MetroWest

Portishead Branch Line (MetroWest Phase 1)

TR040011

Applicant: North Somerset District Council
6.25, Environmental Statement, Volume 4, Appendix 9.2 Bat Technical Appendix
The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009, Regulation 5(2)(a)
Planning Act 2008

Author: CH2M
Revision: Version 2
Date: August 2020

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Document history

Project	Portishead Branch Line (MetroWest Phase 1) Development Consent Order Scheme
Planning Inspectorate Scheme Reference	TR040011
Volume and Application Document Reference	6, 6.25
Document title	Environmental Statement, Volume 4, Appendix 9.2 Bat Assessment
Regulation Number	Regulation 5(2)(a)
Applicant	North Somerset District Council
Lead Author	AT at Pure Ecology

Version	Date	Status of Version
01	26/10/19	Application Issue
02	05/08/20	Updated with new survey data

PURE ECOLOGY

Portishead Branch Line

Bat Technical Appendix 9.2

August 2020

Client	CH2M HILL
Job name	Portishead Branch Line
Report title	Bat Technical Appendix
Reference	ES Appendix 9.2 MetroWestBatRep_Draft 1 Nov 2018_AK

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Summary

1. The Portishead Branch Line (MetroWest Phase 1) Development Consent Order Scheme ("the DCO Scheme") is a nationally significant infrastructure project ("NSIP") and a priority of the West of England's local authorities to improve passenger rail services. The DCO Scheme will re-open 5km of disused railway line between Portishead and Pill and upgrade the Portbury Freight Line. North Somerset is a stronghold for many bat species, including some of the rarest bats in the UK. The ecological importance for bats of the MetroWest wider study area is reflected in the designation of international sites, which includes the North Somerset and Mendip Bats Special Area of Conservation ("SAC"). The DCO Scheme has the potential to give rise to likely significant effects on local bat populations. This report describes and evaluates the ecological baseline from surveys in; autumn 2014 through to winter 2016, winter 2018, 2019 and July 2020, against which the potential ecological effects on bats that may arise from the construction and operation of the DCO Scheme can be assessed in the Environmental Statement.
2. The baseline has been established by various survey methods that comply with current industry standards and survey guidelines. The methodology comprises walked transects, static automated bat detector monitoring, trapping and radio-telemetry and bat roost surveys of structures and trees.
3. Bat activity surveys recorded 13 species on the disused railway line with notable species being lesser and greater horseshoe bats (*Rhinolophus hipposideros* and *R. ferrumequinum*). The disused railway line is a prominent feature within the landscape between Portishead and Pill and provides a link between semi-natural habitats and foraging areas for bats. The study confirms that it provides an important corridor for movement by bats and a radio-tracking study of one male and one female greater horseshoe bat to Brockley Hall Stables Site of Special Scientific Interest ("SSSI") identified use of the railway line by the North Somerset and Mendip Bats SAC bat population. Statistical analysis of greater horseshoe bat activity shows that activity was highest at the western end of the disused railway line in the Portbury Wharf area and activity peaked in June. The disused railway line is an integral part of a permeable landscape for lesser and greater horseshoe bats and provides a corridor for movement west of the Avon Gorge Woodlands SAC that is evaluated as being Regionally important. In 2016, a standardised monitoring protocol for lesser and greater horseshoe activity on the disused railway line identified spatial and temporal variation in bat activity. Greater horseshoe bat activity was highest at the west end of the disused railway line and seasonal monitoring found peak levels of activity were in June.

4. The foraging habitats on the discussed railway line are not within the core sustenance zone of Brockley Stables SSSI maternity roost, but are a regularly used resource important for maintaining the distribution of the home ranges of greater horseshoe bat within the county. Foraging habitats for bats on the disused railway line are important within a site to county context, and lesser and greater horseshoe bats use a derelict store as a night feeding roost. Foraging opportunities enhance the value of the disused railway as a corridor for movement.
5. There are no large communal roosts on the disused railway line, but three day roosts of low conservation importance for local bat populations were confirmed because low numbers of common and soprano pipistrelle bats (*Pipistrellus pipistrellus* and *P. pygmaeus*) roost in bridge structures. There are no confirmed tree roosts on the disused railway line, but evaluation of the tree roost resource identified four trees of high bat roost potential and seven trees with moderate bat roost potential.
6. Four tunnels on the Portbury Freight Line, three of which are within the Avon Gorge Woodlands SAC, have been assessed for summer, autumn and winter roost activity. Three of the tunnels have been confirmed as being used by low numbers of bats as summer day roosts and for winter hibernation, with lesser horseshoe, common pipistrelle, serotine (*Eptesicus serotinus*), Daubenton's (*Myotis daubentonii*), brown long-eared (*Plecotus auritus*) and (probable) natterer's (*Myotis nattereri)* recorded. Although not confirmed roosting, barbastelle bat (*Barbastella barbastellus)* was regularly recorded in one tunnel (Sandstone) during winter 2018, which indicates possible hibernation in, or close to the tunnel. The tunnels are not considered to be important swarming sites, but surveys in autumn recorded social activity and bats appear to use the shelter of the tunnels whilst socialising. Clifton tunnel no. 2 and Sandstone tunnel are the most important roost sites and are assessed as being local (district) value. There are also small lesser horseshoe bat roosts at Pill Station on the Portbury Freight Line that have been evaluated as local value.
7. Bat surveys using data loggers were undertaken along the freight line from Pill Viaduct to the junction with the disused line to collect data between May and October 2019 to determine the level of use of the navigational route by horseshoe bats. These data indicate that activity at, or close to Pill Station, is not strongly associated with the disused railway line, which is an important corridor for bats with movement between the line and Brockley Hall Stables SSSI, a link with the North Somerset and Mendip Bats SAC. Whilst there is likely to be some movement from the wider area, much of the lesser horseshoe bat activity appears to be localised and greater horseshoe bat activity through the station is too low to be considered significant commuting behaviour. The overall importance as a roost habitat and linear landscape feature for bats is of value at local level.

8. A roost appraisal of trees within Network Rail land on the Portbury Freight Line has evaluated the resource as local value, with the trees being important for local bat populations that inhabit the Avon Gorge Woodlands.

1 Introduction

1.1 Background to the DCO Scheme

1.1.1 The Portishead Branch Line was built in the 1860s. Passenger services continued between Portishead and Bristol until 1964, and freight services continued to 1981. The Royal Portbury Dock opened in 1978 and in 2002 the currently operational part of the former Portishead Branch Line was re-opened to service the port for freight only. The owner of the Royal Portbury Dock, Bristol Port Company, has commercial rights to run up to 20 freight trains per day in each direction along the operational railway line. The current volume of freight trains operating is substantially less than this.

1.1.2 MetroWest Phase 1 proposes to re-open the disused section of the Portishead Branch Line from Portishead to Pill and operate an hourly (or an hourly service plus) passenger service between Portishead and Bristol Temple Meads. In order to reintroduce passenger services the disused railway between Portishead and Pill has to be rebuilt. The construction of the disused section is a nationally significant infrastructure project ("NSIP") as defined by the Planning Act 2008 and therefore a Development Consent Order ("DCO") is required for powers to build and operate the railway, as well as to acquire land, where it cannot be acquired by negotiation.

1.1.3 The DCO also includes associated development such as the new station and car parks at Portishead, the re-opening of the former Pill station and new car park and other works along the operational railway Pill and Ashton Vale (Ashton Junction).

1.1.4 Refer to the Environmental Statement ("ES") Chapter 4 Description of the Proposed Work (DCO Document reference 6.7) for the fully detailed project description.

1.2 Structure of the Report

1.2.1 This report presents the findings of the study on bat populations between 2014 and 2020. The study assesses bat activity within foraging habitats and commuting features and evaluates the roost resource in structures and trees. A progressive survey programme of fieldwork each year has been undertaken in response to the emerging ecological baseline and developing DCO Scheme designs.

1.2.2 The study area is described in Section 2 and the scope of the study is defined in Section 3. Sections 4 and 5 present the methods and findings. The methods and results have been sub-divided according to the ecological receptor being evaluated for bats. The surveys undertaken to evaluate each receptor are in chronological order, and the results chart the developing baseline each year.

1.2.3 The results of the study are evaluated in Section 6. This section interprets the survey findings and describes the resource for bats.

1.2.4 Details of roosts resources are shown on plans and tables in Appendix 1, 5, 6 and 9, and photographs of the disused railway line and Portbury Freight Line are provided in Appendix 10. The large amounts of data recorded by the study have been placed in appendices. Acoustic data from activity surveys have been tabulated, with walked transect data in Appendix 2 and static automated bat detector monitoring and analysis in Appendices 3, 4, 7 and 8. Spatial and temporal patterns of bat activity are illustrated on graphs.

1.2.5 Bat surveys using data loggers were undertaken along the freight line from Pill Viaduct to the junction with the disused line to collect data between May and October 2019 to determine the level of use of the navigational route by horseshoe bats. Results of this study are provided in Appendix 11.

2 Study Area

2.1.1 The study area for the DCO Scheme focuses on the Order limits defined by the Red Line Boundary around the DCO Scheme from the proposed new station in Portishead to Ashton Junction in Bristol.

2.1.2 The study area has been divided into Portishead to Pill (disused line) and operational railway referred to as the Portbury Freight Line due to the differences in the DCO Scheme for each section and differences in baseline ecology.

2.2 Disused Railway Line

2.2.1 For the purpose of the bat assessment, the character of the railway line is described in four sections, starting at National Grid Reference (NGR) ST 47111 76500 at the western end of the DCO Scheme in Portishead and ending west of Pill at NGR ST 52012 76279. The alignment is shown on Figure 1a.

Portishead NGR ST 47111 76500 to ST 48134 76136	The disused railway line provides a green corridor through a new housing estate on the eastern outskirts of the town. The alignment of the old railway line at the western end of the route passes through a trading estate, with a bridge taking the line over Portbury Ditch, to Quays Avenue, a neighbourhood road crossing the railway alignment at NGR ST475763. This section of the disused railway line supports mainly scrub habitats, and there are no mature trees. It is relatively isolated by its urban surroundings, and fragmented from the rest of the disused railway line by the neighbourhood road.
Portbury Wharf Area NGR ST 48134 76136 to ST 48493 76009	As the disused railway line continues from the housing estate it passes Portbury Wharf Nature Reserve to the north. Much of the 46 ha nature reserve is rough pasture with associated ditches and ponds. These insect rich habitats provide good quality foraging habitats for bats. There are several large Italian Black Poplar Trees along this section of the route. The railway line is enclosed by mature trees and is more wooded than the open scrub habitats within Portishead.

Farmland
NGR
ST 48493 76009 to
ST 49760 75696

The disused railway passes under two arch bridges that take Sheepway over the disused railway line. Farmland between the two bridges is predominantly pasture, which appears to be agriculturally improved. There is a network farmland hedges, which connect to the railway line and provide potential flight lines for bats.

The disused railway line through the farmland supports relatively low scrub habitat and there are very few mature trees. The habitat of scrub and small trees has a relatively open character. At NGR ST 49344 75754 are fishing lakes immediately adjacent to the railway line. From Sheepway, the farmland narrows between built areas to the north and the M5 motorway to the south. Adjacent to the route are small fields with pasture and the farmland appears to be fairly wet and supports damp grassland.

Royal Portbury Dock
NGR
ST 49760 75696 to
ST 52012 76279

As the disused railway line continues eastwards it passes through a narrow stretch of land between The Portbury Hundred (the A369 road) to the south and industrial areas at Royal Portbury Dock to the north. This section of the disused railway line is wooded, with semi-mature birch trees established at the edge of the track providing a well-defined tree line. There are small field systems with grazed pasture, reedbeds and wetland habitats and along the route. At NGR ST 50054 75725 is Wessex Water’s pumping station.

The combination of woodland, damp grassland and wetland habitats provides favourable habitat for bats. Mature trees border the track of the disused railway line creating an enclosed linear feature and bats can forage and commute along the track. The trees typically have a straight growth, characteristic of fast growing specimens do not contain veteran features or holes.

The disused railway line then passes under the Royal Portbury Dock Road and Marsh Lane, crossing Court House Farm. It continues under the M5 and terminates at the Portbury Freight Line.

Between the M5 and Pill is a tract farmland, which provides a corridor of open countryside between Royal Portbury Dock and Pill that connects to the River Avon (to the north).

2.3 Portbury Freight Line

2.3.1 Portbury Freight Line runs from Royal Portbury Dock to Parson Street Junction where it joins the south west main line between Bristol Temple Meads and Exeter. The railway passes through Pill and continues along the western flank of the Avon Gorge before entering south west Bristol. In Pill, the freight line runs through residential housing estates, passing the disused Pill station at NGR ST 52408 76024, which was closed in 1964. The railway line supports low scrub and grassland and is relatively open.

2.3.2 The route of the freight line passes under several road bridges before entering open countryside north east of the town, between Pill and Ham Green. At Ham Green the railway enters Pill tunnel at NGR ST 52791 75656, and once out of the tunnel it crosses farmland to the River Avon, passing Ham Green Lakes. The freight line runs along the Avon Gorge, with the River Avon to the north and Leigh Woods National Nature Reserve to the south. The railway is at the bottom of the steep sided wooded gorge within the Avon Gorge Woodlands Special Area of Conservation (SAC). The study includes assessment and survey where necessary of the following areas:-

- Structures between Pill and Clifton Tunnel no. 1
- Trees within the Avon Gorge
- Structures and trees at specific locations between Clifton Tunnel no. 1 and Ashton Junction, Bristol.

2.3.3 There are four tunnels between Ham Green and Clifton Suspension Bridge (shown on Figure 1b) which were surveyed for bats. Key features of the tunnels are listed below.

Pill Tunnel
NGR
ST 53079 75607

A 610 m long tunnel with portal entrances approximately 4 m wide and 5 m high.

The tunnel is brick lined throughout. The brickwork is two courses deep and the appearance of the brickwork (and mortar) is in good condition. Opportunities for bats to roost are restricted to the following features in the tunnel:

- Drainage holes/pipes in the ceiling and walls;
- Circular core holes 8 cm in diameter drilled in the walls of the tunnel every few metres;
- Missing bricks – bricks that appear to have been purposely removed from the lower part of the wall, leaving an opening the size of a brick end (c.100 mm X 65 mm).

The core holes and missing bricks may be engineered trial holes in the wall. Approximately two-thirds of the holes inspected extended beyond the brick lining to the natural rock and offer good potential shelter for bats.

Water ingress permeates the tunnel walls and there is seepage through the roof of the tunnel in places, which creates wet and damp conditions in the centre of the tunnel.

The tunnel is close to Ham Green Lakes, which are situated approximately 50 m north-east of the eastern portal of the tunnel.

Sandstone Tunnel
NGR
ST 54921 75057

An 80 m long tunnel with portal entrances approximately 5 m wide and 6 m high.

The tunnel has a brick ceiling and stone lined walls. The stonework covers the lower 3 m of wall and there are regular arch refuge areas in the wall that provide a 0.5 m deep recesses in to the rock.

The refuge arches are backed by natural rock and there are gaps and cavities where at the edge of the stonework with the rock. Many of the gaps have been pointed with cement, but eight of the arches had openings that provide access for bats behind the stone/brick lining.

Sandstone tunnel is situated at the woodland edge of Leigh Woods near the bottom of the Avon Gorge.

Clifton Bridge No. 2 Tunnel
OS grid reference
ST 56168 73664

A 212m long tunnel with portal entrances approximately 4.5m wide and 6m high.

The tunnel has been excavated through rock and approximately two-thirds of the interior is natural rock. Parts of the tunnel are brick lined, with two narrow sections at the eastern end of the structure. There are arch refuges in the walls of the brick lined sections. One of the arches has been repaired with stone (giving the appearance of a dry stone wall at the top of the arch) and gaps in this feature provide opportunities for bats to shelter in crevices.

The natural stone section at the western end of the tunnel is similar in character to a mine environment. The uneven surface of the natural rock offers an array of shallow depressions and there are a very few deep fissures in the rock. Of particular note was a deep fracture in the roof of the tunnel, approximately 25m from the eastern portal.

There are gaps between the brick lining and natural rock face. These gaps were evident at the top of the arch lining with openings to the tunnel interior.

Clifton 2 tunnel is situated at the woodland edge of Leigh Woods near the bottom of the Avon Gorge.

Clifton Bridge No. 1 Tunnel
OS grid reference
ST 56418 73072

Clifton 1 is the shortest of the tunnels at 54m long. The tunnel portals are approximately 8m wide and 6m high.

The tunnel is brick lined and the brickwork is in good condition. There are arch refuges at the side of the tunnel, behind which is the natural rock face. Crevice features in the tunnel are relatively scarce, but there are a low number of holes between the rock and brick lining at the edge of five of the arch refuges.

Clifton 1 is located at the south-eastern end of Leigh Woods, close to Clifton Suspension Bridge. At night, the tunnel is fairly well lit by street lighting on the bridge and the A4 Road (on the opposite side of the Avon Gorge valley).

3 Study Scope

3.1.1 North Somerset supports a wide range of bat species and is a stronghold for several of the UK's rarest bats, including lesser and greater horseshoe bats (*Rhinolophus hipposideros* and *R. ferrumequinum*). All bat species and their roosts are protected in the UK under the Conservation of Habitats and Species Regulations 2017 (the Habitat Regulations), which implements the EC Directive 92/43/EEC (the Habitats Directive). Bats and their roosts are also protected under the Wildlife and Countryside Act (WCA) 1981 (as amended).

3.1.2 The lesser and greater horseshoe bat are two of four UK bat species listed in Annex II of the Habitats Directive, which can require sites to be designated in member states for their protection. The ecological importance of the MetroWest wider study area is reflected in the designation of international sites. This includes the North Somerset and Mendip Bats SAC, which is designated for greater and lesser horseshoe bats and the Avon Gorge Woodlands SAC, which are a stronghold for rare and uncommon bat species.

3.1.3 The greater horseshoe is one of Britain's rarest and endangered bat species, with the UK population estimated as being c.6000-7000. The species is confined to South West England and South Wales, and its distribution is localised and fragmented.

3.1.4 The South West of England and Wales support one of the largest concentrations of lesser horseshoe bats in Europe. The British population is estimated at 14,000 (c.7000 in England, c.7000 in Wales), but populations are localised.

3.1.5 Upgrades to Portbury Freight Line for passenger services will increase the frequency of trains but the track speed of the line will remain the same (30 mph). On line improvements will be made to the track and Pill tunnel will need to be modernised to comply with safety standards for emergency services and routine maintenance.

3.1.6 Baseline data for the DCO Scheme established the presence of bat roosts in structures and trees, and the importance of the disused railway line as a commuting route and foraging habitat for rare and uncommon species. The study considers potential impacts at a landscape scale and provides baseline information for a Habitat Regulations Assessment ("HRA") on European Sites selected for bats as required under the Habitat Regulations.

3.1.7 Potential impacts from reopening the disused railway line are distinct from those associated with upgrading the Portbury Freight Line and the scope of the study distinguishes between these two sections of the DCO Scheme.

3.1.8 This report describes the ecological baseline against which the potential ecological effects on bats that may arise from the construction and operation of the DCO Scheme can be assessed in the Environmental Statement. The baseline has been established by various survey methods that comply with industry standards and survey guidelines from the Bat Conservation Trust that were available at the time of publish (Hundt, 2012 and Collins, 2016).

3.1.9 The bat assessment for the DCO Scheme considered the following factors:

- The importance of the disused railway line as a linear landscape features and corridor for movement by bats;
- The availability and use of foraging habitats for bats along the disused railway line;
- Seasonal use of the disused railway line by bats, including the movement of bats between hibernation sites and maternity roosts.
- The location and type of bat roosts within trees and structures on the disused railway line;
- The location and type of bat roosts at Pill Station and Pill Station House (at 7 Station Road);
- The bat roost resource within trees on Network Rail land in the Avon Gorge Woodlands SAC and structures on Portbury Freight Line;
- The type and conservation status of bat roosts in tunnels on the Portbury Freight Line, including the importance of hibernation sites;
- The importance of tunnels on the Portbury Freight Line for swarming, mating or social activity.

4 Methodology

4.1 Overview

4.1.1 Bat activity on the disused railway line was initially surveyed between late August and October 2014. Walked transect and static automated bat detector surveys provided preliminary results against which recommendations for further survey in 2015 were developed in accordance with published industry standard guidelines (Hundt, 2012). The 2014 and 2015 surveys provide year one baseline data for the study. The survey programme in 2015 comprised acoustic monitoring, roost surveys of structures and trees and advanced survey methods to trap and radio-track bats.

4.1.2 Following consultation with Natural England through their Discretionary Advice Service ("DAS") it was agreed that further advanced survey would be undertaken to obtain baseline information on greater horseshoe bats on the disused railway line. It was considered appropriate to undertake a second trapping survey in 2018 because the results of the radio-tracking survey in 2016 recorded one male greater horseshoe bat from the North Somerset and Mendip Bats SAC population. Analysis of patterns of greater horseshoe bat activity on the disused railway line identified June as a peak month in activity and it was agreed trapping effort would need to be programmed at this time of year when there was the greatest possibility of capturing the target species.

4.1.3 In 2015 bat roost surveys of the four tunnels on Portbury Freight Line commenced, to investigate the use of the tunnels as summer roosts and autumn swarming sites. The survey requirements followed advice from Natural England consultation. The tunnels were monitored in winter 2015, through to the end of February 2016. Survey restrictions applied to surveys on the operational freight line because line blockages and line possessions are required for surveyor safety. The limitations of surveying the operational freight line in 2015 are discussed in more detail in Section 4.9. A second season of winter monitoring of tunnels was undertaken between January and February 2018. Desk study and field survey inspections between January and March 2018 of known and potential underground roosts sites on National Trust, Forestry Commission and Network Rail land in the Avon Gorge investigated the current use of the hibernation resource to help understand the ecological context of the wider roost resource in the local area.

4.1.4 In 2016, year 2 baseline data were obtained for the study. Professional judgement and interpretation of newly published guidance for professional surveys (Collins, 2016) was used to develop a suitable methodology to meet the following objectives:

- Establish a standardized baseline for lesser and greater horseshoe bat activity on the disused railway line using acoustic methods that can be replicated to monitor mitigation and the operation effects of the scheme on the movement of these species along the rail corridor.
- Further survey of the four tunnels on Portbury Freight Line to evaluate the current conservation status of bat roosts in these structures.
- Survey of structures at Pill Station and on Portbury Freight Line that were not within the scope of work in 2015.

4.1.5 Preliminary bat roost assessments in 2017 of eight structures on Portbury Freight Line was undertaken in accordance with current industry guidelines (Collins, 2016) as the emerging engineering works were identified for stage 3 of the Governance for Railway Investment Project (GRIP). A preliminary bat roost assessment of barns at Lodway Farm was undertaken in 2018 as the construction strategy developed. Pill Station House (at 7 Station Road, Pill) was surveyed in 2018 once designs for Pill Station had been produced.

4.1.6 In 2017, a scoping appraisal of trees was undertaken to help understand the potential importance of the tree roost resource on Network Rail land within the context of the Avon Gorge Woodlands SAC.

4.1.7 In 2020, a bat roost assessment of trees and bridges on the Portbury Freight Line, between the Clanage Road compound and the pedestrian crossing in Bower Ashton was undertaken. This follow up survey was to assess previously non-accessed area of the track.

4.2 Desk Study

4.2.1 CH2M obtained records of bats and bat roosts within 2.5 km of the DCO Scheme in April 2014 from Bristol Regional Environmental Records Centre (“BRERC”).

4.2.2 In October 2015, records were obtained from the Avon Wildlife Trust for Portbury Wharf Nature Reserve near Portishead. The nature reserve is centred on NGR ST 48496 76441, and the disused railway line defines the southern boundary.

4.2.3 A review of the report “*Horseshoe Bat Hibernacula Survey: Avon Gorge*” (Quinn, March 1999) commissioned by English Nature has been undertaken for the study on underground sites close to Portbury Freight Line. The project surveyed sites identified primarily from the publication *Caves of the Avon Gorge* by South Bristol Spaeleological Society, which was produced in the 1980s. Information was also gathered on caves and adits in the Avon Gorge through the following consultation:

- Information held by Natural England's Land Management and Conservation Adviser (Chris Westcott) for the Avon Gorge Woodlands SAC;
- Knowledge of caves in Leigh Woods from the National Trust (provided by Head Warden Bill Morris);
- Knowledge of caves on Forestry Commission Land in the Avon Gorge Woodlands (provided by Beat Forester Thomas Blythe);
- Records held by Avon Bat Group (Sam Davies and Harry Fox) within a defined search area on the west side of the Avon Gorge between Clifton Suspension Bridge and Pill.

4.2.4 The Multi-Agency Geographic Information for the Countryside (www.magic.gov.uk) and The Joint Nature Conservation Committee (www.jncc.defra.gov.uk) websites were used to obtain information on designated sites for bats within the wider area.

4.2.5 A review of *The North Somerset and Mendip Bats Special Area of Conservation (SAC) Guidance on Development Version 1* (May 2017) prepared by Larry Burrows, Ecologist, Somerset Ecology Services, Planning Control, Somerset County Council working in partnership with North Somerset Council and Natural England has been undertaken as part of this desk study.

4.3 Disused Railway line

Bat Roosts in Structures

4.3.1 A habitat appraisal of the disused railway line in 2014 evaluated the potential for bat roosts in bridges and culverts. The initial survey considered opportunities for bats to shelter in crevices and cavities in the fabric of the structures. Close focusing binoculars were used to examine features at the top of bridges and a powerful Cluson Clulite torch with a 500m spot beam provided lighting for dark and shaded areas under the structures. Culverts were surveyed from the entrance of the structures.

4.3.2 The presence of bats can be detected from field signs (such as DNA analysis of droppings), but in the absence of evidence activity surveys are required. Industry standards (Hundt, 2012) advocate a level of survey effort that is proportional to the likelihood of bats being present. The conservation status of bat roosts can be evaluated from dusk emergence watches.

4.3.3 The criteria in Table 1 were used to assess the bat roost potential of features in the bridges and culverts.

Table 1. Categories for Bat Roost Potential in Structures

Category	Criteria
High	Large sheltered void or feature with space for several bats (c.10+ bats). Shelter provides stable temperatures and therefore potential for animals to thermoregulate (e.g. for breeding and/or hibernation). Located in a typical/ optimal location on the structure
Medium	Small features that would provide shelter for low numbers of bats, but collectively may be used by a colony. Small features located in a typical/optimal location on the structure.
Low	Small features with potential for solitary bats to shelter in summer, but the crevice or feature is unlikely to provide a stable roost climate.

4.3.4 Dusk emergence surveys of structures on the disused railway line identified as having bat roost potential were undertaken between June and September 2015. Details of the surveys are given in Table 2 and the location of the structures is shown on Figure 5.

Table 2. Dusk Emergence Surveys of Structures

Structure	Bat Roost Potential	Date	Sunset	Survey Period (hours)	Surveyors	Weather Conditions
B1	Low	22/09/15	19:10	1.75	TG, OC	14-15^{0}C 15% cloud, Light breeze (1) No PPT
B2	Moderate	30/06/15	21:31	2	TG, RP	14^{0}C 60% cloud, Light breeze (1) No PPT
		15/09/15	19:28	1.75	CG, RP	12-14^{0}C 100% cloud, Light breeze (1) No PPT

Structure	Bat Roost Potential	Date	Sunset	Survey Period (hours)	Surveyors	Weather Conditions
B3	Low	23/09/15	21:35	1.5	AK, RP	14-18^{0}C 35-40% cloud, Light breeze (1) No PPT
B4	Moderate	19/08/15	20:26	1.75	AK, RP	17^{0}C 100% cloud, Light wind (2-3), No PPT
		14/09/15	19:27	1.5	AK, RP	13^{0}C 100% cloud, Light breeze (1) Light, sporadic rain
B5	Low	12/08/15	20:48	2	AK, RP	21^{0}C 5% cloud, Light breeze (1) No PPT
B7	Low	21/09/15	19:15	1.5	CG, RP	13^{0}C 20% cloud, Light wind (1-2), No PPT
C3	Low	12/08/15	20:48	2	TG, OC	21^{0}C 5% cloud, Light breeze (1) No PPT
C4	Low	30/06/15	21:31	2	AK, OC	14^{0}C 60% cloud, Light breeze (1) No PPT

Surveyors
AK Anton Kattan MCIEEM licensed consultant ecologist with 14 years of experience with bats
RP Robert Pelc gradCIEEM licensed consultant ecologist with 3 years of experience with bats
TG Tracy Gray gradCIEEM licensed consultant ecologist with 4 years of experience with bats

Structure	Bat Roost Potential	Date	Sunset	Survey Period (hours)	Surveyors	Weather Conditions
CG Christopher Greenland an assistant ecologist with 1 year experience with bats **OC** Owen Crawshaw gradCIEEM an assistant ecologist with 2 years of experience with bats Weather conditions: PPT = Precipitation; Wind – Beaufort Scale given in Brackets						

4.3.5 Surveyors were equipped with full-spectrum, frequency division or time-expansion recordable bat detectors. The Elekon BatloggerM, Pettersson D240x (with Roland Edirol digital recorded) and Anabat SD1 bat detectors were used.

Trees

4.3.6 The majority of the trees within the railway land of the disused railway line are young or semi-mature trees without bat roost potential. There were however mature trees at the boundary of the site with canopy cover over the railway line. These trees were inspected to assess the bat roost potential because it is possible they may be removed or reduced in size as part of the DCO Scheme.

4.3.7 In 2014, a walkover survey identified trees with obvious signs of damage. The assessment of these trees was carried out from the ground using close focusing binoculars to examine the upper parts of the trees. A Cluson Clulite with 500m spot beam was used to illuminate dark areas under the canopy and holes/crevices in the timber. The purpose of the ground-based assessment was to locate features in the tree that may provide shelter for bats. Examples of the type of features looked for include:

- Rot holes and cavities;
- Woodpecker holes;
- Splits and cracks in branches, such as storm damaged limbs;
- Loose bark;
- Thick-stem ivy;
- Twisted and entwined limbs.

4.3.8 Trees were graded high, moderate or low according to their potential to provide shelter for bats. The potential shelter for bats was assessed according to the condition of the tree, as described in Table 3.

Table 3. Categories for Trees with Potential Bat Roost Features

Value	Criteria
High	Large dry cavity with the potential to support a colony of bats during the breeding season or winter hibernation. Veteran tree features with smooth or stained timber that may indicate previous use as a bat roost.
Moderate	Features that may provide shelter for bats during summer, but is less likely to provide suitable conditions for breeding or hibernation. Trees with an array of features that collectively may provide an important roost resource for bats. Trees within a woodland context with features that may be important for rarer, tree dwelling bat species. Consideration is given to the known diversity of bats recorded in the Avon Gorge Woodlands.
Low	Small features that would support individual or very low numbers of bats animals, but have insufficient space for communal roosts that may have an important ecological function (such as breeding, hibernation or mating). Shallow features or ivy cover that provides shelter and environmental roost conditions that could be exploited by non-breeding bats in summer.
Negligible	Trees without damage, decay or thick-stem ivy cover and can be discounted as a roost resource based on the age and condition of the tree.

4.3.9 A further survey of trees with bat roost potential was carried out on the 11th and 12th March 2015. Eleven trees (shown on Figure 5) identified as having moderate to high bat roost potential were surveyed using roped access to climb and closely inspect cracks and holes in the trees. A high anchor point was established on the trees using ropes enabling each surveyor to ascend to the canopy and move into a suitable position to inspect features with bat roost potential. Areas showing signs of possible use by bats or having good roost potential were inspected in detail using a torch and flexible fibre-optic video endoscope. Typical signs of bat presence include bat droppings, urine spots, scratch marks, staining, feeding remains and the presence of bats themselves.

Lodway Farm Barns

4.3.10 Barns at Lodway Farm are a complex of agricultural buildings off The Breeches residential road in Pill. The farmyard centred on Ordnance Survey grid reference ST 51780 76038 is to the east of the freight line, adjacent to farmland that will temporarily be used as a construction site compound. It is a former dairy farm with the following buildings within the study area:

- Building LF1 – traditional two storey stone barn (disused);
- Building LF2 – derelict milking parlour;
- Building LF3 – Dutch barn;
- Building LF4 –derelict animal shelters;
- Building LF5 – derelict tin shed;
- Building LF6 – wood store;
- Building LF7 – traditional two storey stone barn;
- Building LF8 – open fronted stone barn used as a machinery store (with workshop).

4.3.11 The layout of buildings at Lodway Farm is shown on Figure 5, Sheet 7 and photographs of the buildings are in Appendix 10.

4.3.12 A preliminary bat roost assessment of the Lodway Farm buildings was undertaken by Anton Kattan and Robert Pelc on the 24th October 2018. A daytime building inspection surveyed the building interiors for evidence of roosting bats. The interior and exterior of the buildings were examined for potential bat access points and crevice roost features in the fabric of the buildings.

Walked Transects

4.3.13 To record bat activity along the disused railway line, walked transect surveys were undertaken from August to October 2014, May to July 2015 and April 2016.

4.3.14 In 2014, access along the disused railway line was restricted by impenetrable scrub. Where access permitted, surveyors walked along the track following the alignment of the route in the centre of the railway corridor. When dense vegetation was encountered, deviations were taken along one side of the disused railway. Transect routes also occasionally followed designated paths around the proposed DCO Scheme. The transects included 14 predetermined stopping points where surveyors monitored bat activity for 3 minutes (referred to as ‘station stops’). The transect route and station stops taken in 2014 are shown on a Figure 2a, with deviations from the (central) track and disused railway line indicated on the plan.

4.3.15 The walked transects undertaken in 2014 are listed in Table 4a. The start position of the walked transect was varied so that sections of the proposed Scheme were surveyed at different times during nightly surveys. The sequence of station stops for each survey is shown in Table 4a. Sections of the Proposed Scheme that were inaccessible are also shown (and these restrictions are discussed further in the survey constraints, Section 4.9). Due to access restrictions preventing a continuous walked route along the entire length of the disused railway it was necessary to drive and park at two locations along the route (shown on Figure 2a); the drive took less than 5 minutes.

Table 4a. Walked Transects in 2014

Date (2014)	Sunset (hrs)	Survey Period (hrs)	Weather Conditions	Transect Route*
28 Aug	20:09	20:05-23:30	16-19°C 60% Cloud Light wind (2) No PPT	1-14
25 Sept	19:04	19:00-22:05	17°C 100% Cloud Light wind (2) No PPT	4-1 7-5 9-8 8-14
20 Oct^{+}	18:20	18:15-20:00	14°C 100%Cloud Light Breeze (1)	14-8 7-5

Date (2014)	Sunset (hrs)	Survey Period (hrs)	Weather Conditions	Transect Route*
			Rain until 18:45hrs and then heavy rain at 19:50hrs	
21 Oct+	18:18	18:15-21:15	13-14°C 100%Cloud Light Breeze (1) Light rain between 18:00-18:50hrs, but clearing.	14-8 7-5 4-1
*Sequence of station stops shown on Figure 2a. +Transect repeated due to rain on the 20th October Weather conditions: PPT = Precipitation; Wind – Beaufort Scale given in Brackets				

4.3.16 In 2015 and 2016, vegetation clearance along the disused railway line provided access for surveyors to walk along the track, following the alignment of the route in the centre of the railway corridor. A standardized transect route that followed the track alignment was established with 10 designated 3-minute listening station stops, as shown on Figure 2b. On each survey, the transect route was walked stopping at each station stop followed by a (continuous) return walk to the starting location. Transect surveys were undertaken twice a month and the starting point alternated between each end of the route each survey. The walked transect surveys cover the period of peak activity for bats at dusk. They were undertaken from sunset and were at least three hours in duration. The prevailing weather conditions, sunset times, and start and finish times of each survey are set out in Table 4b.

Table 4b. Walked Transects in 2015 and 2016

Date	Sunset (hrs)	Survey Period (hrs)	Weather Conditions+	Transect Route*
18 May 2015	21:00	20:55-00:00	10-11°C 95% Cloud Light wind (2) Very light, intermittent rain	1-10
31 May 2015	21:20	21:17-00:30	10°C 15% Cloud Moderate wind (3) No PPT	10-1
8 June 2015	21:27	21:20-00:35	12-15°C 50%Cloud Light wind (2) No PPT	1-10

Date	Sunset (hrs)	Survey Period (hrs)	Weather Conditions+	Transect Route*
23 June 2015	21:35	21:32-00:30	14-18°C 40%Cloud Light Breeze (1) No PPT	10-1
8 July 2015	21:27	21:30-01:15	15-16°C 10%Cloud Light Breeze (1) No PPT	1-10
20 July 2015	21:20	21:05-00:15	15-16°C 10%Cloud Moderate wind (3) No PPT	10-1
4 Aug 2015	20:52	20:50-00:30	15-17°C 75%Cloud Light Breeze (1) No PPT	1-10
18 Aug 2015	20:25	20:13-23:13	16-18°C 40%Cloud Light wind (2) No PPT	10-1
5 April 2016	19:52	19:40-22:15	8-9°C 5%Cloud Light wind (1) No PPT	1-10
18 April 2016	20:13	20:00-23:05	9-11°C 95%Cloud Light wind (2) No PPT	10-1

*Sequence of station stops shown on Figure 2b.
+ Weather conditions: PPT = Precipitation; Wind – Beaufort Scale given in Brackets

4.3.17 Surveyors used an Elekon BatloggerM to record bat calls during the walked transects. The recordings were analysed using Batsound or Kaleidoscope computer software for species identification.

Static Automated Bat Detectors 2014 and 2015

4.3.18 Remote, unattended bat detector recording units (termed 'dataloggers') were deployed at a selection of locations along the disused railway line to monitor the site for rare or uncommon species, with particular consideration to greater and lesser horseshoe bats. The datalogger locations are shown on Figure 3.

4.3.19 Two types of datalogger were used at the site. The first was the SM2BAT made by Wildlife Acoustics and one or two units were set out on any one deployment. The SM2BAT captures 16-bit full spectrum recordings, recording data on a high capacity secure digital card (SDHC card). The second type of datalogger used was the Anabat SD1 (with external 12V battery), a frequency-division detector that records bat sound onto a Compact Flash (CF) card. Both types of unit are suitable for long-term acoustic monitoring to determine the presence of bat species, but the data from different units is not directly comparable.

4.3.20 Each datalogger unit was programmed to be active each night between dusk and dawn and recorded over the periods shown in Tables 5a and 5b. In total, 23 locations were monitored along the disused railway line recording 213 nights of data.

4.3.21 The dataloggers are triggered by the bat's (ultrasonic) echolocation call and record continuously over the duration of bat activity. The bat sound recordings are saved as 15-second duration sound files for analysis. Each sound file records a sequence of echolocation calls from a passing bat or bats, or if there is constant activity in the vicinity of the datalogger consecutive sound files are created for the duration of the activity.

4.3.22 The system of recording bat sound in 15-second samples is a method that has been developed to estimate the number of 'bat passes' at a given point. A single or low number of sound files shows that a bat has passed the datalogger location, whilst foraging or social activity will create high numbers of sound files. This provides discrete data that can be counted and used to characterize the level of bat activity. The data are referred to in the results as a 'registration' of bat activity.

4.3.23 The recordings captured by the SM2BAT were analysed using Kaleidoscope Pro software, by Wildlife Accoustic. The Anabat zero-crossing files were analysed using and AnalookW software.

Table 5a. Deployment of Dataloggers in 2014

Location	Datalogger	NGR	Start Date	End Date	No. Nights Monitoring
S1a	AnabatSD1	ST 49588 75689	28/08/14	30/08/14	3
S1b	AnabatSD1	ST 48294 76071	28/08/14	31/08/14	4
S2a	SM2BAT	ST 49307 75728	25/09/14	26/09/14	1
S2b	SM2BAT	ST 50362 75844	25/09/14	30/09/14	6
S3	AnabatSD1	ST 48285 76083	20/10/14	05/11/14	17

Table 5b. Deployment of Dataloggers in 2015

Location	Datalogger	NGR	Start Date	End Date	No. Nights Monitoring
S4	SM2BAT	ST 50595 75934	09/04/15	17/04/15	8
S5a	SM2BAT	ST 50595 75934	21/04/15	28/04/15	7
S5b	AnabatSD1	ST 48269 76088	21/04/15	29/05/15	9
S6a	AnabatSD1	ST 49591 75696	18/05/15	31/05/15	13
S6b	SM2BAT	ST 50467 75895	18/05/15	26/05/15	9
S7a	AnabatSD1	ST 49325 75726	31/05/15	08/06/15	9
S7b	SM2BAT	ST 50467 75895	31/05/15	08/06/15	9
S8a	AnabatSD1	ST 49542 75696	09/06/15	21/06/15	14
S8b	SM2BAT	ST 49955 75711	09/06/15	14/06/15	6
S9a	AnabatSD1	ST 49977 75726	25/06/15	08/07/15	14
S9b	SM2BAT	ST 49542 75696	25/06/15	05/07/15	10

Location	Datalogger	NGR	Start Date	End Date	No. Nights Monitoring
S10a	AnabatSD1	ST 51788 76277	08/07/15	14/07/15	7
S10b	SM2BAT	ST 48308 76057	09/07/15	14/07/15	7
S10c	SM2BAT	ST 48929 75859	08/07/15	15/07/15	8
S11a	AnabatSD1	ST 50820 76009	20/07/15	03/08/15	15
S11b	SM2BAT	ST 48619 75955	23/07/15	30/07/15	8
S11c	SM2BAT	ST 48222 76097	26/07/15	30/07/15	5
S12a	AnabatSD1	ST 51417 76200	04/08/15	11/08/15	8
S12b	SM2BAT	ST 48542 75993	04/08/15	11/08/15	8
12c	SM2BAT	ST 48899 75837	04/08/15	11/08/15	8

Standardised Static Automated Bat Detector Acoustic Monitoring for Lesser and Greater Horseshoe bats 2016

Field Survey

4.3.24 An acoustic, static-automated bat detector ('datalogger') survey that can be replicated for monitoring horseshoe bat activity on the operational railway was undertaken in 2016. Five dataloggers were deployed at ten fixed locations each month. The datalogger locations are listed in Table 6a and shown on Figure 3.

4.3.25 Standardised acoustic monitoring was undertaken using Wildlife Accoustic's latest generation of full spectrum, realtime dataloggers, the SM4BAT-FS. The SM4BAT-FS captures 16-bit full spectrum recordings, recording data on an SDHC card.

4.3.26 Each datalogger unit was programmed to be active each night between dusk and dawn and recorded over the periods shown in Table 6b.

4.3.27 The dataloggers are triggered by the bat's (ultrasonic) echolocation call and record continuously over the duration of bat activity. The recordings captured by the SM4BAT-FS were analysed using Kaleidoscope Pro software, by Wildlife

Accoustic. This information was used to produce a database of bat activity along the disused railway line throughout the April - September study period. Using this high-resolution database, it is then possible to calculate a bat activity index (BAI) for a range of spatial and temporal bandwidths for lesser and greater horseshoe bats.

Table 6a.Datalogger Locations for Standardised Monitoring in 2016

Location	Section of Disused Railway Line*	NGR
1a	Portished	ST48010 76175
2a	Farmland	ST48739 75910
3a	Farmland	ST49725 75702
4a	Royal Portbury Dock	ST50549 75928
5a	Royal Portbury Dock	ST51425 76210
1b	Portbury Wharf Area	ST48406 76028
2b	Farmland	ST49315 75729
3b	Royal Portbury Dock	ST50186 75778
4b	Royal Portbury Dock	ST50885 76035
5b	Royal Portbury Dock	ST51857 76292
*Refer to Section 2.2 of the report.		

Table 6b. Deployment of Dataloggers in 2016 for Standardised Monitoring

Location	Month	Start Date	End Date	No. of Nights
1a – 5a	April	26/04/16	06/05/16	10
	May	16/05/16	23/05/16	7
	June	06/06/16	13/06/16	7
	July	18/07/16	25/07/16	7
	August	16/08/16	22/08/16	6
	September	19/09/16	26/09/16	7
1b -5b	April	06/05/16	16/05/16	10
	May	23/05/16	30/05/16	7
	June	13/06/16	20/06/16	7
	July	25/07/16	01/08/16	7
	August	22/08/16	29/08/16	7
	September	26/09/16	03/10/16	7

Data Processing

4.3.28 The static automated dataloggers collected raw data in the form of sound file recordings of bat calls. Sound files were analysed using the *Kaleidoscope* software to produce data giving the date, time, location and species of each bat echolocation detected. This information was used to produce a database of bat activity for greater and lesser horseshoe bats on the Disused Railway Line throughout the April – September 2016, using the "acoustic activity index" method presented by Miller (2001). The data captured by the dataloggers were used to derive the presence or absence of bat activity for each species at each datalogger location. The data were coded by grouping activity into one-minute time intervals to give a per-minute presence/absence 'bat activity index' (BAI). It was then possible to derive hourly, daily and monthly BAI for species.

4.3.29 Prior to analysis, the data were processed in the following steps:

i. A database was constructed consisting of one row for each datalogger for every one second time interval occurring within the active period of each datalogger. Data captured by the dataloggers were used to derive the presence (1) or absence (0) of bat activity for each one second time interval at each logger location. Times within the study period when loggers were inactive were not included.
ii. From the raw data, bat activity (by species) was assigned as either present (1) or absent (0) during each discrete one second time interval. The one second time interval was selected as preliminary investigation of the raw data revealed this to be the minimum time interval between successive sound recordings from any single datalogger.
iii. Statistical noise associated with repeat recordings was reduced by grouping the per-second presence/absence of bat activity using a grouping interval of one minute, as per Miller (2001). If the summed per-second presence of bat activity within each one minute interval was > 0, bat activity per minute was set to "1". If no activity was recorded within a one minute time interval, bat activity per minute was set to "0".
iv. Using the per-minute bat activity presence/absence, it was then possible to calculate a bat activity index (BAI) for a range of temporal bandwidths. The following derivations of BAI were calculated:
    a. *Hourly BAI*: the sum of bat activity per minute for each hour. This metric is analogous to count data.
    b. *Daily BAI* : the sum of hourly BAI for each active datalogger on each study night, standardised by dividing the sum by the number of hours dataloggers were active each night (i.e. sunset to sunrise). Standardisation was required as the period of time that

dataloggers were active was not constant between study nights, due to variation in the length of time between sunset and sunrise.

c. *Monthly BAI:* as with daily BAI, the sum of hourly BAI within each month for each active datalogger, standardised by dividing the sum by the total number of hours each datalogger was active in each month. Standardisation was required to account for some variation between months in the amount of time each datalogger was active.

4.3.30 Using BAI, it is possible to create baseline spatial and temporal patterns of bat activity across the study area on the disused railway line from 2016. Data collected in future years can been standardised in the same way for statistical comparison of horseshoe bat activity.

<u>Data analysis</u>
Whole study site: wide spatial and temporal resolution

4.3.31 To establish broad temporal variation in lesser and greater horseshoe bat activity on the disused railway line as a whole, monthly BAI for both species was calculated for all five dataloggers combined to give a single, study site-wide BAI for each month between May and September for both species that could be visually assessed.

Spatial variation across the disused rail line

4.3.32 To understand any broad spatial variation in lesser and greater horseshoe bat activity, standardised monthly BAI for both species was calculated for each datalogger between May and September. To assess if the observed variation in bat activity between dataloggers and between months was statistically significant, analyses were performed using the software *R* (v.3.1.1). For lesser horseshoe and greater horseshoe activity separately, a generalised linear model (GLM) was constructed using log-transformed monthly BAI as the response variable and both month and datalogger identity as independent categorical explanatory variables. Post hoc analysis was conducted on both lesser and greater horseshoe models using Tukey's multiple comparison tests in order to identify statistically significant pairwise differences in LHS activity between months and between loggers. Statistical significance was inferred when $p < 0.05$.

High temporal resolution at key locations

4.3.33 Peak lesser horseshoe activity occurred in September at the east and west ends of the disused railway line. Dataloggers 1 and 5 were therefore investigated further, focusing on September only. First, daily BAI was used to assess variation in LHS bat activity between study nights in September at dataloggers 1 and 5. Second, hourly BAI was used to establish any trends in nightly bat activity between days in September for each datalogger.

4.3.34 Peak greater horseshoe bat activity occurred in June at the west end of the disused railway line and was highest towards the east end of the rail line in May. Dataloggers 1 and 4 were investigated further using daily BAI to assess variation in greater horseshoe bat activity between nights in May and June. Hourly BAI was then used to check for any patterns within the last seven study nights in May for datalogger 4 and in the first 7 study nights in June for datalogger 1. Other study nights in each month were ignored due to a lack of greater horseshoe bat activity.

Lesser horseshoe bat activity near the M5 motorway

4.3.35 Datalogger 5 recorded the highest lesser horseshoe bat activity across the study period. This datalogger was situated at the far east end of the disused railway line, an area adjacent to the river Avon with port facilities to the north and west and a park with additional water bodies to the east. The datalogger 5 locations were split by the M5 motorway. Location 5A was to the west of the motorway, and 5B on the east side. Given the high lesser horseshoe bat activity in this area, further investigation was required to ascertain how bat activity varied in relation to the motorway.

4.3.36 It is important to note that at no point were locations 5A and 5B sampled simultaneously, as it was the same datalogger that was moved from one to the other. Consequently, any comparisons between the two locations are limited and can only provide suggestions of differences in bat activity between the two locations, rather than support any solid conclusions.

4.3.37 Statistical analysis was performed to compare the bat activity between datalogger 5 locations A and B across the whole study period. A GLM was constructed with daily BAI as the response variable and both datalogger location ("A" or "B") and month as independent categorical explanatory variables.

Trapping

4.3.38 Advanced bat survey methods to capture bats for the purpose of a radio-tracking study were undertaken for two nights per month in June and July 2015 and five nights in June 2018.

4.3.39 The trapping surveys covered areas of the disused railway line where lesser and greater horseshoe bats had been recorded by acoustic survey and monitoring. Greater horseshoe bat was the target species for the trapping surveys in 2018 and analysis of the 2016 standardised monitoring acoustic data (as described in Sections 4.3.21 to 4.3.34) identified peak activity was in June, at the western end of the disused railway line.

4.3.40 Avinet and Ecotone mist nets (ranging from 2m-12m in length) and Austbat $4m^2$ double lined harp traps were deployed on the disused railway line. The nets and harp traps were placed under bridges and tree canopy cover where bats will fly low and therefore may be directed towards the traps. Trapping locations in 2015 are shown on Figure 2b and the 2018 trapping locations are shown on Figure 2c. The disused railway line is relatively exposed and to help improve catch efficiency in open habitats four Sussex Autobat acoustic lures were used to attract bats to the traps (Hill, D. A. and Greenaway, 2005). The lures are placed next to mist nets or harp traps and emit synthesised bat calls. Trapping surveys in June and July 2015 used lures with synthesised greater horseshoe, barbastelle, noctule, *Myotis* and Nathusius pipistrelle echolocation calls and barbastelle social calls. Surveys in June 2018 targeting greater horseshoe bats used lures with synthesised greater horseshoe echolocation calls.

4.3.41 Captured bats were examined to determine species, sex, breeding status and, where appropriate, selected for radio tracking. Trapping surveys started at dusk. Trapping surveys in 2015 continued to approximately 02:00hrs, depending on capture success, bat activity and weather conditions. Trapping surveys in 2018 continued until 03:30hrs to cover the nightly period when greater horseshoe bats were known occur at the site (from analysis of the 2016 standardised monitoring acoustic data).

Table 7. Trapping Surveys on the Disused Railway Line

Date	Time (hrs)	Locations	Figure 2b and 2c References	Weather+
23/06/15	21:30 - 01:30 *	Station Road, Sheepway: ST 49360 75819 -Harp Trap ST 49337 75713 - Harp Trap ST 40603 75694 - Harp Trap ST 49541 75703 – 2m Mist Net	 TR1a TR1b TR1c TR1d	18^0C Light breeze (1) 30% Cloud cover No PPT
24/06/15	21:30 - 02:30	Near Wessex Water Building: ST 50098 75750 - Harp Trap ST 49955 75730 - Harp Trap ST 49941 75727 - Harp Trap	 TR2a TR2b TR2c	18^0C Light breeze (1) 60% Cloud cover No PPT
20/07/15	21:00 - 02:00	Station Road, Sheepway ST 49360 75819 –Harp Trap ST 49337 75713 – Harp Trap ST 49603 75694 – Harp Trap ST 49541 75703 – 12m Mist Net	 TR3a TR3b TR3c TR3d	16^0C Light wind (2) 50% Cloud cover No PPT
22/07/15	21:00 - 02:00	Portbury Wharf Area ST 48240 76097 – Harp Trap ST 48493 76003 – 9m Mist Net ST 48921 75855 – Harp Trap ST 49337 75713 – Harp Trap	 TR4a TR4b TR4c TR4d	15-16^0C Light wind (2) 25% Cloud cover No PPT
10/06/18	21:00 - 03:30	ST 48211 76111 – Harp Trap ST 48331 76053 – Harp Trap ST 47978 76195 – Harp Trap ST 49587 75683 – Harp Trap ST 49337 75713 – Harp Trap	TR5a TR5b TR5c TR5d TR5e	15°C Calm <10% Cloud cover No PPT
11/06/18	21:00 - 03:30	ST 48362 76057 – Harp Trap ST 48211 76111 – Harp Trap ST 48041 76167 – Harp Trap ST 49337 75713 – Harp Trap ST 50621 75941 – Harp Trap	TR6a TR6b TR6c TR6d TR6e	15°C Calm <10% cloud No PPT
12/06/18	21:00 - 03:30	ST 49558 75698 – Harp Trap ST 49335 75725 – Harp Trap ST 49541 75705 – Harp Trap ST 50471 75898 – Mist Net ST 50785 76014 – Harp Trap	TR7a TR7b TR7c TR7d TR7e	14°C, Light breeze (1) 25% Cloud cover

Date	Time (hrs)	Locations	Figure 2b and 2c References	Weather+
		ST 50621 75935 – Harp Trap	TR7f	No PPT
13/06/18	21:00 - 03:30	ST 49324 75782 – Harp Trap ST 49541 75705 – Harp Trap ST 49371 75820 – Harp Trap ST 49359 75797 – Mist Net ST 50553 75929 – Mist Net ST 50785 76014 – Harp Trap ST 50617 75920 – Harp Trap	TR8a TR8b TR8c TR8d TR8e TR8f TR8g	14°C, Light breeze (1) 80% Cloud cover Intermittent rain showers
14/06/18	21:00 - 03:30	ST 49364 75827 – Harp Trap ST 49359 75797 – Mist Net ST 49335 75725 – Harp Trap ST 49541 75705 – Harp Trap ST 50617 75920 – Harp Trap ST 50574 75818 – Mist Net ST 47967 76183 – Harp Trap	TR9a TR9b TR9c TR9d TR9e TR9f TR9g	14°C, Light breeze (1) 10% Cloud cover No PPT
*Trapping survey ended for radio-tracking a captured bat + Weather conditions: PPT = Precipitation; Wind – Beaufort Scale given in Brackets				

Radio Telemetry

4.3.42 Following capture on the night of the 23 June 2015 and 14 June 2018, a male and pregnant female greater horseshoe bat respectively were fitted with radio transmitters and in the case of the male (Bat 1), subsequently tracked every night until the morning of the 27th June, and in the case of the female (Bat 2) tracked every night until 17 June, resulting in 3.5 nights of tracking data for each bat. A radio transmitter tag (Biotrack Ltd, Wareham, Dorset, United Kingdom) was fitted to the bat with Torbot or similar skin bond adhesive. The bats were examined quickly and released 45-60 minutes after capture, once the glue attaching the transmitter had cured sufficiently.

4.3.43 The tagged bats were tracked using two to three Sika receivers (Biotrack Ltd., Wareham, United Kingdom) with 3 or 5-element Yagi antenna (Biotrack Ltd) following on foot or by vehicle. Triangulation methods were used to track the bat when it was distant and then when close contact was made the ''homing-in'' method was used to determine a more accurate position of the bat (White and Garrott, 1990). During tracking the locations were recorded every 15-25 min when there was contact with the bat. If contact with the bat was lost because of the topography of the landscape (and fast flight of the bat) surveyors would move to a high vantage point to search for the animal. For each data point fix, the tracker location was recorded to an 8-figure grid reference (using a global positioning system) and the compass bearing of the direction of peak signal was taken.

4.3.44 Ranges 9 software (Anatrack Ltd) was used to calculate Minimum Convex Polygons (MCP) and cluster analysis to assess the greater horseshoe bat's home range area. 100% MCPs were used to show the area that the bat flew through during the entire tracking period, which shows the bat's 'home range'. The radio tracking point resolution for Bat 1 and Bat 2 allowed the following cluster analysis to illustrate activity within their home ranges:

- Bat 1 – cluster analysis of 50%, 75% and 100% of the locations was used to illustrate where activity was concentrated over the tracking period;
- Bat 2 - core areas of activity with 80% clusters.

4.3.45 The radio tracking was undertaken by a team of three to four surveyors.

4.4 Portbury Freight Line Tunnels

Overview

4.4.1 To investigate the use by bats of tunnels on Portbury Freight Line for roosting and swarming a combination of trapping surveys, observation watches and datalogger monitoring was used. The methodology was developed with consideration to access limitations associated with surveying an active railway line. Notably, trapping surveys close to tunnel portals were undertaken in 2015 were in response to restrictions that prevented dusk exit watch surveys. Improved access on the railway line in 2016 allowed traps to be erected at the tunnel portals and two dusk surveys during the bat breeding were undertaken. Hibernation surveys were undertaken over two winter periods, 2015/16 and 2018 because 2015/16 was an exceptionally mild winter.

Summertime Trapping Surveys 2015 and 2016

4.4.2 The primary purpose of the trapping surveys between June and August was to determine if there are maternity roosts in any of the tunnels. In 2015, mist nets and harp traps were deployed in woodland near the tunnel portals to capture bats so that breeding female bats could be fitted with radio transmitters and tracked to determine if they were roosting in the tunnels. In 2016, mist nets and harp traps were erected at the tunnel portals to capture bats that emerge from roosts within the tunnels.

4.4.3 Surveys in September 2015 monitored the tunnels during the mating season. Captured bats were examined to determine species, sex and breeding status.

4.4.4 Woodland trapping methods (used in 2015) are described in Section 4.3.3. In 2016, mist nets and harp were erected across the tunnel portals to intersect animals emerging from within the structures. Sussex Autobat acoustic lures were not used at traps erected at the tunnel portals. Details of the trapping surveys at the tunnel are provided in Table 8.

Table 8. Trapping Surveys at Tunnels on Portbury Freight Line

Date	Trapping Location	Distance from Portal	Time	Weather+
22/06/15	*Clifton 1* Harp Trap at ST 56304 73206 6m Mist net at ST 56402 73088	 10m 140m	21:30-01:00	14^{0}C Light breeze (1) 5% cloud No PPT
	Clifton 2 Harp Trap at ST 56176 73555 Harp Trap at ST 56195 73496	 10m 50m	21:30-01:00	14^{0}C Light breeze (1) 5% cloud No PPT
21/07/15	*Pill* 6m Mist Net at ST 53355 75520 6m Mist Net at ST 53355 75493	 25m 40m	21:00-02:00	17^{0}C Light breeze (1) 50% cloud No PPT
	Clifton 2 Harp Trap at ST 56176 73555 Harp Trap at ST 56167 73549	 10m 30m	21:00-02:00	17^{0}C Light breeze (1) 50% Cloud cover No PPT
23/07/15	*Sandstone* Mist net at ST 54967 75007 Mist net at ST 54973 74995 Mist net at ST 54908 75074	 15m 20m 10m	21:00-01:30	18^{0}C Light breeze (1) 80% cloud No PPT
	Clifton 2 2 Harp Traps at ST 56050 74274	 350m	21:00-01:30	18^{0}C Light breeze (1) 80% cloud No PPT
27/07/15	*Pill* 6m Mist Net at ST 53355 75520 6m Mist Net at ST 53355 75493	 25m 40m	21:00-01:00	16^{0}C Light breeze (1) 100% cloud Light rain
	Clifton 1 2 Harp Traps at ST 56304 73206	 10m	21:00-01:00	16^{0}C Light breeze (1) 100% cloud Light rain

Date	Trapping Location	Distance from Portal	Time	Weather+
17/09/15	*Pill* 6m Mist Net at ST 53355 75520 6m Mist Net at ST 53355 75493	 25m 40m	19:30-01:15	15^0C Light breeze (1) 90% cloud No PPT
	Clifton 2 Harp Trap at ST 56176 73555 Harp Trap at ST 56167 73549	 10m 30m	19:30-01:30	15^0C Light breeze (1) 90% cloud No PPT
21/09/15	*Sandstone* Mist net at ST 54967 75007 Mist net at ST 54973 74995 Mist net at ST 54908 75074	 15m 20m 10m	19:00-00:40	14^0C Light breeze (1) 80% cloud No PPT
02/06/16	Clifton 1 portals –harp traps Clifton 2 portals – harp traps Sandstone portals –mist nets Pill portals –mist nets	0m 0m 0m 0m	20:45-00:10	12^0C Light breeze (1) 100% cloud No PPT
17/08/16	Clifton 1 portals –harp traps Clifton 2 portals – mist nets Sandstone portals –mist nets Pill portals – harp traps	0m 0m 0m 0m	20:00-23:00	21^0C Light breeze (1) 100% cloud Light rain at 21:30hrs
+PPT= Precipitation Wind – Beaufort Scale given in Brackets				

Autumn Swarming Surveys 2015

Static Automated Bat Detector Surveys

4.4.5 Static-automated bat detectors ('dataloggers') were deployed in tunnels on the Portbury Freight Line from the 19th August to 15th October 2015 to monitor for swarming activity.

4.4.6 Two dataloggers were placed in the tunnels to monitor activity at each portal[1]. The dataloggers were positioned approximately 10m from the portal entrance. Each datalogger unit was programmed to be active each night between dusk and dawn and recorded over the periods shown in Table 9.

4.4.7 The recordings captured by the SM2BAT were analysed using Kaleidoscope Pro software, by Wildlife Accoustic. The Anabat zero-crossing files were analysed using and AnalookW software.

Table 9. Deployment of Dataloggers in Tunnels on Portbury Freight Line

Tunnel	Portal	Datalogger	Start Date	End Date	No. Nights Monitoring
Clifton 1	NW	SM2BAT	19/08/15	24/08/15	6
Clifton 1	SE	AnabatSD1	19/08/15	24/08/15	6
Clifton 2	N	SM2BAT	19/08/15	24/08/15	6
Clifton 2	S	SM2BAT	19/08/15	24/08/15	6
Sandstone	NW	SM2BAT	25/08/15	31/08/15	7
Sandstone	SE	AnabatSD1	25/08/15	31/08/15	7
Pill	W	SM2BAT	25/08/15	31/08/15	7
Pill	E	SM2BAT	25/08/15	31/08/15	7
Clifton 1	NW	SM2BAT	01/09/15	08/09/15	8
Clifton 1	SE	SM2BAT	01/09/15	08/09/15	7
Clifton 2	N	AnabatSD1	01/09/15	08/09/15	8
Clifton 2	S	SM2BAT	01/09/15	08/09/15	8
Sandstone	Central*	SM2BAT	09/09/15	15/09/15	7
Pill	W	AnabatSD1	09/09/15	15/09/15	7
Pill	E	SM2BAT	09/09/15	15/09/15	6
Clifton 1	NW	AnabatSD1	16/09/15	21/09/15	6
Clifton 1	SE	SM2BAT	16/09/15	21/09/15	6
Clifton 2	N	SM2BAT	16/09/15	21/09/15	6

[1] Due to a datalogger failure, only one unit was deployed in Sandstone tunnel on the 9th September 2015

Tunnel	Portal	Datalogger	Start Date	End Date	No. Nights Monitoring
Clifton 2	S	SM2BAT	16/09/15	21/09/15	6
Sandstone	NW	SM2BAT	22/09/15	27/09/15	5
Sandstone	SE	SM2BAT	22/09/15	27/09/15	5
Pill	W	AnabatSD1	22/09/15	27/09/15	5
Pill	E	SM2BAT	22/09/15	27/09/15	5
Clifton 1	NW	SM2BAT	28/09/15	08/10/15	6
Clifton 1	SE	SM2BAT	28/09/15	08/10/15	7
Clifton 2	N	AnabatSD1	28/09/15	08/10/15	10
Clifton 2	S	SM2BAT	28/09/15	08/10/15	10
Sandstone	NW	SM2BAT	09/10/15	15/10/15	6
Sandstone	SE	SM2BAT	09/10/15	15/10/15	6
Pill	W	AnabatSD1	09/10/15	15/10/15	6
Pill	E	SM2BAT	09/10/15	15/10/15	6
*Placed in the central section of the tunnel, not at a tunnel portal					

Tunnel Observations

4.4.8 Visual surveys of the tunnels were undertaken in September and October 2015 to investigate bat activity and swarming behaviour by bats within the structures.

4.4.9 Surveyors were equipped with an Elekon BatloggerM (full spectrum), Anabat SD1 (frequency division) or Pettersson D240x (time expansion) bat detectors to record activity at the tunnels. The surveys recorded the bat species encountered and observations on the level and type of bat activity were recorded according to the criteria listed in Table 10.

Table 10. Criteria for Recording Bat Activity at Tunnels on Portbury Freight Line

Level of Activity	Criteria
High	Constant or almost constant (c.80% of the time) with the species likely to be present in the immediate vicinity of the swarming site
Moderate	Regular but intermittent with the species present for at least 50% of the time
Low	Species recorded infrequently
None	No bat activity recorded over the observation interval
Type of Behaviour	
Swarming	Several bats gathered, displaying distinctive circling flight patterns within close proximity the tunnel portal

Social	Low numbers of bats interacting in flight, possibly with social calls
Foraging	Hawking flight behaviour and/or feeding buzzes
Commuting	Direct flights through the observation area (without immediate return)

4.4.10 The protocol for observation watches was developed with consideration to time restrictions required for access on to the railway (discussed further in Section 4.8).

4.4.11 Tunnel watches commenced 2 hours after sunset with a survey period of 2-2.5 hours. One surveyor was allocated to each tunnel and undertook 15 minute observations at the tunnel entrances, alternating between portals for each consecutive observation interval. Details of the tunnel surveys are given in Table 11.

Table 11. Tunnel Observations in Autumn 2015

Tunnel	Date	Sunset	Start Time	End Time	Surveyor	Weather Conditions
Clifton 1	22/09/15	19:10	21:45	00:00	AK	15^0C 15% cloud No wind (0) No PPT
Clifton 2	22/09/15	19:10	21:50	00:20	RP	15^0C 15% cloud No wind (0) No PPT
Sandstone	28/09/15	19:00	22:45	00:45	RP	12^0C 75% cloud Light breeze (1) No PPT
Pill	28/09/15	19:00	22:30	00:15	AK	12^0C 75% cloud Light breeze (1) No PPT
Clifton 2	08/10/15	18:31	00:40	02:55	TG	9^0C 20% cloud No wind (0) No PPT
Sandstone	08/10/15	18:31	01:00	02:55	AK	9^0C 20% cloud No wind (0) No PPT
Clifton 1	09/10/15	18:30	01:00	02:30	AK	9^0C No cloud No wind (0) No PPT
Pill	09/10/15	18:30	01:30	02:30	RP	9^0C No cloud No wind (0) No PPT

Surveyors
AK Anton Kattan MCIEEM licensed consultant ecologist with 14 years of experience
RP Robert Pelc gradCIEEM licensed consultant ecologist with 3 years of experience
TG Tracy Gray gradCIEEM licensed consultant ecologist with 4 years of experience

Weather conditions: PPT = Precipitation; Wind – Beaufort Scale given in Brackets

4.4.12 On the 15th October 2015 a daytime inspection of the tunnels was undertaken by Anton Kattan MCIEEM and Clare Williams MCIEEM. The four tunnels on the Portbury Freight Line were inspected internally (from the ground) to look for crevices and internal voids that could provide shelter for bats. Close-focusing binoculars and a powerful Clulite torch with a 500m spot beam were used. Droppings were collected for species identification by DNA analysis. The droppings were sent to Dr. Robin G Allaby at Warwick University School of Life Sciences.

Winter Tunnel Monitoring

Survey Methodology Rationale

4.4.13 Hibernation surveys rely on detailed inspections during winter to look for and identify hibernating bats, or other field signs such as droppings or carcasses/skeletal remains. Heavily used crevice features can sometimes become stained by oil that rubs off from the bats' fur. Lesser and greater horseshoe bats (*Rhinolophus hipposideros* and *R. ferrumequinum*) are the most conspicuous species because they hang freely from the walls and ceilings within a hibernacula. Other species occupy crevices and are more concealed, often crawling deep into cavities where they are hidden.

4.4.14 It is widely understood that crevice dwelling bat species are under recorded during hibernation inspections. The difficulty surveying hibernating bats in the tunnels on the Portbury Freight Line is exacerbated by the size of the structures, which would require specialist access equipment (and a line closure) to enable surveyors to reach many of the crevice features. The Bat Conservation Trust good practice guidelines for professional ecologists (Collins, 2016) recommend using complementary methods to gather information about hibernating bats. Deploying static automated bat detectors within the hibernacula to monitor sites during the winter period will detect bat activity when animals arouse from hibernation, such as when bats periodically arouse to drink (every few weeks). They will also feed, especially during warmer periods in winter when insect activity can increase. Data from static automated bat detectors provide valuable contextual information by monitoring bat activity within the tunnels, but requires judicious interpretation with consideration to the site-specific constraints, which are discussed in Section 4.9.

<u>Hibernation Inspections</u>

4.4.15 Hibernation bat roost surveys of the tunnels were undertaken in winter 2015/16 and 2018. The first survey period commenced on 17th December 2015 and concluded on the 26th February 2016. The second survey period commenced on the 29th January and concluded on the 6th March 2018. Ten daytime tunnel inspections to look for hibernating bats (and the deploy static automated bat detectors, see Section 4.4.18 below) were undertaken during the survey schedule shown in Table 12.

4.4.16 Each tunnel survey entailed a walk though and systematic inspection of the internal walls and ceiling, with accessible crevice features in the walls (to a height of c.2m above the ground) closely examined with a (Maglite) pen torch or (Videostik) endoscope with a 900mm long fibre-optic cable. A powerful (Clulite) torch with a 500m spot beam and close focusing binoculars were used to inspect crevices and gaps at the top of walls and ceiling of the tunnels.

4.4.17 The presence of bats and field signs were recorded with the following information taken:

- Description of the roost feature;
- Approximate location of the roost perch/ crevice in the tunnel;
- Number of bats and species identification (from observations without handling the animal);
- Active or state of torpor of the animal;
- Location and number of bat droppings, or other field signs;
- Notes on relative freshness, shape and size of droppings.

