eDNA surveying in the North Pennines National Landscape

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Executive Summary

The collection of water samples for **environmental DNA** (eDNA) testing can be used as a novel survey technique to map baseline presence or absence of target species over large areas. This project used eDNA sampling to explore the distribution of two priority species (**water vole** and **white-clawed crayfish**) and one invasive, non-native species (**American mink**) in the **Upper Eden** catchment that lies within the **North Pennines National Landscape**.

Eden Rivers Trust worked with farmers, landowners and managers to collect **99 samples** across **19 watercourses** within the project area and survey **66km** of riparian habitat.

White-clawed crayfish eDNA was detected on **two** samples across **two** watercourses – Croglin Water and Melmerby Beck. **Water vole** eDNA was detected on **11** samples across **five** watercourses – Old Water, New Water, Croglin Water, Melmerby Beck and Rake Beck. **Mink** eDNA was detected on **15** samples across **nine** watercourses – River Gelt, New Water, Rake Beck, Ardale Beck, Crowdundle Beck, Hilton Beck, Hayber Beck, Swindale Beck and Tarn Gill.

The findings have not only **reaffirmed the presence of known populations** of white-clawed crayfish and water vole but also identified **new populations** in the project area. The project has shown mink are present across the project area, leading to successful **deployment of mink traps**.

Connections made with farmers, landowners and managers through the project have led to **habitat enhancement works** in the form of riparian buffer creation and provision of alternative water sources for livestock. **Ten volunteers** contributed **91 hours** to the project and nine were newly trained in eDNA surveying.

eDNA surveying has its **limitations** but is a useful adjunct to field sign surveys when large areas are to be covered in a short period of time with limited resources.

Using eDNA to identify key species in the Upper Eden catchment

99 eDNA samples taken across **19** Upper Eden watercourses within the North Pennines National Landscape

Working with **25** landowners and **10** volunteers

to test for **3** key species;

- White-clawed crayfish
- Water vole
- American mink

What is eDNA?

eDNA (or environmental DNA) is genetic material shed by all living things into their environment. The DNA of species that live in Cumbria's rivers can be detected in water samples.

White-clawed crayfish

An endangered, native freshwater crustacean. Cumbria is a stronghold for this species in the UK. eDNA was detected at 2 sites.

American mink

An invasive, non-native, semi-aquatic carnivore. They are a threat to native wildlife, poultry, game and fishery stocks. eDNA was detected at 15 sites.

9 mink traps deployed as a direct result of the project (and counting...)

Water vole

Once widespread but now classed as endangered in the UK following catastrophic population declines. eDNA was detected at 11 sites.

66 km of watercourses surveyed with the help of **91** volunteer hours

This project is funded by the DEFRA Farming in Protected Landscapes Programme administered by the North Pennines National Landscape

Department for Environment Food & Rural Affairs

North Pennines National Landscape

Eden Rivers Trust

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Acknowledgements

This project would not have been possible without the many farmers, landowners and land managers that kindly granted access for Eden Rivers Trust to perform eDNA sampling on their land. We are extremely grateful for their engagement with the project.

This project was funded by the Department for Environment, Food and Rural Affairs Farming in Protected Landscapes Programme (FiPL) administered by the North Pennines National Landscape.

1. Introduction

The Upper Eden catchment lying within the North Pennines National Landscape (NPNL) (Figure 1) is a rare national stronghold for water vole (*Arvicola amphibius*) and white-clawed crayfish (*Austropotamobius pallipes*). The survival of these native species is under threat in the UK. Since its inception in 1996, Eden Rivers Trust (ERT) has surveyed for these target species along the length of the River Eden and its tributaries. However, the focus of these efforts has not always been in the upper reaches of the catchment. As such, there are few historical records of these target species within the project area (Appendix 1 and 2).

The American mink (*Neovison vison*) is an invasive, non-native species that predates on both white-clawed crayfish and water vole. American mink (hereafter, mink) are a key threat to the survival of water vole. ERT is a partner in the *Cumbria Mink Eradication Strategy* and has invested significant resources in mink trapping and mapping in the Lower Eden catchment, supported by informed and engaged farmers, landowners and managers. ERT is seeking to expand the trapping network to include the water courses in the project area, aiding the survival of water voles, ground nesting birds and other native species, whilst also minimising the economic impact mink may have on farms and estates.

This project aims to use a novel survey technique to map baseline presence or absence of three target species over large areas by looking for genetic material shed into water by those species. This method is known as environmental DNA (eDNA) surveying. In comparison to traditional survey techniques, eDNA surveys can be more time and cost effective (1, 2). Importantly, this baseline data can inform longer term prioritisation of resources for conservation of white-clawed crayfish and water vole. Equally, the data may highlight areas where more resources are needed for eradication of mink.

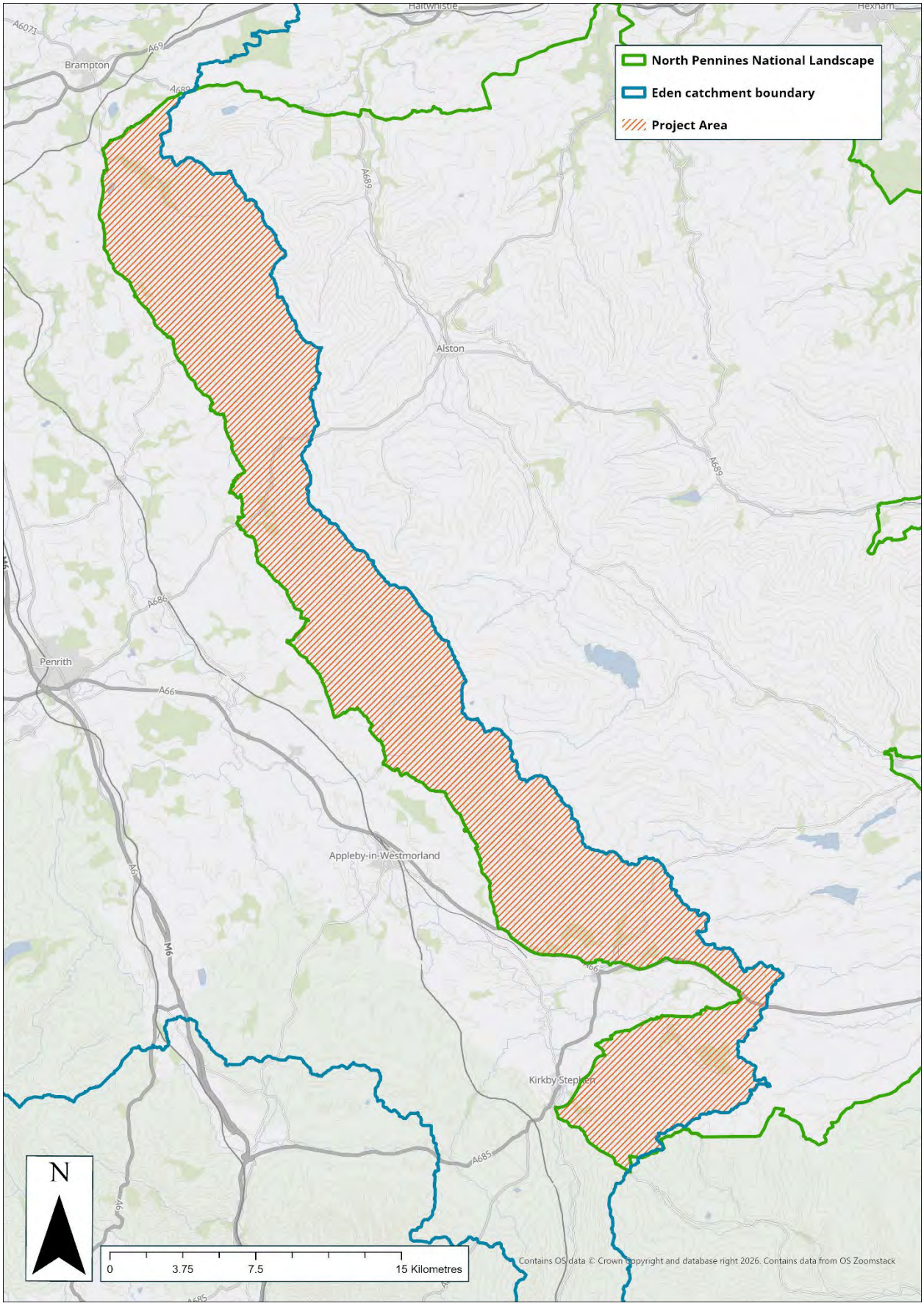

Figure 1: Map of project area which is formed by the area of the Upper Eden catchment that lies within the North Pennines National Landscape

2. Background

a) White-clawed crayfish (*Austropotamobius pallipes*)

The white-clawed crayfish (Figure 2) is a native freshwater crustacean found across south-western Europe and listed as 'Endangered' by the International Union for Conservation of Nature (IUCN) Red List of Threatened Species (3). White-clawed crayfish have a preference for mineral-rich hard water on calcareous, rocky substrate as found in the upper Eden catchment (Appendix 3). They are omnivorous, feeding on invertebrates, small fish, plant matter and detritus. They live amongst rocks and submerged tree roots on the edges of water bodies, preferring slow flow and depth of less than one metre (3).

Figure 2: Photo of white-clawed crayfish. Photo credit: Linda Pitkin 2020 Vision

White-clawed crayfish face a number of threats to their survival. The most critical of which is the presence of invasive non-native crayfish species, namely the signal crayfish (*Pacifastacus leniusculus*) (3). The signal crayfish, native to North America, is larger and more aggressive than the white-clawed crayfish. It will predate on white-clawed crayfish and compete for food and habitat. The signal crayfish and other invasive non-native crayfish can carry the crayfish plague (*Aphanomyces astaci*), a water mould, which can be lethal to the white-clawed crayfish (3). The white-clawed crayfish did not co-evolve with the crayfish plague and as such has reduced immunity in comparison to non-native

crayfish species, which exhibit signs of chronic infection but rarely death (4). Once introduced into a population of white-clawed crayfish, crayfish plague can lead to mass mortality events as documented across Europe since the 19th century. Recent mass mortality events have occurred in the River Erne catchment, Republic of Ireland in 2015 and the River Ure, Yorkshire in 2020 (5, 6). Other threats to the white-clawed crayfish are water pollution, habitat loss and disturbance (3).

Cumbria is one of the last strongholds of the white-clawed crayfish in England. In the Eden catchment this is largely due to better water quality, the presence of underlying calcareous geology and the absence of signal crayfish and crayfish plague. Populations continue to decline across Europe. Within the project area, there are records of white-clawed crayfish in several watercourses including Hilton Beck, Hayber Beck, Crowdundle Beck and on tributaries of Croglin Water, Cumrew Beck and Robberby Water (7, 8) (Appendix 1). These records date from the 1990s to 2024 (7, 8). Crucially, signal crayfish and crayfish plague are not known to be in the project area. However, there are records of signal crayfish elsewhere in the Eden catchment and in the nearby Tees catchment (8, 9).

Eden Rivers Trust continues to work with farmers, landowners and managers on conservation interventions for white-clawed crayfish including the creation of riparian buffers, the installation of alternative water sources to reduce bank erosion and disturbance, ark site identification and biosecurity messaging.

b) Water vole (*Arvicola amphibius*)

The water vole (Figure 3) was once widespread throughout the British Isles but is now listed as endangered on the IUCN Red List for Great Britain (10). Water vole populations are difficult to quantify, but it is estimated that there has been an overall decline in UK distribution of 39% between 2006 and 2022 (11). This is against a backdrop of catastrophic losses over the course of the 20th century which were identified by two National Water Vole Surveys in the 1980-90's (12, 13). The introduction of the invasive, non-native mink is a key driver in the decline of water vole populations and distribution through predation pressure (10). Water voles have several native predators with which they have co-evolved. As such, they have developed specific predator avoidance strategies to ensure their co-existence in the context of a healthy ecosystem. An important predator avoidance strategy is the ability to retreat to their burrows. Unlike our native semi-aquatic mustelid, the otter, female mink are small enough to enter these burrows, making them particularly problematic for water vole (14).

Other threats to water vole are habitat fragmentation and degradation including canalisation of streams, over-mowing and grazing of riverbanks; pollution; and extreme weather events such as flash flooding and drought (10).

Figure 3: Photo of water vole. Photo credit: Margaret Holland.

Within the project area, there are several known historical populations of water voles, which have become increasingly geographically isolated over time (7, 8) (Appendix 3). There was a previous water vole reintroduction within, and close to the project area on the Ministry of Defence Warcop Ranges over a 3-year period from 2007 to 2009 (8, 11). Water vole reintroductions in the Eden catchment in recent years have been further from the project area on the River Lowther sub-catchment (8).

Within the project area there are historic records of water vole in the sub-catchments of the River Gelt, Raven Beck, Hazelrigg Beck, Robberby Water, Ardale Beck, Blencarn Beck, Crowdundle Beck, Crooks Beck, Swindale Beck (north of Brough, known as Swindale Beck 2), Augill Beck, Argill Beck, the River Belah and Rigg Beck (7, 8, 9). All but one of these records date from before 2013, highlighting a disparity in contemporary data and providing justification for further surveys and trialling of novel survey techniques such as eDNA.

c) American mink (*Neovison vison*)

The mink (Figure 4) is an invasive non-native species introduced to the UK following releases and escapes from fur farms throughout the 20th and early 21st century. They are semi-aquatic, generalist predators with a strong preference for riparian habitats.

Mink feed on a range of prey including fish, water vole and other small mammals, birds and freshwater invertebrates, including the white-clawed crayfish (10). The catastrophic threat that mink pose to water vole is discussed above, but mink have also been shown to reduce ground nesting bird success by around 50% (15). One study showed that mink directly caused widespread whole colony breeding failures on the west coast of Scotland, with significant surplus killing (16).

Figure 4: Photo of American Mink. Photo credit: Jan den Ouden

The overall population trend for mink in the UK is uncertain. Some sources suggest the population may be in decline (10) whilst others say the trend cannot be quantified (17). There is an agreement, however, that co-ordinated eradication projects are a necessity. The lack of scientific consensus on the abundance of mink in the UK is a strong justification for the project, which aims to map mink presence in areas where there has been little previous survey effort.

Across the country there have been some success stories including in East Anglia and Cairngorms (17). The Waterlife Recovery Trust has had great success in the eradication

of mink from East Anglia. Their ongoing eradication work over the last five years has ensured that over 8.5% of England is now mink free (18). ERT are partners in the *Cumbria Mink Eradication Strategy*. ERT and dedicated landowners and managers in the catchment currently oversee 90 traps (as of March 2026) and have trapped and humanely dispatched 251 mink since Autumn 2021 (8). ERT uses humane live-capture traps fitted with remote 4G-enabled monitoring devices that will alert the user via their mobile phone when they are deployed.

