

A358 Taunton to Southfields Dualling Scheme

Ecological Baseline Report - Water Vole

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1 Introduction

1.1 Purpose and scope of this document

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 to the A303 at Ilminster to the south. Water vole (*Arvicola amphibius*) surveys were part of the suite of habitat and protected species surveys commissioned in relation to the scheme.

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

The objectives of this report are to:

- collate and review existing records for water vole
- present the methods, constraints and results of the water vole habitat assessment and field signs surveys

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 a Scheme plan.

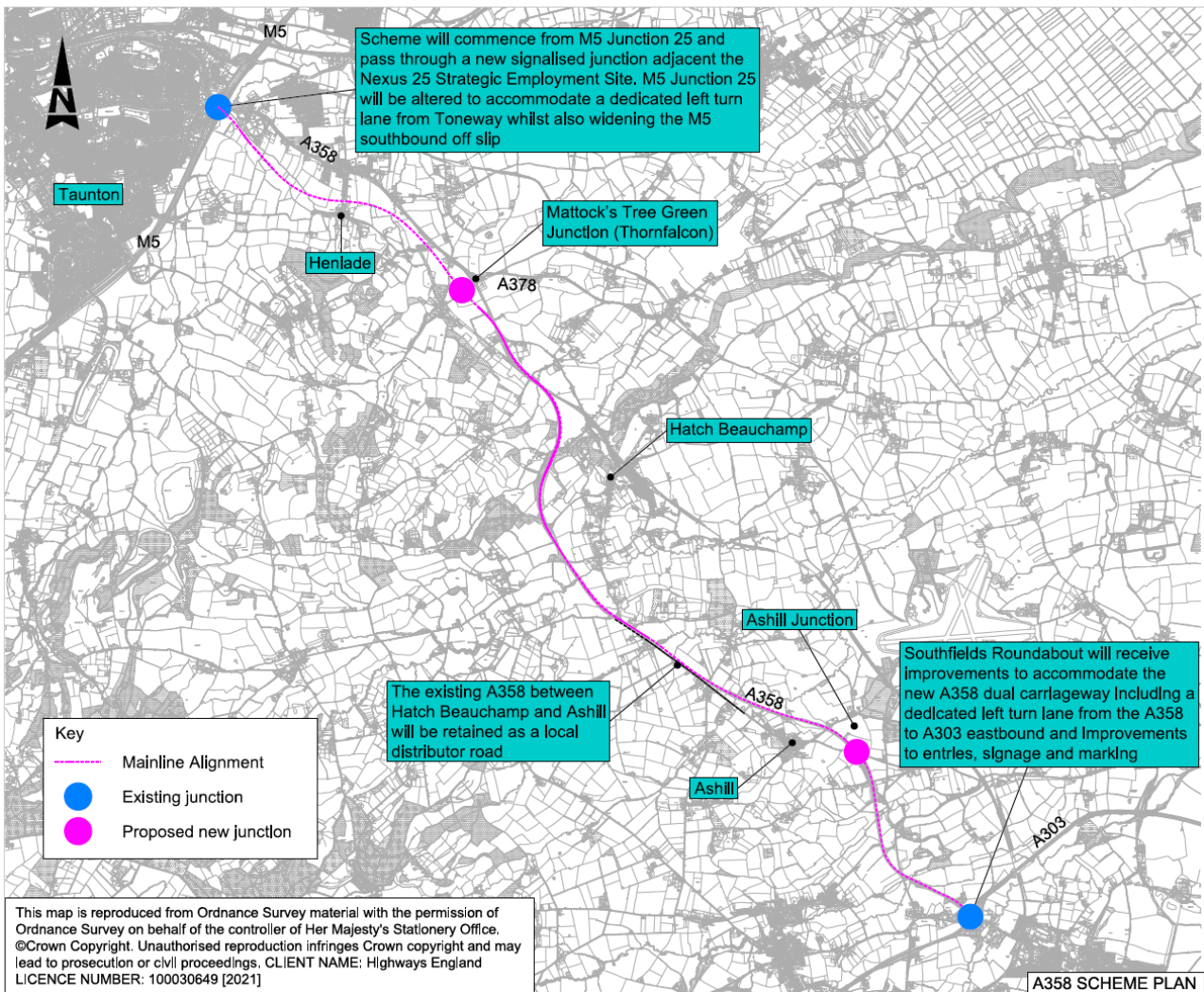


Figure 1-1 Scheme plan

1.3 Study area and zone of influence

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 water vole rely on habitat connectivity to or across the scheme
- areas where there is a risk of pollution and noise disturbance during construction and/or operation

1.3.1 The ZoI depends on the ecological features concerned. The ZoI was agreed in consultation with Natural England and has been defined as watercourses within the boundary of the scheme and extending up to 250 metres upstream and downstream of the defined ecology survey zone, which comprises the footprint of the scheme and associated site clearance area. For certain watercourses likely to be subject to higher impacts, such as culverting or realignment, the survey area was extended up to 500 metres. 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. This legislation will be listed in full within Chapter 8 *Biodiversity* of the ES. Legislation relevant to and discussed within this report are:

- Wildlife and Countryside Act 1981 (as amended)
- Natural Environment and Rural Communities (NERC) Act 2006

1.5 Status of water vole at national level

1.5.1 Water vole is listed as Species of Principal Importance (SPI) for the conservation of biodiversity in England in accordance with the provisions of Section 41 (S41) of the NERC Act 2006. Action plans associated with the species include monitoring (via the National Water Vole Database), reduction of predation by mink (*Neovison vison*) control, habitat protection and the expansion of key areas for water vole.

1.5.2 The water vole is also listed under the now succeeded UK Biodiversity Action Plan (UK BAP) but continues to be regarded as a conservation priority in the subsequent *UK Post-2010 Biodiversity Framework* [3].

1.5.3 Water voles are widely distributed throughout the lowland areas of Great Britain but are absent from Ireland. Water vole populations have declined over the last century across the UK, owing predominately to predation by non-native mink and changes in land management. Between 1989 and 1998 a decline of 78% has been recorded [4].

1.5.4 Since 1998, it is estimated that the UK water vole population has suffered a further 50% decline, although its range remains stable. Changes in land management approaches and captive breeding projects are positive drivers of change, but the future population trend is predicted to continue to show an overall decline [5].

1.6 Status of water vole at county level

1.6.1 Water voles occur on slow flowing watercourses throughout Somerset, including in urban areas.

1.6.2 The *National Water Vole Database and mapping (Project Report 2009 - 2018)* [6] shows a contraction in distribution within Somerset compared to the 1958 – 2008 dataset. However, there are a large number of strongholds throughout the county where populations have persisted, and in some cases have increased.

1.6.3 The South Somerset Local BAP has been withdrawn; however, a more recent biodiversity strategy has been produced by the Somerset Biodiversity Partnership. *The Somerset Biodiversity Strategy 2008 – 2018* [7] which contains objectives to protect, enhance and create a range of habitats, including priority habitats, that can be exploited by SPI such as water vole.

1.7 Species-specific ecology

1.7.1 Water voles in the UK are strongly correlated with aquatic habitats, although populations across Europe (and rare examples in the UK) also form terrestrial communities [8]. They prefer slow flowing rivers, ditches, canals and lakes.

- 1.7.2 Water voles favour watercourses with steep earth banks; excavating burrows into these banks with entrances both above and below the water level. Colonies are vulnerable to changes in water levels; therefore, steep banks ensure that in times of high flow, water voles can retract to areas of higher ground. Water voles feed predominantly on vegetation and require an abundant supply of food throughout the year, with 227 plant species identified in their diet [9]. Their preference is to inhabit well vegetated channels, which provide an abundant food supply whilst providing cover from predators.
- 1.7.3 The males home range is approximately 0.08 miles (ranges from 60 to 300 metres), with females typically having smaller ranges of around 0.04 miles (ranges from 30 to 150 metres) [10]. Water voles are quite short-lived mammals and will have multiple litters each year. In a good year, this means that populations can expand significantly and thus spread into adjacent and less suitable habitat.

2 Methodology

2.1 Desk study

2.1.1 In accordance with the *Water Vole Mitigation Handbook* [8], a detailed desk study was undertaken in September 2021 which identified records of water vole within 5 kilometres of the scheme. Records were obtained from Somerset Environmental Records Centre (SERC).

2.2 Field study

Habitat suitability assessment

- 2.2.1 A targeted approach to surveying was agreed with Natural England prior to surveys commencing. Each accessible watercourse within the study area (within the scheme boundary and up to 250 metres upstream and downstream of the ecology survey zone) was surveyed to assess the suitability of the habitat for supporting water vole. In addition, the habitat suitability assessment area was extended up to 500 metres upstream and downstream for suitable watercourses subject to higher impacts, such as culverting or realignment.
- 2.2.2 Watercourses were considered to be suitable if they had a slow flow speed, were less than 3 metres wide and less than 1 metre deep, had limited fluctuations in water level, provided steep earth banks, were unshaded, and had a continuous swathe of riparian vegetation providing at least 60% ground cover [11].
- 2.2.3 Surveys for water vole field signs followed the guidelines set out in the *Water Vole Mitigation Handbook* [8]. All surveys were undertaken within the water vole's main breeding season (mid-April to September for Southern England) and during suitable weather conditions.
- 2.2.4 At each watercourse a survey was undertaken during the early season (mid-April to June) and during the late season (July to September). Habitat assessments were undertaken on both occasions to account for seasonal variations within the watercourse. During the detailed habitat assessment each watercourse was assigned a ranking of either negligible, low, moderate or high suitability. Suitability of habitat for supporting water voles was based on the following:
- Bank profile, channel profile and characteristics and water levels
 - Availability of food sources
 - Vegetation structure (particularly the extent of suitable marginal vegetation)
 - Level of shading
 - Disturbance levels
 - Bordering land use
 - Connectivity with other areas of suitable or sub-optimal habitat.