Table 12. Schedule of Site Visits to the Four Tunnels on the Portbury Freight Line

Date	Surveyor	Weather Conditions*
17-12-15	Anton Kattan	Temp 10-11°C 90% Cloud Light wind (1) No PPT
05-01-16	Robert Pelc	Temp 9-10°C 45% Cloud Light wind (1) No PPT
19-01-16	Robert Pelc	Temp 6-7°C 0-5% Cloud Light wind (2)

Date	Surveyor	Weather Conditions*
		No PPT
02-02-16	Robert Pelc	Temp 8-9°C 35% Cloud Light wind (1) No PPT
16-02-16	Anton Kattan	Temp 5°C 5% Cloud No wind (0) No PPT
26-02-16	Anton Kattan	Temp 6-7°C 50% Cloud No wind (0) No PPT
29/01/18	Robert Pelc	Temp 11°C, 50% Cloud Light wind (1) No PPT
06/02/18	Robert Pelc	Temp 4-5°C, 35% Cloud Light wind (1) No PPT
20/02/18	Robert Pelc	Temp 9°C, 25% Cloud Light wind (2) No PPT
06/03/18	Robert Pelc	Temp 6-7°C, 100% Cloud No wind (0) No PPT
Weather conditions: PPT – Precipitation (snow/ rain); Wind – Beaufort scale given in brackets.		

Static Automated Bat Detector Monitoring

4.4.18 Static automated bat detectors were deployed during the site visits listed in Table 13, with the units collected in on the final visit on the 26th February 2016.

4.4.19 The bat detectors were positioned in the centre of the tunnels, away from portals in order to record bats flying in the tunnel and help avoid external activity within the surrounding woodland. One bat detector unit was deployed per tunnel in Clifton No. 1, Clifton No. 2 and Sandstone. Given the length of Pill tunnel, two bat detector units were deployed, and were positioned approximately 50m from the east and west portal.

4.4.20 SM2BAT by Wildlife Acoustics bat detectors were used. The SM2BAT captures 16-bit full spectrum recordings on high capacity secure digital cards (SDHC card). The unit was programmed to be active on a nightly basis, monitoring through the night from 1 hour before sunset to 1 hour after sunrise. The dates of the monitoring periods are shown in Table 13. The variation in the number of nights monitoring is a result of battery life in the units, with cold temperatures causing battery deterioration.

Table 13. Static-Automated Bat Detector Deployment Periods

Date of Deployment	Tunnel	End Date of Monitoring	No. of Nights Monitoring
17/12/15	Clifton No. 1	-	0*
	Clifton No. 2	24/12/15	8
	Sandstone	21/12/15	5
	Pill (West Portal)	24/12/15	8
	Pill (East Portal)	21/12/15	5
05/01/16	Clifton No. 1	13/01/16	8
	Clifton No. 2	13/01/16	8
	Sandstone	10/01/16	5
	Pill (West Portal)	10/01/16	5
	Pill (East Portal)	10/01/16	5
19/01/16	Clifton No. 1	29/01/16	10
	Clifton No. 2	27/01/16	8
	Sandstone	25/01/16	6
	Pill (West Portal)	25/01/16	6
	Pill (East Portal)	28/01/16	9
02/02/16	Clifton No. 1	12/02/16	10
	Clifton No. 2	11/02/16	9
	Sandstone	08/02/16	6

Date of Deployment	**Tunnel**	**End Date of Monitoring**	**No. of Nights Monitoring**
	Pill (West Portal)	07/02/16	5
	Pill (East Portal)	10/02/16	8
16/02/16	Clifton No. 1	26/02/16	10
	Clifton No. 2	24/02/16	8
	Sandstone	24/02/16	8
	Pill (West Portal)	20/02/16	4
	Pill (East Portal)	23/02/16	7
29/01/18	Clifton No. 1	05/02/18	8
	Clifton No. 2	05/02/18	8
	Sandstone	04/02/18	7
	Pill (West Portal)	02/02/18	5
	Pill (East Portal)	05/02/18	8
06/02/18	Clifton No. 1	19/02/18	13
	Clifton No. 2	20/02/18	14
	Sandstone	20/02/18	14
	Pill (West Portal)	16/02/18	10
	Pill (East Portal)	20/02/18	14
20/02/18	Clifton No. 1	04/03/18	12
	Clifton No. 2	04/03/18	12
	Sandstone	03/03/18	11
	Pill (West Portal)	02/03/18	10
	Pill (East Portal)	06/03/18	14
*Due to a SDHC card failure, there were no records from the Clifton 1 tunnel during the first deployment.			

4.4.21 The automated bat detectors are activated by the bat's (ultrasonic) echolocation call and record continuously over the duration of bat activity. The recordings are saved as WAV files on the SDHC card. The data were processed and analysed using Wildlife Acoustics' Kaleidoscope Pro software (version 3.1.4). Kaleidoscope Pro has an automated species classifier which allows the calls to be grouped and then each call was manually verified to confirm species identification.

4.5 Bat Roost Surveys of Buildings and Structures on Portbury Freight Line

Pill Station (Disused Platform)

4.5.1 There are two stone arches in a stone retaining wall on the disused platform at Pill Station, shown on the photograph Plate 1. The location of Pill station is shown on Figure 2d. The larger arch (named Arch 1) at the eastern end of the platform is a former store and has a height from floor to ridge of 2m, and a floor plan approximately 3 sqm. A smaller arch (named Arch 2) to the west is 1.25m high, 2m wide and extends back into the stone wall 2.5m. The floor of the arches were earth.

4.5.2 A daytime inspection of the arches was undertaken on the 18th July 2016 by Anton Kattan. An SM2BAT remote, unattended bat detector recording unit was deployed in the each of the arches to monitor the known and potential roost sites. The units were placed at the rear of the arches to minimize the risk of recording bat activity outside and were programmed to record from 1 hour before sunset until 1 hour after sunrise on a nightly basis. The units were deployed on the 18th July 2016 and monitored bat activity for seven nights. The primary objective was to monitor the structure for horseshoe bats (*Rhinolophus* sp.).

Plate 1. Arches on Pill Station Platform

4.5.3 A dawn survey was undertaken on the 28th September 2016. Two surveyors were positioned on the platform to watch for bats returning to the arches. Details of the dawn survey are given in Table 14.

Table 14. Dawn Survey Pill Station

Date (2016)	Sunrise (hrs)	Survey Period (hrs)	Surveyors	Weather Conditions
28t Sept	07:04	05:00-07:10	AK, RP	15^{0}C 10% cloud, Light wind (2) No PPT
Notes Weather conditions: PPT = Precipitation; Wind – Beaufort Scale given in Brackets				

4.5.4 Surveyors were equipped with Elekon BatloggerM full spectrum bat detectors.

4.5.5 Further surveys of Pill Station (Disused Platform) were undertaken between May and October 2019 and results are provided in Appendix 11.

Pill Station House

4.5.6 Pill Station House at 7 Station Road in Pill is close to Pill Station, as shown on Figure 2d. It comprises a two storey house with adjoining ground level office building (shown on Photograph 16, Appendix 10). It is a business premises with offices and storage rooms on the ground floor. The first floor of the house is a flat, which is currently unoccupied.

4.5.7 A preliminary bat roost assessment was undertaken by Anton Kattan and Robert Pelc on the 6th March 2018. A daytime building inspection surveyed the roof spaces for evidence of roosting bats. The interior and exterior of the building was examined for potential bat access points and crevice roost features in the fabric of the building.

4.5.8 The preliminary bat roost assessment identified access points to cavities under roof tiles. Two dusk surveys were undertaken in May and June 2018 to survey these concealed voids in the roof. Two surveyors provided visual coverage of all elevations of the building with bat access points. Details of the dusk surveys are given in Table 16.

Table 16. Dusk Surveys of Pill Station House

Date (2018)	Sunrise (hrs)	Survey Period (hrs)	Surveyors	Weather Conditions
21 May	21:04	21:00-22:45	AK, RP	18-20^{0}C 60% cloud, Light breeze (1) No PPT
7 June	21:23	21:15-22:55	AK, RP	18^{0}C 100% cloud Light wind (2) Mainly dry, but light rain from 22:50hrs
Notes Weather conditions: PPT = Precipitation; Wind – Beaufort Scale given in Brackets				

Viaducts and Underbridges

4.5.9 Fourteen structures on Portbury Freight Line and a small store building on the adjacent towpath have been surveyed for bat roosts. The locations of structures and buildings are shown on Figure 2d. A preliminary bat roost assessment was undertaken on thirteen structures and one structure (Avon Road Bridge) was subject to more detailed assessment with two dusk surveys. A preliminary bat roost assessment was undertaken on the following numbered structures:

- S010 Pill Viaduct at ST 5280 7580 [A]
- S012 Miles Viaduct / Ham Green Lake at ST 5352 7552 [A]
- S014 Underbridge at ST 54602 75835 [B]
- S015 Miles Dock underbridge at ST 5480 7510 [A]
- S018 Quarry underbridge 6 at ST 5510 7480 [A]
- S019 Quarry underbridge 5 at ST 5570 7450 [A]
- S020 Quarry underbridge 4 at ST 5590 7440 [A]
- S021 Quarry 3 underbridge at ST 56068 74293 [B]
- S022 Quarry 2 underbridge at ST 56135 73968 [B]
- S025 Underbridge at ST 5620 7330 [A]
- S026 Nightingale Valley underbridge ST 56305 73199 [B]
- S033 Chilcott Road underbridge at ST 5700 7040 [A]

4.5.10 The preliminary bat roost assessment of the structures S010, S012, S015, S018, S019, S020, S025 and S033 (identified on the list above by 'A') was undertaken by Sophie Mairesse Katrina Rimington (Bridgeway Consulting Ltd.). The daytime surveys were conducted on the 15th and 16th August 2016, during suitable weather conditions. Structures S014, S021, S022 and S026 (identified on the list above by 'B') and a towpath store at NGR ST 56219 73588 adjacent to the freight line were surveyed on the 7th June 2018 by Anton Kattan and Robert Pelc, during suitable weather conditions.

4.5.11 An underground bunker at the premises of Babcock International Group was also surveyed on the 7th June 2018 by Anton Kattan and Robert Pelc. The bunker, referred to as 'Babcock's bunker' in this report is located at NGR ST 56641 71477.

4.5.12 Avon Road bridge at ST 52101 76251 between Avon Road and Lodway Close in Pill was assessed as having low bat roost potential because there are gaps between the concrete deck and bridge abutments. The bridge was surveyed in July and September 2016 for roosting bats, details of which are given in Table 16.

Table 16. Dusk Surveys of Avon Road Bridge

Date (2016)	Sunset (hrs)	Survey Period (hrs)	Surveyors	Weather Conditions
12 July	21:23	21:15-22.55	AK, RP	18^{0}C 30% cloud, Light wind (1) No PPT
13 Sept	19:28	19:13-20:45	AK, RP	21^{0}C 90% cloud, Light wind (1) No PPT
Surveyors **AK** Anton Kattan MCIEEM licensed consultant ecologist with 14 years of experience with bats **RP** Robert Pelc gradCIEEM licensed consultant ecologist with 3 years of experience with bats Weather conditions: PPT = Precipitation; Wind – Beaufort Scale given in Brackets				

4.5.13 A further ground roost assessment was undertaken on two road bridges along a previously unsurveyed section of the Freight Line in July 2020. The bridges are located at Ashton Road and A369 bridge at ST 56653 71485 and the A370 Brunel Way bridge at ST 56633 71538.

4.6 Trees along Avon Gorge and the Portbury Freight Line

Survey Extent

4.6.1 The DCO Scheme will include upgrades to Portbury Freight Line for the passenger service. The upgrades will require engineering work for online improvements to the track and there will be changes to the maintenance of line-side vegetation is for the safe operation of the passenger line.

4.6.2 Portbury Freight Line runs along the Avon Gorge and goes through the Avon Gorge Woodlands Special Area SAC/SSSI. It is an area that is important for bats and an appraisal of the tree roost resource within Network Rail land was required for a preliminary assessment of predicted impacts that may occur as a result of the railway upgrade. An Arboricultural Consultant advised on areas and trees that are within the trackside management plan and may be subject to tree work.

Approach and Methods

4.6.3 The woodland and trees within Network Rail land surveyed by the arboriculturalist were correspondingly assessed to evaluate the potential bat roost resource by Anton Kattan MCIEEM. The survey was conducted over five days on the 2nd,16th,17th and 26th June and 7th July 2017. A follow up survey was conducted on the 22nd July 2020 by a Jacobs ecologist to survey previously non-accessed locations of the track between Clanage Road and the pedestrian crossing in Bower Ashton. This follow up survey was to assess previously non-accessed area of the track.

4.6.4 The bat roost assessment identified individual trees or groups of trees according to the requirement for the arboricultural report. Mature trees with important bat roost features were tagged and included as individual trees in the arboricultural report, with recommendations for further bat survey before trees works. Copies of the arboricultural report plans are provided in Appendix 1 to reference tree locations.

4.6.5 The appraisal of bat roost features trees adopts the approach specified for preliminary ground based assessments recommended by the Bat Conservation Trust (BCT) for professional surveys (Collins, 2016).

4.6.6 The character of the woodland within Network Rail land has been influenced by the varying management regimes adopted in the gorge for the rail operation, forestry commission land and site improvement plan for nature conservation objectives. The arboricultural assessment defined linear groups of trees within woodland that had been under the same management therefore had a similar species composition and age structure. As a result, trees within the linear groups tended to have similar types of bat roost features. The individual trees or woodland were categorised according to the evaluated criteria specified in Table 3 (Section 4.3.8). Trees, or areas of woodland with narrow stem vegetation that is not a potential roost habitat can be assessed as not having roost potential.

4.7 Winter Survey of Caves and Adits in the Avon Gorge Woodlands

4.7.1 Anton Kattan and Robert Pelc undertook an inspection of caves and adits on National Trust, Forestry Commission and Network Rail land in January 2018. The interior of the caves were surveyed for roosting bats and examined for field signs such as droppings that would indicate roost activity has occurred at the underground site. Crevice features were closely examined with a (Maglite) pen torch or (Videostik) endoscope with a 900mm long fibre-optic cable. Head torches and a handheld Clulite torch with a 500m spot beam provided lighting for access to underground areas.

- The presence of bats and field signs were recorded with the following information taken:
- Number of bats and species identification (from observations without handling the animal);
- Active or state of torpor of the animal;

- Number of bat droppings and their distribution in the cave;
- Notes on relative freshness of droppings that may indicate roost occupancy in the current hibernation season.

4.7.2 Table 17 lists the underground sites inspected and their locations are shown on Figure 8.

Table 17. Survey Inspections of Underground Sites in the Avon Gorge

Date 2018	**Name**	**NGR**
19 January	Kennel Cave	ST 54689 75065
19 January	4.7.2.1.1.1 Paradise Bottom (nb. Cave has two entrances shown on Figure 8)	4.7.2.1.1.2 ST 54781 75209
19 January 23 February	Stokeleigh Camp Cave	ST 56051 73313
18 January	Upper Cliff Cave	ST 55998 73408
19 January 6 March	The Adit – Cave Seven	ST 56430 72915
23 February	4.7.2.1.1.3 Burwalls Cave	ST 56376 72897

4.8 Evaluation

4.8.1 In order to evaluate the importance of ecological features identified in the desk study and field surveys, a set of standard measures are outlined in guidance produced by the Institute of Ecology and Environmental Management (2016). For each site, habitat and species/assemblages, a summary grade is determined based on the levels of value recommended in the guidance. This places the importance of each feature in a geographical context, using the following hierarchy:

- International;
- National (i.e. England);
- Regional
- County;
- District (or Unitary Authority, City or Borough);
- Local (or Parish);
- Site – within the immediate zone of influence only (the development site and surroundings).

4.8.2 Where possible, formal criteria are used to set features of conservation importance within this geographical context. For example, the Guidelines for the Selection of Biological SSSIs (Nature Conservancy Council, 1989) can be used as a basis for the assessment of features at a National level. Similarly, published guidelines for the selection of SINCs (Sites of Importance for Nature Conservation) can be used as the basis for assessing features of county level importance.

4.8.3 The significance of bat populations has been determined using the principles described in the CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (2016). Particular consideration has been given to their distribution and rarity at different geographical levels. For this assessment, reference has been made to:

- The UK Post 2010 Biodiversity Framework (published 2012);
- UK Biodiversity Action Plan[2];
- North Somerset Local Biodiversity Action Plan;
- Distribution Atlas of Bats in Britain and Ireland 1980-1999 (Richardson, 2000);
- Mammals of the British Isles Handbook (Harris and Yalden, 2008);
- The State of the UK's Bats: National Bat Monitoring Programme Populations Trends 2011 (www.bats.org.uk)

4.9 Deviations, Constraints and Limitations

Overview

4.9.1 The methodology adopted for the study has established baseline for the DCO Scheme over a four year period. The study has been undertaken with an emerging scheme design and the scope of bat work has developed as the brief for environmental impact assessment progressed. In conjunction with professional survey guidelines (Hundt, 2012 and Collins, 2016), advanced survey methods trapping and radio-tracking bats were employed following the discovery of lesser and greater horseshoe bats during surveys at the end of 2014.

4.9.2 Portbury Freight Line is an active railway line and survey methodologies were adapted to take consideration of track safety requirements. To assess the presence or likely absence of breeding roosts in tunnels, trapping surveys close to tunnel portals were used as an alternative to roost exit watches in

[2] The UK BAP has been superseded by the UK Post-2010 Biodiversity Framework, but many of the tools developed under UK BAP remain of use, including background information about the lists of priority species.

2015. Breeding females (of target species) could be radio-tracked to maternity roosts. It is accepted that identifying roosts using this method is more successful near large roosts and further in 2016 with track access provided more detailed information on roosts in tunnels.

Walked Transects

4.9.3 Bat surveys commenced in August 2014 prior to vegetation clearance on the disused railway line. Sections of the route were inaccessible because of dense, continuous bramble scrub. Walked transects between August and October 2014 deviated from the Scheme alignment, but in 2015 the site was cleared and continuous transects along the disused railway line were undertaken between May 2015 and the end of April 2016.

4.9.4 Weather conditions during October 2014 were inclement and the survey on the 20th October was repeated on the 21st October due to heavy rain.

Trapping Surveys

4.9.5 Trapping surveys using harp traps and mist nets are most effective in woodland and sheltered surroundings where bats must navigate cluttered environments and traps can be placed over gaps on flight paths. The disused railway line is a relatively open environment and the trapping was restricted to sheltered areas such as the bridges and areas with mature trees. Acoustic lures are an effective way of increasing capture rates and were used to improve success trapping in the open environment.

Bat Detectors and Datalogger Units

4.9.6 The capabilities of bat detectors vary and the performance of units is not directly comparable. New generations of bat detectors have been developed each year and the latest systems were used. The systems used for the Scheme were:

- Elekon BatloggerM – a realtime, full-spectrum detector with 312.5 kHz sampling rate.
- Wildlife Acoustic SM4BAT FS – a realtime full spectrum detector with 384kHz sampling rate that captures 16-bit WAV recordings that can be analysed using sound analysis software. SM4BAT FS units were fitted with SMM-U1 omnidirectional microphones.
- Wildlife Acoustic SM2bat – a realtime, full-spectrum detector with 384kHz sampling rate. The SM2bat units were fitted with a SMX-U1 or SMX-UT omnidirectional microphone.
- Titley Anabat SD2 – a frequency division detector with Zero-Crossings Analysis Interface Module hardware.

4.9.7 Wildlife Acoustic's Kaleidoscope Pro 3 analysis software was used for species identification. The software runs a classifier that filters the bat calls in to species groups.

4.9.8 Kaleidoscope Pro 3's classifier was used to sort large batches of data collected on dataloggers into species groups. The bat calls were then verified manually measuring characteristic call parameters such as peak frequency, call duration and interpulse interval.

4.9.9 Static automated bat detectors can capture considerable datasets of common pipistrelle bats. Large datasets of common pipistrelle calls were reviewed by sampling 25% of the data to look for other bat species in the set.

4.9.10 Identification of bat species in the genus *Myotis* sp. cannot be made with confidence because of overlap and similarities in their call parameters.

Standardised Datalogger Monitoring

4.9.11 The standardised datalogger monitoring used fix point locations for monthly monitoring. The exact location for the dataloggers was determined by the availability of trees and structures on which to attach the units. The track was monitored from a single vantage point and positioned to detect bats using the centre of the railway corridor. The datalogger units have omnidirectional microphones, but where bats may deviate from the railway track the units may not detect their echolocation calls.

4.9.12 It is acknowledged that using an activity index (BAI) as described in Section 4.3.33 manipulates the raw data. Grouping data in this way to reduce noise has the potential to reduce the resolution of the data. Finding the optimum balance in the trade-off between reducing noise and maintaining reasonable data resolution is difficult in the absence of a measure of "true" bat activity. Miller (2001) uses a grouping interval of one minute, and we follow his suggestion here. Based on personal bat observation experience, one minute is a suitable interval to reduce the effect of repeat recordings whilst minimising the data loss of real bat activity.

4.9.13 A second issue with the use of an activity index is that, using this data alone, it is not possible to determine the different behaviours being used by bats and therefore determine the relevance of a given location (e.g. for feeding versus commuting). However, whether a location is used repeatedly by a single (or few) bats for feeding versus being used briefly by a larger number of bats as commuting corridor, the activity index still demonstrates that the given location is of some ecological importance to bats, providing a relative and readily comparable measure of activity over time.

Tunnel Autumn Surveys

4.9.14 Track access to Portbury Freight Line required the line to be blocked to prevent train movements during the surveys. Arrangements for track access (for observations) during autumn swarming surveys at tunnels delayed the survey start time and the duration of the surveys was limited to approximately 2 hours, rather than the recommended 4 hour duration (Hundt, 2012). However, the surveys started approximately 2 hours after sunset and covered optimal survey times.

4.9.15 In addition to observational surveys, static automated bat detectors were deployed in the tunnels. Two units were deployed in each tunnel for the monitoring period. Over the survey period, one datalogger failure to operate occurred on the 9^{th} October 2015 at Sandstone tunnel.

Tunnel Winter Surveys

4.9.16 The primary method for winter hibernation survey is a detailed inspection of the structures to identify hibernating bats, or field signs indicating evidence of roosting. This type of survey relies on close inspection of crevice features, ideally with equipment to examine the cavity interior. The size of the four Portbury Freight Line railway tunnels presents a challenge for this type of survey, which relies on direct observation, because many of the potential (crevice) roost locations cannot be reached by surveyors because of the height of the tunnel. This constraint is often experienced at bat hibernation roosts because of the challenging terrain and underground nature of many of the sites.

4.9.17 The Portbury Freight Line tunnels are not expected to retain large accumulations of droppings, which is sometimes evident at hibernation sites where piles of guano can accumulate over decades (and even centuries) in the stable, undisturbed environment of caves and mines. In contrast, the tunnels are an active railway line and debris/ deposits on the floor of the tunnels rapidly dissipate.

4.9.18 Deployment of static automated bat detectors is a complementary survey method that can provide supporting information on winter use at a site. During the winter hibernation period individual bats move around roosts to locations with optimal environmental conditions (for torpor), and periodically arouse to drink. Acoustic monitoring within the hibernation sites records this bat activity. This method of monitoring is particularly effective within enclosed spaces, such as hibernation sites within deep caverns, where bat activity is exclusively associated with movement within the roost. The Portbury Freight Line tunnels are not enclosed in this way because the tunnel portals are open. Consequently, whilst the tunnels provide suitable environments for hibernation because of their size and the underground nature of the structures, bat activity within the tunnels is likely to include winter activity associated with resident bat populations in the Avon Gorge Woodlands.

4.9.19 Survey of the Portbury Freight Line has been undertaken without specialist access equipment and close internal inspection of crevice features is limited to the lower 2m of tunnel wall. Inspection of crevices above 2m from the ground relied on visual inspections using a torch and binoculars, with visibility restricted to the anterior of the cavity. The relevance of this survey constraint is different for each tunnel, with the noticeable potential hibernation features that could not be inspected being:

- Clifton Tunnel no. 2 –a deep fracture in natural rock, approximately 25m from the eastern portal and gaps at the top edge of brick lined sections of the tunnel.
- Pill – occasional holes in the upper walls from drainage pipes/ missing bricks that may provide access to deep crevices in the brick lining.
- Sandstone – there are very occasional small gaps in the stone lining of the upper walls and ceiling, but these could lead to deep crevices.

4.9.20 There were not any potentially suitable cavities for hibernation within Clifton Tunnel no. 1 that could not be inspected.

4.9.21 Bat droppings discovered in Sandstone Tunnel on the 2nd February 2016 could not be recovered for DNA analysis because they were wet and disintegrated on contact. A sample for DNA analysis to confirm species identification could therefore not be obtained.

4.9.22 Data from static automated bat detectors deployed within the tunnels is unlikely to be exclusively related to roost behaviour. As discussed in Section 4.8.18, monitoring hibernation sites with static automated bat detectors for bat activity when animals arouse from hibernation is most effective when the bat detectors can be placed within enclosed roost spaces. The Portbury Freight Line tunnels are more exposed, and the bat detectors are likely to detect winter foraging activity of woodland bats as they pass through, or use sheltered flight areas within the tunnels.

4.9.23 Interpretation of the results has regard to other types of bat activity, such as winter foraging. Analysis of the data with consideration to daily ambient temperatures identifies core periods during the monitoring study when there are low temperatures and animals are most likely to assume extended periods of torpor for hibernation. The monitoring period from mid December to the end of February covers the core hibernation period of bat species in the UK. A failure of the SDHC card in the SM2 unit in Clifton No. 1 during the first deployment resulted in the loss of data from December 2016. However, data from January and February 2016 provides data from the key winter period when temperatures were at their lowest.

4.9.24 Climatic information from the Met Office summarizing the weather experienced in the UK during the winter of 2015/16 records the period December 2015 to February 2016 as the third-warmest for the UK (in a series from 1910), behind the winters of 1989 and 2007[3]. For England and Wales, it was the warmest winter in the series. Winter 2015/16 was also second-wettest for the UK (with only winter 2013/14 wetter). Winter monitoring was extended with a period January –February 2018 providing more typical cold winter weather conditions, when bats need to hibernate.

[3] The Met Office's best assessment of the weather that was experienced across the UK is based on all available data. It hosts the 'UK climate', which holds national and regional climate information for the United Kingdom dating back to 1910. Long-term averages are based on the latest 30-year period 1981-2010.

5 Baseline

5.1 Ecological Context

5.1.1 The landscape surrounding the Scheme supports a number of woodlands that are within areas designated for nature conservation. The DCO Scheme passes through the Avon Gorge Woodlands SAC, with the disused railway line ending approximately 3km west of the designated area. The Avon Gorge Woodlands are a stronghold for lesser and greater horseshoe bats. Ashton Court Site of Scientific Interest (SSSI), with parkland and woodland is situated 1.2km south of the Portbury Freight Line and 4.5km south-east of the disused railway line. Ashton Court SSSI is an important site for bats and supports a large lesser horseshoe maternity roost in Clarken Coombe Lodge. A radio-tracking study of lesser horseshoe bats from Clarken Coombe Lodge in 2008 (by Greena Ecological Consultancy) identified key foraging areas in Abbots Leigh, which is approximately 3km east-south-east from the disused railway line.

5.1.2 Lesser and greater horseshoe bats are qualifying features of the North Somerset and Mendip Bats SAC, which comprises component SSSIs within the Mendips and the North Somerset hills that provide a range of important breeding and hibernation sites for lesser horseshoe bat and greater horseshoe bat. Of particular note for this study is Brockley Hall Stables SSSI, which supports a greater horseshoe maternity colony. Brockley Hall Stables are approximately 9km south-west of the DCO Scheme (at NGR ST471696).

5.1.3 The Scheme falls within ‘Band C’ of the “Bat Consultation Zone” identified within the North Somerset and Mendips Bats SAC Guidance on Development (North Somerset Council, 2018). Bat Consultation Zone illustrates the geographic area where horseshoe bats may be found. It is divided into three bands, A, B and C, reflecting the density at which horseshoe species may be found at a distance from a roost site.

5.1.4 North Somerset supports a diverse assemblage of British bat species and BRERC holds a number of bat roost records within approximately 2.5km of the DCO Scheme, as shown in Table 18.

Table 18: Summary of BRERC Bat Roosts within Approximately 2.5km ***of the DCO Scheme***

Bat Species	**Roost Count***	**Date**	**Grid Reference**	**Approximate Distance (km)**
Lesser Horseshoe Bat	1	2008	ST5273	2.5
Greater Horseshoe	1	1996	ST4574	2.5
Pipistrelle sp.	97	1993	ST4677	1
	80	1994	ST4675	1
	1	2010	ST5376	1
Common Pipistrelle	2	2004	ST4675	0.8
Brown Long-eared	1	2009	ST5075	0.7
Noctule	1	2002	ST4773	>2.5
Noctule	1	2009	ST5075	0.7
Serotine	1	2002	ST4773	2.5
* Roost Count – a record of number of bats recorded at a given roost				

5.1.5 Avon Wildlife Trust hold bat records for bats at Portbury Wharf Nature Reserve, with the following records obtained between 2010 and 2016:

Roosts	Lesser horseshoe Soprano pipistrelle Common pipistrelle Common pipistrelle
Foraging Activity	Soprano pipistrelle Nathusius' pipistrelle Noctule Serotine Brown long-eared Myotis spp. (at least 3 species)

5.1.6 Natural features and quarries in the Avon Gorge provide an array of underground sites and rock features that bats can exploit for hibernation. The 1999 study (Quinn, 1999) commissioned by English Nature provides the most comprehensive survey of caves, rock shelters, shafts and tunnels for bats in the Avon Gorge. The project surveyed sites on both sides of the gorge. Ten of the 16 known sites on the western side of the gorge were surveyed, including Clifton no. 1 and Clifton no. 2 tunnels, which are referred to in the report as Southern railway tunnel and Northern railway tunnel, respectively. Nine of the 23 known sites on the east side of the gorge were surveyed.

5.1.7 The project recorded seven bats during a two-day period in March 1999

- One greater horseshoe bat (*Rhinolophus ferrumequinum*);
- Three lesser horseshoe bats (*Rhinolophus hipposideros*);
- One possible lesser horseshoe bat (unconfirmed identification);
- One daubenton's bat (*Myotis daubentonii);*
- One *Myotis* sp. bat.

5.1.8 In addition to the sightings of bats, greater horseshoe bat droppings were identified in one further site and lesser horseshoe bat droppings were present in two more sites.

5.1.9 A summary of the findings is presented in Table 19. The proximity to the nearest tunnel on the Portbury Freight Line provides an understanding of the underground roost resource in the local area. The location of caves, rock shelters and tunnels with hibernation roosts is shown on Figure 8.

Table 19. Bat hibernation Roosts Recorded in the Avon Gorge Caves in 1999

Site Name	**NGR**	**Bat Interest**	**Distance from Portbury Freight Line Tunnels (km)+**			
			Clifton 1	**Clifton 2**	**Sandstone**	**Pill**
West side of the Avon Gorge						
Cave seven (The Adit)	ST56447293	2 lesser horseshoe bats	**0.1**	0.7	2.6	4.2
Stokeleigh Camp Cave	ST56037331	1 lesser horseshoe bat Droppings	0.4	**0.3**	2.0	3.7
Northern railway tunnel*	ST561736	1 bat in flight (possible lesser horseshoe)	0.6	**0**	1.8	3.6
Lower Second Quarry Cave	ST55897437	1 daubenton's bat (female)	1.4	**0.7**	1.1	3.0
Burwalls Cave	ST56387289	1 *Myotis sp. bat*	**0.1**	0.8	2.6	4.2
Slab Quarry Cave	ST56107389	Bat droppings (unidentified)	0.8	**0.2**	1.6	3.4
East side of the Avon Gorge						
Hades Cave	ST56347393	Piles of lesser horseshoe droppings (previous record of 1 lesser horseshoe bat from 1985)	0.8	**0.3**	1.8	3.6
Bridge Cave/ Headmaster's Study/ Lower Cave	ST56527318	Piles of droppings – possibly greater horseshoe. This site has a long history of use by lesser horseshoe bats	**0.1**	0.6	2.4	4.2
Mercavity Cave	ST56657325	1 female greater horseshoe bat. Piles of droppings.	**0.3**	0.6	2.5	4.2
Notes *Clifton 2 tunnel +The distance to the nearest tunnel is highlighted in **bold**						

5.1.10 Table 20 shows hibernation records in caves and adits within the Avon Gorge (excluding Portbury Freight Line tunnels) recorded by Mr. Robert Pelc and Mr. Anton Kattan (as part of the Metro West surveys) and Mr. Sam Davis (for the Avon Bat Group member). The location of the underground roost sites are shown on Figure 8. Cave Seven (The Adit), which is within Network Rail land is shown on photographs 19 and 20 in Appendix 10.

Table 20. Bat hibernation Roosts Recorded in 2018 on the West Side of the Avon Gorge

Site Name	**NGR**	**Date**	**Bat Interest**	**Distance from Portbury Freight Line Tunnels (km)+**			
				Clifton 1	**Clifton 2**	**Sandstone**	**Pill**
Cave Seven (The Adit)	ST56447293	19/01/18	5 lesser horseshoe bats (and large accumulations of droppings)	**0.1**	0.7	2.6	4.2
		03/02/18	2 lesser horseshoe bats				
		06/03/18	9 lesser horseshoe bats				
Stokeleigh Camp Cave	ST56037331	03/02/18	1 lesser horseshoe bats	0.4	**0.3**	2.0	3.7
Skeleton cave (nr. Stokeleigh Camp)	N/A	09/01/18	1 lesser horseshoe bats	0.4	**0.3**	2.0	3.7
		23/02/18	1 lesser horseshoe bats				
Kernel Cave (on track to Grotto)	ST5468975065	09/01/18	c. 300 droppings (mixed age) lesser horseshoe	2.7	2	**0.3**	1.3
Paradise Bottom (on track to Grotto)	ST5478175209	09/01/18	c. 50 droppings lesser horseshoe	2.8	2.1	**0.2**	1.3

Site Name	NGR	Date	Bat Interest	Distance from Portbury Freight Line Tunnels (km)+			
				Clifton 1	Clifton 2	Sandstone	Pill
Upper Cliff Cave	ST5599873408	18/01/18	1 lesser horseshoe	0.5	**0.2**	1.9	3.4
Burwalls Cave	ST56387289	03/02/18	Bat droppings (unidentified)	**0.1**	0.8	2.6	4.2
Notes +The distance to the nearest tunnel is highlighted in **bold**							

5.2 Bat Activity on the Disused Railway Line

5.2.1 Thirteen bat species were recorded on, or immediately adjacent to the disused railway line during walked transects, static automated bat detector ('dataloggers') monitoring and trapping surveys. These were:

- Greater horseshoe bat *Rhinolophus ferrumequinum*;
- Lesser horseshoe bat *Rhinolophus hipposideros*;
- Serotine bat *Eptesicus serotinus*;
- Leisler's bat *Nyctalus leisleri*;
- Noctule bat *Nyctalus noctula*;
- Common pipistrelle *Pipistrellus pipistrellus*;
- Soprano pipistrelle *Pipistrellus pygmaeus*;
- Nathusius' pipistrelle *Pipistrellus nathusii*;
- Brown long-eared bat *Plecotus auritus*;
- Daubenton's bat *Myotis daubentonii;*
- Natterer's bat *Myotis nattereri*;
- Whiskered bat *Myotis mystacinus*;
- Possible Brandt's *Myotis brandti .*

Walked Transects

August to October 2014

5.2.2 The species recorded on the disused railway line between August and October 2014 on transect walks are listed below, with an overview of the activity in late summer and autumn. The distribution of species records is shown on Figures 6a (horseshoe bats) and 6b (other species, excluding common pipistrelle bats).

Common pipistrelle bats were recorded in all four sections of the disused railway line (defined in Section 2.1) during walked transects and the distribution other bat species is shown on Figures 6a and 6b.

Lesser horseshoe bat	Lesser horseshoe bats were at The Portbury Wharf Area in August and September, where they appear to be foraging.
Greater Horseshoe bat	Recorded at The Portbury Wharf Area in August and at the Royal Portbury Dock in August and September.
Myotis bat species	Recorded at The Portbury Wharf Area in August. Recorded from the Royal Portbury Dock and to the east of the farmland in September.
Soprano pipistrelle bat	A low to moderate level of activity along the disused railway line, but the distribution of activity appeared patchy. The highest levels of activity were recorded at Royal Portbury Dock and The Portbury Wharf Area.
Common pipistrelle bat	Recorded at most of the walked transect stops, common pipistrelle bats are considered to be present along the entire length of the disused railway line.

<u>May 2015 to April 2016</u>

5.2.3 Following vegetation clearance along the disused railway line in 2015 a standardized transect route for the walked transects was established. The transect route followed the track alignment with 10 transect listening station stops, as shown on Figure 2b.

5.2.4 The level of activity recorded at transect stops within each section of the disused railway line is characterised according to the following categories:

High	Constant foraging activity or flight behaviour by several bats.
Moderate	Regular passes and foraging activity.
Low	Occasional bat passes or foraging by a single bat.
None	No bat activity.

5.2.5 The results of the monthly transect surveys are presented in Appendix 2 and the distribution of uncommon and rare bat species are illustrated on Figures 7a-7c. Common pipistrelle and soporano pipistrelle occurred along the entire transect route and therefore distribution maps for these species are not required.

Static Automated Bat Detectors on the Disused Railway Line 2014 and 2015

5.2.6 Static automated bat detectors ('dataloggers') provide long-term monitoring of the disused railway line between August 2014 and August 2015. Between two and three dataloggers were deployed each month and the rare or uncommon species recorded in each section of the disused railway line are summarized in Table 21. A detailed account of all species by month and datalogger location is provided in Appendix 3. The location of the dataloggers is shown on Figure 3.

Table 21. Number of Nights that Uncommon and Rare Species were Recorded on Sections of the Disused Railway Line by Static Automated Bat Detectors in 2014 and 2015.

Location	**Total No. of Nights**	**Number of Nights Species were Recorded**								
		Pn	**Pa**	**Msp**	**Nl**	**Nn**	**Es**	**Nl/Nn or Es**	**Rh**	**Rf**
Royal Portbury Dock	92	2	1	37	16	50	13	43	17	28
Portbury Wharf Area	42	5	7	21	2	12	4	7	6	6
Farmland	79	5	18	53	13	35	19	49	15	36
Total	213	12	26	111	31	97	36	99	38	70

Notes
Species key – Pn Nathusius' pipistrelle (*P. nathusii*); Pa Long-eared (*Plecotus sp.)*Msp (Myotis sp); Nl Leisler's (*Nyctalus leisleri)* Nn Noctule (*Nyctalus noctula*); Es Serotine (*Eptesicus serotinus)* Rh Lesser horseshoe (*Rhinolophus hipposideros*); Rf Greater horseshoe (*Rhinolophus ferrumequinum*).

5.2.7 The data from the static bat detectors were interrogated to determine the frequency species occurred on the disused railway line between August 2014 and August 2015. The approximate time after sunset[4] bats were recorded on the disused railway line was calculated because this can provide an estimate of the time since emergence (from a day roost) the bat activity occurred.

[4] The calculation of time after sunset is approximate to within 15 minutes.

5.2.8 The results of the monthly datalogger monitoring are presented in Appendix 3 and are summarized in Table 22. The assemblage of rare and uncommon bats recorded at datalogger locations along the disused railway line is illustrated on Figures 7a-c.

Table 22. Summary of Datalogger Results for Rare and Uncommon Bat Species in 2014 and 2015

Bat Species	**Datalogger Location (Figure 3)**	**Earliest Registration of the bat Species**		
		Date	**Time after sunset (hrs:mins)**	**Location (Figure 3)**
Lesser horseshoe	S1a, S1b, S2a S3 S4 S5a S6a, S6b S7a S9b S8a S10a S11a S12a	28/08/14	01:08	S1b Portbury Wharf Area
Greater horseshoe	S1a S2b S3 S5a S6a, S6b S7a S8a, S8b S9a, S9b S10a, S10b, S10c S11a, S11b, S11c S12b, S12c	29/07/15	00:41	S11a Royal Portbury Dock
Noctule	S1a S2b S5a S6a, S6b S7a, S7b S8a, S8b	09/4/15 18/05/15 31/05/15	00:00 00:00 00:00	S2b, S6b, S7b Royal Portbury Dock

Bat Species	Datalogger Location (Figure 3)	Earliest Registration of the bat Species		
		Date	Time after sunset (hrs:mins)	Location (Figure 3)
	S9a S10a, S10b, S10c S11a, S11b S12a, S12b, S12c			
Leisler's	S6b S7b S8b S9b S10b, S10c	21/05/15	00:10	S6b Royal Portbury Dock
Serotine	S6b S7b S8b S9b S10b, S10c S11b, S11c S12b,S12c	30/06/15	00:12	S9b Farmland
Myotis sp.	S1a, S1b S2b S5a S6a, S6b S7a, S7b S8a, S8b S9a S10a, S10b, S10c S11a, S11b, S11c S12a, S12b, S12c	28/08/14	00:30	S1b Portbury Wharf Area
Nathusius' pipistrelle	S8b S9b S10b, S10c	12/07/15	00:39	S10b Portbury Wharf Area

Trapping

5.2.9 Four nights of trapping on the disused railway line were undertaken in June and July 2015. The primary objective was to capture lesser or greater horseshoe bats for radio-tracking. The trapping survey captured one male greater horseshoe bat (Bat 1) on the 23rd June 2015. The results of the subsequent 2015 radio tracking study on Bat 1 are presented in Section 5.2.14 to Section 5.2.20.

5.2.10 Five nights of trapping on the disused railway line in June 2018 were undertaken with the primary objective of capturing greater horseshoe bats for radio-tracking. The trapping survey captured one female greater horseshoe bat (Bat 2) on the 14th June 2018. The results of the subsequent radio tracking study in 2018 are presented in Section 5.2.21 to Section 5.2.28.

5.2.11 The trapping surveys were also aimed at identifying breeding colonies that may be using the railway line. The capture results shown in Table 23 confirm that brown long-eared bats and common pipistrelle bat maternity sites are close to the disused railway line with animals being caught on the Portbury Wharf Area and farmland near Sheepway. No rare or uncommon breeding female bats were caught.

Table 23. Trapping Survey Results on the Disused Railway Line

Date	Time (hrs)	Location & Trapping Site Ref*	Species	Sex	Age	Breeding Status
23/06/15		Station Road, Sheepway				
	22:15	TR1a	Pa	F	A	Non-breeding
	22:15	TR1c	Pa	F	A	Pregnant
	22:55	TR1a	Ppyg	M	A	-
	23:15	TR1d	Pp	M	A	-
	00:20	TR1c	Ppyg	M	A	-
	01:15	TR1b	**Rf**	5.2.11.1	5.2.11.1	-
24/06/15		Wessex Water Building, off Portbury Hundred				
	23:45	TR2a	Pp	M	A	-
	00:22	TR2a	Ppy	M	A	-
20/07/15		Station Road, Sheepway				
	23:58	TR3a	Ppy	M	A	-
22/07/15		Portbury Wharf Area				
	22:00	TR4b	Pp	M	A	-
	22:15	TR4b	Pp	F	A	Lactating
	22:40	TR4b	Nn	M	A	-
	22:45	TR4b	Nn	M	A	-
	23:00	TR4b	Pa	F	A	Lactating
10/06/18	22:20	TR5a	Pp	M	A	Pregnant
	22:20	TR5a	Ppy	F	A	Non-breeding
	22:54	TR5d	Pa	F	A	Pregnant
	22:56	TR5d	Pa	M	A	
	23:45	TR5e	Mm	M	A	
11/06/18	22:50	TR6a	Pp	F	A	Not breeding
	23:15	TR6e	Pp	F	A	Pregnant
	01:24	TR6b	Mm	M	A	
12/06/18	22:52	TR7b	Mm	F	A	Unknown

Date	Time (hrs)	Location & Trapping Site Ref*	Species	Sex	Age	Breeding Status
	01:15	TR7c	Ppy	F	A	Not breeding
	01:32	TR7a	Mm	M	A	
	01:32	TR7a	Pp	F	A	Pregnant
	01:32	TR7a	Ppy	M	A	
	01:43	TR7b	Ppy	M	A	
13/06/18	22:10	TR8a	Pp	M	A	
	22:10	TR8a	Ppy	M	A	
	22:10	TR8a	Ppy	M	A	
	22:10	TR8a	Ppy	M	A	
	22:40	TR8a	Pp	F	A	Pregnant
	22:50	TR8a	Pa	F	A	Unknown
	23:02	TR8b	Md	M	A	
	03:36	TR8a	Mm/Mb	F	A	Pregnant
14/06/18	22:17	TR9g	Pa	F	A	Pregnant
	22:52	TR9a	Pa	M	A	
	23:22	TR9g	Mm	F	A	Not breeding
	23:38	TR9a	Mn	M	A	
	00:32	TR9a	Pp	M	A	
	00:56	TR9a	Pa	F	A	Pregnant
	02:42	TR9g	**Rf**	F	A	Pregnant

Notes
*Trapping sites shown on Figure 2b
Species key –Pp Common pipistrelle (*P. pipistrellus*); Ppy Soprano pipistrelle *(P.pygmaeus);* Pa Long-eared (*Plecotus sp.)* Nn Noctule (*Nyctalus noctula*); Md Daubenton's (*M. daubentonii);* Mm Whiskered (*M. mystacinus);* Mb Brandt's (*M. brandti);* Mn Natterer's (*M. nattereri);* Rf Greater horseshoe (*Rhinolophus ferrumequinum*).
Rf - bold font denotes radio transmitter fitted.
M – Male; F - Female
A – Adult; J – Juvenile

5.2.12 In 2015 a total of 14 bats and five species were caught during the four nights of trapping on the disused railway line. In addition to the rare greater horseshoe bat (Bat 1), the survey recorded noctule bats, which are considered to be an uncommon species. Common pipistrelle, soprano pipistrelle and brown long-eared bats are all common and widespread species.

5.2.13 In 2018, at total of 30 bats and seven species were caught during the five nights of trapping on the disused railway line. In addition to the rare greater horseshoe bat (Bat 2), the survey captured/confirmed the presence of common pipistrelle, soprano pipistrelle, brown long-eared bats, Daubenton's and Natterer's which are all relatively common and widespread species. In addition a number of small *Myotis* species (whiskered or Brandt's bat), were also captured. These species are considered less common.

Greater Horseshoe bat Radio-tracking Study

Bat 1. Greater horseshoe male (June 2015)

5.2.14 A male greater horseshoe bat (Bat 1) was captured on the 23rd June 2015 at NGR ST 49337 75713 where the disused railway line passes through a farmland landscape.

5.2.15 Bat 1 was fitted with a radio-transmitter (Tag number 2742) and was subsequently tracked every night until the morning of the 27th June, providing 3.5 nights of tracking data.

5.2.16 Bat 1 was initially tracked west and south of the capture location, until the signal was lost south of the M5. A search of the area on the 24th June relocated Bat 1 in the Wraxall area where it returned to roost in an outbuilding in the village of Wraxall.

5.2.17 The following night, Bat 1 emerged at approximately 22:15hrs and flew in woodland/pasture to the north of Wraxall and then various habitats to the north and east of the town of Nailsea. It roosted in an outbuilding within a complex of farm buildings at Deerhurst Farm. This second roost location is south of Nailsea.

5.2.18 On the 26th June, Bat 1 emerged at 22:21hrs and moved along the river corridor to the south and east of Nailsea and in the Wraxall area. The river corridor is characterised by damp, grazed pasture with tree lines and hedges. On the morning of the 27th June Bat 1 roosted in a new location in outbuildings at Brockley Hall SSSI, which is part of the North Somerset and Mendip SAC. Brockley Hall supports a greater horseshoe bat maternity roost and the species is a qualifying feature of the North Somerset and Mendip SAC.

5.2.19 Minimum Convex Polygons (MCP) and cluster analysis showed that the Bat 1's home range area was 1858.5 ha with a range span of 9.2km. This was also the maximum distance from the capture location. This radio-tracking data for Bat 1 are summarised below:

Date Captured	23rd June 2015
Capture Location	NGR ST 49337 75713, approximately 230m from Station Road.
Duration of tracking survey	3.5 days
Number of tracking fixes	61
Maximum distance travelled in one night	5.1km
Home Range Area	1858.5 ha
Range Span (and distance from disused railway)	9.2km

5.2.20 Figures 4a-4c illustrate the Bat 1's home and core ranges in relation to the Scheme. Bat 1's "outer range" is shown on Figure 4a by the 100% MCP. Cluster analysis for 50% and 75% of the locations on Figure 4b shows where the bat's activity was concentrated over the survey period. Figure 4c provides a representative view of how Bat 1 used the landscape.

Bat 2. Greater horseshoe female (June 2018)

5.2.21 A pregnant female greater horseshoe bat (Bat 2) was captured on the 14th June 2018 at NGR ST 47967 76183.

5.2.22 Bat 2 was fitted with a radio-transmitter (1438) and was subsequently tracked every night until the morning of the 18th June, providing 3.5 nights of tracking data.

5.2.23 The bat was initially tracked west and south of the capture location, and then it roosted in stables on Caswell Lane north of the M5 motorway. The bat was roosting alone and had not returned to a maternity roost. Bat 2 crossed under the M5 motorway at Caswell Lane (NGR ST 48929 74959).

5.2.24 The following night (15th June), Bat 2 emerged at approximately 21:57hrs and flew/foraged around various habitats surrounding Lower Failand, moving south towards Wraxall, and finally heading further south, until it roosted in outbuildings at Brockley Hall SSSI, which is part of the North Somerset and Mendip Bats SAC. Brockley Hall supports a greater horseshoe bat maternity roost and the species is a qualifying feature of the North Somerset and Mendip Bats SAC.

5.2.25 On the 16th June, Bat 2 did not emerge until 23:30hrs, approximately 2 hours after sunset. Count of 349 greater horseshoe bats was recorded from the roost. Bat 2 travelled north to foraging areas south of the disused railway line and Prior's Wood (ancient woodland). On the morning of the 17th June the bat roosted in a new roost location at a stables between Failand and Lower Failand villages. A daytime roost inspection on the 17th June confirmed Bat 2 was roosting alone.

5.2.26 On the 17th June, Bat 2 emerged at 21:54 and foraged in similar areas to the previous night. The signal from the radio transmitter tag on Bat 2 became static in Priory Woods at around 03:00 hrs, and the tag was subsequently found on the forest floor (at 06:30 hrs) confirming the tag had fallen off.

5.2.27 Radio-tracking data for Bat 2 are summarised below:

Date Captured	14th June 2018
Capture Location	NGR ST4796776183
Duration of tracking survey	3.5 days
Number of tracking fixes	147
Maximum distance travelled in one night	8.1km
Home Range Area	3042.2 ha
Range Span (and distance from disused railway)	9.3km

5.2.28 Figures 4d-4e illustrate the Bat 2's home and core ranges in relation to the Scheme. Bat 2's "home range" is shown on Figure 4d by the 100% MCP. Cluster analysis for 80% of the locations on Figure 4e shows where the bat's activity was concentrated over the survey period.

5.3 Standardised Static Automated Bat Detector Acoustic Monitoring for Lesser and Greater Horseshoe Bats in 2016

5.3.1 The level of bat activity captured on data loggers was analysed to identify spatial and seasonal variation in habitat use on the disused railway line. Detailed analysis of these data for lesser and greater horseshoe bats in Sections 5.3.2 to 5.3.13 examines statistical differences in the bat activity. The statistical results and standardised BAI of the spatial and temporal comparison discussed in the text are presented in Appendix 4. Graphs A1 through to D2 and Tables B1-B4 in Appendix 4 are referenced in the following sections. Data logger locations are shown on Figure 3.

Whole study site: wide spatial and temporal resolution

5.3.2 Lesser horseshoe bat activity across the study site as a whole was lowest in June but increased slightly through June and July, peaking in September with bat activity more than three times greater that of June. This is shown on Graph A1.

5.3.3 Greater horseshoe bat activity was greatest in June, after which activity reduced to negligible levels by September, as shown on Graph A2.

Spatial variation across the disused railway line

5.3.4 Lesser horseshoe bat activity was consistently highest at the eastern-most end of the disused railway line (datalogger 5 at the M5) each month between May and September, with the highest bat activity occurring in September, as shown on Graph B1. Datalogger 1 (Portbury Wharf Area) also recorded the highest level of lesser horseshoe activity at the western-most location in September. The lowest lesser horseshoe bat activity occurred within the farmland and Royal Portbury Docks in the middle of the rail line (dataloggers 3 & 4) from May - August, increasing at these locations in September.

5.3.5 Statistical analysis of lesser horseshoe bat activity between dataloggers and months showed bat activity to be statistically significantly greater in September than in any other month (see Table B1). Datalogger 5 at the M5 was found to have statistically significantly higher lesser horseshoe bat activity than any other data logger (see Table B2).

5.3.6 Greater horseshoe bat activity was highest at the western end of the disused railway line (data logger 1) in the Portbury Wharf Area, near to Portishead in each month with the exception of May, when data logger 4 at Royal Portbury Docks recorded the most greater horseshoe bat activity, as shown on Graph B2. Greater horseshoe bat activity at datalogger 1 peaked in June and then dropped in July through to September, whilst greater horseshoe activity at datalogger 4 was greatest in May before gradually reducing from June onwards. The lowest greater horseshoe bat activity in every month was recorded at dataloggers 3 and 5. Greater horseshoe bat activity at datalogger 2 within the farmland followed a similar seasonal pattern to that at datalogger 1 (Portbury Whaf Area), but levels of activity were considerably lower.

5.3.7 Tables B3 and B4 show the results of the statistical analysis for greater horseshoe bat activity. Greater horseshoe activity in June is shown to be statistically significantly greater than in either August or September, and was close to having statistically significantly higher greater horseshoe bat activity than May. September was also found to have statistically significantly lower activity than all other months. The statistical comparison between dataloggers revealed that:

- dataloggers 1, 2 and 4 did not have statistically significantly different activity when compared across the whole study period;
- dataloggers 3 and 5 did not have statistically significant different levels of activity from each other.
- data loggers 1, 2 and 4 all have statistically significant greater levels of activity than loggers 3 and 5, however.

High temporal resolution at key locations

5.3.8 Peak lesser horseshoe bat activity occurred on 25th September at both the east (datalogger 5) and west (datalogger 1) ends of the disused railway line. Nightly bat activity at the east end of the line was higher and more consistent from the 19th - 25th September than at the west end of the line, where nightly bat activity fluctuated between days. At both the east and west ends, lesser horseshoe bat activity dropped off and was minimal after the 25th September, which is when datalogger 1 in the Portbury Wharf Area had been moved to its second location further east from the edge of Portishead and datalogger 5 had been moved to the east side of the M5 motorway. Daily lesser horseshoe bat activity in September at dataloggers 1 and 5 is shown on Graph C1.

5.3.9 There was no evidence of any repeated pattern of hourly lesser horseshoe bat activity recorded by either datalogger 1 or 5 in September. This can be seen on Graphs C2i-C2xii.

5.3.10 Greater horseshoe bat activity was very low in May for dataloggers 1 and 4 until the end of the month, when activity increased at data logger 4 from the 25th - 29th May. This is shown on Graph C3i. In June, greater horseshoe bat activity at the west end of the disused railway line (datalogger 1) occurred each day from the 6th to 12th June. Virtually no greater horseshoe activity was detected by datalogger 4 during this time, with some irregular activity detected on just three days later in the month on 14th, 17th and 18th June. This is shown on Graph C3ii.

5.3.11 An assessment of the hourly bat activity within the last seven study nights in May for datalogger 4 revealed that all greater horseshoe bat activity at this location occurred between midnight and 03:00hrs, with peak activity occurring from 02:00-03:00hrs (as shown on Graphs C4i-C4vii). Graphs C5i to C5vii show that all greater horseshoe bat activity at datalogger 1's location in the Portbury Wharf Area in June occurred between 01:00-04:00hrs, with peak activity generally occurring between 02:00-03:00hrs.

LHS activity near the M5 motorway (datalogger 5)

5.3.12 Although comparisons between the two datalogger locations are imperfect because they monitor activity over consecutive weeks, Graph D1 shows the differences in lesser horseshoe bat activity between locations 5a and 5b in each month. It would appear that location 5a had greater bat activity compared to location 5b in May, August and September, whilst in July there was more activity at location 5b and in June activity was equal between the two locations. Statistical analysis confirmed that bat activity across the whole study period was statistically significantly lower at location 5a than at location 5b (GLM: t = -2.669, p = 0.0093).

5.3.13 Graph D2 shows the daily lesser horseshoe bat activity at both locations in each month. When the datalogger was moved to location 5b on the east side of the M5 motorway, lesser horseshoe bat activity in September (the month with the highest recorded activity) was statistically significantly lower than at location 5a, on the west side of the motorway, in the week preceding the location change. Although it is unknown whether lesser horseshoe bat activity at location 5a continued to be high following the datalogger's location change, or whether lesser horseshoe bat activity was generally reduced after the 25th September, the consistently higher levels of activity at location 5a prior to the location change and the sudden drop in activity at location 5b suggest that the area to the west of the M5 motorway is more important to lesser horseshoe bats than the area to the east side of the motorway.

5.4 Bat Roosts on the Disused Railway line

Roosts in Structures

5.4.1 The bridge structures and culverts along the disused railway line evaluated as having low to moderate potential for bat roosts were surveyed according to industry standard guidelines.

5.4.2 Two of the seven bridges surveyed (by dusk activity surveys) supported bat roosts. These were:

- Bridge B2 – a brick arch bridge for Sheepway, at the western end of the farmland.
- Bridge B4 – a concrete bridge that takes Portbury Dock Road over the disused railway line.

5.4.3 The bridges are used by low numbers of common pipistrelle and soprano pipistrelle bats as a day roost and have been assessed as being small roosts that would be occupied by males or non-breeding females.

5.4.4 In addition to the two day roosts recorded in bridges over the disused railway line, a probable night roost for lesser and greater horseshoe bats was identified in a small, derelict railway store at NGR ST 49542 75696 close to the bridge at Station Road, Sheepway. The night roost was discovered by the automated static bat detector monitoring surveys (described in Section 4.3.2). Datalogger units S8a (AnabatSD1) and S9b (SM2Bat) deployed at the railway store (between the 9th June and 5th July 2015) recorded regular nightly activity at the building.

5.4.5 The locations of bat roosts on the disused railway line are shown on Figure 5 and the results of the roost surveys are summarised in Table 24. Details of the daytime scoping appraisal and evaluation of structures for bats are provided in Appendix 5.

5.4.6 The culverts under the disused railway line are considered to have negligible to low potential for bats to roost. Culverts were typically small concrete pipes (c.1.5m diameter) with brick buttresses. Several of the culverts were flooded when surveyed in March 2015 and it was evident from high water levels that others are likely to flood too. The culverts are relatively short (spanning the railway embankment) and their construction and design is generally unfavourable for bat roosts because there is limited shelter in the pipes and no voids or crevices in the structures.

Table 24. Confirmed Bat Roosts in Structures

Figure 5 Ref*	Grid Reference	Bat Species	Peak Count	Roost Type	Roost Description
B2	ST48504 76004	Common pipstrelle	1	Day roost – non breeding	Behind ivy vegetation on western aspect of bridge.
B4	ST 50646 75961	Soprano pipistrelle	4	Day roost – probably non breeding	Expansion joint at the top of the south abutment wall.
		Common pipistrelle	1	Day roost – non breeding	Expansion joint at the top of the north abutment wall.
NR	ST 49542 75696	Lesser horseshoe Greater horseshoe	-	Night roost	Small derelict store. The building has no door.

Tree Roosts

5.4.7 The assessment of trees recorded four trees with high potential and seven trees moderate bat roost potential within, or immediately adjacent to the disused railway line land. Detailed inspection of the trees using roped access climbing equipment did not find any evidence of bat roosts in the trees.

5.4.8 Of particular note with regard to potential for bats to roost in trees on the disused railway line are three of the four trees with high potential located at The Portbury Wharf Area (shown on Figure 5). The three high potential trees (T1, T8 and T9) contain woodpecker holes, a favoured tree feature for noctule bat roosts. Noctule bats were recorded at The Portbury Wharf Area at sunset and therefore probably roost in trees close to the disused railway line and, although no evidence was found, the possibility this species may roost within the DCO Scheme should not be discounted. Tree roosts can be exceptionally difficult to find because bats will frequently switch roosts, even when nursery colonies are established, and field signs of previous use by bats can disappear quickly.

5.4.9 Details of trees with high and moderate potential for bats is given in Appendix 6 and the location of trees is shown on Figure 5.

Lodway Farm Buildings

5.4.10 There are no confirmed bat roosts at Lodway Farm. The preliminary survey of the eight agricultural buildings did not record any field signs of roosting bats within the interior of the buildings.

5.4.11 The preliminary survey assessed the agricultural buildings as having low to moderate bat roost potential because of crevice features in the fabric of some of the buildings. The building appraisal is described below and photographs (photo 23 to 32) of the buildings shown in Appendix 10.

Building LF 1	A traditional stone barn with an upper storey level that is connected to the adjacent milking parlour with internal doors on the ground floor. The interior of the barn is relatively exposed because uncovered window openings on both floors allow natural light through. Environmental conditions in the buildings are also drafty and cool and there are no enclosed voids or roof spaces. The pitched roof of the barn has a clay tile cover and there is a hole in the north-west corner of the building. This provides crevice roost opportunities under the broken tiles. However, elsewhere the roof cover is complete. Parapets walls at the gable ends block access at the edge of the roof. The underside of the roof is lined by wattle and plaster that is falling away. Holes in the plaster may allow bats access between the roof cover, but the absence of any bat droppings on the upper floor of the building suggests there has not been any significant use by roosting bats. The roof has a pegged timber frame, but all the joints are tightly fitted and there are no gaps for bats. Although the building is disused, the stone walls of the barn are well pointed and there are no significant gaps from missing mortar that could be exploited as a

communal bat roost. There may however be opportunities for solitary bats to roost.

Building LF 1 is evaluated as having moderate potential to support a significant roost because there are opportunities for crevice dwelling bats to roost in the damaged roof.

Building LF 2 A milking parlour attached to LF 1 has a steel frame, stone walls and timber roof structure with clay tile covering. The building is derelict and the roof is in a very poor state of repair. The building has two pitched roofs with a central valley. Parts of the roof have collapsed and skylights are missing. The interior of the building is very exposed and is well lit by natural daylight.

The interior of the milking parlour is painted white and this covers most of the roof beams. The underside of the roof has wattle and plaster finish that is in disrepair. Opportunities of bats to roost are limited to localised crevice features, such as damaged roof beams or gaps between window lintels. No evidence of roosting bats was found during close inspection of the window lintels. The availability of crevice features is unlikely to support a communal roost, but the possibility solitary bats may shelter within the interior cannot be discounted.

Opportunities for bats to roost on the exterior of the milking parlour are limited to damaged areas of the roof where there are gaps under roof tiles. The stone walls are well pointed and do not have any deep crevice features.

Building LF 2 is evaluated as having low potential to support a significant roost because the construction and condition of the building offers limited shelter for communal bat roosts.

Building LF 3 The Dutch barn has a steel frame and domed corrugated sheet roof. There are no walls or enclosed roof space and no crevice opportunities within the building fabric.

Building LF 3 has no bat roost potential.

Building LF 4

The derelict animal shelters adjacent to the milking parlour are in ruins. All that remains are the stone and block walls. The roofs have collapsed and the building has become overgrown with dense scrub vegetation, with mature plants growing out of the walls. The building does not provide any meaningful shelter for roosting bats as the interior is exposed and the dense vegetation obscures any crevice features in the walls.

Building LF 4 has no bat roost potential.

Building LF 5

A tin shed that has fallen into disrepair is situated north-east of the milking parlour. The simple timber structure has sheet metal walls and a roof that has collapsed. The construction of the building is unsuitable for bats and there is no significant shelter within the interior because of the poor state of repair.

Building LF 5 has no bat roost potential.

Building LF 6

An open fronted wood store that has been erected against the boundary stone wall. It is has one gable wall and a pitched roof constructed of reclaimed beams and a corrugated tin cover. The simple construction and open character of the building does not offer any meaningful shelter for roosting bats.

Building LF 6 has no bat roost potential.

Building LF 7

A traditional two storey stone barn that is used for storage. The building is in very good repair. The stone walls are pointed and the barn has a new roof with clay tiles and bitumen felt lining. A slated roof vent at the apex of the roof provides access for bats to the interior, but the absence of bat droppings or other fields signs is a clear indication bats have not sheltered on the underside of the roof. Glazed windows and a tightly fitted door blocks bat access through these openings.

The only opportunities for bats to roost on the exterior of the barn are cavities at the top of the stone walls where there are gaps behind the weather boarding on the southern elevation of the building. Parapets walls at the gable ends block access at the edge of the roof.

Building LF 7 is evaluated as having moderate potential because there are a few suitable external crevices at the top of the walls.

Building LF 8

A large traditional open fronted barn that is used as a machinery store. It has a similar construction to Building LF 6 and is in good condition. The stone walls of the barn are solid and well pointed and the roof is complete, although gaps were noted at the edge of a couple of the ridge tiles. This could provide a cavity space for bats under the roof cover.

The underside of the roof is lined with wattle and plaster. Crevice dwelling bats could exploit gaps around the lining. However, the main machinery store of the barn is not enclosed and the underside of the roof is open.

A workshop at the western end of the barn was locked and could not be inspected. However, an external examination of the workshop did not identify any bat access points.

Building LF 8 is evaluated as having moderate potential because there are a few suitable external crevices on the building.

5.5 Portbury Freight Line Tunnels

Summer Roosts

5.5.1 The trapping surveys at the tunnel portals of Clifton 1, Clifton 2, Sandstone and Pill on Portbury Freight Line in June and August 2016 confirmed that there are no bat maternity roosts in any of the structures. This substantiates the findings of the trapping surveys undertaken in June and July 2015, which did not record any breeding females of rare or uncommon bat species in the vicinity of the tunnels. The results of the trapping surveys are shown in Tables 25a and 25b.

5.5.2 During the trapping surveys, the following records of bats emerging from the tunnels were recorded:

22 June 2015	Clifton 1	1 Common pipistrelle bat	Possible emergence from the east portal 12 minutes after sunset
22 June 2015	Clifton 2	2 Lesser horseshoe bats	Emerged from the west portal 27 minutes after sunset
23 July 2015	Sandstone	2 Long-eared bats	Emerged from west portal 22 minutes after sunset
2 June 2016	Clifton 1	1 Natterer's bat	Adult male bat caught harp trap at north-west portal having emerged from a crevice in the north wall.
17 Aug 2016	Clifton 2	1 Daubenton's bat	Adult male caught in mist net at north portal.
17 Aug 2016	Clifton 2	2 Common pipsitrelle bats	2 adults, 1 male and 1 non-breeding female.

Table 25a. Trapping Survey Results in June and July 2015 near Tunnels on Portbury Freight Line

Tunnel	Date	Time (hrs)	Species	Sex	Age	Breeding Status
Clifton 1	22/06/15	21:50	Ppy	M	A	-
		21:57	Ppy	M	A	
	27/07/15	22:04	Ppy	F	A	Non breeding
		22:17	Ppy	M	A	-
Clifton 2	22/06/15	-	None	-	-	-
	21/07/15	-	None	-	-	-
	23/07/15	-	None	-	-	-

Tunnel	Date	Time (hrs)	Species	Sex	Age	Breeding Status
Pill	21/07/15	21:22	Pp	F	A	Lactating
		21:24	Pp	F	A	Lactating
		21:24	Pp	F	A	Lactating
		21:46	Pp	M	A	-
		22:30	Nl	F	A	Non breeding
	27/07/15	22:26	Ppy	F	J	-
Sandstone	23/07/15	21:40	Es	M	A	-
		21:55	Mn	M	A	-
		22:20	Ppy	M	A	-
		22:45	Pa	M	J	-
		23:00	Es	M	A	-
		23:05	Ppy	M	A	-
		23:06	Pp	F	J	-
		23:20	Ppy	F	A	Non breeding
		00:05	Pp	M	A	-

Notes
Species key –**Pp** Common pipistrelle (*P. pipistrellus*); **Ppy** Soprano pipistrelle *(P.pygmaeus);* **Pa** Brown long-eared (*Plecotus auritus)* **Nl** Leisler's (*Nyctalus leisleri*); **Es** Serotine *Eptesicus serotinus;* **Mn** Natterer's (*Myotis nattereri)*.
M – Male; F - Female
A – Adult; J – Juvenile

Table 25b. Trapping Survey Results in June and August 2016 at the Tunnel Portals on Portbury Freight Line

Tunnel	Date	Time (hrs)	Species	Sex	Age	Breeding Status	Roost Emergence from Tunnel
Clifton 1	2 June	21:43	Mn	M	A	-	Yes
		22:01	Pp	M	A	-	No
		22:16	Ppy	F	A	Non breeding	No
	17 Aug	21:58	Ppy	M	A	-	No
		22:04	Ppy	F	A	Breeding	No
Clifton 2	2 June	21:26	Pa	-M	A	-	No
		21:54	Pp	F	A	Non-breeding	Yes
		22:16	Pp	M	A	-	Yes
	17 Aug	20:45	Py	M	A	Mating	No
		20:45	Py	F	A	Post-lactating	No

Tunnel	Date	Time (hrs)	Species	Sex	Age	Breeding Status	Roost Emergence from Tunnel
		20:45	Pp	F	A	Non-breeding	No
		21:20	Md	M	A	-	Yes
		22:00	Ppy	M	J	-	No
		22:00	Ppy	F	A	Non-breeding	No
		22:00	Ppy	F	J	-	No
		22:30	Pp	F	A	Non-breeding	No
		22:30	Pp	F	A	Non-breeding	No
Pill	2 June	21:54	Pp	F	A	Non-breeding	No
		21:58	Pp	M	A	-	No
		22:16	Md	M	A	-	No
	17 Aug	21:48	Pp	M	A	-	No
		22:06	Pp	F	A	Non-breeding	No
		22:08	Pp	M	A	-	No
		22:23	Pp	M	A	-	No
		22:23	Pp	F	A	Non-breeding	No
		22:32	Pp	M	A		No
		22:43	Pp	M	A		No
		22:43	Pp	M	A		No
		22:50	Pp	F	A	Non-breeding	No
Sandstone	2 June	22:16	Pa	M	A	-	No
		23:34	Pp	M	A	-	No
		23:39	Pp	F	A	Non-breeding	No
	17 Aug	21:18	Rh	F	J	-	No
		22:01	Es	M	A	-	No

Notes
Species key –Pp Common pipistrelle (*P. pipistrellus*); Ppy Soprano pipistrelle *(P.pygmaeus);* Pa Brown long-eared (*Plecotus auritus*; Es Serotine *Eptesicus serotinus;* Mn Natterer's (*Myotis nattereri)*; Md Daubenton's (*Myotis daubentoni).*
M – Male; F - Female
A – Adult; J – Juvenile

Late Summer and Autumn Roosts

5.5.3 A daytime inspection on the 15th October 2015 recorded evidence of bat roosts from droppings in, or around cavities in the walls of two of the tunnels. The survey found the following evidence of bat roosts:

Clifton 2	Deep fracture in the roof of the tunnel, approximately 20m from south portal	Accumulation of 4 droppings	Droppings characteristic of lesser horseshoe bat, but DNA analysis of the sample failed.
Sandstone	Gap in a side refuge arch on the north wall (6th arch from NW portal).	Accumulation of 15 large droppings	Serotine bat droppings confirmed by DNA analysis.
		Accumulation of 10 small droppings	Daubenton's bat droppings confirmed by DNA analysis.

