# M5 Junction 10 Improvements Scheme

## Environmental Statement Appendix 7.14

## Habitats Regulations Assessment

## Statement to Inform an Appropriate Assessment

## TR010063 - APP 6.15

Regulation 5 (2) (g)

Planning Act 2008

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

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# Infrastructure Planning

# Planning Act 2008

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

# M5 Junction 10 Improvements Scheme

Development Consent Order 202[x]

## 6.15 Environmental Statement Appendix 7.14

## Habitats Regulations Assessment

## Statement to Inform an Appropriate Assessment

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# 1. Executive Summary

1.1.1. This Statement to Inform an Appropriate Assessment has been produced by Atkins on behalf of Gloucestershire County Council (GCC) and relates to identified potential for impacts to European eel, Atlantic salmon, sea trout and river lamprey associated with the River Severn Special Area of Conservation (SAC) and Ramsar Site as a result of the proposed M5 Junction 10 Improvements Scheme.

1.1.2. The HRA Screening Assessment in Technical Appendix 7.13 (application document TR010063 – APP 6.15) identified seven European Sites for consideration[1]. No Likely Significant Effects (LSE) were identified in respect of the Wye Valley and Forest of Dean Bat Sites SAC, Walmore Common Special Protection Area (SPA)/ Ramsar Site, Cotswold Beechwoods SAC and the Severn Estuary SPA.

1.1.3. Survey results and desk study records indicate that European eel, Atlantic salmon, sea trout and river lamprey[2] are present, or potentially present, in the River Chelt in the vicinity of the Scheme. European eel, Atlantic salmon and sea trout are qualifying features of the Severn Estuary Ramsar Site, and river lamprey is a qualifying feature of the Severn Estuary SAC and Ramsar Site. The following likely effect pathways were identified:

- Temporary reduction in the extent of functionally linked habitat available to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, in the event that dewatering part of the River Chelt channel is required during construction.
- Water quality impacts to functionally linked habitat within the River Chelt as a result of a pollution event during construction and operation, and consequent detrimental effects to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site.
- Disturbance impacts to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, using functionally linked habitat within the River Chelt during construction as a result of noise and vibration.
- Injury or mortality to river lamprey ammocoetes associated with the Severn Estuary SAC and Ramsar Site using functionally linked habitat within the River Chelt if they are present within burrows in the sediment in the event that dewatering of part of the channel is required during construction.
- Fragmentation as a result of disturbance and pollution, which could result in barrier effects, with European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, unable to disperse or move along the River Chelt.

1.1.4. All other potential likely effect pathways were discounted.

1.1.5. Following a detailed assessment of the above likely effect pathways, it was concluded that there is a risk that the potential impacts could have adverse effects on the integrity of the Severn Estuary SAC/Ramsar Site alone. Mitigation measures have been designed which are effective, reliable, plainly established and uncontroversial. Taking the mitigation into

[1] Wye Valley and Forest of Dean Bat Sites SAC, Walmore Common SPA, Walmore Common Ramsar Site, Severn Estuary SAC, Severn Estuary SPA, Severn Estuary Ramsar Site, and Cotswold Beechwoods SAC

[2] Two brook/river lamprey ammocoetes (young/larvae) were recorded. It is difficult to distinguish between brook and river lamprey when in the ammocoete stage. As a precaution, they are assumed to be river lamprey.

account, no residual effects remain, and therefore the Scheme would not add to any effects associated with other plans or projects.

# 2. Introduction

2.1.1. Atkins, member of the SNC-Lavalin group, was commissioned by Gloucestershire County Council (GCC) to undertake a Habitats Regulations Assessment (HRA) in relation to the M5 Junction 10 Improvements Scheme (hereafter referred to as 'the Scheme').

2.1.2. The M5 links the Midlands with the South West, running from Junction 8 of the M6 at West Bromwich near Birmingham to Exeter in Devon, and linking with the M4 north of Bristol. Junction 10 (of the M5) is located 76 km to the south of Birmingham, 64 km to the north of Bristol, 8 km to the south of Tewkesbury, 6.5 km to the north-west of Cheltenham, and 12 km to the north-east of Gloucester. The location of M5 Junction 10 is shown in Figure 2-1.

2.1.3. The junction is in a strategically important location for the region, particularly as northern and western Cheltenham are the sites of a number of large retail parks and employment areas, and the location of planned future housing and nationally significant business development.


*Figure 2-1 - Location of the Scheme*

2.1.4. Works to M5 Junction 10 are proposed, consisting of a new all-movements junction; the widening of the A4019 east of the junction to the Gallagher Retail Park Junction; and a new link road from the A4019 to the B4634. A small section of the A4019 will be realigned to the west of the junction. Further detail is included in Chapter 2 of the ES (application document TR010063 – APP 6.2).

2.1.5. The HRA Screening Assessment (application document TR010063 – APP 6.15) identified seven European Sites[3] for consideration[4]. The need for Appropriate Assessment, in accordance with Regulation 63(1) of the Conservation of Habitats and Species

[3] Following the changes made to the Conservation of Habitats and Species Regulations 2017 (as amended) by the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019, SACs and SPAs in the UK no longer form part of the EU's Natura 2000 ecological network and now form part of a UK national site network. In this document they are still referred to as European Sites.
[4] Wye Valley and Forest of Dean Bat Sites SAC, Walmore Common SPA/Ramsar Site, Seven Estuary SAC/SPA/Ramsar Site and Cotswold Beechwoods SAC.

Regulations 2017 (as amended) (the 'Habitats Regulations')[5], was identified during the Screening assessment. The Screening assessment concluded that without mitigation, there is potential for a likely significant effect (LSE) to occur in relation to European eel, Atlantic salmon and sea trout, qualifying features of the Severn Estuary Ramsar Site designation, and river lamprey, a qualifying feature of the Severn Estuary SAC and Ramsar Site designations as a result of the following potential impacts:

- Temporary reduction in the extent of functionally linked habitat available to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, in the event that dewatering part of the River Chelt channel is required during construction.
- Water quality impacts to functionally linked habitat within the River Chelt as a result of a pollution event during construction and operation, and consequent detrimental effects to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site.
- Disturbance impacts to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, using functionally linked habitat within the River Chelt during construction as a result of noise and vibration.
- Injury or mortality to river lamprey ammocoetes associated with the Severn Estuary SAC and Ramsar Site using functionally linked habitat within the River Chelt if they are present within burrows in the sediment in the event that dewatering of part of the channel is required during construction.
- Fragmentation as a result of disturbance and pollution, which could result in barrier effects, with European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, unable to disperse or move along the River Chelt.

2.1.6. These potential LSE are considered in this Statement to Inform an Appropriate Assessment (SIAA). No other LSE were identified in the Screening assessment.

2.1.7. This SIAA is required to satisfy Regulation 63(2) of the Habitats Regulations, which requires anyone applying for consent for a project likely to have a significant effect on a European Site to provide the Competent Authority[6] with the information that may reasonably be required to complete an Appropriate Assessment. In this case, GCC is applying for the consent and the Secretary of State (SoS) for Transport is the Competent Authority.

2.1.8. The document has been prepared by a suitably qualified and experienced person following standards published by National Highways[7]. Document headings follow the outline contents provided in 'Appendix C' of these standards. The Habitats Regulations

[5] As amended by The Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.
[6] Competent Authority means a Competent Authority within the meaning of Regulation 7 of the Conservation of Habitats and Species Regulations 2017.
[7] Highways England (2020). Design Manual for Roads and Bridges. LA 115 Habitats Regulations Assessment (formerly HD 44/09). (January 2020, version 1) Online: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section4/LA%20115%20Habitats%20Regulations%20assessment%20-web.pdf

Handbook[8], Planning Inspectorate (PINS) Advice Note Ten[9] and government guidance[10] have also been referred to for guidance.

2.1.9. The author is an Associate Ecologist with Atkins, a Chartered Environmentalist and a Full Member of the Chartered Institute of Ecology and Environmental Management (CIEEM). They hold a BSc (Hons) degree in Biological Sciences. With over 15 years of professional consultancy experience, they have undertaken ecological assessments (including HRA) for numerous projects across the UK, including various scales of highways project. They have attended HRA training provided by CIEEM.

[8] Tyldesley, D., and Chapman, C., (2013) The Habitats Regulations Assessment Handbook, January 2018 edition UK: DTA Publications Limited www.dtapublications.co.uk.
[9] National Infrastructure Planning (August 2022, version 9) Advice Note Ten: Habitats Regulations Assessment relevant to nationally significant infrastructure projects. Online: Advice Note Ten: Habitats Regulations Assessment relevant to nationally significant infrastructure projects | National Infrastructure Planning (planninginspectorate.gov.uk).
[10] Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities and Local Government (July 2019) Appropriate assessment – Guidance on the use of Habitats Regulations Assessment. Online: Appropriate assessment - GOV.UK (www.gov.uk).

# 3. Background to the Scheme

## 3.1. Description of the Scheme

3.1.1. An overview of the Scheme is provided below and illustrated on the figure in Appendix A. Further details are included in Chapter 2 of the Environmental Statement (application document TR010063 – APP 6.2).

3.1.2. The proposed alterations to M5 Junction 10 are to increase the capacity of the junction, and to upgrade the current restricted movements junction to an all-movements junction. To enable travel both south and north on the M5, the two existing Junction 10 slip roads will be removed, and four new slip roads will be constructed to provide access and egress to the M5 in all directions.

3.1.3. Two new overbridges (Piffs Elm Interchange Bridge North and Piffs Elm Interchange Bridge South) will be constructed over the M5, centred either side of the existing Piffs Elm Interchange Bridge (carrying the A4019 over the M5), which will then be demolished. The new overbridges will create a new elongated roundabout junction over the M5.

3.1.4. The A4019 will be realigned to provide an appropriate entry angle to the new roundabout. A dedicated route for cyclists and pedestrians will be provided at grade through the junction. As a result of the new slip roads, the Piffs Elm culvert and the Leigh Brook culvert (also referred to as the Barn Farm culvert), that pass under the M5, will be extended by 100.2m and 16.4m respectively. The alignment of the new southbound on and northbound off slip roads means that an extension of the River Chelt culvert under the M5 will not be required. The speed limit along the A4019 across the new roundabout will be 50mph. The national speed limit for motorways will apply on the new slip roads. The new roundabout, and the approaches to it (from the motorway and the A4019) will be lit.

3.1.5. The creation of new north facing slip roads means that the existing 53.5m long culvert for the Leigh Brook underneath the M5 to the north of Junction 10 will be extended at either end, to a total of 69.9m in length. The riverbanks 200m downstream of the culvert will be reprofiled and planted with appropriate vegetation to improve hydromorphological and ecological diversity. The new south facing slip roads will not extend far enough south to require an extension of the River Chelt culvert, although the river banks 100m upstream and downstream of the culvert will be reprofiled and planted to improve hydromorphological and ecological diversity of this section of the River Chelt.

3.1.6. The existing retaining wall to the south side of the A4019, immediately to the east of the M5, will be demolished.

3.1.7. Highway drainage from the new slip roads and roundabout will be to two new attenuation basins located to west of the M5, to the north and south of the junction.

3.1.8. The embankment to the north of the A4019, and west of the M5 will be steepened to enable an area of priority habitat along the north side of a section of Stanboro Lane to be retained. The existing crib wall retaining wall in this location will be demolished.

3.1.9. A new access track will be created to the northeast of the M5 Junction 10, as a replacement for the existing access points to the field areas and the informal Traveller site, that have been lost as a result of the new southbound off-slip.

3.1.10. To the southeast of the M5 Junction 10, an area of land will be reprofiled by the excavation of material. This area will provide flood storage for the Scheme, and compensation for the loss of flood storage from construction of the Scheme. The land adjacent to (and surrounding) the excavated area will be landscaped to provide a mix of habitats to support biodiversity enhancements within the Scheme. Collectively the excavated area and the landscaped area are referred to as the ‘flood storage area’. The preliminary design for the flood storage area is provided in the Environmental Masterplan (application document TR010063 – APP 2.13).

3.1.11. Whilst the final layout for this flood storage area will be determined at detailed design stage, the layout selected will provide the following design parameters:

- Excavation to no deeper than the Piffs Elm culvert, with capacity to store 190,298m$^3$ of floodwater.
- To provide a sufficient level of flood storage within the parameters of a 1 in 100 year flood event with a 53% climate change allowance.
- The outfall from the attenuation basin adjacent to the flood storage area will provide a regular supply of water into the excavated area (from highway drainage that has been treated through the attenuation basin). This will supply a permanent body of water located between the outfall from the attenuation basin and the Piffs Elm culvert, which will be created by excavating to a greater depth than Piffs Elm culvert. This permanent body of water will not affect the flood storage capacity of the excavated area.

3.1.12. A structure for roosting bats has been included within the flood storage area, to provide mitigation for the loss of roosting sites within the Scheme area.

3.1.13. An underpass (the 'Withybridge (A4019) underpass') will be constructed under the A4019 immediately to the east of Junction 10 to provide a traffic free route for bats to cross under the A4019, as well as pedestrians, cyclists and equestrians. The underpass will be constructed from two precast concrete U-sections to provide a clear opening of 4m height and 5m width, and with wingwalls and a headwall at either end, and a total length of 55m. Physical measures will be in place to prevent vehicular access through the underpass. The underpass will be lit during the day, with the lights switched off between sunset and sunrise.

3.1.14. Works to install signage and technology equipment will be undertaken along the M5 to the north and south of Junction 10. The exact locations of these works will be determined at detailed design and will be limited to works at discrete locations in the existing highway verge (for the installation of new signage for example) or the installation of cabling along the edge of the existing motorway. The specific locations of the signage and cabling works is not fixed at this stage and will be determined at detailed design stage, subject to ecological investigations to ensure that specific impacts (to badgers for example) are avoided.

### West Cheltenham Link Road

3.1.15. The Link Road element of the Scheme comprises a new single carriageway 1.4km in length, between the B4634 to the A4019, designed to provide greater connectivity between the reconfigured M5 Junction 10 and the West Cheltenham Development Area. The Link Road has a segregated cycleway (3m in width) and footway (2m in width) all the way along its west side. The speed limit on the Link Road will be 50mph, reducing to 40mph at the junction with the B4634.

3.1.16. The Link Road crosses predominantly agricultural land. The design of the Link Road includes flood mitigation structures across the floodplain to the north of the River Chelt, and a single span bridge over the River Chelt. The bridge construction will be a single span precast beam bridge with integral full height reinforced concrete abutments, resting on a piled foundation (comprising 1 m diameter bored concrete pile). The bridge will cross the River Chelt at an angle, with the bridge abutments set back from the riverbanks by a minimum of 4m on each side of the river. As the abutments will also be on an angle to the riverbank, then at some points the abutments will be greater than 4m from the riverbank.

3.1.17. The bridge will have a clear span of 24m between the front faces of the abutments (equivalent to a 24.9m skew span), and the bridge deck will be 20.8m wide. The clearance underneath the bridge (between the underside of the bridge and the top of the riverbank) will be 2.8m. This clearance provides sufficient space for floodwater to pass underneath the bridge in the 1% annual exceedance probability event (1 in 100-year return period)

including an allowance for climate change (+53% in flow) with a minimum of 600mm freeboard to soffit.

3.1.18. The clearance underneath the bridge, and the space between the riverbank and bridge abutments will also allow access for small vehicles and livestock along either riverbank at this point.

3.1.19. In order to ensure that access under the River Chelt bridge is maintained, a short section of hard bank protection, such as rip-rap or non-biodegradable geotextile, will be installed along both banks of the River Chelt underneath the River Chelt bridge.

3.1.20. Flood mitigation structures will be provided underneath the Link Road at two locations between the River Chelt and the A4019. These are to ensure that the Link Road does not impede the natural movement of floodwater from the River Chelt north-westerly from a point upstream of the proposed River Chelt bridge. The flood mitigation structures will comprise two groups of precast concrete box culverts, laid on top of 1m of imported granular fill material:

- Group 1: eighteen 3m span x 1.25m clearance box culverts; with one 6m span x 2m clearance box culvert to accommodate a field drain. All culverts will be 31.85m in length and laid perpendicular to the carriageway, with the total group being 63.9m in length parallel to the carriageway.
- Group 2: eighteen 3m span x 1.25m clearance box culverts. The culverts will be 37.4m in length perpendicular to the carriageway, with the total group being 70.9m in length parallel to the carriageway. Group 2 will be located approximately 70.5m south of Group 1.

3.1.21. Two new junctions will connect the Link Road with the existing A4019 (to the north) and the B4634 (to the south).

3.1.22. Street lighting along the Link Road will be limited to the two new junctions and the sections of the Link Road adjacent to the junctions.

3.1.23. Highway drainage from the Link Road will be to two new attenuation basins located at the northern and southern end of the Link Road. The attenuation basin at the northern end of the Link Road also receives highway drainage from the A4019.

### A4019 widening

3.1.24. The A4019 links the M5 Junction 10 to north-west Cheltenham. Currently, the A4019 is a dual carriageway over the M5 Junction, returning to single carriageway east of the junction to serve the turning into Withybridge Lane. The A4019 continues eastwards to Cheltenham as a single carriageway, where it ties into an existing dual carriageway at the Gallagher Retail Park.

3.1.25. The section of the A4019 covered by the Scheme runs from just west of the M5 Junction 10 (at the junction of Stoke Road and the A4019) eastwards through to the existing dual carriageway at the Gallagher Retail Park (finishing just east of the junction of the B4634 and A4019).

3.1.26. As part of the highway improvements incorporated into the Scheme, the A4019 will be widened to a two-lane dual carriageway from Withybridge Lane, eastwards through to the Gallagher Retail Park, where the Scheme will tie into the existing dual carriageway. Widening of the A4019 through Uckington will be predominantly to the southern side of the A4019. Widening to the east and the west of Uckington will be to the northern side of the A4019. To the west of Junction 10 the existing section of two-lane dual carriageway will be replaced with single lanes.

3.1.27. The elevation of the A4019, in the vicinity of the Withybridge Lane junction, will be raised to remove an existing low point that experiences surface water flooding currently. Existing culverts under the A4019 in this location will be removed.

3.1.28. Street lighting will extend for most of the length of the A4019 within the Scheme boundary. The exceptions will be a section to the east and the west of Uckington where there will be no street lighting so as to provide mitigation for bats.

3.1.29. A speed limit along the A4019 of 50mph is proposed from the western extent of the Scheme through to a point west of Uckington between the junction with the new Link Road and Cooks Lane, where the speed limit will be reduced to 40mph through to the Gallagher junction.

3.1.30. The Scheme will include a segregated cycleway (3m width) and footway (2m width) on the northern side of the A4019, which with the exception of a short section of shared use path through Uckington will extend from the junction of the A4019 with Stanboro Lane in the west through to the Gallagher junction at the eastern end of the Scheme. The Scheme will also include a bus lane on the eastbound carriageway between the West Cheltenham Fire Station and the Gallagher junction.

3.1.31. Highway drainage from the A4019 will be to three new attenuation basins located:

- At the western end of the A4019 (off Stanboro Lane).
- Adjacent to the Cheltenham West Community Fire Station (on the A4019).
- At the northern end of the Link Road. This attenuation basin will also receive highway drainage from the northern section of the Link Road.

3.1.32. Enhancements to existing hedgerows and the creation of new hedgerows will be made in several locations to the north of the A4019 to provide mitigation for dormice found to be present in this area. A new structure will be constructed within the highway boundary to the north of the A4019 and east of Uckington, for roosting bats, to provide mitigation for the loss of existing roosts.

## 3.2. Purpose and objectives

3.2.1. Gloucestershire faces significant challenges to achieve its vision for economic growth. The Joint Core Strategy (JCS) is a partnership between Gloucester City Council, Cheltenham Borough Council (CBC) and Tewkesbury Borough Council (TBC) which sets out a strategic planning framework for the three areas. The Adopted JCS 2011-2031 is a coordinated strategic development plan, adopted in December 2017, which shows how the region will develop and includes a shared spatial vision targeting 35,175 new homes and 39,500 new jobs by 2031.

3.2.2. Major development of new housing (c.9,000 homes) and employment land is proposed in the JCS in strategic and safeguarded allocations to the west and north-west of Cheltenham, these being: West Cheltenham (Golden Valley); North West Cheltenham (Elms Park); and safeguard land to the west and the north-west of Cheltenham. The West Cheltenham development, in turn, is linked to wider economic investment, including a government supported cyber business park (Cyber Central UK) adjacent to the Government Communications Headquarters (GCHQ) site in west Cheltenham.

3.2.3. The existing M5 Junction 10 only provides access and egress to and from the north, with no connectivity to M5 south; this causes existing traffic to cross Cheltenham through various routes to access and leave the M5 from the south using other M5 junctions. This contributes significantly to existing traffic flows across Cheltenham, with significant congestion at peak times. To unlock the housing and job opportunities, a highway network is needed that has the capacity to accommodate the increased traffic it will generate, within a sustainable transport context.

3.2.4. Upgrading M5 Junction 10 to an all movements junction has been identified as a key infrastructure requirement to enable the housing and economic development proposed by the JCS and supported in the Gloucestershire Local Enterprise Partnership's (GFirst LEP) Strategic Economic Plan and the transport network sought by GCC in the adopted Gloucestershire Local Transport Plan. Improvements to M5 J10 are critical to maintaining the safe and efficient operation of the junction; and enabling the planned development and

economic growth. A bid was submitted in March 2019 to Homes England to the Housing Infrastructure Fund (HIF), wherein an investment case was made for the following infrastructure improvements. Funding was successfully awarded by Homes England in March 2020 for:

- Element 1: Improvements to Junction 10 on the M5 and a new road linking Junction 10 to west Cheltenham.
- Element 2: A38/A4019 Junction Improvements at Coombe Hill.
- Element 3: A4019 widening, east of Junction 10.
- Element 4: An upgrade to Arle Court Park and Ride.

3.2.5. Elements 1 and 3 comprise the M5 Junction 10 Improvements Scheme (the Scheme). The upgrade to Arle Court Park and Ride (now known as the Arle Court Transport Hub) (Element 4) and the junction improvements at Coombe Hill (Element 2) were included as part of the package of improvements funded by Homes England. As they do not form part of the proposed improvement of M5 Junction 10, and are located some distance from the junction, GCC has decided to take these two elements forward as separate packages of work in order to accelerate the programme for these elements.

3.2.6. The objectives for the Scheme are:

1. Support economic growth and facilitate growth in jobs and housing by providing improved transport network connections in west and north-west Cheltenham.
2. Enhance the transport network in the west and north-west of Cheltenham area with the resilience to meet current and future needs.
3. Improve the connectivity between the Strategic Road Network (SRN) and the local transport network in west and north-west Cheltenham.
4. Deliver a package of measures which is in keeping with the local environment, establishes biodiversity net gain and meets climate change requirements.
5. Provide safe access to services for the local community and including for users of sustainable transport modes within and to the west and north-west of Cheltenham.

## 3.3. Physical land take

3.3.1. The Order limits (also known as the 'red line boundary') are shown on the Land Plans (application document TR010063 – APP 2.2). This includes both the permanent and temporary land take for all works proposed, including for the Scheme and construction areas.

3.3.2. The Order limits covers an area of approximately 200ha. There will be no land-take from any European Sites.

## 3.4. Key stages of the project and timescales

3.4.1. An application for a DCO under S.22 of the Planning Act 2008 is being submitted for the Scheme in October 2023.

3.4.2. Construction is anticipated to begin in April 2025, and finish in December 2027. The main construction works comprise four interlinked and interdependent sections of work:

- Construction of the new Junction 10 including the junction structures and slip roads (anticipated month 5 – month 30).
- Widening and realignment of the A4019 (anticipated month 5 – month 30).
- Construction of the West Cheltenham Link Road and associated flood alleviation works (anticipated month 17 – month 26).
- New signalised junction between the Link Road and B4634 (anticipated month 6 – month 24).

## 3.5. Resource requirements

3.5.1. Throughout construction material assets would be consumed to build the Scheme. The estimated material asset quantities to be consumed by the Scheme are shown in Table 3.1.

Table 3.1 Material Quantities

| Material Assets | Primary Material Quantity ($m^3$) | Primary Material Quantity (Tonnes) |
|---|---|---|
| Aggregate | 981.524 | 1,068,891 |
| Asphalt | 44,201 | 106,083 |
| Concrete | 19,698 | 47,276 |
| Steel | 322 | 2,518 |

3.5.2. Resource requirements have been minimised as far as possible through the application of the prevent, reduce, reuse, recycle and recover waste hierarchy. The figures above take into account the reuse of approximately 201,765 tonnes/148,409 $m^3$ of material on site. This will be achieved through the implementation of a Materials Management Plan (MMP).

3.5.3. Further to this is the expectation that the Principal Contractor will commit to the use of materials with at least 22% recycled content, in line with the regional percentage target.

3.5.4. The Scheme construction also involves habitat loss (i.e. the loss of ecological resources); however, due to the habitat creation measures that will be provided as part of the environmental design as described in the ES, long-term beneficial effects are anticipated once the created habitats have become established.

3.5.5. No resources will be extracted from any European Site.

## 3.6. Waste products arising during construction and operation

3.6.1. The construction of the Scheme will result in the generation of waste. The estimated total quantity of waste produced is 204,695 $m^3$/271,778 tonnes. Mitigation measures include following the waste hierarchy to prevent, reduce, reuse, recycle and recover. The quantity of waste produced takes into account the reuse of a minimum of approximately 148,409 $m^3$/201,765 tonnes of potential waste on site which would substitute the use of primary materials (representing the reuse onsite of at least 70% of total potential waste). The majority of the remaining estimated waste requiring management offsite is expected to be recovered/recycled and the Principal Contractor will commit to achieve a 95% recovery rate for wastes managed offsite.

3.6.2. Reduction and reuse will be achieved through the implementation of a MMP.

3.6.3. Waste that cannot be recycled or recovered, such as hazardous wastes, including any contaminated soil would be identified, removed, and kept separate from other construction wastes, in order to avoid contaminating 'clean' materials. It would then be removed from site by a licensed contractor and taken to a licensed facility for appropriate management.

## 3.7. Other services required

3.7.1. Existing services along the highway will need to be diverted. All necessary utility diversions are within the Order limits.

## 3.8. HRA Screening

3.8.1. The HRA Screening assessment is presented in in Appendix 7.13 of the ES (application document TR010063 – APP 6.15), a summary of which is presented below.

3.8.2. The Screening assessment was undertaken in accordance with current standards published by National Highways[11].

3.8.3. During the Screening assessment, seven European Sites were identified for consideration which met the criteria in LA 115, as shown in Figure 7-14A in Appendix B:

- Wye Valley and Forest of Dean Bat Sites SAC.
- Walmore Common Special Protection Area (SPA)/ Ramsar Site.
- Severn Estuary SAC/SPA/Ramsar Site.
- Cotswold Beechwoods SAC.

3.8.4. The closest SSSI component of the Wye Valley and Forest of Dean Bat Sites SAC is located 21 km west of the Scheme. The SAC was scoped out of further assessment at the coarse screening stage as such a distance is well beyond the zone of influence for any Scheme impacts relating to direct habitat loss, habitat degradation, habitat fragmentation or disturbance. The distance is also considered to be too great for there to be a significant functional linkage between the Scheme and the qualifying feature bat populations. It was concluded that there was no route or mechanism for a LSE on the interest features and therefore the integrity of the site.

3.8.5. Walmore Common SPA/Ramsar Site is located 17.5 km south-west of the Scheme. Although this is a considerable distance, the agricultural habitats present within the Scheme extent were identified as having the potential to support the qualifying populations of Bewick's swan which are associated with the SPA. However, during bird surveys, no Bewick's swan were identified. Furthermore, no records of Bewick's swan were provided from the desk study, and a review of existing literature indicated that the agricultural grassland habitats surrounding the Scheme are not key areas for populations of Bewick's swan[12]. No functional linkage between Walmore Common SPA/Ramsar Site and the Scheme study area was identified, and therefore no LSE, either alone or in-combination have been identified for Walmore Common SPA/Ramsar Site.

3.8.6. At a distance of 7.4 km south of the Scheme, with no hydrological connection and located beyond the Affected Road Network (ARN) for the Scheme, the only potential impact pathway between the Scheme and the Cotswold Beechwoods SAC was the potential for increased recreational pressure on the SAC. This could occur as a result of the Scheme facilitating housing developments within a 15.4 km zone of influence around the SAC, identified in the Cotswold Beechwoods SAC Recreation Mitigation Strategy[13] as an area within which housing growth may result in an increase in recreational use of the SAC. The potential for LSE in combination with other projects was assessed and, following a review of planning policies, potential for in-combination effects as a result of the Scheme and surrounding housing developments was discounted.

[11] Highways England (2020). Design Manual for Roads and Bridges. LA 115 Habitats Regulations Assessment (formerly HD 44/09). (January 2020, version 1) Online: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section4/LA%20115%20Habitats%20Regulations%20assessment%20-web.pdf

[12] Robinson, JA, K Colhoun, JG McElwaine & EC Rees (2004). Bewick's Swan *Cygnus columbianus bewickii* (Northwest Europe population) in Britain and Ireland 1960/61 – 1999/2000. Waterbird Review Series, The Wildfowl & Wetlands Trust/Joint Nature Conservation Committee, Slimbridge.

[13] Liley, D., & Panter, C. (2022). Cotswold Beechwoods SAC Recreation Mitigation Strategy. Unpublished report by Footprint Ecology.

3.8.7. No LSE were identified for the Severn Estuary SPA, located approximately 47.5 km downstream of the Scheme, either for the Scheme alone, or in combination with other plans and projects, on the basis that:

- Water quality impacts via the release of pollutants from the Scheme into the watercourse network upstream of the Seven Estuary SPA would be eliminated by dilution over the distance of at least 40 km that any pollutants would have to travel.
- Potential for changes in air quality to supporting habitats within the SPA, or to functionally linked habitats, has been discounted on the basis of the distance between the designated site and any construction activity and the ARN, and the results of wintering and migratory bird surveys, which indicate that the habitats in the vicinity of any construction activity and the ARN are not functionally linked to the Severn Estuary SPA designations.
- The habitats within and surrounding the Scheme are not considered to provide a role in maintaining the SPA populations of qualifying bird species, or functionally linked to the SPA.
- The Scheme would therefore not add to any water quality or air quality effects, or to any effects on qualifying bird species associated with other plans and projects.
- There are policies in place to ensure that potential for in-combination recreational pressure, as a result of housing developments that the Scheme will facilitate, on Coombe Hill Canal Site of Special Scientific Interest (SSSI) which has been shown to be functionally linked to the Severn Estuary SPA[14], do not occur.

3.8.8. Survey results and desk study records indicate that European eel, Atlantic salmon, sea trout and river lamprey[15] are present, or potentially present, in the River Chelt in the vicinity of the Scheme. European eel, Atlantic salmon and sea trout are qualifying features of the Severn Estuary Ramsar Site, and river lamprey is a qualifying feature of the Severn Estuary SAC and Ramsar Site. The following potential impacts were identified which could result in a LSE:

- Temporary reduction in the extent of functionally linked habitat available to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, in the event that dewatering part of the River Chelt channel is required during construction.
- Water quality impacts to functionally linked habitat within the River Chelt as a result of a pollution event during construction and operation, and consequent detrimental effects to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site.
- Disturbance impacts to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, using functionally linked habitat within the River Chelt during construction as a result of noise and vibration.
- Injury or mortality to river lamprey ammocoetes associated with the Severn Estuary SAC and Ramsar Site using functionally linked habitat within the River Chelt if they are present within burrows in the sediment in the event that dewatering of part of the channel is required during construction.

[14] Palmer, E. and Smart, M. (2021) Identification of wintering and passage roosts on functionally linked land of the Severn Estuary - Gloucestershire and Worcestershire (Phase 5). Natural England Commissioned Reports. NECR401.
[15] Two brook/river lamprey ammocoetes (young/larvae) were recorded. It is difficult to distinguish between brook and river lamprey when in the ammocoete stage. As a precaution, they are assumed to be river lamprey.