At the beginning of this project, there was one active mink trap deployed within the project area, on a tributary of Robberby Water. This trap, deployed in summer 2025, has yet to capture a mink. However, consistent yearly captures across the catchment are evidence that ingress into this area is completely possible (8). There are historical observations on the River Gelt catchment from the 1980s to 2020 (19). Historic *Otter Survey of England* records showed several observations in, or near the project area dating back to the 1970s and 1980s, however, these records are geolocated to a 10km grid reference, so it is not possible to ascertain the exact watercourse on which these observations were made (9) (Appendix 4). It is known that mink sightings will be under-reported (17). Unlike with water voles and white-clawed crayfish, dedicated surveys for mink presence have not been previously done in the survey area. Anecdotally, farmers and landowners/managers involved in the project mention that they have seen or trapped mink on their land, but formal recording pathways are typically underutilised.

The impact of mink on native wildlife is well documented, however there is little data on the impact that mink have on the UK economy as a whole and individual farmers, landowners and managers (20). Mink prey on poultry and game birds, often with a reported surplus kill with confined birds (15). In addition to lost stock, the financial impact of repairing damage to enclosures and the cost of trapping must be considered for landowners (15). One study showed that following the introduction of mink to the isles of Harris and Lewis, the proportion of crofts keeping poultry reduced from 90% to 10%, with an estimated cost to crofting economy of £586,000 (20). Mink are also an economic threat to fish farms and shooting estates in terms of the stock that they kill or injure, and the damage caused to enclosures (15). With regards to sea cages, this can result in mass releases of fish (15). In 2010, the annual cost of mink to the British economy was estimated to be £4,797,000 (equivalent to around £7,476,000 in 2025) (15). This figure does not take account of non-market costs, such as the cost of biodiversity loss.

d) eDNA surveying

Genetic material is shed by all organisms into their surrounding environment. This could be in the form of faeces, urine, skin cells and other tissues (of living or dead

organisms). This DNA can be detected by taking samples from the environment, predominantly soil or water samples. For aquatic and semi-aquatic organisms, such as the target species in this project, water provides a good source of eDNA.

eDNA surveys offer many advantages over traditional survey techniques and are particularly useful for characterisation of biodiversity at a larger sub-catchment scale (1). The use of eDNA sampling is less invasive and has become more cost and time effective than traditional survey methods (1, 2, 21). Furthermore, eDNA surveying provides high taxonomic accuracy (1,2).

eDNA surveys are not without their limitations. The current consensus is that they can complement, but should not replace, traditional surveys methods (1, 2). They have been shown to perform as well as, if not better than, traditional surveys (2). A meta-analysis found that where there is a direct comparison, eDNA surveys are more sensitive and detect more species than traditional methods and that this remains true when analysed by taxonomic group for crustaceans and mammals (1).

Accuracy of eDNA surveys is dependent on many factors relating to the species, environment and methodology (1). With regards to species, their life history, behavioural ecology and population density are all important considerations (2). Both white-clawed crayfish and water voles will become less active in winter months, with optimal sampling months being from April to October and March to September respectively (22). Mink will remain active all year round, but as solitary apex predators will cover great distances and live in relatively low densities (17). As such, their presence could be easily missed.

Key environmental factors in the riparian habitat include flow rates and volume. Following periods of heavy rain, increased volumes of water will dilute eDNA potentially leading to false-negatives (23). Increased flow rates will wash eDNA downstream, leading to geographical mismatch and inaccuracies (23). After heavy rain, it is recommended to wait at least 3 days before eDNA sampling (22). Other environmental factors include the presence of conditions or substances that may lead to the degradation of DNA (2, 24).

In terms of methodology, both sampling technique and type of eDNA analysis are important. False-positives can arise if historic eDNA is disturbed on the riverbed or there is cross-contamination of equipment (2). For this reason, sampling should be from the middle of the water column and not carried out too close to banks. The surveyor should sample working upstream and equipment should be checked, cleaned and dried between sample sites (22).

Analysis is done by meta-barcoding or real-time quantitative polymerase chain reaction (qPCR). Meta-barcoding is used to confirm presence or absence across a broad range of

taxa from a single sample however, it is more expensive. qPCR is used to detect a single target species and can quantify the amount of DNA in the environment, unlike meta-barcoding (Harper 2018). Assay dependant, qPCR can be highly sensitive, making it useful for the detection of rare or cryptic species (25).

eDNA surveying for white-clawed crayfish has been widely used in the UK for several years. The Environment Agency has developed a sampling protocol for native and invasive crayfish populations and recommend operationalisation of eDNA based monitoring methods (26). For water vole, eDNA has been an important adjunct to traditional surveys for several years (27, 28, 29), though a universally adopted protocol is currently lacking in the UK.

eDNA surveying for mink is relatively new with few examples of peer-reviewed studies. In the last year, ERT participated in a field validation process with SureScreen Scientific Ltd to assist in their development of an assay and laboratory protocol for detection of mink via eDNA. As with water vole, eDNA testing for mink has been shown to be an important adjunct to traditional survey methods (30).

3. Aim and Objectives

a) Aim

The aim of this project is to explore the distribution of two priority species (water vole and white-clawed crayfish) and one invasive, non-native species (American mink) in the Upper Eden catchment that lies within the North Pennines National Landscape.

b) Objectives

This aim will be achieved by the following objectives:

1. Use of eDNA sampling techniques to survey seventeen watercourses in the project area
2. Reaffirmation of the presence of known populations of white-clawed crayfish and water vole in the project area
3. Identification of new populations of white-clawed crayfish and water vole in the project area
4. Mapping of American mink presence in the project area, leading to the deployment of mink traps
5. Engagement with farmers, landowners and managers across the project area
6. Engagement and training of Eden Rivers Trust volunteers in eDNA sampling
7. Dissemination of results to a broad but relevant audience

4. Methodology

a) Site selection

Internal historic records for white-clawed crayfish, water vole and mink within the project area were reviewed and mapped as a desktop study. Most of these records were from Biodiversity Action Plan surveys and white-clawed crayfish eDNA surveys conducted by ERT and financed by the Water Environment Improvement Fund (WEIF) administered by the Environment Agency. Additional historical records were sought from the Cumbria Biodiversity Data Centre and the National Biodiversity Network Atlas.

Inclusion criteria

Watercourses were prioritised for inclusion if any of the following criteria were met:

- At least 2km of the watercourse is within the project area
- There are known historical populations of the target species
- The riverbed substrate features calcareous geology
- ERT has existing connections with farmers and landowners/managers

Following this process, 17 watercourses within the project area were identified for inclusion, encompassing just over 66km of rivers and streams.

The selected watercourses were (from north to south): the River Gelt, Old Water, New Water, Croglin Water, Raven Beck, Loo Gill, Melmerby Beck, Rake Beck, Ardale Beck, Ran Beck, Crowdundle Beck, Hilton Beck, Swindale Beck 1, Hayber Beck, Swindale Beck 2, Tarn Gill and the River Belah. As there are two watercourses named Swindale Beck to be included in the project, the most northerly, which is a tributary of Hilton Beck, is referred to as Swindale Beck 1 and the more southerly, which is north of the town of Brough, is known as Swindale Beck 2.

Sample intervals were set at 500-700m to be well within the recommended sample frequency of 1km (22). Ultimately, 96 sample points across these seventeen watercourses were planned with the knowledge that some flexibility may be needed to allow for inaccessible areas or stretches of the watercourse where ERT may be unable to obtain permission to sample (Appendix 5).

b) Sampling

Farmers, landowners and land managers were contacted to discuss the project and gain permission to access their land and obtain samples. Written or verbal permission was sought. The first stage of sampling was performed in autumn 2025, with the remaining sampling performed in spring 2026.

eDNA sample kits and analysis were provided by SureScreen Scientifics Ltd. Sample collection strictly followed the manufacturer guidance and was conducted by trained ERT staff and volunteers (Appendix 6 and 7).

On arrival at the sampling point, an accessible stretch of running water with minimal rapids or barriers, such as waterfalls, was identified. Personal protective equipment (PPE) was donned (see Biosecurity below) and twenty sub-samples of 30mls were collected, moving upstream in a diagonal pattern to sample the full cross-section of the river. Sampling was from the middle of the water column and care was taken to specifically sample any slower flowing areas of water and pools where eDNA may be more likely to accumulate and not be quickly washed downstream or diluted.

Following collection, up to 500mls of water was passed through the filter unit. Very occasionally the pressure in the filter would build, so only 450-500mls could be passed. The filter unit was then flushed with air to remove any water and DNA preservative solution was pushed into the filter unit. The samples were then refrigerated before being sent to the SureScreen Scientific Ltd laboratory for analysis within 2 weeks.

At each sample point a brief habitat survey was conducted using the *Water Vole Conservation Handbook 3rd Edition: Water Vole Survey Form* (excluding the Wildlife Information section) (14) (Appendix 8). This survey gives an overview of the underlying substrate, surrounding land use and vegetation, bank profile and key characteristics of the watercourse including depth, width and flow. ERT risk assessments were adhered to throughout the sample collection process.

c) Analysis

Analysis at the SureScreen Scientific Ltd laboratory uses industry standard, scientifically robust eDNA assays and protocols (22). The sample must first pass an integrity check, which includes a degradation and inhibition check. The sample then goes through an extraction process, followed by real-time quantitative PCR testing for each of the target species (Appendix 9 outlines the exact methodology as provided by SureScreen Scientifics Ltd).

Presence of eDNA for target species is categorised as ‘positive’, ‘negative’ or ‘inconclusive’. If positive, this indicates species presence at or close to the sampling location, at the time the sample was taken or within the recent past. If a sample is positive for a target species, the laboratory will provide the number of positive qPCR replicates out of a series of 12. It can be assumed that small fractions of positive analyses (e.g. 1/12 or 2/12) suggest low level presence and higher fractions (e.g. 11/12 or 12/12) suggest a stronger presence. This cannot be correlated to abundance of the species but is a measure of the quantity of eDNA that was in the sample, which could be

influenced by a number of factors such as the source of DNA (faeces, urine, skin etc.), the proximity of the DNA source to the sample point, the timing of the target species presence in relation to the timing of the sample, rainfall, and presence of substances that may degrade or inhibit DNA.

d) Biosecurity

The majority of samples were collected in chest waders but there were a few occasions where Wellington boots were sufficient when water levels were particularly low in some of the minor watercourses. After every use waders and Wellington boots were checked, cleaned with water and then disinfected with Virkon Aquatic prior to being dried. This was to limit the potential for spread of crayfish plague and signal crayfish, whilst also acting as PPE. It is worth noting that crayfish plague is not known to be present within the project area. On occasions when two different watercourses were due to be tested in the same day, an entirely different pair of waders was taken to change into between watercourses.

Measures were taken to keep sample kits separated from any potential contaminants. Used sample kits were stored in a separate building to unused sample kits before they were sent to the lab. Sample kits were not opened until the sampler was at the predetermined sample point. Fresh gloves were worn at each sample point, reducing the risk of cross-contamination, whilst also improving biosecurity and acting as PPE.

5. Findings

In autumn 2025, 75 samples were taken across 17 watercourses (Figure 5). A further 24 samples were taken in spring 2026 across nine watercourses, which completed much of the planned sampling. Where landowner/manager permission could not be obtained this freed up some surplus eDNA testing kits. These were used to repeat samples that were taken towards the end of the sample period in autumn 2025, in addition to two ad-hoc samples taken when mink traps were being deployed on Mill Beck (Gelt sub-catchment) and Hare Beck (Irthing sub-catchment). Ultimately, 99 samples were taken across 19 watercourses within the project area. Of these 99 samples, 12 were repeat samples.

Ideally, sampling would have been completed in late Summer 2025 (see optimum sampling periods above) but sampling was unable to start before October 2025. This suboptimal sampling period was a limitation of this project, which is discussed in more detail below. Autumn 2025 was remarkably mild, with air temperatures typically above 10°C on sample days and only dropping to 6°C on the final two days of sampling. Crucially, in terms of white-clawed crayfish detection, there were no instances of hard frost or sub-zero temperatures whilst sampling. In mid-November, when temperatures dipped, the decision was made to stop further sampling until spring 2026.

In spring 2026 sampling began again when air temperatures had been above 10°C for 3 days. At this point water vole activity elsewhere in the catchment had been reported to ERT and it was decided that it was appropriate to restart sampling. The weather remained fine and dry with no heavy rain throughout the spring sampling. There was one instance of frost and the air temperature dropped to 6°C on the day that Melmerby and Rake Beck had repeat samples taken. However, air temperature was back to 8-9°C by the following day (see Appendix 10 for sample collection diary and Appendix 11 for mean temperature data from the Met Office).

The project worked with a total of 25 landowners and managers to obtain samples, the vast majority of which were farmers (both owners and tenants). Other significant landowners and managers included the Ministry of Defence, the RSPB and several private estates (Table 1). All but one of the farmers, landowners and managers that were approached did kindly grant permission for the survey.

