



Norfolk County Council

Norwich Western Link Road

2021 Otter and Water Vole Survey Report





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1 Introduction

1.1 Project background

- 1.1.1 The Norwich Western Link Road (NWL) is a highway scheme linking the A1270 Broadland Northway from its junction with the A1067 Fakenham Road to the A47 trunk road near Honingham.
- 1.1.2 The NWL, hereafter referred to as the Scheme, will comprise the following listed below:
- Dualling the A1067 Fakenham Road westwards from its existing junction with the A1270 to a new roundabout located approximately 400m to the north west;
 - Construction of a new roundabout; and
 - Constructing a dual carriageway link from the new roundabout to a new junction with the A47 near Honingham.
- 1.1.3 As part of a separate planned scheme, National Highways proposes to realign and dual the A47 from the existing roundabout at Easton to join the existing dual carriageway section at North Tuddenham. If that scheme proceeds, it is expected that National Highways will construct the Honingham junction and the Norwich Western Link will connect to the north-eastern side of that junction.
- 1.1.4 The Scheme will cross the River Wensum and its flood plain by means of a viaduct. In addition, six other structures are proposed to cross minor roads and to provide habitat connectivity. The Scheme will include ancillary works such as provision for non-motorised users, necessary realignment of the local road network, including the stopping up of some minor roads, and the provision of environmental mitigation measures.

1.2 Ecological background

- 1.2.1 The requirement for an Otter *Lutra lutra* and Water Vole *Arvicola amphibius* survey followed the identification of suitable habitats with the potential to support Otter and Water Vole populations, that may be impacted by the Scheme. These habitats were identified following the Phase 1 Habitat Survey (WSP, 2018) and the refined survey in 2020.
- 1.2.2 Baseline Otter and Water Vole surveys were undertaken in 2019 and 2020 to establish a sufficient baseline to inform impact assessment (WSP, 2021). This included a desk study, Otter and Water Vole field surveys and trail camera deployment (WSP, 2021).
- 1.2.3 Additional surveys were undertaken in 2021 to establish Otter and Water Vole presence along the wider River Wensum and associated floodplain habitat to inform proposals for mitigation and compensation. Trail cameras were also deployed to investigate the status of a potential Otter holt.

1.3 Brief and objectives

- 1.3.1 WSP has been commissioned by Norfolk County Council to complete a comprehensive suite of Otter and Water Vole surveys, with the following objectives listed below.
- Establish whether Otter and Water Vole are present or likely absent within the 2021 Survey Area;
 - Determine, if present, the distribution of Otter and Water Vole within the 2021 Survey Area; and
 - Present the findings of the survey in a baseline report.
- 1.3.2 The results of meeting these objectives will be used to inform mitigation proposals and areas for compensation/enhancement with respect to Otter and Water Vole. Details of the impact assessment and mitigation will be included within the Biodiversity Chapter of the Environmental Statement for the Scheme.

1.4 Study and survey areas

Otter survey area

- 1.4.1 The 2020 Survey Area in relation to Otter included 300m sections of the River Wensum up and downstream from the Scheme Alignment (WSP, 2021). This also included directly connected water features and associated riparian/holt building habitat. The 2020 Survey Area was selected to focus on the immediate area impacted by the Scheme, particularly focussing on the discovery of holts, couches or evidence of features of importance to Otters.
- 1.4.2 The 2021 Survey Area was designed to establish Otter presence along the wider River Wensum and associated floodplain habitat to inform mitigation and areas for compensation/enhancement. Additional upstream and downstream sections of the River Wensum and associated floodplain watercourses beyond the 2020 Survey Area were assessed in order to establish Otter presence up to 800m from the Scheme, the extent for which areas for compensation/enhancement for Otter is proposed. The Survey Area also encompassed two additional ditches within the floodplain. A potential Otter holt identified within the 2020 Survey Area was also monitored as part of the 2021 survey effort in order to gain further information on its status. All suitable habitat identified as having potential to support Otter was surveyed within the Survey Area. The Survey Area extents are shown in separate document Appendix A.

Water vole survey area

- 1.4.3 The 2020 Survey Area in relation to Water Vole comprised 300m sections up and downstream from the Scheme Alignment (WSP, 2021). This also included directly connected water features and associated riparian habitat. This was informed by guidance in The Water Vole Mitigation Handbook (Dean, et al., 2016) which recommends a field survey area of between 200m and 500m upstream and downstream for a scheme with the potential for permanent impacts affecting more than 50m of watercourse.



1.4.4 The 2021 Survey Area was designed to establish Water Vole presence along the wider River Wensum and associated floodplain watercourses to inform mitigation and areas for compensation/enhancement. Additional upstream and downstream sections of the River Wensum and associated floodplain watercourses beyond the 2020 Survey Area were assessed in order to establish Water Vole presence up to 800m from the Scheme, the extent for which areas for compensation/enhancement for Water Vole is proposed. The Survey Area also encompassed two additional ditches within the floodplain. All suitable habitat identified as having potential to support Water Vole populations was surveyed within the Survey Area. The Survey Area extents are shown in separate document Appendix A.