- Fragmentation as a result of disturbance and pollution, which could result in barrier effects, with European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, unable to disperse or move along the River Chelt.

3.8.9. The Screening assessment concluded that without mitigation, there is potential for LSE to occur on European eel, Atlantic salmon and sea trout, qualifying features of the Severn Estuary Ramsar Site designation, and river lamprey, a qualifying feature of the Severn Estuary SAC and Ramsar Site designations. Therefore, an Appropriate Assessment is required. Screening matrices for the Severn Estuary SAC and the Severn Estuary Ramsar Site are included in Appendix C and D respectively.

3.8.10. No LSE were identified for the qualifying bird species of the Severn Estuary Ramsar Site for the reasons described in paragraph 3.8.7 above. Similarly, no LSE were identified for the qualifying habitats within the Severn Estuary SAC and Ramsar Site for the reasons described in paragraph 3.8.7 above.

# 4. Protected sites potentially affected by the proposals

## 4.1. Physical area of the European Site

4.1.1. The Severn Estuary is located between Wales and England in south-west Britain. It is a large estuary with extensive intertidal mud-flats and sand-flats, rocky platforms and islands. Saltmarsh fringes the coast backed by grazing marsh with freshwater ditches and occasional brackish ditches. The subtidal seabed is rock and gravel with subtidal sandbanks. The site also supports reefs of the tube forming worm *Sabellaria alveolate*. The estuary's classic funnel shape, unique in the UK, is a factor causing the Severn to have one of the highest tidal ranges in the world. A consequence of the large tidal range is an extensive intertidal zone, one of the largest in the UK. The tidal regime results in plant and animal communities typical of the extreme physical conditions of liquid mud and tide-swept sand and rock. The species-poor intertidal invertebrate community includes high densities of ragworms, lungworms and other invertebrates forming an important food source for passage and wintering waders and fish. The site is of importance during the spring and autumn migration periods for waders, as well as in winter for large numbers of waterbirds, especially swans, ducks and waders. The fish fauna is very diverse with more than 110 species identified. The site is of particular importance for migratory fish.

### Severn Estuary SAC

4.1.2. The Severn Estuary SAC (EU code: UK0013030) covers an area of 73,714.11 ha.

4.1.3. The Severn Estuary SAC is located 21 km south-west of the Scheme, or over 40 km downstream via the shortest hydrological connection.

4.1.4. All watercourses which are crossed by the Scheme (River Chelt, Leigh Brook, and their tributaries) eventually flow into the River Severn, which is approximately 7.5 km downstream from the closest Scheme interaction. From the nearest confluence point, where the River Chelt joins the River Severn, just upstream of Wainlode Cliff, the Severn Estuary SAC is a further 40 km downstream (a total distance of approximately 47.5 km downstream of the Scheme).

### Severn Estuary Ramsar Site

4.1.5. The Severn Estuary Ramsar Site (EU code: UK11081) covers an area of 24,662.98 ha.

4.1.6. The Severn Estuary Ramsar Site is located 21 km south-west of the Scheme, or over 40 km downstream via the shortest hydrological connection.

4.1.7. All watercourses which are crossed by the Scheme (River Chelt, Leigh Brook, and their tributaries) eventually flow into the River Severn, which is approximately 7.5 km downstream from the closest Scheme interaction. From the nearest confluence point, where the River Chelt joins the River Severn, just upstream of Wainlode Cliff, the Severn Estuary SAC is a further 40 km downstream (a total distance of approximately 47.5 km downstream of the Scheme).

## 4.2. Qualifying interests of the European Site

### Severn Estuary SAC

4.2.1. Qualifying features include[16]:

- 1130 Estuaries – one of the best areas in the UK.
- 1140 Mudflats and sandflats not covered by seawater at low tide – one of the best areas in the UK.
- 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) – one of the best areas in the UK.
- 1110 Sandbanks which are slightly covered by seawater all the time – the site is thought to support a significant presence of this habitat.
- 1170 Reefs – the site is thought to support a significant presence of this habitat.
- 1095 Sea lamprey (*Petromyzon marinus*) – one of the best areas in the UK.
- 1099 River lamprey (*Lampetra fluviatilis*) – one of the best areas in the UK.
- 1103 Twaite shad (*Alosa fallax*) – one of the best areas in the UK.

4.2.2. The site notification information is presented in Appendix E.

### Severn Estuary Ramsar Site

4.2.3. Ramsar Criteria as listed on the Ramsar Information Sheet (RIS)[17] (hereafter referred to as Qualifying Features):

- Estuarine habitats (Ramsar Criteria 1 and 3).
- Migratory fish (Ramsar Criterion 4) – the site is important for the run of migratory fish between sea and river via estuary. Species include:
  - Atlantic salmon (*Salmo salar*)
  - Sea trout (*Salmo trutta*)
  - Sea lamprey
  - River lamprey
  - Allis shad (*Alosa alosa*)
  - Twaite shad (*Alosa fallax*)
  - European eel (*Anguilla anguilla*)
- Fish (Ramsar Criterion 8) – the fish of the whole estuarine and river system is one of the most diverse in Britain, with over 110 species recorded. Salmon, sea trout, sea lamprey, river lamprey, allis shad, twaite shad and eel use the Severn Estuary as a key migration route to their spawning grounds in the main tributaries that flow into the estuary. The site is important as a feeding and nursery ground for many fish species particularly allis shad and twaite shad which feed on mysid shrimps in the salt wedge. In addition, the Severn Estuary has the largest European eel run in Great Britain[18].
- Internationally important populations of wintering birds (Ramsar Criterion 6) including:

[16] https://sac.jncc.gov.uk/site/UK0013030
[17] https://jncc.gov.uk/jncc-assets/RIS/UK11081.pdf
[18] Natural England and the Countryside Council for Wales (2009). The Severn Estuary/Mor Hafren European Marine Site

- Bewick's swan (*Cygnus colombianus bewickii*)
- White fronted-goose (*Anser albifrons*)
- Shelduck (*Tadorna tadorna*)
- Gadwall (*Anas strepera strepera*)
- Dunlin (*Calidris alpina alpina*)
- Common redshank (*Tringa totanus totanus*)
- Wintering waterfowl assemblage of international importance (Ramsar Criterion 5)
- Breeding lesser black-backed gull (*Larus fuscus graellsii*) was identified subsequent to designation for possible future consideration under Ramsar Criterion 6 - 4167 apparently occupied nests representing an average of 2.8% of the western Europe/Mediterranean/west African breeding population (Seabird 2000 Census).

4.2.4. The site notification information is presented in Appendix F.

## 4.3. Conservation objectives

4.3.1. The Severn Estuary SAC and the Severn Estuary Ramsar Site (as well as the Severn Estuary SPA) make up the Severn Estuary European Marine Site. Regulation 33 of the Habitats Regulations requires Natural England and Natural Resources Wales to advise the relevant authorities for each European Marine Site in, or partly in, England and Wales of:

- The conservation objectives for that site.
- Any operations which may cause deterioration of natural habitats or the habitats of species, or disturbance of species for which the site has been designated.

4.3.2. This 'Regulation 33 advice' has been drawn on in this assessment, in particular in relation to the specific objectives for fish.

### Severn Estuary SAC

4.3.3. Natural England has identified the following conservation objectives for the Severn Estuary SAC[19]:

4.3.4. Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:

- The extent and distribution of qualifying habitats and habitats of qualifying species.
- The structure and function (including typical species) of qualifying natural habitats.
- The structure and function of the habitats of qualifying species.
- The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely.
- The populations of qualifying species.
- The distribution of qualifying species within the site.

[19] Natural England (2018). European Site Conservation Objectives for Severn Estuary Special Area of Conservation. Online: http://publications.naturalengland.org.uk/publication/6081105098702848.

4.3.5. The conservation objective for the river lamprey feature of the Severn Estuary SAC is to maintain the feature in favourable condition as defined below[20]:

- The feature will be considered to be in favourable condition when, subject to natural processes, each of the following conditions are met:
  - The migratory passage of both adult and juvenile river lamprey through the Severn Estuary between the Bristol Channel and any of their spawning rivers is not obstructed or impeded by physical barriers, changes in flows or poor water quality.
  - The size of the river lamprey population in the Severn Estuary and the rivers which drain into it, is at least maintained and is at a level that is sustainable in the long term.
  - The abundance of prey species forming the river lamprey's food resource within the estuary, is maintained.
  - Toxic contaminants in the water column and sediment are below levels which would pose a risk to the ecological objectives described above.

### Severn Estuary Ramsar Site

4.3.6. No specific conservation objectives are available for Ramsar sites. The overarching objective of the Ramsar Convention is to stem the loss and progressive encroachment on wetlands now and in the future.

4.3.7. The conservation objective for the assemblage of migratory fish species feature of the Severn Estuary Ramsar Site is to maintain the feature in favourable condition as defined below[21]:

- The feature will be considered to be in favourable condition when, subject to natural processes, each of the following conditions are met:
  - The migratory passage of both adult and juveniles of the assemblage of migratory fish species through the Severn Estuary between the Bristol Channel and any of their spawning rivers is not obstructed or impeded by physical barriers, changes in flows or poor water quality.
  - The size of the populations of the assemblage species in the Severn Estuary and the rivers which drain into it, is at least maintained and is at a level that is sustainable in the long term.
  - The abundance of prey species forming the principal food resources for the assemblage species within the estuary, is maintained.
  - Toxic contaminants in the water column and sediment are below levels which would pose a risk to the ecological objectives described above.

## 4.4. Details of existing baseline conditions

4.4.1. Baseline conditions within the Scheme and associated study area are described below, including details of data collection methodologies and consultations undertaken. Baseline conditions relating to fish only are described in the paragraphs below, as these are the qualifying features that are relevant to this assessment. No data collection has been undertaken at the European sites themselves.

[20] Natural England and the Countryside Council for Wales (2009). The Severn Estuary/Mor Hafren European Marine Site
[21] Natural England and the Countryside Council for Wales (2009). The Severn Estuary/Mor Hafren European Marine Site

## Desk study

4.4.2. The Environment Agency Fish and Ecology Data Explorer for aquatic invertebrates, aquatic macrophytes and fish[22] was assessed for relevant biological records from within 2 km of the Scheme from the last five years.

4.4.3. No Environment Agency data was available from within the last five years from within 2 km of the Scheme. However, a review of Environment Agency fish data from a wider area from the last ten years was undertaken. Seven sites were identified on the River Chelt which have been surveyed within the last ten years. Six of these sites were identified as supporting varying life stages of European eel, with the closest record 1.7 km upstream of the existing M5 River Chelt crossing. Environment Agency fish data also identified sea/brown trout[23] within the River Chelt at three Environment Agency monitoring sites, the closest of which is 1.7 km upstream of the existing M5 River Chelt crossing, recorded during surveys conducted in 2013 and 2014. Atlantic salmon were recorded on one occasion in low numbers at a site 7.6 km downstream of the existing M5 River Chelt crossing in 2014. This is summarised in the table below. Following consultation with the Environment Agency it has also been confirmed that salmon parr have been recorded during a fish rescue undertaken approximately 5 km downstream of the existing M5 River Chelt crossing prior to a weir removal project (no date provided).

Table 4.1 Review of Environment Agency Sites

| Site ID | Description | Qualifying Species Present |
|---|---|---|
| 10409 | 6.5 km upstream of the existing M5 crossing with the River Chelt. Last survey conducted on 22 July 2014 | European eel<br>Sea/brown trout |
| 51163 | 5.4 km downstream from the existing M5 crossing on the River Chelt. Last surveyed 11 September 2013 | European eel |
| 51183 | 1.6 km upstream from the existing M5 crossing with the River Chelt. Last surveyed 11 September 2013 | European eel |
| 51184 | 1.7 km upstream from the existing M5 crossing with the River Chelt. Last surveyed 11 September 2013 | European eel<br>Sea/brown trout |
| 54023 | 4.9 km downstream from the existing M5 crossing with the River Chelt. Last surveyed 23 July 2014 | European eel elvers<br>European glass eels |
| 56463 | 5.4 km upstream from the existing M5 crossing with the River Chelt. Last surveyed 22 July 2014 | European eel elvers<br>Sea/brown trout |
| 52484 | 7.6 km downstream of the existing M5 crossing with the River Chelt. Surveyed once on 29 July 2015. | Atlantic salmon (four recorded during the survey) |

[22] https://environment.data.gov.uk/ecology/explorer/ [Accessed: August 2021].
[23] Brown trout and sea trout are the same species. Brown trout spend all of their time in freshwater habitats, while sea trout feed and mature in the sea and migrate to fresh water to spawn.

## Field survey

4.4.4. The aquatic walkover survey, undertaken on 23 and 24 July 2019, focused around the point of interaction with the Scheme (i.e. proposed crossing point of a watercourse) and, where feasible, 250 m up and downstream of these interactions.

4.4.5. During the walkover survey, habitat characteristics were recorded broadly following habitat descriptors outlined in the River Habitat Survey (RHS) methodology[24], which includes substrates, vegetation types, flow types, approximate channel dimensions and presence of artificial features (channel/bank re-sectioning and/or existing crossing structures, weirs or outfalls).

4.4.6. MoRPh (Modular River Physical) survey was used to assess river habitat condition of the Leigh Brook and River Chelt, during May and July 2022, respectively. The MoRPh method[25] is a quantitative visual geomorphological assessment of a river and riparian zone that records a list of features which are marked as extensive, present, trace or absent based on their extent across the survey reach. Such features include elements such as channel form, in-channel habitats (e.g., riffles, pools, berms), bed substrates, bank material as well as flow types. Broad aquatic ecological plant community structure and characteristics of the bankside and riparian zone were also recorded.

4.4.7. Following review of background records, other scheme data, and observations from the walkover survey, further detailed aquatic species and habitat surveys were undertaken on watercourses which exhibited suitable habitat considered likely to support valuable assemblages of aquatic species. These surveys included:

- River Habitat Survey (RHS)[26] undertaken in July 2020.
- River Corridor Survey (RCS)[27] undertaken in July 2020.
- Macrophytes (LEAFPACS) undertaken in July 2020.
- Macroinvertebrates[28] undertaken in October 2020.
- Fish (electric fishing)[29] undertaken in July 2020.

4.4.8. Of the watercourses that would be directly affected by the Scheme, only the River Chelt was considered to provide suitable spawning and recruitment habitat for fish. All the other watercourses, including the Leigh Brook, are heavily modified drainage ditches and are not considered to provide suitable habitat for qualifying features of the SAC/ Ramsar Site.

4.4.9. Electric fishing surveys were undertaken on 28 and 29 July 2020[30] along reaches screened as requiring survey in accordance with current industry standards:

- BS EN 14962:2006 / BS 6068-5.40:2006 Water quality – Guidance on the scope and selection of fish sampling methods.

[24] Environment Agency (2003) River Habitat Survey in Britain and Ireland - Field Survey Guidance Manual and National Rivers Authority (1992). River Corridor Surveys: Methods and Procedures.
[25] Details of the method can be found at: https://modularriversurvey.org/
[26] Environment Agency, 2003. River Habitat Survey in Britain and Ireland. Field Survey Guidance Manual.
[27] National Rivers Authority, 1992. River Corridor Surveys: Methods and Procedures. Conservation Technical Handbook.
[28] Aquatic macroinvertebrate samples were collected using a standard three-minute kick-sampling technique in accordance with River Invertebrate Prediction & Classification Systems (RIVPACS) standard sampling protocols. RIVPACS is the model implemented within the RICT (River Invertebrate Classification Tool) used by the Environment Agency to determine WFD invertebrate classifications. Reference: EU Star UK (2006) RIVPACS Macroinvertebrate Sampling Protocol. Available at: http://www.eu-star.at/pdf/RivpacsMacroinvertebrateSamplingProtocol.pdf (accessed April 2021)
[29] UKTAG (2008). River Assessment Methods: Fish Fauna (Fisheries Classification Scheme 2) by Water Framework Directive - United Kingdom Technical Advisory Group (WFD-UKTAG): https://www.wfduk.org/sites/default/files/Media/Characterisation%20of%20the%20water%20environment/Biological%20Method%20Statements/river%20fish.pdf
[30] It is noted that survey data will be approximately 3 years old on submission of the DCO application. As detailed in Technical Appendix 7.17 - Validation Report (application document TR010063 – APP 6.15), given that the habitats have not changed significantly during the data collection period for the project, the results of these surveys are considered to remain

- BS EN 14011:2003 / BS 6068-5.32:2003 Water quality – Sampling of fish with electricity.
- Environment Agency (2010) Electric fishing in rivers. Operational Instruction 144_03.
- CEH (2002) Guidelines for Electric Fishing Best Practice R&D Technical Report W2-054/TR.

4.4.10. Locations of the two survey reaches are shown on Figure 7-14B in Appendix B. The upstream and downstream extent of each survey reach (100 m) was defined and isolated using stop-nets. A minimum of one electric fishing run, working in an upstream direction was undertaken at each survey reach, thus aligning the survey with the requirements for determining WFD fish status using the Fisheries Classification Scheme 2[31] (FCS2) model.

4.4.11. The use of stop-nets allowed for a catch depletion methodology to be applied where three catch depletion runs were undertaken along each survey reach. Stunned fish were removed using hand nets and stored in aerated fish holding tanks before being returned to the watercourse following recovery.

4.4.12. Fish captured were identified to species, counted and either fork length or total length measured to the nearest mm (depending on species caught).

4.4.13. Certain species have been classified as minor[32] species, these are defined as small-bodied fish that often occur in high abundance, including stone loach (*Barbatula barbatula*), bullhead (*Cottus gobio*), minnow (*Phoxinus phoxinus*) and three-spined stickleback (*Gasterostreus aculeatus*). Where these occur in high abundance, they are generally noted as either present or absent at the survey site.

4.4.14. There was commonality in habitat availability for fish species across the survey reaches with both reaches exhibiting similar width and depth character and being predominately composed of glide habitat, although riffles were also present. The upper survey reach (WCID10_FH) was slightly more complex in that it also supported run habitat, but also a higher percentage of finer substrate.

4.4.15. The downstream reach, immediately upstream of the existing M5 crossing supported a higher abundance and range of species. Fish survey at this site yielded seven species. Minor species were dominant with stone loach, and minnow recorded in high numbers. Three-spined stickleback were also recorded but in low numbers. Chub (*Squalius cephalus*), brook / river lamprey (*Lampetra* spp.) ammocoetes (juvenile life-stage) and European eel (*Anguilla anguilla*) were also recorded. Habitat records for the fish survey reach identified the dominance of riffle and glide habitat.

4.4.16. Only three species were recorded at the upstream reach, namely bullhead, three-spined stickleback and European eel, which with the exception of bullhead, were recorded in low numbers.

4.4.17. In summary, surveys conducted on the River Chelt identified the presence of European eel at two locations (SO 90140 24760 - SO 90053 24787 and SO 90645 24606 – SO 90518 24634) on 28 and 29 July 2020. Two brook/river lamprey ammocoetes (young/larvae) were recorded in the downstream survey site (SO 90140 24760 – SO 90053 24787) on 29 July 2020. It is difficult to distinguish between brook and river lamprey when in the ammocoete stage. As a precaution, they are assumed to be river lamprey.

valid. Furthermore, the assemblage of fish species considered to be present has not been based solely on field survey data but has also taken into account the results of the desk study. A precautionary approach has been taken whereby those qualifying fish species that returned desk study records from within search area for the River Chelt are assumed to be present and considered as part of this assessment.

[31] WFD-UKTAG, 2008. UKTAG Rivers Assessment Methods. Fish Fauna (Fisheries Classification Scheme 2 (FCS2)).

[32] Environment Agency, 2014. Flow and Level Criteria for Coarse Fish and Conservation Species. Science Report SC020112/SR.

4.4.18. The qualifying feature populations of migratory fish associated with the Severn Estuary SAC and Ramsar Site can all migrate over 40 km upstream where there are no barriers, such as weirs or waterfalls[33,34]. Desk study data and fish surveys have confirmed the presence of European eel, a feature of the Severn Estuary Ramsar Site from within the River Chelt. Fish surveys have confirmed the potential presence of river lamprey, a feature of the Severn Estuary SAC and Ramsar Site, within the River Chelt. In addition, the desk study data included records of Atlantic salmon and sea/brown trout, features of the Severn Estuary Ramsar Site, from the River Chelt. The River Chelt is therefore considered to provide functionally linked habitat for European eel, river lamprey, Atlantic salmon and sea trout associated with the Severn Estuary SAC and Ramsar Site.

4.4.19. The following paragraphs provide a brief overview of the ecology of European eel, Atlantic salmon, sea trout and river lamprey. A key source of information for river lamprey was the report 'Ecology of the River, Brook and Sea Lamprey' part of the Conserving Natura 2000 Rivers series which brings together the best available information on this species[35]. The majority of information about the European eel was extracted from the IUCN Red List of Threatened Species assessment[36]. Information about sea trout is from the Regulation 33 advice[37] and the Marine Life Information Network website[38] and information about Atlantic salmon is primarily from the report 'Ecology of the Atlantic Salmon' part of the Conserving Natura 2000 Rivers series[39].

4.4.20. River lamprey are a migratory species. Mature river lamprey, having spent one or two years mainly in estuaries, stop feeding in the autumn and move upstream into medium to large rivers, usually migrating into fresh water from October to December. Mature adults require a migration route free of obstacles (natural, such as waterfalls, or man-made such as dams, weirs or pollution barriers) in order to reach their spawning grounds with minimum effort. River lamprey migrate upstream to spawning grounds during winter and spring. Spawning starts when the water temperature reaches 10 – 11°C, usually in March and April. The spawning grounds are areas of small stones and gravel in flowing water. After hatching, larvae, known as ammocoetes, swim or are washed downstream by the current to areas of sandy silt in still water where they burrow and spend the next few years in tunnels. After several years of larval development, the larvae metamorphose into their adult form, and migrate downstream to estuaries between July and September. For river lamprey, given that the field survey recorded ammocoetes, indicating that a spawning ground is present close to the Scheme, the key period is considered to be the spawning period in spring.

4.4.21. Critical habitats for river lamprey appear to be:

- Suitable estuarine conditions, free from pollution, with suitable prey fish species.
- A clear migration route from estuary to the spawning grounds, with suitable river flows and no barriers.
- At the spawning areas, suitable hiding places and clean spawning gravels.
- After hatching, slower flowing nursery areas of sandy silt in fresh water, above the estuary.

[33] Maitland, P.S. (2003). Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000 Rivers Ecology Series No. 5. English Nature, Peterborough.
[34] Maitland, P.S. & Hatton-Ellis, T.W. (2003). Ecology of the Allis and Twaite Shad. Conserving Natura 2000 Rivers Ecology Series No. 3. English Nature, Peterborough.
[35] Maitland, P. (2003) Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000, Ecology Series No.5. English Nature, Peterborough.
[36] Jacoby, D. & Gollock, M. 2014. Anguilla. The IUCN Red List of Threatened Species 2014: e.T60344A45833138.
[37] Natural England and the Countryside Council for Wales (2009). The Severn Estuary/Mor Hafren European Marine Site
[38] The Marine Life Information Network (MarLIN) website: https://www.marlin.ac.uk/species/detail/2332[accessed October 2022]
[39] Hendry K & Cragg-Hine D (2003). Ecology of the Atlantic Salmon. Conserving Natura 2000 Rivers Ecology Series No. 7. English Nature, Peterborough.

4.4.22. The river lamprey has declined in Britain over the last hundred years and although not yet classified as threatened, the species has disappeared from many rivers due to pollution, river engineering and various impassable barriers (weirs, dams, etc.).

4.4.23. European eel is also a migratory species. Young are born in the Sargasso Sea in the Atlantic Ocean. After approximately three years they reach the UK and Europe as transparent elvers known as glass eels and continue their journey inland. These then enter freshwater and migrate upstream where they mature in freshwater habitat. Once they are ready to reproduce, eels migrate back to the Sargasso Sea to spawn. European eel migrate upstream between February and July, and downstream between October and November. European eels are critically endangered, with raised pollution levels cited as a major cause of their decline[40].

4.4.24. The Severn Estuary supports an important run of migratory salmon and sea trout which pass through the estuary on their way to and from their spawning grounds in the upper reaches of the rivers and open sea. Sea trout spend their adult life at sea in coastal areas and return to freshwater to spawn in Autumn. The freshwater juveniles then undergo physiological changes as they migrate to salt water. Atlantic salmon hatch in freshwater breeding grounds, developing for two to four years before migrating to the sea in late spring[41]. Once mature, they then return to the breeding grounds they were born in, migrating upstream to spawn from November to February[42].

## Consultation

4.4.25. Early consultation meetings with the Environment Agency were undertaken on 16 January 2020 and 15 July 2021 as part of the development of the DF2 and DF3 design.

4.4.26. Further to these meetings, the Environment Agency provided consultation responses outlining key points for consideration. These included the need for consideration of connectivity to downstream watercourses and functionally linked habitats; presence of protected and notable species, including migratory and non-migratory fish species; opportunities for enhancements to aquatic habitats (watercourses and wetlands); and the need for a Water Framework Directive (WFD) assessment.

4.4.27. Natural England was consulted on an Interim HRA Screening Report[43] and provided comment (comments received 15 April 2021, see comments from Natural England in Appendix G, as well as Atkins response to the comments). Comments were addressed in the updated HRA that supported the Preliminary Environmental Information Report (PEIR)[44]. This assessment incorporated Screening and Appropriate Assessment into one document.

4.4.28. Statutory consultation took place from December 2021, supported by the PEIR. The following comments relevant to the HRA were received as a result of the consultation process:

- Natural England commented: In relation to NPS NN paragraphs 5.22 – 23 relating to designated sites we also draw your attention to:
  A. the emerging Cotswold Beechwoods Special Area of Conservation (SAC) 'strategic solution.' This project's focus on informal recreation involves an area of land ('zone of influence') which includes the scheme red line boundary. This

[40] Guhl, B., Stürenberg, FJ. & Santora, G. Contaminant levels in the European eel (*Anguilla anguilla*) in North Rhine-Westphalian rivers. *Environ Sci Eur* **26,** 26 (2014).
[41] https://www.nature.scot/plants-animals-and-fungi/fish/freshwater-fish/atlantic-salmon [accessed October 2022]
[42] https://www.wildlifetrusts.org/wildlife-explorer/freshwater-fish/atlantic-salmon[accessed October 2022]
[43] Atkins (November 2019) M5 Junction 10 Improvement, Interim HRA Screening Report
[44] Atkins (16/11/21) M5 Junction 10 Improvements Scheme Preliminary Environmental Information Report (PEIR) Biodiversity Chapter. Refer to Appendix 7.13. Online: https://www.gloucestershire.gov.uk/highways/major-projects-list/m5-junction-10-improvements-scheme/

represents a further consideration and an opportunity to integrate the Scheme's design with the strategic allocations' land use planning context.

B. The ongoing joint commission by Gloucestershire's local planning authorities to conduct visitor surveys of key destinations around the Severn Estuary and sites within the Severn Vale identified as having proven or possible functional linkages with the Severn Estuary Special Protection Area (SPA). The latter include Coombe Hill Canal Site of Special Scientific Interest (SSSI) and Coombe Hill Meadows Nature Reserve a short drive west from the Scheme.

- Gloucestershire Wildlife Trust commented: A study commissioned by Natural England found that land at Coombe Hill Canal SSSI and nature reserve is functionally linked to the SPA through the bird assemblages that move between the sites. Impacts on the SSSI and land functionally linked to the SPA are not adequately covered by the PEIR, which does not assess impact on recreational pressure. To be compliant with The Conservation of Habitats and Species Regulations 2017 (As amended) the PEIR should undertake a Habitats Regulations Assessment. This should include assessment of cumulative impacts on the SSSI, and SPA linked land that will result from providing enhanced access for the growing population, which is due to several strategic housing allocations being near to the Scheme.

4.4.29. The HRA assessment that supported the PEIR has now been split into separate Screening and Appropriate Assessment reports. Comments received during Statutory consultation have been addressed in the updated HRA Screening report presented in in Appendix 7.13 of the ES (application document TR010063 – APP 6.15), and this Statement to Inform an Appropriate Assessment report.

4.4.30. On 7 November 2022 the updated HRA was provided to Natural England (this Screening report and Technical Appendix 7.14 - Statement to Inform an Appropriate Assessment (SIAA) (application document TR010063 - APP 6.15). On 9 November 2022 Natural England responded with regard to the Screening report that they are in agreement with the conclusion that likely significant effects as a result of recreational impacts to the Cotswold Beechwood SAC and the Severn Estuary designations can be ruled out; that likely significant effects on the Severn Estuary SPA and Walmore Common SPA can be ruled out; that likely significant effects as a result of air quality impacts can be ruled out. Comments from Natural England's freshwater team were received on 30 November 2022 with regard to the SIAA (included in Appendix G), and these have been addressed in this SIAA report.

## 4.5. Value of the site and the qualifying interests therein to the European Site network

4.5.1. River lamprey is found in coastal waters, estuaries and accessible rivers. The species is found only in western Europe, where it has a wide distribution from southern Norway to the western Mediterranean. The UK populations are considered important for the conservation of the species at an EU level. The river lamprey is widespread in the UK, occurring in many rivers from the Great Glen in Scotland southwards, and populations are strong. Sites that hold healthy populations of river lamprey, with clear water and suitable areas of gravels, silt or sand for spawning, have been selected. The SAC series covers the geographical range of the species and includes a range of high-quality river types in which it occurs. The selected sites are generally extensive river systems, including important tributaries, which provide conservation of the range of habitat features required by the species. Marine sites that are considered important migration routes or feeding grounds for this species have also been selected, usually where they abut a freshwater site. Identification of suitable sites in some parts of the UK has been hampered by the absence of comparative population data, and by difficulties in identifying juvenile lampreys. While the SAC series makes a contribution to securing favourable conservation status for this species, wider measures are also necessary to support its conservation in

the UK. It follows that functionally linked habitats such as the River Chelt are important in maintaining this species. There are eleven SACs with river lamprey as a primary qualifying feature and a further ten SACs where this Annex II species is a qualifying feature, but not a primary reason for site selection. These are spread throughout the UK[45].

4.5.2. European eel has been shown to be distributed from northern Norway southwards along the coast of Europe to the north African coast, and west to northwest Russia. It is thought that the continental distribution of European eel is over an area of approximately 90,000 km$^2$ in Europe and parts of north Africa with a substantially larger range if their marine distribution is considered. In England and Wales, there are thought to be a total of 2 694 km$^2$ of transitional waters, which account for approximately 68% of the potential eel producing habitat across all eleven River Basin Districts. The Severn Estuary has the largest European eel run in Great Britain. It follows that functionally linked habitats such as the River Chelt are important in maintaining this species[46],[47],[48].

4.5.3. Atlantic salmon is widely distributed within the EU, and the UK population comprises a significant proportion of the total European stock. The species is widespread in the UK and is found in several hundred rivers, many of which have runs in excess of 1,000, although the latest estimates of the UK spawning population size are approximately 50% down on the ten year average. Designated sites (including SACs and Ramsar sites) make a contribution to securing favourable conservation status for this species, but wider measures are also necessary to support its conservation in the UK. It follows that functionally linked habitats such as the River Chelt are important in maintaining this species[49].

4.5.4. On the basis that the Severn Estuary supports a key migratory route for sea trout between their spawning grounds and the upper reaches of the rivers and open sea and considering the range of habitats that this species requires, it follows that functionally linked habitats such as the River Chelt are important in maintaining this species.

## 4.6. Likely future baseline changes at the site in the absence of the project

4.6.1. The main threats, pressures and activities with impacts on the site which have the potential to change the future baseline identified in the SAC designation Natural 2000 data form (copy in Appendix E) are:

- Other urbanisation, industrial and similar activities (E06, both inside and outside of the SAC).
- Changes in abiotic conditions (M01, both inside and outside of the SAC).
- Human induced changes in hydraulic conditions (J02, both inside and outside of the SAC).
- Outdoor sports and leisure activities, recreational activities (G01, inside the SAC).
- Modification of cultivation practices (A02, inside the SAC).

