Middlesex, UB8 2AL, UK
 Registered in England and Wales. Company no. 08584396

Project: **RIVER THAMES SCHEME (DATCHET TO TEDDINGTON) (RTS) CAPACITY IMPROVEMENTS AND FLOOD CHANNEL (CI&FC)**

Drawing title: **INVASIVE NON-NATIVE SPECIES CHANNEL SECTION 1 3 OF 3**

Drawing scale: 1:7,500 @ A3 Sheet size: A3
 Drawing no. 122368-BVL-Z0-C1-DR-V-00002 Revision P02



The following INNS have also been recorded within the WFD Waterbodies listed below*

Thames (Egham to Teddington)
Asiatic clam (High)
Himalayan balsam (High)
Chinese mitten crab (High)
Demon shrimp (High)
Floating pennywort (High)
Japanese knotweed (High)
Nuttall's waterweed (High)
Giant hogweed (High)
Mysid crustacean (High)
Rhododendron (High)
Zebra mussel (High)
Common carp (High - Waiting list)
Pikeperch (zander) (Moderate)
New Zealand mudsnail/Jenkins' spire shell (Moderate)
Grass carp (Low)
Northern river shrimp (Low)
Orange balsam (Low)
Northern river crangonyctid (Low)

*Environment Agency River Thames Scheme: Environmental Monitoring Final Interpretive Report (December 2015)

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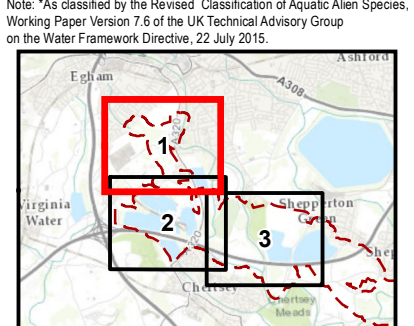
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LEGEND:

- CHANNEL SECTION 2
- POTENTIAL DIVERSION CHANNEL
- PEA SURVEY AREA
- PLANT
- ANIMAL
- WFD WATERBODIES
- NAMED LAKES
- LAKE MONITORED AS PART OF THE RTS ENVIRONMENTAL MONITORING PROJECT
- INLAND WATER

(High) LEVEL OF IMPACT ON NATIVE HABITATS AND BIOTA*
 (Moderate)
 (Low) SPECIES WAITING TO BE ADDED TO THE UKTAG LIST IN PREPARATION FOR THE NEXT RBMP CYCLE



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

IN ADDITION TO THE HAZARDS OR RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, THE FOLLOWING SIGNIFICANT RESIDUAL RISKS SHOULD BE NOTED. FURTHER DETAILS ARE INCLUDED IN THE CDM DESIGN RISK MANAGEMENT REGISTER

CONSTRUCTION:
NOT APPLICABLE

MAINTENANCE, CLEANING AND OPERATION:
NOT APPLICABLE

DECOMMISSIONING OR DEMOLITION:
NOT APPLICABLE

Rev	Drawn	Chkd	Rvwd	Apprvd	Date	Description
P01	MMG	CA	EF	ES	08/03/2016	SUITABLE FOR INFORMATION
P02	ZO	CA	EF	ES	05/05/2016	SUITABLE FOR INFORMATION

Designed by: MMG Date: MARCH 2016

Client: **River Thames Scheme**

PROTECTING our communities
 SECURING our economy
 ENHANCING our Thames

Client Drawing No. | Revision

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Registered office: Cowley Business Park, Cowley, Uxbridge, Middlesex, UB8 2AL, UK
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Project: RIVER THAMES SCHEME (DATCHET TO TEDDINGTON) (RTS) CAPACITY IMPROVEMENTS AND FLOOD CHANNEL (CI&FC)

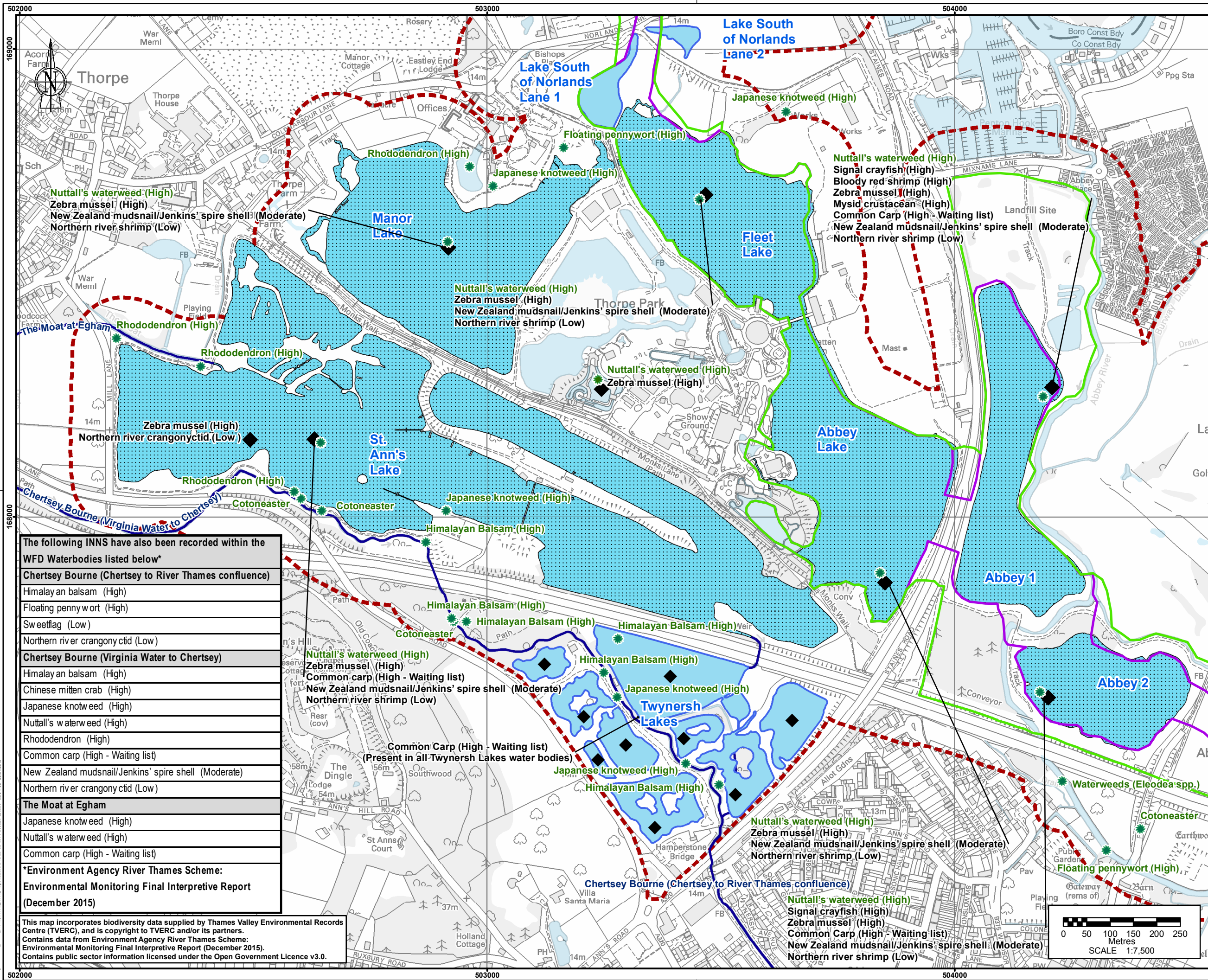
Drawing title: **INVASIVE NON-NATIVE SPECIES CHANNEL SECTION 2**

1 OF 3

Drawing scale: 1:7,500 @ A3 Sheet size: A3

Drawing no. 122368-BVL-Z0-C2-DR-V-00002 Revision P02

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The following INNS have also been recorded within the WFD Waterbodies listed below*

Chertsey Bourne (Chertsey to River Thames confluence)
Himalayan balsam (High)
Floating pennywort (High)
Sweetflag (Low)
Northern river crangonyctid (Low)
Chertsey Bourne (Virginia Water to Chertsey)
Himalayan balsam (High)
Chinese mitten crab (High)
Japanese knotweed (High)
Nuttall's waterweed (High)
Rhododendron (High)
Common carp (High - Waiting list)
New Zealand mudsnail/Jenkins' spire shell (Moderate)
Northern river crangonyctid (Low)
The Moat at Egham
Japanese knotweed (High)
Nuttall's waterweed (High)
Common carp (High - Waiting list)
*Environment Agency River Thames Scheme: Environmental Monitoring Final Interpretive Report (December 2015)

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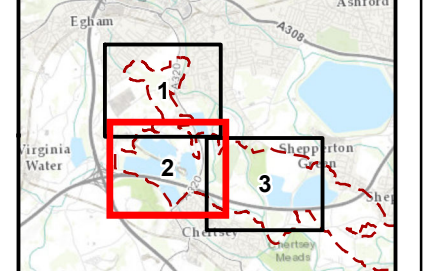
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LEGEND:

- CHANNEL SECTION 2
- POTENTIAL DIVERSION CHANNEL
- PEA SURVEY AREA
- PLANT
- ANIMAL
- WFD WATERBODIES
- NAMED LAKES
- LAKE MONITORED AS PART OF THE RTS ENVIRONMENTAL MONITORING PROJECT
- INLAND WATER

(High) LEVEL OF IMPACT ON NATIVE HABITATS AND BIOTA*
 (Moderate)
 (Low) SPECIES WAITING TO BE ADDED TO THE UKTAG LIST IN PREPARATION FOR THE NEXT RBMP CYCLE
 (High - Waiting list)

Note: *As classified by the Revised Classification of Aquatic Alien Species, Working Paper Version 7.6 of the UK Technical Advisory Group on the Water Framework Directive, 22 July 2015.



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
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CONSTRUCTION: NOT APPLICABLE

MAINTENANCE, CLEANING AND OPERATION: NOT APPLICABLE

DECOMMISSIONING OR DEMOLITION: NOT APPLICABLE

P01	MMG	CA	EF	ES	08/03/2016	SUITABLE FOR INFORMATION
P02	ZO	CA	EF	ES	05/05/2016	SUITABLE FOR INFORMATION
Rev	Drawn	Chkd	Rvwd	Apprvd	Date	Description

Designed by: MMG Date: MARCH 2016

Client: **River Thames Scheme**

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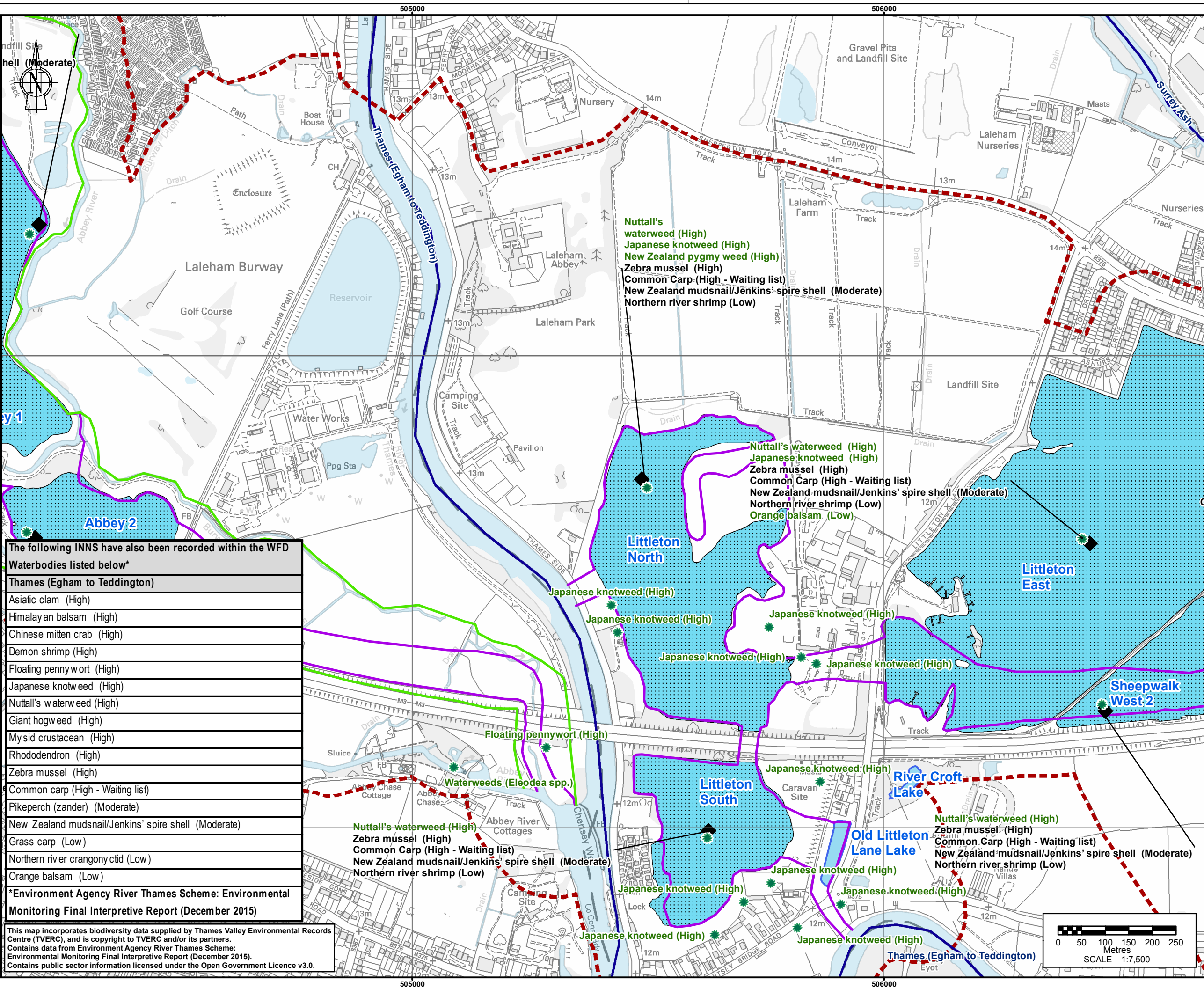
gbv A GALLIFORD TRY, BLACK & VEATCH JOINT VENTURE

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Project: **RIVER THAMES SCHEME (DATCHET TO TEDDINGTON) (RTS) CAPACITY IMPROVEMENTS AND FLOOD CHANNEL (CI&FC)**

Drawing title: **INVASIVE NON-NATIVE SPECIES CHANNEL SECTION 2**
 2 OF 3

Drawing scale: 1:7,500 @ A3 Sheet size: A3
 Drawing no. 122368-BVL-Z0-C2-DR-V-00002 Revision: P02



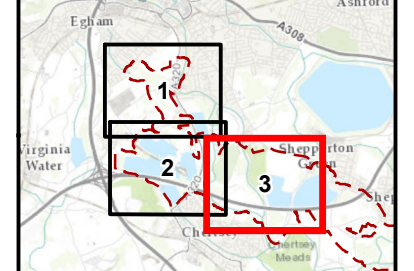
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LEGEND:

- CHANNEL SECTION 2
- POTENTIAL DIVERSION CHANNEL
- - - PEA SURVEY AREA
- ★ PLANT
- ◆ ANIMAL
- WFD WATERBODIES
- NAMED LAKES
- LAKE MONITORED AS PART OF THE RTS ENVIRONMENTAL MONITORING PROJECT
- INLAND WATER

(High) LEVEL OF IMPACT ON NATIVE HABITATS AND BIOTA*
 (Moderate)
 (Low) SPECIES WAITING TO BE ADDED TO THE UKTAG LIST IN PREPARATION FOR THE NEXT RBMP CYCLE
 (High - Waiting list)

Note: *As classified by the Revised Classification of Aquatic Alien Species, Working Paper Version 7.6 of the UK Technical Advisory Group on the Water Framework Directive, 22 July 2015.



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION
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CONSTRUCTION:
 NOT APPLICABLE

MAINTENANCE, CLEANING AND OPERATION:
 NOT APPLICABLE

DECOMMISSIONING OR DEMOLITION:
 NOT APPLICABLE

Rev	Drawn	Chkd	Rvwd	Apprvd	Date	Description
P01	MMG	CA	EF	ES	08/03/2016	SUITABLE FOR INFORMATION
P02	ZO	CA	EF	ES	05/05/2016	SUITABLE FOR INFORMATION

Designed by: MMG Date: MARCH 2016

Client: **River Thames Scheme**

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Client Drawing No. _____ Revision _____

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Project: RIVER THAMES SCHEME (DATCHET TO TEDDINGTON) (RTS) CAPACITY IMPROVEMENTS AND FLOOD CHANNEL (CI&FC)

Drawing title: **INVASIVE NON-NATIVE SPECIES CHANNEL SECTION 2**
 3 OF 3

Drawing scale: 1:7,500 @ A3 Sheet size: A3

Drawing no. 122368-BVL-Z0-C2-DR-V-00002 Revision P02

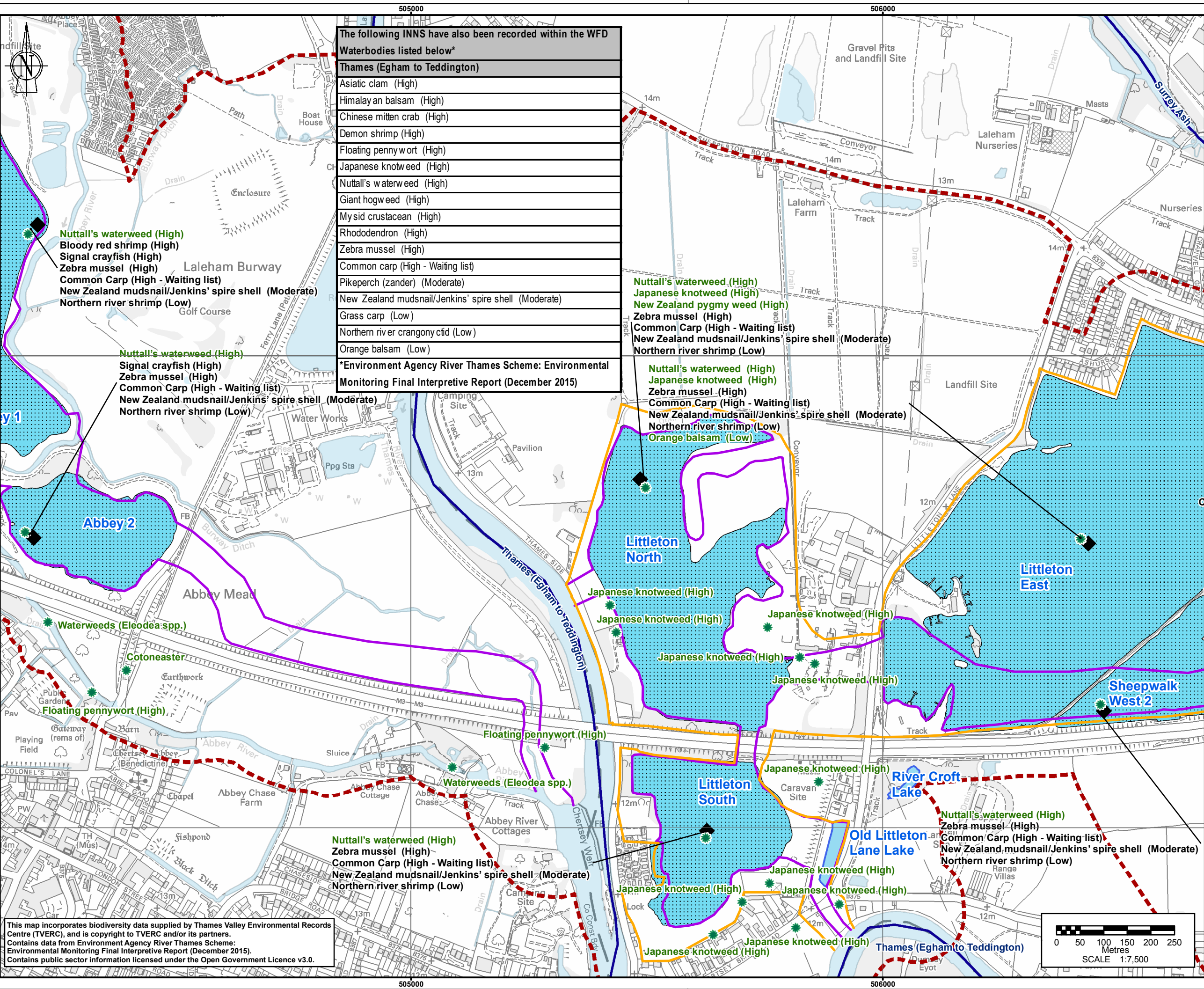
The following INNS have also been recorded within the WFD Waterbodies listed below*

Thames (Egham to Teddington)	
Asiatic clam	(High)
Himalayan balsam	(High)
Chinese mitten crab	(High)
Demon shrimp	(High)
Floating pennywort	(High)
Japanese knotweed	(High)
Nuttall's waterweed	(High)
Giant hogweed	(High)
Mysid crustacean	(High)
Rhododendron	(High)
Zebra mussel	(High)
Common carp	(High - Waiting list)
Pikeperch (zander)	(Moderate)
New Zealand mudsnail/Jenkins' spire shell	(Moderate)
Grass carp	(Low)
Northern river crayfish	(Low)
Orange balsam	(Low)

*Environment Agency River Thames Scheme: Environmental Monitoring Final Interpretive Report (December 2015)

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The following INNS have also been recorded within the WFD

Waterbodies listed below*

Thames (Egham to Teddington)

Asiatic clam (High)
Himalayan balsam (High)
Chinese mitten crab (High)
Demon shrimp (High)
Floating pennywort (High)
Japanese knotweed (High)
Nuttall's waterweed (High)
Giant hogweed (High)
Mysid crustacean (High)
Rhododendron (High)
Zebra mussel (High)
Common carp (High - Waiting list)
Pikeperch (zander) (Moderate)
New Zealand mudsnail/Jenkins' spire shell (Moderate)
Grass carp (Low)
Northern river crangonyctid (Low)
Orange balsam (Low)

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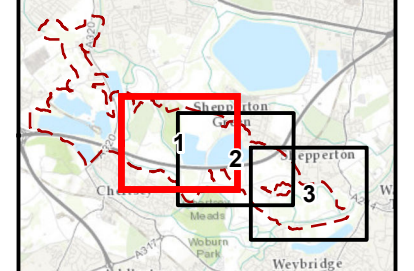
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LEGEND:

- CHANNEL SECTION 3
- POTENTIAL DIVERSION CHANNEL
- PEA SURVEY AREA
- PLANT
- ANIMAL
- WFD WATERBODIES
- NAMED LAKES
- LAKE MONITORED AS PART OF THE RTS ENVIRONMENTAL MONITORING PROJECT
- INLAND WATER

(High) LEVEL OF IMPACT ON NATIVE HABITATS AND BIOTA*
 (Moderate)
 (Low) SPECIES WAITING TO BE ADDED TO THE UKTAG LIST IN PREPARATION FOR THE NEXT RBMP CYCLE
 (High - Waiting list)

Note: *As classified by the Revised Classification of Aquatic Alien Species, Working Paper Version 7.6 of the UK Technical Advisory Group on the Water Framework Directive, 22 July 2015.



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

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CONSTRUCTION: NOT APPLICABLE

MAINTENANCE, CLEANING AND OPERATION: NOT APPLICABLE

DECOMMISSIONING OR DEMOLITION: NOT APPLICABLE

Rev	Drawn	Chkd	Rvwd	Apprvd	Date	Description
P01	MMG	CA	EF	ES	08/03/2016	SUITABLE FOR INFORMATION
P02	ZO	CA	EF	ES	05/05/2016	SUITABLE FOR INFORMATION

Designed by: MMG Date: MARCH 2016



Client Drawing No. | Revision



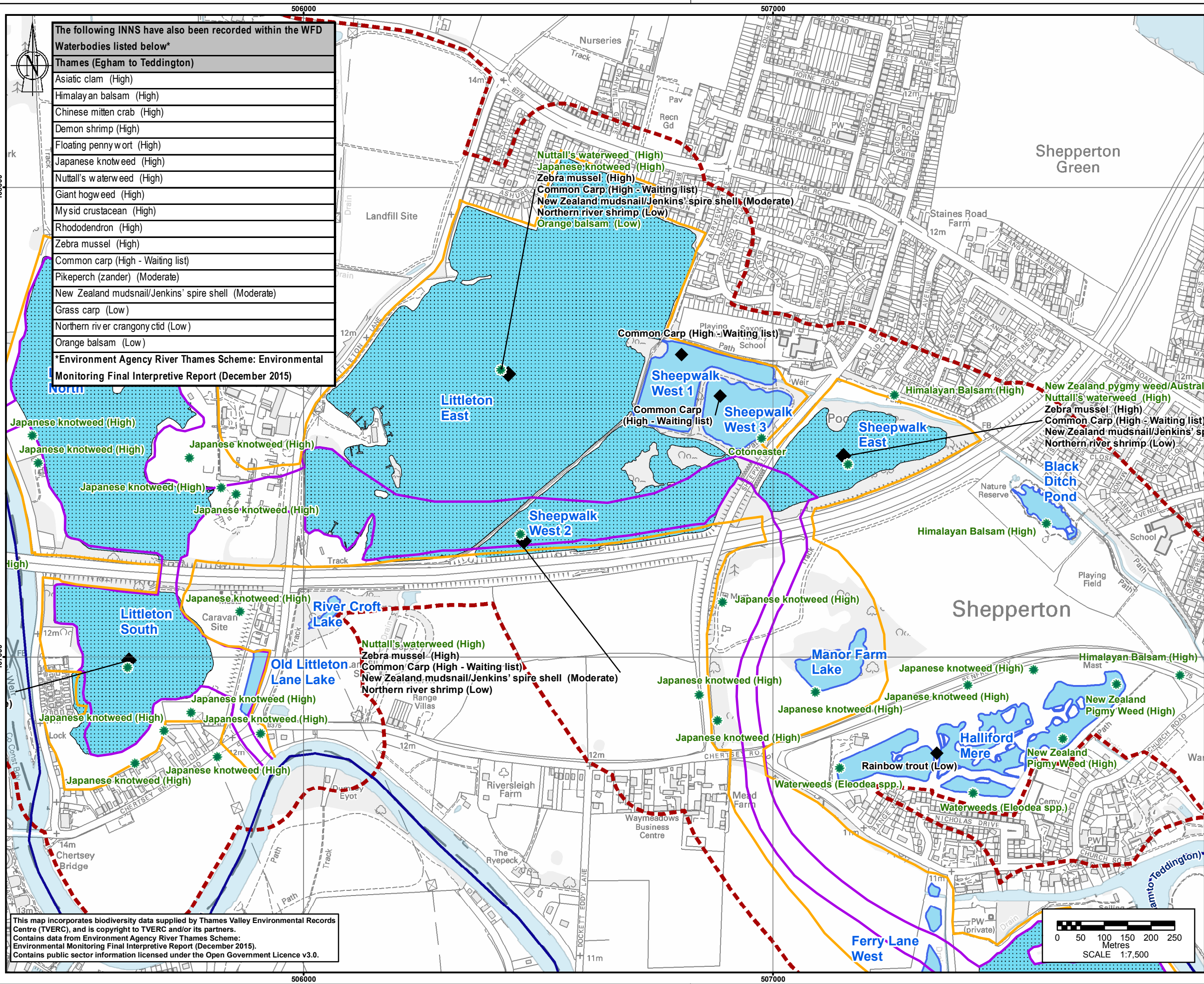
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Project: RIVER THAMES SCHEME (DATCHET TO TEDDINGTON) (RTS) CAPACITY IMPROVEMENTS AND FLOOD CHANNEL (CI&FC)

Drawing title: INVASIVE NON-NATIVE SPECIES CHANNEL SECTION 3 1 OF 3

Drawing scale: 1:7,500 @ A3 Sheet size: A3

Drawing no. 122368-BVL-Z0-C3-DR-V-00002 Revision P02



The following INNS have also been recorded within the WFD Waterbodies listed below*

Thames (Egham to Teddington)
Asiatic clam (High)
Himalayan balsam (High)
Chinese mitten crab (High)
Demon shrimp (High)
Floating pennywort (High)
Japanese knotweed (High)
Nuttall's waterweed (High)
Giant hogweed (High)
Mysid crustacean (High)
Rhododendron (High)
Zebra mussel (High)
Common carp (High - Waiting list)
Pikeperch (zander) (Moderate)
New Zealand mudsnail/Jenkins' spire shell (Moderate)
Grass carp (Low)
Northern river crangonyctid (Low)
Orange balsam (Low)

*Environment Agency River Thames Scheme: Environmental Monitoring Final Interpretive Report (December 2015)

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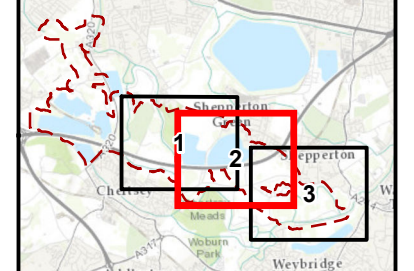
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LEGEND:

- CHANNEL SECTION 3
- POTENTIAL DIVERSION CHANNEL
- - - PEA SURVEY AREA
- ★ PLANT
- ◆ ANIMAL
- WFD WATERBODIES
- NAMED LAKES
- LAKE MONITORED AS PART OF THE RTS ENVIRONMENTAL MONITORING PROJECT
- INLAND WATER

(High) LEVEL OF IMPACT ON NATIVE HABITATS AND BIOTA*
 (Moderate)
 (Low) SPECIES WAITING TO BE ADDED TO THE UKTAG LIST IN PREPARATION FOR THE NEXT RBMP CYCLE
 (High - Waiting list)

Note: *As classified by the Revised Classification of Aquatic Alien Species, Working Paper Version 7.6 of the UK Technical Advisory Group on the Water Framework Directive, 22 July 2015.



