

Our ref: CRS 732,621  
Your ref: 20160106

Second Floor  
Woodlands  
Manton Lane  
Bedford MK41 7LW

Brandon Lewis MP  
Constituency Office  
20 Church Plain  
Great Yarmouth  
Norfolk  
NR30 1NE

Direct Line: 01234 796287

18 January 2016

Dear Mr Lewis

Thank you for your email of 6 January to my colleague [REDACTED] on behalf of your constituent, [REDACTED] regarding the close proximity of the dykes to the side of the A47 Acle Straight.

We are conscious of the fact that these dykes could pose a hazard should vehicles leave the road, but their close proximity to the road makes it impracticable to erect safety barriers.

We are investigating whether it would be possible to move the dykes further from the road but there are environmental constraints that need to be overcome first. The dykes are known to be home to the Lesser Whirlpool Ramshorn Snail which is a species that is protected by UK and European legislation.

To establish if the dykes can be relocated away from the carriageway without affecting the survival of the Lesser Whirlpool Ramshorn Snail, we are planning a trial survey of the ditches to determine where exactly the snails are present and to establish the type of habitat that they prefer.

We are seeking Natural England's consent to carry out the trial and, if this is given, we will relocate the snails to a similar habitat during the summer. The trial is likely to take approximately four years to complete as it will be necessary to monitor the snails to ensure they have adapted to their new surroundings and that the population is stable. I am afraid it will not therefore be possible to relocate the dykes before this trial has been completed.

If [REDACTED] would like more information about the trial, he is welcome to contact our asset manager, [REDACTED] can be contacted at the above address, by telephone on [REDACTED] or by email at [REDACTED]

In the meantime, we do have plans to carry out other minor improvements along the Acle Straight, including:

- improvements to traffic signs, road markings and kerb realignment at the A47/A1064 roundabout
- improvements to warning signs, road markings and hazard posts at farm accesses in the vicinity of Werryman's Way; and

- Improvements to advance direction and warning signs at the Halvergate junction

We expect to complete the first two of these improvements by the end of the financial year with the third, at Halvergate, in the spring.

If [REDACTED] would like more information about these improvements, he is welcome to contact our project sponsor, [REDACTED]. [REDACTED] can also be contacted at the above address, by telephone on [REDACTED] or by email at [REDACTED]

Yours sincerely

[REDACTED]  
Catherine Brookes  
Regional Director  
Network Delivery and Development (East)  
Email: [catherine.brookes@highwaysengland.co.uk](mailto:catherine.brookes@highwaysengland.co.uk)

CRs 732, 621  
Reply due 27.1.16.

[REDACTED]  
**From:** [REDACTED]  
**Sent:** 07 January 2016 11:58  
**To:** [REDACTED]  
**Subject:** RE: 20160106-Acle Straight A47 Drainage Ditches-U

Dear [REDACTED]

Thank you for your enquiry regarding the A47 Acle Straight. We will investigate concerns and send Brandon Lewis a full reply shortly. [REDACTED]

Regards

[REDACTED]  
Highways England | Woodlands | Manton Lane | Bedford | MK41 7LW  
**Tel:** +44 (0) [REDACTED]  
**Web:** <http://www.highways.gov.uk>  
**GTN:** [REDACTED]

**From:** [REDACTED] [mailto:[REDACTED]]  
**Sent:** 06 January 2016 17:23  
**To:** [REDACTED]  
**Subject:** 20160106-Acle Straight A47 Drainage Ditches-U

FAO HIGHWAYS ENGLAND

Good afternoon [REDACTED]

I hope you don't mind me emailing you direct. Mr Brandon Lewis MP for Great Yarmouth Norfolk has recently been contacted by [REDACTED] of [REDACTED] regarding drainage ditches on the A47.

[REDACTED] is concerned at the close proximity of ditches to the A47 Acle Straight and wonders if part of the safety measures which are being introduced to the Acle Straight involve either moving the ditches or placing safety barriers to stop cars from entering the ditches.

Thank you in advance for your help and support in relation to this matter.

Yours sincerely

[REDACTED]  
[REDACTED]  
Constituency Support Officer

Office of Brandon Lewis MP  
Member of Parliament for Great Yarmouth  
20 Church Plain  
Great Yarmouth  
Norfolk  
NR30 1NE

Tel: 01493 854550

Our ref: CRS 734,830  
Your ref:

Brandon Lewis MP  
House of Commons  
LONDON  
SW1A 0AA

Second Floor  
Woodlands  
Manton Lane  
Bedford MK41 7LW

Direct Line: 0300 470 4776

7<sup>th</sup> March 2016

Dear Mr Lewis

Thank you for your letter of 15 February in response to mine of 18 January about the close proximity of the dykes adjacent to the A47 Acle Straight. I acknowledge your frustration that we are not able to carry out work to move the dykes further away from the road sooner.

Whilst we take the safety of all road users very seriously, we, like any other organisation, are required to abide by the law. Regardless of the fact that the dykes are man-made, they have become the habitat of the Little Whirlpool Ramshorn Snail. In the UK, this species is known only to inhabit this site and one in Surrey and they are protected under both UK and European legislation.

I am sorry that we cannot speed up the relocation process. As a protected species, and assuming we acquire Natural England's consent to carry out a relocation trial, they will need careful monitoring over this period to ensure that they have adapted to their new surroundings and that the population is stable before we can carry out any work to permanently relocate the dykes.

Whilst I recognise yours and your constituents' fears about the close proximity of the dykes to the carriageway, the vast majority of personal injury collisions that occur along the Acle Straight are due to tail end collisions or inappropriate overtaking and I set out details of other planned minor improvements in my earlier letter.

I realise my reply will disappoint you but I hope you will accept that we must adhere to UK and European legislation in this matter. I have written in similar terms to Keith Simpson, Member of Parliament for Broadlands.

Yours sincerely



Catherine Brookes  
Regional Director  
Network Delivery and Development (East)  
Email: catherine.brookes@highwaysengland.co.uk

Our ref: CRS 734,830  
Your ref:

Keith Simpson MP  
House of Commons  
LONDON  
SW1A 0AA

Second Floor  
Woodlands  
Manton Lane  
Bedford MK41 7LW

Direct Line: 0300 470 4776

7<sup>th</sup> March 2016

Dear Mr Simpson

Thank you for your letter of 15 February in response to mine of 18 January about the close proximity of the dykes adjacent to the A47 Acle Straight. I acknowledge your frustration that we are not able to carry out work to move the dykes further away from the road sooner.

Whilst we take the safety of all road users very seriously, we, like any other organisation, are required to abide by the law. Regardless of the fact that the dykes are man-made, they have become the habitat of the Little Whirlpool Ramshorn Snail. In the UK, this species is known only to inhabit this site and one in Surrey and they are protected under both UK and European legislation.

I am sorry that we cannot speed up the relocation process. As a protected species, and assuming we acquire Natural England's consent to carry out a relocation trial, they will need careful monitoring over this period to ensure that they have adapted to their new surroundings and that the population is stable before we can carry out any work to permanently relocate the dykes.

Whilst I recognise yours and your constituents' fears about the close proximity of the dykes to the carriageway, the vast majority of personal injury collisions that occur along the Acle Straight are due to tail end collisions or inappropriate overtaking and I set out details of other planned minor improvements in my earlier letter.

I realise my reply will disappoint you but I hope you will accept that we must adhere to UK and European legislation in this matter. I have written in similar terms to Brandon Lewis, Member of Parliament for Great Yarmouth.

Yours sincerely



Catherine Brookes  
Regional Director  
Network Delivery and Development (East)  
Email: catherine.brookes@highwaysengland.co.uk

734, 830  
10/3/16



HOUSE OF COMMONS

LONDON SW1A 0AA

Tel: 020 7219 7231

Email: [brandon.lewis.mp@parliament.uk](mailto:brandon.lewis.mp@parliament.uk)

Catherine Brookes  
Regional Director, Network Delivery and Development (East)  
Highways England  
Second Floor  
Manton Lane  
Bedford  
MK41 7LW

15 February 2016

Dear Ms Brookes

We write further to your letter of 18 January, reference CRS 732 621, regarding the close proximity of the dykes to the side of the A47 Acle Straight.

You state in your letter that you are investigating whether it is possible to move the dykes further from the road, but that you first need to carry out an environmental study on the effects that such a move would have on the Lesser Whirlpool Ramshorn Snail, which will take approximately four years to complete.

The land and dykes around the Acle Straight are man-made, owing to the pumps that regulate the ditches at the sides of these roads, therefore this is not a 'natural' habitat for these snails. More than that, it seems ludicrous that the presence of these snails will lead to a four year delay in relocating the dykes, which are a terrible hazard when road users are involved in an accident that causes their vehicle to leave the highway. The position of the dykes means that cars leaving the road career straight into the dykes as there is no safe area between the road and these bodies of water, which tragically often results in loss of life by drowning, something that can easily be prevented by the relocation of the dykes.

[REDACTED]

---

**From:** [REDACTED]  
**Sent:** 06 September 2015 23:05  
**To:** [REDACTED]  
**Cc:** [REDACTED]  
**Subject:** LWRS UPDATE MEETING AGENDA & ATTENDEES  
**Attachments:** LWRS\_UPDATE MEETING\_contacts\_FOR ISSUE (1).pdf; Meeting Agenda\_v1.docx

Please find attached:

1. a list of confirmed attendees and list of confirmed attendees with attended who haven't responded.
2. An Agenda

Kind regards

[REDACTED]  
[REDACTED]  
Associate Director - Ecology  
Environment & Ground Engineering

[REDACTED]  
AECOM  
8th Floor, The Clarence West Building, 2 Clarence Street West, Belfast, BT2 7GP  
T +44 (0)28 9060 7200 F +44 (0)28 9060 7399  
[www.aecom.com](http://www.aecom.com)

*To download the AECOM Ecology Survey Calendar please [Click Here](#)*

*AECOM and URS have joined together as one company. [Learn more](#)*

---

This email has been scanned by the Symantec Email Security.cloud service.  
For more information please visit <http://www.symanteccloud.com>

---

# Translocation Methods for *Anisus vorticulus*

At



**Carried out for:**

AECOM and Highways England

**Prepared by:**

**Abrehart Ecology**

Pound Farm

Low Road

Great Glemham

Suffolk IP17 2DQ

Tel: 01728 663282 - 07798 941555



Website: [abrehartecology.com](http://abrehartecology.com)





---

## Contents

Hypothesis .....	2
Introduction.....	2
Methods.....	2
Sampling regime 1:.....	2
Sampling regime 2:.....	3
Translocation: .....	3
Data collection:.....	4
Future surveying schedule: .....	4
Abrehart Ecology – Innovation in the project.....	5
GIS.....	5
dGPS .....	5
Statistics.....	5
Botanical studies .....	6
Environmental variables:.....	6
Water quality sampling: .....	6
References: .....	7

## Hypothesis

Can *Anisus vorticulus* be successfully translocated from one marsh system to another and survive in the long term?

## Introduction

The premise of this initial proposal is to move three separate populations of *A. vorticulus* from three dykes in [REDACTED]. Here we will attempt to establish four new populations in dykes where no *A. vorticulus* are present. The new sites are within a different drainage system and this initial test will be to see if they can be moved a short distance and survive and breed.

In 2015 the donor and receptor sites were chosen following extensive surveys across a wide area of [REDACTED]. This demonstrates the effort involved to find suitable donor and receptor sites close together.

## Methods

Initially there will be a test sampling of both donor and receptor sites, under licence [REDACTED], this will be to ensure that both the donor site still holds a high density of animals to translocate and the that receptor sites still have no *A. vorticulus*. These samples will be collected and a full invertebrate assessment of the samples and water chemistry analysis of each sample site will be carried out. The samples will be collected by standard sweep netting. Multi-variate analyses will then be carried out on these data sets.

Once these sites are found to be still suitable the new quantifiable sampling regime will be trialed before the translocation.

3	3	3	3
3	3	3	3

**Fig. 1: Grid pattern for sampling. Each square represents a 1m<sup>2</sup> sampling area. During translocations, animals will be placed into the donor ditch in a 1m x 2m area (indicated in green), with the surrounding grid squares acting as a buffer zone (indicated in blue). The buffer squares will be sampled after the translocation, to determine the rate of spread of *A. vorticulus* throughout the ditch.**

### Sampling regime 1:

No consistent sampling strategy has yet been devised for *A. vorticulus*. This method detailed below will initially be tested on known populations close to donor sites, to determine whether *A. vorticulus* can be sampled in this way. If effective the method will be applied to all donor (3), receptor (4), and control (4) sites.

Samples will be collected using a 15cm diameter core, which will be pushed through the water column onto the substrate; sampling throughout the water column accounts for some disagreement as to the preferred depth for colonization by *A. vorticulus* (reviewed by Terrier 2006). Three samples will be taken from the centre of each of eight 1m<sup>2</sup> grid squares in a particular ditch (Fig. 1). For each separate grid square the three samples will be combined and passed through a 1mm mesh sieve. Molluscs and other invertebrates will be retained

in the sieve, while other residue (vegetation and larger debris) will be retained separately. The sample from the sieve will be placed into a white grid-lined tray for identification. All samples will be identified to species level in the field where possible – where this is not possible, samples will be identified to genus. This will allow the overall mollusc community

at each site to be quantified, as well as the target species *A. Vorticulus*. Additional botanical and abiotic data will be recorded at each sub-sample.

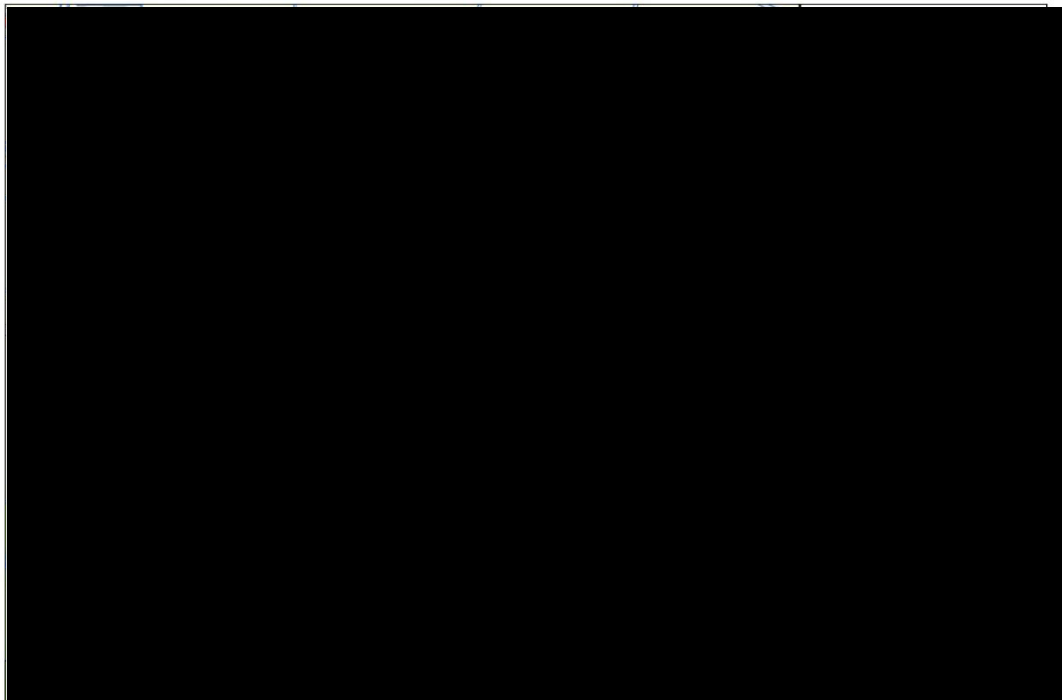
### Sampling regime 2:

Should the method of taking core samples (described above) prove unviable, a simplified sweep netting method will be used. Within each of eight 1m<sup>2</sup> grid squares (Fig. 1) a sweep net will be pushed slowly through the water column to collect the sample. Vigorous movement of the net will be avoided, to retain the integrity of the community composition in each grid square as much as possible. The material collected this way will be approximately equivalent to three core samples, but may be moderately more disruptive to the habitat.

Whichever sampling method is used, all animals and material will be returned to the sample location to limit any long term impacts on the populations. Identifying samples in the field eliminates the requirement for removal of animals from the sampling site; however, this means that surveying will need to be conducted or supervised by a mollusc expert. In the case of this study, the Lead Surveyor will be [REDACTED] (FLS for taxonomy).

### Translocation:

The translocation should be carried out in May, when the population of adults will be at their highest density (Glöer & Groh 2007), and at least 7 days after the full baseline survey has been carried out at all sites. This will allow any disturbance created by the initial survey to settle down before the animals are moved.



**Fig. 2: Recommended use of ditches in Areas 1-3 in a potential future conservation translocation. Donor ditches are shown in pink (132, 129, 130 and 189) in figure 1, receptor ditches shown in green (141, 150 and 138).**

For the translocation 450 *A. vorticulus* will be removed from each donor ditch and placed into receptor ditches (Fig. 2). Animals will be collected using a standard sweep netting technique, which collects a large number of animals at once (in 2015 all donor ditches produced >100 animals in a single sweep). The animals will be picked out and placed in a sample bucket holding water from the receptor site. The animals collected will be classed by size and a range of ages stages will be collected for the translocation, adults will be divided into small adults (2.5–3.0 mm) and large adults (> 3.0 mm) and juveniles less than < 2 mm. All animals will be moved on the day of collection, and placed into receptor ditches in a grid pattern within a 2m x 1m area (every 50cm into the water body and along the width of the area; Fig. 1). Approximately 30 animals will be placed at each of the 15 sub-site locations.

At each of three receptor site a single population from one of the three donor sites will be translocated. At the fourth receptor site a mixed population from all three donor sites will be introduced. This should ensure genetic uniformity within three of the new populations, with one additional colony of mixed genetic diversity.

## Data collection:

In addition to surveys of the flora and fauna, a full suite of 54 abiotic variables will be measured at each donor, receptor, and control site throughout the survey (see Appendix I for a full list).

Consistency in data collection is of the highest importance, and therefore the ability to return to the precise sample sites for future monitoring is a priority. Due to the site being cattle grazed, placing posts or canes at each site has been ruled out as markers as they will undoubtedly be moved by the cattle coming to the dyke to drink. However, the use of dGPS will allow a return to within a few centimetres of each translocated population. All data gathered on the site will be input into our specially designed Access database, allowing ease of access to the data for multi-variate studies into the future. The movement of other wildlife in the dykes will not be possible to control (Mute swans, water voles and Chinese water deer etc.) though their interactions with the new populations may move them across the survey area. This possibility will be considered in future multi-variate analyses.

## Future surveying schedule:

This project is expected to run for up to 20 years, and as such a survey schedule is being compiled. Initially the re-surveying of the donor, receptor and control sites will be carried out six months after the translocation in October. After this an annual survey will be carried out on all 11 sites, initially for five years.

To be able to monitor population trends and to re-inforce the sampling in October 2016 (and each year after), monthly population assessments of the donor sites will be carried out, sampling and identifying to be completed in the field.

After this translocation has been carried out a wider scale scoping survey will be carried across larger areas of the Broads. This will be undertaken following meetings with stakeholders who may have suitable land on their sites for *A. vorticulus* (RSPB, Broads Authority). We will also be looking at sites where populations are known to have become extinct and the habitat has since recovered. These sites may be too locally isolated from other *A. vorticulus* populations to be naturally re-populated, but may be suitable for future translocation work. It is hoped that if this project is successful there is the potential to move animals from dykes being cleared under CL14 licenses into some of these sites to re-boost the population across the Broads. This is a way off, but worth considering for the future as a way to expand populations back into lost sites, using animals that would otherwise have been killed during the dredging process.

---

## Abrehart Ecology – Innovation in the project

### GIS

With field based mapping the building and analysing of terrain surfaces and approaches to identifying patterns within the landscape are important aspects we aim to capture. Recent availability of EA LiDAR data has helped here. Deriving density surfaces can help show the density of objects/features within a landscape as well as distance-based surfaces showing the distance to and relationships between various features. We are currently using this process on a coastal site in Suffolk.

### dGPS

We always use an Archer 2 Handheld Portable Computer dGPS to record all locations, quadrats and additional plant/sample site and all other point information. These units were installed with EZTag software which enables on site differential GNSS data collection suitable for post-processing.

All sub-sample sites and additional plant species records are assigned auto numbered record IDs on the EZtag software to allow cross referencing of the GNSS information with the survey data. To this point in the recording process, all location data is recorded to an accuracy of 2-4m (depending on the availability of satellites).

All data is collected using the mapping system Geo WGS84. Shapefiles of the survey data are exported by EZSurv and projected in Geographic Information System (GIS) to allow presentation of the data. This has been used recently on a Natural England project on the Essex Estuaries where a detailed comparison with 2002 data sets was required to assess the condition of the saltmarshes in Essex. The use of sub-meter GPS records will allow future small scale changes in community structure to be assessed in much greater detail than has been possible in the past.

### Statistics

The Abrehart Ecology team includes the senior statistician, [REDACTED] (Hertfordshire). [REDACTED] has been involved in the statistical assessment of biological and physico-chemical data sets for over 25 years and has developed and adapted numerous techniques to improve and enhance the detection of change in the natural environment. [REDACTED] has recently been awarded the prestigious UK Points of Light award, presented by former US President Jimmy Carter and International Development Minister, Nick Hurd, for her work on the statistical analyses of the epidemiology of schistosomiasis (collaborative work with Schistosomiasis Control Initiative (SCI)).

Of particular relevance to the present project is the multivariate correlation ARESC analysis (methods developed by Dr. Calvo-Urbano; see Trett et al., 2000; Trett et al., 2008, and Trett et al., 2009). This will identify and rank the statistical significance and strengths of associations of the measured environmental parameters with the structures of the faunal and/or floral communities. By doing so, ARESC identifies the key natural and/or anthropogenic factors that determine the structure of the communities and the distribution of species. It has been proposed that the data are examined using a combination of two, fundamentally different multivariate community analytical techniques. These pattern-seeking methods will comprise classification analyses and non-metric, multi-dimensional scaling (NMMDS) ordination techniques. Critically, these techniques enable sites with structurally-related communities, arising from similar prevailing environmental/habitat conditions, to be identified and mapped. For each of the clusters of communities identified by these analyses, indicator analyses will enable the statistical associations between the distributions of the species amongst the clusters to be determined. These, along with the clusters of communities can be mapped to identify key habitats and those of particular conservation interest.

Other statistical techniques available for use in the *A. vorticulus* monitoring project include spatial and temporal autocorrelation analyses and circular statistics (addressing stack and flow current dispersals).

## Botanical studies

Abrehart Ecology specialise in botanical/NVC studies. As part of the monitoring of the sample sites we believe it is vital that a good level of botanical assessment is undertaken. Emergent, peripheral and bankside vegetation comprises an important aspect of the dyke ecosystem as well as representing the interface between the marginal/aquatic habitats and the adjacent terrestrial habitats. This overview will be recorded at each main site with additional records at each translocation sub-sample site and at each future sampling site for baseline information.

It is proposed that the following information is recorded at each sampling site as standard.

- Longitude and latitude of the sample locations; accurate to 10cm post processed (see dGPS data for details of sub-meter GPS recording)
- Vegetation community information – simple visual estimates of the plant community
- General habitat description – relative species composition, patterns in species distribution and description of any notable features of the section
- The abundance of species of interest recorded on a DAFOR scale

Particular attention will be paid to recording the all other notable species seen during site visits including any invasive species.

## Environmental variables:

At least 54 environmental variables will be measured at each sample location (see attached data form).

## Water quality sampling:

A suite of parameters will be assessed at each of the donor, receptor and control sites, including:

Calcium, Filtered as Ca	Nitrite as N
pH	Phosphates , Total as P
Conductivity- Electrical 20C	Total Suspended Solids
Total Hardness as CaCO <sub>3</sub>	BOD + ATU (5 day)
Ammoniacal Nitrogen as N	COD (Total)
Nitrate as N	TOC (Filtered)
Dissolved oxygen	Water temperature
Water colour	

A record of the depth of silt (50% silt : 50% water) using a weighted probe, the depth of silt to the bottom of the dyke and the water depth to the silts will also be recorded.

## References:

- Glöer & Groh (2007) A contribution to the biology and ecology of the threatened species *Anisus vorticulus* (Troschel, 1834) (Gastropoda: Pulmonata: Planorbidae), *Mollusca* 25:33-40
- Terrier et al. (2006) Species account for *Anisus vorticulus* (Troschel, 1834) (Gastropoda: Planorbidae), a species listed in Annexes II and IV of the Habitats Directive, *Journal of Conchology* 39
- Trett, M.W., Calvo Urbano, B., Forster, S.J., Hutchinson, J.D., Trett, S., Feil, R.L. and Best, J.G. (2000). The use of meiofauna in contaminated land assessment. *Environmental Science and Technology*, **34**: 1594 – 1602
- Trett, M.W., Calvo Urbano, B. and Thurgood, R. (2008). Assessment and monitoring of actual ecological effects; nematodes in the service of industry and regulators. In Proceedings of the 10th. International UFZ-Deltares-TNO Conference on Soil-Water Systems (CONSOIL 2008). Milan, June 2008: 82-91
- Trett, M.W., Calvo Urbano, B., Forster, S.J. and Trett, S.P. (2009). Chapter 12: Commercial aspects of the use of nematodes as bioindicators. In *Nematodes as Environmental Indicators*. Eds. Wilson, M.J. and Kakouli-Douarte, T. CAB International; Wallingford (UK) and Cambridge USA)

[REDACTED]

---

**From:** [REDACTED]  
**Sent:** 07 September 2015 22:59  
**To:** [REDACTED]  
**Cc:** [REDACTED]  
**Subject:** PPT - FINAL VERSION  
**Attachments:** LWRS\_UPDATE\_V5.pptx

Final version of ppt attached.

[REDACTED]

[REDACTED]

Associate Director - Ecology  
Environment & Ground Engineering

[REDACTED]

**AECOM**  
9th Floor, The Clarence West Building, 2 Clarence Street West, Belfast, BT2 7GP  
T +44 (0)28 9060 7200 F +44 (0)28 9060 7399  
[www.aecom.com](http://www.aecom.com)

*To download the AECOM Ecology Survey Calendar please [Click Here](#)*

*AECOM and URS have joined together as one company. [Learn more](#)*

---

This email has been scanned by the Symantec Email Security.cloud service.  
For more information please visit <http://www.symanteccloud.com>

---



[REDACTED]

---

**From:** [REDACTED]  
**Sent:** 22 December 2015 12:40  
**To:** [REDACTED]  
**Cc:** [REDACTED]  
**Subject:** RE: Detailed Site Survey Report Submission

Hello [REDACTED]

Thanks for the email.

The report has highlighted that from the surveys conducted this summer there is an opportunity for conducting a small scale translocation (subject to a licence from Natural England).

The window of opportunity for conducting this would be until the breeding season commences in March. Conducting a translocation before March, would mean that we are moving adult snails rather than the juveniles which are present during the late summer. I think we have a good case for conducting the translocation on this small sample, but this would need to be agreed with Natural England. The land owners are happy to accept the translocation and modify their management strategies, which will involve a little negotiation on their behalf with HLS etc., which we have already looked into the mechanism of this.

In our sites this summer, we found more donor sites than we were expecting but found less suitable receptor sites, than we anticipated. Ideally, this summer we would look for additional sites, that could act as additional receptor sites. From the steering group meeting, a number of the participants indicated that they had potential receptor sites and we could look for some others [REDACTED] these should be investigated to identify additional sites in terms of:

- Existing snail assemblage;
- Existing vegetation;
- Existing management; and
- Management restrictions (which require a bit of negotiation)

The proposed translocation will be dependent on a Natural England European Protected Species licence application, which is a reasonably large document but will set us in good stead for any future translocations; if we find additional sites.

Early January, we hope to submit:

1. A fee for the translocation – which will involve the licence application with ecologist's statement, a check of the donor and receptor sites, modification of existing management agreements and the translocation.
2. A fee for an additional scoping study for additional sites, for which we can then propose additional survey next summer.
3. A fee for a suite of multivariate analyses on our existing data. We collected a large amount of data which, as discussed at the steering group meeting a statistical study would benefit the study as it would provide an additional level of understanding of the species.

Please do not hesitate to contact me if you have any queries.  
Kind regards

[REDACTED]

From: [REDACTED]  
Sent: 15 December 2015 11:36  
To: [REDACTED]  
Cc: [REDACTED]  
Subject: RE: Detailed Site Survey Report Submission

[REDACTED]  
[REDACTED] has reviewed the report and has no comments. What are the next steps? Do we now have to wait until late summer 2016 to carry out the trial relocation?

Regards

[REDACTED]  
[REDACTED]  
[REDACTED]  
Web: <http://www.highways.gov.uk>

---

From: [REDACTED]  
Sent: 12 November 2015 17:40  
To: [REDACTED]  
Cc: [REDACTED]  
Subject: FW: Detailed Site Survey Report Submission  
Importance: High

[REDACTED]  
Please find attached the draft version of the little whirlpool ramshorn snail detailed survey.

The report details the surveys that were completed in September and for which we gave an overview of the results at the steering meeting.

#### Summary

We found more ditches than we were expecting already containing little whirlpool ramshorn snail, but less ditches than we anticipated being suitable receptor ditches - just 3 No. were considered appropriate receptor sites with appropriate management / environmental conditions.

The report proposes a small scale translocation under licence to those ditches – subject to agreement with Natural England. We have been negotiating with the landowner in relation to future management and all appears in order to proceed on that front.

This is a very small scale translocation however, and we should be investigating other areas too, to insure a robust experimental translocation, more information on this in the report.

As per below I would like to issue the draft to Natural England to get their comment not least because ultimately they'll be the ones to allow the experiment to go ahead (even in a small scale) and it's important to keep them in the loop.

Kind regards  
[REDACTED]

From: [REDACTED]  
Sent: 10 November 2015 18:06  
To: [REDACTED]  
Cc: [REDACTED]  
Subject: RE: Detailed Site Survey Report Submission

[REDACTED]  
Please find attached the Detailed Survey Report for the little whirlpool ramshorn snail project.

As always, issued as a draft for yours and HE's comments.  
If you are okay – I would like to issue to Natural England too.

A small amount of tidying to do before final issue, and full sign off through the verification process needed – but it brings us to an exciting cross roads.

[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]  
[REDACTED]

**AECOM**  
[REDACTED]  
2 Clarence Street West  
Belfast, Northern Ireland  
[REDACTED]  
[aecom.com](http://aecom.com)

**Built to deliver a better world**  
[LinkedIn](#) [Twitter](#) [Facebook](#) [Instagram](#)

To download the AECOM Ecology Survey Calendar please [Click Here](#)

---

This email has been scanned by the Symantec Email Security.cloud service.  
For more information please visit <http://www.symanteccloud.com>

---

\*\*\*\*\*  
**Highways England Company Limited | Registered Office: Bridge House, 1 Walnut Tree Close, Guildford GU1 4LZ | Registered in England and Wales No. 9346363**  
\*\*\*\*\*

---

**This email has been scanned by the Symantec Email Security.cloud service.  
For more information please visit <http://www.symanteccloud.com>**

---

[REDACTED]

---

**From:** [REDACTED]  
**Sent:** 06 September 2016 16:33  
**To:** [REDACTED]  
**Cc:** [REDACTED]  
**Subject:** RE: A47 Acle Straight - trial snail translocation

[REDACTED]

Many apologies for not replying sooner. I have been in and out of the office, the last couple of weeks.

We are making good progress on the current phase of the work and we have identified the next steps of works for the next phase – which we need to discuss and agree. I have summarised the current phase and the next phase below.

**Current phase progress:**

1. **Snail translocation:** The translocation was completed as previously advised, the report is drafted and I am expecting it for review and subsequent issue to you this week.
2. **Multivariate Analysis:** A host of multivariate analyses have been completed. As is the nature of this kind of work, each iteration sends the statistic guys on another line of investigation. The analyses have produced some interesting results as well as confirmation of some others. The results are being used to inform the continued assessment (see below). The team have produced a report. I have reviewed it and we are making amendments. The team are working together to get this completed.
3. **The scoping study for the next phase:** The search for potential translocation sites has been started and is nearing completion. [REDACTED] has been using historical data sets, the results of the multivariate analyses and speaking to landowners to identify a suite of potential sites for detailed survey. This is well underway but there is still some work required to complete this.

**The next steps for which I am currently drawing up a proposal:**

1. The translocation licence from Natural England requires us to conduct the first monitoring exercise of the translocation sites. This is to check the donor sites are okay and that snail removal has not been detrimental to the population, and additionally to check the receptor sites as to whether the translocation in the very short term has been successful.  
Duration: three – four days to visit all the translocation sites to be done in October (This is five-six months post translocation which was done in April / May).
2. Detailed survey of the scoped in sites (from Number 3 in the list above) to find additional Translocation sites; repeating the detailed survey method from last year on the new sites. This is proving difficult to cost as this feeds from work which is still being completed.  
Duration: This needs to be completed in the available survey season and needs to be completed in September / October.

3. Steering group meeting. As suggested in last year's meeting (9 September 2015), we should hold an additional meeting in 2016. This will update the stakeholders in the work conducted since the last meeting. Holding the meeting in November, will allow for the first round of monitoring to be completed and reported on, multivariate analyses to be presented and the stakeholders to input and provide feedback .  
Duration : half day. Location: Natural England, Dragonfly House, Norwich.

I was hoping to get all the deliverables from the current phase issued, before I presented the proposal for the next phase, but time is ticking on and we are nearing the end of the current season. Whilst one can conduct the detailed snail surveys through the year in discussions with Natural England, it is more meaningful to conduct them in a similar time frame to last year (for continuity of the botanical growing season). Last year we conducted the detailed surveys in August / September so we don't want to leave it too late this year.

In relation to the steering group meeting, we did discuss holding it earlier but Natural England have suggested that we wait to get the translocation monitoring results, furthermore a number of people were unable to attend in September as they were away on holiday. In order to give enough notice we would like to send out invites soon. Is November a good time for you?

I'll get the translocation report issued as soon as possible and provide a proposal for the next phase once all the time inputs have been agreed. I have prepared the required text and this is ready for your review.

Please give me a call if you would like to discuss any of this.

Kind regards

From: [REDACTED]  
Sent: 25 August 2016 16:02  
To: [REDACTED]  
Cc: [REDACTED]  
Subject: A47 Acle Straight - trial snail translocation

[REDACTED]

How's the report on the translocation progressing?

Regards

[REDACTED]

[REDACTED]

Highways England | Woodlands | Manton Lane | Bedford | MK41 7LW  
Tel: [REDACTED] | Mobile: +[REDACTED]  
Web: <http://www.highways.gov.uk>  
GTN: [REDACTED]

*This email may contain information which is confidential and is intended only for use of the recipient/s named above. If you are not an intended recipient, you are hereby notified that any copying, distribution, disclosure, reliance upon or other use of the contents of this email is strictly prohibited. If you have received this email in error, please notify the sender and destroy it.*

**Highways England Company Limited | General enquiries: 0300 123 5000 | National Traffic Operations Centre, 3 Ridgeway, Quinton Business Park, Birmingham B32 1AF | <https://www.gov.uk/government/organisations/highways-england> | [info@highwaysengland.co.uk](mailto:info@highwaysengland.co.uk)**

**Registered in England and Wales no 9346363 | Registered Office: Bridge House, 1 Walnut Tree Close, Guildford, Surrey GU1 4LZ**

Consider the environment. Please don't print this e-mail unless you really need to.