Water vole field signs surveys

- 2.2.5 During both surveys, the banks of each watercourse (up to 2 metres from the water's edge) were inspected for signs of use by water vole, with a note made of the number of each type of water vole field sign recorded so that abundance could be estimated. Field signs recorded included the following:
- Presence of latrines
 - Presence of burrows (both active and inactive)

- Presence of runs
- Presence of footprints
- Presence of feeding remains
- Individual droppings
- Sightings and/or sounds (characteristic sound entering the water) of individuals.

- 2.2.6 All accessible lengths of each watercourse were searched for signs of water vole; this included bankside and in-channel assessments by surveyors. Access along watercourses was limited due to dense vegetation or prohibited access (landowner refusal).
- 2.2.7 Watercourses were surveyed for field signs within the scheme boundary and up to 100 metres upstream and downstream of the ecology survey zone. Where higher quality habitat was identified beyond 100 metres the field signs survey was extended up to 250 metres. Survey extent was further increased to 500 metres for watercourses likely to be subject to greater impacts such as culverting and realignment.
- 2.2.8 An indication of relative population size along each watercourse was estimated based on the number of latrines recorded per site, within the survey area.
- 2.2.9 All field signs found were photographed, mapped with GPS (accurate to <5 metres) and allocated a standardised survey and location reference code.
- 2.2.10 All surveys were undertaken by experienced ecologists meeting the CIEEM competencies for water vole surveys [12] and were familiar with the *Common Standard Monitoring Guidance for Mammals* [13] and the *Design Manual for Roads and Bridges (DMRB) LA 108 Biodiversity* [14]. Surveyors included Sophie Amphlett, Marie Fleming, Jacob Haddon, Steven Mills, Stephanie Bevan, John Daw, Nick Mason, Felix Tuff, Chloe Stephenson, Jack Anderson, Amelia Houghton, Kallum Buxton, Jack Wykes and Anna Burnham.
- 2.2.11 Surveys were undertaken in June 2021 and September 2021. The surveys were undertaken under optimal conditions at suitable times of the year with no periods of heavy rain in the week preceding the surveys (which may have washed away evidence).
- 2.2.12 Survey dates and weather conditions for each of the 23 watercourses surveyed for field signs are provided in Table 2-1.

Table 2-1 Water vole survey dates and weather conditions

Watercourse (ID number) *	Date	Air Temperature (°C)	Rain (0-5)	Cloud Cover (0-8)	Wind (Beaufort scale)	Significant rain (preceding survey)
Blackbrook Business Park (62) **	16/06/2021	22	0	3	2	No
Broughton Brook (15a)	15/06/2021	19	0	0	1	No
	13/09/2021	16	0	1	2	No
Black Brook Tributary 1 (17)	16/06/2021	22	0	3	2	No
	15/09/2021	18	0	0	2	No

Watercourse (ID number) *	Date	Air Temperature (°C)	Rain (0-5)	Cloud Cover (0-8)	Wind (Beaufort scale)	Significant rain (preceding survey)
Black Brook (19)	16/06/2021	22	0	3	2	No
	15/09/2021	18	0	0	2	No
Black Brook Tributary 3 (19.1)	16/06/2021	22	0	3	2	No
	23/09/2021	17	0	4	2	No
Black Brook Tributary 2 (20)	16/06/2021	22	0	3	2	No
	23/09/2021	18	0	0	2	No
Black Brook Tributary 6 (20.1)	16/06/2021	22	0	3	2	No
	23/09/2021	17	0	4	2	No
Thornwater Stream (24)	16/06/2021	22	0	3	2	No
	14/09/2021	14	0	2	2	No
Meare Stream (30)	17/06/2021	18	0	0	2	No
	15/09/2021	18	0	0	2	No
Meare Stream Tributary 1 (31)	18/06/2021	20	0	0	2	No
	10/09/2021	17	0	8	2	No
Unnamed field drainage ditch (32) **	15/09/2021	18	0	0	2	No
Fivehead River Tributary 1 (33) **	17/06/2021	18	0	0	2	No
Fivehead River main channel 1 (34)	09/09/2021	17	0	8	3	No
	17/09/2021	16	0	0	3	No
Fivehead River main channel 2 (36)	21/06/2021	18	0	1	2	No
	14/09/2021	14	0	2	2	No
Fivehead River Tributary 5 (37)	22/06/2021	17	0	2	1	No
	14/09/2021	14	0	2	2	No
Venner's Water (39)	23/06/2021	17	0	2	1	No
	13/09/2021	16	0	1	2	No
River Isle drainage network (42) **	18/06/2021	20	0	0	2	No
Cad Brook drainage network (51)	24/06/2021	18	0	4	3	No
	13/09/2021	16	0	1	2	No
Cad Brook (52)	24/06/2021	18	0	4	3	No
	13/09/2021	16	0	1	2	No
River Ding (54)	09/06/2021	18	0	3	3	No
	08/09/2021	18	0	0	3	No
River Ding	15/06/2021	20	0	2	1	No

Watercourse (ID number) *	Date	Air Temperature (°C)	Rain (0-5)	Cloud Cover (0-8)	Wind (Beaufort scale)	Significant rain (preceding survey)
Tributary 1 (54.1)	08/09/2021	18	0	0	3	No
River Ding drainage network (54a) **	08/09/2021	18	0	0	3	No
Back Stream (55)	09/06/2021	18	0	3	3	No
	08/09/2021	18	0	0	3	No

* Each watercourse was given an ID number, which is referenced on associated mapping

** Indicates where an initial Habitat Suitability Assessment has been completed and the watercourse deemed unsuitable, and therefore scoped out of field sign surveys.

2.3 Assumptions and limitations

- 2.3.1 The surveys provide a 'snapshot' of activity at the site and therefore, there is always the risk of water vole being overlooked, either owing to the timing of the survey or the scarcity of water vole at the site.
- 2.3.2 Conditions on site meant that some areas were difficult to access, owing to the density of bankside vegetation, hedgerows, and dense scrub. An assessment of these areas was made as far as was safe and practicable, however it is possible that signs of water vole were missed and therefore such features would not have been addressed within this report.
- 2.3.3 Access to the following watercourses was restricted:
- Black Brook Tributary 1 (17) – east bank restricted access (access refusal).
 - Black Brook Tributary 6 (20.1) – south bank restricted access with limited views from the north bank due to dense vegetation (access refusal).
 - Meare Stream Tributary 1 (31) – middle section with restricted access in June 2021 (access refusal). Fully accessible during September 2021 surveys.
 - Fivehead River Tributary 5 (37) – southern section with restricted access (access refusal) in June 2021. Fully accessible during September 2021 surveys.
 - Unnamed field drainage ditch (32) – restricted access in June 2021 (access refusal). Fully accessible during September 2021 surveys. Found to be unsuitable.
- 2.3.4 A precautionary approach was used for all watercourses with restricted access whereby water voles were assumed to be present. All waterbodies with restricted access were tributaries to other suitable watercourses and were likely to exhibit similar characteristics and suitability.

3 Results

3.1 Desk study

- 3.1.1 Information received from SERC identified 73 records of water vole within the study area recorded within the last 10 years. Additional records pre-2011 were provided; however, these were historic records and were not reviewed any further.
- 3.1.2 The majority of records are located to the west of the M5, with all records, with the exception of a single record southwest of the scheme, lying north-west of Henlade. A cluster of records was located along the River Tone between Venture Way and Firepool Lock, to the north-east of Taunton town centre.
- 3.1.3 Most records pertained to burrows; however, observations of live water vole in-situ records were also provided. A single latrine was recorded within the boundary of the scheme at Stoke St Mary at the north-western end of the scheme.
- 3.1.4 The desk study confirms water vole are present near the scheme and suggests that Broughton Brook may be utilised by water vole. A map of records has been provided at Appendix A *Historical records from SERC*.

3.2 Habitat Assessment

- 3.2.1 Twenty-three watercourses located within the study area were assessed for their suitability to support water voles. The results of the habitat assessment, including a description of the sections of each of the watercourses located within the study area, are provided below.

Blackbrook Business Park (62)

- 3.2.2 A short section of wet ditch is located within the Blackbrook Business Park to the west of the scheme.
- 3.2.3 The wet ditch is shallow at 0.5 metres in depth and narrow, with a channel width of 1 to metres. The bank profile was steep (>45 degrees) and there was a sluggish flow rate. The ditch was heavily shaded (99%) by overhanging plantation woodland and scrub (along the M5 northbound carriageway). There was a lack of emergent vegetation, however pendulous sedge was present as marginal vegetation along the earth banks.
- 3.2.4 Roadside hedgerows provided limited connectivity to several drainage ponds within the wider business park. It is unknown whether this ditch is connected to Broughton Brook to the east via culverts underneath the existing A358. The ditch is separated from the business park and public access by dense vegetation, resulting in low levels of disturbance.
- 3.2.5 Foraging opportunities from emergent vegetation was absent, however dense marginal vegetation provides sub-optimal foraging opportunities. The earth banks were heavily shaded, and the channel bed was largely dry, reducing opportunities for burrowing. Overall, the watercourse was of negligible suitability for water vole given limitations to foraging and burrowing.