2 Relevant legislation

2.1 Legal compliance

- 2.1.1 Under the Conservation of Habitats and Species Regulations 2017 (as amended) Otter is listed on Schedule 2 of the Habitats Directive (Council Directive 92/43/EEC) and as such is a European Protected Species (EPS). Under Part 3 of the Habitat Regulations it is an offence to:
- deliberately capture, injure or kill a wild Otter;
 - deliberately disturb a wild Otter; and
 - damage or destroy a breeding site or resting place used by Otter.
- 2.1.2 Otter and Water Vole are both listed on Schedule 5 of the Wildlife and Countryside Act (WCA) 1981 (as amended), though they receive different levels of protection under this legislation. An Otter is protected from sale and from disturbance '*while it is occupying a structure or place which it uses for shelter or protection*'. It is also an offence to '*obstruct access to any structure or place used for shelter or protection*'. Water Vole receive full protection under the WCA and it is an offence to;
- intentionally kill, injure or take Water Vole;
 - intentionally or recklessly obstruct, damage or destroy any structure or place used for shelter or protection by Water Vole, or disturb Water Vole while they are occupying such a structure; and
 - sell or advertise for sale Water Vole, whether live or dead.
- 2.1.3 The Natural Environment and Rural Communities (NERC) Act 2006 reinforces the duty upon all public authorities, including planning authorities, to have regard for the conservation of biodiversity when discharging their duties. The Act refines the definition of biodiversity conservation, stating that it includes restoring or enhancing a population or habitat. Section 41 of the NERC Act requires the Secretary of State to list habitats and species of principal importance (HPIs and SPIs) for the conservation of biodiversity in England. The habitats and species listed in accordance with Section 41 largely replicate those listed on the UK Biodiversity Action Plan (BAP) which occur in England and includes Otter and Water Vole.

3 Methods

3.1 Overview

- 3.1.1 Otter and Water Vole surveys were undertaken 20 April 2021 – 13 September 2021 which is in the appropriate season for both species. Otter surveys can be carried out year-round, but spring is preferable and Water Vole surveys are carried out mid-April to September.
- 3.1.2 The surveys were undertaken across multiple days due to the size of the Survey Area, as well as to comply with good practice guidance for Water Voles (Dean, et al., 2016) which recommends undertaking two survey visits, one in the first half of the season (mid-April to the end of June) and one in the second half of the season (July to September inclusive), unless an assessment of effects on Water Voles can be made on a precautionary basis from the first visit alone. In addition to this, a trail camera was deployed in 2021 to assess the status of a potential Otter holt on the River Wensum and incidental records were noted during other survey work undertaken on site.
- 3.1.3 A section of WC5 was surveyed in 2020 that forms part of the 2021 Survey Area. The results of this survey are therefore included in this report in order to cover the complete 2021 Survey Area.
- 3.1.4 All Otter and Water Vole records collected during the 2020 and 2021 surveys will be submitted to Norfolk Biodiversity Information Service (NBIS) in a timely manner.

3.2 Field survey

- 3.2.1 All watercourses identified as suitable habitat in the Survey Area were subject to detailed Otter and Water Vole survey. Watercourses are labelled WC1, WC5, WC7 and WC8, with the River Wensum simply labelled as the River Wensum. The River Wensum is located in the North of the Scheme, with WC1, WC5, WC7 and WC8 all located within the River Wensum's floodplain. The locations of the watercourses are shown in separate document Appendix A.

Otter survey

- 3.2.2 The survey for Otter was carried out with reference to good practice guidance (Chanin, 2003B) and other standard guidance documents (Chanin, 2003A) (Liles, 2003) and comprised a minimum of one visit to each surveyed watercourse within the appropriate season to look for evidence of Otters. The surveys incorporated the following:
- A walked survey of each watercourse and associated riparian/holt building habitat, accessing the channel where possible, to search for field signs of Otter, (Field signs for Otter include spraints, footprints, feeding remains, Otter slides, holts and couches).

Water vole survey

- 3.2.3 The survey for Water Vole was carried out with reference to good practice guidance (Dean, et al., 2016) and comprised a minimum of one visit to each surveyed watercourse within the appropriate season. Watercourses where Water Vole presence was not confirmed during the first survey visit were subject to a second visit (where possible) within the appropriate season in order to sufficiently determine presence/likely absence in accordance with good practice guidance (Dean, et al., 2016).
- 3.2.4 The surveys incorporated the following elements:
- The recording of habitat variables and features relevant to Water Voles (for example general habitat type, shore/bank substrate, bordering land use, vegetation, disturbance level, bank profile, water depth);
 - A walked survey of each watercourse, accessing the channel where possible, to search for field signs of Water Vole, (Field signs for Water Vole include faeces, latrines, feeding stations, burrows, 'lawns', nests, footprints and runways in vegetation); and
 - The recording of any field signs or evidence relating to other relevant wildlife (for example American Mink *Neovison vison* or other rodent species).