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

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CONSTRUCTION: NOT APPLICABLE

MAINTENANCE, CLEANING AND OPERATION: NOT APPLICABLE

DECOMMISSIONING OR DEMOLITION: NOT APPLICABLE

Rev	Drawn	Chkd	Rvwd	Apprvd	Date	Description
P01	MMG	CA	EF	ES	08/03/2016	SUITABLE FOR INFORMATION
P02	ZO	CA	EF	ES	05/05/2016	SUITABLE FOR INFORMATION

Designed by: MMG Date: MARCH 2016

Client: **River Thames Scheme**

PROTECTING our communities
 SECURING our economy
 ENHANCING our Thames

gbv A GALLIFORD TRY, BLACK & VEATCH JOINT VENTURE

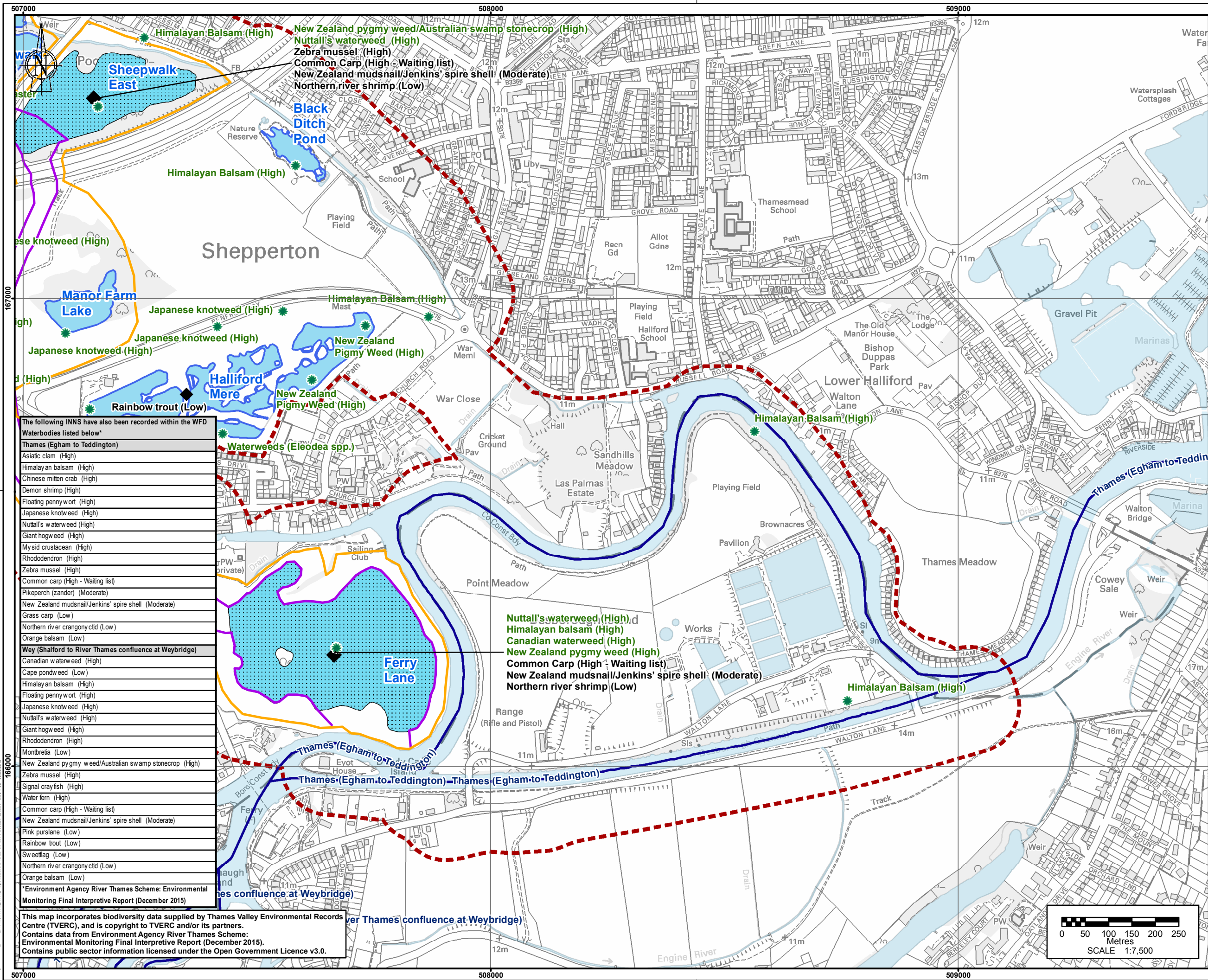
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Project: RIVER THAMES SCHEME (DATCHET TO TEDDINGTON) (RTS) CAPACITY IMPROVEMENTS AND FLOOD CHANNEL (CI&FC)

Drawing title: **INVASIVE NON-NATIVE SPECIES CHANNEL SECTION 3**
 2 OF 3

Drawing scale: 1:7,500 @ A3 Sheet size: A3
 Drawing no. 122368-BVL-Z0-C3-DR-V-00002 Revision P02

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The following INNS have also been recorded within the WFD Waterbodies listed below*

Thames (Egham to Teddington)
Asiatic clam (High)
Himalayan balsam (High)
Chinese mitten crab (High)
Demon shrimp (High)
Floating penny wort (High)
Japanese knotweed (High)
Nuttall's waterweed (High)
Giant hogweed (High)
Myxid crustacean (High)
Rhododendron (High)
Zebra mussel (High)
Common carp (High - Waiting list)
Pikeperch (zander) (Moderate)
New Zealand mudsnail/Jenkins' spire shell (Moderate)
Grass carp (Low)
Northern river crangonyctid (Low)
Orange balsam (Low)
Wey (Shaftord to River Thames confluence at Weybridge)
Canadian waterweed (High)
Cape pondweed (Low)
Himalayan balsam (High)
Floating penny wort (High)
Japanese knotweed (High)
Nuttall's waterweed (High)
Giant hogweed (High)
Rhododendron (High)
Montibretia (Low)
New Zealand pygmy weed/Australian swamp stonecrop (High)
Zebra mussel (High)
Signal cray fish (High)
Water fern (High)
Common carp (High - Waiting list)
New Zealand mudsnail/Jenkins' spire shell (Moderate)
Pink purlane (Low)
Rainbow trout (Low)
Sw eeftag (Low)
Northern river crangonyctid (Low)
Orange balsam (Low)

*Environment Agency River Thames Scheme: Environmental Monitoring Final Interpretive Report (December 2015)

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LEGEND:

- CHANNEL SECTION 3
- POTENTIAL DIVERSION CHANNEL
- PEA SURVEY AREA
- PLANT
- ANIMAL
- WFD WATERBODIES
- NAMED LAKES
- LAKE MONITORED AS PART OF THE RTS ENVIRONMENTAL MONITORING PROJECT
- INLAND WATER

(High) LEVEL OF IMPACT ON NATIVE HABITATS AND BIOTA*
 (Moderate) LEVEL OF IMPACT ON NATIVE HABITATS AND BIOTA*
 (Low) SPECIES WAITING TO BE ADDED TO THE UKTAG LIST IN PREPARATION FOR THE NEXT RBMP CYCLE
 (High - Waiting list) SPECIES WAITING TO BE ADDED TO THE UKTAG LIST IN PREPARATION FOR THE NEXT RBMP CYCLE

Note: *As classified by the Revised Classification of Aquatic Alien Species, Working Paper Version 7.6 of the UK Technical Advisory Group on the Water Framework Directive, 22 July 2015.

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

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CONSTRUCTION: NOT APPLICABLE

MAINTENANCE, CLEANING AND OPERATION: NOT APPLICABLE

DECOMMISSIONING OR DEMOLITION: NOT APPLICABLE

P01	MMG	CA	EF	ES	08/03/2016	SUITABLE FOR INFORMATION
P02	ZO	CA	EF	ES	05/05/2016	SUITABLE FOR INFORMATION
Rev	Drawn	Chkd	Rvwd	Apprvd	Date	Description

Designed by: MMG Date: MARCH 2016

Client: River Thames Scheme

Client Drawing No. | Revision

gbv A GALLIFORD TRY, BLACK & VEATCH JOINT VENTURE

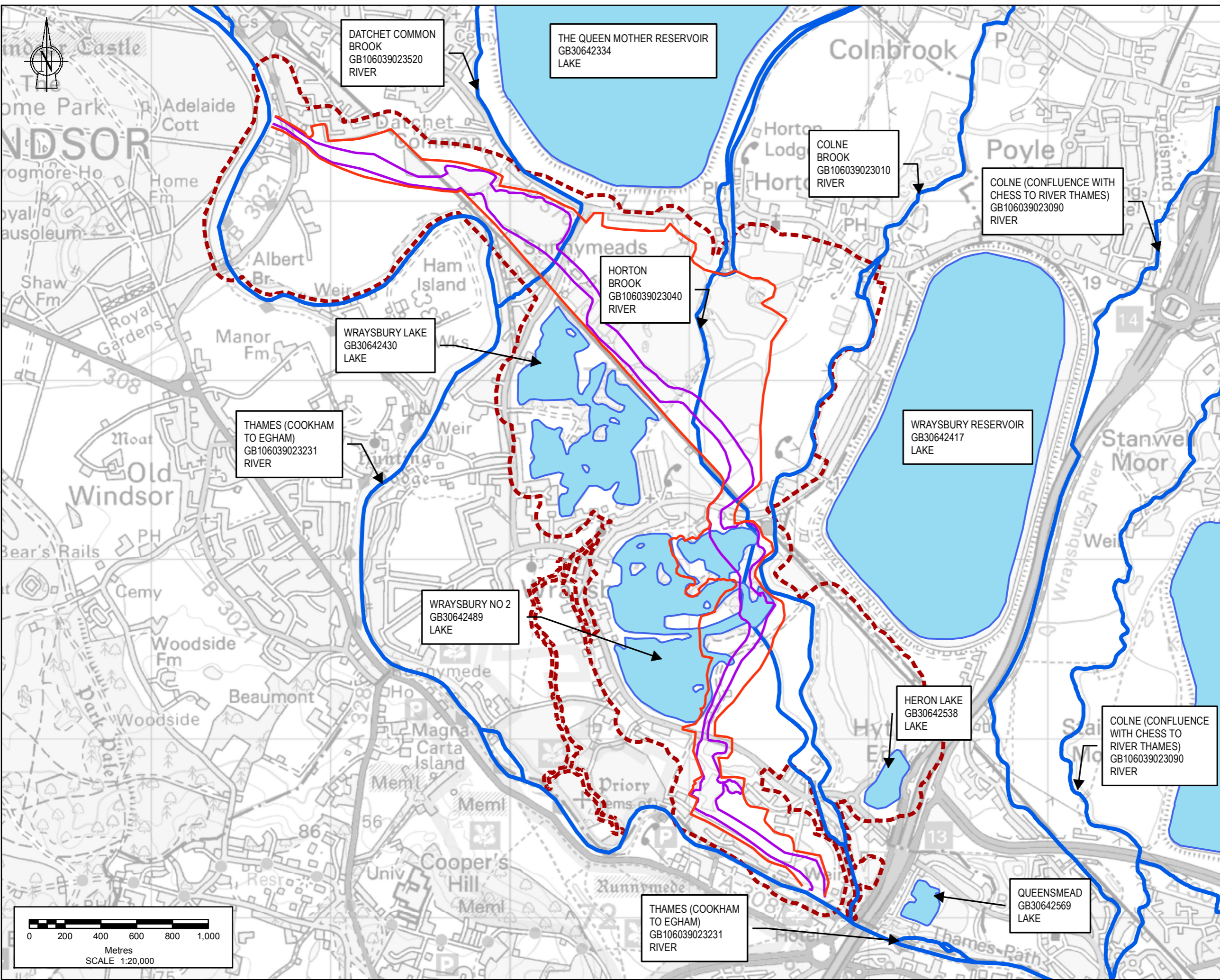
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Drawing title: INVASIVE NON-NATIVE SPECIES CHANNEL SECTION 3 3 OF 3

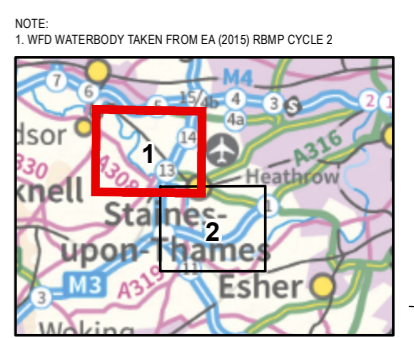
Drawing scale: 1:7,500 @ A3 Sheet size: A3

Drawing no. 122368-BVL-Z0-C3-DR-V-00002 Revision P02



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- LEGEND:**
- CHANNEL SECTION 1
 - CHANNEL SECTION 2
 - CHANNEL SECTION 3
 - POTENTIAL DIVERSION CHANNEL
 - WFD RIVER
 - WFD LAKE
 - PEA STUDY AREA BOUNDARY



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

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CONSTRUCTION :
NOT APPLICABLE

MAINTENANCE, CLEANING AND OPERATION :
NOT APPLICABLE

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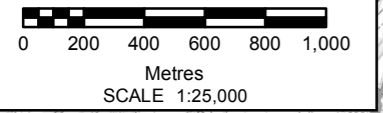
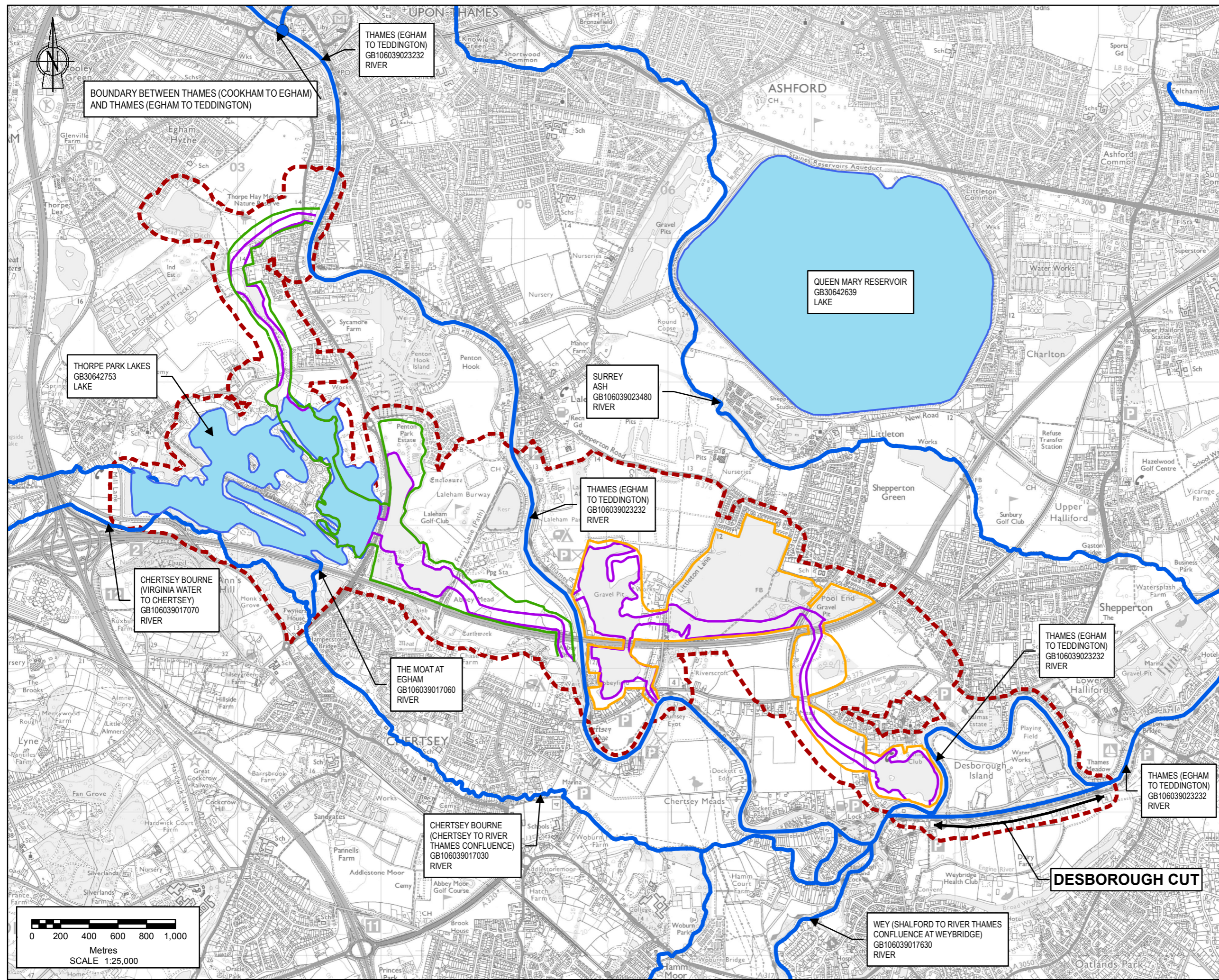
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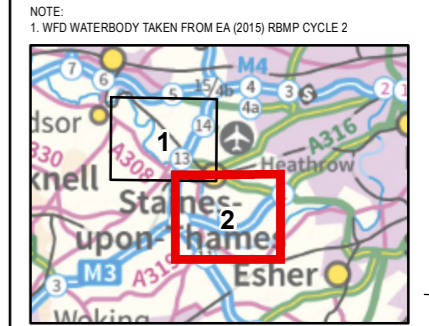
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- LEGEND:**
- CHANNEL SECTION 1
 - CHANNEL SECTION 2
 - CHANNEL SECTION 3
 - POTENTIAL DIVERSION CHANNEL
 - WFD RIVER
 - WFD LAKE
 - PEA STUDY AREA BOUNDARY



SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

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Rev	Drawn	Chkd	Rev'd	Apprv'd	Date	Description

Designed by: JME Date: FEB 2016

Client: **River Thames Scheme**

PROTECTING our communities
SECURING our economy
ENHANCING our Thames

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Registered in England and Wales: Company no. 08584398

Project: **RIVER THAMES SCHEME (DATCHET TO TEDDINGTON) (RTS) CAPACITY IMPROVEMENTS AND FLOOD CHANNEL (C1&C)**

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River Thames Scheme (Datchet to Teddington) Capacity Improvements and Flood Channel Project

Preliminary Ecological Appraisal for the Capacity Improvements to Teddington Weir, Molesey Weir and Sunbury Weir

JANUARY 2016



Preliminary Ecological Appraisal

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1. Introduction

1.1 Background

1.1.1 The Lower Thames has a long history of flooding; the Lower Thames Flood Risk Management Strategy sets out the preferred approach for managing the risk of flooding from Datchet to Teddington, which includes capacity improvements to three weirs (Sunbury, Molesey and Teddington). The Environment Agency, acting as the lead authority for the River Thames Scheme (Datchet to Teddington) (RTS), has procured GBV to undertake outline design and appraisal for the Capacity Improvements and Flood Channel Project (referred to as ‘the Project’).

1.1.2 To inform the early stages of the RTS appraisal and outline design, a Preliminary Ecological Appraisal (PEA) has been undertaken specifically for the three weirs element of the Project; including possible access and storage areas and possible locations of site compounds that may be used during construction for the works at the three weirs.

1.2 Scope of the report

1.2.1 **This report exclusively focuses on the proposed works to the three weirs.** A second PEA for the flood channel (in three sections) and Desborough Cut capacity improvement will be completed as part of the Project in due course.

1.2.2 This PEA (and the subsequent flood channel PEA) will form the first of a series of assessments and reports which will be carried out for the Project. During the current stage (outline design) of the Project, a Habitats Regulations Assessment (HRA), Environmental Impact Assessment (EIA) Scoping and Water Framework Directive (WFD) Assessment will be completed. These assessments and their accompanying reports will utilise information presented in this PEA (and the forthcoming Flood Channel PEA) to draw conclusions on the likelihood for significant effects to arise as a result of the Project and the Project’s level of compliance.

1.2.3 The information provided in this report forms the basis for any further ecological surveys and impact assessments carried out for the capacity improvements to the three weirs; provides information on key ecological constraints; summarises the requirements for further surveys and mitigation measures; and can be used to inform design options.

1.2.4 The aim of the PEA is to obtain information on existing ecological conditions, and to conduct a preliminary assessment of the likely ecological impacts on the proposed development sites. To achieve this, the following steps were taken:

- The desk study area and field survey area (including the ‘zone of influence’ of the scheme) have been identified.
- A desk study has been undertaken, comprising the use and reproduction of data from the Environment Agency, Surrey Biodiversity Information Centre (SBIC), Thames Valley Environmental Records Centre (TVERC) and Geographical Information for Greater London (GIGL). Due to copyright restrictions, not all received information has been reproduced in full.
- Baseline information on the site and surrounding area has been recorded through an ‘Extended Phase 1 Habitat Survey’ (referred to from hereon in simply as

'P1HS') (JNCC, 2010) and obtaining further details in relation to notable or protected habitats and species.

- The ecological features present within the survey area(s) have been evaluated, where possible.
 - Invasive non-native species (INNS) of plants and animals (such as those listed on Schedule 9 of the Wildlife & Countryside Act [WCA]) have been described.
 - Potential constraints to the proposed development have been identified.
 - Recommendations for further survey have been made.
 - Mitigation recommendations have been provided based on current information.
- 1.2.5 This PEA follows guidance published by the Chartered Institute of Ecology and Environmental Management (CIEEM, 2012). This PEA report has been prepared to provide information to inform the design of the capacity improvements at the three weirs and form the baseline for the assessment of any ecological impacts.
- 1.2.6 P1HS maps, with supporting target notes, are included in Appendix A. Photographs of the survey areas are presented in Appendix B. A description of relevant legislation, planning policy, and nature conservation status' are included in Appendix C. Appendix D contains desk study maps of nature conservation sites, protected species and INNS records (where copyright restrictions allow).

1.3 Site context and status

- 1.3.1 The study areas are situated along the Lower River Thames corridor and include the river and adjacent land downstream and upstream of Teddington Lock and Weir (approx. TQ163721 to TQ174711), Molesey Lock and Weir (approx. TQ153684 to TQ145692), and Sunbury Lock and Weir (approx. TQ111686 to TQ103678). See Appendix D for geographical locations and the extent of the study areas. The study areas are within the River Thames river corridor through a semi-urban environment on the edge of London (Figure 1-1). Ecological desk study was carried out comprising the respective weir site, and land within 1km of it. For designated nature conservation sites, the area of search was extended to 2.5km (see Appendix D).

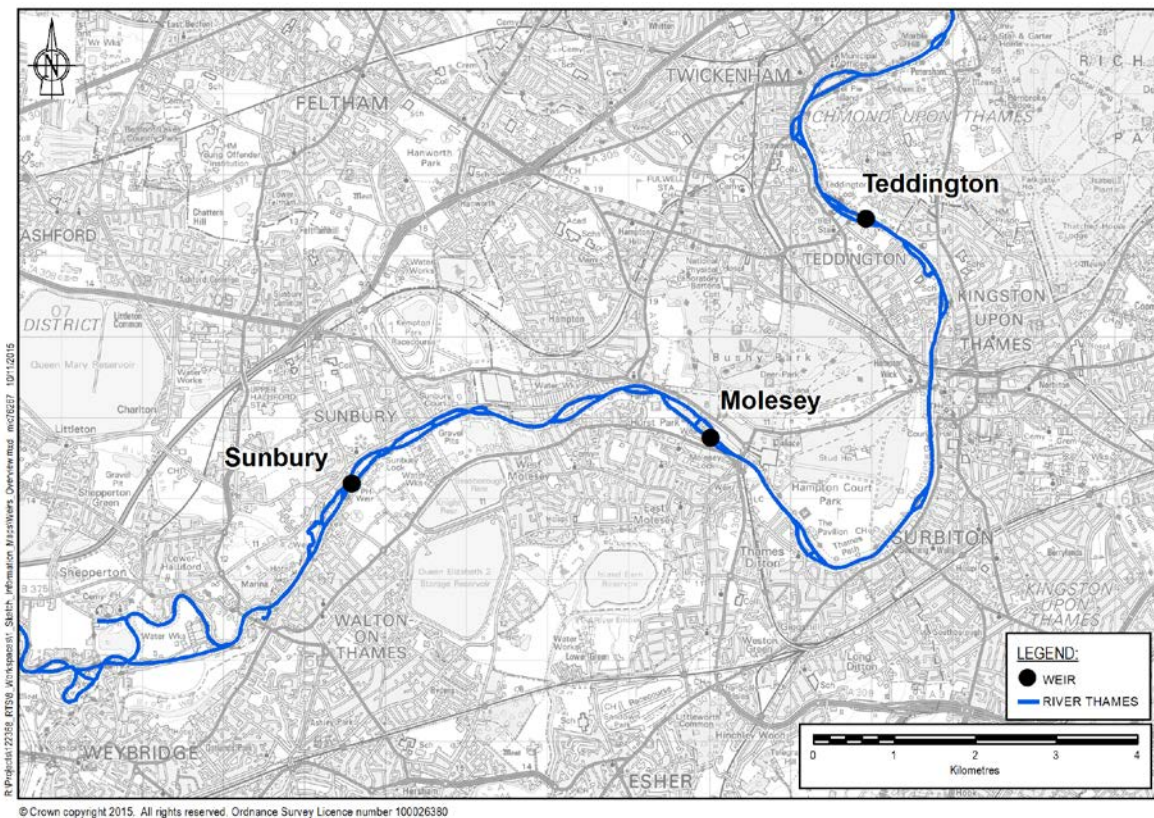


Figure 1-1: Study area

Teddington

1.3.2 As shown in Appendix D, the 2.5km study area around the potential area of works at Teddington Weir includes a number of designated sites; including Richmond Park Special Area of Conservation (SAC), National Nature Reserve (NNR) and Site of Special Scientific Interest (SSSI). The 1km buffer around the potential area of works includes part of Ham Lands Local Nature Reserve (LNR) (a statutory designated site) and Site of Nature Conservation Interest (SNCI¹) (a non-statutory designation), managed by the Royal Borough of Kingston upon Thames and the London Borough of Richmond upon Thames (LBRUT). This is an area of rough semi-improved grassland with scattered scrub, and patches of mixed deciduous woodland. The western bank of the Thames is bordered by residential housing, and areas of open space and parkland are situated to the southeast.

Molesey

1.3.3 Bushy Park & Home Park SSSI and Molesey Heath LNR are located within 2.5km of the potential area of works at Molesey Weir (see Appendix D). The 1km buffer around the potential area of works includes Bushy Park & Home Park SSSI, Hurst Park SNCI (designated for species-rich grassland), Bushy Park & Home Park SNCI and Hampton Court House & Grounds SNCI. The local area is largely residential with extensive areas of green open space.

Sunbury

1.3.4 The 2.5km study area around the potential area of works at Sunbury Weir encompasses a number of statutorily designated sites. Notably, this includes Knight Reservoir, Besborough Reservoir and the Kempton Park Reservoirs; which are all

¹ There are differences between local authorities over naming conventions for non-statutory sites. Within this report, SNCI is the chosen naming convention to cover all sites within the study area which are assigned as SNCI, Site of Importance for Nature Conservation (SINC) or Local Wildlife Site (LWS).

SSSIs and also part of the South West London Waterbodies Special Protection Area (SPA) and Ramsar site (see Appendix D). These sites are designated for the support they afford to internationally important numbers of gadwall *Anas strepera* and shoveler *Anas clypeata* (see Section 3.1). Knight and Besborough Reservoirs are also within the 1km buffer area around the potential area of works; as is Sunbury Park SNCI. The survey area around Sunbury Weir is more rural than the other weir sites, with woodland and scrub bordering the majority of the banks of the Thames.

- 1.3.5 In addition to the sites mentioned above, it should be noted that the whole of the River Thames, through the study area of the three weirs, is designated as either the ‘River Thames and Tidal Tributaries SNCI’ or the ‘River Thames-Elmbridge SNCI’.

1.4 Scheme description

- 1.4.1 A summary of the structural measures potentially required at the three weirs is provided in Table 1-1 below. The solutions described are taken from the Lower Thames Strategy (LTS) and will be further refined during outline design and detailed design. Whilst the final working areas at each weir are not yet determined, potential areas of works have been established for the purposes of the current outline design stage and these are shown on the figures in Appendix A and Appendix D.

Table 1-1: Scheme description

Weir	Overview of design elements required
Teddington Reach	6no. 3.5m radial gates, crest 1m above ordnance datum (AOD), with adjustment to length of weirs to accommodate. Also requires 4no. 3.5m radial gates, crest 1.5m AOD, in the lock cut.
Molesey Reach	Requires 5no. 3.5m radial gates, crest 2.5m AOD, with adjustment to length of weirs to accommodate new sluices.
Sunbury Reach	Requires 3no. 3.5m radial gates; crest 5.5m AOD, with no alterations to the weir.

