A358 Taunton to Southfields Dualling Scheme

Ecological Baseline Report - MoRPh

HE551508-ARP-EBD-ZZ-RP-LE-000022

24 May 2022

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Executive summary

The A358 Taunton to Southfields Dualling scheme would provide a dual carriageway along the length of the A358 between Taunton and Ilminster in Somerset, connecting the M5 motorway at Junction 25 to the A303 to the south.

Modular River Physical (MoRPh) surveys were commissioned as part of the suite of habitat and protected species surveys commissioned in relation to the scheme. This report presents the results of the MoRPh surveys undertaken throughout 2021 and aims to inform the ecology baseline for the scheme.The objectives of this report are to present the results of the MoRPh surveys and inform appropriate mitigation and enhancement as required.

MoRPh surveys were undertaken along a maximum 500 metre reach of any watercourses that were identified as being impacted by the scheme (250 metres upstream and downstream of the point the scheme intersects with the watercourse).

As a result of various constraints, it was only possible to undertake a full MoRPh survey (achieving 20 % coverage of the project area) at 11 crossing locations/river reaches. With only one MoRPh5 survey (sub-reach) being undertaken at five crossing points and no survey being undertaken at one site due to a suitable sub-reach within 250 metres upstream and downstream of the crossing point not being identified.

Of the sites selected as near natural, all sites achieved moderate (3) or fairly good (4) condition scores, excluding 37_US (Fivehead River Tributary 5) which was classified as fairly poor (2). Of the impacted sites selected, only two sites were classified as moderate (3) for their respective river types (site 30_DS Meare Stream and 36_DS Fivehead River main channel 2), with the latter not being associated with any artificial bank face or in channel works (bank top recorded as permanently vegetated/agriculture). Sites 15a_DS (Broughton Brook) and 34_US (Fivehead River main channel 1) were the only MoRPh5 surveys to receive a score of poor (1) for their respective river types. The final condition score for 15a_DS (Broughton Brook) can be attributed to a low average of negative indicators (-2.77) resulting from non-native invasive plant species (NNIPS) and managed ground associated with the bank top, bank face reinforcement extent and material severity, in channel bed siltation, reinforcement extent, severity and artificial features as well as channel bed filamentous algae extent. The final condition score for site 34_US (Fivehead River main channel 1) can be attributed to the low average of negative indicators (-1.92) resulting from bank top managed ground, bank face reinforcement extent and material severity, channel margin artificial features and channel bed reinforcement extent, severity, and filamentous algae extent.

Sites 30_US (Meare Stream), 31_US (Meare Stream Tributary 1) and 33_US (Fivehead River Tributary 1) all received the highest final condition scores (fairly good/4). The final condition score for site 30_US (Meare Stream) can be attributed to the high average positive indicators (2.26) resulting from bank face and channel bed natural material richness. The final condition score for site 31_US (Meare Stream Tributary 1) can be attributed to the high average positive indicators (2.42) resulting from bank face profile richness and channel bed natural material richness. The final condition score for site 33_US (Fivehead River Tributary 1) can be attributed to the high average positive indicators (2.11) resulting from bank face profile richness, and channel bed natural material richness.

Data gathered from these surveys will be utilised in the Defra biodiversity metric calculations presented in the biodiversity net gain report, which will form Appendix 8.6 of the Environmental Statement.

1 Introduction

1.1 Purpose and scope of this document

1.1.1 The A358 Taunton to Southfields Dualling scheme (hereafter referred to as 'the scheme') would provide a dual carriageway along the length of the A358 between Taunton and Ilminster in Somerset, connecting the M5 motorway at Junction 25 to the A303 to the south. Modular River Physical (MoRPh) surveys were part of a suite of habitat and protected species surveys commissioned in relation to the scheme.

1.1.2 This report presents the results of the MoRPh surveys and aims to inform the ecology baseline for the scheme.

1.1.3 The objectives of this report are to:

- detail the survey operations including all positional data, survey methodologies, significant survey events and photographic logs of the watercourse for contextual evidence
- present the results of the Cartographer outputs and desk-based reach scale study for the watercourse crossing points, providing an indicative river type for the specified watercourses
- undertake a river condition assessment using MoRPh survey data and desk study to calculate final river condition score and river condition class

1.2 Scheme overview

1.2.1 The scheme is part of a programme of improvements planned along the A303/A358 corridor aimed at improving connectivity between London, the south-east and the south-west. The A303, alongside the A30, forms part of the strategic road network (SRN) and together with the A358, provides the link between London, the south-east and the south-west.

1.2.2 The programme of improvements, as set out in the Government's *Road Investment Strategy* [1] made a commitment to, *"…upgrade all remaining sections of the A303 between the M3 and the A358 to dual carriageway standard, together with creating a dual carriageway link from M5 at Taunton to the A303"*.

1.2.3 The scheme directly addresses this long-term commitment and would provide a new rural all-purpose dual carriageway link from the M5 at Taunton to the A303 at Southfields roundabout. The new dual carriageway would comprise new and upgraded stretches of the existing A358 road. Full details of the scheme will be provided in Chapter 2 *The Project* of the Environmental Statement (ES). Please refer to Figure 1-1 for scheme plan.

