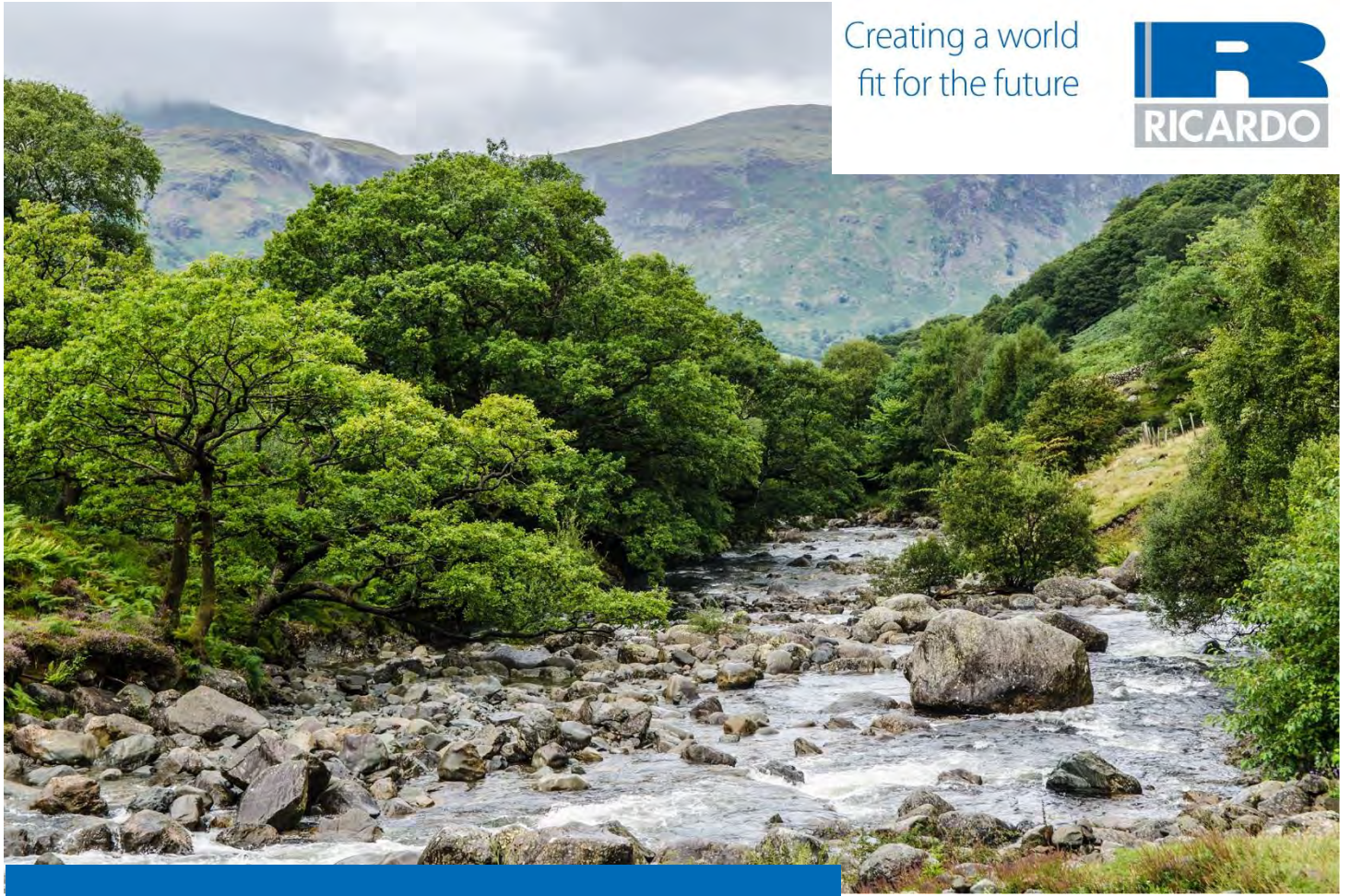


Creating a world  
fit for the future



## Haweswater Aqueduct Resilience Programme

Proposed Marl Hill Section, Volume 6, Proposed Ribble Crossing

Protected Species Survey Report

Technical Appendix 9B.2

RVBC-MH-RC-TA-009-02-002







# Haweswater Aqueduct Resilience Programme

Protected species survey report – TR4 Marl Hill

Project No. 2480524

APRIL 2021



# CONTENTS

---

<b>1</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	Purpose of this report .....	1
1.2	Site information.....	1
<b>2</b>	<b>METHOD .....</b>	<b>3</b>
2.1	Survey timings .....	3
2.2	Otter surveys .....	3
2.3	Water vole surveys and habitat suitability assessment.....	3
2.4	White-clawed crayfish habitat suitability assessment. ....	4
2.5	Survey constraints .....	4
2.6	Biosecurity .....	5
<b>3</b>	<b>RESULTS .....</b>	<b>6</b>
<b>4</b>	<b>APPENDICES – SURVEY MAPS .....</b>	<b>18</b>

# 1 INTRODUCTION

---

## 1.1 Purpose of this report

RSK Biocensus (RSK) was commissioned by Ricardo Environment and Energy (Ricardo) to provide specialist aquatic ecological support in relation to the Haweswater Aqueduct Resilience Programme (HARP). Otter (*Lutra lutra*), water vole (*Arvicola amphibius*) and white-clawed crayfish (*Austropotamobius pallipes*) surveys are required to inform a Water Framework Directive (WFD) assessment, Environmental Impact Assessment (EIA) and mitigation strategy for the scheme.

As part of the scheme United Utilities propose to replace several sections of the existing single line aqueduct. The replacement sections are proposed to be delivered over five distinct sections. From north to south these sections are named as follows:

- Docker (TR1);
- Swarther (TR2);
- Bowland (TR3);
- Marl Hill (TR4); and
- Haslingden to Walmersley (TR5/6).

Nine planning applications are required to cover all five sections. These will be accompanied by an Environmental Statement (ES) for each section and a Habitat Regulations Assessment (HRA) as required for each section.

This report details surveys undertaken on watercourses within the Marl Hill (TR4) section which will likely be impacted by the proposed works.

## 1.2 Site information

*Figure 1* shows the location of the survey reaches and the survey extents for each watercourse identified that will be impacted by the works for section TR4 of the scheme. *Table 1* summarises the survey requirements at each watercourse which were specified by Ricardo.

**Table 1. Site information and survey requirements, TR4 Marl Hill**

Name	Watercourse ID	Section	Eastings and Northings		Date of survey	Surveys Required		
			Upstream	Downstream		Water Vole	Otter	White Clawed Crayfish
Bashall Brook	W512	T04	X: 369928 Y: 444567	X: 370018 Y: 444057	24/04/2020	-	Yes	-
Unnamed Watercourse 430	W520	T04	X: 371521 Y: 444978	X: 371527 Y: 444907	24/04/2020	Yes (x2)	Yes	-
Unnamed Watercourse 431	W521	T04	X: 371727 Y: 445030	X: 371737 Y: 444952	24/04/2020	-	Yes	-
Unnamed Watercourse 433	W523	T04	X: 371960 Y: 445103	X: 371975 Y: 445019	24/04/2020	-	Yes	-
Unnamed Watercourse 442	W533	T04	X: 370293 Y: 444498	X: 370454 Y: 444396	24/04/2020	-	Yes	-
Unnamed Watercourse 463	W557	T04	X: 371799 Y: 445413	X: 371919 Y: 444809	24/04/2020	-	Yes	-
Waddington Brook	W506	T04	X: 372043 Y: 447548	X: 372137 Y: 446634	05/06/2020	Yes	Yes	-
Waddington Brook (Upstream Ribble confluence).	W506	T04	X: 373521 Y: 443840	X: 373924 Y: 443617	01/02/2021	Yes (survey timing sub optimal - habitat suitability assessment only)	Yes	Yes (survey timing sub optimal - habitat suitability assessment only)
Unnamed Watercourse 430 (downstream)	W520	T04	X: 371578 Y: 444453	X: 371684 Y: 444111	05/06/2020	Yes	Yes	-
Unnamed Watercourse 446	W538	T04	X: 371373 Y: 444791	X: 371177 Y: 444010	09/06/2020	Yes	Yes	-
Unnamed Watercourse 445	W537	T04	X: 371255 Y: 444749	X: 371200 Y: 444302	05/06/2020	Yes	Yes	-
Sandy Ford Brook	W530	T04	X: 371051 Y: 445379	X: 371183 Y: 444306	09/06/2020	Yes	Yes	-
Greg Sike	W2321	T04	X: 373964 Y: 443939	X: 374095 Y: 443580	01/02/2021	Yes (survey timing sub optimal - habitat suitability assessment only)	Yes	Yes (survey timing sub optimal - habitat suitability assessment only)
River Ribble	RW03-05	T04	X: 372037 Y: 446276	X: 372261 Y: 445877	24/11/2020	Yes (survey timing sub optimal - habitat suitability assessment only)	Yes	Yes (survey timing sub optimal - habitat suitability assessment only)
River Ribble	W2325	T04	X: 374488 Y: 443947	X: 374020 Y: 443440	01/02/2021	Yes (survey timing sub optimal - habitat suitability assessment only)	Yes	Yes (survey timing sub optimal - habitat suitability assessment only)
Unnamed Watercourse X	RW17	T04	X: 372024 Y: 447501	X: 372011 Y: 447110	02/12/2020	Yes (survey timing sub optimal - habitat suitability assessment only)	Yes	Yes (survey timing sub optimal - habitat suitability assessment only)