- 1.4.2 The work at **Teddington Weir** may require the installation of up to 10 radial gates, which would be likely to result in direct impacts to the existing weir and adjacent wooden posts and patches of ephemeral vegetation. Locations for the works could include the western part of the island near the boat rollers and the lock; and/or, the eastern part of the island along at different points along the weir and the southern bank of the Thames where the weir adjoins the bank. Access and movement of spoil and equipment during construction may utilise the river itself, or may be along the existing path running from Riverside Drive in Ham, and the tow path along the northern bank of the Thames. The position of the site compound is currently unknown, but the survey area includes all areas of open space adjacent to the Project site that may be suitable (for example: a suitable location would be the area of improved grassland between the river and Burnell Avenue, although the feasibility of this has yet to be determined) (see Appendix A).

- 1.4.3 The installation of new structures at **Molesey Weir** could result in impacts on the Larinier fish pass situated between Weir A and Weir B or the smaller fish pass located on Weir C. Access and movement of spoil and equipment during construction will be by river. The preferred location for the site compound is within Hurst Park, although the survey area includes all areas of open space adjacent to the Project site that may be suitable. The preferred site compound location in Hurst Park would be using the same footprint as the recent construction compound for improvement works to Weir B (see Appendix A).

- 1.4.4 The works envisaged to be required at Sunbury Weir (at LTS stage) comprise the installation of 3 radial gates. Depending on the chosen location for the works, impacts on adjacent land could be minimal, where they may be located over the existing weir, although some of the potential working areas could result in greater impacts upon Sunbury Lock Island itself. Access and movement of spoil and equipment during construction may be by river, or use the road to the south of the river linking Sunbury Lock with Waterside Drive. The position of the site compound is unknown, but the survey area includes all areas of open space adjacent to the Project site that may be suitable (for example: the grassland fields immediately to the southeast of the Lock, although the feasibility of this has yet to be determined).

2. Methodology

2.1 Desk study and consultation

- 2.1.1 Existing records relating to the three sites and surrounding areas were commissioned from the relevant biological records centres; GIGL, SBIC and TVERC. Data and advice were also provided by fisheries and biodiversity specialists from the Environment Agency. Information on designated nature conservation sites was gathered up to a radius of 2.5km from each weir (see Appendix D). Other ecological records, including protected species, species included under Section 41 of the Natural Environment and Rural Communities (NERC) Act, notable species and INNS were requested for up to a 1km radius of each weir (the study area). Notable species include Birds of Conservation Concern (Eaton et al., 2009), International Union for the Conservation of Nature (IUCN) Red Data Book invertebrate species, IUCN's Red List of threatened species, and species listed under Appendices I, II, III of the Bern Convention and OSPAR List of Threatened and/or Declining Species and Habitats. Downstream effects of construction of the new weirs will also be considered as part of the wider environmental assessment for the Project.

Background information and consultation

- 2.1.2 A P1HS has previously been undertaken of Sunbury Weir and Teddington Weir by a Biodiversity Officer from the Environment Agency (September 2014). This has been reviewed and used to inform this ecological assessment. Fisheries and biodiversity technical specialists from the Environment Agency have been consulted as part of the review process for this PEA, and all comments taken into account. In addition, the reports listed in Section 6.1 have been reviewed and relevant information included.

2.2 Extended Phase 1 Habitat Survey

- 2.2.1 The P1HS area comprised all lock, weir and associated structures, river embankments and adjacent land (not including private gardens) within 100m of the likely works areas, plus any nearby land potentially suitable for site compounds and/or access to the site. The survey areas for all three sites are shown on the P1HS maps (Appendix A).

Habitats and flora

- 2.2.2 The P1HS was undertaken on 16th September 2014 by Julie Powell, MCIEEM, GBV Principal Ecologist. The survey methods were based on the Phase 1 Habitat Survey methodology (JNCC, 2010) and the Guidelines for Preliminary Ecological Appraisal (CIEEM, 2012).

- 2.2.3 All land parcels were mapped according to JNCC P1HS habitat types with target notes taken, as appropriate, to provide supplementary information on habitat conditions, features too small to map, species composition, structure and management.

Protected and notable species

- 2.2.4 During the survey, habitats were also assessed for their suitability to support protected and notable species, and field signs indicating their presence or absence recorded.

Invasive non-native species

- 2.2.5 The distribution and extent of widespread, visible INNS were also noted where found.

2.3 Assessment of ecological value

- 2.3.1 An indication of the ecological value of habitats and features identified during the appraisal which could be affected by the development, has been provided based on the *Guidelines for Ecological Impact Assessment* (CIEEM, 2011).

- 2.3.2 Each of the identified statutory and non-statutory sites, habitat types and associated species/populations has been attributed a biodiversity value reflecting their geographic significance; examples are provided below:

- **International** e.g. biodiversity feature that is designated or warrants designation as an SAC, SPA, or Ramsar site.
- **National** e.g. biodiversity feature that is designated or warrants designation as a SSSI or National Nature Reserve (NNR).
- **Regional** e.g. biodiversity feature which is one of the best examples of its type within London or Surrey.
- **Borough**, e.g. biodiversity feature that is designated or warrants designation as an LNR or an SNCI, or other feature which is one of the best examples of its type within the Borough.
- **Local**, e.g. biodiversity feature which is one of the best examples of its type within a local context (i.e. within ~1km of the scheme extent).
- Biodiversity features of value **within the zone of influence** (site plus approximately 250m buffer).
- Biodiversity features of **negligible** value.

- 2.3.3 Biodiversity values have also been based upon the following factors:

- Presence of sites or features designated for their nature conservation interest. Examples include internationally, nationally or locally designated sites.
- Size of habitat or species population, habitats or species which are rare, species rich assemblages, species which are endemic or on the edge of their range, large populations or concentrations of uncommon or threatened species and/or plant communities that are typical of valued natural/semi-natural vegetation types.
- Secondary and supporting value, for example, habitats or features which provide a buffer to valued features or which serve to link otherwise isolated features.
- Presence of legally protected sites or species.

- Presence of UK priority habitats and species (Section 41 of the Natural Environmental & Rural Communities Act 2006 (NERC Act S.41)).

2.3.4 This report is likely to be used in support of future planning applications; therefore, relevant local planning policies relating to nature conservation have also been highlighted.

2.4 Limitations

2.4.1 The majority of the survey area was accessible or could be viewed from public access points and in agreement with the landowners/managers. However, no access was obtained for private gardens or businesses. Areas which could not be surveyed are highlighted in the P1HS plans in Appendix A or referenced in target notes.

2.4.2 It is clearly stated where a preliminary value can be given and where further information is required.

2.4.3 This survey was undertaken within the March to September optimal survey window for P1HS. However, assessment of trees for bats is best carried out when trees are without leaves; during the surveys trees were in leaf, which may have limited the suitability of the assessment for bats.

2.4.4 The P1HS was a snapshot in time and conditions may vary at other times of the year.

2.4.5 Information relating to fish and aquatic habitat is based on existing survey reports (as listed in Section 6.1), available baseline datasets (see Section 6.2) and advice provided by the Environment Agency. No new surveys were carried out for fish or aquatic habitat to inform this PEA.

2.4.6 Lack of records from data collected from desk study is often a reflection of previous survey effort rather than confirmation of absence.

3. Results and Evaluation

3.1 Desk study and consultation

3.1.1 A summary of desk study results are provided below. Further details of species records are provided in Appendix D; including maps showing locations of protected species (where copyright allows²).

Designated sites and habitats

3.1.2 The overall study area is crossed by a matrix of gravel pits and many remain as open water. A number of these reservoirs have been designated as part of the South West London Waterbodies SPA, which supports internationally important numbers of gadwall and shoveler that overwinter on the reservoirs. Three of these SPA reservoirs are within 2.5km of Sunbury Weir. In addition to the SPA reservoirs, one SAC, four SSSIs, one NNR, four LNRs and numerous non-statutory SNCI can be found within 2.5km of the three weirs (refer to Appendix D). Given the relatively localised and small-scale nature of the proposed works at the three weirs, it is considered unlikely that any ecological effects would extend beyond 1km of the working areas.

² Copyright restrictions mean that only SBIC protected species records can be mapped (i.e. not GIGL records). However, species lists from both biological records centres have been included to show which protected species, NERC Section 41 Species and Notable Species are found within the 1km study area of each weir.

Therefore further discussion is only provided below on nature conservation sites and species which fall within the 1km study area buffers for the individual weirs.

3.1.3 Table 3-1 provides details of the designated nature conservation sites within 1km of each site, including their reasons for notification. Refer to Appendix D for supporting maps.

3.1.4 Where appropriate in the table (and from this point on in the document) specific references to source datasets are provided by an ID code (in brackets) which can be looked up in Section 6.

Table 3-1: Designated nature conservation sites within 1 km of each weir survey area

Unless otherwise stated against a specific item, this table incorporates biodiversity data supplied by SBIC (ID1361), GIGL (ID1269) and the Environment Agency (ID1028), and is copyright to SBIC, GIGL and the Environment Agency and/or its partners.

Designated Site Name	Distance from Survey area (approx.)	Reasons for Notification and integral value
TEDDINGTON		
Statutory Sites		
Ham Lands LNR	27m North	Urban Fringe. Unique mosaic of different vegetation types attracting many butterfly and bird species, and a diverse floral assemblage. Borough value
Non-statutory Sites (SNCI)		
River Thames and Tidal Tributaries	0m (within the survey area)	The Thames, London's most famous natural feature, is home to many fish and birds, creating a wildlife corridor running right across the capital. Regional value
Ham Lands	29m North	An attractive area of scrub and grassland beside the River Thames, well known for its remarkably diverse plant life. See LNR reasons for notification. Borough value
Churchyard of St Mary with St Alban, Teddington	211m South West	An attractive churchyard with colourful, flowery grassland and some large trees. Borough value
Royal Park Gate Open Space	519m South East	A public park next to the River Thames and continuing northwards as Ham Lands. Borough value
Cassel Hospital	647m East	Pleasant hospital grounds, with lawns of acid grassland, a fringe of woodland and an old walled garden. Borough value
Ham Common West	840m North East	An area of short acid grassland with an attractive pond. Borough value
The Copse at Hampton Wick and Normansfield Hospital	973m South	A wooded nature reserve and the landscaped grounds of a former hospital. Borough value
The Copse, Holly Hedge Field and Ham	997m North East	A flowery meadow, a stand of ancient oaks and an historic avenue of lime trees combine to

Designated Site Name	Distance from Survey area (approx.)	Reasons for Notification and integral value
Avenues		provide habitat for a wealth of animals and plants. Borough value
MOLESEY		
Statutory Sites		
Bushy Park and Home Park SSSI	200m North	Bushy Park and Home Park SSSI is a nationally important site by reason of the following biological features of special interest: acid grassland; veteran trees; assemblages of wood and fungal feeding (saprophytic) invertebrates. National value (ID133)
Non-statutory Sites (SNCI)		
River Thames and Tidal Tributaries	0m (within the survey area)	The Thames, London's most famous natural feature, is home to many fish and birds, creating a wildlife corridor running right across the capital. Regional value
River Thames - Elmbridge	0m (within the survey area)	River habitat within the London Borough Elmbridge (see River Thames for description). This section is Borough value , although it is of greater value in combination with the wider Thames.
Hurst Park (incl. Hurst Minor and Hurst Meadows)	131m West	Selected for its species rich grassland supporting great burnet <i>Sanguisorba officinalis</i> (VC17 Rare) & hoary cinquefoil <i>Potentilla argentea</i> (RDB - IUCN (2001) - Lower Risk - Near Threatened). Borough value
Bushy Park and Home Park	200m North	This area provides an extensive and varied open space on the edge of London. The parks contain several nationally scarce plants, as well as a variety of wetlands and some fine old trees. National value (also designated as a SSSI)
Hampton Court House Grounds	312m North East	An attractive landscaped garden centred on a pond. Borough value
SUNBURY		
Statutory Sites		
South West London Waterbodies Ramsar and SPA, and Knight & Bessborough Reservoirs SSSI	811m East	Lakes support internationally important numbers of gadwall and shoveler. Knight and Bessborough reservoirs are of national importance for wintering shoveler. National value (ID135 & ID133)
Non-statutory Sites (SNCI)		
River Thames - Elmbridge	0m (within the survey area)	River habitat (see River Thames) This section of the Thames is of Borough value , although it is of greater value in combination with the wider Thames.
River Thames (and towpath) Spelthorne	19m North	Section of River Thames which falls within top 10% of UK watercourses due to macroinvertebrate diversity. Supports range of

Designated Site Name	Distance from Survey area (approx.)	Reasons for Notification and integral value
		NERC Priority species including European eel <i>Anguilla anguilla</i> , Atlantic salmon <i>Salmo salar</i> , sea trout <i>Salmo trutta</i> , depressed river mussel <i>Pseudanodonta complanata</i> and otter <i>Lutra lutra</i> . Includes fringing habitats. Regional value
Sunbury Park	86m North	Selected for its wood pasture habitat including veteran trees (at least 8 trees on site classed as veteran). Site supports 7 Red Data Book and 12 notable invertebrate species. Site also serves as Accessible Natural Greenspace within an urban area. At least Borough value
Molesey Reservoir	673m North East	Lake habitat. Borough value
River Ash: Gaston Bridge to Watersplash Farm	996m west	This stretch of river supports the NERC Priority Species, European eel. The river is a good example of 'natural river channel' with a good pool and riffle system. Borough value

Protected and notable species

3.1.5 Table 3-2 below summarises the most significant protected and notable species records within 1 km of the survey areas, recorded since 2003. Those within a 250m buffer of the potential working areas at the three weirs are also presented in figures in Appendix D (along with INNS, which are discussed further in paragraphs 3.1.9 to 3.1.10). Detailed information on relevant legislation and conservation status criteria are detailed in Appendix C.

3.1.6 Bats have been recorded within 1km of Teddington and Molesey weirs (see also 3.2.60). Atlantic salmon, European eel, brown trout and sea trout (data records do not differentiate between brown trout and sea trout, however personal communications with an Environment Agency fisheries specialist has confirmed the presence of both (2015a, pers. comm.))³ have been recorded on the River Thames; water voles in Bushy Park (close to Molesey Weir); and, the depressed river mussel has been recorded in Sunbury Creek (just upstream of Sunbury Weir – thereby being also upstream of Molesey Weir and Teddington Weir).

Waterbodies

3.1.7 Reference to OS 1:10,000 scale maps and aerial photographs indicate the following:

- The River Thames runs through the survey area at all three sites; there are no other waterbodies within 250m at Teddington.
- Within 250m of the survey area at Molesey, there is one small artificial pond (a substantial naturalised pond within the grounds of Hampton Court House School, approximately 245m north of the survey area), and a number of interconnected ditches on the edge of Bushy Park to the northwest. The Rivers Mole and Ember are approximately 250m to the southeast.

³ Sea trout and brown trout are the same species (*Salmo trutta*). A combination of genetics and environmental factors (principally lack of food), will mean that some trout will go to sea to feed before returning to spawn.

- At Sunbury, there are no ponds and only one ditch within 250m of the survey area. There are substantial reservoirs and heavily modified waterbodies in the wider area.
- 3.1.8 The River Thames (Egham to Teddington) WFD waterbody's is currently classed as being of 'Moderate Ecological Potential' (according to data for the 2015 draft RBMP). The current chemical classification is "Fail" due to elevated Tributyltin (TBT) compounds. TBT is a biocide often used in anti-fouling paints (i.e. boat hulls) and is a stable compound persisting in sediments for long periods (Environment Agency, 2015a, Environment Agency, 2015b). It affects the whole food chain as it is indirectly absorbed as sediments are mobilised in the water column. It is persistent and will remain in sediments for decades. As discussed in Section 1.2, a WFD Assessment is being carried out for the Project and will be documented within a separate report.

Table 3-2: Protected and notable species records within 1 km of the Scheme

Unless otherwise stated in the table this table incorporates biodiversity data supplied by SBIC (ID1361), GIGL (ID1269) and the Environment Agency (ID1028), and is copyright to SBIC, GIGL and the Environment Agency and/or its partners.

Species Name	Distance of closest record from Survey Area (approx.)	Data Owner and Notes	Relevant Legal protection and conservation status
TEDDINGTON			
Daubenton's bat <i>Myotis daubentonii</i>	0m	Environment Agency (2013b) (ID329)	Habitat Directive (HabDir) Annex 4, Habitat Regulations (HabReg) Sch 2, WCA Sch5, Bern Convention Appendix II and IUCN threat category: Least Concern.
Atlantic salmon <i>Salmo salar</i>	River Thames	Environment Agency. Migratory route	Natural Environment and Rural Communities (NERC) Act S.41, HabDir Annex 2, Salmon and Freshwater Fisheries Act (SAFFA), OSPAR List and Bern Convention Appendix III.
Brown and sea trout <i>Salmo trutta</i>	River Thames	Environment Agency (2015a, pers. comm.) Migratory route	NERC Act S.41, SAFFA.
European eel <i>Anguilla anguilla</i>	River Thames	Environment Agency. migratory route	NERC Act S.41, Eel Regs, Eels (England and Wales) Regulations 2009, OSPAR List and IUCN threat category: Critically Endangered.
Bullhead <i>Cottus gobio</i>	275m	Environment Agency	HabDir Annex 2.

Species Name	Distance of closest record from Survey Area (approx.)	Data Owner and Notes	Relevant Legal protection and conservation status
Stag beetle <i>Lucanus cervus</i>	Within 1km grid square	GIGL & Environment Agency (provided by People's Trust for Endangered Species (PTES)). All dead wood habitats likely to support this species	NERC Act S.41, HabDir Annex 2, Bern Convention Appendix III.
Pipistrelle bats <i>Pipistrellus</i> sp.	Within 1km grid square	GIGL. In housing; likely to be a roost	NERC Act S.41, HabDir Annex 4, Habitat Regulations (HabReg) Sch 2, WCA Sch5 & Sch8.
Pipistrelle bats <i>Pipistrellus</i> sp.	Within 1km grid square	GIGL. Adjacent to river; likely to be foraging	NERC Act S.41, HabDir Annex 4, HabReg Sch 2, WCA Sch5 & Sch8.
Grass snake <i>Natrix natrix</i>	Within 1km grid square	Environment Agency (provided by Amphibian and Reptile Conservation (ARC))	NERC Act S.41, Wildlife, Countryside Act (WCA) Sch5 sect 9.1(kill/injuring) and Bern Convention Appendix II & III.
Yellow wagtail <i>Motacilla flava</i>	Within 350m	www.magic.gov.uk	IUCN threat category: least concern and Bern Convention Appendix II.
MOLESEY			
European eel	River Thames	River Mole, River Thames Molesey-Teddington Migratory route	NERC Act S.41, Eel Regs, Eels (England and Wales) Regulations 2009, OSPAR List and IUCN threat category: Critically Endangered.
Atlantic salmon	River Thames	Migratory route	NERC Act S.41, HabDir Annex 2, SAFFA, OSPAR List and Bern Convention Appendix III.
Brown and sea trout	River Thames	Environment Agency (2015a, pers. comm.) Migratory route	NERC Act S.41, SAFFA.
Stag beetle	200m east (Hampton Court grounds)	GIGL & Environment Agency (provided by PTES). Numerous records within 1km	NERC Act S.41, HabDir Annex 2 and Bern Convention Appendix III.
<i>Lecanora albella</i>	550m east (Hampton Court grounds)	Environment Agency (provided by British lichen Society)	Nationally Scarce.

Species Name	Distance of closest record from Survey Area (approx.)	Data Owner and Notes	Relevant Legal protection and conservation status
Daubenton's bat	670m northeast (Bushy Park)	GIGL & Environment Agency (provided by Bat Conservation Trust (BCT))	HabDir Annex 4, HabReg Sch 2, WCA Sch5, Bern Convention Appendix II and IUCN threat category: Least Concern.
Water vole <i>Arvicola amphibius</i>	Within 1km grid square	GIGL. Bushy Park and Home Park	NERC Act S.41, WCA Sch5 sect9.1 (kill/injuring) & 9.4.
<i>Cratoneuron filicinum</i> & <i>Scleropodium cespitans</i>	Within 1km grid square	Environment Agency (provided by British Bryological Society)	Notable species.
Barbel <i>Barbus barbus</i>	Molesey weir pool	Environment Agency (ID644)	HabDir Annex 5 and HabReg Sch4.
SUNBURY			
European eel	River Thames Sunbury-Molesey	Environment Agency. Migratory route	NERC Act S.41, Eel Regs, Eels (England and Wales) Regulations 2009, OSPAR List and IUCN threat category: Critically Endangered.
Atlantic salmon	River Thames	Environment Agency. Migratory route	NERC Act S.41, HabDir Annex 2, SAFFA, OSPAR List and Bern Convention Appendix III.
Brown and sea trout	River Thames	Environment Agency (2015a, pers. comm.) Migratory route.	NERC Act S.41, SAFFA.
Bullhead	0m	Environment Agency	HabDir Annex 2.
European Greenfinch <i>Carduelis chloris</i>	0m	Environment Agency	Bern Convention Appendix II.
Eurasian pygmy shrew <i>Sorex minutus</i>	150m on bank of river	SBIC	Bern Convention Appendix III.
Stag beetle	250m northwest	Environment Agency. Numerous records within 1km	NERC Act S.41, HabDir Annex 2 and Bern Convention Appendix III.
Depressed river mussel <i>Pseudanodonta complanata</i>	Sunbury Creek; 550m southwest	Environment Agency	NERC Act S.41 and IUCN threat category: Vulnerable.
Other mobile species known to be in the vicinity of the three weirs (distance not known)			

Species Name	Distance of closest record from Survey Area (approx.)	Data Owner and Notes	Relevant Legal protection and conservation status
Sea lamprey <i>Petromyzon marinus</i>	Downstream of the weir, in the tidal section (specific location unknown)	Environment Agency Fisheries & Biodiversity Technical Specialists (2015a, pers. comm.)	NERC Act S.41, OSPAR List, HabsDir Annex 2, Bern Convention Appendix II.
River lamprey <i>Lampetra fluviatilis</i>	Downstream of the weir, in the tidal section (specific location unknown)	Environment Agency Fisheries & Biodiversity Technical Specialists (2015a, pers. comm.)	NERC Act S.41, HabReg Sch4, HabDir Annex 2 & 5, Bern Convention Appendix III.
Barbel	Between Bell Weir & Penton Hook lock	Environment Agency, 2010b (ID1042)	HabDir Annex 5 and HabReg Sch4.
Bullhead	Between Bell Weir & Penton Hook lock	Environment Agency, 2010b (ID1042)	HabDir Annex 2.
Depressed river mussel	Between Bell Weir & Penton Hook lock	Aldridge, 2006 (ID1745)	NERC Act S.41 and IUCN threat category: Vulnerable.
Otter <i>Lutra lutra</i>	Desborough Cut, Penton Hook and Ham Island	TVERC & SBRIC	HabReg Sch 2, HabDir Annex 2 and Annex 4, WAC Sch5, NERC S41, IUCN threat category; near threatened and Bern Convention Appendix II.

Invasive non-native species

3.1.9 A number of INNS have been recorded in the Thames close to the three weir sites (as shown in Appendix D). INNS that have been recorded are: invasive non-native freshwater mussel species (including Zebra mussel⁴ *Dreissena polymorpha*), Chinese mitten crab *Eriocheir sinensis*, *Cheliocorophium curvispinum*, Northern river crangonyctid *Crangonyx Pseudogracilis*, sideswimmer *Gammarus tigrinus*, Asiatic clam *Corbicula fluminea*, pikeperch / zander *Sander lucioperca*, *Dikerogammarus haemobaphes*, *Physella acuta* (Environment Agency (ID62 & ID1601)). The INNS red-eared terrapin *Trachemys scripta* is also known to be present in the Thames at Teddington (Environment Agency, 2013b).

3.1.10 In late September 2014 the quagga mussel *Dreissena rostriformis bugensis* was confirmed as being present within the survey area⁵. This is the first UK record of this species, which was recently identified as the INNS of most concern to UK ecosystems. It has so far been found only in the Wraysbury River and Wraysbury Reservoir, neither of which are included in this survey area, but the Wraysbury River is connected to the River Thames, so there is potential for expansion into the study area (APEM and URS, October 2014).

⁴ The INNS zebra mussel has been shown to drive native mussels to extinction and is increasing in the River Thames at other locations (Aldridge, 2006; Aldridge et al., 2004).

⁵ <https://www.gov.uk/government/news/quagga-mussel-discovered-for-first-time-in-uk>

Benthic macroinvertebrates

- 3.1.11 Macroinvertebrates have long been used as indicators of water quality and flow changes, and to provide a conservation value for a site. Particular species are susceptible to specific anthropogenic impacts. Surveys have been carried out between 2013-2015, as part of the Environment Agency's Lower Thames Ecological Monitoring Project, which have identified the invertebrate communities present and provided a baseline against which shifts in community character can be assessed (Environment Agency, 2015).
- 3.1.12 Data obtained from kick sampling during the spring and autumn in 2013 and 2014 has been analysed for various metrics: Average Score Per Taxon (ASPT); Number of (scored) Taxa (NTAXA); and, minimum status classes based on site specific observed versus expected values for NTAXA and ASPT (MINTA) based on Biological Monitoring Working Party (BMWP) scoring. For the five river sites located in fairly close proximity to the weirs, a WFD status of Good was derived for Kingston and Moderate at Sunbury, Molesey, Hampton and Teddington (Environment Agency, 2015).
- 3.1.13 Subsequent analysis of the data using the new Whalley, Hawkes, Paisley and Trigg (WHPT) methodology for WFD classification, which is to be adopted in January 2016 under RBMP2 was undertaken on spring and autumn 2014 data. This provided a macroinvertebrate WFD status of High at Sunbury, Good at Molesey and Kingston and Moderate for sites at Hampton and Teddington. Airlift samples generally gave a higher classification than kick sampling methodology (Environment Agency, 2015).
- 3.1.14 In terms of the lower WFD classification recorded at some sites, it is possible that a number of factors may be affecting these sites, including elevated phosphate levels, with a slightly higher mean average value recorded for reactive phosphorous at Teddington Weir from EA data covering the period 2009-2015. However, it is difficult to draw any definite conclusions at this stage and especially as the WFD water quality status for this parameter is consistently recording Moderate at all river sites monitored on the River Thames, including Teddington.
- 3.1.15 It was considered that the presence of at least two species of high impact INNS in all sites would limit WFD classifications (Environment Agency, 2015). It was suggested that a high density of Zebra mussel and *Dikerogammarus haemobaphes* could be causing more than a slight adverse impact on biological elements. Following guidelines in UKTAG (2013), this would limit ecological WFD classifications to a maximum of Moderate at sites (Environment Agency, 2015).
- 3.1.16 Results of the Environment Agency's Lower Thames Ecological Monitoring Project (2015) also highlighted the presence of the following macroinvertebrate species which are of particular interest from a conservation perspective:
- the leech *Glossiphonia paludosa*, which is poorly recorded nationally (Community Conservation Index (CCI) score 7);
 - the mayflies:
 - *Ephemera lineata* which is confined to larger rivers including the Thames (IUCN (pre-1994) designation as vulnerable (CCI score 9));
 - *Heptagenia fuscogrisea* with a mainly northern distribution and only a few records from the Thames Valley (CCI score 7); and
 - *Baetis atrebatinus* found in the central England and Wales, with no records from the Thames valley on the NBN gateway (CCI score 7);
 - The caddisflies *Leptocerus lusitanicus* (CCI score 9) and *Ceraclea senilis* (CCI score 7).

Macrophytes

- 3.1.17 Surveys undertaken in 2012 by THA describe the Teddington weir site as: heavily modified, and the pool mostly constrained by artificially hard embankments with deep water at the margins. No submerged, floating or emergent macrophytes were recorded within the weir pool. The diversity and coverage of aquatic macrophytes within Teddington weir pool is poor and the in-channel macrophyte community is considered to be impoverished, which is typical of the Upper Thames Tideway. This imparts the limited and disturbed nature of the littoral zone within the weir pool and the range in water level over the tidal cycle. Fish utilise macrophytes both for spawning and for refuge. The lack of aquatic vegetation within and around the weir pool may, therefore, restrict spawning of fish species (THA, 2013) (except gravel spawning species).
- 3.1.18 THA also surveyed Sunbury Weir in 2012. Overall, Sunbury Weir pool was characterised by a depauperate macrophyte community, with most species adapted to slow-flowing water conditions. Many of the recorded plants, however, are suited to a variety of depths and substrata, and some are renowned for tolerance to eutrophic waters (THA, 2012).
- 3.1.19 The use of the THA data and associated interpretation, however, must be used with caution due to very high summer flows in 2012 and the subsequent difficulties in surveying (Environment Agency 2015c, pers. comm.). Thus, further macrophyte data acquired as part of the Environment Agency's Lower Thames Ecological Monitoring Project (Environment Agency, 2015), has been incorporated into this PEA. Macrophyte sampling has been undertaken between July and August in 2014 and 2015 at Penton Hook, which is located 11 km upstream of Sunbury, and Raven's Ait located in between Molesey and Teddington and near to EA Kingston benthic invertebrate sampling site.
- 3.1.20 The LEAFPACS method for WFD classification has been carried out on this macrophyte data obtained from site specific surveys and Environment Agency monitoring sites as provided in the draft Lower Thames Ecological Monitoring Project. This has involved the use of various metrics (i.e. River Macrophyte Nutrient Index (RMNI) which is a measure of which plants grow in the river and their association with high nutrients, with a scale of 1 to 10 (higher scores indicate taxa typical of more enriched conditions); number of functional groups of macrophyte taxa which are not helophytes (NFG); and, percentage cover of green filamentous algae (ALG)). All of which are combined to give an Ecological Quality Ratio (EQR) in which a WFD status can be assigned.
- 3.1.21 The output of this analysis for Penton Hook and Ravens Ait provided a RMNI of 7.8 and 8, respectively. This suggests that both sites comprise taxa typical of more enriched conditions. A greater number of taxa were recorded at Penton Hook (13) in comparison to Ravens Ait (7). However, a greater % of algae covering was recorded at Penton Hook (21.3%) in comparison to Ravens Ait (0.05%). It should be noted that there were apparent problems in sampling at Ravens Ait, as the comments sampling log states the right bank was mostly obscured by boats and difficult to access. Nevertheless, these results led to a macrophyte WFD status for both sites of Good (Environment Agency, 2015). Of the aquatic macrophytes listed as high impact INNS, Nuttall's Waterweed *Elodea nuttallii* has been recorded at Penton Hook, but not Ravens Ait. The macrophyte species lists for the two sites are provided in Table 3-3.