Broughton Brook (15a)

- 3.2.6 Broughton Brook is located at the northern extent of the scheme and runs alongside the southbound carriageway of the M5. The watercourse passes underneath the existing A358 at Blackbrook Bridge, located at the southbound M5 exit junction.
- 3.2.7 Broughton Brook is a small watercourse which ranges in depth from 0.5 to >1 metre and had a channel width ranging from 2 to 5 metres. The profile of the watercourse was steep (>45 degrees) with a moderate flow speed. The channel varied from open to heavily shaded by overhanging vegetation (~90% shade). There was a lack of emergent and marginal vegetation throughout the stretch of watercourse surveyed as part of this assessment. Pockets of bankside scrub provided limited terrestrial connectivity between Broughton Brook and Black Brook to the east.
- 3.2.8 The banks of the watercourse had been modified and were largely man-made, with additional sections of earth cliffs subject to a mixture of management methods. The adjacent land use comprised arable farmland, urban, and semi-natural woodland habitats with low levels of disturbance.
- 3.2.9 Foraging opportunities within the channel were limited; however marginal vegetation provided a suitable alternative. Burrowing opportunities were lacking in sections of man-made construction; however, the steep earth cliffs along the western bank provided opportunities and sufficient cover was provided by marginal vegetation. Overall, the watercourse was of moderate suitability for water vole given limitations to connectivity, burrowing and foraging.

Black Brook Tributary 1 (17)

- 3.2.10 Black Brook Tributary 1 originates near Stoke Mary to the south of the scheme and joins Black Brook (19) to the south of the Taunton Park and Ride.
- 3.2.11 Tributary 1 is a small watercourse with a shallow depth <30 centimetres and a narrow channel ranging from 1 to 2 metres in width. The banks had a shallow profile (<45 degrees), with some short sections displaying a steeper profile towards the south. The channel displayed a sluggish flow rate and varied from open, to heavily shaded by overhanging vegetation and field boundary hedgerows (90% shade). Emergent and marginal vegetation was sparse and consisted of pendulous sedge (*Carex pendula*) and fool's watercress (*Apium nodiflorum*). The adjacent land use comprises arable farmland and semi-natural woodland habitats with low levels of disturbance.
- 3.2.12 Foraging opportunities were limited, and marginal vegetation comprised of encroaching ivy (*Hedera helix*) and scrub. Burrowing opportunities were lacking given the shallow profile of the banks. There was however sufficient coverage from adjacent vegetation to conceal burrows and provide cover from predation. Overall, the watercourse was of low suitability for water vole given limitations to burrowing and foraging.

Black Brook (19)

- 3.2.13 Black Brook is located at the northern extent of the scheme. The watercourse is fed by several smaller tributaries which originate to the south and south-west (tributaries 1, 2, 3, 5 and 6). Black Brook runs in a north-westerly direction

towards the A358/M5 Junction, where it passes under Blackbrook Bridge and finally terminates in the River Tone to the north, at Ruishton.

- 3.2.14 Black Brook is a small watercourse which varied in composition and profile. Depth ranged from 0.2 to 1 metre, with a channel width ranging from 1 to 5 metres. The deepest and widest sections were associated with hard engineering (new culverts and road bridges) at the A358/M5 Junction, and the Nexus 25 development site.
- 3.2.15 The profile of Black Brook ranged from sheer banks made from gabion baskets to shallow earth and silt banks leading to the channel bed. Flow rate was slow along the entirety of the watercourse. The majority of the watercourse was heavily shaded by overhanging vegetation (90% shade), with the exception of the recent earthworks in association with the Nexus 25 development (open with 0% shading). A small section of the watercourse to the north of the A358 exhibited dense emergent and marginal vegetation (limited to fool's watercress and pendulous sedge). Pockets of scrub also provided limited terrestrial connectivity between Black Brook and Broughton Brook to the west.
- 3.2.16 The banks of Black Brook were modified (culverted, gabion baskets and bank cutting) around the A358 and Nexus 25 development and the stretch of Black Brook to the north of the existing A358 displayed signs of occasional dredging and bank cutting. The adjacent land use comprised arable farmland, urban, and semi-natural woodland habitats with low to moderate levels of disturbance.
- 3.2.17 Ample foraging opportunities were provided by emergent and marginal vegetation along the majority of the watercourse. Burrowing opportunities were present in the steep earth banks and dense marginal vegetation provided sufficient coverage to burrows. Overall, the watercourse ranged from moderate to high suitability for water vole.

Black Brook Tributary 3 (19.1)

- 3.2.18 Black Brook Tributary 3 originates in Henlade and runs westward to join the main Black Brook watercourse to the south of the Taunton Park and Ride.
- 3.2.19 Tributary 3 is a small watercourse with a shallow depth ranging from dry to 0.5 metres and had a narrow channel ranging from 2 to 5 metres in width. The adjacent land use comprised arable farmland with a single public right of way footpath, with low levels of disturbance.
- 3.2.20 The profile of the watercourse is steep (>45 degrees), with a sluggish flow speed. The channel was shaded by overhanging vegetation and field boundary hedgerows (90% shade). There was a lack of vegetation throughout the stretch of watercourse surveyed as part of this assessment, in part due to overshading and dense bramble (*Rubus fruticosus agg.*) along the earth banks. Adjoining hedgerows provided terrestrial connectivity between other nearby tributaries to the south.
- 3.2.21 Foraging opportunities were limited, and marginal vegetation comprised encroaching ivy and scrub which were sub-optimal foraging resources. Burrowing opportunities were present along the steep earth banks and there was sufficient coverage from adjacent vegetation to conceal any burrows and reduce the risk of predation. Overall, the watercourse was of low suitability for water vole given limitations to foraging and dispersal.

Black Brook Tributary 2 (20)

- 3.2.22 Black Brook Tributary 2 forms from the convergence of two smaller tertiary tributaries (Tributaries 5 and 6) and flows into Tributary 1 to the north-west of Henlade.
- 3.2.23 Tributary 2 is short in length (approximately 300 metres) with a shallow depth <30 centimetres and a narrow channel which ranged from 2 to 5 metres in width. The adjacent land use comprised arable farmland and semi-natural woodland habitats with low levels of disturbance.
- 3.2.24 The profile of the watercourse ranges from steep (>45 degrees) to undercut, with a sluggish flow speed. In addition, areas of dry channel bed, or small pools of standing water were present. The channel was heavily shaded by overhanging vegetation (90% shade) and there was a lack of emergent or marginal vegetation throughout. Adjoining hedgerows provided terrestrial connectivity between other nearby tributaries to the south and west.
- 3.2.25 Foraging opportunities were limited, and the water level was largely unsuitable given the presence of dry channel bed. The banks were undercut in places reducing opportunities for burrowing. Overall, the watercourse was of low suitability for water vole given limitations to foraging, burrowing and dispersal.

Black Brook Tributary 6 (20.1)

- 3.2.26 Black Brook Tributary 6 was largely inaccessible due to restricted land access on one side of the bank, coupled with a dense hedgerow limiting any views from other accessible land parcels. Given the nature of the surrounding habitats and land-use, Tributary 6 was considered to be similar in composition and profile to Tributaries 2 and 3 above, and of low suitability to water vole.

Thornwater Stream (24)

- 3.2.27 Thornwater Stream is located towards the north of the scheme. The watercourse passes underneath the existing A358 adjacent to Thorn Lane.
- 3.2.28 Thornwater Stream is a shallow watercourse <0.5 metres in depth with a channel width ranging from 1 to 2 metres. The profile of the watercourse ranges from shallow, through to steep (>45 degrees) and undercut in places, with an increasing flow rate from slow to moderate along its course. The channel varied from open, to heavily shaded by overhanging vegetation (0% to 100% shade). Emergent vegetation was associated with open and less shaded stretches of the watercourse. Emergent species include foals' watercress, reed sweet grass (*Glyceria maxima*) and pendulous sedge. Tall ruderal vegetation and bramble scrub lined the banks and field boundary hedgerows provide connectivity to adjacent terrestrial habitats.
- 3.2.29 The southern and northern extent of the watercourse were unfenced and bound by urban habitats (residential and farm buildings) meaning they were subject to high levels of anthropogenic disturbance. The northern section was also partly canalised (stone blockwork). These areas were subject to regular maintenance, primarily via frequent mowing. The central stretch of watercourse flowed through a mixture of arable and pastoral farmland, with low levels of disturbance, however there was occasional evidence of bankside poaching and channel compaction from cattle.

3.2.30 Ample foraging opportunities were provided by emergent and marginal vegetation along the majority of the watercourse. However, heavily shaded sections displayed less suitable vegetation. Burrowing opportunities were present in the steep earth banks and dense marginal vegetation provided sufficient coverage to burrows, but these were restricted in multiple sections of canalised or modified banks. Overall, the watercourse ranged from low to moderate suitability for water vole.

Meare Stream (30)

3.2.31 Meare Stream is located towards the centre of the scheme and runs from West Hatch perpendicular to the existing A358, towards Wrantage. The watercourse passes underneath the A358 via a large culvert to the south-east of West Hatch Lane.

3.2.32 Meare Stream is a shallow watercourse with a depth of <0.5 metres and a channel width ranging from 1 to 5 metres. The profile of the watercourse also ranged from undercut, to steep (>45 degrees) with a slow to moderate flow speed. The channel was heavily shaded (75% to 90% shade) by overhanging vegetation, primarily the canopies of mature trees and scrub along the banks. There was a lack of emergent vegetation, however tall ruderal vegetation and scrub were present along the tops of the earth banks providing additional cover and connectivity. Roadside and field boundary hedgerows provided limited connectivity to adjacent terrestrial habitats. The adjacent land use comprises arable farmland and urban habitats with low levels of disturbance.