5.5.4 On the 22nd September 2015, two bats were recorded roosting at night in Clifton 2. The bats were observed resting in rock cavities in the roof of the tunnel and were both identified as *Myotis* species. The bats were possibly Natterer's bats *Myotis nattereri* (judging by the length of their ears), but formal identification (in the hand) could not be made.

Autumn Swarming Activity

5.5.5 Observational surveys in September and October 2015 and datalogger monitoring between August and October 2015 did not record swarming activity. Conspicuous, swarms of bats were absent during the night surveys and the level of activity recorded on automated bat detectors deployed in the tunnels was lower than would be expected at a swarming site. Surveyors observed solitary or low numbers of bats within the tunnels and bouts of activity were typically short in duration (less than a couple of minutes). There was no sustained activity at any of the tunnels.

5.5.6 The peak levels of activity recorded on dataloggers are shown on the series of graphs in Appendix 7, which display the number of registrations[5] per hour per night at each tunnel portal. The results are summarised in Table 26.

Table 26. Summary of Bat Activity Recorded (number of registrations) by Dataloggers in Tunnels between August and October

Tunnel	Monitoring Period	Portal	Species							
			Rf	**Rh**	**Msp**	**Pa**	**Nn**	**Nl**	**Es**	**Nn/Nl/Es**
Clifton 1										
	19-25 Aug	NW	56	113	74	2	1	0	13	4
		SE	41	23	49	2	2	0	0	75
	1-9 Sept	NW	44	50	24	0	0	0	25	0
		SE	77	141	209	5	4	0	6	0
	16-22 Sept	NW	60	51	74	2	0	0	0	7
		SE	14	0	5	10	0	0	2	14
	28 Sept- 5 Oct	NW	0	0	0	68	0	0	0	4
		SE	0	64	193	36	0	0	10	12
Clifton 2										
	19-25 Aug	N	62	10	46	2	0	0	149	4
		S	143	66	111	3	1	0	241	4
	1-9 Sept	N	125	15	269	6	0	0	0	5
		S	235	46	222	0	6	0	290	12
	16-22 Sept	N	97	139	222	1	0	0	111	3
		S	41	136	597	17	1	0	238	19
	28 Sept – 9 Oct	N	2	35	124	4	0	0	0	8
		S	8	225	254	0	0	0	12	31

[5] A 'registration' is a sequence of bat sound captured on a 15 second sound file and is discrete data used to help characterize levels of bat activity during datalogger monitoring.

Tunnel	Monitoring Period	Portal	Species							
			Rf	**Rh**	**Msp**	**Pa**	**Nn**	**Nl**	**Es**	**Nn/Nl/Es**
Sandstone										
	25 Aug – 1 Sept	NW	42	13	245	1	0	3	126	31
		SE	59	10	123	4	0	0	0	9
	9 -16 Sept	Central*	10	29	326	0	0	0	281	7
	22-28 Sept	NW	5	104	76	0	0	0	4	34
		SE	0	0	10	0	0	0	0	19
	9-14 Oct	NW	3	23	156	0	0	0	4	11
		SE	0	0	6	0	0	0	0	13
Pill										
	25 Aug- 1 Sept	E	16	14	33	0	0	0	138	7
		W	26	45	19	0	0	0	175	8
	9-15 Sept	E	6	89	143	0	0	0	22	23
		W	91	34	34	0	0	0	0	0
	22-28 Sept	E	4	46	521	1	0	0	6	6
		W	17	10	21	0	0	0	0	0
	9-14 Oct	E	0	96	476	0	0	0	7	11
		W	0	9	22	0	0	0	0	0

Notes

Species key –**Pp** Common pipistrelle (*P. pipistrellus*); **Ppy** Soprano pipistrelle *(P.pygmaeus);* **Pn** Nathusius' pipistrelle (*P. nathusii*); **Pa** Long-eared (*Plecotus sp.)***Msp** (Myotis sp); **Nl** Leisler's (*Nyctalus leisleri)* **Nn** Noctule (*Nyctalus noctula*); **Es** Serotine (*Eptesicus serotinus)* **Rh** Lesser horseshoe (*Rhinolophus hipposideros*); **Rf** Greater horseshoe (*Rhinolophus ferrumequinum*).

*Placed in the central section of the tunnel, not at a tunnel portal.

5.5.7 Although there was no swarming activity at any of the tunnels, social activity was recorded. Surveyors observed bats exhibiting social flight behaviour, with pairs or low numbers of bats following each other. Dataloggers recorded social bat calls, which are produced when bats communicate. They can be distinguished from echolocation (bats use to navigate) when analysed on computer software (Kaleidoscope) because they are often structurally complex calls. The number of nights social calls were recorded at the tunnels is shown in Table 27.

Table 27. Bat Social Calls Recorded within Tunnels

Tunnel	Date	Number of nights
Clifton 1	September	4
	October	5
Clifton 2	August	4
	September	10
	October	5
Sandstone	August	2
	September	9
	October	4
Pill	September	6
	October	4

5.5.8 The bats recorded near tunnels during trapping surveys in September are shown in Table 28. Male serotine bats and brown long-eared bats captured at Sandstone tunnel and Clifton 2 tunnel may be gathering for mating activity.

Table 28. Trapping Survey Results in September at Tunnels on Portbury Freight Line

Tunnel	Date	Time (hrs)	Species	Sex	Age	Breeding Status
Pill	17/09/15	21:26	Pp	M	A	-
		21:30	Pp	M	A	-
		21:35	Ppy	M	A	-
		22:00	Rh	-	-	Bat escaped net
		22:35	Pp	M	A	-
Clifton 2	17/09/15	23:25	Pa	M	A	-
		23:26	Pa	M	A	-
		23:26	Pa	M	A	-
		23:26	Pa	M	A	-
		23:30	Pa	F	A	Post-lactating
Sandstone	21/09/15	19:35	Pp	M	A	-
		19:45	Es	M	A	-
		19:55	Es	M	A	-
		19:55	Pa	M	A	-
		20:05	Ppy	M	A	-
		20:20	Mn	M	A	-

Notes
Species key –**Pp** Common pipistrelle (*P. pipistrellus*); **Ppy** Soprano pipistrelle *(P.pygmaeus);* **Pa** Long-eared (*Plecotus sp.);* **Es** Serotine *Eptesicus serotinus;* **Mn** Natterer's (*Myotis nattereri).* **Rh** Lesser horseshoe (*Rhinolophus hipposideros*).

Tunnel	Date	Time (hrs)	Species	Sex	Age	Breeding Status
M – Male; F – Female. A – Adult;						

Winter Roosts

Daytime Inspections

5.5.9 Inspection surveys of the tunnels on Portbury Freight Line between December 2015 and the March 2018 recorded a low number of bats and field signs of hibernating in Clifton 1, Clifton 2 and Sandstone. The findings of the inspection surveys are shown in Table 29.

Table 29. Records of bats hibernating in the tunnels and evidence of winter bat roosts.

Date	Tunnel	Location of Roost Feature	Survey Findings
19/01/16	Clifton 1	Crevice 4.5m above ground level in east wall between arches 3 and 4 from the south-east portal.	One (probable) Natterer's bat (*Myotis nattereri*).[ID] Animal was inactive and appeared to be in torpor.
02/02/16	Clifton 2	Rocky wall on the west side of the tunnel 50m from south portal (by the Network Rail sign showing '11'). The roost perch was 1.5m above ground level.	One lesser horseshoe bat Animal inactive/ in topor.
16/02/16	Clifton 2	Rocky wall on the west side of the tunnel 30m from south portal. The roost perch was 3m above ground level.	One lesser horseshoe bat Animal inactive/ in topor.
02/02/16	Sandstone	Refuge arch in the north wall, approximately 20m (and the 6th arch) from the north-west portal.	Two fresh droppings below a crevice in the arch. Droppings were from a small bat, such as pipistrelle or myotis species.*
29/01/18	Clifton 2	Rocky wall on the west side of the tunnel under the brick arch, 50-70m from south	One lesser horseshoe bat

Date	Tunnel	Location of Roost Feature	Survey Findings
		portal (approximately 122.57 chain - Network Rail distance). The roost perch was 1.5m above ground level.	Animal inactive/ in topor.
29/01/18	Sandstone	Man-made crevice in the natural rock approximately 1m above ground in western wall in arch with the Network Rail plate number 3.	One (probable) Natterer's bat (*Myotis nattereri*).[ID] Animal was inactive/ in torpor.
06/02/18	Clifton 2	Top of the tunnel in the natural rock fissure with the larger deep pocket on the eastern side. Approximately 30m into the tunnel from the S portal (nr. Network Rail plate no. 8 on the wall).	One lesser horseshoe bat Animal inactive/ in torpor.
	Sandstone	Same species and roost feature as recorded on 29/01/18	One (probable) Natterer's bat (*Myotis nattereri*).[ID] Probably same bat in (true) hibernation
20/02/18	Clifton 2	Same species and roost location as recorded on 06/02/18.	One lesser horseshoe bat Probably same bat in (true) hibernation
	Sandstone	Crevice in natural rock next to the stone made escape arch, approximately 12-15m from the NW portal in the western side of the tunnel (the next escape arch south to the Network Rail plate no 7 on the wall).	One *Plecotus* sp. bat. Animal inactive/ in torpor.
06/03/18	Clifton 2	Same species and roost location as recorded on 06/02/18 and 20/02/18.	One lesser horseshoe bat Probably same bat in (true) hibernation
		Top of the tunnel in the natural rock fissure with the larger deep pocket on the	One lesser horseshoe bat

Date	Tunnel	Location of Roost Feature	Survey Findings
		western side. Approximately 30m into the tunnel from the S portal (few meters to the north from the red brick ring; Network Rail plate no 8 on the wall).	Animal inactive/ in torpor.
	Sandstone	The same feature as recorded on the 29/01/18 and 06/02/18.	One (probable) Natterer's bat (*Myotis nattereri*).[ID] Animal was inactive/in torpor. Regularly used hibernation site.
		The same feature as recorded on the 29/01/18 and 06/02/18.	One *Plecotus* sp. bat. Animal was inactive/in torpor. Regularly used hibernation site.

[ID] Identified from facial recognition with reference to the length of the bat's ears.
* Droppings could not be collected for DNA analysis because they were wet and disintegrated on contact.

Winter Bat Activity

December 2015 to February 2016

5.5.10 The period December 2015 to February 2016 was relatively warm and this is likely to have influenced hibernation roost behaviour, with animals being more active throughout winter. The coldest weather during this study period was from mid January to late February 2016 and it is reasonable to assume that most bats will be in torpor and will be roosting within, or in very close proximity to their hibernation sites at this time.

5.5.11 Daily temperatures during the monitoring period are shown Tables A1 and A2 in Appendix 8. Table A3 in Appendix 8 provides an extract of the coldest periods of weather between December 2015 and February 2016. It shows patterns of bat activity in each of the tunnels during periods when daily temperatures are below 5°C. The dates during which the static automated bat detector monitoring coincides with the periods of cold temperature are shown in Appendix 8 and the total number of days monitoring during cold weather at each tunnel is:

- Clifton 1 – 33 days
- Clifton 2 – 29 days
- Sandstone – 21 days
- Pill – 16 days

5.5.12 The results of the winter hibernation surveys are summarized in Table 30.

Table 30. Summary of Bat Species Recorded in Tunnels on the Portbury Freight Line December 2015 to February 2016

Bat Species	**Presence of Bats in Tunnels**		
	Recorded During the Monitoring Period	**Present During Cold Weather with Temps < 5°C**	**Observed During Daytime Inspections**
Greater horseshoe	Clifton 1	No	No
	Clifton 2	No	No
Lesser horseshoe	Clifton 1	Yes – 13 of 33 days	No
	Clifton 2	Yes – 7 of 29 days	Yes
	Sandstone	Yes – 9 of 21 days	No
Myotis species	Clifton 1	Yes – 11 of 33 days	Yes (Natterer's)
	Clifton 2	Yes – 4 of 29 days	No
	Sandstone	Yes – 9 of 21 days	Bat droppings
	Pill	Yes – 1 of 16 days	No
Common pipistrelle	Clifton 1	Yes – 5 of 33 days	No
	Clifton 2	Yes – 6 of 29 days	No
	Sandstone	Yes - 6 of 21 days	Bat droppings
Soprano pipistelle	Clifton 1	Yes – 2 of 33 days	No
	Clifton2	Yes – 1 of 29 days	No
	Sandstone	Yes -3 of 21 days	Bat droppings
Serotine	Clifton 2	Yes – 3 of 29 days	No
	Sandstone	No	No
	Pill	Yes - 1 of 16 days	No

Late January to Early March 2018

5.5.13 Weather conditions during the survey period 29th January to the 6th March 2018 included extended spells of cold weather with sub-zero temperature and snow. The daily temperature ranges are shown on Chart B1 in Appendix 8.

5.5.14 The results of the static automated bat detector monitoring are summarized in Table 31, which shows the number of days each bat species was recorded during the study period. A summary account of the bat activity for each species is provided in Appendix 8 (Section B).

Table 31. The Number of Days Bat Species were Recorded within the Portbury Freight Line Tunnels by Static Automated Bat Detectors

Tunnel	Date of Deployment	Duration of Monitoring (No. of days)	Number of Days Species were Recorded							
			Bb	Rh	Msp	Pp	Ppy	Pl	Es	Es / Nl
Clifton 1	29/01/18	8	0	4	4	1	0	0	0	0
	06/02/18	13	0	8	2	4	2	1	0	0
	20/02/18	12	0	2	6	3	0	0	0	1
Clifton 2	29/01/18	8	0	1	0	3	3	0	0	0
	06/02/18	14	1	3	4	5	1	0	1	1
	20/02/18	12	0	3	6	7	1	0	0	0
Sandstone	29/01/18	7	1	5	4	3	0	0	0	1
	06/02/18	14	10	10	8	5	3	0	0	0
	20/02/18	11	2	6	9	4	0	0	0	0
Pill East Portal	29/01/18	5	0	2	1	0	0	0	0	0
	06/02/18	10	0	3	2	2	0	1	0	0
	20/02/18	10	0	4	2	0	0	0	0	0
Pill West Portal	29/01/18	8	0	0	0	0	0	0	0	0
	06/02/18	14	0	6	2	3	0	0	0	0
	20/02/18	14	0	5	3	0	0	0	0	0

Notes
Species key –Pp Common pipistrelle (*P. pipistrellus*); Ppy Soprano pipistrelle *(P.pygmaeus);* Pl *(Plecotus sp.);* Msp (Myotis sp); Es Serotine (*Eptesicus serotinus);* Es/Nl Serotine or possible Leisler's (*Nyctalus leisleri);* Rh Lesser horseshoe (*Rhinolophus hipposideros*); Bb Barbastelle *(Barbastella barbastellus).*

Summary of Winter Roosting Resource

5.5.15 The daytime winter tunnel inspections in 2015/2016 and 2018 confirm that low numbers of bats hibernate within Clifton 1, Clifton 2 and Sandstone tunnels. Clifton 2 and Sandstone tunnels provide the most favourable winter roost conditions because their size and the availability of sheltered locations and crevices to roost. The relative small size of Clifton 1 means the interior is more exposed and there are no deep crevices or sheltered locations in the brickwork of the tunnel lining. There is no confirmed hibernation in Pill tunnel. There are no deep crevices within Pill tunnel and there is notable water ingress through the tunnel lining, which will deter bats from sheltering in drainage hole features.

5.5.16 The 2018 acoustic monitoring data provide a good understanding of the bat species that hibernate in the Avon Gorge. Regular activity within tunnels during the prolonged cold spells (with sub-zero temperatures) is a good indication that bats are roosting within, or in close proximity to the tunnels. This contextual information suggests 'possible roosting' by a species.

5.5.17 Taken together, the visual inspections and acoustic monitoring results provide a good understanding of the tunnel hibernation resource. Using professional judgement, the winter roost resource of the tunnels is interpreted as follows:

Clifton 1	Confirmed winter roost from one (probable Natterer's) bat. The tunnel has a limited hibernation roost resource for crevice dwelling bats because there are very few gaps or holes in the tunnel walls. Hibernation conditions in the tunnel are considered to be sub-optimal because the interior is relatively exposed due to the short length of tunnel, but possible occasional winter use by lesser horseshoe bats cannot be entirely discounted.
Clifton 2 Tunnel	Hibernation site used by low numbers of bats of the following species:

	• Confirmed Lesser horseshoe roost with peak count of two bats. Torpid bats present over several weeks, suggesting they are in (true) hibernation. • Possible that Common pipistrelle and Myotis sp. bats occasionally roost during the winter.
Sandstone Tunnel	Hibernation site used by low numbers of bats of the following species: • Confirmed Myotis bat roost (probable Natterer's) with peak count of one bat. Torpid bat present over several weeks, suggesting it was in (true) hibernation. • Confirmed long-eared bat roost (probable brown long-eared) with peak count of one bat. Torpid bat present over several weeks, suggesting it was in (true) hibernation. • Possible barbastelle and lesser horseshoe roost during winter.
Pill	No confirmed hibernation roosts. Sub-optimal hibernation conditions, there are no notable hibernation roost features in the tunnel. The uniform structure of the tunnel lining does not provide shelter, but the long length of the tunnel does offer underground conditions. Although considered unlikely, the possibility low numbers of lesser horseshoe bats very occasional roost in winter cannot be entirely discounted.

5.6 Portbury Freight Line Structures

Pill Station (Disused Platform)

5.6.1 The two stone arches on the southern platform at Pill station are used by a low number of lesser horseshoe bats as a day roost and by both lesser and greater horseshoe bats for night roosting.

5.6.2 The presence of a small lesser horseshoe bat day roost was established from the following field data:

- One lesser horseshoe bat recorded in Arch 1 during the daytime inspection on the 18th July 2016;
- One lesser horseshoe bat returned to Arch 2 during the dawn survey on the 28th September 2016;
- A small accumulation of 50 fresh bat droppings in Arch 1.

5.6.3 The SM2BAT remote, unattended bat detector recorded regular bat activity within Arch 1 and Arch 2 by lesser and greater horseshoe bats. The results of the roost monitoring are summarized in Table 32.

Table 32. Records of Lesser and Greater Horseshoe Bat Activity in the Arches at Pill Station

Species	Location	Dates Species Recorded (2016)	No. of Days with Diurnal Activity	No. of Nights with Nocturnal Activity
Lesser horseshoe	Arch 1	18 -22 July	5	4
	Arch 2	19 -21 July	3	1
Greater horseshoe	Arch 1	20 July	0	1
	Arch 2	20, 22, 23 July	0	3

5.6.4 Common pipistrelle, noctule and a myotid species were also recorded on one occasion, but the data cannot be interpreted for roosting behaviour.

5.6.5 Further Bat surveys using data loggers were undertaken along the freight line from Pill Viaduct to the junction with the disused line to collect data between May and October 2019 to determine the level of use of the navigational route by horseshoe bats, which is provided in Appendix 11. This also provides further survey information for the bat roost at Pill Station (disused platform). These data indicate that activity at, or close to Pill Station, is not strongly associated with the disused railway line, which is an important corridor for bats with movement between the line and Brockley Hall Stables SSSI, a link with the North Somerset and Mendip Bats SAC. Whilst there is likely to be some movement from the wider area, much of the lesser horseshoe bat activity appears to be localised and greater horseshoe bat activity through the station is too low to be considered significant commuting behaviour.

Pill Station House

5.6.6 There was no evidence of a current or previous bat roost within the roof spaces of Pill Station House when it was surveyed between March and June 2018.

5.6.7 The original part of Pill Station House, dating from around 1866 when the station was built, is a two-storey red brick building. The property has been extended with a single storey extension on the northern elevation. Photographs of the property are in Appendix 10. The building has solid walls the roofs have interlocking Mediterranean style concrete tiles. Opportunities for bats to roost in the fabric of the building are therefore limited and the property is occupied, which means bats do not have access to the living/ office areas.

5.6.8 The daytime inspection on the 6th March identified potential bat access points to crevices under the roof cover of Pill Station House. The house has overhanging eaves and gaps at the edge of the roof provide access to voids between the slates and membrane lining, but the subsequent dusk surveys (21st May and 7th June) confirmed the absence of bats during the breeding season. The level of bat activity recorded in the vicinity of Pill Station House by surveyors watching the building was very low. During both surveys, the bat activity around Pill Station House was characterised by very occasional passes by common pipistrelle bats. One noctule bat was detected from the railway line (on the 21st May), but this species does not usually roost in houses.

Viaducts and Underbridges

5.6.9 The preliminary bat roost assessment of the fourteen viaduct and underbridge structures and store on Portbury Freight Line concluded thirteen of the structures have negligible bat roost potential because there were no cracks, crevices or features that would allow bats access to shelter in the fabric of the structures. The findings of the scoping assessments of the viaducts and underbridges are summarized in Table 33.

Table 33. Summary of Preliminary Bat Roost Assessments of Structures on Portbury Freight Line

<table>
<tr><th colspan="2">Structure</th><th rowspan="2">Description of Bat Roost Features</th></tr>
<tr><th>No.</th><th>Name</th></tr>
<tr><td>S010</td><td>Pill Viaduct</td><td>The six brick arches of the viaduct are in good condition with no cracks/gaps/crevices which could be used by roosting bats.</td></tr>
<tr><td>S014</td><td>Underbridge</td><td>Approximately 20m long and 4m high the underbridge is for farm access between fields. The red brick arch appears to have been repaired, with relatively new bricks at the top of the arch. There is one area of damage at the north-east end of the arch, but the cavities are too small and shallow for roosting bats. The spandrel and wing walls of the underbridge are stone made with no crevices or missing mortar.</td></tr>
<tr><td>S012</td><td>Miles Viaduct / Ham Green Lake</td><td>Three brick arches over water, the structure appears to have been repaired and is in good condition. The shallow crevices and sparse vegetation do not provide sufficient shelter for roosting bats.</td></tr>
<tr><td>S015</td><td>Miles Dock underbridge</td><td>Four arches bridge with a mixture of large stones with sparse vegetation was growing on the abutment. Signs of repairs to the structure, but some damaged bricks were and missing mortar was noted. None of these features were more than 100x150mm. There was a stone parapet with a couple of big cavities, but an inspection of these features confirmed absence. Furthermore, the lower part of the structure gets submerged when the water level is high, making it unsuitable for roosting.</td></tr>
<tr><td>S018</td><td>Quarry underbridge 6</td><td rowspan="2">Single brick arches over pedestrian paths through Leigh Woods. The arches are in good repair, with only shallow cracks and crevice features (less than 15mm deep). There was insufficient shelter for bats to roost.</td></tr>
<tr><td>S019</td><td>Quarry underbridge 5</td></tr>
</table>

Structure		Description of Bat Roost Features
No.	**Name**	
S020	Quarry underbridge 4	
S021	Quarry 3 underbridge	Approximately 6m long and 2m high the underbridge connects the towpath with Quarry No. 3. The underbridge has red brick arched rings and stone abutments. There are no cracks in the arch or missing mortar for bats to exploit. The spandrel and wing walls are stone lightly covered with the ivy, but there is insufficient vegetation cover for roosting bats.
S022	Quarry 2 underbridge	Approximately. 6m long and 2m high underbridge connecting the towpath with the Quarry No. 2. There are no crevices large enough for roosting bats to exploit for shelter. Stone spandrel and wing walls are solid.
S025	Underbridge	Single brick arch over pedestrian path through Leigh Woods. The arch is in good repair, with only shallow cracks and crevice features (less than 15mm deep). There was insufficient shelter for bats to roost.
S026	Nightingale Valley underbridge	Single brick arch over the pedestrian path, the structure is 6m long and 4m high. The red brick arch is in a relatively good state of repair with only a low numbers of small, shallow crevices (ca. 10mm deep). These features would not provide shelter for roosting bats. The stone abutments do not provide roosting opportunities. Small crevices between the stone work of the spandrels and wing walls are blocked by vegetation and moss.

5.6.10 The towpath store at NGR ST 56219 73588 has potential for horseshoe bats to night roost, but no evidence of roosting activity was found. The store is unsuitable for day roosting because there are no crevices or enclosed voids/ spaces in the structure. The interior is too exposed for day roosting, but the store is within an area of favourable habitat for bat and therefore the possibility of night roosting by horseshoe bats cannot be discounted. However, the absence of field signs suggests the store is not well used. There are signs of use by homeless people, which may deter bats from night roosting. The towpath store is a single storey red brick and stone building with two rooms that have separate entrances. One of the compartments is sealed with metal door. The door to the second room is missing room and the interior is approximately 4 sqm, with the red brick arch ceiling. The exterior of the building is covered with vegetation, but there are no external crevices features in the fabric of the building.

5.6.11 There is no roost potential for bats in Babcock's bunker. It is an open fronted structure with concrete ceiling and walls over a steel frame. The approximate dimensions of the bunker are 8m long, 2m deep and 1.2m high. The interior is very exposed and there are no crevices within the fabric of the bunker.

5.6.12 No bats were recorded roosting within the Avon Road Bridge. The two dusk surveys (July and September 2016) provide sufficient information to confirm the likely absence of bat roosts in the structure.

5.6.13 No signs of bats were recorded at either the Ashton Road /A369 or Brunel Way bridge (July 2020), though both were assessed as having moderate bat roost potential because of the many holes and crevices present within the structures.

5.7 Trees along Avon Gorge and the Portbury Freight Line

5.7.1 The trackside tree roost resource of woodland within Network Rail land is relatively limited because a large proportion of the woodland is relatively young, and is estimated to have developed over the latter part of the Twentieth Century. This may be a consequence of land management for the freight line, with clearance for track safety and engineering works (such as maintenance of retaining walls on the Up-side of the line). Where secondary woodland has established trees often have tall, straight growth with a high canopy. This rapid tree growth tends to have a sparse lower canopy and the trees lack large lower branches. Consequently, trees do not suffer limb drop and there are fewer resultant veteran tree features or damage that can develop cavities for bats to shelter. Where mature trees have a large canopy, major limbs have often been removed, probably during track safety clearance works.

5.7.2 Areas of older woodland have been under coppice management, and many of the ancient trees are old coppice stools, with straight multi-stem growth. Many of the ancient coppice trees are small leaved lime, a species that does not readily develop cavity features in the timber. Planted trees and timber management on Forestry Commission land supports very low numbers of ancient or veteran trees. Invasive species such as holm oak have established in previously disturbed areas, such as the quarries in the Avon Gorge. This species does not tend to have many veteran features.

5.7.3 The trackside vegetation from the proposed Clanage Road compound south to the pedestrian crossing in Bower Ashton consists of mostly immature trees with species sycamore *Acer pseudoplatanus* and Norway maple *Acer platanoides* dominating. Immature trees generally provide poor roosting habitat for bats as stems, branches and bark are in relatively good condition and therefore do not provide suitable cracks, cavities or crevices. There are some mature trees scattered alongside the track, most of which are in relatively good condition, with few potential roosting features (PRF). However, three trees and one cluster of trees were recorded as having low potential for roosting bats. One of these was a small crack in the main stem and the others were due to ivy cover. The ivy cover was not thick enough itself to be creating any PRFs, but it may have been obscuring PRFs and thus cannot be ruled out with certainty.

5.7.4 A detailed schedule of the potential roost resource of individual trees or areas of woodland surveyed is provided in Appendix 9.

6 Evaluation

6.1 Disused Railway Line

6.1.1 The disused railway line is a prominent feature within the landscape between Portishead and Pill. The land has been safeguarded in local policy plans and with little intervention from development semi-natural habitats have developed on the railway land. At Portishead, the disused railway line provides a green corridor within the town, which terminates at the proposed Portishead station. The route through countryside between Portishead and Pill is a linear landscape feature of trees and scrub that links semi-natural habitats within Portbury Wharf Nature Reserve, hedgerows through farmland and wetland habitats at Royal Portbury Dock. The importance of the landscape is reflected in the North Somerset and Mendips Bats SAC Guidance on Development (North Somerset Council, 2018), which places the disused railway line in Band C of the Bat Consultation Zone. The Bat Consultation Zone banding A to C relates to the proximity to maternity and other roosts, and illustrates the geographic area where horseshoe bats may be found.

6.1.2 The study confirmed at least 13 bat species were using the disused railway line between 2014 and 2018. The rare lesser and greater horseshoe bats regularly occur between the Portbury Wharf Area and Royal Portbury Dock. Standardised monitoring between April and October 2016 does show varying patterns of activity along the disused railway line. There are distinct peaks of greater horseshoe bat activity at locations 1a (Portishead) and 4b (Royal Portbury Dock, near Royal Portbury Dock Road) (shown on Figure 3), with the relative index of activity being between 80-100 compared to an index of between 1-8 at other monitoring locations. Peak greater horseshoe bat activity in at location 1a was during June, whilst at location 4b it was slightly earlier being late May to mid-June. Most locations recorded low levels of greater horseshoe bat activity throughout most of the season (April to September). Greater horseshoe bat activity at location 3b was very low, with bats only recorded on 2 nights in late August. The relative index of lesser horseshoe bat activity was more consistent between locations, with an index of between 1 and 24 at most locations. There were no records of lesser horseshoe bats at location 3b (Royal Portbury Dock).

6.1.3 It is recognised that using an activity index does not distinguish between a single bat making multiple passes or multiple bats making a single pass. It is also not possible to determine the different behaviours being used by bats and therefore determine the relevance of a given location to bats using this data alone (e.g. for feeding versus commuting). However, whether a location is used repeatedly by a single (or few) bats for feeding versus being used briefly by a larger number of bats as commuting corridor, the activity index still demonstrates that the given location is of some ecological importance to bats, providing a relative and readily comparable measure of activity over time.

6.1.4 Lesser and greater horseshoe bats have territories several square kilometres in size and the radio-tracking study of a male greater horseshoe bat in 2015 and the female greater horseshoe bat in 2018 demonstrates there is movement between the disused railway line and Brockley Hall Stables SSSI and a link with the North Somerset and Mendip Bats SAC. A radio-tracking study of greater horseshoe bats at Brockley Hall Stables SSSI (for English Nature Research Report 442) identified principal foraging areas and flight routes from the maternity colony at the site (Billington, 2002). The study concluded the majority of the foraging areas are within 4km of Brockley Hall Stables and the maximum foraging radius was 6.8km. Various other radio-tracking studies of greater horseshoe bats in the UK suggest that good foraging habitat over 10km from the roost is unlikely to be regularly used. However, it is evident that extended distances to foraging areas do occur when bats use alternative day roosts (i.e. 'satellite' roosts away from the maternity roost). Billington (2002) reported the use of satellite roosts and extended range of 10.2 km from Brockley Hall Stables by a male greater horseshoe bat around Shipham, to the south towards Cheddar Gorge.

6.1.5 The pattern of movement between satellite day roosts was observed during this study for the Scheme, with the male greater horseshoe bat tracked 9.2 km from the disused railway line to Brockley Hall Stables over three nights in 2015. More importantly, the pregnant female tracked in 2018, also used a number of day roosts between Brockley Hall Stables SSSI and the disused railway line, and used foraging areas approximately 9 km from the main breeding site. This suggests the use of satellite roosts and extended foraging ranges is a strategy bats from Brockley Hall Stables may regularly adopt, and the North Somerset and Mendip Bats SAC greater horseshoe population have larger home range areas than previous studies have determined. Foraging areas identified in this study extend north from areas identified in the Brockley Hall Stables SSSI by Billington (2002). The 2002 study identified foraging areas at Cadbury Hill and Walton-in-Gordano, which are south-west of the DCO Scheme, and a landscape appraisal from OS mapping shows there is good habitat connectivity for bats with these foraging areas.

6.1.6 The radio-tracking study for the Portishead Branch Line DCO Scheme confirms the disused railway line is a resource used by greater horseshoe bats from Brockley Stables SSSI. As discussed in Section 6.1.2, standardised monitoring in 2016 has identified peaks in greater horseshoe bat activity and some sections of the railway line appear less favourable for bat activity. The results of the acoustic monitoring are consistent with activity by species that are dispersed in the landscape, and the seasonal variation in levels of greater horseshoe bat activity may be associated with the variation in home ranges during the breeding season, particularly by female bats. These differences may relate to a female's breeding condition where pregnant females such as Bat 2 will forage over extended home ranges in May and June, but where dependant young are present in the maternity roost during July and August, foraging distances are likely to contract (Duverge & Jones, 1994). The foraging habitats on the discussed railway line are not within the core sustenance zone of Brockley Stables SSSI maternity roost, but are a regularly used resource important for maintaining the distribution of home ranges within the county. In view of this assessment, the foraging resource is evaluated as being important at a **county** level.

6.1.7 Notwithstanding the discussion on variations in greater horseshoe bat activity, acoustic monitoring (with bat detectors) on the disused railway line has established that lesser and greater horseshoe bats occur on the site with both species being recorded during every month of survey. The distribution of horseshoe bats extends over most of the disused railway line (as shown on Figures 6a and 7a). The study has not detected any activity that would suggest there are key dispersal routes on the railway line from a large communal roost, and the majority of the horseshoe bat activity was recorded several hours after sunset (as shown in Appendix 3). This is a long time after horseshoe bats typically emerge from their roost, or before they return to their day roost[6]. However, whilst there is no evidence of a large roost close to the DCO Scheme, there are a few early registrations of lesser and greater horseshoe bats (summarized in Table 22, Section 5.2.8), and both species are known to occupy small day roosts in the local area. Two small lesser horseshoe day roosts at Pill Station (southern platform) on the Portbury Freight Line is illustrative of the type of roosting activity that is likely to occur throughout the study area.

[6] The median emergence time of lesser and greater horseshoe bats is 31 and 25 minutes after sunset and both species return to the roost shortly before sunrise, with published data giving times of 5-30 minutes before sunrise (Duvergé and Jones, 1994)

6.1.8 The study has established that habitats within the railway land provide foraging opportunities and lesser and greater horseshoe bats. The derelict store on the disused railway line and the arches at Pill Station (southern platform) are used as day and night roosts. The linear rail corridor provides habitat connectivity for greater and lesser horseshoe bats, which are species that avoid crossing open spaces and prefer a well-connected habitats to exposed landscapes. The disused railway line provides an east west route between Royal Portbury Dock and Portishead with connectivity to good quality foraging areas in the locality. The feeding and foraging requirements of the greater horseshoe bat have been reasonably well studied in the south west of England. Scrub appears to be an important foraging habitat for greater horseshoe bats and studies by Billington (2000) identified frequent use by the species during radio tracking carried out for the Mells Valley SAC in June. Use of scrub habitat on the disused railway line, with peaks of activity in June is consistent with these published findings. There is also connectivity to important types of habitat for feeding, with the disused railway line linking between grazed pasture with hedgerows, semi-natural grassland and woodland, and wetland habitats including riverine habitats of the River Avon. The disused railway line traverses roads, including the M5 motorway that are major barriers to movement for horseshoe bats, and is a corridor for movement around Royal Portbury Dock and Pill to the Avon Gorge (and Avon Gorge Woodlands). This study has recorded seasonal use of the disused railway line by male and female greater horseshoe bats from the North Somerset and Mendip Bats SAC, identifying population use and establishing the disused railway line has a notable function as a SAC bat habitat (within Bat Consultation Zone C). The North Somerset and Mendips Bats SAC Guidance on Development (North Somerset Council, 2018) recognises habitats and features which support the populations of SAC bats outside the designated site are a material consideration in ensuring the integrity of the designated site.

6.1.9 Long-term ringing studies on greater horseshoe bats show that these bats will travel large distances between their various roosts[7] and that these movements by bats, in the magnitude of 50-100km, are important for genetic interchange between colonies. Features such as the disused railway line enable bats to negotiate obstacles on commuting journeys and the disused railway line link across the M5 motorway may facilitate movement between the North Somerset and Mendip Bats SAC and Wye Valley and Forest of Dean Bats SAC greater horseshoe populations.

[7] Ringing studies of greater horseshoe bats in the UK has shown that bats can regularly travel to and from roosts that are up to 50 km apart

6.1.10 The disused railway line is an integral part of a permeable landscape for lesser and greater horseshoe bats and provides a corridor for movement west of the Avon Gorge Woodlands, a stronghold for these species. It is of consequence to the greater horseshoe bat population of the North Somerset and Mendip Bats SAC, which is of European importance. Its importance as a habitat and linear landscape feature for bats is of value at a **Regional level**.

6.1.11 Four bat roosts were confirmed on the disused railway line, with three small day roosts in two of the bridge structures used by common and soprano pipistrelle bats, and a night roost used by lesser and greater horseshoe bats in a derelict store. The Bat Mitigation Guidelines (Mitchell-Jones, 2004) provide guidance on the conservation significance of bat roosts according to the roost status and this has been used to evaluate the roost resource on a geographical scale in Table 34.

Table 34. Evaluation of the Bat Roost Resource on the Disused Railway Line

Roost	Conservation Significance	Evaluation on a Geographical Scale
Common pipistrelle bats in bridge B2	*Low* – a roost that supports individual bats of common species	Site Importance
Common pipistrelle bats in bridge B4	*Low* – a roost that supports individual bats of common species	Site Importance
Soprano pipistrelle bats in bridge B4	*Low* – a roost with a small number of bats of a common species: not a maternity site	Site Importance
Lesser and greater horseshoe bats in a derelict store (NR)	*Moderate* – feeding perches of an Annex 2* species	Local Importance
*Species listed on Annex 2 of the Habitats Directive in 1992 (Council Directive 92/43/EEC)		

6.1.12 The disused railway line does not support large communal bat roosts, and there are no known maternity roosts of rare or scarce species in the immediate vicinity of the disused railway line. Pregnant and lactating common pipistrelle bats and brown long-eared bats captured on the disused railway line indicates there is almost certainly a breeding roost of these species close to the Scheme. Noctule bats were recorded at sunset on The Portbury Wharf Area, where there are trees with high bat roost potential. Although no confirmed trees roosts were found during the study it is considered likely that this species is roosting close to the disused railway line.

6.1.13 The proximity of communal roosts is an important factor when evaluating the quality of foraging resources at a site. The area surrounding a communal bat roost within which habitat availability and quality will have an important influence on the resilience and conservation status of the colony is usually within 3km to 6km of the roost. The nearest known communal horseshoe bat roost is the lesser horseshoe roost at Ashton Court, which is approximately 5.5km from the disused railway line. A radio-tracking study of this colony in 2008 (Greena Ecological Consultancy, 2008) identified key foraging areas, the nearest of which to the DCO Scheme was an area at Abbots Leigh, which covered Fish Pond Wood, East Tanpit Wood and Three Cornered Wood (at the southern-most end of Leigh Woods). This foraging area is over 3km from the disused railway line.

6.1.14 Radio-tracking studies are required to identify accurately foraging areas of bats, but a broad evaluation of the quality of a site can be obtained from acoustic monitoring and habitat appraisal. The criteria developed for this Scheme are presented in Table 35 and are based on observational data, bat detector records and a habitat appraisal.

Table 35: Evaluation Criteria to Assess Foraging Habitats for Local Bat Populations

Geographic frame of reference	**Criteria**
National	A core sustenance zone foraging resource that is integral to maintaining the viability of a nationally or internationally designated roost site for bats. (Examples: 1. Foraging habitats within the home range of juvenile bats at a maternity roost; 2. Roost flight lines within ca. 500m of a maternity or hibernation site.)
Regional	A key foraging area within the core sustenance zone of a nationally or internationally designated site for bats.

Geographic frame of reference	Criteria
County	Foraging habitat that is within a core sustenance zone of a communal roost of a rare species and is a high quality habitat that meets the requirements of the species. A feeding area that is integral to maintaining the distribution of a rare species at a county level.
District	A habitat that supports rare and scarce species and is high quality foraging habitat that fulfils specific requirements of the species concerned. Areas with regular and sustained feeding activity by lesser and greater horseshoe bats and an assemblage of scarce or uncommon bat species. A feeding area that is integral to maintaining the distribution of communal roosts (of high conservation significance) and therefore the distribution of rare species at a district level.
Local	Good quality foraging habitat for bats that supports all, or most bat species recorded within the Scheme, including nationally rare species on a regular basis. Sustained activity from bat detectors records indicates bats may be feeding within the habitat. Key foraging habitats such as woodland and wetlands that can support a high biomass of invertebrate prey are present. Used by breeding females or juveniles during the breeding season, the habitat quality is good and may be important in terms of helping to maintain local populations of locally scarce bat species. The habitat has the potential to support an invertebrate biomass that could fulfil the energetic requirements of breeding female bats.
Site/ immediate zone of influence	Foraging opportunities for bats that use the site, but unlikely support sustained foraging activity. Individual bats foraging, but the habitats are unlikely to be important in terms of sustaining local bat populations. Habitat provides foraging opportunities for commuting bats using the railway line as a navigational route.

6.1.15 The evaluation of foraging habitats on the disused railway is given below:

Portishead NGR ST 47111 76500 to ST 48134 76136	**Site Value**	Scrub habitat within an urban context that provides foraging opportunities that are exploited by common bat species, and possibly used by locally scarce species.
Portbury Wharf Area NGR ST 48134 76136 to ST 48493 76009	**Local Value**	Mature trees and scrub that supports a diversity assemblage of bat species. There is evidence of lesser horseshoe bats foraging along the railway line and breeding female common pipistrelle and brown long-eared bats have been caught near The Portbury Wharf Area. Transitional habitats from grassland to mature trees provide good foraging opportunities for bats. The juxtaposition of railway habitats with semi-natural habitats on Portbury Wharf Nature Reserve contributes to the mosaic of habitats in the locality.
Farmland NGR ST 48493 76009 to ST 49760 75696	**Site Value**	A diverse range of bat species has been recorded on the farmland, but there is little evidence of sustained foraging activity, other than by common and soprano pipistrelle bats. The disused railway line through the farmland is characterised by low scrub, and mature trees are very infrequent along the route. The railway line habitat through the farmland lacks structural diversity and sheltered areas many bat species favour when foraging.

Royal Portbury Dock NGR ST 49760 75696 to ST 52012 76279	**Local Value**	Mature trees and scrub that supports a diversity assemblage of bat species, including lesser and greater horseshoe bats. The study recorded regular foraging by common and soprano pipstrelle bats and occasional foraging by myotis bats, but there is no conclusive evidence of sustained activity by other species. The mature trees and woodland are however considered to be favourable foraging habitat and a precautionary evaluation of up to local value has been adopted.

6.2 Portbury Freight Line

Tunnels

6.2.1 The Clifton no. 1, Clifton no. 2 and Sandstone tunnels are being used by low numbers of bats as day roosts during summer, but there are no confirmed maternity roosts in any of the tunnels. Clifton no. 2 has been confirmed as a night roost. The tunnels are not considered to be important swarming sites, but surveys in autumn recorded social activity and bats appear to use the shelter of the tunnels for socialising.

6.2.2 Winter hibernation roosts have been recorded in Clifton no. 1, Clifton no. 2 and Sandstone tunnels. The roost resource in Clifton no. 1 is limited by the availability of crevice features and absence of enclosed voids, and it is a small tunnel with relatively exposed interior.

6.2.3 There are no confirmed roosts in Pill tunnel and the tunnel has low bat roost potential. There are few roost features and extensive water seepage through the tunnel lining is likely to saturate crevices and discourage bats from roosting.

6.2.4 Winter use of Clifton no. 2 and Sandstone tunnels is considered comparable to that recorded at caves, rock shelters and quarry shafts surveyed throughout the Avon Gorge. These Portbury Freight Line tunnels contribute to the resource of underground sites within Avon Gorge. The underground sites (including the tunnels) are occupied by low numbers of bats (at any one time). There is no evidence Portbury Freight Line tunnels attract high numbers of hibernating bats. Clifton no. 1 and Clifton no. 2 tunnels are near to other known hibernation sites in the Avon Gorge and hibernation in these tunnels may be associated with movement between other underground sites such as caves, rock shelters and quarry mine shafts (in the vicinity of Portbury Freight Line).

6.2.5 Although not confirmed roosting in Portbury Freight Line tunnels, the record of barbastelle bat during winter 2018 is notable because it confirms that this rare species is almost certainly roosting in the Avon Gorge Woodlands.

6.2.6 Clifton no. 2 and Sandstone tunnels are an important hibernation roost resource for local bat populations within the Avon Gorge. The Avon Gorge Woodlands SAC/SSSI are an important site for bats and with rarer species such as lesser horseshoe bats and possibly barbastelle bats hibernating in these tunnels they are considered to be important within the District context.

6.2.7 The caves and adits within the Avon Gorge Woodlands are considered to be an important underground roost resource for bats within the local context. The underground sites surveyed in 2018 on National Trust, Forestry Commission and Network Rail land within the gorge found regular use by lesser horseshoe bats of the caves and adits in winter. Bat are occupying solitary roosts, or gathering in low numbers and roosting activity appears to be dispersed between the many caves and rock features in the gorge. The largest underground roost recorded was Cave Seven (The Adit) on Network Rail land at NGR ST56447293, which supported nine lesser horseshoe bats. Roost behaviour appears to be comparable to that recorded within the Portbury Freight Line tunnels, and the tunnels should therefore be considered a component part of the underground roost resource within the Avon Gorge Woodlands.

6.2.8 The use of the tunnels by bats is summarised and evaluated below. The conservation significance of bat roosts according to roost status provided in the Bat Mitigation Guidelines (Mitchell-Jones, 2004) has been used in the evaluation.

Clifton 1	**Site Value**	A solitary natterer's bat has been recorded roosting in the tunnel during summer and winter and low numbers of common pipistrelle bats may roost in the tunnel in summer. The summer roost/s are of low conservation significance. Winter roosts are considered to be of moderate conservation significance, but given the limited hibernation resource Clifton 1 is considered to be at the lower end of this category.
Clifton 2	**District Value**	During summer, a low number of lesser horseshoe, common pipistrelle and daubenton's bats have been recorded roosting during the day. *Myotis* sp. are also known to use the tunnel as a night roost. The tunnel is considered to be of moderate conservation significance during summer and is evaluated as being of value in a local context for local bat populations. During autumn, Clifton 2 attracts social activity. It is evident from datalogger monitoring that there is regular activity and there are peaks in activity during the night, shown in Appendix 7. Whilst the level of activity is much lower than would be expected at a swarming site, peaks of activity on an hourly basis suggest that low numbers of bats may be gathering and socialising at the tunnel. Lesser and greater horseshoe bats and *Myotis* bats socialize at Clifton 2 and the tunnel is considered to be important in a local context. Male brown long-eared bats were captured near the tunnel portal in September and were possibly gathering for mating. Clifton 2 is used by low numbers of hibernating lesser horseshoe bats and the tunnel is considered to be of moderate conservation significance for winter roosting.

		Clifton 2 is used by bats throughout the year and is considered to contribute to the roost resource within the Avon Gorge Woodlands. Taken together, the roost resource is considered to be important within the district context.
Sandstone	**District Value**	Bat droppings in the tunnel confirm that crevices are being used by serotine bat and Daubenton's bat. The time of year bats are roosting in the tunnel has not been confirmed, but it is possible crevices are being used throughout the year. The number of droppings found in the tunnel suggests low numbers of bats are roosting and Sandstone tunnel is of moderate conservation significance. Surveys in autumn confirm that Sandstone tunnel is important for social activity. It is evident from datalogger monitoring that there is regular activity and peaks in activity during the night, shown in Appendix 7. Whilst the level of activity is much lower than would be expected at a swarming site, peaks of activity on an hourly basis suggest that low numbers of bats may be gathering and socialising at the tunnel. Greater horseshoe bats, *Myotis* bats and long-eared bats socialize at Sandstone and the tunnel is considered to be important in a local context. Trapping surveys caught male serotine bats, brown long-eared bats and natterer's bat near the tunnel. These adult males may be gathering for mating. The tunnel is considered to be of moderate conservation significance for winter roosting. Sandstone Tunnel contributes to the roost resource within the Avon Gorge Woodlands and is considered to be important within the district context.

Pill	**Site Value**	No evidence of bats roosting during summer was recorded at Pill Tunnel. During autumn, it is evident that social activity occurs at the site, but the level of activity is lower than other tunnels and peaks in activity (that indicates sustained activity) are less frequent. Where there are occasional peaks in activity, this tends to be by greater horseshoe bats or *Myotis* sp. of bat. Observational data from swarming activity surveys support the assertion that low numbers of bats use the tunnel in autumn.

Pill Station

6.2.9 The stone arches on the disused southern platform at Pill station are being used as a day roost by lesser horseshoe bats and a night roost by lesser and greater horseshoe bats. Low numbers of bats are using the structures, with observational survey data confirming solitary animals shelter during summer. Acoustic monitoring of the site confirms roosting is frequent and therefore the structures are considered to be important within a local context.

6.2.10 Bat surveys using data loggers were undertaken along the freight line from Pill Viaduct to the junction with the disused line to collect data between May and October 2019 to determine the level of use of the navigational route by horseshoe bats. These data indicate that activity at, or close to Pill Station, is not strongly associated with the disused railway line, which is an important corridor for bats with movement between the line and Brockley Hall Stables SSSI, a link with the North Somerset and Mendip Bats SAC. Whilst there is likely to be some movement from the wider area, much of the lesser horseshoe bat activity appears to be localised and greater horseshoe bat activity through the station is too low to be considered significant commuting behaviour. The overall importance as a roost habitat and linear landscape feature for bats is of value at local level.

Tree Roost Resource along the Avon Gorge and Portbury Freight Line

6.2.11 The bat roost appraisal evaluates the woodland resource within Network Rail land as being of local value, with the trees being important within a site context for local bat populations that inhabit the Avon Gorge Woodlands SAC/SSSI.

6.3 Summary

6.3.1 The evaluation of ecological receptors identified for bats within the scheme are summarised in Table 36.

Table 36. Evaluation of Habitats and Features for Bats

Location	**Habitat or Feature**	**Value**
Disused railway line		
Portishead	Commuting Route	Site
	Foraging Habitat	Site
	Roost Resource	Negligible
Portbury Wharf Area	Commuting Route	Regional
	Foraging Habitat	County
	Roost Resource	Site
Farmland	Commuting Route	Regional

Location	Habitat or Feature	Value
	Foraging Habitat	Site
	Roost Resource	Local
Royal Portbury Dock	Commuting bats	Regional
	Foraging bats	County
	Structures	Site
Portbury Freight Line		
Clifton 1	Roost Resource	Site
Clifton 2	Roost Resource	District
Sandstone	Roost Resource	District
Pill	Roost Resource	Site
Pill Station	Roost Resource	Local
	Commuting Route	Local
Avon Gorge Woodland	Roost Resource	Local

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Figures

Legend

- Portishead
- Portbury Common
- Farmland
- Royal Portbury Dock

0 200 400 600 m

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Figure 1a. Disused Railway Line

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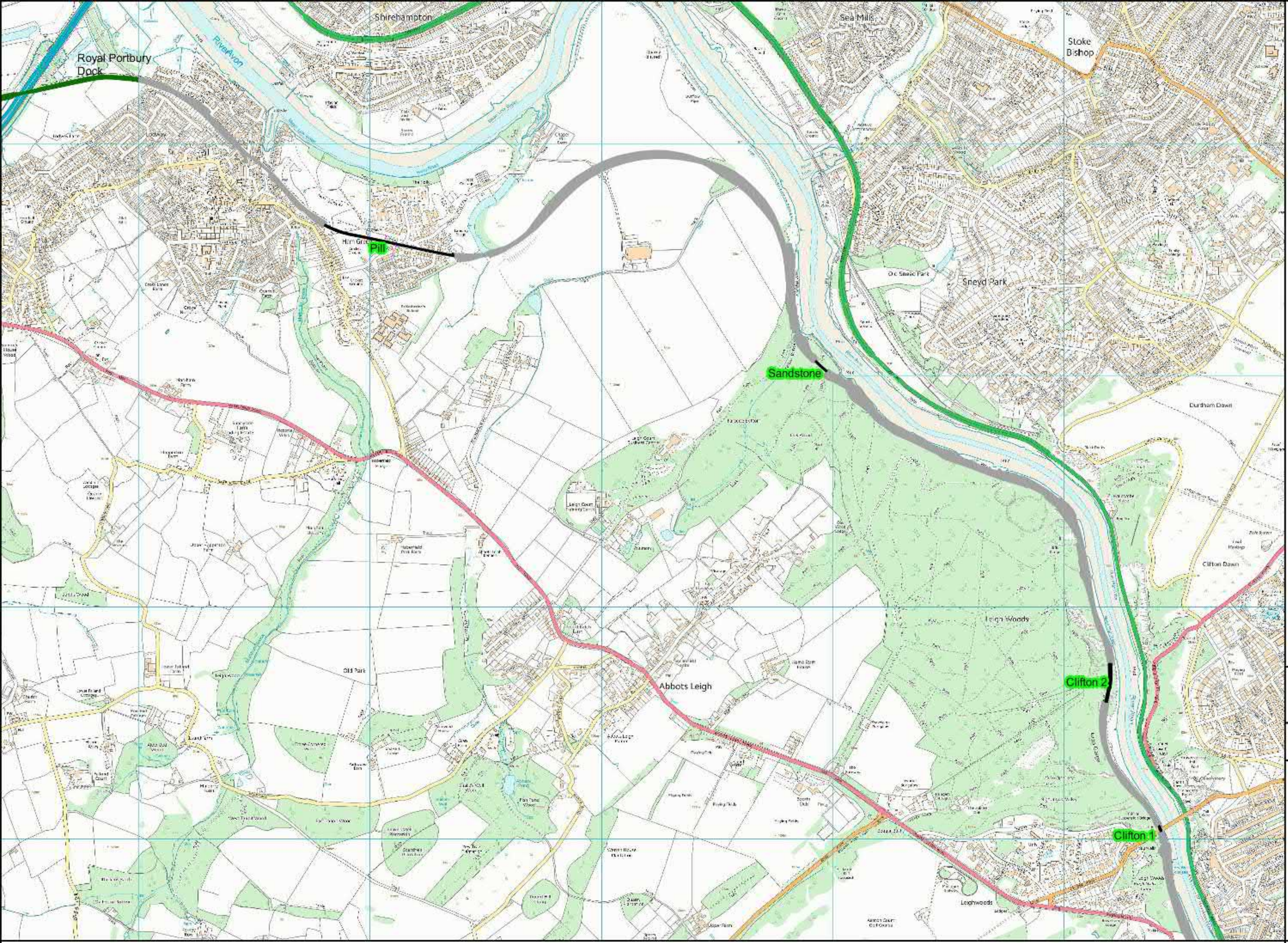

Legend

- Freight line
- Disused railway line
- Tunnels

0 200 400 600 m

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Figure 1b. Tunnels on Portbury Freight Line

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Figure 2a. Disused Railway Line: Walked Transect Route 2014

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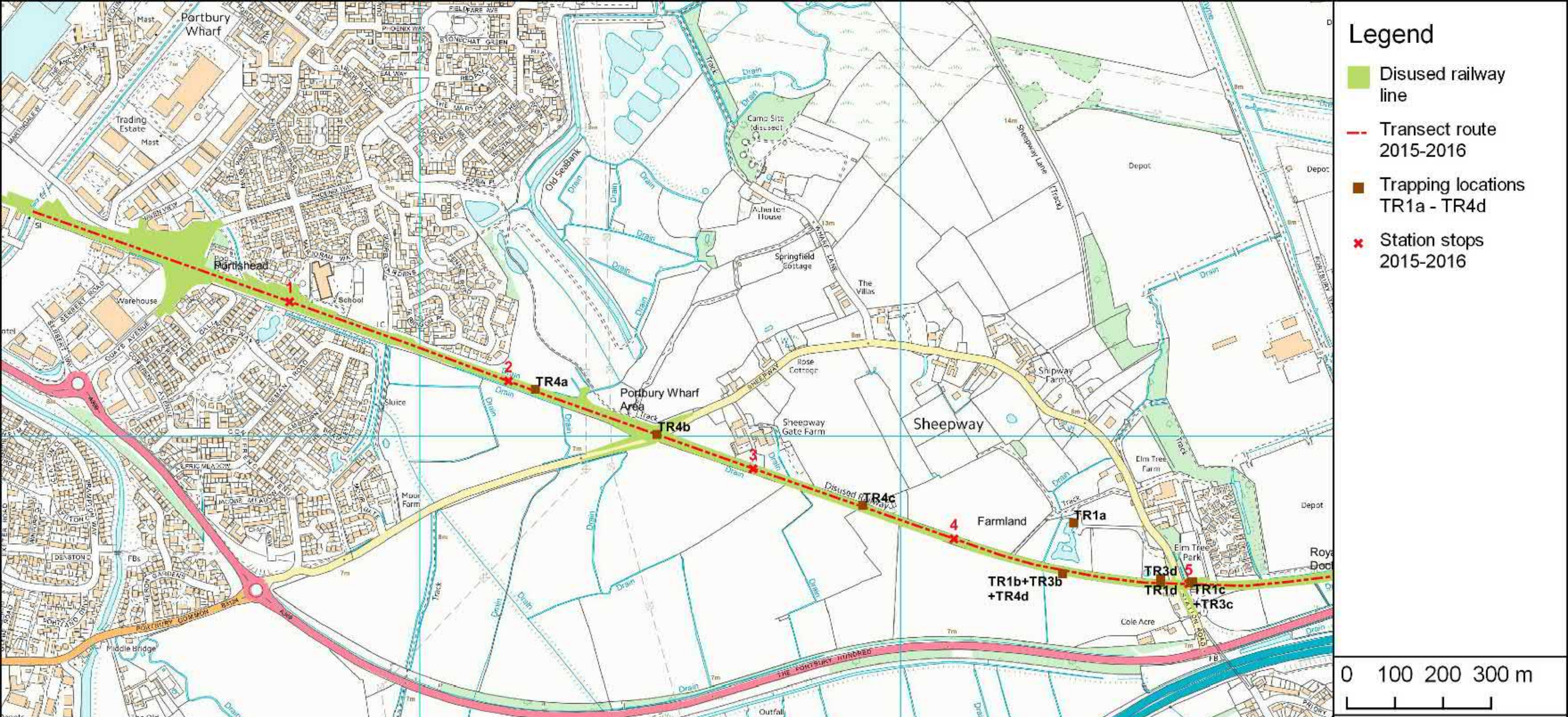

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Figure 2b. Disused Railway Line: Walked Transect Route 2015/16 and Trapping Locations 2015

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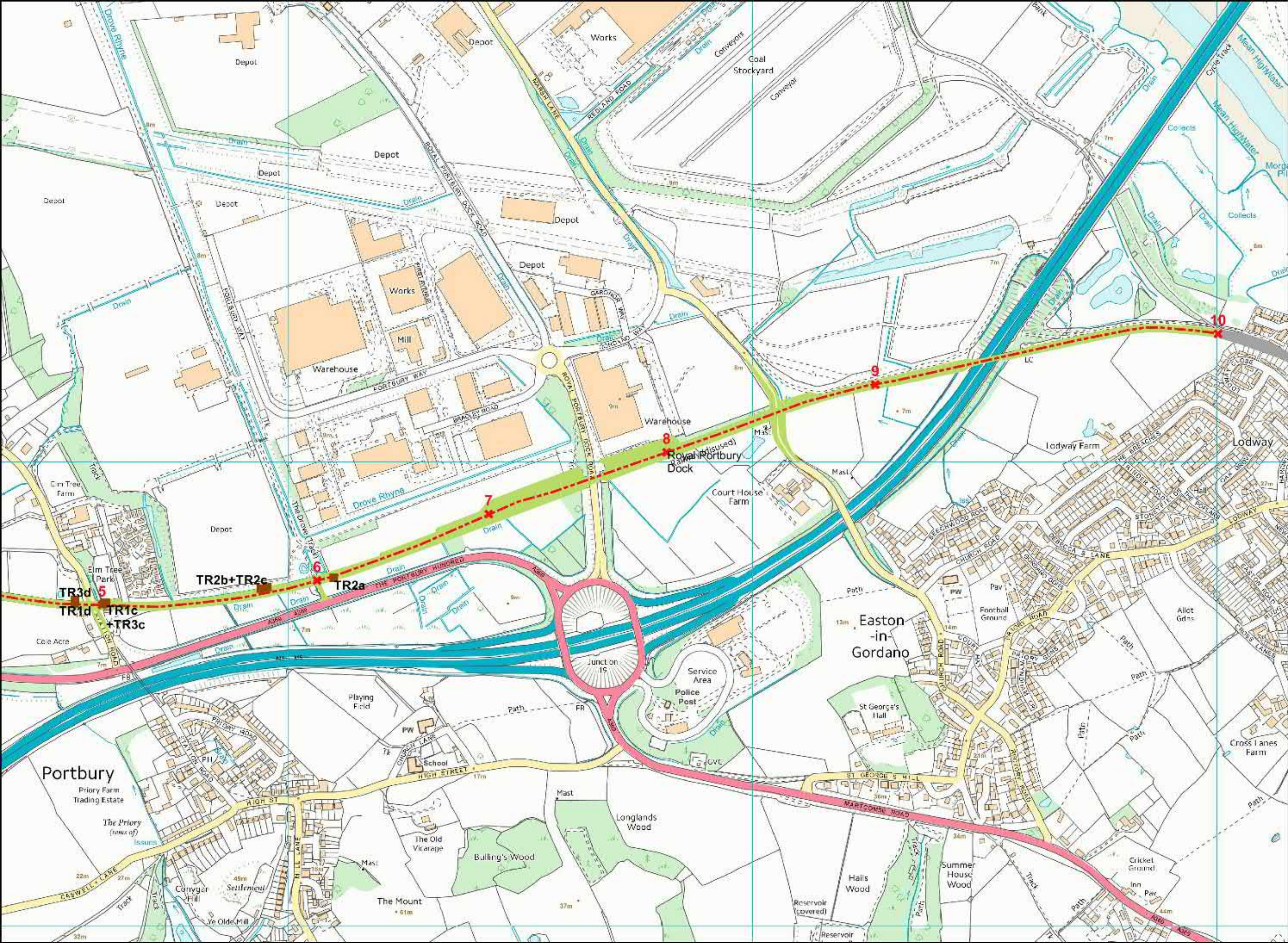

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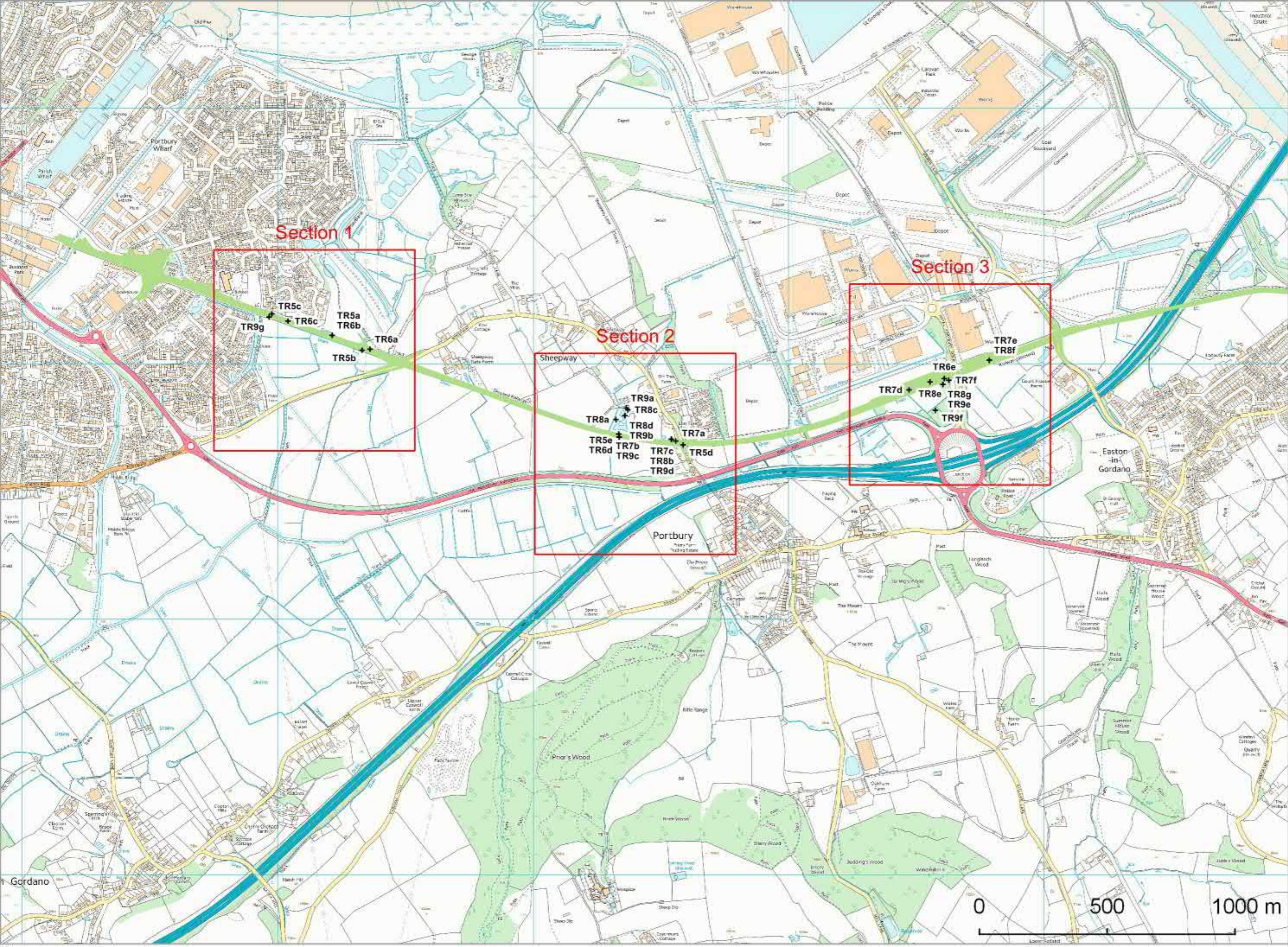
Figure 2b. Disused Railway Line: Walked Transect Route 2015/16 and Trapping Locations 2015



Legend

+ Trapping locations 10th - 14th June 2018

Sheet 1 of 4

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Figure 2c. Disused Railway Line: Trapping Locations 2018

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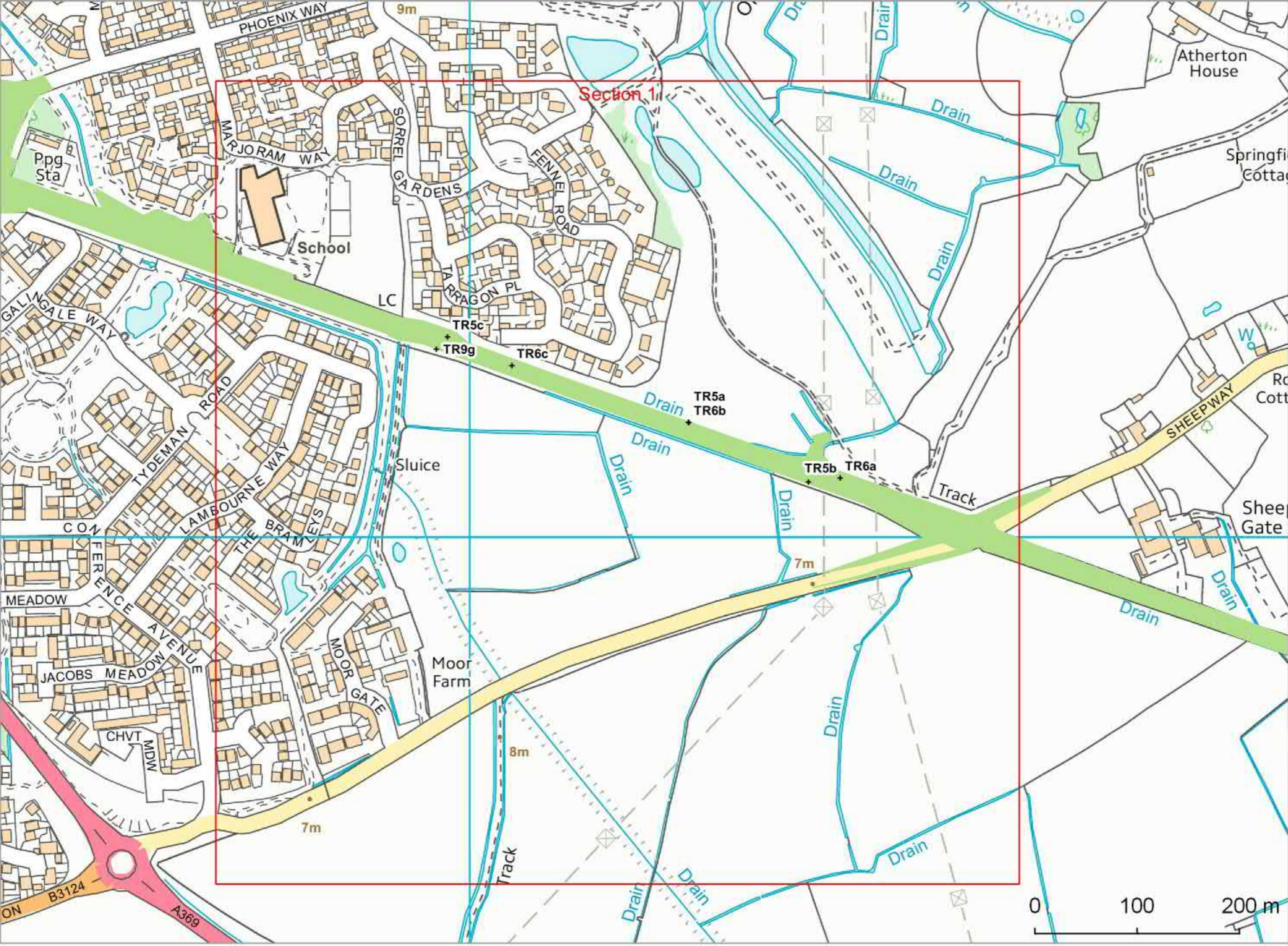

Legend

+ Trapping locations 10th - 14th June 2018

Sheet 2 of 4

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Figure 2c. Disused Railway Line: Trapping Locations 2018 in Section 1