Table 3-3: Macrophyte Species Recorded at Ravens Ait and Penton Hook

Source: Environment Agency, 2015

Groupings	Species Recorded
RAVENS AIT (LOCATED BETWEEN MOLESEY AND TEDDINGTON)	
Macroalgae	<i>Cladophora glomerata</i> , <i>Rhizoclonium hieroglyphicum</i> and blanketweed agg. (percentage cover <0.1%).
Vascular plants	<i>Lemna minuta</i> , <i>Lythrum salicaria</i> , <i>Metha aquatica</i> , <i>Nuphas lutea</i> , <i>Sparganium emersum</i> and <i>Spirodela ptyrhiza</i> along. All of these recorded individual (percentage coverages of <0.1%).
Additional species	<i>Aster</i> sp., <i>Carex otrubae</i> , <i>Cratoneuron filicinum</i> and <i>Lycopus europaeus</i> (percentage cover <0.1%).
Bryophytes	<i>Leptodyctium riparium</i> (<i>amblystegium riparium</i>) and <i>Octodicerus fontanum</i> (percentage cover <0.1%).
PENTON HOOK (LOCATED 11 KM UPSTREAM OF SUNBURY)	
Macroalgae	<i>Cladophora glomerata</i> , <i>Rhizoclonium hieroglyphicum</i> , blanketweed agg. (ranging 2.5 to 5% coverage) Unidentified unbranched filamentous non-slimy green algae excluding <i>Cladophora</i> , <i>Vaucheria</i> and <i>Hydrodictyon</i> (ranging from 10 to 25% coverage).
Bryophytes	<i>Cinclidotus fontinaloides</i> , <i>Fontinalis antipyretica</i> and <i>Octodicerus fontanum</i> (ranging from <0.1% to 1% cover).
Vascular plants	<i>Elodea nuttallii</i> (a high impact INNS), <i>Iris pseudacorus</i> , <i>Lemna gibba</i> , <i>Lythrum salicaria</i> , <i>Myriophyllum spicatum</i> , <i>Nuphar lutea</i> , <i>Potamogeton nodosus</i> , <i>Ranunculus fluitans</i> , <i>Rumex hydrolapathum</i> , <i>Sagittaria sagittifolia</i> and <i>Sparganium emersum</i> (ranging from <0.1% to 1% cover).
Additional species	<i>Aster</i> sp., <i>Barbula vulgaris</i> , <i>Bidens frondosa</i> , <i>Carex pendula</i> , <i>Carex remota</i> , <i>Cratoneuron filicinum</i> , <i>Epilobium hirsutum</i> , <i>Lycopus europaeus</i> , <i>Pulicaria dysenterica</i> and <i>Salix fragilis</i> (ranging from <0.1% to 1% cover).

Fish

3.1.22 Evidence from Environment Agency monitoring and juvenile surveys conducted by Jacobs in 2006, recorded fifteen species of fish, including two Habitats Directive species (barbel and bullhead), between Bell weir and Penton Hook (Environment Agency, 2010b).

3.1.23 The Environment Agency has conducted hydro-acoustic and boom boat surveys targeting the adult fish populations throughout the Lower Thames on an annual basis since 2001 (Environment Agency, 2010b). Data is available for Sunbury and Molesey weir pools and downstream of Kingston Bridge (the closest survey point to Teddington weir) (see Figure 3-1 for their specific locations); however data within the last five years is only available for Sunbury and Molesey (see Tables 3-4 and 3-5). Survey data found that roach *Rutilus rutilus* were the most abundant species caught over the whole survey area, followed by gudgeon *Gobio gobio* and dace *Leuciscus leuciscus* at Sunbury and bleak *Alburnus alburnus* and dace at Molesey.

Table 3-4: Fish catch numbers from boom boat surveys conducted over the last five years at Sunbury weir pool

It should be noted that variations between years are likely to be heavily influenced by survey effort as the amount of time spent surveying each location varies each year.

Data provided by the Environment Agency (ID644).

Sunbury Weir Pool	2010	2011	2012	2013
Barbel [<i>Barbus barbus</i>]	1	6	3	7
Bleak [<i>Alburnus alburnus</i>]	26	14	5	42
Chub [<i>Leuciscus cephalus</i>]	0	1	2	1
Common (wild) carp [<i>Cyprinus carpio</i>]	0	0	1	0
Common bream [<i>Abramis brama</i>]	1	0	0	0
Dace [<i>Leuciscus leuciscus</i>]	53	61	5	233
European eels > elvers [<i>Anguilla anguilla</i>]	1	0	1	2
Gudgeon [<i>Gobio gobio</i>]	31	24	0	45
Perch [<i>Perca fluviatilis</i>]	5	2	0	10
Pike [<i>Esox lucius</i>]	3	1	1	2
Roach [<i>Rutilus rutilus</i>]	517	273	11	497
Total	638	382	29	839

Table 3-5: Fish catch numbers from boom boat surveys conducted over the last five years at Molesey weir pool

Data provided by the Environment Agency (ID644).

Molesey Weir Pool	2010	2011	2012	2013	2014
Atlantic salmon [<i>Salmo salar</i>]	0	0	1	0	0
Barbel [<i>Barbus barbus</i>]	0	1	2	1	3
Bleak [<i>Alburnus alburnus</i>]	1	11	1	19	39
Brown / sea trout [<i>Salmo trutta</i>]	0	0	0	2	2
Chub [<i>Leuciscus cephalus</i>]	0	21	12	12	3
Common (wild) carp [<i>Cyprinus carpio</i>]	1	1	4	1	2
Common bream [<i>Abramis brama</i>]	0	0	1	0	0
Dace [<i>Leuciscus leuciscus</i>]	2	5	36	6	24
European eels > elvers [<i>Anguilla anguilla</i>]	0	0	0	0	1
Gudgeon [<i>Gobio gobio</i>]	0	7	1	0	0
Mirror carp [<i>Cyprinus carpio</i>]	0	0	1	0	2
Perch [<i>Perca fluviatilis</i>]	1	3	4	6	8
Pike [<i>Esox lucius</i>]	3	3	6	8	3
Roach [<i>Rutilus rutilus</i>]	1	29	31	19	6
Ruffe [<i>Gymnocephalus cernuus</i>]	0	0	0	0	1
Zander [<i>Sander lucioperca</i>]	1	0	1	5	1
Total	10	81	101	79	95



Figure 3-1: Fish catch boom boat survey locations

3.1.24 Roach easily adapts to most habitat conditions, and is more tolerant of poor water quality than most other fish species and breeds among dense submerged vegetation in backwaters or lakes, flooded meadows or in shallow, fast-flowing river habitats on plant or gravel bottoms (Kottelat & Freyhof, 2007). Gudgeon is a bottom feeder and therefore favours gravel beds (www.wildlifetrusts.org/species/gudgeon) but is found in nearly all types of riverine habitats (www.iucnredlist.org), and spawns in shallow water on gravel. Dace favours large streams and rivers with rock or gravel bottom; also spawns on shallow gravel beds (www.iucnredlist.org). Bleak, another abundant species tolerant of poor quality habitats, prefers open waters and is found in large numbers where there is an inflow of food from pumping stations or behind weirs; substrate is not important to this species although it spawns in shallow riffles, occasionally above submerged vegetation (www.iucnredlist.org). As such it is not ecologically sensitive to changes in flow patterns or substrate.

3.1.25 The eel is subject to national conservation work under the 2006 Eel Regulations. The Eels (England & Wales) Regulations 2009, which afford powers to the Environment Agency to implement measures for the recovery of European eel stocks. Data from the boom boat surveys over the last five years at Sunbury and further downstream includes records for eels, with the highest numbers downstream of the Walton intake (see Figure 3-1 for the specific location) (Environment Agency, ID644).

3.1.26 Both salmon and trout have been recorded in small numbers in the Thames during Environment Agency routine monitoring, however, catch returns and the occurrence of both species is low (Environment Agency, 2010b).

Depressed river mussel

3.1.27 In 2006 a specific survey targeting depressed river mussel *P. complanata* was undertaken on the stretch of the Thames upstream of all three weir sites (Aldridge, 2006). The species was found at sites where the sediment was a compacted combination of fine sand and silt, and the mussels were often located adjacent to

cobbles and boulders. Two of the depressed river mussel found carried the INNS zebra mussel, which has been shown to drive native mussels to extinction and is increasing in the River Thames (Aldridge, 2006; Aldridge et al., 2004).

3.2 Extended Phase 1 Habitat Survey

3.2.1 The following sections detail the findings of the P1HS, which included mapping all habitats and an assessment of suitability of habitats to support protected and notable species. The P1HS plans and target notes (TN) providing supplementary information are included in Appendix A. Photographs of key features are included in Appendix B.

Habitats and flora

Teddington

3.2.2 There were four dominant notable habitat types present within the survey area, with amenity grassland and hard standing dominating much of the area to the south and east. The area, structure and composition of these habitats are described below.

Semi-improved grassland with tall ruderals and scattered scrub

3.2.3 This habitat (TN1) extends either side of the path connecting Riverside Drive and the tow path north of the river, and is present in patches within Ham Lands LNR, where it becomes increasingly species-rich, and Ham Common SNCI. Rough semi-improved grassland is also present in patches along the tow path and at habitat edges. This habitat type has supporting value for invertebrates, birds, reptiles and a high biodiversity value compared to other habitats within the survey area, and is the key habitat described in the reasons for designation of the LNR. Badger foraging signs were noted in the grassland along the northern edge of the survey area within the LNR (TN5).

Broad-leaved semi natural woodland

3.2.4 Woodland dominates much of the survey area north of the river (TN2), in Ham Lands LNR and 'Swan Ait', the island between Teddington Lock and Weir (photograph 1 and TN10).

3.2.5 The woodland north of the river is generally immature and scrubby, dominated by willow *Salix*, hawthorn *Crataegus monogyna*, elder *Sambucus nigra*, apple *Malus* sp., ash *Fraxinus excelsior*, and some planted oak *Quercus robur*. The woodland is interspersed by mature willow, ash and oak trees. The understorey is generally sparse and species-poor with bramble *Rubus fruticosus*, ivy and patches of tall ruderals (notably Himalayan balsam *Impatiens glandulifera* to the northwest (TN6)). A bike track has been created at TN5, with areas of undulating bare ground, scattered wild rose *Rosa canina* and bramble scrub; this area is more open and may have supporting value for reptiles. Many of the mature trees have potential supporting value for roosting bats.

3.2.6 The woodland on the island between the lock and weir (Swan Ait) comprises a number of mature horse chestnut trees *Aesculus hippocastanum* and some non-native species, with a sparse understorey but good ground cover (photograph 2). Many of the mature trees have potential supporting value for roosting bats.

Scattered Trees

3.2.7 The semi-improved grassland in the northeast of the survey area is parkland-style habitat with scattered mature trees throughout; there are mature trees around the edges of the large grassland areas and along paths in particular (TN15). Many of

these trees had potential supporting value for roosting bats and the habitat as a whole is potentially suitable for foraging bats and reptiles.

Running water and intertidal habitats

- 3.2.8 The survey area (and scheme design) is centred on the River Thames. The banks of the river are hard along the entire stretch of the survey area except adjacent to Ham Lands LNR downstream of the lock and weir (along Surrey Bank). Here, the sand and gravel beaches, 'soft' banks (not subject to hard engineering or reinforcement) supporting tall ruderals including purple loosestrife *Lythrum salicaria*, asters *Asteraceae* sp. and water mint *Mentha aquatica*, and undercut banks provide potential supporting value for otters (as lying up sites) (see photograph 3, Appendix B). There is also a length of unprotected bank/ beach on Swan Ait immediately downstream of the weir on the right bank. At periods of high water, the gravel beds may provide important habitat for fish including salmonids. The banks are significantly undercut in places, held in place by substantial tree roots and artificial groins. The soft river edges and adjacent habitat also has potential supporting value for grass snakes. The water body and surrounding tree-lines and woodland edges have potentially high supporting value for foraging and commuting bats.
- 3.2.9 Weirs B and C and the Weir R overfall are likely to have created diverse and locally important pool and gravel-shoal habitats downstream. The weir pool is likely to be hydrologically sensitive and dependent on existing flow dynamics. The species composition utilising the weir habitats is not fully understood, and the effects on river ecology and conservation status of the local populations cannot be fully assessed without further information on conditions at the weir and in the wider environment. Consideration will be given to the potential for any significant effects upon these features as part of further work for the Project, as outlined in Section 1.2.

Evaluation

- 3.2.10 The site is situated in an urban environment on the edge of London. The complex of habitats on the site, in the context of the wider landscape and considering their potential supporting value to protected and notable species recorded in the desk study and described above, are considered to be of **local** ecological value. This is reflected by the designation of much of the site as an LNR and SSSI. The weir pools provide potentially important habitat for fish; further assessment will be carried out as part of the Project, as outlined in Section 1.2.

Molesey

- 3.2.11 There were three dominant notable habitat types present within the survey area; semi-improved grassland, semi-natural broadleaved woodland, and the running water and aquatic habitats of the River Thames. Much of the area comprised amenity grassland and hard standing, of negligible ecological value, and private well-maintained gardens line the northern banks of the Thames, with some mature trees likely to have potential to support roosting bats (photograph 4).

Semi-improved grassland

- 3.2.12 The grassland areas at Hurst Park, at the western end of the survey area, had recently been cut but appeared to comprise some rough species-poor semi-improved grassland to the north, and areas of species-rich grassland to the south (within the Hurst Park SSSI; see Table 3-1), with potential supporting value for reptiles (TN6). The embankments along the southern bank of the Thames also comprised species-poor semi-improved grassland (TN5) but being relatively isolated by the tow path and water, and north-facing, had limited suitability to support reptiles. The western end of Ash Island also had small open areas of rough grassland with scattered scrub, with potential supporting value for reptiles (TN4).

Broad-leaved semi natural woodland

- 3.2.13 Ash Island was dominated by this habitat type, although much of this area supports immature sycamore *Acer psuedoplatanus* woodland/scrub with a poor understorey and amenity grassland clearings (photograph 6); of low ecological value. Only one mature horse chestnut tree at the eastern end of the island was identified as supporting features potentially suitable for roosting bats.

Running water and aquatic habitats

- 3.2.14 The River Thames runs through the survey area. The banks are hard (reinforced by sheet piling) and although they support some tall ruderals along the tops, are of limited ecological value. However, the river and adjacent tree-lines are an important potential foraging resource for bats, otters and birds.
- 3.2.15 A weir pool is present downstream of Molesey Weir. Surveys undertaken prior to reconstruction of Weir B identified no significant depositional features downstream of the weir pool within the centre of the channel, although depositional features that are potentially suitable for fish spawning do exist along the channel margins. It is clear that the weir pool has developed over significant time as a result of the mix of water from the three parts of the weir complex. The depositional features have also developed in response to the changing flows that have come through the weirs and by the northern channel, providing potentially important habitat for fish (Atkins, January 2013). However, conservation value and the species composition utilising the weir habitats will be considered further for any significant effects upon these features as part of further work for the Project, as outlined in Section 1.2.

Evaluation

- 3.2.16 The site is situated in an urban environment on the edge of London, adjacent to substantial areas of open space in Bushy Park and Hampton Court Park. However, the limited natural habitats, relative isolation of the semi-improved grassland habitats within the survey area, the immature scrubby nature of the broadleaved woodland on Ash Island, and the hard banks of the River Thames, result in a likely value of the site **within the zone of influence** only. The species-rich grassland within Hurst Park has greater ecological value (up to Borough value), and the weir structure on Molesey Weir D (TN3) has potential supporting value for roosting bats. The weir pool and gravel weir shoal recorded at Weir A in 2013 is likely to have developed over a significant period of time, and provides potentially important habitat for fish; further assessment will be carried out as part of the Project, as outlined in Section 1.2.

Sunbury

- 3.2.17 The predominant notable habitats in this survey area were rough semi-improved grassland with scattered scrub and ruderals, broadleaved woodland, tree-lined running water, and dense scrub habitats. A number of dilapidated boat houses with corrugated iron roofs were also present on the island, with potential supporting value for roosting bats.

Semi-improved grassland with scattered scrub and ruderals

- 3.2.18 The north-western part of Sunbury Lock Island comprises rough, tall grassland with patches of dense bramble scrub and areas of tall ruderals (photograph 8); highly suitable habitat for reptiles and a diverse assemblage of invertebrates and birds. There are tall ruderals along the soft banks of the river in this location but water voles are not considered present (as explained in paragraph 3.2.44). Relatively well-managed semi-improved (SI) grassland habitat is also present in the southwest of the survey area, and short well-managed SI grassland with scattered trees is present in the southeast. These areas have more limited potential supporting value for reptiles,

invertebrates and birds and are more common in the surrounding landscape. However, an area of scrub with scattered trees also lies adjacent to the SI grassland to the southwest of the site, creating a diverse species composition and structure.

Broad-leaved semi natural woodland

3.2.19 Early successional woodland covers much of Sunbury Lock Island, dominated by ash and sycamore, with a dense canopy and sparse shade-tolerant ground flora (TN2). Although many of the trees are immature with a poor structure, scattered mature trees are present, supporting features potentially suitable for roosting bats. There are some open areas of semi-improved grassland where gaps in the canopy exist, creating habitat potentially suitable for reptiles. The wider area will be used by commuting and foraging bats.

Tree-lined running water

3.2.20 The River Thames runs through the survey area, and some sections of the bank are soft with tall ruderals, rough grassland, and occasional trees (e.g. TN5). The eastern side of the channel is reinforced with concrete boulders. There is a weir pool downstream of Sunbury weir which provides potentially important habitat for fish; further assessment will be carried out as part of the Project, as outlined in Section 1.2.

3.2.21 The river corridor is bordered on both sides by deciduous woodland/tree-lines along much of the survey area (photographs 9 & 11). Although this habitat corridor is narrow, comprising a line of trees and scrub in places, the combination of mature/veteran trees, less mature trees and scrub creates a heterogeneous structure along the waters' edge. This habitat type has supporting value for birds including kingfisher, otters, and is an excellent habitat for many species of foraging and commuting bats.

Scrub

3.2.22 Scattered and dense scrub is distributed throughout the survey area. Low-lying scattered scrub with a diverse structure is present at the north-western end of Sunbury Lock Island (TN3), and patches of dense bramble scrub in tall grassland habitats dominate the northern edge of the Island (TN8). Both these areas have high supporting value for invertebrates, provide a food resource for birds, and are very suitable for reptiles. Dense and scattered scrub/outgrown hedgerow is also present along much of the southern bank of the Thames within the survey area, adjacent to semi-improved grassland and scattered trees. These two habitat types in combination also provide suitable resources for invertebrates, birds and reptiles.

Evaluation

3.2.23 The site is situated in a more rural environment on the edge of London, and is dominated by a multi-functional green corridor created by the tree-lined section of the River Thames. More naturalised, soft banks (no hard engineering or reinforcement) of the River Thames are heavily poached and subject to disturbance. The supporting value of structures to bats is unknown. The complex of habitats on the site, in the context of the wider landscape and considering their potential supporting value to protected and notable species recorded in the desk study and described above, are considered to be of **local** ecological value, although the importance of the site as a green corridor in the landscape is notable. The weir pools provide potentially important habitat for fish; further assessment will be carried out as part of the Project, as outlined in Section 1.2.

Protected and notable species

Teddington

Bats

- 3.2.24 Bats are protected against killing, injury, disturbance, obstruction, or damage to breeding sites or resting places by the Wildlife and Countryside Act (WCA) and Conservation Regulations (see Appendix C).
- 3.2.25 The river corridor, and adjacent tree lines and woodland edges within the survey area are likely to provide important commuting resources for bats, linking the old buildings of Richmond, Richmond Park and Petersham Meadows to the north, and Bushy Park and Sunbury reservoirs to the south and west (all likely to be important roosting and foraging resources). The complex of rough semi-improved grassland, woodland and riverine habitats within the survey area, notably in Ham Lands LNR which supports a diverse floral assemblage, also provides a potentially high value foraging resource for bats. Daubenton's bat has been recorded foraging over the river in 2013, which is an ideal environment for this species in particular. Surveys carried out in 2012 recorded six species of bats foraging over or close to Teddington Weir, Lensbury Club and Ham Lands LNR along the banks of the River Thames (Fure 2012).
- 3.2.26 There are a number of trees within the woodland, along the edge of the river, and on the island between the lock and weir, that provide potentially suitable roost sites for bats. In addition, the building at the end of Gauge weir on the south bank of the river is potentially suitable for roosting bats. This is a brick structure with a pitched roof; there were thick cobwebs under soffits and guttering on the north and east sides of the building, but no access could be obtained to survey the south or west sides. The access hatches in the abutment ends of the roller sluice structure are also likely to provide suitable roosting sites for bats, possibly during hibernation, although limited accessibility at the time of the survey makes this difficult to confirm.
- 3.2.27 The scale of the survey area, and the habitat recorded within, means it is considered likely to be a valuable area for foraging and commuting bats. Overall, the site is considered to be of **local** value for foraging, roosting and commuting bats, although the presence of any bat roosts or rare species may increase the value of the site. However, the river and green corridors that are partially included in the survey area comprise higher value for bats in combination with the wider environment. The riverine and rough grassland habitats comprise a potentially valuable foraging resource, and the river, woodland edges and tree lines link potentially important resources in the wider landscape. One bat record exists for within 1km of the site at Teddington, although no records exist for the site itself. With the exception of the abutment ends of the roller sluice structure, no features are present in the survey area that are not also present in equal or greater quality and extent in the wider landscape.

Reptiles

- 3.2.28 Reptiles have legal protection against killing and injury under the WCA.
- 3.2.29 The semi-improved grassland throughout the survey area and patches of scattered scrub around the edges of the bike track, provides suitable habitat for reptiles. The more species-rich grassland with low-lying scattered scrub intersected by pathways, within Ham Lands LNR and Ham Common SSSI, has high potential value for reptiles. Grass snake records exist for within 1km of the site, and this species is known to favour wet environments found to the north of the survey area. No other widespread reptile records exist within 1km of the site (slow worms or common lizards).

3.2.30 Although further surveys are required to evaluate the importance of different habitats, overall the survey area is considered to be of up to **local** value for reptiles.

Badgers

3.2.31 Badgers are protected from disturbance whilst occupying a sett, through the Protection of Badgers Act 1992.

3.2.32 No badger setts were recorded during the survey, and much of the site is limited in its suitability for badger setts as it is heavily disturbed. Badger foraging signs were recorded in the semi-improved grassland in Ham Lands LNR, a less disturbed grassland area on the northern edge of the survey area. As such, a badger sett is likely to be present nearby.

3.2.33 Many of the habitats within the wider study area may provide a foraging resource for the local badger population throughout the year, however, the lack of field signs elsewhere indicates that they are irregularly used and are likely to form part of a wider foraging resource, including the grasslands within the LNR. The areas where badgers could forage and have active setts are generally north of the river within Ham Lands LNR, and the semi-improved grassland and parkland habitats to the southeast. The amenity grassland across the site is also suitable for foraging, although access may be restricted to sites south of the river.

3.2.34 There are no desk study records for badger within 100m of the survey area.

3.2.35 Although many of the habitats on site provide a potentially suitable foraging resource for the local badger population, foraging signs were sparse and much of the survey area is heavily disturbed. The less disturbed LNR has higher value for sett building in the context of the local environment and as such, supports greater potential value for this species. However, badgers are a common species and protected against persecution only. Overall, the site is considered to have **local** value for badgers in the context of the surrounding landscape.

Birds

3.2.36 All birds, their nests and eggs are protected under Sections 1-8 of the WCA making it an offence to damage or destroy the nest of a wild bird whilst breeding. Certain species of bird, for example the barn owl, bittern and kingfisher receive additional protection under Schedule 1 of the WCA (Schedule 1 birds), which affords them protection against disturbance.

3.2.37 The habitats present within the survey area were not considered species-rich, however, in the wider landscape and owing to the size of the survey site, the habitats have significant value for birds. The complex of habitats within the survey area (notably woodland, rough grassland, scattered scrub, and riverine habitats) results in structural diversity, and is well connected to the surrounding landscape. The grassland and scattered scrub habitats within Ham Lands LNR are of particular value to birds. The bird species present on the site are expected to be typical of the surrounding landscape, and include the notable species yellow wagtail, recorded approximately 350m south of the site (www.magic.gov.uk).

3.2.38 Much of the habitat suitable for use by nesting birds is close to, or within a reasonable distance of the river and feeding areas; therefore it is considered that the survey area is of **local** ecological value for birds.

White-clawed crayfish

- 3.2.39 There are no desk-study records of white-clawed crayfish available for the site. Although historic records of this species have been found at Molesey and upstream, the river at Teddington comprises hard banks along the majority of the section, has a silty substrate, and has few riverbank features or gravel beds suitable for this species. Furthermore, the presence of American signal crayfish significantly reduces the likelihood of white-clawed crayfish being present. As such, the survey area is likely to be of no value to white-clawed crayfish.

Otters

- 3.2.40 Otters are listed as S41 species and local BAP species as well as being protected under the Conservation Regulations and WCA.
- 3.2.41 Although the soft banks of the river adjacent to Ham Lands LNR and Ham Common SNCI comprise potentially suitable habitats for holts and lying-up sites, particularly where tree roots and undercut banks create a cavity under the banks, no field signs or evidence of this species was recorded during the survey.
- 3.2.42 There are recent records of otters along much of the River Thames corridor (TVERC (ID1268) & SBRIC (ID1361)), although none received in the desk study for the site. The River Thames is integral to facilitate the movement of otters upstream/downstream and as such, the site is considered to have **local** value for this species. If holts or lay-up sites are found to be present during further surveys, this will increase the value of the site for otters.

Water voles

- 3.2.43 Water voles are listed as NERC Section 41 Priority Species as well as afforded protection by the WCA.
- 3.2.44 No field signs or evidence of water voles was found during the survey. There are no desk study records of water voles within the survey area, the tidal fluctuations in the area reduce the value of the site for this species, and technical specialists at the Environment Agency advise that this stretch of the River Thames is not suitable for water voles (2015b, pers. comm.). Therefore, this species is believed to be absent from the survey area.

Fish

- 3.2.45 Fish surveys were undertaken at the site in 2012 (THA, 2013); during this survey indicator status for a species was given if it is sensitive to disturbance, anthropogenic stress or of particular importance to a habitat; European eels were the only indicator species recorded at Teddington. The fish community within Teddington Weir pool, based on available evidence, is representative of a moderately impacted lowland river (THA, 2013).
- 3.2.46 Desk study records of Atlantic salmon, European eel, and bullhead exist for the River Thames within the Teddington Weir study area, and salmon and eel use the river corridor as a migratory route. The presence of these species indicates a relatively clean water environment and sustainable functioning ecosystem. Environment Agency Fisheries and Biodiversity Technical Specialists (2015a, pers. comm.) have also advised that sea lamprey *Petromyzon marinus* and river lamprey *Lampetra fluviatilis* can be found in the vicinity (they are known to be within the tidal section of the Thames, downstream of the study area).
- 3.2.47 However, upstream passage of fish, particularly migratory fish, is impeded by structures and weirs along the River Thames's extent. Whilst the design of fish passes

for adult migratory salmonids is well advanced, the requirements of other species, and requirements for downstream migration of all species are not fully understood (Environment Agency, 2010a). Two fish passes and an eel pass exist at Teddington Weir, but these are unlikely to be sufficient to facilitate the migration of a sustainable population of all migratory species present. Given the existing fish passes at Teddington were designed for salmonids, it is likely they will need to be replaced in the future to comply with anticipated future legislation (APEM, July 2015).

- 3.2.48 Given the migratory value and recent improvements in water quality of the Thames, as well as the manner in which the survey area forms an important 'gateway' between the tidal and freshwater river, the river within the survey area is likely to be of **up to borough** value for fish. However, the river Thames in its entirety is clearly of greater value to fish given its diversity of habitat types and the species it supports.

Saproxyllic invertebrates

- 3.2.49 Numerous desk study records exist for stag beetles *Lucanus cervus* within the study area, the closest being approximately 380m from the survey area. There are some dead-wood habitats with potential to support stag beetles and other saproxyllic invertebrates within the Ham Lands LNR, Ham Common SSSI and adjacent parkland habitats and as such, the site is considered likely to be of value **within the zone of influence** for this group of species. The surrounding landscape supports a network of habitats suitable for saproxyllic invertebrates (see Table 3-1).