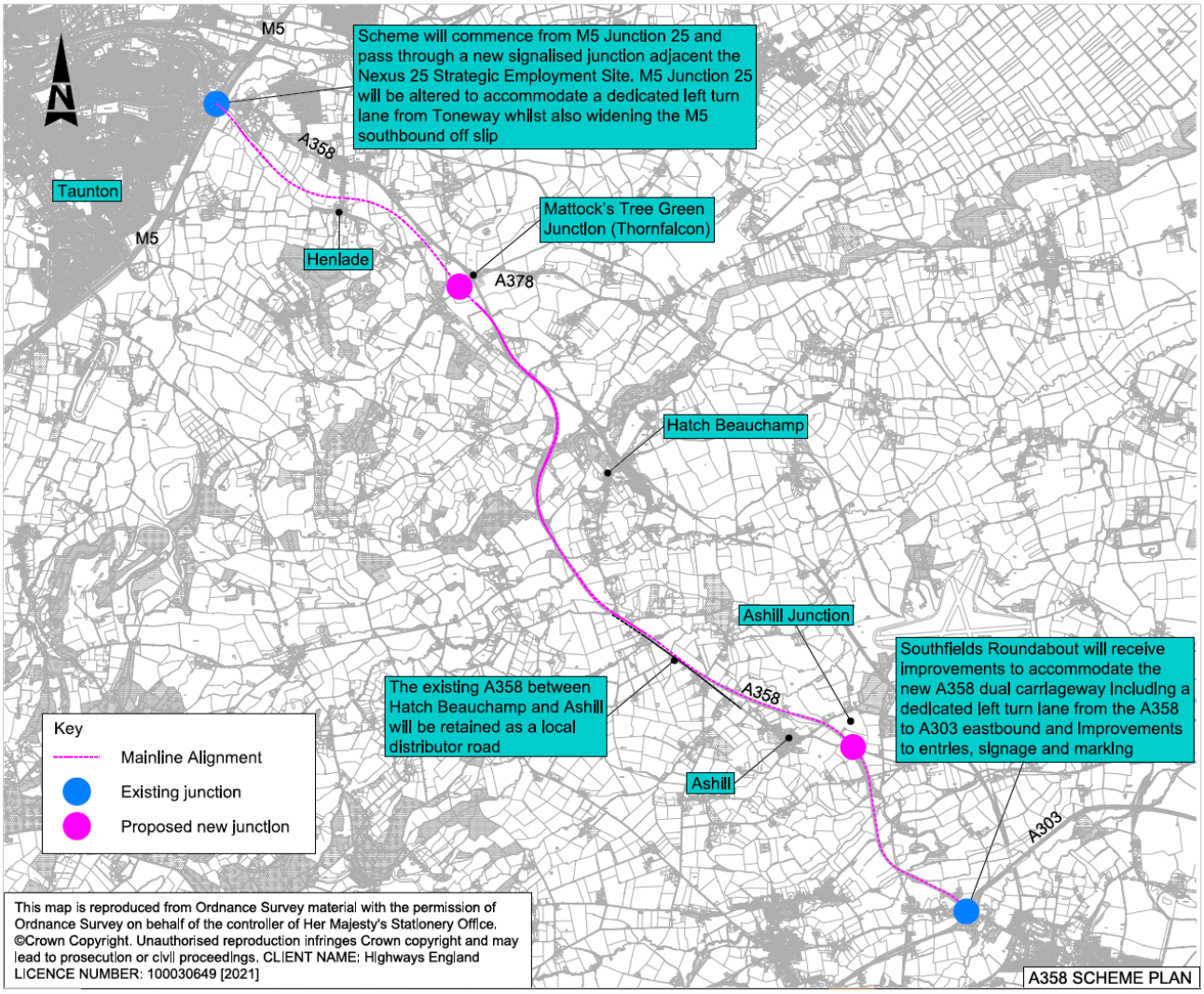

Figure 1-1 Scheme plan

1.3 Study area and zone of influence (ZoI)

1.3.1 The Chartered Institute for Ecology and Environmental Management (CIEEM) *Guidelines for Ecological Impact Assessment* [2] recommend that all potentially important ecological features that occur within the Zone of Influence (ZoI) for a scheme are investigated. The ZoI includes:

- areas to be directly within the land take for the scheme
- areas that would be temporarily affected during construction
- areas likely to be impacted by hydrological disruption
- areas where there is a risk of pollution and noise disturbance during construction and/or operation

1.3.2 The ZoI depends on the ecological features concerned. With regard to the watercourses likely to be affected by the scheme, the ZoI has been defined as all watercourses that cross the scheme and associated aquatic and riparian habitat (within 250 metres upstream and downstream of the scheme crossing point) of the defined ecology survey zone, which comprises the footprint of the scheme and associated site clearance area. This ZoI is hereafter referred to as the study area.

1.4 Legislation

1.4.1 A framework of international, European, national and local legislation and planning policy guidance exists to protect and conserve wildlife and habitats in England. This legislation will be listed in full within Chapter 8 *Biodiversity* of the ES. Legislation relevant to and discussed within this report are:

- The Conservation of Habitats and Species Regulations 2017
- Wildlife and Countryside Act 1981
- Natural Environment and Rural Communities (NERC) Act 2006
- Invasive Alien Species (Enforcement and Permitting) Order 2019

2 Methodology

2.1 Desk study

2.1.1 A desk-based, reach scale, study was undertaken for all the watercourses crossed by the scheme to contribute to determining the indicative river type. The river type was determined using an extended reach that contained sub-reaches where MoRPh5 surveys were planned to be conducted. The reaches selected for surveying were typically several kilometres in length to determine the respective watercourse 'type' robustly. The main requirement was that each reach broadly displayed a similar width and planform along its length with no large structures (dams/weirs) or large tributaries (width exceeding a quarter of that of the river channel being characterised). A summary of the data sources used to help inform the desk study are provided in the bullets below. Cartographer and Google Earth Pro were used in combination for assessing the extended reaches whilst Soilscapes was utilised to provide a simplified soils data set for areas of interest at a 1:250,000 scale. Together, these sources helped to delineate the indicative river type ahead of the MoRPh5 surveys:

- Cartographer Ver. 6.31.0
- Google Earth Pro 7.3.4.8248
- Cranfield Soil and AgriFood Institute (CSAFI) (Soilscapes) [3]

2.1.2 There are a total of 15 river types incorporated into the river condition assessment (present UK application, Europe 22 broad river types have been identified; Rinaldi et al, 2016 [4]):

- Canals and navigable rivers
- Large rivers
- Indicative river types A to M (Figure 2-1) which are relevant to this survey

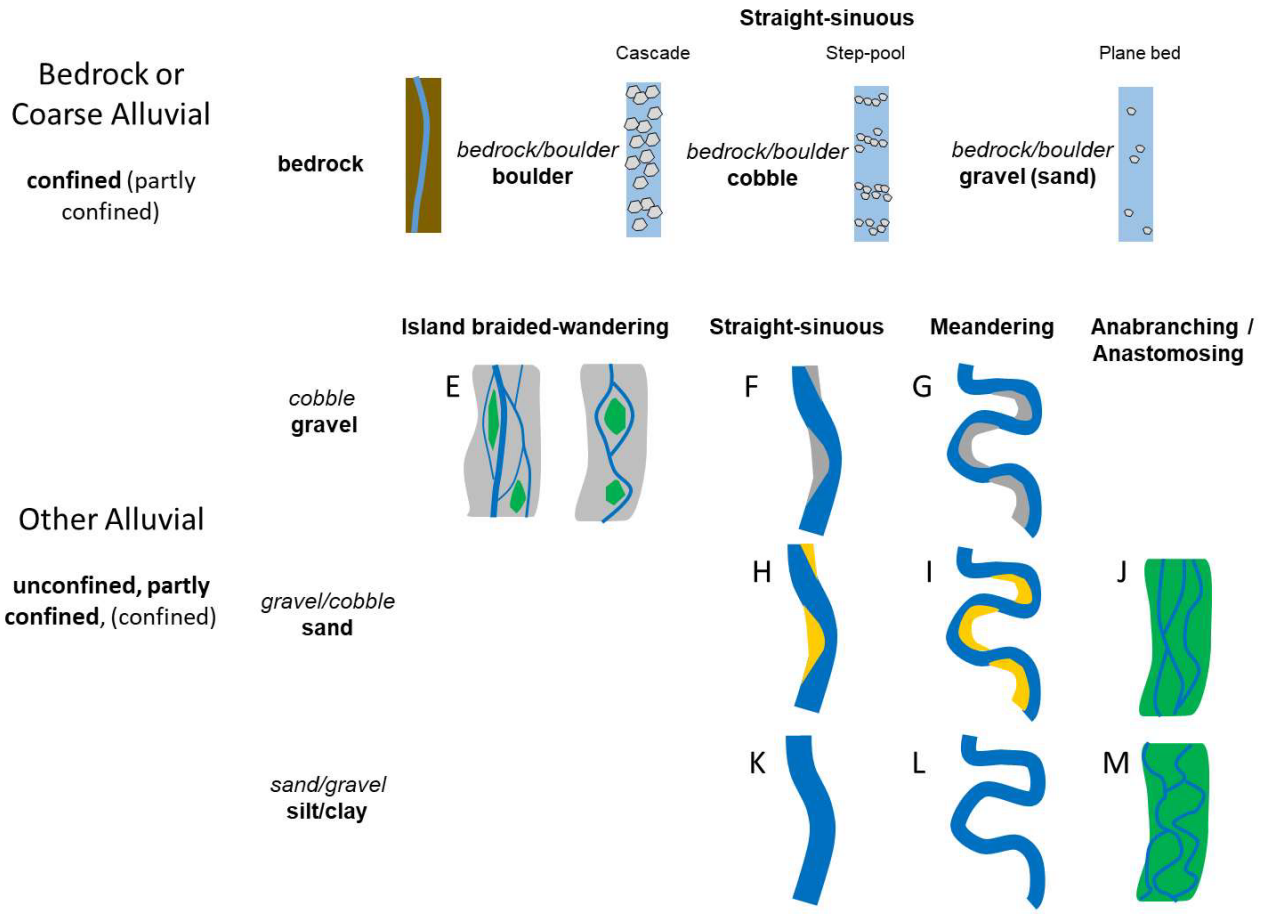

Figure 2-1 Thirteen near-natural river types that might be encountered in England (Gurnell et al., 2020 [5])

2.1.3 Eight river type indicators were combined to determine the indicative river type for the scheme (see Table 2-1 below). Five indicators (A1-A5) were assessed by the desk-based reach scale study of an extended reach, within which the study area is located. A further three (A6-A8) were automatically estimated from MoRPh5 survey data once it had been uploaded into Cartographer. To determine indicators A1 to A5 (during the desk study), a qualified MoRPh surveyor assessed the watercourses using maps and aerial imagery along with topographic information.