[REDACTED]

---

**From:** [REDACTED]  
**Sent:** 24 May 2016 15:07  
**To:** [REDACTED]  
**Cc:** [REDACTED]  
**Subject:** RE: A47 Acle Straight - Little whirlpool ramshorn snail translocation

[REDACTED]  
I was just about to send you an update – so your email was perfectly timed.

To answer your question straight away - The licence allows the translocation to be conducted up until the end of May, so the actual movement of snails is imminent – you will remember that before the snails could be moved, we had to recheck the donor site (to make sure they were there) and recheck the receptor sites (to make sure they weren't there) before we could proceed – this has all been completed and all is going to plan.

I summarise the work conducted to date (as of 20/05/2016):

- Secured the Licence from Natural England to carry out the translocation (NE were super-efficient);
- Are in conversation with [REDACTED] about how this will affect ditch management and discussing the derogation options – they seem to be very accommodating;
- Been talking to [REDACTED] (Natural England HLS) about changing the derogation in the HLS agreement;
- We are drawing up changes to the Ditch Management Plan for the [REDACTED] in view of the little whirlpool ramshorn snail in the site;
- We have finished all the re-surveying of 44 sample sites in areas 1 and 3;
- We have assessed monitoring protocols and sample techniques for smaller scale sampling in the future;
- We are starting the translocation of three populations of little whirlpool ramshorn snail from three ditches in Units 1 and 7 of the [REDACTED] and are about to move them to Area 3 of the [REDACTED] - A population from each ditch will be placed in two locations, one as a control;
- Phase one of the multi-variate studies are nearly finished and will be reporting soon;
- The samples collected in this round of surveys are fixed and stored and are starting to be picked out for ID;
- We are about to set a date for the water sampling collection, which should be in about 10 days' time once all the field sampling and disturbance has finished; and,
- Survey data inputting is proceeding as we survey.

I trust all is well  
[REDACTED]



From: [REDACTED]  
Sent: 24 May 2016 13:29  
To: [REDACTED]  
Cc: [REDACTED]  
Subject: RE: A47 Acle Straight - Little whirlpool ramshorn snail translocation

[REDACTED]  
Was the translocation conducted in April?

Regards

[REDACTED]  
[REDACTED]  
Highways England | Woodlands | Manton Lane | Bedford | MK41 7LW  
Tel: +44 [REDACTED] | Mobile: + [REDACTED]  
Web: <http://www.highways.gov.uk>  
GTN: [REDACTED]

---

From: [REDACTED] or [mailto:[REDACTED]]  
Sent: 22 March 2016 23:30  
To: [REDACTED]  
Cc: [REDACTED]  
Subject: RE: A47 Acle Straight - Little whirlpool ramshorn snail translocation

[REDACTED]  
Apologies once again for the delay in responding.

[REDACTED] had an excellent meeting with Natural England mollusc expert [REDACTED] last week.

[REDACTED] is fully supportive of our proposed methodology in principal, despite it being quite small in nature and has also said that in principal from the conversation:

1. He will accept a class licence to conduct the work with the associated method statements rather than a more complicated European Protected species licence.
2. He suggests that we put in for a 5 year timeframe for the licence. This is excellent news as it means if we find suitable sites for additional translocations the next application will merely update the details of the licence rather than having to submit an entirely new application – a significant cost saving.
3. He will accept the translocation being conducted in April.

[REDACTED] is prioritising the licence and agreements with the land owner. I will let you know how we are progressing. In relation to how long does a licence take to get? – it's normally c. 9 weeks!! However, [REDACTED] is going to speak with the NE licencing officer to ensure that our licence is promptly dealt with. The 9 week rule generally applies to Bats and Great Crested Newts, luckily our NE mollusc expert doesn't have to deal with many applications so this time frame won't apply to our application!

Post translocation monitoring will be a condition of the licence so I will run this past you before we submit. We don't want to commit to a level of monitoring that Highways England are not content with.

Kind regards  
[REDACTED]

From: [REDACTED]  
Sent: 17 March 2016 15:12  
To: [REDACTED]  
Cc: [REDACTED]  
Subject: Re: A47 Acle Straight - Little whirlpool ramshorn snail translocation

Thanks [REDACTED] Will you please let me know when the application is submitted. What's the normal NE timescale for considering such applications - or is there no norm?

Regards

[REDACTED]  
Highways England

Sent from Blackberry

[REDACTED]  
From: [REDACTED]  
Sent: Wednesday, March 16, 2016 11:03 AM GMT Standard Time  
To: [REDACTED]  
Cc: [REDACTED]  
Subject: RE: A47 Acle Straight - Little whirlpool ramshorn snail translocation

[REDACTED]  
Apologies for not getting back to you yesterday.

The licence application is progressing pulling together the range of documents required to accompany the formal application.

After a lot of chasing [REDACTED] has a telephone conference call with [REDACTED] (Natural England Mollusc specialist) today, to discuss the project and it's hoped that the this will clear the way for a very smooth licence application process.

Once everything is sorted and in place - we expect a rapid execution of the translocation.

Kind regards

[REDACTED]  
From: [REDACTED]  
Sent: 15 March 2016 11:10  
To: [REDACTED]  
Cc: [REDACTED]  
Subject: A47 Acle Straight - Little whirlpool ramshorn snail translocation

[REDACTED]  
How is the Natural England European Protected Species licence application for the little whirlpool ramshorn snail translocation progressing? Thanks

Regards

[REDACTED]  
[REDACTED]  
Highways England | Woodlands | Manton Lane | Bedford | MK41 7LW

Tel: [REDACTED] Mobile: [REDACTED]

Web: <http://www.highways.gov.uk>

GTN: [REDACTED]

*This email may contain information which is confidential and is intended only for use of the recipient/s named above. If you are not an intended recipient, you are hereby notified that any copying, distribution, disclosure, reliance upon or other use of the contents of this email is strictly prohibited. If you have received this email in error, please notify the sender and destroy it.*

**Highways England Company Limited | General enquiries: 0300 123 5000 | National Traffic Operations Centre, 3 Ridgeway, Quinton Business Park, Birmingham B32 1AF | <https://www.gov.uk/government/organisations/highways-england> | [info@highwaysengland.co.uk](mailto:info@highwaysengland.co.uk)**

**Registered in England and Wales no 9346363 | Registered Office: Bridge House, 1 Walnut Tree Close, Guildford, Surrey GU1 4LZ**

Consider the environment. Please don't print this e-mail unless you really need to.

*This email may contain information which is confidential and is intended only for use of the recipient/s named above. If you are not an intended recipient, you are hereby notified that any copying, distribution, disclosure, reliance upon or other use of the contents of this email is strictly prohibited. If you have received this email in error, please notify the sender and destroy it.*

**Highways England Company Limited | General enquiries: 0300 123 5000 | National Traffic Operations Centre, 3 Ridgeway, Quinton Business Park, Birmingham B32 1AF | <https://www.gov.uk/government/organisations/highways-england> | [info@highwaysengland.co.uk](mailto:info@highwaysengland.co.uk)**

**Registered in England and Wales no 9346363 | Registered Office: Bridge House, 1 Walnut Tree Close, Guildford, Surrey GU1 4LZ**

Consider the environment. Please don't print this e-mail unless you really need to.

*This email may contain information which is confidential and is intended only for use of the recipient/s named above. If you are not an intended recipient, you are hereby notified that any copying, distribution, disclosure, reliance upon or other use of the contents of this email is strictly prohibited. If you have received this email in error, please notify the sender and destroy it.*

**Highways England Company Limited | General enquiries: 0300 123 5000 | National Traffic Operations Centre, 3 Ridgeway, Quinton Business Park, Birmingham B32 1AF | <https://www.gov.uk/government/organisations/highways-england> | [info@highwaysengland.co.uk](mailto:info@highwaysengland.co.uk)**

**Registered in England and Wales no 9346363 | Registered Office: Bridge House, 1 Walnut Tree Close, Guildford, Surrey GU1 4LZ**

Consider the environment. Please don't print this e-mail unless you really need to.

Crossland, Yvonne

---

**From:** [REDACTED]  
**Sent:** 01 July 2016 17:42  
**To:** [REDACTED]  
**Cc:** [REDACTED]  
**Subject:** RE: A47 Acle Straight - Little whirlpool ramshorn snail translocation  
**Attachments:** P1070579.jpg; P1070575.JPG

Hi [REDACTED]

Thank you for the email.

I have placed some text next to your questions below. I've also added a section on the next phases currently outside the existing work order.

Please don't hesitate to contact me if you need any additional information.

[REDACTED]

- Date of translocation of Ramshorn Snails. ( I am aware that you going to translocate an initial sample of snails – what is the intended date for this first stage?)
  - The pilot translocation has been completed, the report is currently being written – additional detail below
- How long is the translocation due to last?
  - The pilot translocation has been completed. It was a small scale translocation as although we found a number of suitable donor sites last year (i.e. sites with snails), the 2015 surveys did not find many suitable receptor sites (i.e. sites that had no snails, but had suitable vegetation, ditch structure etc.)
  - 800 snails were moved from 3No. ditches from [REDACTED] to 2No. ditches in [REDACTED] (in 8 receptor locations) – see attached photos of an example of age sorting and the snails in their new home.
- What actions are still outstanding to enable translocation to happen (i.e. Licence?).
  - As the pilot translocation has now been completed the next stages in the existing work order include:
    - sorting (picking out) the samples and including these and the water sample analysis data in to the ongoing multivariate analyses.
    - Completing the reporting both to Natural England for the Licence condition and to Highways England to report on the exercise.
    - Commence the scoping study to find additional potential sites for additional phases of translocation. The results of the multivariate analyses are required to feed into this process. In addition we are to speak to Natural England about us arranging another working group meeting to report back on the translocation and to discuss other potential sites.
- How frequent will the snails be monitored for their breeding patterns and survival rates?
  - Monitoring was not scoped for in the current work order. It is, as previously discussed a condition of the licence and will need to be completed once a year – suggested month October – This need to be checked with the rest of the team.
- When do you intend to publicise and or issue a briefing note to politicians / public?
  - This is an exciting story and hopefully will yield some exciting results. Notwithstanding the translocation itself, the multivariate analyses will increase knowledge of the species, that will inform future mitigation of this rather elusive species. We have no plans to publicise, and have been asked to be quite low key about our work. However, we are happy to work with Highways England and their communications unit

to make sure a scientifically correct message is released when HE think it is appropriate. The robustness of this study lends itself to academic publication and with HE's approval we would be keen to pursue this too.

- As alluded to above, as part of the scoping study to find more sites to translocate to in the future, we would like to report back to the working group (specifically local members of the group) that met in September 2015. This may also represent a suitable opportunity to publicise the work to date.

The next Phases:

- Monitoring of translocated ditches (in 2016 and beyond)
- Subject to a successful scoping study and thus finding new potential sites, detailed survey of identified ditches to find additional donor / receptor sites (in September 2016)
- Another round of translocation in new sites 2017

From: [redacted] [mailto:[redacted]]

Sent: 28 June 2016 17:34

To: [redacted]

Cc: [redacted]

Subject: A47 Acle Straight - Little whirlpool ramshorn snail translocation

Hello [redacted]

In the absence of [redacted] who is on holiday, would you please help by providing an update regarding the progress being made with the translocation of the Little Whirlpool Ramshorn Snail by responding to the questions below. This information is required to update dashboard reports for our Major Projects team.

- Date of translocation of Ramshorn Snails. ( I am aware that you going to translocate an initial sample of snails – what is the intended date for this first stage?)
- How long is the translocation due to last?
- What actions are still outstanding to enable translocation to happen (i.e. Licence?).
- How frequent will the snails be monitored for their breeding patterns and survival rates?
- When do you intend to publicise and or issue a briefing note to politicians / public?

Please provide any other related information for our records (summary of work conducted since your last feedback to [redacted] on 24/May/2016 would be helpful).

This request is short notice, however, I would appreciate any feedback by the end of the week. Please feel free to ring if you wish to discuss.

Regards

[redacted]  
Highways England | Woodlands | Manton Lane | Bedford | MK41 7LW

Tel: +44 (0) [redacted]

Web: <http://www.highways.gov.uk>

GTN: [redacted]

*This email may contain information which is confidential and is intended only for use of the recipient/s named above. If you are not an intended recipient, you are hereby notified that any copying, distribution, disclosure, reliance upon or other use of the contents of this email is strictly prohibited. If you have received this email in error, please notify the sender and destroy it.*

**Highways England Company Limited | General enquiries: 0300 123 5000 | National Traffic Operations Centre, 3 Ridgeway, Quinton Business Park, Birmingham B32 1AF | <https://www.gov.uk/government/organisations/highways-england> | [info@highwaysengland.co.uk](mailto:info@highwaysengland.co.uk)**

**Registered in England and Wales no 9346363 | Registered Office: Bridge House, 1 Walnut Tree Close, Guildford, Surrey GU1 4LZ**

Consider the environment. Please don't print this e-mail unless you really need to.

Project:	<b>LWRS</b>	Job No/Ref:	
Purpose:	<b>Start up Meeting Project Team and Natural England</b>	Date held:	<b>07/03/2016</b>
Held at:	TC	Made by:	[REDACTED]
Present:	[REDACTED] AECOM [REDACTED] [REDACTED] Abrehart Ecology [REDACTED] [REDACTED] Natural England [REDACTED] [REDACTED] AECOM [REDACTED]	Distribution:	[REDACTED]
Apologies:	[REDACTED]		

Item	Notes	Action
1.	[REDACTED] and [REDACTED] presented overview of the three stages of Phase 3.	A short document based on the scope that has been produced for tender purposes has been produced and disseminated with these minutes.
	[REDACTED] requested clarification in relation to communication outside the immediate team especially if 3 <sup>rd</sup> party landowners were to be contacted in relation to Stage 3 of this Phase (Scoping of additional sites)..	[REDACTED] to distribute names and emails of Highways England personnel who should be consulted prior to information going outside of immediate project team as well as being kept abreast of the project.
.	[REDACTED] queried whether the multivariate analyses need to be completed prior to the translocation – [REDACTED] stated that this was value added to the programme and would not stop initial phases, but would augment future stages of the project. Collection of additional data during the translocation would also be added into the analyses.	
	Lines of Communication. A discussion was held regarding the lines of communication with NE licencing e.g [REDACTED] and [REDACTED] will arrange with other NE personnel that their time is to be booked to the NE Discretionary Advice Service with AECOM. [REDACTED] needs to be kept informed, but [REDACTED] may contact relevant NE staff as required.	[REDACTED] advise colleagues on the DAS agreement.

[REDACTED]  
[REDACTED]  
www.aecom.com

[REDACTED]  
[REDACTED]  
[REDACTED]

	<p>Any Other Business – [REDACTED] asked about timescales. The timescales were discussed.                  Translocation – March / April                  Scoping prior to July                  Multivariate Analyses – submission July depending on results generated.</p>	
	<p>[REDACTED] asked about Risk Assessments for the project</p>	<p>[REDACTED] to disseminate existing RA – these will be updated / reviewed prior to field work this year.</p>

[REDACTED]  
 [REDACTED]  
 www.aecom.com

[REDACTED]  
 [REDACTED]  
 [REDACTED]



# Meeting Agenda



Meeting Title: **Little Whirlpool Ramshorn Snail Update meeting - Telephone conference**

Project: \_\_\_\_\_ Job No/Ref: 60343567

Location: **Telephone** Date held: **19/07/2016**

Duration: **1.5hr** Time: **14:00**

Invitees: [Redacted] Natural England [Redacted]  
 [Redacted] Abrehart Ecology [Redacted]  
 [Redacted] AECOM [Redacted]

Distribution:  
 [Redacted]  
 [Redacted]  
 [Redacted]

No.	Item	Actions
1	<p>Translocation</p> <p>[Redacted] and [Redacted] described the translocation work, including the methodology employed. The translocation was now complete. The report is still outstanding. This is a priority for [Redacted] to complete so that it can be issued to Highways England.</p>	[Redacted] to complete report
2.	<p>Multivariate Analysis</p> <p>[Redacted] described briefly the work that has been done to date. Some interesting associations between plant assemblages, abiotic variables and mollusc composition have been shown at a level of significance that explains much of the variation. Some more work is required and a meeting between [Redacted] [Redacted] and potentially [Redacted] (NE) should be arranged to discuss additional analyses.</p>	[Redacted] to arrange completion of report
3.	<p>Scoping Study</p> <p>The scoping study will commence in the next while. A meeting was discussed to be held at Dragonfly House to update the steering group and ask attendees what sites should be targeted for detailed study. [Redacted] suggested that we should use the consultation that was done in 2015 to inform this and not hold a meeting, but telephone those third parties that might have sites. [Redacted] suggested that it would be better to have a steering group meeting after the translocation had yielded some results – it was noted that this monitoring was not part of the current CTO and additional fees would be required for this action, that was a condition of the NE licence.</p> <p>To move the scoping on, [Redacted] should go through the 2015 consultation results and issue [Redacted] with a list of potential sites that had been suggested by the consultees. [Redacted] could then approach land owners for access. Any suitable sites could then be surveyed in detail this autumn (additional CTO). [Redacted] stated that it is important that such detailed survey was not delayed too long so that the botanical assemblage would be comparable with the current data sets. Leaving it too late would skew any analysis conducted on the plant data. [Redacted] agreed, however this would not be an issue with the mollusc assemblage.</p>	[Redacted] to prepare list. [Redacted] to start scoping / liaison with landowners
4.	<p>Monitoring</p> <p>Monitoring of the translocated sites is now required of the pilot study donor and receptor sites. [Redacted] stated that the method used would be sensitive to the environment – in what was described as a reduced sampling regime, in cognisance of the fact that the ditches (in specific places only ) had been</p>	

disturbed this year and it would be unwise to conduct a vigorous sweep so soon after the translocation, but it was an appropriate time to monitor. [redacted] described the monitoring protocol that he wished to employ.

5. Steering Group Meeting –

As per above, (item 3) it was suggested that this was held in September to discuss results to date. [redacted] suggested holding such a gathering after the first round of monitoring is completed, as whether the translocation was successful was the most important result.

[redacted] asked if a meeting could be held in Dragonfly House. October was suggested as a date. By this stage a new CTO could be organised and the monitoring completed for Year 1. [redacted] to check available dates in Dragonfly House. [redacted] to check when key members of the Client [redacted] Abrehart and AECOM [redacted] team could attend. Invites would be sent in September – assuming HE are content to fund the meeting.

[redacted] said it was important to make sure that the opinions/ thoughts of the September 2015 steering group were addressed in the new meeting. Issues to include were:

- A description of the methodology and the translocation
- The results of the multivariate analyses
- The results of the translocation
- Addressing of issues raised ( [redacted] to check notes from previous meeting)
- The new sites – and results if detailed survey has been commissioned by
- The next steps.

Any Other Business

[redacted] would speak to [redacted] about a new CTO to accommodate:

Monitoring

Dragonfly House Meeting

Detailed survey of sites identified in the scoping study.

Date and Venue of Next Meeting TBC

[redacted] to check dates [redacted] to find suitable dates.

[redacted] to check notes. [redacted] to speak to other members of NE that had attended the meeting.

[redacted] to start drawing up new CTO.

[REDACTED]

---

**From:** [REDACTED]  
**Sent:** 19 April 2016 16:24  
**To:** [REDACTED]  
**Subject:** FW: A29 - Anisus vorticulus licence application  
**Attachments:** A29-AVorticulus\_AbrehartEcology\_2016.pdf;  
DetailedSurveyReport\_AVorticulus\_AECOM\_20151116\_V4.pdf;  
RecordingSheets\_Vegetation\_AECOMA47\_20150806.pdf;  
RecordingSheets\_Molluscan\_AECOMA47\_20160406.pdf;  
Recordingsheet\_EnvironmentalPhase2\_AECOMA47\_20150806.pdf;  
AVorticulus\_TranslocationMethods\_AbrehartEcology\_2016.pdf

[REDACTED]  
Principal Ecologist at Abrehart Ecology

Tel: [REDACTED] mobil [REDACTED]  
email: [REDACTED]  
Pound Farm  
Low Road  
Great Glenham  
Saxmundham  
Suffolk  
IP17 2DQ

abrehart   
ecology

The information in this email is private, may be confidential, and is intended for the addressee only. If received in error, please inform Abrehart Ecology immediately and delete the message from your computer. Copying, distributing or disclosing its contents is strictly prohibited. Whilst Abrehart Ecology makes every effort to keep its systems virus free, it is your responsibility to check/scan all messages and attachments if any. No responsibility can be accepted by Abrehart Ecology.

**From:** [REDACTED] [mailto:\[REDACTED\]](mailto:[REDACTED])  
**Sent:** Friday, April 15, 2016 2:54 PM  
**To:** [REDACTED]  
**Subject:** A29 - Anisus vorticulus licence application

Hi [REDACTED]

Please find the attached licence application for a Anisus vorticulus translocation in [REDACTED]

Thank you for the chat the other day it was very useful.

If there is any chance of this being processed quickly it would be much appreciated. I understand how busy you are though.

Kind regards

[REDACTED]  
[REDACTED]  
Principal Ecologist at Abrehart Ecology

Tel: [REDACTED] mobile [REDACTED]

email: [REDACTED]

Pound Farm  
Low Road  
Great Glemham  
Saxmundham  
Suffolk  
IP17 2DQ



The information in this email is private, may be confidential, and is intended for the addressee only. If received in error, please inform Abrehart Ecology immediately and delete the message from your computer. Copying, distributing or disclosing its contents is strictly prohibited. Whilst Abrehart Ecology makes every effort to keep its systems virus free, it is your responsibility to check/scan all messages and attachments if any. No responsibility can be accepted by Abrehart Ecology.

196

The Conservation of Habitats and Species Regulations 2010  
(as amended)  
Wildlife & Countryside Act 1981

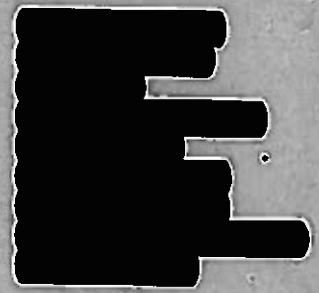


### Licence Application Form

Application for a licence to kill, take, disturb or possess wild animals:  
Science, education and conservation

**Please Note - Applications can be completed online.  
For more information please visit our website.**

- Please complete this application form using dark ink and BLOCK CAPITALS.
- Return the completed form to the address shown.
- All questions should be answered as appropriate. Questions marked with "\*" are mandatory and failing to complete these may result in delays to your application.
- If there is insufficient space for completing answers on this form, please attach a separate sheet.
- Natural England will aim to determine the outcome of a completed licence application within its published service standards.
- If you experience any problems completing this application or using the online Case Work Management (CWM) system - please see our website for guidance or contact Wildlife Licensing.
- Additional guidance is provided in Using CWM - Applicant Guidance Document. This can be downloaded from our website or you can ask Wildlife Licensing to send you a copy.



**For Office Use Only**

CWM Ref No: \_\_\_\_\_

Charter Deadline: \_\_\_\_\_

#### 1. Applicant Details

Please enter the details of the person or company who will become the licensee  
(For guidance please see attached annex)

- If the applicant is already registered as a customer please complete Registered Customer Details (a)
- If the applicant is not already registered as a customer please complete the New Customer Registration (b)

##### (a) Registered Customer Details

*Customer Number	*Surname	*Forename	*Postcode
<input type="text"/>	<input type="text"/>	<input type="text"/>	<input type="text"/>

##### (b) New Customer Registration

Please note: if you are the agent/named ecologist registering on behalf of the applicant you will need to provide their full authorisation with this application.

\*Email Address

\*Title (please tick as appropriate) Mr  Mrs  Ms  Other  (Please Specify)

*Forename	Middle Name	*Surname
<input type="text"/>	<input type="text"/>	<input type="text"/>

**Professional Membership**  
(e.g. CIEEM, IEMA, etc)

If you represent  
an organisation  
please complete  
(i) (ii) and (iii)

(i) \*Business Title

(ii) \*Company

(iii) \*Position

House Name / No.

\*Address Line 1

\*Address Line 2

Address Line 3

Town

\*County

\*Postcode

Country

Either 'Telephone No.' or 'Mobile No.' must be completed

Telephone No.

Mobile No.

Fax no.

\*Customer Type (e.g. Farmer, Householder, Ecologist, etc.)

\*Are you VAT registered?

Yes  No

If 'Yes' VAT Number

\*Are you registered with the  
Rural Payments Agency?

Yes  No

If 'Yes' RPA SBI Number

**(c) Alternative Applicant Contact Details**

In the event that the applicant is unavailable to discuss the application, it would be helpful if alternative contact details could be provided. By completing this section you are confirming that this contact is authorised to act on behalf of the applicant.

Name:

Tel Number:

Email Address:

**5. Agent / Named Ecologist Details**

(a) Will an agent / named ecologist be used in conjunction with this application?

(For guidance please see attached annex)

Yes  No

- If the agent is already registered as a customer, please complete Registered Agent / Ecologist Details (b)
- If the agent is not already registered as a customer, please complete the New Agent / Ecologist Registration (c)
- If there will not be an agent / ecologist used in conjunction with this application, please go to the next section.

**(b) Registered Agent / Ecologist Details**

\*Customer Number

\*Surname

\*Forename

\*Postcode

**(c) New Agent/Named Ecologist Registration**

*Please note: If you are the applicant registering on behalf of the agent/named ecologist you will need to provide their full authorisation with this application.*

\*Email Address

\*Title

(please tick as appropriate) Mr  Mrs  Ms  Other  (Please Specify)

\*Forename

Middle Name

\*Surname

Professional Membership  
(e.g. CIEEM, IEMA, etc)

*If you represent  
an organisation  
please complete  
(i), (ii) and (iii)*

(i) \*Business Title

(ii) \*Company

(iii) \*Position

House Name / No.

\*Address Line 1

\*Address Line 2

Address Line 3

Town

\*County

\*Postcode

Country

*Either 'Telephone No.' or 'Mobile No.' must be completed.*

Telephone No.

Mobile No.

Fax no.

\*Customer Type (e.g. Farmer, Householder, Ecologist, etc.)

\*Are you VAT registered? Yes  No  If 'Yes' VAT Number

\*Are you registered with the Rural Payments Agency? Yes  No  If 'Yes' RPA SBI Number

**(d) Alternative Ecologist Contact Details**

**In the event that the named ecologist is unavailable to discuss the application, it would be helpful if alternative contact details could be provided. By completing this section you are confirming that this contact is authorised to act on behalf of the named ecologist and has a detailed knowledge of the application.**

Name:

Tel Number:

Email Address:

**3. Communication Preferences**

Please indicate who should be contacted if we need to discuss this application:

Applicant  Agent / Ecologist

Please indicate to whom the outcome documentation for this application should be sent:

Applicant  Agent / Ecologist

Applicant preferences: Email  Post  Telephone

If 'Yes' for telephone, please provide a contact no.

Agent / Ecologist preferences: Email  Post  Telephone

If 'Yes' for telephone, please provide a contact no.

**3. Previous Applications**

(a) \* To your knowledge, have there been any previous applications or licence decisions concerning this site?

Yes  No

*If 'No' please go to the next section. If 'Yes' to (a) please complete the following*

(b) \* Date of most recent application:

(c) \* What was the subject of the previous applications?

(d) \* What is the application or licence reference number?

(e) \* What was the outcome of the previous application? (Please select one of the following)

Granted  Not Granted  Advice Only  Deferred  Not Yet Known

**4. Purpose**

(a) \* Confirm the purpose of the application:

- Science or education, under section 53(2)(a) and/or section 16(3)(a)
- Ringing or marking, under section 53(2)(b) and/or section 16(3)(b)
- Conserving wild animals, under section 53(2)(c) and/or section 16(3)(c)
- Protecting any zoological collection, under 53(2)(d) and/or section 16(3)(d)
- Photography, under section 16(3)(e)

(b) \* What are the main aims?

To locate healthy populations of *Anisus vorticulus* around . Now these have been re-located these populations are now to be considered for translocation (donor sites) to suitable habitat nearby (receptor sites). As part of the study, detailed multi-variate studies are now being carried out to



(c) \* Is data being collected? If yes, please describe what it will be used for?

Yes. A wide range of data has already been collected as part of the initial phase with over 10,000 individual species records produced, each with 54 abiotic parameters attached. This new extension to the survey will produce an equally large data set. We will carry out a full aquatic invertebrate survey of the donor and receptor sites prior to the translocation with detailed chemical analysis of the water at each sample site. This work will add a large standardised data set to carry out additional multi-variate studies on. We aim to produce a paper on this study and on this species.

(d) \* What publications have you produced or contributed to regarding this topic?

Abrehart Ecology has carried out many A17 pieces of research in the past and have carried out several surveys for the [redacted] and [redacted] on this species too. We are hoping to produce a number of papers from this research and will also hope to contribute to the eDNA project which hopefully will be coming off soon. Abrehart Ecology has carried out a number of trial translocations of another mollusc [redacted]

*If purpose confirmed above includes 'Conserving Wild animals' please answer all of the following. If not, please go to the next section.*

(e) \* What are the conservation aims of the proposed work? If you wish to control one species to conserve another you should give evidence (e.g. counts) for how one species affects the other(s).

To attempt to translocate *Anisus vorticulus*. This will be of value to the species where sites may be required to be altered for public safety, road widening etc. There will be a large volume of associated data collected which will aid further studies into this species hoping to show habitat requirements and preferences. This will be the largest piece of research on this species in the UK, with many more years of studies and across many sites in the Broads. This work will be able to feed into the upcoming Article 17 work and to be of great use to the eDNA project. We already have been able to map a wide range of additional S41 species and will continue this as part of the work. The translocation is being made into

(f) \* How will you monitor the effects on the target species?

There will be a 20 year monitoring project for this and additional translocations. The project is funded by Highways England and they are very keen to find a way to make this work.

***TRANSLOCATION OF  
THE LITTLE WHIRLPOOL  
RAMSHORN SNAIL –  
DETAILED SURVEYS***

***Highways England***

***November 2015***

Prepared by:.....

[Redacted]

Ecologist

Checked by:.....

[Redacted]

Principal Ecologist

Approved by: .....

[Redacted]

Associate Director

Rev No	Comments	Checked by	Approved by	Date
1	Draft	[Redacted]	[Redacted]	9/11/15
2	Draft	[Redacted]	[Redacted]	10/09/2015
3	Draft	[Redacted]	[Redacted]	13/11/2015

[Redacted]

[Redacted]

Job No 47075202

Reference

October 2015

This document has been prepared by AECOM Limited for the sole use of our client (the "Client") and in accordance with generally accepted consultancy principles, the budget for fees and the terms of reference agreed between AECOM Limited and the Client. Any information provided by third parties and referred to herein has not been checked or verified by AECOM Limited, unless otherwise expressly stated in the document. No third party may rely upon this document without the prior and express written agreement of AECOM Limited.

## Contents

1	Introduction .....	3
	Background.....	3
	Scoping survey.....	3
	Detailed Survey - Purpose .....	4
	Study Area .....	4
2	Methods.....	6
1.1	2.1 Ditch Selection.....	6
1.2	2.2 Field Method (Sampling).....	6
1.3	2.3 Ditch Assessment.....	9
1.4	2.3 Ditch Assessment.....	9
3	Results .....	11
	3.1 Area 1.....	11
	3.2 Area 2.....	12
	3.3 Area 3.....	12
	3.4 Area 5.....	13
4	Discussion.....	15
	4.1 Indications of Habitat Preferences of Little Whirlpool Ramshorn Snail.....	15
	4.2 Implications for a Conservation Translocation.....	15
	4.3 Limitations of the Detailed Surveys and Recommendations for Further Work.....	16
5	References.....	18

## List of Appendices

- Appendix A. Recording forms
- Appendix B. Illustrated sample locations
- Appendix C. Area 1 mollusc diversity data and ditch assessment
- Appendix D. Area 2 mollusc diversity data and ditch assessment
- Appendix E. Area 3 mollusc diversity data and ditch assessment
- Appendix F. Area 5 mollusc diversity data and ditch assessment

## List of Tables

Table 1	DAFOR scale used in mollusc community recording .....	8
Table 2	DAFOR scale used in botanical recording .....	8
Table 3	Scoring system used to assess the suitability of the management regime .....	9
Table 4	Scoring system used to assess the summarise botanical structure and diversity .....	9
Table 5	Scoring system used to assess silt depth.....	10
Table 6	Scoring system used to summarise levels of marginal poaching.....	10
Table 7	Scoring system used to summarise suitability of water chemistry.....	10
Table 8	Scoring system used to summarise the diversity and structure of mollusc communities .....	10
Table 9	Scoring system used to categorise little whirlpool ramshorn snail population size.....	10

## List of Figures

Figure 1 Location of Areas 1, 2, 3, 4 and 5 within the study area.....	5
Figure 2 Surveyed ditches and sample locations in Areas 1, 2 and 3.....	7
Figure 3 Surveyed ditches and sample locations in Area 5. ....	7
Figure 4 Recommended use of ditches in Areas 1-3 in a potential future conservation translocation.....	14

# 1 Introduction

## Background

Little whirlpool ramshorn snail *Anisus vorticulus* is small aquatic snail, with a dorsal-ventral flattened shell approximately 5mm in diameter. It is an UK Biodiversity Action Plan Priority Species and the only British non-marine gastropod which is a European Protected Species. It is also listed in Annex II of the EU Habitats and Species Directive and therefore requires the designation of special areas for conservation. In the UK, populations have been declining since the 1960s and it is thought to be threatened by drainage, over frequent dredging and eutrophication, although the mechanism of decline is not clear (JNCC, 2007; Van Damme, 2012).

Historical records of little whirlpool ramshorn snail exist for the marshes directly adjacent to the A47 between Norwich and Great Yarmouth also known as the 'Acle Straight'. In 2015, Highways England (formerly Highways Agency) commissioned a feasibility study (AECOM, 2015a) to review existing literature, current legislation and consult relevant stakeholders for a conservation translocation of little whirlpool ramshorn snail in and around the grazing marshes adjacent to the Acle Straight. The study considered the ecology of the species, the proposed method of translocation and steps required to progress the project. A detailed description of the planned conservation translocation pilot study and each of the proposed project phases are described in the previously issued feasibility study (AECOM, 2015a).

A key recommendation was a detailed survey of potential donor and receptor sites in the area to identify the size and distribution of populations of little whirlpool ramshorn snail and attempt to identify suitable donor ditches (ditches that already have healthy populations of snail within them) and receptor ditches (ditches where the snail is understood to be absent, but habitat requirements are met and therefore could potentially support the species).

## Scoping survey

A non-intrusive scoping survey was undertaken in early August 2015 (AECOM, 2015b), to refine the geographical area for the detailed survey to ditch systems with the greatest potential to support little whirlpool ramshorn snail.