## 2 METHOD

---

### 2.1 Survey timings

Surveys were undertaken in April, June and December 2020 as well as early February 2021 by a team of highly experienced aquatic ecologists. For most of the surveys the weather was fine and clear, however in June occasional light rain was recorded.

In the week preceding each of the surveys no significant rainfall was recorded.

### 2.2 Otter surveys

Otter surveys followed an amended methodology derived from that detailed within Chanin 2003<sup>1</sup>. Where access permitted, both banks of each watercourse were surveyed to look for and record signs of otter. Emphasis was given to investigating prominent features such as bridge arches, fallen trees and root systems as well as rocks and ledges along the banks where spraints, footprints, evidence of resting or breeding sites and feeding remains were most likely to be present. Presence of access points, such as slides or runs, were also recorded. The location of any evidence was marked using a hand-held tablet device allowing the data to be mapped using GIS software. Photographs were taken to evidence sign of otter as well as the habitat present on the site.

### 2.3 Water vole surveys and habitat suitability assessment

The water vole surveys followed the standard methods outlined within Strachan (2011)<sup>2</sup> and Dean *et al.* (2016)<sup>3</sup> respectively. Where accessible, surveyors searched both banks of each watercourse for evidence of water voles including burrows, feeding platforms, grazing (including food remains), latrines and footprints.

The location of any water vole evidence was recorded using a hand-held tablet device allowing the data to be mapped using GIS software. Photographs were also taken to evidence water vole activity as well as the habitat present on site.

Where surveys were undertaken outside the survey season for water vole (April – September) the suitability of the habitat for Water Voles was assessed using the following criteria (Dean *et al.*, 2016<sup>4</sup>):

---

<sup>1</sup> Chanin, P. 2003. Ecology of the European Otter. Conserving Natura 2000 Rivers Ecology Series No. 10. English Nature, Peterborough.

<sup>2</sup> Strachan, R. (2011). Water Vole Conservation Handbook – The Third Edition. Wildlife Conservation Research Unit, Oxford

<sup>3</sup> Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016). The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series). Eds Fiona Mathews and Paul Chanin. The Mammal Society, London

<sup>4</sup> Dean, M., Strachan, R., Gow, D. and Andrews, R. (2016). *The Water Vole Mitigation Handbook (The Mammal Society Mitigation Guidance Series)*. Eds Fiona Mathews and Paul Chanin. The Mammal Society, London.



- Bank profile;
- Bank substrate, specifically its suitability for burrowing;
- Water depth;
- Likely frequency and height of water level changes, relative to bank height;
- Amount of shading from trees/shrubs;
- Bankside herbaceous vegetation type (tall tussocky grass, mown grass etc.);
- Bankside herbaceous vegetation density;
- In-channel herbaceous vegetation type;
- In-channel herbaceous vegetation width (from toe of bank to the point at which the Bank meets water level);
- In-channel herbaceous vegetation density;
- Percentage of the channel with in-channel herbaceous vegetation;
- Evidence of current or recent management, and the likely effects of management; and
- Any other relevant factors.

Classification of habitat suitability was made as follows:

- **Excellent** – optimal habitat with good cover, food sources and other features that would allow water vole populations to thrive throughout the year.
- **Suitable** – habitat that has all the elements required by water vole, certainly in the summer, and probably through most winters.
- **Moderate** – habitat that has some of the features that are suitable for water vole, but with some constraints so that suitability throughout the year is not certain.
- **Unsuitable** – habitat lacking one or more crucial element for use by water voles. This category does not necessarily preclude the habitat being used by water voles, but it would not be able to support a resident population.

## 2.4 White-clawed crayfish habitat suitability assessment.

Where required instream habitat was assessed for its suitability to support white-clawed crayfish. The suitability of the habitat for white-clawed crayfish was assessed using the following criteria:

- Abundance and distribution of submerged refuges;
- Evidence of poor water quality i.e. sewage fungus;
- River flow velocity;
- Quantities of fine sediment;
- Abundance of potential food sources i.e. macroinvertebrates; and
- Evidence of invasive non-native crayfish species.

## 2.5 Survey constraints

There were no obvious constraints to undertaking the surveys. Where presence absence surveys were undertaken, the timings were considered suitable for water vole and otter and the surveys were not compromised by poor weather. Surveyors were also able to access the full extent of each watercourse.



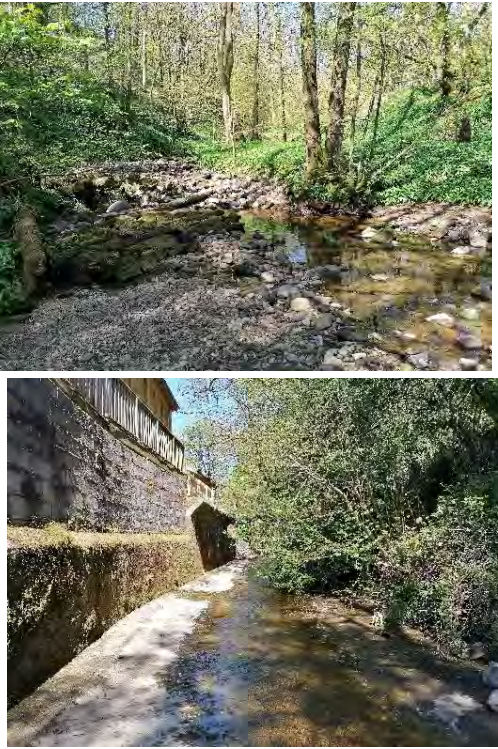
## **2.6 Biosecurity**

All RSK ecologists have undertaken internal training on biosecurity practices, which are in accordance with those described by the Great Britain Non-Native Species Secretariat's (GB NNSS) check-clean-dry policy. Furthermore, they have all completed, as a minimum, modules 1 and 3 of the GB NNSS e-learning modules on biosecurity. In addition to adhering to this procedure, surveyors worked in a downstream direction in flowing watercourses to further minimise risk. All equipment was thoroughly checked, cleaned (and disinfected) and dried before it was used in a different watercourse.

### 3 RESULTS

Table 2 summarises the results of the surveys at each respective site.