2.1.4 Indicators A6 to A8 describe the riverbed material and were derived from MoRPh5 surveys, and as such do not constitute part of the initial desk study. Where two MoRPh5 surveys were assessed, the MoRPh5 survey with the coarsest bed material was used to estimate the indicative river type (as such, MoRPh5 surveys from the same reach/watercourse have the same river type).

Table 2-1 Indicators derived from desk study and MoRPh5 field survey that contribute to assessing the river type and function (Gurnell et al, 2020 [5])

Source	Code	Name
Desk study	A1	Braiding index (BI)
Desk study	A2	Sinuosity index (SI)
Desk study	A3	Anabranching index (AI)
Desk study	A4	Level of confinement (U, PC, C)

Source	Code	Name
Desk study	A5	Valley gradient
Field survey	A6	Bedrock reaches
Field survey	A7	Coarsest bed material size class
Field survey	A8	Average alluvial bed material size class

2.1.5 The findings of this desk study were used to inform the indicative river type for the specified watercourses (in conjunction with indicators A6-A8) and were used to supplement the provisional condition score (generated from Cartographer following input of field survey data) and provide a final condition score/class.

2.2 Field study

2.2.1 A total of 17 watercourse crossing locations were identified as being impacted by the scheme. Location details in relation to the scheme are summarised in Table 2-2 and mapped in Appendix A Modular river survey (MoRPh) survey extent. MoRPh5 surveys were undertaken along a maximum 500 metre reach (250 metres upstream and downstream of the point the scheme intersects with the watercourse).

Table 2-2 Summary of locations scoped in for MoRPh5 survey

Survey ID	Watercourse	Scheme crossing NGR	Upstream extent NGR	Downstream extent NGR
15a	Broughton Brook	ST 25593 24725	ST 25430 24562	ST 25656 24956
19a	Black Brook	ST 25769 24572	ST 25950 24369	ST 25656 24810
17	Black Brook Tributary 1	ST 26005 24230	ST 26047 24021	ST 26195 24168
20	Black Brook Tributary 2/5	ST 26306 23938	ST 26397 23716	ST 26367 23998
19b	Black Brook Tributary 3	ST 26525 23807	ST 26649 23611	ST 26367 23998
24	Thornwater Stream	ST 27546 23555	ST 27621 23339	ST 27578 23763
30	Meare Stream	ST 29245 21573	ST 29243 21333	ST 29359 21768
31	Meare Stream Tributary 1	ST 29452 20806	ST 29301 20637	ST 29668 20910
33	Fivehead River Tributary 1	ST 29721 19292	ST 29483 19227	ST 29543 19182
34	Fivehead River main channel 1	ST 29721 19292	ST 29551 19162	ST 29930 19399
36	Fivehead River main channel 2	ST 30629 18516	ST 30445 18422	ST 30836 18633
37	Fivehead River Tributary 5	ST 30827 18374	ST 30834 18136	ST 30986 18591
39	Venner's Water	ST 31566 17915	ST 31490 17735	ST 31758 18072
51	Cad Brook drainage network	ST 33212 16561	ST 32953 16538	ST 33283 16715
52	Cad Brook	ST 33224 10467	ST 33073 16292	ST 33385 16622
54	River Ding/River Ding drainage network	ST 33609 15773	ST 33517 15557	ST 33816 15935
55	Back Stream/River Ding drainage network	ST 33764 15708	ST 33595 15731	ST 34139 15732

2.2.2 MoRPh5 surveys were undertaken between 21 and 30 September 2021.

2.2.3 The field surveys were led by George Bleathman, a Senior Aquatic Ecologist with seven years' professional experience working within the commercial sector. He has experience of providing aquatic support to large-scale infrastructure projects

and has worked extensively in the field. George is certified in River Condition Assessments.

2.2.4 During the surveys surveyors adhered to strict biosecurity protocol to reduce the risk of transmitting invasive non-native species (INNS). Surveyors worked in an upstream to downstream direction on each watercourse and, before moving between hydrologically unconnected watercourses, all personal protective equipment (PPE) was thoroughly checked and cleaned.

2.2.5 MoRPh5 surveys (Shuker *et al*., 2017 [6], Gurnell *et al*., 2019 [7]) were used in the river condition assessment to collect field information for sub-reach(es) of watercourses, with the aim of surveying at least 20% of the total river length within the study area (250 metres from the crossing point). Surveys were undertaken between mid-summer and autumn in low flow conditions with clear water allowing visual assessment of the bed and bank faces. Where low/intermediate flows were present and bed visibility was restricted, survey staff were able to estimate bed material types by assessing the sections of bed that were visible.

2.2.6 Each MoRPh5 survey was 50 metres in survey length for each sub-reach, consisting of five contiguous MoRPh modules of 10 metres. Sufficient MoRPh5 surveys should be undertaken to provide a minimum survey coverage of 20% of the total river length within the study area. Each sub-reach should represent the range of local river conditions. In particular, one sub-reach must be located to capture the most physically degraded part of the river within the study area, whilst the other (if applicable) is located to capture the most natural/unmodified part of the river (Shuker *et al*., 2017 [6], Gurnell *et al*., 2019 [7]). Given that all rivers surveyed were less than 5 metres in width, the surveyor aimed to select two 50 metre MoRPh5 survey sub-reaches within each 500-metre length of watercourse, thus surveying the prescribed 20%.

2.2.7 MoRPh5 surveys incorporated the riparian habitat, 10 metres from the bank edge, and recorded information relating to the bank top, bank face, channel-water margin and the riverbed. The surveys were each conducted on a single river thread. The surveys captured the extent and character of:

- bank and bed sediments
- morphological and hydraulic features/habitats
- riparian and aquatic vegetation extent and structure
- presence and extent of non-native invasive plant species (NNIPS)
- bank top land use pressures
- human interventions within the river channel

2.3 Assessing river condition

2.3.1 River conditions were assessed using 32 condition indicators that were automatically extracted from MoRPh5 survey field data. Each river condition indicator was assigned a score of 0 to + 4 (positive indicators) or 0 to – 4 (negative indicators). Positive indicators represent the diversity (richness) and abundance (extent) of physical habitats offered by vegetation, sediment, vegetation-sediment related physical features, and hydraulic habitats that can be observed at low flow. Negative indicators represent the extent and severity of local human interventions or pressures.

2.3.2 A preliminary condition score for each MoRPh5 survey was calculated as the sum of the average of the positive condition indicator scores and the average of the negative condition indicator scores for the sub-reach. The preliminary condition score was translated into a final condition score (5-good, 4-fairly good, 3-moderate, 2-fairly poor, 1-poor) based upon the river type.

2.4 Assumptions and limitations

2.4.1 MoRPh surveys are ordinarily conducted during periods of low flow, during spring or early summer; this enables the recording of information on both vegetation and physical properties of the river and its margins. Although the 2021 surveys were undertaken between mid-summer and autumn, care was given to accurately identify and quantify physical features that may have been obscured by vegetation and therefore the timing of the surveys was not considered to be a significant limitation to the survey findings

2.4.2 Dense vegetation coverage was encountered at five of the survey sites. The bank faces were heavily vegetated and overgrown, primarily with scrub and shrubs, thus making two MoRPh5 surveys impractical (two being required for 20% coverage). Sites where only one MoRPh5 survey could be conducted included 17 (Black Brook Tributary 1), 19a (Black Brook), 20 (Black Brook Tributary 2/5), 33 (Fivehead River Tributary 1), and 51 (Cad Brook drainage network), with no survey being undertaken at site 19b (Black Brook Tributary 3).

2.4.3 MoRPh5 surveys are designed to assess the reaches that are most representative of the watercourse, as such reaches that are most ‘impacted’ and ‘natural’ are selected. By only conducting one survey (due to visibility/access restrictions) at five sites, the assessment may be biased to the characteristics of that specific section of reach. This bias only impacts the results for a reach whereby the results reflect a worse / best case scenario. However, these limitations are not deemed significant as a single MoRPh5 survey does provide an indicative river type and final condition score.