The scoping survey used a six-tiered scoring system (0=negligible potential, 5=very good potential), based on management, profile, botanical diversity and indicators of water quality to assess the potential of a length of ditch to support little whirlpool ramshorn snail. A total of 28.2 km of ditch was systematically assessed in this way.

To summarise:

- All ditches (8.1 km) in [REDACTED] were deemed to have good ('4') or very good ('5') potential to support little whirlpool ramshorn snail.
- Only 50 m of a possible 393 m of ditch in [REDACTED] were of moderate/good ('3') potential whilst the remainder were of low potential ('1').
- 1.295 km of the total 2.49 km of ditches in [REDACTED] had good potential ('4') whilst the remaining ditches were considered to have moderate ('2') to negligible ('0') potential.
- 2.96 km of 3.2 km of ditch in [REDACTED] were considered to have low potential, whilst the remaining 0.24 km had moderate ('2') potential.
- [REDACTED] was by far the largest and most complex site comprising 22 km of ditch. Of these ditches, 2.96 km had good ('4') or very good potential ('5'), an additional 3.96 km had moderate/good potential ('3') and the remaining 15.15 km had low ('2') or negligible potential ('0').

The scoping study recommended that ditches with negligible or low potential are scoped out of any subsequent detailed surveys. Such ditches had characteristics such as heavy shading by woodland, lack of aquatic macrophytes, signs of highly eutrophic conditions as a result of nearby arable land use or intensive management. Literature examined in the feasibility study (AECOM, 2015a) identified these features as constituting poor habitat for little whirlpool ramshorn snail, therefore, surveying these ditches would provide little value for this particular stage of the project.

The scoping study concluded that [REDACTED] had very little potential for inclusion in a conservation translocation as either a donor or receptor site 92.5% of the ditches had low ('1') or negligible ('0') potential to support little whirlpool ramshorn snail and the remainder had moderate potential. Consequently, [REDACTED] was scoped out of further investigation and is not considered further in the current study.

AECOM (2015b) provides full details of the methods and results of the scoping survey and reference should be made to that document for further information.

### Detailed Survey - Purpose

The current report gives specifics of the detailed surveys carried out in late August and September 2015. The aim of the detailed surveys was rigorously and quantifiably to assess those ditches classified in the scoping survey as having moderate/good ('3') to very good potential ('5') to support little whirlpool ramshorn snail and therefore, indicate the abundance and distribution of any populations within the study area.

1.3 Through recording abiotic ditch characteristics alongside quantified mollusc community and botanical assessments, the aim was also to gather additional information with regard to habitat preferences of little whirlpool ramshorn snail in the study area and therefore subjectively inform the choice of donor and receptor sites of a potential future conservation translocation.

Furthermore, the feasibility study (AECOM, 2015a) in its summary of the literature on the target species reported a common theme that precise habitat requirements of the target species are unknown. Therefore, an additional aim was to collect information on ditch characteristics to allow a quantitative study of habitat preferences. Whilst this analysis lies beyond the remit of the current report, there is great value in investigating currently unknown relationships with a view to informing conservation practices of little whirlpool ramshorn snail in the [redacted] and further afield.

### Study Area

1.4 The study area comprises five selected areas of low-lying grazing [redacted]. These areas are presented in Figure 1. This land was gradually claimed from the sea from the 12<sup>th</sup> – 16<sup>th</sup> Century and the underlying substrate reflects the estuarine clay deposited in the area. In the mid to late 1900s, increasing agricultural intensity led to the conversion of much of the area to arable land use. However, in [redacted] was established and environmentally friendly farming practices were encouraged. Freshwater grazing marsh Higher Level Stewardship schemes are now a common feature in local farming practice. The marshes are typically used as pasture for grazing for cattle and sheep during the summer. The land rises to the [redacted] and this area has primarily arable land use.

#### Areas 1, 2 and 3 – [redacted]

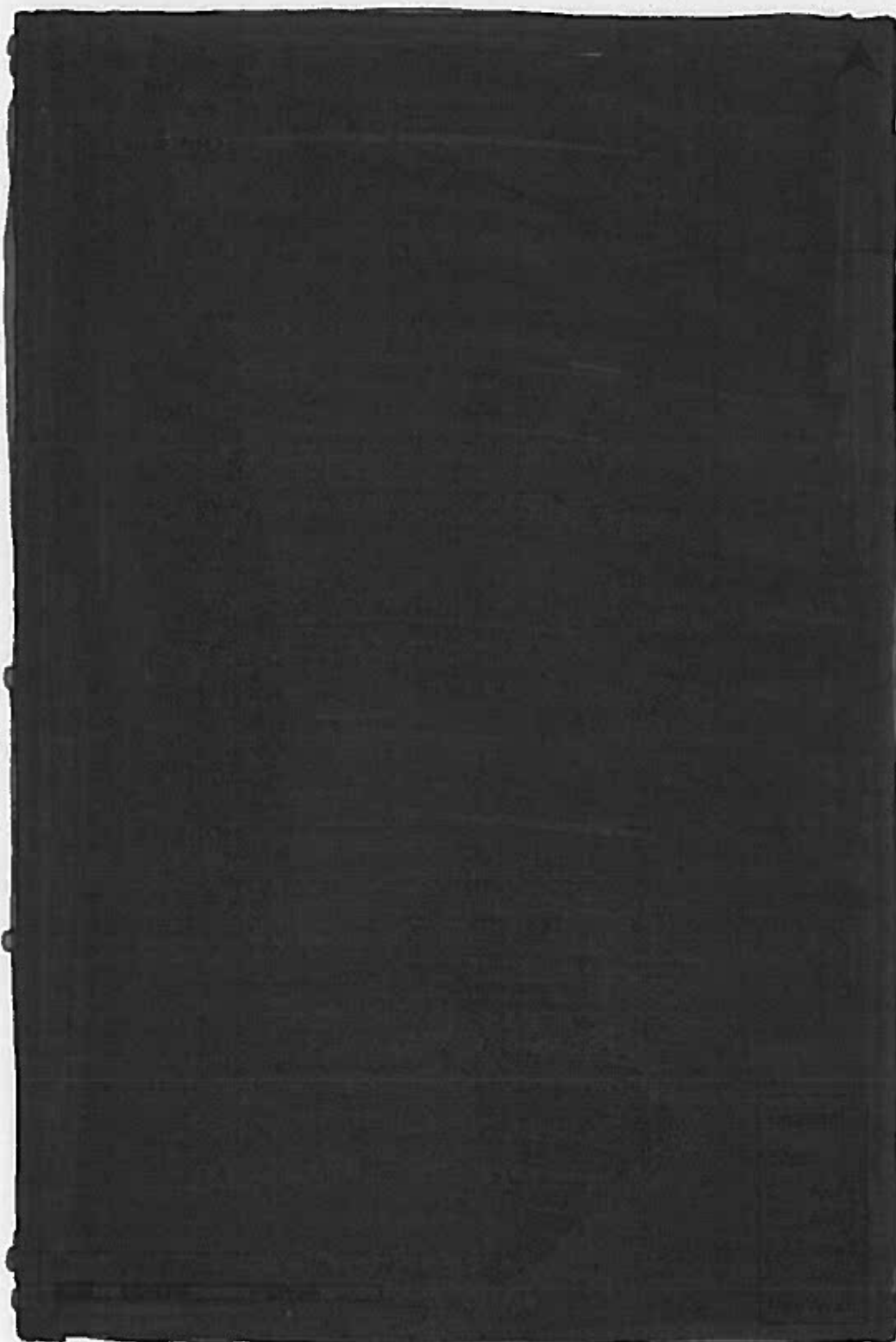
1.4.1 [redacted] are located to [redacted] (Figure 1). The Marshes form part of the [redacted] and [redacted] Special Area of Conservation (SAC) and Special Protection Area (SPA).

All three Areas in [redacted] have short, semi-improved grass swards grazed by sheep and cattle. On the whole, ditch management in these Areas is low intensity and has been limited to vegetation cutting rather than clearance of debris. The majority of the ditches have not been cleared within the last 10 years (Landowner, *pers. comm.*), however, large ditches, for example those adjacent to the [redacted] are cleared frequently under management by the Internal Drainage Board (IDB).  
1.4.2 Evidence of marginal vegetation cutting was recorded in western sections of [redacted] (AECOM, 2015b).

#### Area 5 - [redacted]

[redacted] form the southern section of [redacted] [redacted] situated to the [redacted] [redacted] is intersected by ditches of varying width and depth, several of which are maintained by the IDB. The majority of the remaining ditches are cleared on one side at a time every five years.

The marshes are grazed by commercial beef herds at a density of c.1,200 cows over 1,330 ha with additional younger stock.



**Figure 1** Location of Areas 1, 2, 3, 4 and 5 within the study area.



## 2 Methods

### 2.1 Ditch Selection

Priority was given to surveying the ditches with good or very good potential as identified in the scoping report (AECOM, 2015b). This was done to establish the presence/likely absence of the little whirlpool ramshorn snail within ditches and therefore, indicate the location of potential donor or receptor sites.

Ditches connecting good or very good ditches which were of moderate potential were also included in the detailed survey. The inclusion of moderate potential ditches in such locations was to assess possible connectivity between populations (should they be found). This inclusion was deemed important to rule out the potential of a 'false positive' result, which could be attained post translocation, at a receptor site caused by migration from neighbouring populations rather than successful translocation.

Ditches [REDACTED] were not formally assessed in the scoping study as access to this part of the site was not possible, however, they were included in the detailed survey as they form links between potentially suitable ditches.

### 2.2 Field Method (Sampling)

The method for this survey was adapted from the existing protocol for assessing grazing marsh ditches for the presence of little ramshorn whirlpool snail described by Willing (2014), with appropriate amendments for this project.

A total of 100 samples were taken across [REDACTED] in August and September 2015, in ditches identified with moderate ('3') to very good ('5') potential as recommended in AECOM (2015b), at intervals of 50-100m. See Appendix A for higher resolution images of sample locations.

At each sample location, ditch characteristics and a range of other biotic and abiotic features were recorded. These included exposed and submerged bank profiles, width, depth, and levels of grazing, poaching and shelving. A YSI Quattro Multiparameter meter and probe was used to record pH, conductivity ( $\mu\text{S}/\text{cm}$  at  $25^\circ\text{C}$ ), dissolved oxygen (%) and temperature ( $^\circ\text{C}$ ) in the surface 10cm of water.

Mollusc community and botanical diversity were recorded three times per sample. Therefore, each sample comprised three mollusc and botanical community subsamples, namely A, B and C. Subsample B formed the central point (recorded as a 10 figure grid reference using a handheld GPS) whilst subsamples A and C were taken 15m either side of the location of point B.

The ditch characteristic and botanical diversity recording sheets were adapted from Buglife's manual for the survey and evaluation of grazing marsh ditch systems (Palmer et al., 2013) and all recording sheets are presented in Appendix A. Data and sample collection was undertaken by pairs of surveyors. Each pair was composed of an experienced on-site mollusc surveyor either [REDACTED] (Ecologist and National Mollusc Specialist) or [REDACTED] (Aquatic Ecologist), and a second team member responsible for recording ditch features and botanical diversity.

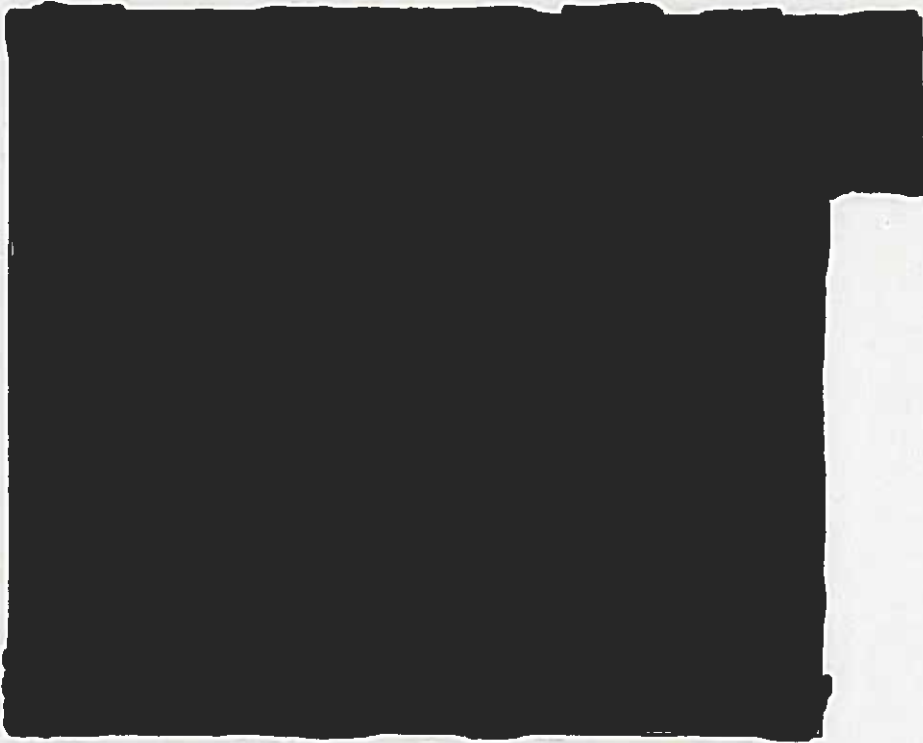


Figure 2 Surveyed ditches and sample locations in [redacted] Sample IDs and Ditch IDs shown adjacent to each feature, in normal and bold text, respectively.



Figure 3 Surveyed ditches and sample locations in [redacted] Sample IDs and Ditch IDs shown adjacent to each feature in normal and bold text, respectively.

### 2.2.1 Mollusc community recording method

The process of mollusc community recording described in this Section was repeated for each subsample; therefore, three sets (A, B and C) of mollusc community data were collected per sample location. Appendix A presents a copy of the recording sheet for molluscs that was used.

Aquatic sampling hand nets (0.5-mm net mesh) were used in 30-second sweeps to collect molluscs. Sweeps were repeated three times for each subsample in different sections of the ditch profile, i.e. floating vegetation (where present), the benthic layer and the submerged side of the near bank.

The material from the three sweeps was placed in a white tray. Molluscs were released from the ditch material by adding ditch water and agitating the contents of the tray. The floating debris was slowly poured through a 10-mm sieve to remove large debris until just a small amount of refined material remained in the tray. The molluscs were retained in the corner of the tray, during the pouring off process. It was accepted that a small proportion of the molluscs may be poured away, however, this loss was considered negligible. The material in the corner of the tray was then evenly distributed throughout the bottom of the tray.

The abundance of all molluscs was recorded on a modified DAFOR scale (Table 1). Though only a small number of readily identifiable pea mussel *Pisidium* sp. were identified to species in the field. In addition, the abundance of notable and rare molluscs, including little whirlpool ramshorn snail, shining ramshorn snail *Segmentina nitida*, slender amber snail *Oxytoma sarsi*, pea mussel species *Pisidium pseudosphaerium*, large-mouthed valve snail *Valvata macrostoma* and Desmoulin's whorl snail *Vertigo moulinsiana* were counted (where possible). Where these notable molluscs were found in high densities, the abundance was estimated by evenly distributing the remaining material in the tray, counting the molluscs in a small section and scaling up the count to estimate the number in the subsample.

Table 1 DAFOR scale used in mollusc community recording.

Value	Descriptor	Estimation of abundance	Numerical Proxy
D	Dominant	100+	5
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1

Consequently, over 4,000 individual records of aquatic molluscs alone were collected during this study. To summarise the vast amount of information collected and carryout the ditch assessment described in Section 2.3, the mollusc community data were condensed in the following manner. For each recorded mollusc species the modified DAFOR scale was converted into numerical form and represented using the numerical proxies 1 to 5 (Table 1). The sum of A, B, and C's numerical proxies was then calculated with a resulting score between 1 and 15 which summarised the abundance of each species per sample.

Scores 1-5 low indicated that a species was recorded as rare and occasional in all three subsamples or abundant in one sample but not recorded in the other two samples. Scores from 5-10 indicate that the species was recorded in low to moderate abundance in all three samples and scores exceeding 10 indicate that the species was abundant or dominant in all three subsamples.

### Botanical diversity recording method

The bankside, emergent, floating and submerged flora of the ditch was also recorded within each subsample. The relative abundance of each floral species occurring within 5m of the subsample was recorded on the DAFOR scale (Table 2). This included vegetation on both the nearside and opposite bank and up to 1 m from the water's edge.

The recording sheet, a copy of which can be found in Appendix A, was adapted from Buglife's grazing marsh ditch survey and evaluation manual (Palmer et. al, 2013).

Table 2 DAFOR scale used in botanical recording

Value	Descriptor	Percentage cover
D	Dominant	>75%
A	Abundant	51-75%
F	Frequent	26-50%
O	Occasional	11-25%
R	Rare	1-10%

### 2.3 Ditch Assessment

The scoping survey (AECOM, 2015b) split ditches in Areas 1, 2, 3 and 5 into manageable units based on their intersections with neighbouring ditches in the landscape. The aim was to assess the suitability of ecologically significant lengths of ditch for little whirlpool ramshorn snail using non-intrusive methods. To follow on, a more in-depth assessment of ditches deemed to have moderate to very good potential was carried out using seven parameters which encompass the suitability criteria set out in the feasibility study report (AECOM, 2015a) and refined in the scoping study (AECOM, 2015b), namely:

- ditch management regime;
- botanical structure and diversity;
- silt depth;
- marginal poaching;
- water chemistry;
- mollusc community diversity and structure; and,
- little whirlpool ramshorn snail presence and population size.

The scoring systems for each parameter, set out in Tables 3-9, reflect the currently available knowledge of little whirlpool ramshorn snail habitat preferences. For example, a ditch with wide, submerged margins with evidence of poaching was awarded a score of '5' compared to a ditch with no evidence of poaching and steep-sided banks which was given a score of '1' (Table 6 Scoring system used to summarise levels of marginal poaching, Table 6). On the whole, scores of '5' reflected features and characteristics which are currently suggested to increase the suitability of a ditch for little whirlpool ramshorn snail.

Up to three samples (each comprising three subsamples A, B and C) were collected along moderate to very good potential ditches using the methods detailed in Section 2.2. Subsequently, the information collected for samples in the same length of ditch were collectively assessed against the seven parameters. For example, the information collected in samples 1.5 and 1.19 were both used to assess Ditch 133 in Area 1.

The seven scores were then reviewed and a judgement was made on the suitability of each ditch to form a donor or receptor ditch for a conservation translocation. Donor ditches in Area 1 and receptor ditches in Areas 2, 3, and 5 were either confirmed as fit for proposed purpose ('Donor - Yes', 'Receptor - Yes'), sub-optimal for their proposed use ('Donor - Sub', 'Receptor - Sub') or not suitable ('Donor - No', 'Receptor - No').

Consequently, despite being underpinned by meaningful summaries of the large amount of data collected, this final aspect of the ditch assessment had an element of subjectivity. For example, interpretation of the little whirlpool ramshorn snail score was straight forward. Proposed donor ditches in Area 1 with scores of '4' or '5' were deemed suitable donor sites, compared with proposed donor ditches with a score of '2' where densities were low and unlikely to cope well with the loss of significant proportions of the population. In addition, the association between ditch management regimes and the presence of little whirlpool ramshorn snail is one of the more rigorously understood relationships. Therefore, interpretation of ditch management scores was also straightforward. Ditches in areas with high intensity management e.g. those managed by the Internal Drainage Board, were considered unsuitable as either donor or receptor ditches.

The remaining five scores were considered supplementary information, largely due to their intrinsic relationships with ditch management regime however, here lies room for improvement in this method. Detailed statistical analyses investigating the relationships between the occurrence of the target species and parameters such as water chemistry and mollusc community diversity and structure could provide valuable insights into the species ecology and aid future ditch assessments and the planning of conservation translocations.

Table 3 Scoring system used to assess the suitability of the management regime

Description	Score
'Appropriate' - Low intensity, ditch clearance no more frequent than once every 10 years	5
'Potentially suitable' - Clearance happens too frequently, however there is potential for management to be adapted	3
'Inappropriate' - IDB drainage channel, frequent clearance is mandatory and unlikely to change in the future.	1

Table 4 Scoring system used to assess the summarise botanical structure and diversity

Description	Score
Diverse and plentiful submerged or floating aquatic macrophytes	5
Moderate density of a few species of aquatic or floating macrophytes	4
Very few submerged ('occasional' or lower) submerged or floating aquatic macrophytes	3
Emergent macrophytes dominant along margins, with common duckweed <i>Lemna minor</i> dominant on water surface.	2
No submerged or floating aquatic flora, emergent vegetation in the early stages of development.	1

Table 5 Scoring system used to assess silt depth.

Description	Score
Over 50 cm of silt	5
Thin layer of silt up to 25cm deep	3
No silt in the bottom of the ditch	1

Table 6 Scoring system used to summarise levels of marginal poaching.

Description	Score
Wide, shallow, submerged margins with moderate to high levels of poaching	5
Narrower margins, sloping (less than 45 degrees), only partially submerged with low levels of poaching	3
No evidence of poaching or steep sides to bank (over 45 degrees)	1

Table 7 Scoring system used to summarise suitability of water chemistry.

Description	Score
Neutral pH, conductivity under 800 $\mu\text{S}/\text{cm}$ .	5
Non-neutral pH (above 8.5 or below 6.5), conductivity over 800 $\mu\text{S}/\text{cm}$ .	3
Extreme pH (Above 9.5 or below 5), conductivity over 1100 $\mu\text{S}/\text{cm}$ .	1

Table 8 Scoring system used to summarise the diversity and structure of mollusc communities

Description	Score
Over 20 species of mollusc per sample and/or four or more notable species	5
Good diversity of molluscs (15+) and/or one or two notable species	4
No notable species of molluscs, however 10 or more species of common species recorded	3
Very few species of mollusc present (5-10), comprised only of common and ubiquitous species	2
Very low diversity, only 1-4 common species recorded	1

Table 9 Scoring system used to categorise little whirlpool ramshorn snail population size.

Description	Score
Over 50 individuals recorded, abundant a sub-sample	5
Reasonable density, 20-50 individuals recorded	4
Up to 20 individuals recorded	3
1 or 2 individuals recorded	2
None recorded	1

## 3 Results

The following Sections provide a general description of the broad field conditions in Area 1, 2, 3 and 5, a summary of the mollusc community and an overall habitat assessment of the ditches in each Area.

### 3.1 Area 1

#### 3.1.1 General description

Area 1 was predominantly semi-improved grassland, grazed by sheep and cattle, with large ditches delimiting the area and eight smaller ditches orientated approximately north-south running through the grazing marsh. Access to four ditches on the site was not possible as land owner permission had been refused. A total of 31 samples were taken in the 2.7 km of ditch.

The seven ditches surveyed within the marshes were typically 1-3 m wide with poached shelves typically under 1 m wide, occasionally widening to 1.5 m where cattle frequently visited to drink. Silt depth varied across Area 1, in places only 0.2 m of clear water was above more than 1 m of silt. Overall, the depth of the silt and gentle profile of the ditches within the marshes suggested that dredging had not occurred within the last 10 years.

Botanical diversity of the bankside, emergent and floating vegetation was low. The banks were dominated by either pond sedges *Carex* spp., common reed *Phragmites australis* and rushes *Juncus* spp. with few accompanying herb species. Emergent vegetation was limited to common reed where the gradual underwater profile of the ditch allowed it to extend into the channel. The diversity of the aquatic macrophytes was limited to floating species such as common duckweed *Lemna minor*, water soldier *Stratiotes aloides* and frogbit *Hydrocharis morsus-ranae*. Towards the eastern end of Area 1 common duckweed was frequently at least 'abundant' or 'dominant' on the water surface.

\_\_\_\_\_ runs along a \_\_\_\_\_  
\_\_\_\_\_ These ditches were heavily shaded by vegetation from the embankment, which comprised tall fen species such as common reed, hemp agrimony *Eupatorium cannabinum* and greater willowherb *Epilobium hirsutum*. Silt in this section of ditch was typically over 1 m deep and common duckweed was abundant on the water's surface with ivy-leaved duckweed *Lemna trisulca* dominant under the surface.

#### 3.1.2 Mollusc community

Within Area 1, 36 mollusc species were recorded (Appendix C, Table C1). These included 24 common species such as common bithynia *Bithynia tentaculata*, pea mussels *Pisidium* spp., margined ramshorn snail *Planorbis planorbis* and common pond snail *Radix balthica*. The number of species recorded in each sample varied from 11 to 24, with an average of 18 per sample.

Within Area 1, 10 noteworthy species were recorded including Leach's bithynia *Bithynia leachii*, shining ramshorn snail *Segmentina nitida*, *Oxyloma sarsi* and *Sphaerium nucleus*.

Little whirlpool ramshorn snail was recorded at 15 sample locations with variation in density from 1-2 to over 100 individuals per sample. The highest densities of the snail were clustered in the western end of the site

#### 3.1.3 Habitat assessment

Appendix C, Table C2 presents the tabulated results of the habitat assessment for Area 1. Figure 4 presents a map concluding the potential use of each ditch in a conservation translocation.

Five lengths of ditch, totalling 869 m, were identified as suitable donor sites for little whirlpool ramshorn snail based on the high densities found in the ditches.

Three ditches, totalling 1,223 m in length, were identified as sub-optimal donor sites i.e. little whirlpool ramshorn snail was recorded in all these ditches, however, the density of the population was too low to make these suitable donor site. A greater amount of effort would be required to gather a significant number of individuals required for the translocation and the removal of individuals from the ditch may significantly affect the population.

Little whirlpool ramshorn snail was not recorded in five ditches, totalling 608 m in length, therefore these ditches were identified as unsuitable donor sites. The botanical diversity and overall structure of these ditches was largely considered suitable for the target species, therefore the reasons for its absence is unknown at this stage.

### 3.2 Area 2

#### 3.2.1 General description

Two samples were taken from one section of ditch 50m long [REDACTED]. This was the only ditch identified in the scoping survey as having potential for inclusion in this project either as a donor or receptor site.

The botanical diversity and structure of the ditch was considered good due to the abundance of submerged and floating aquatic macrophytes such as water soldier, water violet *Hottonia palustris* and frogbit, with emergent branched bur-reed *Sparganium erectum* and lesser water parsnip *Berula erecta* present along the margins.

Silt depth throughout the length of the ditch was between 25 and 75cm, suggesting the management of the ditches on the site was low intensity.

#### 3.2.2 Mollusc community

The mollusc communities of the two samples were fairly simple (Appendix D, Table D1). The total number of mollusc species collected were just 15 and 16 species. Common species such as common bithynia, margined ramshorn snail and greater pond snail *Lymnaea stagnalis* were the most abundant with local species such as Lister's river snail *Viviparus connectus*, flat ramshorn snail and Leach's bithynia only recorded in low abundance. Overall, the mollusc community was considered of moderate diversity for a freshwater grazing marsh system.

#### 3.2.3 Habitat assessment

Little whirlpool ramshorn snail was not recorded in the ditch, therefore, it could not be considered as a donor ditch for this project. Furthermore, despite good botanical structure of the ditch and a reasonable silt layer, it was also considered a sub-optimal receptor ditch. The ditch is isolated from other good quality ditches, it had connectivity to eutrophic sections of ditch, therefore, the long-term prospects of a seeded population of little whirlpool ramshorn snail would be poor unless water quality across Area 2 could be improved.

Appendix D, Table D2 presents the tabulated results of the habitat assessment for Area 2. Figure 4 presents a map concluding the potential use of each ditch in a conservation translocation.

### 3.3 Area 3

#### 3.3.1 General description

A total of nine sections of ditch, c.1.3 km in length, were carried forward from the scoping survey to the detailed survey in Area 3.

Area 3 is used for grazing cattle and as such each of the ditches on the site had poached margins, although these were not always submerged. Silt depth across the site was frequently recorded over 0.25 m deep which suggested that low intensity ditch management was carried out on the site.

Diversity and structure of the bankside, submerged and floating flora was considered very good with hard *Juncus inflexus* and soft rush *Juncus effusus* frequent along the bankside with associated herbs such as water mint *Mentha aquatica*, gypsywort *Lycopus europaeus* and water plantain *Alisma plantago-aquatica*. The water surface was frequently dominated by water soldier and frogbit. A few rare species were also recorded with greater water parsnip *Sium latifolium* and lesser water plantain *Baldellia ranunculoides* being most notable.

#### 3.3.2 Mollusc community

The number of mollusc species per sample varied from 14 to 26 (Appendix E, Table E1). Within Area 3, nine local or rare species, including the semi-aquatic Desmoulin's whorl snail were recorded. Little whirlpool ramshorn snail was recorded in 11 of the 16 samples taken, with the greatest densities recorded in ditches 146 and 147 in the southern eastern corner of the site.

The mollusc communities recorded in each sample were considered good for a freshwater grazing marsh system. Local and rare species were common in the samples and common detritivores were not overwhelmingly abundant.

#### 3.3.3 Habitat assessment

The site was originally identified as a potential receptor site for the project, however, the presence of little-whirlpool ramshorn snail precludes most of the suitable ditches on the site from use as receptor locations.

Consequently, six ditches were not considered suitable receptor sites, however, they do represent potential donor sites. Three ditches, a total of 335m in length, did not have little whirlpool ramshorn snail despite having very similar physical

structures and botanical and mollusc communities. These ditches are not strictly distinct from those holding little whirlpool ramshorn snail populations, however, the trackways and underground pipes connecting the water bodies are likely to form reasonable short-term migration (physical) barriers to a more surface-dwelling species.

Appendix E, Table E2 presents the tabulated results of the habitat assessment for Area 3. Figure 4 presents a map concluding the potential use of each ditch in a conservation translocation.

### 3.4 Area 5

#### 3.4.1 General description

In Area 5, 28 ditches were carried forward from the scoping survey to this detailed assessment, comprising a total of c.4.2 km split into 28 sections. These ditches were clustered in the north-eastern side of Area 5.

Area 5 was used for grazing cattle, consequently the edges of the ditches were poached, and grazed where the cattle could reach the marginal vegetation. However, the poached margins were rarely submerged and marginal vegetation was restricted to the main channel. In comparison with Areas 1, 2 and 3 many of the ditches on Area 5 were wider 3-4 m, rather than the 2-3 m wide ditches sampled in Areas 1, 2, and 3.

The silt layer in the ditches was rarely above 0.25 m deep and on the whole it was absent from the ditch. This suggested recent clearance of most channels across the site. In addition, there was significant variation in the cover of vegetation across the site which reflected patterns of ditch clearance on the site. Some ditch clearance was very recent, for example, Ditch 48 was identified to have 'good' potential to form a suitable receptor site for the translocation in the scoping study (AECOM, 2015b) however, the ditch had been cleared prior to the start of the detailed surveys and very little vegetation cover was present.

Towards the north-eastern corner of the site, vegetation structure improved to include greater amounts of submerged and floating aquatic macrophytes. In these areas, water soldier could be found dominating the water surface.

#### 3.4.2 Mollusc community

A total of 35 aquatic mollusc species were recorded in the ditches of Area 5 and on average 16.5 species were recorded per sample (Appendix F, Table F1). The common species whirlpool ramshorn snail *Anisus vortex*, common bithynia, common pond snail *Radix balthica* and margined ramshorn snail were most abundant, whilst local or rare species were less so.

Little whirlpool ramshorn snail was not recorded in any ditch sampled in Area 5.

#### 3.4.3 Habitat assessment

Of the 28 sections surveyed, 26 sections (3.678 km) were considered sub-optimal as receptor sites for this translocation based on the ditch management regime. The ditches were last cleared two years ago in 2013 and clearance of the ditches is carried out on a five-year basis which limits the build-up of sediment and silt. Regular clearance maintains the ditches in early to mid-successional stages.

However, the present botanical diversity and presence of cattle of the marshes suggests that if ditch clearance was carried out less frequently (for example every 10-15 years), prospects of little whirlpool ramshorn snail within Area 5 would greatly improve.

Appendix F, Table F2 presents the tabulated results of the habitat assessment for Area 5. Figure 5 presents a map concluding the potential use of each ditch in a conservation translocation.





Figure 4 Recommended use of ditches in [redacted] in a potential future conservation translocation.

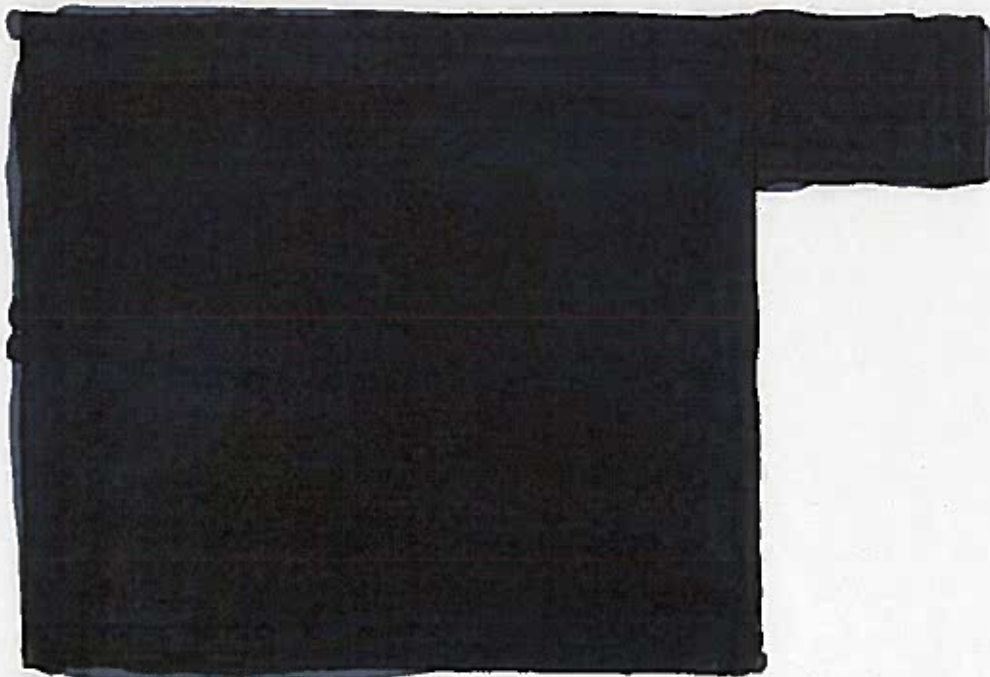


Figure 5 Recommended use of ditches in [redacted] in a potential future conservation translocation.

## 4 Discussion

### 4.1 Indications of Habitat Preferences of Little Whirlpool Ramshorn Snail

As discussed in the conservation translocation feasibility study (AECOM, 2015a), there is limited consensus on the preferences of the little whirlpool ramshorn snail with regard to biotic and abiotic habitat characteristics throughout the available literature. Through the use of information collated on habitat preferences in an extensive literature review and consultation process in AECOM (2015a) these detailed surveys assessed information pertinent to assessing grazing marshes ditches for their suitability to support little whirlpool ramshorn snail. Subsequently, this study has shed some light on the habitat preferences of little whirlpool ramshorn snail in four sites in the [REDACTED]

Little whirlpool ramshorn snail was recorded in two of the four Areas, subjected to detailed survey in the study area, in locations close to historical records. The snail was abundant in Area 1 within narrow ditches, up to 2m wide predominantly vegetated by common duckweed *Lemna minor*, which is typically interpreted as an indicator of eutrophic conditions, with limited associated aquatic macrophytes and simple marginal vegetation. The species was also recorded in Area 3 within more botanically diverse ditches which more readily fit with the Van Damme (2012) description of requirements for botanically diverse ditches.