3.2.33 Foraging opportunities were absent given the lack of emergent vegetation. Bankside marginal vegetation was also limited to dense scrub and woodland vegetation. The banks were heavily shaded and rocky in places, reducing opportunities for burrowing. Overall, the watercourse was of low suitability for water vole given limitations for foraging, burrowing and dispersal.

Meare Stream Tributary 1 (31)

3.2.34 Meare Stream Tributary 1 is located at the centre of the scheme and runs alongside the northbound carriageway of the existing A358, before passing underneath via a large concrete underpass on Griffin Lane.

3.2.35 Tributary 1 originates as a dry ditch within Bickenhall Wood to the west of the A358 and progressed to a small slow flowing watercourse alongside Lady Anna's Wood before passing underneath the existing A358. The watercourse had an undercut profile with tall banks between 1 to 3 metres in height and a narrow channel width of 1 to 2 metres. The depth varies from dry to 0.5 metres, with riffles (silt and stone) and deeper pools located at small meanders and natural weirs comprised of fallen deadwood and exposed roots. The watercourse was heavily shaded (80% shade) by the adjacent woodland and bankside scrub. Emergent and marginal vegetation was absent where the watercourse runs through the woodland, however, a canalised stretch of the watercourse along Griffin Lane contained pendulous sedge and fools' watercress.

3.2.36 The banks of the watercourse have been heavily modified at the existing A358 overpass, which comprises a large concrete bridge with steep abutments sloping down to a steep canalised valley holding the realigned section of the watercourse. The adjacent land use comprised arable farmland, urban, and semi-natural woodland habitats with low levels of disturbance.

3.2.37 Foraging opportunities were absent given the lack of emergent vegetation and sections of dry channel bed. Bankside marginal vegetation was also limited to dense scrub and woodland vegetation. The banks were undercut and heavily shaded reducing opportunities for burrowing due to bank instability. Water voles typically avoid heavily shaded habitats where the growth of suitable foraging materials is limited. Overall, the watercourse was of low suitability for water vole given limitations to foraging, burrowing and dispersal.

Unnamed field drainage ditch (32)

3.2.38 The field drainage ditch is located towards the centre of the scheme and has a source at the eastern edge of Bickenhall Woods. The ditch runs through an arable field, into a belt of plantation woodland and terminates at a drainage pond along the northbound carriageway of the existing A358.

3.2.39 The drainage ditch was dry along its entire length. It had an average depth of <0.5 metres from bank-top to channel bed, and a narrow channel width of <1 metre. The profile of the ditch was steep (>45 degrees). The section of ditch within the arable field was unshaded, however the remaining ditch running through the plantation woodland was heavily shaded by canopy cover (80% shade). There was a lack of emergent vegetation, outcrops of marginal sedges were present along the bank tops within the plantation woodland. Encroaching grassland was present along the banks and within the channel bed; however, this stretch of ditch had recently been mown. The plantation woodland and woodland edge habitat provided limited terrestrial connectivity, however no aquatic connections to nearby watercourses were noted. The adjacent arable land and plantation woodland were located on private land, resulting in low levels of disturbance.

Foraging opportunities were absent given the lack of emergent and bankside vegetation. The banks of the ditch were steep but short, reducing burrowing opportunities for water vole. The lack of water within the ditch, in addition to reduced vegetative cover and impacts of mowing within the arable field further reduced burrowing opportunities. Overall, the watercourse was of negligible suitability for water vole given limitations to foraging, burrowing and dispersal.

Fivehead River Tributary 1 (33)

3.2.40 Fivehead River Tributary 1 is located towards the centre of the scheme and has a source to the north of Bickenhall where it flows eastwards towards the convergence with the main Fivehead River to the west of the existing A358.

3.2.41 Tributary 1 is a small watercourse with an average depth of <0.5 metres and had a channel width ranging from 1 to 2 metres. The profile of the watercourse was vertical and undercut with a moderate flow speed. The channel was heavily shaded by overhanging vegetation (80% shade) and there was a lack of emergent and marginal vegetation. The banks were, however, lined by mature bankside trees, mixed scrub and sedges. Hedgerows and scrub provided limited connectivity to adjacent terrestrial habitats. The banks were comprised of earth, stone and gravel and are subject to mixed forms of management. The adjacent land use comprised arable and pastoral farmland, with low levels of disturbance.

3.2.42 Foraging opportunities were absent given the lack of emergent vegetation. Bankside marginal vegetation was also limited to scrub and woodland vegetation. The banks were undercut, contained loose rock and pebble, and were heavily

shaded reducing opportunities for burrowing. Overall, the watercourse was of negligible suitability for water vole given limitations to foraging, burrowing and dispersal.

Fivehead River main channel 1 (34)

- 3.2.43 The Fivehead River Main Channel 1 is located towards the centre of the scheme approximately 1km to the south of Hatch Beauchamp. The watercourse runs perpendicular to the A358 and flows directly underneath the road via a large bridge.
- 3.2.44 Main channel 1 is variable in composition, depth and profile. To the west of the A358 the river was shallow at >0.5 metres, and narrow, with an average channel width of 2 metres. The profile was vertical and undercut, with a moderate flow speed. The banks and channel were composed of stone, gravel and earth. The section of river running directly underneath the A358 had been artificially channelled, with steep concrete banks leading up to the road bridge. To the east of the A358 the river became shallower at <0.5 metres and wider at 2 to 5 metres, with a slower flow speed. The riverbanks remained vertical and undercut.
- 3.2.45 The channel was moderately shaded (60% to 80% shade along its length) by bankside trees and scrub. Hedgerows, bankside trees and scrub provided limited and intermittent connectivity to adjacent terrestrial habitats. The surrounding land-use comprised arable farmland, urban, and small pockets of semi-natural woodland habitats with low levels of disturbance.
- 3.2.46 Foraging opportunities were absent given the lack of emergent vegetation. Bankside marginal vegetation was also limited to scrub and woodland vegetation. The banks were undercut, contained loose rock and pebble, and were heavily shaded reducing opportunities for burrowing. There were also multiple sections of artificial channel and concrete banks further reducing the suitability to water vole. Overall, the watercourse ranged from negligible to low suitability for water vole given limitations to foraging, burrowing and dispersal.

Fivehead River main channel 2 (36)

- 3.2.47 The Fivehead River main channel 2 is located along the Taunton Dean and Somerset District boundary, to the south of Capland. The watercourse runs perpendicular to the existing A358 and flows directly underneath the scheme.
- 3.2.48 Main channel 2 was variable in composition, depth and profile. The section of watercourse to the west of the A358 was overshadowed, steep and largely dry, with occasional pools of standing water. To the east of the A358 the watercourse was steep (>45 degrees), with a moderate flow speed and a depth ranging from 0.5 to 1 metre, and a channel width of 2 to 5 metres. The channel was heavily shaded (90% to 95% shade) by the bankside woodland canopy and tall ruderal vegetation. There was a lack of emergent vegetation along the majority of the watercourse, however marginal sedges and small pockets of water pepper (*Persicaria hydropiper*) and gypsywort (*Lycopus europaeus*) were present to the east. The banks of the watercourse were subject to mixed management from adjacent arable and pastoral land-use.
- 3.2.49 Foraging opportunities were limited to sections where slow flowing, or standing water were present, along with pockets of emergent vegetation. Bankside marginal vegetation was also limited to scrub and woodland vegetation. The earth

banks were heavily shaded and steep, and the channel bed was largely dry along the southern extent of the watercourse. Overall, the watercourse ranged from negligible to low suitability for water vole given limitations to foraging, burrowing and dispersal.

Fivehead River Tributary 5 (37)

- 3.2.50 Fivehead River Tributary 5 runs along a series of field boundaries and through arable fields before terminating at the Fivehead River main channel 2 to the north-east of the existing A358.
- 3.2.51 Tributary 5 is variable in composition, depth and profile. The watercourse to the west of the existing A358 runs alongside field boundary hedgerows and through the centre of an arable field. This section of the watercourse was a narrow dry ditch (<1 metre wide), with undercut banks, and tall ruderal vegetation along the banks and within the channel bed itself. The watercourse ranged from open to moderately shaded (0 to 70% shade) from overhanging hedgerow vegetation. The banks were fenced off from grazing and arable farming activities resulting in low levels of disturbance.
- 3.2.52 The remaining section of watercourse to the east of the A358 was also variable and ranged in profile from steep (>45 degrees) to shallow (<45 degrees) as it approached main channel 2. Depth was shallow (<0.5 metres) and the channel width remained narrow at <1 metre. The watercourse ranged from open to moderately shaded (0 to 70% shade) from overhanging hedgerow vegetation. The upper banks were subject to mixed management, including flailing, however dense ruderal growth was present within the channel and comprised water dropwort (*Oenanthe crocata*), hedge parsley (*Torilis arvensis*) and nettle (*Urtica dioica*).
- 3.2.53 Foraging opportunities were limited to tall ruderal vegetation towards the western extent of the watercourse (a section of dry channel). However, the eastern extent contained a more suitable water level, in addition to emergent vegetation, which provided foraging opportunities for water vole. The earth banks were suitable for burrowing in terms of their overall composition and profile, however, large stretches of dry channel bed reduced the suitability for burrowing. Overall, the watercourse ranged from negligible to moderate suitability for water vole given limitations to foraging, burrowing and dispersal.