Molesey

Bats

- 3.2.50 The terrestrial habitat adjacent to the river corridor at Molesey generally comprises parkland, rough grassland and gardens, and has lower value for foraging bats than the other two sites. However, species that favour more open environments, including pipistrelles and Daubenton's bats are likely to utilize the river corridor and water habitats nearby for foraging. The nearby housing is also likely to provide suitable roosting resources for pipistrelle bats in particular. The complex of rough semi-improved grassland, woodland and aquatic habitats in nearby Bushy Park also provide a potentially high value foraging resource for bats. Daubenton's bat was recorded foraging over Bushy Park in 2008 (GIGL, ID1269).
- 3.2.51 There is a wooden structure on Molesey Weir D (TN3) with a pitched roof supported by wooden beams, and open gable ends (see photograph 5). Although this structure has open sides (see photograph 6), the shelter provided by the pitched roof increases the likelihood of crevice-dwelling bats utilizing the crevices between the supporting beams and underside of the roof for roosting. Lifted and loose roof tiles, particularly along the ridge of the roof, provide access to the space between the tiles and wooden sheeting, which is also potentially suitable for roosting bats. The situation of the building over water and close to gardens and woodland increases the value of this potential roosting feature.
- 3.2.52 The scale of the survey area, and the habitat recorded within and nearby, means it is considered likely to be a good area for foraging and commuting bats, and have the potential to support roosting bats. Overall, the site is considered likely to be of **up to local** value for bats, although the presence of any bat roosts or rare species may increase the value of the features on site. Although only one record exists for the site itself, and with the exception of the weir structure, no features are present in the survey area that are not also present in equal or greater quality and extent in the wider landscape.

Reptiles

- 3.2.53 The limited areas of rough semi-improved grassland within and along the edges of the woodland and scrub habitat on the island (TN4), and the grassland along the tow path (TN5) have some potential to support reptiles. However, these habitats are isolated and are considered to have low value for this species group. The diverse habitat structure of the species-rich semi-improved grassland within Hurst Park (an SSSI designated for its floral assemblage), has high potential value for reptiles however. These rough grassland habitats within the SSSI are considered to be of up to **local** value for reptiles, and other grassland areas within the survey area are likely to be of value **within the zone of influence** only.

Birds

- 3.2.54 The habitats present within the survey area are not considered high value for birds in the context of the surrounding landscape, with the exception of the species-rich grassland within Hurst Park which may provide an important foraging resource. Hampton Water Treatment Works, Bushy Park and Hampton Court Gardens are all situated within 500m of the survey area, also providing flower-rich grassland habitats. These grassland areas in combination may support a notable assemblage of the less common finches and seed-eating species; the bird species present on the remainder of the site are expected to be typical of the surrounding garden and amenity grassland dominated landscape. It is considered that the survey area is of negligible value for birds, with the exception of Hurst Park which may be of **local** ecological value for birds.

White-clawed crayfish

- 3.2.55 Due to the slow, deep water environment in the survey area it was difficult to identify the suitability of these stretches for white-clawed crayfish. However, previous studies have identified gravel substrate along the edges of the channel downstream of the weir, providing potentially suitable habitat for this species. However, there are no downstream records for this species in this area. Furthermore, records exist for the INNS, signal crayfish, within the Thames catchment, which threaten the survival and reduce the distribution of the native white-clawed crayfish through competition and disease. The potential value of the survey area for this species is likely to be **negligible**.

Otters

- 3.2.56 Although otters may use the river corridor as a migratory route and foraging resource, there are no features with potential to be used as a holt or lying-up site by this species, within the survey area. Healthy fish populations (including records of salmonid species) in the river indicate good water quality and that a good food supply may be present for otters in the survey area. The river corridor within the survey area is considered to be of value **within the zone of influence** only for this species, although the water quality and potential commuting corridor should be maintained.

Water voles

- 3.2.57 There are records of water voles in Bushy Park, approximately 300m north of the banks of the Thames. The banks of the river within the survey area are largely unsuitable for water voles however, with hard reinforced edges, docks and houseboats, and high levels of disturbance. The soft edges at the western end of Ash Island are heavily disturbed and poached, making this area generally unsuitable. Overall, the survey area has **negligible** value for water voles and no further surveys are recommended.

Fish

3.2.58 Atlantic salmon, brown/ sea trout and European eel have all been recorded within the Thames at Molesey Weir. These notable native species use the channel as a migratory route. However, passage of fish, particularly migratory fish, is impeded by structures and weirs along the River Thames's extent. One fish pass for salmonids, one multi-species pass (a Larinier super-active-baffle pass) and two elver passes exist at Molesey Weir, are likely to facilitate quite good passage of migratory species. Given the migratory value and recent improvements in water quality of the Thames, the river is likely to be of **at least local** value for fish within the survey area; although clearly the River Thames is of much greater value in its entirety. As previously discussed, the weir pools provide potentially important habitat for fish; further assessment will be carried out as part of the Project, as outlined in Section 1.2.

Bryophytes and saproxylic invertebrates

3.2.59 Although desk study records exist for two notable bryophyte species and stag beetles within 1km of the survey area, there are limited habitats with potential to support these species or other notable bryophytes and saproxylic invertebrates within the survey area. As such, the site is considered to be of **negligible** value to these species groups.

Sunbury

Bats

3.2.60 The river corridor, and adjacent tree lines and woodland edges within the survey area (see photographs 9 & 10) are likely to provide important foraging resources for bats. The river corridor through this survey area also provides a potentially important commuting route between the open spaces of Bushy Park and Hampton Court, the suitable roosting opportunities provided by the old buildings and housing in Hampton court and Molesey, and the open spaces of Chertsey and Shepperton to the west. The diversity of habitats within the survey area and notably along the river's edge, comprising woodland, scrub, semi-improved grassland, tall ruderals, and running water, also provides a potentially high foraging resource for bats.

3.2.61 There are also some mature trees with features potentially suitable for roosting bats on Sunbury Lock Island (TN2), and dilapidated structures with features suitable for roosting bats at TN4 and TN6. The buildings on the island were not accessible for full survey, although a review of the structures from the public right of way and aerial photographs suggests that they may provide features suitable for use as a maternity and summer roost. The wooden structure on Sunbury Weir A (similar to that found at Molesey) had loose and lifted roof tiles on the gable roof and along the ridge, as well as substantial supporting beams inside the roof structure (see photograph 7), creating features potentially suitable for summer-roosting bats.

3.2.62 Taking into account the foraging, commuting and roosting value of features found within the survey area at Sunbury, in addition to the adjacent Sunbury Park and reservoirs to the south, the site is considered to be of at least **local** value for bats. If bats are found roosting in the structures or trees within the site, or rare species are found during surveys, this may increase the likely value of the site.

Reptiles

3.2.63 The areas of semi-improved grassland, low-lying scrub and ruderals throughout the survey area, notably at TN2, TN3, TN5, and TN8 on the Phase 1 maps, provides suitable habitat for reptiles. The more structural diverse habitats at the southern tip and western side of the island has high potential value for reptiles. Although no desk study records exist for within 1km of the site, grass snakes, slow worms and common lizards are considered likely to be present within these habitats.

- 3.2.64 Although further surveys are required to evaluate the importance of different habitats, overall the survey area is considered to be of up to **local** value for reptiles.

Birds

- 3.2.65 The habitats present within the survey area were not considered species-rich, however, in the wider landscape and owing to the size of the survey site, the habitats have significant value for birds. The complex of habitats within the survey area (notably woodland, rough grassland, scattered scrub, and riverine habitats) results in structural diversity, and is well connected to the surrounding landscape. The bird species present on the site are expected to be typical of the surrounding landscape. Much of the habitat suitable for use by nesting birds is close to, or within a reasonable distance of the river and feeding areas; therefore it is considered that the survey area is of **local** ecological value for breeding birds.

- 3.2.66 The semi-improved grassland habitats to the south of the survey area, situated between the Thames and the reservoirs, has potential supporting value for roosting and feeding gadwall and shoveler found on the nearby SPA and SSSI reservoirs (see Table 3-1). However, gadwall and shoveler feed mostly on submerged aquatic vegetation and water invertebrates; they are dabbling ducks and unless this grassland habitat becomes flooded during the winter months, it is unlikely to be an important resource for these species.

White-clawed crayfish

- 3.2.67 There are no desk-study records of white-clawed crayfish available for the site. Historic records of this species have been found at Molesey and upstream. The river at Sunbury includes some sections of soft banks, overhanging trees, and with the numerous meanders in this area may have some gravel beds suitable for this species. However, these records date back to the 1980's and more recent records exist for the INNS, signal crayfish, within the Thames catchment, which threaten the survival and reduce the distribution of the native white-clawed crayfish through competition and disease. The current value of the survey area for this species is considered to be **negligible**.

Otters

- 3.2.68 Although the soft banks of the river adjacent to Sunbury Lock Island comprise potentially suitable habitats for holts and lying-up sites, the area is heavily disturbed by fishermen and no field signs or evidence of this species was recorded during the survey.

- 3.2.69 There are recent records of otters along much of the River Thames corridor (TVERC (ID1268) & SBRIC (ID1361)), although none received in the desk study for the site. The River Thames is integral to facilitate the movement of otters upstream/downstream and as such, the site is considered to have up to **local** value for this species, if they are found to be using the river corridor. If holts or lay-up sites are found to be present this will increase the value of the site for otters.

Water voles

- 3.2.70 Although the soft banks of the river adjacent to Sunbury Lock Island comprise potentially suitable habitats for water voles, particularly where bank-side vegetation dominates in more open areas to the west of the island (close to Weir B), no field signs or evidence of the species was found during the survey. As there are no records of water voles in the survey area, and no field signs were recorded during the suitable survey season, it is considered likely that this species is absent from the survey area. As such, the habitat within the survey area is considered to be of **negligible** value for water voles.

Fish and water quality

- 3.2.71 Atlantic salmon, European eel, brown trout, sea trout and bullhead are present in the River Thames within or close to the survey area, and salmon and eel use the river corridor as a migratory route. The presence of these species, along with records of depressed river mussel approximately 550m upstream, indicates a relatively clean water environment and sustainable functioning ecosystem. However, passage of fish, particularly migratory fish, is impeded by structures and weirs along the River Thames's extent. A fish trap designed specifically for salmonids, and an eel pass exist at Sunbury Weir B (there is also an eel pass at Sunbury Lock), but these are unlikely to be sufficient to facilitate the migration of sustainable populations of all species as fish are unable to migrate upstream unaided. Whilst the design of fish passes for adult migratory salmonids is well advanced, the requirements of other species, and requirements for downstream migration of all species are not fully understood (Environment Agency, 2010a). Given the existing fish passes at Sunbury were designed for salmonids, it is likely they will need to be replaced in the future to comply with likely future legislation likely to include a greater range of fish species (APEM, July 2015).
- 3.2.72 Given the migratory value and recent improvements in water quality of the Thames, the river is likely to be of **at least local** value for fish within the survey area; although clearly the River Thames is of much greater value in its entirety. As previously discussed, the weir pools provide potentially important habitat for fish; further assessment will be carried out as part of the Project, as outlined in Section 1.2.

Bryophytes and saproxylic invertebrates

- 3.2.73 Sunbury Park, designated as an SNCI for its wood pasture habitat with veteran trees and notable invertebrate species, is situated adjacent to the northern edge of the survey area. Although no desk study records exist for notable bryophytes or invertebrates within 1km, there are some veteran trees and dead wood habitats with potential to support these species within the survey area. As such, the site is considered to be of value **within the zone of influence** for these species groups.

3.3 Invasive non-native species

- 3.3.1 Himalayan balsam was observed during the survey at Teddington and Sunbury. At Teddington this was noted along the banks of the river adjacent to the LNR (TN8) and in a damp area within the deciduous woodland at the northwest end of the survey area (TN6). At Sunbury, this species was seen on Sunbury Lock Island, very close to the weir.
- 3.3.2 A systematic search was not made for the further Schedule 9 (Part II) plant species listed in the Wildlife and Countryside Act, many of which are aquatic. However, the INNS' floating pennywort *Hydrocotyle ranunculoides* and false acacia *Robinia pseudoacacia* (both of which are included in Schedule 9), as well as Michaelmas daisy *Aster amellus*, orange balsam *Impatiens capensis*, *buddleja*, snowberry *Symphoricarpos*, and rhododendron were also recorded during the P1HS of Teddington and Sunbury Weirs undertaken by the Environment Agency in September 2014. Given the nature of the site (heavily disturbed, urban environment), the risk of occurrence of other INNS (such as Japanese knotweed *Fallopia japonica*) is considered medium.

4. Discussion and recommendations

4.1 Introduction

4.1.1 The results of the desk study and P1HS have identified the following potential ecological features which may be affected (directly or indirectly) from the scheme proposals as they are currently known, in the absence of mitigation and reasonable avoidance measures. Possible effects are discussed below, along with any required further survey work and /or measures to be employed to mitigate for the potential effects of the scheme on the identified ecological receptors. This assessment of impacts and recommendations should be reviewed as design is developed.

4.2 Designated sites

All sites

4.2.1 Direct temporary construction impacts (such as temporary habitat loss and/ or disturbance during sensitive migration periods) are anticipated on the River Thames and Tidal Tributaries SNCI and River Thames-Elmbridge SNCI. Such effects are likely to be localised and it should be possible to mitigate for them through careful timing of the works and the application of best practice construction management (although the need for any further mitigation associated with changes to hydrodynamics and geomorphology will be established as part of the work). See Section 4.3 for further details on the potential impacts to the river corridor and supporting habitats.

Teddington

4.2.2 Direct temporary impacts on Ham Lands LNR and SNCI may arise if the site compound and access routes to working areas are positioned within the designated site. Works should be planned in a manner that avoids damage to and protects the integrity of the site and the reasons for designation (e.g. amenity grassland, existing access tracks and areas of hard standing should be selected for use over other habitat types; see paragraphs 4.3.2). If impacts are likely to arise, consultation with LBRUT will be required and detailed method statements should be produced to manage impacts. Mitigation works should be designed and planned to help avoid or minimise these impacts on the designated site and to enhance the conservation value of the site after the works are complete, to ensure no net loss of biodiversity.

4.2.3 The Royal Park Gate Open space (see Table 3-1) is very unlikely to be affected by the works, despite its proximity to the site. No other designated sites will be affected by the work; as there is sufficient distance between the designated sites and the proposed works areas to prevent direct effects, and no interdependent resources are likely to be impacted.

Molesey

4.2.4 Impacts on Hurst Park, Bushy Park and Home Park SNCI are not anticipated as a result of these works. The preferred location for the site compound (within Hurst Park) is situated so that it is outside of the SNCI and it is not envisaged that there would be any reason to encroach on the SNCI (refer to paragraph 4.3.9). No other designated sites described in Table 3-1 will be affected by the work as there is sufficient distance between the designated sites and the proposed works areas to avoid direct effects, and no interdependent resources are likely to be impacted.

Sunbury

4.2.5 Due to the distance of the reservoirs from the survey area (>800m), and the limited anticipated zone of influence of the works, it is considered very unlikely that any

impacts on the reasons for notification (gadwall and shoveler) of the South West London Waterbodies Ramsar and SPA, and Knight & Bessborough Reservoirs SSSI would arise as a result of the works. However, as a precautionary measure, if the site compound, storage or access routes are likely to be positioned on the semi-improved grassland habitats located between the Thames and the designated sites to the south (see TN9, P1HS Map, Page 4, Appendix A) and are to be used in winter, consultation should be undertaken with Natural England (NE) and other local nature conservation organisations to understand whether they are of importance as supporting habitat to the bird species associated with the SPA. The HRA for the Project will give further consideration to this aspect (see Section 1.2).

- 4.2.6 The River Ash SNCI, which is known to support European eels, is 996m west of the potential working area. As this tributary flows into the Thames upstream of Sunbury Weir, the SNCI will not be directly impacted by the works. The success of the European eel population relies in part, on silver eel escapement from rivers across Europe, which in turn relies on the rivers remaining navigable during migration to their spawning grounds in the Sargasso Sea. Runs of silver eels to their spawning grounds, typically start in autumn and last until early spring. Migration mostly occurs during dark moonless nights, and usually starts in flood water following heavy rain (JNCC, 2014). Consideration will be given to the programming of works and/or design so as to prevent fragmentation by physical barriers or light during this period.
- 4.2.7 Sunbury Park and its veteran trees will not be affected by the works. It is not anticipated that other designated sites described in Table 3-1 will be affected by the works, due to the distance of the proposed works to these habitats, the isolated nature of habitats (e.g. grassland or lakes outside the zone of influence of the Project), and the scale/scope of works.

4.3 Habitats and flora

- 4.3.1 Impacts on those habitats described in Chapter 3.2 would need to be considered in order to comply with local planning policy. The precise nature of impacts on each of these habitats is unknown at this stage, but general implications of impacts on each notable habitat type are discussed below. The three sites fall within a number of different local authorities and relevant policies from the Core Strategies are listed in Table 4-1.

Table 4-1: Relevant Core Strategy Planning Policies for each site

Site	Local Authority	Planning Policy (Core Strategy)
Teddington & Molesey	LBRUT (ID1749)	CP4 Biodiversity: The Borough’s biodiversity...will be safeguarded and enhanced. Biodiversity enhancements will be encouraged particularly in areas of deficiency (...Teddington, Twickenham...), in areas of new development and along wildlife corridors and green chains such as the River Thames....
		CP10 Open land and Parks: The [Borough’s open land and parks] will be safeguarded and improved for biodiversity, sport and recreation and heritage, and for visual reasons.
		CP11 River Thames Corridor: The natural and built environment... of the River Thames corridor within the Borough will be protected and enhanced, and the special character of the different reaches identified in the Thames Strategy and the Thames Landscape Strategy respected.

Site	Local Authority	Planning Policy (Core Strategy)
Molesey & Sunbury	Elmbridge Borough Council (ID1751)	CS15 Biodiversity: The Council will seek to avoid loss and contribute to a net gain in biodiversity across the region and the objectives of the Surrey Biodiversity Action Plan.
		CS14 Green infrastructure: The River Thames corridor is classed as green/blue infrastructure. The Council will protect, enhance and manage a diverse network of accessible multi-functional green infrastructure.
Sunbury	Spelthorne Borough Council (ID1750)	EN7 Tree Protection: The Council will promote tree preservation orders wherever appropriate to safeguard healthy trees of amenity value, giving priority to the protection of those known to be under threat. Permission will not normally be granted to fell preserved trees, but where such trees are felled replacement planting will be required.
		EN8 Protecting and improving the landscape and biodiversity: The Council will seek to protect and improve the landscape and biodiversity of the Borough...
		EN9 River Thames and its tributaries: The Council will seek to maintain and look for opportunities to enhance the setting of the River Thames and its tributaries.

Teddington

Semi-improved grassland with tall ruderals and scattered scrub

- 4.3.2 If access to works areas were to be obtained down the existing public rights of way between Riverside Drive and the tow path along the northern bank of the river, temporary disturbance of adjacent habitats may arise (especially if the paths required temporary widening). However, access methods and routes are not yet determined and good practice for ground protection and reinstatement would be followed; therefore, it is not expected that any long term damage would be caused. This habitat type across the northern part of the survey area (much of which is within Ham Lands LNR) has high potential supporting value for invertebrates, birds, badgers and reptiles, and a high biodiversity value compared to other habitats within the survey area. It is also a main reason for designation of the Ham Lands LNR. As such, if possible, it is recommended that placement of site compound(s) and storage areas avoids this area, and any impacts as a result of access are kept to a minimum. If storage of topsoil on this habitat type is required, it should be carried out in accordance with the British Standard for topsoil (BS 3882:2015). Reinstatement should be done in a manner to ensure areas are restored to their former condition, including adequate drainage of the reinstated ground.

Broad-leaved semi-natural woodland & scattered trees

- 4.3.3 Woodland dominates much of the survey area north of the river and on Swan Island; mature (and likely veteran) trees are scattered across the semi-improved grassland in the north east of the survey area (TN15). Although the woodland north of the river has a relatively poor structure, there are some mature canopy trees with greater biodiversity value; many of the trees in the grassland habitats are very old and also have high biodiversity value. This woodland is also included within the reasons for designation of the Ham Lands LNR and Ham Common SSSI.
- 4.3.4 The Project should seek to retain and protect the woodland, veteran and mature trees when designing construction, storage and access. If this is achieved, impacts on

this habitat type are unlikely to arise as a result of the works. BS5837:2012 Trees in relation to design, demolition and construction – recommendations should be followed for works on or near trees. Tree Protection Plans (TPP) for trees being retained within or adjacent to working areas should be put in place prior to construction commencing. Any trees should be replaced as agreed with Richmond Borough Council to ensure no net loss of habitat/connectivity, and no impacts on the wildlife corridor and ‘green chain’ (Richmond Borough Council CP4) along the Thames. The Thames Strategy and Landscape Strategy should be reviewed if significant tree removal is proposed, to ensure no impacts on the special character of the river corridor.

Running water and intertidal habitats

- 4.3.5 Previous studies have identified gravels, cobbles and granules within Teddington Weir pool, although gravels are limited to the left bank of the lock island (THA, 2013). Based on available evidence, the fish community within Teddington Weir pool is representative of a moderately impacted lowland river. There is some limited scope for spawning of some lithophilic and phytolithophilic fish (e.g. carp and roach). Juvenile fish within the weir pool may utilise the area as a nursery, moving into lentic areas in the littoral zone of the pool (e.g. Lock Island) (THA, 2013).
- 4.3.6 The potential for significant effects to arise as a result of changes to the weir pool downstream of Teddington Weir will be considered as part of the further work for the Project, as outlined in Section 1.2. Forthcoming information from hydraulic modelling carried out for the RTS will be used to inform consideration of whether alterations can be expected to the size and/ or habitat conditions of the existing weir pool. Due consideration will then be given (as part of the EIA Scoping and WFD Assessment processes) to whether any changes have the potential to give rise to significant effects (which could be adverse or beneficial) on fish or other aquatic species, including WFD status of macroinvertebrates and macrophytes.
- 4.3.7 Consultation with LBRUT should be carried out as the River Thames is an SNCI. Further consultation with Environment Agency Fisheries & Biodiversity Teams should be carried out to agree mitigation for all in-channel works that could affect spawning and migratory fish (and eels). Provision should be made to ensure migratory routes are maintained throughout construction, and improved post-construction.
- 4.3.8 Stringent Pollution Control Measures should be implemented and the Environment Agency’s Pollution Prevention Guidance should be followed for in-channel works. Any works in or close to the river should avoid any damage or loss of notable species, either directly or through light impacts, or impacts on water quality/hydrology.

Molesey

Species rich semi-improved grassland

- 4.3.9 The semi-improved grassland within Hurst Park is species-rich in places, has high biodiversity value, and supporting value for reptiles, birds and invertebrates. In particular, notable floral species are present within the grassland, including great burnet and hoary cinquefoil (included in the reasons for notification of the SNCI). As discussed in paragraph 4.2.3, it is intended that the footprint of access tracks and/or the storage compound in Hurst Park will be kept within the existing works areas and hard standing; and therefore that impacts on notable floral communities would not arise. If this situation changes and works or storage of topsoil, equipment, machinery or temporary buildings on this habitat type is required, then a survey for notable flora species would be required. Any topsoil movement or storage should be carried

out in accordance to British Standards and reinstatement should be undertaken in a manner to ensure areas are restored to their former condition, including adequate drainage of the reinstated ground.

Broad-leaved semi natural woodland

- 4.3.10 The woodland on Ash Island is considered to be of relatively low ecological value, although one mature horse chestnut tree has higher biodiversity value and potential supporting value for bats. Priority has been given to retaining this tree and as such, the works are unlikely to result in impacts on this feature.

Running water

- 4.3.11 The potential for significant effects to arise as a result of changes to the weir pool downstream of Molesey Weir will be considered as part of the further work for the Project, as outlined in Section 1.2. Forthcoming information from hydraulic modelling carried out for the RTS will be used to inform consideration of whether alterations can be expected to the size and/ or habitat conditions of the existing weir pool. Due consideration will then be given (as part of the EIA Scoping and WFD Assessment processes) to whether any changes have the potential to give rise to significant effects (which could be adverse or beneficial) on fish or other aquatic species, including WFD status of macroinvertebrates and macrophytes.
- 4.3.12 Paragraphs 4.3.7 and 4.3.8 describe further recommendations which are relevant for works within and adjacent to the River Thames at all sites.
- 4.3.13 Elmbridge Borough Council and LBRUT should be consulted, as the River Thames is an SNCI.

Sunbury

Semi-improved grassland with scattered scrub and ruderals

- 4.3.14 The northwestern part of Sunbury Lock Island is dominated by this habitat complex, which has high biodiversity value; and potential supporting value for invertebrates, birds and reptiles (see paragraph 3.2.18). Semi-improved grassland habitats are also present elsewhere within the survey area, although supporting lower biodiversity value. Impacts on the grassland/scattered scrub/ruderal habitat complex on the island should be avoided if possible; if impacts on this habitat or semi-improved grassland elsewhere in the survey area are likely to occur, further surveys may be required, depending on the scale and nature of impacts. If storage of topsoil, equipment, machinery or temporary buildings on this habitat type is required, it should be carried out in accordance to British Standards and reinstatement should be done in a manner to ensure areas are restored to their former condition, including adequate drainage of the reinstated ground.

Broadleaved semi-natural woodland

- 4.3.15 Early successional woodland with a poor structure and relatively low biodiversity value dominates much of Sunbury Lock Island, with scattered mature trees throughout (with supporting value for bats in particular). Priority should be given to retaining these mature trees. The surrounding woodland increases their value as an integral part of a wider habitat and green corridor.

Tree-lined running water

- 4.3.16 The soft banks of the river have higher biodiversity value than the hard engineered sections. The river corridor is bordered on both sides by deciduous woodland/tree-lines, creating an important multifunctional green corridor with high biodiversity

- value. This also results in a habitat complex with potential supporting value for a number of notable species including bats, kingfishers (and other birds), invertebrates, eels and otters. This habitat structure and continuity/integrity should be retained throughout construction, including avoidance of lighting in dark corridors throughout the year (for bats and eel migration).
- 4.3.17 Previous studies have identified riverbed habitats in and around the weir pools (downstream of Sunbury Weir); the most common substrate type was coarse gravel. There were also areas of dominant fine sands or sands around the weir pool and along the right (south-eastern) bank. These habitats have potential supporting value for notable fish species, including spawning salmonids.
- 4.3.18 The potential for significant effects to arise as a result of changes to the weir pool downstream of Sunbury Weir will be considered as part of the further work for the Project, as outlined in Section 1.2. Forthcoming information from hydraulic modelling carried out for the RTS will be used to inform consideration of whether alterations can be expected to the size and/ or habitat conditions of the existing weir pool. Due consideration will then be given (as part of the EIA Scoping and WFD Assessment processes) to whether any changes have the potential to give rise to significant effects (which could be adverse or beneficial) on fish or other aquatic species, including the WFD status of macrophytes and macroinvertebrates..
- 4.3.19 Paragraphs 4.3.7 and 4.3.8 describe further recommendations which are relevant for works within and adjacent to the River Thames at all sites.
- 4.3.20 Elmbridge and Spelthorne Borough Councils should be consulted in relation to works at this site as the River Thames is a SNCI.

Scrub

- 4.3.21 Scattered and dense scrub is distributed throughout the survey area. Scrub in combination with other habitat types, provides a suitable resource for invertebrates, birds and reptiles. If impacts on scrub are likely to occur, then the mitigation outlined in Section 4.4 for reptiles and birds will apply. Despite the common nature of this habitat type, it regularly forms part of an important habitat complex or green corridor, and should be restored/allowed to recolonise post-construction.

4.4 Protected and notable species

- 4.4.1 In accordance with local planning policies and legislation (where applicable), loss or disturbance of protected or notable species should be avoided. The three sites fall within a number of local authorities and relevant policies from the Core strategies are listed in Table 4-1.

Bats

- 4.4.2 Any trees requiring removal or likely to be damaged or disturbed (including noise disturbance) as a result of the works, would be subject to an inspection/further survey if they have been highlighted on the Phase 1 maps and/or described in this report as having potential for roosting bats.
- 4.4.3 Any removal of or disturbance to habitat likely to be important for foraging or commuting should be assessed to determine the likely impact on bats. Further surveys may be required to confirm usage and value. The scheme should be designed to ensure no significant impact to connectivity. This includes the trees overhanging and lining the River Thames at Sunbury.

- 4.4.4 If works to or demolition of the buildings/structures that have been highlighted within this report as having potential for bat roosts is required, including the structure over Weir D at Molesey, dilapidated buildings on Sunbury Island, and the building at the end of the roller sluice at Teddington, further surveys/inspections should be undertaken to determine if bat roosts are present. Similarly, if works are considered likely to cause noise and/or light impacts, which would have the potential to disturb bats roosting in these structures (if present), further surveys should be undertaken.
- 4.4.5 Any further surveys or inspections that are required should be carried out in line with best practice survey methodologies, (Bat Conservation Trust, 2012).