Trail camera deployment

- 3.2.5 A trail camera was deployed on the River Wensum for 68 days to assess the status of a potential Otter holt identified in the 2020 Otter and Water Vole surveys (WSP, 2021). The trail camera location is labelled TC4 and is shown in separate document Appendix B. The footage was analysed for sightings of Otter, Water Vole and any other relevant species (for example American Mink or Brown Rat *Rattus norvegicus*).

3.3 Dates of survey and personnel

- 3.3.1 The Otter and Water Vole surveys were led by ecologists with extensive Otter and Water Vole survey experience with a strong understanding of their ecology and the ability to identify their field signs. All lead surveyors met the criteria within the CIEEM Competencies for Species Survey for Otter (CIEEM, 2013A) and Water Vole (CIEEM, 2013B).
- 3.3.2 Surveys were completed on the dates shown in Table 3-1 for both Otter and Water Vole between 1 July 2020 and 13 September 2021.

Table 3-1 – Otter and Water Vole Survey Dates

Date	Watercourse surveyed	Water Vole surveying season (early/late)
1 July 2020	WC5 (downstream section)	Late
13 September 2020	WC5 (downstream section)	Late
20 April 2021	River Wensum (upstream section), WC5 (upstream section)	Early
27 July 2021	River Wensum (downstream section), WC7	Late
13 September 2021	WC1 (upstream section), WC5 (upstream section), WC7, WC8	Late

Note: The early surveying season for Water Vole is between mid-April/early May and the end of June and the late surveying season is between July and September.

3.3.3 Trail cameras were deployed or collected on the following dates;

- 8 July 2021 – TC4 deployed; and
- 13 September 2021 – TC4 collected.

3.4 Notes and limitations

- 3.4.1 The River Wensum and WC5 were surveyed from the banks. Water depth meant that it was not achievable to survey these watercourses safely from within the channel. As both watercourses comprised a mixture of steep, sloping and poached banks, which allowed sufficient visibility for surveying from the bank, this is not considered a limitation. WC7 and WC1 were surveyed from within the channel where it was safe to do so.
- 3.4.2 Both surveys of WC7 took place in the second half Water Vole survey season, whereas good practice guidance (Dean, et al., 2016) recommends undertaking one survey in the first half survey season and one in the second half of the season spread at least two months apart. Even though this watercourse was subject to two visits in the second half of the season less than two months apart, this was not considered a significant limitation given that Water Vole presence was confirmed on the second visit.

- 3.4.3 The extent of dense vegetation on approximately 200m of the downstream section of the River Wensum (shown in separate document Appendix A) meant that access to the bank was not possible to search for signs of Otter and Water Vole. Land access constraints also meant that the entire northern bank of the downstream section could not be surveyed. Where access was not possible, binoculars were used to observe the northern bank from the south. The northern bank was bordered by a golf course that was subject to frequent maintenance, where the banks appeared to be subject to regular mowing and the marginal vegetation was trimmed to bank height. As a result, there was limited cover and food for Water Vole thereby reducing the suitability for Water Vole, so this was not considered a significant survey limitation.
- 3.4.4 The extent of dense vegetation present within WC1 – upstream and the presence of barbed wire fences bordering both banks meant that access to the full length of its channel was not possible. Spot checks were therefore carried out along the water channel wherever safe access was possible. No field signs were recorded within this watercourse, but as a result of the accessibility issues and having only been subject to one survey, the presence of Water Vole or Otter evidence cannot be discounted. Habitat assessments have been used to inform the relative Water Vole population density.
- 3.4.5 Only one survey of WC8 was undertaken. No confirmatory field signs were recorded within this watercourse, but as a result of having only been subject to one survey, the presence of water vole or otter evidence cannot be discounted. Habitat assessments have been used to inform the relative water vole population density.

4 Results

4.1 Overview

- 4.1.1 A summary of positive evidence of species occurrence recorded during the surveys is presented in Tale 4-1.

Table 4-1 – Summary of Evidence of Species Recorded in Survey Area

Species	Watercourse
Water Vole	River Wensum - upstream and downstream, WC5 - upstream and downstream, WC7, WC8
Otter	River Wensum - upstream, WC5
Brown Rat	River Wensum – upstream
Small mammals, such as Bank Vole <i>Myodes glareolus</i>	WC5 – upstream, WC7

4.2 Habitat descriptions

- 4.2.1 The watercourses surveyed comprised the River Wensum, two ditches and one stream which were set within a combination of grassland, arable and floodplain grazing marsh. The locations of the watercourses are shown in separate document Appendix A.