The over-riding ditch characteristics which appeared (subjectively) to relate to the occurrence of little whirlpool ramshorn snail were the interlinked parameters of silt depth and ditch management regime. Where ditch clearance as part of a management regime was carried out frequently (within 5 year cycles), silt layers in the ditches were either absent or thin (up to 0.25 m). For example, in Area 5 silt layers were invariably thin and little whirlpool ramshorn snail was not recorded. On the other hand, the depth of the silt layer in ditches in Areas 1 and 3 (over 1m in certain ditches) suggested less intense maintenance, probably in the region of 10-year cycles and little whirlpool ramshorn snail was recorded, often in good densities.

Hingley (1979) suggested that it took more than five years for little whirlpool ramshorn snail to become established following [REDACTED]. In addition, over-frequent ditch clearance is widely cited as one of the main threats to the long-term prospect of the species (English Nature, 2000; Van Damme, 2012). Therefore, it is perhaps unsurprising that despite showing all the signs of good potential to support little ramshorn snail Area 5 was devoid of the species.

### 4.2 Implications for a Conservation Translocation

The results of this study suggest that a conservation translocation can commence within the sites surveyed. As Area 5 is unlikely to form a suitable receptor site for some years, even if its management is relaxed, a small scale translocation using Areas 1 and 3 is the best option to begin a pilot conservation translocation. This complies with the recommendations of the IUCN/SSC (2013) guidelines which recommend a pilot study is carried out to test a proposed conservation translocation.

The suitable donor ditches within Areas 1 and 3 should be used to source donor populations of little whirlpool ramshorn snail and the three suitable receptor ditches identified in Area 3 should be used for the pilot translocation. It is possible that a successful translocation is more likely to occur between suitable ditches in the same system, than between suitable ditches in separate systems where a greater number of factors such as water chemistry are likely to differ.

Suitable donor ditches were identified in Areas 1 and 3. These ditches supported high densities of little whirlpool ramshorn snail, which are likely to cope well with donating individuals for a translocation without suffering long-term effects. Whilst there is no evidence that this will be the case, the populations were high density for this species and continued monitoring of the populations during and post-translocation would give confidence in the robustness of the populations. In addition, no invasive species or other biosecurity risks were identified on these sites.

In terms of potential receptor ditches, three ditches in Area 3 were identified. These ditches were found to be suitable in every aspect investigated for little ramshorn whirlpool snail however the species was absent, consequently these ditches fulfil the criteria for receptor sites. These were joined to ditches where species was recorded by pipes underneath trackways in the marshes, however, these are likely to form reasonable barriers to the migration. Therefore, a translocation between ditches in Area 3 may be a suitable starting point for the conservation translocation project. Willing (2006) attempted a similar procedure at sites in the West Sussex Arun Valley, however, the results of the translocation have been inclusive.

Area 5 was identified during the feasibility study (AECOM, 2015a) and scoping survey (AECOM, 2015b) as a possible receptor site for a conservation translocation. However, these detailed surveys have effectively ruled-out the use of this site. These ditches have been ruled out in the short-to-medium term predominantly due to the current management regime of the ditches which reduces the build-up sediment and transition of the ditches into later successional stages, as previously discussed. If the frequency of the ditch clearance is relaxed in Area 5 it will take several years for it to form a suitable

receptor site. The floral assemblage and silt depth should be monitored if management relaxation is an option. This monitoring will determine, when / if these ditches become more suitable.

#### 4.3 Limitations of the Detailed Surveys and Recommendations for Further Work

##### 4.3.1 Limitations of the detailed surveys

There are a number of limitations to the current study which require consideration.

First, little whirlpool ramshorn snail is described as a 'stenotypic r-strategist', that is to say it is a habitat specialist with a rapid rate of population growth during its breeding cycle from March until July-November (Gibber and Groh 2007). The current study was conducted August to September and the vast majority of the individuals recorded were juveniles up to 3mm in diameter. The minute size of the juveniles can make them hard to detect, therefore it is possible that populations were overlooked or under-estimated due to surveyor error. Although, this risk is considered negligible, it is recommended that sampling at the proposed donor and receptor ditches is carried out on a small scale prior to translocation.

Secondly, water chemistry analysis in the current study was limited to pH, conductivity, temperature and dissolved oxygen. Aquatic invertebrates are intrinsically sensitive to water chemistry and it is likely that a greater range of physico-chemical parameters other than those recorded in the current study influence the distribution of little whirlpool ramshorn snail.

Finally, as discussed in Section 2.3, the final stages of the ditch assessment entailed elements of subjectivity and an understanding of the target species' ecology. Unfortunately, this was largely due to a lack of consensus and evidence base for the habitat preferences of the target species in the available literature. It is likely that habitat preferences vary from location to location and that a lack of consensus reflects this variation. However, the large amount of information collected in the current study presents the opportunity to investigate quantified analyses of a range of habitat and mollusc community features which may influence little whirlpool ramshorn snail distribution at the site scale.

##### 4.3.2 Further surveys / Recommended study

The limitations of the current study do not undermine the integrity of the conclusions drawn from the detailed surveys and subsequent ditch assessment. However, there is the need for a small number of additional studies and surveys which will allow this conservation translocation project to reach its full potential.

These include:

1. Repeated surveys of the receptor ditches identified in Area 3 to rule out the possibility of translocating the target species to ditches already occupied. It is recommended that subsamples are undertaken more closely together and a greater number of samples are undertaken per length of ditch.
2. It is recommended that additional water chemistry analyses are undertaken in Areas 1 and 3. These should include a greater range of physico-chemical parameters such as cations Na, K, Ca, Mg, trace metals, dissolved gases (CO<sub>2</sub>, H<sub>2</sub>S and O<sub>2</sub>), organic materials and nutrients. This would allow more detailed evaluation the pilot translocation by accounting for any differences in water quality in more detail.
3. Scoping of sites to the north of the A47 to determine the extent of the local population as far as possible.
4. Scope additional receptor sites with suitable long term management regimes such as RSPB reserves to allow expansion of the conservation translocation project following the pilot translocation.

As previously mentioned, the dataset collected during the current study is extensive and includes over 8,000 mollusc and plant records and over 1,500 measures of ditch characteristics at 100 sample locations in the study area. Therefore, multivariate statistical analysis should be used to reveal potential inter-relationships within the dataset. In addition, aquatic macroinvertebrate communities are important biological indicators of water quality. For that reason, it is also recommended that sampling of aquatic macroinvertebrate communities is carried out in the donor and receptor sites to allow the analysis of relationships between macroinvertebrate species, little whirlpool ramshorn snail and physico-chemical water parameters at the donor and receptor sites.

#### 4.3.3 Translocation protocol

A translocation protocol will need to be drawn up on the basis of the knowledge gained from this study, the feasibility study (AECOM, 2015a) and on-going consultation with stakeholders. Recommendations for the protocol include:

- Phased approach- increase in translocation effort each year;
- Monitoring; and,
- Sectioning the ditches using a fine mesh to separate seeded donor populations in the receptor site- to enable differentiation between population translocation from between Area 1 and 3 and populations translocated within Area 3.

## 5 References

- AECOM. 2015a. Feasibility study on the translocation of the little whirlpool ramshorn snail. Report to Highways Agency.
- AECOM. 2015b. Translocation of the little whirlpool ramshorn snail – scoping survey. Report to Highways Agency.
- English Nature, 2000. Norfolk Biodiversity Action Plan Little Whirlpool Ram's-horn Snail (*Anisus vorticulus*), Available at: <http://www.norfolk-biodiversity.org/actionplans/speciesactionplans/littlewhirlpoolsnail.aspx>. (updated 2012).
- Glöer, P. & Groh, K., 2007. A contribution to the biology and ecology of the threatened species *Anisus vorticulus* (Troschel, 1834) (Gastropoda: Pulmonata: Planorbidae). *Mollusca*, 25(1), pp.33–40.
- Hingley, M. R., 1979. The colonisation of newly dredged drainage channels on the Pevensy level (East Sussex) with special reference to gastropods. *London: Journal of Conchology*, 30: 105 - 22.
- IUCN/SSC, 2013. Guidelines for Reintroductions and Other Conservation Translocations, Gland, Switzerland.
- Joint Nature Conservation Committee. 2007. Second Report by the UK under Article 17 on the implementation of the Habitats Directive from January 2001 to December 2006. Peterborough, UK.
- Palmer, M., Drake, M., Stewart, N. 2013. A manual for the survey and evaluation of the aquatic plant and invertebrate assemblages of grazing marsh ditch systems. Pages 10-11. Version 6. Buglife, Peterborough.
- Van Damme, D. 2012. *Anisus vorticulus*. The IUCN Red List of Threatened Species 2012: e.T155966A738056. <http://dx.doi.org/10.2305/IUCN.UK.2012-1.RLTS.T155966A738056.en>. Downloaded on 20 October 2015.
- Willing, M. J. 2006. Monitoring, survey and translocation of populations of the little whirlpool ramshorn snail *Anisus vorticulus* at Pulborough Brooks, Amberley Widibrooks and North Stoke, June-November 2005. An unpublished report to the RSPB and Environment Agency (Worthing).
- Willing, M.J., 2014. A full survey of ditches on RSPB Pulborough Brooks for the Little Whirlpool Ram's-horn Snail *Anisus vorticulus*: (November 2013 / July 2014), Report to RSPB.

## Appendix A: Recording Forms

Date	
Site ID	
Ditch no.	
Photo(s)	
Grid ref.	
Side A	
Side B	

Water features	
pH	
Conductivity (mcS)	
D.O.	
Temp	
Water column	

Abiotic Data Recording Sheet

	Adjacent Land use	
	A	B
Improved grassland		
Semi-improved grassland		
Unimproved grassland		
Arable		
Swamp/fen		
Drains		
Cattle/sheep grazed		
Sheep grazed		
Hay/Silage		
Stockproof boundary		
Temporary fencing		
Spill on bank		

	Bank vegetation (DAPOR)	
	A	B
Tall grass/reed		
Short grass		
Bare ground		
Tall herbs		
Overhanging vegetation		
Scrub <1.5m		
fen		
Woodland ground flora		
Shaded (%)		

	Vegetation cover	
	DAPOR	Absent
Open water surface		
Floating Lemna/Azolla		
Other floating aquatics		
Floating algae		
Lemna tricola		
Other submerged plants		
Submerged algae		
Open substrate		
Emergent		
Low emergent/Floating root		
Exposed vegetation		
Exposed mud		
Litter / debris		
Shaded		
Emergent/floating root in channel %		

Water width (m)	Bank top width (m)	Freshwater depth (cm)	Silt depth (cm)	Slope bank		Profile under water A	Profile under water B	Substrate	Turbidity
				bank A	bank B				
0-1	0-2	0-25	0-25	0-15	0-15	0-15	0-15	Clay	Clear
1-2	2-4	26-50	25-50	16-30	16-30	16-30	16-30	Alluvial	Slight
2-3	4-6	51-100	51-75	31-55	31-55	31-55	31-55	Peat	Mod
3-4	6-8	100-200	76-100	56-70	56-70	56-70	56-70	Sand	Heavy
4+	>10	>200	>100	71-90	71-90	71-90	71-90	Gravel	

	Grazing/vegetation structure					
	None	Low		Med		High
	A	B	A	B	A	B
Grazing						
Feeding						
Stock formation						
Shelf formation						
Impedance						
Grassy margin						

NOTES

	Management			
	1	2-3	4-10	>10
Years since last cleared	Not known			
Water relative to normal (cm)	Not known		Normal?	
Cleared to side	A	B		
Reached profile	A	B		
Cleared by				

AECOM Mollusc Data Recording Sheet

Site:

Date:

Mollusc species	Subsample (counts)		
	A	B	C
Acroloxus lacustris			
Anisus leucostoma			
Anisus vortex			
Anisus verticulus			
Bathymphalus contortus			
Bithynia leachii			
Bithynia tentaculata			
Galba truncatula			
Gyraulus albus			
Gyraulus crista			
Hippeutis complanatus			
Lymnaea fuscus			
Lymnaea palustris			
Lymnaea stagnalis			
Musculum lacustris			
Oxyloma pfeiferi			
Oxyloma sarsi			
Physa acuta			
Physa fontinalis			
Pisidium milium			
Pisidium nitidum			
Pisidium personatum			
Pisidium pseudosphaerium			
Pisidium sp			
Planorbis cornuus			
Planorbis carinatus			
Planorbis planorbis			
Potamopyrgus antipodarum			
Radix auricula			
Radix balthica			
Segmentina nitida			
Sphaerium corneus			
Sphaerium nucius			
Succinea putris			
Valvata cristata			
Valvata macrustoma			
Valvata piscinalis			
Vertigo mouliniana			
Viviparus sp.			
Viviparus connectus			
Zonitoides nitidula			



AECOM Vegetation Data Recording Sheet

Emergent plants				Site
Species	Subsample (DAFOR)			Date:
	A	B	C	
Agrost stol				
Alisma lance				
Alisma plant				
Alopec genic				
Angelica sylv				
Aplium nodif				
Aplium rep				
Berula erect				
Butom umbel				
Carex acutif				
Carex otrub				
Carex pseud				
Carex ripar				
Cirsium pal				
Dactyl glom				
Eleochar pal				
Elytrog repen				
Epilob hirsut				
Epilob parvi				
Equiset fluv				
Eupator can				
Festuca rub				
Fillipend ulm				
Gallium palus				
Glycer fluit				
Glycer max				
Holcus lanat				
Iris pseudac				
Juncus artic				
Juncus bufo				
Juncus effus				
Juncus inflex				
Lathyr prat				
Lolium pere				
Lotus pedun				
Lycop europ				
Lythrum sal				
Mentha aqua				
Myosot laxa				
Myosot scor				
Oenan aqu				
Oenan fist				
Phragm aust				
Plant lanceo				
Poa trivialis				
Potentill ans				
Ran acris				
Ran flammu				
Ran sceler				
Rorip nas ag				
Rumex hydol				
Rumex obtus				
Salix ciner				
Salix fragi				
Salix sp.				
Samolus val				
Schoen lab				
Scroph aur				
Scutel galer				
Solan dulca				
Sparg erect				
Stachys pal				

Aquatic plants (submerged-leaves)			
Species	Subsample (DAFOR)		
	A	B	C
Callit brut			
Callit obtus			
Callit platy			
Callit stag			
Cerat dem			
Cerat subm			
Chara vulg			
Elodea can			
Elodea nutt			
Filam alg			
Front anti			
Hottonia pal			
Myrioph spic			
Myrioph vert			
Potam berch			
Potam crisp			
Potam natan			
Potam pect			
Potam pus			
Potam trich			
Ran aqu agg			
Ran circ			
Sagitt sag			
Sparg emers			
Sparg erect			
Zannic palus			

Floating leaved plants			
Species	Subsample (DAFOR)		
	A	B	C
Azolla filicu			
Hydroch mor			
Hydroco ran			
Hydroco vul			
Lemna gibba			
Lemna minor			
Lemna minut			
Lemna trisul			
Nuphar lut			
Nymph alba			
Persic amph			
Spiro polyr			
Stratio alo			
Wolff arrh			

## Appendix B: Illustrated sample locations

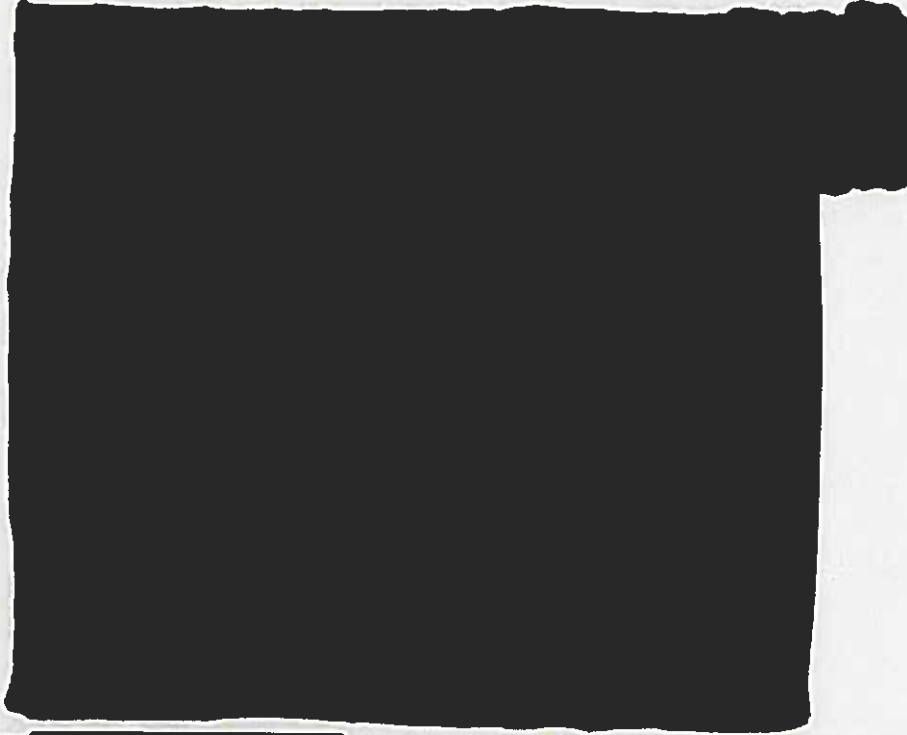


Figure B1 [REDACTED] Sample IDs and Ditch IDs shown adjacent to each feature, in normal and bold text, respectively.

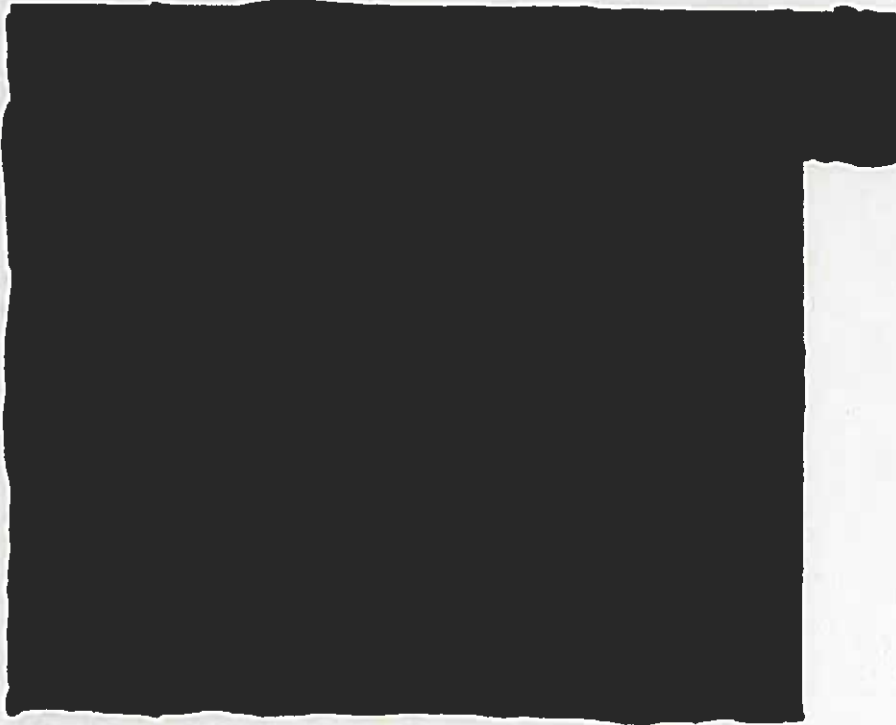


Figure B2. [REDACTED] Sample IDs and Ditch IDs shown adjacent to each feature, in normal and bold text, respectively.

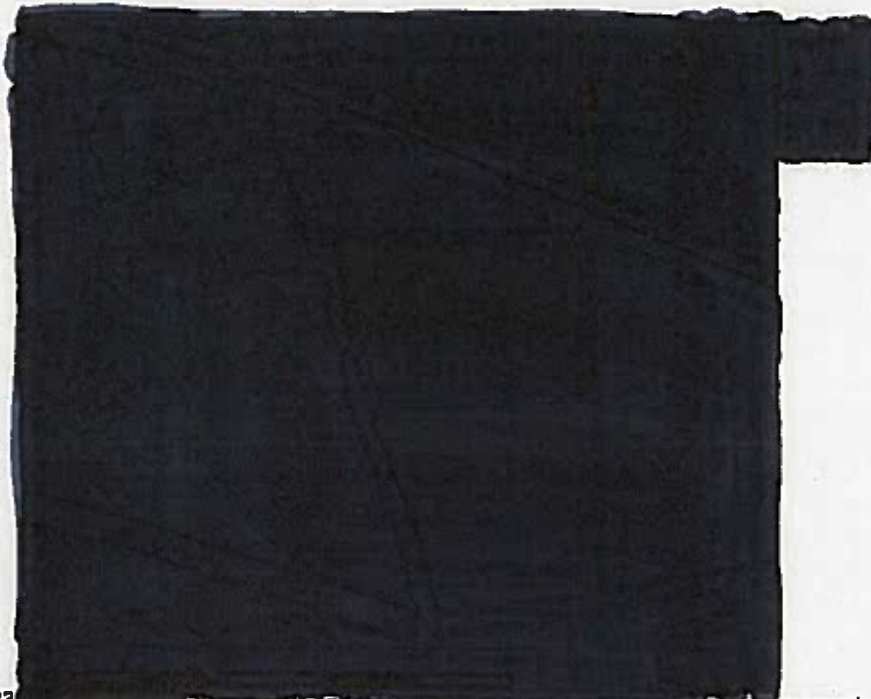


Figure B3 [redacted] Sample IDs and Ditch IDs shown adjacent to each feature, in normal and bold text, respectively.



Figure B4 [redacted] Sample IDs and Ditch IDs shown adjacent to each feature, in normal and bold text, respectively.

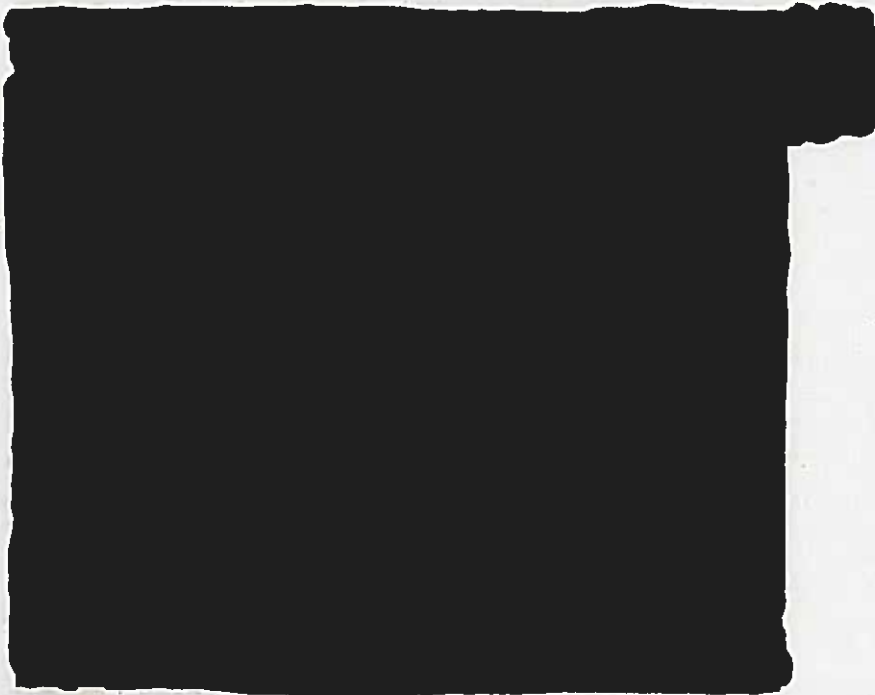


Figure B5. [REDACTED] Sample IDs and Ditch IDs shown adjacent to each feature, in normal and bold text, respectively.

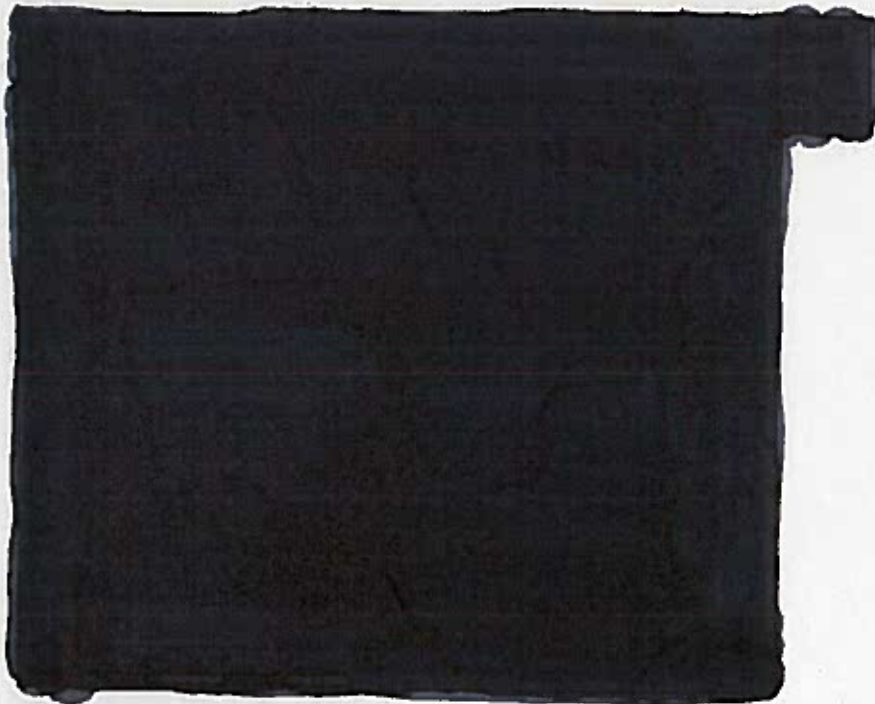


Figure B6. [REDACTED] Sample IDs and Ditch IDs shown adjacent to each feature, in normal and bold text, respectively.

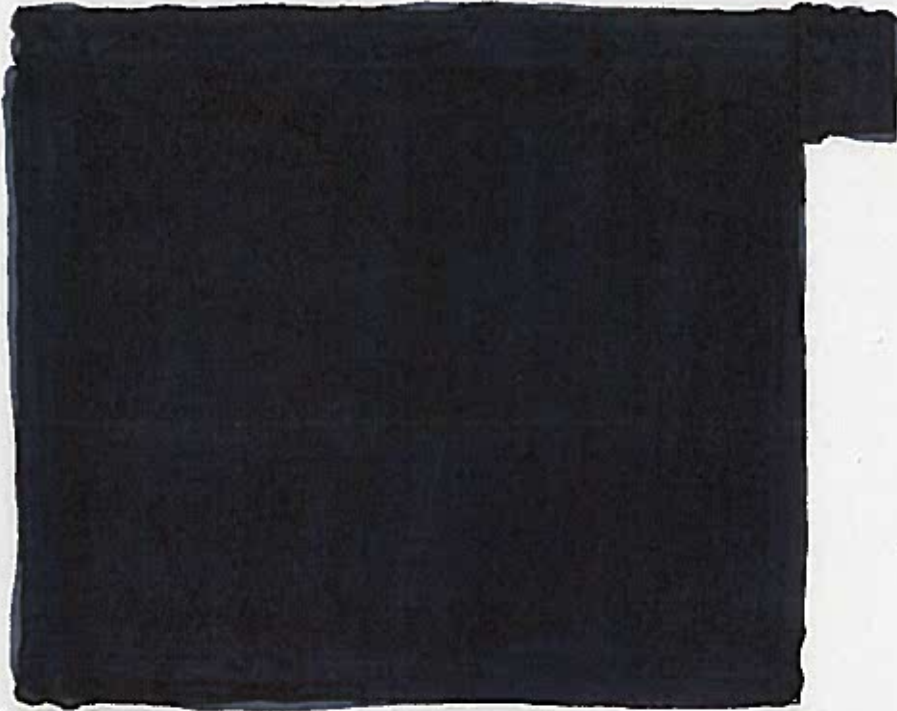


Figure B7. [REDACTED] Sample IDs and Ditch IDs shown adjacent to each feature, in normal and bold text, respectively.

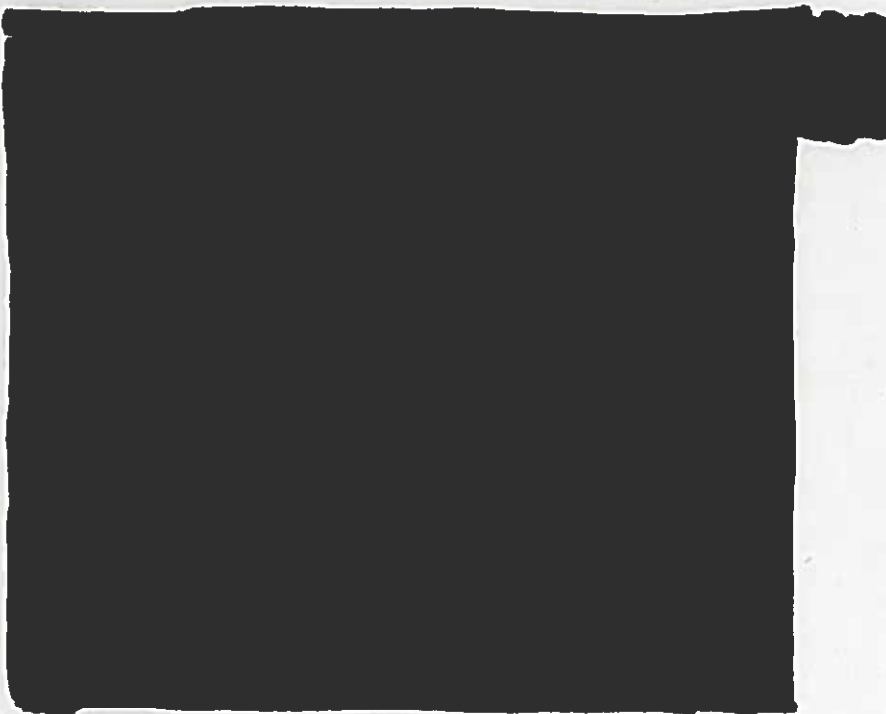


Figure B8. [REDACTED] Sample IDs and Ditch IDs shown adjacent to each feature, in normal and bold text, respectively.