4.6.2. Factors adversely affecting the site's ecological character including changes in land (including water) use and development projects listed on the RIS include[50]:

- Dredging (on site and off site).

[45] www.jncc.gov.uk [Accessed September 2022]
[46] Jacoby, D. & Gollock, M. 2014. Anguilla. The IUCN Red List of Threatened Species 2014: e.T60344A45833138. Online: http://dx.doi.org/10.2305/IUCN.UK.2014-1.RLTS.T60344A45833138.en
[47] https://jncc.gov.uk/jncc-assets/RIS/UK11081.pdf
[48] Natural England and the Countryside Council for Wales (2009). The Severn Estuary/Mor Hafren European Marine Site
[49] www.jncc.gov.uk [Accessed October 2022]
[50] https://jncc.gov.uk/jncc-assets/RIS/UK11081.pdf

- Erosion (on site).
- Recreational/tourism disturbance (on site and off site).

4.6.3. The Site Improvement Plan[51] identifies the following priority issues at the SAC:

1. Public access/disturbance – public access and recreation (including third party activities) may have an impact on bird species sensitive to disturbance, causing displacement from feeding, roosting and moulting areas, and if severe could affect the long term survival and population numbers and distributions within the Severn Estuary.
2. Physical modification – Modification to water courses and barriers to Annex II migratory fish (and those included in the fish assemblage) in the tributary rivers are preventing completion of the life cycle and potentially altering the hydrodynamics of the site. This includes existing structures and operations (bridges, power station lagoons, jetties, dredging, flood alleviation) influencing the flow of water, sediments and therefore migration.
3. Impacts of development – strategic planning issue. More rigorous assessment of cumulative, in-combination and offsite impacts (drainage, disturbance, runoff, impacts on managed realignment etc) on sensitive bird species and other habitats and species may be required, given the range of planned development within and adjacent to the Severn Estuary (including residential, transport, energy and other industrial developments).
4. Coastal squeeze – As sea levels rise, man-made defences are constraining the natural roll back of estuarine habitats, causing squeeze and loss of habitat and having impacts on species dependent upon those habitats (birds: feeding/roosting, and fish: feeding/nursery and shelter areas).
5. Change in land management – Changes in management and use of grassland and saltmarsh habitat within and bordering the estuary affects species composition, habitat availability, and quality of saltmarsh habitats.
6. Changes in species distributions – There is a risk of significant changes in estuarine populations (including declines in some SPA bird populations in parts of the Severn Estuary resulting from climate change and other man-made and natural modifications to on-and offsite environments). In many cases the causes of the changes to species distribution are unknown.
7. Water pollution – There is uncertainty over water quality in the Severn Estuary due to diffuse (including agricultural) or direct pollution (e.g. industrial, sewage treatment works, thermal, radioactive). There is a requirement for better understanding of water and sediment quality issues. The Severn River Basin Management Plan identifies that 17% of the estuarine water bodies in the river basin district currently achieve good ecological status while the others are at moderate status.
8. Air pollution - impact of atmospheric nitrogen deposition. Activities around the Severn Estuary include fertiliser application, potentially dairy and poultry production, road traffic, industry (including power stations), and shipping which are all sources of nitrogen pollution. Nitrogen deposition exceeds site relevant critical loads, with potential impacts on vegetation structure and diversity.
9. Marine consents and permits - minerals and waste – The cumulative impacts of aggregate extraction, maintenance dredging and disposal can have adverse impacts on features.

[51] Natural England (19/03/15) Improvement Programme for England's Natura 2000 Sites (IPENS) Planning for the Future, Site Improvement Plan, Severn Estuary (Version 1.0).

10. Fisheries (recreational marine and estuarine) – Further information is required on the levels and location of activity and potential impact of recreational bait digging and recreational fishing/angling.
11. Fisheries (commercial marine and estuarine) – Dredges (including hydraulic), benthic trawls and seines are categorised as 'red' for the reef features (specifically the sub-feature Sabellaria spp. Reef) as part of Defra's revised approach to commercial fisheries management in European Marine Sites (EMS). A by-law is now in place to address this and is being implemented by Devon and Severn IFCA (D&SIFCA).
12. Invasive species – There are recent reports of marine invasive non-native species. These could have an impact on native species and habitats but the abundance and impact in the Severn Estuary of these species is unclear.
13. Maine litter – The marine environment is a sink for man-made litter which often originates from rivers. Impacts are not fully understood.
14. Marine pollution incidents – Marine pollution incidents and responses to such incidents have the potential for significant negative impacts on the site and its features.

4.6.4. Of these identified issues, 2, 3, 6, 7, 8, 9, 10, 11, 13 and 14 are relevant to fish. A number of actions are identified in the Site Improvement Plan to address these issues. It follows that if these actions are not undertaken or are unsuccessful that changes to the baseline would occur.

4.6.5. The following paragraphs list specific threats to the river lamprey taken from the report 'Ecology of the River, Brook and Sea Lamprey' part of the Conserving Natura 2000 Rivers series which brings together the best available information on this species[52][53].

4.6.6. River lamprey are susceptible to pollution, both from direct toxic effects, but pollution can also have a major impact on lamprey by smothering both spawning gravels and nursery silts. Pollution can also act as a barrier effect for migratory species such as river lamprey. Significant pollution can eliminate whole populations of river lamprey from rivers, and there are examples where this has happened in the past. It is usually severe pollution in the lower reaches that prevents upstream migration and kills downstream migrants, despite the fact that there may be hundreds of kilometres of river upstream where the water quality is good and there is plenty of good spawning and larval habitat. Some pollution in the lower reaches appears to be tolerated, however.

4.6.7. Similarly, engineering works such as dams and weirs can be obstacles to upstream migration and the success of local populations of lamprey. Channelisation can also be damaging to lampreys, mainly through destruction of their habitat. The removal of areas of riffle and associated spawning gravels, and the dredging of essential nursery silt beds, may entirely eliminate lampreys and other fish from a river.

4.6.8. Other threats include:

- Water abstraction and land drainage, which may lead to unstable habitats with variable water levels that flood and disturb both spawning gravels and nursery silts, and leave them dry at other times.
- Eutrophication, which acts in a similar way to some other forms of pollution. The abundant algae and bacteria resulting from increased nutrients smother both the spawning gravels (preventing spawning or killing eggs) and the nursery silts, creating anoxic conditions there.

[52] Maitland, P. (2003) Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000, Ecology Series No.5. English Nature, Peterborough.
[53] Although these reports have no official status in the implementation of the Habitats Directive, they are a helpful source of information for organisations setting conservation objectives and monitoring favourable conservation status.

- Trapping by anglers for use as bait: Indiscriminate trapping of adults could damage populations and the search for larvae (by digging out substrate) not only affects the population directly but also causes significant damage to their habitat.

4.6.9. It is uncertain how climate change may affect the river lamprey, but one scenario is that the species may be able to inhabit rivers further north.

4.6.10. The Regulation 33 advice[54] identifies that lamprey are vulnerable to noise, toxic contamination, changes in nutrient loading, changes in the thermal regime, changes in turbidity, changes in salinity, changes in oxygenation and introduction of microbial pathogens.

4.6.11. European eels are critically endangered[55], with raised pollution levels cited as a major cause of their decline[56]. Other threats include: barriers to migration, body condition, climate change and/or changes in oceanic currents, disease and parasites, exploitation and trade, hydrology, habitat loss and predation.

4.6.12. Atlantic salmon are subject to many pressures in Europe, including pollution, the introduction of non-native salmon stocks, physical barriers to migration, exploitation from netting and angling, physical degradation of spawning and nursery habitat, and increased marine mortality[57].

4.6.13. The Regulation 33 advice[58] does not provide separate advice on vulnerabilities for Ramsar site features such as European eel, Atlantic salmon or sea trout, but states that those identified for fish species associated with the SAC are also relevant to migratory fish associated with the Ramsar Site. These are listed in paragraph 4.6.10.

## 4.7. Key ecological factors for maintaining site integrity

4.7.1. The purpose of the Appropriate Assessment is to establish whether there are elements of the project which could have an adverse effect on the integrity of the European sites. The integrity of a European site is defined as:

- "…the coherent sum of the site's ecological structure, function and ecological processes, across its whole area, which enables it to sustain the habitats, complex of habitats and/or populations of species for which the site is designated."[59]

4.7.2. Conservation objectives are a set of specified objectives to be met in order to make sure that the site contributes in the best possible way to achieving favourable conservation status at the appropriate level.

4.7.3. A site can be described as having a high degree of integrity where the inherent potential for meeting site conservation objectives is realized, the capacity for self-repair and self-renewal under dynamic conditions is maintained, and a minimum of external management support is required[60].

4.7.4. The Favourable Condition Tables in the Severn Estuary European Marine Site Regulation 33 Advice document[61] are intended to supplement the conservation objectives and, together with the conservation objectives, inform the scope and nature of any appropriate assessment that may be needed. The targets identified for each qualifying feature in these

[54] Natural England and the Countryside Council for Wales (2009). The Severn Estuary/Mor Hafren European Marine Site
[55] Jacoby, D. & Gollock, M. 2014. Anguilla. The IUCN Red List of Threatened Species 2014: e.T60344A45833138. Online: http://dx.doi.org/10.2305/IUCN.UK.2014-1.RLTS.T60344A45833138.en
[56] Guhl, B., Stürenberg, FJ. & Santora, G. Contaminant levels in the European eel (*Anguilla anguilla*) in North Rhine-Westphalian rivers. *Environ Sci Eur* **26,** 26 (2014). Online: https://doi.org/10.1186/s12302-014-0026-1
[57] Atlantic salmon (Salmo salar) - Special Areas of Conservation (jncc.gov.uk) [Accessed October 2022].
[58] Natural England and the Countryside Council for Wales (2009). The Severn Estuary/Mor Hafren European Marine Site
[59] Managing Natura 2000 sites - The provisions of Article 6 of the Habitats Directive 92/43/EEC (2019) Online: https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52019XC0125(07).
[60] Tyldesley, D., and Chapman, C., (2013) The Habitats Regulations Assessment Handbook, January 2018 edition UK: DTA Publications Limited www.dtapublications.co.uk.
[61] Natural England and the Countryside Council for Wales (2009). The Severn Estuary/Mor Hafren European Marine Site

tables are considered to be the key ecological factors for maintaining site integrity in relation to river lamprey and migratory fish (specifically European eel, Atlantic salmon and sea trout). These are listed below:

- Water quality is sufficient to support migratory passage. Levels (for temperature, salinity, turbidity, pH, and dissolved oxygen) should comply with targets established under the Environment Agency Review of Consents and the Water Framework Directive.
- Flows from the river into the estuary must be sufficient to allow migration.
- No artificial barriers significantly impairing adults from reaching existing and historical spawning grounds, or juveniles from moving downstream.
- No decline in number of returning adults from established baseline.
- River population targets for the Usk and Wye must be met.
- No significant reduction in abundance of key prey species against an established baseline.

# 5. Assessment methodologies and assumptions

## 5.1. Assessment techniques

5.1.1. The purpose of the Appropriate Assessment is to determine whether, in view of a European Site's conservation objectives, the plan or project (either alone or in-combination with other projects and plans) would have an adverse effect (or risk of this) on the integrity of the site with respect to the site structure, function and conservation objectives. If adverse impacts are anticipated, potential mitigation measures to alleviate impacts should be proposed and assessed.

5.1.2. This Appropriate Assessment:

- Outlines the elements of the Scheme that were identified as having an LSE on one or more qualifying features of a European Site.
- Obtains additional desk study data as necessary and characterises the LSE, e.g. whether short/long term, reversible or irreversible, and in relation to the amount and importance of the interest affected, and the overall effect on the European Site's Conservation Objectives. This has been done in sufficient detail to ensure all impacts have been considered and sufficiently appraised.
- Assesses the effects of the Scheme on the Conservation Objectives of the relevant qualifying features.
- Determines whether the integrity of the European site(s) will be affected, taking into account proposed mitigation measures.

5.1.3. LA 115[62], the Habitats Regulations Handbook[63], PINS Advice Note Ten[64] and government guidance[65] has been followed in the preparation of this Appropriate Assessment.

## 5.2. Significance criteria

5.2.1. The following paragraphs discuss significance criteria in relation to the potential effects identified.

### Reduction in habitat area

5.2.2. There will be no reduction of habitat within the Severn Estuary SAC / Ramsar Site. In the event that partial dewatering of the River Chelt channel is required during construction, this would result in temporary loss of a highly localised area of functionally linked habitat. The Severn Estuary catchment area covers an area of over 21,000 km$^2$ (2,100,000 ha) and over 600 rivers drain into the estuary[66]. Taking into account the amount of river

[62] Highways England (2020). Design Manual for Roads and Bridges. LA 115 Habitats Regulations Assessment (formerly HD 44/09). (January 2020, version 1) Online: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section4/LA%20115%20Habitats%20Regulations%20assessment%20-web.pdf.
[63] Tyldesley, D., and Chapman, C., (2013) The Habitats Regulations Assessment Handbook, January 2018 edition UK: DTA Publications Limited www.dtapublications.co.uk.
[64] National Infrastructure Planning (August 2022, version 9) Advice Note Ten: Habitats Regulations Assessment relevant to nationally significant infrastructure projects. Online: Advice Note Ten: Habitats Regulations Assessment relevant to nationally significant infrastructure projects | National Infrastructure Planning (planninginspectorate.gov.uk).
[65] Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities and Local Government (July 2019) Appropriate assessment – Guidance on the use of Habitats Regulations Assessment. Online: Appropriate assessment - GOV.UK (www.gov.uk).
[66] https://severnestuarypartnership.org.uk/ [accessed July 2022]

habitats available and linked to the SAC within the catchment, the area affected (a stretch of approximately 20 m) is likely to make a very limited contribution to the maintenance of the SAC/Ramsar Site populations of migratory fish. Nevertheless, this has been considered in light of the conservation objectives, the threats, pressures and conservation status of the qualifying features.

## Water quality

5.2.3. There is little data concerning the water quality requirements of river lamprey, European eel, Atlantic salmon or sea trout. Regulation 33 advice[67] states that water quality levels should comply with targets established under the Environment Agency Review of Consents and the Water Framework Directive, and that the baseline is water quality sampling data collected by the Environment Agency.

5.2.4. An assessment of the impact of the Scheme on water quality has been undertaken in line with LA 113[68]. The Highways England Water Risk Assessment Tool (HEWRAT) has been used to assess the impact of routine runoff on surface water quality. This includes the assessment of the acute impacts from soluble pollutants, chronic impacts from sediment related pollutants and compliance with Environmental Quality Standards (EQS) using annual average concentrations of soluble pollutants. The HEWRAT has also been used to provide an indication of the risk of a spillage causing a pollution impact/incident on a receiving watercourse. The risk is defined as the probability that there will be a spillage of pollutant and that the pollutant will reach and impact the watercourse to such an extent that it causes a serious pollution incident. The risk is expressed as the probability of an incident in any one year. The results of the assessment are used to determine the magnitude of impact, which along with the importance of the receptor determines the significance of impact. Further detail is included in Chapter 8 - Water Environment (application document TR010063 – APP 6.6).

## Species disturbance and mortality

5.2.5. Anthropogenic noise and vibration may be sufficiently intense to result in mortality or mortal injury in fish. However, there are limited data on mortality in fish from sound exposure, and these accounts are when animals are very close to pile driving sources. Anthropogenic sounds at lower levels may result in temporary hearing impairment, physiological changes including stress effects, changes in behaviour or the masking of biologically important sounds[69]. In terms of behavioural changes, avoidance is the most likely response in fish[70].

### Species sensitivity to noise and vibration

5.2.6. It is currently unknown whether lamprey are able to hear sound, and if so, whether this sound is used to provide information on their surrounding environment[71]. Lamprey do not possess specialist hearing structures or a swim bladder. Therefore, the hearing ability of lampreys is believed to be limited compared to other freshwater fish species[72]. While it might be argued that lamprey use the “auditory scene” to learn about their environment,

[67] Natural England and the Countryside Council for Wales (2009). The Severn Estuary/Mor Hafren European Marine Site
[68] Highways England (2020). Design Manual for Roads and Bridges. LA113 Road Drainage and the Water Environment (formerly HD 45/09).(March 2020, Revision 1). Online: d6388f5f-2694-4986-ac46-b17b62c21727 (standardsforhighways.co.uk)
[69] Popper A N, and Hawkins A D, (2019). An overview of fish bioacoustics and the impacts of anthropogenic sound on fishes. Journal of Fish Biology Volume 9, Issue 5.
[70] Subacoustech Environmental (2011) MEP Impacts of Underwater Piling Noise on Migratory Fish. Subacoustech Environmental Report No. E321R0102.
[71] Hawkins, A.D. and Popper, A.N. (2012). Effects of noise on fish, fisheries, and invertebrates in the U.S. Atlantic and Arctic from Energy Industry sound-generating activities. U.S. Department of the Interior Bureau of Ocean Energy Management.
[72] Popper, A. (2005) A review of hearing by sturgeon and lamprey. A report submitted to the U.S. Army Corps of Engineers, Portland District.

their behavioural repertoire is generally rather limited, and so it may be possible that sound is not relevant to them at all[72].

5.2.7. European eel respond primarily to particle motion rather than sound pressure, which they are unable to detect unless converted to particle motion by the swim bladder. It is thought that for adult eel this is likely to be inefficient due to the large distance between the swim bladder and otolith organs[73]. Similarly, Atlantic salmon only detect particle motion[74]. Hearing in sea/brown trout is thought to be less sensitive than in Atlantic salmon[75], therefore in the absence of data for sea/brown trout, taking a reasonably precautionary approach, data for Atlantic salmon has been used.

5.2.8. No formal guidance exists in a UK regulatory context on acceptable underwater noise levels for fish. Popper *et al*[74] developed absolute sound exposure guidelines for fish through a comprehensive literature review, supported by a working group of experts in bioacoustics from Norway, the UK and USA. They provide criteria that can be applied to assess the potential effects of noise on fish from different activities. Criteria for pile driving thresholds for mortality and physiological effects are provided; however, a single threshold for behavioural response is not. A behavioural threshold is considered less appropriate than for mortality and physiological effects, because behaviour is so varied between and within species, including between fish of different ages and sizes, and the motivation of the fish exposed to man-made sound sources will also vary[71].

### Predicting noise effects

5.2.9. The acoustic signal (or noise) from a single source may change during propagation, and the signal received at a given location will differ from the signal close to the source[76]. Propagation through water and through substrate may change the characteristics of a sound. Due to the complexity of the sound field produced from a given source (e.g. piling), relatively simple models are not useful in predicting the impact zones for aquatic species[77].

5.2.10. Water is an excellent medium for sound transmission because of its high molecular density. Sound travels approximately five times faster in water than in air (about 1,500 vs. 300 m/s). Sound also attenuates less over the same distance in water than in air. Consequently, sound travels much greater distances at higher amplitude levels in water compared to air, thereby enabling long distance communication, but also a potential long-distance impact of noise on aquatic species[78].

5.2.11. Conversely, the water-air interface is a nearly perfect reflecting boundary for acoustic waves due to the high impedance contrast between the two media[79], with only 0.1% of acoustic energy naturally transmitted at such a boundary[80].

5.2.12. Therefore, the acoustic signal received by fish at any location cannot be accurately predicted, even if there is a clear account of the nature of sound source itself. However,

[73] Piper, A.T., White, P.R., Wright. R.M., Leighton, T.G. and Kemp, P.S. (2019). Response of seaward-migrating European eel (Anguilla anguilla) to an infrasound deterrent. Ecological Engineering 127; 480–486.
[74] Popper, A.N., Hawkins, A.D., Fay, R.R., Mann, D.A., Bartol, S., Carkson, T.J., Cooms, S., Ellison, W.T., Gentry, R.L., Halvorsen, M.B., Lokkeborg, S., Rogers, P.H., Southall, B.L., Zeddies, D.G. and Tavolga, W.N. (2014) Sound exposure guidelines for fishes and sea turtles: A technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI.
[75] Nedwell, J., Turnpenny, A.W.H., Lovell, J., Parvin, S.J., Workman, R., Spinks, J.A.L. and Howell, D. (2007) A validation of the dBht as a measure of the behavioural and auditory effects of underwater noise. Subacoustech Report No. 534R1231
[76] Ellison and Frankel, cited in: Popper, A.N., Hawkins, A.D., Fay, R.R., Mann, D.A., Bartol, S., Carkson, T.J., Cooms, S., Ellison, W.T., Gentry, R.L., Halvorsen, M.B., Lokkeborg, S., Rogers, P.H., Southall, B.L., Zeddies, D.G. and Tavolga, W.N. (2014) Sound exposure guidelines for fishes and sea turtles: A technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI.
[77] Hastings, M.C. and Popper, A.N. (2005) Effects of sound on fish. California Department of Transportation. Contract 43A0139 Task Order 1.
[78] Slabbekoorn, H., Bouton, N., van Opzeeland, I., Coers, A., ten Cate, C. and Popper, A. (2010) A noisy spring: the impact of globally rising underwater sound levels on fish. Trends in Ecology and Evolution, 25:419–427.
[79] Wehner, D. and Landro, M. (2017) Experiments on the sound transmission at the water-air interface for different source-interface distances.
[80] Bok, E., Park, J.J., Choi, H., Han, C.K., Wright, O.B. and Lee, S.H. (2008) Physical Review Letters, 120.

considering construction techniques required for the Scheme with the greatest potential for noise effects (i.e. piling to create the foundations for the Link Road bridge abutments, adjacent to the River Chelt), published data from a compendium of pile driving underwater sound data[81] can be related back to published sound exposure guidelines[74] to predict the potential for physiological or mortality effects. Broadly this approach has been used to define the potentially affected localised area within which such effects could feasibly occur, based on physical works planned and these published thresholds of noise. This area has then been related to the broader availability of such habitats within the SAC and functionally-linked tributaries, to inform the assessment of significance, taking into account the conservation objectives, the threats, pressures and conservation status of the qualifying features.

#### Predicting vibration effects

5.2.13. Whilst no formal guidance exists on acceptable vibration levels in a UK regulatory context, a guidance threshold[82] (Peak Particle Velocity of 13 mm/s) for Canadian rivers exists (designed to protect salmonid spawning gravels and incubating eggs) and has previously been cited by Natural England in the context of HRA.

5.2.14. Broadly, and with reference to Chapter 6 - Noise and Vibration (application document TR010063 – APP 6.4), a precautionary area within which vibration from construction could exceed this threshold has been identified to inform the assessment of effects. This area has then been related to the broader availability of such habitats within the SAC and functionally-linked tributaries, to inform the assessment of significance, taking into account the conservation objectives, the threats, pressures and conservation status of the qualifying features.

### Fragmentation

5.2.15. Temporary disturbance during construction and pollution during construction and operation could also result in temporary barrier effects, with European eel, Atlantic salmon, sea trout and river lamprey unable to disperse or move along the River Chelt. The Severn Estuary catchment area covers an area of over 21,000 km$^2$ (2,100,000 ha) and over 600 rivers drain into the estuary[83]. Taking into account the amount of river habitats available and linked to the SAC within the catchment, the area affected (a stretch of approximately 20 m) is likely to make a limited contribution to the maintenance of the SAC/Ramsar Site populations of migratory fish. Nevertheless, this has been considered in light of the conservation objectives, the threats, pressures and conservation status of the qualifying features.

## 5.3. Mitigation

5.3.1. No mitigation measures were taken into consideration during the Screening assessment. Specific mitigation to address the potential adverse effects identified are discussed in Section 7 of this report.

## 5.4. Alternative solutions

5.4.1. The Scheme has been through a thorough option selection and identification process (detailed in the Chapter 3 of the ES – Assessment of Alternatives (application document TR010063 – APP 6.2)) based on a staged approach that began in 2012. All options for

[81] Buehler, D., Oestman, R., Reyff, J., Pommerenck, K. and Mitchell, B. (2015) Caltrans Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish. Report Number CTHWANP-RT-15-306.01.01.
[82] Wright, D. G., and G. E. Hopky (1998). Guidelines for the use of explosives in or near Canadian fisheries waters. Canadian Technical Report of Fisheries and Aquatic Sciences 2107.
[83] https://severnestuarypartnership.org.uk/ [accessed July 2022]

the location and redesign of Junction 10 that have been identified from three studies undertaken between 2012 and 2018 have been assessed against economic, engineering, environmental, social and cultural criteria.

5.4.2. The initial options assessment for the Scheme sought to identify the type of transport solution that was needed in order to support the developments planned in the area, as set out in the JCS[84]. These ranged from a 'do minimum' option, which comprised delivering only the committed network improvements to 2031, to 'do something' options with increasing levels of investment alongside demand management options. Option DS7, was developed to meet housing delivery requirements, and therefore was considered the most feasible in terms of delivering the social, economic and political goals outlined in the JCS.

## Options for M5 Junction 10

5.4.3. Nine options to upgrade the M5 Junction 10 to an all movements junction were identified originally from the three studies undertaken between 2012 and 2018, with each of these meeting the housing delivery requirements. Four of these options were discounted at the subsequent sifting and assessment stage because they were considered to be ineffective and not support the achievement of the transport objectives. The five remaining options were taken forwards for further consideration at the Technical Appraisal Report (TAR) Development Workshop to be developed further for appraisal.

5.4.4. The TAR workshop was held, attended by specialists in engineering, environmental and traffic modelling, to consider all previous options and to identify potential new options. This review identified six concept options (the five taken forwards into the TAR workshop plus a variation on one of these options). All six options included the widening of the A4019 and a new road link to the West Cheltenham development site.

5.4.5. A sifting exercise was undertaken on these six concept options. A qualitative assessment was carried out using a range of sustainability criteria comprising economic/engineering, environmental and social/cultural metrics. As part of the first review stage, two options were sifted out for unacceptable impacts on the River Chelt floodplain and being unable to manage the level of traffic expected to occur, whilst a further option (Option 2B), listed below, was identified and added to the options to be carried forward.

5.4.6. Subsequently, five options were carried forward to appraisal in the TAR[85], as follows:

- Option 1A – new junction north of the existing M5 Junction 10.
- Option 2 – upgrade existing M5 Junction 10 with gyratory roundabout.
- Option 2A - upgrade existing M5 Junction 10 with gyratory roundabout offset to the north.
- Option 2B – upgrade existing M5 Junction 10 with gyratory roundabout offset to the south.
- Option 5 - new junction north of existing (in alternative position to Option 1A).

5.4.7. All options were compatible with the objectives of the Homes England Bid and provided an integrated scheme of transport infrastructure improvements that could facilitate the planned housing and economic development.

5.4.8. From this process it was concluded that Options 1A and 5 should not be taken further forward, as they provided a less sustainable option compared to Options 2, 2A and 2B, primarily in relation to affordability, value for money and environmental reasons. The assessment concluded that Options 2, 2A and 2B would all meet the Scheme objectives, but that there was marginal difference in the overall benefits or disadvantages of these three options when compared with each other. A preferred solution was not recommended

[84] Gloucester City, Cheltenham Borough and Tewkesbury Borough (Adopted December 2017) Joint Core Strategy 2011 – 2031.
[85] Atkins (15/09/20) M5 Junction 10 Improvement Volume 1 – Report Technical Appraisal Report.

as part of the TAR and therefore, Options 2, 2A and 2B (each including the A4019 widening and West Cheltenham Link Road), were taken forward to the non-statutory public consultation (Autumn 2020).

## Options for improvements to the A4019

5.4.9. Improvements to the A4019 were first identified in the August 2016 Transport Assessment as part of the Elms Park (North-west Cheltenham) application for planning permission. A Concept Option for upgrading the existing A4019 was included in the Homes England Bid for funding in March 2019, followed by a review to consider the Concept Option included and to identify potential new options.

5.4.10. Subsequently, three options were identified to provide the required benefit of providing additional capacity on the A4019 to cope with the additional traffic associated with the planned developments. The options identified are listed below:

- Option 1 – standard dual carriageway cross section (D2UAP).
- Option 2 – reduced central reserve width dual carriageway cross section.
- Option 3 – no central reserve dual carriageway cross section.

5.4.11. A sifting exercise took place for the three options above, with the requirement for dedicated right turn lanes, it was concluded that a central reserve was required. Therefore, Option 1 was carried forward for all M5 Junction 10 scheme options.

## Options for the Link Road

5.4.12. For the West Cheltenham Link Road (the 'Link Road') route, four options were developed (as shown in Figure 3-4 of Chapter 3 – Assessment of Alternatives (application document TR010063 – APP 6.2)), and assessed against the following main assessment categories:

- Impact on floodplain.
- Directness of route from M5 Junction 10.
- Impact on properties.
- Impact on environment (in addition to the floodplain and properties).

5.4.13. Following this sifting assessment for the Link Road route corridor options, Option 3 was taken forward for all shortlisted M5 Junction 10 scheme options.

## Development of the preferred route option for the M5 Junction 10 Improvements Scheme

5.4.14. Each of the Options 2, 2A and 2B for M5 Junction 10 included the same proposal for the Link Road and the widening of the A4019.

5.4.15. Of the three options shortlisted from the sifting exercise and considered at the non-statutory consultation, Option 2 was the option that GCC recommended should be taken forward to an application for statutory powers to construct for the M5 Junction 10 Improvements Scheme.

5.4.16. Further assessment and design development work was undertaken following the non-statutory public consultation in Autumn 2020. This took into account feedback received during that public consultation and the results of further survey and assessment work. This work considered:

- Review of the alignment and cross section of the West Cheltenham Link Road.
- A4019 widening at Uckington.
- Extending the improvement works on the A4019 eastwards as far as Gallagher

Retail Park (junction of the A4019 and B4634).

- Repurposing Withybridge Lane.

## 5.5. In-combination assessment

5.5.1. The Habitats Regulations require assessment of the potential for LSE of the project 'in-combination' with other projects and plans. This refers to the cumulative effects which will or might result from the addition of the effects of other relevant plans or projects to the effects of the subject plan or project.

5.5.2. The Habitats Regulations Handbook[86] advises that any plans or projects at the following stages may be relevant to an in-combination assessment:

- Applications lodged but not yet determined.
- Projects subject to periodic review e.g., annual licences, during the time that their renewal is under consideration.
- Refusals subject to appeal procedures and not yet determined.
- Projects authorised but not yet started.
- Projects started but not yet completed.
- Known projects that do not require external authorisation.
- Proposals in adopted plans.
- Proposals in finalised draft plans formally published or submitted for final consultation, examination or adoption.

5.5.3. The following County Council and District/Borough Council websites and planning portals have been reviewed for information on any plans or projects that may add to the effects of the Scheme on the migratory fish species associated with the Severn Estuary SAC/Ramsar Site and, therefore, may have an in-combination effect with the Scheme.

- Gloucestershire County Council.
- Forest of Dean District Council.
- Cheltenham Borough Council.
- Tewkesbury Borough Council.
- Gloucester City Council.
- Stroud District Council.

5.5.4. The Planning Inspectorate website[87] has also been reviewed.

5.5.5. This review is considered to be sufficient to inform the in-combination assessment for the HRA of the Scheme.

[86] Tyldesley, D., and Chapman, C., (2013) The Habitats Regulations Assessment Handbook, January 2018 edition UK: DTA Publications Limited www.dtapublications.co.uk.
[87] National Infrastructure Planning (planninginspectorate.gov.uk)

# 6. Potential Impacts on Protected Sites: Severn Estuary SAC and Ramsar Site

## 6.1. Where the impact directly or indirectly affects the site

6.1.1. No potential for direct impacts potentially resulting in a LSE has been identified.

6.1.2. Survey results and desk study records indicate that European eel, Atlantic salmon, sea trout and river lamprey are present in the vicinity of the Scheme. In the absence of mitigation, the following indirect impacts on the Severn Estuary SAC and Ramsar Site have been identified as potentially resulting in a LSE:

- Temporary reduction in the extent of functionally linked habitat available to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, in the event that dewatering part of the River Chelt channel is required during construction.
- Water quality impacts to functionally linked habitat within the River Chelt as a result of a pollution event during construction and operation, and consequent detrimental effects to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site.
- Disturbance impacts to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, using functionally linked habitat within the River Chelt during construction as a result of noise and vibration.
- Injury or mortality to river lamprey ammocoetes associated with the Severn Estuary SAC and Ramsar Site using functionally linked habitat within the River Chelt if they are present within burrows in the sediment in the event that dewatering of part of the channel is required during construction.
- Fragmentation as a result of disturbance and pollution, which could result in barrier effects, with European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, unable to disperse or move along the River Chelt.