**Table 2. Otter and water vole survey results – TR4 Marl Hill**

<b>T04: W512 Bashall Brook</b>	
	<p><b>Eastings and Northings</b>            Upstream: X: 369928 Y: 444567            Downstream: X: 370018 Y: 444057</p> <ul style="list-style-type: none"> <li>• <b>Evidence of otter, suitable habitat at W512.</b></li> </ul> <p>Evidence of otter was recorded at W512; four spraints were recorded (<i>Figure 2 – W512</i>). W512 is considered suitable habitat for otter.</p> <p>W512 was a moderately flowing stream with varying flow types and pools. The channel substrate was predominantly comprised of bedrock, boulder, cobble, and gravel. Filamentous algae was occasionally present throughout the surveyed reach. The width of the channel was variable ranging from c. 2.4 - 4.5 m. Similarly, the depth was also variable ranging from c. 0.03 - 0.45 m. Large woody debris and side bars were present throughout the watercourse providing heterogeneous flow and aquatic habitat.</p> <p>The majority of W512 was comprised of steep, wooded, channel sides with bankside herbs.</p> <p>W512 had a section of artificial substrate and vertical embankment with a culvert present immediately upstream of the bridge. Downstream of the bridge a large man-made cascade was present. A fish ladder was adjacent to this obstruction but was blocked by boulders and cobbles at the time of the survey.</p>

**T04: W520 Unnamed Watercourse 430 (Upstream reach)**



**Eastings and Northings**

Upstream: X: 371521 Y: 444978

Downstream: X: 371527 Y: 444907

- **No evidence of otter and moderate habitat suitability at W520.**
- **Potential water vole evidence but low habitat suitability.**

No evidence of otter was observed.

Three burrows were recorded (*Figure 2 – W520*). Notwithstanding this, most of the site is considered of low suitability for water voles due to the extensive tree cover throughout the section surveyed and limited food resources.

Despite the burrows being found, in the absence of definitive evidence i.e. latrines, it is considered unlikely that water vole are present at the site.

The watercourse was a shallow, slow-flowing stream with steep earth and rock banks. Abundant tree cover and woody debris was present throughout with ground flora consisting of grass, herbs and *Juncus* sp. (a Rush).

The channel substrate was a mix of boulder, cobble, sand and gravel. The stream was bordered by sheep-grazed pasture. The width of the channel was c. 0.5 m and the water depth was c. 2 cm.

**T04: W520 Unnamed Watercourse 430 (Downstream reach)**



**Eastings and Northings**

Upstream: X: 371578 Y: 444453

Downstream: X: 371684 Y: 444111

- **No evidence of otter or water vole.**
- **W520 is unsuitable for water vole, but of low to moderate suitability for otter.**

No evidence of water vole was found during surveys. Due to heavy shading throughout and lack of available foraging resources, the reach was considered unsuitable for water vole.

	<p>No evidence of otter was recorded on W520, however, the watercourse possessed suitable resting sites (exposed tree roots and cavities below large boulders) and commuting potential for otters.</p> <p>The watercourse was a steep sided, shallow flowing stream, shaded throughout with both native deciduous and non-native ever green canopy (<i>rhododendron</i> sp.). The in-channel substrate was comprised of boulder, cobble, and gravel with occasional coarse woody debris.</p> <p>A small section of W520 had artificially reinforced banks, stone walls, and a weir was present in the upstream section.</p> <p>The width of the channel was c. 2.5 m and the water depth was c. 10 cm.</p>
--	--

**T04: W521 Unnamed Watercourse 431**



<p><b>Eastings and Northings</b>          Upstream: X: 371727 Y: 445030          Downstream: X: 371737 Y: 444952</p> <ul style="list-style-type: none"> <li><b>No otter evidence, low habitat suitability at W521.</b></li> </ul> <p>No evidence of otter was recorded at W521 during the surveys (<i>Figure 2 – W521</i>).</p> <p>W521 was predominantly dry with areas of shallow standing water. The width of the channel was c. 0.3 m and the water depth was c. 1 cm, where water was present.</p> <p>The shallow sloping banks were vegetated with grasses and trees with occasional <i>Juncus</i> sp., herbs and scrub. The ditch was bordered by sheep-grazed pasture. The in-channel substrate was comprised of boulder, cobble and gravel.</p>
--



**T04: W523 Unnamed Watercourse 433**



**Eastings and Northings**

Upstream: X: 371960 Y: 445103

Downstream: X: 371975 Y: 445019

- **No evidence of otter at W523, habitat of moderate suitability.**

No evidence of otter was recorded during the surveys (*Figure 2 – W523*).

The watercourse was a shallow, slow flowing stream with no in-channel vegetation. The width of the channel was c. 0.5 m and the water depth was c. 2 cm.

The channel substrate was a mix of boulder, cobble, and gravel with occasional mud. The banks were steep and principally bare earth or grass. The bordering vegetation was comprised of grass, *Juncus* sp., scrub and trees.

**T04: W533 Unnamed Watercourse 442**



**Eastings and Northings**

Upstream: X: 370293 Y: 444498

Downstream: X: 370454 Y: 444396

- **No evidence of otter at W533, habitat of low suitability.**

No evidence of otter was recorded during the surveys (*Figure 2 – W533*).

W533 was predominantly dry with occasional standing water and some filamentous algae present. The substrate was boulder, cobble, and gravel. The width of the channel was c. 0.3 m and the water depth was c. 1 cm.

The channel cuts through grazed pasture and follows a line of trees. Bank growth mainly consists of trees, grass and *Juncus* sp. with occasional scrub and herbs (dominated by nettles).

**T04: W557 Unnamed Watercourse 463**



**Eastings and Northings**

Upstream: X: 371799 Y: 445413

Downstream: X: 371919 Y: 444809

- **No evidence of otter at W557, habitat of moderate suitability.**

No evidence of otter was recorded during the surveys at W557 (*Figure 2 – W557*).

W557 was a wooded, shallow ditch with intermittent reaches of ponded water or water with no perceivable flow. The substrate consisted of boulder, cobble, and gravel. The width of the channel was c. 0.4 m and the water depth was c. 3 cm where water was present.

Bankside vegetation was comprised mostly of grasses and *Juncus* sp. with areas of bare ground and occasional scrub or tree cover. The stream was bordered by sheep grazed pasture. No in-channel vegetation was observed and there was evidence of trampling and poaching on the banks.

**T04: W506 Waddington Brook**



**Eastings and Northings**

Upstream: X: 372043 Y: 447548

Downstream: X: 372137 Y: 446634

- **No evidence of water vole recorded on W506.**
- **Two otter spraints were recorded at the upstream extent of the reach.**
- **Habitat within the survey reach was generally unsuitable for both species.**


No evidence of water vole was recorded on W506. The brook does however provide some suitable foraging and burrowing habitat.

The watercourse was generally, a moderately flowing, shallow brook with a substrate comprised predominantly from boulders, cobble, gravel, silt, and bedrock. Bedrock cascades and pools were



	<p>also frequent. Although variable, the width of the channel was 1 – 3.5 m and the water depth was c. 20 cm.</p> <p>Vegetation on the steep, sheep-grazed banks was comprised of herbs, <i>Juncus</i> sp. and ferns. No in-channel vegetation was recorded.</p>
--	--

**T04: W506 Waddington Brook (Upstream river Ribble confluence)**

	<p><b>Eastings and Northings</b>        Upstream: X: 373521 Y: 443840        Downstream: X: 373924 Y: 443617</p> <ul style="list-style-type: none"> <li>• <b>Evidence of otter at W506, some suitable habitat present.</b></li> <li>• <b>No evidence of water vole, habitat of low suitability.</b></li> </ul> <p>The channel width was c. 1.25 m, and, at the time of survey, the water depth was c. 10 cm, although both of these were variable. The substrate comprised mostly of boulder, cobble, gravel, and sand, with some silt at the downstream end.</p> <p>Sewage fungus was recorded over a large stretch of the reach indicating a water quality issues may be a problem within the watercourse.</p> <p>Evidence of otter was recorded in the form of spraint and footprints (<i>Figure 2 – W506</i>). Habitat was not considered to be of high suitability for otter, but there were sections of woody and anthropogenic debris on the bank which otters may choose to use for refuge.</p> <p>The channel had suitable habitat for white-clawed crayfish, due to the presence of boulders and large cobbles that can serve as potential refuges. The potential water quality issues as indicated by the presence of sewage fungus would reduce the likelihood of white-clawed crayfish being present here. No evidence of crayfish was recorded during the survey and no remains were observed within the otter spraint.</p> <p>No evidence of water vole was recorded during the survey and habitat was largely unsuitable at W506.</p>
--	---

**T04: W538 Unnamed Watercourse 446**



**Eastings and Northings**

Upstream: X: 371373 Y: 444791

Downstream: X: 371177 Y: 444010

- **No evidence of otter or water vole on W538.**

W538 was largely unsuitable for water vole with no definitive water vole evidence recorded during the survey i.e. latrines.