Venner's Water (39)

- 3.2.54 Venner's Water is located towards the centre of the scheme to the north-west of Ashill. The watercourse runs perpendicular to the A358 and crosses underneath an un-named road leading to Ashill, before passing underneath the existing A358.
- 3.2.55 Venner's Water is a small watercourse which ranged in depth from <0.5 to 1 metre and had a channel width ranging from 2 to 5 metres. The profile of the watercourse was steep (>45 degrees) with a sluggish to slow flow speed. The channel varied from open, to heavily shaded by overhanging hedgerow and woodland vegetation (30% to 80% shade). The majority of the watercourse lacked emergent vegetation, however short sections to the north displayed willowherb (*Epilobium sp*), water dropwort and yellow iris (*Iris pseudocorus*). Marginal and bankside vegetation was also lacking along the majority of the watercourse as a result of heavy shading. Field boundary hedgerows and pockets of scrub and woodland provided limited connectivity to adjacent terrestrial habitats.

- 3.2.56 The banks of the watercourse ranged from artificial (in proximity to residential dwellings), to a mixture of earth and stone. The adjacent land-use comprised arable farmland and urban habitats with low levels of disturbance.
- 3.2.57 Foraging opportunities were limited to sections to the north with pockets of emergent vegetation. Bankside marginal vegetation was largely lacking, further reducing foraging opportunities along the majority of the watercourse. The modified sections of bank were unsuitable for burrowing, however, the heavily shaded steep earth banks further to the north provided sub-optimal burrowing opportunities. Overall, the watercourse ranged from negligible to low suitability for water vole given limitations to foraging, burrowing and dispersal.

River Isle drainage network (42)

- 3.2.58 The River Isle drainage network is located towards the south of the scheme and to the north of Rapps. A series of small watercourses located to the east of the A358 connect to form the wider drainage network which flows eastwards to meet the River Isle.
- 3.2.59 The short section of watercourse subject to assessment was shallow with a depth of <0.5 metres and a channel width that ranged from 1 to 2 metres. The profile of the watercourse was steep (>45 degrees), with no flow (dry channel bed). The channel was heavily shaded (80% shade) by the canopy of the surrounding woodland. Emergent and marginal vegetation was absent, however encroaching grassland and ruderal vegetation was present along the banks and within the channel. The banks comprised of earth and were subject to mixed management as a result of varied adjacent land use. Adjacent habitats included plantation woodland, arable and pastoral farmland with moderate levels of disturbance. Connectivity was provided by other small ditches comprising the wider drainage network.
- 3.2.60 Foraging opportunities were absent given the lack of emergent and suitable bankside vegetation. The banks of the ditch were steep but short, reducing burrowing opportunities for water vole. The lack of water within the ditch, in addition to reduced vegetative cover further reduced burrowing opportunities. Overall, the watercourse was of negligible suitability for water vole given limitations to foraging, and burrowing.

Cad Brook drainage network (51)

- 3.2.61 The Cad Brook drainage network is located towards the south of the scheme and to the south of Rapps. The drainage network comprises a series of ditches which originate to the west of the existing A358 near South Town, and flow eastwards to terminate in Cad Brook to the east of the A358. The southern section of the drainage network was entirely dry during the initial assessment and considered unsuitable for water vole. The southern sections were therefore scoped out and excluded from further survey effort.
- 3.2.62 The northern section of the Cad Brook drainage network comprised a small drainage ditch following several small field boundaries. The ditch had a steep profile (>45 degrees) and a channel width ranging from 1 to 2 metres and an average depth of <0.5 metres. The flow was sluggish, and the banks and channel were comprised of earth and stone. Shading ranged from 50% to 80% from overhanging hedgerow vegetation and the bankside was dominated by hemlock (*Conium maculatum*) and nettle.

3.2.63 Foraging opportunities were absent, however, sparse marginal vegetation provided sub-optimal foraging opportunities. The earth banks were heavily shaded and steep, and the channel bed was largely dry, reducing opportunities for burrowing. There were however short sections of watercourse holding a sufficient level of water combined with nearby foraging resources. Overall, the watercourse ranged from negligible to low suitability for water vole given limitations to foraging, burrowing and dispersal.

Cad Brook (52)

3.2.64 Cad Brook is located towards the southern end of the scheme and runs approximately 300 metres south of Rapps. The watercourse runs perpendicular to the A358 and crosses underneath via a large concrete underpass.

3.2.65 Cad Brook is a small watercourse which ranged in depth from 0.5 to 1 metre and had a channel width ranging from 1 to 2 metres. The profile of the watercourse was steep (>45 degrees) with a sluggish to slow flow speed. The channel varied from open, to heavily shaded by overhanging hedgerow vegetation (5% to 80% shade). The majority of the watercourse lacked emergent vegetation, however short sections displayed dense water dropwort, reed canary grass, hemlock, water mint (*Mentha aquatica*), fool's watercress and willowherb. Field boundary hedgerows provided limited connectivity to adjacent drainage ditches and other terrestrial habitats.

3.2.66 The banks of the watercourse comprised of earth and stone and did not appear to be affected by arable activities, despite the water course being unfenced. The adjacent land-use comprised arable farmland and urban habitats with low levels of disturbance.

3.2.67 Ample foraging opportunities were provided by emergent and marginal vegetation along the eastern extent of the watercourse. There was however a lack of submergent vegetation along the remainder of the watercourse. Burrowing opportunities were present in the steep earth banks and bankside marginal vegetation provided sufficient cover to burrows. Overall, the watercourse ranged from negligible to moderate suitability for water vole.

River Ding (54)

3.2.68 The River Ding is the southernmost watercourse along the scheme. The watercourse passes underneath an unnamed road at Horton Cross via a stone blockwork bridge, and under the existing A358 via a large concrete underpass.

3.2.69 To the west of the A358 the River Ding is a moderately sized watercourse with tall undercut earth banks (1 to 3 metres in height) and had a channel width between 2 to 5 metres. The flow was moderate and the depth ranged from 0.5 to 1 metre, with several deeper pools observed at meander points. A water treatment facility is located approximately 500 metres upstream of the A358. The channel had been modified in association with the facility, with large gabion baskets, culverts and concrete outfall pipes (incl. steep abutments into the banks) located on the north bank. The channel was heavily shaded (80% shade) by overhanging woodland canopy and scrub. Emergent vegetation was absent; however, the banks were dominated by tall ruderal vegetation and large outcrops of Himalayan balsam (*Impatiens glandulifera*). The adjacent land use comprised arable farmland which would typically result in low disturbance, however, a frequently

used public footpath ran alongside the River Ding and there was evidence of dogs entering the watercourse at regular intervals, resulting in moderate disturbance.

- 3.2.70 A large man-made weir located approximately 100 metres downstream (to the east) of the existing A358 marked a change in the overall profile, depth, and width of the watercourse. To the east, the watercourse retained a steep profile (>45 degrees), however the height of the banks was markedly reduced (0.5 to 1 metre). The depths decrease to 0.5 to 1 metre and the channel width reduced from 5 to 2 metres along its length. The watercourse also displayed a sluggish flow speed, with several pools of standing water present within the woodland and along the woodland edge. The channel was heavily shaded (80% to 100% shade) by the canopy of the adjacent woodland. Emergent vegetation was absent, and the majority of the earth banks were bare, with the exception of encroaching ivy and common nettle. The adjacent land use comprised arable farmland and private semi-natural woodland habitats with low levels of disturbance.
- 3.2.71 Foraging opportunities were lacking along the entirety of the watercourse, and marginal vegetation comprised encroaching ivy and scrub which are sub-optimal foraging resources. Burrowing opportunities were lacking towards the west due to large undercut banks and man-made structures associated with the water treatment facility. Burrowing opportunities were limited to the east of the watercourse; however, short sections of steep earth bank were present with sufficient cover from overhanging marginal vegetation along the woodland edge. Overall, the watercourse was of low to moderate suitability for water vole given limitations to burrowing and foraging.

River Ding Tributary 1 (54.1)

- 3.2.72 River Ding Tributary 1 is a short section of watercourse located adjacent to the River Ding, which is the southernmost watercourse along the scheme. This watercourse originates to the east of Horton and runs eastwards before joining the main River Ding channel at Horton Cross.
- 3.2.73 Tributary 1 is a small and steep (>45 degrees) watercourse with a narrow channel width of 1 to 2 metres and was largely dry, with small pools of standing water (<0.5 metres in depth). The channel was moderately shaded (70% shade) by overhanging hedgerow vegetation and scrub. The earth banks and channel bed were dominated by tall ruderal vegetation, including hemlock and common nettle. The channel bed also had a thick layer of silt.
- 3.2.74 The adjacent land use comprised arable farmland habitats with low levels of disturbance. However, there were public and unofficial footpaths running alongside the watercourse, with evidence of dogs entering both Tributary 1 and the main River Ding channel, which results in moderate levels of disturbance.
- 3.2.75 Foraging opportunities from emergent vegetation were absent, however dense marginal vegetation provided sub-optimal foraging opportunities. The earth banks were shaded and sufficiently steep, however the channel bed was largely dry, reducing opportunities for burrowing. Overall, the watercourse was of low suitability for water vole given limitations to foraging and burrowing.

River Ding drainage network (54a)

- 3.2.76 The River Ding drainage network flows into the River Ding and Back Stream at the southern end of the scheme. It comprises of two small drainage ditches along

the edge of a large woodland block designated as part of the Jordan's Park Local Wildlife Site (LWS) and connects to Back Stream to the south via a field boundary hedgerow.

- 3.2.77 The drainage network is a series of shallow (<0.5 metres bank height) linear ditches, with steep profiles (>45 degrees) and narrow channel widths of 1 to 2 metres. The ditches were largely dry, however there were sections of slow flowing water and pools of standing water, particularly to the west of the woodland. There was a lack of emergent and marginal vegetation, and the banks of the watercourse were largely bare earth, with encroaching ivy and scrub. The southern banks of the watercourse displayed signs of recent clearance and dredging works. The network was heavily shaded (60% to 100%) by the adjacent woodland and hedgerow vegetation.
- 3.2.78 Foraging opportunities were limited along the entirety of the watercourse, and marginal vegetation comprised of encroaching ivy and scrub, which are sub-optimal foraging resources. Burrowing opportunities were lacking given the shallow profile of the banks and sections of dry channel bed. Overall, the watercourse was of negligible suitability for water vole.