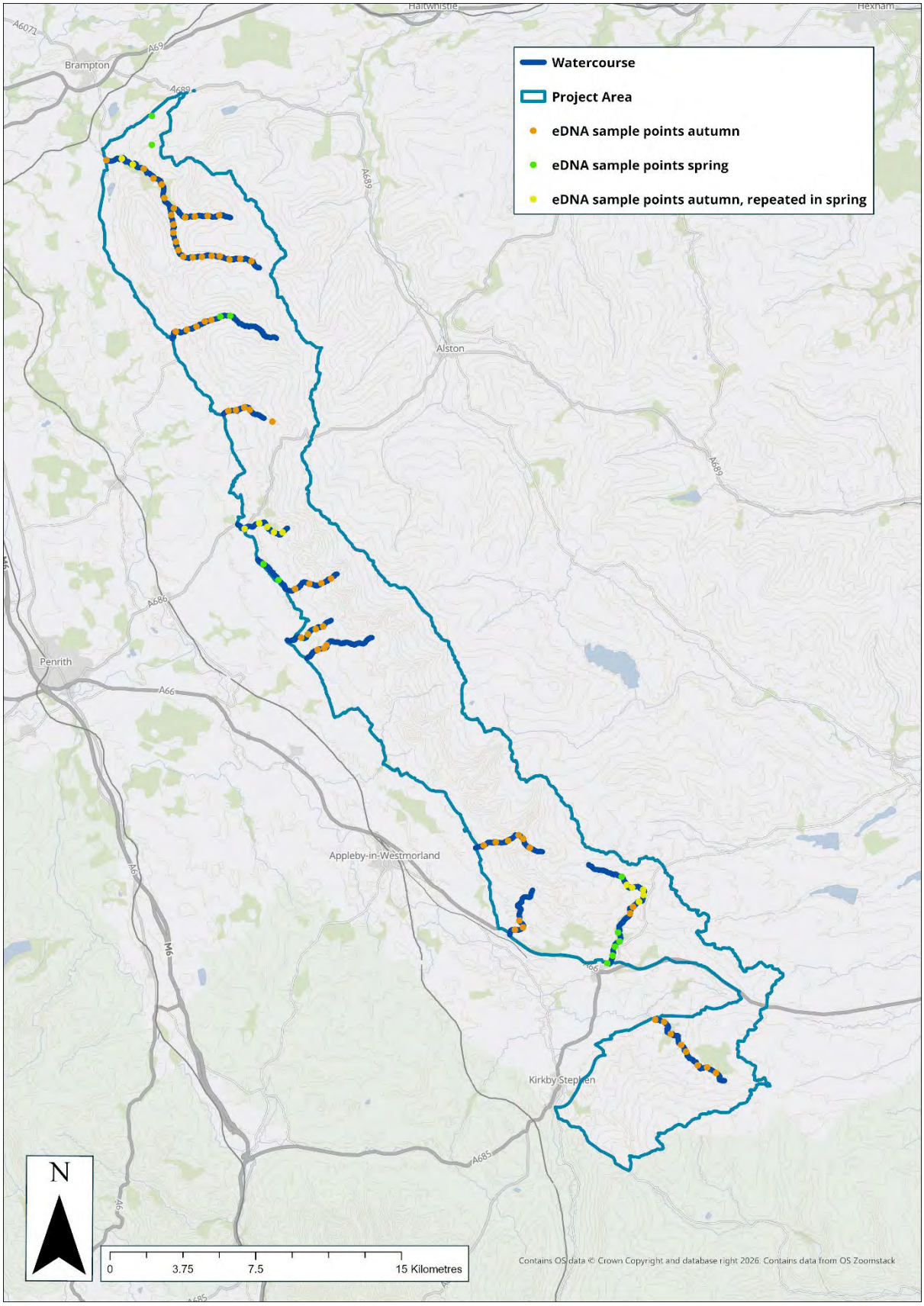

Figure 5: Map showing location of eDNA samples collected in autumn 2025 and spring 2026

Landowner/manager by type	Number
Farmer	18
Private estate owner	3
Gamekeeper	2
MoD	1
Conservation organisation	1

Table 1: Summary of landowners and managers working with the project to grant permission for sampling

The sampling involved four ERT staff members and ten volunteers. Nine volunteers were newly trained in eDNA sampling for the purposes of this project. One of the volunteers had been previously trained in eDNA sampling for white-clawed crayfish. In total, 91 volunteer hours were contributed to the project.

a) eDNA results

Of the 99 samples collected, 27 were positive for eDNA of one or more target species. White-clawed crayfish eDNA was detected on two samples across two watercourses – Croglin Water and Melmerby Beck. Water vole eDNA was detected on 11 samples across five watercourses – Old Water, New Water, Croglin Water, Melmerby Beck and Rake Beck. Mink eDNA was detected on 15 samples across nine watercourses – River Gelt, New Water, Rake Beck, Ardale Beck, Crowdundle Beck, Hilton Beck, Hayber Beck, Swindale Beck 2 and Tarn Gill (Figure 6).

The number of positive replicates for white-clawed crayfish and water vole was always indicative of a low- to mid-level eDNA presence in the samples (1/12 to 4/12 positive replicates). The number of positive replicates for mink varied from 1/12 to 11/12. None of the samples failed the laboratory integrity check, indicating that sampling technique and processing of samples prior to analysis was sound.

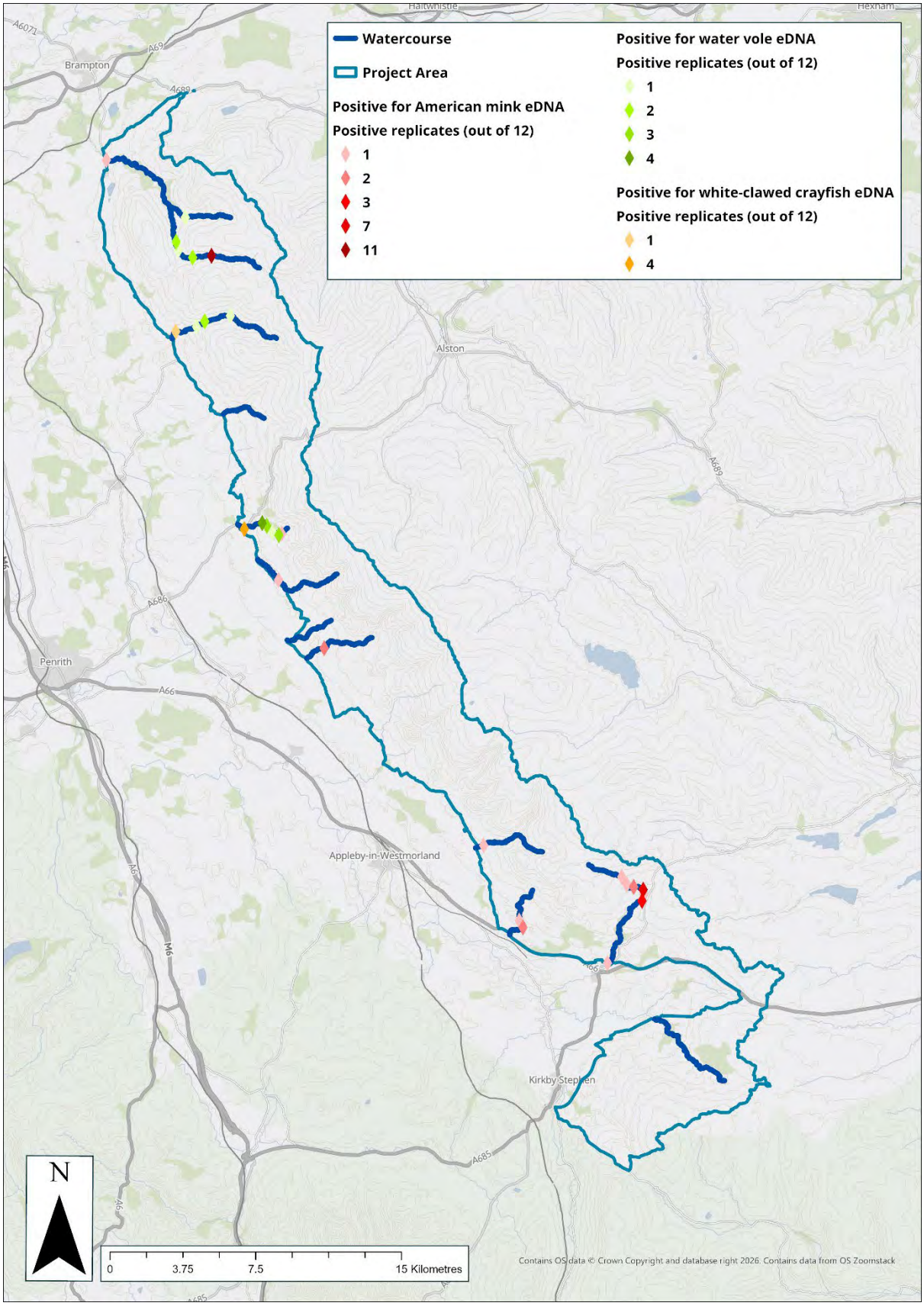

Figure 6: Map showing location of positive eDNA samples by species with number of positive replicates

b) Habitat surveys

A characterisation of each of the watercourses included in the project is given below, based on habitat surveys that were completed at each sample point. The watercourses are listed north to south.

River Gelt

Just over 5km of the River Gelt was surveyed in autumn 2025, from the confluence of Old Water and New Water to Castle Carrock village. Two autumn samples were repeated in spring 2026 as they had originally been taken at the very end of the sample period after some heavy rain.

Figure 7: Photo of eDNA sampling on the River Gelt. The photo shows typical habitat for this section of the river.

This section of the River Gelt is heavily wooded with several sections classified as ancient and semi-natural woodland (31) with abundant leaf litter. The bedrock geology of this section of the River Gelt is calcareous, classed as 'limestone with subordinate sandstone and argillaceous rocks' by the British Geological Survey (BGS) Rock Classification Scheme (RCS) (32). These features mean that there is potential for the habitat to support white-clawed crayfish. The stretch did include some natural barriers in the form of waterfalls and weirs. There was evidence of previous industry, presumably related to quarrying, such as reinforced banksides and dismantled bridges.

Figure 8: Photo of reinforced bankside close to signs of previous industry on the River Gelt

The river along this stretch was recorded as 2-10m wide with a range of depths from <0.5m to up to 2m. There was variety in the riverbed and bank substrate, from boulders to stone, gravel, sand, silt and earth. There were both rock and earth cliffs recorded. The bank profile was very varied from shallow to vertical and undercut. A significant proportion of the bank was fenced from livestock. There was some United Utilities (UU) infrastructure on this stretch.

Dippers, badger latrines and otter spraint and anal jelly were all observed along the River Gelt.

One sample tested positive for mink eDNA and a mink trap has subsequently been deployed. No samples tested positive for white-clawed crayfish or water vole eDNA.

Figure 9: Photo of waterfall on the River Gelt

Old Water

Just under 4km of Old Water was surveyed in autumn 2025. The head of Old Water runs through open moorland with some scrub and immature hawthorn, willow, rowan and alder. Downstream, close to the New Water confluence, Old Water runs through mature woodland with a stretch of ancient and semi-natural woodland (31).

The underlying bedrock on the lower stretches is 'limestone with subordinate sandstone and

Figure 10: Photo of stretch of Old Water closer to New Water confluence showing overhanging broadleaf trees, leaf litter and rock cliffs

argillaceous rocks' and on the upper stretches it is 'limestone, sandstone, siltstone and mudstone' (32).

There are several waterfalls along the length of Old Water, some UU infrastructure and a stone bridge with a public right of way over it. The surrounding land is used to graze cattle in low densities. There are signs that cattle come down to the water's edge at several points. The banks are not fenced.

Figure 11: Photo of stone bridge over Old Water

Figure 12: Photo of cattle grazing at Old Water

Throughout the wooded section there are some deeper gullies and steep rock cliffs. There are overhanging broadleaf trees with abundant leaf litter. This section represents potential crayfish habitat. On the upper, open stretch the banks are steeper and well vegetated with deep rush and sedge cover indicating suitable water vole habitat. Old Water is typically 2-5m wide and less than 1m deep throughout. The current was recorded as 'slow' to 'fast'.

Figure 13: Photo of upper stretches of Old Water showing vegetated steep banks with rush, heather, bracken, grasses and scattered trees

Figure 14: Photo of otter spraint on edge of Old Water

Otter spraint and dipper were observed on the upper stretches of Old Water. One sample tested positive for water vole eDNA and follow-up field-sign surveys for latrines,

burrows and feeding signs have been planned for summer 2026. No samples tested positive for white-clawed crayfish or mink eDNA.

New Water

Over 7.5km of New Water was surveyed in autumn 2025, from Crook Burn to the Old Water confluence. New Water runs through open moorland with some scrub and woodland sections including some areas of woodland dominated by mature alder and some areas of newly planted broadleaf trees.

There is a public right of way crossing New Water via a bridge and running parallel to the lower 3km of New Water.

The underlying bedrock on the lower 4km stretch of New Water is 'limestone with subordinate sandstone and argillaceous rocks' and on the upper stretch it is 'limestone, sandstone, siltstone and mudstone' (32).

Figure 15: Photo of sampling the lower stretch of New Water below a previously quarried area with reinforced bank side

Figure 16: Photo of UU infrastructure and reinforced bankside on New Water

Figure 17: Photo of stone and wood bridge crossing New Water

The lower stretches have some significant UU infrastructure, including a weir and reinforced banks. There are signs of previous industry including reinforced banks and areas of quarried rock. There is the aforementioned bridge made from stone and wood. There are several waterfalls with sections of vertical rock cliffs and some steep gullies along the length of New Water.

The land to the west and south of New Water is managed as upland grazing for sheep and for grouse shooting. The land to the east and north is upland grazing for cattle and forms part of RSPB Geltsdale reserve. Some stretches are fenced, though this is not consistent.

Figure 18: Photo of upper stretch of New Water showing adjacent land use

Typically, New Water was recorded as 2-10m wide and less than 1m deep and 'slow' to 'fast' flowing. However, in the middle stretch of New Water, the valley becomes more open with steep earth banks, deep rush and herbaceous cover, slow flow in back channels and deep pools. This represents suitable water vole habitat. Some burrows and feeding signs were detected here. Several dippers, heron and otter spraints were observed along the length of New Water, along with an unidentifiable, probable mustelid dropping.

Three samples on New Water tested positive for water vole eDNA and one sample tested positive for mink eDNA. Follow-up field sign surveys for latrines, burrows and feeding signs have been planned for summer 2026 and a mink trap is in the process of being deployed. No samples tested positive for white-clawed crayfish eDNA.

Figure 19: Photo of slow flowing back channel in New Water

Figure 20: Photo of possible feeding signs on New Water

Figure 21: Photo of evidence of burrow on New Water

Croglin Water

In autumn 2025, 2.5km of Croglin Water was surveyed with plans to survey a further 4.5km in spring 2026. The survey area is from Kiln Beck to Croglin Village. Due to difficulties contacting landowners in the upper reaches of Croglin Water only a further 1.5km was surveyed in spring 2026.

Figure 22: Photo of stretch of Croglin Water through broadleaf woodland showing overhanging vegetation and leaf litter

The underlying bedrock for the majority of the surveyed area is 'limestone with subordinate sandstone and argillaceous rocks' (32).

Most of this stretch of Croglin Water runs through moorland used predominantly for upland sheep grazing. However, there is an area of mature broadleaf woodland upstream of Croglin village. This section has abundant overhanging vegetation and leaf litter, indicating suitable habitat for white-clawed crayfish. There were further areas of newly planted broadleaf woodland further upstream.

Figure 23: Photo of stretch of Croglin Water running through area of upland grazing

The bank is fenced or walled in sections throughout the surveyed area through there is evidence at some points where sheep come down to the water's edge. Typically, Croglin Water was recorded as 2-5m wide, less than 1m deep and slow to rapid current. The bank profile was steep, and banks were well vegetated with grass, rush and sedges.

One sample on Croglin Water tested positive for white-clawed crayfish eDNA. Four samples tested positive for water vole eDNA and follow-up field sign surveys for latrines, burrows and feeding signs are planned for summer 2026. No samples tested positive for mink eDNA.

Raven Beck and Loo Gill

Close to 3km of Raven Beck and Loo Gill was surveyed in autumn 2025, from just above the ford, north-west of Selah Bridge down to Raven Bridge. Loo Gill is a tributary of Raven Beck.

The underlying bedrock of Loo Gill and a short stretch of Raven Gill just below the confluence is 'limestone with subordinate sandstone and argillaceous rocks' (32).

This section of Loo Gill is open moorland, used predominantly as upland grazing with scattered trees and shrubs. Below the confluence, Raven Beck runs through a steep sided sandstone gully (32). This section runs through 'ancient and semi-natural woodland' (31).