No evidence of otter was recorded on W538. Although the habitat was regarded as being largely unsuitable for otter with few foraging and resting opportunities at this location, the watercourse could still be used for commuting.

The channel width was c. 2 m and the water depth was c. 5 cm.

The upstream section of W538 was a dry, tree-bordered ditch between cattle-grazed, improved / semi-improved pasture. The substrate was predominantly boulder, cobble, gravel, and clay.

The channel passed under a road into a rhododendron dominated plantation. Areas of shallow ponded water were present within the channel at this location.

W538 passed under another road and entered another cattle-grazed, semi-improved / improved pasture. The bank was poached through trampling.

**T04: W537 Unnamed Watercourse 445**



**Eastings and Northings**

Upstream: X: 371255 Y: 444749

Downstream: X: 371200 Y: 444302

- **No evidence of otter or water vole on W537.**
- **Habitat largely unsuitable for both species.**

The channel width was c. 1.0 m, and, at the time of survey, the channel was predominantly dry with some ponded areas with no flow.





No evidence of water vole was found during surveys. Due to heavy shading throughout and a lack of suitable foraging resources, the reach is considered largely unsuitable for water vole. A small section of channel is unshaded providing suitable bankside habitat for water vole (pictured). This is located towards the downstream extent of the survey reach and was dry at the time of the survey.

No evidence of otter was recorded on W537. Due to the lack of available foraging and resting opportunities, the habitat was regarded as being unsuitable for otter.

W537 was a predominantly shaded channel with trees growing along both banks. A short section of the channel entered a meadow where herbs, grass and *Juncus* sp. dominate the banks. The channel was dry with a few sections of ponded water. The substrate was boulder, cobble, and gravel.

**T04: W530 Sandy Ford Brook**



**Eastings and Northings**

Upstream: X: 371051 Y: 445379

Downstream: X: 371183 Y: 444306

- **No evidence of otter or water vole at W530.**
- **Habitat generally unsuitable for both species.**

No evidence of otter was found at W530. The habitat was generally unsuitable for otter because, although suitable resting areas were identified (cavities under bankside trees), low flows currently limit aquatic foraging opportunities.

The upper section of W530 was potentially suitable for water vole with lush bankside vegetation present and bankside substrate for burrowing. Small mammal activity was observed in the form of burrows and feeding evidence (pictured) but this was characteristic of bank voles (*Myodes glareolus*).

The channel width ranged from 2 - 5 m and the water depth remained shallow throughout at c. 3 cm.

The upper reaches of the stream bisect pasture and at this point there was little, or no flow observed.

The gently sloping banks were vegetated with herbs, grasses and *Juncus* sp.. The in-channel substrate was comprised of boulder, cobble, gravel, silt, and clay.

As the watercourse flows downstream, the gently sloping banks are replaced by steep forested banks which have minimal herbaceous vegetation. The substrate was boulder, cobble, and gravel, with frequent coarse woody debris.

**T04: W2321 Greg Sike**



**Eastings and Northings**

Upstream: X: 373964 Y: 443939

Downstream: X: 374095 Y: 443580

- **Evidence of otter present at W2321.**
- **No evidence of water vole and habitat largely unsuitable.**
- **No evidence of white-clawed crayfish but suitable habitat available.**

The channel width was c. 1 m, and, at the time of survey, the water depth was c. 10 cm, although both of these were variable. The substrate comprised mostly of cobble, gravel, and sand with boulders in some sections. The downstream reach comprised of finer sediment and was composed mostly of sand and silt.

No holts, couches or spraint were recorded at W2321. A single otter footprint (pictured) was however recorded in an area of sand adjacent to the watercourse (*Figure 2 – W2321*). Although the watercourse provides limited opportunities for refuge this evidence suggests that otter could use the watercourse for foraging.

As the banks of the watercourse were mostly shallow, heavily shaded and lacking herbaceous vegetation the habitat was assessed to be largely unsuitable for water vole.

Certain sections of W231 were assessed to have suitable habitat for white-clawed crayfish due to the presence of refuges in the form of boulders and large cobbles. No evidence of crayfish was recorded during the survey.



**T04: W2325 River Ribble**



**Eastings and Northings**

Upstream: X: 374488 Y: 443947

Downstream: X: 374020, Y: 443440

- **Evidence of otter at W2325, suitable habitat present.**
- **No evidence of white-clawed crayfish but suitable habitat present.**
- **No evidence of water vole, habitat of moderate suitability.**

The channel width at W2325 was c. 35 m and, at the time of survey, the water depth was mostly c. 30 - 40 cm. The substrate comprised mainly of boulders, large cobbles, and gravel.

On the left-hand bank of the watercourse a well-used public footpath was present that encompassed the entire survey reach. During the survey several members of the public, including dog walkers, were observed using this right of way.

Evidence of otter was present in the form of spraint (5 separate locations), two suspected couches and 3 potential holts (*Figure 2 – W2325*). Otter footprints were observed that lead from beneath one of the potential holts (cavity beneath tree roots – pictured left), heading towards the watercourse (*Figure 2 – W2325*).

The habitat was considered suitable for white-clawed crayfish, with plenty of suitable refuges in the form of boulders and tree roots. No evidence of crayfish was recorded during the survey and no remains were observed within the otter spraint.

Although habitat is largely unsuitable for water vole a densely vegetated area (pictured) is present on the right-hand bank of the watercourse (immediately downstream of the road bridge). This area could provide suitable burrowing and foraging habitat for water vole. As this area is likely to be inundated when the river is in spate, it is not optimal habitat for water voles.

There were several marginal sections where the substrate was comprised of sand and silt and provided either optimal or sub-optimal habitat for lamprey.

**T04: RW03-RW05**



**Eastings and Northings**

Upstream: X: 372037 Y: 446276

Downstream: X: 372261 Y: 445877

- **Evidence of otter, suitable habitat present at RW03-RW05.**
- **No evidence of white-clawed crayfish but suitable habitat present.**
- **No evidence of water vole, habitat of moderate suitability.**

Evidence of otter was observed on the river Ribble at RW03-RW05 in the form of spraint and footprints (both pictured). No otter holts or resting areas (couches) were recorded (*Figure 2 – RW03-RW05*). A cavity was present beneath some tree roots at the upstream extent of the reach (left bank) but there was no evidence to suggest it was being used by otters as refuge.

The reach provides optimal habitat for white-clawed crayfish owing to the abundance of suitable refuges. These included coarse substrate (boulders & cobbles), submerged tree roots and soft banks for burrowing. No evidence of crayfish was recorded during the survey and no remains were observed within the otter spraint.

Habitat within the reach was assessed to be of moderate suitability for water voles. The site contains steep banks suitable for burrowing, however certain sections of the reach have bank reinforcements in place which inhibit burrowing.

At the time of survey, the bankside and emergent vegetation was sparse (partly owing to the timings of the survey). A small area of emergent reeds was present downstream of the road bridge (right bank), which could provide foraging habitat for water vole.



**T04: RW17**



**Eastings and Northings**

Upstream: X: 372024 Y: 447501

Downstream: X: 372011 Y: 447110

- **Evidence of otter, suitable habitat present at RW17.**
- **No evidence of white-clawed crayfish but suitable habitat present.**
- **No evidence of water vole, habitat of moderate suitability.**

Three otter spraints were observed during the survey and one potential couch was recorded at the base of a tree trunk (*Figure 2 – RW17*). Habitat within the survey extent is suitable for otter but due to the size of the watercourse foraging opportunities could be limited.

The reach provides optimal habitat for white-clawed crayfish owing to the abundance of suitable refuges. These included coarse substrate (boulders & cobbles) and coarse woody debris. No evidence of crayfish was recorded during the survey and no remains were observed within the otter spraint.

Habitat was largely unsuitable for water vole as large sections of the channel were shaded by tree cover, inhibiting the growth of low-lying herbaceous plants. Bank substrate was also primarily large boulders and therefore often unsuitable for burrowing.