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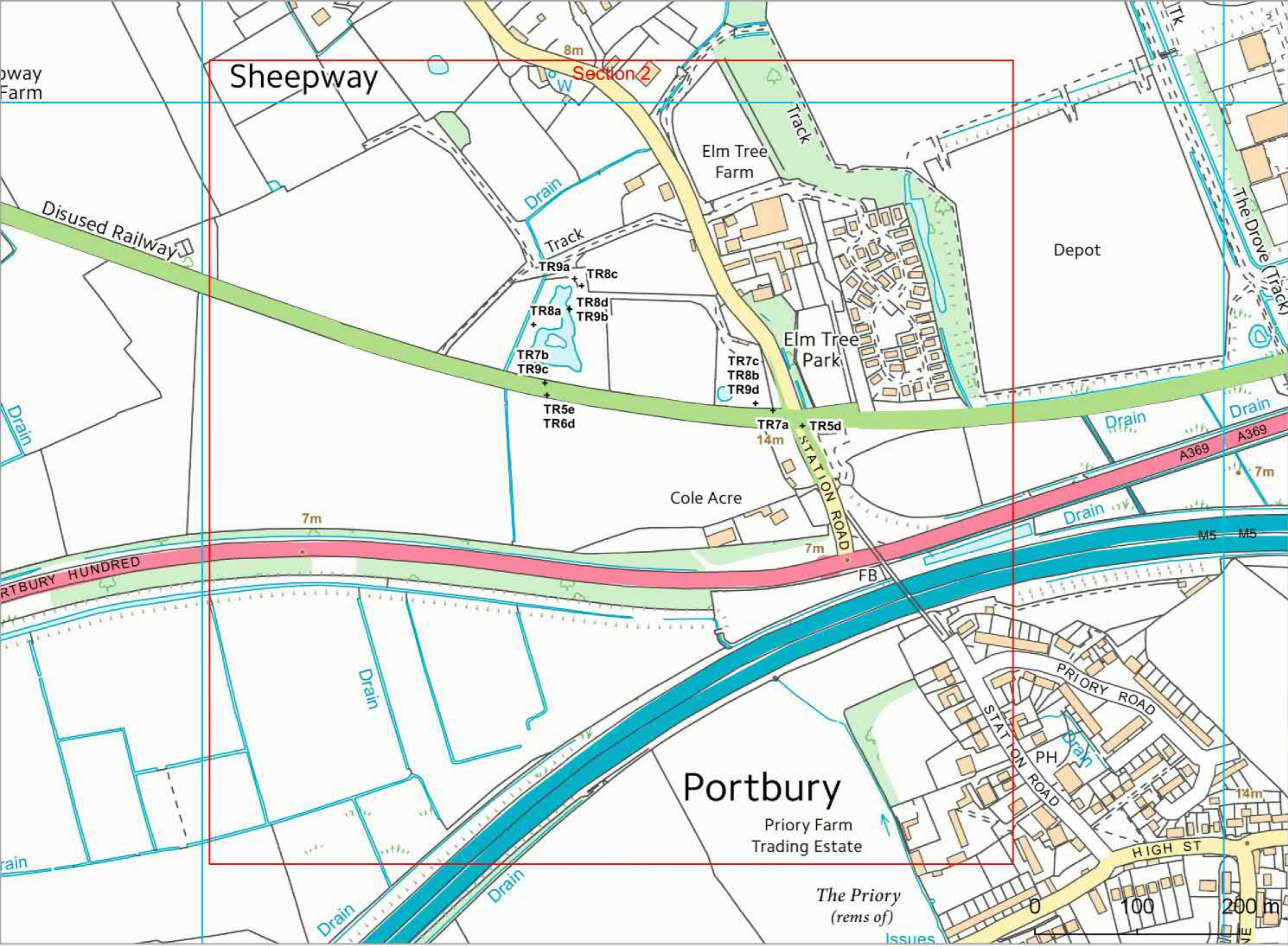

Legend

\+ Trapping locations 10th - 14th June 2018

Sheet 3 of 4

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Figure 2c. Disused Railway Line: Trapping Locations 2018 in Section 2

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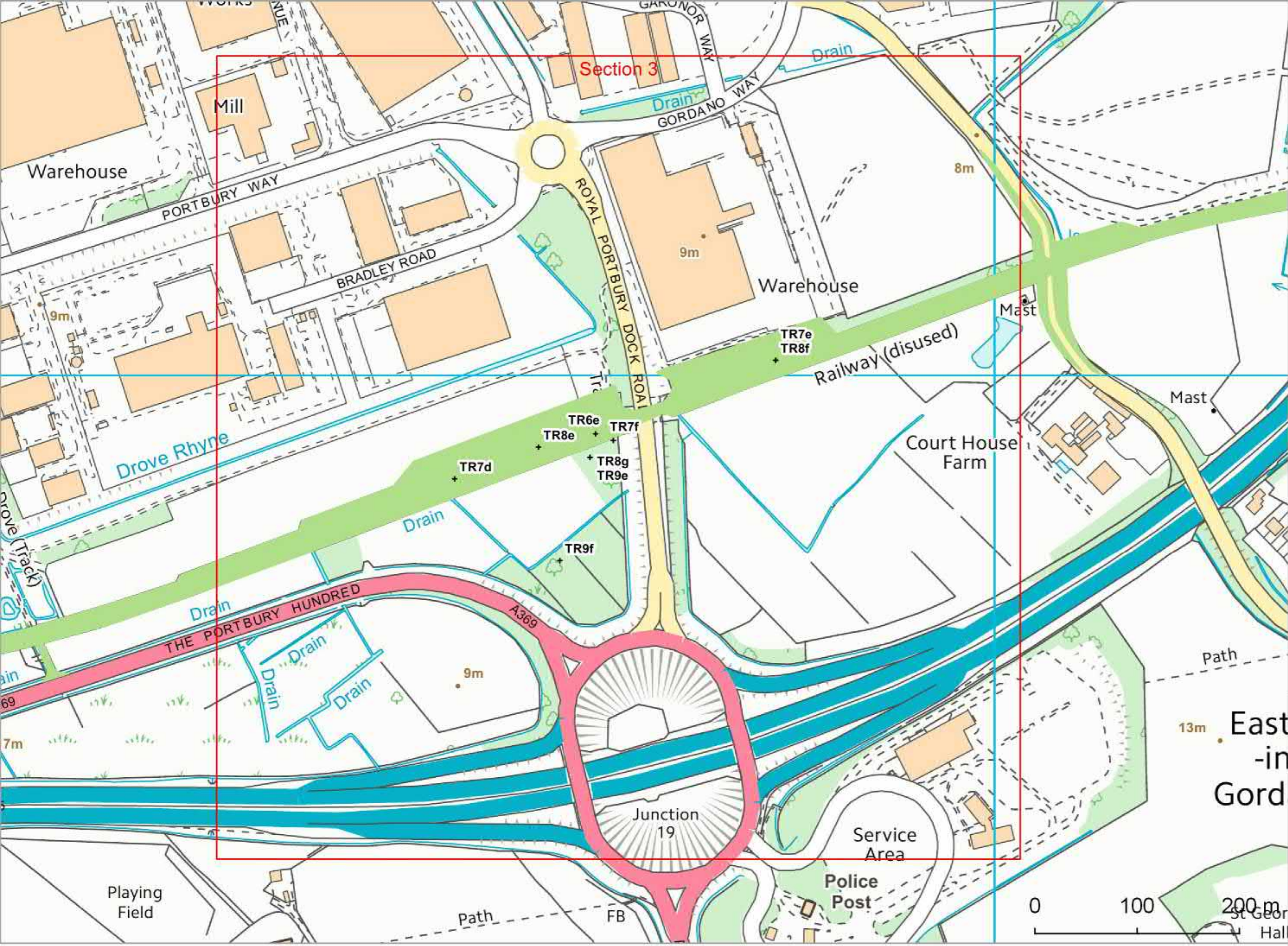

Legend

+ Trapping locations 10th - 14th June 2018

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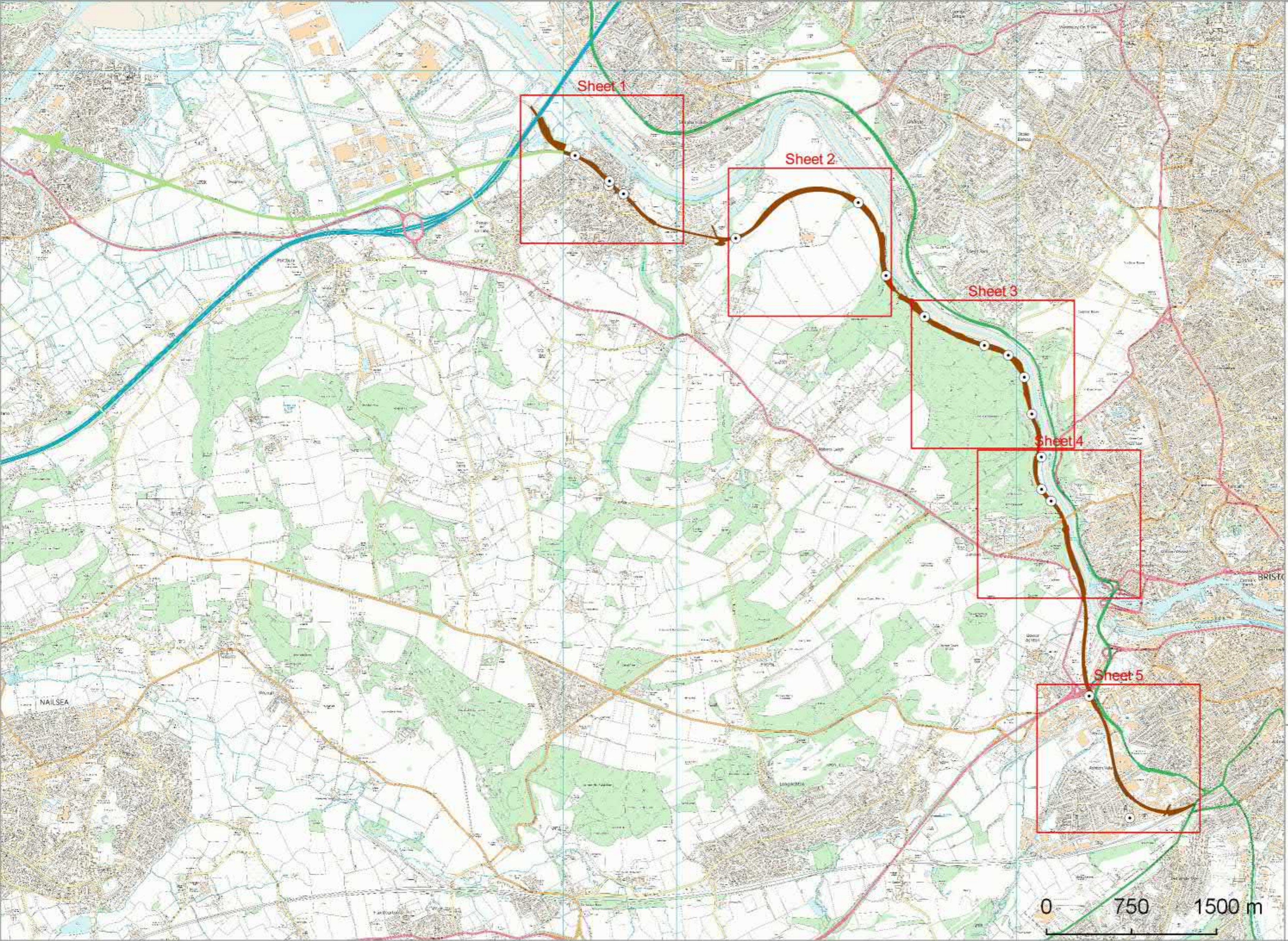
Figure 2c. Disused Railway Line: Trapping Locations 2018 in Section 3



Legend

- Disused Railway Line
- Portbury Freight Line
- Viaducts, Underbridges and Structures

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Figure 2d. Viaducts, Underbridges and Structures on Portbury Freight Line

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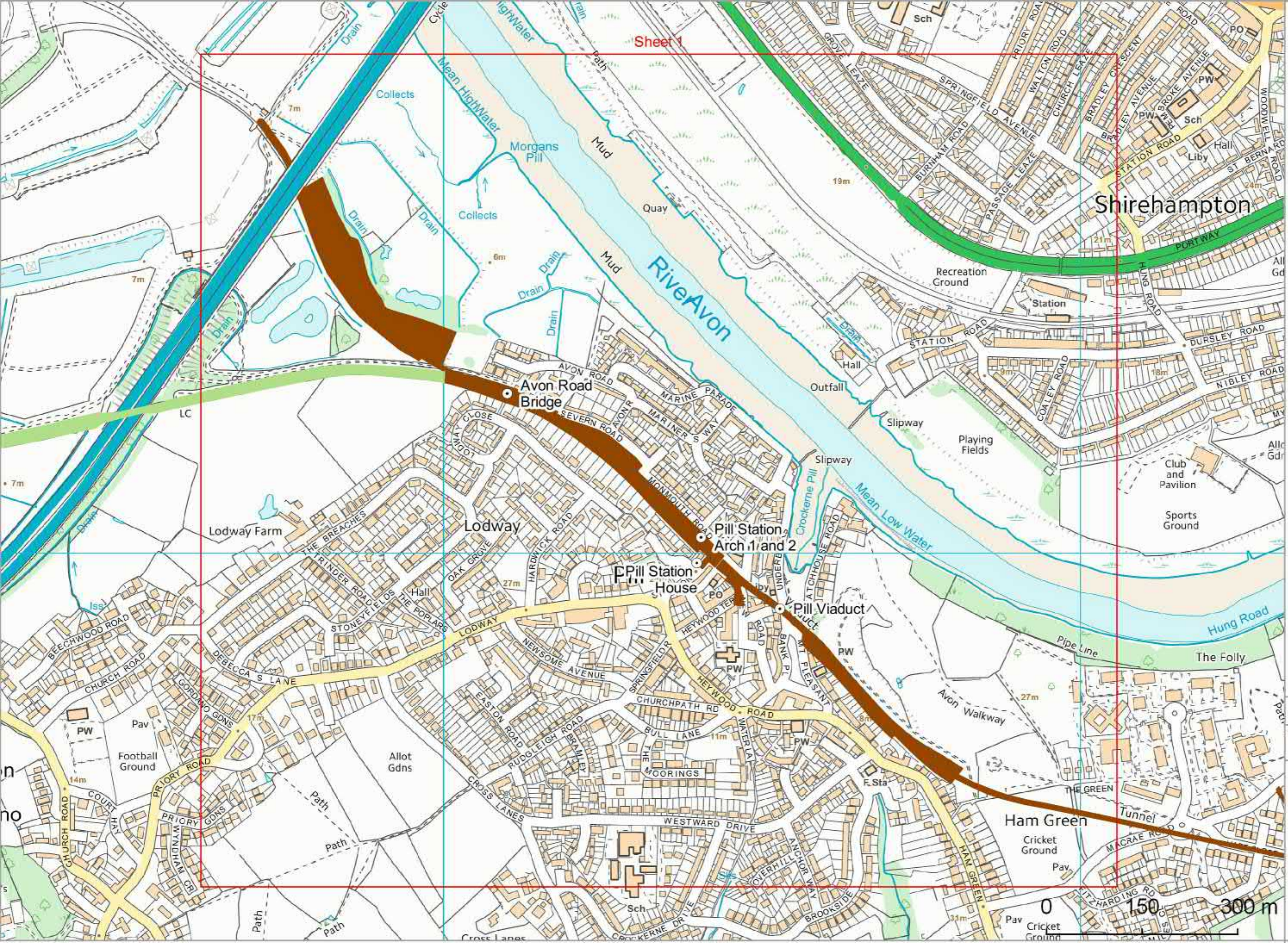

Legend

- Disused Railway Line
- Portbury Freight Line
- Viaducts, Underbridges and Structures

Sheet 1 of 5

PURE ECOLOGY

DATE: 23/07/18
PROJECT: Metro West
REF.: 230.6
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Figure 2d. Viaducts, Underbridges and Structures on Portbury Freight Line

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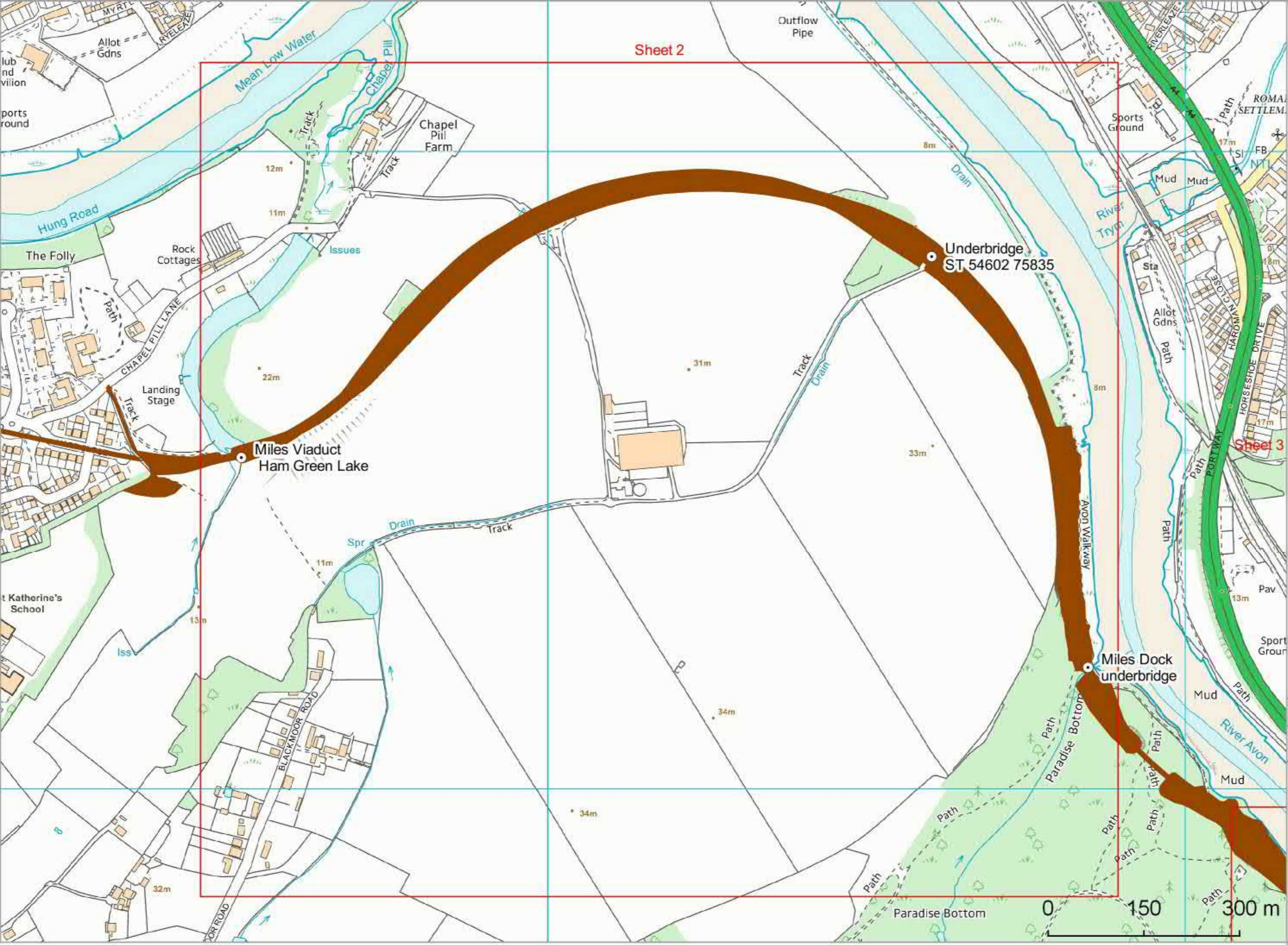

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Figure 2d. Viaducts, Underbridges and Structures on Portbury Freight Line

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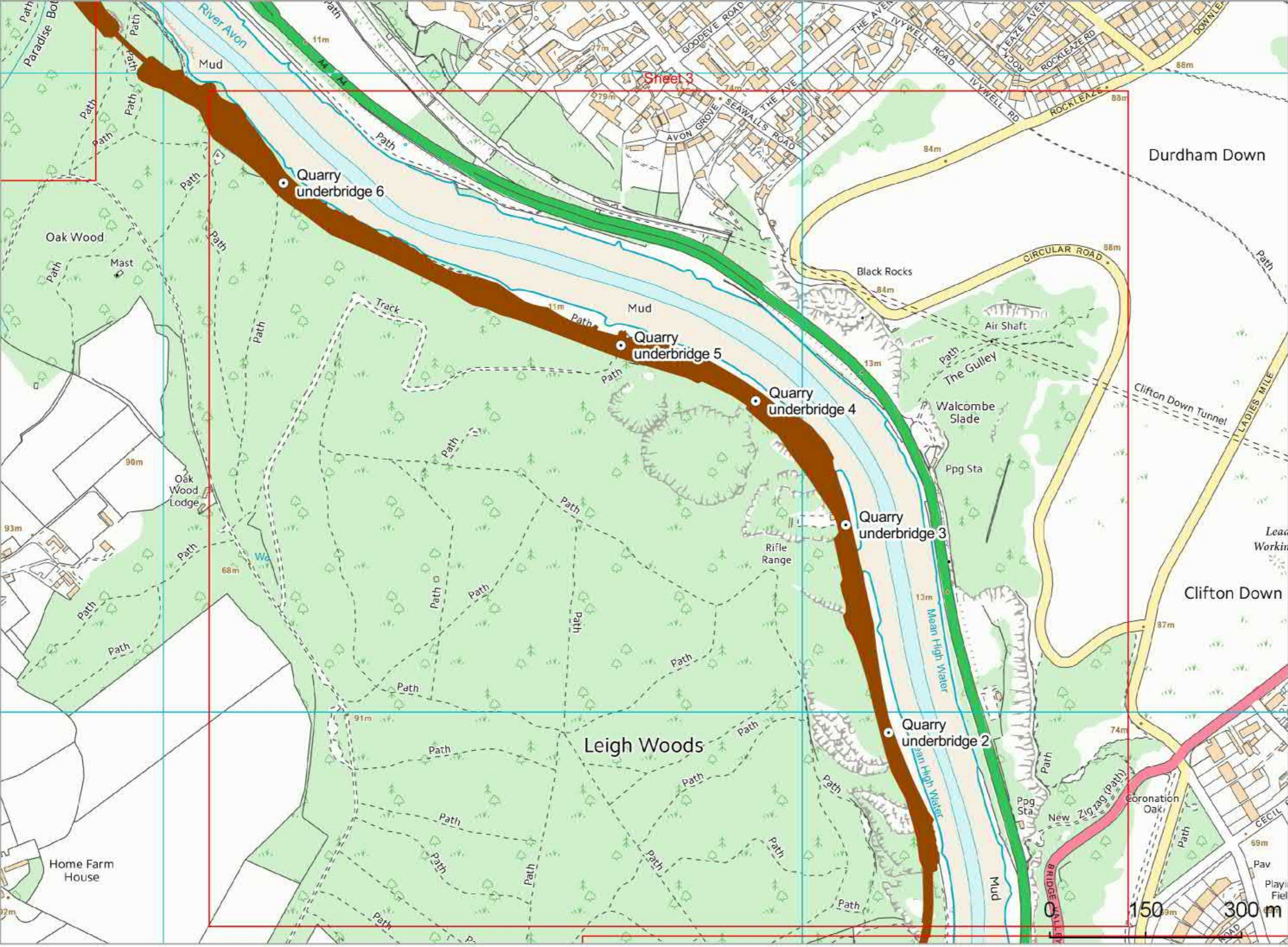

Legend

Portbury Freight Line

Viaducts, Underbridges and Structures

Sheet 3 of 5

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DATE: 23/07/18
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Figure 2d. Viaducts, Underbridges and Structures on Portbury Freight Line

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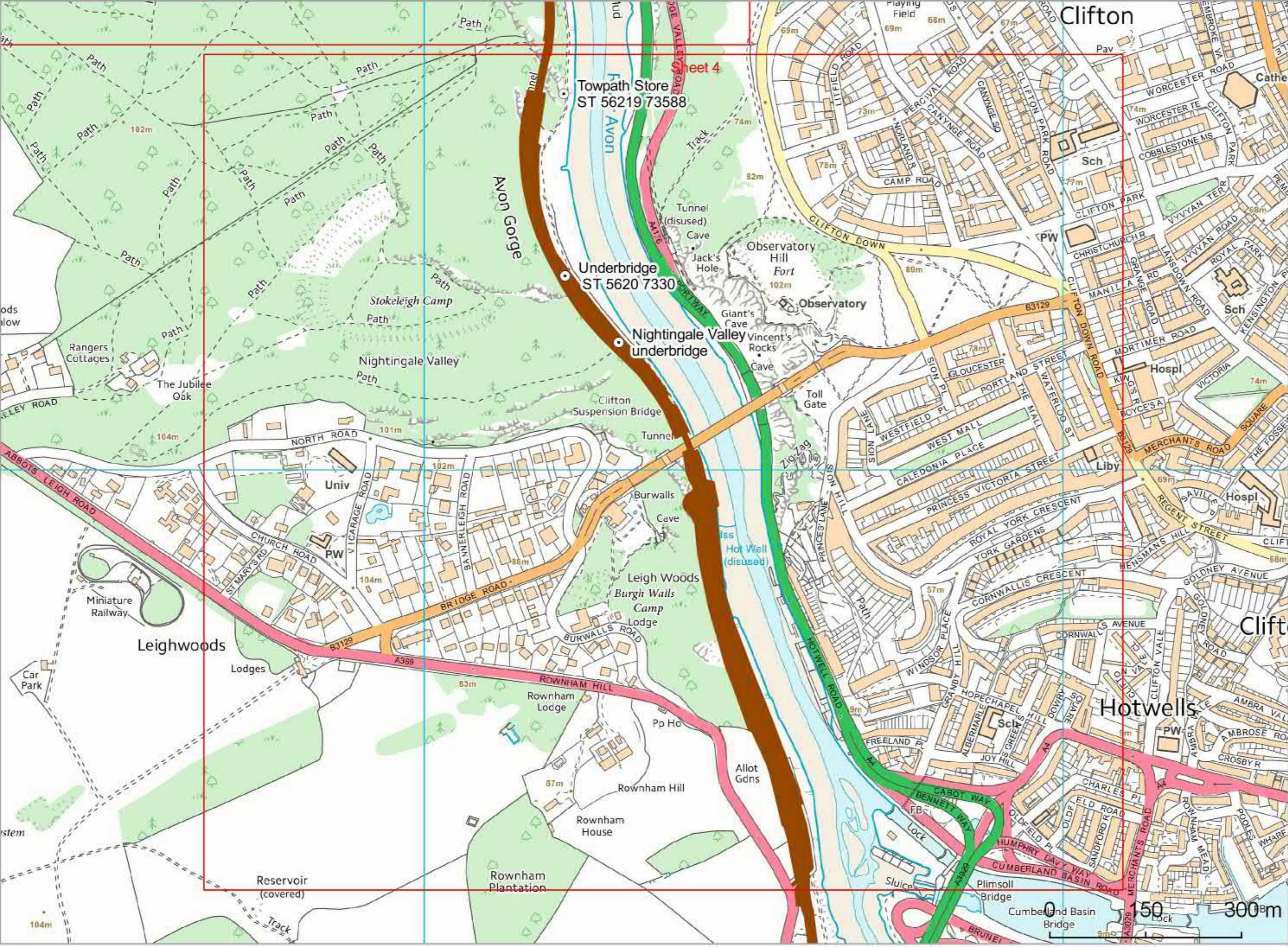

Legend

Portbury Freight Line

Viaducts, Underbridges and Structures

Sheet 4 of 5

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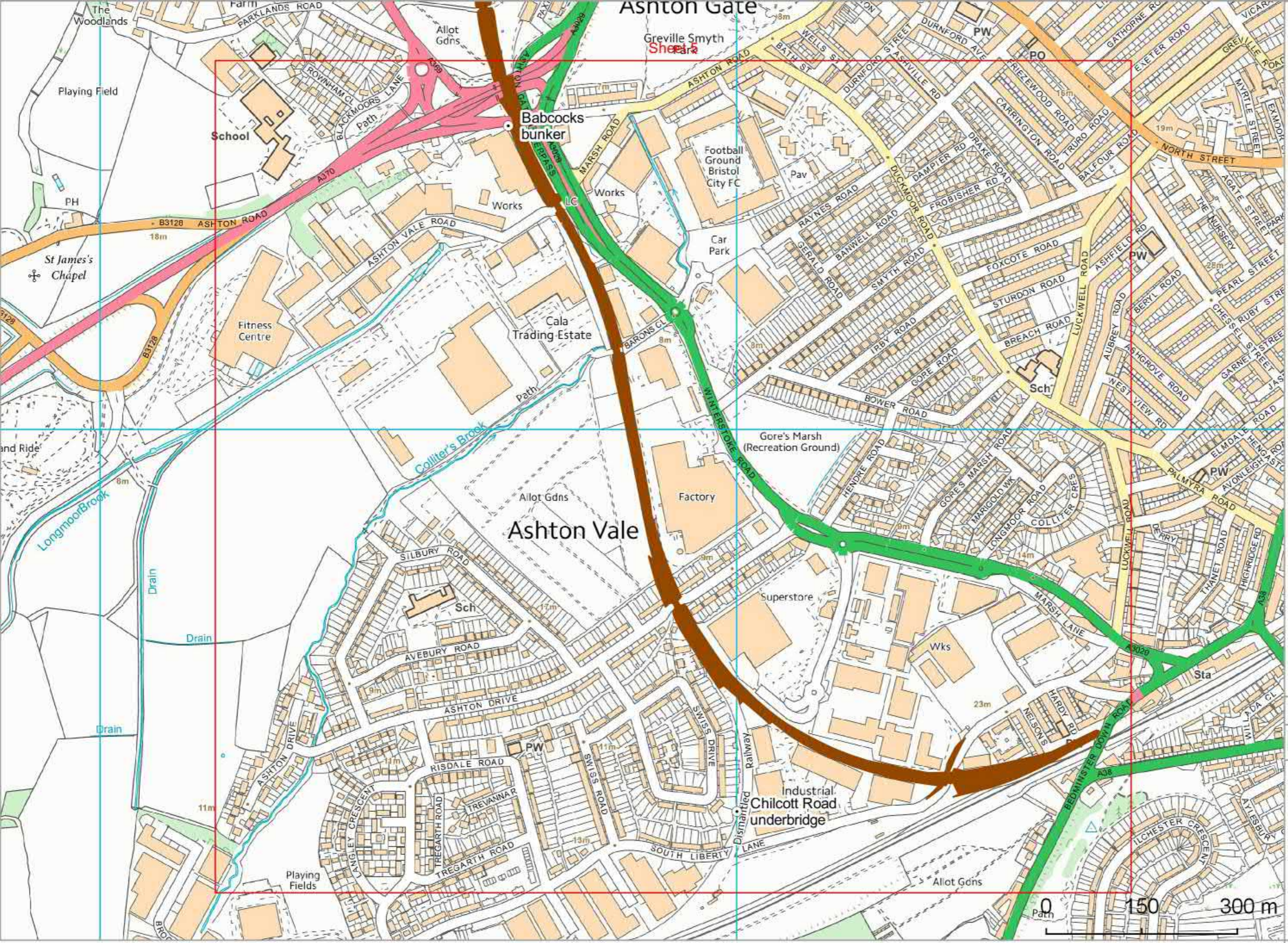
Figure 2d. Viaducts, Underbridges and Structures on Portbury Freight Line



Legend

Portbury Freight Line

Viaducts, Underbridges and Structures

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Figure 2d. Viaducts, Underbridges and Structures on Portbury Freight Line

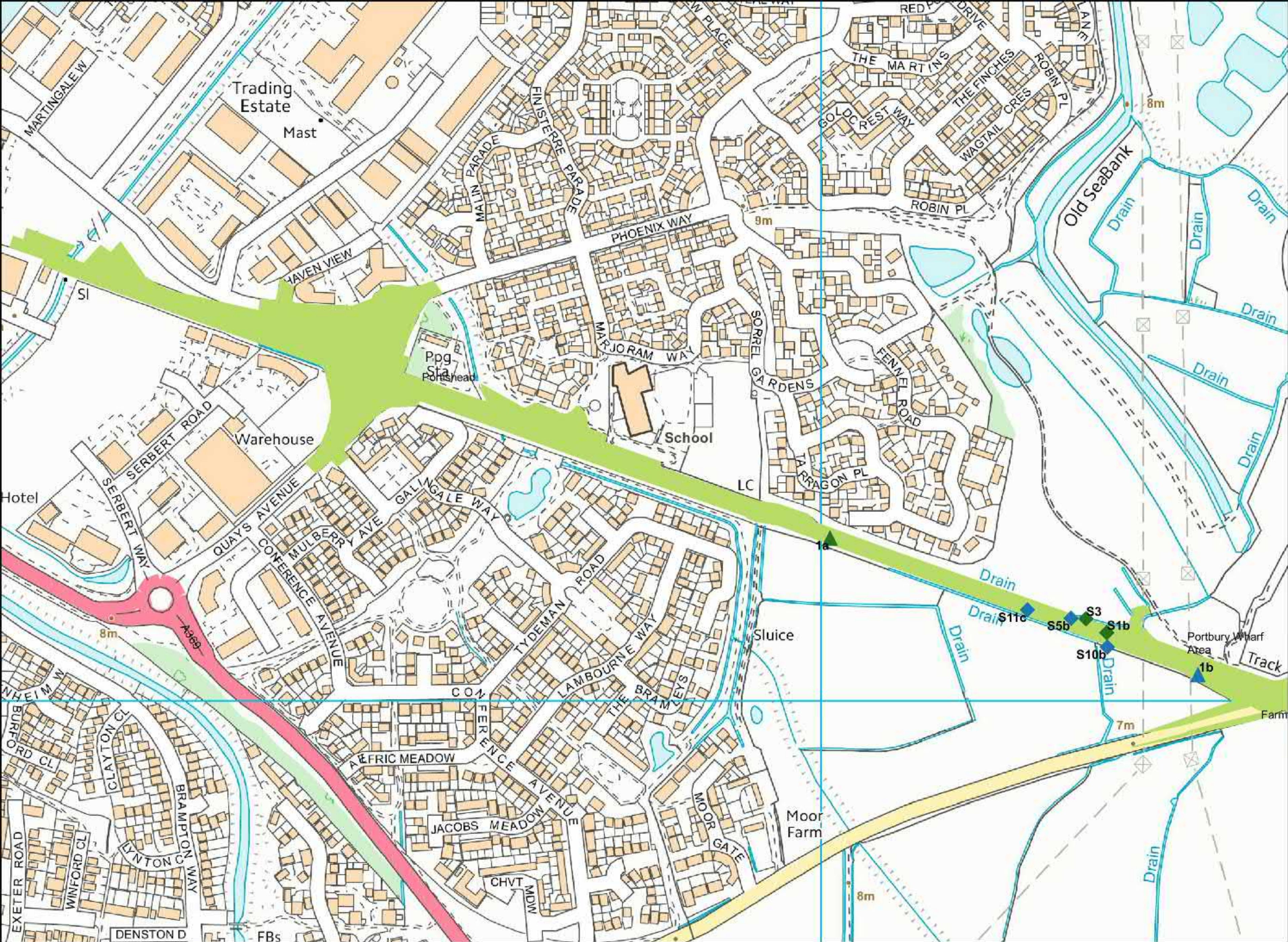

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Figure 3. Static Automated Bat Detector Locations

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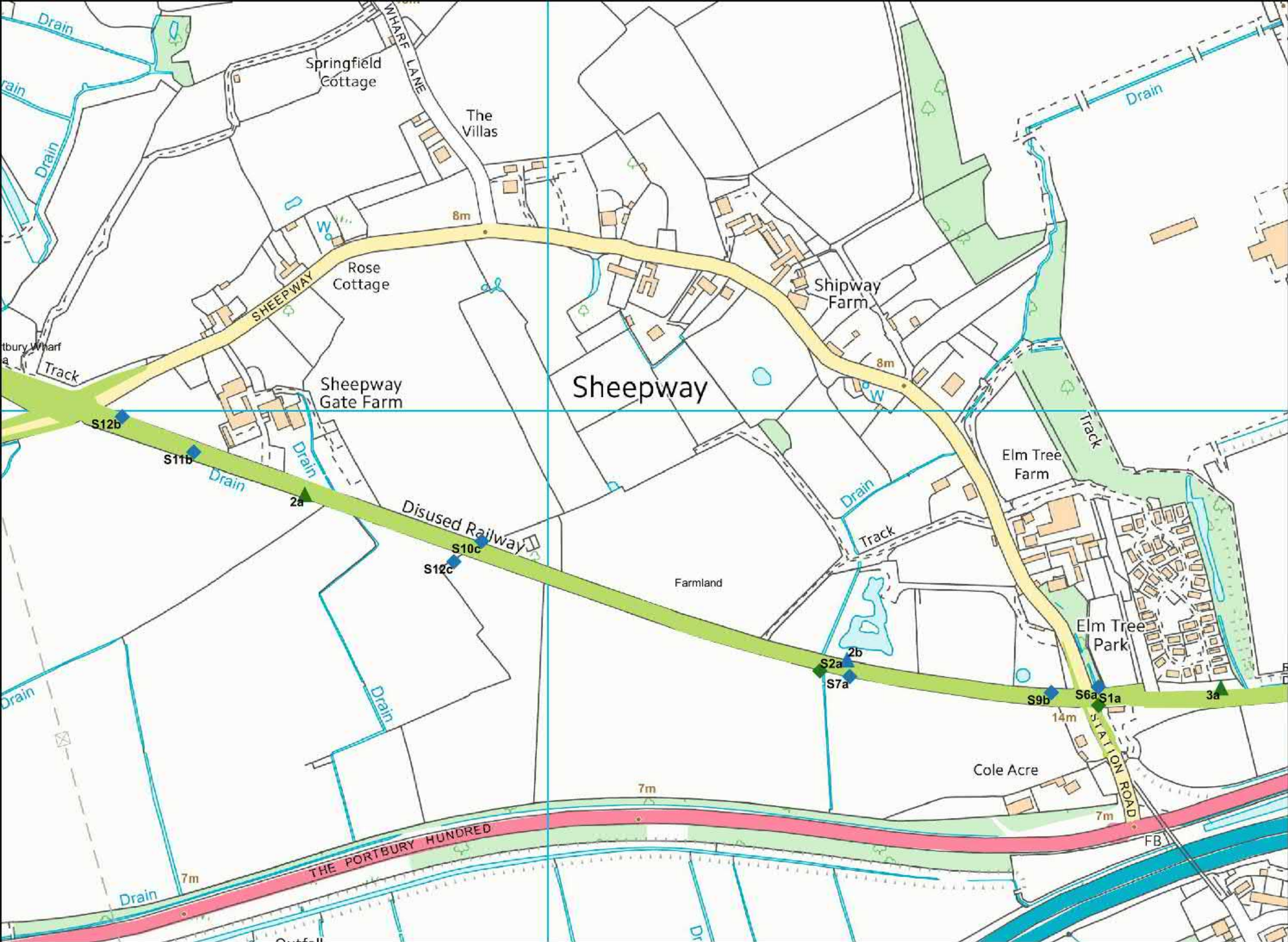

Legend

- Disused railway line
- Data loggers 2016 locations 1a - 5a
- Data loggers 2016 locations 1b - 5b
- Data loggers - 2015
- Datat loggers - 2014

0 50 100 150 m

SHEET 2 of 4

PURE ECOLOGY

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Figure 3. Static Automated Bat Detector Locations

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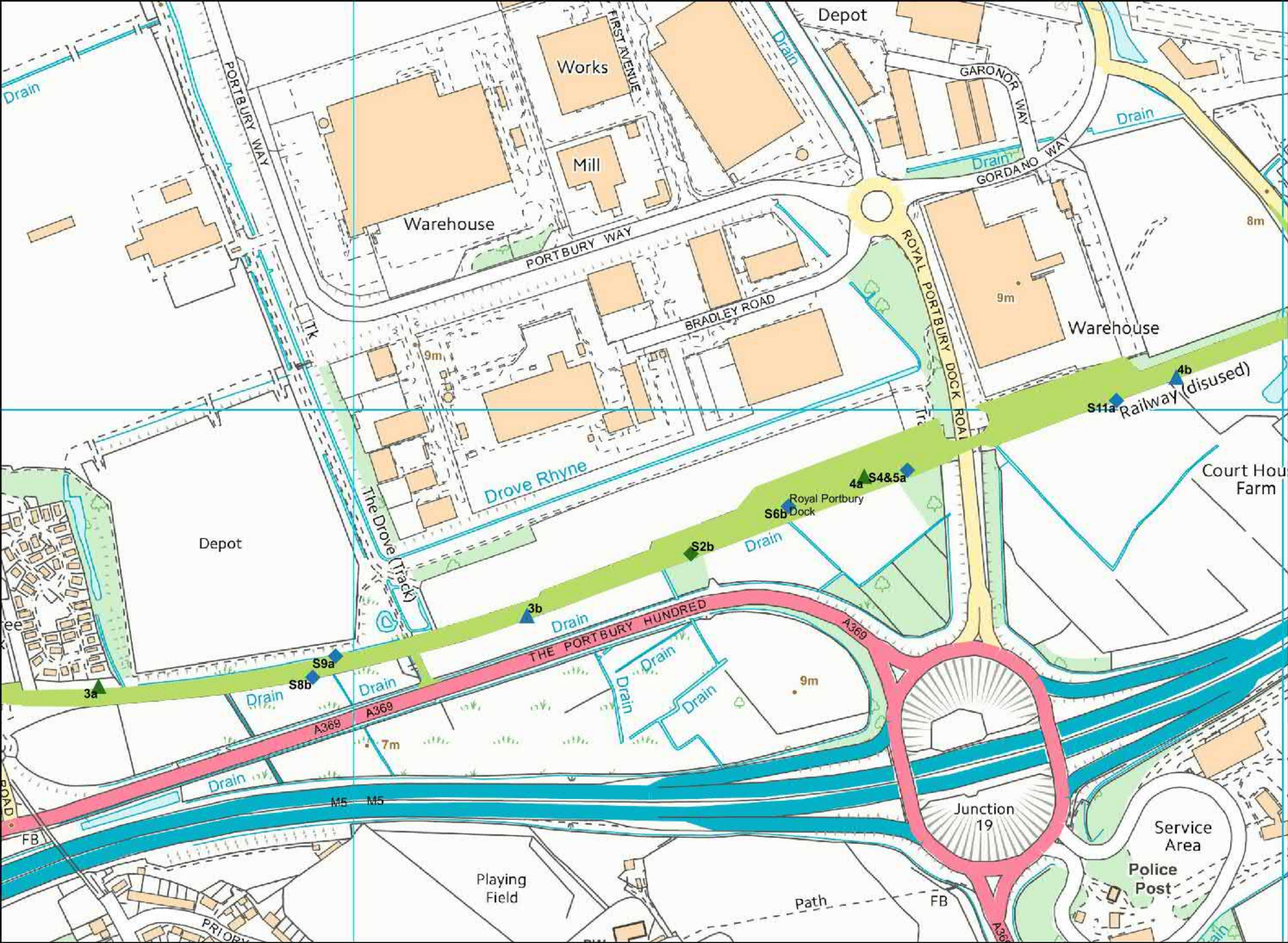

Legend

- Disused railway line
- Data loggers 2016 locations 1a - 5a
- Data loggers 2016 locations 1b - 5b
- Data loggers - 2015
- Datat loggers - 2014

0 50 100 150 m

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PURE ECOLOGY

DATE: 14/09/17
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Figure 3. Static Automated Bat Detector Locations

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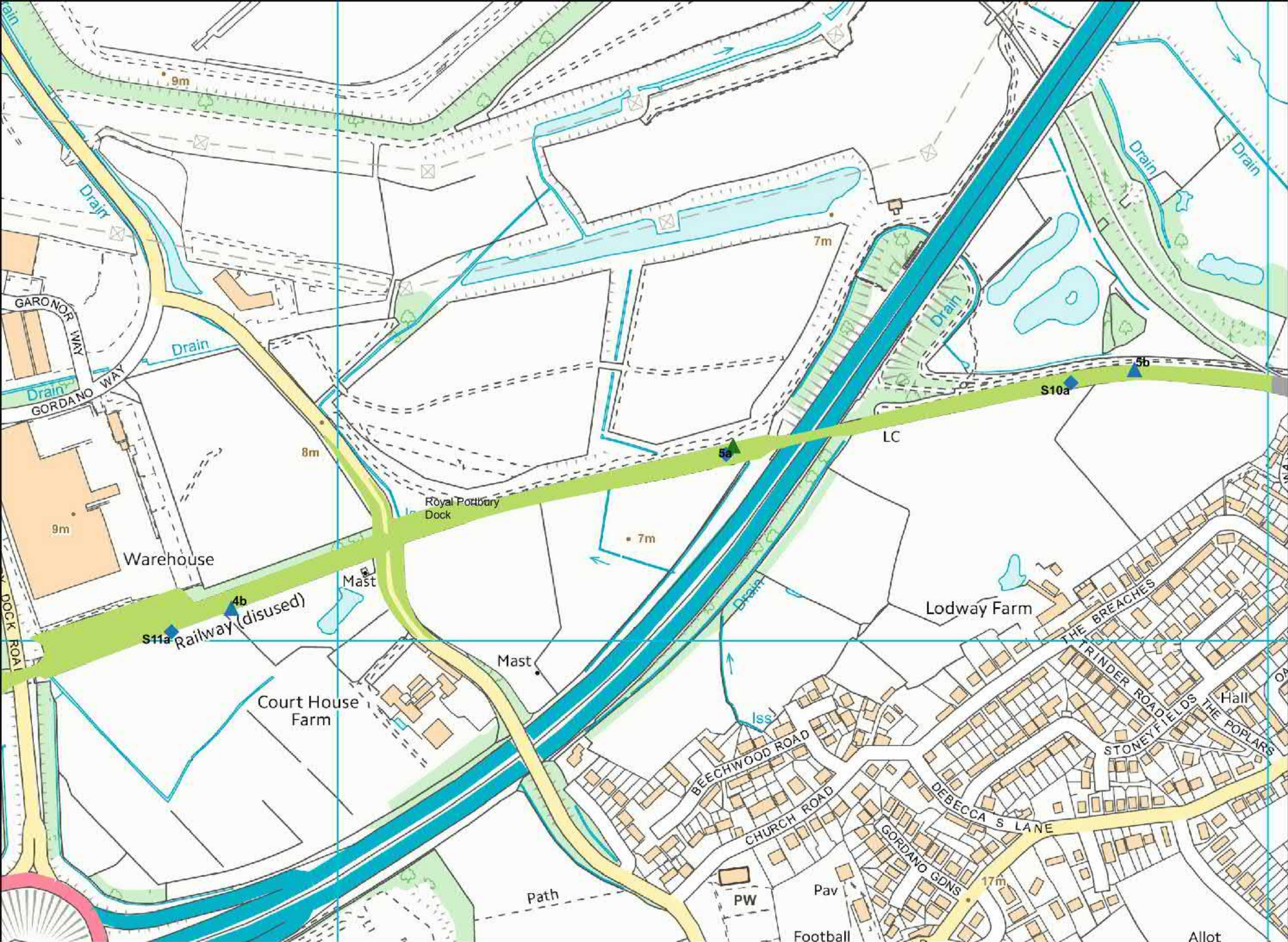

Legend

- Disused railway line
- Data loggers 2016 locations 1a - 5a
- Data loggers 2016 locations 1b - 5b
- Data loggers - 2015
- Datat loggers - 2014

0 50 100 150 m

SHEET 4 of 4

PURE ECOLOGY

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Figure 3. Static Automated Bat Detector Locations

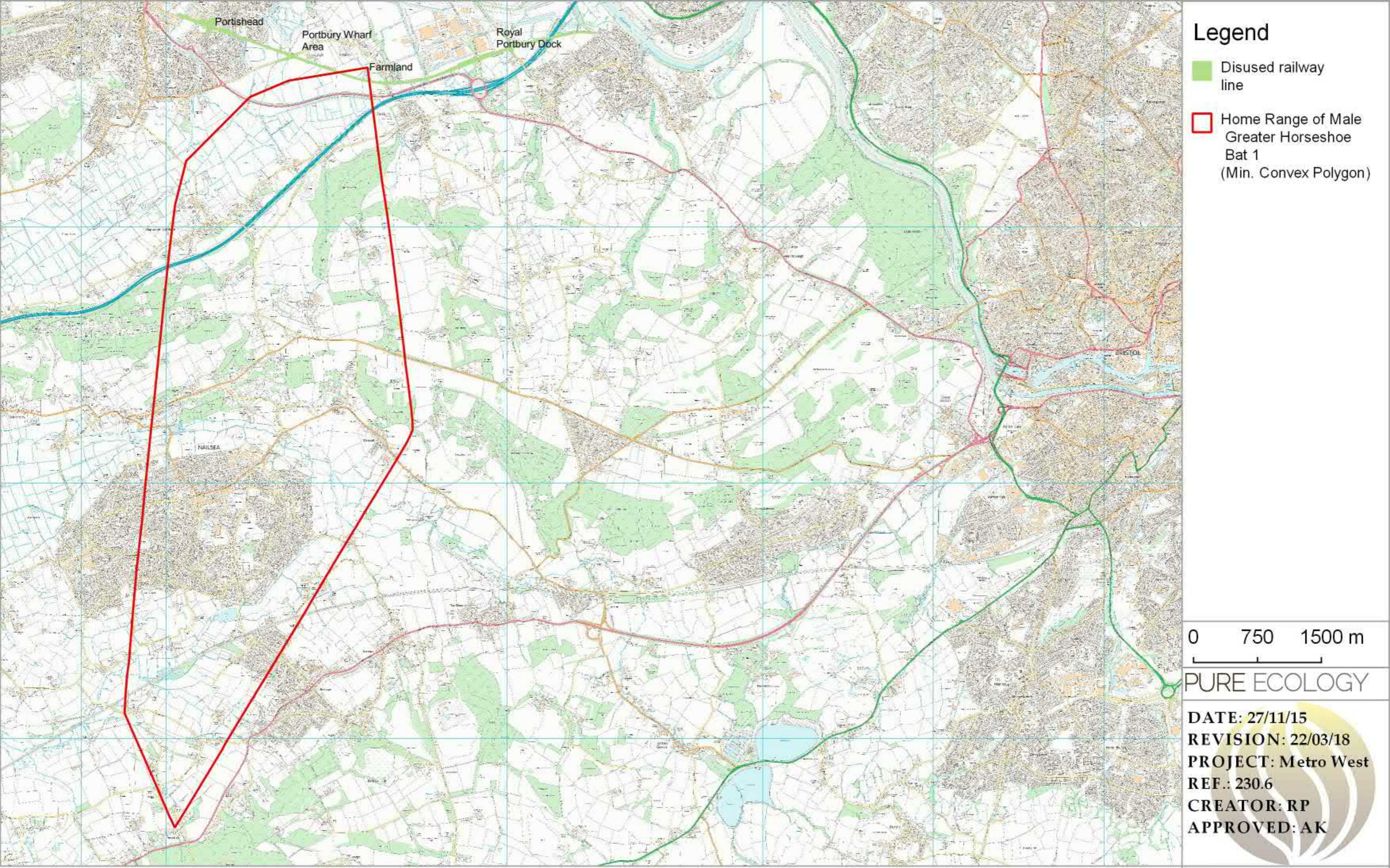

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Figure 4a. Bat 1: Male Greater Horseshoe Home Range 2015

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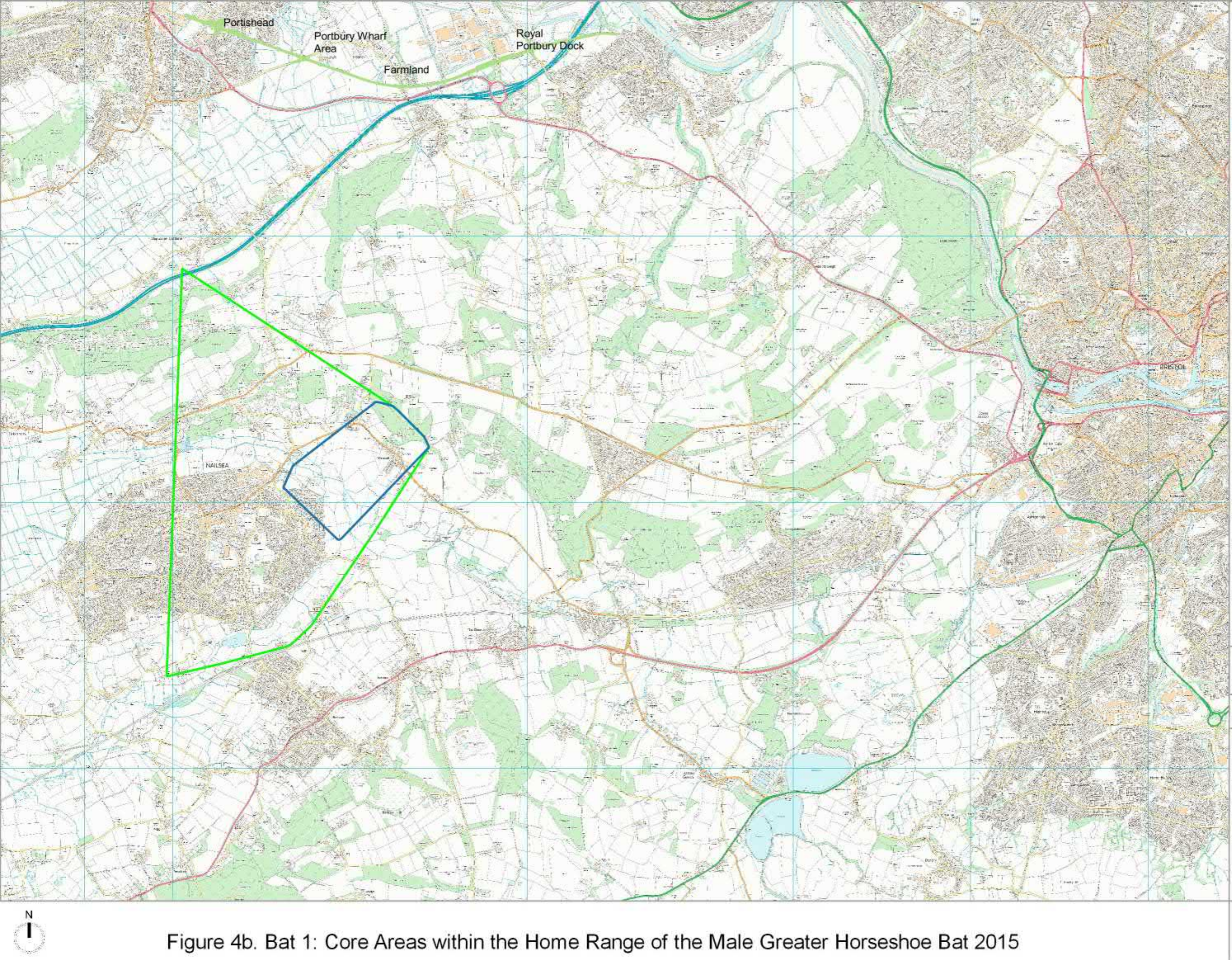

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Figure 4b. Bat 1: Core Areas within the Home Range of the Male Greater Horseshoe Bat 2015

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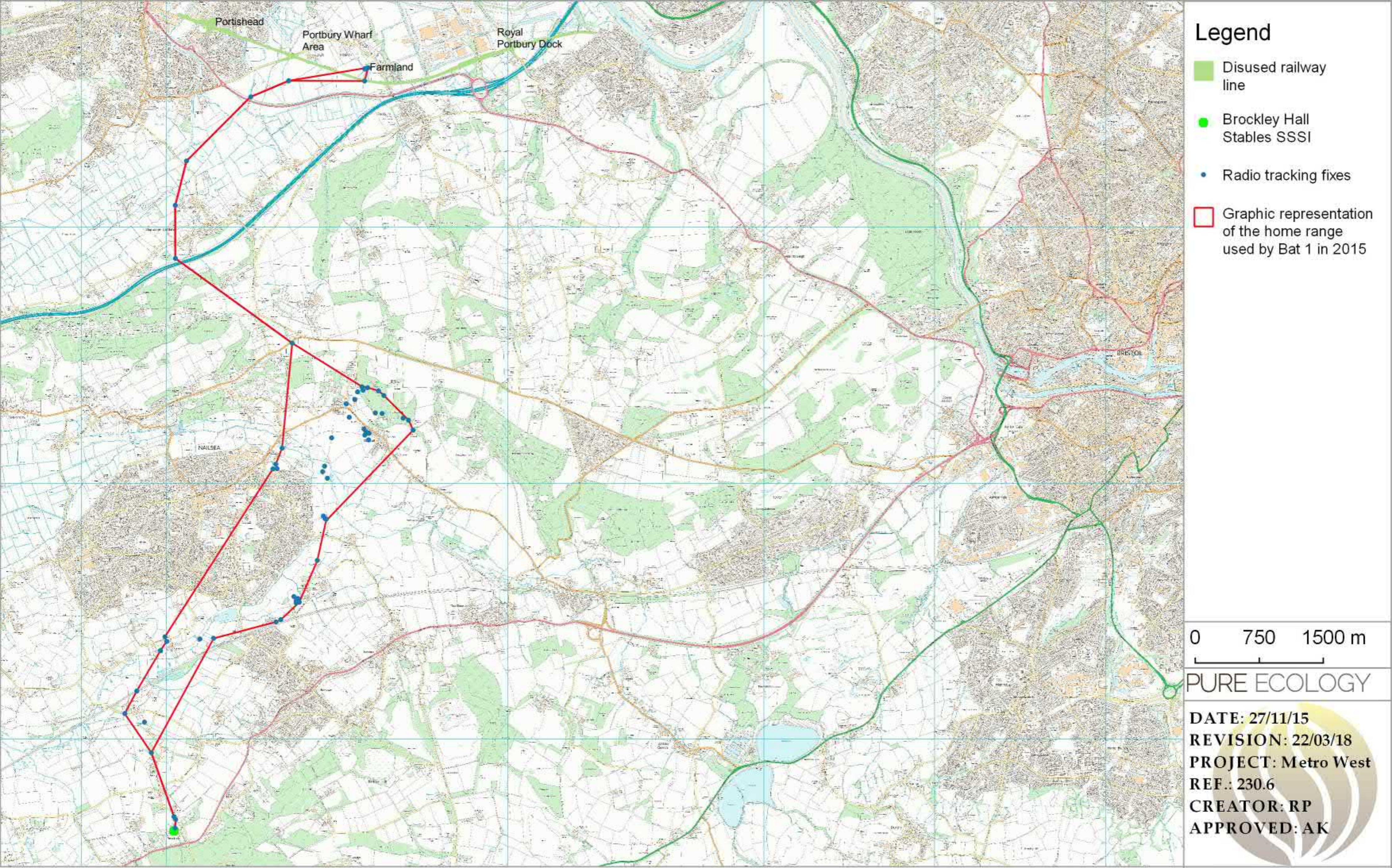

Figure 4c. Bat 1: Graphic Representation of the Landscape used by the Male Greater Horseshoe Bat in 2015

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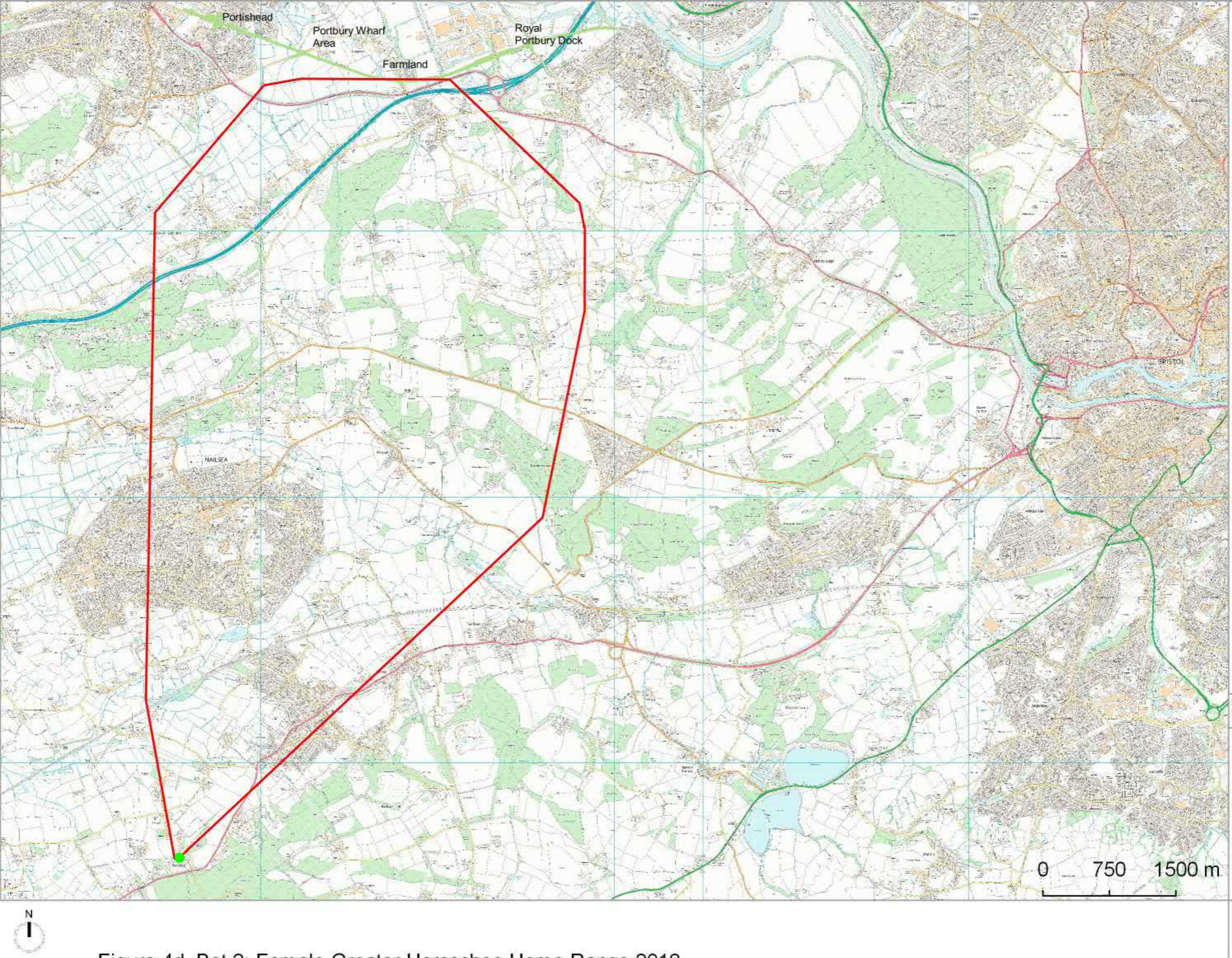

Legend

Disused Railway Line

Home Range of Female Greater Horseshoe Bat 2 (Min. Convex Polygon)

Brockley Hall Stables SSSI

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Figure 4d. Bat 2: Female Greater Horseshoe Home Range 2018

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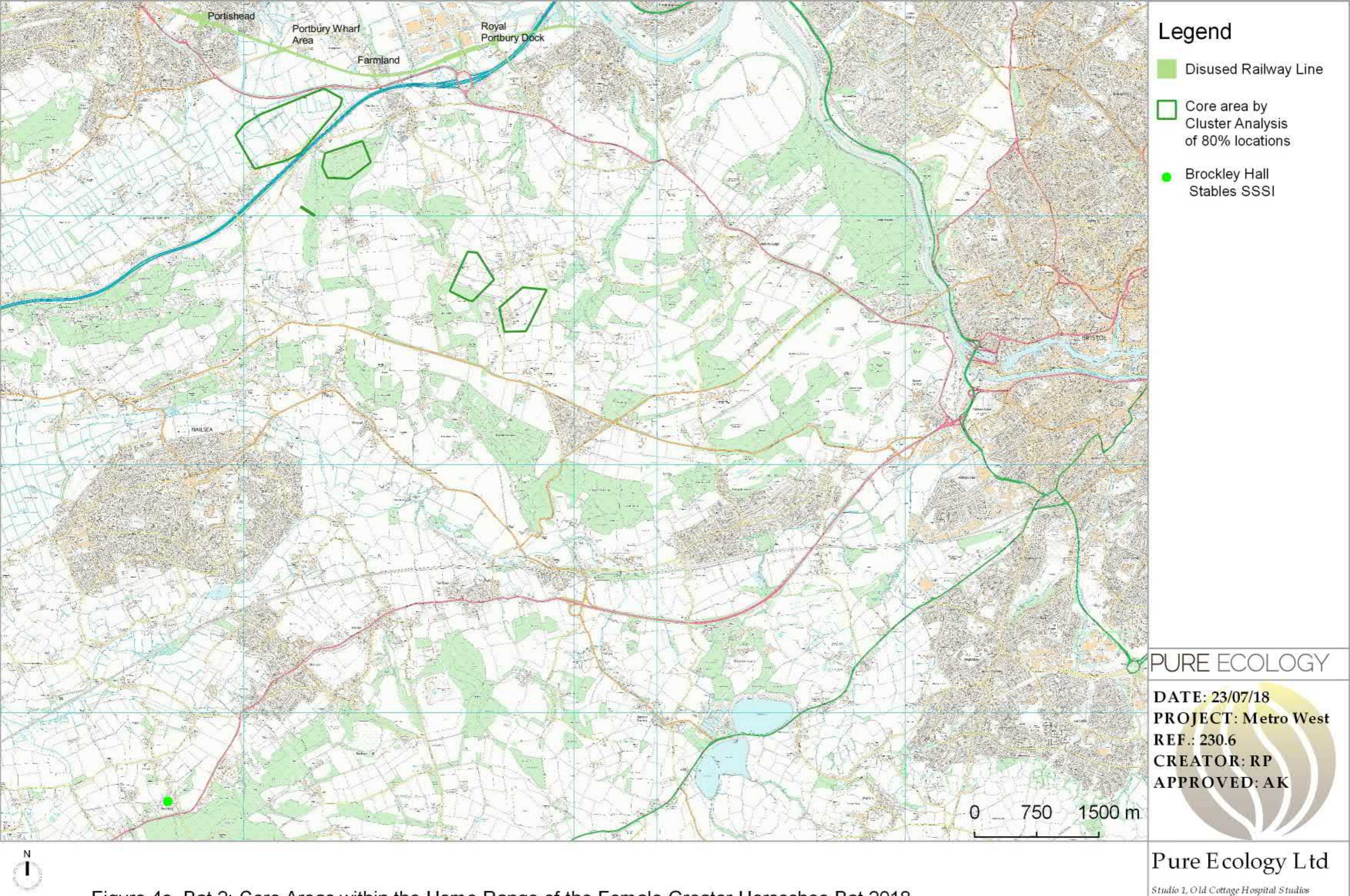

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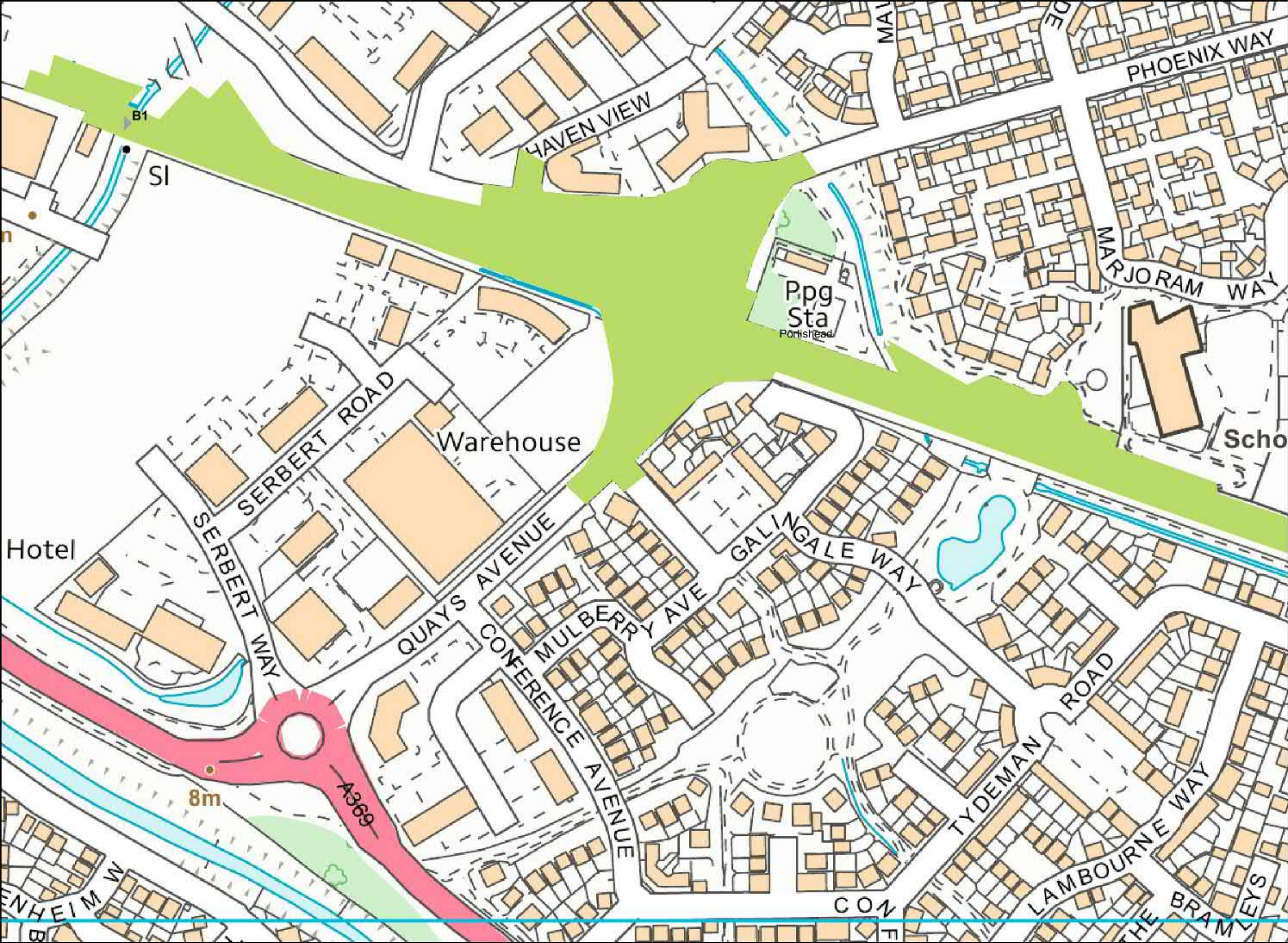
Figure 4e. Bat 2: Core Areas within the Home Range of the Female Greater Horseshoe Bat 2018



Legend
- Disused railway line
- Tree
- Tree with high bat roost potential
- Confirmed roost in bridge
- Bridge
- Confirmed roost in bridge
- Culvert

0 25 50 75 100 m

SHEET 1 of 7

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Figure 5. Structures and Trees