2.4.4 Site 19b (Black Brook Tributary 3) was not accessible for survey, therefore, no MoRPh assessment of this reach has been made.

2.4.5 Factors influencing the efficacy of the surveys at each of the different sites are summarised in Section 3.2.

3 Results

3.1 Desk study

3.1.1 The results from the desk-based reach scale study can be found in Section 3.3, where they are assessed in conjunction with the field survey results, preliminary and final condition scores.

3.2 MoRPh5 surveys

3.2.1 A complete suite of surveys that were completed, along with positions of MoRPh5 surveys, are summarised in Table 3-1. As a result of the various constraints detailed in Section 2.4, it was only possible to undertake a full MoRPh5 survey (achieving 20% coverage of the project area) at 11 crossing locations/river reaches. Only one MoRPh5 survey (sub-reach) was undertaken at five crossing points (17 - Black Brook Tributary 1, 19a - Black Brook, 20 - Black Brook Tributary 2/5, 33 - Fivehead River Tributary 1, and 51 – Cad Brook drainage network), and no survey being undertaken at site 19b (Black Brook Tributary 3) due to a lack of a suitable sub-reach being identified within 250 metres upstream and downstream of the crossing point. For a more detailed summary of the survey sites with contextual notes, please refer to the *Ecological Baseline Report - River Corridor Survey and Macrophytes* which will form Appendix 8.5 of the ES [8]. Raw MoRPh data can be made available upon request as a csv. download from Cartographer where there is a requirement for further investigation into the drivers of habitat condition at sub-reach/module scale. Appendix A provides details of the survey locations and extents, and Appendix C provides evidence of the surveys undertaken in the form of a photographic log.

Table 3-1 Summary table of MoRPh5 survey locations

Survey ID*	Watercourse	NGR US	NGR DS	Fully surveyed?
15a_US_Nat	Broughton Brook	ST 25474 24614	ST 25479 24639	Yes
15a_DS_Imp	Broughton Brook	ST 25573 24713	ST 25612 24743	Yes
17_US_Nat	Black Brook Tributary 1	ST 25970 24196	ST 25998 24237	Partial
19a_US_Imp	Black Brook	ST 25795 24543	ST 25783 24599	Partial
20_DS_Nat	Black Brook Tributary 2/5	ST 26307 24062	ST 26329 24038	Partial
24_US_Nat	Thornwater Stream	ST 27597 23421	ST 27574 23462	Yes
24_DS_Imp	Thornwater Stream	ST 27576 23649	ST 27567 23681	Yes
30_US_Nat	Meare Stream	ST 29257 21365	ST 29248 21408	Yes
30_DS_Imp	Meare Stream	ST 29238 21510	ST 29232 21544	Yes
31_US_Nat	Meare Stream Tributary 1	ST 29314 20678	ST 29337 20729	Yes
31_DS_Imp	Meare Stream Tributary 1	ST 29406 20789	ST 29449 20808	Yes
33_US	Fivehead River Tributary 1	ST 29552 19170	ST 29525 19206	Partial
34_US_Imp	Fivehead River main channel 1	ST 29686 19272	ST 29723 19300	Yes
34_DS_Nat	Fivehead River main channel 1	ST 29828 19347	ST 29862 19380	Yes
36_US_Nat	Fivehead River main channel 2	ST 30489 18459	ST 30528 18472	Yes
36_DS_Imp	Fivehead River main channel 2	ST 30629 18518	ST 30668 18540	Yes
37_US_Nat	Fivehead River Tributary 5	ST 30832 18152	ST 30828 18203	Yes

Survey ID*	Watercourse	NGR US	NGR DS	Fully surveyed?
37_DS	Fivehead River Tributary 5	ST 30891 18512	ST 30938 18529	Yes
39_DS_Nat	Venner's Water	ST 31523 17821	ST 31548 17872	Yes
39_US_Imp	Venner's Water	ST 31691 18094	ST 31735 18105	Yes
51_DS_Nat	Cad Brook drainage network	ST 33280 16591	ST 33314 1661	Partial
52_US_Nat	Cad Brook	ST 33100 16376	ST 33145 16420	Yes
52_DS_Imp	Cad Brook	ST 33213 16470	ST 33264 16483	Yes
54_DS_Imp	River Ding/River Ding drainage network	ST 33520 15595	ST 33544 15643	Yes
54_US_Nat	River Ding/River Ding drainage network	ST 33588 15711	ST 33609 15781	Yes
55_US_Imp	Back Stream/River Ding drainage network	ST 33747 15690	ST 33788 15712	Yes
55_DS_Nat	Back Stream/River Ding drainage network	ST 33877 15704	ST 33920 15710	Yes

* DS = Down stream, US = Up stream, Imp = Impact, Nat = Natural.

3.3 River Types and Condition Scores

3.3.1 Following the desk-based study and MoRPh5 surveys, it was possible to calculate the preliminary condition score, river type, and ultimately the final condition score for each MoRPh5 survey, detailed in Table 3-2.

Table 3-2 Characteristics of the MoRPh5 survey sub-reaches

MoRPh5 survey subreach	A1 Braiding index	A2 Sinuosity index	A3: Anabranching index	A4: Level of Confinement	A5: Reach valley gradient	A6 Bedrock subreach	A7 Coarsest bed material	A8 Average alluvial bed material size class	River type	Preliminary condition score	Final condition class/ final condition score
15a_US_Nat	0	1.05	0	Unconfined	0	No	Gravel-pebble	Sand	H	0.83	Moderate / 3
15a_DS_Imp										-1.19	Poor / 1
17_US_Nat	0	1.24	0	Unconfined	0.01	No	Silt	Silt	K	1.22	Fairly good / 4
19a_US_Imp	0	1.09	0	Unconfined	0	No	Gravel-pebble	Sand	H	0.24	Fairly poor / 2
20_DS_Nat	0	1.03	0	Unconfined	0	No	Silt	Silt	K	0.77	Moderate / 3
24_US_Nat	0	1.13	0	Unconfined	0.01	No	Cobble	Sand	H	0.65	Moderate / 3
24_DS_Imp	0									0.22	Fairly poor / 2
30_US_Nat	0	1.03	0	Partly confined	0.01	No	Cobble	Gravel-pebble	F	1.72	Fairly good / 4
30_DS_Imp										0.56	Moderate / 3
31_US_Nat	0	1.01	0	Partly confined	0.03	No	Boulder	Gravel-pebble	D	1.88	Fairly good / 4
31_DS_Imp										-0.13	Fairly poor / 2
33_US	0	1.16	0	Unconfined	0.01	No	Cobble	Gravel-pebble	F	1.95	Fairly good / 4
34_US_Imp	0	1.02	0	Unconfined	0.01	No	Cobble	Cobble	F	-1.03	Poor / 1
34_DS_Nat										1.04	Moderate / 3
36_US_Nat	0	1.12	0	Unconfined	0.01	No	Gravel-pebble	Gravel-pebble	F	0.85	Moderate / 3
36_DS_Imp										0.95	Moderate / 3
37_US_Nat	0	1.06	0	Unconfined	0.02	No	Cobble	Sand	H	0.43	Fairly poor / 2
37_DS										0.7	Moderate / 3
39_DS_Nat	0	1.32	0	Unconfined	0.01	No	Cobble	Gravel-pebble	F	0.86	Moderate / 3
39_US_Imp										-0.03	Fairly poor / 2
51_DS_Nat	0	1.01	0	Unconfined	0.01	No	Gravel-pebble	Gravel-pebble	F	0.91	Moderate / 3
52_US_Nat	0	1.04	0	Unconfined	0.01	No	Cobble	Sand	H	1.04	Moderate / 3
52_DS_Imp										-0.2	Fairly poor / 2
54_DS_Imp	0	1.01	0	Unconfined	0.01	No	Cobble	Gravel-pebble	F	0.07	Fairly poor / 2
54_US_Nat										1.04	Moderate / 3
55_US_Imp	0	1.04	0	Unconfined	0.01	No	Cobble	Gravel-pebble	F	-0.12	Fairly poor / 2
55_DS_Nat										1.32	Moderate / 3

3.3.2 Across the entire survey array, indexes for braiding and anabranching were classed as ‘0’, indicating that there was only one main channel to the watercourses observed during the survey.