The bank profile was variable throughout, from shallow to vertical. The recorded width was 1-5m and depth less than 1m with slow flow.

Figure 24: Photo of sampling in Raven Beck at a deep pool adjacent to sandstone cliff

Figure 25: Photo of sampling in typical habitat on Loo Gill, scattered trees with vegetated steep banks

There is a public right of way running parallel to and then crossing Raven Beck and a track with a ford crossing Loo Gill. Little evidence of grazing to the water's edge was seen and in some sections the bank is fenced. Dipper were seen on Raven Beck.

None of the samples taken from Raven Beck or Loo Gill tested positive for eDNA of the target species.

Melmerby Beck and Rake Beck

In autumn 2025, 3.5km of Melmerby Beck and one of its tributaries, Rake Beck, were surveyed from Swire Sike to Melmerby Village. This sampling was done at the end of the autumn sampling period, three days after a period of heavy rain and as air temperature dropped to below 10°C. As such, it was decided to repeat this sampling in spring 2026.

Figure 26: Photo of Rake Beck with adjacent upland grazing

The underlying bedrock is predominantly sandstone and siltstone with some areas of igneous rock (32). There is no limestone bedrock in this area.

Rake Beck runs through permanent grassland with some shrubs, used for upland grazing, before entering coniferous woodland and meeting Melmerby Beck. Further downstream, Melmerby Beck enters broadleaf woodland classed as 'ancient and semi-natural woodland' (31) before running through Melmerby village.

The bank profile was varied but mostly classed as steep. The width was recorded as 1-2m throughout and less than 1m deep. Flow was fast to rapid.

Figure 27: Photo of sampling on Melmerby Beck showing adjacent predominantly coniferous woodland

In terms of disturbance, Melmerby Beck runs adjacent to the village green and is crossed by a road and foot bridge. Rake Beck is crossed by a ford and foot bridge within the woodland area. The upper stretch of Rake Beck is grazed and for the most part is not currently fenced.

None of the samples taken from Melmerby Beck or Rake Beck tested positive for eDNA of the target species in autumn 2025. On repeat sampling in spring 2026, one sample tested positive for white-

clawed crayfish eDNA and four samples tested positive for water vole eDNA. One sample tested positive for mink eDNA. A mink trap is in the process of being deployed.

Figure 28: Photo of sampling a typical stretch of Melmerby Beck thorough conifer woodland in steep sided valley

Figure 29: Photo of Melmerby Beck in Melmerby village with village green to right

Ardale Beck

Figure 30: Photo of sampling on Ardale Beck close to area of broadleaf woodland

In autumn 2025, just under 3km of Ardale Beck was surveyed from Ranscleugh Sike to Townhead hamlet. A further 3km was surveyed in spring 2026 from Townhead to Sunnygill Bridge.

The underlying bedrock is sandstone and siltstone with a small section of limestone at Townhead hamlet (32). Higher in the catchment (beyond the survey area) the underlying bedrock is limestone.

From Ranscleugh Sike to Townhead, the adjacent land is largely permanent grassland for upland grazing of sheep. From Townhead hamlet to Sunnygill Bridge the adjacent land is permanent improved grassland with some areas of broadleaf woodland.

The bank profile is varied but mostly classed as shallow to steep. Typically, banks were grazed and covered in short grass. There were a few rush-filled back channels. Width was recorded as 1-2m and depth was <1m. Flow was fast.

There is a public footpath and permissive footpath crossing Ardale Beck via wooden footbridges just downstream and upstream of Townhead hamlet respectively. There is a bridleway (Maiden Way Roman Road) crossing upper Ardale. There are old lime kilns and signs of previous industry in this area. There are several fords along the surveyed stretch of the beck allowing vehicular access.

One of the samples taken from Ardale Beck tested positive for mink eDNA. None of the samples tested positive for white-clawed crayfish or water vole eDNA. A mink trap is in the process of being deployed.

Figure 31: Photo of sampling on upper Ardale showing typical terrain and upland grazing

Ran Beck

Just under 3km of Ran Beck was surveyed in autumn 2025 from the head of Ran Beck to Blencarn Lake. The underlying bedrock is siltstone, mudstone and sandstone (32).
The land adjacent to Ran Beck is predominantly permanent grassland used for grazing sheep and cows. Some of these fields have mature alder and other broadleaved trees along the length of the beck and the banks are not fenced. Ran Beck then enters Blencarn Lake which is stocked for flyfishing. There were good numbers of waterfowl present on the lake.

Figure 32: Photo of sampling on lower stretch of Ran Beck showing mature alder trees and variety of bankside vegetation

On the lower section of Ran Beck, there was a good variety of vegetation on the bank sides and several *Juncus* flushes with deep cover and submerged vegetation. The upper fields were grazed to the water's edge with signs of bank erosion. Bank profile was steeper in some areas such as shown in Figure 32 but was typically classed as shallow with depth <50cm. Flow was slow with no deep pools. Width was 1-2m and depth less

than 50cm. There are two public rights of way crossing Ran Beck. Upper Ran Beck runs adjacent to farm buildings.

None of the samples taken from Ran Beck tested positive for eDNA of the target species.

Figure 33: Photo of sampling on upper section of Ran Beck showing open permanent grassland grazed by livestock

Figure 34: Photo of erosion on Ran Beck bank side

Crowdundle Beck

In autumn 2025, 1.5km of the central section of Crowdundle Beck was sampled. Unfortunately, ERT was unable to secure permission to sample the remaining 3km of Crowdundle Beck in spring 2026.

Figure 35: Photo of sampling on Crowdundle Beck showing surrounding broadleaf woodland

The underlying bedrock is sandstone and mudstone (32). The adjacent land to the sampled area is broadleaf woodland, including a stretch of ancient and semi-natural woodland (31). Surrounding the woodland is permanent grazing land. A public right of way crosses Crowdundle Beck south of Wythwaite.

The bank profile was generally steep with some shallower sections. There were areas of good burrowing substrate, though the banks were often rocky. Typically, width was 2-5m, less than 1m deep and rapid flow.

One sample on Crowdundle Beck tested positive for mink eDNA.

Figure 36: Photo of Crowdundle Beck showing steep banks with earth and rocky bank substrate

No samples tested positive for white-clawed crayfish or water vole eDNA. Options for mink trapping are being explored with the landowner and neighbouring landowners.

Hilton Beck and Swindale Beck 1

In autumn 2025, 4.4km of Hilton Beck and Swindale Beck 1 were surveyed. The stretch surveyed was from Marn Gill on Swindale Beck 1 to Hilton village. The underlying bedrock here is sandstone, siltstone and mudstone (32). Outside of the survey area the upper catchment of Hilton Beck is limestone bedrock (32). The survey area falls almost entirely within the Ministry of Defence (MoD) Warcop Training Area and as such additional permissions and training were sought prior to the survey.

Hilton Beck was recorded as 5-10m wide, less than 1m deep and fast throughout.

Figure 37: Photo of Hilton Beck with track/public right of way running parallel to it

It runs through an open valley with adjacent track/public right of way.

Bank profile was typically shallow. A variety of bankside vegetation was noted, from mature broadleaf woodland in the lower stretch of Hilton Beck to wet rush filled flushes and submerged water mint closer to the Swindale Beck 1 confluence.

There is a ford and footbridge at the confluence with Swindale Beck 1. There is evidence of old industry here with landslips and spoil heaps.

Swindale Beck 1 runs through a steeper, narrower valley with some scree and landslips adjacent to the beck. The bankside vegetation here is typically grasses, bracken and rush. The area is grazed by sheep. The bank profile is shallow to steep, width 1-2m and depth less than 1m. Flow was fast.

Figure 38: Photo of Swindale Beck 1 showing steeper sided valley with some scree

A good variety of raptors were seen including a hen harrier, merlin, buzzard, kestrel and peregrine falcon. Dippers were present on Hilton Beck. There was no bankside fencing.

One sample on Hilton Beck tested positive for mink eDNA. No samples tested positive for white-clawed crayfish or water vole eDNA. Options for mink trapping are being explored with the MoD.

Hayber Beck

Originally, the project planned to survey 3.8km of Hayber Beck, which falls almost entirely within MoD Warcop Training Area. Additional permissions and training were sought prior to the survey. Following discussions with the MoD, it became apparent that, for safety reasons, part of the proposed survey area could not be accessed. However, 2km of Hayber Beck was accessible on a non-firing day and surveyed in autumn 2025. The remaining 1.8km will not be accessible as part of this project.

The underlying bedrock of Hayber Beck is sandstone and mudstone (32). Outside of the survey area, the upper catchment of Hayber Beck is limestone bedrock (32).
The adjacent land is grassland with areas of mixed broadleaf and conifer woodland. There are some tracks, bridges, buildings and culverts on the surveyed stretch.

The beck was recorded as 1-2m wide and less than 1m deep with slow flow. Banks were steep, well vegetated and with ideal burrowing substrate. There was a good variety of bankside vegetation and submerged vegetation.

Figure 39: Photo of stretch of Hayber Beck through area with mixed broadleaf woodland showing abundant leaf litter

Figure 40: Photo of sampling on Hayber Beck in area with deep well vegetated banks, submerged weed and adjacent mixed woodland

Two samples on Hayber Beck tested positive for mink eDNA. No samples tested positive for white-clawed crayfish or water vole eDNA. Options for mink trapping are being explored with the MoD.

Swindale Beck 2 and Tarn Gill

In autumn 2025, over 3km of Tarn Gill and the upper part of Swindale Beck 2 was surveyed. In spring 2026 a further 0.5km of upper Tarn Gill and 3km of lower Swindale Beck 2 from Thornthwaite to Brough was surveyed. Also in spring 2026, five of the upper Swindale Beck 2 and Tarn Gill samples taken in autumn 2025 were repeated. The original sampling of these points had been done towards the end of the autumn surveying period.

Figure 41: Photo of Swindale Beck 2 showing waterfall and adjacent broadleaf woodland

Upper Tarn Gill lies within the MoD Danger Area so additional permissions and training were sought prior to the survey. Permission to survey required liaison with both the landowners and the MoD.

Figure 42: Photo of fenced buffer zone with new tree planting adjacent to Swindale Beck 2

Swindale Beck 2 and Tarn Gill sits on limestone bedrock. Specifically, 'limestone with subordinate sandstone and argillaceous rocks' (32). The land adjacent to upper Swindale Beck and Tarn Gill is a private estate which has undergone recent landscape restoration, including tree planting, wetland creation and peatland restoration. The land adjacent to lower Swindale Beck is a private estate comprising of a significant stretch of 'ancient and semi-natural woodland' (31) with some permanent grassland for grazing.

There are several waterfalls, footbridges, a vehicular bridge and a ford on the surveyed stretch. There are two public bridleways, a public footpath and a permissive footpath crossing and running parallel to Swindale Beck 2 and Tarn Gill at various points.

Figure 43: Photo of sampling Swindale Beck 2 close to an area of bankside reinforcement

Figure 44: Photo of sampling Tarn Gill in area with steep well vegetated earth banks and new tree planting

There are some areas of bankside reinforcement and gabions. Banks were largely fenced with buffer zones. Typically, the watercourse was recorded as 1-5m wide, less than 1m deep and sluggish to fast flow. Banks were typically steep and well vegetated

Figure 45: Photo of sampling on Swindale Beck 2 in area of broadleaf woodland with overhanging vegetation

with submerged weed and bankside tall grass, sedges and rush. On Tarn Gill and upper Swindale Beck, these features, in addition to good burrowing substrate, slow flowing back channels and some adjacent pools/ponds and occasional deep pools within the watercourse represent good upland water vole habitat.

On lower Swindale Beck the abundant overhanging vegetation and leaf litter with underlying limestone bedrock represent suitable habitat for white-clawed crayfish. Dippers and herons were seen throughout the survey. Otter spraint was found on Tarn Gill.

In autumn 2025, one sample on Swindale Beck 2 tested positive for mink eDNA. No samples tested positive for white-clawed crayfish or water vole eDNA. In spring 2026, five samples tested positive for mink eDNA and no samples tested positive for white-clawed crayfish or water vole eDNA. Attempts to deploy a mink trap were hampered by lack of cellular reception but with specialist kit deployment was achieved in spring 2026.

River Belah

Six kilometres of the River Belah were surveyed in autumn 2025 from Potter Sike to Oxenthwaite Bridge.

The underlying bedrock the length of the Belah is limestone (32). The head of the River Belah is on open heather moorland and peat bog, used predominantly for upland grazing and shooting interests. It flows downstream through two significant blocks of ancient and semi-natural woodland (31) with adjacent land used for grazing.

Figure 46: Photo of section of the upper Belah with bank fencing, new adjacent tree planting and steep, well vegetated earth banks

There are several public rights of way crossing the Belah on this stretch. There was evidence of previous industry including the remains of a viaduct and spoil heaps from presumed historical quarrying and/or mining.

Figure 47: Photo of public right of way crossing the Belah above section of deep limestone scar gully

Figure 48: Photo of River Belah running through block of ancient and semi-natural woodland with remains of viaduct on valley side

The River Belah has multiple waterfalls and deep limestone scars making sections of the survey area completely inaccessible.
The underlying geology means a wide variety of width, depth and flow were recorded in the habitat survey. A local tenant farmer explained that the river will run dry in some sections during the summer due to the underground cave systems.

Figure 49: Photo of sampling in the River Belah at an area of wider, slower flow through ancient and semi-natural woodland. Improved grassland used for grazing is adjacent

Typically, width was between 2-10m, depth from <0.5m to >2m and flow from fast to rapid. Banks were partly fenced. In the upper reaches of the Belah there are stretches representing good water vole habitat with deep well vegetated banks and adjacent high ground. Some of these sections are fenced with buffer zones and new tree planting.

None of the samples taken from the River Belah tested positive for eDNA of the target species.

Mill Beck and Hare Beck

Two ad-hoc eDNA samples were taken to use up the surplus eDNA testing kits on the final day of sampling. These were taken from a tributary of the River Gelt which was previously known to have had water vole (Mill Beck) and a tributary of the River Irthing (Hare Beck). Both watercourses run through rough, upland terrain dominated by *Juncus*. Both were typically 1m wide and <50cm deep with steep sided, well vegetated earth banks. There was some submerged vegetation. Both watercourses represented good habitat for water vole but not white-clawed crayfish.

6. Discussion

Of the 99 samples taken across 19 watercourses in autumn 2025, 27 samples tested positive for one or more target species' eDNA across 12 watercourses. This equates to eDNA detection in 27% of samples and on 63% of watercourses.

a) White-clawed crayfish

Two samples tested positive for white-clawed crayfish eDNA.