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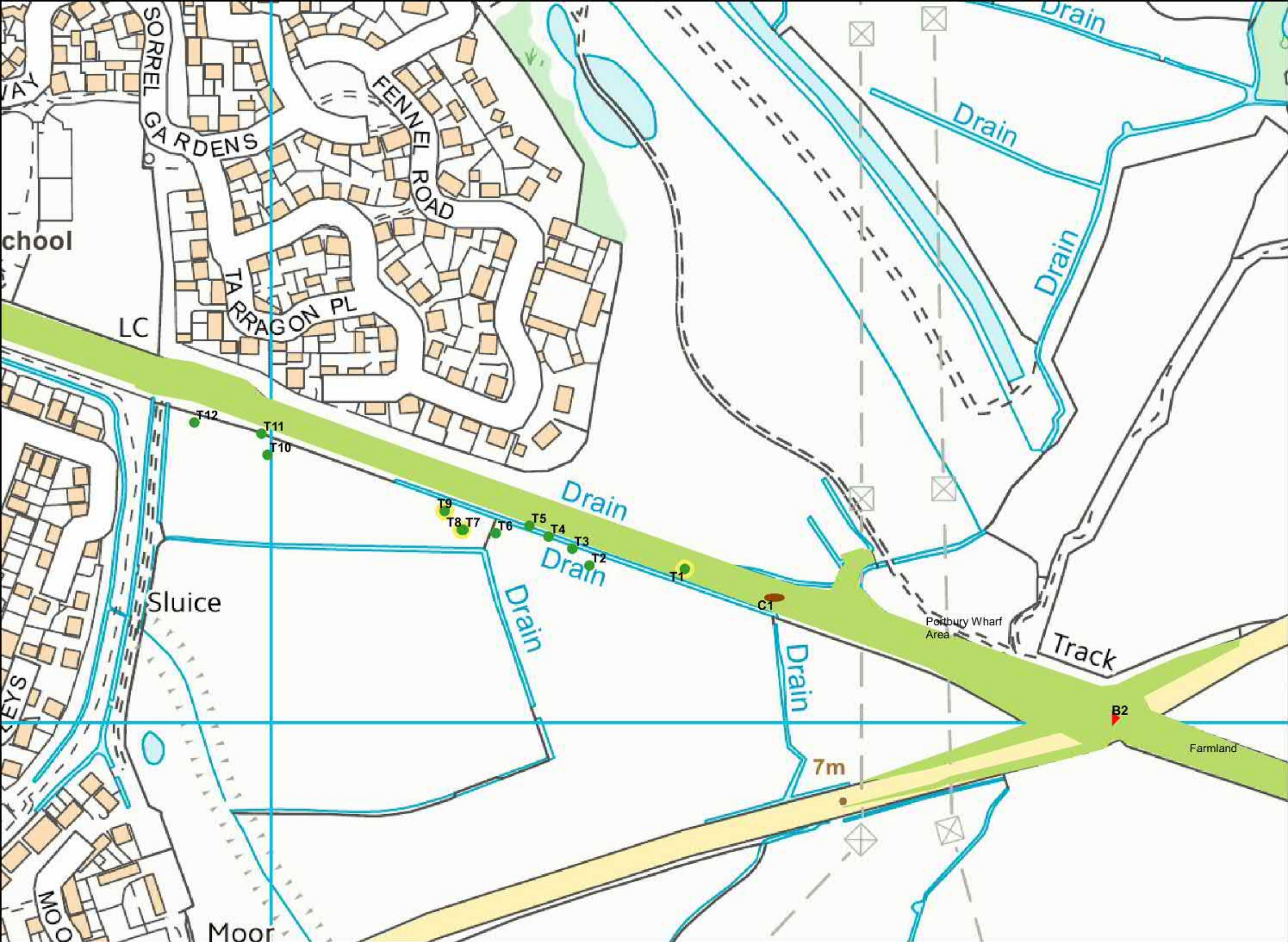

Legend

- Disused railway line
- Tree
- Tree with high bat roost potential
- Confirmed roost in bridge
- Bridge
- Confirmed roost in bridge
- Culvert

0 25 50 75 100 m

SHEET 2 of 7

PURE ECOLOGY

DATE: 27/11/15
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Figure 5. Structures and Trees

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Legend

- Disused railway line
- Tree
- Tree with high bat roost potential
- Confirmed roost in bridge
- Bridge
- Confirmed roost in bridge
- Culvert

0 25 50 75 100 m

SHEET 3 of 7

PURE ECOLOGY

DATE: 27/11/15
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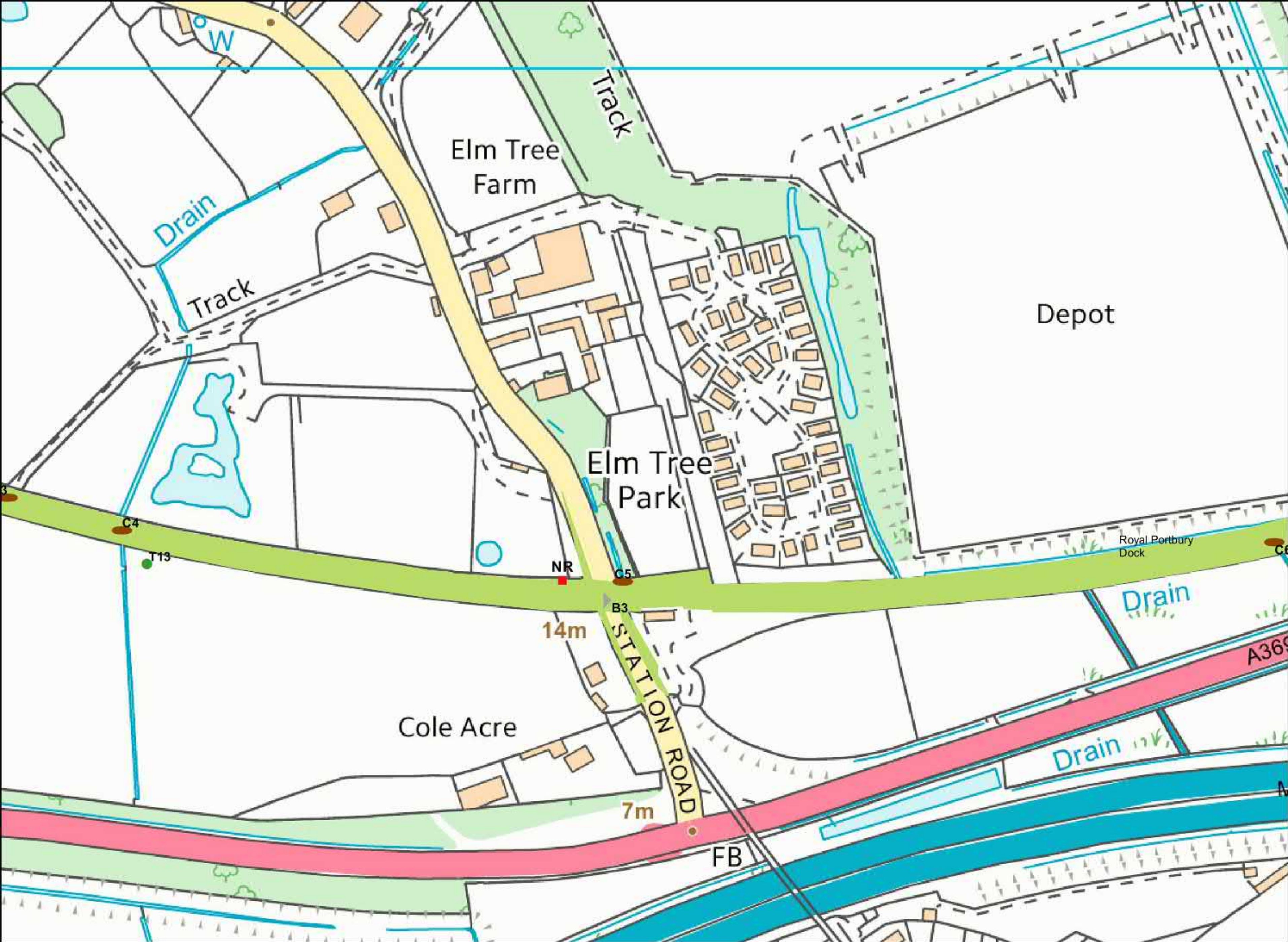
Figure 5. Structures and Trees



Legend

- Disused railway line
- Tree
- Tree with high bat roost potential
- Confirmed roost in bridge
- Bridge
- Confirmed roost in bridge
- Culvert

0 25 50 75 100 m

SHEET 4 of 7

PURE ECOLOGY

DATE: 27/11/15
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PROJECT: Metro West
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Figure 5. Structures and Trees

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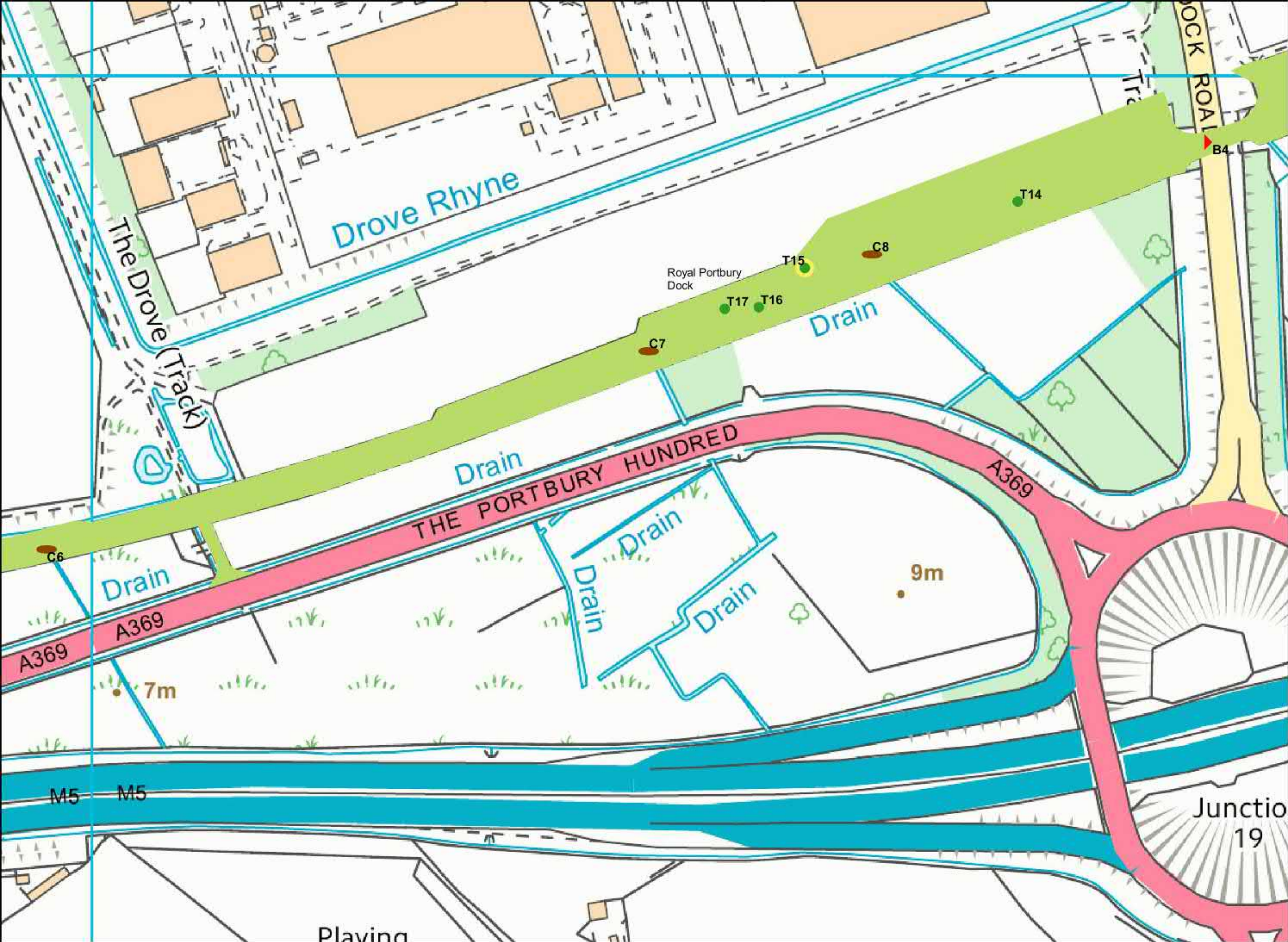

Legend

- Disused railway line
- Tree
- Tree with high bat roost potential
- Confirmed roost in bridge
- Bridge
- Confirmed roost in bridge
- Culvert

0 25 50 75 100 m

SHEET 5 of 7

PURE ECOLOGY

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Figure 5. Structures and Trees

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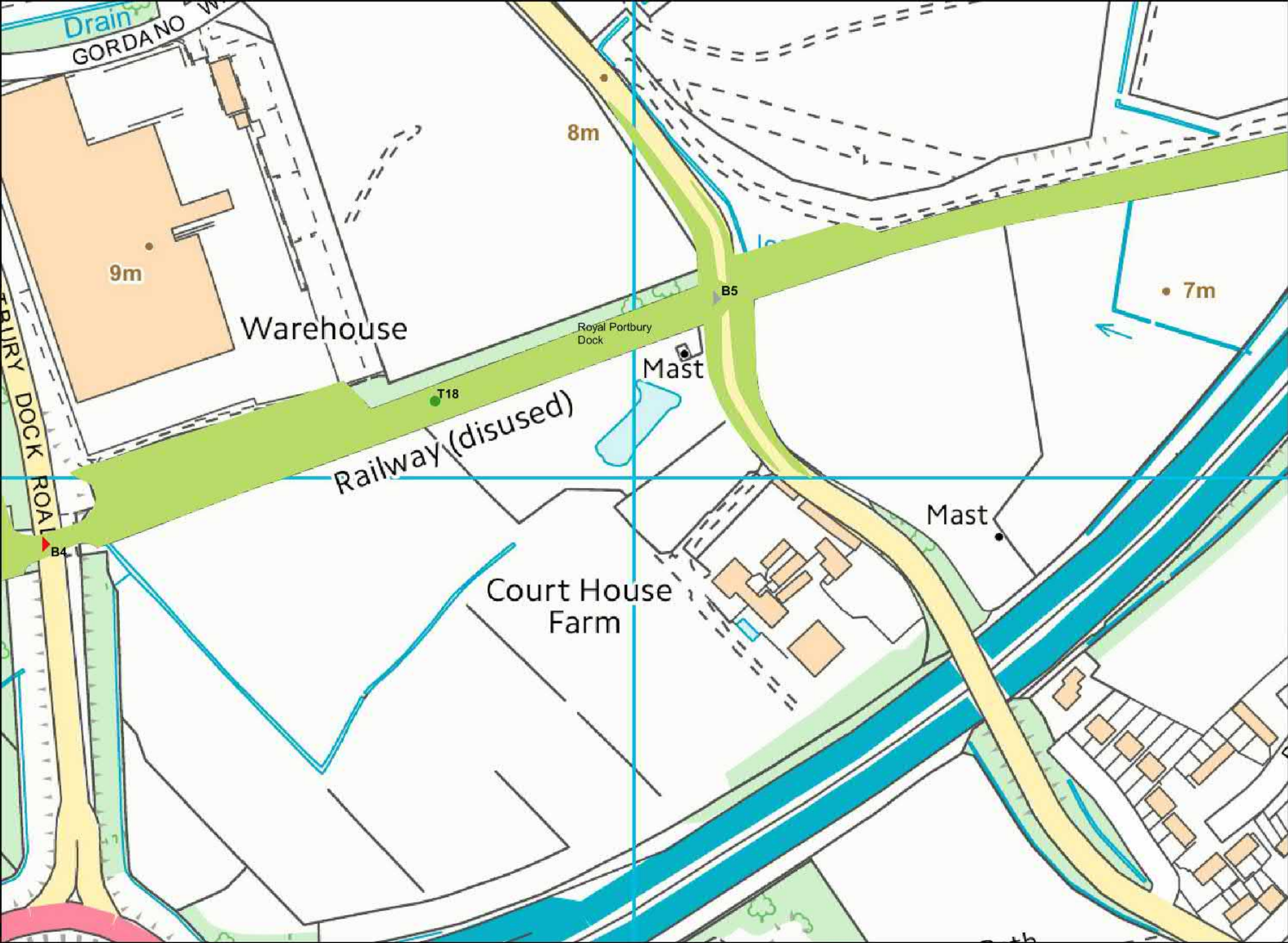

Legend

- Disused railway line
- Tree
- Tree with high bat roost potential
- Confirmed roost in bridge
- Bridge
- Confirmed roost in bridge
- Culvert

0 25 50 75 100 m

SHEET 6 of 7

PURE ECOLOGY

DATE: 27/11/15
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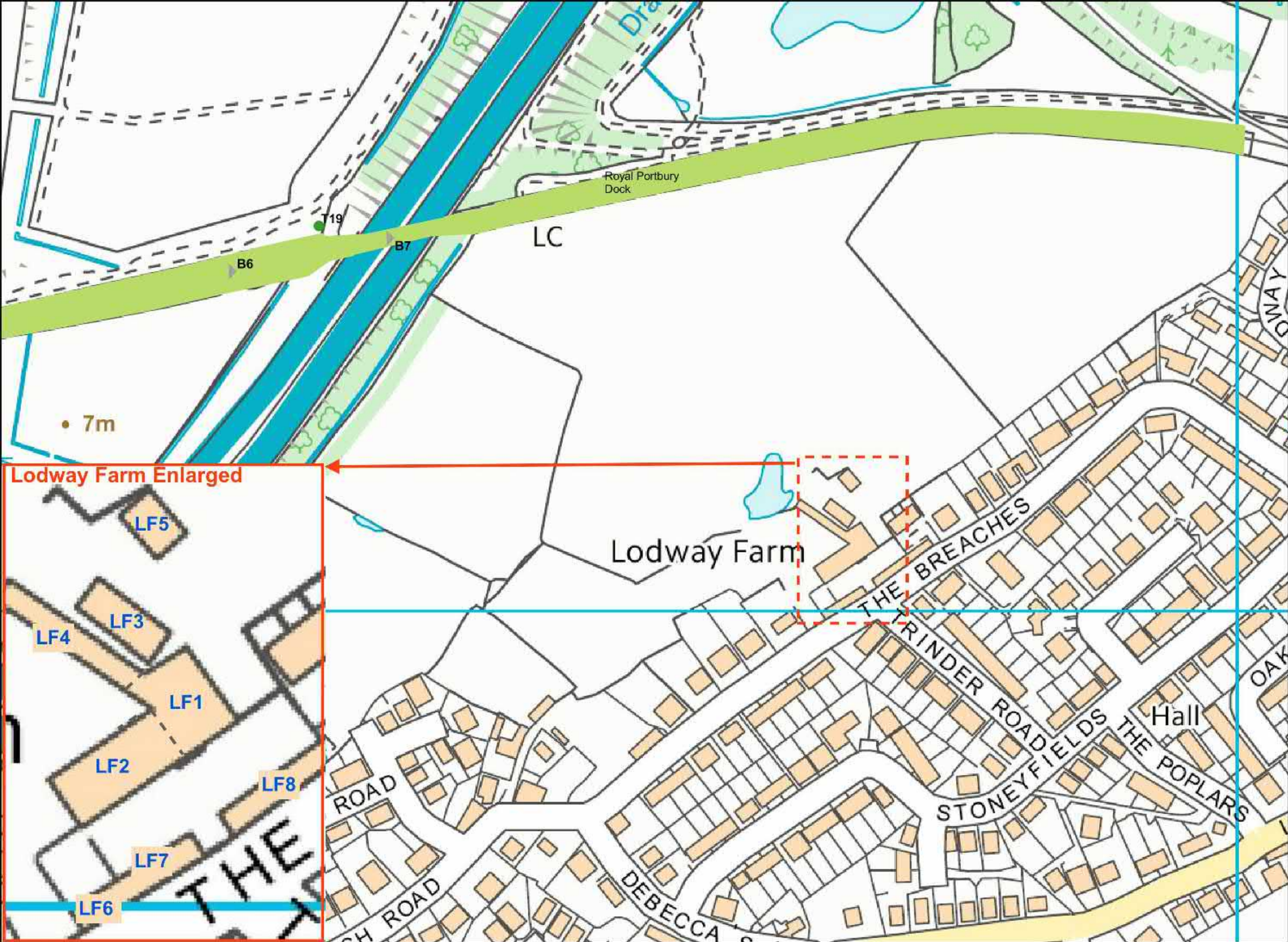
Figure 5. Structures and Trees



SHEET 7 of 7

PURE ECOLOGY

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REVISION: 07/11/18
PROJECT: Metro West
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Figure 5. Structures and Trees

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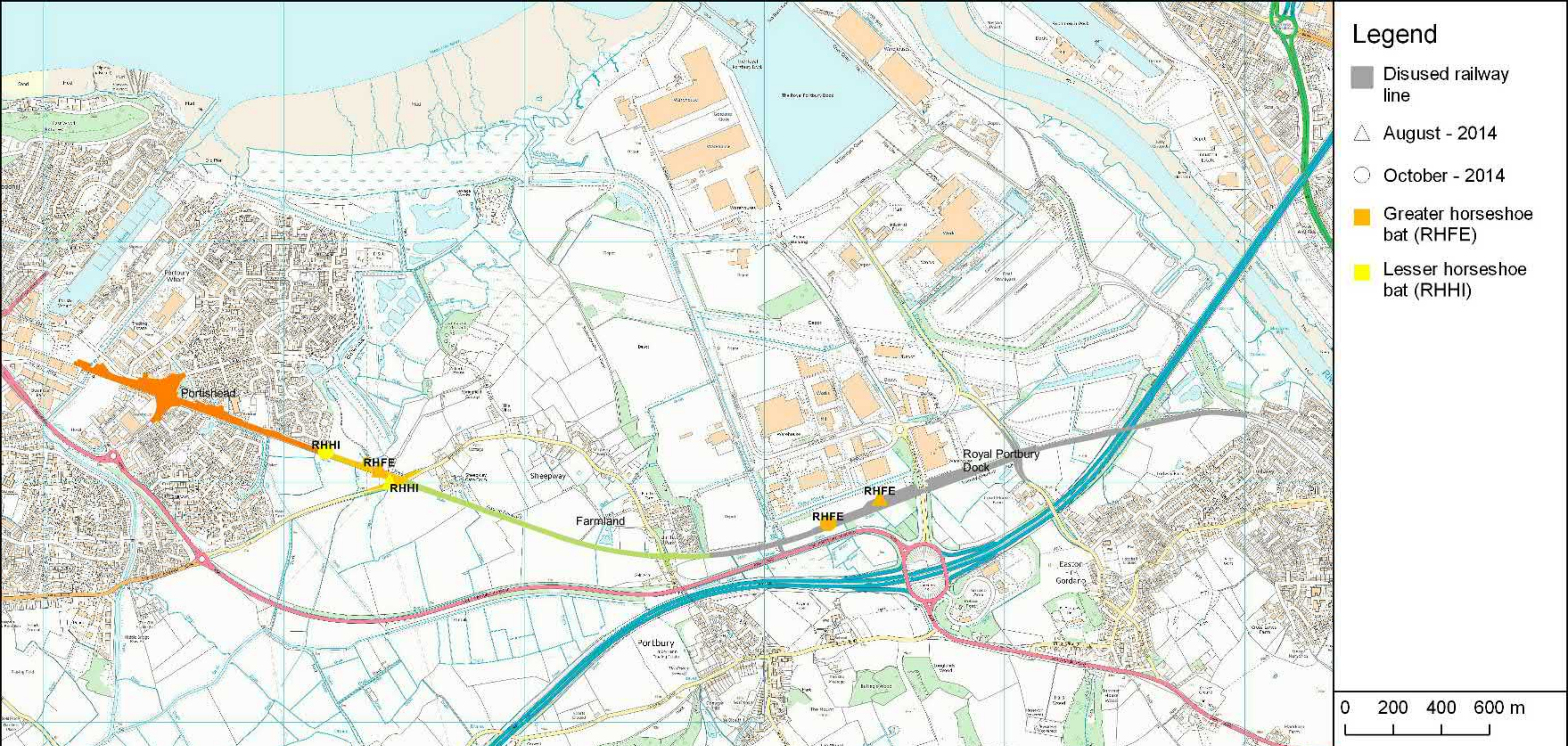

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PROJECT: Metro West
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Figure 6a. Records of Greater and Lesser Horseshoe Bat Species from Walked Transect in 2014

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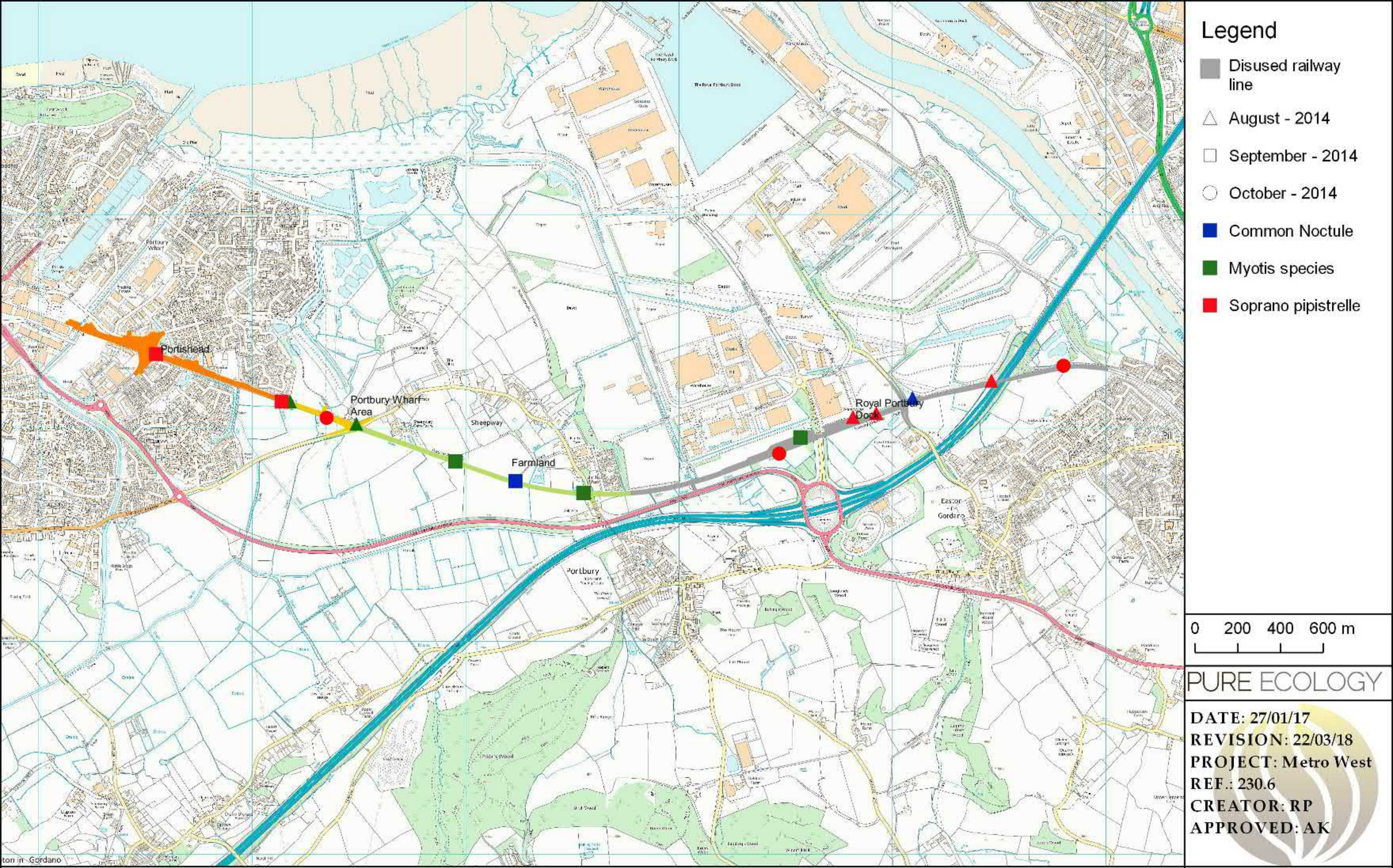

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REVISION: 22/03/18
PROJECT: Metro West
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Figure 6b. Records of Noctule, Myotis species and Soprano pipistrelle Bats from Walked Transect in 2014

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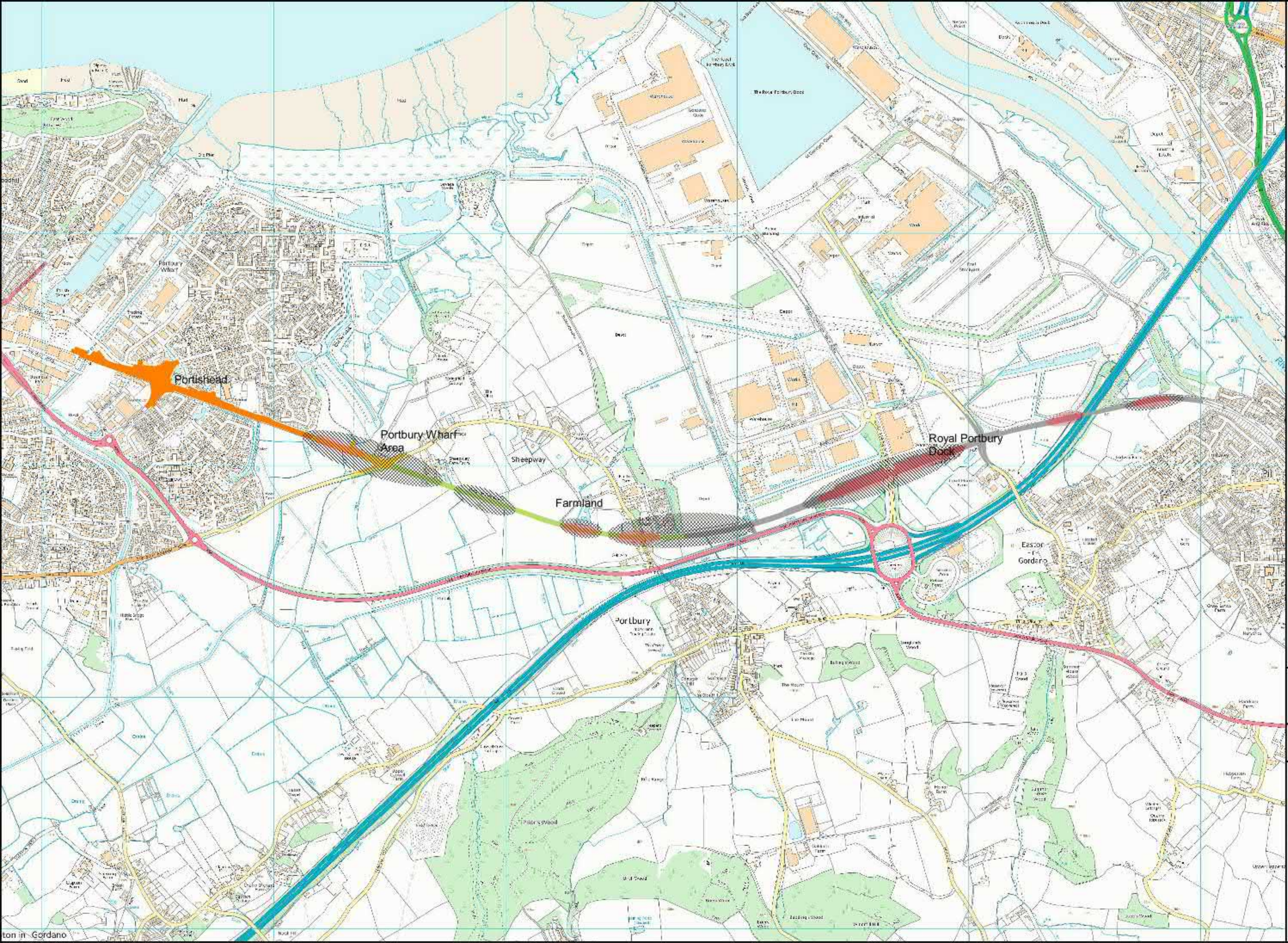

Legend

- Disused railway line
- Greater horseshoe bat
- Lesser horseshoe bat

0 200 400 600 m

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DATE: 27/01/17
REVISION: 22/03/18
PROJECT: Metro West
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Figure 7a. Estimated Distribution of Greater and Lesser Horseshoe Bat Species on the Disused Railway Line in 2015

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REVISION: 22/03/18
PROJECT: Metro West
REF.: 230.6
CREATOR: RP
APPROVED: AK

Figure 7b. Estimated Distribution of Nathusius' pipistrelle Bat and Myotis Bat Species on the Disused Railway Line in 2015

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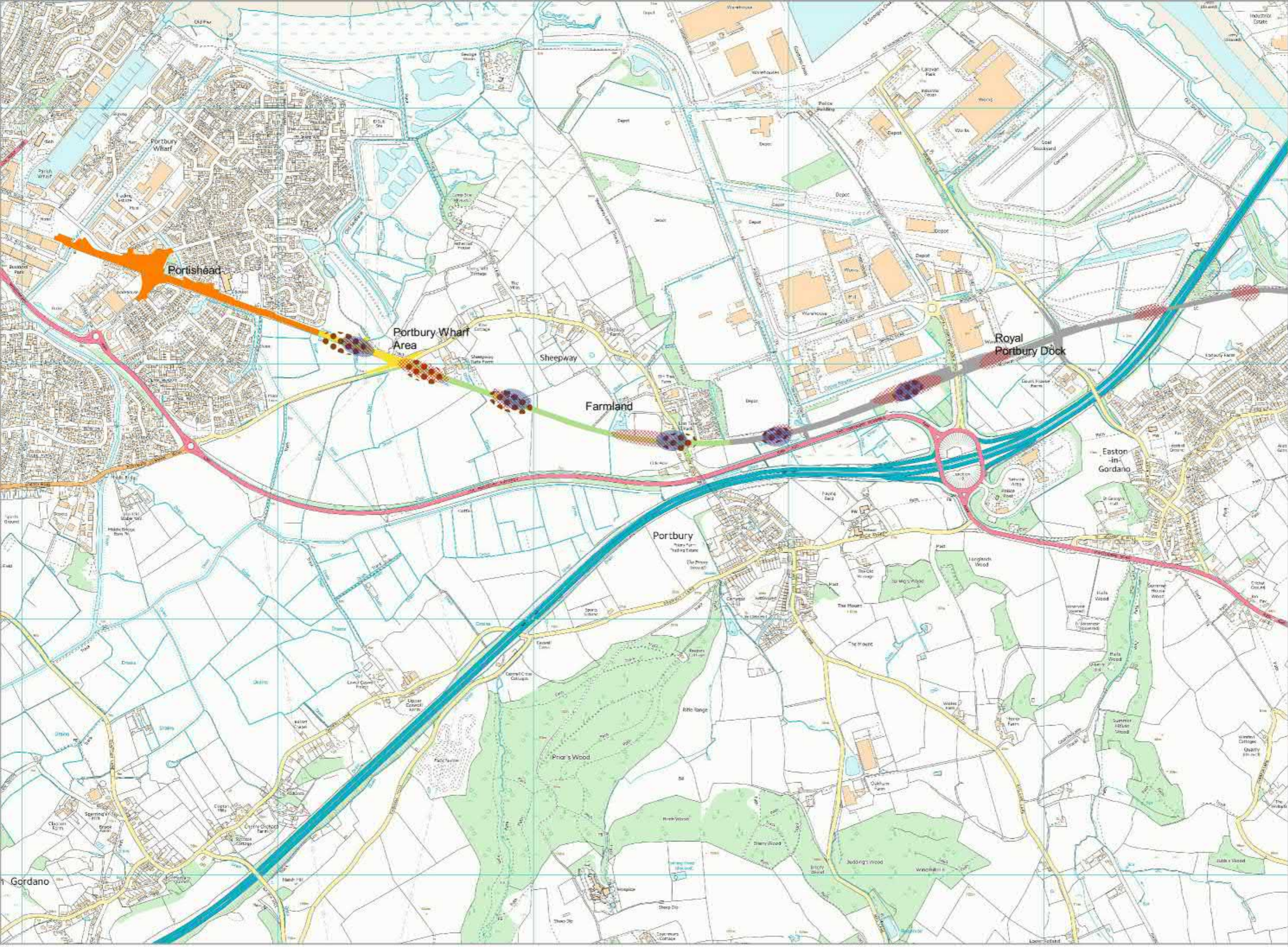
Herefordshire
HR8 1ED



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DATE: 21/07/17
REVISION: 22/03/18
PROJECT: Metro West
REF.: 230.6
CREATOR: RP
APPROVED: AK

Figure 7c. Estimated Distribution of Leisler's Bat, Noctule Bat and Serotine Bat on the Disused Railway Line in 2015

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HR8 1ED

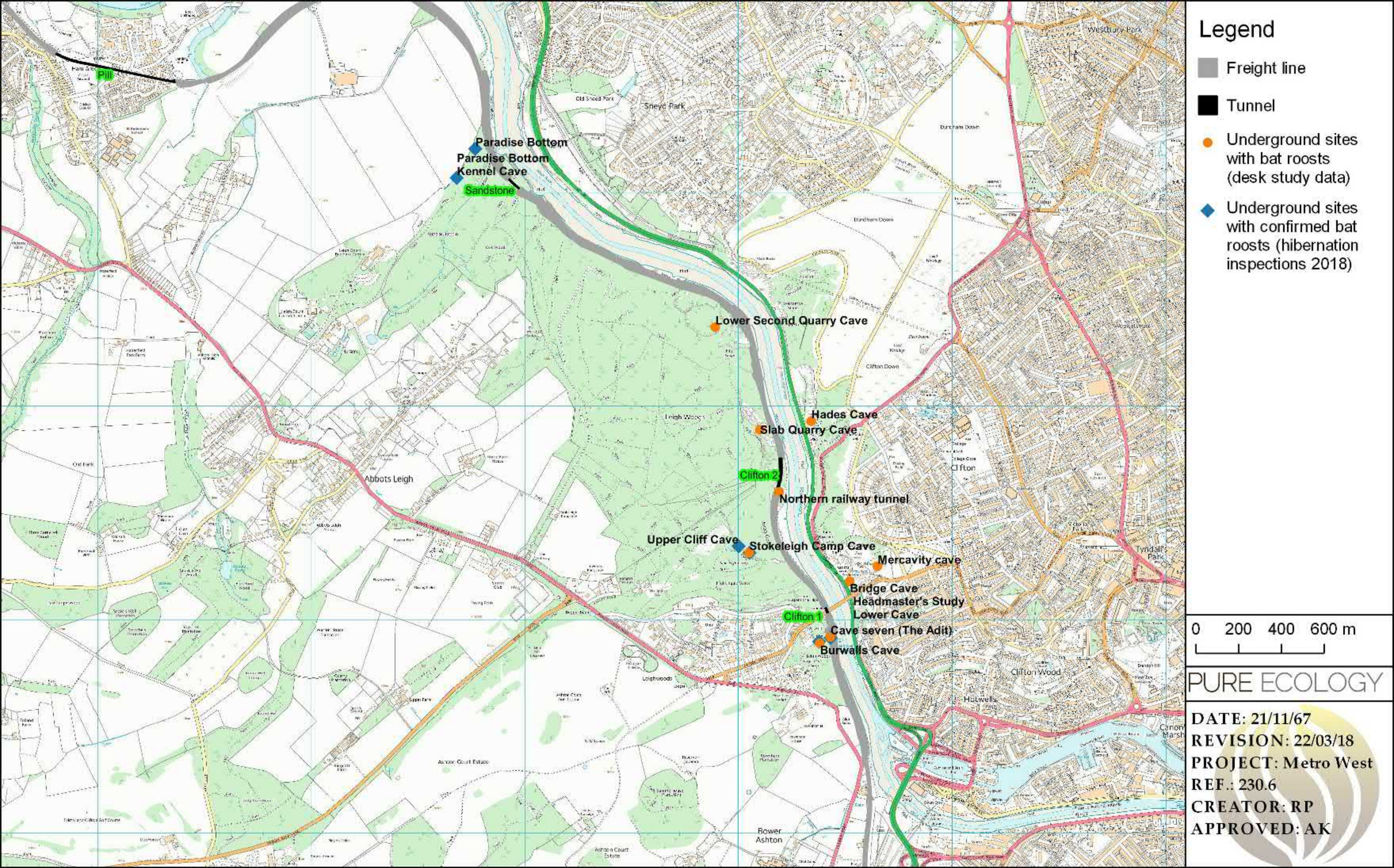

Figure 8. Caves, rock shelters and adits in Avon Gorge with bat roosts.

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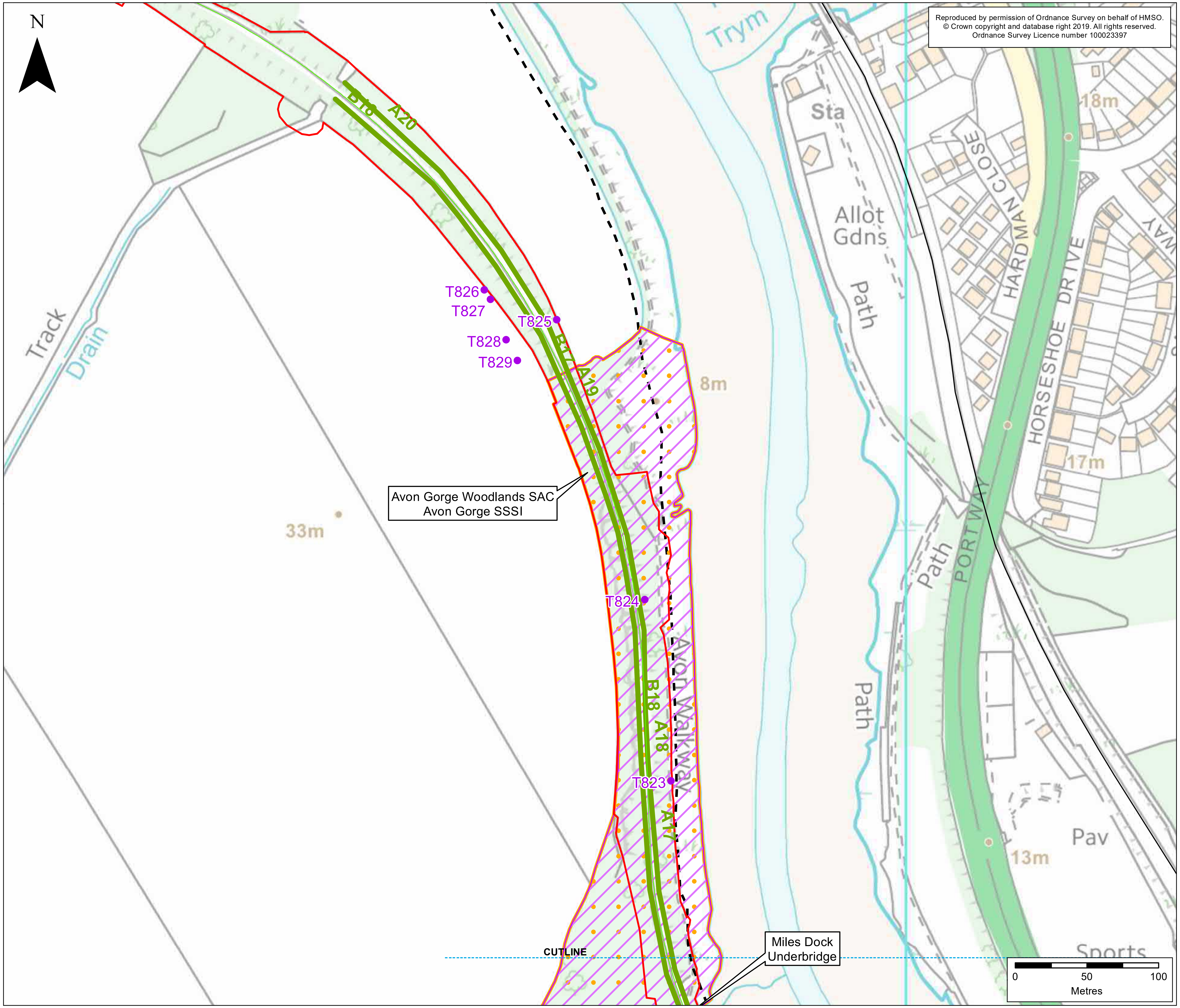
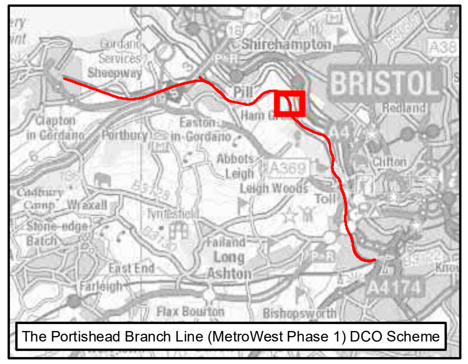
Herefordshire
HR8 1ED

Appendix 1. Tree Plans for the Avon Gorge and Portbury Freight Line

The following plans show locations of trees surveyed to identify the bat roosting potential of individual trees or areas of woodland within the Avon Gorge and from the Avon Gorge to the pedestrian crossing in Bower Ashton. The detailed assessment is provided in Appendix 9.





KEY

- Order Limits

Railway Line

- Existing Railway Line
- Individual Trees
- Bristol City Council Boundary
- Areas of trees
- Special Area of Conservation
- Site of Special Scientific Interest

Note:

Rare Whitebeam (Sorbus) trees to be removed or coppiced.

Code	***Name***
EMI	*S.eminens*
BRI	*S.bristoliensis*
AVO	*S.avonensis*

ES-B	JG	RS	CF	18/09/2020	Second draft
ES-A	EJ	CW	CF	04/10/2019	First draft
Rev	By	Chkd	Apprvd	Date	Description

Client

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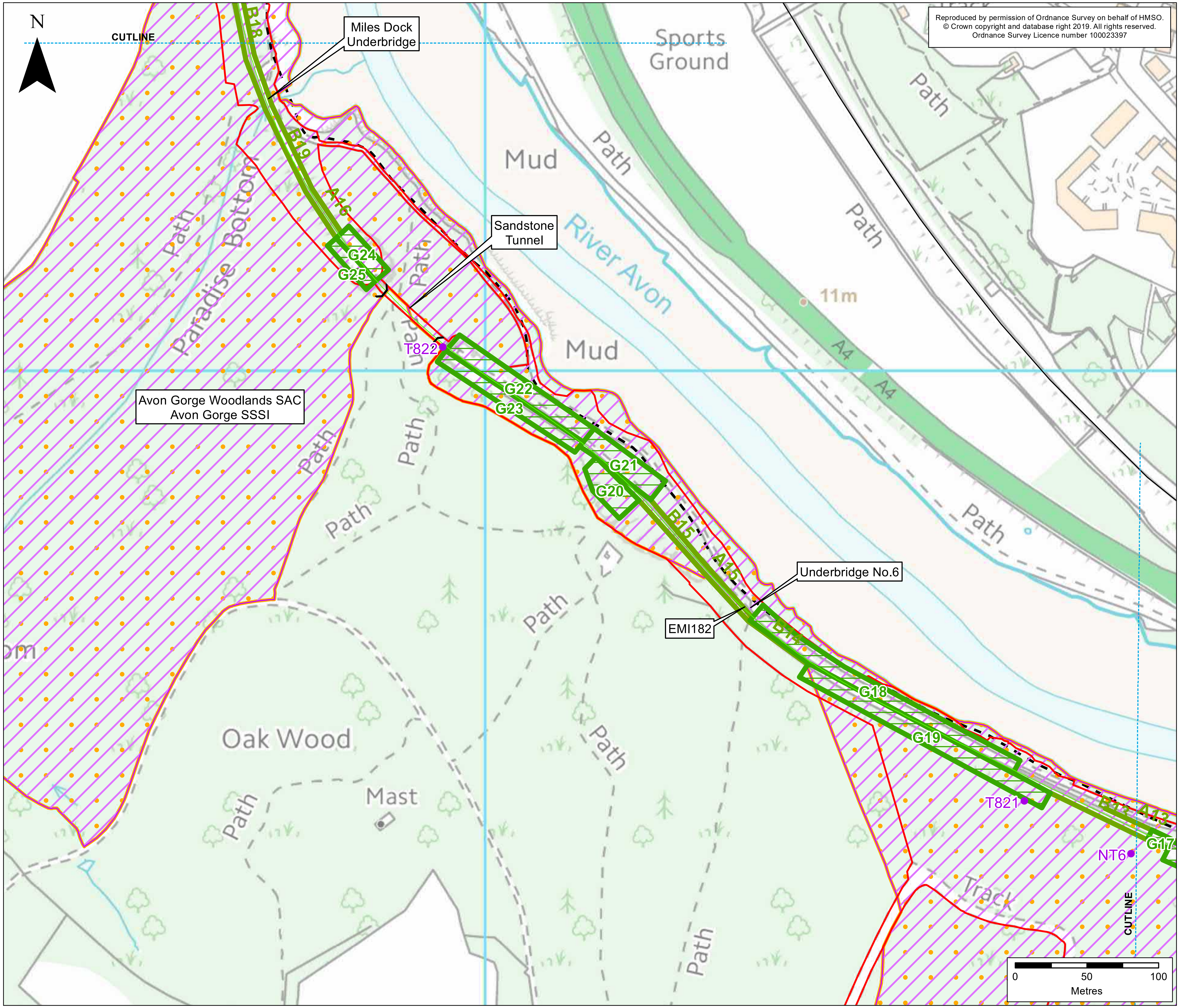
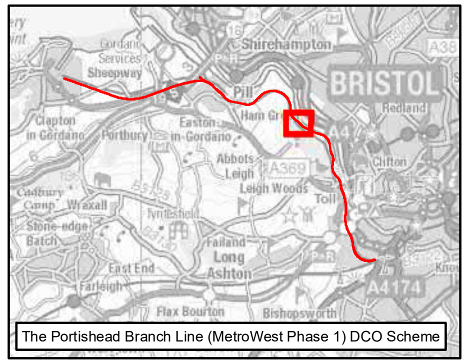
Project : Portishead Branch Line (MetroWest Phase 1)

Drawing : Annex F Figure C. 1:
Tree Survey
(Sheet 1 of 8)
APFP Regulation 5(2)(a)

Drawn By : Jamie Gilham	Date: 18/09/2020
Checked By : Richard Smedley	Date: 18/09/2020
Approved By : Carolyn Francis	Date: 18/09/2020
Drawing No. : 674946-004-001 - A	Revision ES-B
Drawing Scale : 1:2,500 @ A3	





KEY

- Order Limits

Railway Line

- Existing Railway Line
- Railway Tunnel
- Individual Trees
- Bristol City Council Boundary
- Groups of Trees
- Areas of trees
- Special Area of Conservation
- Site of Special Scientific Interest

Note:

Rare Whitebeam (Sorbus) trees to be removed or coppiced.

Code	***Name***
EMI	*S.eminens*
BRI	*S.bristoliensis*
AVO	*S.avonensis*

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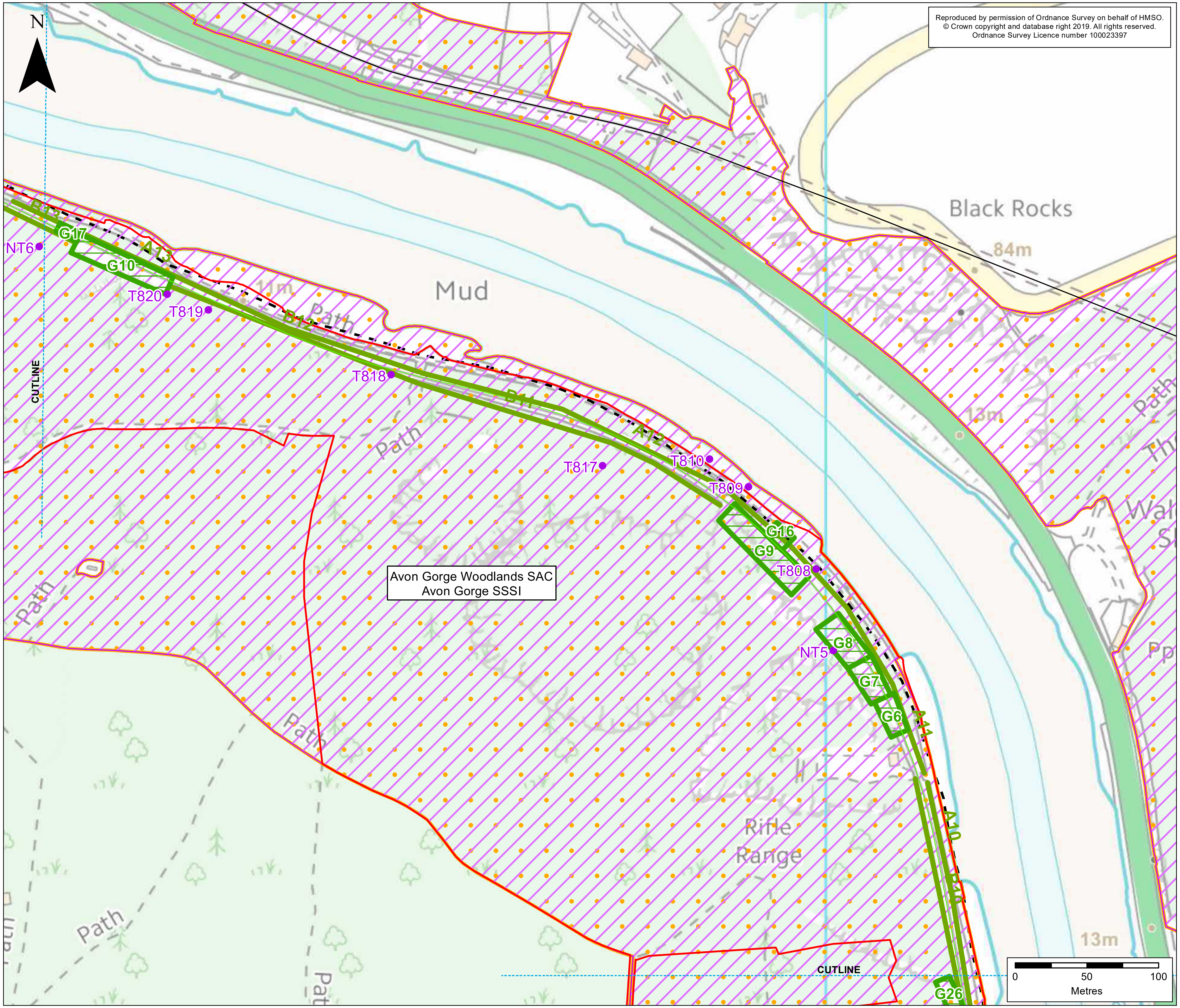
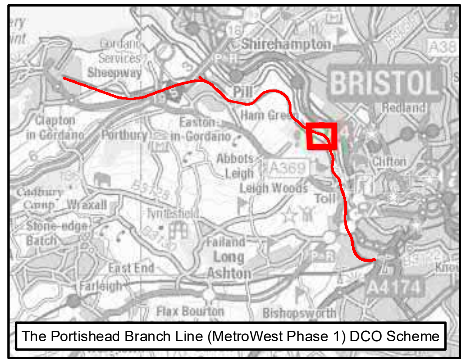
Drawing No. : 674946-004-001 - A	Revision ES-B
Drawing Scale : 1:2,500 @ A3	





KEY

Order Limits

Railway Line

Existing Railway Line

Individual Trees

Bristol City Council Boundary

Groups of Trees

Areas of trees

Special Area of Conservation

Site of Special Scientific Interest

Note:

Rare Whitebeam (Sorbus) trees to be removed or coppiced.

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ES-A	EJ	CW	CF	04/10/2019	First draft
Rev	By	Chkd	Apprvd	Date	Description

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Drawing : Annex F Figure C. 1: Tree Survey (Sheet 3 of 8) *APFP Regulation 5(2)(a)*

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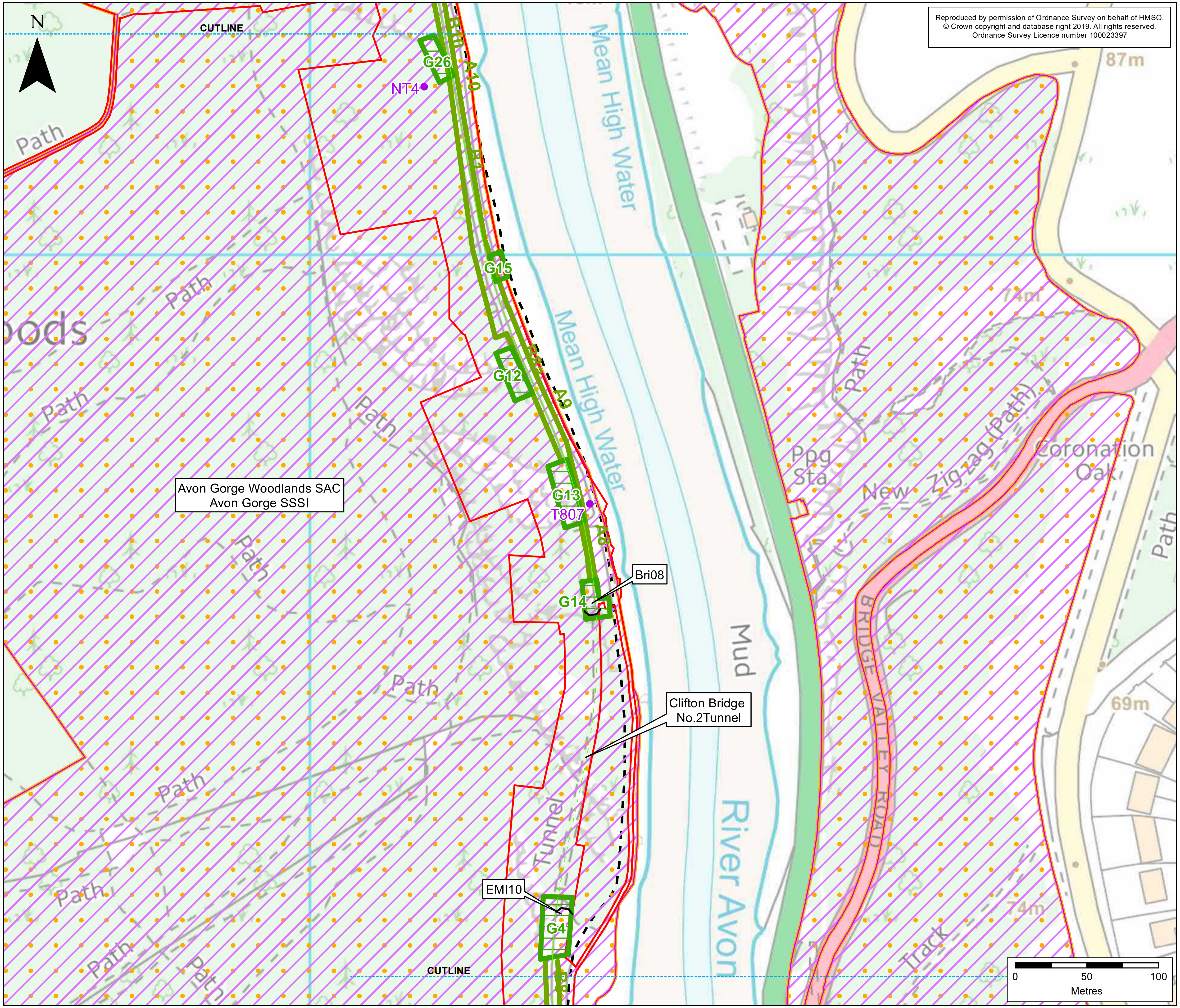
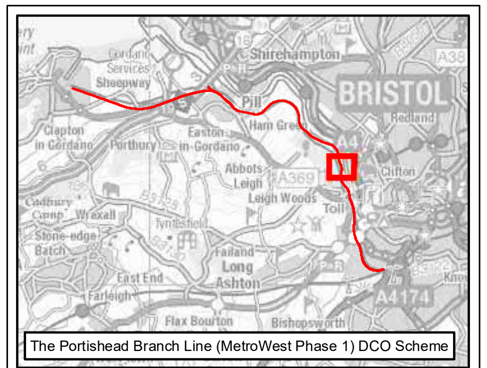
Checked By : Richard Smedley	Date: 18/09/2020
Approved By : Carolyn Francis	Date: 18/09/2020
Drawing No. : 674946-004-001 - A	Revision ES-B
Drawing Scale : 1:2,500 @ A3	





KEY

- Order Limits
- Railway Tunnel
- Individual Trees
- Bristol City Council
- Groups of
- Areas of trees
- Special Area of Conservation
- Site of Special Scientific Interest

Note:

Rare Whitebeam (Sorbus) trees to be removed or coppiced.

Code	**Name**
EMI	*S.eminens*
BRI	*S.bristoliensis*
AVO	*S.avonensis*

ES-B	JG	RS	CF	18/09/2020	Second draft
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Rev	By	Chkd	Apprvd	Date	Description

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Drawing : Annex F Figure C. 1: Tree Survey (Sheet 4 of 8) *APFP Regulation 5(2)(a)*

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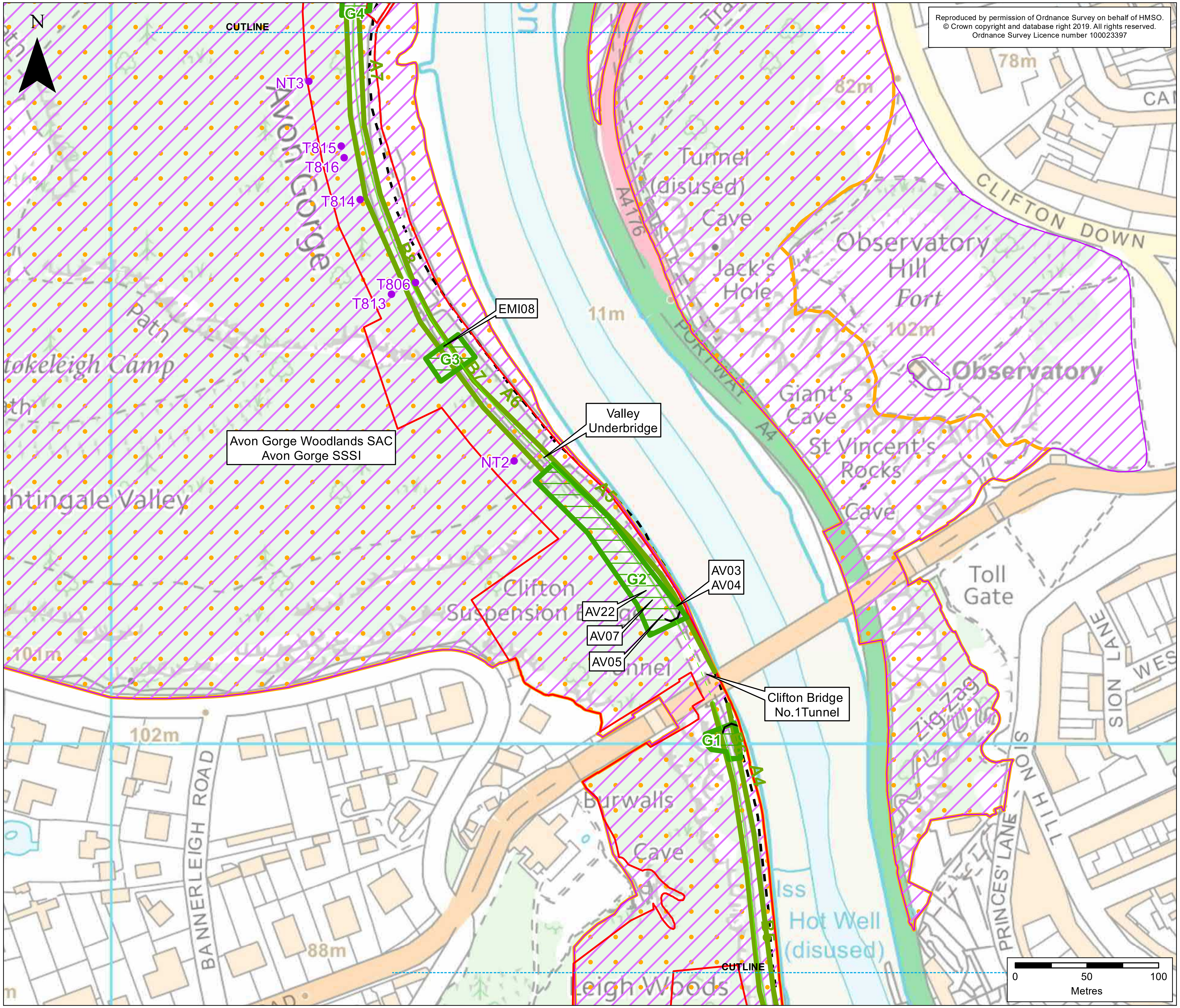
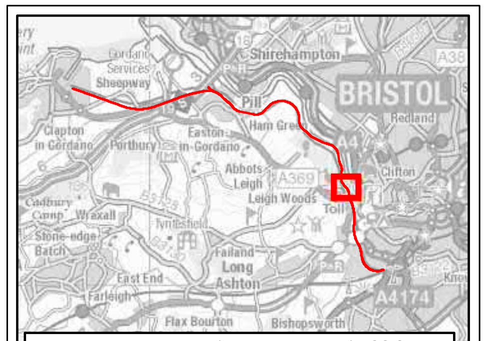
Approved By : Carolyn Francis	Date: 18/09/2020

Drawing No. : 674946-004-001 - A

Revision ES-B

Drawing Scale : 1:2,500 @ A3





The Portishead Branch Line (MetroWest Phase 1) DCO Scheme

KEY

- Order Limits
- Railway Tunnel
- Individual Trees
- Bristol City Council Boundary
- Groups of Trees
- Areas of trees
- Special Area of Conservation (SAC)
- Site of Special Scientific Interest

Note:

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Code	***Name***
EMI	*S.eminens*
BRI	*S.bristoliensis*
AVO	*S.avonensis*

ES-B	JG	RS	CF	18/09/2020	Second draft
ES-A	EJ	CW	CF	04/10/2019	First draft
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Drawing : Annex F Figure C. 1: Tree Survey (Sheet 5 of 8) *APFP Regulation 5(2)(a)*

Drawn By : Jamie Gilham Date: 18/09/2020

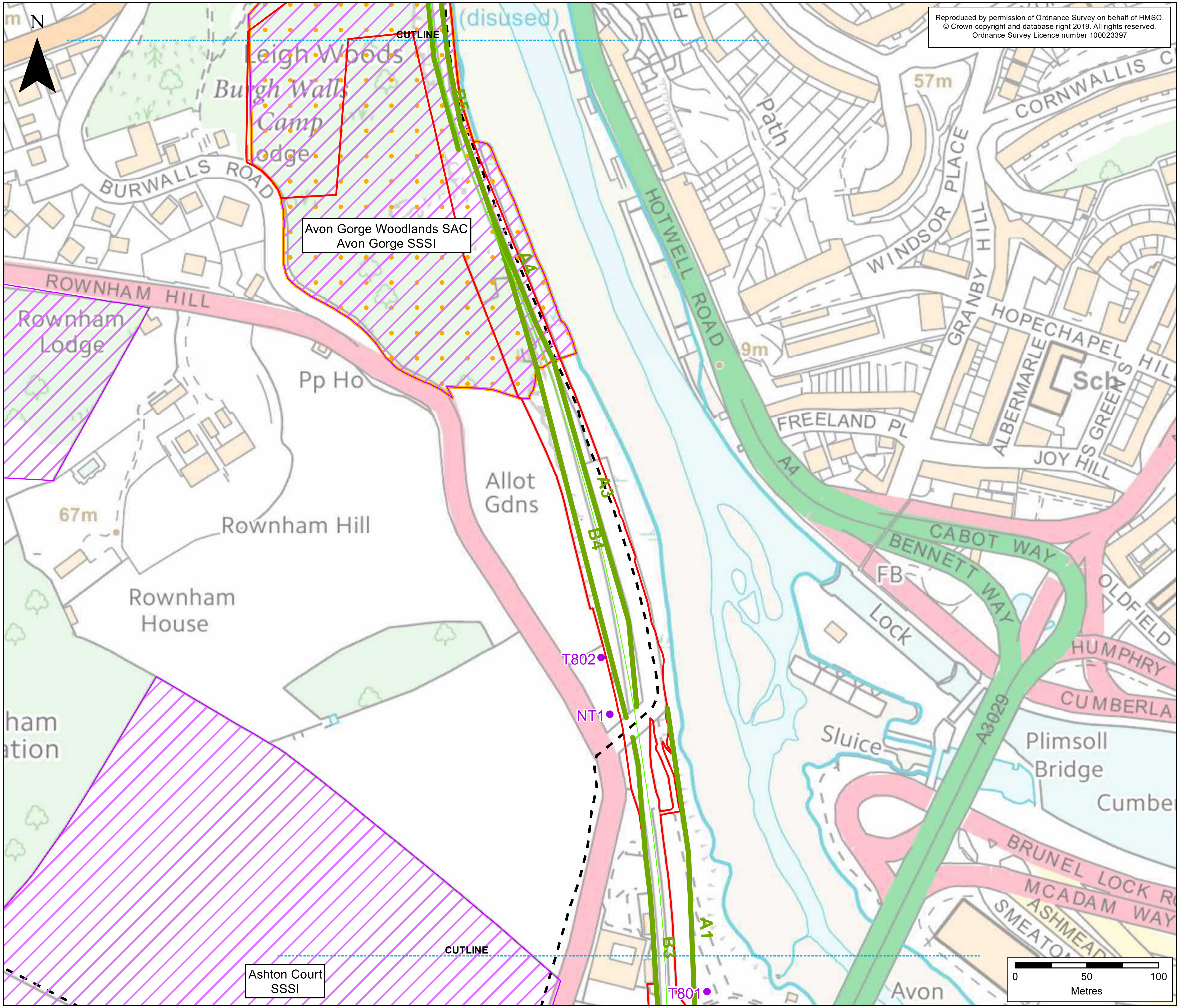
Checked By : Richard Smedley Date: 18/09/2020

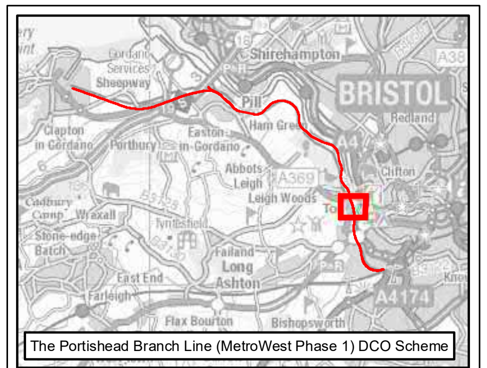
Approved By : Carolyn Francis Date: 18/09/2020

Drawing No. : 674946-004-001 - A

Revision: ES-B

Drawing Scale : 1:2,500 @ A3





KEY

- Order Limits
- Individual Trees
- Bristol City Council Boundary
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- Special Area of Conservation (SAC)
- Site of Special Scientific Interest

Note:

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BRI	*S.bristoliensis*
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Rev	By	Chkd	Apprvd	Date	Description
ES-B	JG	RS	CF	18/09/2020	Second draft
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Drawing : Annex F Figure C. 1: Tree Survey (Sheet 6 of 8) *APFP Regulation 5(2)(a)*

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Approved By : Carolyn Francis Date: 18/09/2020