River Wensum

- 4.2.2 The area surveyed was split into two sections, with one section upstream of the 2020 Survey Area and the other downstream.

Upstream

- 4.2.3 The upstream section of the River Wensum comprised a mixture of steep and sloping banks, with some parts poached by cattle. Bankside vegetation was dominated by reed sweet grass *Glyceria maxima* with nettle *Urtica dioica*, sedge, rushes, greater reedmace *Typha latifoli* and common reed *Phragmites australis* frequent and occasional willow trees *Salix sp.* also present. Areas of steep bank offered burrowing potential and abundant riparian vegetation supplied cover and foraging opportunities, providing optimal habitat for Water Vole. The River Wensum also offered linear connectivity with other watercourses, providing optimal habitat for Otter.

Downstream

- 4.2.4 The southern bank of the downstream section of the River Wensum was shallow and heavily poached by cattle. Dense marginal vegetation was present along the bank, mostly comprising reeds. The northern bank was not subject to poaching, but still fairly shallow and bordered by a golf course with low-mown amenity grass on the bank. Marginal vegetation was present; however, it had been trimmed to bank height. Occasional willow trees, water mint *Mentha aquatica* and forget-me-knot *Myosotis sp.* were also present. A section of the southern bank was surrounded with dense nettle (shown in separate document Appendix A), meaning that access to the bank was not possible. Areas of abundant riparian vegetation on the southern bank supplied cover and foraging opportunities, however the northern bank was mainly covered in short, mown vegetation and the majority of the banks were shallow, with the southern bank also poached. This offered limited opportunities for burrowing, providing sub-optimal habitat for Water Vole. The River Wensum also offered linear connectivity with other watercourses, providing optimal habitat for Otter.

Watercourse 1 - Upstream

- 4.2.5 An unmanaged ditch with shallow banks that was only accessible for short stretches as the majority of the watercourse was bordered with barbed wire fencing. Accessibility was further decreased by dense vegetation. The ditch was choked with reeds, hawthorn *Crataegus monogyna*, goat willow *Salix caprea*, bramble *Rubus fruticosus agg.* and scrub. Shallow water was observed in a few areas, however most of the watercourse was damp and sludgy. As a result of accessibility issues, even though no field signs were observed during surveys the presence of Water Vole could not be discounted. As the banks were shallow, WC1 offered limited burrowing opportunities, however, the vegetation present provided suitable habitat for foraging and cover, and links to watercourses with confirmed Water Vole presence increased the likelihood of use by Water Vole. The use of WC1 for occasional foraging and dispersal by the local Water Vole population can therefore not be ruled out.

Watercourse 5

- 4.2.6 The area surveyed was split into two sections, with one section upstream of the 2020 Survey Area and the other downstream.

Upstream

- 4.2.7 The western section of the stream comprised a mixture of steep and sloping banks, with some parts poached by cattle and others fenced. Cattle were present in the field to the south so both banks were assessed from the north bank as the stream was only approximately 2m wide. The majority of bankside vegetation consisted of heavily grazed grass; however, some taller vegetation was present on the edge of the bank, especially where fencing was present. Some marginal vegetation was present, including common reed, forget-me-knot sp., meadowsweet *Filipendula ulmaria* and purple loosestrife *Lythrum salicaria*. The eastern section of the stream had steep banks with a shallow sloping toe and similarly to the previous stretch, had been heavily grazed by cattle up to the edge of the bank with some marginal vegetation present. At the eastern most end of the section the steep banks continued, however were covered in vegetation on western bank decreasing their visibility. This section also had dense sections of nettles along its bank. Overall, there were opportunities for burrowing along the steep sections of the banks though there were limited opportunities for foraging and cover as although some sections had marginal vegetation, much of the bank was heavily grazed. The upstream section of WC5 was therefore considered to provide sub-optimal habitat for Water Voles.

Downstream

- 4.2.8 The downstream section of WC5 was approximately 3m wide with dense marginal vegetation present, including reeds and frequent yellow flag iris *Iris pseudacorus*. The earth banks were a mixture of steep and sloping, with some areas poached by cattle. Overall, areas of steep and moderately sloping bank offered burrowing potential and sections of abundant riparian vegetation supplied cover and foraging opportunities, providing optimal habitat for Water Vole.

Watercourse 7

- 4.2.9 WC7 comprised a ditch bordered by barbed wire fencing, with arable land present to the north and poor semi-improved grassland to the south. Water was present in the ditch, with a minimum depth of approximately 0.5m. Dense vegetation was present on both banks, including sweet vernal grass *Anthoxanthum odoratum*, reed canary grass *Phalaris arundinacea*, nettles, rushes and greater reedmace. In some sections dense emergent vegetation was present including hemlock water-dropwort *Oenanthe crocata*. Much of the surface was also covered with duckweed *Lemna minor* and some recently planted hawthorn trees were planted along the northern bank. Overall, steep banks provided optimal burrowing habitat and abundant riparian vegetation supplied cover and foraging opportunities, providing optimal habitat for Water Vole.