Back Stream (55)

- 3.2.79 Back Stream is located to the south of the scheme and splits from the River Ding main channel at the A358. The watercourse passes underneath the A358 via a large concrete underpass.
- 3.2.80 Back Stream is a moderately sized watercourse with a steep profile (>45 degrees) and channel ranging from 2 to 5 metres in width. The depth varied from 0.5 to 1 metre, with riffles (stone and pebble) and deeper pools located at meander points. Flow speed was slow and emergent vegetation was present in small pockets, mainly comprising of reed canary grass and fools' watercress. The watercourse was moderately shaded (50% to 60% shade) by overhanging vegetation, including large mature bankside trees and scrub. Himalayan balsam was also present along the watercourse. Field boundary hedgerows leading up to the watercourse provided additional connectivity to the River Ding to the north. The adjacent land use comprised arable farmland habitats with low levels of disturbance.
- 3.2.81 Foraging opportunities were present towards the east of the watercourse; however, the coverage of emergent vegetation was scattered and thin overall. Burrowing opportunities were also more frequent towards the west along steep earth banks and cliffs. Overall, the watercourse was of low to moderate suitability for water vole given limitations to burrowing and foraging along the majority of the watercourse.

3.3 Field study

- 3.3.1 Eighteen out of the 23 watercourses subject to the habitat suitability assessment were deemed suitable (low to high suitability) for supporting water vole. These eighteen watercourses were all then subject to water vole field signs surveys. Positive field signs of water vole were recorded on six out of the 23 watercourses subject to assessment. Further details on the distribution, type and quantity of field signs have been provided in Table 3-1 below and mapped in Appendix B *Water vole survey area and field signs*.

Broughton Brook (15a)

- 3.3.2 A range of field signs were recorded along Broughton Brook, directly to the north and south of the Black Brook Bridge. Burrows were identified at seven separate locations; the majority of which were located within 30m upstream and downstream of the Black Brook Bridge (where Broughton Brook passes underneath the existing A358). A cluster of three burrows were also identified approximately 300 metres upstream of the A358. One feeding station and two latrines were also recorded approximately 25 metres downstream of the A358 amongst a series of burrows.

Black Brook (19)

- 3.3.3 Evidence of water vole was recorded on Black Brook, approximately 70 metres to the north of the existing A358. Footprints and a fresh latrine were found on the banks of the watercourse, and on floating debris within the channel.

Black Brook Tributary 3 (19.1)

- 3.3.4 Feeding remains and a small cluster of fresh droppings were recorded on the northern bank of the Black Brook Tributary 3, approximately 140 metres upstream of the convergence between Tributary 1 and 3. A latrine and old feeding remains were also recorded on top of a stone block which had fallen into the channel from an adjacent derelict bridge <10 metres downstream of the convergence between Tributary 2 and 3.

Thornwater Stream (24)

- 3.3.5 Evidence of water vole was recorded along Thornwater Stream, with all field signs found south of the existing A358. A potential burrow was identified approximately 10 metres to the south of the A358. A cluster of burrows, latrines and feeding stations were recorded 150 metres south-west of the survey area off Greenway Lane.

Cad Brook (52)

- 3.3.6 A total of seven feeding stations were recorded along Cad Brook, six of which were to the east of the existing A358. Four burrows were also recorded, but spread along the eastern extent of the watercourse, many of which coincided with feeding stations.

River Ding (54)

- 3.3.7 A cluster of potential burrows were recorded along the northern bank of the River Ding, along the woodland edge to the east of the existing A358.

Table 3-2 Summary of field signs identified along each watercourse in June 2021 and September 2021

Watercourse (ID number)*	Date	Field signs	Easting	Northing	Notes
Broughton Brook (15a)	15/06/2021	Potential water vole burrows	325613	124835	Burrows of sufficient size and shape for water vole
		Water vole burrows	325587	124717	Confirmed burrows on the east bank

Watercourse (ID number)*	Date	Field signs	Easting	Northing	Notes
	13/09/2021	Water vole latrine	325441	124577	Three separate latrines on concrete plinth
		Water vole feeding station, latrines and burrows	325617	124812	Feeding remains (pendulous sedge), latrine on east bank and x5 water vole burrows within 20 metre stretch of watercourse
		Potential water vole burrows	325613	124750	Burrows of sufficient size and shape for water vole
		Potential water vole burrows	325610	124737	Burrows of sufficient size and shape for water vole
Black Brook (19)	15/09/2021	Probable water vole footprints	325743	124974	Footprints on south bank (probably water vole) but faded
		Water vole footprints and latrines	325678	124836	Footprints on west bank in mud, with fresh latrines (in channel on a stone) and along east bank
Black Brook Tributary 3 (19.1)	23/09/2021	Water vole feeding station and latrine	326171	124202	Feeding remains and droppings on the north bank. View partly obscured by dense ruderal vegetation and bramble.
		Water vole latrine and feeding remains	326325	124035	Latrine on top of stone blockwork from an old collapsed bridge, with feeding remains along the banks.
Thornwater Stream (24)	16/06/2021	Potential water vole burrows	327684	123120	x4 potential water vole burrows, of sufficient size and location
		Feeding station, burrows, latrines	327682	123128	An area with multiple burrows, feeding stations and a latrine
		Potential water vole burrows	327569	123671	Typical of water vole, or sufficient size and location
Cad Brook (52)	24/06/2021	Water vole feeding station	333259	116477	Feeding remains typical of water vole
		Water vole feeding station	333327	116575	Feeding remains typical of water vole
		Potential water vole burrow	333338	116588	Typical of water vole, of sufficient size and location
		Water vole feeding station	333394	116650	Feeding remains typical of water vole
		Potential water vole burrows	333333	116582	Several burrows typical of water vole, or sufficient size and location
		Water vole feeding station	333400	116665	Cluster of x4 feeding stations within 10 metre stretch of watercourse, with feeding remains typical of water vole

Watercourse (ID number)*	Date	Field signs	Easting	Northing	Notes
		Potential water vole burrow	333404	116681	Typical of water vole, or sufficient size and location
		Water vole feeding station	333405	116688	Feeding remains typical of water vole
		Potential water vole burrow	333411	116694	Typical of water vole, or sufficient size and location
	15/09/2021	Potential water vole burrows and x1 latrine	333265	116526	Small cluster of burrows and a small number of droppings
River Ding (54)	15/06/2021	Potential water vole burrows	333827	115959	Cluster of small and partly dug burrows in the earth bank (north bank)

* Each watercourse was given an ID number, which is referenced on associated mapping

4 Conclusions

4.1 Key Findings

- 4.1.1 A biological records search undertaken in September 2021 returned 73 records of water vole within 5 kilometres of the scheme, within the last 10 years. The majority of records were located to the west of the M5 and towards the north-west of Henlade. A second cluster of records was located along the River Tone between Venture Way and Firepool Lock to the north-east of Taunton town centre.
- 4.1.2 Most records pertained to burrows; however, observations of live water vole in-situ were also provided. A single latrine was recorded within the boundary of the scheme at Stoke St Mary at the north-western end of the scheme.
- 4.1.3 The desk study confirms water vole are present in close proximity to the scheme and suggests that Broughton Brook may be utilised by water vole.
- 4.1.4 The *Water Vole Mitigation Handbook* [8] states “presence of water vole droppings is the only field sign that can be used reliably on its own”. However, the identification of several different types of field sign, within proximity to each other, is indicative of water vole presence. As such, the distribution, type and quantity of field signs recorded in June 2021 and September 2021 suggest water vole are present in low numbers along Broughton Brook, Black Brook, Black Brook Tributary 3, Thornwater Stream, Cad Brook and the River Ding.
- 4.1.5 Cad Brook (52) exhibited the highest quantity of field signs, with a total of 8 separate locations displaying feeding stations and clusters of burrows. All positive field signs on Cad Brook were recorded along open sections of the watercourse, along the boundary of an arable field and through the centre of a field used for grazing.
- 4.1.6 A total of 18 watercourses were assessed as being suitable for water vole, however only six watercourses were found to display positive field signs. This further suggests that water voles are present in low numbers with sparse coverage, or small meta-populations, spread along the scheme.
- 4.1.7 The precautionary principle applied to watercourses with restricted access (ID 17, 20.1, 31 and 37) assumes that these watercourses may provide suitable habitats and that water voles are likely to be present. This results in a total of 10 watercourses along the scheme that have either confirmed, or assumed presence, of water vole.
- 4.1.8 The majority of the watercourses surveyed were heavily shaded and lacked in-channel vegetation or had highly variable water levels; all of which are considered to be key factors in the likelihood of water vole absence. Cad Brook may therefore represent one of the most suitable watercourses along the scheme. Cad Brook is not considered to be better connected to the surrounding landscape, or other waterbodies. It displays a similar level of aquatic and terrestrial connections, and ultimately terminates in the River Isle, as do several of the other watercourses nearby.
- 4.1.9 It is not possible to conclude likely absence of water vole on watercourses where evidence was absent during two surveys. Given the overall spread of field signs along the scheme, it is entirely possible that water vole may frequent other

watercourses (including low suitability) on an infrequent basis and their potential future presence should therefore not be ruled out.

Abbreviations List

Please refer to ES Chapter 17 Abbreviations.