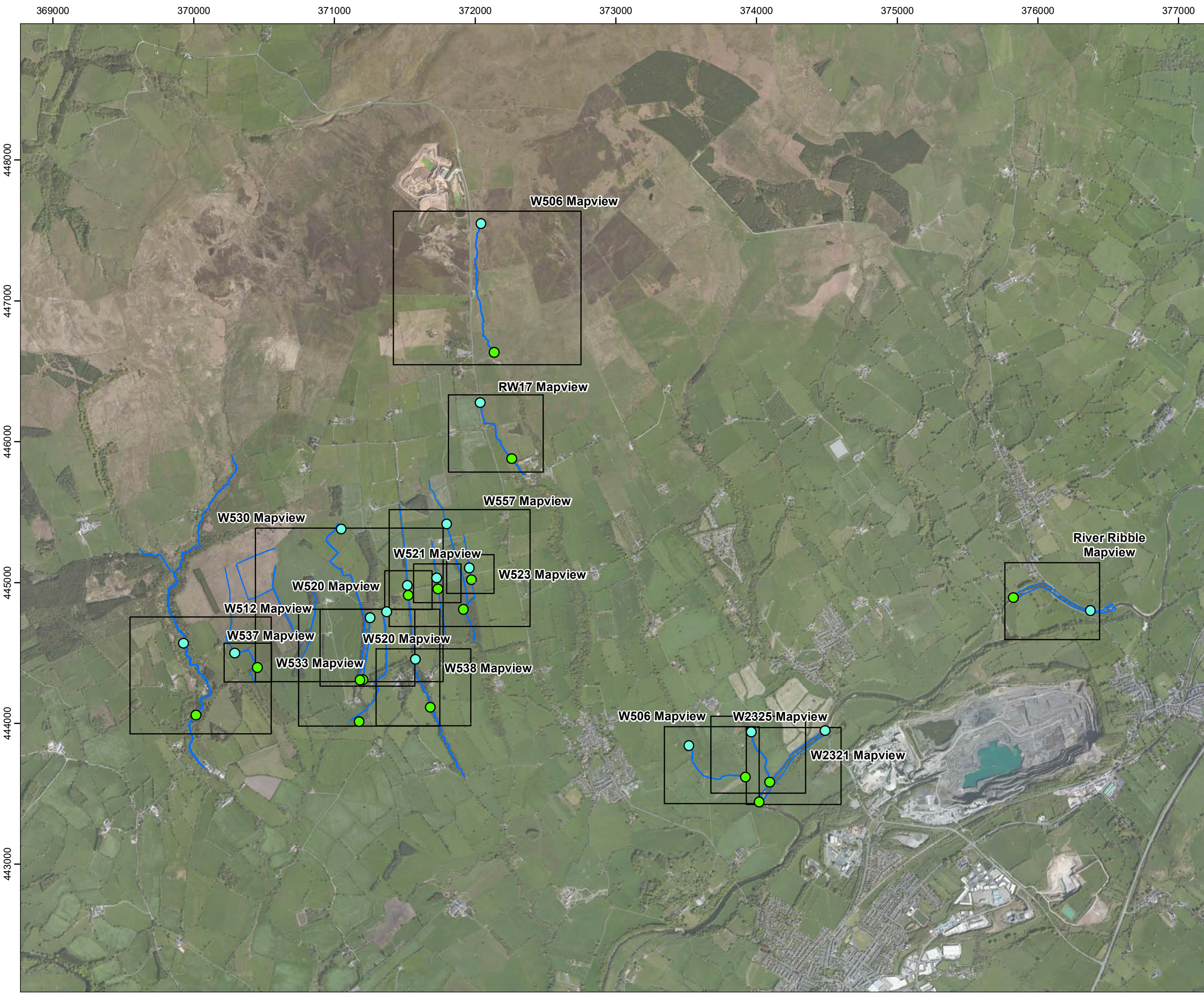
Upstream of the main confluence on the reach the watercourse flows adjacent to an area of open grassland for approximately 100 m (pictured). The left-hand bank is reasonably steep at this point and is comprised of earth making it suitable for burrowing. *Juncus* sp. is abundant in this location, which does provide potential foraging habitat.

At this location with the watercourse averages just 0.4 m in width and 0.15 m in water depth. No areas of deep open water (which water vole could use to evade predation) were recorded adjacent to the suitable burrowing habitat.

## 4 APPENDICES – SURVEY MAPS

---





- Legend:**
- Waterbody
  - Upstream Survey Extent
  - Downstream Survey Extent
  - Map View

Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter

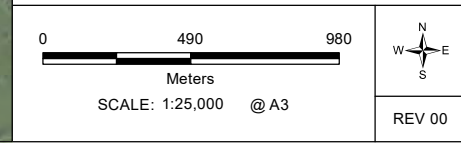


Rev	Date	Description	Drm	Chk	App
00	17/02/2021	2480524	RG	SP	BF

HARP Aquatics



TITLE: Figure 1:  
 Otter and Water Vole Survey  
 Overview Map - Marl Hill (TR4)



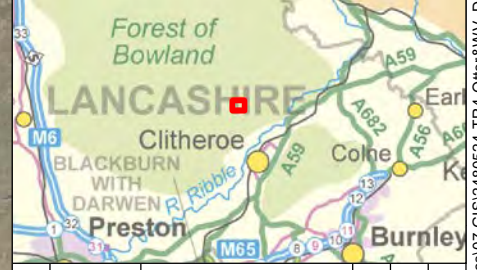


371500 371600 371700 371800 371900 372000 372100 372200 372300 372400 372500 372600 372700



- Legend:**
- Waterbody
  - Upstream Survey Extent
  - Downstream Survey Extent
- Otter Evidence**
- ▲ Otter Spraint
- Potential Water Vole Evidence**
- Burrow
  - ▲ Feeding Signs

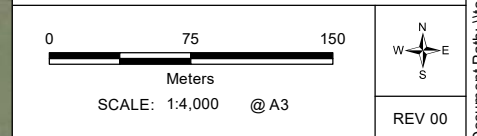
Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter



Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W506	RG	SP	BF

**HARP Aquatics**

TITLE: Figure 2:  
 Otter and Water Vole Survey Results  
 Marl Hill (TR4) - Watercourse W506





371600

371700

371800

371900

4445100

4445000

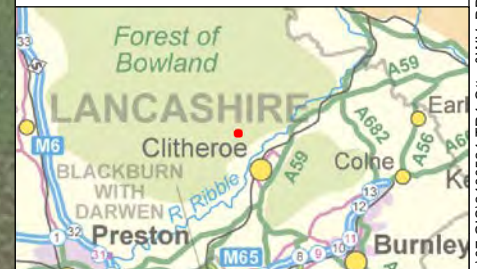
4444900



**Legend:**

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent

Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter

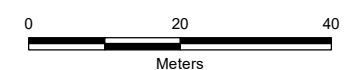


Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W521	RG	SP	BF

HARP Aquatics



TITLE: Figure 2:  
 No Otter or Water Vole Survey Results  
 Marl Hill (TR4) - Watercourse W521



SCALE: 1:1,000 @ A3



REV 00





- Legend:**
- Waterbody
  - Upstream Survey Extent
  - Downstream Survey Extent

Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter



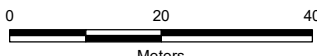
Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W523	RG	SP	BF

**HARP Aquatics**




**RSK**  
**biocensus**  
 EXPERTS IN ECOLOGY

**TITLE: Figure 2:  
 No Otter or Water Vole Survey Results  
 Marl Hill (TR4) - Watercourse W523**



Meters  
 SCALE: 1:1,000 @ A3



N  
 W E  
 S

REV 00

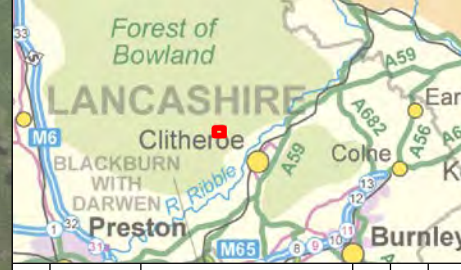


369600 369700 369800 369900 370000 370100 370200 370300 370400 370500



- Legend:**
- Waterbody
  - Upstream Survey Extent
  - Downstream Survey Extent
- Otter Evidence**
- ▲ Otter Spraint

Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter

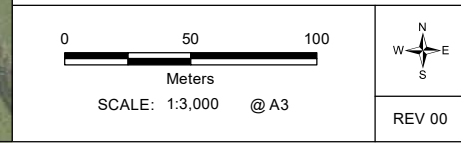


Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W512	RG	SP	BF

HARP Aquatics



TITLE: Figure 2:  
 Otter Survey Results  
 Marl Hill (TR4) - Watercourse W512





370300

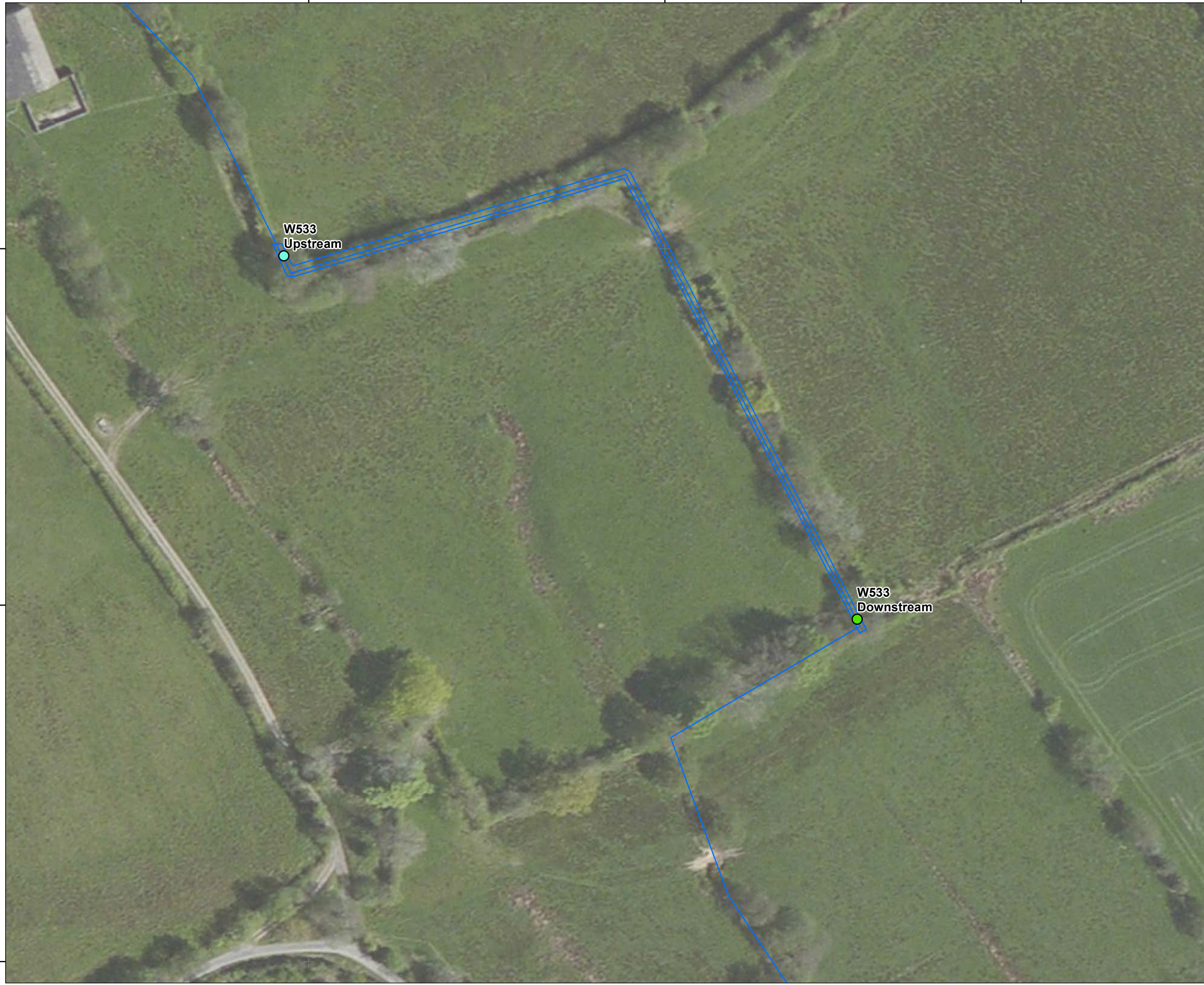
370400

370500

444500

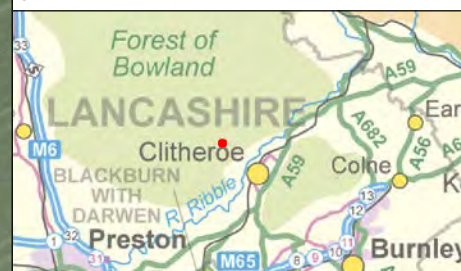
444400

444300



- Legend:**
- Waterbody
  - Upstream Survey Extent
  - Downstream Survey Extent

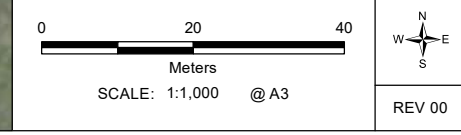
Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter



Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W533	RG	SP	BF

**HARP Aquatics**

**TITLE: Figure 2:  
 No Otter or Water Vole Survey Results  
 Marl Hill (TR4) - Watercourse W533**

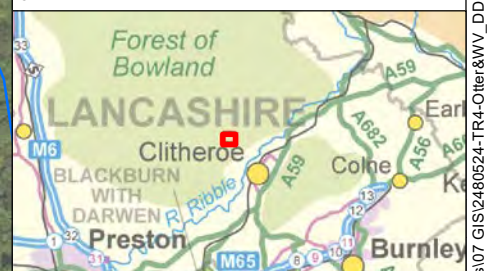






- Legend:**
- Waterbody
  - Upstream Survey Extent
  - Downstream Survey Extent
- Potential Water Vole Evidence**
- Burrow
  - ▲ Feeding Signs

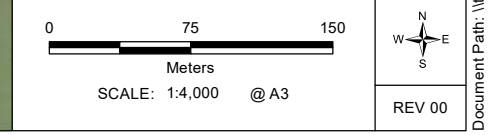
Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter



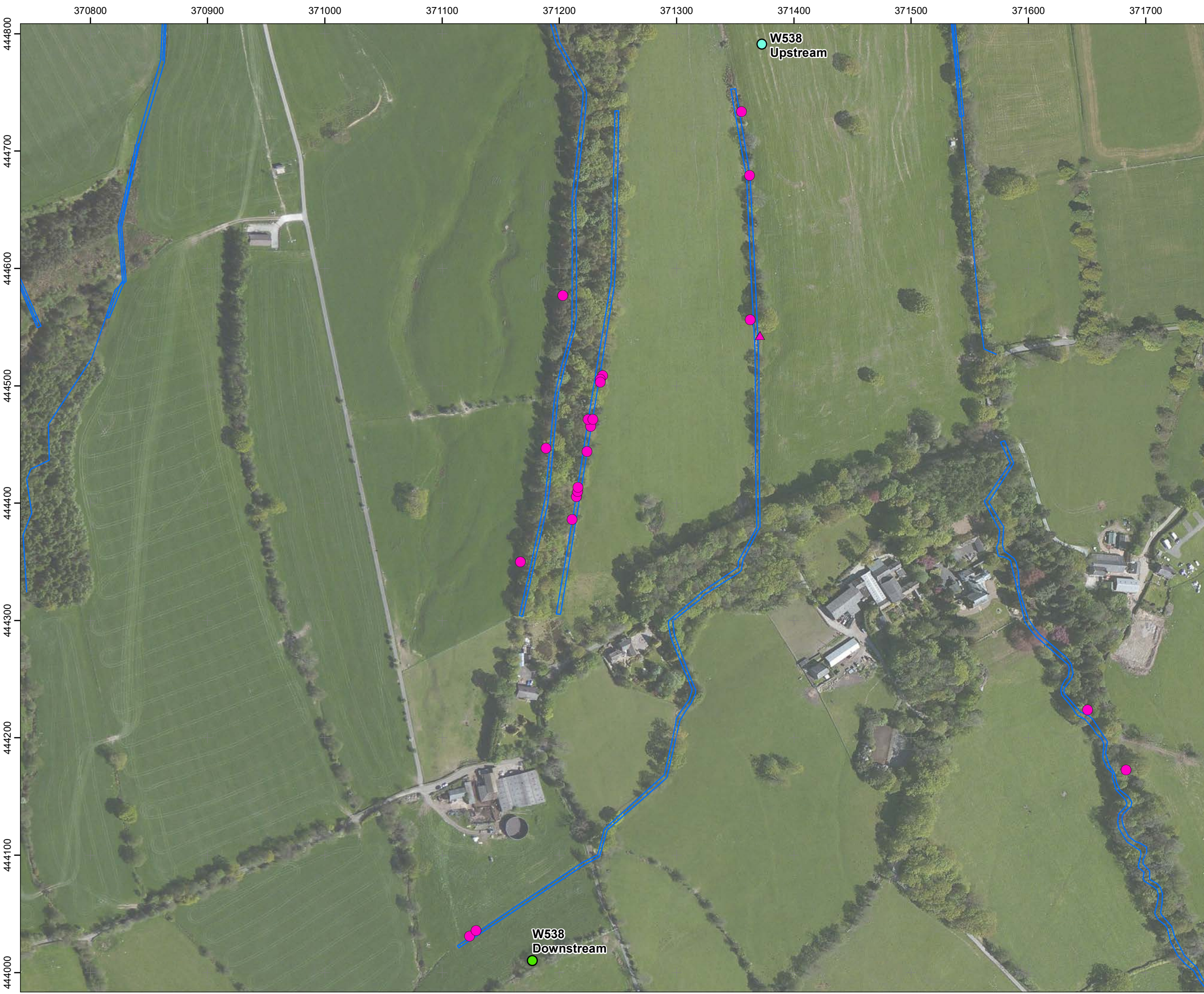
Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W530	RG	SP	BF