3.3.3 The sinuosity index (SI) ranged from 1.01 to 1.32, which is categorised as straight sinuous (< 1.5), with meandering classed as a sub-reach returning an index of >1.5.

3.3.4 Only two sites recorded a level of confinement of “partly confined” (valley confinement 10 – 90%), with all other sites classified as unconfined.

3.3.5 Bedrock within all of the observed MoRPH5 survey sub-reaches was not recorded, with only traces observed within specific modules. The coarsest bed material recorded within different sub-reaches ranged from silt to boulder, with the average size of alluvial bed material across the different MoRPh5 survey sub-reaches ranging from silt to gravel-pebble.

3.3.6 Following the classification of river types, one site was classified as D, eight as F, six as H and two as K. As illustrated in Figure 2-1, river type D is described as a partly confined course alluvial straight-sinuous plane bed with boulder and gravel (sand). River type F is described as unconfined/partly confined other alluvial straight-sinuous cobble (gravel) watercourse. River type H is described as an unconfined other alluvial straight-sinuous gravel/cobble (sand) watercourse. With river type K described as an unconfined other alluvial straight-sinuous sand/gravel (silt) watercourse.

3.3.7 To illustrate the findings of this report, the final condition score boundaries for the relevant indicative river type (A to M) were overlain on the preliminary condition scores for the MoRPh5 survey sub-reaches, as shown in Figure 3-1. A table reporting the raw indicator values for all MoRPh5 sub reaches is provided in Appendix B. A clear distinction in the final condition scores between sites selected in the field as natural or impacted can be seen. Of the sites selected as near natural, all sites achieved moderate (3) or fairly good (4) condition scores, excluding 37_US (Fivehead River Tributary 5) which was classified as fairly poor (2). Of the impact sites selected, only two sites were classified as moderate (3) for their respective river types (site 30_DS Meare Stream and 36_DS Fivehead River main channel 2), with the latter not being associated with any artificial bank face (C7 – C9) or in channel works (E8 – E10). Sites 15a_DS (Broughton Brook) and 34_US (Fivehead River main channel 1) were the only MoRPh5 surveys to receive a score of poor (1) for their respective river types. The final condition score for 15a_DS (Broughton Brook) can be attributed to a low average of negative indicators (-2.77) resulting from NNIPS (B4; -3) and managed ground associated with the bank top (B5; -4), bank face reinforcement extent (C8; -4) and material severity (C9; -4), in channel bed siltation (E7; -3), reinforcement extent (E8; -4), severity (E9; -4) and artificial features (E10; -4) as well as channel bed filamentous algae extent (12; -3). The final condition score for site 34_US (Fivehead River main channel 1) can be attributed to the low average of negative indicators (-1.92) resulting from bank top managed ground (B5; -4), bank face reinforcement extent (C8; -4) and material severity (C9; -4), channel margin artificial features (D5; -2) and channel bed reinforcement extent (E8; -4), severity (E9; -4), and filamentous algae extent (E12; -3)

3.3.8 Conversely, sites 30_US (Meare Stream), 31_US (Meare Stream Tributary 1) and 33_US (Fivehead River Tributary 1) all received the highest final condition scores (fairly good/4). The final condition score for site 30_US (Meare Stream) can be

attributed to the high average positive indicators (2.26) resulting from bank face and channel bed natural material richness (C5 (4) and E6 (4), respectively). The final condition score for site 31_US (Mears Stream Tributary 1) can be attributed to the high average positive indicators (2.42) resulting from bank face profile richness (C4; 4) and channel bed natural material richness (E6; 4). The final condition score for site 33_US (Fivehead River Tributary 1) can be attributed to the high average positive indicators (2.11) resulting from bank face profile richness (C4; 4), and channel bed natural material richness (E6; 4).

3.3.9 For those sites where two surveys could not be completed due to visibility or access restrictions, the need for further surveys in spring to early summer have been identified.

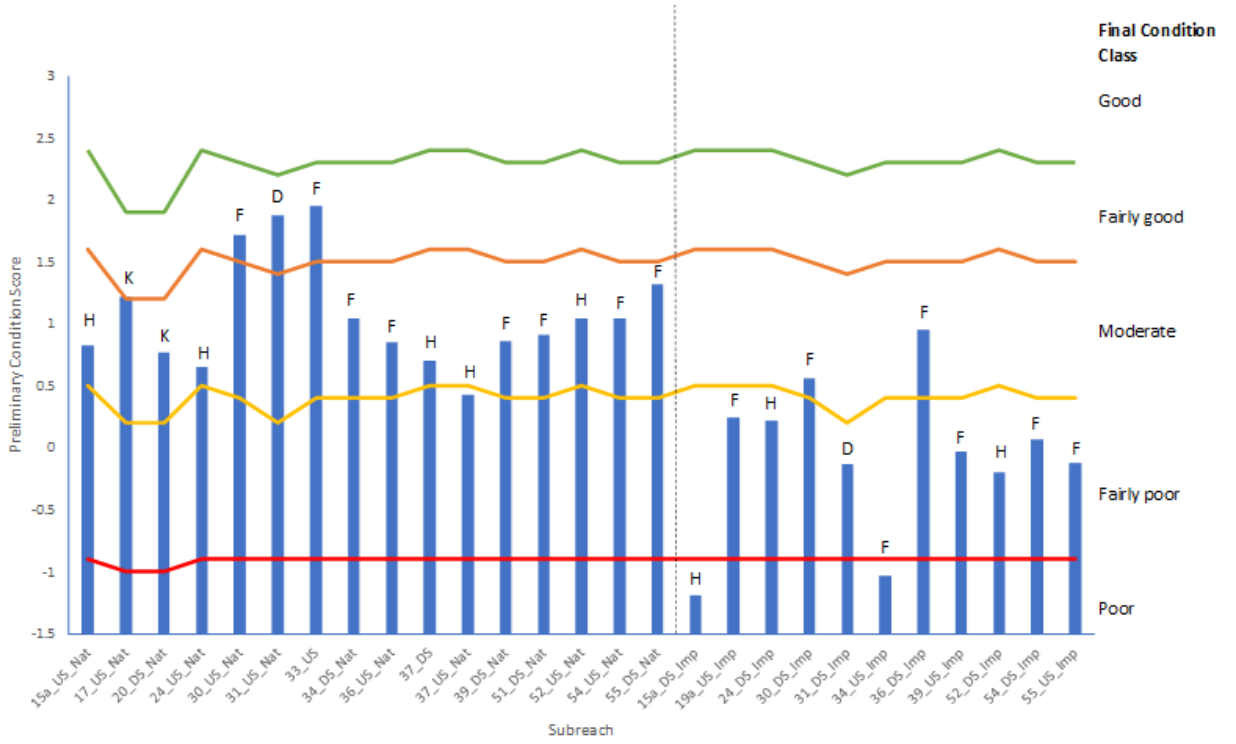

Figure 3-1 Final condition score boundaries for the relevant indicative river type (A to M) overlain on the preliminary condition scores for the project sub-reaches (vertical dashed line separates near-natural from impacted reaches)

4 Conclusions

4.1.1 In response to the A358 Taunton to Southfields Dualling Scheme, a River Condition Assessment (RCA) for Biodiversity Metric 3.0 was undertaken at known crossing points. MoRPh field surveys were carried out to characterise the local physical structure of the watercourse channels and margins at a scale that complemented biological surveys. Using a MoRPh5 approach, a sequence of five adjacent MoRPh surveys quantified over 30 indicators that contribute to a preliminary condition score for a watercourses sub reach. To conclude the RCA, a river type survey was undertaken at a desk-based reach-scale, to evaluate the hydro geomorphological river type. This translated the preliminary condition score for each MoRPh5 into a final condition score, shown in Table 3-2, which reflects what is achievable for that river type.