Glossary

Please refer to ES Chapter 18 Glossary.

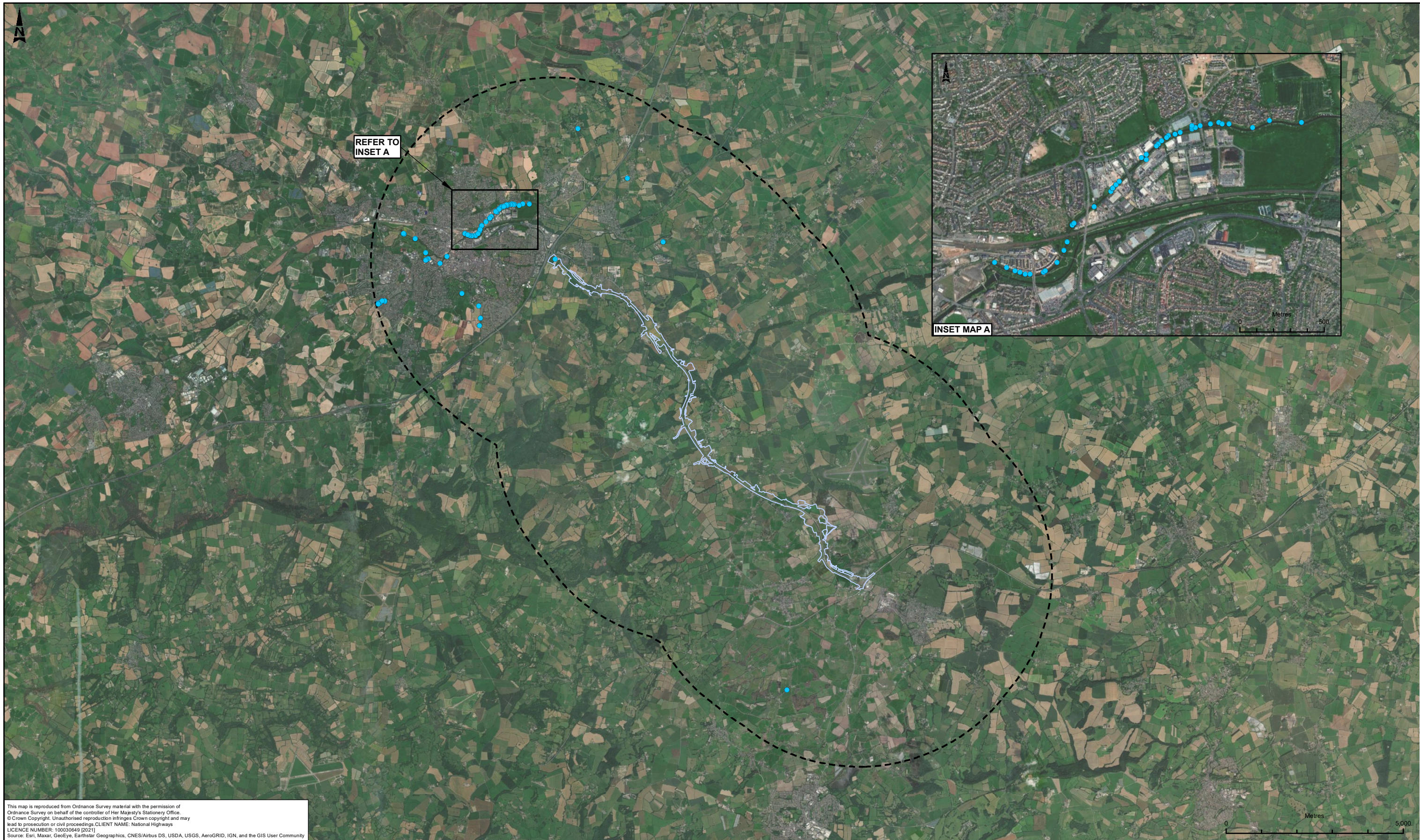
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Appendices

Appendix A Historical records from SERC



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- LEGEND**
- ECOLOGY SURVEY ZONE
 - 5KM DATA SEARCH AREA
 - SERC RECORD**
 - EUROPEAN WATER VOLE

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)

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MAINTENANCE / CLEANING	NONE
USE	NONE
DECOMMISSIONING / DEMOLITION	NONE

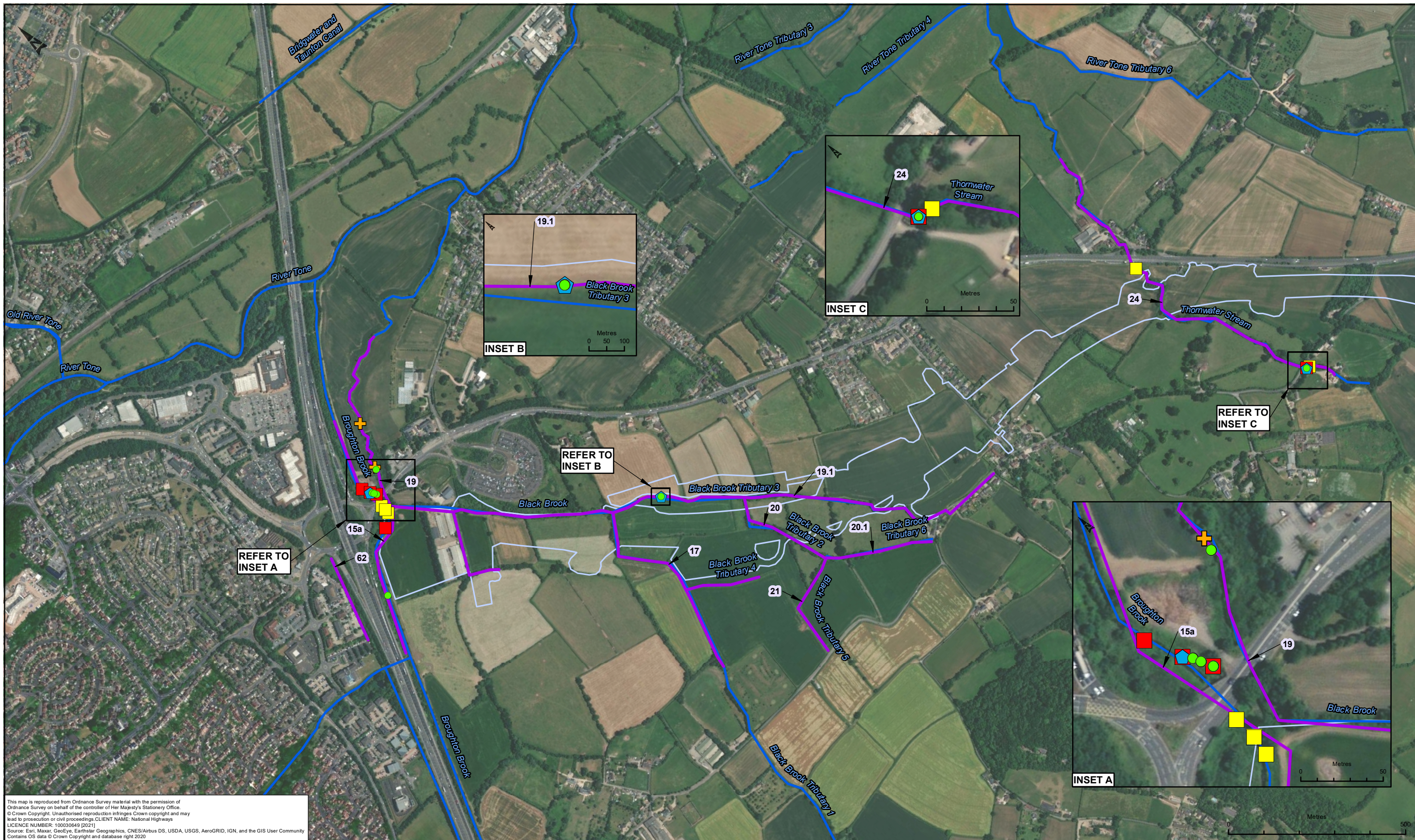
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P02	12/05/22	ISSUE FOR INFORMATION	LL	MA	JS	SV

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Appendix B Water vole survey area and field signs



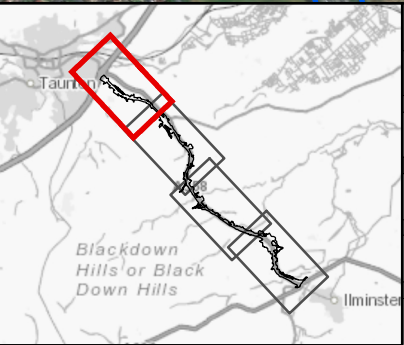
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LEGEND