6.1.3. Construction phase water quality impacts could arise as a result of mobilization of suspended sediments leading to silt laden runoff entering watercourses; and potential for accidental contamination associated with the spillage or leakage of fuels, lubricants and other chemicals required for construction.

6.1.4. Construction phase impacts could potentially occur during the construction of the Link Road, specifically the Link Road bridge over the River Chelt. Construction activities in this area are described in the following paragraphs. The construction sequence for the Link Road is as follows:

- Site clearance and boundary fencing.
- Pre earthworks drainage.
- Topsoil strip.
- Install site access and haul roads and construction hardstanding's and River Chelt plant crossing.
- Statutory Undertaker (SU) Diversions where required.

- Construct bulk earthworks and structures (bridge over the River Chelt and the flood mitigation structures).
- Highways drainage.
- Highways formation and capping.
- Pavement construction.
- Vehicle restraint system installation.
- Verge fill.
- Verge topsoil.
- Road markings.

6.1.5. In addition to the main site compound, three satellite sites/offices, two mobile welfare facilities, and one additional materials storage area are proposed. These are within the areas of temporary land take shown on the Land Plans (application document TR010063 – APP 2.2) and will operate for the period of the construction of the respective structure or Scheme element. One satellite site/office is near to the new River Chelt bridge, providing site offices and welfare. In addition, a material storage area is adjacent to the Link Road (north of the River Chelt) for the culvert units that comprise the flood mitigation structures beneath the Link Road between the River Chelt and the A4019.

6.1.6. A temporary haul road will be required along the length of the Link Road, so as to construct this element of the Scheme, and the associated flood mitigation structures and the River Chelt bridge. This will also include the construction of a temporary bridge across the River Chelt, adjacent to the proposed new bridge. A working area for cranage and beam delivery will be required adjacent to the location of the new bridge. These are within the areas of temporary land take shown on the Land Plans (application document TR010063 – APP 2.2).

6.1.7. The bridge construction will be a single span precast beam bridge with integral full height reinforced concrete abutments, resting on a piled foundation (comprising 1 m diameter bored concrete pile). Ten piles would be rotary bored on each side of the River Chelt.

6.1.8. In order to ensure that access under the River Chelt bridge is maintained, a short section of hard bank protection such as rip-rap or non-biodegradable geotextile will be installed along both banks of the River Chelt underneath the River Chelt bridge. The precise method of bank protection will be determined at the detailed design stage but there may be a requirement for partial dewatering of the channel during installation.

6.1.9. Operational phase water quality impacts could arise as a result of contaminated road runoff entering the River Chelt.

## 6.2. Loss of Area of European Site

6.2.1. There will be no land take within the Severn Estuary SAC or Ramsar Site (or any other European Site).

## 6.3. Change in species population numbers of qualifying interests

6.3.1. The following potential impacts have been identified during construction and operation of the Scheme that could result in a change in species population numbers of river lamprey, Atlantic salmon, sea trout and European eel.

### Pollution event during construction and operation

6.3.2. Pollution impacts could result in injury or mortality to European eel, Atlantic salmon, sea trout and river lamprey, or their prey species, or damage functionally linked habitat within

the River Chelt during construction and operation which could in turn negatively impact these species.

6.3.3. LA 113 states that "for assessment of impacts associated with soluble pollutants, outfalls within 1 km (measured along the watercourse) shall be aggregated for the purposes of cumulative assessment[88]". It therefore follows that soluble pollutants are considered to be sufficiently diluted beyond 1 km. The Severn Estuary catchment area covers an area of over 21,000 km$^2$ (2,100,000 ha) and over 600 rivers drain into the estuary[89]. In the unlikely event that a pollution incident occurs and affects a 1 km stretch of the River Chelt, only a small area of functionally linked habitat for European eel, Atlantic salmon, sea trout and river lamprey would be affected, and consequently only low numbers of individual fish would be impacted.

6.3.4. The conservation objectives have been considered. Of particular relevance is the need to: maintain migratory passage of both adult and juveniles through the Severn Estuary between the Bristol Channel and any of their spawning rivers, and ensure passage is not obstructed or impeded by poor water quality; maintain the size of the populations of species in the Severn Estuary and the rivers which drain into it; and ensure toxic contaminants in the water column and sediment are below levels which would pose a risk to fish passage, population size and abundance of prey species. Taking the conservation objectives into account, and considering that European eel, Atlantic salmon, sea trout and river lamprey are all in decline or critically endangered, a major pollution incident as a result of the Scheme (during construction or operation) could potentially result in an adverse impact on the integrity of the Severn Estuary SAC and Ramsar Site in the absence of mitigation.

## Disturbance during construction

6.3.5. Taking a worst-case scenario (for example should percussive rather than rotary-piling become the only viable construction method for the Link Road bridge abutments adjacent to the River Chelt), the compendium of near-source (10 m) pile driving sound data identified a mean peak of 198dB (re 1 µPa) and a mean sound exposure level (SEL; the total energy of the sound, taking into account received level and duration of exposure) of 171dB (re 1 µPa2-s) for impact-piling[90]. With reference to published sound exposure thresholds[91], this is below the injury thresholds for European eel, Atlantic salmon and sea trout (peak of >207dB and an SEL of 203dB) and river lamprey (peak of >213dB and an SEL of >216dB). This is also below the published threshold for Temporary Threshold Shift (TTS; short or long-term changes in hearing sensitivity that may or may not reduce fitness) quoted as >186dB SEL for all species.

6.3.6. The mean impact-piling signals[90] are also based almost entirely on monitoring of piling installation within the water column, as opposed to on adjacent land (as per the Scheme), through which the signal will attenuate further, before entering the water column. For the Scheme, piling would be set back from the river by at least 4 m, therefore the underwater acoustic signals generated as a result of the Scheme are therefore likely to be lower than those presented above.

6.3.7. There remains a risk of behavioural (i.e. avoidance) effects, given the acoustic signals are likely to be perceptible to European eel, Atlantic salmon and sea trout (and perhaps river

[88] Highways England (2020). Design Manual for Roads and Bridges LA 113 Road drainage and the water environment (formerly HD 45/09). (March 2020, version 1) Online: d6388f5f-2694-4986-ac46-b17b62c21727 (standardsforhighways.co.uk)
[89] https://severnestuarypartnership.org.uk/ [accessed July 2022]
[90] Buehler, D., Oestman, R., Reyff, J., Pommerenck, K. and Mitchell, B. (2015) Caltrans Technical Guidance for Assessment and Mitigation of the Hydroacoustic Effects of Pile Driving on Fish. Report Number CTHWANP-RT-15-306.01.01.
[91] Popper, A.N., Hawkins, A.D., Fay, R.R., Mann, D.A., Bartol, S., Carkson, T.J., Cooms, S., Ellison, W.T., Gentry, R.L., Halvorsen, M.B., Lokkeborg, S., Rogers, P.H., Southall, B.L., Zeddies, D.G. and Tavolga, W.N. (2014) Sound exposure guidelines for fishes and sea turtles: A technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI.

lamprey). European eel, Atlantic salmon and sea trout are sensitive to particle motion rather than sound pressure. At distances that are relatively close to the sound source, this particle motion is a major component of a sound field; at greater distances from the source the primary component of the field is pressure. The decrease in particle motion with distance from the source occurs because the attenuation of motion is considerably more rapid over distance than is the attenuation of pressure[92]. Consequently, the component of the sound field to which these species are sensitive is likely to diminish very quickly, with distance from source.

6.3.8. Taking percussive piling as a worst-case scenario, vibration assessments as described in Chapter 6 – Noise and Vibration (application document TR010063 – APP 6.4) showed that the area potentially affected by vibration of greater than 13 mm/s is within 10 m of the activity (vibration of 12.8 mm/s is predicted at 10 m from the source). It is anticipated that rotary piling will be used for the Scheme and therefore it is likely that the distance would be considerably less in reality.

6.3.9. Disturbance as a result of noise and vibration during construction may cause European eel, Atlantic salmon, sea trout and river lamprey to avoid or move away from the affected area for a relatively short period (as discussed in Section 6.7). Key periods for European eel are when this species is migrating upstream between February and July, or downstream between October and November. Key periods for river lamprey are when this species is migrating upstream to spawning grounds during winter and spring, where mating takes place in March and April, and downstream between July and September[93]. For river lamprey, given that the field survey recorded ammocoetes, indicating that a spawning ground is present close to the Scheme, the key period is considered to be the spawning period in spring (March to April). Key periods for trout and salmon are November to February, with peaks in October and November.

6.3.10. Disturbance may temporarily and locally displace fish from feeding and shelter resources near to the source of the disturbance, but is unlikely to cause any reduced fitness or individual mortality that could result in a long term or population level effect.

6.3.11. Taking into account the extensive catchment area and availability of alternative watercourses within this catchment area (as described above), only a small area of functionally linked habitat for European eel, Atlantic salmon, sea trout and river lamprey would be affected, and consequently only low numbers of individual fish would be impacted.

6.3.12. The conservation objectives have been considered. Of particular relevance is the need to: maintain migratory passage of both adult and juveniles through the Severn Estuary between the Bristol Channel and any of their spawning rivers, and ensure passage is not obstructed or impeded. Taking the conservation objectives into account, and considering that European eel, Atlantic salmon, sea trout and river lamprey are all in decline or critically endangered, disturbance as a result of the construction of the Scheme, which could deter fish from the area, particularly during key sensitive periods, could potentially result in an adverse impact on the integrity of the Severn Estuary SAC and Ramsar Site in the absence of mitigation.

### Injury/mortality during dewatering

6.3.13. Dewatering of part of the channel of the River Chelt, which could potentially be required during the installation of bank protection, could result in injury or mortality to river lamprey ammocoetes present in burrows in the sediment. Ammocoetes spend a number of years in burrows in sediment, so river lamprey ammocoetes are vulnerable to this activity at any time of the year. It is anticipated that approximately 20 m length of channel may be

[92] Popper, A. (2005) A review of hearing by sturgeon and lamprey. A report submitted to the U.S. Army Corps of Engineers, Portland District.
[93] Maitland, P. (2003) Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000, Ecology Series No.5. English Nature, Peterborough.

impacted. Taking into account the extensive catchment area and availability of alternative watercourses within this catchment area (as described above), only a small area of functionally linked habitat for river lamprey would be affected, and consequently only low numbers of individual fish would be impacted.

6.3.14. The conservation objectives have been considered. Of particular relevance is the need to maintain the size of the populations of species in the Severn Estuary and the rivers which drain into it. Taking the conservation objectives into account, and considering that river lamprey are in decline, injury or mortality as a result of the Scheme, could potentially result in an adverse impact on the integrity of the Severn Estuary SAC and Ramsar Site in the absence of mitigation.

## 6.4. Disturbance to species within European Site

6.4.1. The Severn Estuary SAC and Ramsar Site are beyond the zone of influence for any Scheme impacts relating to disturbance. However, there is potential for disturbance impacts to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, using functionally linked habitat within the River Chelt during construction of the Scheme as a result of noise and vibration. Such disturbance impacts could potentially result in an adverse impact on the integrity of the Severn Estuary SAC and Ramsar Site in the absence of mitigation. This is discussed further in paragraphs 6.3.5 to 6.3.12 above.

## 6.5. Effects of fragmentation caused by the Scheme

6.5.1. In the event that dewatering is required during the installation of bank protection, only part of the width of the channel would be dewatered. Furthermore, there will be no new permanent in-river structures. Therefore, fish passage would be physically maintained at all times during construction and operation.

6.5.2. However. the disturbance effects described above could result in habitat fragmentation/barrier effects, with European eel, Atlantic salmon, sea trout and river lamprey unable to disperse or move along the River Chelt as a result of such disturbance. Similarly, pollution could also result in fragmentation.

6.5.3. Taking into account the extensive catchment area and availability of alternative watercourses within this catchment area (as described above), it is likely that only low numbers of individual fish would be impacted.

6.5.4. The conservation objectives have been considered. Of particular relevance is the need to: maintain migratory passage of both adult and juveniles through the Severn Estuary between the Bristol Channel and any of their spawning rivers, and ensure passage is not obstructed or impeded. Taking the conservation objectives into account, and considering that European eel, Atlantic salmon, sea trout and river lamprey are all in decline or critically endangered, fragmentation as a result of the Scheme, which could deter fish from the area, particularly during key sensitive periods, could potentially result in an adverse impact on the integrity of the Severn Estuary SAC and Ramsar Site in the absence of mitigation.

## 6.6. The reversibility of the impacts

6.6.1. Hydrological impacts to functionally linked habitat within the River Chelt as a result of a pollution event during construction and operation could in theory be reversed with an appropriate clean-up operation/remedial action followed by habitat management.

6.6.2. Pollution impacts could result in injury or mortality to European eel, Atlantic salmon, sea trout and river lamprey, or their prey species, so such impacts have the potential to be irreversible to individual fish.

6.6.3. Disturbance as a result of noise and vibration during construction within 10 m of the River Chelt, particularly piling activities, may cause European eel, Atlantic salmon, sea trout and river lamprey to avoid or move away from the affected area for a relatively short period (as discussed in Section 6.7), after which fish could return.

6.6.4. Injury or mortality of river lamprey ammocoetes present in burrows in sandy silt as a result of dewatering would be irreversible to individual fish.

## 6.7. The duration of the effects

6.7.1. The Scheme would be constructed between 2025 and 2027. The Link Road has a 14 month construction programme, with piling itself confined to a five day period. Construction related effects are therefore temporary. Operational pollution effects could be permanent, although a one-off pollution event would be temporary.

## 6.8. Integrity of European Site checklist

6.8.1. The integrity checklists below are taken from tables C.1 and C.2 of Appendix C of LA 115[94].

Table 6.1 Integrity of site checklist (From LA 115 Table C.1)

| Does the Scheme have the potential to: | |
|---|---|
| 1. Cause delays in progress towards achieving the conservation objectives of the site? | Yes |
| 2. Interrupt progress towards achieving the conservation objectives of the site? | Yes |
| 3. Disrupt those factors that help to maintain the favourable conditions of the site? | Yes |
| 4. Interfere with the balance, distribution and density of key species that are the indicators of the favourable condition of the site? | Yes |

Table 6.2 Other indicators (From LA 115 Table C.2)

| Does the Scheme have the potential to: | |
|---|---|

[94] Highways England (2020). Design Manual for Roads and Bridges. LA 115 Habitats Regulations Assessment (formerly HD 44/09). (January 2020, version 1) Online: http://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section4/LA%20115%20Habitats%20Regulations%20assessment%20-web.pdf

| Does the Scheme have the potential to: | |
|---|---|
| 1. Cause changes to the vital defining aspects (e.g. nutrient balance) that determine how the site functions as a habitat or ecosystem? | Yes (functionally linked habitat only) |
| 1. Change the dynamics of the relationships (between, for example, soil and water or plants and animals) that define the structure and/or function of the site? | Yes (functionally linked habitat only) |
| 2. Interfere with predicted or expected natural changes to the site (such as water dynamics or chemical composition)? | No, the effect pathways will not interfere with any expected natural changes to the European sites. |
| 3. Reduce the area of key habitats? | Yes (functionally linked habitat only) |
| 4. Reduce the population of key species? | Yes (to species using functionally linked habitat only) |
| 5. Change the balance between key species? | No, the effect pathways will not change the balance between key species. |
| 6. Reduce the diversity of the site? | No, the effect pathways will not reduce the diversity of the site. |
| 7. Result in disturbance that could affect population size or density of the balance between key species? | Yes (to species using functionally linked habitat only) |
| 8. Result in fragmentation? | Yes (functionally linked habitat only) |
| 9. Result in loss or reduction of key features (e.g. tree cover, tidal exposure, annual flooding etc.)? | Yes (functionally linked habitat only) |

# 7. Mitigation

7.1.1. As discussed in Section 6, in the absence of mitigation, there is the potential for an adverse effect on site integrity as a result of the impact pathways identified. Therefore, mitigation has been designed which is outlined in the sections below. The mitigation measures are effective and reliable, such that the potential adverse effects identified will be reduced to a negligible level.

## 7.2. Construction

7.2.1. To mitigate the potential for a pollution incident to occur during construction, works will proceed following standard good practice working methods for environmental protection which will adhere to GPPs[95] and CIRIA C715[96] Environmental good practice. These will be secured via the Register of Environmental Actions and Commitments (REAC) (application document TR010063 – APP 7.4) which sets out measures that will be followed by the Principal Contractor. Measures include:

- All debris arising from the construction and works will be effectively encapsulated and removed from site.
- No pollutants will enter drainage or run-off to a watercourse.
- The contractor will ensure that they have a robust Pollution Response Plan in place before works start.
- Any pollution incident will be contained and cleaned up immediately and reported.
- Provision will be made for the installation of silt control measures within watercourses e.g., silt curtains, to prevent downstream propagation of fine sediment generated through bankside/in-channel working in watercourses.
- No storage of oils or chemicals will be allowed within 10 m of a watercourse.

7.2.2. The bridge construction will be a single span precast beam bridge with integral full height reinforced concrete abutments, resting on a piled foundation (comprising 1 m diameter bored concrete pile). The use of pre-cast elements will minimise on site concrete pouring.

7.2.3. To mitigate the potential for disturbance/injury/mortality to migratory fish species using functionally linked habitat within the River Chelt, the following measures will be put in place. These will be secured via the Register of Environmental Actions and Commitments (REAC) (application document TR010063 – APP 7.4), followed by the Principal Contractor and overseen by a suitably qualified and experienced Ecological Clerk of Works (ECoW):

- All haul roads, lay down areas and compounds will be located at least 10 m from watercourses, except where access is required to specific locations for works to bridges/culverts for example. Where possible, site tracking routes will be arranged to avoid watercourse margins to limit disturbance to watercourse riparian and bankside habitats and fish species.
- Soft start procedures will be implemented to gradually increase the sound/vibration intensity over a period of time. The aim is to gradually habituate migratory fish to increased noise/vibration or temporarily deter migratory fish before the full volume/vibration intensity is reached so that noise exposure is reduced. Soft start up methods will be employed on plant being used for any in-channel works and works within 20 m of the River Chelt, including piling, at the start of each working

[95] https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/guidance-for-pollution-prevention-gpps-full-list/
[96] CIRIA (2006), CIRIA C648 Control of water pollution from linear construction projects Technical guidance. London.

day to ensure sudden disturbance to fish and other wildlife is minimised as far as practically possible. The soft-start duration should be a period of not less than 20 minutes and should piling cease for a period greater than 20 minutes, the soft start procedure must be repeated.

- Ten piles would be rotary bored on each side of the River Chelt. Rotary piling results in less noise and vibration than percussive piling.
- Prior to any in-channel works or de-watering, measures shall be implemented that act to temporarily displace fish from the working area. Measures may include the removal of channel features from the working area that provide cover such as large wood to reduce the overall attractiveness of the working area for fish species. This is particularly relevant to benthic species such as European eel that frequently occupy voids between larger substrates. Such in channel features that provide cover will be replaced after the construction works.
- In the event that dewatering is required during the installation of bank protection, only part of the width of the channel will be dewatered. Therefore, continuity of flow and fish passage would be maintained at all times during construction. A fish rescue plan will be developed in consultation with the Environment Agency and Natural England, which may include the need to relocate lamprey ammocoetes prior to dewatering in order to reduce the potential for injury/mortality. The fish rescue plan will also include a requirement for an ecological watching brief.
- Appropriate screening of any pumping equipment during dewatering activities will be implemented (2 mm screens) to avoid any potential entrainment/mortality of fish during the works.
- Consider the use of temporary stop nets across the channel upstream of the works to prevent fish from becoming entrained in the working area.
- Where possible, works most likely to cause disturbance to migratory species in the River Chelt (i.e., the construction of the new bridge crossing and installation of bank protection associated with the crossing) will be timed to occur outside of the key ecologically sensitive periods for migratory fish species. Due to the range of species potentially present, it may not be practical to avoid all sensitive periods. However, based on the fisheries habitat provision at the crossing and confirmed species presence the migratory and/or spawning periods for European eel, river lamprey and sea/brown trout will be the focus of the timing consideration. February to July and October to November will be avoided as far as possible, as they are the key migratory periods for European eel[97], which also avoids the spawning period for lamprey (March to April[98]), sea trout and Atlantic salmon (peaks in October to November). These periods will be confirmed through ongoing consultation with Natural England and the Environment Agency.
- Where works during migratory periods are unavoidable, no night-time (taken to be between 30 minutes prior to sunset until 30 minutes following sunrise) vibration work will be undertaken. If night working is essential, minimal and directional lighting will be used.

7.2.4. There will be further enhancement within the aquatic environment, and this is described in Chapter 7 – Biodiversity (application document TR010063 – APP 6.5).

[97] https://www.fishsec.org/2020/05/15/eel-migration-report-provides-insights-but-also-highlights-data-gaps/
[98] Maitland, P. (2003) Ecology of the River, Brook and Sea Lamprey. Conserving Natura 2000, Ecology Series No.5. English Nature, Peterborough.

## 7.3. Operation

7.3.1. The Scheme design incorporates a clear span bridge structure over the River Chelt. There will be no new permanent in stream structures that would impact on passage of fish along the River Chelt.

7.3.2. To mitigate the potential for pollutants to enter the water environment during operation, SuDs have been incorporated into the Scheme's drainage strategy. The drainage design uses swales and ditches where possible, rather than pipework. Where there are additional areas of impermeable surfacing the highway drainage will be routed to attenuation basins before discharge into surface watercourses. The swales, ditches and attenuation basins will allow suspended solids to settle out and remove soluble pollutants to varying degrees before discharge to the River Chelt and Leigh Brook. These features will also provide opportunities for biodiversity and the creation of green/riparian corridors through the Scheme to maintain and improve connectivity. Currently runoff from the highways drains directly to the adjacent surface watercourses (River Chelt and Leigh Brook) with no attenuation of the pollutants present. The attenuation basins will be designed to sit naturally in the landscape.

7.3.3. The Scheme drainage design consists of nine drainage catchments. All drainage catchments discharge to surface water (either the Leigh Brook or River Chelt). The nine drainage catchments, their current mitigation and Scheme mitigation are shown in the table below. For further details refer to the Drainage Strategy Report in Appendix 2.1 of the ES (application document TR010063 – APP 6.15), which also includes drainage plans.

Table 7.1 Overview of drainage catchments and Scheme drainage design

| Drainage catchment name | Receiving watercourse | Current mitigation | The Scheme mitigation |
|---|---|---|---|
| J1 | Leigh Brook | Vegetated ditch | Basin* |
| Link Road | River Chelt | None | Swale, basin, vegetated ditch |
| A4019 Main Line at Elms Park | River Chelt | Vegetated ditch | Basin |
| Combined Basin | Leigh Brook | Vegetated ditch | Swale**, basin, wetland |
| S1 | River Chelt | Vegetated ditch | Basin |
| S1 South | River Chelt | Vegetated ditch | None |
| M5 South of the River Chelt*** | River Chelt | None | None |
| S2 | Leigh Brook | Vegetated ditch | Swale, basin |
| B Road | River Chelt | None | None |

*Only 0.492 ha (48%) of this catchment drains through the basin.

**Only 1.028 ha (16%) of this catchment drains through the swale.

*** This catchment is outside of the Scheme drainage works and hence no data has been collected or modelled as part of the Scheme on the drainage areas. This drainage catchment has been included as it will form part of the cumulative assessment for outfalls into the River Chelt. The area has been estimated using HADDMS and professional judgement.

7.3.4. The surface water quality assessment has been undertaken in accordance with LA 113 and LA 104 [99]. The assessments consider the impact of routine road runoff on receiving watercourses and the risk of a spillage causing a pollution incident. To fully understand the potential impacts of the Scheme on surface water quality assessments have been undertaken based on the current road layout and drainage system within the Scheme's footprint and on the Scheme road layout and drainage system. Further detail is included in Chapter 8 - the Road Drainage and Water Environment Chapter (application document TR010063 – APP 6.6), specifically Appendix 8.3.

7.3.5. The impact of routine runoff on surface water quality has been assessed using the Highways England Water Risk Assessment Tool (HEWRAT). The HEWRAT has been used to assess whether the impact of routine runoff on surface water quality is acceptable by assessing the acute impacts from soluble pollutants, chronic impacts from sediment related pollutants and compliance with Environmental Quality Standards (EQS) using annual average concentrations of soluble pollutants.

7.3.6. The following results are obtained from the HEWRAT:

- A pass or fail result for acute impacts from soluble pollutants.
- A pass or fail result for chronic impacts due to sediment related pollutants.
- Compliance with EQSs annual average concentrations of soluble pollutants.

7.3.7. When the annual average concentrations of soluble pollutants predicted by the HEWRAT exceed the EQS a detailed bioavailability assessment is carried out using the UKTAG Rivers and Lakes Metal Bioavailability Assessment Tool (M-BAT).

7.3.8. The acute impacts from soluble pollutants assessment and compliance with EQSs annual average concentrations of soluble pollutants primarily considers copper and zinc as these are the pollutants that are routinely found in road runoff and pose a risk to the water environment. There are likely to be other pollutants present in road runoff. The HEWRAT uses copper and zinc as indictor pollutants and therefore the mitigation measures put in place to control copper and zinc are likely to be adequate to control any other pollutants.

7.3.9. The results of the routine runoff assessment show that all drainage catchments (which discharge to the Leigh Brook or River Chelt) pass the acute impacts from soluble pollutants assessment, chronic impacts from sediment bound pollutants assessment and are compliant with the freshwater EQS for dissolved copper and zinc with the Scheme in place.

7.3.10. Two drainage catchments (Combined Basin and S2) have a minor beneficial impact as a result of the Scheme. This is a result of the additional mitigation applied to these drainage catchments. The calculated treatment efficiencies for the current drainage design and the Scheme drainage design are presented in Table 7.2 and Table 7.3. The Scheme scenario is applying additional mitigation of a swale, basin and wetland for the Combined Basin drainage catchment and a swale and basin for the S2 drainage catchment. For the Combined Basin drainage catchment this additional mitigation is resulting in a 'Pass' for the chronic sediment related pollutions assessment with the Scheme in place, compared to a 'Fail' currently. For the S2 drainage catchment this additional mitigation is resulting in a 'Pass' for the acute impacts from soluble related pollutants assessment and chronic sediment related pollutants assessment with the Scheme in place, compared to a 'Fail' currently.

[99] Highways England (2020). Design Manual for Roads and Bridges. LA 104 Environmental Assessment and Monitoring (formerly HA 205/08, HD 48/08, IAN 125/15, and IAN 133/10). (August 2020, version 1) Online: https://www.standardsforhighways.co.uk/prod/attachments/0f6e0b6a-d08e-4673-8691-cab564d4a60a?inline=true. Highways England (202). Design Manual for Roads and Bridges. LA 113 Road Drainage and the Water Environment (formerly HD 45/09). (March 2020) Online: https://www.standardsforhighways.co.uk/prod/attachments/d6388f5f-2694-4986-ac46-b17b62c21727?inline=true

7.3.11. A spillage assessment has also been undertaken using the HEWRAT. The assessment determines the risk of a pollution incident occurring as a result of a spillage. Using the spillage assessment method, for the risk of a serious pollution incident to be acceptable the calculated annual probability of such an incident shall not be greater than 1%. Using the spillage assessment method, for the risk of a serious pollution incident to be acceptable the calculated annual probability shall not be greater than 0.5% where spillage has the potential to affect a:

- Site of Special Scientific Interest (SSSI).
- Source Protection Zone (SPZ).
- Protected area.
- Drinking water supply.
- Commercial activity abstracting from the watercourse.

7.3.12. The results of the spillage assessment show the annual probability of a pollution incident occurring as a result of a spillage is less than 0.01 (1%) with the Scheme in place, which is deemed acceptable. For three drainage catchments (J1, A4019 Main Line at Elms Park and Combined Basin) as well as the annual probability of a pollution incident occurring as a result of a spillage being less than 0.005 (0.5%) they also have a reduction in annual probability of 50% or more when compared to the current scenario. This reduction in annual probability of 50% or more is a result of additional mitigation being applied to the drainage catchments. The Scheme is including the additional mitigation of a basin for drainage catchments J1 and A4019 Main Line at Elms Park and a swale, basin and wetland for the Combined Basin drainage catchment. Table 7.2 and Table 7.3 present the calculated spillage risk reduction factors for the current drainage design and Scheme drainage design.

Table 7.2 Calculated treatment efficiencies and spillage risk reduction factors for the current drainage design

| Drainage catchment name | Receiving watercourse | Suspended solids % removal | Dissolved copper % removal | Dissolved zinc % removal | Spillage risk reduction factor (presented as a decimal) |
|---|---|---|---|---|---|
| J1 | Leigh Brook | 25 | 15 | 15 | 0.70 |
| A4019 Main Line at Elms Park | River Chelt | 25 | 15 | 15 | 0.70 |
| Combined Basin | Leigh Brook | 25 | 15 | 15 | 0.70 |
| S1 | River Chelt | 25 | 15 | 15 | 0.70 |
| S2 | River Chelt | 25 | 15 | 15 | 0.70 |
| B Road | Leigh Brook | 0 | 0 | 0 | 1.00 |
| M5 south of the River Chelt | River Chelt | 0 | 0 | 0 | 1.00 |
| Piffs Elm Culvert | Leigh Brook | 25 | 15 | 15 | 0.7 |

Table 7.3 Calculated treatment efficiencies and spillage risk reduction factors for the Scheme drainage design

| Drainage catchment name | Receiving watercourse | Suspended solids % removal | Dissolved copper % removal | Dissolved zinc % removal | Spillage risk reduction factor (presented as a decimal) |
|---|---|---|---|---|---|
| J1 | Leigh Brook | 47 | 31 | 27 | 0.53 |
| Link Road | River Chelt | 94 | 75 | 70 | 0.21 |
| A4019 Main Line at Elms Park | River Chelt | 70 | 49 | 41 | 0.35 |
| Combined Basin | Leigh Brook | 89 | 67 | 72 | 0.13 |
| S1 | River Chelt | 70 | 49 | 41 | 0.35 |
| S1 South | River Chelt | 70 | 49 | 41 | 0.70 |
| M5 South of the River Chelt | River Chelt | 0 | 0 | 0 | 1.00 |
| S2 | Leigh Brook | 94 | 75 | 70 | 0.5 |
| B Road | River Chelt | 0 | 0 | 0 | 1.00 |

# 8. In-combination assessment

8.1.1. Following a detailed assessment of the elements of the Scheme that were identified as having a LSE, it was concluded that the following potential impacts could have adverse effects on the integrity of the Severn Estuary SAC/Ramsar Site alone:

- Temporary reduction in the extent of functionally linked habitat available to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, in the event that dewatering part of the River Chelt channel is required during construction.
- Water quality impacts to functionally linked habitat within the River Chelt as a result of a pollution event during construction and operation, and consequent detrimental effects to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site.
- Disturbance impacts to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, using functionally linked habitat within the River Chelt during construction as a result of noise and vibration.
- Injury or mortality to river lamprey ammocoetes associated with the Severn Estuary SAC and Ramsar Site using functionally linked habitat within the River Chelt if they are present within burrows in the sediment in the event that dewatering of part of the channel is required during construction.
- Fragmentation as a result of disturbance and pollution, which could result in barrier effects, with European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, unable to disperse or move along the River Chelt.

8.1.2. Taking into account the mitigation measures described in Section 7, which are effective and reliable, the potential adverse effects identified will all be avoided.

8.1.3. No residual effects remain, and therefore the Scheme would not have potential to add to any effects associated with other plans or projects. No in-combination assessment is therefore required.

# 9. Proposals for monitoring and reporting

9.1.1. The mitigation measures proposed are plainly established and uncontroversial. Therefore, no future monitoring is proposed.