**HARP Aquatics**

TITLE: Figure 2:  
 Water Vole Survey Results  
 Marl Hill (TR4) - Watercourse W530

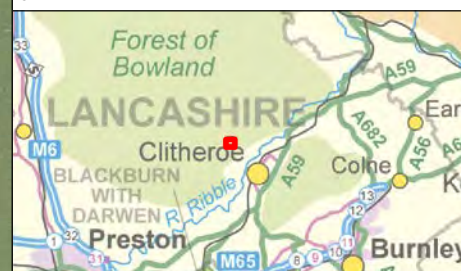






- Legend:**
- Waterbody
  - Upstream Survey Extent
  - Downstream Survey Extent
- Potential Water Vole Evidence**
- Burrow
  - ▲ Feeding Signs

Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter

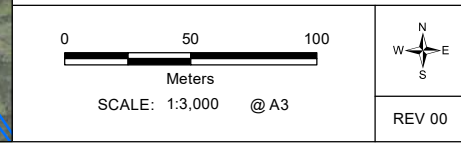


Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W538	RG	SP	BF

HARP Aquatics



TITLE: Figure 2:  
 Water Vole Survey Results  
 Marl Hill (TR4) - Watercourse W538





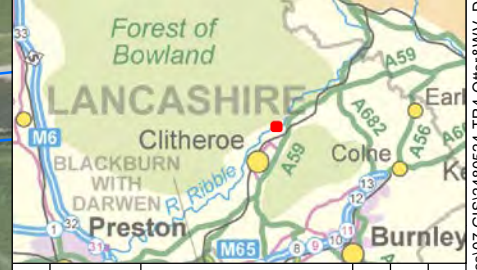
375800 375900 376000 376100 376200 376300 376400

445100  
445000  
444900  
444800  
444700  
444600



- Legend:**
- Waterbody
  - Upstream Survey Extent
  - Downstream Survey Extent
- Otter Evidence**
- Potential Otter Couch
  - ▲ Otter Spraint
  - ★ Otter Footprint

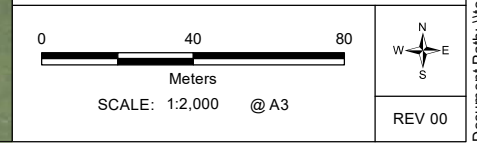
Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter



Rev	Date	Description	Drm	Chk	App
00	22/04/2021	River Ribble	RG	SP	BF

**HARP Aquatics**

TITLE: Figure 2:  
 Otter Survey Results  
 Marl Hill (TR4) - Watercourse River Ribble





371900

372000

372100

372200

372300

372400

446300

446200

446100

446000






445900

445800

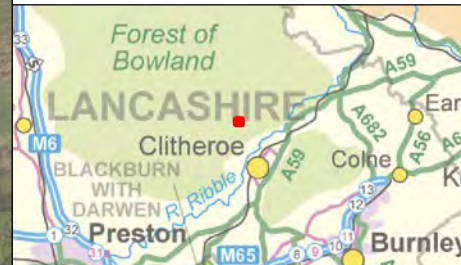
RW17  
Upstream

RW17  
Downstream

Legend:

-  Waterbody
-  Upstream Survey Extent
-  Downstream Survey Extent
- Otter Evidence**
-  Potential Otter Couch
-  Otter Spraint

Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter




Rev	Date	Description	Drm	Chk	App
00	22/04/2021	RW17	RG	SP	BF

HARP Aquatics



TITLE: Figure 2:  
 Otter Survey Results  
 Marl Hill (TR4) - Watercourse RW17

0 40 80  
 Meters  
 SCALE: 1:2,000 @ A3



REV 00



373700 373800 373900 374000 374100 374200 374300

444000

443900

443800

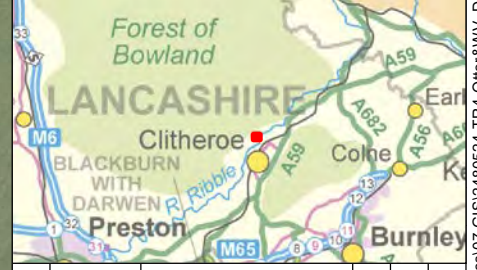
443700

443600



- Legend:**
- Waterbody
  - Upstream Survey Extent
  - Downstream Survey Extent
- Otter Evidence**
- Potential Otter Holt
  - ▲ Otter Spraint
  - ★ Otter Footprint

Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter

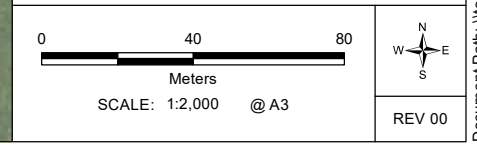


Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W2321	RG	SP	BF

HARP Aquatics



TITLE: Figure 2:  
 Otter Survey Results  
 Marl Hill (TR4) - Watercourse W2321





374000

374100

374200

374300

374400

374500

374600

443900

443800

443700

443600

443500



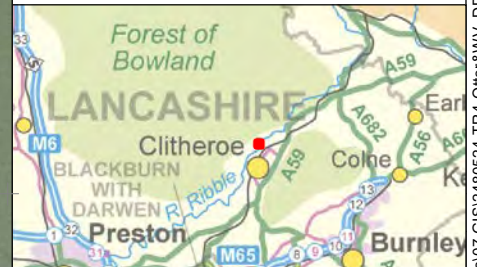
W2325  
Upstream

W2325  
Downstream

**Legend:**

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent
- Otter Evidence**
- Potential Otter Holt
- Potential Otter Couch
- ▲ Otter Spraint
- ★ Otter Footprint

Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter

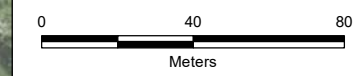


Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W2325	RG	SP	BF

HARP Aquatics

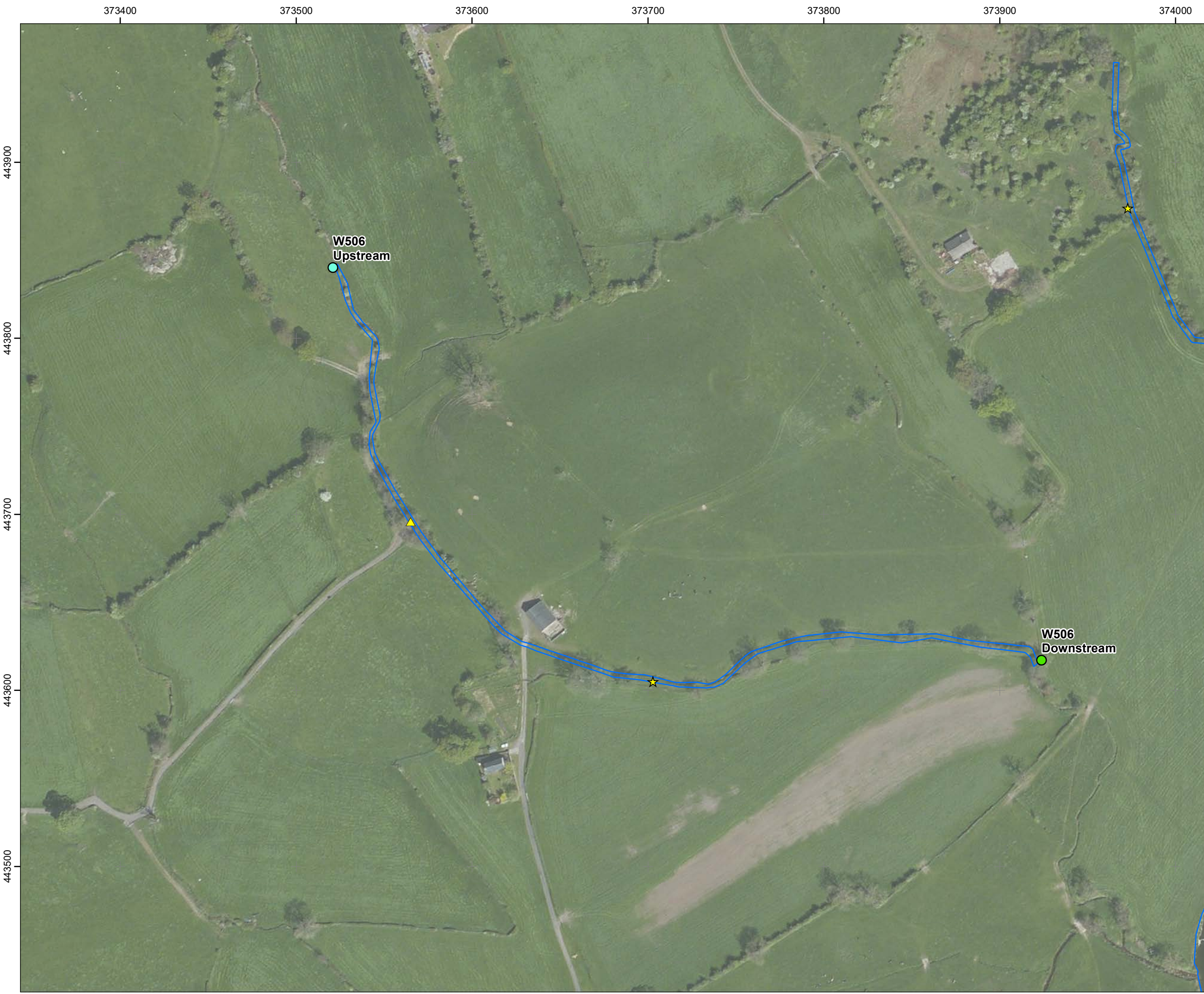


TITLE: Figure 2:  
 Otter Survey Results  
 Marl Hill (TR4) - Watercourse W2325



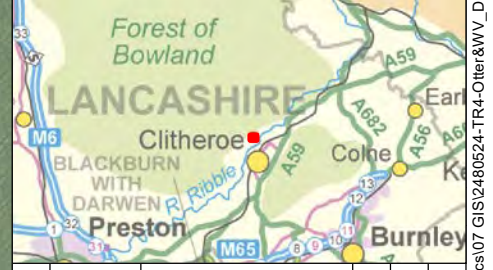
REV 00





- Legend:**
- Waterbody
  - Upstream Survey Extent
  - Downstream Survey Extent
- Otter Evidence**
- ▲ Otter Spraint
  - ★ Otter Footprint

Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter



Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W506	RG	SP	BF

**HARP Aquatics**

TITLE: Figure 2:  
 Otter Survey Results  
 Marl Hill (TR4) - Watercourse W506

Meters  
SCALE: 1:2,000 @ A3

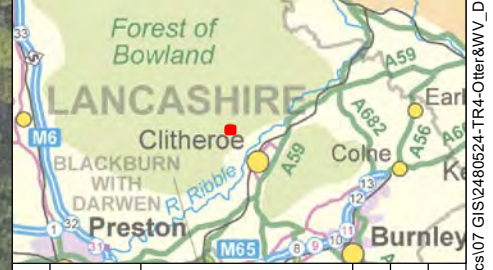
REV 00





- Legend:**
- Waterbody
  - Upstream Survey Extent
  - Downstream Survey Extent
- Potential Water Vole Evidence
- Burrow
  - ▲ Feeding Signs

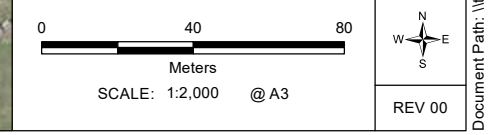
Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter



Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W537	RG	SP	BF

**HARP Aquatics**

TITLE: Figure 2:  
 Water Vole Survey Results  
 Marl Hill (TR4) - Watercourse W537





371400

371500

371600

444900

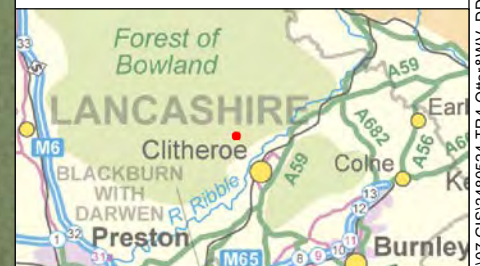
444900



**Legend:**

- Waterbody
- Upstream Survey Extent
- Downstream Survey Extent
- Potential Water Vole Evidence**
- Burrow

Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter

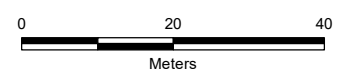


Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W520	RG	SP	BF

HARP Aquatics



TITLE: Figure 2:  
 Water Vole Survey Results  
 Marl Hill (TR4) - Watercourse W520



SCALE: 1:1,000 @ A3



REV 00



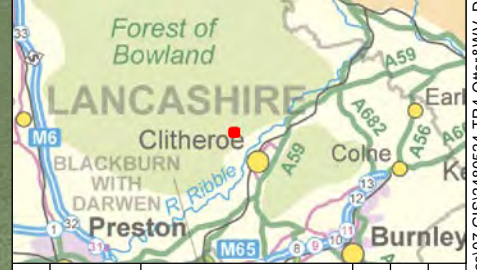
371300 371400 371500 371600 371700 371800 371900

444500  
444400  
444300  
444200  
444100  
444000



- Legend:**
- Waterbody
  - Upstream Survey Extent
  - Downstream Survey Extent
- Potential Water Vole Evidence
- Burrow

Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter

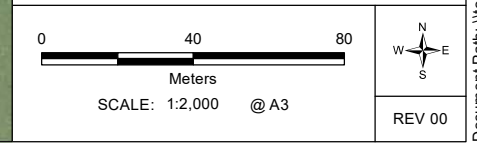


Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W520	RG	SP	BF

**HARP Aquatics**

**RSK**  
**biocensus**  
 EXPERTS IN ECOLOGY

TITLE: Figure 2:  
 Water Vole Survey Results  
 Marl Hill (TR4) - Watercourse W520

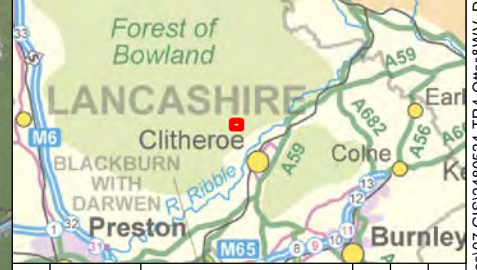






- Legend:**
- Waterbody
  - Upstream Survey Extent
  - Downstream Survey Extent
- Potential Water Vole Evidence
- Burrow

Coordinate System: British National Grid  
 Projection: Transverse Mercator  
 Datum: OSGB 1936  
 Units: Meter



Rev	Date	Description	Drm	Chk	App
00	22/04/2021	W557	RG	SP	BF

**HARP Aquatics**

TITLE: Figure 2:  
 No Otter or Water Vole Survey Results  
 Marl Hill (TR4) - Watercourse W557