- ECOLOGY SURVEY ZONE
- POTENTIAL BURROWS
- WATER VOLE SURVEY EXTENT
- WATERCOURSES

WATER VOLE FIELD SIGN

- LATRINE
- + FOOTPRINTS
- ⬠ FEEDING STATION
- CONFIRMED BURROWS



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USE	NONE
DECOMMISSIONING / DEMOLITION	NONE

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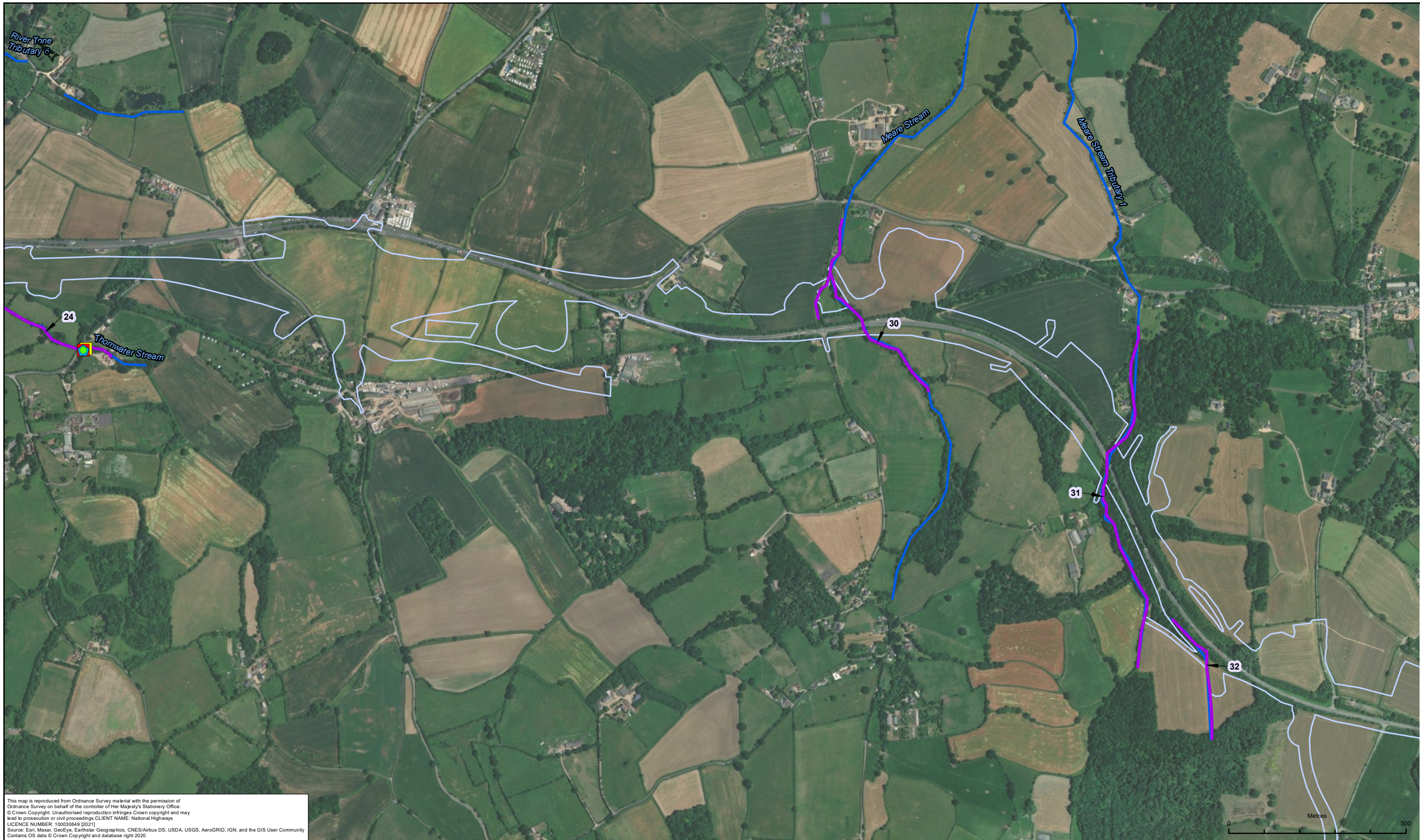
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Drawing Status: SUITABLE FOR INFORMATION

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Drawing Title: WATER VOLE SURVEY RESULTS SHEET 1 OF 4				
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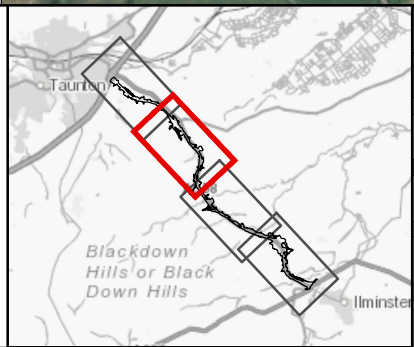
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LEGEND

- ECOLOGY SURVEY ZONE
- POTENTIAL BURROWS
- WATER VOLE SURVEY EXTENT
- WATERCOURSES

WATER VOLE FIELD SIGN

- LATRINE
- + FOOTPRINTS
- ⬠ FEEDING STATION
- CONFIRMED BURROWS



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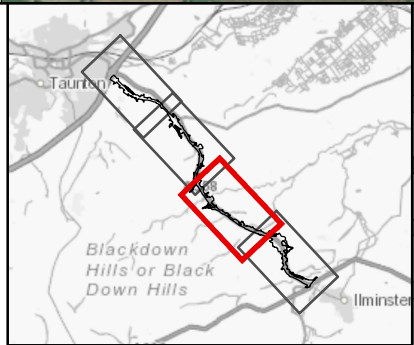
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LEGEND

- ECOLOGY SURVEY ZONE
- POTENTIAL BURROWS
- WATER VOLE SURVEY EXTENT
- WATERCOURSES

WATER VOLE FIELD SIGN

- LATRINE
- + FOOTPRINTS
- ⬠ FEEDING STATION
- CONFIRMED BURROWS



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USE	NONE
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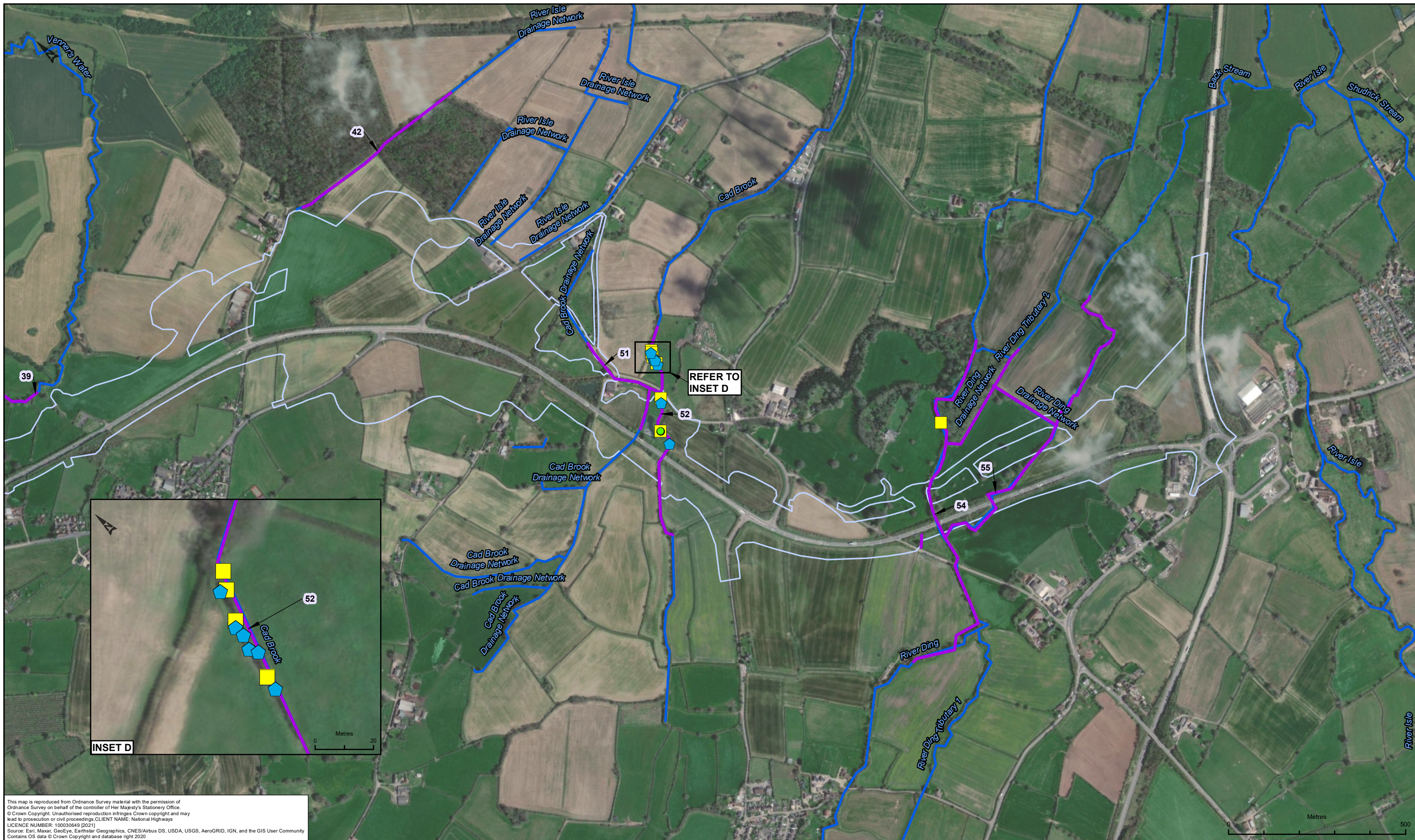
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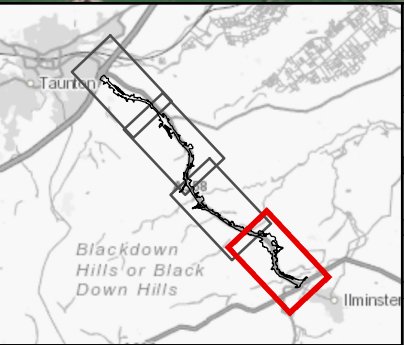
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LEGEND

- ECOLOGY SURVEY ZONE
- POTENTIAL BURROWS
- WATER VOLE SURVEY EXTENT
- WATERCOURSES

WATER VOLE FIELD SIGN

- LATRINE
- + FOOTPRINTS
- ⬠ FEEDING STATION
- CONFIRMED BURROWS



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