4.1.2 Of the MoRPh5 sub reaches surveyed, only two (15a_DS_Imp and 34_US_Imp) received a ‘Poor’ final condition class. Eight sub reaches recorded a final condition class of ‘Fairly poor’, all of which were associated with negative indicator scoring features to a certain extent. A total of 13 sub reaches received a final condition score of ‘Moderate’, of which, both sub reaches at crossing point received. A reflection of the limited access to the immediate crossing point using ingress/egress routes available at the time of survey. Three sub reaches recorded a final condition score of ‘Fairly good’, with no sub reaches within the survey receiving a final condition score of ‘Good’ at the time of observations.

Abbreviations List

Please refer to ES Report Chapter 17 Abbreviations

Glossary

Please refer to ES Report Chapter 18 Glossary

References

[1] Department for Transport, “Road investment strategy: 2015 to 2020,” March 2015. [Online]. Available: https://www.gov.uk/government/publications/road-investment-strategy-for-the-2010-to-2020-road-period. [Accessed January 2021].

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[5] A. M. Gurnell, S. J. Scott, J. England, D. Gurnell, R. Jeffries, L. Shuker and G. Wharton, “Assessing river condition: A multiscale approach designed for operational application in the context of biodiversity net gain,” *River Research and Applications,* vol. 36, pp. 1559-1578, 2020.

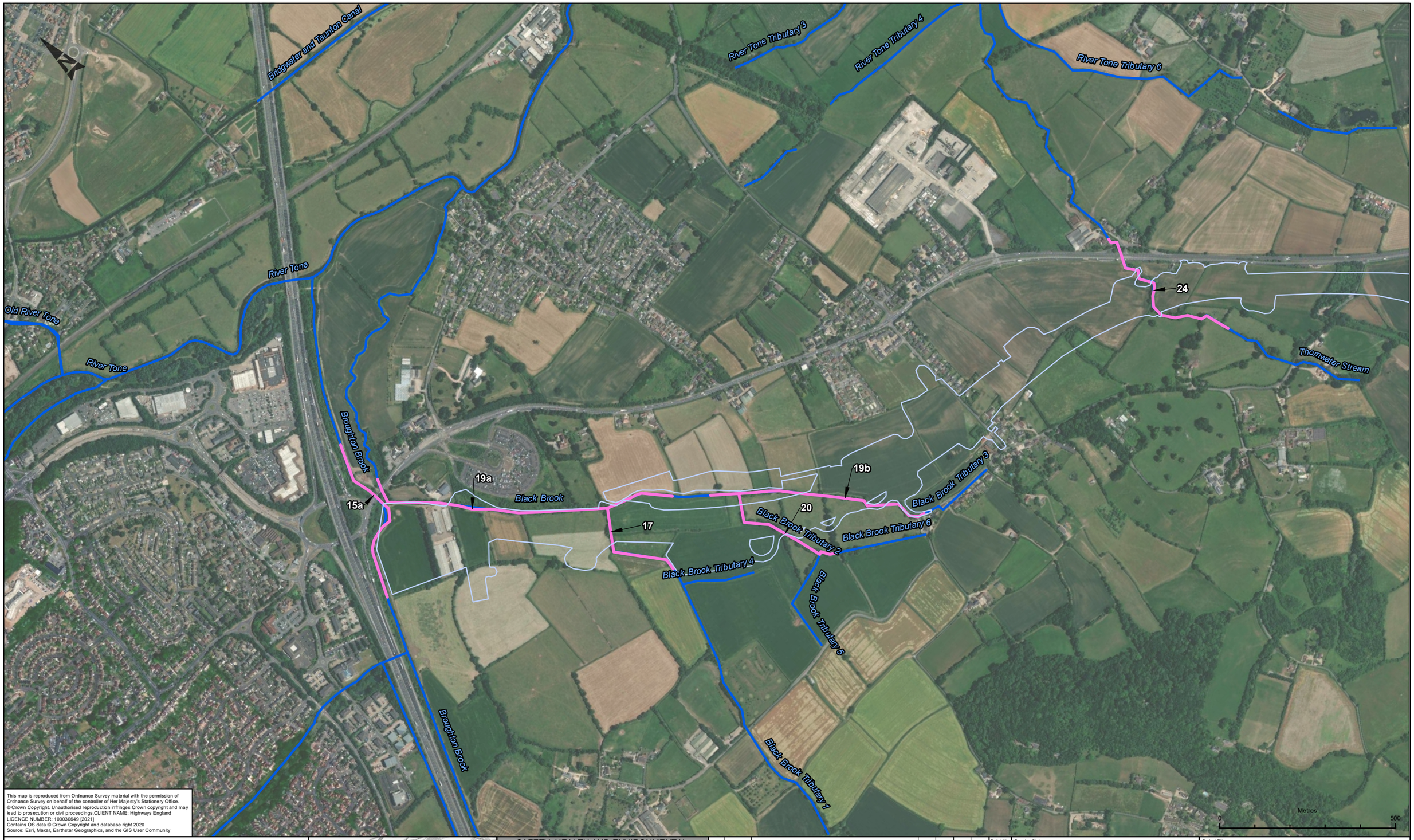
[6] L. Shuker, A. M. Gurnell and G. Wharton, “MoRPh; A citizen science tool for monitoring and appraising physical habitat changes in rivers,” *Water and Environment Journal,* vol. 31, no. 2, 2017.

[7] A. M. Gurnell, J. England, L. Shuker and G. Wharton, “The contribution of citizen science volunteers to river monitoring and management: International and national perspectives and the example of the MoRPh survey,” *River Research and Applications,* vol. 35, no. 8, pp. 1359-1373, 2019.

[8] National Highways, “A358 Taunton to Southfields Dualling Scheme Environmental Statement, chapter 8: Appendix 8.5,” National Highways, 2022.

Appendices

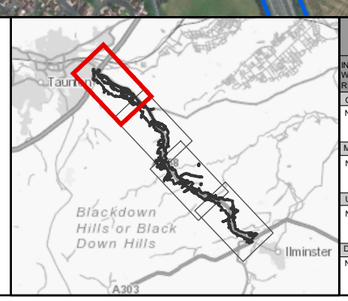
Appendix A Modular river survey (MoRPh) survey extent



LEGEND

- ECOLOGY SURVEY ZONE
- MODULAR RIVER SURVEY (MoRPh) EXTENT (250M EITHER SIDE OF SCHEME CROSSING POINT)
- WATERCOURSES

LABELS SHOW SURVEY LOCATION ID



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Client: national highways

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Drawing Title: MODULAR RIVER SURVEY (MORPH) SURVEY EXTENT SHEET 1 OF 4

Scale	By	Checked	Approved	Authorised
1:10,000	LL	MA	JS	SV

Original Size	Date	Date	Date	Date
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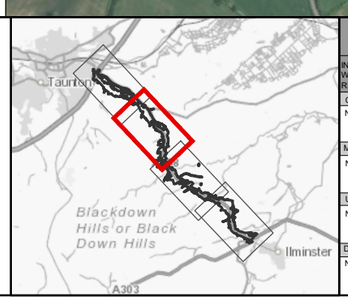
Drawing Number: HE551508 (HE P/N) - ZZ (Location) | ARP (Originator) - VES (Volume) - DR - LE - 000287 (Type | Role | Number)

Revision: P02

LEGEND

- ECOLOGY SURVEY ZONE
- WATERCOURSES
- MODULAR RIVER SURVEY (MoRPh) EXTENT (250M EITHER SIDE OF SCHEME CROSSING POINT)

LABELS SHOW SURVEY LOCATION ID



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Suitability: S2 — SUITABLE FOR INFORMATION