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Revision: ES-B

Drawing Scale : 1:2,500 @ A3

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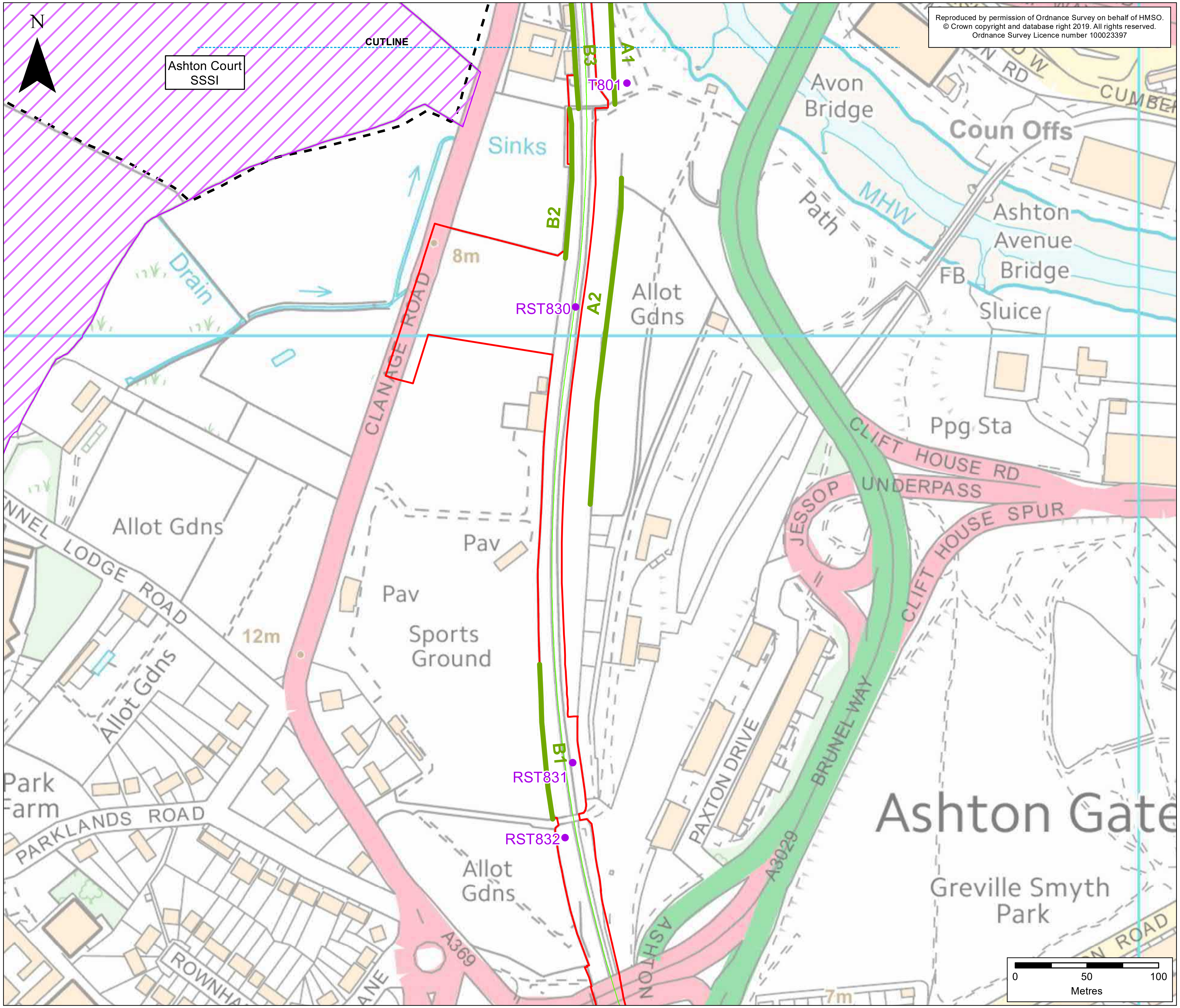

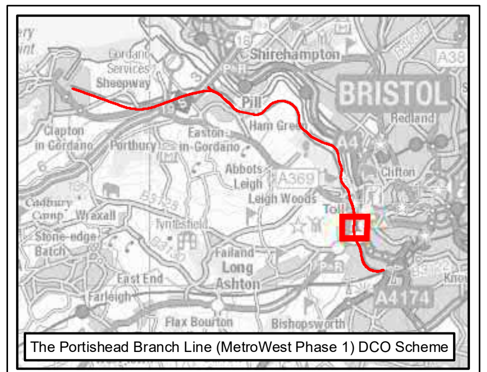

KEY

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Approved By :	Carolyn Francis	Date: 18/09/2020

Drawing No. : 674946-004-001 - A

Revision: ES-B

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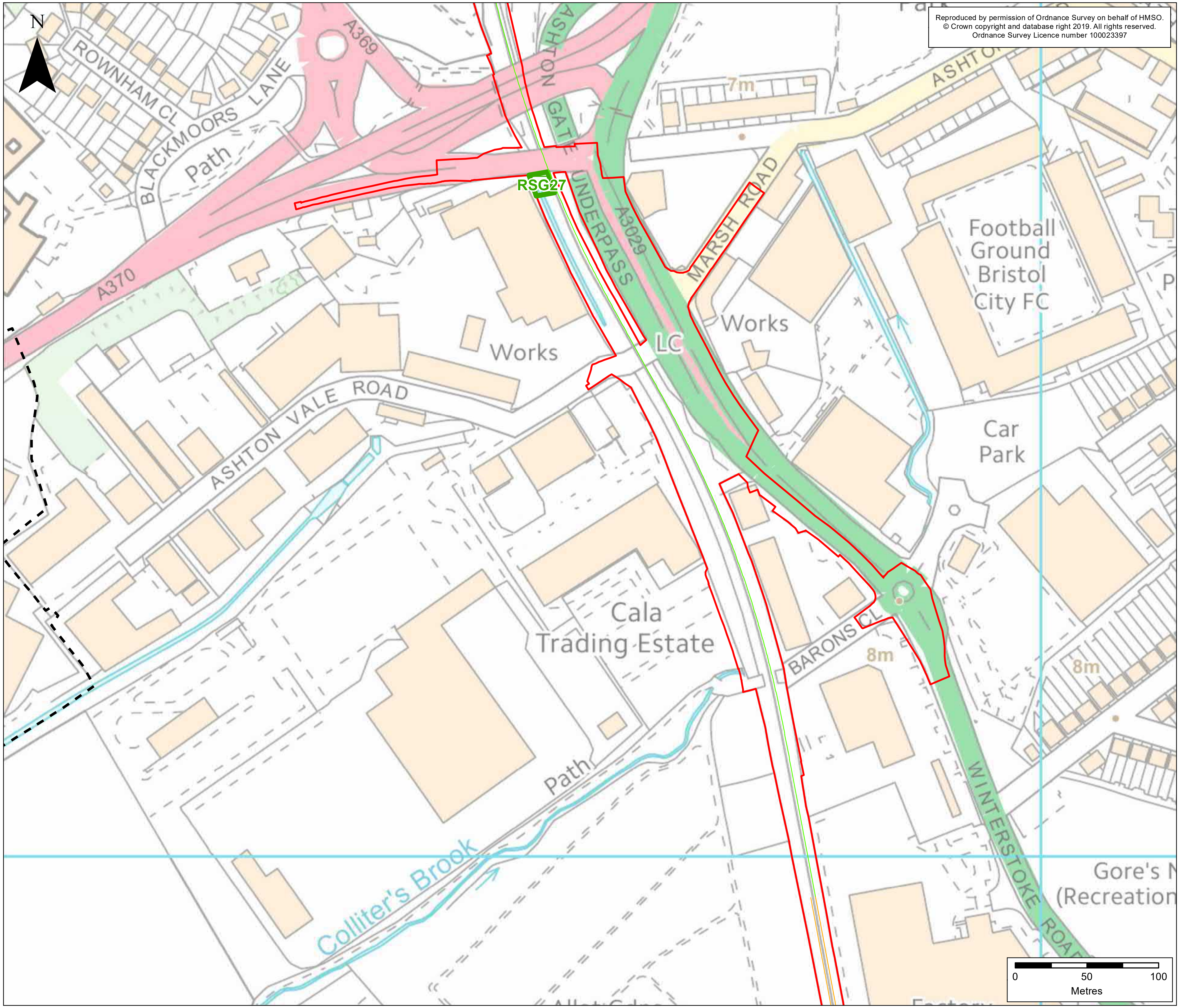

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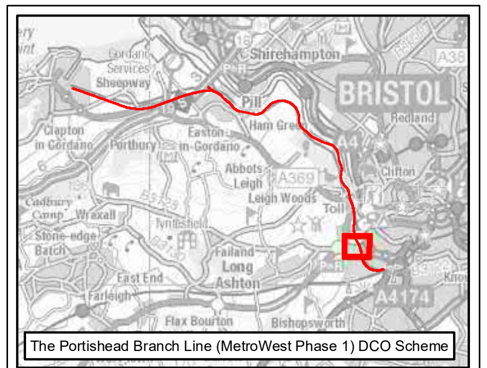

KEY

- Order Limits
- Bristol City Council Boundary
- Groups of Trees

Note:

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Code	Name
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BRI	S.bristoliensis
AVO	S.avonensis

Rev	By	Chkd	Apprvd	Date	Description
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ES-A	EJ	CW	CF	04/10/2019	First draft

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Project : Portishead Branch Line (MetroWest Phase 1)

Drawing : Annex F Figure C. 1: Tree Survey (Sheet 8 of 8) *APFP Regulation 5(2)(a)*

Drawn By : Jamie Gilham	Date: 18/09/2020
Checked By : Richard Smedley	Date: 18/09/2020
Approved By : Carolyn Francis	Date: 18/09/2020

Drawing No. : 674946-004-001 - A
Revision: ES-B

Drawing Scale : 1:2,500 @ A3

Document Path: U:\we\Environmental_Assessment\Projects\MetroWest Phase 1\GIS\MXDs\Tree_Management\Annex_F_Figure1_Tree_Survey_v3.mxd

Appendix 2. Walked Transect Survey of the Disused Railway Line: May 2015 – April 2016

Transect Survey Results: May 2015 – April 2016

Date	**Transect Section**	**Species**								
		Pp	**Ppy**	**Msp**	**Psp**	**Nn**	**Nl**	**Es**	**Rh**	**Rf**
18/05/15	Portishead	x	x	x	X	x	x	x	x	x
	Portbury Wharf Area	L	L	x	X	x	x	x	x	x
	Farmland	L-M	x	x	X	x	L	x	x	x
	Royal Portbury Docks	L-M	x	x	X	x	x	x	x	x
31/05/15	Portishead	L	x	x	X	x	x	x	x	x
	Portbury Wharf Area	M	x	x	X	x	x	x	x	x
	Farmland	L-M	x	L	X	x	x	x	x	x
	Royal Portbury Docks	L-M	L	x	X	x	x	x	x	x
08/06/15	Portishead	L	x	x	X	x	x	x	x	x
	Portbury Wharf Area	L	L	x	X	x	x	x	x	x
	Farmland	L-M	M-L	x	X	L	x	x	L-M	x
	Royal Portbury Docks	L-M	M	x	X	X	x	M	x	x
23/06/15	Portishead	x	x	x	X	X	x	x	x	x
	Portbury Wharf Area	L	x	x	X	L	x	L	x	L
	Farmland	L	L	x	L	L	x	L	L	x
	Royal Portbury Docks	L-M	L	x	X	L	x	x	x	x
08/07/15	Portishead	L	x	x	X	x	x	x	x	x
	Portbury Wharf Area	L	x	x	X	x	x	L	x	x
	Farmland	L	L	x	X	x	x	x	x	x
	Royal Portbury Docks	L-M	M	x	X	x	x	x	x	x

Date	Transect Section	Species								
		Pp	Ppy	Msp	Psp	Nn	Nl	Es	Rh	Rf
20/07/15	Portishead	L	x	x	X	x	x	x	x	x
	Portbury Wharf Area	x	x	x	X	L	x	x	x	x
	Farmland	L-M	L	x	L	x	x	L	x	L
	Royal Portbury Docks	L	x	x	X	x	x	x	x	x
04/08/15	Portishead	L	L	x	X	x	x	x	x	x
	Portbury Wharf Area	M	L	x	X	x	x	x	x	x
	Farmland	L	L	x	X	L	x	L	x	x
	Royal Portbury Docks	L-M	L-M	x	X	L	L	x	x	L
18/08/15	Portishead	L	x	x	X	x	x	x	x	x
	Portbury Wharf Area	M	x	x	X	x	x	x	x	L
	Farmland	L-M	L-M	L	X	x	L	x	x	x
	Royal Portbury Docks	M	L	L	X	x	L	x	x	x
05/04/16	Portishead	L	x	x	x	x	x	x	x	x
	Portbury Wharf Area	L	x	x	x	L	x	x	x	x
	Farmland	L	x	L		L	x	x	x	x
	Royal Portbury Docks	L	L	x	x	x	x	x	x	x
18/04/16	Portishead	L	x	x	x	x	x	x	x	x
	Portbury Wharf Area	L	L	x	x	x	x	L	x	x
	Farmland	L	L	x	x	x	x	x	x	x
	Royal Portbury Docks	M	L	x	x	x	x	x	x	x
Species										

Date	Transect Section	Species								
		Pp	Ppy	Msp	Psp	Nn	Nl	Es	Rh	Rf

Pp Common pipistrelle; **Ppy** Soprano pipistrelle; **Msp** Myotis sp.; **Psp** Long-eared sp. **Nn** Noctule; **Nl** Leisler's; **Es** Serotine; **Rh** Lesser horseshoe; **Rf** Greater horseshoe.
Levels of bat activity
H – High; **M** – Moderate; **L-** Low; **x** – No bat activity

Appendix 3. Static Automated Bat Detector Monitoring on the Disused Railway Line 2014 to 2016

The results of the static automated bat detector (datalogger) monitoring on the disused railway line are presented in chronological order and in tables according to the period of monitoring the dataloggers were deployed.

The data show the number of 'registrations' per species. A registration is the term given to a 15-second sound file that recorded bat calls and represents a single bat, or low number of passes by a bat at a given point. Counting the number of registrations per species is a discrete measure of bat activity at the datalogger locations and that is used to characterise the level of activity.

Summary of the Number of Nights that Species were Recorded on the Disused Railway Line by Static Automated Bat Detectors.

Figure 3 Ref	Location	Month	Duration of Monitoring (No. of nights)	Number of Nights Species were Recorded										
				Pp	Ppy	Pn	Pa	Msp	Nl	Nn	Es	Nl/Nn or Es	Rh	Rf
S1a	**Royal Portbury Dock** (ST 49588 75689)	August 2014	3	3	3	0	0	3	0	0	0	0	1	1
S1b	**Portbury Wharf Area** (ST 48294 76071)	August 2014	4	4	0	0	0	2	0	0	0	0	1	0
S2a	**Farmland** (ST 49307 75728)	September 2014	1	1	1	0	0	0	0	1	0	0	1	0
S2b	**Royal Portbury Dock** (ST 50362 75844)	September 2014	6	6	0	0	0	3	0	1	0	0	0	2
S3	**Portbury Wharf Area** (ST 48285 76083)	October/ November 2014	17	17	12	0	0	8	0	2	0	0	5	1
S4	**Royal Portbury Dock** ST 50595 75934	April 2015	8	8	2	0	0	0	0	4	1	6	3	0
S5a	**Royal Portbury Dock** ST 50595 75934	April 2015	7	7	5	0	0	3	0	1	0	1	6	0
S5b	**Portbury Wharf Area** ST 48269 76088	April 2015	9	9	7	0	0	2	0	3	0	1	0	0
S6a	**Farmland**	May	13	13	10	0	0	5	0	4	0	1	1	7

Figure 3 Ref	Location	Month	Duration of Monitoring (No. of nights)	Number of Nights Species were Recorded										
				Pp	Ppy	Pn	Pa	Msp	Nl	Nn	Es	Nl/Nn or Es	Rh	Rf
	ST 49591 75696	2015												
S6b	**Royal Portbury Dock** ST 50467 75895	May 2015	9	9	5	0	1	2	6	9	4	6	1	2
S7a	**Farmland** ST 49325 75726	May/June 2015	9	9	9	0	0	9	0	1	0	2	1	4
S7b	**Royal Portbury Dock** ST 50467 75895	May/June 2015	9	9	7	0	0	1	4	8	5	7	0	0
S8a	**Farmland** ST 49542 75696	June 2015	14	14	14	0	0	6	0	12	0	14	9	8
S8b	**Royal Portbury Dock** ST 49955 75711	June 2015	6	6	6	2	0	2	6	6	3	6	0	3
9a	**Royal Portbury Dock** ST 49977 75726	June/July 2015	14	14	14	0	0	3	0	8	0	3	0	5
9b	**Farmland** ST 49542 75696	June/July 2015	10	10	10	4	10	9	8	0	10	10	3	1
10a	**Royal Portbury Dock** ST 51788 76277	July 2015	7	7	7	0	0	5	0	4	0	3	2	2
10b	**Portbury Wharf Area** ST 48308 76057	July2015	7	7	7	5	5	7	2	6	2	5	0	3
10c	**Farmland**	July	8	8	7	1	1	8	5	6	1	7	0	6

Figure 3 Ref	Location	Month	Duration of Monitoring (No. of nights)	Number of Nights Species were Recorded										
				Pp	Ppy	Pn	Pa	Msp	Nl	Nn	Es	Nl/Nn or Es	Rh	Rf
	ST 48929 75859	2015												
11a	**Royal Portbury Dock** ST 50820 76009	July August 2015	15	15	15	0	0	8	0	2	0	4	1	13
11b	**Farmland** ST 48619 75955	July 2015	8	8	8	0	2	5	0	2	1	3	0	3
11c	**Portbury Wharf Area** ST 48222 76097	July 2015	5	5	5	0	2	2	0	1	2	1	0	2
12a	**Royal Portbury Dock** ST 51417 76200	August 2015	8	8	8	0	0	7	0	7	0	7	3	0
12b	**Farmland** ST 48542 75993	August 2015	8	8	7	0	1	3	0	3	3	4	0	1
12c	**Farmland** ST 48899 75837	August 2015	8	8	8	0	4	8	0	6	4	8	0	6
Total Number of Nights			**213**	**213**	**177**	**12**	**26**	**111**	**31**	**97**	**36**	**99**	**38**	**70**

Notes
Species key –Pp Common pipistrelle (*P. pipistrellus*); Ppy Soprano pipistrelle *(P.pygmaeus);* Pn Nathusius' pipistrelle (*P. nathusii*); Pa Long-eared (*Plecotus sp.)*Msp (Myotis sp); Nl Leisler's (*Nyctalus leisleri)* Nn Noctule (*Nyctalus noctula*); Es Serotine (*Eptesicus serotinus)* Rh Lesser horseshoe (*Rhinolophus hipposideros*); Rf Greater horseshoe (*Rhinolophus ferrumequinum*).

Datalogger Monitoring Results on the Disused Railway Line for April 2015

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
Lesser horseshoe	S4	Royal Portbury Dock ST 50595 75934	11/04/15	1	05:22
			13/04/15	22	03:47
			14/04/15	50	02:14
	S5a	Royal Portbury Dock ST 50595 75934	21/04/15	10	03:01
			22/04/15	5	04:07
			23/04/15	1	02:55
			25/04/15	4	05:32
			26/04/15	6	04:33
			27/04/15	1	01:53
Myotis Sp	S5a	Royal Portbury Dock ST 50595 75934	21/04/15	13	01:56
			22/04/15	3	00:54
			23/04/15	7	03:54
	S5b	Portbury Wharf Area ST 48269 76088	23/04/15	1	03:40

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
			24/04/15	1	03:11
Noctule	S4	Royal Portbury Dock ST 50595 75934	09/04/15	2	00:00
			13/04/15	1	00:47
			14/04/15	1	10:27
			16/04/15	1	00:23
	S5a	Royal Portbury Dock ST 50595 75934	24/04/15	1	03:21
	S5b	Portbury Wharf Area ST 48269 76088	25/04/15	1	04:22
			24/04/15	1	03:37
			23/04/15	1	04:22
Noctule/ Leisler's or Serotine	S4	Royal Portbury Dock ST 50595 75934	10/04/15	4	00:35
			1104/15	1	05:35
			13/04/15	2	05:35
			14/04/15	1	03:14
			15/04/15	2	00:24
			16/04/15	2	01:02
	S5a	Royal Portbury Dock	25/04/15	2	03:53

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
		ST 50595 75934			
	S5b	Portbury Wharf Area ST 48269 76088	27/04/15	1	01:18

Datalogger Monitoring Results on the Disused Railway Line for May - June 2015

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
Lesser horseshoe	S6a	Farmland ST 49591 75696	24/05/15	1	03:34
	S6b	Royal Portbury Dock ST 50467 75895	20/05/15	1	02:20
	S7a	Farmland ST 49325 75726	06/06/15	3	04:55
	9b	Farmland ST 49542 75696	26/06/15	1	05:30
			28/06/15	5	02:09
			29/06/15	2	04:04
Greater horseshoe	S6a	Farmland ST 49591 75696	20/05/15	1	04:09
			21/05/15	31	03:00
			23/05/15	1	02:29
			25/05/15	2	02:24
			27/05/15	4	04:08
			29/05/15	1	04:28
			30/05/15	1	04:01
	S6b	Royal Portbury Dock	20/05/15	2	03.03

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
		ST 50467 75895			
			25/05/15	1	04.39
	S7a	Farmland ST 49325 75726	05/06/15	1	02:53
			06/06/15	2	05:00
			07/06/15	14	04:03
			08/06/15	1	03:01
Long-eared sp	S6b	Royal Portbury Dock ST 50467 75895	19/05/15	1	00:56
Myotis Sp	S6a	Farmland ST 49591 75696	22/05/15	2	01:58
			23/05/15	1	02:42
			24/05/15	2	00:32
			25/05/15	1	03:39
			27/05/15	1	03:08
	S6b	Royal Portbury Dock ST 50467 75895	21/05/15	1	01:46
			22/05/15	3	01:08
			23/05/15	2	01:16
			24/05/15	8	02:13

Species	**Figure 3 Ref**	**Location**	**Date**	**No of Registrations per night**	**Earliest Registration Past Sunset (hrs:mins)**
			26/05/15	2	02:56
	S7a	Farmland ST 49325 75726	31/05/15	7	01:11
			01/06/15	1	03:27
			02/06/15	2	04:06
			03/06/15	10	01:03
			04/06/15	8	01:05
			05/06/15	1	01:03
			06/06/15	15	01:31
			07/06/15	2	01:43
			08/06/15	6	02:53
	S7b	Royal Portbury Dock ST 50467 75895	03/06/15	1	01:39
Leisler's	S6b	Royal Portbury Dock ST 50467 75895	20/05/15	2	08:00
			21/05/15	1	00:28
			22/05/15	7	00:13
			23/05/15	8	00:10
			24/05/15	4	00:25
			25/05/15	4	00:23

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
	S7b	Royal Portbury Dock ST 50467 75895	02/06/15	2	00:57
			03/06/15	31	00:18
			05/06/15	4	06:07
			07/06/15	2	01:04
Noctule	S6a	Farmland ST 49591 75696	23/05/15	7	00:10
			24/05/15	3	00:36
			29/05/15	1	00:35
	S6b	Royal Portbury Dock ST 50467 75895	18/05/15	1	00:00
			19/05/15	2	23:54
			20/05/15	2	07:36
			21/05/15	32	00:07
			22/05/15	20	00:01
			23/05/15	19	00:07
			24/05/15	16	00:07
			25/05/15	19	00:17
			26/05/15	1	03:05
	S7a	Farmland	03/06/15	2	07:10

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
		ST 49325 75726			
	S7b	Royal Portbury Dock ST 50467 75895	31/05/15	3	00:00
			01/06/15	39	00:23
			02/06/15	412 (within ½hr period)	04:48
			03/06/15	25	00:19
			04/06/15	10	07:09
			05/06/15	11	00:14
			06/06/15	5	07:09
			07/06/15	7	07:03
Serotine	S6b	Royal Portbury Dock ST 50467 75895	20/05/15	6	00:18
			21/05/15	4	00:24
			23/05/15	2	00:16
			25/05/15	2	01:30
	S7b	Royal Portbury Dock ST 50467 75895	31/05/15	1	00:24
			03/06/15	1	00:18
			05/06/15	1	00:39

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
			06/06/15	1	00:41
			07/06/15	1	00:42
Noctule/ Leisler's or Serotine	S6a	Farmland ST 49591 75696	30/05/15	1	01:11
	S6b	Royal Portbury Dock ST 50467 75895	19/05/15	1	23:59
			20/05/15	11	00:21
			21/05/15	1	07:53
			22/05/15	8	00:13
			23/05/15	15	00:03
			26/05/15	1	04:14
	S7a	Farmland ST 49325 75726	04/06/15	1	01:57
			06/06/15	2	01:06
	S7b	Royal Portbury Dock ST 50467 75895	31/05/15	11	00:03
			02/06/15	1	07:46
			03/06/15	11	00:19
			04/06/15	1	00:51
			05/06/15	3	03:36

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
			06/06/15	1	01:52
			07/06/15	2	01:02

Datalogger Monitoring Results on the Disused Railway Line for June – July 2015

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
Lesser horseshoe	S8a	Farmland ST 49542 75696	09/06/15	1	02:07
			10/06/15	1	02:31
			12/06/15	4	04:49
			14/06/15	9	02:16
			15/06/15	14	04:17
			16/06/15	2	03:02
			17/06/15	9	03:13
			19/06/15	1	05:38
			20/06/15	5	03:06
	9b	Farmland ST 49542 75696	26/06/15	1	05:30
			28/06/15	5	02:09
			29/06/15	2	04:04
Greater Horseshoe	S8a	Farmland ST 49542 75696	11/06/15	2	03:16
			12/06/15	2	04:01
			15/06/15	1	05:29
			16/06/15	1	03:48

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
			17/06/15	1	04:57
			18/06/15	2	02:07
			20/06/15	1	04:11
			21/06/15	1	04:40
	S8b	Royal Portbury Dock ST 49955 75711	10/06/15	1	04:56
			11/06/15	1	04:32
			12/06/15	3	04:08
	9a	Royal Portbury Dock ST 49977 75726	29/06/15	1	03:09
			01/07/15	1	04:33
			02/07/15	1	04:56
			04/07/15	1	01:21
			05/07/15	1	03:40
	9b	Farmland ST 49542 75696	26/06/15	1	04:14
Long-eared sp	9b	Farmland ST 49542 75696	25/06/15	6	00:32
			26/06/15	12	00:54
			27/06/15	2	06:22

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
			29/06/15	17	00:47
			30/06/15	18	01:00
			01/07/15	9	00:49
			02/07/15	3	02:27
			25/06/15	3	00:57
			03/07/15	3	02:40
			04/07/15	1	03:25
Nathusius'	S8b	Royal Portbury Dock ST 49955 75711	13/06/15	1	00:59
			12/06/15	1	03:22
	9b	Farmland ST 49542 75696	26/06/15	1	01:06
			01/07/15	1	00:44
			02/07/15	1	01:03
			03/07/15	1	02:55
Myotis Sp	S8a	Farmland ST 49542 75696	09/06/15	2	00:43
			10/06/15	6	00:43
			11/06/15	5	00:54
			14/06/15	2	01:14

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
			16/06/15	3	00:56
			20/06/15	2	02:51
	S8b	Royal Portbury Dock ST 49955 75711	11/06/15	2	02:42
			14/06/15	2	03:24
	9a	Royal Portbury Dock ST 49977 75726	25/06/15	1	01:23
			02/07/15	1	02:51
			03/07/15	1	04:11
	9b	Farmland ST 49542 75696	25/06/15	4	00:44
			26/06/15	14	05:26
			28/06/15	1	01:08
			29/06/15	3	00:59
			30/06/15	3	00:13
			01/07/15	3	01:05
			03/07/15	2	02:30
Leisler's	S8b	Royal Portbury Dock ST 49955 75711	09/06/15	1	00:38

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
			10/06/15	4	01:16
			11/06/15	4	00:38
			12/06/15	2	02:13
			13/06/15	2	05:00
			14/06/15	2	04:21
	9b	Farmland ST 49542 75696	25/06/15	5	00:29
			26/06/15	2	06:12
			28/06/15	2	05:55
			30/06/15	4	00:59
			01/07/15	8	00:40
			02/07/15	1	05:44
			03/07/15	4	01:47
			04/07/15	1	02:41
Noctule	S8a	Farmland ST 49542 75696	09/06/15	5	00:20
			10/06/15	2	00:54
			11/06/15	9	00:32
			12/06/15	3	00:04
			14/06/15	11	00:13

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
			15/06/15	2	03:36
			16/06/15	1	01:01
			18/06/15	5	00:48
			20/06/15	4	01:10
			21/06/15	3	05:41
			22/06/15	2	06:17
	S8b	Royal Portbury Dock ST 49955 75711	09/06/15	1	00:31
			10/06/15	5	00:31
			11/06/15	5	01:16
			12/06/15	7	00:21
			13/06/15	4	04:18
			14/06/15	3	05:00
	9a	Royal Portbury Dock ST 49977 75726	26/06/15	3	03:39
			27/06/15	3	00:32
			28/06/15	3	02:46
			29/06/15	1	06:37
			30/06/15	4	00:34
			01/07/15	3	00:40

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
			02/07/15	1	00:32
			04/07/15	2	00:16
Serotine	S8b	Royal Portbury Dock ST 49955 75711	09/06/15	2	01:28
			11/06/15	1	02:29
			12/06/15	1	05:35
	9b	Farmland ST 49542 75696	25/06/15	20	00:32
			26/06/15	30	00:35
			27/06/15	53	00:24
			28/06/15	51	00:40
			29/06/15	117	00:31
			30/06/15	118	00:12
			01/07/15	55	00:48
			02/07/15	36	00:34
			03/07/15	36	00:26
			04/07/15	7	02:33
Noctule/ Leisler's or Serotine	S8a	Farmland ST 49542 75696	09/06/15	4	00:59
			10/06/15	6	00:46

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
			11/06/15	6	00:51
			12/06/15	4	00:15
			13/06/15	4	01:13
			14/06/15	10	00:20
			15/06/15	5	00:38
			16/06/15	8	00:37
			17/06/15	7	00:59
			18/06/15	11	00:36
			19/06/15	15	00:38
			20/06/15	14	00:27
			21/06/15	9	01:02
			22/06/15	9	04:43
	S8b	Royal Portbury Dock ST 49955 75711	09/06/15	2	00:28
			10/06/15	9	01:00
			11/06/15	7	00:35
			12/06/15	25	00:05
			13/06/15	7	01:12
			14/06/15	8	03:14
	9a	Royal Portbury Dock	28/06/15	1	03:05

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
		ST 49977 75726			
			02/07/15	1	02:50
			02/07/15	1	03:02
	9b	Farmland ST 49542 75696	25/06/15	17	00:32
			26/06/15	27	00:54
			27/06/15	50	00:31
			28/06/15	20	00:40
			29/06/15	55	00:41
			30/06/15	62	00:59
			01/07/15	215	00:46
			02/07/15	13	00:31
			03/07/15	42	00:48
			04/07/15	11	02:33

Datalogger Monitoring Results on the Disused Railway Line for July-August 2015

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
Lesser Horseshoe	10a	Royal Portbury Docks ST 51788 76277	09/07/15	1	04:06
			29/07/15	1	02:48
	11a	Royal Portbury Dock ST 50820 76009	11/07/15	1	04:05
Greater Horseshoe	10a	Royal Portbury Docks ST 51788 76277	09/07/15	1	04:06
	10b	Portbury Wharf Area ST 48308 76057	11/07/15	1	04:05
			10/07/15	3	04:16
			11/07/15	3	04:08
			14/07/15	2	04:44
	10c	Farmland ST 48929 75859	08/07/15	1	01:17
			09/07/15	2	01:20
			10/07/15	1	01:08
			11/07/15	2	00:56
			12/07/15	1	02:08

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
			14/07/15	2	01:46
	11a	Royal Portbury Dock ST 50820 76009	20/07/15	1	01:20
			21/07/15	4	01:29
			22/07/15	5	00:28
			23/07/15	4	02:32
			24/07/15	5	02:29
			26/07/15	3	03:18
			29/07/15	3	00:41
			30/07/15	2	01:38
			31/07/15	1	01:59
			01/08/15	3	02:02
			02/08/15	1	02:30
			03/08/15	1	04:44
			04/08/15	6	02:31
	11b	Farmland ST 48619 75955	25/07/15	2	01:29
			29/07/15	1	02:11
			30/07/15	1	05:14

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
	11c	Portbury Wharf Area ST 48222 76097	29/07/15	8	01:53
			30/07/15	17	03:08
Long-eared	10b	Portbury Wharf Area ST 48308 76057	10/07/15	4	04:03
			11/07/15	5	04:18
			12/07/15	1	01:25
			14/07/15	9	01:27
			15/07/15	5	02:39
	10c	Farmland ST 48929 75859	14/07/15	1	04:12
	11b	Farmland ST 48619 75955	23/07/15	2	01:06
			30/07/15	3	05:32
	11c	Portbury Wharf Area ST 48222 76097	29/07/15	2	04:15
			30/07/15	2	03:58
Nathusius'	10b	Portbury Wharf Area ST 48308 76057	09/07/15	1	01:52
			10/07/15	12	06:32

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
			11/07/15	4	06:19
			12/07/15	1	00:39
			14/07/15	2	00:51
	10c	Farmland ST 48929 75859	09/07/15	4	00:51
Myotis sp	10a	Royal Portbury Dock ST 51788 76277	08/07/15	1	02:29
			11/07/15	1	04:49
			12/07/15	1	05:11
			13/07/15	1	05:18
			15/07/15	1	03:57
	10b	Portbury Wharf Area ST 48308 76057	09/07/15	1	01:29
			10/07/15	7	02:14
			11/07/15	8	03:12
			12/07/15	2	01:24
			13/07/15	15	01:32
			14/07/15	4	04:20
			15/07/15	3	04:35

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
	10c	Farmland ST 48929 75859	08/07/15	1	01:15
			09/07/15	14	02:08
			10/07/15	11	01:13
			11/07/15	13	01:38
			12/07/15	10	04:13
			13/07/15	6	02:53
			14/07/15	4	01:16
			15/07/15	2	02:35
	11a	Royal Portbury Dock ST 50820 76009	20/07/15	1	01:06
			21/07/15	4	00:46
			22/07/15	2	03:50
			25/07/15	1	00:11
			27/07/15	1	06:46
			28/07/15	1	00:42
			02/08/15	1	04:42
			03/08/15	3	00:29
	11b	Farmland	23/07/15	1	02:03

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
		ST 48619 75955			
			24/07/15	8	00:53
			25/07/15	2	02:11
			26/07/15	2	03:01
			29/07/15	3	01:11
	11c	Portbury Wharf Area ST 48222 76097	27/07/15	10	04:55
			30/07/15	1	03:10
Leisler's	10b	Portbury Wharf Area ST 48308 76057	10/07/15	1	03:34
			11/07/15	2	00:29
	10c	Farmland ST 48929 75859	10/07/15	2	01:23
			11/07/15	1	02:42
			12/07/15	1	00:29
			14/07/15	1	00:42
			15/07/15	1	03:48
Noctule	10a	Royal Portbury Docks ST 51788 76277	09/07/15	1	00:26

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
			10/07/15	2	04:03
			11/07/15	3	00:01
			12/07/15	3	00:03
			13/07/15	6	00:14
	10b	Portbury Wharf Area ST 48308 76057	09/07/15	1	00:56
			10/07/15	19	00:10
			11/07/15	5	01:50
			12/07/15	14	00:10
			13/07/15	36	00:28
			14/07/15	1	00:26
	10c	Farmland ST 48929 75859	09/07/15	6	02:38
			10/07/15	30	00:28
			11/07/15	38	00:09
			12/07/15	34	00:08
			13/07/15	21	00:14
			14/07/15	225	00:01
	11a	Royal Portbury Dock	29/07/15	1	05:55

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
		ST 50820 76009			
			23/07/15	1	23:28
	11b	Farmland ST 48619 75955	25/07/15	7	00:39
			27/07/15	2	00:18
	11c	Portbury Wharf Area ST 48222 76097	29/07/15	1	08:50
Serotine	10b	Portbury Wharf Area ST 48308 76057	12/07/15	1	01:28
			14/07/15	5	01:02
	10c	Farmland ST 48929 75859	11/07/15	1	00:48
	11b	Farmland ST 48619 75955	23/07/15	6	00:45
	11c	Portbury Wharf Area ST 48222 76097	27/07/15	1	03:32
Noctule/Leisler's or Serotine	10a	Royal Portbury Docks ST 51788 76277	10/07/15	2	04:14
			12/07/15	1	00:44
			14/07/15	3	00:44

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
	10b	Portbury Wharf Area ST 48308 76057	09/07/15	5	00:43
			10/07/15	5	00:12
			11/07/15	1	02:37
			12/07/15	6	01:32
			14/07/15	11	00:40
	10c	Farmland ST 48929 75859	09/07/15	1	05:43
			10/07/15	16	00:24
			11/07/15	3	00:56
			12/07/15	8	00:18
			13/07/15	2	02:43
			14/07/15	15	00:33
			15/07/15	2	02:57
	11a	Royal Portbury Dock ST 50820 76009	22/07/15	1	02:40
			25/07/15	1	00:40
			26/07/15	1	06:32
			02/08/15	1	00:20

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
	11b	Farmland ST 48619 75955	25/07/15	5	00:35
			28/07/15	1	02:22
			30/07/15	3	01:01
	11c	Portbury Wharf Area ST 48222 76097	27/07/15	1	06:22

Datalogger Monitoring Results on the Disused Railway Line for August 2015

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
Lesser Horseshoe	12a	Royal Portbury Dock ST 51417 76200	08/08/15	1	03:19
			11/08/15	1	05:07
			12/08/15	1	04:26
Greater Horseshoe	12b	Farmland ST 48542 75993	11/08/15	1	04:39
	12c	Farmland ST 48899 75837	04/08/15	1	01:07
			05/08/15	1	06:36
			06/08/15	1	01:39
			07/08/15	1	00:56
			08/08/15	2	01:22
			11/08/15	1	04:42
Long-eared	12b	Farmland ST 48542 75993	07/08/15	2	00:51
	12c	Farmland ST 48899 75837	06/08/15	3	01:54

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
			08/08/15	1	02:36
			09/08/15	3	01:29
			10/08/15	3	02:12
Myotis sp	12a	Royal Portbury Dock ST 51417 76200	05/08/15	1	02:39
			06/08/15	3	00:32
			07/08/15	1	01:16
			08/08/15	1	00:39
			09/08/15	4	02:44
			10/08/15	5	00:41
			11/08/15	3	01:15
	12b	Farmland ST 48542 75993	07/08/15	4	04:07
			09/08/15	1	04:45
			11/08/15	1	04:40
	12c	Farmland ST 48899 75837	04/08/15	1	02:12
			05/08/15	3	01:33
			06/08/15	4	01:25
			07/08/15	5	01:26

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
			08/08/15	5	01:52
			09/08/15	8	01:11
			10/08/15	9	01:25
			11/08/15	5	01:37
Noctule	12a	Royal Portbury Dock ST 51417 76200	04/08/15	19	00:08
			05/08/15	21	00:07
			06/08/15	2	02:48
			07/08/15	4	00:12
			10/08/15	3	00:16
			11/08/15	3	00:12
			12/08/15	1	06:15
	12b	Farmland ST 48542 75993	04/08/15	1	00:45
			05/08/15	3	00:23
			07/08/15	3	00:04
	12c	Farmland ST 48899 75837	04/08/15	6	00:14
			05/08/15	13	00:13
			07/08/15	2	00:43

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
			08/08/15	8	00:25
			09/08/15	10	00:17
			10/08/15	2	02:18
Serotine	12b	Farmland ST 48542 75993	04/08/15	1	00:52
			05/08/15	1	00:50
			09/08/15	2	02:48
	12c	Farmland ST 48899 75837	05/08/15	2	01:13
			06/08/15	2	01:14
			08/08/15	4	00:51
			11/08/15	4	01:23
Noctule/Leisler's or Serotine	12a	Royal Portbury Dock ST 51417 76200	05/08/15	7	00:31
			06/08/15	3	00:23
			07/08/15	1	00:27
			08/08/15	8	00:23
			09/08/15	1	00:19
			10/08/15	7	00:19
			11/08/15	2	00:13

Species	Figure 3 Ref	Location	Date	No of Registrations per night	Earliest Registration Past Sunset (hrs:mins)
	12b	Farmland ST 48542 75993	04/08/15	4	00:23
			05/08/15	7	00:39
			06/08/15	1	06:46
	12c	Farmland ST 48899 75837	04/08/15	5	00:28
			05/08/15	6	00:27
			06/08/15	4	00:35
			07/08/15	27	00:18
			08/08/15	1	00:51
			09/08/15	42	00:18
			10/08/15	7	00:27
			11/08/15	5	00:21

Standardised Datalogger Monitoring 2016

The Number of Nights that Species were Recorded on the Disused Railway Line by Static Automated Bat Detectors in 2016

Figure 3 Ref	**Month**	**Duration of Monitoring (No. of nights)**	**Number of Nights Species were Recorded**										
			Pp	**Ppy**	**Pn**	**Pa**	**Msp**	**Nl**	**Nn**	**Es**	**Nl/Nn or Es**	**Rh**	**Rf**
1a	April	10	10	4	3	1	2	0	6	0	2	4	0
1b			10	10	3	4	8	4	8	2	6	2	3
2a			6	5	1	0	4	0	3	0	6	2	0
2b			10	10	0	10	9	5	9	7	4	3	6
3a			10	9	2	0	6	0	1	0	7	5	0
3b			10	10	0	1	4	6	10	2	1	0	0
4a			7	5	0	1	5	6	4	3	5	0	1
4b			10	10	0	0	7	3	7	1	3	1	2
5a			7	4	3	0	8	3	2	1	2	6	2
5b			10	8	2	0	4	3	6	6	5	0	0

Notes
Species key –Pp Common pipistrelle (*P. pipistrellus*); Ppy Soprano pipistrelle *(P.pygmaeus);* Pn Nathusius' pipistrelle (*P. nathusii*); Pa Long-eared (*Plecotus sp.)*Msp (Myotis sp); Nl Leisler's (*Nyctalus leisleri)* Nn Noctule (*Nyctalus noctula*); Es Serotine (*Eptesicus serotinus)* Rh Lesser horseshoe (*Rhinolophus hipposideros*); Rf Greater horseshoe (*Rhinolophus ferrumequinum*).

Figure 3 Ref	Month	Duration of Monitoring (No. of nights)	Number of Nights Species were Recorded										
			Pp	**Ppy**	**Pn**	**Pa**	**Msp**	**Nl**	**Nn**	**Es**	**Nl/Nn or Es**	**Rh**	**Rf**
1a	May	7	7	5	1	1	4	2	2	1	1	3	4
1b			7	7	3	0	5	1	5	3	7	2	4
2a			7	4	1	0	3	0	4	0	3	3	1
2b			7	7	1	4	7	2	6	7	6	6	6
3a			7	7	0	0	1	3	5	6	6	3	1
3b			7	7	0	4	2	4	6	0	3	0	0
4a			7	7	1	0	4	3	3	1	0	0	1
4b			7	7	0	0	7	0	4	4	3	5	7
5a			7	7	1	0	7	0	0	0	1	5	1
5b			7	6	0	0	5	3	5	4	5	2	2

Notes
Species key –Pp Common pipistrelle (*P. pipistrellus*); Ppy Soprano pipistrelle *(P.pygmaeus);* Pn Nathusius' pipistrelle (*P. nathusii*); Pa Long-eared (*Plecotus sp.)*Msp (Myotis sp); Nl Leisler's (*Nyctalus leisleri)* Nn Noctule (*Nyctalus noctula*); Es Serotine (*Eptesicus serotinus)* Rh Lesser horseshoe (*Rhinolophus hipposideros*); Rf Greater horseshoe (*Rhinolophus ferrumequinum*).

Figure 3 Ref	Month	Duration of Monitoring (No. of nights)	Number of Nights Species were Recorded										
			Pp	Ppy	Pn	Pa	Msp	Nl	Nn	Es	Nl/Nn or Es	Rh	Rf
1a	June	7	7	7	2	6	7	3	6	3	3	2	7
1b			7	7	7	0	6	0	7	0	6	2	3
2a			7	7	5	0	7	4	7	5	4	1	4
2b			7	7	0	5	7	3	4	4	6	4	4
3a			7	7	0	0	3	2	7	4	5	2	5
3b			7	7	0	0	4	1	6	2	1	0	0
4a			7	7	0	1	7	3	6	2	3	1	3
4b			7	7	0	0	7	1	5	0	3	4	4
5a			7	7	2	2	7	0	5	0	4	4	3
5b			7	7	0	0	4	3	6	3	2	5	1

Notes
Species key –Pp Common pipistrelle (*P. pipistrellus*); Ppy Soprano pipistrelle *(P.pygmaeus);* Pn Nathusius' pipistrelle (*P. nathusii*); Pa Long-eared (*Plecotus sp.)*Msp (Myotis sp); Nl Leisler's (*Nyctalus leisleri)* Nn Noctule (*Nyctalus noctula*); Es Serotine (*Eptesicus serotinus)* Rh Lesser horseshoe (*Rhinolophus hipposideros*); Rf Greater horseshoe (*Rhinolophus ferrumequinum*).

Figure 3 Ref	Month	Duration of Monitoring (No. of nights)	Number of Nights Species were Recorded										
			Pp	Ppy	Pn	Pa	Msp	Nl	Nn	Es	Nl/Nn or Es	Rh	Rf
1a	July	7	7	7	4	7	6	2	6	1	5	2	6
1b			7	7	6	3	7	0	3	0	2	0	4
2a			7	6	4	0	5	3	7	3	2	3	6
2b			7	7	0	5	7	5	6	5	3	5	7
3a			7	7	2	6	3	6	6	5	5	2	6
3b			7	7	0	3	0	4	6	5	0	0	0
4a			7	7	1	3	7	5	6	4	5	1	3
4b			7	7	1	3	6	2	3	2	1	1	7
5a			7	7	3	0	7	3	5	2	7	2	3
5b			7	7	0	3	4	4	5	1	6	7	1

Notes
Species key –Pp Common pipistrelle (*P. pipistrellus*); Ppy Soprano pipistrelle *(P.pygmaeus);* Pn Nathusius' pipistrelle (*P. nathusii*); Pa Long-eared (*Plecotus sp.)*Msp (Myotis sp); Nl Leisler's (*Nyctalus leisleri)* Nn Noctule (*Nyctalus noctula*); Es Serotine (*Eptesicus serotinus)* Rh Lesser horseshoe (*Rhinolophus hipposideros*); Rf Greater horseshoe (*Rhinolophus ferrumequinum*).

Figure 3 Ref	Month	Duration of Monitoring (No. of nights)	Number of Nights Species were Recorded										
			Pp	Ppy	Pn	Pa	Msp	Nl	Nn	Es	Nl/Nn or Es	Rh	Rf
1a	August	6	6	6	0	4	6	0	3	0	2	5	5
1b		7	7	7	3	3	7	0	5	3	5	3	7
2a		6	6	5	2	0	5	4	4	3	4	1	4
2b		7	7	7	0	6	7	6	5	7	4	3	6
3a		6	6	6	0	5	3	2	4	4	4	1	0
3b		7	7	7	0	0	3	0	5	1	3	0	2
4a		6	6	6	1	0	5	2	3	3	2	0	1
4b		7	7	7	0	0	7	3	6	3	2	2	2
5a		6	6	6	0	0	6	0	3	2	1	5	1
5b		7	7	7	0	1	6	1	7	5	4	4	2

Notes
Species key –Pp Common pipistrelle (*P. pipistrellus*); Ppy Soprano pipistrelle *(P.pygmaeus);* Pn Nathusius' pipistrelle (*P. nathusii*); Pa Long-eared (*Plecotus sp.)*Msp (Myotis sp); Nl Leisler's (*Nyctalus leisleri)* Nn Noctule (*Nyctalus noctula*); Es Serotine (*Eptesicus serotinus)* Rh Lesser horseshoe (*Rhinolophus hipposideros*); Rf Greater horseshoe (*Rhinolophus ferrumequinum*).

Figure 3 Ref	Month	Duration of Monitoring (No. of nights)	Number of Nights Species were Recorded										
			Pp	Ppy	Pn	Pa	Msp	Nl	Nn	Es	Nl/Nn or Es	Rh	Rf
1a	September	7	7	6	2	5	6	1	1	1	2	7	3
1b			7	6	1	3	7	0	1	0	0	4	3
2a			7	7	3	3	7	0	1	1	0	4	2
2b			7	7	3	6	7	3	3	3	1	4	2
3a			6	7	4	7	6	2	4	3	4	4	0
3b			7	7	3	1	4	0	3	0	3	0	0
4a			6	7	4	1	7	1	1	0	2	2	0
4b			7	7	0	3	7	0	4	0	3	6	0
5a			6	7	2	1	7	0	1	0	2	7	0
5b			7	7	2	0	5	2	2	0	0	4	0

Notes
Species key –Pp Common pipistrelle (*P. pipistrellus*); Ppy Soprano pipistrelle *(P.pygmaeus);* Pn Nathusius' pipistrelle (*P. nathusii*); Pa Long-eared (*Plecotus sp.)*Msp (Myotis sp); Nl Leisler's (*Nyctalus leisleri)* Nn Noctule (*Nyctalus noctula*); Es Serotine (*Eptesicus serotinus)* Rh Lesser horseshoe (*Rhinolophus hipposideros*); Rf Greater horseshoe (*Rhinolophus ferrumequinum*).

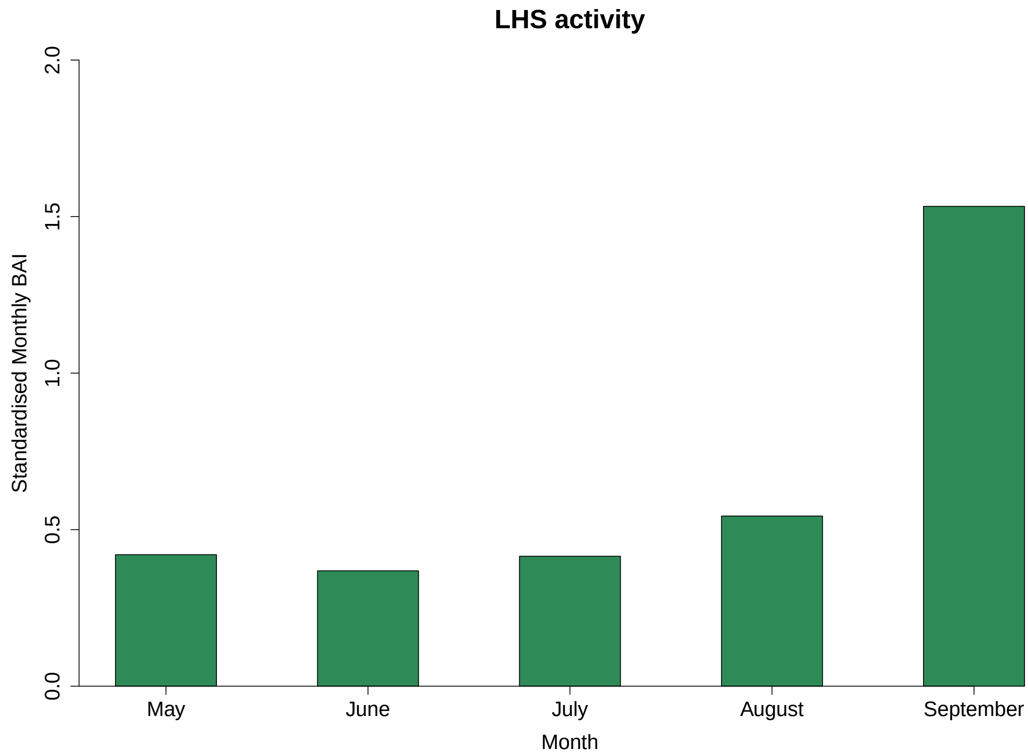
Appendix 4. BAI Analysis of 2016 Lesser and Greater Horseshoe Bats

The analysed BAI for lesser and greater horseshoe bat activity captured in 2016 during the standardised static automated bat detector acoustic monitoring (see Section 5.3.1) is presented on the graphs and tables in this appendix.

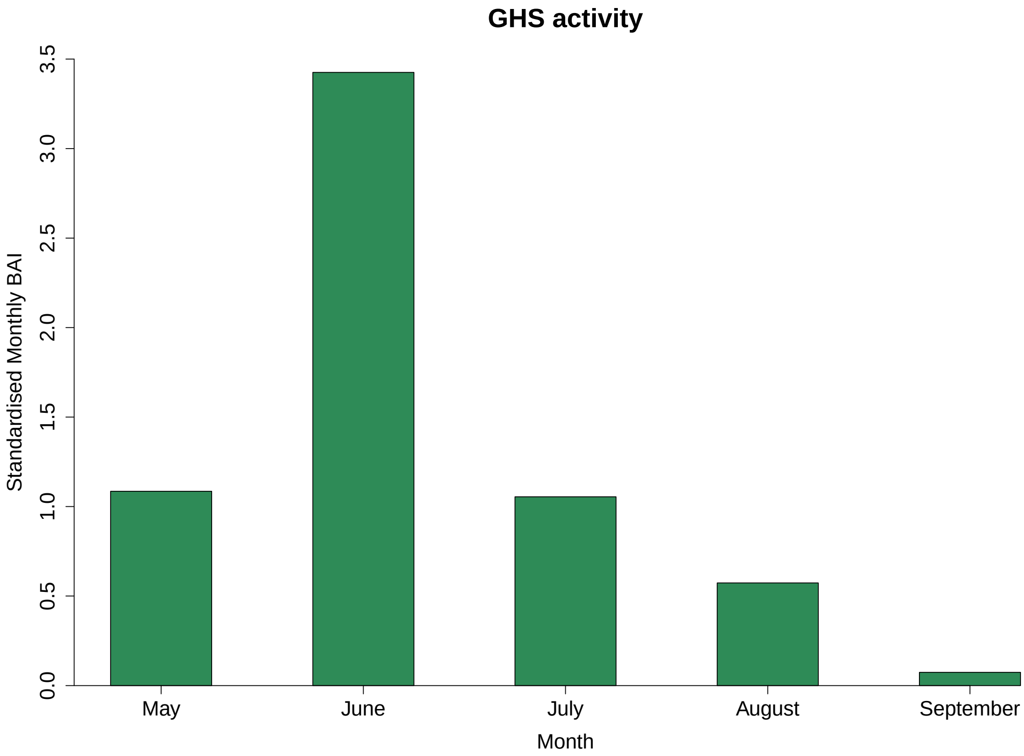
Abbreviations
LHS – Lesser horseshoe bat
GHS – Greater horseshoe bat

A. Whole study site: wide spatial and temporal resolution

Graph A1. Monthly BAI for lesser horseshoe bats on the disused railway line



Graph A2. Monthly BAI for greater horseshoe bats on the disused railway line



B. Spatial variation across the disused railway line

Graph B1. Standardised monthly BAI for lesser horseshoe at each datalogger location

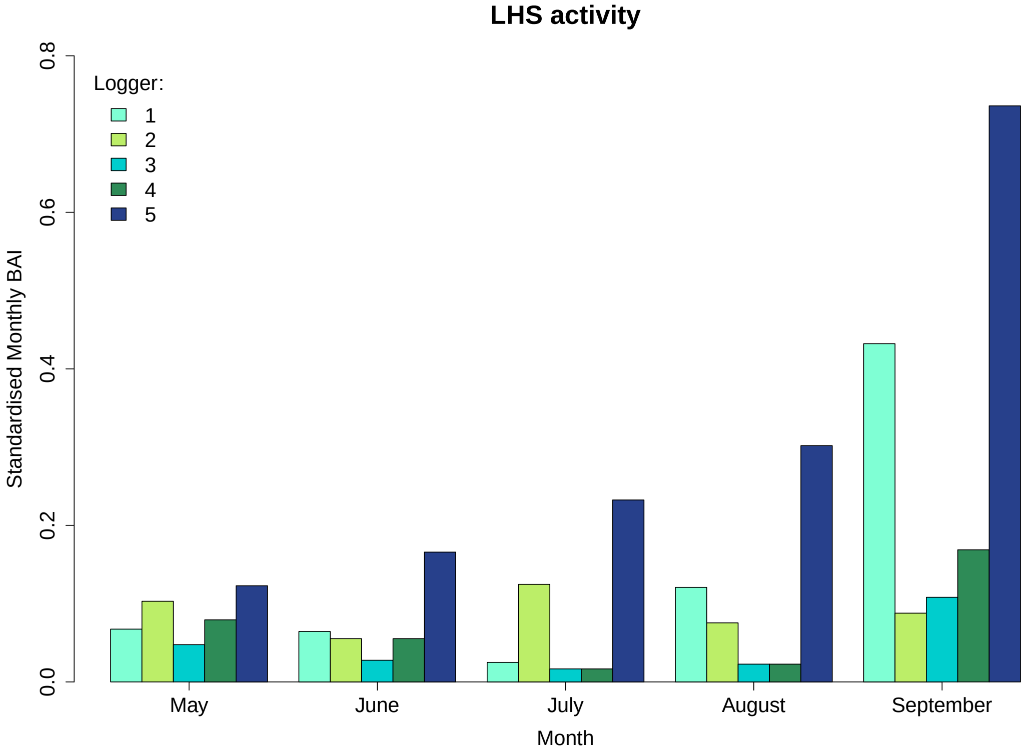


Table B1: Statistical analysis of temporal variation in LHS bat activity between months.

Month comparison	Estimate	Standard Error	*z* value	*p* value
Jun. vs. May	-0.245	0.351	-0.699	0.957
Jul. vs. May	-0.523	0.351	-1.489	0.569
Aug. vs. May	-0.150	0.351	-0.427	0.993
Sep. vs. May	1.001	0.351	2.851	**0.035**
Jul. vs. Jun.	-0.278	0.351	-0.791	0.933
Aug. vs. Jun.	0.096	0.351	0.272	0.999
Sep. vs. Jun.	1.247	0.351	3.550	**0.004**
Aug. vs. Jul	0.373	0.351	1.063	0.826
Sep. vs. Jul.	1.525	0.351	4.341	**< 0.001**
Sep. vs. Aug.	1.151	0.351	3.278	**0.009**

Table B2: Statistical analysis of spatial variation in LHS bat activity between data loggers.

Data logger comparison	Estimate	Standard Error	*z* value	*p* value
2 vs. 1	-0.043	0.351	-0.123	1.000
3 vs. 1	-0.904	0.351	-2.573	0.075
4 vs. 1	-0.583	0.351	-1.661	0.458
5 vs. 1	1.027	0.351	2.924	**0.028**
3 vs. 2	-0.861	0.351	-2.450	0.102
4 vs. 2	-0.540	0.351	-1.538	0.538
5 vs. 2	1.070	0.351	3.047	**0.020**
4 vs. 3	0.320	0.351	0.913	0.892
5 vs. 3	1.931	0.351	5.497	**<0.001**
5 vs. 4	1.610	0.351	4.584	**<0.001**

Graph B2. Standardised monthly BAI for greater horseshoe at each datalogger location

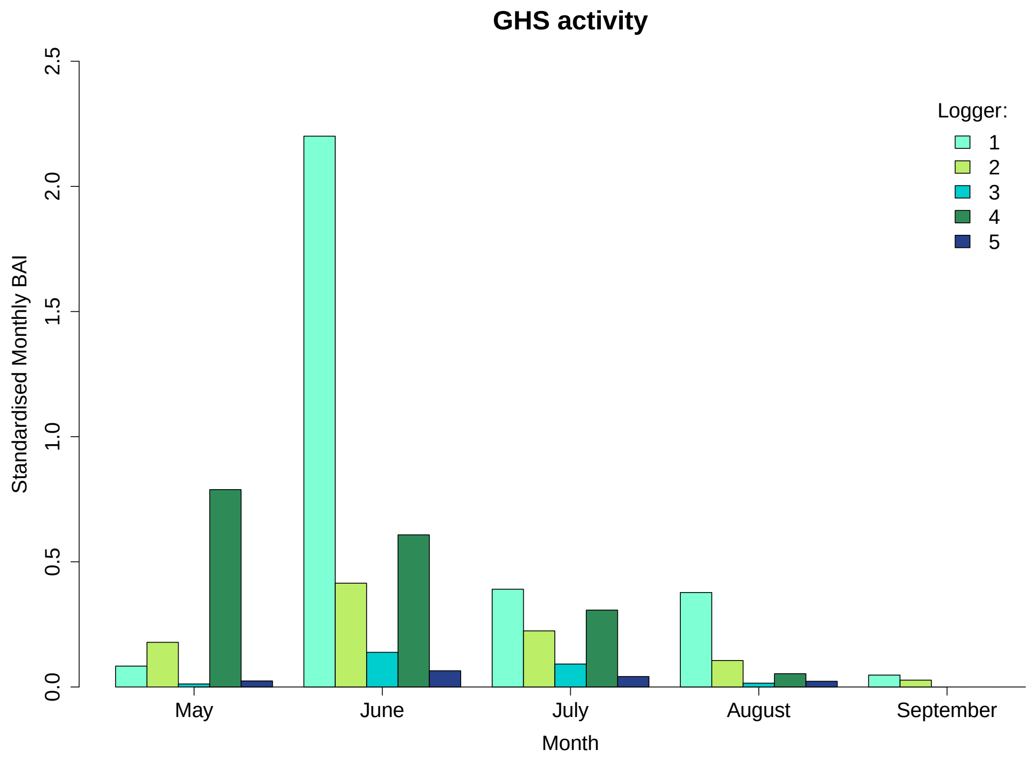


Table B3: Statistical analysis of temporal variation in GHS bat activity between months.

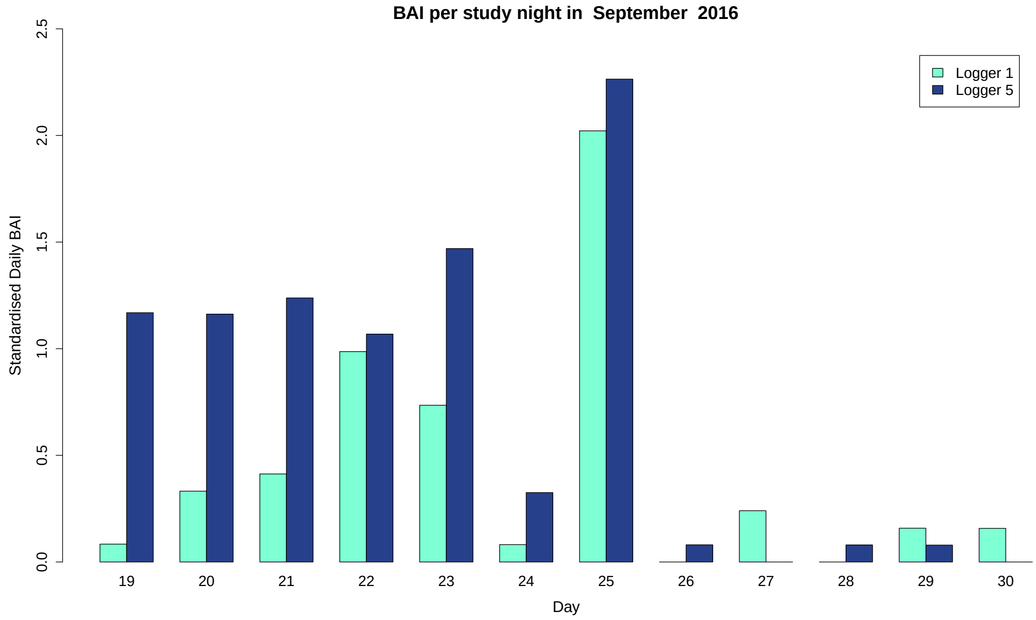
Month comparison	**Estimate**	**Standard Error**	***z* value**	***p* value**
Jun. vs. May	1.435	0.575	2.495	0.092
Jul. vs. May	0.663	0.575	1.153	0.778
Aug. vs. May	-0.305	0.575	-0.531	0.984
Sep. vs. May	-2.869	0.575	-4.990	**<0.001**
Jul. vs. Jun.	-0.772	0.575	-1.342	0.665
Aug. vs. Jun.	-1.740	0.575	-3.026	**0.021**
Sep. vs. Jun.	-4.304	0.575	-7.485	**<0.001**
Aug. vs. Jul	-0.968	0.575	-1.684	0.444
Sep. vs. Jul.	-3.532	0.575	-6.143	**<0.001**
Sep. vs. Aug.	-2.564	0.575	-4.459	**<0.001**

Table B4: Statistical analysis of spatial variation in GHS bat activity between data loggers.

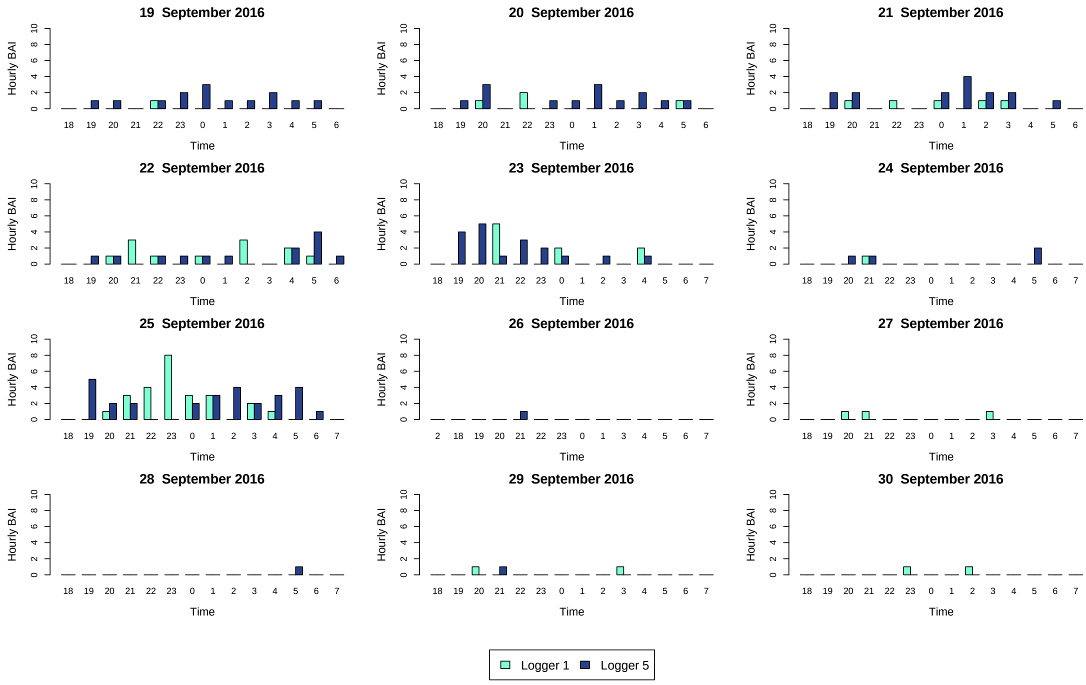
Data logger comparison	**Estimate**	**Standard Error**	***z* value**	***p* value**
2 vs. 1	-0.654	0.575	-1.138	0.786
3 vs. 1	-2.584	0.575	-4.494	**< 0.001**
4 vs. 1	-0.989	0.575	-1.719	0.422
5 vs. 1	-2.684	0.575	-4.667	**< 0.001**
3 vs. 2	-1.930	0.575	-3.356	**0.007**
4 vs. 2	-0.334	0.575	-0.581	0.978
5 vs. 2	-2.030	0.575	-3.530	**0.004**
4 vs. 3	1.596	0.575	2.775	**0.044**
5 vs. 3	-0.100	0.575	-0.173	1.000
5 vs. 4	-1.695	0.575	-2.948	**0.027**

C. High temporal resolution at key locations

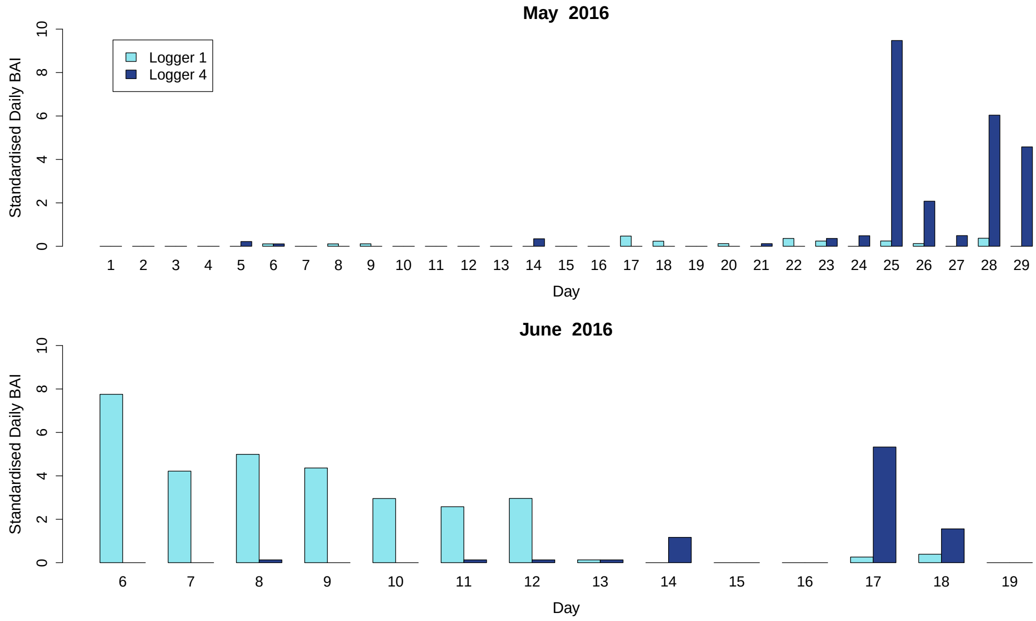
Graph C1. Daily lesser horseshoe bat activity in September at dataloggers 1 and 5.