# 10. Consultations

10.1.1. See paragraphs 4.4.25 to 4.4.29 and Appendix G.

# 11. Conclusions

11.1.1. Following a detailed assessment of the elements of the Scheme that were identified as having a LSE, it was concluded that the following potential impacts could have adverse effects on the integrity of the Severn Estuary SAC/Ramsar Site alone:

- Temporary reduction in the extent of functionally linked habitat available to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, in the event that dewatering part of the River Chelt channel is required during construction.
- Water quality impacts to functionally linked habitat within the River Chelt as a result of a pollution event during construction and operation, and consequent detrimental effects to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site.
- Disturbance impacts to migratory European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, using functionally linked habitat within the River Chelt during construction as a result of noise and vibration.
- Injury or mortality to river lamprey ammocoetes associated with the Severn Estuary SAC and Ramsar Site using functionally linked habitat within the River Chelt if they are present within burrows in the sediment in the event that dewatering of part of the channel is required during construction.
- Fragmentation as a result of disturbance and pollution, which could result in barrier effects, with European eel, Atlantic salmon and sea trout associated with the Severn Estuary Ramsar Site, and river lamprey associated with the Severn Estuary SAC and Ramsar Site, unable to disperse or move along the River Chelt.

11.1.2. Mitigation measures have been designed which are effective, reliable, plainly established and uncontroversial. They will avoid the potential adverse effects identified. No residual effects remain, and therefore the Scheme would not add to any effects associated with other plans or projects.

# 12. References


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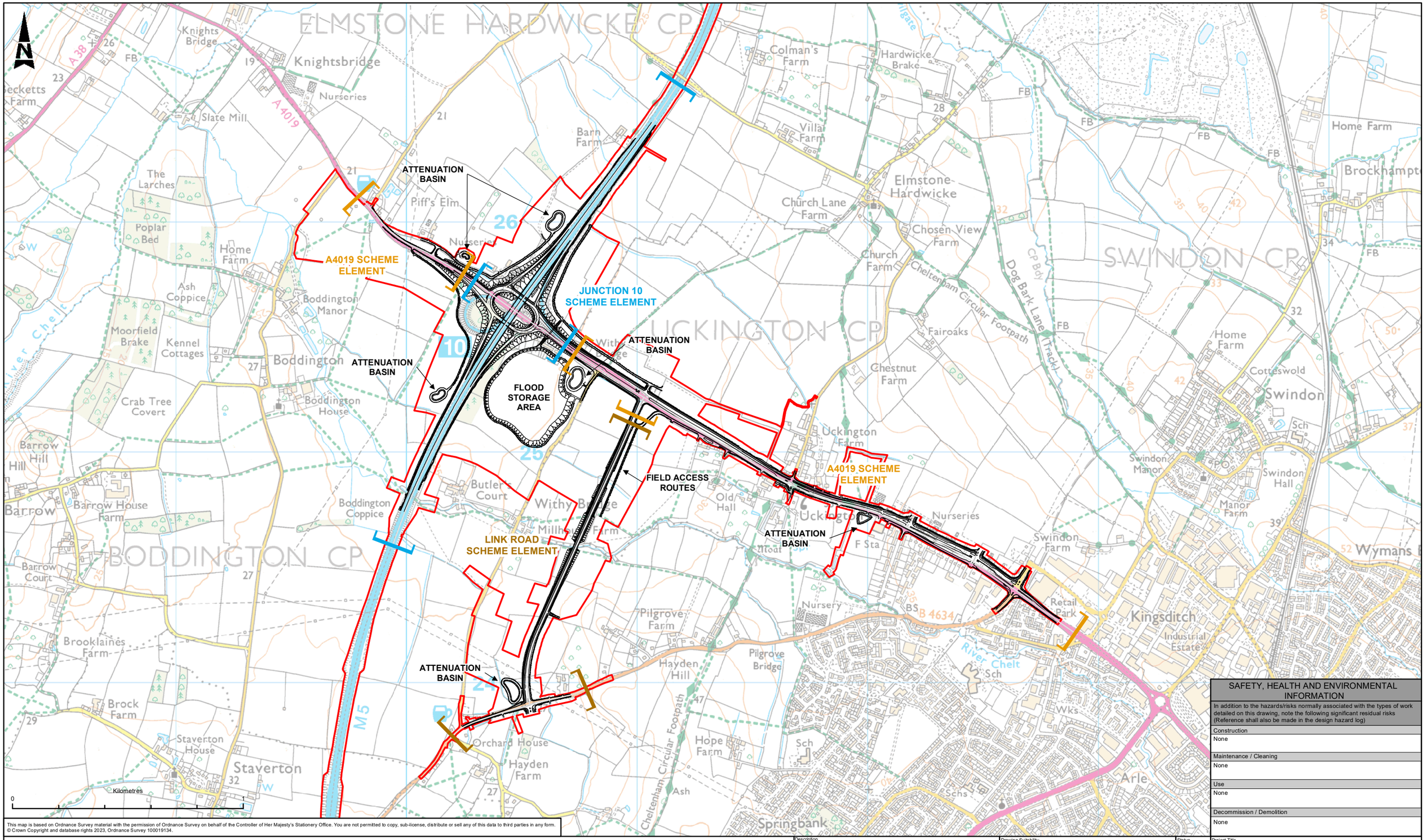
# Appendices

# Appendix A. Scheme Drawing

| Figure reference | Document title | Sheet | Document number | Revision |
|---|---|---|---|---|
| 2-1 | Scheme overview | 1 of 1 | GCCM5J10-ATK-EGN-ZZ-GS-GI-000001 | 0 |






LEGEND

SCHEME ALIGNMENT

ORDER LIMITS

## SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made in the design hazard log)

**Construction**
None

**Maintenance / Cleaning**
None

**Use**
None

**Decommission / Demolition**
None

| Description | Status | Revision | Drawn | Checked | Reviewed | Authorised | Issue Date |
|---|---|---|---|---|---|---|---|
| PUBLISHED | A1 | P03 | JM | SL | CC | LJ | 21/08/23 |

Drawing Suitability: **PUBLISHED** — Status: **A1**

Project Title: M5 Junction 10 Improvements Scheme

Drawing Title: FIGURE 2-1 SCHEME OVERVIEW

ATKINS
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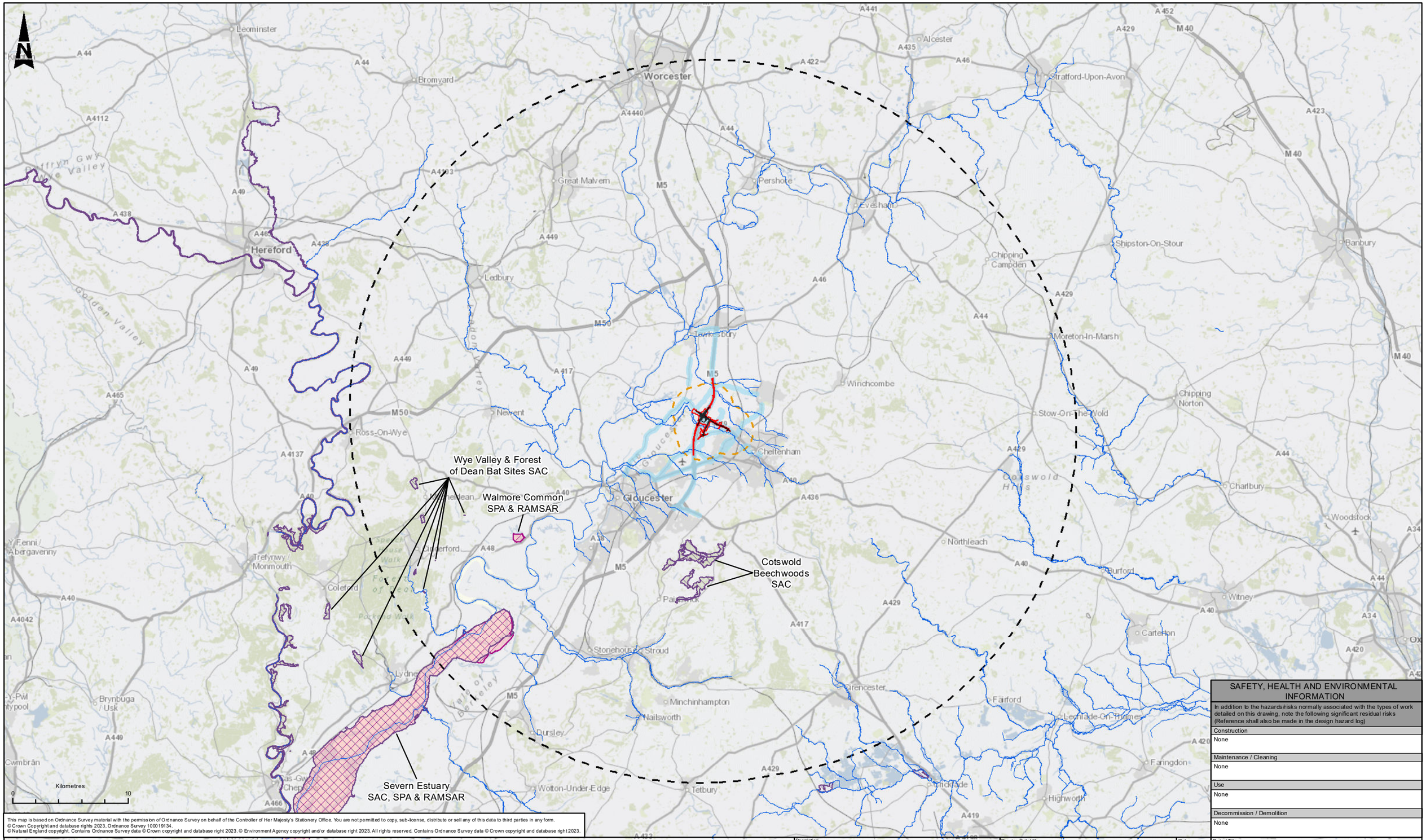
Client: Gloucestershire County Council

Drawing Number: Project | Originator | Volume — GCCM5J10 - ATK - EGN ZZ - GS - GI - 000001 — Location | Type | Role | Number

| Original Size: | Scale | Project Ref: | Sheet: | Rev: |
|---|---|---|---|---|
| A3 | 1:15,000 | 5214106 | 1 of 1 | P03 |

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

| Figure reference | Document title | Sheet | Document number | Revision |
|---|---|---|---|---|
| 7-14A | European designated sites | 1 of 1 | GCCM5J10-ATK-EBD-ZZ-GS-GI-000032 | 0 |
| 7-14B | Aquatic ecology survey locations | 1 of 4 | GCCM5J10-ATK-EBD-ZZ-GS-GI-000083 | 0 |
| 7-14B | Aquatic ecology survey locations | 2 of 4 | GCCM5J10-ATK-EBD-ZZ-GS-GI-000083 | 0 |
| 7-14B | Aquatic ecology survey locations | 3 of 4 | GCCM5J10-ATK-EBD-ZZ-GS-GI-000083 | 0 |
| 7-14B | Aquatic ecology survey locations | 4 of 4 | GCCM5J10-ATK-EBD-ZZ-GS-GI-000083 | 0 |






LEGEND

- ORDER LIMITS
- SCHEME ALIGNMENT
- 2KM STUDY AREA
- 30KM STUDY AREA
- WATERCOURSES
- AFFECTED ROAD NETWORK 200M BUFFER
- SPECIAL AREAS OF CONSERVATION
- SPECIAL PROTECTION AREAS
- RAMSAR SITES

| Description | Status | Revision | Drawn | Checked | Reviewed | Authorised | Issue Date |
|---|---|---|---|---|---|---|---|
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| PUBLISHED | A1 | P02 | SD | LH | CC | LJ | 12/09/23 |

Drawing Suitability: PUBLISHED

Status: A1

Project Title: M5 Junction 10 Improvements Scheme

Drawing Title: FIGURE 7-14A
EUROPEAN DESINGATED SITES

ATKINS
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Client: Gloucestershire County Council

Drawing Number: GCCM5J10 - ATK - EBD - ZZ - GS - GI - 000032
(Project | Originator | Volume | Location | Type | Role | Number)

| Original Size: | Scale | Project Ref: | Sheet: | Rev: |
|---|---|---|---|---|
| A3 | 1:300,000 | 5214106 | 1 of 1 | P02 |

## SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

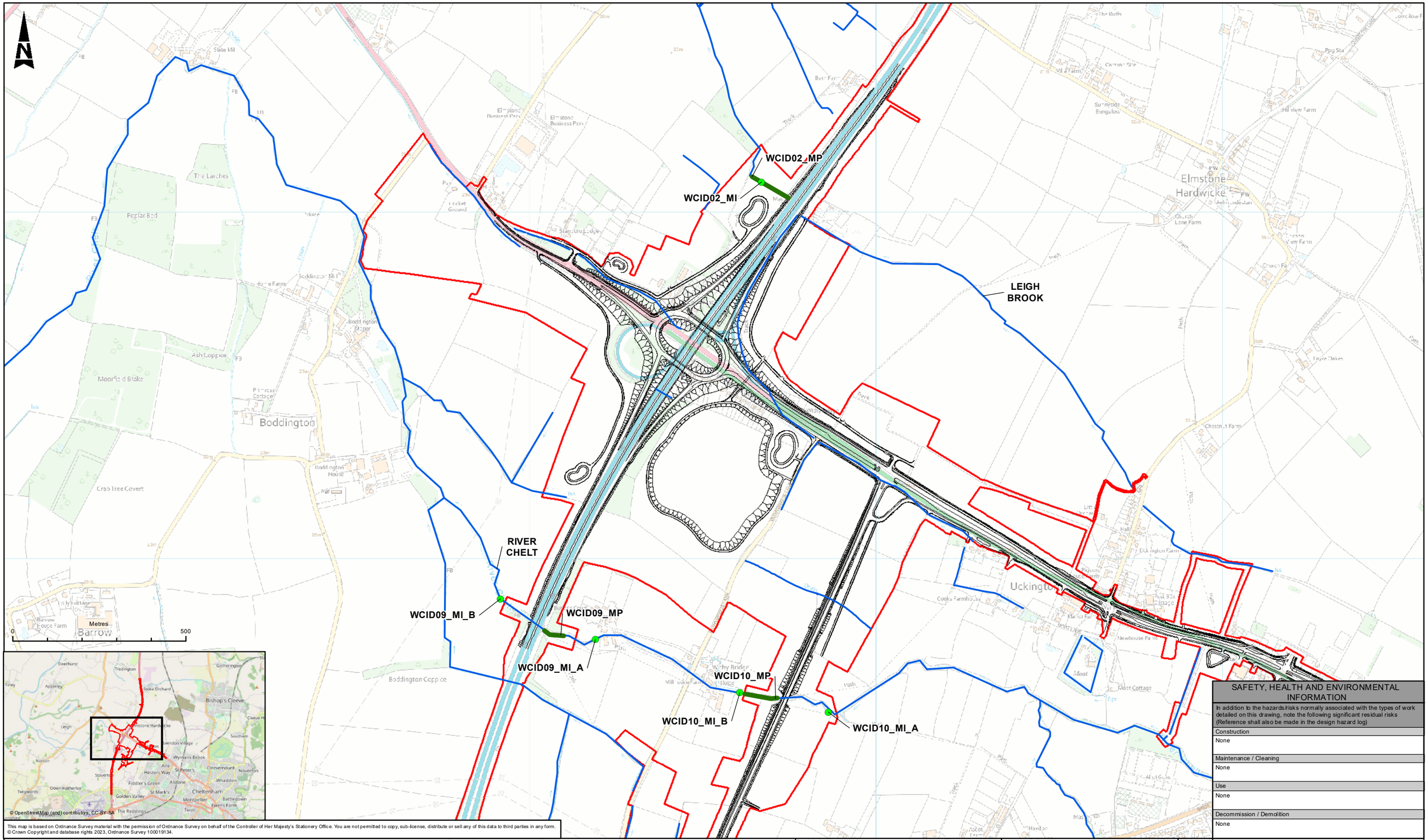
In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made in the design hazard log)

**Construction**
None

**Maintenance / Cleaning**
None

**Use**
None

**Decommission / Demolition**
None









LEGEND

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

**SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION**

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made in the design hazard log)

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

| Description | Status | Revision | Drawn | Checked | Reviewed | Authorised | Issue Date |
|---|---|---|---|---|---|---|---|
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| PUBLISHED | A1 | P02 | EM | LH | CC | LJ | 120923 |

Drawing Suitability: **PUBLISHED**

Status: **A1**

Project Title: M5 Junction 10 Improvements Scheme

Drawing Title: FIGURE 7-14B AQUATIC ECOLOGY SURVEY LOCATIONS

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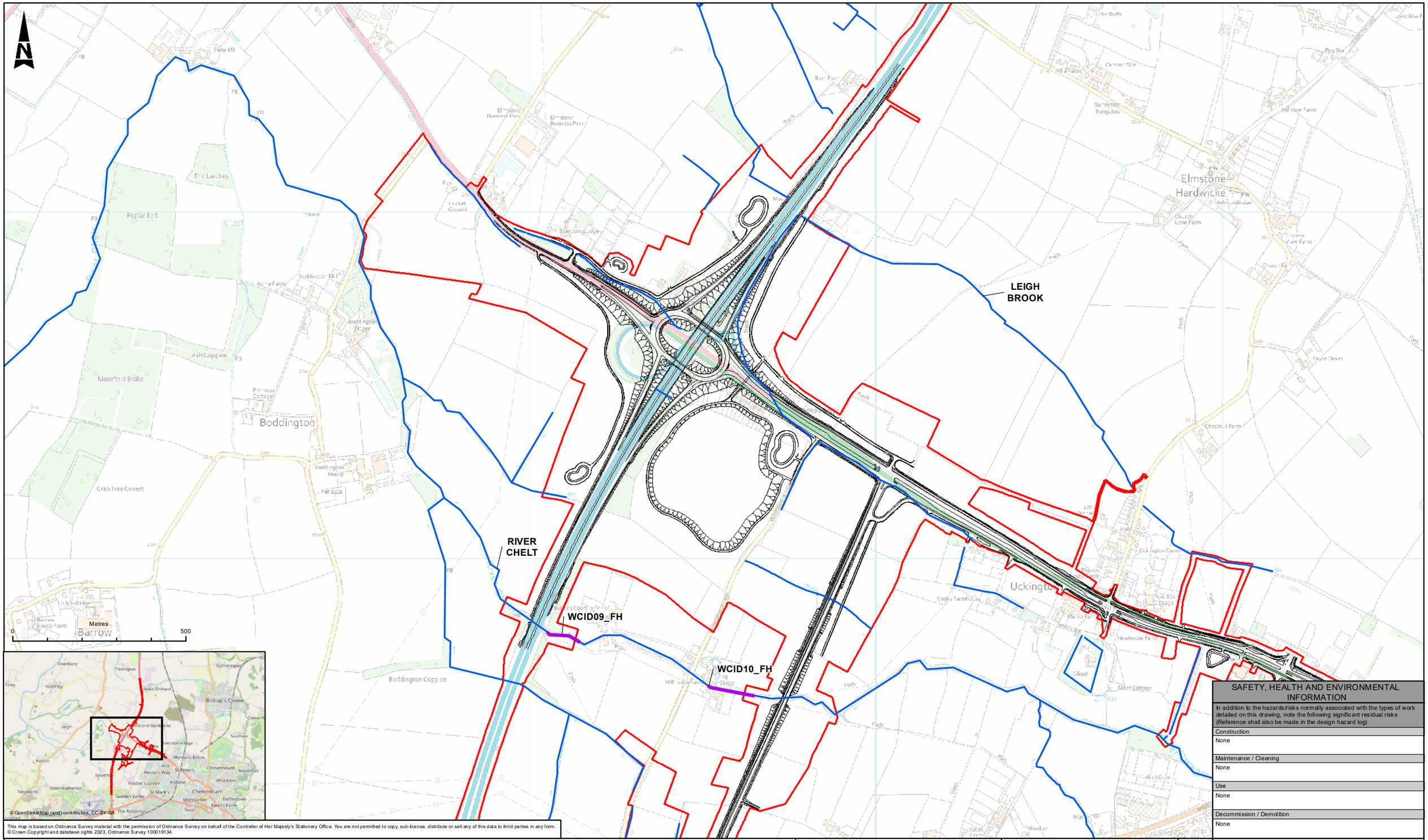
Client: Gloucestershire County Council

Drawing Number: GCCM5J10 - ATK - EBD ZZ - GS - GI - 000083

(Project | Originator | Volume | Location | Type | Role | Number)

| Original Size: | Scale | Project Ref: | Sheet: | Rev: |
|---|---|---|---|---|
| A3 | 1:10,000 | 5214106 | 1 of 4 | P02 |






LEGEND

- ORDER LIMITS
- SCHEME ALIGNMENT
- WATERCOURSES
- FISH SURVEY LOCATIONS

**SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION**

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made in the design hazard log)

**Construction**
None

**Maintenance / Cleaning**
None

**Use**
None

**Decommission / Demolition**
None

| Description | Status | Revision | Drawn | Checked | Reviewed | Authorised | Issue Date |
|---|---|---|---|---|---|---|---|
| PUBLISHED | A1 | P02 | EM | LH | CC | LJ | 120923 |

Drawing Suitability: PUBLISHED — Status: A1

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Client: Gloucestershire County Council

Project Title: M5 Junction 10 Improvements Scheme

Drawing Title: FIGURE 7-14B AQUATIC ECOLOGY SURVEY LOCATIONS

Drawing Number: GCCM5J10 - ATK - EBD ZZ - GS - GI - 000083

| Original Size: | Scale | Project Ref: | Sheet: | Rev: |
|---|---|---|---|---|
| A3 | 1:10,000 | 5214106 | 2 of 4 | P02 |

WCID02_RHS

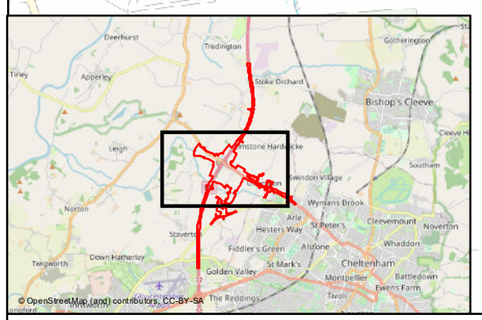
LEIGH BROOK

RIVER CHELT

WCID09_RHS

WCID10_RHS

Metres
0 500






LEGEND

- ORDER LIMITS
- SCHEME ALIGNMENT
- WATERCOURSES
- RIVER HABITAT SURVEY LOCATIONS

## SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made in the design hazard log)

**Construction**
None

**Maintenance / Cleaning**
None

**Use**
None

**Decommission / Demolition**
None

| Description | Status | Revision | Drawn | Checked | Reviewed | Authorised | Issue Date |
|---|---|---|---|---|---|---|---|
| | | | | | | | |
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| PUBLISHED | A1 | P02 | EM | LH | CC | LJ | 120923 |

Drawing Suitability: PUBLISHED
Status: A1

Project Title: M5 Junction 10 Improvements Scheme

Drawing Title: FIGURE 7-14B AQUATIC ECOLOGY SURVEY LOCATIONS

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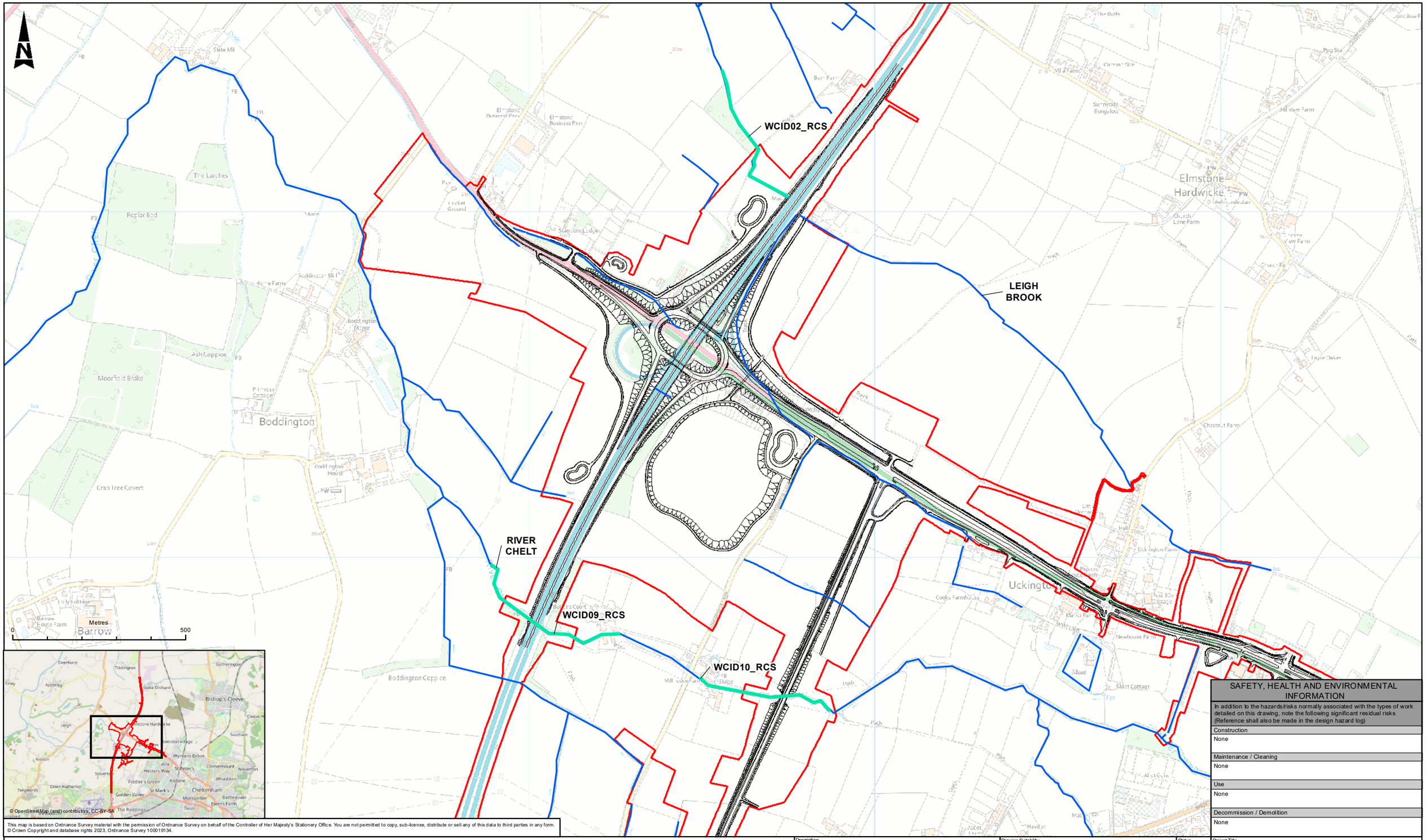
Client: Gloucestershire County Council

Drawing Number: GCCM5J10 - ATK - EBD ZZ - GS - GI - 000083
(Project | Originator | Volume | Location | Type | Role | Number)

| Original Size: | Scale | Project Ref: | Sheet: | Rev: |
|---|---|---|---|---|
| A3 | 1:10,000 | 5214106 | 3 of 4 | P02 |






LEGEND

- ORDER LIMITS
- SCHEME ALIGNMENT
- WATERCOURSES
- RIVER CORRIDOR SURVEY LOCATIONS

**SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION**

In addition to the hazards/risks normally associated with the types of work detailed on this drawing, note the following significant residual risks (Reference shall also be made in the design hazard log)

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

| Description | Status | Revision | Drawn | Checked | Reviewed | Authorised | Issue Date |
|---|---|---|---|---|---|---|---|
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| | | | | | | | |
| PUBLISHED | A1 | P02 | EM | LH | CC | LJ | 120923 |

Drawing Suitability: PUBLISHED

Status: A1

Project Title: M5 Junction 10 Improvements Scheme

Drawing Title: FIGURE 7-14B AQUATIC ECOLOGY SURVEY LOCATIONS

ATKINS
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Client: Gloucestershire County Council

Drawing Number: GCCM5J10 - ATK - EBD ZZ - GS - GI - 000083

(Project | Originator | Volume | Location | Type | Role | Number)

| Original Size: | Scale | Project Ref: | Sheet: | Rev: |
|---|---|---|---|---|
| A3 | 1:10,000 | 5214106 | 4 of 4 | P02 |

# Appendix C. Severn Estuary SAC Screening Matrix

| Severn Estuary SAC Screening Matrix | | |
|---|---|---|
| Project | M5 Junction 10 Improvements Scheme | |
| European Site under Consideration | Severn Estuary SAC | |
| Date: | Author (Name/Organisation): | Verified (Name/Organisation) |
| August 2021 | Associate Ecologist<br>Atkins | Associate Director<br>Atkins |
| Description of Project<br>Describe any likely direct, indirect or secondary impacts of the project (either alone or in-combination with other plans or projects) on the European Site by virtue of: | | |
| Size and scale (road type and probable traffic volume) | The M5 Junction 10 Improvements Scheme involves construction of improvement works to M5 Junction 10, consisting of a new all-movements motorway junction; a new West Cheltenham Link Road (the Link Road from the A4019 to the B4634 (Old Gloucester Road)), and the widening of the A4019 (Tewkesbury Road) east of the junction to the Gallagher Retail Park Junction. A small section of the A4019 will be realigned to the west of the junction. | |
| Land-take | The Scheme would not require land-take from the SAC. | |
| Distance from the European Site or key features of the site (from edge of the project assessment corridor) | The Scheme is 21 km north east of the SAC, or approx. 40 km via the shortest hydrological connection. | |
| Resource requirements (from the European Site or from areas in proximity to the site, where of relevance to consideration of impacts) | The Scheme does not require resources from the SAC. | |
| Emissions (e.g. polluted surface water runoff – both soluble and insoluble pollutants, atmospheric pollution) | Although there is a direct hydrological connection between the Scheme and the Severn Estuary SAC, at such a distance, it is considered that the potential for direct impacts via release of pollutants from the Scheme would be eliminated by dilution. LA 113 states that "for assessment of impacts associated with soluble pollutants, outfalls within 1 km (measured along the watercourse) shall be aggregated for the purposes of cumulative assessment[100]". It therefore follows that soluble pollutants are considered to be sufficiently diluted beyond 1 km. | |

[100] Highways England (2020). Design Manual for Roads and Bridges LA 113 Road drainage and the water environment (formerly HD 45/09). (March 2020, version 1) Online: d6388f5f-2694-4986-ac46-b17b62c21727 (standardsforhighways.co.uk)

| Severn Estuary SAC Screening Matrix | |
|---|---|
| | Although not relied upon for the screening conclusions, pollution prevention methods will be in place including standard water protection measures to avoid chemical or sediment pollution of any watercourses. Works will proceed following standard good practice working methods for environmental protection which will adhere to the Guidance for Pollution Prevention (GPPs)[101] and the Construction Industry Research and Information Association[102] (CIRIA) C715 Environmental good practice. These will be secured via the Register of Environmental Actions and Commitments (REAC) (application document TR010063 – APP 7.4).<br>The drainage strategy to be implemented by the Scheme incorporates SuDS to mitigate the pollution risk associated with road runoff as well as accidental spills.<br>However, given the relatively small size of the proposed works in comparison with the distance, size and mixing of the receptor designations, risks of significant spillage of chemical contaminant or silt pollution could be discounted even without any additional pollution controls.<br>The SAC is located beyond the distance from any construction activity at which dust from demolition or construction would be a potential impact, and more than 200 m from the ARN. Therefore, no air quality impacts are anticipated. |
| Excavation requirements (e.g. impacts of local hydrogeology) | At a distance of 21 km, excavation works associated with the Scheme will not impact the local hydrogeology of the SAC. |
| Transportation requirements | Construction traffic will not be routed in the vicinity of the SAC. |
| Duration of construction, operation, etc | The Scheme would be constructed between 2025 and 2027. |
| Other | Not applicable (N/A) |
| Description of avoidance and/or mitigation measures<br>Describe any assumed (plainly established and uncontroversial) mitigation measures, including information on: | |
| Nature of proposals | Mitigation has not been considered as part of the screening assessment. |
| Location | N/A |
| Evidence for effectiveness | N/A |
| Mechanism for delivery (legal conditions, restrictions or other legally enforceable obligations) | N/A |