Watercourse 8

4.2.10 WC8 comprised a ditch with a mixture of steep and sloping banks, with some parts poached by cattle. There was also a combination of shallow and deeper water present, with a maximum depth of approximately 0.5m. Dense marginal vegetation was present on both banks, including water mint, reed sweet grass, reed canary grass, water forget-me-knot *Myosotis scorpioides*, greater reed mace, common reed, purple loosestrife and great willowherb *Epilobium hirsutum*. Overall, areas of steep and moderately sloping bank offered burrowing potential and abundant riparian vegetation supplied suitable habitat for cover and foraging. Additionally, close proximity to watercourses with confirmed water vole presence increased the likelihood of use by water vole. The use of WC8 for burrowing, foraging and dispersal by the local water vole population can therefore not be ruled out.

4.3 Otter field survey

- 4.3.1 Field signs of Otter were recorded in the upstream section of the River Wensum during the survey. An incidental Otter sighting was also recorded near the upstream section of WC5 during a Breeding Bird Survey. A summary of evidence of Otter is given in Table 4-2. Full survey data is included in Appendix C.
- 4.3.2 The survey did not record any signs of Otter within the downstream section of the River Wensum, the upstream section of WC1, the downstream section of WC5, WC7 or WC8.
- 4.3.3 Although a potential Otter holt on the River Wensum was noted in 2020 and 2021, after further investigation the feature was not found to relate to Otter. Consequently, while Otter do utilise habitats within the Survey Area no holts were considered to be present at the time of the surveys.

Table 4-2 – Evidence of Otter

Watercourse	Date evidence recorded	Description of evidence present
WC5 - upstream	07/04/2021 Incidental record	Otter sighting recorded south of the watercourse, moving along the edge of the woodland.
River Wensum - upstream	20/04/2021	Otter prints found along the edge of both the north and south banks. Shell remains with scrapes inside were also present on the south bank.

4.4 Trail camera deployment

- 4.4.1 TC4 recorded Brown Rat only. Full survey data is included in Appendix C.
- 4.4.2 No evidence of Otter using this feature was recorded. In addition, closer inspection of the feature suggested that it was not an Otter holt as it did not provide sufficient shelter.

4.5 Water Vole field survey

4.5.1 Field signs of Water Vole were recorded in the River Wensum – upstream and downstream, WC5 – upstream and downstream, WC7 and WC8; a summary of evidence of Water Vole is provided in Table 4-3. Full survey data is included in Appendix C.

The survey did not record any signs of Water Vole within WC1 - upstream. However, as some of the watercourses and waterbodies were subject to limitations, as outlined in section 3.4, and Water Vole are confirmed to be present in the vicinity, habitat suitability was also used to infer Water Vole presence for certain watercourses, as shown in Table 4-3.

Table 4-3 – Evidence of Water Vole

Watercourse	Survey number	Date	Water Vole presence	Water Vole presence inferred from habitat suitability	Description of evidence present
River Wensum - upstream	Survey 1 2021	20/04/2021	Yes	No	A total of 12 burrows recorded on the northern bank distributed along the watercourse and 22 located on the southern bank, with all but one clumped into two groups in the west and east of the watercourse. A single burrow was located at the westernmost end of the watercourse. A total of eight latrines were recorded on the northern bank and seven on the southern bank, with all but one record on each bank located at the westernmost end. On the northern bank, a single latrine was located at the east end and on the southern bank a single latrine was located in the central section of the watercourse. Almost half of the latrines recorded were associated with feeding remains and one was found near two burrows. Six records of feeding remains were recorded on the northern bank, with a concentration at the western end and one single record located to the east. A total of 12 records of feeding remains were recorded on the southern bank clumped into two groups in the westernmost end of the watercourse and the east. Out of these feeding remain records, three were also found near burrows. Three records of prints were recorded on the northern bank and one on the southern bank. All the prints were concentrated at the easternmost end apart from a single record located towards the centre of the watercourse.
River Wensum - downstream	Survey 1 2021	27/07/2021	Yes	No	Nine latrines were recorded on the southern bank of the downstream section of the River Wensum, distributed throughout the watercourse, with a concentration at the eastern end. A concentration of five records of feeding remains were also recorded in this area with two recordings associated with latrines. A single record of feeding remains was located at the westernmost end of the watercourse.
WC1 - upstream	Survey 1 2021	13/09/2021	No	Yes	No evidence of Water Vole recorded. Suitable habitat not fully accessible.
WC5 - upstream	Survey 1 2021	20/04/2021	Yes	No	Nine burrows were recorded on the south bank, with six burrows grouped together in threes at the east end of the watercourse. Three burrows were located in the western section, with two next to each other at the waterline. A single latrine was recorded on the central section and a single record of feeding remains was recorded on the western stretch of the watercourse.
WC5 - downstream	Survey 1 2020	01/07/2020	Yes	No	Recordings of three latrines, all associated with feeding remains were concentrated on the south bank to the east of the watercourse. Opposite these recordings, on the north bank another latrine was recorded. A single latrine was also recorded further to the west on the south bank. An additional record of feeding remains was recorded at the western end of the watercourse on the southern bank.
WC5 - downstream	Survey 2 2020	13/08/2020	Yes	No	Seven records of feeding remains at the western end of the southern bank, with six of the records clustered together, one of which had a latrine associated with it.