The first sample was on Croglin Water close to sites where white-clawed crayfish have previously been reported, and upstream from a known regionally important, white-clawed crayfish population. This positive sample showed low-level presence of eDNA (1/12 positive replicates). The second sample was on Melmerby Beck at a point where white-clawed crayfish have previously been reported. It was good to be able to reaffirm the presence of this previously known population. This positive sample showed a higher-level presence of eDNA (4/12 positive replicates).

Disappointingly, other watercourses where white-clawed crayfish had been previously recorded, tested negative. This included Crowdundle Beck, Hilton Beck and Hayber Beck. These could represent true-negative or false-negative results. True-negatives, if white-clawed crayfish no longer exist there (see Background for threats to their survival), or false-negatives, if the presence of white-clawed crayfish has been missed by the survey. Several reasons why false-negatives could have occurred are discussed in the Limitations section below.

b) Water vole

Eleven samples tested positive for water vole eDNA across five watercourses: Old Water, New Water, Croglin Water, Melmerby Beck and Rake Beck.

Old Water and New Water are both within the Gelt sub-catchment and therefore connected. Interestingly, searches of historical records did not find any prior evidence of water voles on Old Water, New Water and Croglin Water (Appendix 2). Water vole have been previously recorded in Melmerby and Rake Beck. Once again, it was good to be able to reaffirm the presence of a previously known population.

The positive samples showed low- to mid-level presence of eDNA (1/12 to 4/12 positive replicates). Farmers and land managers at the above sites have kindly consented to field sign surveys for water voles in summer 2026 to search for latrines, feeding signs and burrows. The surveys will provide an opportunity to build on new working relationships

with these farmers and land managers. This may lead to identification of habitat enhancement opportunities for water vole. The surveys can also offer a training opportunity for staff, volunteers and other interested third parties such as landowners and managers.

There are historical records of water vole on nine of the remaining 14 watercourses but unfortunately the eDNA sampling was negative on this occasion. They are the River Gelt, Loo Gill, Ardale Beck, Ran Beck, Crowdundle Beck, Hayber Beck, Swindale Beck 2, Tarn Gill and the River Belah. As with white-clawed crayfish, this failure to detected water vole eDNA could be a true-negative or false-negative. Possible reasons for false-negatives are discussed further in Limitations below.

Of concern, on the nine watercourses where water vole had previously been recorded but eDNA was not found on this occasion, six tested positive for mink eDNA. Two watercourses, New Water and Rake Beck, tested positive for both water vole and mink eDNA. On New Water these positive samples were detected just 1km apart. On Rake Beck these two positive samples were detected at the same point.

c) American mink

Fifteen samples tested positive for mink across nine watercourses: River Gelt, Old Water, Rake Beck, Ardale Beck, Crowdundle Beck, Hilton Beck, Hayber Beck, Swindale Beck 2 and Tarn Gill.

Of these watercourses, the only two with an accurate historical record of mink are the River Gelt and a tributary of Ardale Beck. As a cryptic, wide-roaming and solitary species, it was not unexpected that mink eDNA would be found in areas that were not previously known to have mink. This finding is in keeping with the published literature stating mink are generally underreported as a species, leading to a lack of scientific consensus on the abundance of mink in the UK (10, 17).

Trap deployment is being explored with farmers, landowners and managers on all watercourses included in the project. All farmers, landowners and managers have been extremely cooperative and generous with their time.

The main barrier to trap deployment within the project area is the lack of cellular reception for the remote monitoring devices. The area is geographically remote with watercourses that typically run through deep valleys and gullies. Even with the exploration of options, such as the use of long aerials, the technology has its limitations. These difficulties are important to consider in the context of the *Cumbria Mink Eradication Strategy* which will follow the methodology used by the Waterlife Recovery

Trust in East Anglia. Cellular coverage in East Anglia is unlikely to be as problematic as it is in Cumbria, given the differing terrains across the regions.

d) Limitations

As mentioned above, there were several limitations of this project. The most significant limitation was the overall timing of the sampling which fell largely outside of the optimal eDNA sampling period for white-clawed crayfish and water voles (Figure 45). The reasons for these optimal sampling periods are discussed above in Background.

The optimal eDNA survey window for white-clawed crayfish is April to October. Of the 99 samples taken, 28 were taken within the optimum sampling period, including at Croglin Water where the one positive sample was taken. The positive sample at Melmerby Beck was taken outside of the optimal sample period. There is a chance that sampling outside of optimal periods could have led to false-negatives i.e. white-clawed crayfish were present but not detected. Their behavioural ecology, largely governed by water temperature and seasonality, means they are less active or burrowed into banks and sediment during the winter months. This means they are less likely to shed DNA to the water.

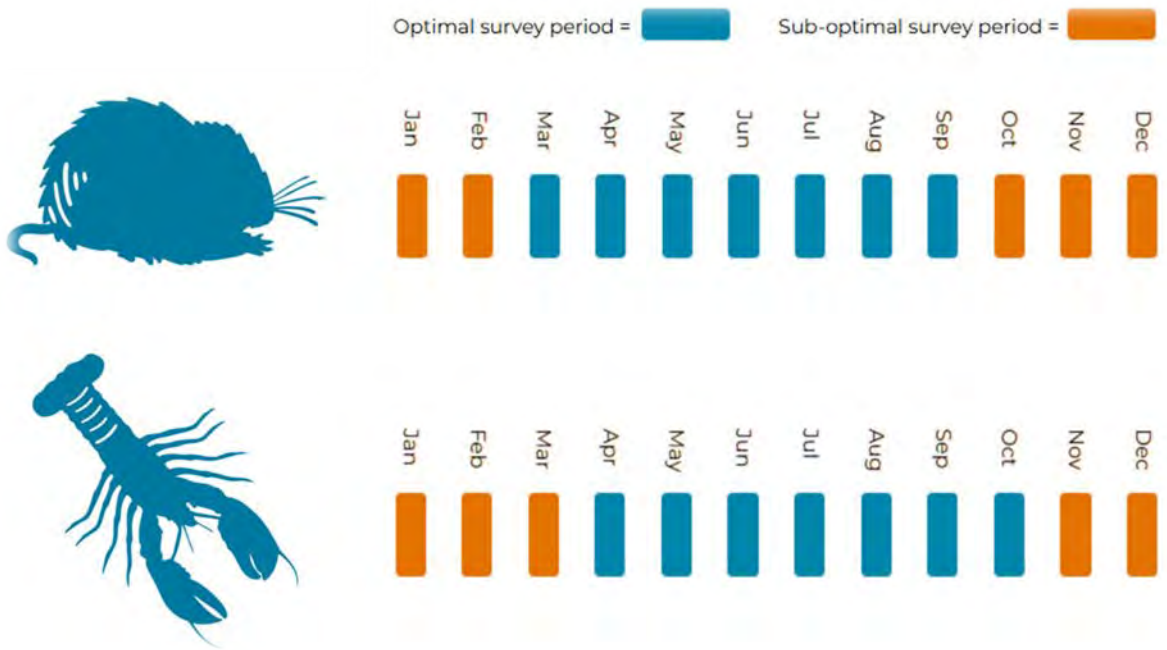

Figure 50: Optimal sampling periods for the target species (from SureScreen Scientifics Ltd)

The optimal eDNA survey window for water voles is March to September. Of the 99 samples taken, 24 were taken within the optimum sampling period. One of the positive Croglin Water samples and all the positive Melmerby and Rake Beck samples were taken within the optimum sampling period. The positive samples at Old Water, New

Water and the remaining Croglin Water samples were all taken outside of the optimum sampling period. As discussed above, this can lead to false-negatives. Outside of the optimum survey window water voles will be spending more time in their burrows eating the food they have stockpiled in early autumn. They may leave their burrows intermittently but are certainly less active with less chance of shedding DNA to the water and wider environment.

As previously discussed, October and November 2025 were unseasonably warm which may have had some effect on target species activity levels, but sampling during this time was still not ideal. Many factors, which are not fully understood, impact seasonal behavioural ecology of these species. Climate and more specifically, air and water temperatures, may be one variable factor but other factors such as number of daylight hours, will not vary.

In theory, mink may be sampled for all year round, but females do tend to be less mobile during winter months.

Figure 46 shows the positive eDNA results by date across all three target species and clearly shows that by November no samples tested positive for white-clawed crayfish or water vole eDNA.

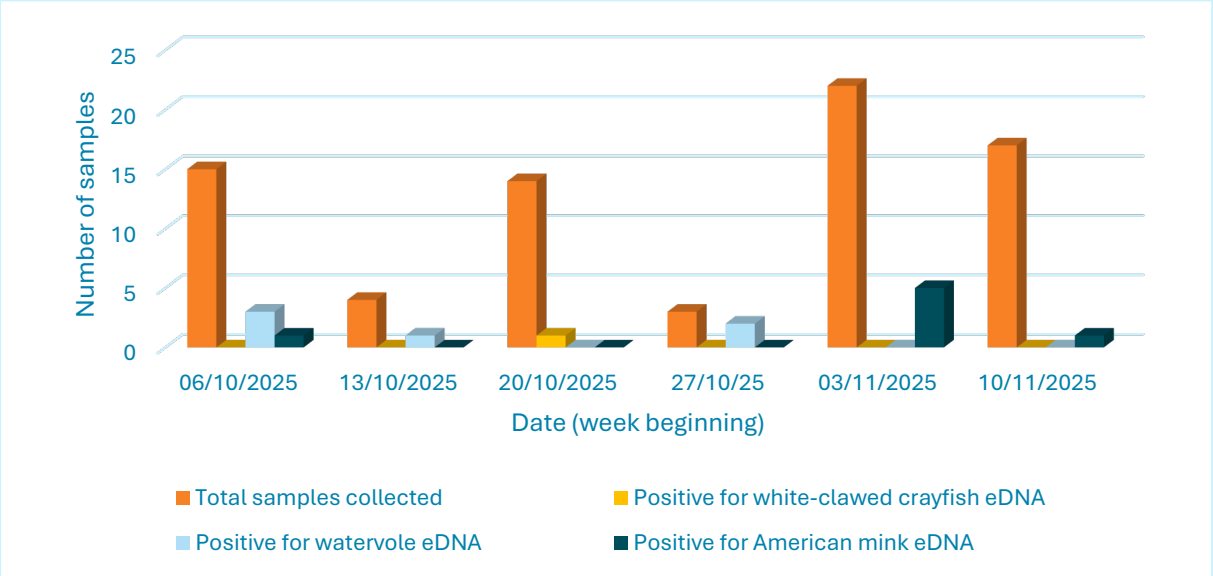

Figure 51: Positive eDNA results by date across all three target species

This limitation was partially mitigated against by stopping the survey as soon as sub-zero air temperatures were recorded in mid-November. At this point, an extension to the project was negotiated with North Pennines National Landscape to allow the sampling to be completed in March 2026. Full mitigation would have required the survey to be done entirely within the optimum sample period for all three target species, April-September. This was not possible due to project timelines and funding windows, largely beyond the control of ERT and the project funders.

Choosing to conduct a multi-species eDNA survey on the same water samples is a limitation, regardless of seasonality and optimal sample windows. Each of the target species will have preferential habitat and differing behavioural ecology. For example, habitat with overhead trees and abundant leaf litter with rocky substrate may be suitable for white-clawed crayfish, but due to excessive over-shadowing and insufficient burrowing substrate may be unsuitable for water vole. During site selection a balance needed to be found that represented a range of habitats where all target species could be found, though some would be more likely than others.

Regarding sampling, efforts were made to sample across the full cross-section of the watercourse, but this may limit species detection given that white-clawed crayfish have a preference for shallower water, and water voles have a preference for deep pools.

If the study had been designed with just one target species in mind rather than three, the sampling could have been targeted specifically to that one species. This could have increased the likelihood of detection and decreased the risk of false-negative results, albeit with increased labour and time effort, if the other two species were to be accounted for individually. The analysis of the samples is not affected by the multi-species nature of the project when using qPCR.

A further limitation was the incidences of heavy and persistent rain that occurred during the sampling period in November 2025. During early November there were two 'yellow weather warnings' for rain and several flood alerts affecting the project area.

Ideally eDNA surveying should not be done during or following periods of heavy rain. The reasons are two-fold. Heavy rain increased the volume of water in watercourses meaning that there is a dilutional effect on any eDNA that is present and it may not be detected during analysis as a result (23). This could result in a false-negative. Heavy rain increases the flow rate which means that eDNA is washed downstream and potentially out of the survey area or to a survey area where there may be a geographical mismatch (23). This could result in a false-negative at the actual location of the target species and a false-positive further downstream.

This was mitigated against by waiting the recommended 3-5 days after heavy rain events before resuming sampling (22). Delaying sampling did however have the negative impact of pushing sampling dates further outside of the optimal sampling window. The aim was to strike a pragmatic balance between obtaining results that were accurate and reliable, whilst still meeting the aims and objectives of the project in terms of the number of samples collected within the allocated time window.

The sampling of Melmerby and Rake Beck was completed just before the pause in sampling for winter; temperatures had dropped and there had been a yellow weather warning for heavy rain and flooding just 3 days prior. Given there were existing records

of white-clawed crayfish and water vole on Melmerby and Rake Beck, it was decided to repeat the Melmerby and Rake Beck samples in spring 2026 with spare eDNA sample kits. The positive eDNA samples obtained in spring 2026 from the same stretch are indicative of the effect that seasonality and weather events can have on the accuracy of results.

Access and permissions presented a further limitation. Despite ERT being well connected to farmers, landowners and managers within the project area, there were some areas where difficulties contacting landowners were encountered. This was mainly when it was not known who owned or managed a specific stretch of the watercourse, or where contact details could not be found. In all but one case where we managed to communicate directly with the landowner/manager, they were very kind in granting permission for ERT to do the survey.

On MoD land, the process of gaining permission to access was understandably more complicated due to safety reasons. We were kindly given training and guided through this process by the team at the MoD.

Four of the watercourses that we planned to survey fell partially or entirely within the MoD Training Area (Hilton Beck, Swindale Beck 1, Hayber Beck and Tarn Gill). As discussed above, part of Hayber Beck was out of bounds for the purposes of this survey. The other areas could be accessed on non-firing days with strict adherence to safety procedures.

Sample points were planned and mapped at 500-700m intervals following the desktop study. As a rule, the sample points had not been visited prior to the day of sampling, although some of the terrain was familiar to the staff and volunteers. On arrival at a sample site, two considerations needed to be made:

1. Was the point suitable for sampling in terms of the target species?
2. Was the point suitable for sampling in terms of the health and safety of the staff and volunteers?

Unsuitable sites were those on waterfalls, weirs or near other water company infrastructure, in steep gullies or inaccessible due to thick vegetation or livestock. Following this assessment, some sample points needed to be moved up- or down-stream to a more suitable location. This meant that occasionally sample points were only 400m apart and sometimes up to 800-900m apart. This represents a limitation of the project in the sense that some stretches may have been over-sampled (leading to duplicated detection of the same individual or population) and other stretches may have been under-sampled (leading to missed detections).