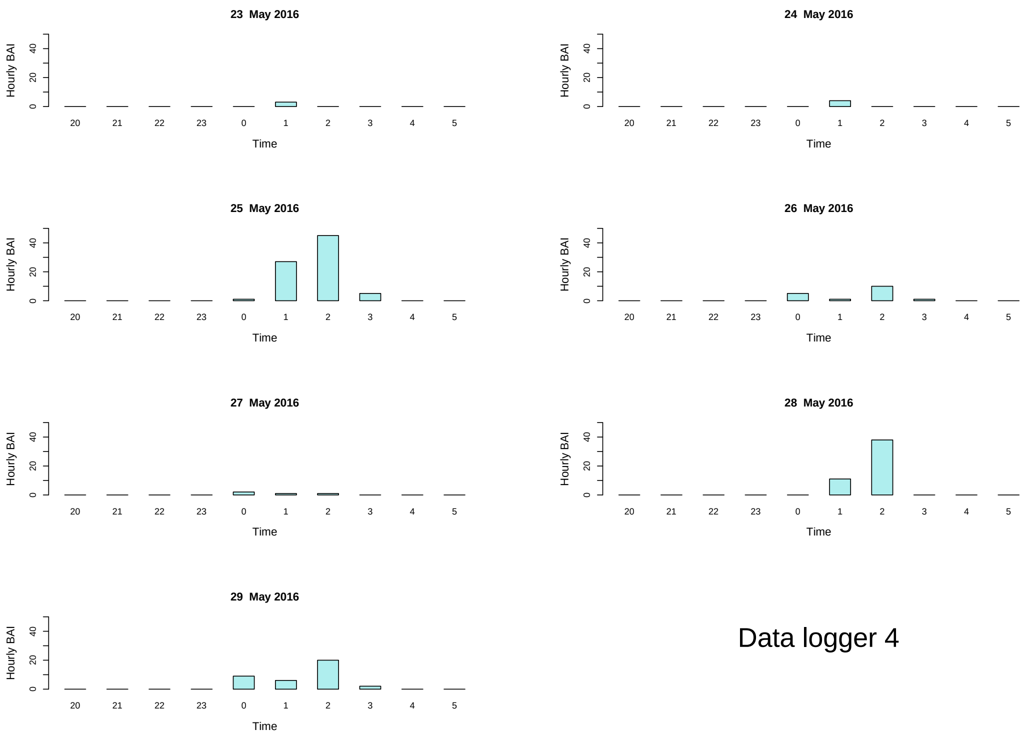
Graphs C2i – xii . Hourly BAI for lesser horseshoe activity at dataloggers 1 and 5 in September



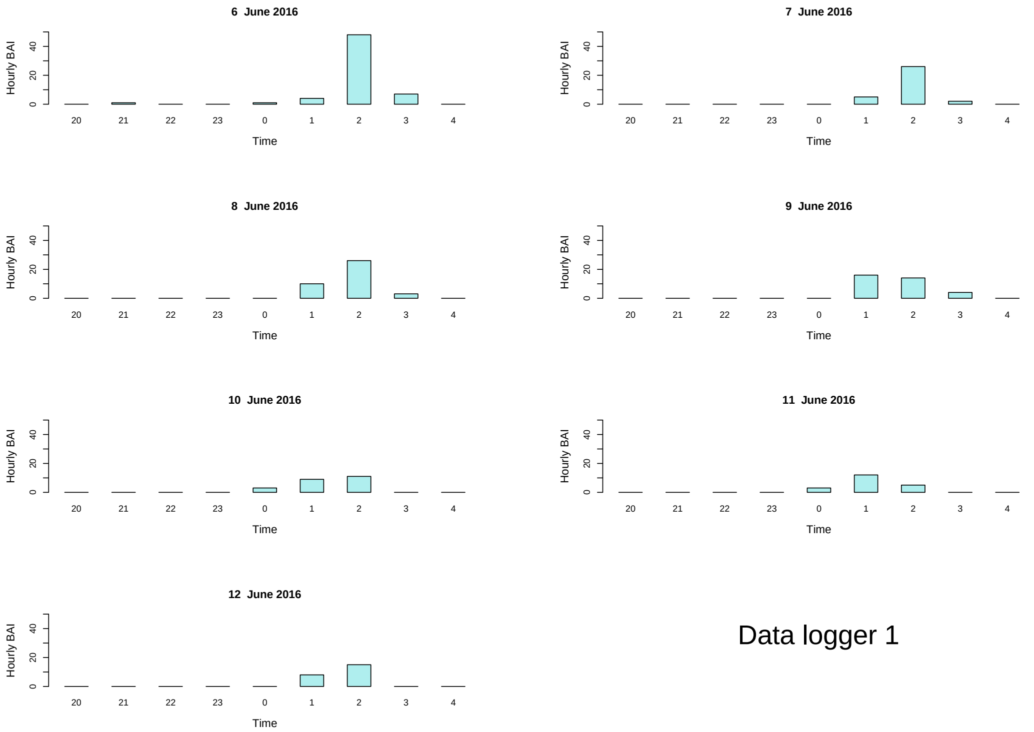
Graphs C3i-ii. Daily BAI for greater horseshoe bat at dataloggers 1 and 4 in May and June



Graph C4i-vii. Hourly BAI for greater horseshoe bats from the 23rd to 29th May



Graph C5i-vii. Hourly BAI for greater horseshoe bats from the 6th – 12th June



D. LHS activity near the M5 motorway (datalogger 5)

Graph D1. Comparison of monthly BAI for greater horseshoe bats at dataloggers 5a and 5b

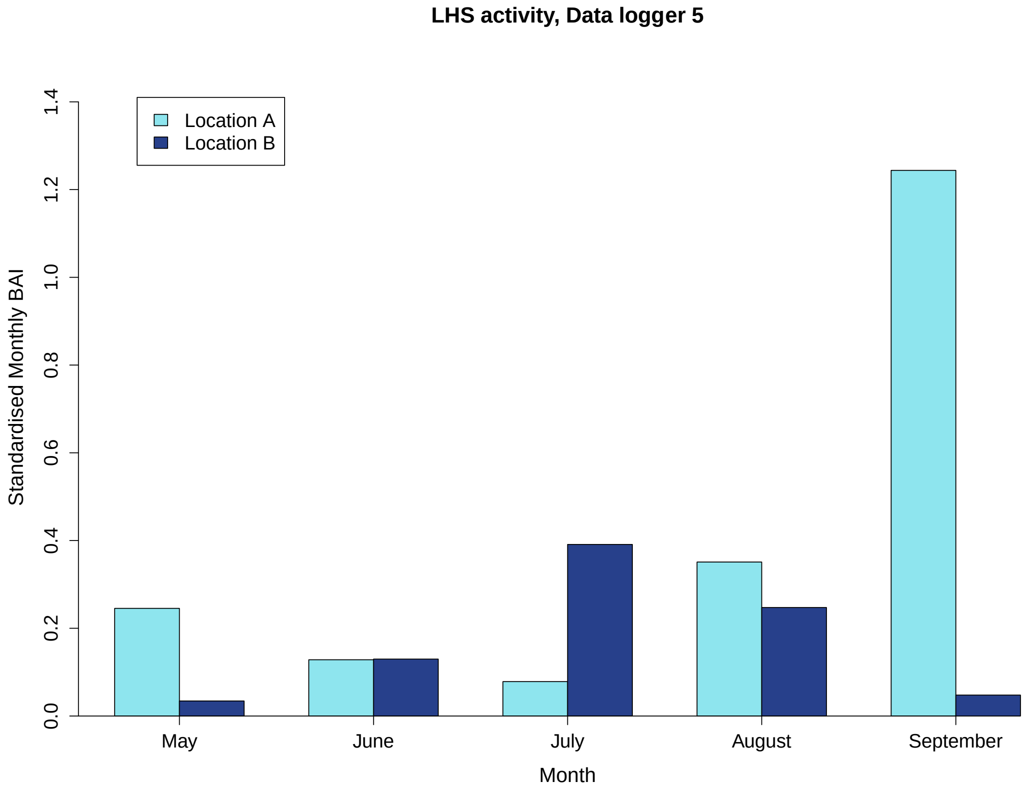
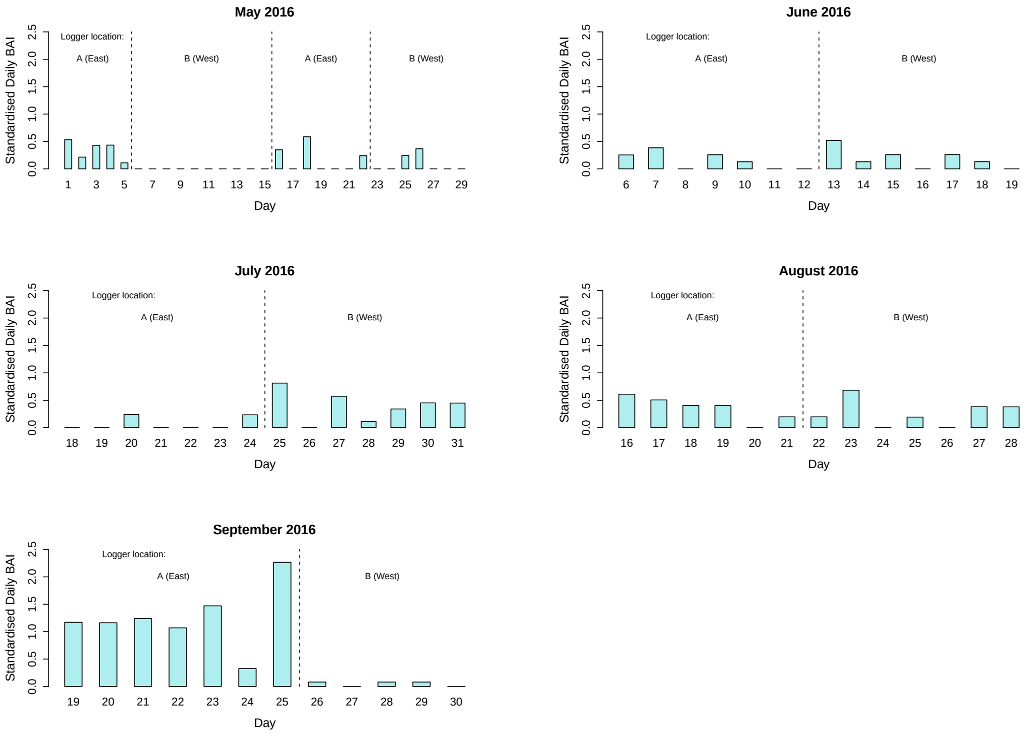


Figure. Graph D2 Daily BAI for lesser horseshoe at dataloggers 5a and 5b each month



Appendix 5. Bat Roost Appraisal of Structures

The walkover survey identified nine bridges and four culverts along the disused railway line. Following vegetation clearance in 2015, access to a further two culverts and a derelict railway store building was possible.

The bridges did not have any obvious structure defects on the exterior and the majority of the potential shelter for bats was in expansion joints and small crevices in bricked arches/stone abutments. Culverts were typically small concrete pipes with brick buttresses. Several of the culverts were flooded during inspections of these features in winter, which precludes them from being suitable for hibernation. Details of the daytime surveys of structures are given below. The location of structures is shown on Figure 5.

Evaluation of Potential Roosts in Structures

Ref*	Grid Reference	Description of Structure	Bat Roost Potential	Evaluation+
B1	ST 47191 76468	Brick arch	Dense vegetation cover over the structure. Possible gaps under bridge deck	Low potential
B2	ST48504 76004	Brick arch carrying Sheepway unclassified road	The brick work is in good condition, but there are a low number of small crevices from missing mortar in brickwork under arch. Ivy cover on abutments is fairly sparse.	Confirmed Roost (Common pipistrelle bat)
B3	ST 49587 75688	Brick arch carrying Sheepway unclassified road	2 drainage pipes 30cm deep in the roof of the arch. Low number of small gaps c.10cm deep in the stone abutment walls.	Low potential
B4	ST 50646 75961	Concrete bridge with 10m span carrying Royal Portbury Dock Road	Expansion joints at the top of the abutment walls and between concrete floor beams across the span.	Confirmed (Common and soprano pipistrelle bat)
B5	ST 51057 76112	Brick arch bridge with stone abutments	Small crevices between bricks and stonewalls from missing mortar.	Low potential

Ref*	Grid Reference	Description of Structure	Bat Roost Potential	Evaluation+
B6	ST 51404 76207	Small brick arch bridge over an agricultural pass.	The brick work is complete and there are no obvious gaps in the fabric of the structure. The bridge is small with a 4m wide and 3m high arch span and could be closely inspected.	No potential
B7	ST 51544 76226	Concrete motorway bridge	Expansion joints at the top of walls.	Low potential
B8	ST 51978 76283	Low concrete bridge over cyclepath.	No bat roost features	No Potential
B9	ST 52098 76246	Small bridge with brick abutments and a concrete deck.	Expansion joints at top of the walls	Low potential
NR	ST 49542 75696	Small, derelict brick store covered with ivy. It is a single storey building with pitched roof and chimney at one end. It measures approximately 3m (L) by 2m (W) and is 3m to the ridge of the roof. There is a door and window opening on one side.	Capped chimney provides enclosed void. Interior space	Confirmed night roost.

Ref*	Grid Reference	Description of Structure	Bat Roost Potential	Evaluation⁺
C1	ST 48301 76072	Small brick culvert for agricultural drainage ditch	Comprehensive scoping assessment	No bat roost potential because culvert pipe floods.
C2	ST 48771 75904	Small brick culvert for agricultural drainage ditch	Comprehensive scoping assessment	No bat roost potential because culvert pipe floods.
C3	ST 49233 75752	Brick culvert with a vertical chamber with steel grating.	Comprehensive scoping assessment	Limited access for bats and no cavities or voids.
C4	ST 49307 75737	Brick embankment and 1.5m wide concrete pipe.	Visual inspection from embankment	Brick work and concrete pipe appear to be solid with no obvious defects.
C5	ST 49591 75691	Brick culvert with a vertical chamber with steel grating.	Comprehensive scoping assessment	Limited access for bats and no cavities or voids.
C6	ST 50344 75841	Brick embankment and 1.5m wide concrete pipe.	Visual inspection from embankment	Brick work and concrete pipe appear to be solid with no obvious defects.
C7	ST 50317 75845	Brick embankment and 1.5m wide concrete pipe.	Visual inspection from embankment	Brick work and concrete pipe appear to be solid with no obvious defects.
C8	ST 50418 75887	Brick embankment and 1m wide concrete pipe.	Visual inspection from embankment	The design of the culvert is considered to limit potential roost features, but there may be defects in the 18m long concrete pipe. Water level is high (with only 30cm air clearance through pipe) and culvert is likely to flood.

Ref*	Grid Reference	Description of Structure	Bat Roost Potential	Evaluation+
Notes ***Reference is shown on Figure 5. **B** denotes Bridge; **C** denotes Culvert; **NR** denotes night roost building.				

Appendix 6. Tree Roost Resource on the Disused Railway Line

Trees with bat roost potential are shown on Figure 5

Evaluation of Potential Roosts in Trees

Tree Ref	Grid Reference	Tree Species	Habitat Description	Roost Description	Height Above Ground Level	Evaluation
T1	ST 48243 76090	Italian Black Poplar	Portbury Wharf Area. Woodland, pasture and semi-natural habitats.	Rot hole in main limb on north side	6m	High
				Woodpecker hole on east side	7m	
				Damaged and loose bark on north side of main limb	8m	
T2	ST 48187 76092	Italian Black Poplar	Portbury Wharf Area. Woodland, pasture and semi-natural habitats.	Broken limb on south side with possible cavities	6m	Low
				Large scar on north side of trunk	6m	
T3	ST 48171 76105	Italian Black Poplar	Portbury Wharf Area. Woodland, pasture and semi-natural habitats.	Horizontal split on underside of small limb on east side of tree	8m	Low
T4	ST 48163 76109	Italian Black Poplar	Portbury Wharf Area. Woodland, pasture and semi-natural habitats.	Rot hole in the end of a small branch on the south side of the tree	4m	Low
				Scar with flaking bark on south side of the tree trunk	5m	
T5	ST 48159 76110	Italian Black Poplar	Portbury Wharf Area. Woodland, pasture and semi-natural habitats.	Scar with rot hole c.20cm wide on north side of tree trunk	10m	Moderate

Tree Ref	Grid Reference	Tree Species	Habitat Description	Roost Description	Height Above Ground Level	Evaluation
				Dead limb with splits on north side of tree	15m	
T6	ST 48132 761112	Italian Black Poplar	Portbury Wharf Area. Woodland, pasture and semi-natural habitats.	Large broken limb with flaking bark on south-east side	5m	Moderate
				Flaking bark around small broken limb on north side	6m	
				Ivy cover over decayed timber	9m	
T7	ST 48113 76113	Italian Black Poplar	Portbury Wharf Area. Woodland, pasture and semi-natural habitats.	Woodpecker hole on east side of trunk	5m	Moderate
				Flaking bark on dead limb on east side	6m	
				Rot hole in small branch on south-east side	9m	
T8	ST 48112 76113	Italian Black Poplar	Portbury Wharf Area. Woodland, pasture and semi-natural habitats.	Dying, tree has a beheaded trunk with a woodpecker hole on north side	5m	High
T9	ST 48102 76124	Italian Black Poplar	Portbury Wharf Area. Woodland, pasture and semi-natural habitats.	Beheaded main branch with woodpecker hole on north-east side	10m	High
				Flaking bark and decay on broken limb	6m	

Tree Ref	Grid Reference	Tree Species	Habitat Description	Roost Description	Height Above Ground Level	Evaluation
T10	ST 47998 76157	Italian Black Poplar	Close to housing estate and adjacent to pasture.	Small areas of damage on west side	12m	Low
				Flaking bark on south side	Various	
T11	ST 47998 76158	Italian Black Poplar	Close to housing estate and adjacent to common land	Beheaded main branch with cracks	Top of tree	Moderate
T12	ST 47955 76176	Italian Black Poplar	Close to housing estate and adjacent to pasture.	Hole in trunk on west side	2m	Low
T13	ST 49311 75709	White Poplar	Arable and pasture farmland	Large limb on south side with split in barn	5m	Moderate
				Split in limb (goes all the way through the branch) on south side	10m	
T14	ST 50543 75926	Italian Black Poplar	Secondary woodland along railway line at edge of industrial estate with countryside	Rot hole in trunk on south side	4.5m	Moderate
T15	ST 50418 75887	Poplar	Secondary woodland along railway line at edge of industrial estate with countryside	Dying tree with ivy cover over decayed timber	Various	High
				Rot hole on north side of trunk	1m	
T16	ST 50391 75864	Oak	Secondary woodland along railway line at edge of industrial estate with countryside	Horizontal split in limb on north side of tree	3m	Moderate

Tree Ref	Grid Reference	Tree Species	Habitat Description	Roost Description	Height Above Ground Level	Evaluation
T17	ST 50371 75863	Birch	Secondary woodland along railway line at edge of industrial estate with countryside	Thick stem ivy	Various	Low
T18	ST 50883 76045	Birch	Urban edge with arable and pasture farmland	Twin stem tree with thick stem ivy over deadwood	Various	Low
T19	ST 51461 76226	Oak	Green corridor and cyclepath at the edge of town	Mature tree with ivy and dead wood in canopy of tree	Various	Low

Appendix 7. Datalogger Monitoring of Tunnels on Portbury Freight Line between August and October

The results of the datalogger monitoring between August and October 2015 are presented on a series of charts to show the data captured on each datalogger deployed at the tunnel portals. The graphs display:

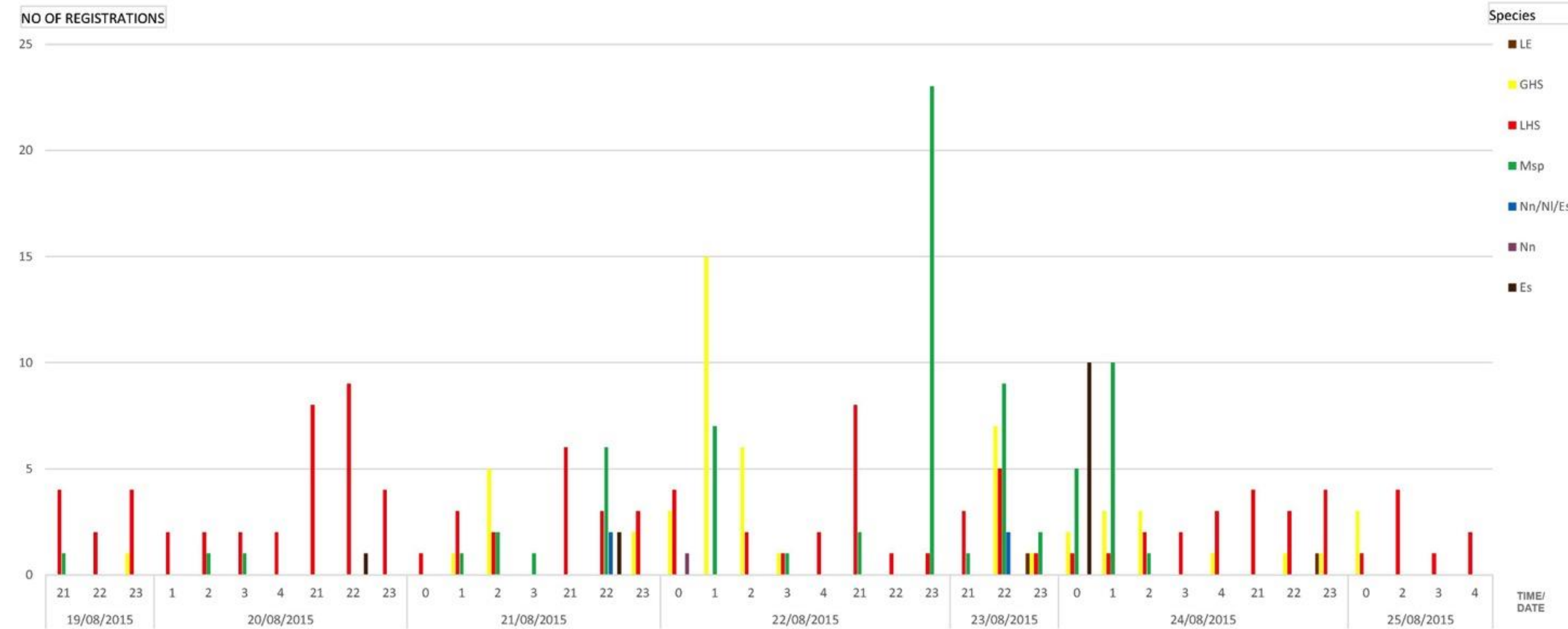
- The monitoring period on the horizontal axis;
- The hour of time shown on the horizontal axis – abbreviated 24hour clock (e.g 21:00hrs shown as 21);
- Total number of registrations per species per hour.

Species Key	
ES	Serotine bat *Eptesicus serotinus*
GHS	Greater horseshoe bat *Rhinolophus ferrumequinum*
LE	Long-eared bat *Plecotus sp*
LHS	Lesser horseshoe bat *Rhinolophus hipposideros*
Msp	Myotis species
Nl	Leisler’s bat *Nyctalus leisleri*
Nn	Noctule bat *Nyctalus noctula*
Nn/Nl/Es	Noctule, Leisler’s or Serotine bat

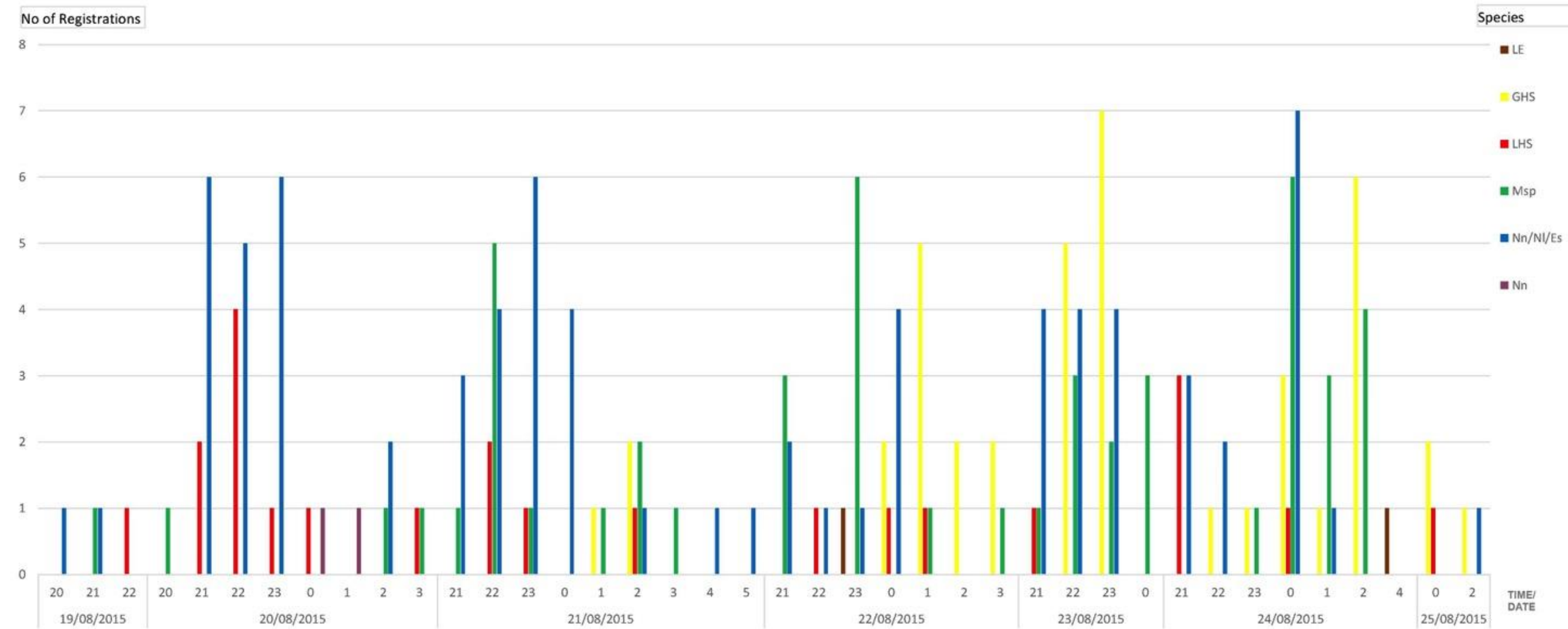
Social calls from bats interacting within the tunnels are shown as a discrete entry on the charts as they cannot be assigned to an individual species with sufficient certainty.

Clifton 1.

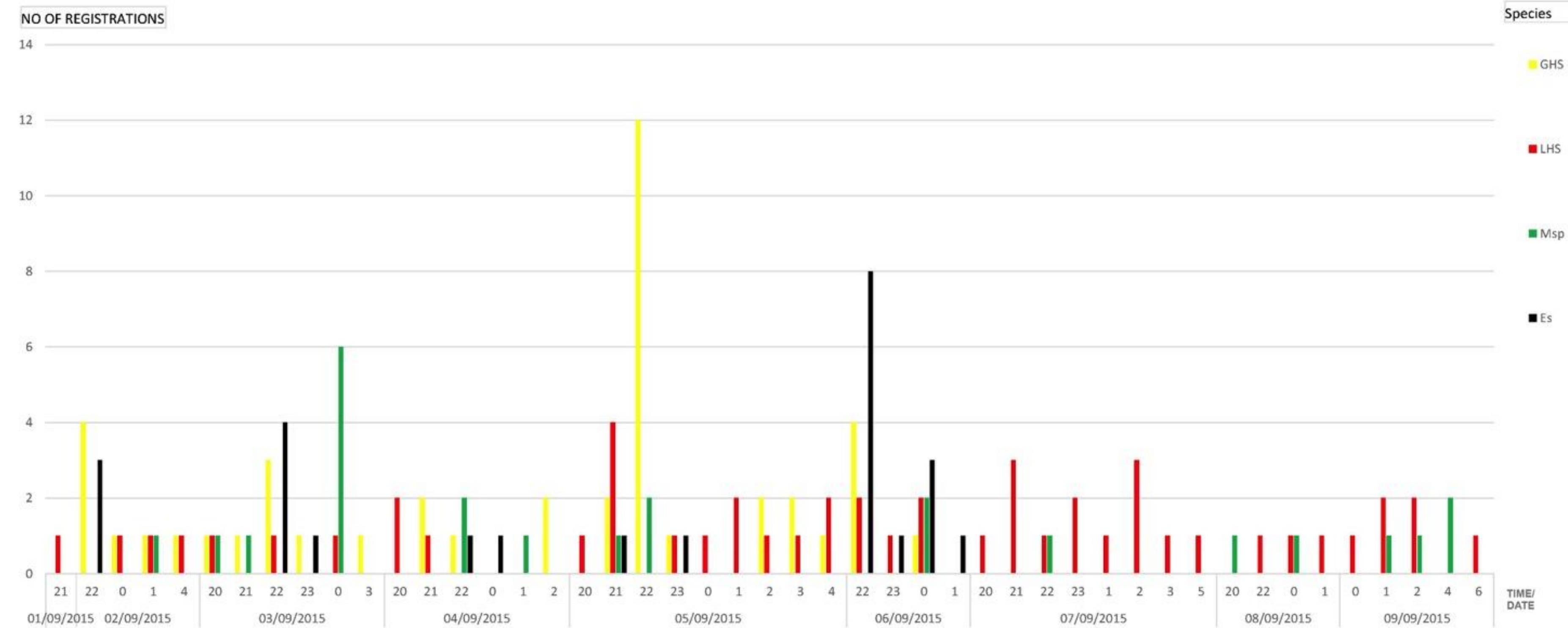
North-West Portal: 19th August, 6 nights monitoring



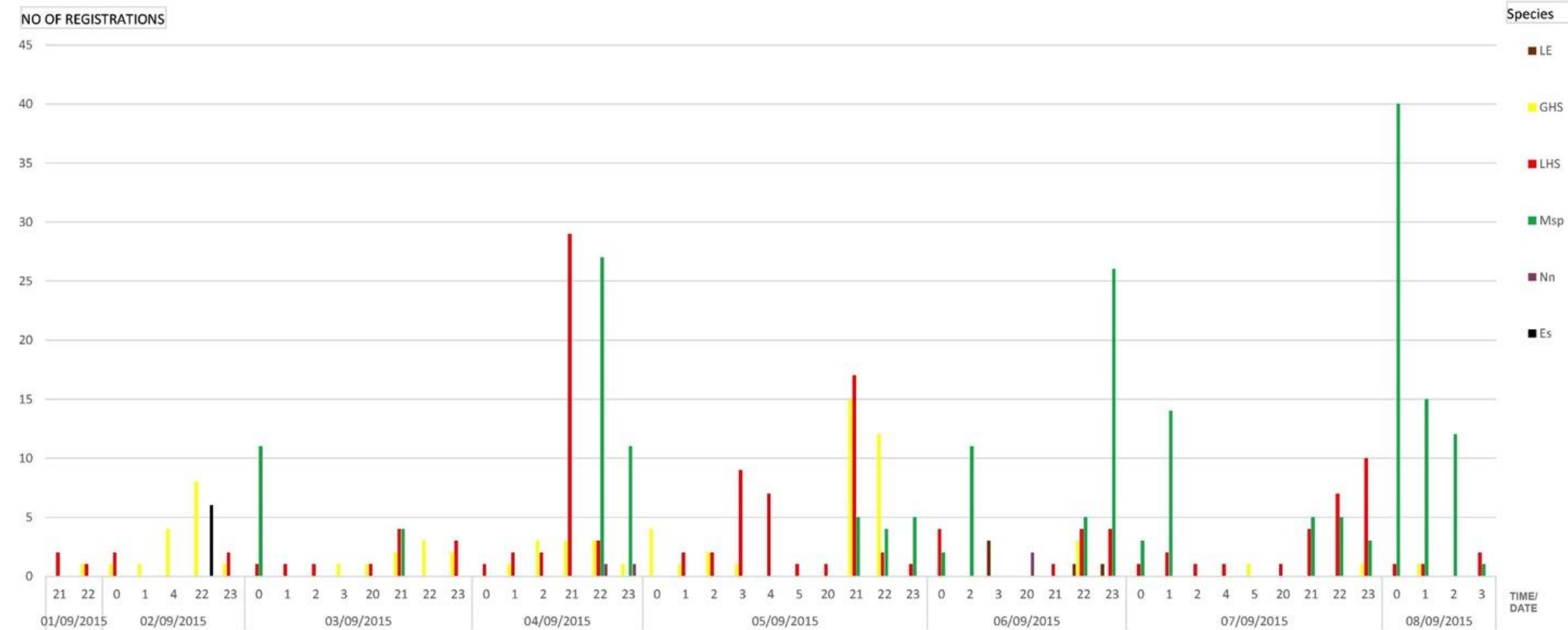
South_East Portal: 19th August, 6 nights monitoring



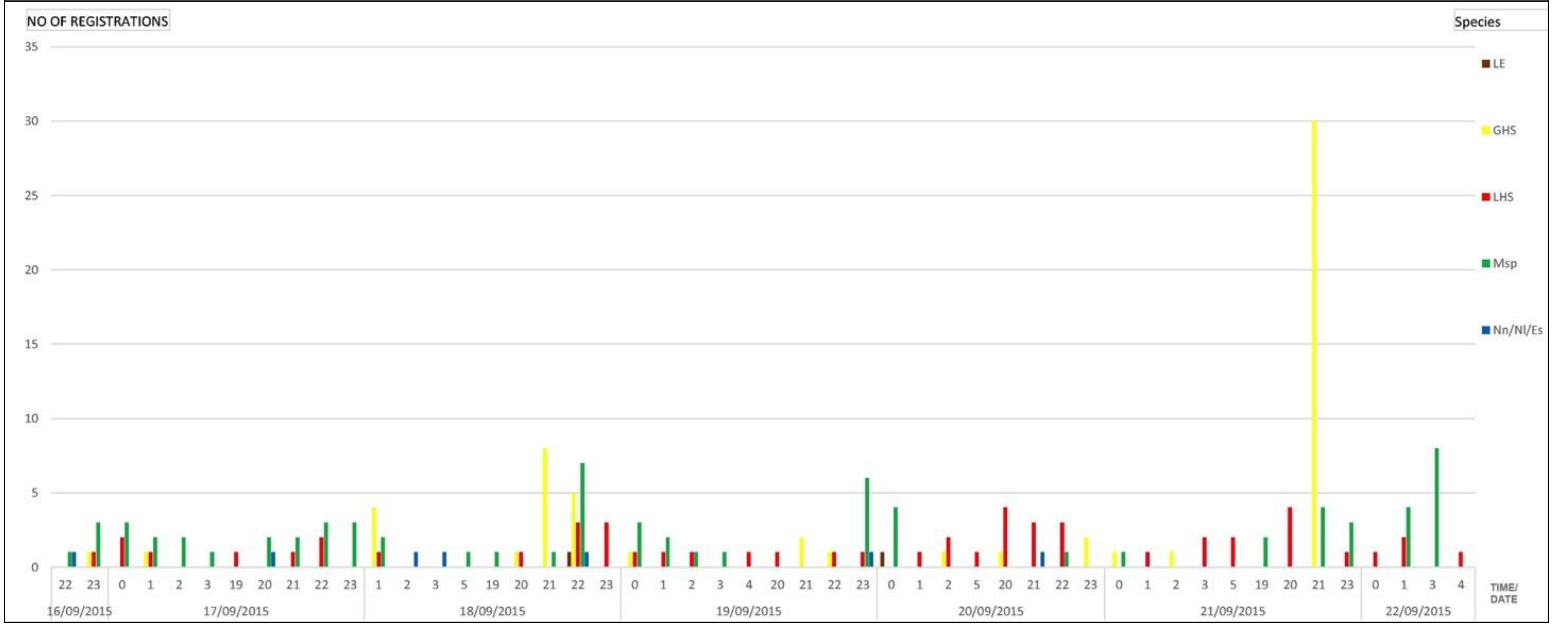
North-West Portal: 1st September, 7 nights monitoring



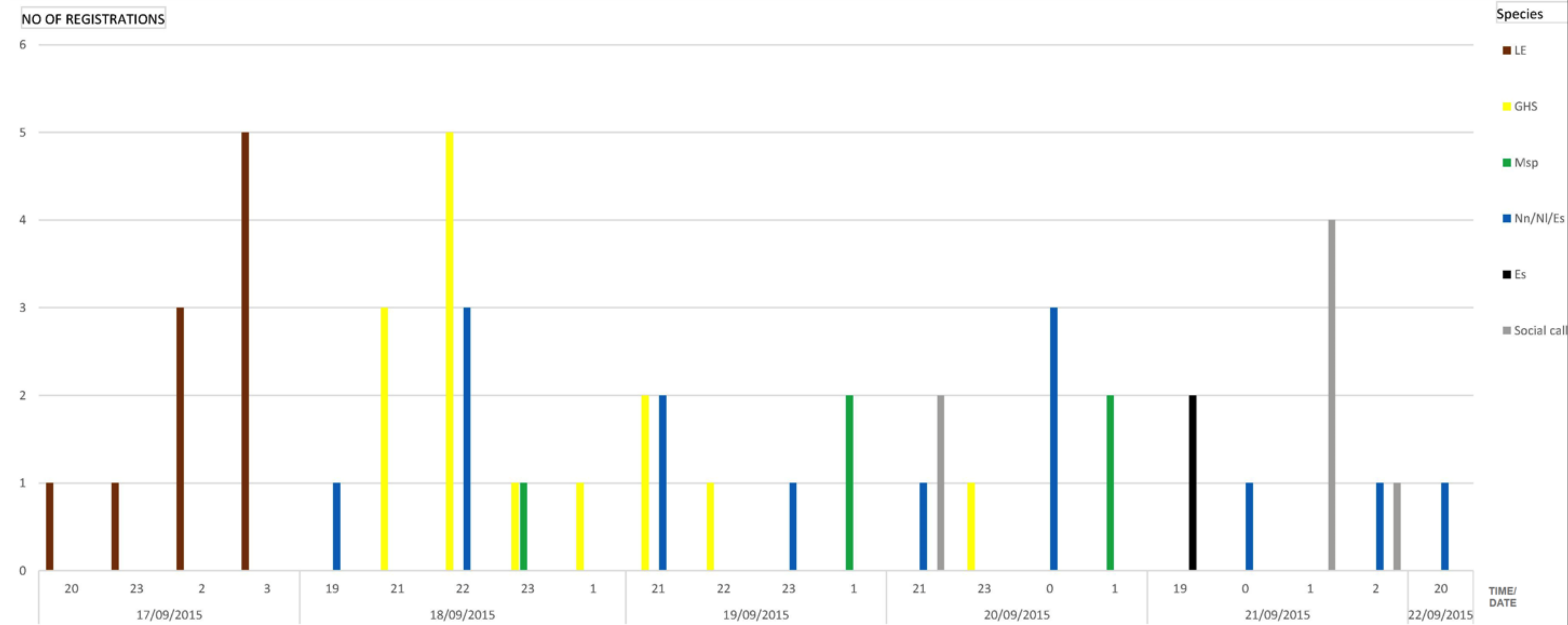
South-East Portal: 1st September, 7 nights monitoring



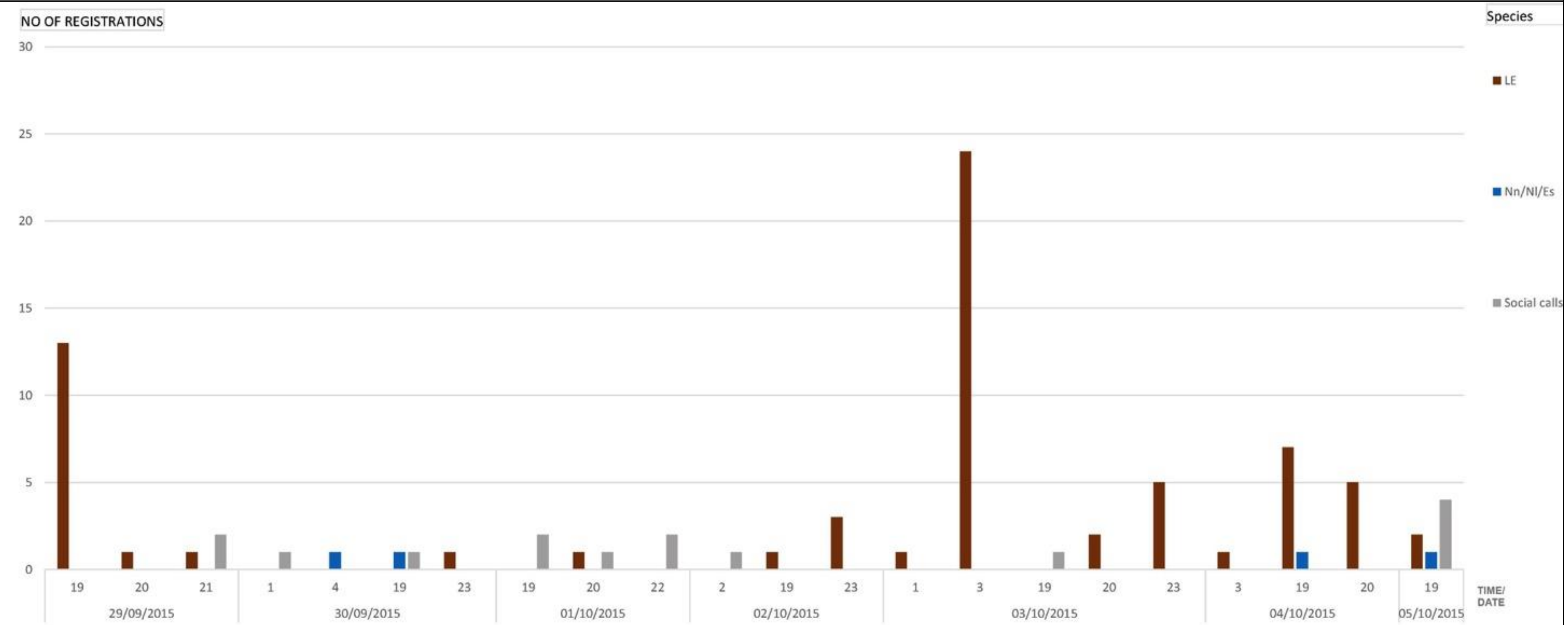
North-West Portal: 16th September, 6 nights monitoring



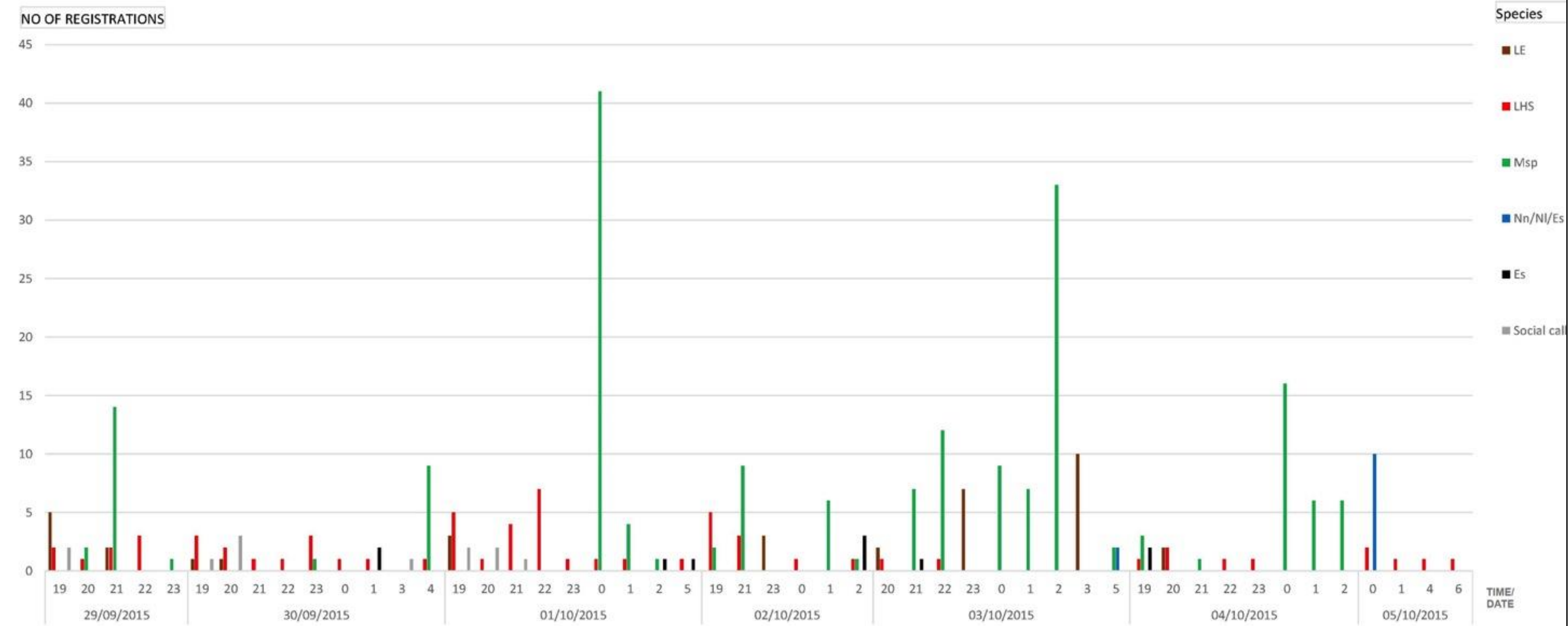
South-East Portal: 16th September, 6 nights monitoring



North-West Portal: 28th September, 6 nights monitoring

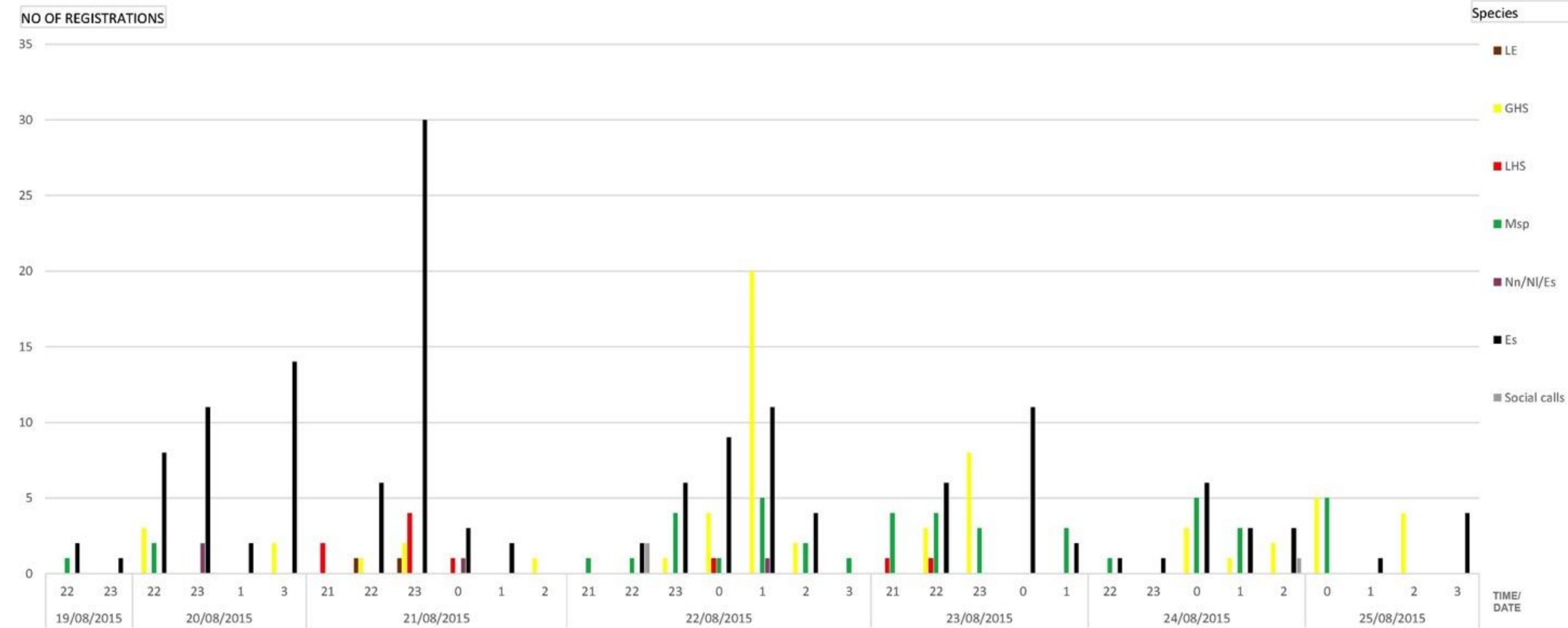


South-East Portal: 28th September, 6 nights monitoring

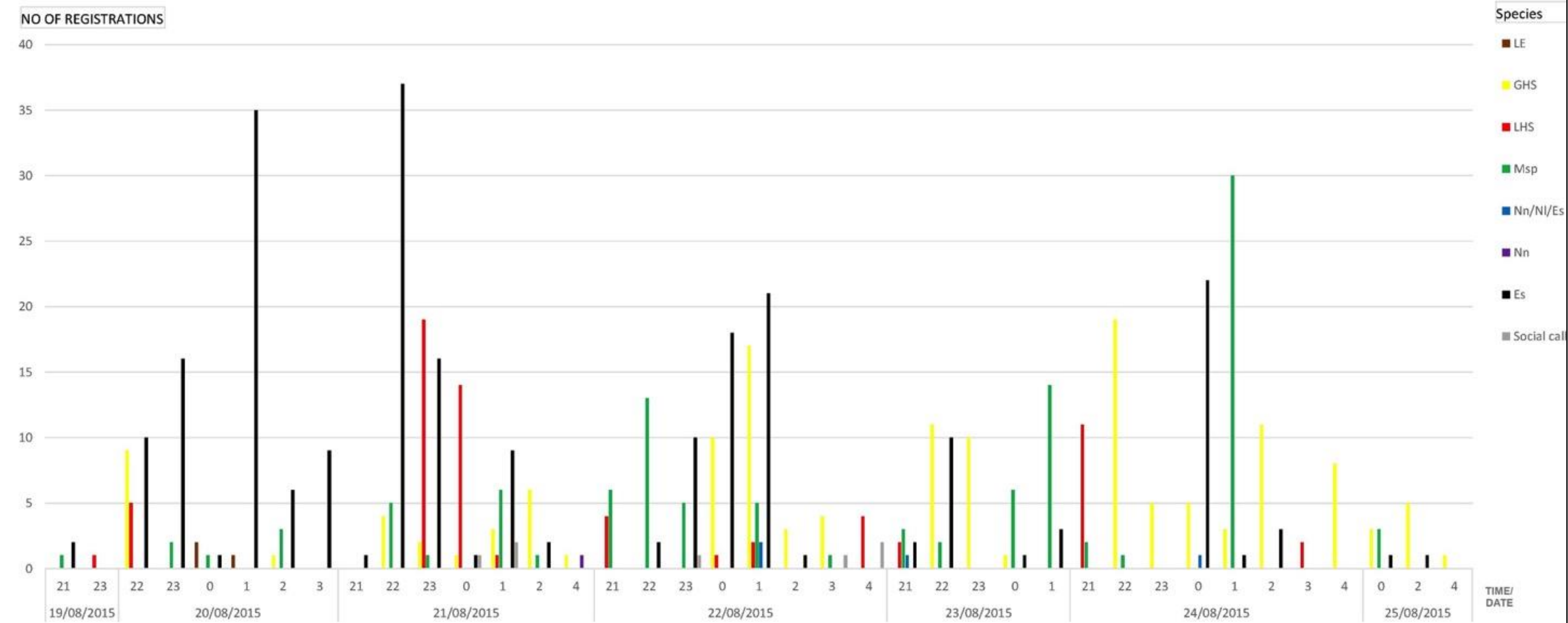


Clifton 2

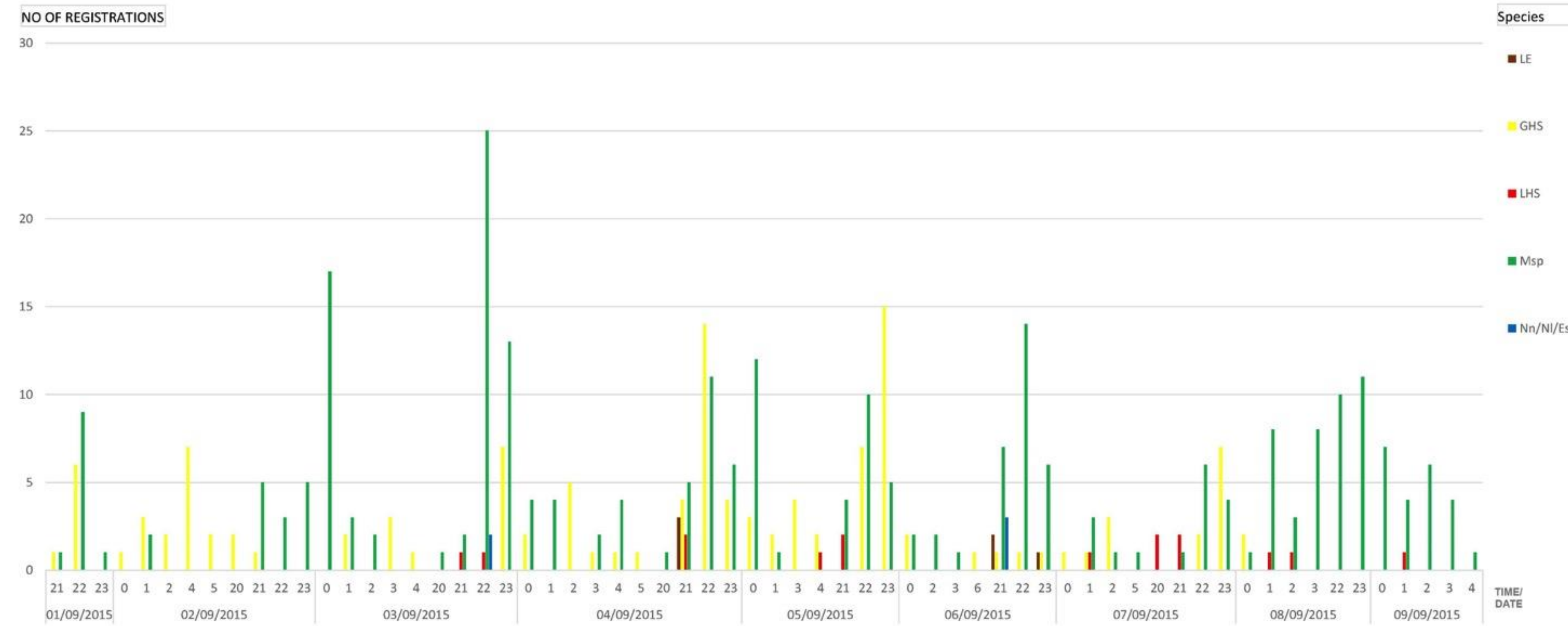
North Portal: 19th August, 6 nights monitoring



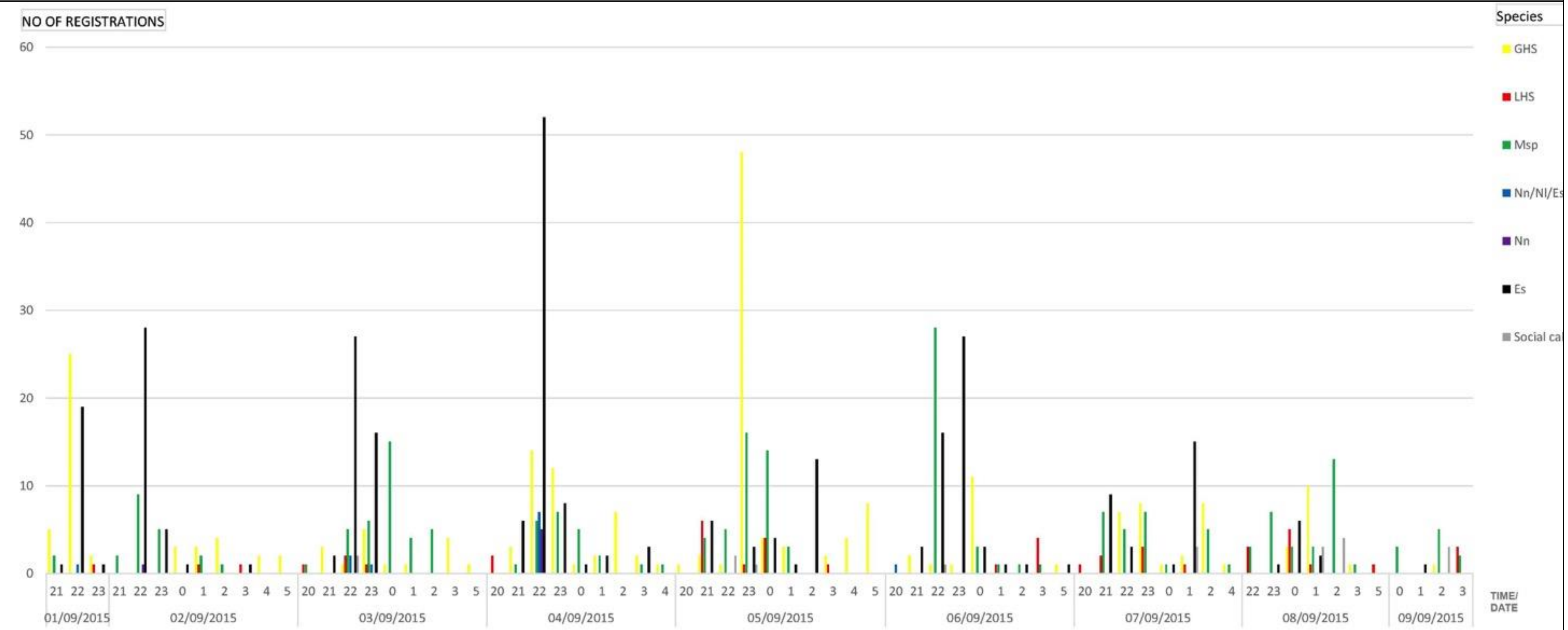
South Portal: 19th August, 6 nights monitoring



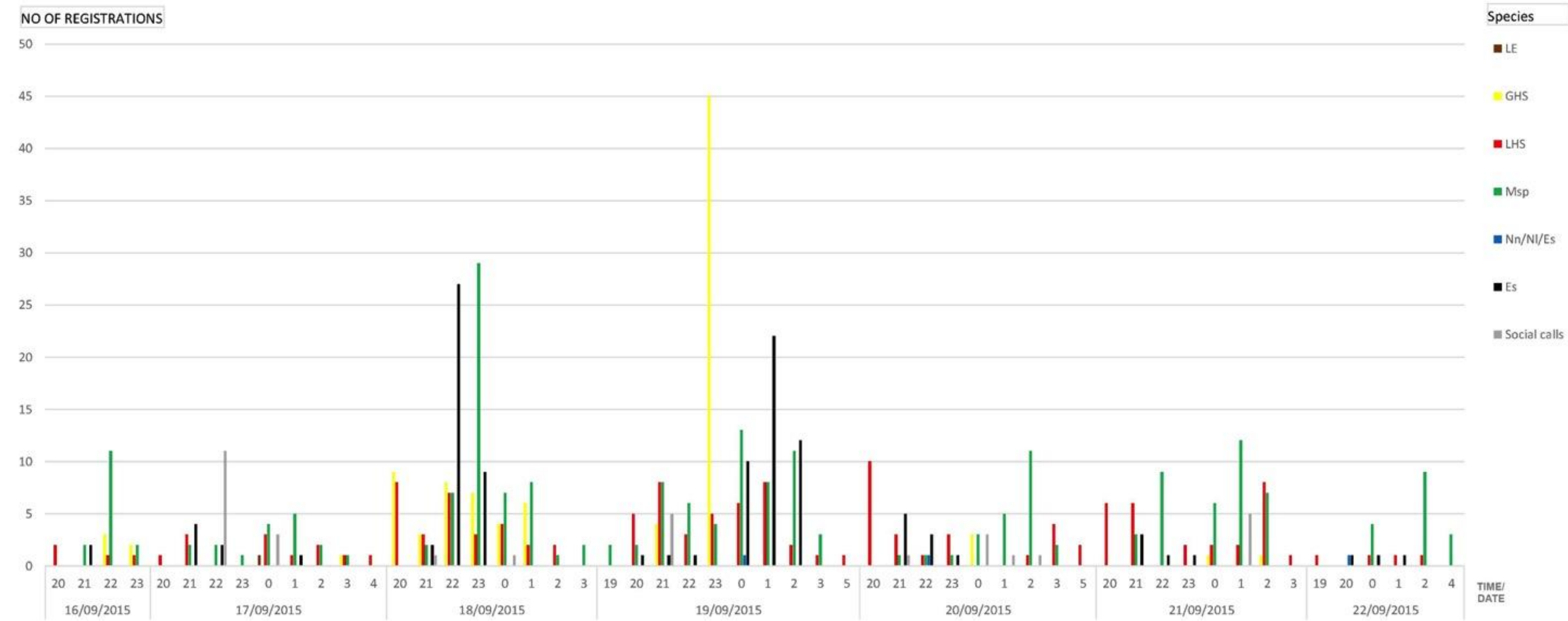
North Portal: 1st September, 8 nights monitoring



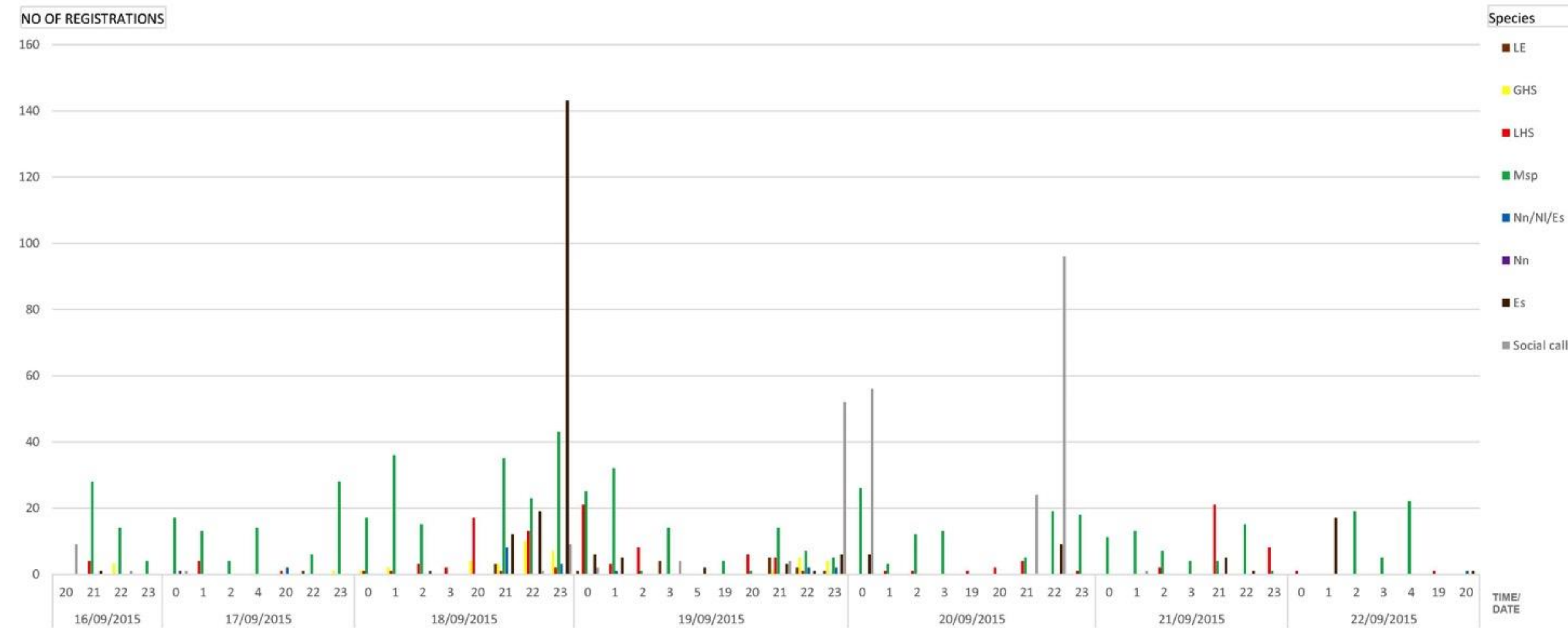
South Portal: 1st September, 8 nights monitoring



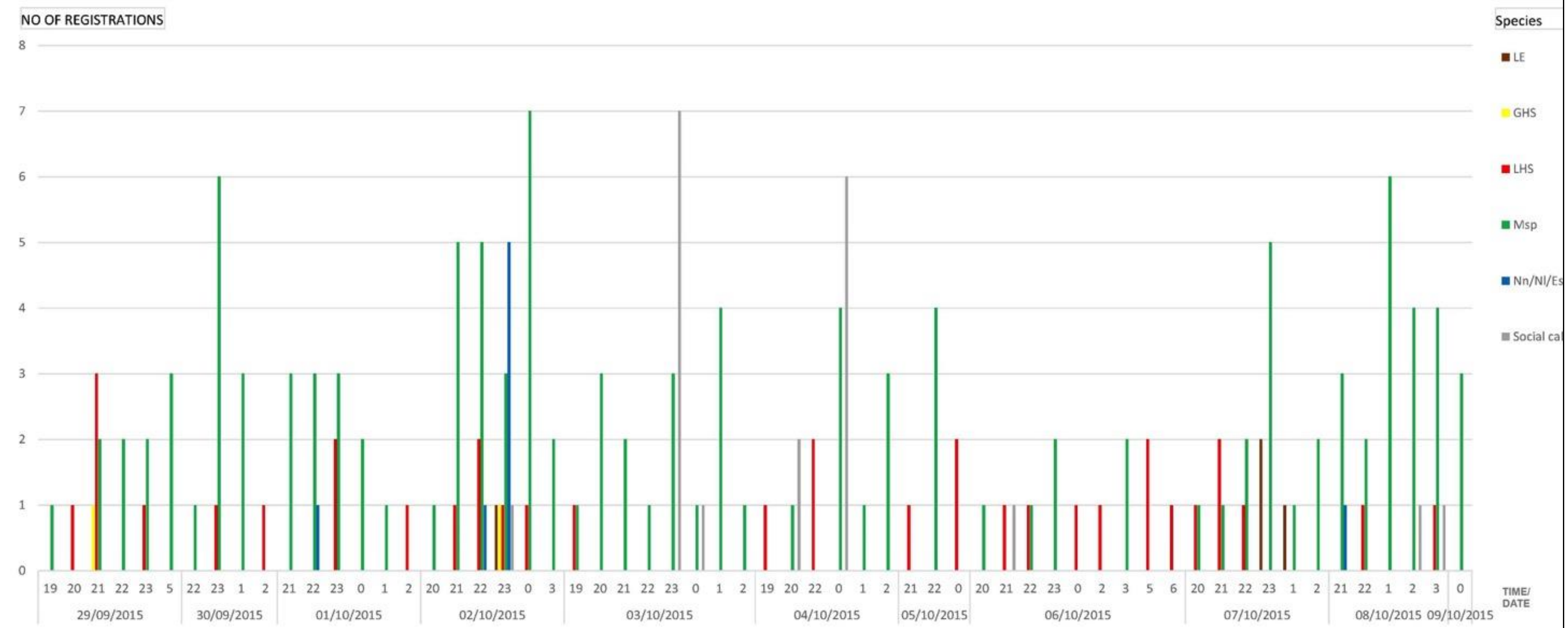
North Portal: 16th September, 7 nights monitoring



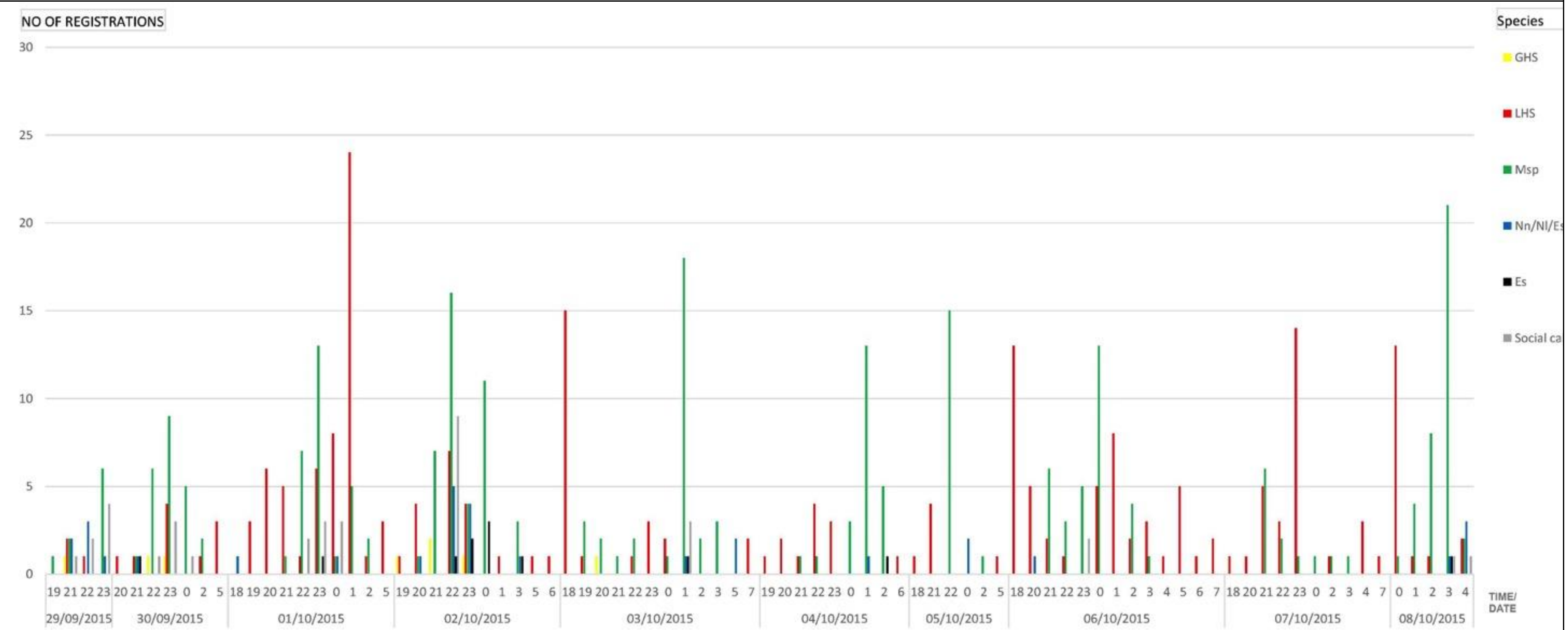
South Portal: 16th September, 6 nights monitoring



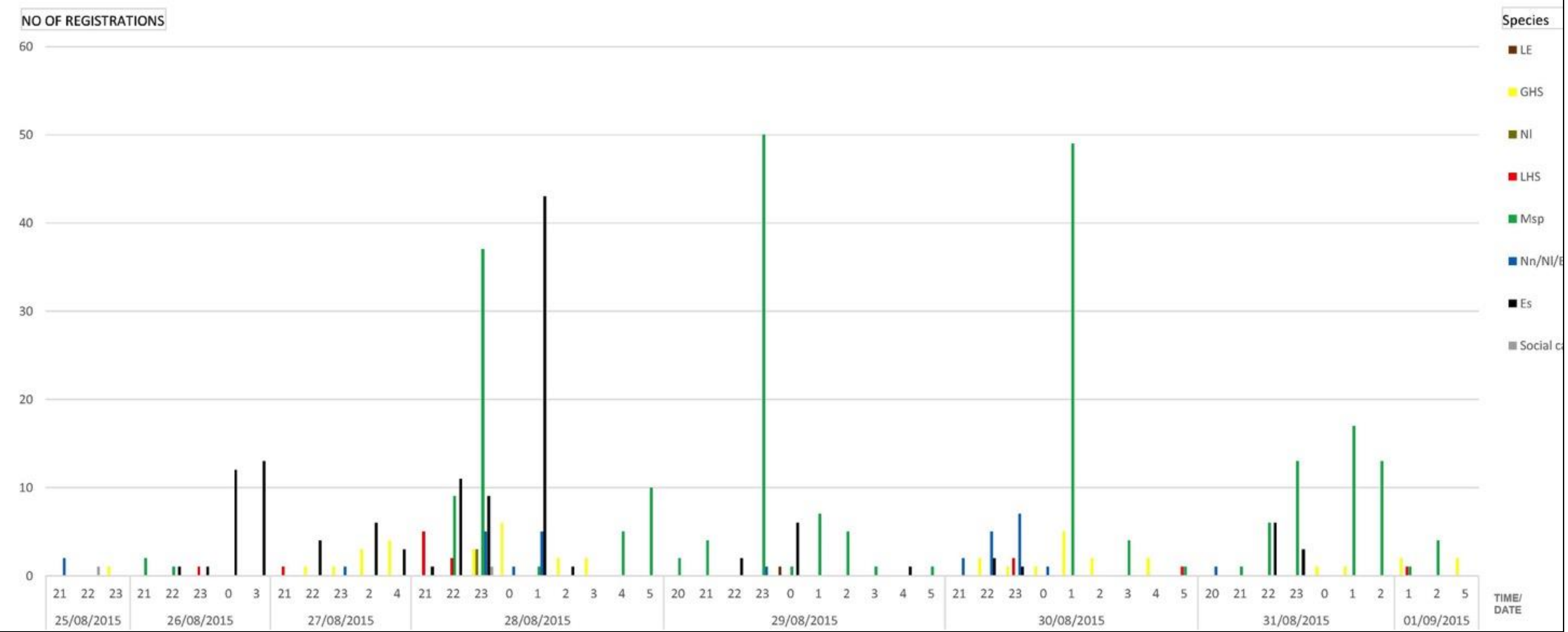
North Portal: 28th September, 10 nights monitoring