## Appendix C: Area 1 mollusc diversity data and ditch assessment

Table C1. Area 1 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy<sup>1</sup> for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

Sample ID	1.1	1.2	1.3	1.4	1.5	1.6																																																																																																																																																																								
Grid reference	[REDACTED]																																																																																																																																																																													
Status	Species																																																																																																																																																																													
Common	<table border="1"> <tr><td><i>Acrotrochus lacustris</i></td><td>5</td><td>5</td><td>4</td><td>1</td><td>1</td><td></td></tr> <tr><td><i>Anisus leucostoma</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Anisus vortex</i></td><td>4</td><td>5</td><td>4</td><td>5</td><td>4</td><td>2</td></tr> <tr><td><i>Amigera crista</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Bithynia tentaculata</i></td><td>5</td><td>8</td><td>6</td><td>9</td><td>6</td><td>9</td></tr> <tr><td><i>Galba truncatula</i></td><td>8</td><td>5</td><td>6</td><td>3</td><td>4</td><td>1</td></tr> <tr><td><i>Lymnaea auricularia</i></td><td></td><td>1</td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Lymnaea palustris</i></td><td>6</td><td>6</td><td>4</td><td>6</td><td>3</td><td>5</td></tr> <tr><td><i>Lymnaea stagnalis</i></td><td></td><td>3</td><td></td><td>2</td><td>2</td><td>6</td></tr> <tr><td><i>Musculum lacustris</i></td><td></td><td>1</td><td></td><td></td><td></td><td>1</td></tr> <tr><td><i>Oxyloma Pfeifferi</i></td><td>6</td><td>4</td><td>6</td><td>1</td><td>2</td><td>3</td></tr> <tr><td><i>Physa fontinalis</i></td><td></td><td>4</td><td>3</td><td>8</td><td>5</td><td>8</td></tr> <tr><td><i>Pisidium milium</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium nitidum</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium obtusale</i></td><td></td><td>2</td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium personatum</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium sp</i></td><td>9</td><td>9</td><td>4</td><td>8</td><td>2</td><td>5</td></tr> <tr><td><i>Planorbis cornutus</i></td><td></td><td>3</td><td>9</td><td>2</td><td></td><td>2</td></tr> <tr><td><i>Planorbis carinatus</i></td><td></td><td></td><td></td><td>1</td><td>5</td><td>1</td></tr> <tr><td><i>Planorbis planorbis</i></td><td>8</td><td>3</td><td>3</td><td>3</td><td>4</td><td>10</td></tr> <tr><td><i>Radix balthica</i></td><td>8</td><td>7</td><td>3</td><td>8</td><td>8</td><td>14</td></tr> <tr><td><i>Sphaerium comeum</i></td><td>1</td><td>6</td><td>4</td><td>8</td><td>4</td><td>4</td></tr> <tr><td><i>Stagnicola fuscus</i></td><td></td><td></td><td>2</td><td></td><td></td><td></td></tr> <tr><td><i>Succinea putris</i></td><td>3</td><td>5</td><td></td><td>2</td><td>5</td><td>7</td></tr> </table>						<i>Acrotrochus lacustris</i>	5	5	4	1	1		<i>Anisus leucostoma</i>							<i>Anisus vortex</i>	4	5	4	5	4	2	<i>Amigera crista</i>							<i>Bithynia tentaculata</i>	5	8	6	9	6	9	<i>Galba truncatula</i>	8	5	6	3	4	1	<i>Lymnaea auricularia</i>		1					<i>Lymnaea palustris</i>	6	6	4	6	3	5	<i>Lymnaea stagnalis</i>		3		2	2	6	<i>Musculum lacustris</i>		1				1	<i>Oxyloma Pfeifferi</i>	6	4	6	1	2	3	<i>Physa fontinalis</i>		4	3	8	5	8	<i>Pisidium milium</i>							<i>Pisidium nitidum</i>							<i>Pisidium obtusale</i>		2					<i>Pisidium personatum</i>							<i>Pisidium sp</i>	9	9	4	8	2	5	<i>Planorbis cornutus</i>		3	9	2		2	<i>Planorbis carinatus</i>				1	5	1	<i>Planorbis planorbis</i>	8	3	3	3	4	10	<i>Radix balthica</i>	8	7	3	8	8	14	<i>Sphaerium comeum</i>	1	6	4	8	4	4	<i>Stagnicola fuscus</i>			2				<i>Succinea putris</i>	3	5		2	5	7
<i>Acrotrochus lacustris</i>	5	5	4	1	1																																																																																																																																																																									
<i>Anisus leucostoma</i>																																																																																																																																																																														
<i>Anisus vortex</i>	4	5	4	5	4	2																																																																																																																																																																								
<i>Amigera crista</i>																																																																																																																																																																														
<i>Bithynia tentaculata</i>	5	8	6	9	6	9																																																																																																																																																																								
<i>Galba truncatula</i>	8	5	6	3	4	1																																																																																																																																																																								
<i>Lymnaea auricularia</i>		1																																																																																																																																																																												
<i>Lymnaea palustris</i>	6	6	4	6	3	5																																																																																																																																																																								
<i>Lymnaea stagnalis</i>		3		2	2	6																																																																																																																																																																								
<i>Musculum lacustris</i>		1				1																																																																																																																																																																								
<i>Oxyloma Pfeifferi</i>	6	4	6	1	2	3																																																																																																																																																																								
<i>Physa fontinalis</i>		4	3	8	5	8																																																																																																																																																																								
<i>Pisidium milium</i>																																																																																																																																																																														
<i>Pisidium nitidum</i>																																																																																																																																																																														
<i>Pisidium obtusale</i>		2																																																																																																																																																																												
<i>Pisidium personatum</i>																																																																																																																																																																														
<i>Pisidium sp</i>	9	9	4	8	2	5																																																																																																																																																																								
<i>Planorbis cornutus</i>		3	9	2		2																																																																																																																																																																								
<i>Planorbis carinatus</i>				1	5	1																																																																																																																																																																								
<i>Planorbis planorbis</i>	8	3	3	3	4	10																																																																																																																																																																								
<i>Radix balthica</i>	8	7	3	8	8	14																																																																																																																																																																								
<i>Sphaerium comeum</i>	1	6	4	8	4	4																																																																																																																																																																								
<i>Stagnicola fuscus</i>			2																																																																																																																																																																											
<i>Succinea putris</i>	3	5		2	5	7																																																																																																																																																																								
Local	<table border="1"> <tr><td><i>Bathymophalus contortus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Bithynia leachi</i></td><td>10</td><td>6</td><td>5</td><td>9</td><td>5</td><td>11</td></tr> <tr><td><i>Hippeutis complanatus</i></td><td></td><td></td><td></td><td>3</td><td></td><td></td></tr> <tr><td><i>Valvata cristata</i></td><td>1</td><td>6</td><td>6</td><td>5</td><td>2</td><td></td></tr> <tr><td><i>Viviparus connectus</i></td><td>1</td><td></td><td>3</td><td></td><td></td><td></td></tr> </table>						<i>Bathymophalus contortus</i>							<i>Bithynia leachi</i>	10	6	5	9	5	11	<i>Hippeutis complanatus</i>				3			<i>Valvata cristata</i>	1	6	6	5	2		<i>Viviparus connectus</i>	1		3																																																																																																																																								
<i>Bathymophalus contortus</i>																																																																																																																																																																														
<i>Bithynia leachi</i>	10	6	5	9	5	11																																																																																																																																																																								
<i>Hippeutis complanatus</i>				3																																																																																																																																																																										
<i>Valvata cristata</i>	1	6	6	5	2																																																																																																																																																																									
<i>Viviparus connectus</i>	1		3																																																																																																																																																																											
Naturalised	<table border="1"> <tr><td><i>Physa acuta</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Potamopyrgus antipodarum</i></td><td>1</td><td></td><td></td><td></td><td></td><td></td></tr> </table>						<i>Physa acuta</i>							<i>Potamopyrgus antipodarum</i>	1																																																																																																																																																															
<i>Physa acuta</i>																																																																																																																																																																														
<i>Potamopyrgus antipodarum</i>	1																																																																																																																																																																													
Rare	<table border="1"> <tr><td><i>Sphaerium nucleus</i></td><td></td><td>3</td><td>5</td><td></td><td></td><td></td></tr> </table>						<i>Sphaerium nucleus</i>		3	5																																																																																																																																																																				
<i>Sphaerium nucleus</i>		3	5																																																																																																																																																																											
RDB1	<table border="1"> <tr><td><i>Segmentina nitida</i></td><td>11</td><td>15</td><td>15</td><td>9</td><td></td><td></td></tr> </table>						<i>Segmentina nitida</i>	11	15	15	9																																																																																																																																																																			
<i>Segmentina nitida</i>	11	15	15	9																																																																																																																																																																										
RDB1, EPS	<table border="1"> <tr><td><i>Anisus vorticulus</i></td><td>7</td><td>6</td><td>4</td><td></td><td></td><td></td></tr> </table>						<i>Anisus vorticulus</i>	7	6	4																																																																																																																																																																				
<i>Anisus vorticulus</i>	7	6	4																																																																																																																																																																											
RDB3	<table border="1"> <tr><td><i>Oxyloma sarsi</i></td><td></td><td>5</td><td>1</td><td></td><td>1</td><td>3</td></tr> <tr><td><i>Pisidium pseudosphaerium</i></td><td>1</td><td>6</td><td>8</td><td></td><td></td><td></td></tr> </table>						<i>Oxyloma sarsi</i>		5	1		1	3	<i>Pisidium pseudosphaerium</i>	1	6	8																																																																																																																																																													
<i>Oxyloma sarsi</i>		5	1		1	3																																																																																																																																																																								
<i>Pisidium pseudosphaerium</i>	1	6	8																																																																																																																																																																											

<sup>1</sup>Modified DAFOR scale used in mollusc community recording.

Value	Description	Estimation of abundance	Numerical Proxy
D	Dominant	100+	5
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1



Table C1 continued. Area 1 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy<sup>1</sup> for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

Sample ID	1.7	1.8	1.9	1.11	1.10	1.13
Grid reference	[REDACTED]					
Status	[REDACTED]					
Species	[REDACTED]					
<b>Common</b>						
<i>Acroloxus lacustris</i>		6	3	1		
<i>Anisus leucostoma</i>						
<i>Anisus vortex</i>	3	2		5		
<i>Arniger crista</i>		2				
<i>Bithynia tentaculata</i>	9	7	7	6		
<i>Galba truncatula</i>	3	3	5	4		1
<i>Lymnaea auricularia</i>						
<i>Lymnaea palustris</i>	1	6	1	6	1	
<i>Lymnaea stagnalis</i>				1		
<i>Musculum lacustris</i>		1			9	
<i>Oxytoma pfeifferi</i>		7	6			
<i>Physa fontinalis</i>		6	6	3		2
<i>Pisidium milium</i>						
<i>Pisidium nitidum</i>						
<i>Pisidium obusale</i>						
<i>Pisidium personatum</i>		6	1			
<i>Pisidium sp</i>		9	9	6		10
<i>Pianorbatus comeus</i>	2		2	1		
<i>Pianorbis carinatus</i>	2		1	1		
<i>Pianorbis pianorbis</i>	4		2	3	6	3
<i>Radix balthica</i>	5	2	6	5	6	4
<i>Sphaerium comeum</i>	6	1	8	7	3	11
<i>Stagnicola fuscus</i>	2		2			
<i>Succinea putris</i>		2	2			1
<b>Local</b>						
<i>Bathymphalus contortus</i>					3	
<i>Bithynia leachii</i>	4	6	8	11	2	3
<i>Hippautilus complanatus</i>	3			1	6	1
<i>Valvata cristata</i>	2	6	6	5	1	
<i>Viviparus connectus</i>	1	1	4			
<b>Naturalised</b>						
<i>Physa acuta</i>						3
<i>Potamopyrgus antipo-</i>						
<b>Rare</b>						
<i>Sphaerium nucleus</i>	1		1	2	1	
<b>RDB1</b>						
<i>Segmentina nitida</i>	11	12	7	6	3	6
<b>RDB1, EPS</b>						
<i>Anisus vorticulus</i>	12	8	11	6		
<b>RDB3</b>						
<i>Oxytoma sarsi</i>	1		3	2		
<i>Pisidium pseudosphaerium</i>		8	13		1	

<sup>1</sup>Modified DAFOR scale used in mollusc community recording

Value	Descriptor	Estimation of abundance	Numerical Proxy
D	Dominant	100+	5
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1

Table C1 continued. Area 1 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

Sample ID	1.14	1.15	1.16	1.17	1.18	1.19																																																																																																																																																																								
Grid reference	[REDACTED]																																																																																																																																																																													
Status	Species																																																																																																																																																																													
Common	<table border="1"> <tr><td><i>Acrotaxus lacustris</i></td><td>2</td><td>2</td><td></td><td>4</td><td></td><td>2</td></tr> <tr><td><i>Anisus leucostoma</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Anisus vortex</i></td><td>1</td><td>3</td><td>7</td><td>5</td><td>7</td><td>6</td></tr> <tr><td><i>Armiger crista</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Bithynia tentaculata</i></td><td>7</td><td>6</td><td>9</td><td>9</td><td>9</td><td>8</td></tr> <tr><td><i>Gaiba truncatula</i></td><td></td><td>3</td><td>6</td><td>5</td><td>6</td><td>5</td></tr> <tr><td><i>Lymnaea auricularis</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Lymnaea palustris</i></td><td>3</td><td>2</td><td>7</td><td>5</td><td>9</td><td></td></tr> <tr><td><i>Lymnaea stagnalis</i></td><td></td><td></td><td></td><td>1</td><td>1</td><td></td></tr> <tr><td><i>Musculum lacustris</i></td><td></td><td></td><td></td><td></td><td></td><td>4</td></tr> <tr><td><i>Oxytoma Pfeifferi</i></td><td>1</td><td>1</td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Physa fontinalis</i></td><td></td><td>4</td><td>6</td><td>6</td><td>9</td><td>9</td></tr> <tr><td><i>Pisidium milium</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium nitidum</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium obtusale</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium personatum</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium sp</i></td><td>6</td><td>7</td><td>4</td><td>6</td><td>8</td><td>2</td></tr> <tr><td><i>Planorbis comeus</i></td><td>2</td><td>7</td><td>1</td><td></td><td></td><td></td></tr> <tr><td><i>Planorbis carinatus</i></td><td></td><td></td><td></td><td></td><td>2</td><td></td></tr> <tr><td><i>Planorbis planorbis</i></td><td>1</td><td></td><td></td><td></td><td>4</td><td></td></tr> <tr><td><i>Radix balthica</i></td><td>1</td><td>7</td><td>6</td><td>7</td><td>9</td><td>6</td></tr> <tr><td><i>Sphaerium comeum</i></td><td>9</td><td>6</td><td>3</td><td></td><td></td><td></td></tr> <tr><td><i>Stagnicola fuscus</i></td><td></td><td></td><td>2</td><td></td><td></td><td></td></tr> <tr><td><i>Succinea putris</i></td><td></td><td></td><td></td><td>2</td><td>1</td><td>3</td></tr> </table>						<i>Acrotaxus lacustris</i>	2	2		4		2	<i>Anisus leucostoma</i>							<i>Anisus vortex</i>	1	3	7	5	7	6	<i>Armiger crista</i>							<i>Bithynia tentaculata</i>	7	6	9	9	9	8	<i>Gaiba truncatula</i>		3	6	5	6	5	<i>Lymnaea auricularis</i>							<i>Lymnaea palustris</i>	3	2	7	5	9		<i>Lymnaea stagnalis</i>				1	1		<i>Musculum lacustris</i>						4	<i>Oxytoma Pfeifferi</i>	1	1					<i>Physa fontinalis</i>		4	6	6	9	9	<i>Pisidium milium</i>							<i>Pisidium nitidum</i>							<i>Pisidium obtusale</i>							<i>Pisidium personatum</i>							<i>Pisidium sp</i>	6	7	4	6	8	2	<i>Planorbis comeus</i>	2	7	1				<i>Planorbis carinatus</i>					2		<i>Planorbis planorbis</i>	1				4		<i>Radix balthica</i>	1	7	6	7	9	6	<i>Sphaerium comeum</i>	9	6	3				<i>Stagnicola fuscus</i>			2				<i>Succinea putris</i>				2	1	3
<i>Acrotaxus lacustris</i>	2	2		4		2																																																																																																																																																																								
<i>Anisus leucostoma</i>																																																																																																																																																																														
<i>Anisus vortex</i>	1	3	7	5	7	6																																																																																																																																																																								
<i>Armiger crista</i>																																																																																																																																																																														
<i>Bithynia tentaculata</i>	7	6	9	9	9	8																																																																																																																																																																								
<i>Gaiba truncatula</i>		3	6	5	6	5																																																																																																																																																																								
<i>Lymnaea auricularis</i>																																																																																																																																																																														
<i>Lymnaea palustris</i>	3	2	7	5	9																																																																																																																																																																									
<i>Lymnaea stagnalis</i>				1	1																																																																																																																																																																									
<i>Musculum lacustris</i>						4																																																																																																																																																																								
<i>Oxytoma Pfeifferi</i>	1	1																																																																																																																																																																												
<i>Physa fontinalis</i>		4	6	6	9	9																																																																																																																																																																								
<i>Pisidium milium</i>																																																																																																																																																																														
<i>Pisidium nitidum</i>																																																																																																																																																																														
<i>Pisidium obtusale</i>																																																																																																																																																																														
<i>Pisidium personatum</i>																																																																																																																																																																														
<i>Pisidium sp</i>	6	7	4	6	8	2																																																																																																																																																																								
<i>Planorbis comeus</i>	2	7	1																																																																																																																																																																											
<i>Planorbis carinatus</i>					2																																																																																																																																																																									
<i>Planorbis planorbis</i>	1				4																																																																																																																																																																									
<i>Radix balthica</i>	1	7	6	7	9	6																																																																																																																																																																								
<i>Sphaerium comeum</i>	9	6	3																																																																																																																																																																											
<i>Stagnicola fuscus</i>			2																																																																																																																																																																											
<i>Succinea putris</i>				2	1	3																																																																																																																																																																								
Local	<table border="1"> <tr><td><i>Bathyomphalus contortus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Bithynia leachii</i></td><td>10</td><td>6</td><td>2</td><td></td><td>14</td><td>6</td></tr> <tr><td><i>Hippeutis complanatus</i></td><td>8</td><td>2</td><td>3</td><td>1</td><td></td><td>2</td></tr> <tr><td><i>Valvata cristata</i></td><td>8</td><td>5</td><td>7</td><td>3</td><td>7</td><td>6</td></tr> <tr><td><i>Viviparus connectus</i></td><td></td><td>6</td><td>4</td><td></td><td></td><td></td></tr> </table>						<i>Bathyomphalus contortus</i>							<i>Bithynia leachii</i>	10	6	2		14	6	<i>Hippeutis complanatus</i>	8	2	3	1		2	<i>Valvata cristata</i>	8	5	7	3	7	6	<i>Viviparus connectus</i>		6	4																																																																																																																																								
<i>Bathyomphalus contortus</i>																																																																																																																																																																														
<i>Bithynia leachii</i>	10	6	2		14	6																																																																																																																																																																								
<i>Hippeutis complanatus</i>	8	2	3	1		2																																																																																																																																																																								
<i>Valvata cristata</i>	8	5	7	3	7	6																																																																																																																																																																								
<i>Viviparus connectus</i>		6	4																																																																																																																																																																											
Naturalised	<table border="1"> <tr><td><i>Physa acuta</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Potamopyrgus antipodarum</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>						<i>Physa acuta</i>							<i>Potamopyrgus antipodarum</i>																																																																																																																																																																
<i>Physa acuta</i>																																																																																																																																																																														
<i>Potamopyrgus antipodarum</i>																																																																																																																																																																														
Rare	<table border="1"> <tr><td><i>Sphaerium nucleus</i></td><td>4</td><td>1</td><td></td><td></td><td></td><td></td></tr> </table>						<i>Sphaerium nucleus</i>	4	1																																																																																																																																																																					
<i>Sphaerium nucleus</i>	4	1																																																																																																																																																																												
RDB1	<table border="1"> <tr><td><i>Segmentina nitida</i></td><td>15</td><td>1</td><td>3</td><td>1</td><td>5</td><td>4</td></tr> </table>						<i>Segmentina nitida</i>	15	1	3	1	5	4																																																																																																																																																																	
<i>Segmentina nitida</i>	15	1	3	1	5	4																																																																																																																																																																								
RDB1, EPS	<table border="1"> <tr><td><i>Anisus vorticulus</i></td><td>3</td><td>9</td><td></td><td></td><td></td><td></td></tr> </table>						<i>Anisus vorticulus</i>	3	9																																																																																																																																																																					
<i>Anisus vorticulus</i>	3	9																																																																																																																																																																												
RDB3	<table border="1"> <tr><td><i>Oxytoma sarsi</i></td><td></td><td>7</td><td>7</td><td></td><td>2</td><td>6</td></tr> <tr><td><i>Pisidium pseudo-sphaerium</i></td><td></td><td></td><td>1</td><td></td><td></td><td></td></tr> </table>						<i>Oxytoma sarsi</i>		7	7		2	6	<i>Pisidium pseudo-sphaerium</i>			1																																																																																																																																																													
<i>Oxytoma sarsi</i>		7	7		2	6																																																																																																																																																																								
<i>Pisidium pseudo-sphaerium</i>			1																																																																																																																																																																											

Modified DAFOR scale used in mollusc community recording

Value	Description	Estimates of abundance	Numerical Proxy
B	Dominant	100+	5
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1

Table C1 continued. Area 1 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

Sample ID		1.21	1.22	1.23	1.24	1.25	1.26
Grid reference		[REDACTED]					
Status	Species	6	3	6	6	6	01
Common	<i>Acroloxus lacustris</i>	1	8	1	2	4	1
	<i>Anisus leucostoma</i>				1		
	<i>Anisus vortex</i>	11	8	5	6	5	8
	<i>Armiger crista</i>		6	4	4	4	
	<i>Bithynia tentaculata</i>	9	11	8	10	9	8
	<i>Galba truncatula</i>	1	5	7	5	6	
	<i>Lymnaea auricularia</i>						
	<i>Lymnaea palustris</i>	4	4	4	5	6	7
	<i>Lymnaea stagnalis</i>	4	6	3	4	3	7
	<i>Musculum lacustris</i>						1
	<i>Oxytoma Pfeifferi</i>	5	3	1	3	2	
	<i>Physa fontinalis</i>	9	10	9	10	9	9
	<i>Pisidium milium</i>			7	2		
	<i>Pisidium nitidum</i>						
	<i>Pisidium obtusale</i>						
	<i>Pisidium personatum</i>				1		
	<i>Pisidium sp</i>	7	6	8	4	6	5
	<i>Planorbis comeus</i>	3	4	1	3	4	6
	<i>Planorbis carinatus</i>	2	1				
	<i>Planorbis planorbis</i>	5	6			2	5
<i>Radix balthica</i>	7	10	11	6	12	10	
<i>Sphaerium comeum</i>							
<i>Stagnicola fuscus</i>							
<i>Succinea putris</i>	6	1				1	
Local	<i>Bathymphalus contortus</i>		1				
	<i>Bithynia leachii</i>	12	6	2	3	5	8
	<i>Hippetis complanatus</i>		3	8	3	6	3
	<i>Valvata cristata</i>	2	5	7	6	4	3
	<i>Viviparus connectus</i>						
Naturalised	<i>Physa acuta</i>						
	<i>Potamopyrgus antipodarum</i>						
Rare	<i>Sphaerium nucleus</i>						
RDB1							
RDB1, EPS	<i>Segmentina nitida</i>	11	12	3	10	7	3
RDB3	<i>Anisus vorticulus</i>		1	1	1	4	
	<i>Oxytoma sarsi</i>		8	6	7	7	2
	<i>Pisidium pseudosphaerium</i>		6	1	3	5	

\*Modified DAFOR scale used in mollusc community recording

Value	Descriptor	Estimate of abundance	Numerical Proxy
D	Dominant	100+	5
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1

Table C1 continued. Area 1 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy<sup>1</sup> for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

Sample ID	1.27	1.28	1.29	1.31	1.32	1.33	1.34																																																																																																																																																																																																
Grid reference	[REDACTED]																																																																																																																																																																																																						
Status	Species																																																																																																																																																																																																						
Common	<table border="1"> <tr><td><i>Acroloxus leucstris</i></td><td>4</td><td></td><td>4</td><td>2</td><td>1</td><td>3</td><td>5</td></tr> <tr><td><i>Anisus leucostoma</i></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Anisus vortex</i></td><td>6</td><td>8</td><td>7</td><td>4</td><td>9</td><td>6</td><td>6</td></tr> <tr><td><i>Amniger crista</i></td><td>1</td><td>1</td><td>5</td><td></td><td></td><td>7</td><td>6</td></tr> <tr><td><i>Bithynia tentaculata</i></td><td>10</td><td>7</td><td>9</td><td>7</td><td>9</td><td>9</td><td>9</td></tr> <tr><td><i>Galba truncatula</i></td><td>3</td><td>4</td><td>3</td><td>5</td><td>2</td><td>1</td><td>2</td></tr> <tr><td><i>Lymnaea auricularia</i></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Lymnaea palustris</i></td><td>6</td><td>5</td><td>6</td><td></td><td>6</td><td>3</td><td>5</td></tr> <tr><td><i>Lymnaea stagnalis</i></td><td>3</td><td>2</td><td>8</td><td></td><td>3</td><td>5</td><td>7</td></tr> <tr><td><i>Musculum leucstris</i></td><td>3</td><td></td><td></td><td></td><td>1</td><td>1</td><td></td></tr> <tr><td><i>Oxytoma pfeifferi</i></td><td>1</td><td>1</td><td></td><td>3</td><td>4</td><td></td><td>1</td></tr> <tr><td><i>Physa fontinalis</i></td><td>12</td><td>9</td><td>11</td><td>8</td><td>13</td><td>9</td><td>9</td></tr> <tr><td><i>Pisidium milium</i></td><td>1</td><td></td><td>4</td><td></td><td></td><td>4</td><td></td></tr> <tr><td><i>Pisidium nitidum</i></td><td></td><td></td><td></td><td></td><td></td><td>6</td><td>2</td></tr> <tr><td><i>Pisidium obtusale</i></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium personatum</i></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium sp</i></td><td>9</td><td>7</td><td>7</td><td>6</td><td>3</td><td>9</td><td>9</td></tr> <tr><td><i>Planorbis comeus</i></td><td>5</td><td>1</td><td>5</td><td>5</td><td>1</td><td>5</td><td>4</td></tr> <tr><td><i>Planorbis carinatus</i></td><td></td><td></td><td>1</td><td>2</td><td></td><td></td><td></td></tr> <tr><td><i>Planorbis planorbis</i></td><td>2</td><td>5</td><td>6</td><td>4</td><td>5</td><td></td><td>5</td></tr> <tr><td><i>Radix balthica</i></td><td>10</td><td>9</td><td>9</td><td>6</td><td>8</td><td>8</td><td>8</td></tr> <tr><td><i>Sphaerium comeum</i></td><td>9</td><td></td><td>3</td><td>6</td><td></td><td>5</td><td>3</td></tr> <tr><td><i>Stagnicola fuscus</i></td><td></td><td></td><td></td><td>4</td><td></td><td></td><td></td></tr> <tr><td><i>Succinea putris</i></td><td></td><td>1</td><td>1</td><td>1</td><td>1</td><td>3</td><td>4</td></tr> </table>							<i>Acroloxus leucstris</i>	4		4	2	1	3	5	<i>Anisus leucostoma</i>								<i>Anisus vortex</i>	6	8	7	4	9	6	6	<i>Amniger crista</i>	1	1	5			7	6	<i>Bithynia tentaculata</i>	10	7	9	7	9	9	9	<i>Galba truncatula</i>	3	4	3	5	2	1	2	<i>Lymnaea auricularia</i>								<i>Lymnaea palustris</i>	6	5	6		6	3	5	<i>Lymnaea stagnalis</i>	3	2	8		3	5	7	<i>Musculum leucstris</i>	3				1	1		<i>Oxytoma pfeifferi</i>	1	1		3	4		1	<i>Physa fontinalis</i>	12	9	11	8	13	9	9	<i>Pisidium milium</i>	1		4			4		<i>Pisidium nitidum</i>						6	2	<i>Pisidium obtusale</i>								<i>Pisidium personatum</i>								<i>Pisidium sp</i>	9	7	7	6	3	9	9	<i>Planorbis comeus</i>	5	1	5	5	1	5	4	<i>Planorbis carinatus</i>			1	2				<i>Planorbis planorbis</i>	2	5	6	4	5		5	<i>Radix balthica</i>	10	9	9	6	8	8	8	<i>Sphaerium comeum</i>	9		3	6		5	3	<i>Stagnicola fuscus</i>				4				<i>Succinea putris</i>		1	1	1	1	3	4
<i>Acroloxus leucstris</i>	4		4	2	1	3	5																																																																																																																																																																																																
<i>Anisus leucostoma</i>																																																																																																																																																																																																							
<i>Anisus vortex</i>	6	8	7	4	9	6	6																																																																																																																																																																																																
<i>Amniger crista</i>	1	1	5			7	6																																																																																																																																																																																																
<i>Bithynia tentaculata</i>	10	7	9	7	9	9	9																																																																																																																																																																																																
<i>Galba truncatula</i>	3	4	3	5	2	1	2																																																																																																																																																																																																
<i>Lymnaea auricularia</i>																																																																																																																																																																																																							
<i>Lymnaea palustris</i>	6	5	6		6	3	5																																																																																																																																																																																																
<i>Lymnaea stagnalis</i>	3	2	8		3	5	7																																																																																																																																																																																																
<i>Musculum leucstris</i>	3				1	1																																																																																																																																																																																																	
<i>Oxytoma pfeifferi</i>	1	1		3	4		1																																																																																																																																																																																																
<i>Physa fontinalis</i>	12	9	11	8	13	9	9																																																																																																																																																																																																
<i>Pisidium milium</i>	1		4			4																																																																																																																																																																																																	
<i>Pisidium nitidum</i>						6	2																																																																																																																																																																																																
<i>Pisidium obtusale</i>																																																																																																																																																																																																							
<i>Pisidium personatum</i>																																																																																																																																																																																																							
<i>Pisidium sp</i>	9	7	7	6	3	9	9																																																																																																																																																																																																
<i>Planorbis comeus</i>	5	1	5	5	1	5	4																																																																																																																																																																																																
<i>Planorbis carinatus</i>			1	2																																																																																																																																																																																																			
<i>Planorbis planorbis</i>	2	5	6	4	5		5																																																																																																																																																																																																
<i>Radix balthica</i>	10	9	9	6	8	8	8																																																																																																																																																																																																
<i>Sphaerium comeum</i>	9		3	6		5	3																																																																																																																																																																																																
<i>Stagnicola fuscus</i>				4																																																																																																																																																																																																			
<i>Succinea putris</i>		1	1	1	1	3	4																																																																																																																																																																																																
Local	<table border="1"> <tr><td><i>Bathymphalus contortus</i></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Bithynia leachii</i></td><td>1</td><td>12</td><td>2</td><td>5</td><td>10</td><td>6</td><td>6</td></tr> <tr><td><i>Hippeutis complanatus</i></td><td>6</td><td>1</td><td>10</td><td>2</td><td>1</td><td>1</td><td></td></tr> <tr><td><i>Valvata cristata</i></td><td>7</td><td>3</td><td>6</td><td>7</td><td></td><td>8</td><td>9</td></tr> <tr><td><i>Viviparus connectus</i></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>							<i>Bathymphalus contortus</i>								<i>Bithynia leachii</i>	1	12	2	5	10	6	6	<i>Hippeutis complanatus</i>	6	1	10	2	1	1		<i>Valvata cristata</i>	7	3	6	7		8	9	<i>Viviparus connectus</i>																																																																																																																																																															
<i>Bathymphalus contortus</i>																																																																																																																																																																																																							
<i>Bithynia leachii</i>	1	12	2	5	10	6	6																																																																																																																																																																																																
<i>Hippeutis complanatus</i>	6	1	10	2	1	1																																																																																																																																																																																																	
<i>Valvata cristata</i>	7	3	6	7		8	9																																																																																																																																																																																																
<i>Viviparus connectus</i>																																																																																																																																																																																																							
Naturalised	<table border="1"> <tr><td><i>Physa acuta</i></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Potamopyrgus antipodarum</i></td><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>							<i>Physa acuta</i>								<i>Potamopyrgus antipodarum</i>																																																																																																																																																																																							
<i>Physa acuta</i>																																																																																																																																																																																																							
<i>Potamopyrgus antipodarum</i>																																																																																																																																																																																																							
Rare	<table border="1"> <tr><td><i>Sphaerium nucleus</i></td><td>1</td><td></td><td>2</td><td></td><td></td><td></td><td></td></tr> </table>							<i>Sphaerium nucleus</i>	1		2																																																																																																																																																																																												
<i>Sphaerium nucleus</i>	1		2																																																																																																																																																																																																				
RDB1	<table border="1"> <tr><td><i>Segmentina nitida</i></td><td>6</td><td>4</td><td>1</td><td>11</td><td>6</td><td>8</td><td>5</td></tr> </table>							<i>Segmentina nitida</i>	6	4	1	11	6	8	5																																																																																																																																																																																								
<i>Segmentina nitida</i>	6	4	1	11	6	8	5																																																																																																																																																																																																
RDB1, EPS	<table border="1"> <tr><td><i>Anisus vorticulus</i></td><td></td><td></td><td>11</td><td></td><td></td><td></td><td>9</td></tr> </table>							<i>Anisus vorticulus</i>			11				9																																																																																																																																																																																								
<i>Anisus vorticulus</i>			11				9																																																																																																																																																																																																
RDB3	<table border="1"> <tr><td><i>Oxytoma sarsi</i></td><td>4</td><td></td><td>3</td><td></td><td>1</td><td>3</td><td>3</td></tr> <tr><td><i>Pisidium pseudosphaerium</i></td><td>4</td><td></td><td></td><td>2</td><td></td><td>3</td><td>5</td></tr> </table>							<i>Oxytoma sarsi</i>	4		3		1	3	3	<i>Pisidium pseudosphaerium</i>	4			2		3	5																																																																																																																																																																																
<i>Oxytoma sarsi</i>	4		3		1	3	3																																																																																																																																																																																																
<i>Pisidium pseudosphaerium</i>	4			2		3	5																																																																																																																																																																																																

<sup>1</sup>Modified DAFOR scale used in mollusc community recording

Value	Description	Estimation of abundance	Numerical Proxy
D	Dominant	100+	5
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1

Table C2. Area 1 ditch assessment. 'Potential' field refers to the potential of the ditch to support little whirlpool ramshorn snail as assessed in the scoping study (AECOM, 2015b).