Despite stringent procedures, cross contamination of samples may have occurred. Several steps were taken to minimise this risk such as cleaning of PPE between sites,

not opening the sampling kit until arrival at the sample point, wearing gloves during sample collection, and storing used sampling kits in a different building to unused kits.

The sample collection methodology recommended by SureScreen Scientifics Ltd. was followed throughout. However, used and unused sample kits could not be easily separated on walking to and from sample sites. They were transported together in rucksacks due to the remoteness of the sample points and the number of sample kits that needed to be carried each day.

The ERT vehicle is occasionally used to transport mink carcasses, but these would be transported in the back of a Ford Ranger and sample kits were transported within a rucksack in the cab. Mink carcasses are always transported in a Ziplock bag within a contained plastic box. After processing the plastic box is disinfected.
Any cross-contamination, though unlikely, could result in a false-positive result.

7. Dissemination and outreach

After results were received from SureScreen Scientific Ltd, we contacted any relevant farmer, landowner or land manager directly to share the results. This was normally by telephone but occasionally email or in person. A one-to-one discussion was held about the findings and possible limitations of the project with the opportunity to ask questions.

Every farmer, landowner and manager was offered a copy of the laboratory report pertaining to their land. It was at this point that we sought permission for inclusion of the results in the final report. All participating farmers, landowners and managers were asked if they would like to receive copies of this final report by email or post, only four declined. Along with this final report, a summary infographic and resources on the target species will be sent.

If relevant, we also sought permission for future surveys (for example in the case of a sample positive for water vole eDNA) and discussed mink trap deployment. Follow-up surveys planned for summer 2026 will enable further engagement opportunities.

A presentation on the proposed project (prior to results being received) was given to ERT's Fellside Farmer Group meeting in November 2025. We plan to present the final results to the Dufton Farm Cluster in summer 2026.

Whilst the key audience for dissemination is farmers, landowners and managers in the project area, there is also value in disseminating the findings to statutory bodies, other NGOs and citizen scientists.

We presented the results of the project at the Cumbria Biodiversity Data Centre annual conference in February 2026 and the Cumbria Catchment Partnership meeting in March 2026. The Environment Agency, Natural England and the Waterlife Recovery Trust have expressed interest in seeing the final report and we will forward it on to them. We have been invited to speak at a local RSPB wildlife group in late 2026. Results will also be disseminated to volunteers that worked on the project assisting with eDNA sampling.

Some of the planned outreach and dissemination opportunities fall outside of the project delivery window but we still feel attendance would be worthwhile. Results will also be made available on ERT's website and external PR in appropriate media outlets is being planned.

8. Measuring success

The objectives that we set out to achieve have been completed to varying degrees.

1. Use of eDNA sampling techniques to survey seventeen watercourses in the project area

A total of 99 samples across 19 watercourses were taken, meeting and surpassing our first objective.

2. Reaffirmation of the presence of known populations of white-clawed crayfish and water vole in the project area

The project reaffirmed the presence of known populations of white-clawed crayfish in Melmerby Beck and water vole in Melmerby and Rake Beck. White-clawed crayfish are known to be in Croglin Water but not on the stretch sampled as part of this project, with the nearest populations approximately 1.8km away. The survey failed to reaffirm the presence of known populations of white-clawed crayfish on three watercourses.

The project reaffirmed the presence of known populations of water vole on Melmerby and Rake Beck. Where new populations of water vole were identified on Old Water and New Water, there were previous records several kilometres downstream on the Gelt catchment (i.e. the same sub-catchment). The survey failed to reaffirm the presence of known populations of water vole on nine watercourses.

3. Identification of new populations of white-clawed crayfish and water vole in the project area

As mentioned above, a new population of white-clawed crayfish was identified on Croglin Water, 1.8km from the nearest previously known population. New populations of water vole were identified on Old Water, New Water and Croglin Water. The nearest previous records on the Gelt sub-catchment were over 5km away.

The identification of these new populations of priority species presents scope for further field sign surveys and monitoring, guides ERT and partners in prioritisation of resources to the most appropriate geographical area and allows assessment of habitat for potential improvement works.

4. Mapping of American mink presence in the project area, leading to the deployment of mink traps

Mink eDNA was detected on 15 samples across nine watercourses. In all instances this has led to promising discussions with farmers, landowners and managers regarding mink trap deployment. Six landowners and managers have agreed to traps and nine have subsequently been deployed.

The deployment of a further two traps is complicated by access and safety considerations on MoD land, but ERT is working closely with the team to find a workable solution.

On watercourses that did not test positive for mink eDNA, there has still been significant interest in deployment of mink traps from farmers, landowners and managers participating in the project. As a direct result of this project, a further six farmers, landowners and managers have kindly agreed to mink traps across four watercourses within the project area in addition to the traps mentioned above.

Furthermore, the connections made through the course of this project are also leading to mink trap deployment elsewhere on the Eden catchment outside of the project area.

5. Engagement with farmers, landowners and managers across the project area

The project worked with 25 landowners and managers to obtain eDNA samples. The vast majority were farmers (both owners and tenants). Of these farmers, landowners and managers, 12 represented new contacts for ERT and 13 had worked with ERT on previous projects.

Through this engagement we were able to advise on and offer habitat enhancement works in the form of riparian buffer creation and alternative water source provision for livestock on five different sites. On three of these sites, we aim to assist the farmer with woodland creation schemes in the next financial year. Furthermore, on one site we were able to liaise with the local council to expedite a bridge repair on a public right of way.

6. Engagement and training of Eden Rivers Trust's volunteers in eDNA sampling

Ten volunteers kindly gave up their time collecting samples alongside ERT staff. Nine volunteers were newly trained in eDNA sampling for the purposes of this project. One of the volunteers had been previously trained in eDNA sampling for white-clawed crayfish. In total, 91 volunteer hours contributed towards the project.

7. Dissemination of results to a broad but relevant audience

The various dissemination and outreach opportunities are discussed in detail above. Most notable were the presentations to the Fellside Farmer Group, Dufton Farm Cluster and at the Cumbria Biodiversity Data Centre annual conference. Results will also be disseminated to statutory bodies and relevant NGOs.

9. Next steps

Building on the success of this project we hope to secure funding and resources for the following next steps:

- Field sign surveys for burrows, latrines and feeding signs in summer 2026 where samples tested positive for water vole eDNA;
- Hand search surveys and repeat eDNA sampling in summer 2026 where samples tested positive for white-clawed crayfish eDNA;
- Expansion of the Eden catchment mink trapping network to interested farmers, landowners and managers engaged through the project;
- Further eDNA sampling of watercourses in the Eden catchment that were not covered in this project;
- Ongoing work with fellside farmers to support habitat enhancement works of benefit to white-clawed crayfish and water vole.

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11. Appendices

Appendix 1: Map of records of white-clawed crayfish in project area prior to commencement of project

Appendix 2: Map of records of water vole in project area prior to commencement of project

Appendix 3: Map of underlying bedrock substrate in project area

Appendix 4: Map of records of American mink in project area prior to commencement of project

Appendix 5: Map of planned eDNA sample points

Appendix 6: eDNA sample kit

Appendix 7: Manufacturer methodology for taking eDNA samples

Appendix 8: Habitat survey form

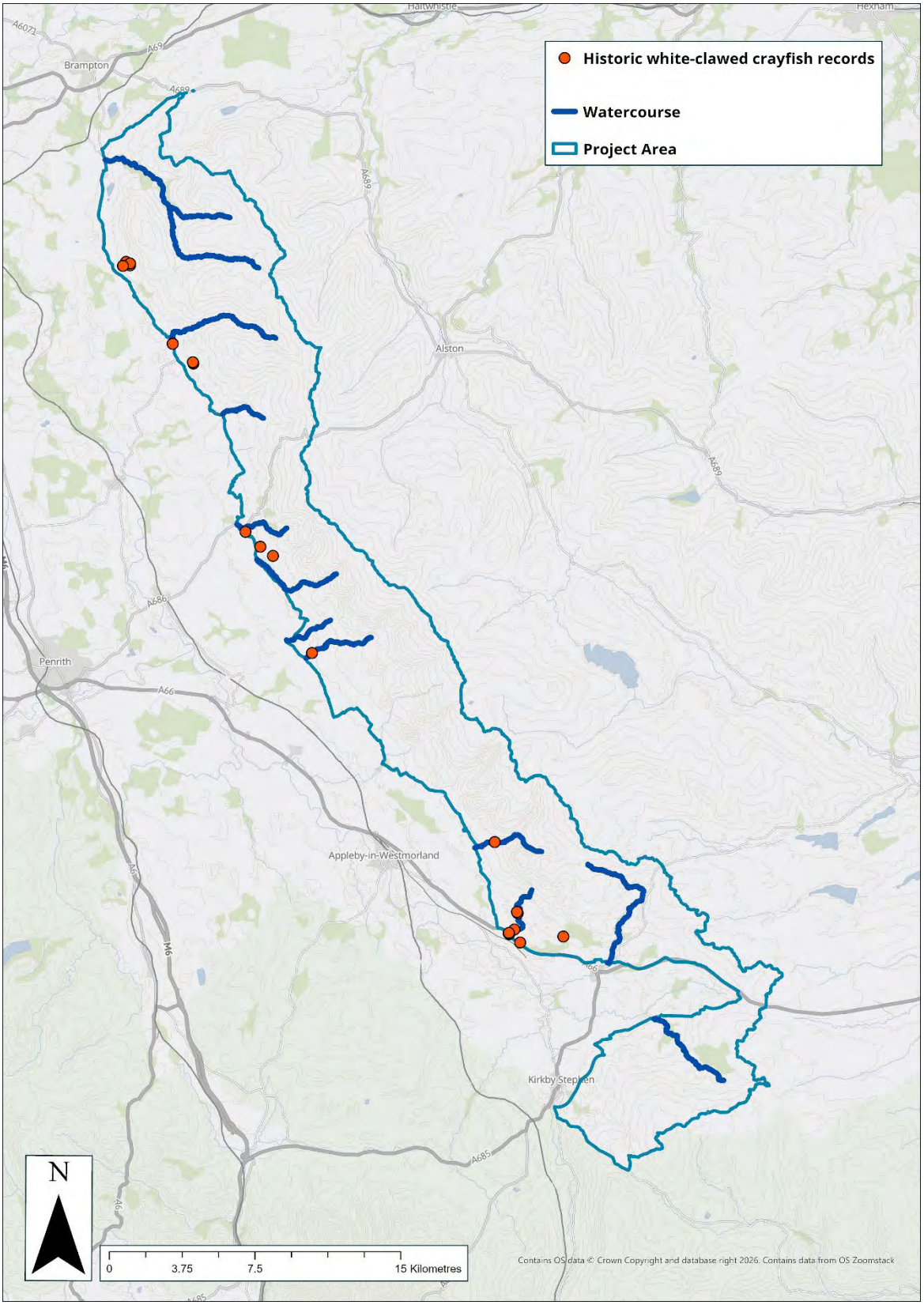
Appendix 9: Sample analysis methodology as provided by SureScreen Scientifics Ltd

Appendix 10: Sample collection diary

Appendix 11: Mean temperature data from the Met Office

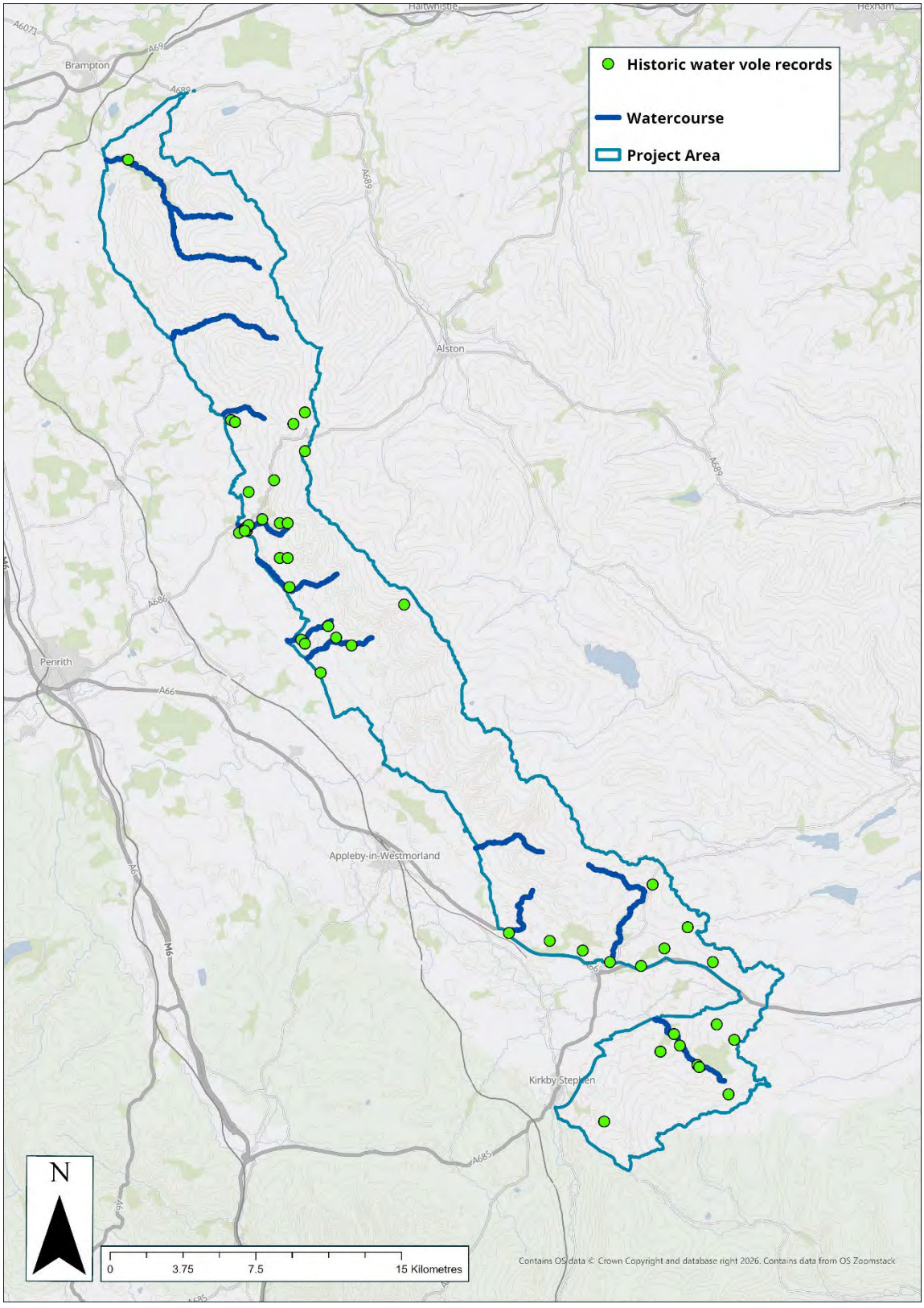
Appendix 1

Map of records of white-clawed crayfish in project area prior to commencement of project (1980 – present) (7, 8, 9, 19)