Watercourse	Survey number	Date	Water Vole presence	Water Vole presence inferred from habitat suitability	Description of evidence present
WC7	Survey 1 2021	27/07/2021	No	No	A single burrow was recorded on the southern bank towards the eastern end of the ditch and a run was recorded from the burrow, continuing west. Two records of feeding remains were located on the south bank in the centre and east of the ditch.
WC7	Survey 2 2021	13/09/2021	Yes	No	Five burrows were recorded throughout the southern bank of the ditch, with a concentration of burrows towards the eastern end. Six latrines were recorded clustered together at the eastern end of the ditch, with the majority associated with feeding remains. Ten records of feeding remains were recorded throughout the ditch, with a concentration of feeding signs at the east end. A single record of prints was located in the central section of the ditch.
WC8	Survey 1 2021	14/09/2021	Yes	Yes	One record of feeding remains recorded.

- 4.5.2 No evidence of American Mink was recorded during the surveys.
- 4.5.3 Evidence of small mammals, such as bank vole, were recorded in WC5 - upstream and WC7.
- 4.5.4 Evidence of Brown Rat was recorded in the River Wensum – upstream.

4.6 Relative Water Vole population density

- 4.6.1 The latrine counts from the surveys can give an indication of relative Water Vole population density for each watercourse (as described in section 4.2 above). This aids in identifying the most valuable parts of the Survey Area for Water Voles, along with areas most suitable for enhancement, however latrine counts cannot provide robust estimates of absolute numbers of animals. The method was informed by guidance in The Water Vole Mitigation Handbook (Dean, et al., 2016).
- 4.6.2 The thresholds used were based on the approximate number of latrines per 100m of bankside habitat and the overall threshold was decided by taking into account the varying thresholds met throughout the whole watercourse or waterbody. During the early survey season, the thresholds were ≥ 10 for high density, 3-9 for medium density and ≤ 2 (or none with other confirmatory field signs) for low density. During the late survey season, the thresholds were ≥ 20 for high density, 6-19 for medium density and ≤ 5 (or none with other confirmatory field signs) for low density. Latrine counts from the surveys indicate the following relative population densities, as shown in Table 4-4.

Table 4-4 – Relative Water Vole Population Densities

Watercourse	Relative population densities
River Wensum - upstream	Medium density
River Wensum - downstream	Low density
WC5 - upstream	Low density
WC5 - downstream	Low density
WC7	Low density

- 4.6.3 The limitations noted in section 3.4 meant that Water Vole absence could not be confirmed by lack of field signs in WC1 - upstream, so habitat assessments were used to assist in estimating the Water Vole population density present. Both WC1 – upstream and WC8 had suitable foraging and dispersal habitat for Water Vole and an existing Water Vole population in nearby connecting habitat. WC8 also had suitable burrowing habitat. However, Mink have previously been confirmed in the surrounding area in the 2020 surveys (WSP, 2021) and WC1 - upstream also had limited burrowing opportunities. Therefore, WC1 and WC8 were assessed as having low densities of Water Vole present.

5 References

5.1 Project references

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Appendix A – Otter and Water Vole Survey Area (see separate document)



Appendix B - Otter and Water Vole Survey Results (see separate document)

Appendix C – Field Survey Data

Table C-1 – River Wensum – Upstream Field Survey Results

Date	Grid reference	Field sign	Species	Description
20/04/2021	TG1375715654	Prints	Otter	Otter prints
20/04/2021	TG1375115663	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1374115672	Prints	Water Vole	Water Vole prints
20/04/2021	TG1372615673	Prints	Water Vole	Water Vole prints
20/04/2021	TG1368315668	Latrine	Water Vole	Old latrine, x10-15 droppings.
20/04/2021	TG1366415680	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1366315673	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1358615676	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1358115682	Burrow	Water Vole	Possible burrow
20/04/2021	TG1357715677	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1354315680	Prints	Water Vole	Intermittently on mud banks until TG1347515653.
20/04/2021	TG1354315680	Prints	Rat	Intermittently on mud banks until TG1347515653.
20/04/2021	TG1341915726	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1341915726	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1336815793	Feeding remains	Water Vole	x2 piles of feeding remains.
20/04/2021	TG1335315813	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1335315813	Latrine	Water Vole	x25 droppings.
20/04/2021	TG1335515817	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1335515817	Latrine	Water Vole	x10 droppings.
20/04/2021	TG1335815819	Latrine	Water Vole	Minimum of 55 droppings.
20/04/2021	TG1335815820	Latrine	Water Vole	x20 droppings.