Ditch ID	Start Grid Reference	End Grid Reference	Type	Potential	Length (m)	Management	Botany	Silt	Poaching	Chemistry	LWRS	Mollusca	Samples	Comments	Further use
[REDACTED]	[REDACTED]	[REDACTED]	Donor	4. Good Potential	133.6	5	4	3	3	5	3	5	5 1.2, 1.3, 1.7, 1.9	Good density of A. vorticulus	Donor-Yes
[REDACTED]	[REDACTED]	[REDACTED]	Donor	4. Good Potential	73.7	5	4	5	3	5	1	5	1 4	A. vorticulus absent	Donor-No
[REDACTED]	[REDACTED]	[REDACTED]	Donor	4. Good Potential	147.3	5	4	3	3	5	1	4	1 6	A. vorticulus absent	Donor-No
[REDACTED]	[REDACTED]	[REDACTED]	Donor	4. Good Potential	153.4	5	2	5	3	5	4	5	1 4, 1 15	Good density of A. vorticulus	Donor-Yes
[REDACTED]	[REDACTED]	[REDACTED]	Donor	4. Good Potential	132.6	3	3	3	3	3	1	4	1 5, 1 19	A. vorticulus absent	Donor-No
[REDACTED]	[REDACTED]	[REDACTED]	Donor	4. Good Potential	104.2	5	2	5	3	5	1	3	1 13	A. vorticulus absent	Donor-No
[REDACTED]	[REDACTED]	[REDACTED]	Donor	4. Good Potential	50.6	5	4	5	3	5	4	5	1 1	Good density of A. vorticulus	Donor-Yes
[REDACTED]	[REDACTED]	[REDACTED]	Donor	4. Good Potential	352	5	3	5	3	5	3	5	1 14, 1 31, 1 12	Good density of A. vorticulus	Donor-Yes
[REDACTED]	[REDACTED]	[REDACTED]	Donor	4. Good Potential	198	5	3	5	3	5	1	4	1 6, 1 17	Too few A. vorticulus	Donor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Donor	4. Good Potential	210.9	5	3	3	3	5	2	5	1 21, 1 22, 1 32	Too few A. vorticulus	Donor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Donor	4. Good Potential	149.9	5	4	5	3	5	3	5	1 24, 1 25	Too few A. vorticulus	Donor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Donor	4. Good Potential	150.3	5	4	5	3	5	5	5	1 29, 1 34	Good density of A. vorticulus	Donor-Yes
[REDACTED]	[REDACTED]	[REDACTED]	Donor	4. Good Potential	814.8	5	3	5	3	5	2	5	1 23, 1 33, 1 26, 1 27	Too few A. vorticulus	Donor-Sub



## Appendix D: Area 2 mollusc diversity data and ditch assessment

Table D1. Area 2 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy<sup>1</sup> for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

Sample ID		2.1	2.2
Grid reference			
Status	Species		
Common	<i>Acroloxus lacustris</i>	3	1
	<i>Anisus vortex</i>		3
	<i>Bithynia tentaculata</i>	8	7
	<i>Galba truncatula</i>	1	
	<i>Lymnaea stagnalis</i>	5	3
	<i>Musculum lacustris</i>		1
	<i>Physa fontinalis</i>	4	5
	<i>Pisidium milium</i>	1	
	<i>Pisidium obtusale</i>	2	
	<i>Pisidium sp</i>	8	3
	<i>Planorbarius comeus</i>		1
	<i>Planorbis planorbis</i>	10	5
	<i>Radix balthica</i>	6	3
	<i>Sphaerium comeum</i>	7	
	<i>Succinea putris</i>	3	4
Local	<i>Bithynia leachii</i>	1	1
	<i>Hippëutis complanatus</i>		1
	<i>Viviparus connectus</i>	4	3
RDB3	<i>Oxyloma sarsi</i>		1
	<i>Pisidium pseudosphaerium</i>	2	6

<sup>1</sup>Modified DAFOR scale used in mollusc community recording

Value	Description	Estimation of abundance	Numerical Proxy
D	Dominant	100+	5
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1

Table D2. Area 2 ditch assessment. 'Potential' field refers to the potential of the ditch to support little whirlpool ramshorn snail as assessed in the scoping study (AECOM, 2015b)

Ditch ID		
Start Grid Reference		
End Grid Reference		
Type	Receptor 2	Receptor-Sub
Potential	Moderate Potential	
Length (m)	49.2	
Management	5	
Botany	5	
Silt	5	
Poaching	3	
Chemistry	3	
LWRS	1	
Molluscs	3.2.1. 2.2	
Samples	3.2.1. 2.2	Poor quality of nearby ditches
Comments		
Further use		





**Appendix E: Area 3 mollusc diversity data and ditch assessment**

Table E1. Area 3 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy<sup>1</sup> for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

Sample	3.1	3.2	3.3	3.4	3.6	3.7																																																																																																																																																																	
Grid reference	[REDACTED]																																																																																																																																																																						
Status	Species																																																																																																																																																																						
Common	<table border="1"> <tr><td><i>Acroloxus lacustris</i></td><td>3</td><td>6</td><td>4</td><td>3</td><td></td><td>1</td></tr> <tr><td><i>Anisus leucostoma</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Anisus vortex</i></td><td></td><td></td><td></td><td></td><td>2</td><td></td></tr> <tr><td><i>Armiger crista</i></td><td>1</td><td></td><td></td><td></td><td>1</td><td></td></tr> <tr><td><i>Bithynia tentaculata</i></td><td>6</td><td>3</td><td>2</td><td>2</td><td>2</td><td>3</td></tr> <tr><td><i>Galba truncatula</i></td><td></td><td></td><td>1</td><td></td><td>5</td><td></td></tr> <tr><td><i>Lymnaea auricularia</i></td><td></td><td></td><td>1</td><td>2</td><td></td><td>1</td></tr> <tr><td><i>Lymnaea palustris</i></td><td></td><td>1</td><td>3</td><td>1</td><td>2</td><td>3</td></tr> <tr><td><i>Lymnaea stagnalis</i></td><td>5</td><td>2</td><td>4</td><td>5</td><td>4</td><td>1</td></tr> <tr><td><i>Musculum lacustris</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Oxyloma pfeifferi</i></td><td>3</td><td>7</td><td>6</td><td>6</td><td></td><td>2</td></tr> <tr><td><i>Physa fontinalis</i></td><td>3</td><td>4</td><td>4</td><td></td><td>4</td><td>2</td></tr> <tr><td><i>Pisidium nitidum</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium obtusale</i></td><td></td><td></td><td></td><td></td><td>1</td><td></td></tr> <tr><td><i>Pisidium personatum</i></td><td></td><td></td><td></td><td></td><td>1</td><td></td></tr> <tr><td><i>Pisidium sp</i></td><td>6</td><td>4</td><td>5</td><td>1</td><td>2</td><td>4</td></tr> <tr><td><i>Planorbis comeus</i></td><td>1</td><td>2</td><td>2</td><td>2</td><td></td><td>1</td></tr> <tr><td><i>Planorbis carinatus</i></td><td></td><td>1</td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Planorbis planorbis</i></td><td>3</td><td>6</td><td>6</td><td>6</td><td>5</td><td>6</td></tr> <tr><td><i>Radix balthica</i></td><td>6</td><td>4</td><td>6</td><td>4</td><td>2</td><td>2</td></tr> <tr><td><i>Sphaerium comeum</i></td><td>1</td><td>2</td><td></td><td>3</td><td></td><td>1</td></tr> <tr><td><i>Stagnicola fuscus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Succinea putris</i></td><td></td><td></td><td>1</td><td>1</td><td>3</td><td>1</td></tr> </table>						<i>Acroloxus lacustris</i>	3	6	4	3		1	<i>Anisus leucostoma</i>							<i>Anisus vortex</i>					2		<i>Armiger crista</i>	1				1		<i>Bithynia tentaculata</i>	6	3	2	2	2	3	<i>Galba truncatula</i>			1		5		<i>Lymnaea auricularia</i>			1	2		1	<i>Lymnaea palustris</i>		1	3	1	2	3	<i>Lymnaea stagnalis</i>	5	2	4	5	4	1	<i>Musculum lacustris</i>							<i>Oxyloma pfeifferi</i>	3	7	6	6		2	<i>Physa fontinalis</i>	3	4	4		4	2	<i>Pisidium nitidum</i>							<i>Pisidium obtusale</i>					1		<i>Pisidium personatum</i>					1		<i>Pisidium sp</i>	6	4	5	1	2	4	<i>Planorbis comeus</i>	1	2	2	2		1	<i>Planorbis carinatus</i>		1					<i>Planorbis planorbis</i>	3	6	6	6	5	6	<i>Radix balthica</i>	6	4	6	4	2	2	<i>Sphaerium comeum</i>	1	2		3		1	<i>Stagnicola fuscus</i>							<i>Succinea putris</i>			1	1	3	1
<i>Acroloxus lacustris</i>	3	6	4	3		1																																																																																																																																																																	
<i>Anisus leucostoma</i>																																																																																																																																																																							
<i>Anisus vortex</i>					2																																																																																																																																																																		
<i>Armiger crista</i>	1				1																																																																																																																																																																		
<i>Bithynia tentaculata</i>	6	3	2	2	2	3																																																																																																																																																																	
<i>Galba truncatula</i>			1		5																																																																																																																																																																		
<i>Lymnaea auricularia</i>			1	2		1																																																																																																																																																																	
<i>Lymnaea palustris</i>		1	3	1	2	3																																																																																																																																																																	
<i>Lymnaea stagnalis</i>	5	2	4	5	4	1																																																																																																																																																																	
<i>Musculum lacustris</i>																																																																																																																																																																							
<i>Oxyloma pfeifferi</i>	3	7	6	6		2																																																																																																																																																																	
<i>Physa fontinalis</i>	3	4	4		4	2																																																																																																																																																																	
<i>Pisidium nitidum</i>																																																																																																																																																																							
<i>Pisidium obtusale</i>					1																																																																																																																																																																		
<i>Pisidium personatum</i>					1																																																																																																																																																																		
<i>Pisidium sp</i>	6	4	5	1	2	4																																																																																																																																																																	
<i>Planorbis comeus</i>	1	2	2	2		1																																																																																																																																																																	
<i>Planorbis carinatus</i>		1																																																																																																																																																																					
<i>Planorbis planorbis</i>	3	6	6	6	5	6																																																																																																																																																																	
<i>Radix balthica</i>	6	4	6	4	2	2																																																																																																																																																																	
<i>Sphaerium comeum</i>	1	2		3		1																																																																																																																																																																	
<i>Stagnicola fuscus</i>																																																																																																																																																																							
<i>Succinea putris</i>			1	1	3	1																																																																																																																																																																	
Local	<table border="1"> <tr><td><i>Bithynia leachii</i></td><td>7</td><td>6</td><td>6</td><td>6</td><td>4</td><td>5</td></tr> <tr><td><i>Hippaetis complanatus</i></td><td>4</td><td>2</td><td>6</td><td>2</td><td>5</td><td>2</td></tr> <tr><td><i>Viviparus connectus</i></td><td></td><td>1</td><td>3</td><td>3</td><td>2</td><td>2</td></tr> </table>						<i>Bithynia leachii</i>	7	6	6	6	4	5	<i>Hippaetis complanatus</i>	4	2	6	2	5	2	<i>Viviparus connectus</i>		1	3	3	2	2																																																																																																																																												
<i>Bithynia leachii</i>	7	6	6	6	4	5																																																																																																																																																																	
<i>Hippaetis complanatus</i>	4	2	6	2	5	2																																																																																																																																																																	
<i>Viviparus connectus</i>		1	3	3	2	2																																																																																																																																																																	
Naturalised	<i>Physa acuta</i>																																																																																																																																																																						
Rare	<i>Sphaerium nucleus</i>																																																																																																																																																																						
RDB1, EPS	<i>Anisus vorticulus</i>																																																																																																																																																																						
RDB3	<table border="1"> <tr><td><i>Oxyloma sarsi</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium pseudosphaerium</i></td><td>3</td><td>1</td><td>1</td><td>2</td><td>2</td><td></td></tr> <tr><td><i>Vertigo moulinsiana</i></td><td></td><td></td><td></td><td></td><td>2</td><td>2</td></tr> </table>						<i>Oxyloma sarsi</i>							<i>Pisidium pseudosphaerium</i>	3	1	1	2	2		<i>Vertigo moulinsiana</i>					2	2																																																																																																																																												
<i>Oxyloma sarsi</i>																																																																																																																																																																							
<i>Pisidium pseudosphaerium</i>	3	1	1	2	2																																																																																																																																																																		
<i>Vertigo moulinsiana</i>					2	2																																																																																																																																																																	

<sup>1</sup>Modified DAFOR scale used in mollusc community recording

Value	Description	Estimation of abundance	Numerical Proxy
D	Dominant	100+	8
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1

Table E1 continued. Area 3 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy<sup>1</sup> for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

Sample	3.8	3.9	3.11	3.12	3.13	3.14																																																																																																																																																																	
Grid reference	[REDACTED]																																																																																																																																																																						
Status	Species																																																																																																																																																																						
Common	<table border="1"> <tr><td><i>Acroloxus lacustris</i></td><td>1</td><td>2</td><td>1</td><td>4</td><td>2</td><td>4</td></tr> <tr><td><i>Anisus leucostoma</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Anisus vortex</i></td><td></td><td>5</td><td>1</td><td>3</td><td></td><td>2</td></tr> <tr><td><i>Armiger crista</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Bithynia tentaculata</i></td><td>2</td><td>2</td><td>3</td><td>3</td><td>5</td><td>7</td></tr> <tr><td><i>Galba truncatula</i></td><td>6</td><td>1</td><td></td><td>5</td><td></td><td>3</td></tr> <tr><td><i>Lymnaea auricularia</i></td><td>1</td><td></td><td>1</td><td></td><td></td><td></td></tr> <tr><td><i>Lymnaea palustris</i></td><td>1</td><td>2</td><td>6</td><td>1</td><td>2</td><td>3</td></tr> <tr><td><i>Lymnaea stagnalis</i></td><td>1</td><td>1</td><td>2</td><td>4</td><td></td><td>3</td></tr> <tr><td><i>Musculum lacustris</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Oxytoma pfeifferi</i></td><td>5</td><td>5</td><td>4</td><td>4</td><td>4</td><td>6</td></tr> <tr><td><i>Physa fontinalis</i></td><td>2</td><td>4</td><td>1</td><td>4</td><td>2</td><td>4</td></tr> <tr><td><i>Pisidium nitidum</i></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr> <tr><td><i>Pisidium obtusale</i></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr> <tr><td><i>Pisidium personatum</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium sp</i></td><td>10</td><td>3</td><td>6</td><td>6</td><td>6</td><td>9</td></tr> <tr><td><i>Planorbis comeus</i></td><td>2</td><td>1</td><td></td><td>3</td><td></td><td>3</td></tr> <tr><td><i>Planorbis carinatus</i></td><td></td><td></td><td>2</td><td>1</td><td></td><td>1</td></tr> <tr><td><i>Planorbis planorbis</i></td><td>6</td><td>3</td><td>6</td><td>6</td><td>7</td><td>2</td></tr> <tr><td><i>Radix balthica</i></td><td>5</td><td>7</td><td>7</td><td>6</td><td>5</td><td>5</td></tr> <tr><td><i>Sphaerium comeum</i></td><td>4</td><td></td><td>4</td><td></td><td>1</td><td>1</td></tr> <tr><td><i>Stagnicola fuscus</i></td><td></td><td></td><td></td><td>2</td><td></td><td></td></tr> <tr><td><i>Succinea putris</i></td><td></td><td></td><td></td><td>1</td><td></td><td>2</td></tr> </table>						<i>Acroloxus lacustris</i>	1	2	1	4	2	4	<i>Anisus leucostoma</i>							<i>Anisus vortex</i>		5	1	3		2	<i>Armiger crista</i>							<i>Bithynia tentaculata</i>	2	2	3	3	5	7	<i>Galba truncatula</i>	6	1		5		3	<i>Lymnaea auricularia</i>	1		1				<i>Lymnaea palustris</i>	1	2	6	1	2	3	<i>Lymnaea stagnalis</i>	1	1	2	4		3	<i>Musculum lacustris</i>							<i>Oxytoma pfeifferi</i>	5	5	4	4	4	6	<i>Physa fontinalis</i>	2	4	1	4	2	4	<i>Pisidium nitidum</i>						1	<i>Pisidium obtusale</i>						1	<i>Pisidium personatum</i>							<i>Pisidium sp</i>	10	3	6	6	6	9	<i>Planorbis comeus</i>	2	1		3		3	<i>Planorbis carinatus</i>			2	1		1	<i>Planorbis planorbis</i>	6	3	6	6	7	2	<i>Radix balthica</i>	5	7	7	6	5	5	<i>Sphaerium comeum</i>	4		4		1	1	<i>Stagnicola fuscus</i>				2			<i>Succinea putris</i>				1		2
<i>Acroloxus lacustris</i>	1	2	1	4	2	4																																																																																																																																																																	
<i>Anisus leucostoma</i>																																																																																																																																																																							
<i>Anisus vortex</i>		5	1	3		2																																																																																																																																																																	
<i>Armiger crista</i>																																																																																																																																																																							
<i>Bithynia tentaculata</i>	2	2	3	3	5	7																																																																																																																																																																	
<i>Galba truncatula</i>	6	1		5		3																																																																																																																																																																	
<i>Lymnaea auricularia</i>	1		1																																																																																																																																																																				
<i>Lymnaea palustris</i>	1	2	6	1	2	3																																																																																																																																																																	
<i>Lymnaea stagnalis</i>	1	1	2	4		3																																																																																																																																																																	
<i>Musculum lacustris</i>																																																																																																																																																																							
<i>Oxytoma pfeifferi</i>	5	5	4	4	4	6																																																																																																																																																																	
<i>Physa fontinalis</i>	2	4	1	4	2	4																																																																																																																																																																	
<i>Pisidium nitidum</i>						1																																																																																																																																																																	
<i>Pisidium obtusale</i>						1																																																																																																																																																																	
<i>Pisidium personatum</i>																																																																																																																																																																							
<i>Pisidium sp</i>	10	3	6	6	6	9																																																																																																																																																																	
<i>Planorbis comeus</i>	2	1		3		3																																																																																																																																																																	
<i>Planorbis carinatus</i>			2	1		1																																																																																																																																																																	
<i>Planorbis planorbis</i>	6	3	6	6	7	2																																																																																																																																																																	
<i>Radix balthica</i>	5	7	7	6	5	5																																																																																																																																																																	
<i>Sphaerium comeum</i>	4		4		1	1																																																																																																																																																																	
<i>Stagnicola fuscus</i>				2																																																																																																																																																																			
<i>Succinea putris</i>				1		2																																																																																																																																																																	
Local	<table border="1"> <tr><td><i>Bithynia leachii</i></td><td>9</td><td>6</td><td>8</td><td>6</td><td>3</td><td>3</td></tr> <tr><td><i>Hippeutis complanatus</i></td><td>13</td><td>2</td><td>10</td><td>9</td><td>7</td><td>11</td></tr> <tr><td><i>Viviparus connectus</i></td><td>2</td><td>2</td><td>2</td><td></td><td></td><td>1</td></tr> </table>						<i>Bithynia leachii</i>	9	6	8	6	3	3	<i>Hippeutis complanatus</i>	13	2	10	9	7	11	<i>Viviparus connectus</i>	2	2	2			1																																																																																																																																												
<i>Bithynia leachii</i>	9	6	8	6	3	3																																																																																																																																																																	
<i>Hippeutis complanatus</i>	13	2	10	9	7	11																																																																																																																																																																	
<i>Viviparus connectus</i>	2	2	2			1																																																																																																																																																																	
Naturalised	<table border="1"> <tr><td><i>Physa acuta</i></td><td></td><td></td><td></td><td></td><td></td><td>1</td></tr> </table>						<i>Physa acuta</i>						1																																																																																																																																																										
<i>Physa acuta</i>						1																																																																																																																																																																	
Rare	<table border="1"> <tr><td><i>Sphaerium nucleus</i></td><td>1</td><td></td><td></td><td></td><td>2</td><td>1</td></tr> </table>						<i>Sphaerium nucleus</i>	1				2	1																																																																																																																																																										
<i>Sphaerium nucleus</i>	1				2	1																																																																																																																																																																	
RDB1, EPS	<table border="1"> <tr><td><i>Anisus vorticulus</i></td><td>4</td><td>4</td><td>4</td><td>11</td><td>11</td><td>11</td></tr> </table>						<i>Anisus vorticulus</i>	4	4	4	11	11	11																																																																																																																																																										
<i>Anisus vorticulus</i>	4	4	4	11	11	11																																																																																																																																																																	
RDB3	<table border="1"> <tr><td><i>Oxytoma sarsi</i></td><td>2</td><td></td><td></td><td>2</td><td>2</td><td>2</td></tr> <tr><td><i>Pisidium pseudosphaerium</i></td><td>7</td><td>2</td><td></td><td>4</td><td></td><td>6</td></tr> <tr><td><i>Vertigo moulinsiana</i></td><td></td><td></td><td></td><td>1</td><td></td><td></td></tr> </table>						<i>Oxytoma sarsi</i>	2			2	2	2	<i>Pisidium pseudosphaerium</i>	7	2		4		6	<i>Vertigo moulinsiana</i>				1																																																																																																																																														
<i>Oxytoma sarsi</i>	2			2	2	2																																																																																																																																																																	
<i>Pisidium pseudosphaerium</i>	7	2		4		6																																																																																																																																																																	
<i>Vertigo moulinsiana</i>				1																																																																																																																																																																			

<sup>1</sup>Modified DAFOR scale used in mollusc community recording

Value	Descriptor	Estimation of abundance	Numerical Proxy
D	Dominant	100+	5
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1

Table E1 continued. Area 3 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy\* for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

	Sample	3.15	3.16	3.17	3.18
	Grid reference				
Status	Species				
Common	<i>Acroloxus lacustris</i>		2	3	1
	<i>Anisus leucostoma</i>	2			
	<i>Anisus vortex</i>	4	7	1	2
	<i>Amniger crista</i>				
	<i>Bithynia tentaculata</i>	4	11	3	3
	<i>Galba truncatula</i>	1		3	3
	<i>Lymnaea auricularia</i>	2			
	<i>Lymnaea palustris</i>	6		3	4
	<i>Lymnaea stagnalis</i>	2	6	2	3
	<i>Musculum lacustris</i>		3		
	<i>Oxytoma Pfeifferi</i>	5	3	4	1
	<i>Physa fontinalis</i>	6	11	8	
	<i>Pisidium nitidum</i>				
	<i>Pisidium obtusale</i>		2		
	<i>Pisidium personatum</i>				
	<i>Pisidium sp</i>	5	7	8	4
	<i>Planorbis corneus</i>	2	4	1	1
	<i>Planorbis carinatus</i>	2			
	<i>Planorbis planorbis</i>	5	5	1	3
	<i>Radix balthica</i>	5	14	3	6
<i>Sphaerium comeum</i>		1		2	
<i>Stagnicola fuscus</i>					
<i>Succinea putris</i>	1	12	3	2	
Local	<i>Bithynia leachi</i>	10		7	6
	<i>Hippeutis complanatus</i>	2	6	11	7
	<i>Viviparus connectus</i>	1		2	2
Naturalised	<i>Physa acuta</i>			1	
Rare	<i>Sphaerium nucleus</i>				
RDB1, EPS	<i>Anisus vorticulus</i>	3	1		2
RDB3	<i>Oxytoma sarsi</i>		2		1
	<i>Pisidium pseudosphaerium</i>		3	3	4
	<i>Vertigo moulinsiana</i>				

\*Modified DAFOR scale used in mollusc community recording.

Value	Description	Estimation of abundance	Numerical Proxy
D	Dominant	100+	5
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1

Table E2. Area 3 ditch assessment. 'Potential' field refers to the potential of the ditch to support little whirlpool ramshorn snail as assessed in the scoping study (AECOM, 2015b)

Ditch ID	Start Grid Reference	End Grid Reference	Type	Potential	Length (m)	Management	Botany	Silt	Poaching	Chemistry	LWRS	Mollusca	Samples	Comments	Further use
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	176	3	5	3	3	3	3	3	53.9, 3.18	A. vorficulus already present	Receptor-No
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	49.7	3	5	5	3	3	1	43.17		No A. vorficulus recorded, suitable otherwise	Receptor-Yes
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	133.2	5	5	5	3	3	1	43.3, 3.4		No A. vorficulus recorded	Receptor-Yes
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	189.8	5	5	5	3	5	3	53.6, 3.7		A. vorficulus already present	Receptor-No
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	121.2	5	5	5	3	5	5	43.8, 3.13		A. vorficulus already present	Receptor-No
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	3. Moderate/Good Potential	180.8	5	5	5	5	3	5	53.11, 3.12		A. vorficulus already present	Receptor-No
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	99.7	5	5	5	3	3	5	53.14		A. vorficulus already present	Receptor-No
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	3. Moderate/Good	152.9	3	5	3	3	5	1	43.2		No A. vorficulus recorded	Receptor-Yes
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	191	3	4	3	3	3	3	43.15, 3.16		A. vorficulus already present	Receptor-No

↑  
↑

## **Appendix F: Area 5 mollusc diversity data and ditch assessment**

Table F1. Area 5 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy<sup>1</sup> for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

Sample ID	5.1	5.2	5.3	5.4	5.5	5.6																																																																																																																																																										
Grid reference	[REDACTED]																																																																																																																																																															
Status	Species																																																																																																																																																															
Common	<table border="1"> <tr><td><i>Acroloxus lacustris</i></td><td>1</td><td></td><td></td><td></td><td>7</td><td>7</td></tr> <tr><td><i>Anisus vortex</i></td><td>12</td><td>8</td><td>8</td><td>9</td><td>10</td><td>12</td></tr> <tr><td><i>Armiger crista</i></td><td></td><td>3</td><td>4</td><td>2</td><td>2</td><td>3</td></tr> <tr><td><i>Bithynia tentaculata</i></td><td>9</td><td>5</td><td>4</td><td>4</td><td>11</td><td>4</td></tr> <tr><td><i>Galba truncatula</i></td><td></td><td>1</td><td></td><td></td><td>5</td><td></td></tr> <tr><td><i>Lymnaea palustris</i></td><td>1</td><td></td><td>1</td><td>2</td><td>3</td><td></td></tr> <tr><td><i>Lymnaea stagnalis</i></td><td></td><td>2</td><td>1</td><td></td><td>3</td><td>4</td></tr> <tr><td><i>Musculum lacustris</i></td><td></td><td></td><td>3</td><td></td><td>1</td><td></td></tr> <tr><td><i>Oxytoma pleifferi</i></td><td>4</td><td>5</td><td>6</td><td>5</td><td></td><td></td></tr> <tr><td><i>Physa fontinalis</i></td><td>8</td><td>2</td><td>9</td><td>3</td><td>8</td><td>7</td></tr> <tr><td><i>Pisidium milium</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium nitidum</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium obtusale</i></td><td></td><td>2</td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium personatum</i></td><td></td><td>1</td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium sp</i></td><td>4</td><td>6</td><td>1</td><td>1</td><td>3</td><td>7</td></tr> <tr><td><i>Pianorbis comeus</i></td><td>2</td><td>1</td><td>9</td><td></td><td>5</td><td>4</td></tr> <tr><td><i>Pianorbis carinatus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pianorbis pianorbis</i></td><td>5</td><td>3</td><td>7</td><td>4</td><td>9</td><td>6</td></tr> <tr><td><i>Radix bathica</i></td><td>10</td><td>10</td><td>11</td><td>7</td><td>1</td><td>7</td></tr> <tr><td><i>Sphaerium comeum</i></td><td>3</td><td></td><td></td><td>12</td><td>12</td><td>8</td></tr> <tr><td><i>Stagnicola fuscus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Succinea putris</i></td><td>1</td><td>5</td><td>4</td><td>1</td><td>3</td><td>1</td></tr> </table>						<i>Acroloxus lacustris</i>	1				7	7	<i>Anisus vortex</i>	12	8	8	9	10	12	<i>Armiger crista</i>		3	4	2	2	3	<i>Bithynia tentaculata</i>	9	5	4	4	11	4	<i>Galba truncatula</i>		1			5		<i>Lymnaea palustris</i>	1		1	2	3		<i>Lymnaea stagnalis</i>		2	1		3	4	<i>Musculum lacustris</i>			3		1		<i>Oxytoma pleifferi</i>	4	5	6	5			<i>Physa fontinalis</i>	8	2	9	3	8	7	<i>Pisidium milium</i>							<i>Pisidium nitidum</i>							<i>Pisidium obtusale</i>		2					<i>Pisidium personatum</i>		1					<i>Pisidium sp</i>	4	6	1	1	3	7	<i>Pianorbis comeus</i>	2	1	9		5	4	<i>Pianorbis carinatus</i>							<i>Pianorbis pianorbis</i>	5	3	7	4	9	6	<i>Radix bathica</i>	10	10	11	7	1	7	<i>Sphaerium comeum</i>	3			12	12	8	<i>Stagnicola fuscus</i>							<i>Succinea putris</i>	1	5	4	1	3	1
<i>Acroloxus lacustris</i>	1				7	7																																																																																																																																																										
<i>Anisus vortex</i>	12	8	8	9	10	12																																																																																																																																																										
<i>Armiger crista</i>		3	4	2	2	3																																																																																																																																																										
<i>Bithynia tentaculata</i>	9	5	4	4	11	4																																																																																																																																																										
<i>Galba truncatula</i>		1			5																																																																																																																																																											
<i>Lymnaea palustris</i>	1		1	2	3																																																																																																																																																											
<i>Lymnaea stagnalis</i>		2	1		3	4																																																																																																																																																										
<i>Musculum lacustris</i>			3		1																																																																																																																																																											
<i>Oxytoma pleifferi</i>	4	5	6	5																																																																																																																																																												
<i>Physa fontinalis</i>	8	2	9	3	8	7																																																																																																																																																										
<i>Pisidium milium</i>																																																																																																																																																																
<i>Pisidium nitidum</i>																																																																																																																																																																
<i>Pisidium obtusale</i>		2																																																																																																																																																														
<i>Pisidium personatum</i>		1																																																																																																																																																														
<i>Pisidium sp</i>	4	6	1	1	3	7																																																																																																																																																										
<i>Pianorbis comeus</i>	2	1	9		5	4																																																																																																																																																										
<i>Pianorbis carinatus</i>																																																																																																																																																																
<i>Pianorbis pianorbis</i>	5	3	7	4	9	6																																																																																																																																																										
<i>Radix bathica</i>	10	10	11	7	1	7																																																																																																																																																										
<i>Sphaerium comeum</i>	3			12	12	8																																																																																																																																																										
<i>Stagnicola fuscus</i>																																																																																																																																																																
<i>Succinea putris</i>	1	5	4	1	3	1																																																																																																																																																										
Local	<table border="1"> <tr><td><i>Bathymphalus contortus</i></td><td></td><td>5</td><td>2</td><td></td><td>6</td><td>4</td></tr> <tr><td><i>Bithynia leachii</i></td><td>7</td><td>2</td><td>2</td><td>10</td><td>7</td><td>5</td></tr> <tr><td><i>Gyrulus albus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Hippeutis complanatus</i></td><td>5</td><td>3</td><td>7</td><td></td><td>1</td><td>4</td></tr> <tr><td><i>Valvata cristata</i></td><td></td><td></td><td>3</td><td></td><td>4</td><td>2</td></tr> <tr><td><i>Vertigo antivertigo</i></td><td></td><td>1</td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Viviparus connectus</i></td><td>1</td><td>1</td><td>1</td><td></td><td>7</td><td>7</td></tr> </table>						<i>Bathymphalus contortus</i>		5	2		6	4	<i>Bithynia leachii</i>	7	2	2	10	7	5	<i>Gyrulus albus</i>							<i>Hippeutis complanatus</i>	5	3	7		1	4	<i>Valvata cristata</i>			3		4	2	<i>Vertigo antivertigo</i>		1					<i>Viviparus connectus</i>	1	1	1		7	7																																																																																																									
<i>Bathymphalus contortus</i>		5	2		6	4																																																																																																																																																										
<i>Bithynia leachii</i>	7	2	2	10	7	5																																																																																																																																																										
<i>Gyrulus albus</i>																																																																																																																																																																
<i>Hippeutis complanatus</i>	5	3	7		1	4																																																																																																																																																										
<i>Valvata cristata</i>			3		4	2																																																																																																																																																										
<i>Vertigo antivertigo</i>		1																																																																																																																																																														
<i>Viviparus connectus</i>	1	1	1		7	7																																																																																																																																																										
Naturalised	<table border="1"> <tr><td><i>Physa acuta</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Potamopyrgus antipodarum</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>						<i>Physa acuta</i>							<i>Potamopyrgus antipodarum</i>																																																																																																																																																		
<i>Physa acuta</i>																																																																																																																																																																
<i>Potamopyrgus antipodarum</i>																																																																																																																																																																
Rare	<table border="1"> <tr><td><i>Sphaerium nucleus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>						<i>Sphaerium nucleus</i>																																																																																																																																																									
<i>Sphaerium nucleus</i>																																																																																																																																																																
RDB1	<table border="1"> <tr><td><i>Segmentina nitida</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>						<i>Segmentina nitida</i>																																																																																																																																																									
<i>Segmentina nitida</i>																																																																																																																																																																
RDB3	<table border="1"> <tr><td><i>Oxytoma sarsi</i></td><td>3</td><td></td><td>1</td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium pseudosphaerium</i></td><td></td><td>2</td><td></td><td></td><td></td><td></td></tr> </table>						<i>Oxytoma sarsi</i>	3		1				<i>Pisidium pseudosphaerium</i>		2																																																																																																																																																
<i>Oxytoma sarsi</i>	3		1																																																																																																																																																													
<i>Pisidium pseudosphaerium</i>		2																																																																																																																																																														

<sup>1</sup>Modified DAFOR scale used in mollusc community recording

Value	Descriptor	Estimation of abundance	Numerical Proxy
D	Dominant	100+	5
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1

Table F1 continued. Area 5 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy' for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

Sample ID	5.7	5.8	5.9	5.11	5.12	5.13																																																																																																																																																										
Grid reference	[REDACTED]																																																																																																																																																															
Status	Species																																																																																																																																																															
Common	<table border="1"> <tr><td><i>Acrotaxus lacustris</i></td><td>4</td><td>3</td><td>6</td><td>3</td><td>8</td><td>7</td></tr> <tr><td><i>Anisus vortex</i></td><td>7</td><td>8</td><td>7</td><td>9</td><td>14</td><td>8</td></tr> <tr><td><i>Amniger crista</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Bithynia tentaculata</i></td><td>8</td><td>7</td><td>5</td><td>9</td><td>7</td><td>8</td></tr> <tr><td><i>Galba truncatula</i></td><td>4</td><td>1</td><td>1</td><td>2</td><td>3</td><td></td></tr> <tr><td><i>Lymnaea palustris</i></td><td>4</td><td>3</td><td>2</td><td>1</td><td>10</td><td>1</td></tr> <tr><td><i>Lymnaea stagnalis</i></td><td>2</td><td>2</td><td>2</td><td>4</td><td>7</td><td>12</td></tr> <tr><td><i>Musculum lacustris</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Oxytoma Pfeifferi</i></td><td>1</td><td>3</td><td>1</td><td>2</td><td>11</td><td>6</td></tr> <tr><td><i>Physa fontinalis</i></td><td>4</td><td></td><td>3</td><td>3</td><td>8</td><td>8</td></tr> <tr><td><i>Pisidium milium</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium nitidum</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium obusale</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium personatum</i></td><td></td><td></td><td></td><td></td><td>2</td><td>8</td></tr> <tr><td><i>Pisidium sp</i></td><td>3</td><td>3</td><td></td><td>3</td><td>5</td><td>9</td></tr> <tr><td><i>Pianorbis cornutus</i></td><td></td><td>2</td><td>1</td><td>2</td><td></td><td></td></tr> <tr><td><i>Pianorbis carinatus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pianorbis pianorbis</i></td><td>6</td><td>5</td><td>5</td><td>5</td><td>9</td><td>2</td></tr> <tr><td><i>Radix balthica</i></td><td>1</td><td></td><td>4</td><td>4</td><td>8</td><td>1</td></tr> <tr><td><i>Sphaerium cornutum</i></td><td>7</td><td>5</td><td>3</td><td>7</td><td>6</td><td></td></tr> <tr><td><i>Stagnicola fuscus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Succinea putris</i></td><td></td><td>2</td><td>5</td><td>4</td><td></td><td></td></tr> </table>						<i>Acrotaxus lacustris</i>	4	3	6	3	8	7	<i>Anisus vortex</i>	7	8	7	9	14	8	<i>Amniger crista</i>							<i>Bithynia tentaculata</i>	8	7	5	9	7	8	<i>Galba truncatula</i>	4	1	1	2	3		<i>Lymnaea palustris</i>	4	3	2	1	10	1	<i>Lymnaea stagnalis</i>	2	2	2	4	7	12	<i>Musculum lacustris</i>							<i>Oxytoma Pfeifferi</i>	1	3	1	2	11	6	<i>Physa fontinalis</i>	4		3	3	8	8	<i>Pisidium milium</i>							<i>Pisidium nitidum</i>							<i>Pisidium obusale</i>							<i>Pisidium personatum</i>					2	8	<i>Pisidium sp</i>	3	3		3	5	9	<i>Pianorbis cornutus</i>		2	1	2			<i>Pianorbis carinatus</i>							<i>Pianorbis pianorbis</i>	6	5	5	5	9	2	<i>Radix balthica</i>	1		4	4	8	1	<i>Sphaerium cornutum</i>	7	5	3	7	6		<i>Stagnicola fuscus</i>							<i>Succinea putris</i>		2	5	4		
<i>Acrotaxus lacustris</i>	4	3	6	3	8	7																																																																																																																																																										
<i>Anisus vortex</i>	7	8	7	9	14	8																																																																																																																																																										
<i>Amniger crista</i>																																																																																																																																																																
<i>Bithynia tentaculata</i>	8	7	5	9	7	8																																																																																																																																																										
<i>Galba truncatula</i>	4	1	1	2	3																																																																																																																																																											
<i>Lymnaea palustris</i>	4	3	2	1	10	1																																																																																																																																																										
<i>Lymnaea stagnalis</i>	2	2	2	4	7	12																																																																																																																																																										
<i>Musculum lacustris</i>																																																																																																																																																																
<i>Oxytoma Pfeifferi</i>	1	3	1	2	11	6																																																																																																																																																										
<i>Physa fontinalis</i>	4		3	3	8	8																																																																																																																																																										
<i>Pisidium milium</i>																																																																																																																																																																
<i>Pisidium nitidum</i>																																																																																																																																																																
<i>Pisidium obusale</i>																																																																																																																																																																
<i>Pisidium personatum</i>					2	8																																																																																																																																																										
<i>Pisidium sp</i>	3	3		3	5	9																																																																																																																																																										
<i>Pianorbis cornutus</i>		2	1	2																																																																																																																																																												
<i>Pianorbis carinatus</i>																																																																																																																																																																
<i>Pianorbis pianorbis</i>	6	5	5	5	9	2																																																																																																																																																										
<i>Radix balthica</i>	1		4	4	8	1																																																																																																																																																										
<i>Sphaerium cornutum</i>	7	5	3	7	6																																																																																																																																																											
<i>Stagnicola fuscus</i>																																																																																																																																																																
<i>Succinea putris</i>		2	5	4																																																																																																																																																												
Local	<table border="1"> <tr><td><i>Bathymophalus contortus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Bithynia leachi</i></td><td>5</td><td>5</td><td>2</td><td>4</td><td>2</td><td>6</td></tr> <tr><td><i>Gyalus albus</i></td><td>2</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Hippeutis complanatus</i></td><td></td><td></td><td></td><td>1</td><td>1</td><td>2</td></tr> <tr><td><i>Valvata cristata</i></td><td>2</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Vertigo antvertigo</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Viviparus connectus</i></td><td>2</td><td>7</td><td>6</td><td>4</td><td>7</td><td>3</td></tr> </table>						<i>Bathymophalus contortus</i>							<i>Bithynia leachi</i>	5	5	2	4	2	6	<i>Gyalus albus</i>	2						<i>Hippeutis complanatus</i>				1	1	2	<i>Valvata cristata</i>	2						<i>Vertigo antvertigo</i>							<i>Viviparus connectus</i>	2	7	6	4	7	3																																																																																																									
<i>Bathymophalus contortus</i>																																																																																																																																																																
<i>Bithynia leachi</i>	5	5	2	4	2	6																																																																																																																																																										
<i>Gyalus albus</i>	2																																																																																																																																																															
<i>Hippeutis complanatus</i>				1	1	2																																																																																																																																																										
<i>Valvata cristata</i>	2																																																																																																																																																															
<i>Vertigo antvertigo</i>																																																																																																																																																																
<i>Viviparus connectus</i>	2	7	6	4	7	3																																																																																																																																																										
Naturalised	<table border="1"> <tr><td><i>Physa acuta</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Potamopyrgus antipodarum</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>						<i>Physa acuta</i>							<i>Potamopyrgus antipodarum</i>																																																																																																																																																		
<i>Physa acuta</i>																																																																																																																																																																
<i>Potamopyrgus antipodarum</i>																																																																																																																																																																
Rare	<table border="1"> <tr><td><i>Sphaerium nucleus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>						<i>Sphaerium nucleus</i>																																																																																																																																																									
<i>Sphaerium nucleus</i>																																																																																																																																																																
RDB1	<table border="1"> <tr><td><i>Segmentina nitida</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>						<i>Segmentina nitida</i>																																																																																																																																																									
<i>Segmentina nitida</i>																																																																																																																																																																
RDB3	<table border="1"> <tr><td><i>Oxytoma sarsi</i></td><td>1</td><td>2</td><td></td><td></td><td></td><td>1</td></tr> <tr><td><i>Pisidium pseudosphaerium</i></td><td>3</td><td></td><td></td><td></td><td>5</td><td>5</td></tr> </table>						<i>Oxytoma sarsi</i>	1	2				1	<i>Pisidium pseudosphaerium</i>	3				5	5																																																																																																																																												
<i>Oxytoma sarsi</i>	1	2				1																																																																																																																																																										
<i>Pisidium pseudosphaerium</i>	3				5	5																																																																																																																																																										