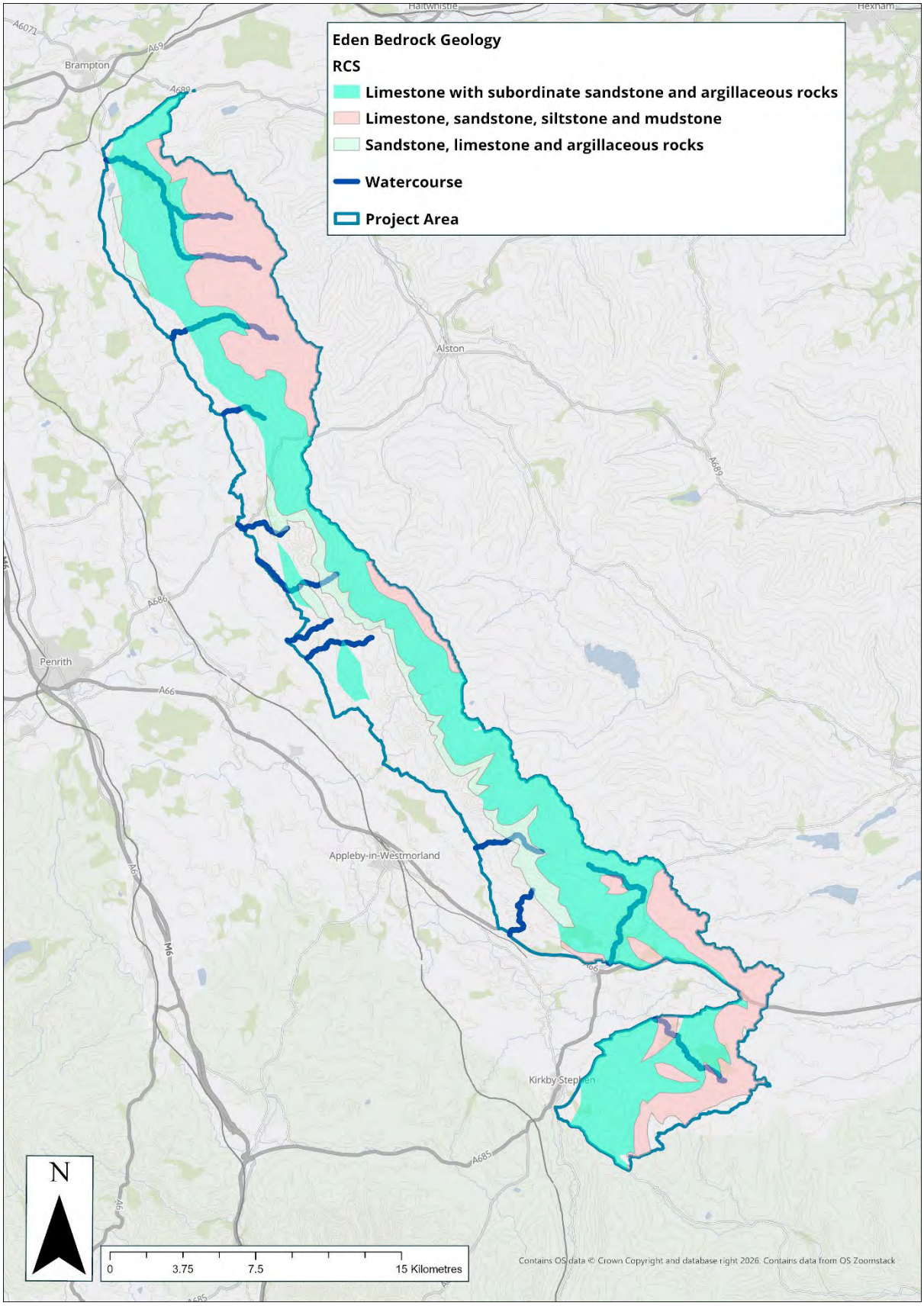
Appendix 2

Map of records of water vole in project area prior to commencement of project (2003 – present) (7, 8, 9, 19)



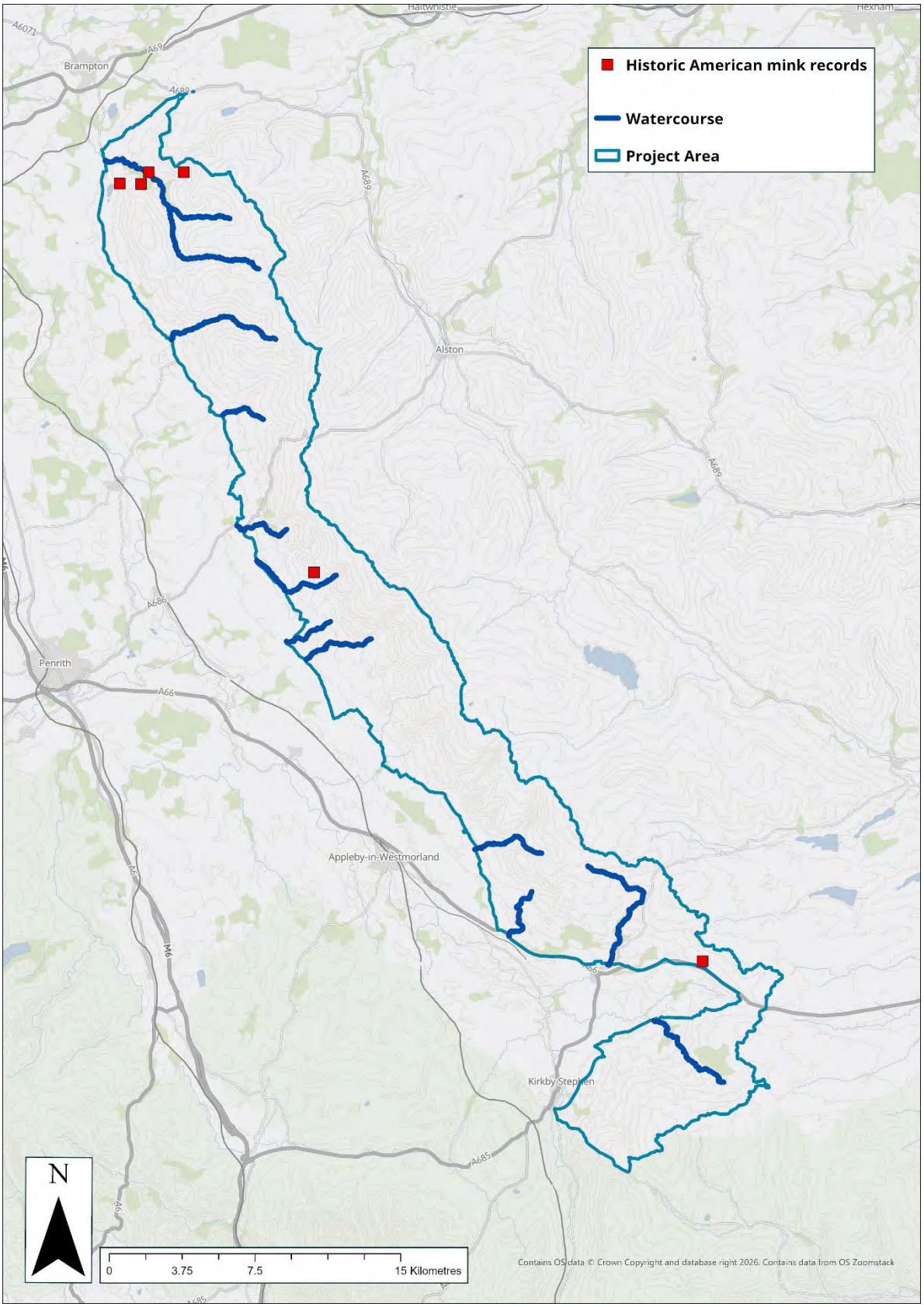
Appendix 3

Map of underlying bedrock substrate in project area (32)



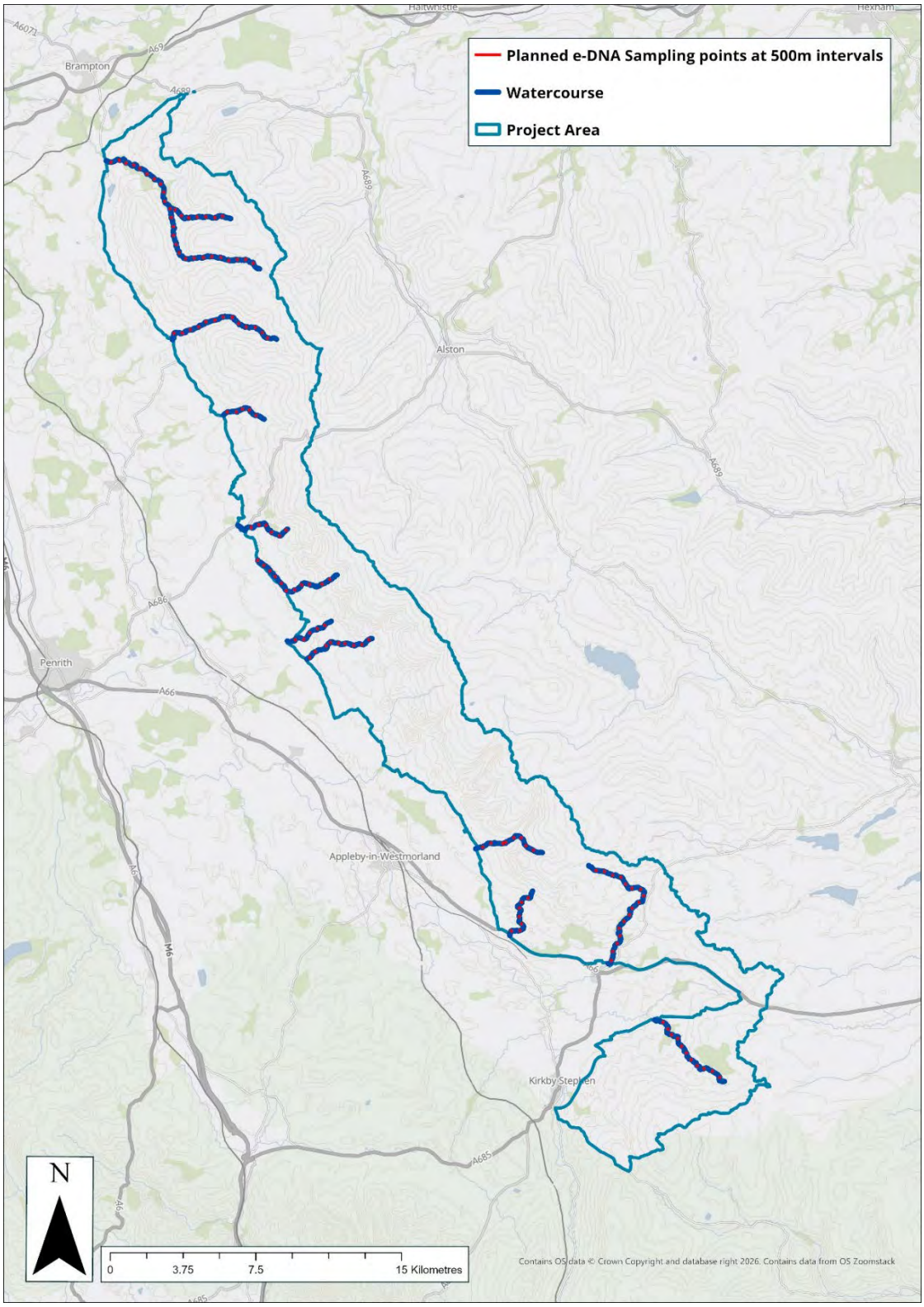
Appendix 4

Map of records of American mink in project area prior to commencement of project (1982 – present) (7, 8, 9, 19)



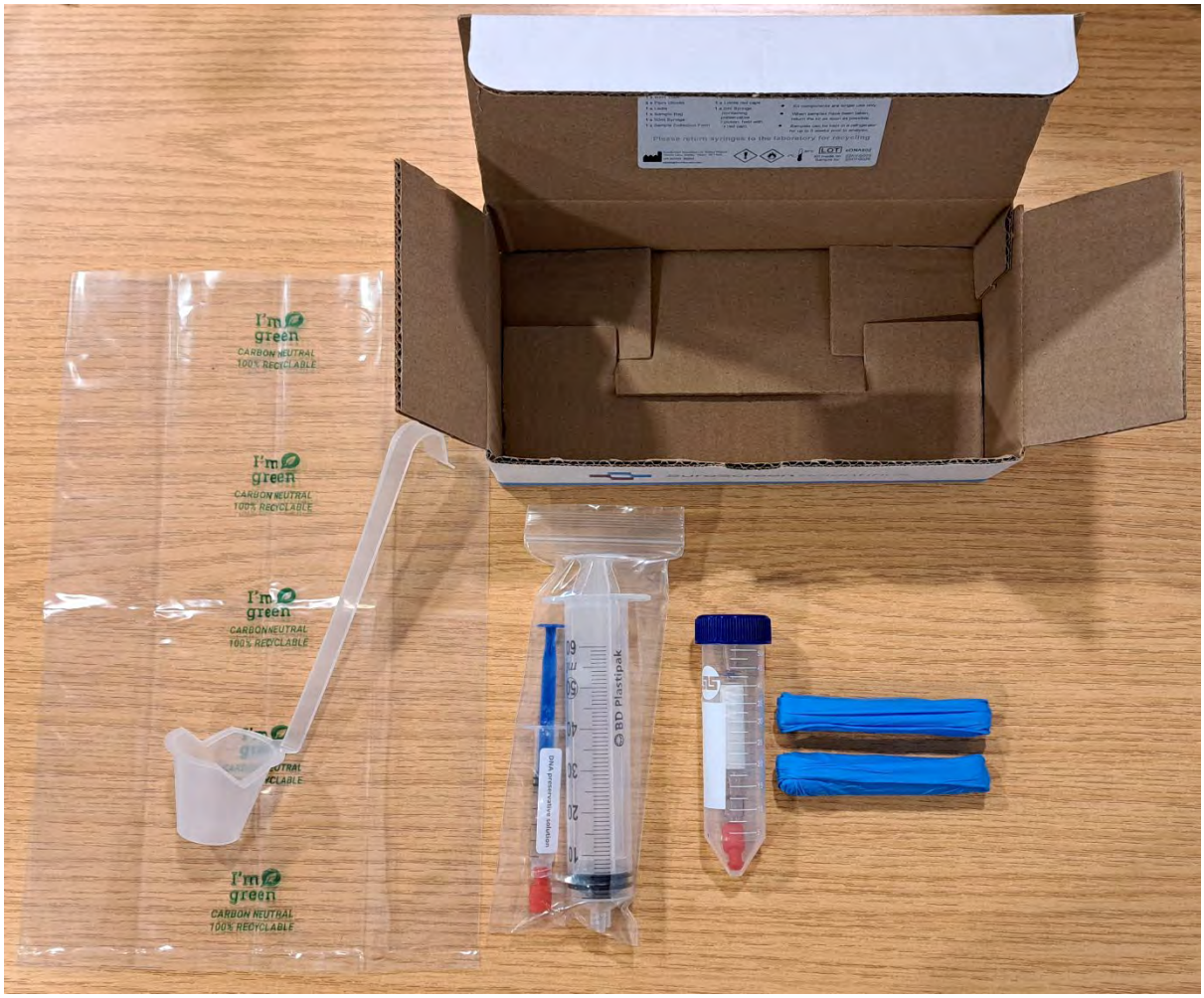
Appendix 5

Map of planned eDNA sample points



Appendix 6

eDNA sample kit supplied by SureScreen Scientifics Ltd

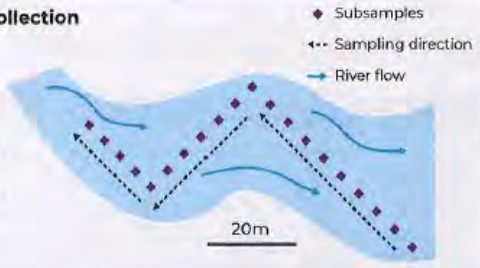


Appendix 7

Manufacturer methodology for taking eDNA samples supplied by SureScreen Scientifics Ltd