Drawing Status

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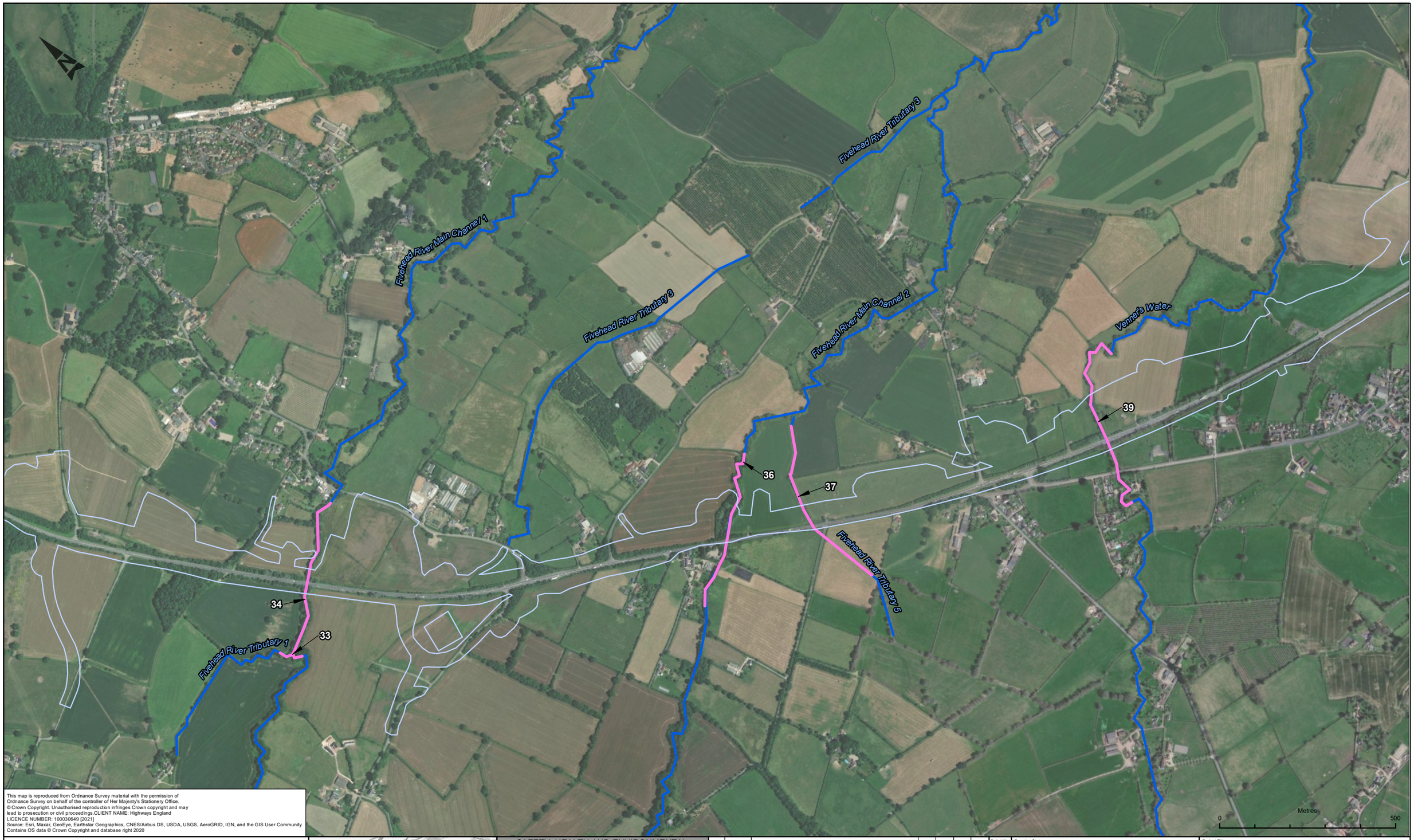
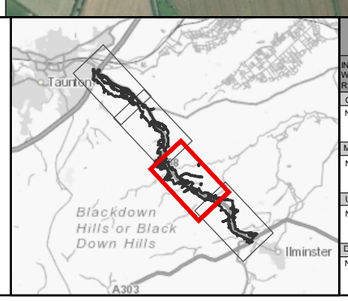
Revision: P02



LEGEND

- ECOLOGY SURVEY ZONE
- WATERCOURSES
- MODULAR RIVER SURVEY (MoRPh) EXTENT (250M EITHER SIDE OF SCHEME CROSSING POINT)

LABELS SHOW SURVEY LOCATION ID



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Drawing Title: MODULAR RIVER SURVEY (MORPH) SURVEY EXTENT SHEET 3 OF 4

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Revision: P02

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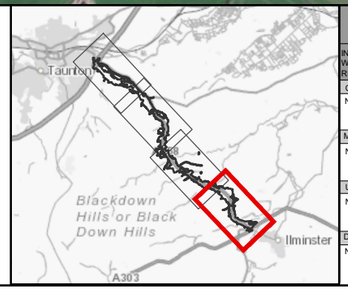
- ECOLOGY SURVEY ZONE
- WATERCOURSES
- MODULAR RIVER SURVEY (MoRPh) EXTENT (250M EITHER SIDE OF SCHEME CROSSING POINT)

LABELS SHOW SURVEY LOCATION ID



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ZZ - DR - LE - 000290
Location | Type | Role | Number