\*Modified DAFOR scale used in mollusc community recording

Value	Description	Estimation of abundance	Numerical Proxy
D	Dominant	100+	8
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1



Table F1 continued. Area 5 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy\* for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

Sample ID	5.14	5.15	5.16	5.17	5.18	5.19																																																																																																																																																										
Grid reference	[REDACTED]																																																																																																																																																															
Status	Species																																																																																																																																																															
Common	<table border="1"> <tr><td><i>Acroloxus lacustris</i></td><td>3</td><td>8</td><td>4</td><td>9</td><td>6</td><td>6</td></tr> <tr><td><i>Anisus vortex</i></td><td>3</td><td>8</td><td>5</td><td>8</td><td>4</td><td>2</td></tr> <tr><td><i>Armiger crista</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Bithynia tentaculata</i></td><td>6</td><td>9</td><td>10</td><td>9</td><td>4</td><td>9</td></tr> <tr><td><i>Galba truncatula</i></td><td>1</td><td>3</td><td></td><td>1</td><td>1</td><td></td></tr> <tr><td><i>Lymnaea palustris</i></td><td></td><td>1</td><td>1</td><td>3</td><td>2</td><td></td></tr> <tr><td><i>Lymnaea stagnalis</i></td><td>8</td><td>9</td><td>5</td><td>9</td><td>7</td><td>10</td></tr> <tr><td><i>Musculum lacustris</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Oxytoma Pfeifferi</i></td><td>8</td><td>8</td><td>7</td><td>6</td><td>1</td><td>3</td></tr> <tr><td><i>Physa fontinalis</i></td><td>5</td><td>7</td><td>2</td><td>6</td><td></td><td>4</td></tr> <tr><td><i>Pisidium milium</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium nitidum</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium obtusale</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium personatum</i></td><td></td><td>4</td><td></td><td>5</td><td></td><td>2</td></tr> <tr><td><i>Pisidium sp</i></td><td>4</td><td>7</td><td>1</td><td>12</td><td></td><td>2</td></tr> <tr><td><i>Planorbis cornuus</i></td><td></td><td></td><td></td><td>5</td><td>2</td><td>1</td></tr> <tr><td><i>Planorbis carinatus</i></td><td></td><td></td><td>1</td><td></td><td></td><td></td></tr> <tr><td><i>Planorbis planorbis</i></td><td>7</td><td>3</td><td>9</td><td>4</td><td>8</td><td>6</td></tr> <tr><td><i>Radix balthica</i></td><td>7</td><td>6</td><td>7</td><td>7</td><td>6</td><td>5</td></tr> <tr><td><i>Sphaerium comeum</i></td><td></td><td>4</td><td>2</td><td>3</td><td>1</td><td></td></tr> <tr><td><i>Stagnicola fuscus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Succinea putris</i></td><td>2</td><td></td><td>2</td><td></td><td>2</td><td></td></tr> </table>						<i>Acroloxus lacustris</i>	3	8	4	9	6	6	<i>Anisus vortex</i>	3	8	5	8	4	2	<i>Armiger crista</i>							<i>Bithynia tentaculata</i>	6	9	10	9	4	9	<i>Galba truncatula</i>	1	3		1	1		<i>Lymnaea palustris</i>		1	1	3	2		<i>Lymnaea stagnalis</i>	8	9	5	9	7	10	<i>Musculum lacustris</i>							<i>Oxytoma Pfeifferi</i>	8	8	7	6	1	3	<i>Physa fontinalis</i>	5	7	2	6		4	<i>Pisidium milium</i>							<i>Pisidium nitidum</i>							<i>Pisidium obtusale</i>							<i>Pisidium personatum</i>		4		5		2	<i>Pisidium sp</i>	4	7	1	12		2	<i>Planorbis cornuus</i>				5	2	1	<i>Planorbis carinatus</i>			1				<i>Planorbis planorbis</i>	7	3	9	4	8	6	<i>Radix balthica</i>	7	6	7	7	6	5	<i>Sphaerium comeum</i>		4	2	3	1		<i>Stagnicola fuscus</i>							<i>Succinea putris</i>	2		2		2	
<i>Acroloxus lacustris</i>	3	8	4	9	6	6																																																																																																																																																										
<i>Anisus vortex</i>	3	8	5	8	4	2																																																																																																																																																										
<i>Armiger crista</i>																																																																																																																																																																
<i>Bithynia tentaculata</i>	6	9	10	9	4	9																																																																																																																																																										
<i>Galba truncatula</i>	1	3		1	1																																																																																																																																																											
<i>Lymnaea palustris</i>		1	1	3	2																																																																																																																																																											
<i>Lymnaea stagnalis</i>	8	9	5	9	7	10																																																																																																																																																										
<i>Musculum lacustris</i>																																																																																																																																																																
<i>Oxytoma Pfeifferi</i>	8	8	7	6	1	3																																																																																																																																																										
<i>Physa fontinalis</i>	5	7	2	6		4																																																																																																																																																										
<i>Pisidium milium</i>																																																																																																																																																																
<i>Pisidium nitidum</i>																																																																																																																																																																
<i>Pisidium obtusale</i>																																																																																																																																																																
<i>Pisidium personatum</i>		4		5		2																																																																																																																																																										
<i>Pisidium sp</i>	4	7	1	12		2																																																																																																																																																										
<i>Planorbis cornuus</i>				5	2	1																																																																																																																																																										
<i>Planorbis carinatus</i>			1																																																																																																																																																													
<i>Planorbis planorbis</i>	7	3	9	4	8	6																																																																																																																																																										
<i>Radix balthica</i>	7	6	7	7	6	5																																																																																																																																																										
<i>Sphaerium comeum</i>		4	2	3	1																																																																																																																																																											
<i>Stagnicola fuscus</i>																																																																																																																																																																
<i>Succinea putris</i>	2		2		2																																																																																																																																																											
Local	<table border="1"> <tr><td><i>Bathymphalus contortus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Bithynia leachii</i></td><td>8</td><td>4</td><td>6</td><td>2</td><td>9</td><td></td></tr> <tr><td><i>Gyraulus albus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Hippeutis complanatus</i></td><td></td><td></td><td></td><td>2</td><td></td><td></td></tr> <tr><td><i>Valvata cristata</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Vertigo antiveritigo</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Viviparus connectus</i></td><td>6</td><td>5</td><td>2</td><td>2</td><td>6</td><td>7</td></tr> </table>						<i>Bathymphalus contortus</i>							<i>Bithynia leachii</i>	8	4	6	2	9		<i>Gyraulus albus</i>							<i>Hippeutis complanatus</i>				2			<i>Valvata cristata</i>							<i>Vertigo antiveritigo</i>							<i>Viviparus connectus</i>	6	5	2	2	6	7																																																																																																									
<i>Bathymphalus contortus</i>																																																																																																																																																																
<i>Bithynia leachii</i>	8	4	6	2	9																																																																																																																																																											
<i>Gyraulus albus</i>																																																																																																																																																																
<i>Hippeutis complanatus</i>				2																																																																																																																																																												
<i>Valvata cristata</i>																																																																																																																																																																
<i>Vertigo antiveritigo</i>																																																																																																																																																																
<i>Viviparus connectus</i>	6	5	2	2	6	7																																																																																																																																																										
Naturalised	<table border="1"> <tr><td><i>Physa acuta</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Potamopyrgus antipodarum</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>						<i>Physa acuta</i>							<i>Potamopyrgus antipodarum</i>																																																																																																																																																		
<i>Physa acuta</i>																																																																																																																																																																
<i>Potamopyrgus antipodarum</i>																																																																																																																																																																
Rare	<table border="1"> <tr><td><i>Sphaerium nucleus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>						<i>Sphaerium nucleus</i>																																																																																																																																																									
<i>Sphaerium nucleus</i>																																																																																																																																																																
RDB1	<table border="1"> <tr><td><i>Segmentina nitida</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>						<i>Segmentina nitida</i>																																																																																																																																																									
<i>Segmentina nitida</i>																																																																																																																																																																
RDB3	<table border="1"> <tr><td><i>Oxytoma sarsi</i></td><td></td><td></td><td>2</td><td>3</td><td>1</td><td></td></tr> <tr><td><i>Pisidium pseudosphaerium</i></td><td></td><td>3</td><td></td><td>3</td><td></td><td>1</td></tr> </table>						<i>Oxytoma sarsi</i>			2	3	1		<i>Pisidium pseudosphaerium</i>		3		3		1																																																																																																																																												
<i>Oxytoma sarsi</i>			2	3	1																																																																																																																																																											
<i>Pisidium pseudosphaerium</i>		3		3		1																																																																																																																																																										

\*Modified DAFOR scale used in mollusc community recording.

Value	Descriptor	Estimate of abundance	Numerical Proxy
D	Dominant	100+	8
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1

Table F1 continued. Area 5 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy\* for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

Sample ID	5.21	5.22	5.23	5.24	5.25	5.26																																																																																																																																																										
Grid reference	[REDACTED]																																																																																																																																																															
Status	Species																																																																																																																																																															
Common	<table border="1"> <tr><td><i>Acroloxus lacustris</i></td><td>9</td><td>10</td><td>5</td><td>8</td><td>10</td><td>2</td></tr> <tr><td><i>Anisus vortex</i></td><td>11</td><td>11</td><td>11</td><td>12</td><td>12</td><td>9</td></tr> <tr><td><i>Armiger crista</i></td><td></td><td></td><td></td><td></td><td>4</td><td>5</td></tr> <tr><td><i>Bithynia tentaculata</i></td><td>12</td><td>8</td><td>7</td><td>10</td><td>8</td><td>10</td></tr> <tr><td><i>Galba truncatula</i></td><td></td><td>1</td><td></td><td>9</td><td>5</td><td></td></tr> <tr><td><i>Lymnaea palustris</i></td><td></td><td>3</td><td>2</td><td></td><td></td><td>5</td></tr> <tr><td><i>Lymnaea stagnalis</i></td><td>13</td><td>11</td><td>4</td><td>5</td><td>6</td><td></td></tr> <tr><td><i>Musculum lacustris</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Oxytoma pleifferi</i></td><td>3</td><td>7</td><td>1</td><td>5</td><td>5</td><td>8</td></tr> <tr><td><i>Physa fontinalis</i></td><td>11</td><td>10</td><td></td><td>7</td><td>7</td><td>8</td></tr> <tr><td><i>Pisidium milium</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium nitidum</i></td><td></td><td></td><td></td><td></td><td>2</td><td></td></tr> <tr><td><i>Pisidium obtusale</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium personatum</i></td><td>1</td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium sp</i></td><td>6</td><td>6</td><td>3</td><td>10</td><td>12</td><td>4</td></tr> <tr><td><i>Planorbis corneus</i></td><td>2</td><td>5</td><td>1</td><td>3</td><td>4</td><td>1</td></tr> <tr><td><i>Planorbis carinatus</i></td><td>1</td><td></td><td></td><td></td><td></td><td>2</td></tr> <tr><td><i>Planorbis planorbis</i></td><td>10</td><td>8</td><td>10</td><td>3</td><td>8</td><td>7</td></tr> <tr><td><i>Radix balthica</i></td><td>13</td><td>11</td><td>8</td><td>4</td><td>4</td><td>7</td></tr> <tr><td><i>Sphaerium corneum</i></td><td>6</td><td>5</td><td>2</td><td>4</td><td>6</td><td>8</td></tr> <tr><td><i>Stagnicola fuscus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Succinea putris</i></td><td>7</td><td>4</td><td></td><td>8</td><td>5</td><td>7</td></tr> </table>						<i>Acroloxus lacustris</i>	9	10	5	8	10	2	<i>Anisus vortex</i>	11	11	11	12	12	9	<i>Armiger crista</i>					4	5	<i>Bithynia tentaculata</i>	12	8	7	10	8	10	<i>Galba truncatula</i>		1		9	5		<i>Lymnaea palustris</i>		3	2			5	<i>Lymnaea stagnalis</i>	13	11	4	5	6		<i>Musculum lacustris</i>							<i>Oxytoma pleifferi</i>	3	7	1	5	5	8	<i>Physa fontinalis</i>	11	10		7	7	8	<i>Pisidium milium</i>							<i>Pisidium nitidum</i>					2		<i>Pisidium obtusale</i>							<i>Pisidium personatum</i>	1						<i>Pisidium sp</i>	6	6	3	10	12	4	<i>Planorbis corneus</i>	2	5	1	3	4	1	<i>Planorbis carinatus</i>	1					2	<i>Planorbis planorbis</i>	10	8	10	3	8	7	<i>Radix balthica</i>	13	11	8	4	4	7	<i>Sphaerium corneum</i>	6	5	2	4	6	8	<i>Stagnicola fuscus</i>							<i>Succinea putris</i>	7	4		8	5	7
<i>Acroloxus lacustris</i>	9	10	5	8	10	2																																																																																																																																																										
<i>Anisus vortex</i>	11	11	11	12	12	9																																																																																																																																																										
<i>Armiger crista</i>					4	5																																																																																																																																																										
<i>Bithynia tentaculata</i>	12	8	7	10	8	10																																																																																																																																																										
<i>Galba truncatula</i>		1		9	5																																																																																																																																																											
<i>Lymnaea palustris</i>		3	2			5																																																																																																																																																										
<i>Lymnaea stagnalis</i>	13	11	4	5	6																																																																																																																																																											
<i>Musculum lacustris</i>																																																																																																																																																																
<i>Oxytoma pleifferi</i>	3	7	1	5	5	8																																																																																																																																																										
<i>Physa fontinalis</i>	11	10		7	7	8																																																																																																																																																										
<i>Pisidium milium</i>																																																																																																																																																																
<i>Pisidium nitidum</i>					2																																																																																																																																																											
<i>Pisidium obtusale</i>																																																																																																																																																																
<i>Pisidium personatum</i>	1																																																																																																																																																															
<i>Pisidium sp</i>	6	6	3	10	12	4																																																																																																																																																										
<i>Planorbis corneus</i>	2	5	1	3	4	1																																																																																																																																																										
<i>Planorbis carinatus</i>	1					2																																																																																																																																																										
<i>Planorbis planorbis</i>	10	8	10	3	8	7																																																																																																																																																										
<i>Radix balthica</i>	13	11	8	4	4	7																																																																																																																																																										
<i>Sphaerium corneum</i>	6	5	2	4	6	8																																																																																																																																																										
<i>Stagnicola fuscus</i>																																																																																																																																																																
<i>Succinea putris</i>	7	4		8	5	7																																																																																																																																																										
Local	<table border="1"> <tr><td><i>Bathymphalus contortus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Bithynia leachii</i></td><td>8</td><td>6</td><td>12</td><td>7</td><td>10</td><td>8</td></tr> <tr><td><i>Gyrulus albus</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Hippeutis complanatus</i></td><td></td><td></td><td></td><td>5</td><td>3</td><td></td></tr> <tr><td><i>Valvata cristata</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Vertigo antivertigo</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Viviparus connectus</i></td><td>9</td><td>7</td><td>4</td><td>3</td><td>5</td><td>3</td></tr> </table>						<i>Bathymphalus contortus</i>							<i>Bithynia leachii</i>	8	6	12	7	10	8	<i>Gyrulus albus</i>							<i>Hippeutis complanatus</i>				5	3		<i>Valvata cristata</i>							<i>Vertigo antivertigo</i>							<i>Viviparus connectus</i>	9	7	4	3	5	3																																																																																																									
<i>Bathymphalus contortus</i>																																																																																																																																																																
<i>Bithynia leachii</i>	8	6	12	7	10	8																																																																																																																																																										
<i>Gyrulus albus</i>																																																																																																																																																																
<i>Hippeutis complanatus</i>				5	3																																																																																																																																																											
<i>Valvata cristata</i>																																																																																																																																																																
<i>Vertigo antivertigo</i>																																																																																																																																																																
<i>Viviparus connectus</i>	9	7	4	3	5	3																																																																																																																																																										
Naturalised	<table border="1"> <tr><td><i>Physa acuta</i></td><td></td><td></td><td>10</td><td></td><td></td><td></td></tr> <tr><td><i>Potamopyrgus antipodarum</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>						<i>Physa acuta</i>			10				<i>Potamopyrgus antipodarum</i>																																																																																																																																																		
<i>Physa acuta</i>			10																																																																																																																																																													
<i>Potamopyrgus antipodarum</i>																																																																																																																																																																
Rare	<table border="1"> <tr><td><i>Sphaerium nucleus</i></td><td></td><td>1</td><td></td><td>2</td><td></td><td></td></tr> </table>						<i>Sphaerium nucleus</i>		1		2																																																																																																																																																					
<i>Sphaerium nucleus</i>		1		2																																																																																																																																																												
RDB1	<table border="1"> <tr><td><i>Segmentina nitida</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> </table>						<i>Segmentina nitida</i>																																																																																																																																																									
<i>Segmentina nitida</i>																																																																																																																																																																
RDB3	<table border="1"> <tr><td><i>Oxytoma sarsi</i></td><td></td><td></td><td></td><td></td><td></td><td></td></tr> <tr><td><i>Pisidium pseudosphaerium</i></td><td>1</td><td>2</td><td></td><td>9</td><td>12</td><td></td></tr> </table>						<i>Oxytoma sarsi</i>							<i>Pisidium pseudosphaerium</i>	1	2		9	12																																																																																																																																													
<i>Oxytoma sarsi</i>																																																																																																																																																																
<i>Pisidium pseudosphaerium</i>	1	2		9	12																																																																																																																																																											

\*Modified DAFOR scale used in mollusc community recording

Value	Description	Estimation of abundance	Numerical Proxy
D	Dominant	100+	5
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1

Table F1 continued. Area 5 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy<sup>1</sup> for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

Sample ID	5.27	5.28	5.29	5.31	5.32	5.33
Grid reference	[REDACTED]					
Species	[REDACTED]					
Status						
Common						
<i>Acrotaxus lacustris</i>	7	3	3	4	2	2
<i>Anisus vortex</i>	11	7	11	7	5	10
<i>Amniger crista</i>	7	1	7			
<i>Bithynia tentaculata</i>	8	3	5	7	8	8
<i>Galba truncatula</i>	4	2	4	7	1	
<i>Lymnaea palustris</i>	5	2	7	3	2	3
<i>Lymnaea stagnalis</i>	4	2		1	3	11
<i>Muscukum lacustris</i>			4			
<i>Oxytoma pleifferi</i>	5	5	4	6	4	
<i>Physa fontinalis</i>	5	5		3	4	8
<i>Physidium nitidum</i>	2					
<i>Physidium obtusale</i>						
<i>Physidium personatum</i>	2					
<i>Physidium sp</i>	12	3	8		2	7
<i>Pianorbis comeus</i>	3	2	2		2	2
<i>Pianorbis carinatus</i>						
<i>Pianorbis planorbis</i>	8	8	5	6	8	13
<i>Radix balthica</i>	5	3	6	5	7	10
<i>Sphaerium comeum</i>	10	4		11	8	
<i>Stagnicola fuscus</i>						
<i>Succinea putris</i>	3	2	3			3
Local						
<i>Bathyomphalus contortus</i>						
<i>Bithynia leachi</i>	8	6	6	4	3	3
<i>Gyrulus albus</i>						
<i>Hippeutis complanatus</i>		1	5			
<i>Valvata cristata</i>						
<i>Vertigo antiveritigo</i>						
<i>Viviparus connectus</i>	4	4	4	3	2	7
Naturalised						
<i>Physa acuta</i>						
<i>Potamopyrgus antipodarum</i>						
Rare						
<i>Sphaerium nucleus</i>						5
RDB1						
<i>Segmentina nitida</i>						
RDB3						
<i>Oxytoma sarsi</i>				1		
<i>Physidium pseudosphaerium</i>			6			2

<sup>1</sup>Modified DAFOR scale used in mollusc community recording

Value	Descriptor	Estimate of abundance	Numerical Proxy
D	Dominant	100+	5
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1

Table F1 continued. Area 5 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy<sup>1</sup> for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

Sample ID		5.34	5.35	5.36	5.37	5.38	5.39
Status	Grid reference Species						
Common	<i>Acroloxus lacustris</i>		5	4	8	6	6
	<i>Anisus vortex</i>	7	5	9	12	13	6
	<i>Armiger crista</i>				5	4	
	<i>Bithynia tentaculata</i>	7	8	9	10	10	3
	<i>Galba truncatula</i>	3			3		5
	<i>Lymnaea palustris</i>	1	6	5	5	7	5
	<i>Lymnaea stagnalis</i>	6	4	3	8	8	7
	<i>Musculum lacustris</i>	2					
	<i>Oxytoma Pfeifferi</i>	3	4	6	2	6	3
	<i>Physa fontinalis</i>	4	4	6	11	9	3
	<i>Pisidium milium</i>						
	<i>Pisidium nitidum</i>						
	<i>Pisidium obtusale</i>						
	<i>Pisidium personatum</i>						
	<i>Pisidium sp</i>	6	7	4	9	9	2
	<i>Planorbis cornuus</i>					1	5
	<i>Planorbis carinatus</i>				1	7	1
	<i>Planorbis planorbis</i>	7	2	8	11	9	3
	<i>Radix balthica</i>	5	3	7	9	8	3
	<i>Sphaerium cornuum</i>	4	2	5	11	11	
<i>Stagnicola fuscus</i>							
<i>Succinea putris</i>			2	6	7	3	
Local	<i>Bathymphalus contortus</i>		1				
	<i>Bithynia leachi</i>	9	5	10	11	12	8
	<i>Gyrulus albus</i>						
	<i>Hippeutis complanatus</i>				1	2	1
	<i>Valvata cristata</i>						
	<i>Vertigo antiverlugo</i>						
	<i>Viviparus connectus</i>	3		2	4	3	1
Naturalised	<i>Physa scuta</i>						
	<i>Potamopyrgus antipodarum</i>						
Rare	<i>Sphaerium nucleus</i>	1					
RDB1	<i>Segmentina nitida</i>						
RDB3	<i>Oxytoma sarsi</i>	7			1		3
	<i>Pisidium pseudosphaerium</i>	4			9	6	

<sup>1</sup>Modified DAFOR scale used in mollusc community recording

Value	Descriptor	Estimation of abundance	Numerical Proxy
D	Dominant	100+	8
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1

Table F1 continued. Area 5 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy<sup>1</sup> for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

Sample ID		5.41	5.42	5.43	5.44	5.45	5.46
Grid reference		[REDACTED]					
Status	Species						
Common	<i>Acroloxus lacustris</i>	3	3	5	4		6
	<i>Anisus vortex</i>	8	8	7	4	8	5
	<i>Armiger crista</i>						
	<i>Bithynia tentaculata</i>	6	4	7	4	12	9
	<i>Galba truncatula</i>	5	7	6	5		6
	<i>Lymnaea palustris</i>			3	1		4
	<i>Lymnaea stagnalis</i>	6	3	6	2	2	
	<i>Musculum lacustris</i>						1
	<i>Oxytoma pfefferi</i>	3	4	5	6	3	5
	<i>Physa fontinalis</i>	3	7	6		8	7
	<i>Pisidium milium</i>					6	
	<i>Pisidium nitidum</i>						
	<i>Pisidium obtusale</i>						
	<i>Pisidium personatum</i>						
	<i>Pisidium sp</i>	6	4	5		7	9
	<i>Planorbis cornuus</i>	7	1	4		6	
	<i>Planorbis carinatus</i>			1			
	<i>Planorbis planorbis</i>	10	9	7	8	12	6
	<i>Radix balthica</i>	3	6	5	5	7	
	<i>Sphaerium cornuum</i>	1		2		1	5
<i>Stagnicola fuscus</i>							
<i>Succinea putris</i>	4	4	6	3	6	3	
Local	<i>Bathymphalus contortus</i>						1
	<i>Bithynia leachii</i>	7	9	8	6		6
	<i>Gyraulus albus</i>						
	<i>Hippeutis complanatus</i>	2			1		8
	<i>Valvata cristata</i>						5
	<i>Vertigo antvertigo</i>						
	<i>Viviparus connectus</i>	1	3	2	2	2	6
Naturalised	<i>Physa acuta</i>						
	<i>Potamopyrgus antipodarum</i>						1
Rare	<i>Sphaerium nucleus</i>						
RDB1	<i>Segmentina nitida</i>						1
RDB3	<i>Oxytoma sarsi</i>	2	1		2	4	
	<i>Pisidium pseudosphaerium</i>	6		5			9

<sup>1</sup>Modified DAFOR scale used in mollusc community recording

Value	Descriptor	Estimation of abundance	Numerical Proxy
D	Dominant	100+	5
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1

Table F1 continued. Area 5 aquatic mollusc abundance scores per sample. Scores calculated by converting the modified DAFOR scale into numerical proxy<sup>1</sup> for each subsample, then calculating the sum to give a score between 1-15. Colours represent conditional formatting applied in Microsoft Excel using a traffic light system for values from 1-15, where green and red indicate high and low scores, respectively.

Sample ID		5.49	5.51	5.52	5.53	5.54	5.55	5.56
Grid reference		[REDACTED]						
Status	Species							
Common	<i>Acroloxus lacustris</i>	7	9	4	8	8	5	6
	<i>Anisus vortex</i>	5	8	5	7	9	11	7
	<i>Armiger crista</i>							
	<i>Bithynia tentaculata</i>	7	9	4	10	5	3	10
	<i>Gaiba truncatula</i>	9	2	3			5	
	<i>Lymnaea palustris</i>	8	3	1	1	2	2	1
	<i>Lymnaea stagnalis</i>		5	6	7	2	9	2
	<i>Musculum lacustris</i>	1						
	<i>Oxyloma Pfeifferi</i>	8	2	2	7	4	2	
	<i>Physa fontinalis</i>	10	7	4	2	6		3
	<i>Pisidium milium</i>							
	<i>Pisidium nitidum</i>							
	<i>Pisidium obtusale</i>	4						
	<i>Pisidium personatum</i>	2				2		
	<i>Pisidium sp</i>	9	4	1	2	9	6	3
	<i>Pianorbis corneus</i>				1		5	
	<i>Pianorbis carinatus</i>		2					
	<i>Pianorbis pianorbis</i>	5	7	5	9	7	1	3
	<i>Radix balthica</i>	1	10	4	9	6	3	1
	<i>Sphaerium corneum</i>	4	3	4		2	2	4
<i>Stagnicola fuscus</i>						1		
<i>Succinea putris</i>	1	5		4	4	4	2	
Local	<i>Bathymphalus contortus</i>							
	<i>Bithynia leachi</i>	6	13		10	8	5	9
	<i>Gyrulus albus</i>							
	<i>Hippeutis complanatus</i>	5				3	3	
	<i>Valvata cristata</i>	6						
	<i>Vertigo antivertigo</i>							
	<i>Viviparus connectus</i>	6	5	3	3		5	3
Naturalised	<i>Physa acute</i>							
	<i>Potamopyrgus antipodarum</i>							
Rare	<i>Sphaerium nucleus</i>							
RDB1	<i>Segmentina nitida</i>							
RDB3	<i>Oxyloma sarsi</i>					2	1	
	<i>Pisidium pseudo-sphaerium</i>	9	3			8	4	

<sup>1</sup>Modified DAFOR scale used in mollusc community recording

Value	Description	Estimation of abundance	Numerical Proxy
D	Dominant	100+	5
A	Abundant	50-100	4
F	Frequent	21-50	3
O	Occasional	6-20	2
R	Rare	1-5	1

Table F2. Area 5 ditch assessment. 'Potential' field refers to the potential of the ditch to support little whirlpool ramshorn snail as assessed in the scoping study (AECOM, 2015b)

Ditch ID	Start Grid Reference	End Grid Reference	Type	Potential	Length (m)	Management	Botany	Silt	Poaching	Chemistry	LWRS	Molluscs	Samples	Comments	Further use
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	114.7	3	5	3	3	5	1	4	5.36	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	116.2	3	5	3	3	5	1	5	5.37, 5.38	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	5. Very Good	33.3	3	5	3	3	3	1	3	5.39	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	1. Low Potential	49.3	3	4	3	3	5	1	4	5.42	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	0. No Potential	230.8	3	4	3	1	3	1	4	5.41, 5.55	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	2. Moderate Potential	85.2	3	5	3	5	3	1	4	5.44	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	124.7	3	5	3	3	3	1	4	5.45	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	165.3	3	5	3	3	5	1	4	5.15, 5.16	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	188.1	3	4	3	3	5	1	4	5.12	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	2. Moderate Potential	113.3	3	5	3	3	3	1	4	5.11	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	148.6	3	5	3	3	5	1	4	5.13, 5.14	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	2. Moderate Potential	146.6	3	5	5	3	3	1	4	5.34, 5.35	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	97.4	3	4	3	3	3	1	4	5.33	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	238.2	1	3	1	3	5	1	4	5.31, 5.32	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	3. Moderate/Good Potential	204.2	3	5	3	5	5	1	4	5.25, 5.26, 5.27	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	3. Moderate/Good Potential	85.3	3	4	3	3	3	1	5	5.54	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	3. Moderate/Good Potential	114.4	3	4	3	3	3	1	4	5.29	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	300.5	3	4	3	3	5	1	5	5.17, 5.18, 5.19, 5.53	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	215.9	3	5	3	3	3	1	5	5.21, 5.22, 5.23	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	40.2	3	3	3	3	3	1	5	5.24	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	198.1	3	4	3	3	3	1	5	5.48	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	295	3	3	1	3	3	1	4	5.5, 5.6	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	4. Good Potential	72.4	3	3	3	3	3	1	4	5.1	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	3. Moderate/Good Potential	98.8	3	2	3	5	3	1	5	5.2	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	3. Moderate/Good Potential	258.1	3	3	3	3	3	1	4	5.3, 5.4	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	Not scoped	76.1	3	3	3	3	3	1	4	5.9, 5.52	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	Not scoped	186.6	3	3	3	3	5	1	4	5.51, 5.56	Current management	Receptor-Sub
[REDACTED]	[REDACTED]	[REDACTED]	Receptor	Not scoped	184.5	3	3	5	3	3	1	4	5.7, 5.8	Current management	Receptor-Sub

↑

↪

## AECOM Vegetation Data Recording Sheet

### Emergent plants

Site:

Date:

Species	Subsample (DAFOR)			Species	Subsample (DAFOR)		
	A	B	C		A	B	C
Agrost stol				Thal flav			
Alisma lance				Trifol prat			
Alisma plant				Trifol rep			
Alopec genic				Typha ang			
Angelic sylv				Typha lati			
Apium nodif				Urtica dioica			
Apium rep				Veron caten			
Berula erect				Vicia cracca			
Butom umbel							
Carex acutif							
Carex otrub							
Carex pseud							
Carex ripar							
Cirsium pal							
Dactyl glom							
Eleoch pal							
Elytrig repen							
Epilob hirsut							
Epilob parvi							
Equiset fluv							
Eupator can							
Festuc rub							
Filipend ulm							
Galium palus							
Glycer fluit							
Glycer max							
Holcus lanat							
Iris pseudac							
Juncus artic							
Juncus bufo							
Juncus effus							
Juncus inflex							
Lathyr prat							
Lolium pere							
Lotus pedun							
Lycop europ							
Lythrum sali							
Mentha aqua							
Myosot laxa							
Myosot scor							
Oenan aqu							
Oenan fist							
Phragm aust							
Plant lanceo							
Poa trivialis							
Potentil ans							
Ran acris							
Ran flammu							
Ran sceler							
Rorip nas ag							
Rumex hydol							
Rumedx obtus							
Salix ciner							
Salix fragi							
Salix sp.							
Samolus val							
Schoen tab							
Scroph aur							
Scutel galer							
Solan dulca							
Sparg erect							
Stachys pal							

### Aquatic plants (submerged-leaves)

Species	Subsample (DAFOR)		
	A	B	C
Callit brut			
Callit obtus			
Callit platy			
Callit stag			
Cerat dem			
Cerat subm			
Chara vulg			
Elodea can			
Elodea nutt			
Filam alg			
Front anti			
Hottonia pal			
Myriop spic			
Myriop vert			
Potam berch			
Potam crisp			
Potam natan			
Potam pect			
Potam pus			
Potam trich			
Ran aqu agg			
Ran circ			
Sagit sag			
Sparg emers			
Sparg erect			
Zannic palus			

### Floating leaved plants

Species	Subsample (DAFOR)		
	A	B	C
Azolla filicu			
Hydroch mor			
Hydroco ran			
Hydroco vul			
Lemna gibba			
Lemna minor			
Lemna minut			
Lemna trisul			
Nuphar lut			
Nymph alba			
Persic amph			
Spiro polyr			
Stratio alo			
Wolff arrh			



## AECOM Mollusc Data Recording Sheet - Phase 2

Site:

Date:

Sample ID:

Mollusc species	Sample (counts)		
	A	B	C
Acroloxus lacustris			
Anisus leucostoma			
Anisus vortex			
<b>Anisus vorticulus</b>			
Bathyomphalus contortus			
Bithynia leachii			
Bithynia tentaculata			
Galba truncatula			
Gyraulus albus			
Gyraulus crista			
Hippeutis complanatus			
Lymnaea fuscus			
Lymnaea palustris			
Lymnaea stagnalis			
Musculum lacustris			
Oxyloma pfeiferi			
<b>Oxyloma sarsi</b>			
Physa acuta			
Physa fontinalis			
Pisidium milium			
Pisidium nitidum			
Pisidium personatum			
<b>Pisidium pseudosphaerium</b>			
Pisidium sp			
Planorbarius corneus			
Planorbis carinatus			
Planorbis planorbis			
Potamopyrgus antipodarum			
Radix auricula			
Radix balthica			
<b>Segmentina nitida</b>			
Sphaerium corneus			
Sphaerium nucleus			
Succinea putris			
Valvata cristata			
<b>Valvata macrostoma</b>			
Valvata piscinalis			
<b>Vertigo moulinsiana</b>			
Viviparous sp.			
Viviparus connectus			
Zonitoides nitidula			

# Environmental Data Recording Sheet

Date	
Site ID	
Ditch no.	
Photo(s)	
Grid ref.	
Site ref	
Sample ID	

Adjacent Land use		
Improved grassland		
Semi-improved grassland		
Unimproved grassland		
Arable		
Swamp/Fen		
Drove		
Cattle/horse grazed		
Sheep grazed		
Hay/Silage		
Stockproof boundary		
Temporary fencing		
Spoil on bank		

Bank vegetation (DAFOR)		
Tall grass/reed		
Short grass		
Bare ground		
Tall herbs		
Overhanging vegetation		
Scrub <1.5m		
Fen		
Ground flora		
Shaded (%)		

	Vegetation cover	
	DAFOR	Absent
Open water surface		
Floating Lemna/Azolla		
Other floating aquatics		
Floating algae		
Lemna trisulca		
Other submerged plants		
Submerged algae		
Open substrate		
Emergent		
Low swamp/Floating mat		
Exposed vegetation		
Exposed mud		
Litter / detritus		
Shaded		
Emergents/floating mat in channel %		

Water features	
pH	
Conductivity (mS)	
D.O.	
Temp	
Water colour	

Ditch Features										
Water width (m)	Bank top width (m)	Freeboard (cm)	Water depth (cm)	Silt depth (cm)	Slope - bank A	Slope - bank B	Profile under water A	Profile under water B	Substrate	Turbidity
0-1	0-2	0-25	0-25	0-25	0-15	0-15	0-15	0-15	Clay	Clear
1-2	2-4	26-50	25-50	25-50	16-30	16-30	16-30	16-30	Alluvial	Slight
2-3	4-6	51-100	51-75	51-75	31-55	31-55	31-55	31-55	Peat	Mod
3-4	6-8	100-200	76-100	76-100	56-70	56-70	56-70	56-70	Sand	Heavy
4+	>10	>200	>100	>100	71-90	71-90	71-90	71-90	Gravel	

	Grazing/vegetation structure							
	None		Low		Med		High	
	A	B	A	B	A	B	A	B
Grazing								
Poaching								
Block formation								
Shelf formation								
Tangledness								
Grassy margin								

Management					
Years since last cleared	Not known	1	2-3	4-10	>10
Water relative to normal (cm)	Not known	+	-	Normal?	
Cleared to side	A	B			
Benched profile	A	B			
Cleared by					

**NOTES**

# Phase 3 Little Whirlpool Ramshorn Snail Phase Overview

Highways England

---

# 1 TRANSLOCATION

---

## 1.1 Task Number

GAA009.006

## 1.2 Task Deadline

ASAP – Completion March/April

## 1.3 Task Overview

The 2015 detailed site survey report highlighted that from the surveys conducted, there is an opportunity for conducting a small scale translocation (subject to a licence from Natural England).