[101] https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/guidance-for-pollution-prevention-gpps-full-list/
[102] CIRIA (2006), CIRIA C648 Control of water pollution from linear construction projects Technical guidance. London.

| Severn Estuary SAC Screening Matrix | |
|---|---|
| Characteristics of European Site(s)<br>A brief description of the European Site to be produced, including information on: | |
| Name of European Site and its EU code | Severn Estuary SAC (UK0013030) |
| Location and distance of the European Site from the proposed works | The SAC is located 21 km south west of the Scheme, or 40 km downstream via the shortest hydrological connection. |
| European Site size | 73,714.11 ha |
| Key features of the European Site including the primary reasons for selection and any other qualifying interests | Annex I habitats that are a primary reason for selection of this site:<br>• 1130 Estuaries.<br>• 1140 Mudflats and sandflats not covered by seawater at low tide.<br>• 1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*).<br>Annex I habitats present as a qualifying feature, but not a primary reason for selection of this site:<br>• 1110 Sandbanks which are slightly covered by sea water all the time.<br>• 1170 Reefs.<br>• Annex II species that are a primary reason for selection of this site:<br>• 1095 Sea lamprey (*Petromyzon marinus*).<br>• 1099 River lamprey (*Lampetra fluvitalis*).<br>• 1103 Twaite shad (*Alosa fallax*). |
| Vulnerability of the European Site – any information available from the standard data forms on potential effect pathways | Principal threats and pressures comprise:<br>• Other urbanisation, industrial and similar activities;<br>• Changes in abiotic conditions;<br>• Human induced changes in hydraulic conditions;<br>• Outdoor sports and leisure activities; and<br>• Modification of cultivation practices. |
| European Site conservation objectives – where these are readily available | Ensure that the integrity of the site is maintained or restored as appropriate, and ensure that the site contributes to achieving the Favourable Conservation Status of its Qualifying Features, by maintaining or restoring:<br>The extent and distribution of qualifying habitats and habitats of qualifying species;<br>The structure and function (including typical species) of qualifying natural habitats;<br>The structure and function of the habitats of qualifying species;<br>The supporting processes on which qualifying natural habitats and the habitats of qualifying species rely;<br>The populations of qualifying species; and<br>The distribution of qualifying species within the site. |
| Assessment criteria | |

| Severn Estuary SAC Screening Matrix | |
|---|---|
| Describe the individual elements of the project (either alone or in-combination with other plans or projects) likely to give rise to impacts on the European Site. | |
| The Scheme is located approximately 21 km from the SAC or 40 km via the shortest hydrological connection. Potential impact pathways have been identified via the hydrological connection and via construction impacts on habitats that might be functionally linked to fish populations associated with the SAC site. The assessment below discusses these potential impact pathways in more detail. | |
| Initial assessment<br>The key characteristics of the site and the details of the European Site should be considered in identifying potential impacts.<br>Describe any likely changes to the site arising as a result of: | |
| Reduction of habitat area | The Scheme would not result in a reduction in habitat area from within the SAC. The Scheme may result in a temporary reduction in the extent of functionally linked habitat in the event that dewatering part of the River Chelt channel is required during construction. |
| Disturbance to key species | The Scheme is too far from the SAC for there to be any disturbance to species within the SAC itself.<br>Survey results and desk study records indicate that river lamprey[103] are potentially present in the vicinity of the Scheme within the River Chelt. As such, there is potential for short-term impacts to this species within or surrounding the Scheme as a result of noise or vibration disturbance during construction of the new Link Road, in particular the construction of the new bridge over the River Chelt. The new bridge abutments will be set back from the banks of the River Chelt by 4 m. Rotary piling will be required in the construction of the bridge. In addition, a temporary River Chelt crossing will be required during construction.<br>There is also the potential for injury/mortality to river lamprey ammocoetes if they are present within burrows in the sediment of the River Chelt in the event that dewatering of part of the channel is required during construction. |
| Habitat or species fragmentation | Although the Scheme would not result in a physical barrier to fish migration, the disturbance and pollution impacts described above and below respectively could potentially result in habitat fragmentation/barrier effects. |
| Reduction in species density | The Scheme would not result in a reduction in species density within the SAC. |
| Changes in key indicators of conservation value (water quality, etc) | Water quality impacts to functionally linked habitat within the River Chelt as a result of a pollution event during construction and operation, and consequent detrimental effects to migratory river lamprey cannot be ruled out.<br>Such impacts could arise through changes to water quality as a result of mobilization of suspended sediments leading to silt laden runoff entering watercourses; and potential for accidental |

[103] Two brook/river lamprey ammocoetes (young/larvae) were recorded. It is difficult to distinguish between brook and river lamprey when in the ammocoete stage. As a precaution, they are assumed to be river lamprey.

| Severn Estuary SAC Screening Matrix | |
|---|---|
| | contamination associated with the spillage or leakage of fuels, lubricants and other chemicals required for construction. In particular, such impacts could occur during the construction of the new bridge over the River Chelt and the temporary River Chelt crossing. Operational phase water quality impacts could arise as a result of contaminated road runoff entering the River Chelt. |
| Climate change | Climate change is not listed as a threat or pressure in relation to this site. |
| Describe any likely impacts on the European Site as a whole in terms of: | |
| Interference with the key relationships that define the structure of the site | The evidence indicates that water quality impacts to functionally linked habitat within the River Chelt as a result of a pollution event during construction and operation, and consequent detrimental effects to migratory river lamprey cannot be ruled out. |
| Interference with key relationships that define the function of the site | Disturbance impacts to migratory river lamprey using functionally linked habitat within the River Chelt during construction cannot be ruled out.<br>Injury or mortality to river lamprey ammocoetes if they are present within burrows in the sediment of the River Chelt in the event that dewatering of part of the channel is required during construction cannot be ruled out.<br>Fragmentation as a result of disturbance and pollution, which could result in barrier effects, with river lamprey unable to disperse or move along the River Chelt, cannot be ruled out. |
| Indicate the significance as a result of the identification of impacts set out above in terms of: | |
| Reduction of habitat area | Potential LSE in relation to functionally linked habitat |
| Disturbance to key species | Potential LSE |
| Habitat or species fragmentation | Potential LSE |
| Loss | N/A |
| Fragmentation | N/A |
| Disruption | N/A |
| Disturbance | N/A |
| Change to key elements of the site (e.g. water quality, hydrological regime etc) | Potential LSE |
| Describe from the above those elements of the project, or combination of elements, where the above impacts are likely to be significant or where the scale or magnitude of impacts is not known. | |
| Construction of the new bridge over the River Chelt, construction of the temporary River Chelt crossing, dewatering part of the River Chelt channel (if required), operational phase water quality impacts. | |

| Severn Estuary SAC Screening Matrix | |
|---|---|
| Outcome of screening stage | Potential for a LSE |
| Are the appropriate statutory environmental bodies in agreement with this conclusion (delete as appropriate and attach relevant correspondence). | Yes |

# Appendix D. Severn Estuary Ramsar Site Screening Matrix

| Severn Estuary Ramsar Site Screening Matrix | | |
|---|---|---|
| Project | M5 Junction 10 Improvements Scheme | |
| European Site under Consideration | Severn Estuary Ramsar Site | |
| Date: | Author (Name/Organisation): | Verified (Name/Organisation) |
| November 2019 | Associate Ecologist<br>Atkins | Associate Director<br>Atkins |
| Description of Project<br>Describe any likely direct, indirect or secondary impacts of the project (either alone or in-combination with other plans or projects) on the European Site by virtue of: | | |
| Size and scale (road type and probable traffic volume) | The M5 Junction 10 Improvements Scheme involves construction of improvement works to M5 Junction 10, consisting of a new all-movements motorway junction; a new West Cheltenham Link Road (the Link Road from the A4019 to the B4634 (Old Gloucester Road)), and the widening of the A4019 (Tewkesbury Road) east of the junction to the Gallagher Retail Park Junction. A small section of the A4019 will be realigned to the west of the junction. | |
| Land-take | The Scheme would not require land-take from the Ramsar site. | |
| Distance from the European Site or key features of the site (from edge of the project assessment corridor) | The Scheme is 21 km north east of the Ramsar site, or approx. 40 km via the shortest hydrological connection. | |
| Resource requirements (from the European Site or from areas in proximity to the site, where of relevance to consideration of impacts) | The Scheme does not require resources from the Ramsar site. | |
| Emissions (e.g. polluted surface water runoff – both soluble and insoluble pollutants, atmospheric pollution) | Although there is a direct hydrological connection between the Scheme and the Severn Estuary Ramsar Site, at such a distance, it is considered that the potential for direct impacts via release of pollutants from the Scheme would be eliminated by dilution. LA 113 states that "for assessment of impacts associated with soluble pollutants, outfalls within 1 km (measured along the watercourse) shall be aggregated for the purposes of cumulative assessment[104]". It therefore follows that soluble pollutants are considered to be sufficiently diluted beyond 1 km. | |

[104] Highways England (2020). Design Manual for Roads and Bridges LA 113 Road drainage and the water environment (formerly HD 45/09). (March 2020, version 1) Online: d6388f5f-2694-4986-ac46-b17b62c21727 (standardsforhighways.co.uk)

| Severn Estuary Ramsar Site Screening Matrix | |
|---|---|
| | Although not relied upon for the screening conclusions, pollution prevention methods will be in place including standard water protection measures to avoid chemical or sediment pollution of any watercourses. Works will proceed following standard good practice working methods for environmental protection which should adhere to the Guidance for Pollution Prevention (GPPs)[105] and the Construction Industry Research and Information Association[106] (CIRIA) C715 Environmental good practice. These will be secured via the Register of Environmental Actions and Commitments (REAC) (application document TR010063 – APP 7.4).<br>The drainage strategy to be implemented by the Scheme incorporates SuDS to mitigate the pollution risk associated with road runoff as well as accidental spills.<br>However, given the relatively small size of the proposed works in comparison with the distance, size and mixing of the receptor designations, risks of significant spillage of chemical contaminant or silt pollution could be discounted even without any additional pollution controls.<br>The Ramsar site is located beyond the distance from any construction activity at which dust from demolition or construction would be a potential impact, and more than 200 m from the ARN. Therefore, no air quality impacts are anticipated. |
| Excavation requirements (e.g. impacts of local hydrogeology) | At a distance of 21 km, excavation works associated with the Scheme will not impact the local hydrogeology of the Ramsar site. |
| Transportation requirements | Construction traffic will not be routed in the vicinity of the Ramsar site. |
| Duration of construction, operation, etc | The Scheme would be constructed between 2025 and 2027. |
| Other | Not applicable (N/A) |
| Description of avoidance and/or mitigation measures<br>Describe any assumed (plainly established and uncontroversial) mitigation measures, including information on: | |
| Nature of proposals | Mitigation has not been considered as part of the screening assessment. |
| Location | N/A |
| Evidence for effectiveness | N/A |
| Mechanism for delivery (legal conditions, restrictions or other legally enforceable obligations) | N/A |

[105] https://www.netregs.org.uk/environmental-topics/guidance-for-pollution-prevention-gpp-documents/guidance-for-pollution-prevention-gpps-full-list/
[106] CIRIA (2006), CIRIA C648 Control of water pollution from linear construction projects Technical guidance. London.

| Severn Estuary Ramsar Site Screening Matrix | |
|---|---|
| Characteristics of European Site(s)<br>A brief description of the European Site to be produced, including information on: | |
| Name of European Site and its EU code | Severn Estuary Ramsar Site (UK11081) |
| Location and distance of the European Site from the proposed works | The Ramsar site is located 21 km south west of the Scheme, or 40 km downstream via the shortest hydrological connection. |
| European Site size | 24,662.98 ha |
| Key features of the European Site including the primary reasons for selection and any other qualifying interests | Ramsar criterion 1:<br>Due to immense tidal range (second-largest in world), this affects both the physical environment and biological communities.<br>Habitats Directive Annex I features present on the SAC include:<br>• H1110 Sandbanks which are slightly covered by sea water all the time.<br>• H1130 Estuaries.<br>• H1140 Mudflats and sandflats not covered by seawater at low tide.<br>• H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*).<br><br>Ramsar criterion 3:<br>Due to unusual estuarine communities, reduced diversity and high productivity.<br><br>Ramsar criterion 4:<br>This site is important for the run of migratory fish between sea and river via estuary. Species include salmon (*Salmo salar*), sea trout (*S. trutta*), sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*), allis shad (*Alosa alosa*), twaite shad (*A. fallax*), and European eel (*Anguilla anguilla*). It is also of particular importance for migratory birds during spring and autumn.<br>Ramsar criterion 8:<br>The fish assemblage of the whole estuarine and river system is one of the most diverse in Britain, with over 110 species recorded. Salmon, sea trout, sea lamprey, river lamprey, allis shad, twaite shad and European eel use the Severn Estuary as a key migration route to their spawning grounds in the many tributaries that flow into the estuary. The site is important as a feeding and nursery ground for many fish species, particularly allis shad and twaite shad, which feed on mysid shrimps in the salt wedge.<br><br>Ramsar criterion 5:<br>Assemblages of international importance:<br>Species with peak counts in winter:<br>70,919 waterfowl (5 year peak mean 1998/99-2002/03) |

| Severn Estuary Ramsar Site Screening Matrix | |
|---|---|
| | Ramsar criterion 6 – species/populations occurring at levels of international importance:<br>Qualifying species/populations (as identified at designation):<br>Species with peak counts in winter:<br>• Tundra swan (*Cygnus columbianus bewickii*), NW Europe - 229 individuals, representing an average of 2.8% of the GB population (5 year peak mean 1998/9-2002/3).<br>• Greater white-fronted goose (*Anser albifrons albifrons*), NW Europe – 2,076 individuals, representing an average of 35.8% of the GB population (5 year peak mean for 1996/7-2000/01).<br>• Common shelduck (*Tadorna tadorna*), NW Europe – 3,223 individuals, representing an average of 1% of the population (5 year peak mean 1998/9-2002/3).<br>• Gadwall (*Anas strepera strepera*), NW Europe - 241 individuals, representing an average of 1.4% of the GB population (5 year peak mean 1998/9-2002/3).<br>• Dunlin (*Calidris alpina alpine*), W Siberia/W Europe – 25,082 individuals, representing an average of 1.8% of the population (5 year peak mean 1998/9-2002/3).<br>• Common redshank (*Tringa totanus tetanus*) - 2,616 individuals, representing an average of 1% of the population (5 year peak mean 1998/9-2002/3).<br>Species/populations identified subsequent to designation for possible future consideration under criterion 6:<br>Species regularly supported during the breeding season:<br>• Lesser black-backed gull (*Larus fuscus graellsii*), W Europe/Mediterranean/W Africa – 4,167 apparently occupied nests, representing an average of 2.8% of the breeding population (Seabird 2000 Census).<br>• Species with peak counts in spring/autumn:<br>• Ringed plover (*Charadrius hiaticula*), Europe/Northwest Africa - 740 individuals, representing an average of 1% of the population (5 year peak mean 1998/9-2002/3).<br>• Species with peak counts in winter:<br>• Eurasian teal (*Anas crecca*), NW Europe – 4,456 individuals, representing an average of 1.1% of the population (5 year peak mean 1998/9-2002/3).<br>• Northern pintail (*Anas acuta*), NW Europe - 756 individuals, representing an average of 1.2% of the population (5 year peak mean 1998/9-2002/3). |
| Vulnerability of the European Site – any information available from the standard data forms on potential effect pathways | Factors (past, present or potential) adversely affecting the site's ecological character:<br>• Dredging.<br>• Erosion.<br>• Recreational/tourism disturbance. |
| European Site conservation objectives – | No specific conservation objectives found. |

| Severn Estuary Ramsar Site Screening Matrix | |
|---|---|
| where these are readily available | The overarching objective of the Ramsar Convention is to stem the loss and progressive encroachment on wetlands now and in the future. |
| Assessment criteria<br>Describe the individual elements of the project (either alone or in combination with other plans or projects) likely to give rise to impacts on the European Site. | |
| The Scheme is located approx. 21 km from the Ramsar site or 40 km via the shortest hydrological connection. Potential impact pathways have been identified via the hydrological connection and via construction impacts on habitats that might be functionally linked to bird and fish populations associated with the Ramsar site. The assessment below discusses these potential impact pathways in more detail. | |
| Initial assessment<br>The key characteristics of the site and the details of the European Site should be considered in identifying potential impacts.<br>Describe any likely changes to the site arising as a result of: | |
| Reduction of habitat area | The Scheme would not result in a reduction in habitat area from within the Ramsar site.<br>Monthly wintering and migratory bird surveys were undertaken within 250 m of the Scheme from September 2019 to March 2020 inclusive.<br>Lesser black-backed gull was recorded in reasonably high numbers on one occasion (a peak count of 148 in September 2019).<br>It is considered that these individuals are likely to be from breeding populations within urban areas such as Cheltenham and/or Gloucester, which are closer to the Scheme than the Ramsar site breeding colonies at Steep Holm and Flat Holm[107] (approximately 90 km south west). Cheltenham Borough Council states that "Lesser Black-Backed Gulls nest in the residential areas of Cheltenham and on industrial units in the Kingsditch area"[108]. The JNCC Seabird Monitoring Programme online database states that the Gloucestershire Urban Gulls Cheltenham site (85627) supported 273 lesser black-backed gull apparently occupied territories in 2011 (year of last count) and the Gloucester City: Gloucester site (86737) supported 2230 lesser black-backed gull apparently occupied nests in 2009 (year of last count)[109]. It follows that the lesser black-backed gulls recorded are unlikely to be part of the Ramsar qualifying feature population.<br>The habitats within the Survey Area are not considered to provide a role in maintaining the Ramsar Site bird populations.<br>Survey results and desk study records indicate that European eel, Atlantic salmon, sea trout and river lamprey are present in the vicinity of the Scheme within the River Chelt. The Scheme may result in a temporary reduction in the extent of functionally linked |

[107] Burton, N.H.K., Musgrove, A.J., Rehfisch, M.M., and Clark N.A. (2010) Birds of the Severn Estuary and Bristol Channel: Their current status and key environmental issues. Marine Pollution Bulletin 61 (2010) 115–123
[108] Cheltenham Borough Council (2018) Urban Gulls Scrutiny Task Group Report. Available at: https://democracy.cheltenham.gov.uk/documents/s27390/2018_12_04_CAB_Urban_Gulls_scrutiny_report.pdf
[109] Available at https://app.bto.org/seabirds/public/index.jsp

| Severn Estuary Ramsar Site Screening Matrix | |
|---|---|
| | habitat in the event that dewatering part of the River Chelt channel is required during construction. |
| Disturbance to key species | The Scheme is too far from the Ramsar site for there to be any disturbance to species within the Ramsar Site itself.<br>Survey results and desk study records indicate that European eel, Atlantic salmon, sea trout and river lamprey[110] are present, or potentially present, in the vicinity of the Scheme within the River Chelt. As such, there is potential for short-term impacts to these species within or surrounding the Scheme as a result of noise or vibration disturbance during construction of the new Link Road, in particular the construction of the new bridge over the River Chelt. The new bridge abutments will be set back from the banks of the River Chelt by 4 m. Rotary piling will be required in the construction of the bridge. In addition, a temporary River Chelt crossing will be required during construction.<br>There is also the potential for mortality to river lamprey ammocoetes if they are present within burrows in the sediment of the River Chelt in the event that dewatering of part of the channel is required during construction.<br>The Scheme would not result in disturbance of qualifying bird species within functionally linked habitats, as there is not considered to be a significant functional linkage between the Scheme and the qualifying feature populations (see above).<br>Recreational disturbance to functionally linked habitats at Coombe Hill Canal SSSI (Coombe Hill Canal SSSI is of high importance to all of the wintering surface-feeding ducks and lapwing, and is of high importance to mallard and snipe in autumn and to gadwall and mallard in spring) as a result of the Scheme facilitating housing developments in the area has been ruled out. This is on the basis that there are planning policies in place to deal with the potential effects and ensure that cumulative effects do not occur. Such planning policies are relevant to, and will be implemented by, the surrounding housing developments. |
| Habitat or species fragmentation | Although the Scheme would not result in a physical barrier to fish migration, the disturbance and pollution impacts described above and below respectively could potentially result in habitat fragmentation/barrier effects. |
| Reduction in species density | The Scheme would not result in a reduction in species density within the Ramsar site. |
| Changes in key indicators of conservation value (water quality, etc) | Water quality impacts to functionally linked habitat within the River Chelt as a result of a pollution event during construction and operation, and consequent detrimental effects to migratory European eel, Atlantic salmon, sea trout and river lamprey associated with the Severn Estuary Ramsar Site, cannot be ruled out.<br>Such impacts could arise through changes to water quality as a result of mobilization of suspended sediments leading to silt laden runoff entering watercourses; and potential for accidental |

[110] Two brook/river lamprey ammocoetes (young/larvae) were recorded. It is difficult to distinguish between brook and river lamprey when in the ammocoete stage. As a precaution, they are assumed to be river lamprey.

| Severn Estuary Ramsar Site Screening Matrix | |
|---|---|
| | contamination associated with the spillage or leakage of fuels, lubricants and other chemicals required for construction. In particular, such impacts could occur during the construction of the new bridge over the River Chelt and the temporary River Chelt crossing. Operational phase hydrological impacts could arise as a result of contaminated road runoff entering the River Chelt. |
| Climate change | Climate change is not listed as a threat or pressure in relation to this site. |
| Describe any likely impacts on the European Site as a whole in terms of: | |
| Interference with the key relationships that define the structure of the site | The evidence indicates that water quality impacts to functionally linked habitat within the River Chelt as a result of a pollution event during construction and operation, and consequent detrimental effects to migratory European eel, Atlantic salmon, sea trout and river lamprey associated with the Severn Estuary Ramsar Site cannot be ruled out. |
| Interference with key relationships that define the function of the site | Disturbance impacts to migratory European eel, Atlantic salmon, sea trout and river lamprey associated with the Severn Estuary Ramsar Site using functionally linked habitat within the River Chelt during construction cannot be ruled out.<br>Injury or mortality to river lamprey ammocoetes if they are present within burrows in the sediment of the River Chelt in the event that dewatering of part of the channel is required during construction cannot be ruled out.<br>Fragmentation as a result of disturbance and pollution, which could result in barrier effects, with European eel, Atlantic salmon, sea trout and river lamprey unable to disperse or move along the River Chelt, cannot be ruled out. |
| Indicate the significance as a result of the identification of impacts set out above in terms of: | |
| Reduction of habitat area | Potential LSE in relation to functionally linked habitat |
| Disturbance to key species | Potential LSE |
| Habitat or species fragmentation | Potential LSE |
| Loss | N/A |
| Fragmentation | N/A |
| Disruption | N/A |
| Disturbance | N/A |
| Change to key elements of the site (e.g. water quality, hydrological regime etc) | Potential LSE |
| Describe from the above those elements of the project, or combination of elements, where the above impacts are likely to be significant or where the scale or magnitude of impacts is not known. | |

| Severn Estuary Ramsar Site Screening Matrix | |
|---|---|
| Construction of the new bridge over the River Chelt, construction of the temporary River Chelt crossing, dewatering part of the River Chelt channel (if required), operational phase water quality impacts. | |
| Outcome of screening stage | Potential for a LSE |
| Are the appropriate statutory environmental bodies in agreement with this conclusion (delete as appropriate and attach relevant correspondence). | Yes |

# Appendix E. Severn Estuary SAC citation sheet

Severn Estuary SAC citation

Severn Estuary SAC standard data form

**EC Directive 92/43 on the Conservation of Natural Habitats and of Wild Fauna and Flora**
**Citation for Special Area of Conservation (SAC)**

| | |
|---|---|
| **Name:** | Severn Estuary/ Môr Hafren |
| **Unitary Authority/County:** | England: Bristol City, Gloucestershire, Bath & North East Somerset, Somerset, South Gloucestershire.<br>Wales: Bro Morgannwg/Vale of Glamorgan, Caerdydd/Cardiff, Casnewydd/ Newport, Sir Fynwy/ Monmouthshire. |
| **SAC status:** | Designated on 10 December 2009 |
| **Grid reference:** | ST321748 |
| **SAC EU code:** | UK0013030 |
| **Area (ha):** | 73715.40 |
| **Component SSSI:** | **Upper Severn Estuary SSSI, Severn Estuary SSSI, Bridgwater Bay SSSI.** |

**Site description:**
The Severn Estuary lies on the south west coast of Britain at the mouth of four major rivers (the Severn, Wye, Usk, and Avon). The immense tidal range (the second highest in the world) and classic funnel shape make the Severn Estuary unique in Britain and very rare worldwide. This tidal range creates strong tidal streams and high turbidity, producing communities characteristic of the extreme physical conditions of liquid mud and tide-swept sand and rocks.

The **Estuary** includes a wide diversity of habitats including **Sandbanks which are slightly covered by sea water all the time, Mudflats and sandflats not covered by sea water at low tide**, **Atlantic salt meadows**, and **Reefs**, which are identified as Annex I habitat types in their own right.

The intertidal zone of mudflats, sand banks, rocky platforms and saltmarsh is one of the largest and most important in Britain. The estuary has a diverse geological setting and a wide range of geo-morphological features, especially sediment deposits. It is important for the interpretation of coastline dynamics and land-forms, and also past changes, in sea level, sediment supply, climate and river flow. The estuary's overall interest depends on its large size, and on the processes and interrelationships between the intertidal and marine habitats and its fauna.

The fluctuating salinity and highly mobile sediments with consequent high turbidity limits the benthic invertebrates of the mud and sandflats to relatively few species. Those which are tolerant of such conditions occur in very high densities on the more stable mudflats. Beds of eel-grass *Zostera* spp. also occur on some mudflats. A greater variety of invertebrates occurs on the intertidal rock platforms, a more stable habitat with rock pools and a relatively high cover of seaweeds.

The estuary fringes have large areas of saltmarsh. These are often grazed by sheep and/or cattle, a significant factor determining the plant communities. A range of saltmarsh types is present, with both gradual and stepped transitions between bare mudflat and upper marsh.

The estuarine fauna includes: invertebrate populations of importance (especially as a food resource for a wide range of bird and fish species), internationally important populations of waterfowl; and large populations of migratory fish, including **Sea lamprey** *Petromyzon marinus*, **River lamprey** *Lampetra fluviatilis* (both of which spawn in freshwater but complete part of their life cycle in the sea), **Twaite shad** *Alosa fallax* and the nationally rare and endangered Allis Shad *Alosa alosa*.

**Qualifying habitats:** The site is designated under Article 4(4) of the Directive (92/43/EEC) as it hosts the following habitats listed in Annex I:

- Estuaries
- Sandbanks which are slightly covered by sea water all the time. (Subtidal sandbanks)
- Mudflats and sandflats not covered by seawater at low tide. (Intertidal mudflats and sandflats)
- Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)
- Reefs

**Qualifying species:** The site is designated under Article 4(4) of the Directive (92/43/EEC) as it hosts the following species listed in Annex II:

- Sea Lamprey (*Petromyzon marinus)*
- River Lamprey (*Lampetra fluviatilis)*
- Twaite Shad (*Alosa fallax)*

This citation relates to a site entered in the Register of European Sites for Great Britain.
Register reference number: UK0013030
Date of registration: 10 December 2009

[redacted]

On behalf of the Secretary of State for Environment, Food and Rural Affairs

# NATURA 2000 – STANDARD DATA FORM

## Special Areas of Conservation under the EC Habitats Directive (includes candidate SACs, Sites of Community Importance and designated SACs).

Each Natura 2000 site in the United Kingdom has its own Standard Data Form containing site-specific information. The data form for this site has been generated from the Natura 2000 Database submitted to the European Commission on the following date:

22/12/2015

The information provided here, follows the officially agreed site information format for Natura 2000 sites, as set out in the Official Journal of the European Union recording the Commission Implementing Decision of 11 July 2011 (2011/484/EU).

The Standard Data Forms are generated automatically for all of the UK's Natura 2000 sites using the European Environment Agency's Natura 2000 software. The structure and format of these forms is exactly as produced by the EEA's Natura 2000 software (except for the addition of this coversheet and the end notes). The content matches exactly the data submitted to the European Commission.

Please note that these forms contain a number of codes, all of which are explained either within the data forms themselves or in the end notes.

Further technical documentation may be found here
http://bd.eionet.europa.eu/activities/Natura_2000/reference_portal

As part of the December 2015 submission, several sections of the UK's previously published Standard Data Forms have been updated. For details of the approach taken by the UK in this submission please refer to the following document:
http://jncc.defra.gov.uk/pdf/Natura2000_StandardDataForm_UKApproach_Dec2015.pdf

More general information on Special Areas of Conservation (SACs) in the United Kingdom is available from the SAC home page on the JNCC website. This webpage also provides links to Standard Data Forms for all SACs in the UK.

Date form generated by the Joint Nature Conservation Committee
25 January 2016.