Reptiles

- 4.4.6 All works in suitable habitat for reptiles (currently comprising the rough grassland habitats and mature tree rootballs at Teddington, the rough grassland in Hurst Park at Molesey, and the loose debris embankment at the western end of Sunbury Lock Island) should be carried out during the active season (April to October). This generally includes loose soil and debris, culverts, paving, large tree roots that are in-part above the surface of the soil, etc. The rough grassland habitats within Hurst Park at Molesey are not expected to be impacted by the works.
- 4.4.7 Where works are small-scale and habitat manipulation is considered likely to be effective, clearance of tall ruderal vegetation, rough grassland, or scrub should be undertaken in two stages over two consecutive days to allow reptiles to disperse. This can only be undertaken in mild weather conditions (and between April and October) when reptiles are active i.e. when the temperature does not fall below 9 degrees centigrade overnight, Langton *et al* (2001) and where suitable adjacent habitat is retained.
- 4.4.8 Any large-scale impacts in suitable habitat would require a reptile survey to confirm distribution and inform a suitable mitigation strategy. The survey methodology should be in line with Froglife Advice Sheet 10 (1999).

Badgers

- 4.4.9 No badger setts were highlighted during the P1HS, although foraging signs were observed within Ham Lands LNR at Teddington. The habitats within 30m of works, storage and access areas should be re-assessed prior to construction to confirm the absence/presence of badger setts. Badgers are protected whilst occupying a sett and mitigation may be required if an active sett(s) is discovered. The works are not anticipated to have a significant impact on wider badger territory.

Birds

- 4.4.10 Vegetation clearance (e.g. trees, scrub and long grass) should be undertaken outside of peak bird breeding season (March to September inclusive). If clearance is required during this period, nesting bird checks should be undertaken by a suitably qualified ecologist prior to clearance. If an active nest is identified, work must cease until the young have fledged.
- 4.4.11 If any works to the banks of the River Thames at Sunbury are required, surveys for kingfisher should be undertaken. This would not be relevant along the entirety of the river, but in sheltered locations with overhanging branches. A suitably qualified ecologist would plot areas that may require further survey. If impacts on the grassland fields to the south of Sunbury Weir are likely to arise, surveys for dabbling ducks should be undertaken; refer to paragraph 4.2.5.

4.4.12 A reinstatement strategy will be required to ensure no net loss of habitat for birds.

Great Crested Newt

4.4.13 Great crested newts (GCN) are considered very unlikely to be present within the works areas considering the location and scale of works, general lack of ponds and no desk study records. The recommendations outlined above for reptiles will also help to reduce the small risk of impacts upon amphibians.

4.4.14 If GCN are encountered works should stop, and suitable mitigation should be put in place, which may include working under a European Protected Species (EPS) license.

White-clawed crayfish

4.4.15 Freshwater white-clawed crayfish have been recorded in the past at Molesey Weir and upstream. However, these records date back to the 1980's and the presence of the invasive non-native signal crayfish and advice from Environment Agency Fisheries and Biodiversity Technical Specialists (2015b, pers. comm.) suggests absence. As such, further surveys for this species are not recommended at any of the weir sites.

Water voles

4.4.16 Based on the limited desk study records, habitat assessment, lack of field signs during the survey, advice of technical specialists from the Environment Agency, and the likely footprint of the works, water vole habitat surveys are not recommended for the works at any of the three weirs.

Otters

4.4.17 Pre-construction otter surveys should be undertaken within 70m of any works required on the river at Teddington and Sunbury. If an otter holt or lay-up site is found within the survey area, appropriate mitigation should be implemented, this may require an EPS development license.

4.4.18 The water courses or their banks should not be blocked or obstructed. Any excavations left overnight should be left with suitable egress to allow otters to escape. Harmful substances should be locked away overnight. There should be no light spill onto the river corridor.

4.4.19 Stringent Pollution Control Measures should be implemented and the Environment Agency's Pollution Prevention Guidance should be followed for any in-channel works.

Fish

4.4.20 The creation of cofferdams and temporary working platforms at the weirs during construction will result in small-scale, temporary, direct loss of habitat potentially suitable for use by notable, locally uncommon and/or spawning fish. Installation of the cofferdams also has the potential to temporarily impede the passage of migratory fish species. If the use of cofferdams is likely to result in fragmentation or impedance impacts on migratory fish species, provision of temporary passage will be required to facilitate continued migration.

4.4.21 Forthcoming information from hydraulic modelling carried out for the RTS will be used to inform consideration of whether alterations can be expected to the size and/or habitat conditions of existing weir pools and other gravel shoal habitats within the study area.

4.4.22 Due consideration of fish survey data and the forthcoming hydraulic modelling will be used to inform EIA Scoping and WFD Assessment work to fully assess the value of

the weir pools for fish, and to identify any likely significant effects (which could be adverse or beneficial) on fish or other aquatic species and /or the effectiveness of fish passes from the planned weir capacity improvements.

- 4.4.23 Continued dialogue should be maintained with the Environment Agency’s fisheries specialists throughout the Project in order to continue to benefit from their local knowledge, survey data and to help establish required mitigation (for example, determining any consenting requirements and/ or time constraints that should be adhered to for the installation of cofferdams and other aspects of the works).

4.5 Invasive non-native species

- 4.5.1 Many INNS plants are listed on Schedule 9 of the WCA Act 1981 (which makes it an offence to plant or otherwise allow these species to grow in the wild). A pre-construction INNS plant survey should be undertaken during the optimal survey season (May – August) to identify and map all INNS of plant. This will also include areas that have not been previously surveyed due to access restrictions.
- 4.5.2 Paragraphs 3.1.9 to 3.1.10 discuss the known aquatic species of INNS likely to be of relevance. Further data gathering and detailed assessment of the risk and mitigation likely to be required for these and any other relevant INNS will be carried out as part of the further environmental work for the Project (as outlined in Section 1.2).
- 4.5.3 A management plan to prevent the spread of INNS of flora and fauna during the works should be produced prior to construction commencing and strictly enforced during construction.

5. Conclusions

- 5.1.1 The size and scale of all the works required for the Project (i.e. the capacity improvements to the three weirs and Desborough Cut as well as the Flood Channel) mean that outline design, detailed design and construction will extend over several years. Currently, it is anticipated that the capacity improvement works and Flood Channel will not be ready for use until 2024.
- 5.1.2 Construction of the weirs is currently programmed to be undertaken from 2018 onwards. The order of construction at the weirs is planned to be: Teddington, followed by Molesey (in 2019) and Sunbury (2020). Construction of the Flood Channel is not likely to commence until approximately 2020/2021.
- 5.1.3 In light of the Project timeframes, habitat features and the status of species may alter prior to the completion of the works. It is generally recognised that most ecological data is valid for between two to five years (depending on the type of data and its intended use).
- 5.1.4 This report summarises the dominant habitat types and suitability for protected and notable species at the time of the survey, and provides a preliminary assessment of the impacts based on current design.
- 5.1.5 *Teddington Weir* is on the edge of an urban environment, although it includes and is adjacent to a large area of open space. The complex of habitats within the survey area which includes woodland, rough grassland, and traditional parkland habitats, in the context of the wider landscape and considering their potential supporting value for protected and notable species recorded in the desk study and during the P1HS, are

- considered to be of local ecological value. This is reflected by the designation of much of the site as a LNR and SNCI.
- 5.1.6 The survey area at *Molesey Weir* is situated in an urban environment, but adjacent to substantial areas of open space in Bushy Park and Hampton Court Park. However, the limited natural habitats, relative isolation of the semi-improved grassland habitats within the survey area, the immature scrubby nature of the broadleaved woodland on Ash Island, and the hard banks of the River Thames at this location, result in the site as a whole being assessed as of value within the zone of influence only. The species-rich grassland within Hurst Park has greater ecological value, and the structure over Weir D has potential supporting value for roosting bats.
- 5.1.7 *Sunbury Weir* is situated in a more rural environment, and is dominated by a multi-functional green corridor created by the tree-lined section of the River Thames. More naturalised, soft banks of the River Thames are heavily poached and subject to disturbance. The value of structures (buildings and the wooden structure on Sunbury Weir) to bats is unknown. The complex of habitats on the site is considered to be of local ecological value, although the importance of the site as a green corridor in the landscape is notable. The presence of a notable assemblage of foraging bats, or bat roosts within the survey area, may increase this evaluation.
- 5.1.8 Further assessment and general mitigation that may be required has been described in Section 4, the detail of which will need to be further refined during outline and detailed design as the proposed programmes and designs, including access routes and site compound locations (especially for Teddington and Sunbury) evolve.
- 5.1.9 In summary, **key mitigation measures** highlighted at this stage include:
- At *Teddington Weir*: it is recommended that no site compounds or storage areas are constructed within Ham Lands LNR; and that any impacts as a result of access through this area are kept to a minimum by following relevant British Standards and good practice guidelines (such as those listed below). The Project should also seek to retain and protect the woodland, veteran and mature trees that dominate much of the survey area north of the river and on Swan Island (refer to Appendix A). Should any trees require removal, then they should be replaced with the agreement of LBRUT to ensure no net loss of habitat/connectivity, and no impacts on the wildlife corridor and ‘green chain’ along the Thames (see Table 4-1).
 - At *Molesey Weir*: it is anticipated that the site compound will be located over the previous Molesey Weir B works’ site compound at Hurst Park and that therefore the temporary works footprint would not extend into the surrounding sensitive habitats – which are of notable value for flora and supporting value for reptiles, birds and invertebrates. Should this situation change, then further survey for notable flora and mitigation (including reinstatement) would be required.
 - At *Sunbury Weir*: the north-western part of Sunbury Lock Island has high biodiversity value and potential supporting value for invertebrates, birds and reptiles. Impacts on the grassland/ scattered scrub, ruderal habitat complex on the island should be avoided where possible. If/ where impacts on these habitats cannot be avoided then the need for further surveys should be considered (which will depend on the likely scale and nature of the impacts). The soft banks of the river and the tree-lined river corridor have high biodiversity value with potential supporting value for a number of notable species including bats, kingfishers (and other birds), invertebrates, eels and otters. This habitat structure and continuity/integrity should be retained throughout construction, including avoidance of lighting in dark corridors throughout the year. In addition to the

more widely applicable ecological survey recommendations in Section 4.4, there are also specific recommendations relating to the potential need for surveys in the vicinity of Sunbury weir focused on kingfisher, gadwall and shoveler. Gadwall and shoveler are qualifying features of the nearby SPA and it is possible that Natural England will require a Habitats Regulations Screening Assessment if working areas impinge on certain habitats at certain times of year (see paragraph 4.2.5).

Relevant to all three weirs:

- Consultation should be maintained with the relevant local authorities (LBRUT, Spelthorne Borough Council or Elmbridge Borough Council) as the River Thames is an SSCI.
- Environment Agency Fisheries & Biodiversity Teams should be engaged with each stage of the Project in order to agree mitigation for all in-channel works that could affect spawning and migratory fish (and eels). Provision should be made to ensure migratory routes are maintained throughout construction, and where possible improved post-construction.
- Forthcoming information from hydraulic modelling being carried out for the RTS should be used to inform consideration of whether alterations can be expected to the size and/or habitat conditions of existing weir pools, gravel shoals and other aquatic habitats and/or the effectiveness of fish passes from the planned weir capacity improvements. Due consideration should then be given (as part of the EIA Scoping and WFD Assessment processes) to whether any identified changes have the potential to give rise to significant effects (which could be adverse or beneficial) on fish or other aquatic species, including WFD status of macroinvertebrates and macrophytes. This should also include an assessment of the potential for the works to give rise to TBT mobilisation (as a result of disturbing riverbed sediments); and, the potential for this to result in indirect impacts upon depressed river mussel, fish and other species.
- Stringent Pollution Control Measures should be implemented and the Environment Agency's Pollution Prevention Guidance should be followed for in-channel works.
- Vegetation clearance (e.g. trees, scrub and tall grass) should be undertaken outside of peak bird breeding season (March to September inclusive). If clearance is required during this period, nesting bird checks should be undertaken by a suitably qualified ecologist prior to clearance. If an active nest is identified, work must cease until the young have fledged.
- Significant impacts on the habitats and features with a higher biodiversity value or potential supporting value for protected or notable species are likely to be avoided through informed, careful design and construction methods. It is important that the loss or disturbance of protected or notable species is avoided to comply with local planning policies and legislation. Potential survey and mitigation requirements for relevant protected and notable species have been outlined in Section 4.4. Recommendations, which are ultimately contingent upon chosen working areas, include possible additional surveys at the three weirs, in certain locations, for bats, otter, reptiles and INNS of fauna and flora (as well as the species discussed above specifically of relevance to Sunbury Weir).
- Survey recommendations should be reviewed as the Project moves through the outline design and detailed design stages so that need for and extent of surveys and mitigation can be refined and based upon current proposed working areas and methods. Given the long timeframe of the Project, it will be important to take

into account the duration for which particular survey results and datasets remain valid when commissioning surveys, interpreting data and drawing conclusions.

- Pre-construction INNS survey should be undertaken during the optimal survey season (May – August) to identify and map all INNS of plant. Further data gathering and detailed assessment of the risk and mitigation likely to be required for these and any other relevant INNS should be carried out as part of the further environmental work for the Project, as outlined in Section 1.2. A management plan – detailing methods to prevent the spread of any INNS of flora and fauna during the works – should be produced prior to construction commencing and strictly enforced.
- Topsoil storage should be carried out in accordance with the British Standard for topsoil (BS 3882:2015). Reinstatement should be done in a manner to ensure areas are restored to their former condition, including adequate drainage of the reinstated ground.
- The Project should seek to retain woodland and individual trees (especially mature and veteran trees which may also have supporting value for bats) where possible and should follow '*BS5837:2012 Trees in relation to design, demolition and construction – recommendations*' for all works on or near to trees.

5.1.10 There are enhancement opportunities for flora and fauna which should be explored further as part of the environmental assessment; such as the potential to improve access for fish and other migratory/ mobile species including otters and eels.

6. References

6.1 Documents

Name of document	GBV dataset ID number
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• British Standards (2007). <i>BS3882:2007 Specifications for topsoil and requirements for use</i> .	1745
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6.2 Datasets

Name of dataset	GBV dataset ID number
• Geographical Information for Greater London (GIGL) species and site records.	1269
• Local Records Centre protected species and site records. Environment Agency.	1028
• Non-native invasive species by waterbody. Environment Agency.	1601
• River Thames fish catch records - 2004 to 2014. Environment Agency.	644
• Sites of Special Scientific Interest (SSSI's). Natural England.	133
• Special Protection Areas. Natural England.	135
• Species Surveys - Non-Native Species. Environment Agency (Geostore).	62
• Surrey Biological Information Centre (SBIC) species and site records.	1361
• Thames Valley Ecological Records Centre (TVERC) species records.	1268

7. Appendices

Appendix A: Extended Phase 1 Habitat Maps

Please see Figure W-DR-V-00052 (Sheets 22-27) in Pack 3 within Appendix A: 'Maps & Figures' in the EIA Scoping Report.

Appendix B: Photographs

Photograph 1: Mixed deciduous woodland dominated by horse chestnut trees (with potential to support roosting bats) on island between Teddington Lock and Weir (TN10). Open areas of ground flora potentially suitable for reptiles



Photograph 2: Semi-improved grassland adjacent to the north bank of the river, with scattered mature trees, creating traditional parkland habitat suitable for saproxylic invertebrates, bryophytes and foraging bats. The rough grassland is also potentially suitable for reptiles



Photograph 3: The soft, inundated banks of the Thames to the north of the survey area, adjacent to Ham Lands LNR



Photographs 4a and 4b:
Private gardens with mature trees potentially suitable for roosting bats along northern edge of Thames at Molesey



Photograph 5: Weir structure at Molesey



Photograph 6:
Amenity/improved
grassland clearing at Ash
Island, Molesey



Photograph 7: Structure
potentially suitable for
roosting bats at Sunbury
Weir



Photograph 8: Scrubby,
more open habitat with
patches of semi-improved
grassland and tall ruderals,
at the western end of
Sunbury Lock Island



Photograph 9: Tree-lined southern bank of the Thames at Sunbury, ideal for Daubenton's bats



Photograph 10: Sunbury lock, looking east. Horse chestnut tree potentially suitable for roosting bats on south bank of the Thames. Vegetation growing on soft banks of the Thames



Photograph 11: Tree-lined channel at Sunbury, looking east. Mature ash and oak dominated woodland and tree lines make this habitat suitable for foraging and roosting bats, as well as otters, water voles and birds



Appendix C: Legislation, planning policy & conservation status

Note that the details provided in this appendix are for general guidance only, and should not be relied upon as a definitive statement of the law. The legislation is only applicable in Britain only (i.e. not the Isle of Man, Northern Island, the Republic of Ireland or the Channel Islands.) Only legislation relevant to the RTS scheme is included.

C.1 Relevant Legislation

National and European Legislation Afforded to Habitats

International Statutory Designations

Special Protection Areas (SPAs) are sites of European importance and are designated under the EC Birds Directive 2009/147/EC on the conservation of wild birds respectively. They form part of the wider Natura 2000 network across Europe.

SPAs are classified under Article 2 of the EC Birds Directive both for rare bird species (as listed on Annex I) and for important migratory species.

Ramsar sites are designated under the Convention on Wetlands of International Importance, agreed in Ramsar, Iran, in 1971. The Convention covers all aspects of wetland conservation and recognises the importance of wetland ecosystems in relation to global biodiversity conservation. The Convention refers to wetlands as “areas of marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres” however they may also include riparian and coastal zones. Ramsar sites are statutorily protected under the Wildlife & Countryside Act 1981 (as amended) with further protection provided by the Countryside and Rights of Way (CROW) Act 2000. Policy statements have been issued by the Government in England highlighting the special status of Ramsar sites. The Government in England has issued policy statements which ensure that Ramsar sites are afforded the same protection as areas designated under the EC Birds as part of the Natura 2000 network (e.g. SPAs).

National Statutory Designations

Sites of Special Scientific Interest (SSSI) are designated by nature conservation agencies in order to conserve key flora, fauna, geological or physiogeographical features within the UK. The original designations were under the National Parks and Access to the Countryside Act 1949 but SSSIs were then re-designated under the Wildlife & Countryside Act 1981 (as amended). As well as reinforcing other national designations (including National Nature Reserves), the system also provides statutory protection for terrestrial and coastal sites which are important within the European Natura 2000 network and globally. Further provisions for the protection and management of SSSIs have been introduced by the Countryside and Rights of Way Act 2000.

Local Statutory Designations

Local authorities in consultation with the relevant nature conservation agency can declare **Local Nature Reserves (LNRs)** under the National Parks and Access to the Countryside Act 1949. LNRs are designated for flora, fauna or geological interest and are

managed locally to retain these features and provide research, education and recreational opportunities.

Non- Statutory Designations

All non-statutorily designated sites are referred to as **Local Wildlife Sites (LWS) or Sites of Interest for Nature Conservation (SINC)**, and can be designated by the local authority for supporting local conservation interest. Combined with statutory designation, these sites are considered within Local Development Frameworks under the Town and Country Planning system and are a material consideration during the determination of planning applications. The protection afforded to these sites varies depending on the local authority involved.

National and European Legislation Afforded to Species

The EC Habitats Directive aims to promote the maintenance of biodiversity by requiring Member States to take measures to maintain or restore wild species listed on the Annexes to the Directive at a favourable conservation status, introducing robust protection for those species of European importance. The Directive is transposed into UK law by The Conservation of Habitats and Species Regulations (amended) 2011 (the Habitat Regulations) and the Offshore Marine Conservation (Natural Habitats, &c.) Regulations 2007 (as amended). The following notes are relevant for all species protected under the EC Habitats Directive:

In the Directive, the term 'deliberate' is interpreted as being somewhat wider than intentional and may be thought of as including an element of recklessness.

The Habitats Regulations do not define the act of 'migration' and, therefore, as a precaution, it is recommended that short distance movement of animals for e.g. foraging, breeding or dispersal purposes are also considered.

In order to obtain a European Protected Species Mitigation licence, the application must demonstrate that it meets all of the following three 'tests':

- the action(s) are necessary for the purpose of preserving public health or safety or other imperative reasons of overriding public interest including those of a social or economic nature and beneficial consequence of primary importance for the environment;
- there is no satisfactory alternative; and
- the action authorised will not be detrimental to the maintenance of the species concerned at a favourable conservation status in their natural range.

The Wildlife and Countryside Act 1981 (as amended) is the principle mechanism for the legislative protection of wildlife in Great Britain. It does not extend to Northern Ireland, the Channel Islands or the Isle of Man. This legislation is the means by which the Convention on the Conservation of European Wildlife and Natural Habitats (the 'Bern Convention') and the European Union Directives on the Conservation of Wild Birds (79/409/EEC).

The WCA 1981 has been subject to a number of amendments, the most important of which are through the Countryside and Rights of Way (CRoW) Act (2000) and Nature Conservation (Scotland) Act 2004.

Other legislative Acts affording protection to wildlife and their habitats include:

- Deer Act 1991
- Natural Environment & Rural Communities (NERC) Act 2006

- Protection of Badgers Act 1992
- Wild Mammals (Protection) Act 1996

Badgers

Badgers *Meles meles* are protected under The Protection of Badgers Act 1992 which makes it an offence to:

- Wilfully kill, injure, take, or attempt to kill, injure or take a badger
- Cruelly ill-treat a badger, including use of tongs and digging
- Possess or control a dead badger or any part thereof
- Intentionally or recklessly damage, destroy or obstruct access to a badger sett⁶ or any part thereof
- Intentionally or recklessly disturb a badger when it is occupying a badger sett
- Intentionally or recklessly cause a dog to enter a badger sett
- Sell or offers for sale, possesses or has under his control, a live badger

Impacts of legislation on development works

A development licence will be required from the relevant countryside agency for any development works liable to affect an active badger sett, or to disturb badgers whilst they occupy a sett. Guidance has been issued by the countryside agency's to define what would constitute a licensable activity⁷. It is not possible to obtain a licence to translocate badgers.

Birds

With certain exceptions, all birds, their nests and eggs are protected under Sections 1-8 of the WCA. Among other things, this makes it an offence to:

- Intentionally (or recklessly in Scotland) kill, injure or take any wild bird
- Intentionally (or recklessly in Scotland) take, damage or destroy (or, in Scotland, otherwise interfere with) the nest of any wild bird while it is in use or being built
- Intentionally take or destroy an egg of any wild bird
- Sell, offer or expose for sale, have in his possession or transport for the purpose of sale any wild bird (dead or alive) or bird egg or part thereof

Certain species of bird, for example the barn owl, bittern and kingfisher receive additional protection under Schedule 1 of the WCA and Annex 1 of the European Community Directive on the Conservation of Wild Birds (2009/147/EC) and are commonly referred to as "Schedule 1" birds. This affords them protection against:

- Intentional or reckless disturbance while it is building a nest or is in, on or near a nest containing eggs or young
- Intentional or reckless disturbance of dependent young of such a bird

Impacts of legislation on development works

Works should be planned to avoid the possibility of killing or injuring any wild bird, or damaging or destroying their nests. The most effective way to reduce the likelihood of

⁶ A badger sett is defined in the legislation as "any structure or place which displays signs indicating current use by a badger". This includes seasonally used setts. Natural England (2009) have issued guidance on what is likely to constitute current use of a badger sett: www.naturalengland.org.uk/Images/WMLG17_tcm6-11815.pdf

⁷ For guidance on what constitutes disturbance and other licensing queries, see Natural England (2007) Badgers & Development: A Guide to Best Practice and Licensing. www.naturalengland.org.uk/Images/badgers-dev-guidance_tcm6-4057.pdf, Natural England (2009) Interpretation of 'Disturbance' in relation to badgers occupying a sett www.naturalengland.org.uk/Images/WMLG16_tcm6-11814.pdf,

nest destruction in particular is to undertake work outside the main bird nesting season which typically runs from March to August. Where this is not feasible, it will be necessary to have any areas of suitable habitat thoroughly checked for nests prior to vegetation clearance.

Schedule 1 birds are additionally protected against disturbance during the nesting season. Thus, it will be necessary to ensure that no potentially disturbing works are undertaken in the vicinity of the nest. The most effective way to avoid disturbance is to postpone works until the young have fledged. If this is not feasible, it may be possible to maintain an appropriate buffer zone or standoff around the nest.

Herpetofauna (amphibians and reptiles)

The great crested newt *Triturus cristatus* receives full protection under the Habitats Regulations through their inclusion on Schedule 2. Regulation 41 prohibits:

- Deliberate killing, injuring or capturing of Schedule 2 species

With the exception of the pool frog, these species are also listed on Schedule 5 of the WCA and they are additionally protected from:

- Intentional or reckless disturbance (at any level)
- Intentional or reckless obstruction of access to any place of shelter or protection
- Selling, offering or exposing for sale, possession or transporting for purpose of sale.

Other native species of herpetofauna are protected solely under Schedule 5 of the WCA. Species such as the adder *Vipera berus*, grass snake *Natrix natrix*, common lizard *Zootoca vivipara* and slow-worm *Anguis fragilis* are listed in respect to Section 9(1) & (5). For these species, it is prohibited to intentionally (or recklessly in Scotland) kill or injure these species

Impacts of legislation on development works

A European Protected Species Mitigation (EPSM) Licence issued by the relevant countryside agency (e.g. Natural England) will be required for works liable to affect the breeding sites or resting places amphibian and reptile species protected under Habitats Regulations. A licence will also be required for operations liable to result in a level of disturbance which might impair their ability to undertake those activities mentioned above (e.g. survive, breed, rear young and hibernate). The licences are to allow derogation from the relevant legislation, but also to enable appropriate mitigation measures to be put in place and their efficacy to be monitored.

Although not licensable, appropriate mitigation measures may also be required to prevent the intentional killing or injury of adder, grass snake, common lizard and slow worm, thus avoiding contravention of the WCA.

Water voles

The water vole *Arvicola amphibius* fully protected under Schedule 5 of the WCA. This makes it an offence to:

- Intentionally kill, injure or take (capture) water voles
- Intentionally or recklessly damage, destroy or obstruct access to any structure or place used for shelter or protection
- Intentionally or recklessly disturb water voles while they are occupying a structure or place used for shelter or protection

Impacts of legislation on development works

If development works are liable to affect habitats known to support water voles, the relevant countryside agency must be consulted. It must be shown that means by which the proposal can be re-designed to avoid contravening the legislation have been fully explored e.g. the use of alternative sites, appropriate timing of works to avoid times of the year in which water voles are most vulnerable, and measures to ensure minimal habitat loss. Conservation licences for the capture and translocation of water voles may be issued by the relevant countryside agency (e.g. Natural England) for the purpose of development activities if it can be shown that the activity has been properly planned and executed and thereby contributes to the conservation of the population. The licence will then only be granted to a suitably experienced person if it can be shown that adequate surveys have been undertaken to inform appropriate mitigation measures. Identification and preparation of a suitable receptor site will be necessary prior to the commencement of works.

Otters

Otters *Lutra lutra* are fully protected under the Habitats Regulations through their inclusion on Schedule 2. Regulation 41 prohibits:

- Deliberate killing, injuring or capturing of Schedule 2 species
- Damage or destruction of a breeding site or resting place

Otters are also currently protected under the WCA through their inclusion on Schedule 5. Under this Act, they are additionally protected from

- Intentional or reckless disturbance (at any level)
- Intentional or reckless obstruction of access to any place of shelter or protection

Impacts of legislation on development works

An EPSM Licence issued by the relevant countryside agency (e.g. Natural England) will be required for works liable to affect otter breeding or resting places (often referred to as holts, couches or dens) or for operations likely to result in a level of disturbance which might impair their ability to undertake those activities mentioned above (e.g. survive, breed, and rear young). The licence is to allow derogation from the relevant legislation but also to enable appropriate mitigation measures to be put in place and their efficacy to be monitored

Bats

All species are fully protected by Habitats Regulations 2010 as they are listed on Schedule 2. Regulation 41 prohibits:

- Deliberate killing, injuring or capturing of Schedule 2 species (e.g. all bats)
- Deliberate disturbance of bat species as:
- to impair their ability:
 - to survive, breed, or reproduce, or to rear or nurture young;
 - to hibernate or migrate
 - to affect significantly the local distribution or abundance of the species
- Damage or destruction of a breeding site or resting place

Bats are afforded the following additional protection through the WCA as they are included on Schedule 5:

- Intentional or reckless disturbance (at any level)
- Intentional or reckless obstruction of access to any place of shelter or protection

Impacts of legislation on development works

Works which are liable to affect a bat roost or an operation which are likely to result in an illegal level of disturbance to the species will require an EPSM licence. The licence is

to allow derogation from the legislation through the application of appropriate mitigation measures and monitoring.

White clawed crayfish

The white clawed crayfish *Austropotamobius pallipes* receives protection under Schedule 5 of the WCA in respect of Sections 9(1) and 9(5). This makes it an offence to intentionally take (capture) or buy or sell white-clawed crayfish.

Impacts of legislation on development works

The relevant countryside agency will need to be consulted about development which could impact on a watercourse or wetland known to support white clawed crayfish. Conservation licences for the capture and translocation of crayfish can be issued if it can be shown that the activity has been properly planned and executed and thereby contributes to the conservation of the population. The licence will only be granted to a suitably experienced person if it can be shown that adequate surveys have been undertaken to inform appropriate mitigation measures. Identification and preparation of a suitable receptor site will be necessary prior to the commencement of the works.

Wild Mammals (Protection Act) 1996

All wild mammals are protected against intentional acts of cruelty under the above legislation. This makes it an offence to mutilate, kick, beat, nail or otherwise impale, stab, burn, stone, crush, drown, drag or asphyxiate any wild mammal with intent to inflict unnecessary suffering.