Date	Grid reference	Field sign	Species	Description
20/04/2021	TG1334915832	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1333715838	Latrine	Water Vole	x15 droppings.
20/04/2021	TG1333715838	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1334115864	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1333915887	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1333715896	Latrine	Water Vole	x7 droppings.
20/04/2021	TG1331915927	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1331915927	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1331915927	Latrine	Water Vole	x25 droppings, mixture of old and new.
20/04/2021	TG1331615938	Feeding remains	Water Vole	x2 piles and visible nibbling.
20/04/2021	TG1372715657	Prints	Water Vole	Water Vole prints
20/04/2021	TG1360615661	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1360615661	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1360615661	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1360615661	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1353615661	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1353615661	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1353615661	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1352515614	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1351315615	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1350515620	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1350415620	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1350415620	Burrow	Water Vole	Water Vole burrow

Date	Grid reference	Field sign	Species	Description
20/04/2021	TG1350015621	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1347615645	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1346715647	Latrine	Water Vole	x7 droppings.
20/04/2021	TG1346615649	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1346615649	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1346615649	Latrine	Water Vole	Water Vole latrine
20/04/2021	TG1346515650	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1342515686	Feeding remains	Otter	Shell remains with scrapes inside.
20/04/2021	TG1337815765	Prints	Otter	Otter prints
20/04/2021	TG1336215784	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1334215819	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1333915816	Dead animal	Rat	Dead Rat
20/04/2021	TG1333615822	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1333215831	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1333115835	Burrow	Water Vole	Disused.
20/04/2021	TG1333515839	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1333515839	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1333515839	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1333515839	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1333515839	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1332915911	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1333215923	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1333215923	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1333215923	Latrine	Water Vole	x30 droppings.
20/04/2021	TG1332315931	Latrine	Water Vole	x17 droppings.

Date	Grid reference	Field sign	Species	Description
20/04/2021	TG1332315931	Latrine	Water Vole	x25 droppings.
20/04/2021	TG1332315931	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1332315931	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1332315931	Latrine	Water Vole	Multiple droppings, degraded and old.
20/04/2021	TG1332315931	Latrine	Water Vole	Multiple droppings, degraded and old.
20/04/2021	TG1332315931	Prints	Otter	Otter prints
20/04/2021	TG1333215953	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1334815972	Burrow	Water Vole	Multiple burrows - all looked rat sized apart from one.

Table C-2 – River Wensum – Downstream Field Survey Results

Date	Grid reference	Field sign	Species	Description
27/07/2021	TG1441215196	Feeding remains	Water Vole	Water Vole feeding remains
27/07/2021	TG1440715197	Latrine	Water Vole	x5 droppings, mixture of old and new.
27/07/2021	TG1439115189	Latrine	Water Vole	x15 droppings.
27/07/2021	TG1438215188	Latrine	Water Vole	x10 fresh droppings, plus old droppings flattened together.
27/07/2021	TG1438215188	Feeding remains	Water Vole	Water Vole feeding remains
27/07/2021	TG1436615178	Feeding remains	Water Vole	Water Vole feeding remains
27/07/2021	TG1436515179	Latrine	Water Vole	x15 droppings.
27/07/2021	TG1435915178	Feeding remains	Water Vole	Water Vole feeding remains
27/07/2021	TG1431915208	Latrine	Water Vole	x6 new droppings and x10 older droppings.

Date	Grid reference	Field sign	Species	Description
27/07/2021	TG1430315248	Latrine	Water Vole	x8 new droppings, plus flattened old droppings.
27/07/2021	TG1430315248	Feeding remains	Water Vole	Water Vole feeding remains
27/07/2021	TG1427015302	Latrine	Water Vole	x4 droppings.
27/07/2021	TG1437715187	Feeding remains	Water Vole	Water Vole feeding remains
27/07/2021	TG1437715187	Latrine	Water Vole	x1 dropping.
27/07/2021	TG1436915186	Latrine	Water Vole	x5 droppings, mixture of old and new.