The window of opportunity for conducting this would be until the breeding season commences in March/April. Conducting a translocation March /April, would mean that we are moving adult snails rather than the juveniles which are present during the late summer. This would need to be agreed with Natural England. The land owners are happy to accept the translocation and modify their management strategies, which will involve a negotiation on their behalf with HLS etc.. The mechanism of this has been looked into.

The proposed translocation will be dependent on a Natural England European Protected Species licence application, which is a reasonably large document but will set us in good stead for any future translocations, (if we find additional potential sites – Task 2).

The fee for this task (the first of three tasks associated with Phase 3) includes work on the following:

1. Translocation – which will involve the licence application with ecologist's statement, a check of the donor and receptor sites, modification of existing management agreements and the translocation.

## 1.4 Task Objectives and Milestones

Objective: To translocate

Milestones:

- Negotiation with Natural England
- Production of Translocation Methodology
- Licence Application, complete with Method statement to Natural England
- Pre Translocation Survey of proposed receptor and proposed donor sites
- Sample Analysis
- Arrange Derogation from Higher Level Stewardship (HLS) with Landowners and DEFRA

- Translocation
- Reporting

## 1.5 Task Outcomes

Translocation of a population of little whirlpool ramshorn snail.

AECOM will prepare the required reports to accompany the licence application.

AECOM will prepare a technical note documenting the findings and recommendations from the study.

As a requirement of the licence AECOM will prepare a short condition report for Natural England.

## 1.6 Project Risk and Management

- Failure/delay to obtaining licence from Natural England in time
- Failure/delay to obtaining permission to enter third party land
- Failure to derogate from Higher Level Stewardship (HLS) with Landowners and DEFRA
- Failure to find the little whirlpool ramshorn snail again, in the identified donor sites in pre translocation surveys
- Finding little whirlpool ramshorn snail in the identified receptor sites in pre translocation surveys
- Poor weather freezing the ditches preventing survey / translocation
- This fee includes costs for telephone meetings only

---

## 2 SCOPING

---

### 2.1 Task Number

GAA009.008

### 2.2 Task Deadline

Summer, (in order to find sites to potentially detail survey in August/September)

### 2.3 Task Overview

In the detailed ditch surveys in 2015, more potential donor sites than expected were recorded but the survey recorded less suitable receptor sites, than anticipated. Ideally, this summer additional sites that could act as receptor sites will be looked for.

From the steering group meeting held at Dragonfly House (09/2015), a number of the participants indicated that they had potential receptor sites, additionally others could be sought (i.e. to the [REDACTED]). Additional areas should be investigated to identify additional sites in terms of:

- Existing snail assemblage;
- Existing vegetation;
- Existing management; and
- Management restrictions (which require a bit of negotiation)

The fee for this task (the second of three tasks associated with this stage of work) includes work on the following:

2. An additional scoping study for additional sites, for which we can then propose additional survey next summer.

### 2.4 Task Objectives and Milestones

Objective: Scoping study to find additional potential sites

Desktop study for potential sites; Possible sites in [REDACTED] and sites to [REDACTED]

Liaison with Land owners / managers to access sites / and finding out HLS status

This fee includes costs for telephone meetings only

Visiting Sites to scope out areas for further study (based on methodology devised in 2015 scoping study) - capped at 2 full days in the field (two people).

### 2.5 Task Outcomes

- AECOM will prepare a technical note documenting the findings and recommendations from the study.
- A list of potential sites for detailed survey.

## 2.6 Project Risk and Management

- Failure/delay to obtaining permission to enter third party land.
- May not find sufficient receptor sites.
- May find too many receptor sites for scoping in the allocated time.

---

## 3 Multivariate Analyses

---

### 3.1 Task Number

GAA009.007

### 3.2 Task Deadline

Summer

### 3.3 Task Overview

The fee for this task (the third of three tasks associated with this stage of work) includes work on the following:

3. A suite of multivariate analyses on our existing data. A large amount of data was collected, which, as discussed at the steering group meeting, a statistical study would benefit the study as it would provide an additional, statistical level of understanding of the species.

### 3.4 Additional Detail

It has been proposed that the data are examined using a combination of two, fundamentally different multivariate community analytical techniques. These pattern-seeking methods will comprise classification analyses and non-metric, multi-dimensional scaling (NMMDS) ordination techniques. Critically, these techniques enable sites with structurally-related communities, arising from similar prevailing environmental/habitat conditions, to be identified and mapped. For each of the clusters of communities identified by these analyses, indicator analyses will enable the statistical associations between the distributions of the species amongst the clusters to be determined. These, along with the clusters of communities can be mapped to identify key habitats and those of particular conservation interest.

Additionally, it is proposed that the measured (quantified) environmental parameters for each of the sampling locations described within the marshes be analysed using multivariate correlation (ARESC) analyses (Trett et al., 2000; Trett et al., 2009 and Trett et al., 2011). These will identify and rank the statistical significance and strengths of associations of the measured environmental parameters with the structures of the mollusc communities. This approach should provide critical data for any future proposed translocations of selected snail species of specific conservation interest to new sites within the [REDACTED] habitats.

### 3.5 Task Objectives and Milestones

To statistically test the environmental parameters recorded against the presence / absence of little whirlpool snail.



Fee also includes for chemical analysis of samples of sites where little whirlpool ramshorn snail has been found – to add as variables to data set, and some additional “sample picking” of already retained samples.

### **3.6 Task Outcomes**

AECOM will prepare a technical note documenting the findings and recommendations from the study

### **3.7 Project Risk and Management**

Limited Risks – although the results may prove inconclusive

---

## 4 References

---

Trett, M.W., Calvo Urbano, B., Forster, S.J., Hutchinson, J.D., Trett, S., Feil, R.L. and Best, J.G. (2000). The use of meiofauna in contaminated land assessment. *Environmental Science and Technology*, 34: 1594 – 1602

Trett, M.W., Calvo Urbano, B. and Thurgood, R. (2008). Assessment and monitoring of actual ecological effects; nematodes in the service of industry and regulators. In Proceedings of the 10th. International UFZ-Deltares-TNO Conference on Soil-Water Systems (CONSOIL 2008). Milan, June 2008: 82-91

Trett, M.W., Calvo Urbano, B., Forster, S.J. and Trett, S.P. (2009). Chapter 12: Commercial aspects of the use of nematodes as bioindicators. In *Nematodes as Environmental Indicators*. Eds. Wilson, M.J. and Kakouli-Douarte, T. CAB International; Wallingford (UK) and Cambridge USA)

[REDACTED]

---

**From:** [REDACTED]  
**Sent:** 12 November 2015 17:40  
**To:** [REDACTED]  
**Cc:** [REDACTED]  
**Subject:** FW: Detailed Site Survey Report Submission  
**Attachments:** 20151110\_DraftdetailedsurveyReport\_AVorticulus\_V4.pdf

**Importance:** High

[REDACTED]

Please find attached the draft version of the little whirlpool ramshorn snail detailed survey.

The report details the surveys that were completed in September and for which we gave an overview of the results at the steering meeting.

Summary

We found more ditches than we were expecting already containing little whirlpool ramshorn snail, but less ditches than we anticipated being suitable receptor ditches - just 3 No. were considered appropriate receptor sites with appropriate management / environmental conditions.

The report proposes a small scale translocation under licence to those ditches – subject to agreement with Natural England. We have been negotiating with the landowner in relation to future management and all appears in order to proceed on that front.

This is a very small scale translocation however, and we should be investigating other areas too, to insure a robust experimental translocation, more information on this in the report.

As per below I would like to issue the draft to Natural England to get their comment not least because ultimately they'll be the ones to allow the experiment to go ahead (even in a small scale) and it's important to keep them in the loop.

Kind regards

[REDACTED]

---

**From:** [REDACTED]  
**Sent:** 10 November 2015 18:06  
**To:** [REDACTED]  
**Cc:** [REDACTED]  
**Subject:** RE: Detailed Site Survey Report Submission

[REDACTED]

Please find attached the Detailed Survey Report for the little whirlpool ramshorn snail project.

As always, issued as a draft for yours and HE's comments.  
If you are okay – I would like to issue to Natural England too.

A small amount of tidying to do before final issue, and full sign off through the verification process needed – but it brings us to an exciting cross roads.

[REDACTED]

[REDACTED] CEnv MCIEEM  
Associate Director, Ecology  
D [REDACTED]  
M [REDACTED]  
[REDACTED]

**AECOM**  
9th Floor, The Clarence West Building  
2 Clarence Street West  
Belfast, Northern Ireland  
T +44-(0)28-90607200  
[aecom.com](http://aecom.com)

**Built to deliver a better world**

[LinkedIn](#) [Twitter](#) [Facebook](#) [Instagram](#)

To download the AECOM Ecology Survey Calendar please [Click Here](#)

---

This email has been scanned by the Symantec Email Security.cloud service.  
For more information please visit <http://www.symanteccloud.com>

---

[REDACTED]

---

**From:** [REDACTED]  
**Sent:** 19 April 2016 16:17  
**To:** [REDACTED]  
**Subject:** FW: A29 - Anisus vorticulus licence application  
**Attachments:** 2016-23292-SCI-SCI LETTER.pdf; 2016-23292-SCI-SCI LICENCE.pdf; WML LR29 -30.pdf; Untitled attachment 00144.txt

[REDACTED]  
Principal Ecologist at Abrehart Ecology

Tel: [REDACTED] mobile [REDACTED]  
email: [REDACTED]  
Pound Farm  
Low Road  
Great Glenham  
Saxmundham  
Suffolk  
IP17 2DQ



The information in this email is private, may be confidential, and is intended for the addressee only. If received in error, please inform Abrehart Ecology immediately and delete the message from your computer. Copying, distributing or disclosing its contents is strictly prohibited. Whilst Abrehart Ecology makes every effort to keep its systems virus free, it is your responsibility to check/scan all messages and attachments if any. No responsibility can be accepted by Abrehart Ecology.

**From:** [REDACTED] [mailto:\[REDACTED\]](mailto:[REDACTED])  
**Sent:** Monday, April 18, 2016 10:09 AM  
**To:** [REDACTED]  
**Subject:** RE: A29 - Anisus vorticulus licence application

Dear [REDACTED]

Please see your licence and letter attached; reference 2016-23292-SCI-SCI. I have also attached the report form.

Kind regards

[REDACTED]  
Technical Adviser  
Science, Education and Conservation Licensing Team  
Wildlife Licensing

Natural England  
First Floor, Temple Quay House, 2 The Square, Bristol, BS1 6DG  
Telephone: [REDACTED]  
Email: [wildlife.scicons@naturalengland.org.uk](mailto:wildlife.scicons@naturalengland.org.uk)

[www.gov.uk/natural-england](http://www.gov.uk/natural-england)

**We are here to secure a healthy natural environment for people to enjoy, where wildlife is protected and England's traditional landscapes are safeguarded for future generations.**

In an effort to reduce Natural England's carbon footprint, I will, wherever possible, avoid travelling to meetings and attend via audio, video or web conferencing.

**Natural England is accredited to the Cabinet Office Customer Service Excellence Standard**

---

**From:** [REDACTED] [mailto:[REDACTED]]  
**Sent:** 15 April 2016 14:54  
**To:** [REDACTED]  
**Subject:** A29 - Anisus vorticulus licence application

Hi [REDACTED]

Please find the attached licence application for a Anisus vorticulus translocation in [REDACTED]

Thank you for the chat the other day it was very useful.

If there is any chance of this being processed quickly it would be much appreciated. I understand how busy you are though.

Kind regards

[REDACTED]  
[REDACTED]  
Principal Ecologist at Abrehart Ecology

Tel: [REDACTED] mobile [REDACTED]  
email: [REDACTED]  
Pound Farm  
Low Road  
Great Glemham  
Saxmundham  
Suffolk  
IP17 2DQ

abrehart   
ecology

The information in this email is private, may be confidential, and is intended for the addressee only. If received in error, please inform Abrehart Ecology immediately and delete the message from your computer. Copying, distributing or disclosing its contents is strictly prohibited. Whilst Abrehart Ecology makes every effort to keep its systems virus free, it is your responsibility to check/scan all messages and attachments if any. No responsibility can be accepted by Abrehart Ecology.

Date: 18 April 2016  
Our Ref: 2016-23292-SCI-SCI  
Your Ref: C182057



Customer Services  
Wildlife Licensing  
First Floor  
Temple Quay House  
2 The Square  
Bristol  
BS1 6DG  
T: 0300 060 3900  
F: 0845 601 3438

[REDACTED]

Dear [REDACTED]

**CONSERVATION OF HABITATS AND SPECIES REGULATIONS 2010 (AS AMENDED) AND  
WILDLIFE AND COUNTRYSIDE ACT 1981 (AS AMENDED)**

Your application for a Science, Education and Conservation licence:

WML-A29 - Schedule 5 for survey, science, education or conservation has been granted.

Your Licence numbered 2016-23292-SCI-SCI is attached and it is valid from 21 April 2016 to 20 May 2016.

Please ensure that you have read and understand all of the conditions and notes applicable to the licence and that you comply with them at all times.

Failure to do so could result in you committing an offence. Please note that most wildlife offences carry a maximum penalty not exceeding level 5 on the standard scale (currently £5000) and/or 6 months in prison.

Please also ensure that you submit all necessary returns information. Your return is due on 03 June 2016.

If you have any queries please email [wildlife.scicons@naturalengland.org.uk](mailto:wildlife.scicons@naturalengland.org.uk) or call 0300 060 3900, quoting your customer ID and the above reference number.

Yours sincerely,

[REDACTED]  
Customer Services,  
Wildlife Licensing  
[wildlife.scicons@naturalengland.org.uk](mailto:wildlife.scicons@naturalengland.org.uk)

**Conservation of Habitats and Species Regulations  
2010 (as amended) and Wildlife and Countryside Act  
1981 (as amended)**



Customer Services  
Wildlife Licensing  
First Floor  
Temple Quay House  
2 The Square  
Bristol  
BS1 6DG  
T: 0300 060 3900  
F: 0845 601 3438

**LICENCE - Schedule 5 for survey, science,  
education or conservation**

This licence authorises acts that would otherwise be offences under the above legislation

Any request for information in this licence will be considered under the Environmental Information Regulations 2004 and the Freedom of Information Act 2000 as appropriate.

**Natural England Ref:** 2016-23292-SCI-SCI

Under the Conservation of Habitats and Species Regulations 2010 (as amended) and Wildlife and Countryside Act 1981 (as amended) Natural England has granted this licence for Schedule 5 (Wildlife and Countryside Act) - Animals except bats, dormice and great crested newts for the purpose of:

**Science or education, under section 53(2)(a) and/or section 16(3)(a)**

to:

**Name (in full):**

**Company Name:**

**Address:**

**County:**

**Postcode:**

**Between the dates of:**

21 April 2016	and	20 May 2016	inclusive
---------------	-----	-------------	-----------

**At (locations):**

Site/Location Name	County	OS Grid Reference
[REDACTED]	Norfolk	[REDACTED]
[REDACTED]	Norfolk	[REDACTED]



For the following species:

Species Common Name (Taxonomic Name)	Number	Activity	Method	Detailed Location	OS Grid Reference
Little whirlpool ram's-horn snail ( <i>Anisus vorticulus</i> )	0	Disturb	Net	[REDACTED]	[REDACTED]
Little whirlpool ram's-horn snail ( <i>Anisus vorticulus</i> )	0	Take	Net	[REDACTED]	[REDACTED]

This licence is granted subject to the licensee, including servants and named agents, adhering to the conditions and notes specified below.

Signature:

[REDACTED]

Date:

18 April 2016

(for and on behalf of Natural England)

## WARNING

- This licence authorises acts that would otherwise be offences under the Conservation of Habitats and Species Regulations 2010 (as amended) and Wildlife and Countryside Act 1981 (as amended). Any departure from the conditions relating to this licence may be an offence under that legislation;
- This licence conveys no authority for actions prohibited by any other legislation;
- This licence can be modified or revoked at any time by Natural England, but this will not be done unless there are good reasons for doing so. The licence is likely to be revoked immediately if it is discovered that false information had been provided which resulted in the issue of the licence.

## LICENCE CONDITIONS

1. These conditions apply to the licensee and any additional authorised person. The licensee and any additional authorised person(s) are responsible for ensuring that any licensed operations/ activities comply with all terms and conditions of the licence.
2. The licensee and any additional authorised person(s), shown on the licence, may act under the authority of this licence. The licensee or any additional authorised person(s) may also employ assistants provided they work under the direct personal supervision of the licensee or authorised person.
3. Whilst engaged in activities permitted by this licence, the licensee and/or any additional authorised person(s), must have access to a copy of this licence and produce it to any police officer or any Natural England officer on demand.

## LICENCE CONDITIONS

4. The Licensee and any additional authorised person(s) shall permit an officer of Natural England, accompanied by such persons as he/she considers necessary for the purpose, on production of his/her identification on demand, reasonable access to the site for monitoring purposes and to be present during any operations carried out under the authority of this licence for the purpose of ascertaining whether the conditions of this licence are being, or have been, complied with. The Licensee shall give all reasonable assistance to an officer of Natural England and any persons accompanying him/her.
5. This licence does not convey any right of entry upon land, and the landowner's/occupier's prior permission must be obtained, as necessary, before the licence is used.
6. No licensed activity shall be carried out under this licence on a National Nature Reserve or Marine Nature Reserve except with the prior written permission of Natural England.
7. A person authorised by the licensee shall provide him/her with such information as is within his/her knowledge and is necessary for the Report, which the licensee is required to make to Natural England.
8. The 'Report by licensee of action taken under licence' must be completed, even if no licensed action is taken. It must be submitted on line or sent to the Natural England office at the address shown on this licence, to arrive no later than 14 days (two weeks) after the expiry of the licence. Failure to make a report may result in the licence being revoked and/or any future applications being refused.

Additional condition(s):

This licence may be modified or revoked at any time by Natural England.

There is no limit to the number of Little whirlpool ramshorn snail (*Anisus vorticulus*) that may be disturbed or taken under this licence provided all conditions and notes are adhered to.

## NOTES

1. Please read the details of your licence carefully to ensure that you comply with it paying particular attention to the number and species licensed as this may differ to what was requested in your application.
2. Under Regulation 58(1) of the Conservation of Habitats and Species Regulations 2010 (as amended), it is an offence to contravene or fail to comply with a licence condition. This includes all persons authorised to act under this licence.
3. An additional authorised person is a suitably trained and experienced person who is able to carry out work under a licence without the personal supervision of the licensee. To carry out licensed activities their name will be on the licence. To comply with the licence conditions, additional licenced persons should have a copy of the licence accessible when acting under the licence.

## NOTES

4. An assistant is a person assisting the licensee or the additional authorised person(s). Assistants are only authorised to act under a licence whilst they are under the direct supervision of either the licensee or the additional authorised person(s).
5. Please note the information of the 'Report by licensee of action taken under licence' may have changed from previous years. The data required in your report and the required format can be viewed on the Natural England website. Alternatively you can request a copy from the Natural England address shown on your licence.

Additional note(s):

## Additional Authorised Individuals

The additional authorised individuals listed below are also authorised to act under the terms and conditions of this licence:

Title	First Name	Surname	Address Line 1	Postcode
██████	██████	██████	██████	██████
██████	██████	██████	██████████	██████



## Report of Action Taken

Licence return and renewal form to kill, take, disturb or possess wild animals: Science, education and conservation

Please Note – Returns can be completed online at  
[www.gov.uk/environmental-management/wildlife-habitat-conservation](http://www.gov.uk/environmental-management/wildlife-habitat-conservation)

- Please complete this return form using **dark ink** and BLOCK CAPITALS, even if no action was taken.
- Return the completed form to the address shown, to arrive no later than two weeks after the expiry of the licence.
- All questions should be answered as appropriate. Questions marked with ‘\*\*’ are mandatory.
- If there is insufficient space for completing answers on this form, please attach a separate sheet.
- It is a condition of your licence to provide Natural England with a report detailing action taken under licence. Failure to provide a report may lead to future applications for licences being refused.

Wildlife Licensing  
Natural England  
First Floor  
Temple Quay House  
2 The Square  
Bristol, BS1 6DG.  
T. 0300 060 3900  
[wildlife.scicons@naturalengland.org.uk](mailto:wildlife.scicons@naturalengland.org.uk)

### 1. Licence Return Reporting Period

Licence Reference Number (e.g. 2016-1234-SPM-WML)

Licensee Name:

Company:

Agent/Ecologist Name:

Company:

(a) \* Is this a nil return?

Yes  No

Please note: Only confirm a nil return if:

- 1) Your licence conditions require you to submit return information and you have not undertaken any activity in connection with your licence or registration, or
- 2) You wish to renew your licence and
  - a) You are only required to submit your return information to another organisation, or
  - b) You are only required to submit return information when requested by Natural England.

If ‘Yes’ to (a) ...

\*Have you submitted your return information to another organisation if required as per your licence conditions?

Yes  No

(b) \* Licence report period

From:

To:

(c) If you are making a request to cancel your licence please provide a reason and complete the licence return information for the period up to your request.

## 2. Licence Return Details

(a) Please add details of each action taken during the reporting period. You may add multiple actions if necessary.

	Action 1	Action 2	Action 3
Application subject	Schedule 5 (Wildlife and Countryside Act) Animals		
* Species			
* Date of Action			
Number Taken			
Number Killed			
Number Released			
Other			
<i>Place of Capture</i>			
* County			
* OS Grid Reference			
* Site Name			
<i>Place of Release</i>			
County			
OS Grid Reference			
Site Name			

*Please Note: At least one of the number taken / killed / released fields should be completed in each record*

(b) Where applicable, please detail how this has contributed to conservation of the species or scientific knowledge.

--

(c) \* Were any animals not released?

Yes  No

If  
'Yes'...

\* What happened to the animals not released?

(d) Please provide any additional information.

### 3. Declaration

The data protection notice which was printed in your application applies to this report of action taken. We can send you a copy of the notice on request. Contact Customer Services Tel. 0300 060 3900

Important Advice:

- If your application is made under the Wildlife and Countryside Act 1981 (as amended) or the Conservation of Habitats and Species Regulations 2010 (as amended), any person who in order to obtain a licence knowingly or recklessly makes a statement or representation, or furnishes a document or information which is false in a material particular, shall be guilty of an offence and may be liable to criminal prosecution. Any person found guilty of such an offence is liable, on summary conviction, to imprisonment for a term not exceeding six months or to a fine not exceeding level 5 on the standard scale, or to both. Regarding other wildlife legislation, we will look to provisions in the Fraud Act 2006 (as amended) in respect of applicants making any false representations.
- Natural England or the Secretary of State can modify or revoke at any time any licence that is issued, but this will not be done unless there is good reason for doing so. Any licence that is issued is likely to be revoked immediately if it discovered that false information has been provided that resulted in the issue of a licence.

I have read and understood the privacy notice above.

## Renewing Your Licence

Do you wish to renew your licence?

Yes  No

If 'Yes'...

Renewal Option:

As previously issued  With alterations (*incl. change of address*)

If Renewal  
with  
Alterations

Please provide details of any alterations (including changes to postal/email address). If significant alterations are requested, you may still be required to complete a full application form)

## Declarations

If 'Yes' to  
Renewal.  
..

Where required, I undertake to obtain permission from landowners / occupiers of land to exercise any licence resulting from this application, and to allow any employee or representative of Natural England to monitor or inspect the work described in this application.

I have read and understood the guidance provide in the application form and on the Wildlife Licensing internet guidance pages.

I, or any persons listed in the renewal application, have not been convicted of any wildlife related or animal welfare offence, in the last 5 years, which is not spent under the Rehabilitation of Offenders Act 1974. If you cannot agree to this declaration please select the renewal option button above "With alterations" and give details of relevant convictions, including dates.

I declare the particulars given are correct to the best of my knowledge and belief, and I apply for a licence in accordance with the information I have provided.

If 'No' to  
Renewal.  
..

I have read and understood the guidance provided on the Wildlife licensing Internet guidance pages for completing this return.

I declare the particulars given as part of this licence return are correct to the best of my knowledge and belief.

I agree to the declaration above on this date.

Signature of Licensee:

For electronic applications, please insert an electronic signature above or tick this box to confirm with the declaration.

Name: (*In BLOCK letters*)

Date:

[REDACTED]

---

**From:** [REDACTED]  
**Sent:** 06 September 2016 16:33  
**To:** [REDACTED]  
**Cc:** [REDACTED]  
**Subject:** RE: A47 Acle Straight - trial snail translocation

Many apologies for not replying sooner. I have been in and out of the office, the last couple of weeks.

We are making good progress on the current phase of the work and we have identified the next steps of works for the next phase – which we need to discuss and agree. I have summarised the current phase and the next phase below.

Current phase progress:

1. Snail translocation: The translocation was completed as previously advised, the report is drafted and I am expecting it for review and subsequent issue to you this week.
2. Multivariate Analysis: A host of multivariate analyses have been completed. As is the nature of this kind of work, each iteration sends the statistic guys on another line of investigation. The analyses have produced some interesting results as well as confirmation of some others. The results are being used to inform the continued assessment (see below). The team have produced a report, I have reviewed it and we are making amendments. The team are working together to get this completed.
3. The scoping study for the next phase: The search for potential translocation sites has been started and is nearing completion. [REDACTED] has been using historical data sets, the results of the multivariate analyses and speaking to landowners to identify a suite of potential sites for detailed survey. This is well underway but there is still some work required to complete this.

The next steps for which I am currently drawing up a proposal:

1. The translocation licence from Natural England requires us to conduct the first monitoring exercise of the translocation sites. This is to check the donor sites are okay and that snail removal has not been detrimental to the population, and additionally to check the receptor sites as to whether the translocation in the very short term has been successful.  
Duration: three – four days to visit all the translocation sites to be done in October (This is five-six months post translocation which was done in April / May).
2. Detailed survey of the scoped in sites (from Number 3 in the list above) to find additional Translocation sites; repeating the detailed survey method from last year on the new sites. This is proving difficult to cost as this feeds from work which is still being completed.  
Duration: This needs to be completed in the available survey season and needs to be completed in September / October.
3. Steering group meeting. As suggested in last year's meeting (9 September 2015), we should hold an additional meeting in 2016. This will update the stakeholders in the work conducted since the last meeting. Holding the meeting in November, will allow for the first round of monitoring to be completed and reported on, multivariate analyses to be presented and the stakeholders to input and provide feedback.  
Duration : half day. Location: Natural England, Dragonfly House, Norwich.



I was hoping to get all the deliverables from the current phase issued, before I presented the proposal for the next phase, but time is ticking on and we are nearing the end of the current season. Whilst one can conduct the detailed snail surveys through the year in discussions with Natural England, it is more meaningful to conduct them in a similar time frame to last year (for continuity of the botanical growing season). Last year we conducted the detailed surveys in August / September so we don't want to leave it too late this year.

In relation to the steering group meeting, we did discuss holding it earlier but Natural England have suggested that we wait to get the translocation monitoring results, furthermore a number of people were unable to attend in September as they were away on holiday. In order to give enough notice we would like to send out invites soon. Is November a good time for you?

I'll get the translocation report issued as soon as possible and provide a proposal for the next phase once all the time inputs have been agreed. I have prepared the required text and this is ready for your review.

Please give me a call if you would like to discuss any of this.

Kind regards

[REDACTED]  
From: [REDACTED]  
Sent: 25 August 2016 16:02  
To: [REDACTED]  
Cc: [REDACTED]  
Subject: A47 Acle Straight - trial snail translocation

[REDACTED]  
How's the report on the translocation progressing?

Regards

[REDACTED]  
[REDACTED]  
Highways England | Woodlands | Manton Lane | Bedford | MK41 7LW  
Tel: [REDACTED] | Mobile: [REDACTED]  
Web: <http://www.highways.gov.uk>  
GTN: [REDACTED]

*This email may contain information which is confidential and is intended only for use of the recipient/s named above. If you are not an intended recipient, you are hereby notified that any copying, distribution, disclosure, reliance upon or other use of the contents of this email is strictly prohibited. If you have received this email in error, please notify the sender and destroy it.*

**Highways England Company Limited | General enquiries: 0300 123 5000 | National Traffic Operations Centre, 3 Ridgeway, Quinton Business Park, Birmingham B32 1AF | <https://www.gov.uk/government/organisations/highways-england> | [info@highwaysengland.co.uk](mailto:info@highwaysengland.co.uk)**

**Registered in England and Wales no 9346363 | Registered Office: Bridge House, 1 Walnut Tree Close, Guildford, Surrey GU1 4LZ**

Consider the environment. Please don't print this e-mail unless you really need to.

**Public Interest Test results table**

<b>Request for Information relating to Moving the Little Whirlpool Ramshorn Snail colony on the A47</b>	
<b>EIR Exemption S.12(5)(g) Protecting the Environment to which the Information Relates</b>	
<b><i>Factors supporting disclosure</i></b>	<b><i>Factors supporting non-disclosure</i></b>
<ul style="list-style-type: none"> <li>• There is an important public interest in the work of public bodies being transparent and open to scrutiny to increase diligence and to protect the public purse;</li> <li>• There is a public interest in disclosing information about rare and endangered species as to do so will increase public understanding of their plight and encourage conservation</li> <li>• There is a general presumption in favour of disclosure.</li> </ul>	<ul style="list-style-type: none"> <li>• The information contains data about the location of a protected snail. To disclose the information could endanger the continued existence of the snail</li> <li>• Disclosure of the location could expose its habitat to deliberate interference or damage.</li> <li>• Disclosure may adversely affect the protection of the said environment.</li> <li>• Highways England cannot be assured that releasing the information will not endanger the Ramshorn Snail by those with an interest in seeing the A47 Acle Straight widened.</li> <li>• To release the information would be to release it into the wider public domain, as the response will be published on the HE website, which does not guarantee that information will not be used adversely by others.</li> </ul>
<p><b>Conclusion:</b> Protection of confidentiality of information under Regulation 12(5)(g) requires public authorities to establish that:</p> <ul style="list-style-type: none"> <li>• The information is not on emissions</li> <li>• Disclosure of the information is likely to cause harm to the environment</li> <li>• The confidentiality will be adversely affected by disclosure and</li> <li>• The public interest in maintaining the exception outweighs the public interest in disclosing the information.</li> </ul> <p>Protection of the Little Whirlpool Ramhorn Snail outweighs the benefits of releasing information which may disclose precise locations of its colonies. Given that the EIR is intended to contribute to a better environment, there is a public interest in avoiding an action that could cause harm to the environment. Therefore the fact that we have engaged with this exemption means that there is public interest in not disclosing some information. On balance, information that may disclose locations of the Ramshorn snail, its colonies or sites assessed for relocation will not be disclosed.</p> <p><b>PIT Members:</b></p> <p><b>Date of PIT: 26 September 2016</b></p>	