To avoid possible contravention, due care and attention should be taken when carrying out works (for example operations near burrows or nests) with the potential to affect any wild mammal in this way, regardless of whether they are legally protected through other conservation legislation or not.

Legislation Afforded To Plants

With certain exceptions, all wild plants are protected under the WCA. This makes it an offence for an 'unauthorised' person to intentionally (or recklessly in Scotland) uproot wild plants. An authorised person can be the owner of the land on which the action is taken, or anybody authorised by them.

Certain rare species of plant, for example some species of orchid, are also fully protected under Schedule 8 of the Wildlife and Countryside Act 1981 (as amended).

In addition to the UK legislation outlined above, several plant species are fully protected under Schedule 5 of The Conservation of Habitats and Species Regulations 2010. These are species of European importance.

Invasive non-native species

Part II of Schedule 9 of the WCA lists invasive non-native plant species for which it is a criminal offence in England and Wales to plant or cause to grow in the wild due to their impact on native wildlife. Species include Japanese Knotweed *Fallopia japonica*, Giant Hogweed *Heracleum mantegazzianum* and Himalayan Balsam *Impatiens glandulifera*.

Impacts of legislation on development works

It is not an offence for plants listed in Part II of Schedule 9 of the WCA 1981 to be present on the development site however it is an offence to cause them to spread. Therefore, if any of the species are present on site and construction activities may result

in further spread (e.g. earthworks, vehicle movements) then it will be necessary to design and implement appropriate mitigation prior to construction commencing.

Injurious weeds

Under the Weeds Act 1959 any land owner or occupier may be required prevent the spread of certain 'injurious weeds' such as Spear Thistle *Cirsium vulgare*, Creeping Thistle *Cirsium arvense*, Curled Dock *Rumex crispus*, Broad-leaved Dock *Rumex obtusifolius*, and Common Ragwort *Senecio jacobaea*. It is a criminal offence to fail to comply with a notice requiring such action to be taken. The Ragwort Control Act 2003 establishes a ragwort control code of practice as common ragwort is poisonous to horses and other livestock. This code provides best practice guidelines and is not legally binding.

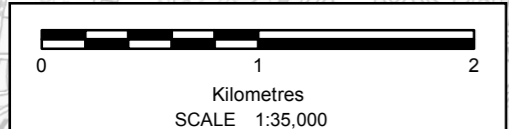
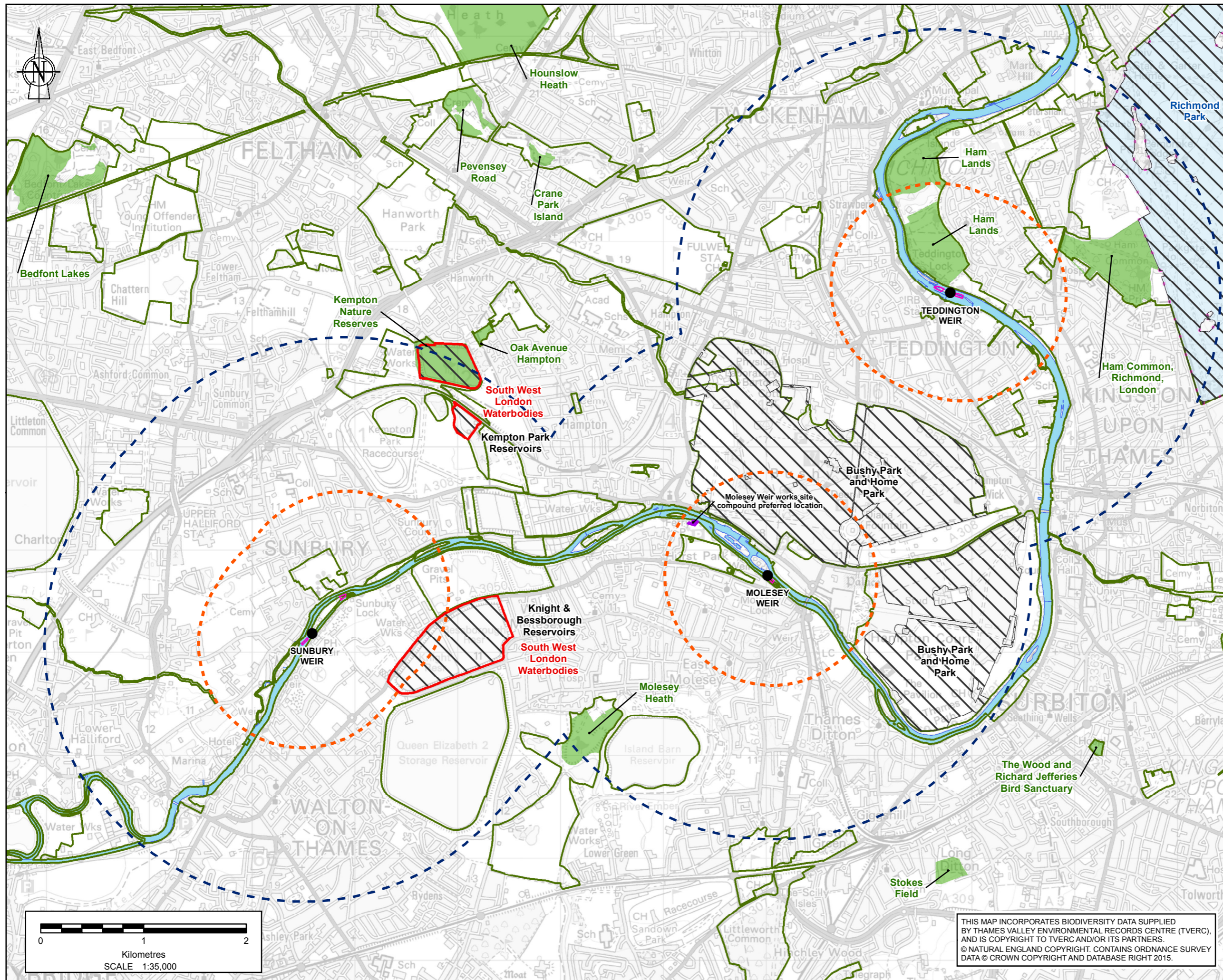
C.2 PLANNING POLICY

Fifty-six habitats and 943 species of principal importance are included on the S41 list. These are all the habitats and species in England that were identified as requiring action in the UK Biodiversity Action Plan and continue to be regarded as conservation priorities in the subsequent UK Post-2010 Biodiversity Framework.

The S41 list is used to guide decision-makers such as public bodies, including local and regional authorities, in implementing their duty under section 40 of the Natural Environment and Rural Communities Act 2006, to have regard to the conservation of biodiversity in England, when carrying out their normal functions (e.g. consideration of Planning Applications).

Appendix D: Desk study maps

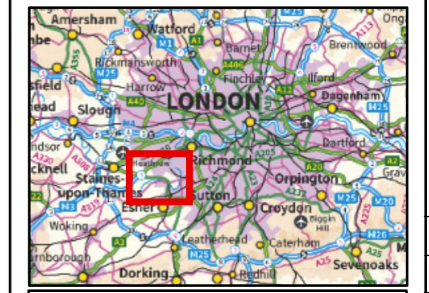
Figure number	Description of figure
122368-BVL-Z0-SW-DR-V-00006	Designated Nature Conservation Sites within 2.5km of Teddington Weir, Molesey Weir and Sunbury Weir.
122368-BVL-Z0-WT-DR-V-00001	Designated Nature Conservation Sites, Protected Species & Recorded Invasive Non-Native Species (INNS) with 250m of the potential area of works at Teddington Weir.
122368-BVL-Z0-WM-DR-V-00001	Designated Nature Conservation Sites, Protected Species & Recorded Invasive Non-Native Species (INNS) with 250m of the potential area of works at Molesey Weir and Molesey Weir works preferred site compound.
122368-BVL-Z0-WS-DR-V-00004	Designated Nature Conservation Sites, Protected Species & Recorded Invasive Non-Native Species (INNS) with 250m of the potential area of works at Sunbury Weir.



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- LEGEND:**
- WEIR
 - ◊ WEIR POTENTIAL AREA OF WORKS
 - 1 KM INDIVIDUAL WEIR STUDY AREA BUFFER
 - 2.5 KM BUFFER
 - ◊ SPECIAL PROTECTION AREA AND RAMSAR SITE
 - ◊ SPECIAL AREA OF CONSERVATION
 - ◊ SITE OF SPECIAL SCIENTIFIC INTEREST
 - ◊ NATIONAL NATURE RESERVE
 - ◊ LOCAL NATURE RESERVE
 - ◊ SITE OF NATURE CONSERVATION INTEREST
 - ◊ RIVER THAMES
- NOTE: SITE OF NATURE CONSERVATION INTEREST DATA INCLUDES LOCAL WILDLIFE SITES AND SITES OF IMPORTANCE FOR NATURE CONSERVATION.



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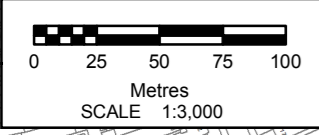
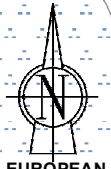
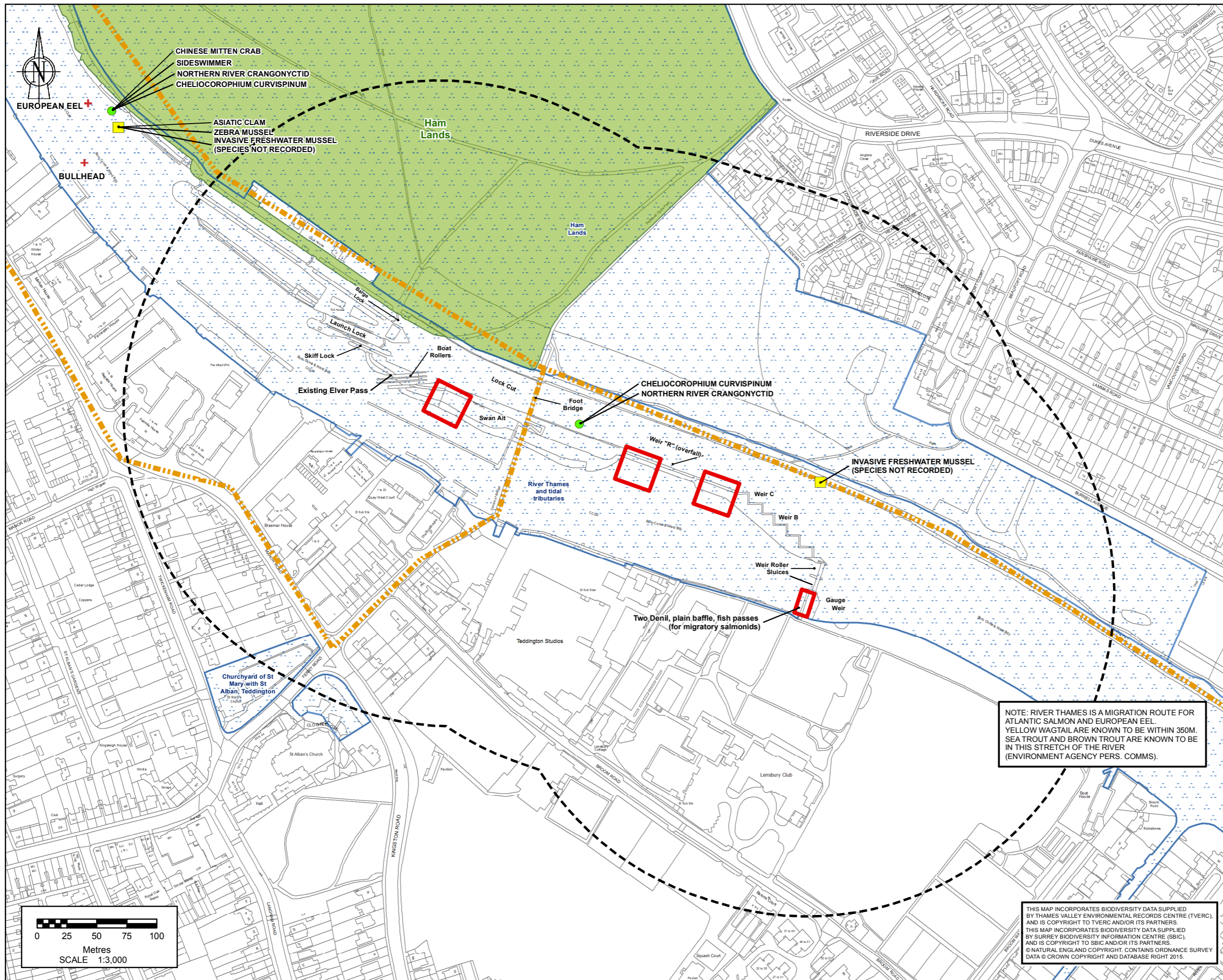
Designed by: MM Date: AUGUST 2015
Client: River Thames Scheme
Client Drawing No: XXXXX-XXXX-XX Revision: A.0



Project: RIVER THAMES SCHEME (DATCHET TO TEDDINGTON) (RTS) CAPACITY IMPROVEMENTS AND FLOOD CHANNEL (CI&FC)
Drawing title:

SUNBURY, MOLESEY AND TEDDINGTON WEIRS DESIGNATED NATURE CONSERVATION SITES

Drawing scale: 1:35,000 @A3 Sheet size: A3
Drawing no. 122368-BVL-20-SR-DW-V-00006 Revision: P01



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- LEGEND:**
- RARE AND PROTECTED SPECIES SURVEY
 - +
 - BONY FISH
 -
 - CRUSTACEAN
 -
 - MOLLUSC
 -
 - THAMES PATH NATIONAL TRAIL
 -
 - LOCAL NATURE RESERVE
 -
 - SITE OF NATURE CONSERVATION INTEREST
 -
 - WEIR POTENTIAL AREA OF WORKS
 -
 - 250M BUFFER AROUND THE POTENTIAL AREA OF WORKS

NOTE: SITE OF NATURE CONSERVATION INTEREST DATA INCLUDES LOCAL WILDLIFE SITES AND SITES OF IMPORTANCE FOR NATURE CONSERVATION.



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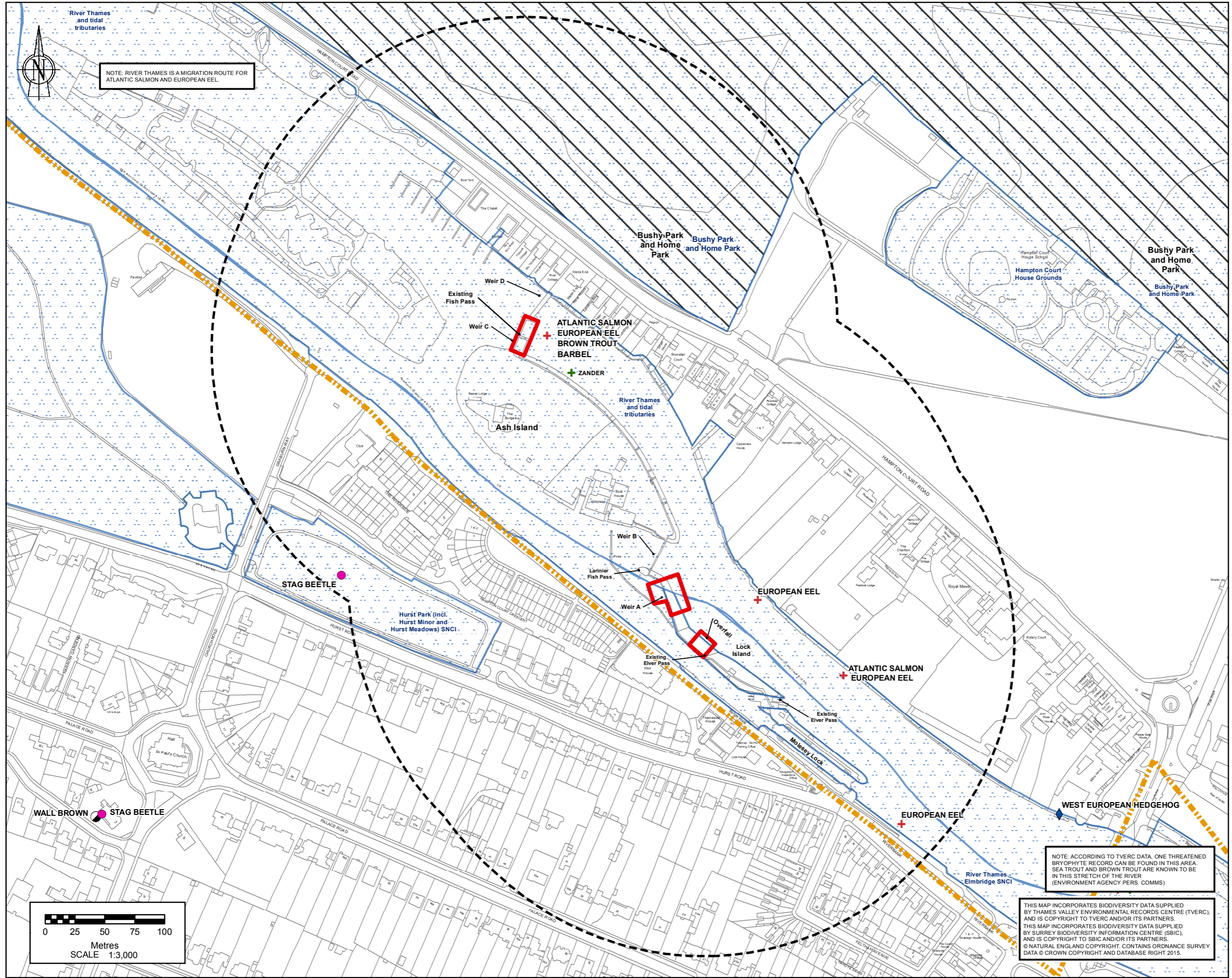
Project: RIVER THAMES SCHEME (DATCHET TO TEDDINGTON) (RTS) CAPACITY IMPROVEMENTS AND FLOOD CHANNEL (CI&FC)

DESIGNATED NATURE CONSERVATION SITES, PROTECTED SPECIES AND INVASIVE NON-NATIVE SPECIES TEDDINGTON WEIR

Drawing scale: 1:3,000 @ A3 Sheet size: A3
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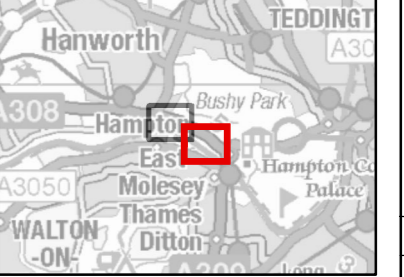


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 - ◆ TERRESTRIAL MAMMAL
 - RARE AND PROTECTED SPECIES SURVEY
 - ⊕ BONY FISH
 - INSECT - BEETLE
 - INSECT - BUTTERFLY
 - ◆ TERRESTRIAL MAMMAL
 - INVASIVE NON-NATIVE SPECIES
 - ⊕ BONY FISH
 - THAMES PATH NATIONAL TRAIL
 - SITE OF NATURE CONSERVATION INTEREST
 - SITE OF SPECIAL SCIENTIFIC INTEREST
 - WEIR POTENTIAL AREA OF WORKS
 - 250M BUFFER AROUND THE POTENTIAL AREA OF WORKS

NOTE: SITE OF NATURE CONSERVATION INTEREST DATA INCLUDES LOCAL WILDLIFE SITES AND SITES OF IMPORTANCE FOR NATURE CONSERVATION.



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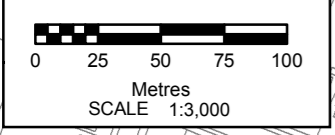
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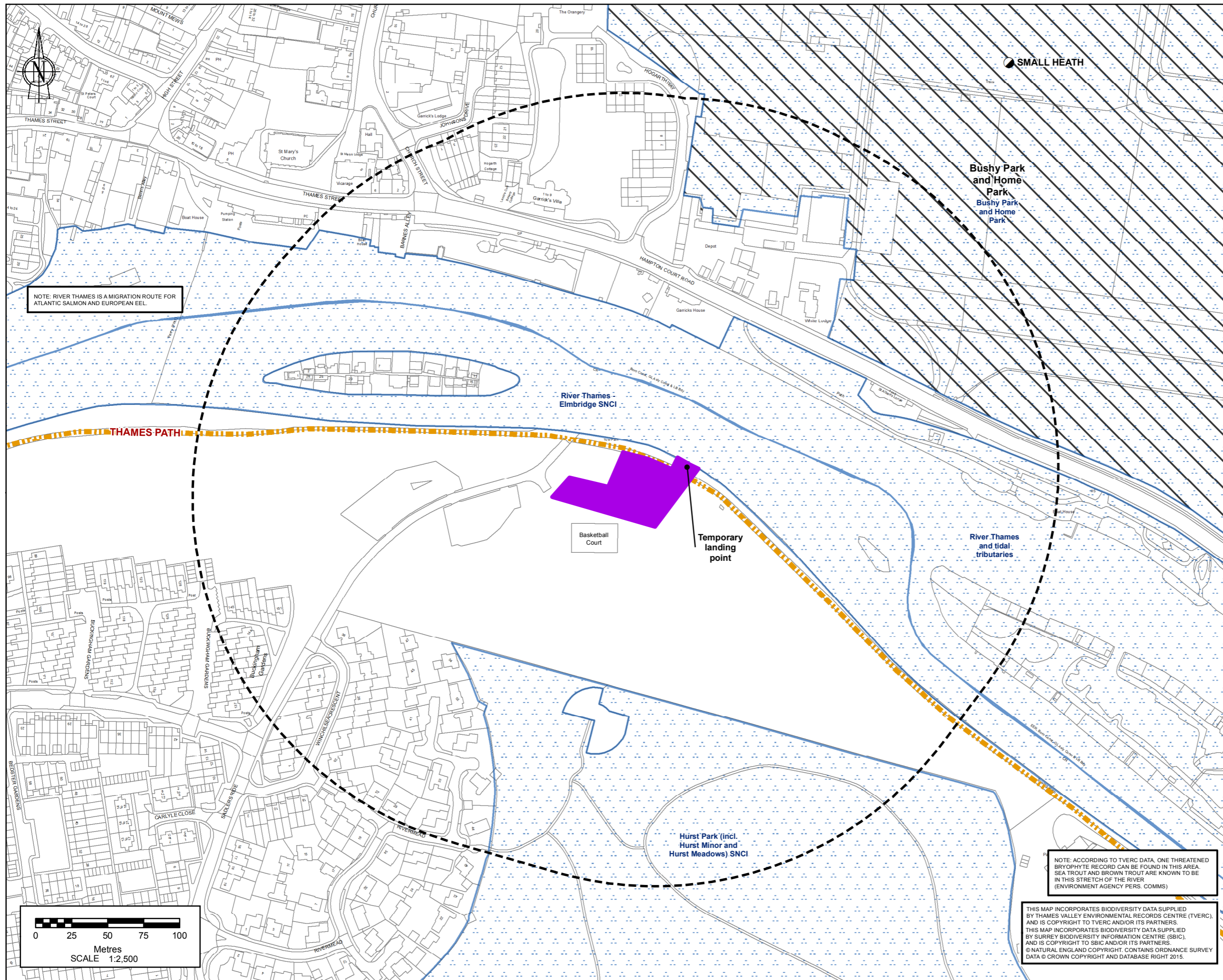
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Drawing scale: 1:3,000 @A3 Sheet size: A3
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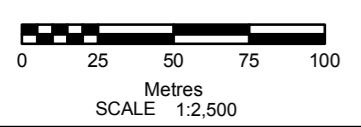


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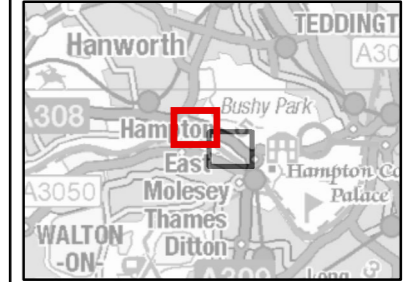
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- LEGEND:**
- INSECT - BUTTERFLY
 - THAMES PATH NATIONAL TRAIL
 - SITE OF NATURE CONSERVATION INTEREST
 - ▨ SITE OF SPECIAL SCIENTIFIC INTEREST
 - PREFERRED SITE COMPOUND AREA
 - 250M BUFFER AROUND THE POTENTIAL AREA OF WORKS

NOTE: SITE OF NATURE CONSERVATION INTEREST DATA INCLUDES LOCAL WILDLIFE SITES AND SITES OF IMPORTANCE FOR NATURE CONSERVATION.



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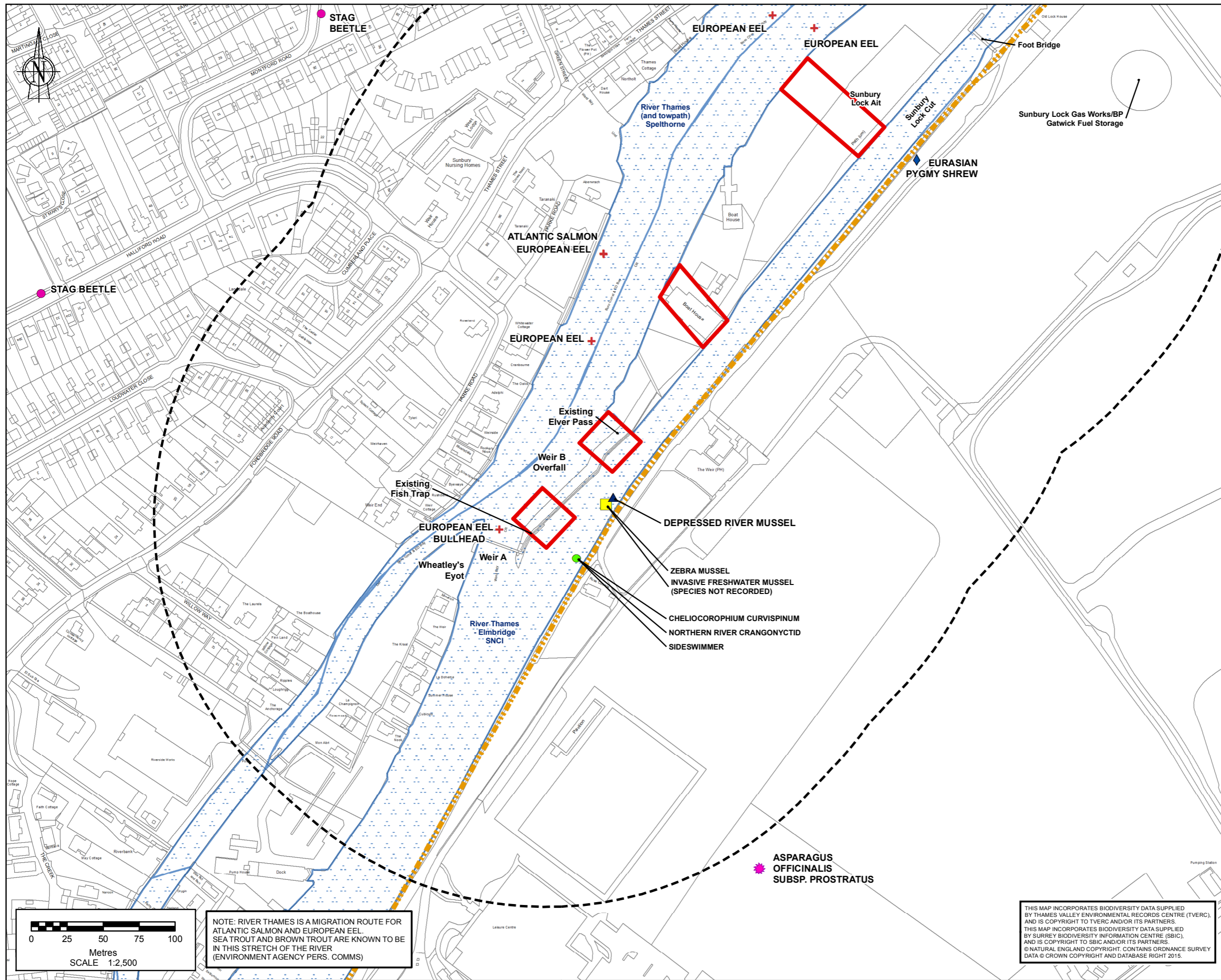
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Project: RIVER THAMES SCHEME (DATCHET TO TEDDINGTON) (RTS) CAPACITY IMPROVEMENTS AND FLOOD CHANNEL (CI&FC)

Drawing title: DESIGNATED NATURE CONSERVATION SITES, PROTECTED SPECIES AND INVASIVE NON-NATIVE SPECIES MOLESEY COMPOUND AREA PAGE 2 OF 2

Drawing scale: 1:2,500 @A3 Sheet size: A3
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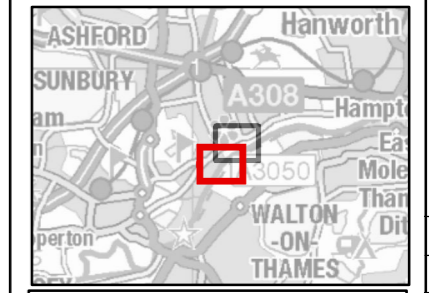


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 - INSECT - BEETLE
 - TERRESTRIAL MAMMAL
 - MUSSEL
 - RARE AND PROTECTED SPECIES SURVEY
 - BONY FISH
 - NERC SECTION 41 SPECIES
 - INSECT - BEETLE
 - FLOWERING PLANT
 - INVASIVE NON-NATIVE SPECIES
 - CRUSTACEAN
 - MOLLUSC
 - THAMES PATH NATIONAL TRAIL
 - SITE OF NATURE CONSERVATION INTEREST
 - WEIR POTENTIAL AREA OF WORKS
 - 250M BUFFER AROUND SPECIES SURVEY
 - THE POTENTIAL AREA OF WORKS

NOTE: SITE OF NATURE CONSERVATION INTEREST DATA INCLUDES LOCAL WILDLIFE SITES AND SITES OF IMPORTANCE FOR NATURE CONSERVATION.