Instructions

Instructions for sample collection

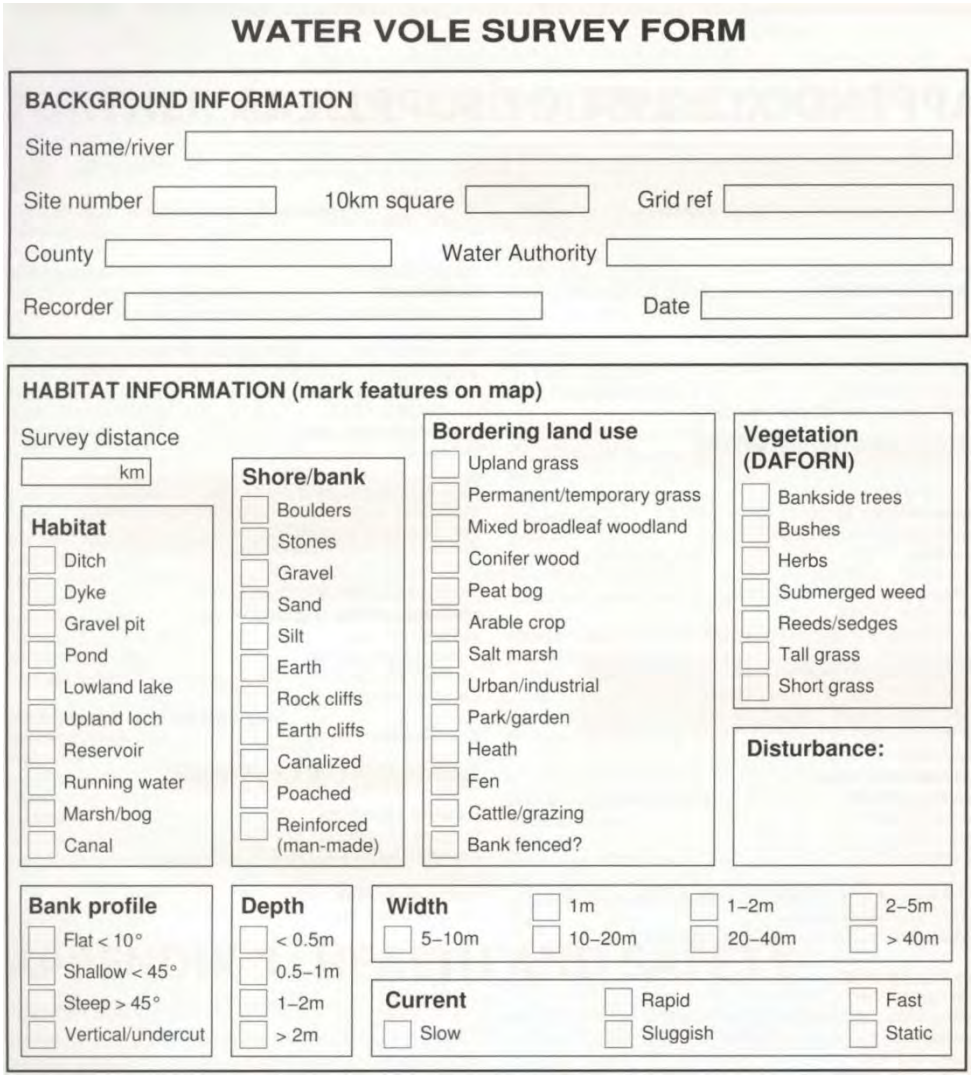


1. Identify 20 sites around the pond/river where you plan to collect your subsamples from. These should be spaced as evenly as possible around the site. In rivers, samples should be taken in an upstream diagonal pattern where possible, if it is necessary to enter the watercourse. Alternatively you can collect samples along the perimeter of a pond or along both shores of a river, using a telescopic pole to obtain subsamples from areas difficult to access or which are further from the river bank.
2. Put on the gloves provided and open the bag.
3. Using the 30ml ladle provided, collect a subsample from at least 5-10cm deep from each of the sites previously identified in step 1 (total 20 subsamples). The water sample should be taken from the middle of the water column. Where possible, avoid any disruption of sediment as this can both clog the filter quicker and introduce ancient DNA into the sample. Transfer each ladle full of water to the bag provided In larger sites it may be necessary to use a telescopic pole.
4. Once all sites have been sampled, tightly scrunch the bag and shake vigorously for 10 seconds (to mix any DNA within the sample equally).
5. Using the large syringe, take 50ml of sample and attach the syringe using a half twist action to the narrow end of the filter unit (the syringe will only fit to one end of the filter). Apply pressure to the syringe until all liquid has passed into and through the filter unit. Note, twisting too far can damage the luer lock connection on the filter. Remove the filter unit from the syringe and repeat this step until up to 500ml (minimum required volume = 150ml) is filtered/the filter becomes clogged/you are no longer able to push any liquid through. The more liquid passed through the filter unit, the more reliable results will be, however, be careful not to exert too much force as the filter casing can crack under extreme pressure. If/when resistance becomes too high, finish filtering the sample. Record the amount of liquid which has been filtered on this sheet.
6. Empty the syringe and fill with air, attach this to the filter and repeatedly push air through the filter until it is free of water
7. Screw one red cap onto the thick end of the filter unit. Place to one side.
8. Carefully take the red cap from the small pre-filled blue syringe, this contains an excess of the preservative solution. Place the red cap to one side, connect the syringe to the open end of the filter unit and apply gentle pressure until all 2ml of solution is stored within the filter casing.
9. Screw the red cap from step 8 to the narrow end of the filter, ensure both cap ends are tight, and then place the filter into the 50ml storage tube provided.
10. Finally, fill in the sample collection form (on the reverse of this page).
11. Place the 50ml tube containing the sealed filter and the large syringe (this helps us reduce plastic waste in the lab) in theclear plastic bag and return to the laboratory address below for analysis, with the corresponding analysis form.
12. Results will be emailed to you within the specified turnaround time.

Detailed sample collection guidance
For further assistance with sample collection, visit our website or scan this QR code to access our detailed step-by-step filtration sample collection guide.

Appendix 8

Habitat survey form (14)



WATER VOLE SURVEY FORM

BACKGROUND INFORMATION

Site name/river

Site number | 10km square | Grid ref

County | Water Authority

Recorder | Date

HABITAT INFORMATION (mark features on map)

Survey distance

km

Habitat
- Ditch
- Dyke
- Gravel pit
- Pond
- Lowland lake
- Upland loch
- Reservoir
- Running water
- Marsh/bog
- Canal

Shore/bank
- Boulders
- Stones
- Gravel
- Sand
- Silt
- Earth
- Rock cliffs
- Earth cliffs
- Canalized
- Poached
- Reinforced (man-made)

Bordering land use
- Upland grass
- Permanent/temporary grass
- Mixed broadleaf woodland
- Conifer wood
- Peat bog
- Arable crop
- Salt marsh
- Urban/industrial
- Park/garden
- Heath
- Fen
- Cattle/grazing
- Bank fenced?

Vegetation (DAFORN)
- Bankside trees
- Bushes
- Herbs
- Submerged weed
- Reeds/sedges
- Tall grass
- Short grass

Disturbance:

Bank profile
- Flat < 10°
- Shallow < 45°
- Steep > 45°
- Vertical/undercut

Depth
- < 0.5m
- 0.5–1m
- 1–2m
- > 2m

Width
- 1m
- 1–2m
- 2–5m
- 5–10m
- 10–20m
- 20–40m
- > 40m

Current
- Rapid
- Fast
- Slow
- Sluggish
- Static

Appendix 9

Sample analysis methodology as provided by SureScreen Scientifics Ltd

"Samples have been analysed for the presence of target species eDNA following readily available and scientifically published eDNA assays and protocols.

The analysis is conducted in two phases. The sample first goes through an extraction process where the filter is incubated in order to obtain any DNA within the sample. The extracted sample is then tested via real-time PCR (also called q-PCR) for each of the selected target species. This process uses species-specific molecular markers (known as primers) to amplify a select part of the DNA, allowing it to be detected and measured in 'real time' as the analytical process develops. qPCR combines amplification and detection of target DNA into a single step. With qPCR, fluorescent dyes specific to the target sequence are used to label targeted PCR products during thermal cycling. The accumulation of fluorescent signals during this reaction is measured for fast and objective data analysis. The primers used in this process are specific to a part of mitochondrial DNA only found in each individual species. Separate primers are used for each of the species, ensuring no DNA from any other species present in the water is amplified. If target species DNA is present, the DNA is amplified up to a detectable level, resulting in positive species detection. If target DNA is not present then amplification does not occur, and a negative result is recorded.

Analysis of eDNA requires scrupulous attention to detail to prevent the risk of false positive and false negative results. True positive controls, negative controls, and spiked synthetic DNA are included in every analysis and these have to be correct before any result is declared. Stages of the analysis are also conducted in different buildings at our premises for added security. SureScreen Scientifics Ltd is ISO9001 accredited and participates in Natural England's proficiency testing scheme for GCN eDNA testing."

Appendix 10

Sample collection diary

Date	Activity	Location	No. samples	Air temp (°C)	Precipitation	Notes on conditions
08/10/2025	eDNA sampling	New Water	10	11	None	Fine, dry, mild. No recent heavy rain
10/10/2025	eDNA sampling	Gelt and Old Water	5	12	None	Fine, dry, mild. No recent heavy rain
16/10/2025	eDNA sampling	New Water and Old Water	4	9	None	Fine, dry, mild. No recent heavy rain
20/10/2025	eDNA sampling	Old Water	3	10	None	Fine, dry, mild. No recent heavy rain
21/10/2025	eDNA sampling	Croglin Water	2	11	Light rain	Heavy rain earlier in day and overnight, noted flow fast
22/10/2025	eDNA sampling	Ran Beck	4	11	None	Fine, dry, mild. Heavy rain previous day but flow slow/levels not high
24/10/2025	eDNA sampling	Raven Beck and Loo Gill	5	9	None	Fine, dry, mild. No recent heavy rain
27/10/2025	eDNA sampling	Croglin Water	3	9	None	Fine, dry, mild. No recent heavy rain
05/11/2025	eDNA sampling cancelled at Gelt - weather					Heavy rain 2-3/11, localised flooding, yellow weather warning
06/11/2025	eDNA sampling	Belah	3	12	None	Fine, dry, mild. Heavy rain earlier in week but flow slow/levels not high
07/11/2025	eDNA sampling	Ardale	4	12	None	Fine, dry, mild. Heavy rain earlier in week but flow slow/levels not high
08/11/2025	eDNA sampling	Hilton/Hayber and Crowdundle	12	11	Light rain AM	Light rain settled then fine, dry, mild. Hilton/Hayber flow slow/levels not high. Crowdundle fast flow.
09/11/2025	eDNA sampling	Gelt	3	10	None	Fine, dry, mild but heavy rain earlier in day. Flow fast but levels not high
10/11/2025	eDNA sampling	Belah	5	10	None	Fine, dry, mild. Heavy rain earlier in week. Flow fast but levels not high
11/11/2025	eDNA sampling	Swindale	7	11	Light rain AM	Light rain settled then intermittent drizzle, mild. Flow fast but levels not high
13/11/2025	eDNA sampling cancelled at Croglin and Melmerby - weather					Heavy rain 12-13/11, localised flooding, yellow weather warning
14/11/2025	eDNA sampling cancelled at Swindale - weather	Melmerby	1	6	Drizzle	Windy but mild, day after heavy rain so only one downstream sample taken. Flow fast but levels not high - receeded after previous day.
16/11/2025	eDNA sampling	Melmerby	4	6	None	Cooler but fine and dry. Overnight temperatures did not drop below zero. Beck level and flow returned to normal from 3 days previous.
03/03/2026	eDNA sampling	Swindale	5	10	None	Fine, dry, mild. No recent heavy rain
04/03/2026	eDNA sampling	Croglin and Ardale	3	12	None	Fine, dry, mild. No recent heavy rain
06/03/2026	eDNA sampling	Melmerby and Rake	5	6	None	Fine, dry, frost first thing, quickly warming up. No recent heavy rain
09/03/2026	eDNA sampling	Swindale and Tarn Gill	6	8	None	Fog, dry. No recent heavy rain
10/03/2026	eDNA sampling	Ardale	1	8	None	Fine, dry, mild. No recent heavy rain
11/03/2026	eDNA sampling	Gelt, Mill Beck, Hare Beck	4	8	None	Fine, dry, mild. No recent heavy rain

Appendix 11

Mean temperature data from the Met Office. Available at https://www.metoffice.gov.uk/blog/2025/the-met-office-year-in-weather-2025 Accessed 06/02/2026

Provisional October 2025 stats	Mean temp (°C)		Rainfall (mm/%)		Sunshine (hours/ %)	
	Actual	91/20 anom	Actual	91/20 anom	Actual	91/20 anom
UK	10.4	0.7	121.2	99	63.3	69
England	11.2	0.6	81.0	90	72.2	70

Provisional November 2025 stats	Mean temp (°C)		Rainfall (mm/%)		Sunshine (hours/ %)	
	Actual	91/20 anom	Actual	91/20 anom	Actual	91/20 anom
UK	7.2	0.7	162.1	131	60.6	105
England	8.2	1.1	137.5	149	70.5	109

Project supported by a grant from the Farming in Protected Landscapes Fund
administered by the North Pennines National Landscape

Department for Environment Food & Rural Affairs

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March 2026