# NATURA 2000 - STANDARD DATA FORM

**For Special Protection Areas (SPA),**
**Proposed Sites for Community Importance (pSCI),**
**Sites of Community Importance (SCI) and**
**for Special Areas of Conservation (SAC)**

SITE **UK0013030**

SITENAME **Severn Estuary/ Môr Hafren**

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## 1. SITE IDENTIFICATION

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| 1.1 Type | 1.2 Site code |
|---|---|
| B | UK0013030 |

### 1.3 Site name

Severn Estuary/ Môr Hafren

| 1.4 First Compilation date | 1.5 Update date |
|---|---|
| 2007-08 | 2015-12 |

### 1.6 Respondent:


**Name/Organisation:** Joint Nature Conservation Committee

**Address:** Joint Nature Conservation Committee Monkstone House City Road Peterborough PE1 1JY

**Email:**


| | |
|---|---|
| **Date site proposed as SCI:** | 2007-08 |
| **Date site confirmed as SCI:** | 2008-12 |
| **Date site designated as SAC:** | 2010-12 |
| **National legal reference of SAC designation:** | Regulations 11 and 13-15 of the Conservation of Habitats and Species Regulations 2010 (http://www.legislation.gov.uk/uksi/2010/490/contents/made). |

## 2. SITE LOCATION

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### 2.1 Site-centre location [decimal degrees]:

| Longitude | Latitude |
|---|---|
| -2.978055556 | 51.46861111 |

### 2.2 Area [ha]:

73714.11

### 2.3 Marine area [%]

98.0

### 2.4 Sitelength [km]:

0.0

### 2.5 Administrative region code and name

| NUTS level 2 code | Region Name |
|---|---|
| UKL2 | East Wales |
| UKK2 | Dorset and Somerset |
| UKK1 | Gloucestershire, Wiltshire and Bristol/Bath area |
| UKZZ | Extra-Regio |

### 2.6 Biogeographical Region(s)

Atlantic (100.0 %)

## 3. ECOLOGICAL INFORMATION

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### 3.1 Habitat types present on the site and assessment for them

| Annex I Habitat types | | | | | | Site assessment | | | |
|---|---|---|---|---|---|---|---|---|---|
| Code | PF | NP | Cover [ha] | Cave [number] | Data quality | A\|B\|C\|D | A\|B\|C | | |
| | | | | | | Representativity | Relative Surface | Conservation | Global |
| 1110 | | | 11779.51 | | G | C | C | B | C |
| 1130 | | | 73677.25 | | G | A | A | B | B |
| 1140 | | | 20271.38 | | G | A | B | B | B |
| 1170 | | | 1474.28 | | P | C | C | A | C |
| 1310 | | | | | | D | | | |
| 1320 | | | 191.66 | | G | D | | | |
| 1330 | | | 656.06 | | G | A | B | B | A |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 2110 | | | | | | D | | | |

- **PF:** for the habitat types that can have a non-priority as well as a priority form (6210, 7130, 9430) enter "X" in the column PF to indicate the priority form.
- **NP:** in case that a habitat type no longer exists in the site enter: x (optional)
- **Cover:** decimal values can be entered
- **Caves:** for habitat types 8310, 8330 (caves) enter the number of caves if estimated surface is not available.
- **Data quality:** G = 'Good' (e.g. based on surveys); M = 'Moderate' (e.g. based on partial data with some extrapolation); P = 'Poor' (e.g. rough estimation)

### 3.2 Species referred to in Article 4 of Directive 2009/147/EC and listed in Annex II of Directive 92/43/EEC and site evaluation for them

| Species | | | | | Population in the site | | | | | | Site assessment | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| G | Code | Scientific Name | S | NP | T | Size | | Unit | Cat. | D.qual. | A\|B\|C\|D | A\|B\|C | | |
| | | | | | | Min | Max | | | | Pop. | Con. | Iso. | Glo. |
| F | 1102 | Alosa alosa | | | p | | | | P | DD | D | | | |
| F | 1103 | Alosa fallax | | | p | | | | P | DD | A | B | C | A |
| F | 1099 | Lampetra fluviatilis | | | p | | | | P | DD | C | B | C | B |
| F | 1095 | Petromyzon marinus | | | p | | | | P | DD | C | A | C | B |

- **Group:** A = Amphibians, B = Birds, F = Fish, I = Invertebrates, M = Mammals, P = Plants, R = Reptiles
- **S:** in case that the data on species are sensitive and therefore have to be blocked for any public access enter: yes
- **NP:** in case that a species is no longer present in the site enter: x (optional)
- **Type:** p = permanent, r = reproducing, c = concentration, w = wintering (for plant and non-migratory species use permanent)
- **Unit:** i = individuals, p = pairs or other units according to the Standard list of population units and codes in accordance with Article 12 and 17 reporting (see reference portal)
- **Abundance categories (Cat.):** C = common, R = rare, V = very rare, P = present - to fill if data are deficient (DD) or in addition to population size information
- **Data quality:** G = 'Good' (e.g. based on surveys); M = 'Moderate' (e.g. based on partial data with some extrapolation); P = 'Poor' (e.g. rough estimation); VP = 'Very poor' (use this category only, if not even a rough estimation of the population size can be made, in this case the fields for population size can remain empty, but the field "Abundance categories" has to be filled in)

## 4. SITE DESCRIPTION

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### 4.1 General site character

| Habitat class | % Cover |
|---|---|
| N03 | 1.0 |
| N02 | 99.0 |
| **Total Habitat Cover** | 100 |

**Other Site Characteristics**

1 Terrestrial: Soil & Geology: mud,clay,shingle,sedimentary,sand,peat  2 Terrestrial: Geomorphology and landscape: coastal  3 Marine:

Geology: sandstone/mudstone,pebble,sand,peat,gravel,shingle,sedimentary,cobble,biogenic reef,limestone/chalk,mud  4 Marine: Geomorphology: intertidal sediments (including sandflat/mudflat),estuary,subtidal rock (including rocky reefs),subtidal sediments (including sandbank/mudbank),intertidal rock,cliffs,pools,tidal rapids,islands,open coast (including bay),islands

### 4.2 Quality and importance

Sandbanks which are slightly covered by sea water all the time for which the area is considered to support a significant presence.  Estuaries for which this is considered to be one of the best areas in the United Kingdom.  Mudflats and sandflats not covered by seawater at low tide for which this is considered to be one of the best areas in the United Kingdom.  Reefs for which the area is considered to support a significant presence.  Atlantic salt meadows (Glauco-Puccinellietalia maritimae) for which this is considered to be one of the best areas in the United Kingdom.  Petromyzon marinus for which this is considered to be one of the best areas in the United Kingdom.  Lampetra fluviatilis for which this is considered to be one of the best areas in the United Kingdom.  Alosa fallax for which this is considered to be one of the best areas in the United Kingdom.

### 4.3 Threats, pressures and activities with impacts on the site

The most important impacts and activities with high effect on the site

| Negative Impacts | | | |
|---|---|---|---|
| Rank | Threats and pressures [code] | Pollution (optional) [code] | inside/outside [i\|o\|b] |
| H | E06 | | B |
| H | M01 | | B |
| H | J02 | | B |
| H | G01 | | I |
| H | A02 | | I |

| Positive Impacts | | | |
|---|---|---|---|
| Rank | Activities, management [code] | Pollution (optional) [code] | inside/outside [i\|o\|b] |
| H | A04 | | I |
| H | A02 | | I |
| M | G03 | | B |
| H | D05 | | I |

Rank: H = high, M = medium, L = low
Pollution: N = Nitrogen input, P = Phosphor/Phosphate input, A = Acid input/acidification,
T = toxic inorganic chemicals, O = toxic organic chemicals, X = Mixed pollutions
i = inside, o = outside, b = both

### 4.5 Documentation

Conservation Objectives - the Natural England links below provide access to the Conservation Objectives (and other site-related information) for its terrestrial and inshore Natura 2000 sites, including conservation advice packages and supporting documents for European Marine Sites within English waters and for cross-border sites. The Natural Resources Wales weblink below provides access to information on its designated sites. Detailed information about this Natura 2000 site can be accessed via the Management Plan link provided in Section 6.2. See also the 'UK Approach' document for more information (link via the JNCC website).

Link(s): http://publications.naturalengland.org.uk/category/6490068894089216

https://naturalresources.wales/conservation-biodiversity-and-wildlife/find-protected-areas-of-land-and-seas/designated-s

http://publications.naturalengland.org.uk/category/3212324
http://jncc.defra.gov.uk/pdf/Natura2000_StandardDataForm_UKApproach_Dec2015.pdf

## 5. SITE PROTECTION STATUS (optional)

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### 5.1 Designation types at national and regional level:

| Code | Cover [%] | Code | Cover [%] | Code | Cover [%] |
|---|---|---|---|---|---|
| UK04 | 22.7 | UK00 | 77.3 | UK01 | 3.4 |

# 6. SITE MANAGEMENT

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## 6.1 Body(ies) responsible for the site management:

| | |
|---|---|
| Organisation: | Natural Resources Wales |
| Address: | |
| Email: | |

| | |
|---|---|
| Organisation: | Natural England |
| Address: | |
| Email: | |

## 6.2 Management Plan(s):

An actual management plan does exist:

[X] Yes Name: SEVERN ESTUARY / MÔR HAFREN
Link:
https://naturalresources.wales/media/673887/severn-estuary-sac-spa-and-ramsar-reg-33-advice-from-ne-and-ccw-jur

[ ] No, but in preparation

[ ] No

## 6.3 Conservation measures (optional)

For available information, including on Conservation Objectives, see Section 4.5.

# EXPLANATION OF CODES USED IN THE NATURA 2000 STANDARD DATA FORMS

The codes in the table below are also explained in the official European Union guidelines for the Standard Data Form. The relevant page is shown in the table below.

1.1 Site type

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Designated Special Protection Area | 53 |
| B | SAC (includes candidates Special Areas of Conservation, Sites of Community Importance and designated SAC) | 53 |
| C | SAC area the same as SPA. Note in the UK Natura 2000 submission this is only used for Gibraltar | 53 |

3.1 Habitat representativity

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Excellent | 57 |
| B | Good | 57 |
| C | Significant | 57 |
| D | Non-significant presence | 57 |

3.1 Habitat code

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| 1110 | Sandbanks which are slightly covered by sea water all the time | 57 |
| 1130 | Estuaries | 57 |
| 1140 | Mudflats and sandflats not covered by seawater at low tide | 57 |
| 1150 | Coastal lagoons | 57 |
| 1160 | Large shallow inlets and bays | 57 |
| 1170 | Reefs | 57 |
| 1180 | Submarine structures made by leaking gases | 57 |
| 1210 | Annual vegetation of drift lines | 57 |
| 1220 | Perennial vegetation of stony banks | 57 |
| 1230 | Vegetated sea cliffs of the Atlantic and Baltic Coasts | 57 |
| 1310 | Salicornia and other annuals colonizing mud and sand | 57 |
| 1320 | Spartina swards (Spartinion maritimae) | 57 |
| 1330 | Atlantic salt meadows (Glauco-Puccinellietalia maritimae) | 57 |
| 1340 | Inland salt meadows | 57 |
| 1420 | Mediterranean and thermo-Atlantic halophilous scrubs (Sarcocornetea fruticosi) | 57 |
| 2110 | Embryonic shifting dunes | 57 |
| 2120 | Shifting dunes along the shoreline with Ammophila arenaria ("white dunes") | 57 |
| 2130 | Fixed coastal dunes with herbaceous vegetation ("grey dunes") | 57 |
| 2140 | Decalcified fixed dunes with Empetrum nigrum | 57 |
| 2150 | Atlantic decalcified fixed dunes (Calluno-Ulicetea) | 57 |
| 2160 | Dunes with Hippopha□ rhamnoides | 57 |
| 2170 | Dunes with Salix repens ssp. argentea (Salicion arenariae) | 57 |
| 2190 | Humid dune slacks | 57 |
| 21A0 | Machairs (* in Ireland) | 57 |
| 2250 | Coastal dunes with Juniperus spp. | 57 |
| 2330 | Inland dunes with open Corynephorus and Agrostis grasslands | 57 |
| 3110 | Oligotrophic waters containing very few minerals of sandy plains (Littorelletalia uniflorae) | 57 |
| 3130 | Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or of the Isoëto-Nanojuncetea | 57 |
| 3140 | Hard oligo-mesotrophic waters with benthic vegetation of Chara spp. | 57 |
| 3150 | Natural eutrophic lakes with Magnopotamion or Hydrocharition - type vegetation | 57 |

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| 3160 | Natural dystrophic lakes and ponds | 57 |
| 3170 | Mediterranean temporary ponds | 57 |
| 3180 | Turloughs | 57 |
| 3260 | Water courses of plain to montane levels with the Ranunculion fluitantis and Callitricho-Batrachion vegetation | 57 |
| 4010 | Northern Atlantic wet heaths with Erica tetralix | 57 |
| 4020 | Temperate Atlantic wet heaths with Erica ciliaris and Erica tetralix | 57 |
| 4030 | European dry heaths | 57 |
| 4040 | Dry Atlantic coastal heaths with Erica vagans | 57 |
| 4060 | Alpine and Boreal heaths | 57 |
| 4080 | Sub-Arctic Salix spp. scrub | 57 |
| 5110 | Stable xerothermophilous formations with Buxus sempervirens on rock slopes (Berberidion p.p.) | 57 |
| 5130 | Juniperus communis formations on heaths or calcareous grasslands | 57 |
| 6130 | Calaminarian grasslands of the Violetalia calaminariae | 57 |
| 6150 | Siliceous alpine and boreal grasslands | 57 |
| 6170 | Alpine and subalpine calcareous grasslands | 57 |
| 6210 | Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco-Brometalia) (* important orchid sites) | 57 |
| 6230 | Species-rich Nardus grasslands, on silicious substrates in mountain areas (and submountain areas in Continental Europe) | 57 |
| 6410 | Molinia meadows on calcareous, peaty or clayey-silt-laden soils (Molinion caeruleae) | 57 |
| 6430 | Hydrophilous tall herb fringe communities of plains and of the montane to alpine levels | 57 |
| 6510 | Lowland hay meadows (Alopecurus pratensis, Sanguisorba officinalis) | 57 |
| 6520 | Mountain hay meadows | 57 |
| 7110 | Active raised bogs | 57 |
| 7120 | Degraded raised bogs still capable of natural regeneration | 57 |
| 7130 | Blanket bogs (* if active bog) | 57 |
| 7140 | Transition mires and quaking bogs | 57 |
| 7150 | Depressions on peat substrates of the Rhynchosporion | 57 |
| 7210 | Calcareous fens with Cladium mariscus and species of the Caricion davallianae | 57 |
| 7220 | Petrifying springs with tufa formation (Cratoneurion) | 57 |
| 7230 | Alkaline fens | 57 |
| 7240 | Alpine pioneer formations of the Caricion bicoloris-atrofuscae | 57 |
| 8110 | Siliceous scree of the montane to snow levels (Androsacetalia alpinae and Galeopsietalia ladani) | 57 |
| 8120 | Calcareous and calcshist screes of the montane to alpine levels (Thlaspietea rotundifolii) | 57 |
| 8210 | Calcareous rocky slopes with chasmophytic vegetation | 57 |
| 8220 | Siliceous rocky slopes with chasmophytic vegetation | 57 |
| 8240 | Limestone pavements | 57 |
| 8310 | Caves not open to the public | 57 |
| 8330 | Submerged or partially submerged sea caves | 57 |
| 9120 | Atlantic acidophilous beech forests with Ilex and sometimes also Taxus in the shrublayer (Quercion robori-petraeae or Ilici-Fagenion) | 57 |
| 9130 | Asperulo-Fagetum beech forests | 57 |
| 9160 | Sub-Atlantic and medio-European oak or oak-hornbeam forests of the Carpinion betuli | 57 |
| 9180 | Tilio-Acerion forests of slopes, screes and ravines | 57 |
| 9190 | Old acidophilous oak woods with Quercus robur on sandy plains | 57 |
| 91A0 | Old sessile oak woods with Ilex and Blechnum in the British Isles | 57 |
| 91C0 | Caledonian forest | 57 |
| 91D0 | Bog woodland | 57 |
| 91E0 | Alluvial forests with Alnus glutinosa and Fraxinus excelsior (Alno-Padion, Alnion incanae, Salicion albae) | 57 |
| 91J0 | Taxus baccata woods of the British Isles | 57 |

3.1 Relative surface

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | 15%-100% | 58 |
| B | 2%-15% | 58 |
| C | < 2% | 58 |

3.1 Conservation status habitat

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Excellent conservation | 59 |
| B | Good conservation | 59 |
| C | Average or reduced conservation | 59 |

3.1 Global grade habitat

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Excellent value | 59 |
| B | Good value | 59 |
| C | Significant value | 59 |

3.2 Population (abbreviated to 'Pop.' in data form)

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | 15%-100% | 62 |
| B | 2%-15% | 62 |
| C | < 2% | 62 |
| D | Non-significant population | 62 |

3.2 Conservation status species (abbreviated to 'Con.' in data form)

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Excellent conservation | 63 |
| B | Good conservation | 63 |
| C | Average or reduced conservation | 63 |

3.2 Isolation (abbreviated to 'Iso.' in data form)

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Population (almost) Isolated | 63 |
| B | Population not-isolated, but on margins of area of distribution | 63 |
| C | Population not-isolated within extended distribution range | 63 |

3.2 Global Grade (abbreviated to 'Glo.' Or 'G.' in data form)

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A | Excellent value | 63 |
| B | Good value | 63 |
| C | Significant value | 63 |

3.3 Assemblages types

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| WATR | Non breeding waterfowl assemblage | UK specific code |
| SBA | Breeding seabird assemblage | UK specific code |
| BBA | Breeding bird assemblage (applies only to sites classified pre 2000) | UK specific code |

## 4.1 Habitat class code

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| N01 | Marine areas, Sea inlets | 65 |
| N02 | Tidal rivers, Estuaries, Mud flats, Sand flats, Lagoons (including saltwork basins) | 65 |
| N03 | Salt marshes, Salt pastures, Salt steppes | 65 |
| N04 | Coastal sand dunes, Sand beaches, Machair | 65 |
| N05 | Shingle, Sea cliffs, Islets | 65 |
| N06 | Inland water bodies (Standing water, Running water) | 65 |
| N07 | Bogs, Marshes, Water fringed vegetation, Fens | 65 |
| N08 | Heath, Scrub, Maquis and Garrigue, Phygrana | 65 |
| N09 | Dry grassland, Steppes | 65 |
| N10 | Humid grassland, Mesophile grassland | 65 |
| N11 | Alpine and sub-Alpine grassland | 65 |
| N14 | Improved grassland | 65 |
| N15 | Other arable land | 65 |
| N16 | Broad-leaved deciduous woodland | 65 |
| N17 | Coniferous woodland | 65 |
| N19 | Mixed woodland | 65 |
| N21 | Non-forest areas cultivated with woody plants (including Orchards, groves, Vineyards, Dehesas) | 65 |
| N22 | Inland rocks, Screes, Sands, Permanent Snow and ice | 65 |
| N23 | Other land (including Towns, Villages, Roads, Waste places, Mines, Industrial sites) | 65 |
| N25 | Grassland and scrub habitats (general) | 65 |
| N26 | Woodland habitats (general) | 65 |

## 4.3 Threats code

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| A01 | Cultivation | 65 |
| A02 | Modification of cultivation practices | 65 |
| A03 | Mowing / cutting of grassland | 65 |
| A04 | Grazing | 65 |
| A05 | Livestock farming and animal breeding (without grazing) | 65 |
| A06 | Annual and perennial non-timber crops | 65 |
| A07 | Use of biocides, hormones and chemicals | 65 |
| A08 | Fertilisation | 65 |
| A10 | Restructuring agricultural land holding | 65 |
| A11 | Agriculture activities not referred to above | 65 |
| B01 | Forest planting on open ground | 65 |
| B02 | Forest and Plantation management & use | 65 |
| B03 | Forest exploitation without replanting or natural regrowth | 65 |
| B04 | Use of biocides, hormones and chemicals (forestry) | 65 |
| B06 | Grazing in forests/ woodland | 65 |
| B07 | Forestry activities not referred to above | 65 |
| C01 | Mining and quarrying | 65 |
| C02 | Exploration and extraction of oil or gas | 65 |
| C03 | Renewable abiotic energy use | 65 |
| D01 | Roads, paths and railroads | 65 |
| D02 | Utility and service lines | 65 |
| D03 | Shipping lanes, ports, marine constructions | 65 |
| D04 | Airports, flightpaths | 65 |
| D05 | Improved access to site | 65 |
| E01 | Urbanised areas, human habitation | 65 |
| E02 | Industrial or commercial areas | 65 |

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| E03 | Discharges | 65 |
| E04 | Structures, buildings in the landscape | 65 |
| E06 | Other urbanisation, industrial and similar activities | 65 |
| F01 | Marine and Freshwater Aquaculture | 65 |
| F02 | Fishing and harvesting aquatic ressources | 65 |
| F03 | Hunting and collection of wild animals (terrestrial), including damage caused by game (excessive density), and taking/removal of terrestrial animals (including collection of insects, reptiles, amphibians, birds of prey, etc., trapping, poisoning, poaching, predator control, accidental capture (e.g. due to fishing gear), etc.) | 65 |
| F04 | Taking / Removal of terrestrial plants, general | 65 |
| F05 | Illegal taking/ removal of marine fauna | 65 |
| F06 | Hunting, fishing or collecting activities not referred to above | 65 |
| G01 | Outdoor sports and leisure activities, recreational activities | 65 |
| G02 | Sport and leisure structures | 65 |
| G03 | Interpretative centres | 65 |
| G04 | Military use and civil unrest | 65 |
| G05 | Other human intrusions and disturbances | 65 |
| H01 | Pollution to surface waters (limnic & terrestrial, marine & brackish) | 65 |
| H02 | Pollution to groundwater (point sources and diffuse sources) | 65 |
| H03 | Marine water pollution | 65 |
| H04 | Air pollution, air-borne pollutants | 65 |
| H05 | Soil pollution and solid waste (excluding discharges) | 65 |
| H06 | Excess energy | 65 |
| H07 | Other forms of pollution | 65 |
| I01 | Invasive non-native species | 65 |
| I02 | Problematic native species | 65 |
| I03 | Introduced genetic material, GMO | 65 |
| J01 | Fire and fire suppression | 65 |
| J02 | Human induced changes in hydraulic conditions | 65 |
| J03 | Other ecosystem modifications | 65 |
| K01 | Abiotic (slow) natural processes | 65 |
| K02 | Biocenotic evolution, succession | 65 |
| K03 | Interspecific faunal relations | 65 |
| K04 | Interspecific floral relations | 65 |
| K05 | Reduced fecundity/ genetic depression | 65 |
| L05 | Collapse of terrain, landslide | 65 |
| L07 | Storm, cyclone | 65 |
| L08 | Inundation (natural processes) | 65 |
| L10 | Other natural catastrophes | 65 |
| M01 | Changes in abiotic conditions | 65 |
| M02 | Changes in biotic conditions | 65 |
| U | Unknown threat or pressure | 65 |
| XO | Threats and pressures from outside the Member State | 65 |

## 5.1 Designation type codes

| CODE | DESCRIPTION | PAGE NO |
|---|---|---|
| UK00 | No Protection Status | 67 |
| UK01 | National Nature Reserve | 67 |
| UK02 | Marine Nature Reserve | 67 |
| UK04 | Site of Special Scientific Interest (UK) | 67 |

# Appendix F. Severn Estuary Ramsar Site citation sheet

Severn Estuary Ramsar site RIS (Information Sheet on Ramsar Wetlands) sheet

# Information Sheet on Ramsar Wetlands (RIS)

*Categories approved by Recommendation 4.7 (1990), as amended by Resolution VIII.13 of the 8th Conference of the Contracting Parties (2002) and Resolutions IX.1 Annex B, IX.6, IX.21 and IX. 22 of the 9th Conference of the Contracting Parties (2005).*

Notes for compilers:

1. The RIS should be completed in accordance with the attached *Explanatory Notes and Guidelines for completing the Information Sheet on Ramsar Wetlands*. Compilers are strongly advised to read this guidance before filling in the RIS.

2. Further information and guidance in support of Ramsar site designations are provided in the *Strategic Framework for the future development of the List of Wetlands of International Importance* (Ramsar Wise Use Handbook 7, 2nd edition, as amended by COP9 Resolution IX.1 Annex B). A 3rd edition of the Handbook, incorporating these amendments, is in preparation and will be available in 2006.

3. Once completed, the RIS (and accompanying map(s)) should be submitted to the Ramsar Secretariat. Compilers should provide an electronic (MS Word) copy of the RIS and, where possible, digital copies of all maps.

## 1. Name and address of the compiler of this form:

FOR OFFICE USE ONLY.

DD MM YY

Designation date | Site Reference Number

**Joint Nature Conservation Committee**
Monkstone House
City Road
Peterborough
Cambridgeshire PE1 1JY
UK
Telephone/Fax: +44 (0)1733 – 562 626 / +44 (0)1733 – 555 948
Email: RIS@JNCC.gov.uk

## 2. Date this sheet was completed/updated:

Designated: 13 July 1995

## 3. Country:

**UK (England/Wales)**

## 4. Name of the Ramsar site:

**Severn Estuary**

## 5. Designation of new Ramsar site or update of existing site:

**This RIS is for:** Updated information on an existing Ramsar site

## 6. For RIS updates only, changes to the site since its designation or earlier update:

### a) Site boundary and area:

** Important note: If the boundary and/or area of the designated site is being restricted/reduced, the Contracting Party should have followed the procedures established by the Conference of the Parties in the Annex to COP9 Resolution IX.6 and provided a report in line with paragraph 28 of that Annex, prior to the submission of an updated RIS.

### b) Describe briefly any major changes to the ecological character of the Ramsar site, including in the application of the Criteria, since the previous RIS for the site:

## 7. Map of site included:

Refer to Annex III of the *Explanatory Notes and Guidelines*, for detailed guidance on provision of suitable maps, including digital maps.

**a) A map of the site, with clearly delineated boundaries, is included as:**

i) **hard copy** (required for inclusion of site in the Ramsar List): *yes* ✓ -or- *no* □;
ii**) an electronic format** (e.g. a JPEG or ArcView image) Yes
iii) **a GIS file providing geo-referenced site boundary vectors and attribute tables** *yes* ✓ -or- *no* □;

**b) Describe briefly the type of boundary delineation applied:**

e.g. the boundary is the same as an existing protected area (nature reserve, national park etc.), or follows a catchment boundary, or follows a geopolitical boundary such as a local government jurisdiction, follows physical boundaries such as roads, follows the shoreline of a waterbody, etc.

The site boundary is the same as, or falls within, an existing protected area.

For precise boundary details, please refer to paper map provided at designation

## 8. Geographical coordinates (latitude/longitude):

51 13 29 N 03 02 57 W

## 9. General location:

Include in which part of the country and which large administrative region(s), and the location of the nearest large town.

Nearest town/city: Bristol

In the south-west of the United Kingdom, between Wales and England

**Administrative region:** Bro Morgannwg/ Vale of Glamorgan; Caerdydd/ Cardiff; Casnewydd/ Newport; Avon; City of Bristol; Fynwy/ Monmouthshire; Gloucestershire; Gwent; North Somerset; Somerset; South Glamorgan; South Gloucestershire

## 10. Elevation (average and/or max. & min.) (metres): 11. Area (hectares): 24662.98

Min. -4
Max. 17
Mean 0

## 12. General overview of the site:

Provide a short paragraph giving a summary description of the principal ecological characteristics and importance of the wetland.

The estuary's classic funnel shape, unique in Britain, is a factor causing the Severn to have the second-largest tidal range in the world (after the Bay of Fundy, Canada). This tidal regime results in plant and animal communities typical of the extreme physical conditions of liquid mud and tide swept sand and rock. The species-poor invertebrate community includes high densities of ragworms, lugworms and other invertebrates forming an important food source for passage and wintering waders.

A further consequence of the large tidal range is the extensive intertidal zone, one of the largest in the UK, comprising mudflats, sand banks, shingle, and rocky platforms.

Glassworts and annual sea-blite colonise the open mud, with beds of all three species of eelgrass *Zostera* occurring on more sheltered mud and sandbanks. Large expanses of common cord-grass also occur on the outer marshes. Heavily grazed saltmarsh fringes the estuary with a range of saltmarsh types present. The middle marsh sward is dominated by common saltmarsh-grass with typical associated species. In the upper marsh, red fescue and saltmarsh rush become more prominent.

## 13. Ramsar Criteria:

Circle or underline each Criterion applied to the designation of the Ramsar site. See Annex II of the *Explanatory Notes and Guidelines* for the Criteria and guidelines for their application (adopted by Resolution VII.11).

**1, 3, 4, 5, 6, 8**

## 14. Justification for the application of each Criterion listed in 13 above:

Provide justification for each Criterion in turn, clearly identifying to which Criterion the justification applies (see Annex II for guidance on acceptable forms of justification).

Ramsar criterion 1

Due to immense tidal range (second-largest in world), this affects both the physical environment and biological communities.

Habitats Directive Annex I features present on the pSAC include:

H1110 Sandbanks which are slightly covered by sea water all the time

H1130 Estuaries

H1140 Mudflats and sandflats not covered by seawater at low tide

H1330 Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*)

Ramsar criterion 3

Due to unusual estuarine communities, reduced diversity and high productivity.

Ramsar criterion 4

This site is important for the run of migratory fish between sea and river via estuary. Species include Salmon *Salmo salar*, sea trout *S. trutta*, sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, allis shad *Alosa alosa*, twaite shad *A. fallax*, and eel *Anguilla anguilla*. It is also of particular importance for migratory birds during spring and autumn.

Ramsar criterion 8

The fish of the whole estuarine and river system is one of the most diverse in Britain, with over 110 species recorded. Salmon *Salmo salar*, sea trout *S. trutta*, sea lamprey *Petromyzon marinus*, river lamprey *Lampetra fluviatilis*, allis shad *Alosa alosa*, twaite shad *A. fallax*, and eel *Anguilla anguilla* use the Severn Estuary as a key migration route to their spawning grounds in the many tributaries that flow into the estuary. The site is important as a feeding and nursery ground for many fish species particularly allis shad *Alosa alosa* and twaite shad *A. fallax* which feed on mysid shrimps in the salt wedge.

Ramsar criterion 5

**Assemblages of international importance:**

**Species with peak counts in winter:**
70919 waterfowl (5 year peak mean 1998/99-2002/2003)

**Ramsar criterion 6 – species/populations occurring at levels of international importance.**

**Qualifying Species/populations (as identified at designation):**

**Species with peak counts in winter:**

| | |
|---|---|
| Tundra swan , *Cygnus columbianus bewickii*, NW Europe | 229 individuals, representing an average of 2.8% of the GB population (5 year peak mean 1998/9-2002/3) |
| Greater white-fronted goose , *Anser albifrons albifrons*, NW Europe | 2076 individuals, representing an average of 35.8% of the GB population (5 year peak mean for 1996/7-2000/01) |
| Common shelduck , *Tadorna tadorna*, NW Europe | 3223 individuals, representing an average of 1% of the population (5 year peak mean 1998/9-2002/3) |
| Gadwall , *Anas strepera strepera*, NW Europe | 241 individuals, representing an average of 1.4% of the GB population (5 year peak mean 1998/9-2002/3) |
| Dunlin , *Calidris alpina alpina*, W Siberia/W Europe | 25082 individuals, representing an average of 1.8% of the population (5 year peak mean 1998/9-2002/3) |
| Common redshank , *Tringa totanus totanus*, | 2616 individuals, representing an average of 1% of the population (5 year peak mean 1998/9-2002/3) |

**Species/populations identified subsequent to designation for possible future consideration under criterion 6.**

**Species regularly supported during the breeding season:**

| | |
|---|---|
| Lesser black-backed gull , *Larus fuscus graellsii*, W Europe/Mediterranean/W Africa | 4167 apparently occupied nests, representing an average of 2.8% of the breeding population (Seabird 2000 Census) |

**Species with peak counts in spring/autumn:**

| | |
|---|---|
| Ringed plover , *Charadrius hiaticula*, Europe/Northwest Africa | 740 individuals, representing an average of 1% of the population (5 year peak mean 1998/9-2002/3) |

**Species with peak counts in winter:**

| | |
|---|---|
| Eurasian teal , *Anas crecca*, NW Europe | 4456 individuals, representing an average of 1.1% of the population (5 year peak mean 1998/9-2002/3) |
| Northern pintail , *Anas acuta*, NW Europe | 756 individuals, representing an average of 1.2% of the population (5 year peak mean 1998/9-2002/3) |

Contemporary data and information on waterbird trends at this site and their regional (sub-national) and national contexts can be found in the Wetland Bird Survey report, which is updated annually. See www.bto.org/survey/webs/webs-alerts-index.htm.
See Sections 21/22 for details of noteworthy species
Details of bird species occuring at levels of National importance are given in Section 22

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**15. Biogeography** (required when Criteria 1 and/or 3 and /or certain applications of Criterion 2 are applied to the designation)**:**

Name the relevant biogeographic region that includes the Ramsar site, and identify the biogeographic regionalisation system that has been applied.

**a) biogeographic region:**

Atlantic

**b) biogeographic regionalisation scheme** (include reference citation):

Council Directive 92/43/EEC

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## 16. Physical features of the site:

Describe, as appropriate, the geology, geomorphology; origins - natural or artificial; hydrology; soil type; water quality; water depth, water permanence; fluctuations in water level; tidal variations; downstream area; general climate, etc.

| | |
|---|---|
| Soil & geology | alluvium, basic, biogenic reef, clay, cobble, gravel, limestone/chalk, mud, neutral, nutrient-rich, peat, sand, sandstone/mudstone, sedimentary, shingle |
| Geomorphology and landscape | cliffs, coastal, estuary, floodplain, intertidal rock, intertidal sediments (including sandflat/mudflat), islands, lowland, open coast (including bay), pools, subtidal rock (including rocky reefs), subtidal sediments (including sandbank/mudbank), tidal rapids |
| Nutrient status | eutrophic |
| pH | circumneutral |
| Salinity | brackish / mixosaline, saline / euhaline |
| Soil | mainly mineral |
| Water permanence | usually permanent |
| Summary of main climatic features | Annual averages (Cardiff, 1971–2000) (www.metoffice.com/climate/uk/averages/19712000/sites/cardiff.html)<br>Max. daily temperature: 14.3° C<br>Min. daily temperature: 6.8° C<br>Days of air frost: 33.0<br>Rainfall: 1111.7 mm<br>Hrs. of sunshine: 1518.0 |

**General description of the Physical Features:**

The Severn Estuary is a large estuary with extensive intertidal mudflats and sandflats, rocky platforms and islands. Saltmarsh fringes the coast backed by grazing marsh with freshwater ditches and occasional brackish ditches. The seabed is rock and gravel with subtidal sandbanks. The estuary's classic funnel shape, unique in the UK, is a factor causing the Severn to have the second-highest tidal range in the world. This tidal regime results in plant and animal communities typical of the extreme physical conditions of liquid mud and tide-swept sand and rock. A further consequence of the large tidal range is an extensive intertidal zone, one of the largest in the UK.