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Designed by: **MMG** Date: **AUGUST 2015**

Client: **River Thames Scheme**

PROTECTING our communities
 SECURING our economy
 ENHANCING our Thames

Client Drawing No. _____ Revision _____

gbv A GALLIFORD TRY, BLACK & VEATCH JOINT VENTURE

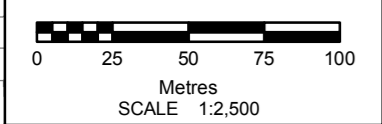
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 Registered in England and Wales. Company no. 08584398

Project: **RIVER THAMES SCHEME (DATCHET TO TEDDINGTON) (RTS) CAPACITY IMPROVEMENTS AND FLOOD CHANNEL (CI&FC)**

Drawing title: **DESIGNATED NATURE CONSERVATION SITES, PROTECTED SPECIES AND INVASIVE NON-NATIVE SPECIES SUNBURY WEIR PAGE 1 OF 2**

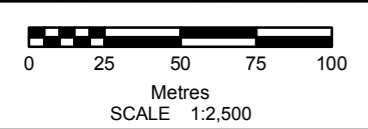
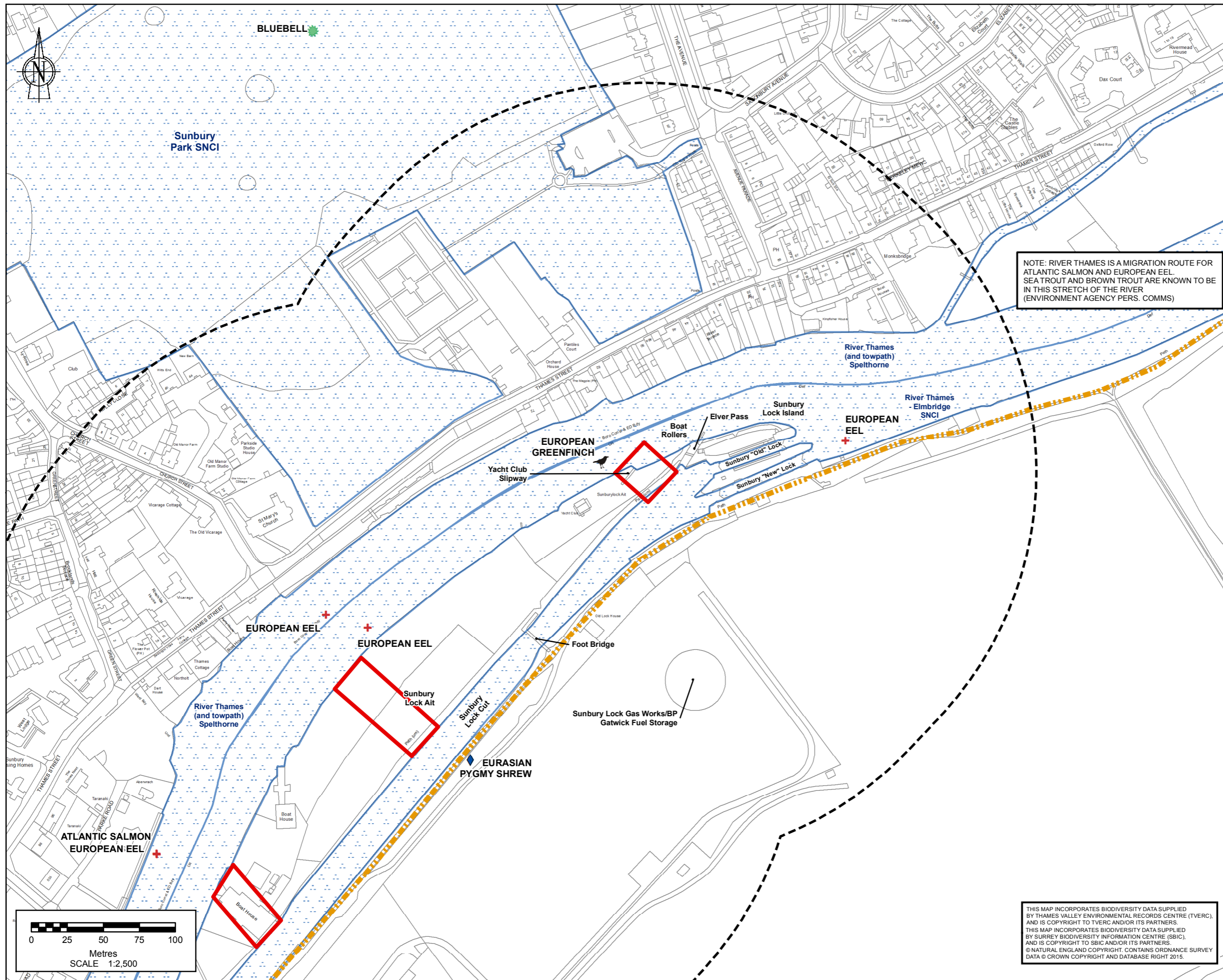
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 - BIRD
 - FLOWERING PLANT
 - TERRESTRIAL MAMMAL
 - RARE AND PROTECTED SPECIES SURVEY
 - BONY FISH
 - THAMES PATH NATIONAL TRAIL
 - SITE OF NATURE CONSERVATION INTEREST
 - WEIR POTENTIAL AREA OF WORKS
 - 250M BUFFER AROUND THE POTENTIAL AREA OF WORKS

NOTE: SITE OF NATURE CONSERVATION INTEREST DATA INCLUDES LOCAL WILDLIFE SITES AND SITES OF IMPORTANCE FOR NATURE CONSERVATION.



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Designed by: MMG Date: AUGUST 2015



Client Drawing No. _____ Revision _____



Project: RIVER THAMES SCHEME (DATCHET TO TEDDINGTON) (RTS) CAPACITY IMPROVEMENTS AND FLOOD CHANNEL (CI&FC)

Drawing title: DESIGNATED NATURE CONSERVATION SITES, PROTECTED SPECIES AND INVASIVE NON-NATIVE SPECIES SUNBURY WEIR PAGE 2 OF 2

Drawing scale: 1:2,500 @ A3 Sheet size: A3

Drawing no. 122368-BVL-Z0-WS-DR-V-00004 Revision P03

RTS Capacity Improvements & Flood Channel (CI&FC) Project

Ecological Walkover Survey Report of Land at Broom Road Recreation Ground, Teddington

Last updated: 13th February 2017

Quality assurance:

Version	Date	Author	Checker	Reviewer	Status
P01.1	13/02/17	M. Rung	K. Quinton	E. Stevens	Draft
P01.2	13/06/17	C. Aylward	K. Quinton	E. Stevens	Draft Issue to EA



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DRAFT

1. Introduction

1.1. Background

1.1.1. The River Thames Scheme (RTS) developed in the Lower Thames Flood Risk Management Strategy (LTFRMS) comprises a flood diversion channel in three sections:

- Channel Section 1 – Datchet to Hythe End;
- Channel Section 2 – Egham Hythe to Chertsey; and
- Channel Section 3 – Laleham to Shepperton.

1.1.2. The RTS also comprises capacity improvement works to the existing weir complexes at Sunbury, Molesey and Teddington through addition of extra weir gates as well as capacity improvement to the Desborough Cut through widening on the north (or left) bank.

1.1.3. The works at the three weirs are required to mitigate a small increase in downstream flood risk (between the Desborough 'loop' at Shepperton and Teddington) that has been identified as likely to occur once the proposed flood channel is operational.

1.1.4. This PEA report exclusively focuses on the potential creation of a site compound on land at Broom Road Recreation Ground and the use of barges upon the west bank of the River Thames (adjacent to the proposed site compound) to facilitate works for the capacity improvements at Teddington Weir. This report acts as an addendum to 'the Weirs' PEA (GBV, 2015).

2. Methodology

2.1. Extended Phase 1 Habitat Survey

2.1.1. An extended Phase 1 Habitat Survey (P1HS) was undertaken on 24th January 2017 by Matt Rung MCIEEM, GBV Senior Ecologist on land within Broom Road Recreation Ground, Teddington. The survey methods were based on the Phase 1 Habitat Survey methodology (JNCC, 2010) and the Guidelines for Preliminary Ecological Appraisal (CIEEM, 2013). The extent of the survey area is shown on the Phase 1 Habitat Survey Plan in Appendix A.

Habitats and flora

2.1.2. All land parcels were mapped according to JNCC P1HS habitat types with target notes taken, as appropriate, to provide supplementary information on habitat conditions, features too small to map, species composition, structure and management.

Protected and notable species

2.1.3. During the survey, habitats wherever possible, were also assessed for their suitability to support protected and notable species, and field signs indicating their presence or absence recorded.

Invasive species

2.1.4. The distribution and extent of widespread, visible invasive species were also noted where found.

Ecological value

2.1.5. An indication of the ecological value of habitats and features identified during the appraisal which could be affected by the development, has been undertaken based on the Guidelines for Ecological Impact Assessment (CIEEM, 2016).

2.1.6. Each of the identified statutory and non-statutory sites, habitat types and associated species/populations have been attributed a biodiversity value reflecting their geographic significance; examples are provided below:

- i. **International** e.g. biodiversity feature that is designated or warrants designation as a Special Area for Conservation (SAC), Special Protection Area (SPA), or Ramsar site
- ii. **National** e.g. biodiversity feature that is designated or warrants designation as a Site of Special Scientific Interest (SSSI) or National Nature Reserve (NNR)
- iii. **Regional** e.g. biodiversity feature which is one of the best examples of its type within Yorkshire
- iv. **Borough**, e.g. biodiversity feature that is designated or warrants designation as a Local Wildlife Site (LWS) or other feature which is one of the best examples of its type within the Borough
- v. **Local**, e.g. biodiversity feature which is one of the best examples of its type within a local context (i.e. within ~1km of the scheme extent)

- vi. Biodiversity features of value within the zone of influence (site plus approx. 250m buffer)
- vii. Biodiversity features of negligible value.

2.1.7. Biodiversity values have also been based upon the following factors:

- i. Presence of sites or features designated for their nature conservation interest. Examples include internationally, nationally or locally designated sites
- ii. Size of habitat or species population, habitats or species which are rare, species rich assemblages, species which are endemic or on the edge of their range, large populations or concentrations of uncommon or threatened species and/or plant communities that are typical of valued natural/semi-natural vegetation types
- iii. Secondary and supporting value, for example, habitats or features which provide a buffer to valued features or which serve to link otherwise isolated features
- iv. Presence of legally protected sites or species
- v. Presence of UK priority habitats and species (S41 of the Natural Environmental & Rural Communities Act 2006 (NERC Act)).

2.2. Limitations

Timing

- 2.2.1. The survey was conducted during a sub-optimum survey window for botanical/invasive species assessment (which generally extends from April-October), and during a period when many protected species are less visible. However, given that the habitats present at the recreation ground are managed for amenity purposes it is considered that habitats were accurately surveyed and no species of value are present. Further surveys for protected/invasive species have been recommended where appropriate.

3. Results

3.1. Desk study and consultation

3.1.1. A summary of desk study results are provided below. Further details of species records are provided in 'the Weirs' PEA (2015); including maps showing locations of protected species (where copyright allows¹).

Designated sites and habitats

3.1.2. Given the relatively localised and small-scale nature of the proposed works to construct the compound, it is considered unlikely that any ecological effects would extend beyond 1km of the working areas. Therefore further discussion is only provided below on nature conservation sites and species which fall within the 1km study area.

3.1.3. Table 3-1 provides details of the designated nature conservation sites within 1km of the survey area, including their reasons for notification. Refer to 'the Weirs' PEA for supporting maps.

Table 3-1: Designated nature conservation sites within 1km of the Survey Area

Unless otherwise stated against a specific item, this table incorporates biodiversity data supplied by GIGL (ID1269) and the Environment Agency (ID1028), and is copyright to GIGL and the Environment Agency and/or its partners.

Designated Site Name	Distance from Survey area (approx.)	Reasons for Notification and integral value
TEDDINGTON		
Statutory Sites		
Ham Lands LNR	913m North	Urban Fringe. Unique mosaic of different vegetation types attracting many butterfly and bird species, and a diverse floral assemblage. Borough value
Non-statutory Sites (SNCI)		
River Thames and Tidal Tributaries	0m (within the survey area)	The Thames, London's most famous natural feature, is home to many fish and birds, creating a wildlife corridor running right across the capital. Regional value
Ham Lands	913m North	An attractive area of scrub and grassland beside the River Thames, well known for its remarkably diverse plant life. See LNR reasons for notification. Borough value
Royal Park Gate Open Space	642m South East	A public park next to the River Thames and continuing northwards as Ham Lands. Borough value
The Copse at Hampton Wick and Normansfield Hospital	334m South	A wooded nature reserve and the landscaped grounds of a former hospital. Borough value

¹ Copyright restrictions mean that GIGL records cannot be mapped. However, a species list from GIGL has been included to show which protected species, NERC Section 41 Species and Notable Species are found within the 1km study area of the survey area.

Protected and notable species

- 3.1.4. Table 3-2 below summarises the most significant protected and notable species records within 1km of the survey area, recorded since 2003. Detailed information on relevant legislation and conservation status criteria are detailed in Appendix C of the 'the Weirs PEA'.
- 3.1.5. Bats have been recorded within 180m of Broom Road. Atlantic salmon, European eel, brown trout and sea trout² have been recorded on the River Thames.

Waterbodies

- 3.1.6. Reference to OS 1:10,000 scale maps and aerial photographs indicate that the River Thames runs directly adjacent to the eastern boundary of the survey area; there are no other waterbodies within 250m of the survey area.

Table 3-2: Protected and notable species records within 1km of the Scheme

Unless otherwise stated in the table this table incorporates biodiversity data supplied by GIGL (ID1269) and the Environment Agency (ID1028), and is copyright to SBIC, GIGL and the Environment Agency and/or its partners.

Species Name	Distance of closest record from Survey Area (approx.)	Data Owner and Notes	Relevant Legal protection and conservation status
Daubenton's bat <i>Myotis daubentonii</i>	180m	Environment Agency (2013b) (ID329)	Habitat Directive (HabDir) Annex 4, Habitat Regulations (HabReg) Sch 2, WCA Sch5, Bern Convention Appendix II and IUCN threat category: Least Concern.
Atlantic salmon <i>Salmo salar</i>	River Thames	Environment Agency. Migratory route	Natural Environment and Rural Communities (NERC) Act S.41, HabDir Annex 2, Salmon and Freshwater Fisheries Act (SAFFA), OSPAR List and Bern Convention Appendix III.
Brown and sea trout <i>Salmo trutta</i>	River Thames	Environment Agency (2015a, pers. comm.) Migratory route	NERC Act S.41, SAFFA.
European eel <i>Anguilla anguilla</i>	River Thames	Environment Agency. migratory route	NERC Act S.41, Eel Regs, Eels (England and Wales) Regulations 2009, OSPAR List and IUCN threat category: Critically Endangered.

² Sea trout and brown trout are the same species (*Salmo trutta*). A combination of genetics and environmental factors (principally lack of food), will mean that some trout will go to sea to feed before returning to spawn. Data records do not differentiate between brown trout and sea trout, however personal communications with an Environment Agency fisheries specialist has confirmed the presence of both (2015a, pers. comm.)

Species Name	Distance of closest record from Survey Area (approx.)	Data Owner and Notes	Relevant Legal protection and conservation status
Stag beetle <i>Lucanus cervus</i>	Within 1km grid square	GIGL & Environment Agency (provided by People's Trust for Endangered Species (PTES)). All dead wood habitats likely to support this species	NERC Act S.41, HabDir Annex 2, Bern Convention Appendix III.
Pipistrelle bats <i>Pipistrellus</i> sp.	Within 1km grid square	GIGL. In housing; likely to be a roost	NERC Act S.41, HabDir Annex 4, Habitat Regulations (HabReg) Sch 2, WCA Sch5 & Sch8.
Pipistrelle bats <i>Pipistrellus</i> sp.	Within 1km grid square	GIGL. Adjacent to river; likely to be foraging	NERC Act S.41, HabDir Annex 4, HabReg Sch 2, WCA Sch5 & Sch8.
Grass snake <i>Natrix natrix</i>	474m	Environment Agency (provided by Amphibian and Reptile Conservation (ARC))	NERC Act S.41, Wildlife, Countryside Act (WCA) Sch5 sect 9.1(kill/injuring) and Bern Convention Appendix II & III.

3.2. Habitats and flora

- 3.2.1. The following sections detail the findings of the extended P1HS, which included a P1HS and assessment of suitability of habitats to support protected and notable species. The Phase 1 Habitat Plan providing supplementary information is included in Appendix A. Target notes (TN) are included in Table 3-3.
- 3.2.2. There were two dominant habitat types present within the survey area. These were amenity grassland and broadleaved scattered trees. These are described in detail below.

Broadleaved scattered trees

- 3.2.3. Broadleaved scattered trees are present throughout the survey area and range from semi-mature to mature. Species recorded were London plane *Platanus x hispanica* and weeping willow *Salix x sepulcralis*.

Amenity grassland

- 3.2.4. The survey area is primarily composed of closely mown amenity grassland which is used as a recreation area. Species recorded included perennial rye grass *Lolium perenne*, ribwort plantain *Plantago lanceolata*, daisy *Bellis perennis*, Yorkshire fog *Holcus lanatus*, white clover *Trifolium repens* and cock's-foot *Dactylis glomerata*.



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Adjacent land

- 3.2.5. The survey area borders the River Thames to the east which is separated from the survey area by a fence and vertical, canalised stone wall. This would be the location for barges to potentially dock at the site as there is already existing infrastructure present to facilitate this.
- 3.2.6. To the north and south is private land with buildings (Walbrook Teddington Rowing Club, Teddington School and Twickenham Sea Cadets), separated by a fence. To the west is amenity grassland which is contiguous with amenity grassland within the survey area.

Evaluation

- 3.2.7. The survey area is situated within Broom Road Recreation Ground on the edge of London and is regularly used by the public. No invasive species were recorded. The habitats present are common and indicative of a managed landscape and because of this are considered to be important within the zone of influence level only.
- 3.2.8. The canalised stone wall presents negligible habitat value for notable or protected species.

3.3. Fauna

Bats

- 3.3.1. Bats are protected against killing, injury, disturbance, obstruction, or damage to breeding sites or resting places by the Wildlife and Countryside Act (WCA) and Conservation of Habitats & Species Regulations (2010) (Appendix C, 'the Weirs PEA').
- 3.3.2. There are a number of trees present within the survey that have bat roost potential. Two willow trees (Target Note 1 and 2) contain cavities (woodpecker holes) between 6-8m above ground. No droppings or evidence of bats was recorded during the survey but these trees have a high bat roost potential. One London plane tree (Target Note 3) is moderately covered with ivy that may obscure potential cavities. However, no cavities were visible and it is likely that if a cavity was present this would be small as the ivy was not densely covering the tree. In addition, the ivy itself has the potential to be used as a transient summer roost by individual bats. It is therefore considered that this tree has a moderate bat roost potential.

Table 3-3: Target notes referencing ecological interest present within the survey area

Target Note	Description
1	Weeping willow with high bat roost potential. Woodpecker hole located 6-8m above ground.
2	Weeping willow with high bat roost potential. Woodpecker hole/cavity present on main trunk at a height of 8m.
3	London plane tree with moderate bat roost potential. Moderate cover of ivy present along main trunk. No other features noted.

- 3.3.3. The survey area provides some bat foraging opportunity owing to the presence of broadleaved scattered trees and amenity grassland. As the survey area is located directly adjacent to the River Thames, which is considered an important commuting and foraging route, it is likely that bats will use the survey area to forage occasionally. However, the small

size of the survey area and well managed, species poor habitats present render it of limited value.

- 3.3.4. The bat roost potential of three trees within the survey area is considered to be important at the zone of influence level for roosting. The small size of the survey area (~1 ha) and the species poor, well managed habitat recorded within, means it is considered likely to be of negligible value for foraging and commuting bats.

Reptiles

- 3.3.5. Reptiles have legal protection against killing and injury under the WCA.
- 3.3.6. The amenity grassland within the survey area has limited value for reptiles as the area is uniform, well-managed and cut short. The habitat is not linked to any other habitats with greater value for reptiles and is bound by the River Thames to the east, amenity grassland and a road to the west and to the north and south by buildings and hardstanding. The survey area is considered to have negligible value for reptiles.

Great Crested Newt

- 3.3.7. Great crested newts (GCN) are considered very unlikely to be present within the survey area considering the habitat present, lack of ponds within 250m and no desk study records.
- 3.3.8. If GCN are encountered works should stop, and suitable mitigation should be put in place, which may include working under a European Protected Species (EPS) license.

Badgers

- 3.3.9. Badgers are protected from disturbance whilst occupying a sett, through the Protection of Badgers Act 1992.
- 3.3.10. No badger setts were recorded during the survey and the survey area is limited in its suitability for badger setts as it is composed of amenity grassland which is flat, cut short and offers limited cover for badger. Amenity grassland within the survey area does provide some suitable foraging habitat but it is small in area (~1 ha) and not connected to wider landscapes and therefore offers limited foraging habitat. The survey area is considered to have negligible value for badger.

Birds

- 3.3.11. All birds, their nests and eggs are protected under Sections 1-8 of the WCA making it an offence to damage or destroy the nest of a wild bird whilst breeding. Certain species of bird, for example the barn owl, bittern and kingfisher receive additional protection under Schedule 1 of the WCA (Schedule 1 birds), which affords them protection against disturbance.
- 3.3.12. Suitable nesting habitat within the survey area is limited to broadleaved scattered trees. Amenity grassland is regularly managed with a closely cut sward height rendering ground nesting potential negligible. The survey area is located directly adjacent to the River Thames which provides a major commuting and feeding resource for a rich bird assemblage. The survey area is therefore considered to be important at the zone of influence level for birds.

Saproxylic invertebrates

3.3.13. Desk study records exist for stag beetles *Lucanus cervus* within 1km of the survey area. Within the survey area the habitats are limited for stag beetles; there is no evidence of dead wood and the presence of uniform amenity grassland as the major habitat is also of limited value for stag beetle. The survey area is therefore considered to have negligible value for stag beetle.

Other protected species

3.3.14. Species associated with the River Thames that were highlighted by the desk study such as European eel and fish species (salmon and brown trout) do not have the potential to occur within the survey area but were highlighted as present within the River Thames which is directly adjacent and is the route by which barges will transport equipment and materials to Teddington Weir. Due to its value as a habitat and corridor for the assemblage of species it supports, the River Thames is assessed collectively as having Regional value (see Table 3-1).

3.3.15. The River Thames corridor is integral to facilitate the movement of otter upstream/downstream. However, no potential suitable features occur within the survey area for otter (such as lay up or holt sites) and the banks of the River Thames at this location are hard and vertical and offer limited points of access for otter. It is therefore considered that otter have negligible value within the survey area.

3.3.16. Water voles were not highlighted by the desk study as being present within 1km of the survey area. There is no suitable habitat within the survey area for these species and the tidal fluctuations in the area reduce the value of the site for this species, and technical specialists at the Environment Agency have advised that this stretch of the River Thames is not suitable for water voles (2015b, pers. comm.). Therefore, this species is believed to be absent from the survey area.

3.3.17. White-clawed crayfish were not highlighted by the desk study as being present within 1km of the survey area. There is no suitable habitat within the survey area for these species and the river at Teddington comprises hard banks along the majority of the section, has a silty substrate, and has few riverbank features or gravel beds suitable for this species. Furthermore, the presence of American signal crayfish significantly reduces the likelihood of white-clawed crayfish being present. As such, the survey area is likely to be of no value to white-clawed crayfish.

4. Discussion and recommendations

4.1. Introduction

4.1.1. The results of the desk study and P1HS have identified the following potential ecological features which may be affected (directly or indirectly) from the scheme proposals as they are currently known, in the absence of mitigation and reasonable avoidance measures. Possible effects are discussed below, along with any required further survey work and /or measures to be employed to mitigate for the potential effects of the scheme on the identified ecological receptors. This assessment of impacts and recommendations should be reviewed as design is developed.

4.2. Habitats and flora

4.2.1. Impacts on those habitats described in Chapter 3.2 would need to be considered in order to comply with local planning policy. Relevant policies from the relevant local authority are listed in Table 4-1. It is anticipated that amenity grassland (up to 1ha) and broadleaved scattered trees will be removed during the construction of the site compound.

4.2.2. Good practice for ground protection and reinstatement should be followed; therefore, it is not expected that any long term damage would be caused to the amenity grassland. If storage of topsoil of this habitat type is required, it should be carried out in accordance with the British Standard for topsoil (BS 3882:2015).

4.2.3. Where possible trees should be retained and protected in accordance with the British Standard (BS 5837:2012). Any trees should be replaced as agreed with Richmond Borough Council to ensure no net loss of habitat/connectivity, and no impacts on the wildlife corridor and 'green chain' (Richmond Borough Council CP4) along the Thames.

4.2.4. There will be no in-channel works required for the construction of the site compound. The hard engineered bank is likely to only require the removal of railings to allow barge access. However, the movement of clean spoil may occur by barge at this location and presents a small risk of silt release to the River Thames during loading and unloading. To prevent any impact on the River Thames and its associated fauna and flora a number of safeguards should be implemented. Apart from loading and unloading of barges, a buffer between the working areas and the edge of the River Thames should be maintained to provide protection to the River Thames from construction related activities. There should be no lighting over the River Thames and in dark corridors within the survey area throughout the year (for bats and eel migration). Stringent Pollution Control Measures should be implemented and the Environment Agency's Pollution Prevention Guidance should be followed to prevent any impact on the River Thames. An Environmental Management Plan should be produced prior to construction commencing and strictly enforced, including a section on sediment and silt release control.

Table 4-1: Relevant Core Strategy Planning Policies

Site	Local Authority	Planning Policy (Core Strategy)
Teddington & Molesey	LBRUT (ID1749)	CP4 Biodiversity: The Borough’s biodiversity...will be safeguarded and enhanced. Biodiversity enhancements will be encouraged particularly in areas of deficiency (...Teddington, Twickenham...), in areas of new development and along wildlife corridors and green chains such as the River Thames....
		CP10 Open land and Parks: The [Borough’s open land and parks] will be safeguarded and improved for biodiversity, sport and recreation and heritage, and for visual reasons.
		CP11 River Thames Corridor: The natural and built environment... of the River Thames corridor within the Borough will be protected and enhanced, and the special character of the different reaches identified in the Thames Strategy and the Thames Landscape Strategy respected.

4.3. Protected and notable species

4.3.1. In accordance with local planning policies and legislation (where applicable), loss or disturbance of protected or notable species should be avoided. Due to the likely delay until construction a pre-construction survey for invasive species should be carried out and bio-security measures implemented as required.

Bats

4.3.2. Any trees requiring removal or likely to be damaged or disturbed (including noise disturbance) as a result of the works, would be subject to an inspection/further survey if they have been highlighted on the Phase 1 maps and/or described in this report as having potential for roosting bats (Target Notes 1-3).

4.3.3. Any further surveys or inspections that are required should be carried out in line with best practice survey methodologies, (Bat Conservation Trust, 2016). Retained trees should be protected and lighting directed away from them (see Section 4.2 above).

Birds

4.3.4. Any tree removal should be undertaken outside of peak bird breeding season (March to September inclusive) where possible. If removal is required during this period, nesting bird checks should be undertaken by a suitably qualified ecologist prior to removal. If an active nest is identified, work must cease until the young have fledged.

4.3.5. A reinstatement strategy will be required to ensure no net loss of habitat for birds.

4.4. References

- Bat Conservation Trust (2016). Bat Surveys – Good Practice Guidelines, 3rd Edition.
- CIEEM (2013). Guidelines for Preliminary Ecological Appraisal. Institute of Ecology and Environmental Management
- CIEEM (2016). Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal, 2nd edition. Chartered Institute of Ecology and Environmental Management, Winchester.
- Environment Agency (2015a). Personal Communications with Fisheries and Biodiversity Technical Specialists, D. Clifton-Dey.
- Environment Agency (2015b). Personal Communications with Fisheries and Biodiversity Technical Specialists, P. St Pierre.
- Galliford-Try, Black & Veatch (2015). River Thames Scheme (Datchet to Teddington) Capacity Improvements and Flood Channel Project. Preliminary Ecological Appraisal for the Capacity Improvements to Teddington Weir, Molesey Weir and Sunbury Weir.
- JNCC (2010). Handbook for Phase 1 Habitat Survey: A Technique for Environmental Audit. First published 1990; reprinted in 1993; reprinted in 2003 with limited revisions & additions; reprinted in 2004; reprinted in 2007 with minor additions; reprinted in 2010



Appendix A: Extended Phase 1 Habitat Plan

Please see Figure W-DR-V-00052 (Sheet 24 of 28) in Pack 3 within Appendix A: 'Maps & Figures' in the EIA Scoping Report.

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