Revision: P02

Appendix B MoRPh5 raw data

MoRPh5 survey subreach	Preliminary Condition Score	Shape	Average Width	Positive Index Average	Negative Index Average	A6 - Bedrock Reaches	A7 - Coarest Bed Material Size class	A8 - Average Alluvial bed	B1 - Bank top vegetation structure	B2 - Bank top tree feature richness	B3 - Bank top water related features	B4 - Bank top NNIPS cover	B5 - Bank top managed ground	C1 - Bank face riparian vegetation	C2 - Bank face tree feature richness	C3 - Bank face natural bank profile extent	C4 - Bank face natural bank profile richness	C5 - Bank face natural bank material richness	C6 - Bank face bare sediment extent	C7 - Bank face artificial bank profile	C8 - Bank face reinforcement extent	C9 - Bank face reinforcement material severity	C10 - Bank face NNIPS cover
15a_Nat, US	0.83	1.79	4.30	1.37	-0.54	FALSE	GP	SI	2	2	0	-2	0	1	1	2	1	1	0	0	0	0	-3
15a_Imp, DS	-1.19	5.18	5.28	1.58	-2.77	FALSE	GP	SA	2	0	0	-3	-4	1	1	2	1	1	4	0	-4	-4	-3
17_Nat, US	1.21862352	1.45	1.36	1.53	-0.31	FALSE	SI	SI	2	0	0	0	-2	2	2	3	4	1	3	-2	0	0	0
19a_Imp, DS	0.24	2.15	3.42	1.47	-1.23	FALSE	GP	SA	2	0	1	0	-3	2	1	3	4	2	0	-1	-2	-2	0
20_DS	0.77	1.56	2.00	1.16	-0.38	FALSE	SI	SI	1	0	1	0	-2	1	1	3	3	1	2	0	-1	-1	0
24_Nat, US	0.65	1.26	1.50	1.26	-0.62	FALSE	CO	SA	2	0	0	0	-2	1	1	2	2	1	3	0	0	0	0
24_Imp, DS	0.22	1.61	2.30	1.53	-1.31	FALSE	GP	SI	1	0	0	0	-4	1	1	3	4	1	4	0	-3	-4	0
30_Nat, US	1.72	1.17	2.80	2.26	-0.54	FALSE	CO	GP	1	0	0	0	-3	2	3	3	3	4	2	0	0	0	-2
30_Imp, DS	0.56	1.22	3.38	1.79	-1.23	FALSE	CO	SA	1	0	0	0	-4	2	1	3	4	1	1	0	-2	-2	-2
31_Nat, US	1.88	1.02	2.10	2.42	-0.54	FALSE	BO	GP	3	1	0	0	-2	3	3	3	4	3	2	0	0	0	0
31_Imp, DS	-0.13	0.64	2.18	1.79	-1.92	FALSE	BO	GP	1	0	0	0	-4	2	1	2	3	2	4	-3	-3	-3	0
33, US	1.95	1.70	2.86	2.11	-0.15	FALSE	CO	GP	2	0	1	0	-2	2	2	3	4	2	1	0	0	0	0
34_Imp, US	-1.03	1.58	3.30	0.89	-1.92	FALSE	CO	CO	1	0	0	0	-4	2	0	2	1	0	1	0	-4	-4	0
34_Nat, DS	1.04	1.61	3.22	1.42	-0.38	FALSE	CO	GP	1	0	0	0	-3	1	1	2	2	1	1	0	0	0	-2
36_Nat, US	0.85	1.20	1.50	1.32	-0.46	FALSE	GP	SA	1	0	0	0	-4	1	0	3	3	1	0	0	0	0	0
36_Imp, DS	0.95	2.08	2.82	1.95	-1.00	FALSE	GP	GP	2	0	0	0	-3	3	1	3	3	2	3	0	-2	-2	0
37_Nat, US	0.43	0.56	0.40	0.58	-0.15	FALSE	SI	SI	1	0	0	0	-2	1	0	2	1	1	0	0	0	0	0
37, DS	0.70	1.00	1.38	1.16	-0.46	FALSE	CO	SA	1	0	0	0	-3	1	1	2	1	1	0	0	0	0	0
39_Nat, DS	0.86	1.06	1.76	1.63	-0.77	FALSE	GP	SA	2	0	0	-1	-3	2	1	2	2	1	3	0	0	0	-3
39_Imp, US	-0.03	1.42	2.24	1.89	-1.92	FALSE	CO	GP	2	0	1	0	-4	3	0	3	3	1	4	0	-3	-2	0
51_Nat, DS	0.91	1.09	1.20	1.37	-0.46	FALSE	GP	GP	2	0	0	0	-3	1	1	2	2	1	1	0	0	0	0
52_Nat, US	1.04	1.68	2.20	1.42	-0.38	FALSE	CO	SA	1	0	0	0	-3	2	1	3	3	2	1	0	0	0	0
52_Impact, DS	-0.20	2.16	3.84	1.26	-1.46	FALSE	CO	SA	2	0	0	0	-4	1	1	3	3	1	0	0	-3	-3	0
54_Imp, DS	0.07	2.35	2.40	1.84	-1.77	FALSE	GP	SA	2	0	2	0	-3	1	1	3	3	1	1	0	-2	-2	-2
54_Nat, US	1.04	2.28	5.00	1.42	-0.38	FALSE	CO	GP	1	0	0	0	-3	1	1	3	4	1	1	0	0	0	-1
55_Imp, US	-0.12	1.84	4.02	1.42	-1.54	FALSE	CO	GP	2	0	0	0	-4	1	0	3	3	1	2	0	-4	-4	-3
55_Nat, DS	1.32	1.28	3.30	1.63	-0.31	FALSE	CO	GP	1	0	0	0	-2	2	1	3	3	1	1	0	0	0	-1

MoRPh5 survey subreach	D1 - Channel margin aquatic vegetation extent	D2 - Channel margin aquatic morphotype richness	D3 - Channel margin physical features extent	D4 - Channel margin physical features richness	D5 - Channel margin artificial features	E1 - Channel aquatic morphotype richness	E2 - Channel bed treee features richness	E3 - Channel bed hydraulic feature richness	E4 - Channel bed natural features extent	E5 - Channel bed natural features richness	E6 - Channel bed material richness	E7 - Channel bed siltation	E8 - Channel bed reinforcement extent	E9 - Channel bed reinforcement severity	E10 - Channel bed artificial features severity	E11 - Channel bed NNIPS extent	E12 - Channel bed filamentous algae extent
15a_Nat, US	2	1	3	1	0	3	0	0	3	1	2	-2	0	0	0	0	0
15a_Imp, DS	2	2	2	1	0	3	1	1	3	1	2	-3	-4	-4	-4	0	-3
17_Nat, US	1	0	2	1	0	1	2	1	1	1	2	0	0	0	0	0	0
19a_Imp, DS	2	1	2	1	-1	2	0	1	1	1	2	-2	0	0	-4	0	-1
20_DS	1	0	1	1	0	2	2	1	0	0	1	0	0	0	0	0	-1
24_Nat, US	1	0	3	1	0	1	2	1	0	0	3	-2	0	0	-4	0	0
24_Imp, DS	1	0	1	2	0	1	3	0	2	1	3	-2	0	0	-4	0	0
30_Nat, US	3	2	2	2	-1	2	3	2	3	2	4	-1	0	0	0	0	0
30_Imp, DS	2	2	4	2	0	1	1	1	3	2	3	0	0	0	-4	0	-2
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34_Nat, DS	2	1	4	1	0	0	2	1	3	1	3	0	0	0	0	0	0
36_Nat, US	2	2	1	1	-1	2	2	0	3	1	2	-1	0	0	0	0	0
36_Imp, DS	3	2	1	2	-1	1	3	1	3	2	2	0	0	0	-4	0	-1
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37, DS	2	1	1	1	0	2	1	1	2	1	3	0	0	0	0	0	-3
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54_Imp, DS	2	3	1	1	-1	3	1	2	3	2	3	-2	-2	-2	-4	-2	-1
54_Nat, US	1	0	1	1	0	1	2	1	3	2	3	-1	0	0	0	0	0
55_Imp, US	1	0	1	1	-4	2	2	1	3	2	2	0	0	0	0	0	-1
55_Nat, DS	2	2	3	2	0	1	1	1	3	2	2	0	0	0	0	0	-1

Appendix C Photographic log

C.1 Site 15a – Broughton Brook

Figure C-1 Site 15a DS Impact

Figure C-2 Site 15a US Natural

C.2 Site 17 – Black Brook Tributary 1

Figure C-3 Site 17 US Natural

Figure C-4 Site 17 DS - No Survey

C.3 Site 19a – Black Brook

Figure C-5 Site 19a US Impact

Figure C-6 Site 19a Further US – No Survey

C.4 Site 19b – Black Brook Tributary 3

Figure C-7 Site 19b DS – No Survey

Figure C-8 Site 19b US – No Survey

C.5 Site 20 – Black Brook Tributary 2/5

Figure C-9 Site 20 DS Impacted

Figure C-10 Site 20 US – No Survey

C.6 Site 24 - Thornwater Stream

Figure C-11 Site 24 DS Impacted

Figure C-12 Site 24 US Natural

C.7 Site 30 – Meare Stream

Figure C-13 Site 30 DS Impacted

Figure C-14 Site 30 US Natural

C.8 Site 31 – Meare Stream Tributary 1

Figure C-15 Site 31 DS Impacted

Figure C-16 Site 31 US Natural

C.9 Site 33 - Fivehead River Tributary 1

Figure C-17 Site 33 Natural

C.10 Site 34 - Fivehead River main channel 1

Figure C-18 Site 34 US Impacted

Figure C-19 Site 34 DS Natural

C.11 Site 36 - Fivehead River main channel 2

Figure C-20 Site 36 DS Impacted

Figure C-21 Site 36 US Natural

C.12 Site 37 – Fivehead River Tributary 5

Figure C-22 Site 37 US Impacted

Figure C-23 Site 37 DS Natural

C.13 Site 39 – Venner's Water

Figure C-24 Site 39 US Impacted

Figure C-25 Site 39 DS Natural

C.14 Site 51 – Cad Brook Drainage Network

Figure C-26 Site 51 US – No Survey

Figure C-27 Site 51 DS Natural

C.15 Site 52 – Cad Brook

Figure C-28 Site 52 US Natural

Figure C-29 Site 52 DS Impact

C.16 Site 54 – River Ding/River Ding Drainage Network

Figure C-30 Site 54 US Natural

Figure C-31 Site 54 DS Impact

C.17 Site 55 – Back Stream/River Ding Drainage Network

Figure C-32 Site 55 US Impact

Figure C-33 Site 55 DS Natural

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