## 17. Physical features of the catchment area:

Describe the surface area, general geology and geomorphological features, general soil types, general land use, and climate (including climate type).

The Severn Estuary is a large estuary with extensive intertidal mudflats and sandflats, rocky platforms and islands. Saltmarsh fringes the coast backed by grazing marsh with freshwater ditches and occasional brackish ditches. The seabed is rock and gravel with subtidal sandbanks. The estuary's classic funnel shape, unique in the UK, is a factor causing the Severn to have the second-highest tidal range in the world. This tidal regime results in plant and animal communities typical of the extreme physical conditions of liquid mud and tide-swept sand and rock. A further consequence of the large tidal range is an extensive intertidal zone, one of the largest in the UK.

## 18. Hydrological values:

Describe the functions and values of the wetland in groundwater recharge, flood control, sediment trapping, shoreline stabilization, etc.

Shoreline stabilisation and dissipation of erosive forces, Sediment trapping

### 19. Wetland types:

Inland wetland, Marine/coastal wetland

| Code | Name | % Area |
|---|---|---|
| G | Tidal flats | 84.1 |
| H | Salt marshes | 4.7 |
| D | Rocky shores | 4.7 |
| E | Sand / shingle shores (including dune systems) | 4.4 |
| Tp | Freshwater marshes / pools: permanent | 1 |
| B | Marine beds (e.g. sea grass beds) | 0.9 |
| F | Estuarine waters | 0.2 |

### 20. General ecological features:

Provide further description, as appropriate, of the main habitats, vegetation types, plant and animal communities present in the Ramsar site, and the ecosystem services of the site and the benefits derived from them.

The large tidal range leads to strong tidal streams and high turbidity, producing communities characteristic of the extreme physical conditions of liquid mud and tide-swept sand and rock. Broad intertidal flats with areas of unstable sand and muddy flats support high densities of invertebrates. Intertidal rock platforms support a wide variety of invertebrate species. There are large areas of subtidal sand, rock and gravel with a variety of aquatic estuarine communities including *Sabellaria alveolata* reef. Areas of saltmarsh fringe the estuary, mostly grazed with a range of vegetation communities. There are gradual and stepped transitions between bare mudflat to upper marsh and grassland. Main vegetation types are: upper saltmarsh with *Festuca rubra* and *Juncus gerardii*; middle marsh dominated by *Puccinellia maritima* with *Glaux maritima* and *Triglochin maritima*; dense monocultures of *Spartina anglica* at the edge of the mudflats-brackish pools and depressions with *Phragmites australis* and *Bolboschoenus maritimus*.

Ecosystem services

### 21. Noteworthy flora:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

**Nationally important species occurring on the site.**

**Higher Plants.**

*Aster linosyris* (nationally rare),

*Alopecurus bulbosus*, *Althaea officinalis*, *Bupleurum tenuissimum*, *Hordeum marinum*, *Lepidium latifolium*, *Petroselinum segetum*, *Puccinellia rupestris*, *Trifolium squamosum*, *Zostera marina/angustifolia*, *Zostera noltei* (all nationally scarce)

### 22. Noteworthy fauna:

Provide additional information on particular species and why they are noteworthy (expanding as necessary on information provided in **12**. Justification for the application of the Criteria) indicating, e.g. which species/communities are unique, rare, endangered or biogeographically important, etc., including count data. *Do not include here taxonomic lists of species present – these may be supplied as supplementary information to the RIS.*

**Birds**

**Species currently occurring at levels of national importance:**

**Species regularly supported during the breeding season:**

| | |
|---|---|
| Herring gull , *Larus argentatus argentatus*, NW Europe and Iceland/W Europe ) | 1540 apparently occupied nests, representing an average of 1.1% of the GB population (Seabird 2000 Census) |

**Species with peak counts in spring/autumn:**

| | |
|---|---|
| Little egret , *Egretta garzetta*, West Mediterranean | 17 individuals, representing an average of 1% of the GB population (5 year peak mean 1998/9-2002/3) |
| Ruff , *Philomachus pugnax*, Europe/W Africa | 12 individuals, representing an average of 1.7% of the GB population (5 year peak mean 1998/9-2002/3) |
| Whimbrel , *Numenius phaeopus*, Europe/Western Africa | 333 individuals, representing an average of 11.1% of the GB population (5 year peak mean 1998/9-2002/3 - spring peak) |
| Eurasian curlew , *Numenius arquata arquata*, N. a. arquata Europe (breeding) | 2021 individuals, representing an average of 1.3% of the GB population (5 year peak mean 1998/9-2002/3) |
| Common greenshank , *Tringa nebularia*, Europe/W Africa | 26 individuals, representing an average of 4.3% of the GB population (5 year peak mean 1998/9-2002/3) |
| **Species with peak counts in winter:** | |
| Eurasian wigeon , *Anas penelope*, NW Europe | 4658 individuals, representing an average of 1.1% of the GB population (5 year peak mean 1998/9-2002/3) |
| Northern shoveler , *Anas clypeata*, NW & C Europe | 297 individuals, representing an average of 2% of the GB population (5 year peak mean 1998/9-2002/3) |
| Common pochard , *Aythya ferina*, NE & NW Europe | 1118 individuals, representing an average of 1.8% of the GB population (5 year peak mean 1998/9-2002/3) |
| Water rail , *Rallus aquaticus*, Europe | 11 individuals, representing an average of 2.4% of the GB population (5 year peak mean 1998/9-2002/3) |
| Spotted redshank , *Tringa erythropus*, Europe/W Africa | 10 individuals, representing an average of 7.3% of the GB population (5 year peak mean 1998/9-2002/3) |

**Species Information**

Species occurring at levels of international importance on the site.

**Fish.**

*Alosa alosa* (IUCN Red data book – threatened; Habitats Directive Annex II, Annex V (S1102)),
*Alosa fallax* (IUCN Red data book – threatened; Habitats Directive Annex II, Annex V (S1103))
*Lampetra fluviatilis* (IUCN Red data book – threatened; Habitats Directive Annex II (S1099)),
*Petromyzon marinus* (Habitats Directive Annex II (S1095))

**Nationally important species occurring on the site.**

**Invertebrates.**

*Tenellia adspersa* (nationally rare); *Corophium lacustre* (nationally scarce); *Gammarus insensibilis* (nationally scarce)

## 23. Social and cultural values:

Describe if the site has any general social and/or cultural values e.g. fisheries production, forestry, religious importance, archaeological sites, social relations with the wetland, etc. Distinguish between historical/archaeological/religious significance and current socio-economic values.

Aesthetic
Archaeological/historical site
Environmental education/ interpretation

Fisheries production
Livestock grazing
Non-consumptive recreation
Scientific research
Sport fishing
Sport hunting
Tourism
Traditional cultural
Transportation/navigation

**b)** Is the site considered of international importance for holding, in addition to relevant ecological values, examples of significant cultural values, whether material or non-material, linked to its origin, conservation and/or ecological functioning? No

If Yes, describe this importance under one or more of the following categories:

i) sites which provide a model of wetland wise use, demonstrating the application of traditional knowledge and methods of management and use that maintain the ecological character of the wetland:

ii) sites which have exceptional cultural traditions or records of former civilizations that have influenced the ecological character of the wetland:

iii) sites where the ecological character of the wetland depends on the interaction with local communities or indigenous peoples:

iv) sites where relevant non-material values such as sacred sites are present and their existence is strongly linked with the maintenance of the ecological character of the wetland:

## 24. Land tenure/ownership:

| Ownership category | On-site | Off-site |
|---|---|---|
| Non-governmental organisation (NGO) | + | + |
| Local authority, municipality etc. | + | + |
| National/Crown Estate | + | |
| Private | + | + |
| Public/communal | + | + |
| Other | + | |

## 25. Current land (including water) use:

| Activity | On-site | Off-site |
|---|---|---|
| Nature conservation | + | + |
| Tourism | + | + |
| Recreation | + | + |
| Current scientific research | + | + |
| Fishing: commercial | + | + |
| Fishing: recreational/sport | + | + |
| Gathering of shellfish | + | |
| Bait collection | + | |
| Arable agriculture (unspecified) | | + |
| Grazing (unspecified) | + | + |
| Permanent pastoral agriculture | | + |

| | | |
|---|---|---|
| Hunting: recreational/sport | + | + |
| Industrial water supply | + | |
| Industry | + | + |
| Sewage treatment/disposal | + | + |
| Harbour/port | + | + |
| Flood control | + | + |
| Mineral exploration (excl. hydrocarbons) | + | + |
| Mining/quarrying | + | + |
| Transport route | + | + |
| Urban development | | + |
| Military activities | + | + |

## 26. Factors (past, present or potential) adversely affecting the site's ecological character, including changes in land (including water) use and development projects:

*Explanation of reporting category:*

1. *Those factors that are still operating, but it is unclear if they are under control, as there is a lag in showing the management or regulatory regime to be successful.*
2. *Those factors that are not currently being managed, or where the regulatory regime appears to have been ineffective so far.*

*NA = Not Applicable because no factors have been reported.*

| Adverse Factor Category | Reporting Category | Description of the problem (Newly reported Factors only) | On-Site | Off-Site | Major Impact? |
|---|---|---|---|---|---|
| Dredging | 1 | | + | + | + |
| Erosion | 1 | | + | | + |
| Recreational/tourism disturbance (unspecified) | 1 | | + | + | |
| | | | | | |

| |
|---|
| For category 2 factors only.<br>What measures have been taken / are planned / regulatory processes invoked, to mitigate the effect of these factors? |
| Is the site subject to adverse ecological change? NO |

## 27. Conservation measures taken:

List national category and legal status of protected areas, including boundary relationships with the Ramsar site; management practices; whether an officially approved management plan exists and whether it is being implemented.

| Conservation measure | On-site | Off-site |
|---|---|---|
| Site/ Area of Special Scientific Interest (SSSI/ASSI) | + | + |

| | | |
|---|---|---|
| National Nature Reserve (NNR) | + | |
| Special Protection Area (SPA) | + | |
| Land owned by a non-governmental organisation for nature conservation | + | + |
| Management agreement | + | + |
| Site management statement/plan implemented | + | |
| Other | + | |
| Management plan in preparation | + | + |

**b)** Describe any other current management practices:
The management of Ramsar sites in the UK is determined by either a formal management plan or through other management planning processes, and is overseen by the relevant statutory conservation agency. Details of the precise management practises are given in these documents.

### 28. Conservation measures proposed but not yet implemented:

e.g. management plan in preparation; official proposal as a legally protected area, etc.

No information available

### 29. Current scientific research and facilities:

e.g. details of current research projects, including biodiversity monitoring; existence of a field research station, etc.

**Contemporary.**

**Fauna.**
Numbers of migratory and wintering wildfowl and waders are monitored annually as part of the national Wetland Birds Survey (WeBS) organised by the British Trust for Ornithology, Wildfowl & Wetlands Trust, the Royal Society for the Protection of Birds and the Joint Nature Conservation Committee.
Wildfowl shooting monitoring. Returns received annually from Wildfowling Clubs.

**Completed.**

**Flora and Fauna.**
CCW/EN Marine Intertidal Phase 1 survey of the biotopes of the Severn Estuary in 2003/4
BTO Research report 335 for CCW/EN (November 2003). Low tide distribution of waterbirds of Severn Estuary SPA. Results of 2002/03 WeBS low tide counts and a historical analysis (Burton *et al*. 2003).
WWT Wetlands Advisory Service. Report for CCW (April 2003). Baseline bird monitoring of the River Severn.
Joint Nature Conservation Committee (1997) Subtidal biotope survey at mouth of the River Parrett.
Joint Nature Conservation Committee (1997) Upper estuary intertidal rocky shore survey.
Mettam, C (1997) *Biotopes in the subtidal sandbanks of the Severn estuary*. Report to English Nature

### 30. Current communications, education and public awareness (CEPA) activities related to or benefiting the site:

e.g. visitor centre, observation hides and nature trails, information booklets, facilities for school visits, etc.

There are fixed interpretation panels and hides at Bridgwater Bay, Newport Wetlands Reserve, Flat Holm LNR and field centre. Interpretation boards at Black Rock.

### 31. Current recreation and tourism:

State if the wetland is used for recreation/tourism; indicate type(s) and their frequency/intensity.

**Activities, Facilities provided and Seasonality.**
Walking, dog walking, and birdwatching are concentrated along the sea walls all the year round and on the saltmarsh and sandy beaches.

Bathing, beach recreation, including sand yachting and wind surfing are practised on the sandy beaches, mainly in the summer.

There are boat clubs/marinas in the sub-estuaries with sailing, motor boats, and jet skiing.

Angling is carried out from the shore and small boats. There is a certain amount of bait digging.

Wildfowling is carried out from September to February all around the Estuary; consents and further management measures are being addressed. There are agreed refuge areas for the birds.

## 32. Jurisdiction:

Include territorial, e.g. state/region, and functional/sectoral, e.g. Dept. of Agriculture/Dept. of Environment, etc.

Head, Natura 2000 and Ramsar Team, Department for Environment, Food and Rural Affairs, European Wildlife Division, Zone 1/07, Temple Quay House, 2 The Square, Temple Quay, Bristol, BS1 6EB

Head, Countryside Division, Welsh Assembly Government, Cathays Park, Cardiff, CF1 3NQ

## 33. Management authority:

Provide the name and address of the local office(s) of the agency(ies) or organisation(s) directly responsible for managing the wetland. Wherever possible provide also the title and/or name of the person or persons in this office with responsibility for the wetland.

Site Designations Manager, English Nature, Sites and Surveillance Team, Northminster House, Northminster Road, Peterborough, PE1 1UA, UK / Site Safeguard Officer, International Designations, Countryside Council for Wales, Maes-y-Ffynnon, Penrhosgarnedd, Bangor, Gwynedd, LL57 2DW

## 34. Bibliographical references:

Scientific/technical references only. If biogeographic regionalisation scheme applied (see **15** above), list full reference citation for the scheme.

### Site-relevant references


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Please return to: **Ramsar Secretariat, Rue Mauverney 28, CH-1196 Gland, Switzerland**
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# Appendix G. Consultation with Natural England

| Natural England comment (16/04/2021) | | Atkins response (14/07/2021) |
|---|---|---|
| Survey work – Natural England has reviewed the surveys to date and can offer the following comments | The bat surveys are acceptable; it is noted that they are current and up to date. The surveys are a mix of static and transect surveys, covering the whole season. This is agreed with. For clarification, the consultation document, paragraph 2.4.12 regarding thermal cameras is acceptable. | Noted. |
| | Figure 9, Buildings within the bat roost study area and figure 10, Bat activity survey locations, show further areas of study. Static detector locations and crossing points, in relation to options 2, 2a and 2b have been highlighted. This is accepted. Bat roost potential in relation to options 2, 2a and 2b have been highlighted. This is also accepted. It should be noted that if bats are found on site, an EPS licence will also be needed from Natural England prior to any works taking place. | Noted and agreed. |
| | Regarding the GCN surveys, they have been restricted to eDNA, with a commitment to undertake population size class assessments in the future, or alternatively engage with Gloucestershire's district level licensing system. This is agreed with. Regarding further GCN surveys, it does not appear that any information is provided here. | Noted.<br>Discussions are ongoing with Naturespace regarding district level licensing. The applicant will be collecting further data (HSI and eDNA where possible) on ditches and any waterbodies where access has not previously been granted, if this can now be arranged, in 2021. This information will be passed to Naturespace so that they can assess the suitability of the scheme for district level licensing. |
| | When the application is submitted in 2022 some of the surveys will be three years old. The applicant proposes to address this through a further phase 1 habitat survey. This is agreed with. | Noted.<br>An extended Phase 1 validation survey is proposed in 2021. This will focus on targeted areas, namely within the scheme boundary, where the greatest impact is anticipated. In addition, validation surveys for bats are proposed. These will comprise validation surveys of seven transects (Transect numbers 2, 4, 5, 7, 8, 9, 19). |

| Natural England comment (16/04/2021) | | Atkins response (14/07/2021) |
|---|---|---|
| | | Three surveys of each transect are proposed during 2021. Further information is included in the Bat Survey Protocol, which is shared with Natural England along with this response. |
| | It is not considered that likely significant effects (LSE) can be ruled out based on migratory functionally linked species of the Severn Estuary SPA/SAC/Ramsar Site. The report concludes that based on the River Chelt, LSE can be ruled out. The premise for this conclusion is based on the lack of Environment Agency survey data for these waterbodies. However, a check shows that for example eel data is available. It should be noted that eels are currently classed as critically endangered. It is recommended therefore, that data is formally requested from the Environment Agency, and used to inform the HRA. | Noted.<br>Previous desk study looked at Environment Agency data <5 years old within 2km of the site. No recent (<5 years old) Environment Agency data are available from within 2 km of the site. However, a wider study area and longer data period has now been reviewed. This indicates that qualifying species (eel and trout) are present on site. This confirms, as per Natural England's comment, that eels have been recorded in the vicinity of the site.<br>In addition, the applicant has now undertaken fish surveys for the project. Surveys conducted on behalf of Atkins on the River Chelt in 2020 identified the presence of European eel at two locations (SO 90140 24760 - SO 90053 24787 and SO 90645 24606 – SO 90518 24634) on 28 and 29 July 2020. Bullhead, stone loach and minnow were also present.<br>In terms of potential impacts to fish species, the Scheme would not introduce a barrier and is not expected to reduce connectivity for fish movement in operation. Construction practices will adhere to best practice guidelines and methods such as soft start procedures. The assessment will consider potential for temporary harm, disturbance and barriers to fish movement during construction as well as operational impacts. It may be necessary to time works outside of the key ecologically sensitive periods for fish. Ecologically sensitive design of structures such as culverts will be incorporated to the Scheme, to maintain connectivity, continuity of flow and natural substrate establishment.<br>On the basis that there are potential impact pathways, which if not mitigated could impact on qualifying species of a European site, the applicant accepts that is it probable that an appropriate assessment will be required. |

| Natural England comment (16/04/2021) | | Atkins response (14/07/2021) |
|---|---|---|
| | Regarding surveys of the other species, it appears to be in line with the relevant guidelines, and no issues appear to have arisen. | Noted. |
| Habitat Regulations Assessment Stage 1 Screening document | Natural England is currently not satisfied, on the basis of the objective information which has so far been provided, that it can be excluded that the proposed plan or project will have a significant effect on both the Severn Estuary SPA and Walmore Common SPA either individually or in combination with other plans or projects. Furthermore, Natural England is not yet satisfied that the proposed operations are not likely to damage any of the interest features of the Severn Estuary SSSI. Natural England therefore requests that additional information is provided in order to address these current uncertainties. | See responses to further, more specific comments, below. |
| Wye Valley and Forest of Dean Bat Site SAC | The HRA Screening document screens out any impacts on the Wye Valley and Forest of Dean Bat Site SAC on distance. The submitted maps highlight the screening distance that has been used. It is stated that the nearest component site is over 21km away and outside of any core sustenance zone for horseshoe bats. Therefore, the distance between the SAC and the proposal site is too great for any significant functional linkage. It is accepted that impacts from the scheme such as disturbance from lighting and habitat loss and fragmentation would not occur due to distance. The conclusion could be strengthened by considering any commuting/foraging routes in relation to the above information and making clear whether there are any ecological pathways. | Noted.<br>A review of known foraging/commuting routes for qualifying bat species of the SAC will be undertaken, as well as a more in-depth consideration of any ecological pathways between the Scheme and the SAC. |
| Severn Estuary | The report omits the following SAC/Ramsar Site designated species:<br>• Atlantic salmon<br>• Sea trout | Noted. Consultation is ongoing with the Environment Agency.<br>As detailed above review of Environment Agency ecology data has been undertaken. Six Environment Agency sites were identified on the River Chelt that have been surveyed within the last 10 |

| Natural England comment (16/04/2021) | | Atkins response (14/07/2021) |
|---|---|---|
| | • Allis shad<br>• European eel<br>We would recommend that the report is revised to consider the ecology of these species. Consultation with the Environment Agency, if not already, may provide up to date local knowledge of which species are to be found in the River Chelt and other nearby watercourses. | years (detailed above). All six sites identified varying life stages of European eel, from glass eels, elvers and adult eels.<br>Fish surveys have also been undertaken to inform the baseline for the Scheme at two locations on the River Chelt (SO 90140 24760 - SO 90053 24787 and SO 90645 24606 – SO 90518 24634). Both surveys recorded European eel.<br>On the basis that there are potential impact pathways, which if not mitigated could impact on qualifying species of a European site, the applicant accepts that is it probable that an appropriate assessment will be required. |
| | 3.3.11 Severn Estuary SPA/SAC/Ramsar Site<br>We note that effects on the SAC habitats have been screened out on the basis of distance and corresponding dilution (e.g. pollution). We propose that the narrative should be strengthened by referring to relevant industry standards for construction site practices (fuel/oil storage, surface water run-off from works compounds etc), together with works along the length of the new route(s) and scope for these to be secured via e.g. CEMP or equivalent. The objective should be to prevent pollution rather than to rely on distance and dilution to protect downstream habitats (including the SAC/Ramsar Site) | Noted. The applicant confirms that construction practices will adhere to industry best practice methodologies. Further information on this will be incorporated into the updated HRA Screening report. |
| | 3.3.12 There is no reference to eels | Noted. The SAC/Ramsar Site species that appear to have been omitted will be incorporated into the updated HRA Screening report. |
| | 3.3.14 – 15 Please refer to our comments above about SAC/Ramsar Site species omitted from the current version of the report. You should review your conclusions when you have considered these species. With particular regard to European eel, this species' ecology is such that careful consideration should be given to their potential presence in local watercourses/water bodies near the proposed scheme. | Noted.<br>The SAC/Ramsar Site species that appear to have been omitted will be incorporated into the updated HRA Screening report. |

| Natural England comment (16/04/2021) | | Atkins response (14/07/2021) |
|---|---|---|
| | 3.3.17 – Functional linkage for Severn Estuary SPA wild birds<br>We note that these species have been screened out on the grounds of distance between the project site and the SPA. In order to strengthen the HRA report narrative, we recommend that you reference the following unpublished report, recently commissioned by Natural England: "Identification of land with proven or possible functional linkages with the Severn Estuary SSSI/SPA – Phase 5 (Gloucestershire and Worcestershire)" (Link Ecology).<br>From our understanding of the report we would conclude that significant effects on functionally linked land may be screened out though the report shows that such land lies much closer to the project area than the SPA itself. | Thank you for sending the Link Ecology report to us. When we come to update the HRA we will strengthen this argument and draw on the aforementioned report as evidence. |
| | Appendix F: Ramsar Site migratory species mentioned however no detail on eels, salmon etc specifically. Looks like copy from SAC section. | Noted. Information on these species will be incorporated into the updated HRA Screening report. |
| | Lack of detail on pollution prevention mechanisms or whether the channel will be heavily modified in any way as part of the works in HRA. Pollution prevention mention appears to be phrased in a way that may suggest its being used to screen out LSE. | Noted. Further detail will be incorporated into the updated HRA Screening report. |
| | Would like to see SPA species survey detail in HRA and specifically impacted lapwing numbers in relation to estimated number in the Severn Estuary and conservation status. Possible need for bird disturbance strategy depending on work timings and impacted land? | Noted. Further detail will be incorporated into the updated HRA Screening report. |
| Walmore Common SPA | 3.3.9<br>The document also screens out impacts on Walmore Common SPA for a number of reasons. It is stated that the | Noted. Further detail, including additional survey data, will be incorporated into the updated HRA Screening report. |

| Natural England comment (16/04/2021) | | Atkins response (14/07/2021) |
|---|---|---|
| | site is 12.5 km away and there are other suitable habitats closer to the SPA. This is not necessarily agreed with, as it is stated that further surveys will be undertaken.<br>Confirmation is therefore required as to when the wintering and migratory bird species survey be available. The report narrative should then be updated to include reference to this survey work and any issues arising. | |
| SSSI Impact Risk Zones | 3.3.18<br>We would caution against using the SSSI Impact Risk Zones as evidence to support screening out significant effects. Our advice above regarding the functional linkage research is provided in order to ensure your reasoning is based on the most up to date available scientific information and takes account of the recent Holohan judgement (Ref C461/17) case law. This reinforces the need for an appropriate assessment, to include an examination of the implications of the proposed project for habitat types and species to be found outside the boundaries of the site provided those implications are likely to affect the conservation objectives of the site. | Noted. Alternative evidence to screen out significant effects will be drawn upon, as appropriate. The probable need for an Appropriate Assessment has already been noted above. |
| In-combination | 3.4 Screening in combination<br>We note that no other relevant plans or projects are referenced. We would encourage you to consider relevant projects (e.g. those permitted but not yet implemented NB there may be other criteria) where ecological pathways may exist (using the source-pathway-receptor approach).<br>For example, the strategic allocations associated with Cheltenham (Gloucester, Cheltenham and Tewkesbury Joint Core Strategy adopted proposals maps document refers) should be considered. Cheltenham planning application reference 16/02000/OUT (4000 homes and 24ha of | Noted. This will be considered when we update the HRA Screening report. |

| Natural England comment (16/04/2021) | | Atkins response (14/07/2021) |
|---|---|---|
| | employment use land) may require consideration accordingly. | |
| Air quality | It is considered from the submitted documents that there has been an oversight in terms of air quality. The affected road network needs to be identified and confirmed whether any protected sites are within 200m.<br>As part of the process, through the HRA consideration of designated sites is sought and the impacts from air quality examined. This will include for example, consideration of nitrogen deposition on any woodland SSSI's. We would draw the Council's attention to the two pieces of case law; the Wealden Judgement and Dutch Nitrogen Case. | Noted. Traffic data has now been received and the assessment is underway.<br><br>The Air Quality assessment will follow DMRB LA105. As per LA105, *internationally, nationally and locally designated sites of ecological conservation importance on protected species and on habitats and other species identified as being of principal importance for the conservation of biodiversity (known as designated habitats) within 200m of the ARN shall be included in the air quality assessment. NOTE Designated habitats include 'Ramsar' sites, special protection areas, special areas of conservation, sites of special scientific interest, local nature reserves, local wildlife sites, nature improvement areas, ancient woodland and veteran trees.* |
| Air pollution | We would expect the project to address the impacts of air quality on the natural environment. In particular, it should address any traffic impacts associated with new development, particularly where this impacts on European sites and SSSIs. The HRA should also consider any detrimental impacts on the natural environment and suggest appropriate avoidance or mitigation measures where applicable.<br>Natural England advises that one of the main issues which should be considered within the HRA are proposals which are likely to generate additional nitrogen emissions as a result of increased traffic generation, which can be damaging to the natural environment.<br>The effects on local roads in the vicinity of any proposed development on nearby designated nature conservation sites (including increased traffic, construction of new roads, | See response above. |

| Natural England comment (16/04/2021) | | Atkins response (14/07/2021) |
|---|---|---|
| | and upgrading of existing roads) and the impacts on vulnerable site from air quality effects on the wider road networks in the area (a greater distance away from the development) can be assessed using traffic projections and the 200m distance criterion followed by local Air Quality modelling where required. We consider that the designated sites at risk from local impacts are those within 200m of a road with increased traffic which feature habitats that are vulnerable to nitrogen deposition/acidification. APIS provides a searchable database and information on pollutants and their impacts on habitats and species. | |
| Nationally Designated Landscapes | As the development site is adjacent to the Cotswold AONB, consideration should be given to the direct and indirect effects upon this designated landscape and in particular the effect upon its purpose for designation, as well as the content of the relevant management plan for the Cotswold AONB. | Potential impacts to the Cotswold AONB will be considered as part of the landscape and ecology assessments. |

Date: 30 November 2022
Our ref: M5 Junction 10 Improvements Scheme
Your ref:

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T 0300 060 3900

Lizzie Hall
Adkins Global

**BY EMAIL ONLY**

Dear Lizzie

**M5 Junction 10 Improvements Scheme**
**Habitats Regulations Assessment – statement to inform Appropriate Assessment**

Natural England is a non-departmental public body. Our statutory purpose is to ensure that the natural environment is conserved, enhanced, and managed for the benefit of present and future generations, thereby contributing to sustainable development.

Thank you for your consultation of 7 November 2022 on the updated *Habitats Regulations Assessment - statement to inform Appropriate Assessment (Appendix 7.14)*. On 9 November 2022 we provided brief comments on the terrestrial aspects of the updated HRA and we agreed that a conclusion of no adverse effects on the integrity of the various sites could be achieved. This letter provides comments on the freshwater aspects of the updated HRA which are more detailed.

Overall we agree that a conclusion of no adverse effects on the integrity of the Severn Estuary can be achieved. However we have the following concerns:

- We would caution against the use of "de-minimis" arguments which are used throughout the report to determine that any impact from the scheme would be deemed to be negligible
- We would caution against dismissing standard pollution prevention measures as being necessary for a conclusion of no adverse effect on site integrity
- We note that there are no drainage plans within the assessment itself nor any reference to such plans. We would encourage you to include this detail.
- The proposal is relying on SUDS schemes to mitigate the impact of ongoing road pollution run off from the road. Runoff from the road currently enters the River Chelt, without any SUDS/mitigation measures in place, and as such this is a potential improvement on the current status. Nonetheless we would encourage you to include some quantification of road run-off post construction and an analysis of whether this may harm the site.
- We feel the in-combination assessment requires further detail. At the moment the main argument is the fact that as the Severn catchment is so large, pollution from this scheme will have a negligible impact alone, however these impacts have not been thoroughly assessed in combination with all the other planned development in the region.
- We feel that, as part of biodiversity net gain, this scheme may offer opportunities for river restoration to mitigate the historic and ongoing impact of road run-off into the River Chelt. The assessment could make an initial start at identifying these opportunities.

We have the following more specific comments:

1.1.5 – we would caution against using de minimis arguments

6.3.3 – This is a major road development scheme, and there is the potential for a significant pollution incidents during the construction phase of this development. Given the critical status of European eel and the declining population of Atlantic salmon, a significant pollution incident as a result of the scheme could potentiality result in an adverse impact on the integrity of the site if sufficient mitigation measures are not in place to control an event. We would caution against using 'de minimis' arguments in relation to the small number of fish being impacted. The scheme should be assessed in-combination with all other water quality pollution pressures, which are significant in the region.

6.3.4 – we would advise classifying pollution prevention measures as mitigation

6.3.13 – we would recommend considering re-locating lamprey ammocetes before de-watering in order to reduce the likelihood of mortality

6.5.3 – we would advise classifying pollution prevention measures as mitigation

6.6.2 – we would caution against using de minimis arguments

6.7.1 – we would recommend outlining the drainage arrangements for the new road/bridge

Table 6.1 row 1 – we would caution against using de minimis arguments

Table 6.2 row 1 – no assessment has yet been made of the operational impact of the scheme on ongoing pollution (water quality) and therefore we would not advise coming to this conclusion before further examination of these impacts

Table 6.2 row 8 – we would caution against using de minimis arguments

7.2.1 bullet 1 – this statement needs to be backed up with evidence

7.2.4 bullet 2 - any in channel features should be replaced after the construction works are completed, and ideally opportunities for in-channel enhancement measures additionally sought, such as installation of woody debris

7.3.4 – we recommend considering whether any other determinands should be assessed as a result of the operational impact of the road run-off from this scheme

8.1.1 bullet 2 – The scheme is relying entirely on SUDs schemes to intercept road runoff but the assessment contains little analysis of whether they will be successful. We would recommend introducing more rigour and challenge around this conclusion.

Table 8.1 - Warners of Cheltenham, North West Cheltenham Site B and Safeguarded site north-east of Junction 10 – we do not agree with these assessments and believe likely significant effects in-combination are a possibility and therefore need to be assessed at appropriate assessment

We hope this is helpful.

Yours sincerely

[redacted]

Dr Paul Horswill
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West Midlands Area Team

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