Table C-3 – WC5 - Upstream Field Survey Results

Date	Grid reference	Field sign	Species	Description
20/04/2021	TG1329315707	Burrow	Water Vole	Burrow at waterline.
20/04/2021	TG1329315707	Burrow	Water Vole	Burrow at waterline.
20/04/2021	TG1329815693	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1336415662	Feeding remains	Water Vole	Water Vole feeding remains
20/04/2021	TG1329815512	Latrine	Water Vole	x4 droppings.
20/04/2021	TG1331115490	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1331115490	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1331115490	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1333015441	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1333015441	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1333015441	Burrow	Water Vole	Water Vole burrow
20/04/2021	TG1333015441	Burrow	Small mammal	Unidentified small mammal burrow

Table C-4 – WC5 – Downstream Field Survey Results

Date	Grid reference	Field sign	Species	Description
01/07/2020	TG1401415133	Latrine	Water Vole	x2 droppings.
01/07/2020	TG1401115117	Latrine	Water Vole	x5 droppings.
01/07/2020	TG1401115117	Feeding remains	Water Vole	Water Vole feeding remains
01/07/2020	TG1401115117	Latrine	Water Vole	x3 droppings.
01/07/2020	TG1401115117	Feeding remains	Water Vole	Water Vole feeding remains
01/07/2020	TG1401115117	Latrine	Water Vole	x2 droppings.
01/07/2020	TG1401115117	Feeding remains	Water Vole	Water Vole feeding remains
01/07/2020	TG1396515144	Latrine	Water Vole	x23 droppings.
01/07/2020	TG1392615166	Feeding remains	Water Vole	Water Vole feeding remains
13/08/2020	TG1397515144	Feeding remains	Water Vole	Water Vole feeding remains
13/08/2020	TG1396915145	Feeding remains	Water Vole	Water Vole feeding remains
13/08/2020	TG1396515144	Feeding remains	Water Vole	Possible Water Vole feeding remains – correct angle but small.
13/08/2020	TG1396515144	Latrine	Water Vole	Water Vole latrine
13/08/2020	TG1395515148	Feeding remains	Water Vole	Extensive pile of feeding remains.
13/08/2020	TG1395815150	Feeding remains	Water Vole	Water Vole feeding remains
13/08/2020	TG1394915151	Feeding remains	Water Vole	Water Vole feeding remains
13/08/2020	TG1392515169	Feeding remains	Water Vole	Water Vole feeding remains

Table C-5 – WC7 Field Survey Results

Date	Grid reference	Field sign	Species	Description
27/07/2021	TG1404815489	Burrow	Water Vole	Burrow at water level.
27/07/2021	TG1404815489	Run	Water Vole	From burrow, continuing west along back of bank.

Date	Grid reference	Field sign	Species	Description
27/07/2021	TG1401215533	Feeding remains	Water Vole	Old.
27/07/2021	TG1392715598	Feeding remains	Water Vole	Water Vole feeding remains
27/07/2021	TG1389215616	Burrow	Small mammal	Unidentified small mammal burrow
13/09/2021	TG1409815451	Feeding remains	Water Vole	Water Vole feeding remains
13/09/2021	TG1409815455	Burrow	Water Vole	Water Vole burrow
13/09/2021	TG1408515464	Latrine	Water Vole	x10 droppings.
13/09/2021	TG1408515464	Feeding remains	Water Vole	Water Vole feeding remains
13/09/2021	TG1408315465	Latrine	Water Vole	x14 droppings.
13/09/2021	TG1407815470	Latrine	Water Vole	x4 droppings.
13/09/2021	TG1407815470	Feeding remains	Water Vole	Water Vole feeding remains
13/09/2021	TG1407615472	Latrine	Water Vole	x50 droppings.
13/09/2021	TG1407615472	Feeding remains	Water Vole	Water Vole feeding remains
13/09/2021	TG1407515472	Latrine	Water Vole	x25 droppings plus old flattened droppings.
13/09/2021	TG1407515472	Feeding remains	Water Vole	Water Vole feeding remains
13/09/2021	TG1407515472	Burrow	Water Vole	Water Vole burrow
13/09/2021	TG1407515472	Latrine	Water Vole	x30 droppings.
13/09/2021	TG1407115476	Burrow	Water Vole	Water Vole burrow
13/09/2021	TG1406915477	Feeding remains	Water Vole	Water Vole feeding remains
13/09/2021	TG1402515516	Burrow	Water Vole	Water Vole burrow
13/09/2021	TG1402015523	Feeding remains	Water Vole	Water Vole feeding remains
13/09/2021	TG1400915538	Feeding remains	Water Vole	Water Vole feeding remains
13/09/2021	TG1398415562	Prints	Water Vole	Water Vole prints
13/09/2021	TG1394115592	Feeding remains	Water Vole	Water Vole feeding remains

Date	Grid reference	Field sign	Species	Description
13/09/2021	TG1393315590	Burrow	Small mammal	Unidentified small mammal burrow
13/09/2021	TG1391915600	Burrow	Water Vole	Water Vole burrow
13/09/2021	TG1391015602	Feeding remains	Water Vole	Water Vole feeding remains

Table C-6 – Trail Camera Results

Trail camera	Date	Description of species recorded
TC4	08/07/2021 – 13/09/2021	5x Brown Rat, 5x Wren <i>Troglodytes troglodytes</i> , 1x Blackbird <i>Turdus merula</i> , 2x chicken <i>Gallus gallus domesticus</i> , 4x unidentified bird.

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