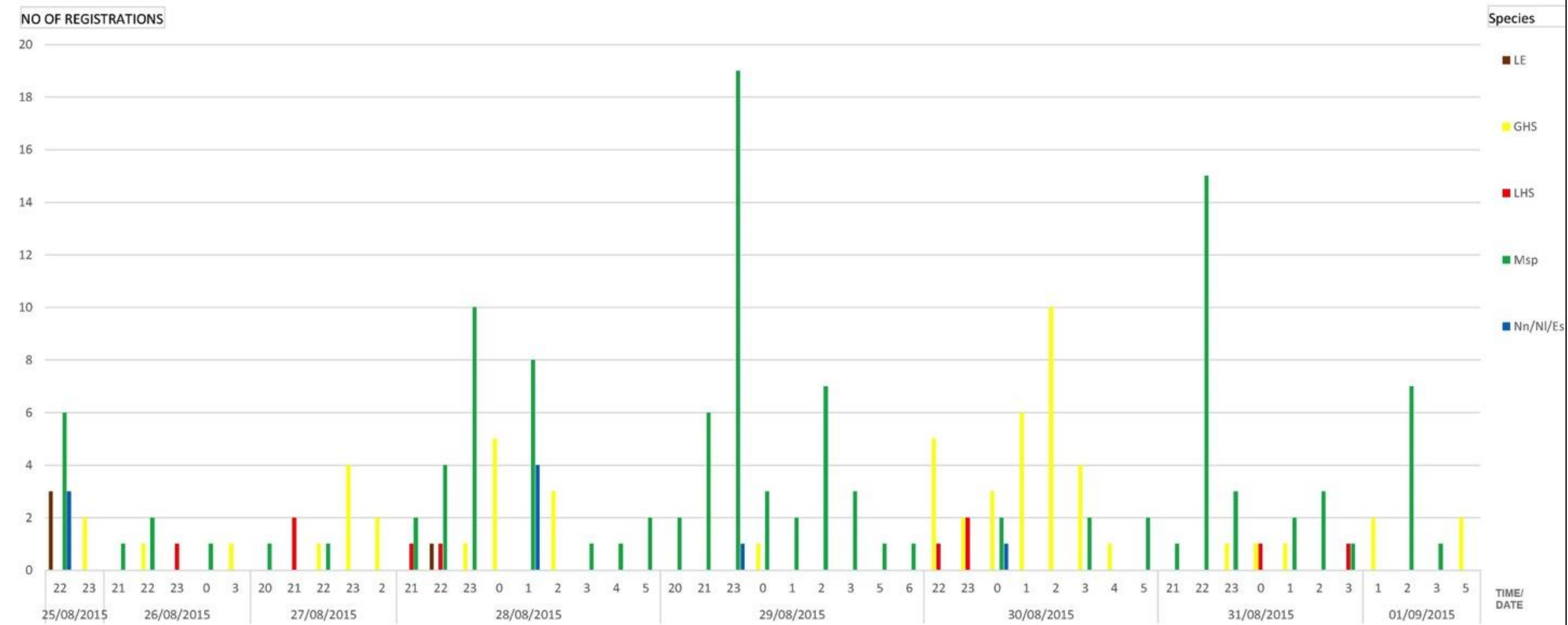
South Portal: 28th September, 9 nights monitoring



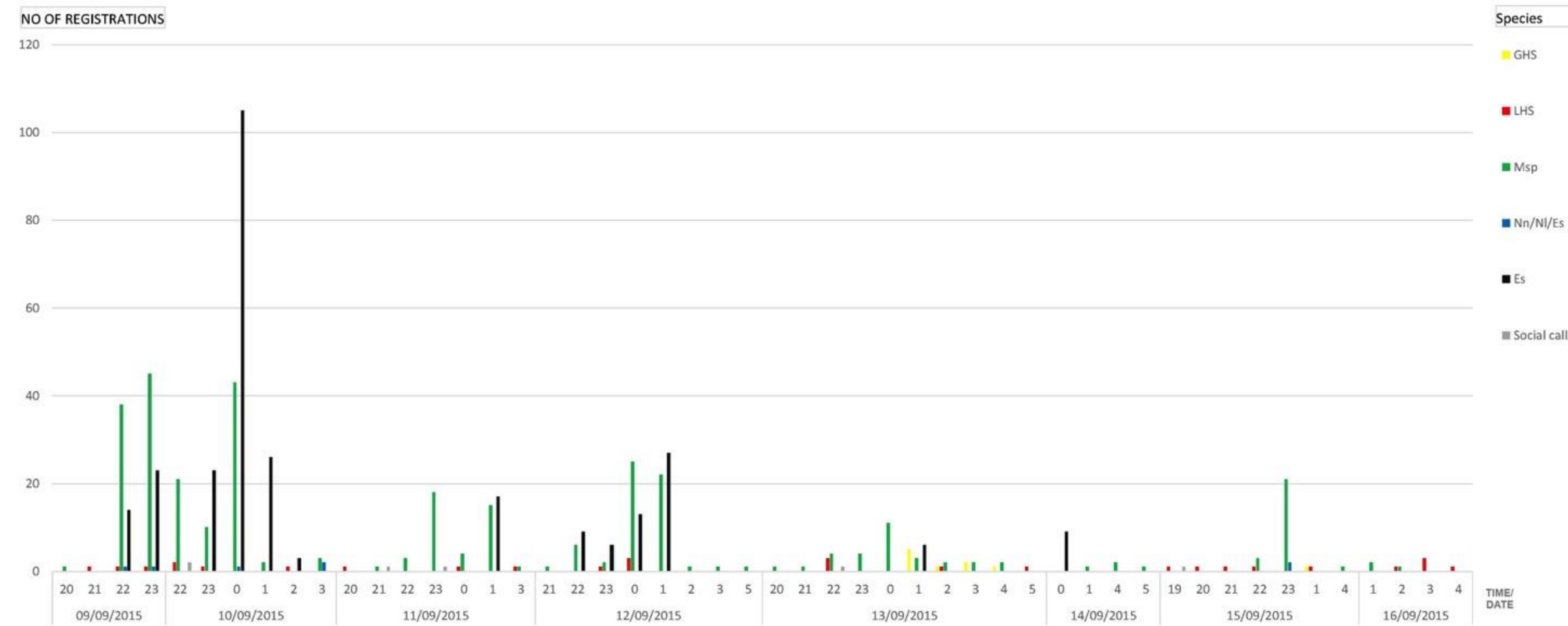
Sandstone
North-West Portal: 25th August, 7 nights monitoring



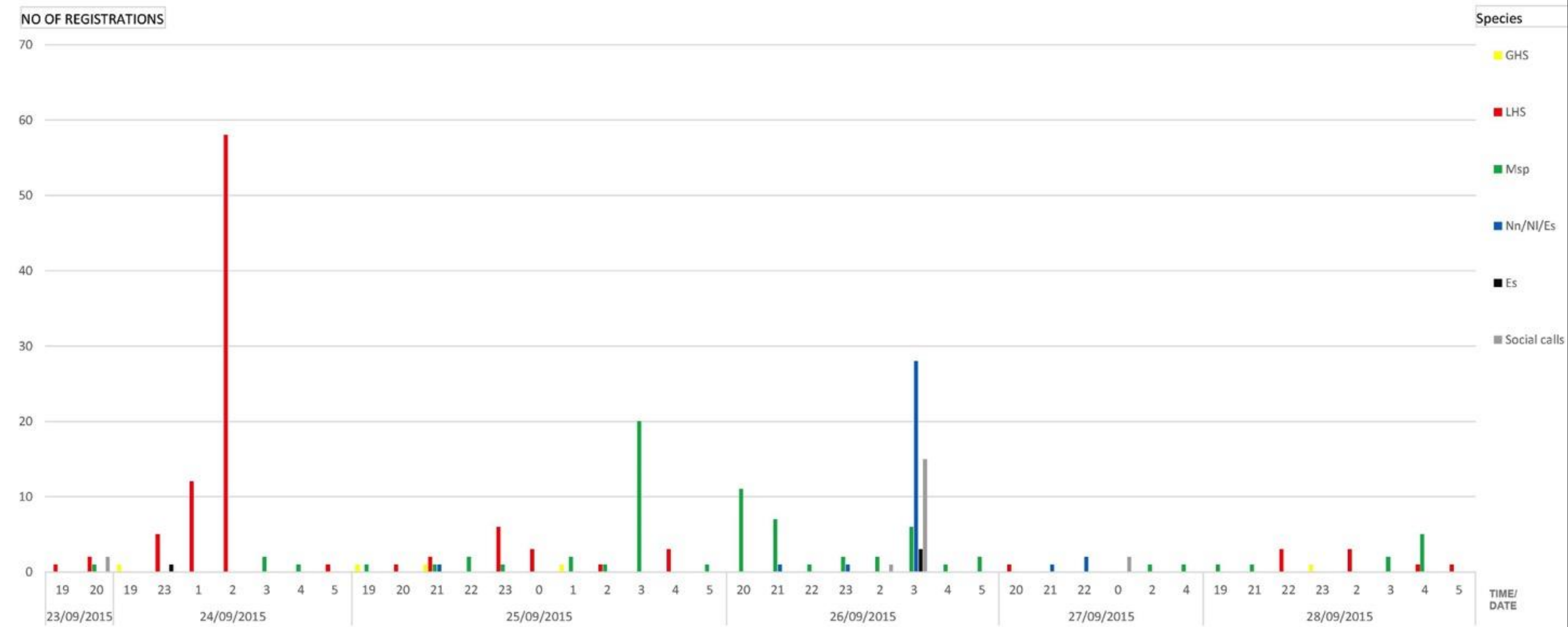
South-East Portal: 25th August, 7 nights monitoring



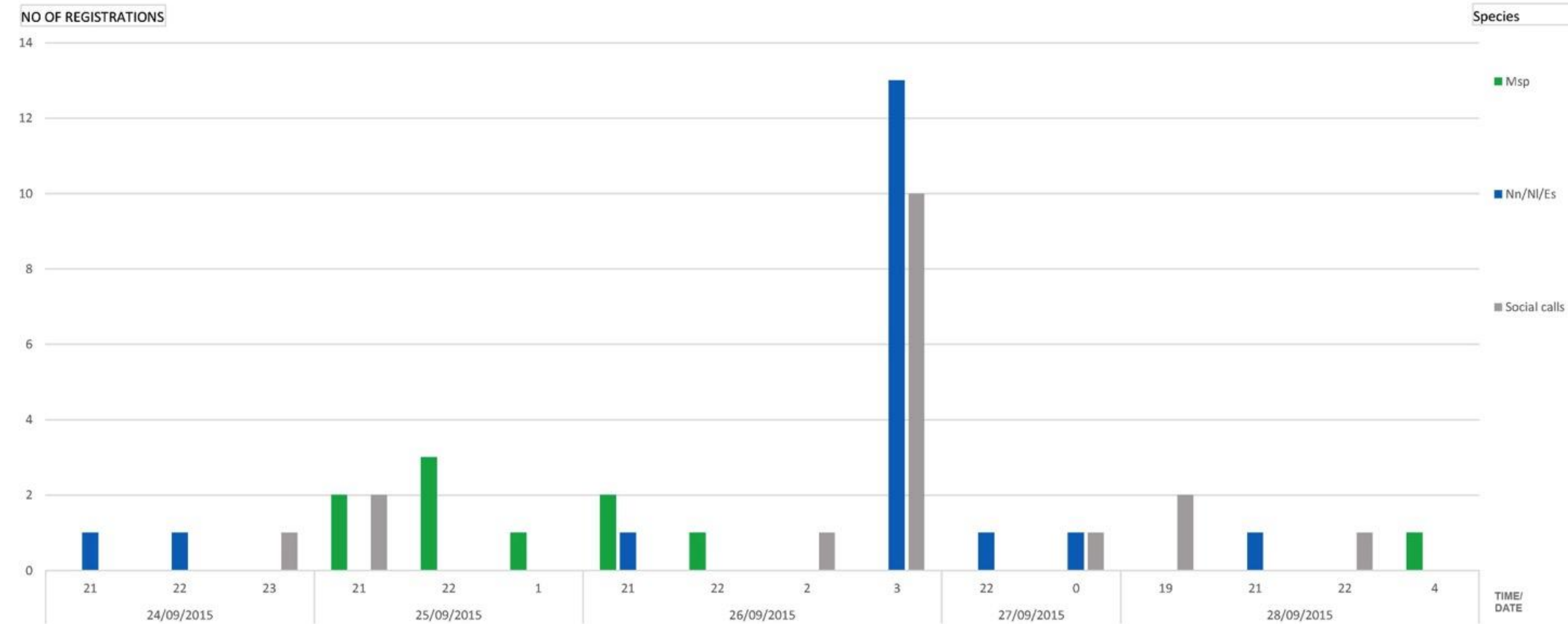
Centre of Tunnel: 9th September, 7 nights monitoring



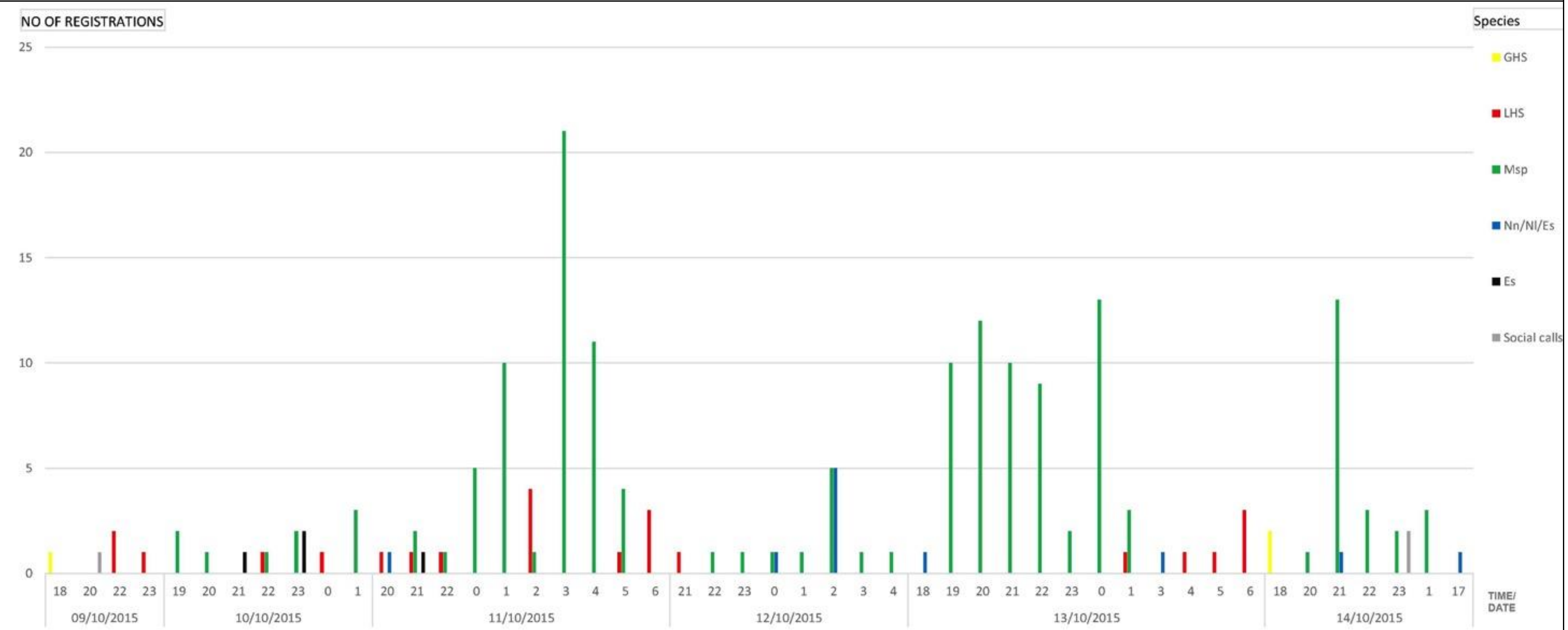
North-West Portal: 22nd September, 6 nights monitoring



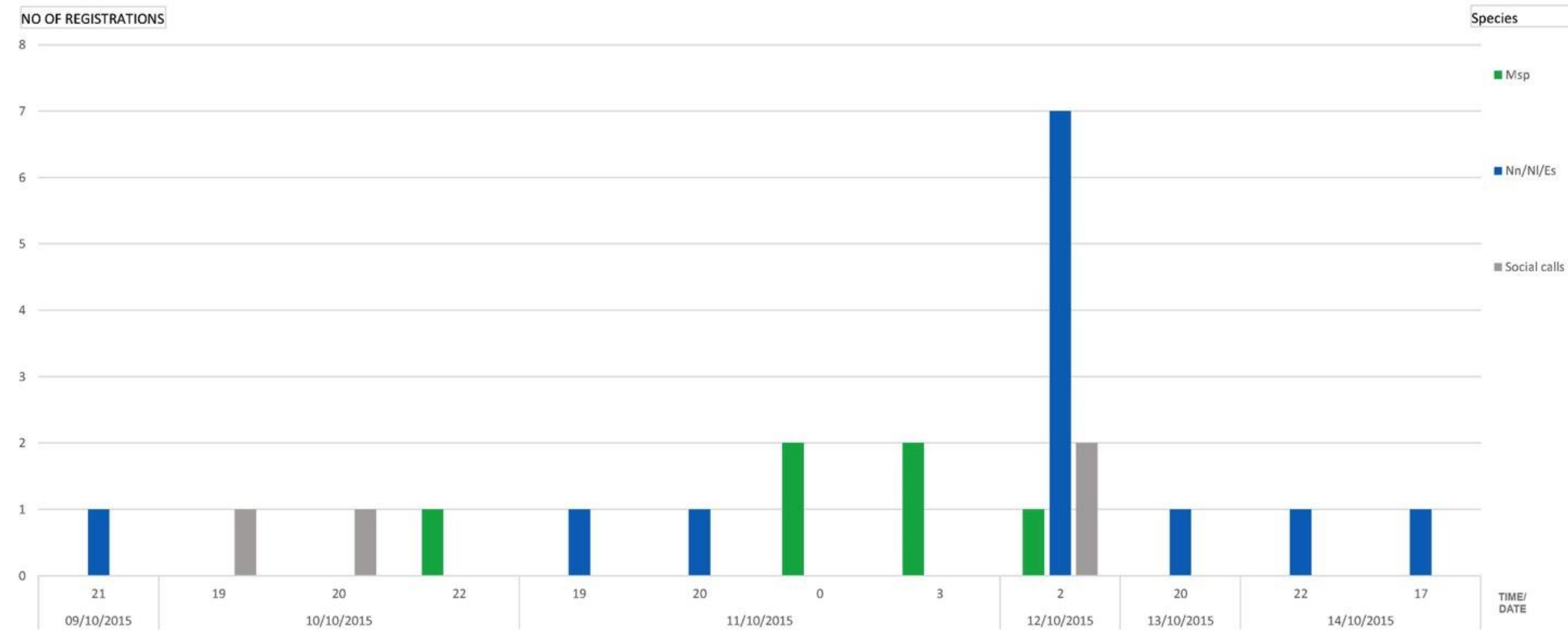
South-East Portal: 22nd September, 7 nights monitoring
(No activity recorded on the 22nd and 23rd September)



North-West Portal: 9th October, 6 nights monitoring

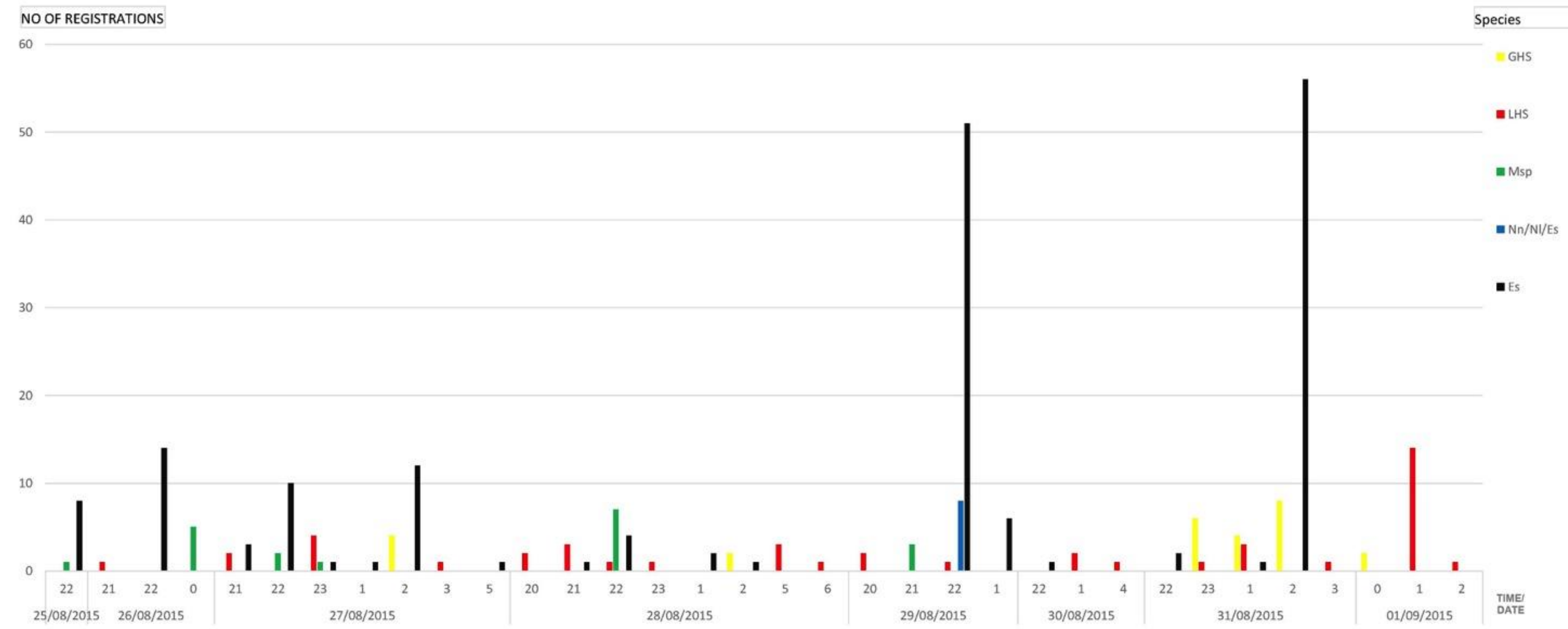


South-East Portal: 9th October, 6 nights monitoring

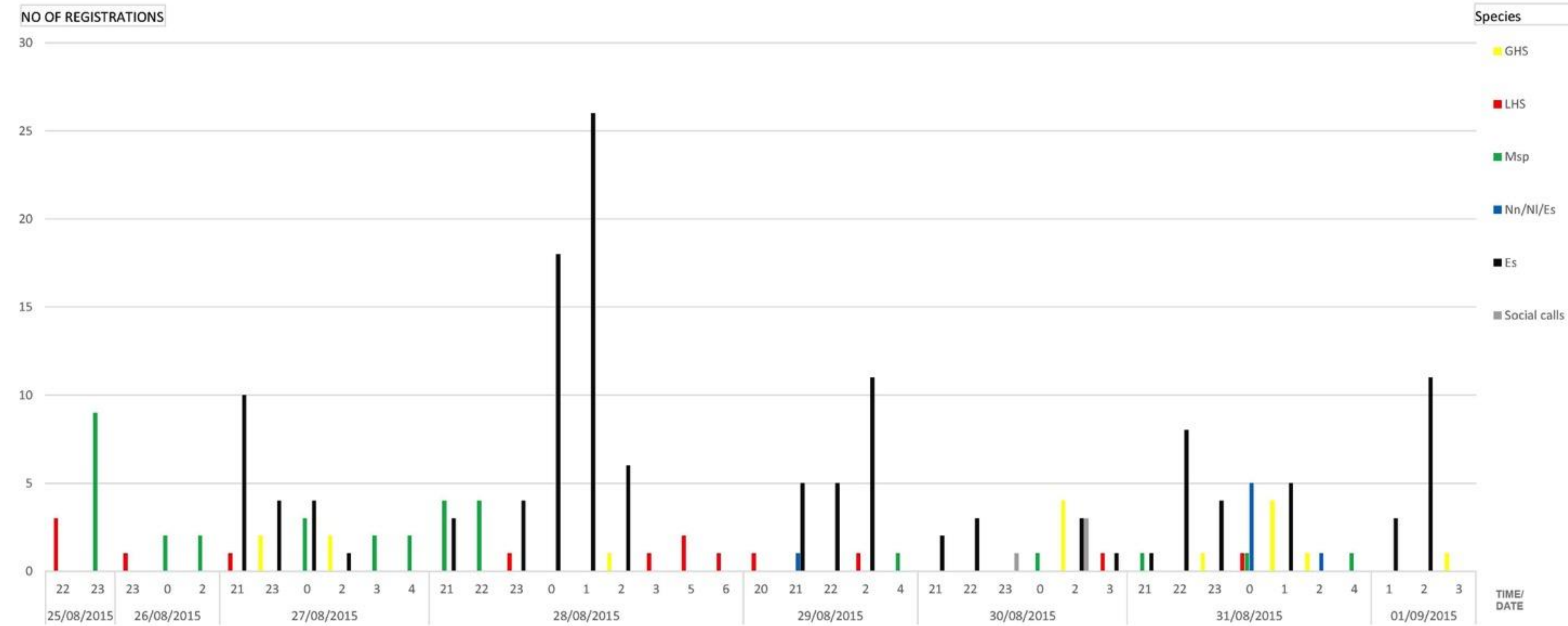


Pill

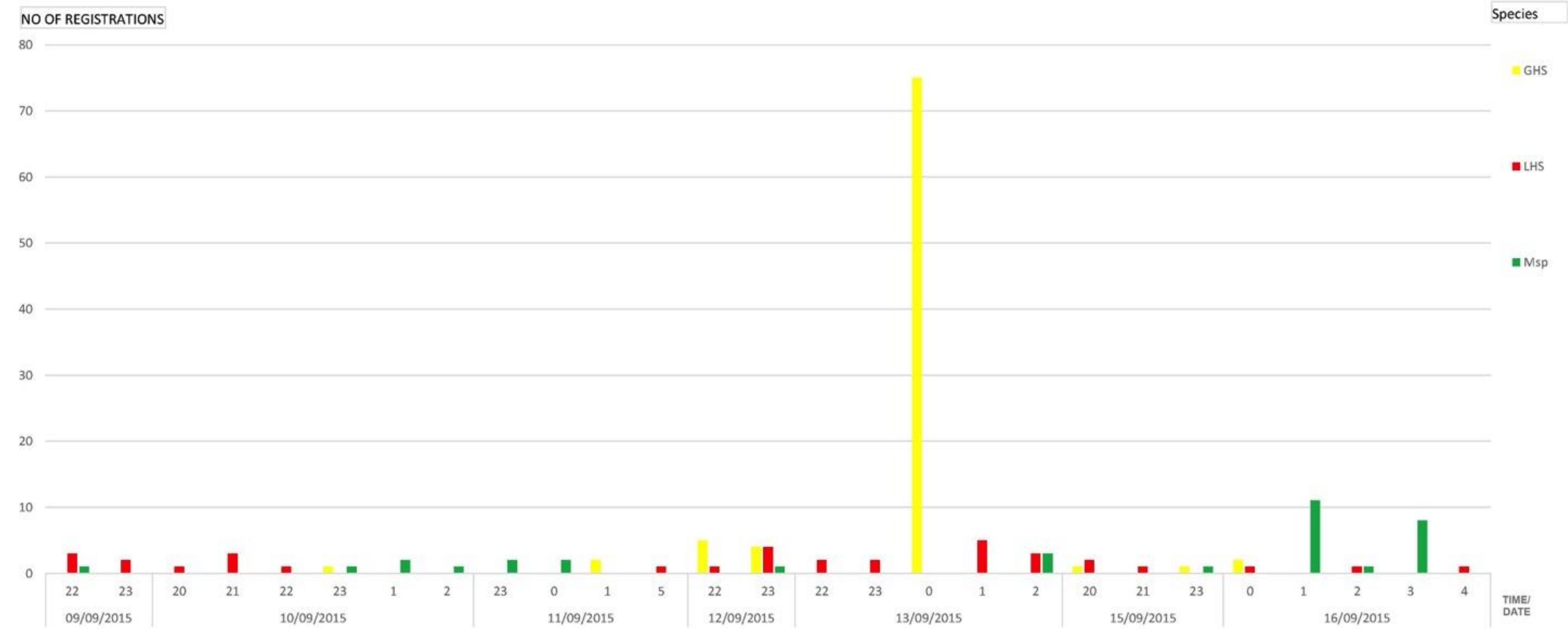
West Portal: 25th August, 7 nights monitoring



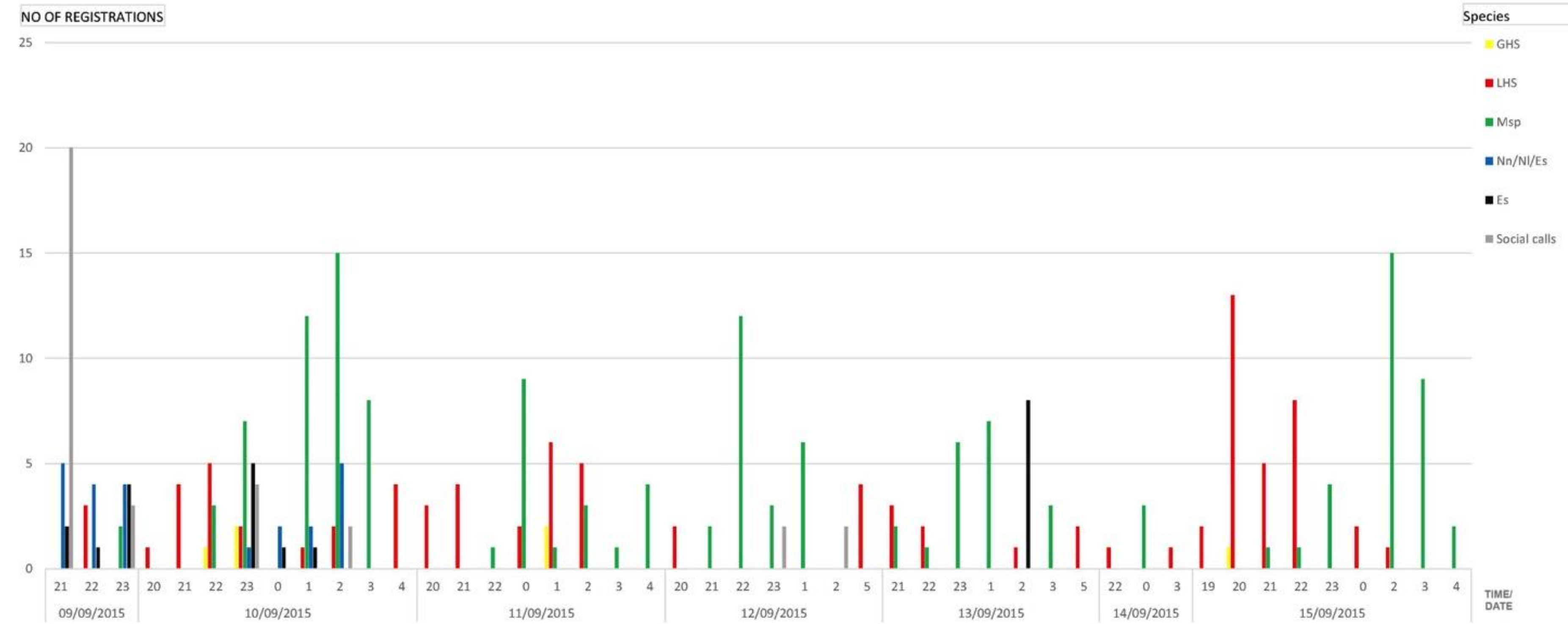
East Portal: 25th August, 7 nights monitoring



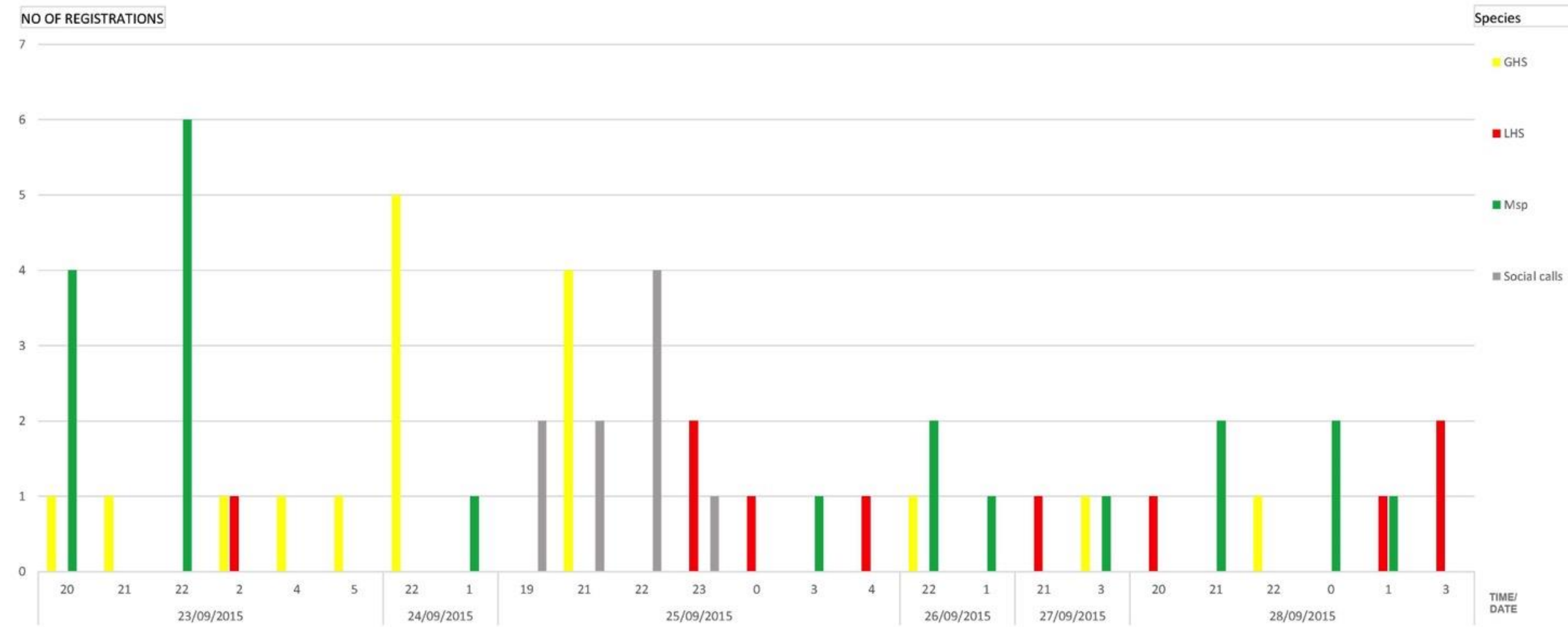
West Portal: 9th September, 6 nights monitoring



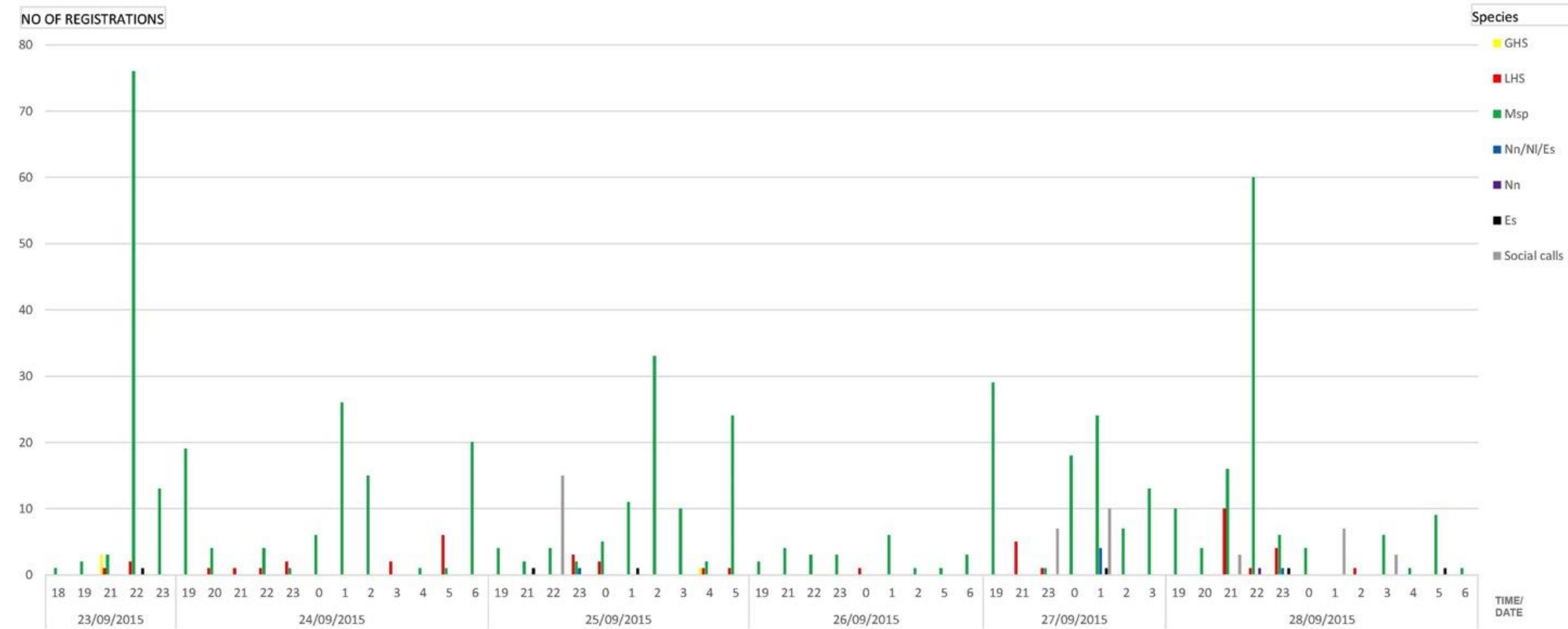
East Portal: 9th September, 7 nights monitoring



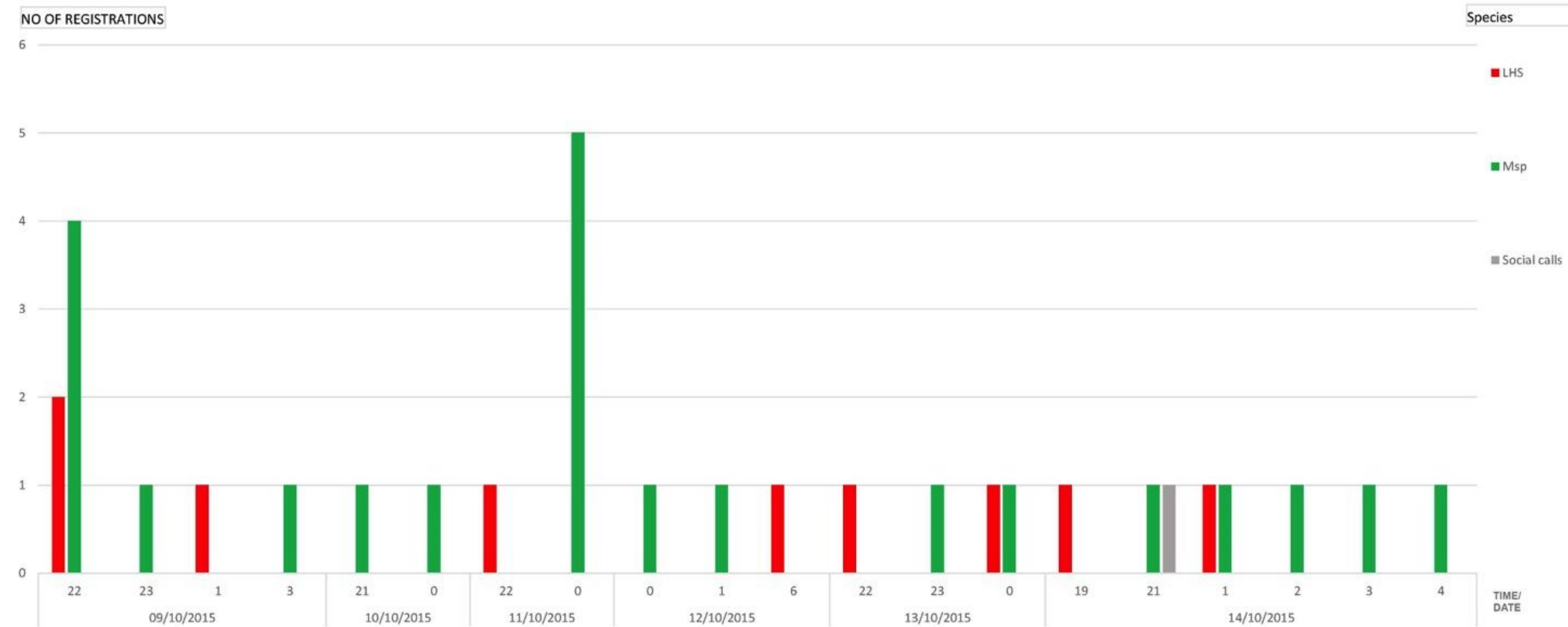
West Portal: 22nd September, 5 nights monitoring



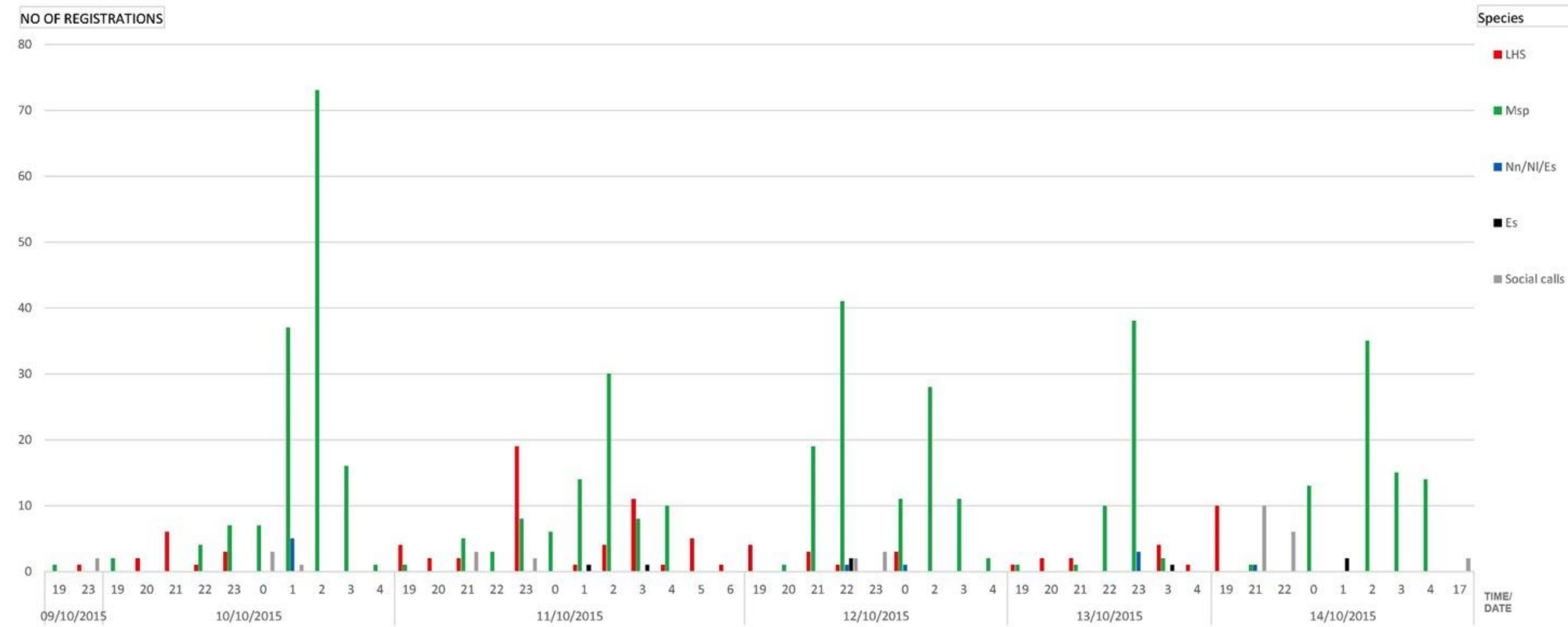
East Portal: 22nd September, 5 nights monitoring
(No activity recorded on the 22 September)



West Portal: 9th October, 6 nights monitoring



East Portal: 9th October, 6 nights monitoring



Appendix 8. Winter Roost Surveys for Portbury Freight Line Tunnels

A. *December 2015 to February 2016 Survey Period*

The static automated bat detectors recorded winter bat activity and confirmed the presence of the following bat species within the tunnels during winter:

Greater horseshoe bats	Recorded in Clifton 1 on one night in January 2016. Recorded in Clifton 2 on one night in December 2015.
Lesser horseshoe bats	Recorded in Clifton 1 and 2 throughout January and February 2016. Recorded in Sandstone in December 2015 and from mid January to mid February 2016.
Myotis sp.	Recorded sporadically throughout the study period in Clifton 1 (January and February 2016) and Clifton 2 and Sandstone (December 2015 to the end of February 2016). Recorded in Pill tunnel only once in December 2015.
Common pipistrelle	Recorded throughout much of the study period at Clifton 1 (January and February 2016) and Clifton 2 and Sandstone (December 2015 to the end of February 2016). Most frequent at Standstone tunnel, and regular activity in mid January at Clifton 2.
Soprano pipistrelle	Recorded throughout the study period in Clifton 1 (January and February 2016) and Clifton 2 and Sandstone (December 2015 to the end of February 2016), but generally short, and relatively infrequent periods of activity.
Serotine	Recorded at Clifton 2 between mid January and mid February 2016. Activity in the tunnels is relatively infrequent. Serotine or a possible Leisler's bats (*Nyctalus leisleri)* were recorded on one day at Sandstone tunnel between mid to late December 2015 and at Pill tunnel between mid to late February 2016.

The dates on which bat species were recorded at each tunnel are shown on the Tables A1 and A2. Daily temperatures and bat activity during the coldest periods of weather over the monitoring period are presented in Table A3.

Notes and Abbreviations

Temperatures
Weather data provides the temperature range **High** (warmest), **Avg** (Average) and **Low** (coldest) daily temperatures

Species key
Pp Common pipistrelle (*P. pipistrellus*); **Ppy** Soprano pipistrelle *(P.pygmaeus);*
Msp (Myotis sp);
Es Serotine (*Eptesicus serotinus);* **Es/Nl** Serotine or possible Leisler's (*Nyctalus leisleri);*
Rh Lesser horseshoe (*Rhinolophus hipposideros*); **Rf** Greater horseshoe (*Rhinolophus ferrumequinum*).

Table A1. Static Automated Bat Detector Results for Clifton 1 and Clifton 2 Tunnels

Date	**Weather Data Temp. (C)**			**Bat Species Recorded in Tunnels Clifton 1**							**Clifton 2**						
Dec-15	**High**	**Avg**	**Low**	Rf	Rh	Msp	Pp	Ppy	Es	ES/Nl	Rf	Rh	Msp	Pp	Ppy	Es	ES/Nl
17	14	12	10										■				
18	13	11	10														■
19	14	13	12														
20	14	10	7								■			■			
21	12	9	6											■			
22	13	11	9														
23	10	8	6														
24	11	7	4														
Jan-16																	
5	8	7	6			■						■					
6	8	6	4		■									■			
7	10	7	3		■												
8	9	6	3		■	■	■					■	■				
9	9	7	5		■												
10	6	4	3														
11	6	4	3			■											
12	5	4	3														
13	6	3	2														
19	3	-1	-4											■			

Date	**Weather Data Temp. (C)**			**Bat Species Recorded in Tunnels Clifton 1**							**Clifton 2**						
Dec-15	**High**	**Avg**	**Low**	Rf	Rh	Msp	Pp	Ppy	Es	ES/Nl	Rf	Rh	Msp	Pp	Ppy	Es	ES/Nl
20	3	-2	-6			■						■		■		■	
21	7	3	0		■	■		■				■	■				
22	11	8	6		■		■	■					■	■		■	
23	11	9	7				■									■	■
24	13	12	11		■	■	■	■				■	■	■	■	■	
25	13	9	6		■		■					■		■			
26	12	8	6	■													
27	12	8	4		■												
28	9	6	2														
29	11	10	9														
Feb-16																	
2	8	6	3														
3	7	4	3			■								■			
4	10	8	5		■		■					■			■		
5	9	8	7		■	■	■					■				■	
6	10	8	5														
7	9	6	3													■	
8	7	6	4			■											
9	5	3	2				■										
10	8	4	1														

Date	**Weather Data Temp. (C)**			**Bat Species Recorded in Tunnels Clifton 1**							**Clifton 2**						
Dec-15	**High**	**Avg**	**Low**	Rf	Rh	Msp	Pp	Ppy	Es	ES/Nl	Rf	Rh	Msp	Pp	Ppy	Es	ES/Nl
11	7	4	2			■											
12	7	3	1		■	■											
16	6	2	-2		■	■											
17	6	4	3		■												
18	6	3	0		■							■	■				
19	8	4	1		■	■	■	■				■	■				
20	10	8	7		■			■				■					
21	12	10	9														
22	9	6	2		■	■	■					■		■			
23	8	4	1											■		■	
24	6	2	-1														
25	5	2	0														
26	6	3	0														

Table A2. Static Automated Bat Detector Results for Standstone and Pill Tunnels

Date	**Weather Data Temp. (C)**			**Sandstone**							**Pill**						
Dec-15	**High**	**Avg**	**Low**	Rf	Rh	Msp	Pp	Ppy	Es	ES/Nl	Rf	Rh	Msp	Pp	Ppy	Es	ES/Nl
17	14	12	10			■	■										
18	13	11	10		■	■	■										
19	14	13	12			■	■	■		■							
20	14	10	7			■	■										
21	12	9	6		■	■	■										
22	13	11	9														
23	10	8	6														
24	11	7	4														
Jan-16																	
5	8	7	6			■											
6	8	6	4														
7	10	7	3			■		■									
8	9	6	3				■										
9	9	7	5														
10	6	4	3														
11	6	4	3														
12	5	4	3														
13	6	3	2														
19	3	-1	-4			■											

Date	**Weather Data Temp. (C)**			**Sandstone**							**Pill**						
Dec-15	**High**	**Avg**	**Low**	Rf	Rh	Msp	Pp	Ppy	Es	ES/Nl	Rf	Rh	Msp	Pp	Ppy	Es	ES/Nl
20	3	-2	-6		■	■											
21	7	3	0		■	■							■				
22	11	8	6		■	■	■	■									
23	11	9	7		■		■	■									
24	13	12	11				■	■									
25	13	9	6														
26	12	8	6														
27	12	8	4														
28	9	6	2														
29	11	10	9														
Feb-16																	
2	8	6	3		■	■											
3	7	4	3		■	■	■										
4	10	8	5		■	■	■	■									
5	9	8	7		■	■	■	■									
6	10	8	5				■										
7	9	6	3														
8	7	6	4														
9	5	3	2														
10	8	4	1														

Date	**Weather Data Temp. (C)**			**Sandstone**							**Pill**						
Dec-15	**High**	**Avg**	**Low**	Rf	Rh	Msp	Pp	Ppy	Es	ES/Nl	Rf	Rh	Msp	Pp	Ppy	Es	ES/Nl
11	7	4	2														
12	7	3	1														
16	6	2	-2		■												■
17	6	4	3		■												
18	6	3	0		■												
19	8	4	1			■	■	■									
20	10	8	7		■		■										
21	12	10	9														
22	9	6	2			■	■										
23	8	4	1		■												
24	6	2	-1														
25	5	2	0														
26	6	3	0														

Table A3. Bat Activity within Tunnels during Periods of Cold Weather with Low Temperatures below 5°C
*(**Nb.** See notes at the end of the table for colour coding reference of cells)*

Date	Weather Data			Bat Species Recorded in Tunnels														
	Temp. (°C)			Clifton 1				Clifton 2					Sandstone				Pill	
	High	Avg	Low	Rh	Msp	Pp	Ppy	Rh	Msp	Pp	Ppy	Es	Rh	Msp	Pp	Ppy	Msp	ES/Nl
Dec-15																		
24	11	7	4															
Jan-16																		
6	8	6	4	■						■								
7	10	7	3	■										■		■		
8	9	6	3	■	■	■		■	■						■			
9	9	7	5	■														
10	6	4	3															
11	6	4	3		■													
12	5	4	3															
13	6	3	2															
19	3	-1	-4							■				■				
20	3	-2	-6		■			■		■		■	■	■				
21	7	3	0	■	■		■	■	■				■	■			■	
27	12	8	4	■														
28	9	6	2															
Feb-16																		
2	8	6	3										■	■				

Date	Weather Data Temp. (°C)			Bat Species Recorded in Tunnels														
				Clifton 1				Clifton 2					Sandstone				Pill	
	High	Avg	Low	Rh	Msp	Pp	Ppy	Rh	Msp	Pp	Ppy	Es	Rh	Msp	Pp	Ppy	Msp	ES/Nl
3	7	4	3		■					■			■	■	■			
4	10	8	5	■		■		■			■		■	■	■	■		
6	10	8	5												■			
7	9	6	3									■						
8	7	6	4		■													
9	5	3	2			■												
10	8	4	1															
11	7	4	2		■													
12	7	3	1	■	■													
16	6	2	-2	■	■								■					■
17	6	4	3	■									■					
18	6	3	0	■				■	■				■					
19	8	4	1	■	■	■	■	■	■					■	■	■		
22	9	6	2	■	■	■		■		■				■	■			
23	8	4	1							■		■	■					
24	6	2	-1															
25	5	2	0															
26	6	3	0															

Notes
Weather data source www.metoffice.com.
Weather data provides the temperature range **High** (warmest), **Avg** (Average) and **Low** (coldest) daily temperatures**;**

Date	Weather Data Temp. (°C)			Bat Species Recorded in Tunnels														
				Clifton 1				Clifton 2					Sandstone				Pill	
	High	Avg	Low	Rh	Msp	Pp	Ppy	Rh	Msp	Pp	Ppy	Es	Rh	Msp	Pp	Ppy	Msp	ES/Nl

	Low temperatures in the range 0-5°C
	Low temperature range below 0°C

Species key –Pp Common pipistrelle (*P. pipistrellus*); Ppy Soprano pipistrelle *(P.pygmaeus);* Msp (Myotis sp); Es Serotine (*Eptesicus serotinus);* Es/Nl Serotine or possible Leisler's (*Nyctalus leisleri);* Rh Lesser horseshoe (*Rhinolophus hipposideros*).

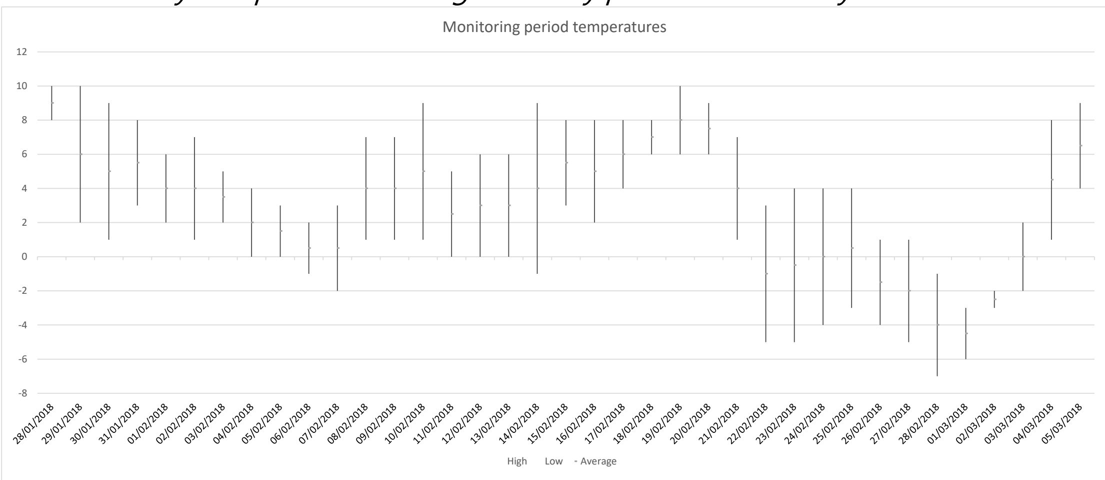
B. January to March 2018 Survey Period

The static automated bat detectors recorded winter bat activity and confirmed the presence of the following bat species within the tunnels during winter:

Barbastelle bat	Recorded in Clifton 2 on one night in 17th February 2018. Recorded in Sandstone for 10 nights from beginning of February to the 20th February and one record in the beginning of March.
Lesser horseshoe bats	Recorded in all the tunnels from January throughout the study period. The Clifton 1 and Sandstone tunnels had the highest number of nights where the bat was recorded with 10 nights in Sandstone tunnel from the beginning of February with no records in Pill west Portal at the start of the monitoring period.
Myotis sp.	Recorded in all the tunnels throughout the study period. Clifton 1, Clifton 2 and Sandstone had the most frequent activity and in Pill tunnel recorded sporadically. At the beginning of the monitoring period (end January beginning of February) none of the bats were recorded in Clifton 2 and Pill West Portal tunnel.
Common pipistrelle	Recorded less than 50% of the time in Clifton 1, Clifton 2 and Sandstone. Very low or no records in Pill (only two nights in February in Pill East Portal and 3 nights in West Portal during the same period).
Soprano pipistrelle	Recorded infrequently in Clifton 1, Clifton 2 and Sandstone and not recorded in the Pill tunnel. The Clifton 2 tunnel had the highest number of nights recorded at the end of January with the lower records throughout February and March. The Clifton 1 and Sandstone had the low activity mainly in mid-February but generally short, and relatively infrequent periods of activity.
Long-eared bat	Recorded in Pill East Portal on one night in 18th February 2018 and in Clifton 1 for one night on the 18th February.

Serotine *Eptesicus serotinus*	Recorded in Clifton 2 on one occasion on the 19th February. Serotine or a possible Leisler's bats (*Nyctalus leisleri)* were recorded on one night at Clifton 1 tunnel and at Clifton 2 on two occasions in mid to end of February.

Chart B1. Daily Temperatures during the study period 29th January to 6th March 2018



Source: www.timeanddate.com/weather/uk

Appendix 9. Tree Roost Resource on Portbury Freight Line

The table below summarises the potential roost resource of individual trees or areas of woodland surveyed and provides recommendations for further work required to further establish their potential value for bats and to find evidence of the presence of bats. Where trees do not require further assessment before arboriculture works this has been clearly stated. The tree locations are shown on the plans in Appendix 1.

Assessment of the Potential Bat Roost Resource in Trees Identified for Possible Arboricultural Work

Ref*	Description	Assessment	PRF	Survey Recommendations Before Felling
A1	Ash/ Sycamore woodland. Semi-mature trees in good condition.	Low	Ivy cover	No further survey required
T801	Ash with sparse thick stem ivy	Negligible to low	Ivy cover	No further survey required
A2	Birch, ash and alder woodland	Negligible	None	No further survey required
RST830	Willow next to track with crack in main stem at 4m, crack may open up in to a cavity	Low	Cracked stem	One tree climbing survey to further assess features
RST831	Norway maple 3m back from track, ivy on main stem and broken limbs	Low	Ivy cover and broken limbs	One tree climbing survey to further assess features
RSG27	Cluster of sycamores next to bridge with ivy cover that may be obscuring features	Low	Ivy cover	One tree climbing survey to further assess features
RST832	Sycamore with thick ivy cover next to bridge. Ivy could be obscuring features	Low	Ivy cover	One tree climbing survey to further assess features
B1	Large multi-stem ash and sycamore coppice	Negligible	None	No further survey required
B2	Birch, sycamore and ash trees	Negligible	None	No further survey required
B3	Large ash and sycamore with thin ivy cover	Negligible	None	No further survey required
NT1	Large ash tree in woodland context. Tree in good condition, but restricted visibility of tree	Negligible	No obvious features	Repeat ground survey in winter
T802	Large ash tree in woodland at base of rock face ID00	Low	Ivy cover	No further survey required
B4	Large mature ash trees on rockface ID00	Moderate	Damaged and fallen trees	Two tree climbing surveys of trees with PRF

Ref*	Description	Assessment	PRF	Survey Recommendations Before Felling
B5	Sycamore and ash trees in secondary woodland	Low to Moderate	Ivy cover over dead wood	One tree climbing inspection of trees with PRF
B6	Ash, sycamore, cherry and elm trees in secondary woodland	Low	Ivy cover	No further survey required
G1	Scrub – no large trees	None	None	No further survey required
G2	Scrub with a low number of mature trees	Negligible	None	No further survey required
NT2	Ash tree	None	None	No further survey required
B7	Mature ash and lime trees with hazel understorey	Moderate	Fallen deadwood with decay	Two tree climbing surveys/ inspections of deadwood habitats
G3	Mature trees at the top of rockface ID04. No obvious PRF but close inspection not possible	Unconfirmed	Unknown	Specialist access equipment needed for preliminary survey
T803	Tree with twisted limbs and therefore possible shelter for summer roosting.	Moderate	Twisted limbs with summer roost potential	Two tree climbing surveys
NT3	Ash with broken limb	Moderate to High	Cavity in broken limb	Two tree climbing surveys
B8	Woodland is mostly small trees of scrub height (with occasional mature trees identified separately on this schedule)	None	None	No further survey
G4	Rockface ID05 with whitebeam and holm oak	Unconfirmed	Unknown	Specialist access equipment needed for preliminary survey.

Ref*	Description	Assessment	PRF	Survey Recommendations Before Felling
B9	Ancient lime and hazel coppice	Low	Small/ shallow decay in trunks	Repeat ground survey in winter
NT4	Whitebeam tree	None	None	No further survey
G5	Lime tree canopy and yew understorey on rockface ID08	Negligible	None	No further survey
B10	Large ash trees in old quarry with several tree failures	Moderate	Fallen trees and branches	Two tree climbing surveys/ inspections of deadwood habitats
G6	Rockface with whitebeam and holm oak	Unconfirmed	Unknown	Specialist access equipment needed for preliminary survey.
NT5	Large beech tree at top of rockface. No obvious decay, but closer inspection needed	Unconfirmed	Unknown	Specialist access equipment needed for preliminary survey.
G7	Small trees	None	None	No further survey
G8	Mature trees at top of rockface	Unconfirmed	Unknown	Specialist access equipment needed for preliminary survey.
G9	Small and semi-mature trees at the top of the rock face	Negligible to low	Ivy	No further survey
G16	Old coppice lime, young sycamore and hazel. No decay in trees	None	None	No further survey
B11	Large coppice ash trees	Low to moderate	Thick stem ivy possibly covering deadwood features	Two tree climbing surveys

Ref*	Description	Assessment	PRF	Survey Recommendations Before Felling
B12	Mature woodland with large trees	Moderate to high	Thick stem ivy and deadwood features	Three tree climbing inspections if large trees removed
G10	Semi-mature lime trees on rockface	Low	Ivy cover on young trees	No further survey required
A3	Secondary woodland of sycamore and ash. Trees have tall, straight growth with few branches below canopy.	Low	Thick stem ivy	No further survey required
A4	Young secondary woodland of sycamore and ash on a narrow verge. Taller trees have straight growth with few branches below canopy. Some areas the vegetation is scrub height	Negligible to low	Ivy cover	No further survey required
A5	Young secondary woodland of sycamore and ash. Ivy is young and therefore growth is tight against the tree	Negligible	None	No further survey required
T804	Sycamore tree with decay	Low to Moderate	Decay on trunk and branches	One tree climbing survey to further assess features
A6	Young secondary woodland of sycamore and ash. Ivy is young and therefore growth is tight against the tree	Negligible	None	No further survey required
T805	Very sparse thick stem ivy on mature tree to be removed	Negligible	None	No further survey required
G11	Rock outcrop with sycamore, ash, birch and rare whitebeam	Negligible	None	No further survey required
A7	Ash and sycamore woodland with conaopy dominated by mature ash trees.	Low	Ivy cover and shallow	No further survey required

Ref*	Description	Assessment	PRF	Survey Recommendations Before Felling
			deadwood features	
T806	Dead tree with sparse thick stem ivy	Low	Thick stem ivy over dead trunk	One tree climbing survey to further assess features
G12	Mature lime trees and whitebeam on rockface	Low to moderate	Rot holes at the base of lime trees	One –two inspections with specialist access equipment
B8a	Mature woodland with lime trees on steep bank	Unconfirmed	Unknown	Large area of high quality woodland, likely to be retained but further preliminary survey would be needed if removed.
G13	Whitebeam and holm oak on rockface ID07	Negligible	No obvious features	Specialist access equipment needed for preliminary survey.
B8b	Strip of tall, narrow semi-mature trees	Negligible	None	No further survey
G14	Rockface with whitebeam and invasive species including holm oak and cotoneaster	None	None	No further survey
A8	Mainly scrub and small trees	None	None	No further survey
T807	Mature common whitebeam	None	None	No further survey
A9	Ash and scycamore woodland with hazel and elm understorey. Narrow strip of woodland	Negligible	None	No further survey
A10	Narrow strip of mixed woodland, with some mature trees. Mature trees are in good condition	Low	Ivy cover	No further survey

Ref*	Description	Assessment	PRF	Survey Recommendations Before Felling
G15	Cluster of whitebeam. Trees scrub size and growth not suitable for bats.	None	None	No further survey
A11	Mature ash and sycamore with some holm oak. Tall straight growth, some trees have thin ivy cover, but not thick enough for bats to shelter.	Negligible	None	No further survey
T808	Dead birch	None	None	No further survey
T809	Dead birch	None	None	No further survey
T810	Oak with irregular growth	Unconfirmed	Split on west side	Tree climbing inspection to assess cavity feature
A12	Mixed woodland with mature trees, but no major decay.	Low	Mature trees have small rot holes and shallow splits, but no large cavities	Further preliminary survey would be needed if high numbers of trees were removed.
A13	Mixed woodland with mature trees. No obvious potential bat roost trees.	Low	Mature trees may have deadwood features	Further preliminary assessment in winter would be required if high numbers of mature trees were removed.
B13	Mature ash and lime woodland with large mature trees on slope.	Moderate	No obvious large cavities, but there is decay in mature trees	Further preliminary assessment in winter would be required if high numbers of mature trees were removed.

Ref*	Description	Assessment	PRF	Survey Recommendations Before Felling
A14	Narrow fenced verge with pine hazel and ash. All small trees	None	None	No further survey required
NT6	Dead elm 3-6 months. Small tree and trunk/branches too small for bat roost features	None	None	No further survey required
G17	White beam sapling in lime woodland. Trees either small or in good condition	Negligible	None	No further survey required
G18	Scrub vegetation	None	None	No further survey required
G19	Scrub bank with whitebeam at woodland edge. There are large veteran trees including sweet chestnut in the woodland.	Trackside – Negligible Woodland interior – High	Veteran trees	Veteran trees would need up to three tree climbing surveys before any work to them
T811	Large oak	Low to Moderate	Cut and fallen branches, but rot holes appear shallow	Tree climbing survey for close inspection of rot hole features from missing branches
B14	Mature woodland on slopes of quarry	Unconfirmed	Unknown	Further preliminary survey needed if mature trees are to be removed
B15	Mature lime trees on steep slope	Unconfirmed	Unknown	Further preliminary survey in winter needed if mature trees are to be removed

Ref*	Description	Assessment	PRF	Survey Recommendations Before Felling
A15	Mature woodland with large trees, which appear to be in good condition	Low	Ivy cover Mature tree with rot holes and shallow splits, but no large cavities	Further preliminary survey in winter needed if mature trees are to be removed
G20	Oak, lime and whitebeam	Negligible to low	No obvious features, but deadwood in canopy of larger trees	Further preliminary survey in winter needed if mature trees are to be removed
G21	Linear woodland strip on rockface	Low	Unknown, but mature trees in woodland	Further preliminary survey in winter needed if woodland removed. Specialist access equipment required for ground based assessment.
T813	Mature ash tree	High	Dead limb on SE elevation and wounds on trunk 12m AGL	Three tree climbing surveys to further assess features
T814	Small-leaved lime coppice	Low	Cormic growth in canopy and wounds on trunk	One tree climbing survey to further assess features

Ref*	**Description**	**Assessment**	**PRF**	**Survey Recommendations Before Felling**
T815	Large ash tree	High	Secondary stem has died and there is thick stem ivy over deadwood features	Three tree climbing surveys to further assess features
T816	Dead elm tree	Low	Broken branches in canopy with shallow splits	Retain as standing dead wood if possible. One dusk emergence watch survey to further assess features if tree is removed
T818	Small leaved lime – tree leaning over track	Low – Moderate	Thick stem ivy and flaking bark	Two tree climbing surveys to further assess features
T817	Dead cherry/ lime but no rot hole features	None	None	No further survey required
T819	Dead field maple coppice	Moderate	Flaking bark and splits in limbs	Two dusk/dawn emergence watch surveys to further assess features
T820	Oak	Moderate	One twisted limb and one dead limb with flaking bark	Two tree climbing surveys to further assess features
T821	Small-leaved lime damaged by fallen tree	Negligible	No obvious features	No further survey required

Ref*	**Description**	**Assessment**	**PRF**	**Survey Recommendations Before Felling**
G22	Sweet chestnut coppices – large trees in good condition	Negligible	No obvious features	No further survey required
T822	Sweet Chestnut – large coppice	Negligible	No obvious features	No further survey required
G23	Linear strip of oak and birch woodland with one large oak tree	Moderate (in one tree)	Large oak with rot hole on SE elevation 3.5m AGL	Two tree climbing surveys to further assess features on the oak tree
G24	Woodland with sweet chestnut, birch and lime trees. Young healthy trees	Negligible	None	No further survey required
G25	Woodland with sweet chestnut, birch and lime trees.	Negligible	None	No further survey required
A16	Small-leaved lime trees. Important area of woodland and qualifying habitat of the SAC/SSSI. Large trees with straight growth and no damage	Negligible	No obvious features	No further survey required
A17	Ash and lime woodland with large small-leaved lime trees at the base of the embankment. Ivy cover on trees and dead wood in trees at track chainage 124mi19.2ch	Low - Moderate	Ivy cover Dead wood features	Two tree climbing surveys of trees at 124mi19.2ch
T823	Dead tree	High	Standing dead wood with ivy cover and splits in truck (at various heights)	Retain as standing dead wood if possible. Three dusk/dawn emergence watch surveys to further assess features if tree is removed

Ref*	Description	Assessment	PRF	Survey Recommendations Before Felling
A18	Tall, narrow ash and oak trees on rock embankment with holm oak scrub	Negligible	No obvious features	No further survey required for vegetation removal on rock embankment, but woodland beyond this has large trees that would need further preliminary assessment if affected by tree works
A19	Hazel, lime and some holm oak. No bat roost trees	None	None	No further survey
T824	Large oak tree	Moderate	Dead branches in canopy	Two tree climbing surveys to further assess features on the oak tree
T825	Ash – three stems	Moderate	Ivy cover over dead wood on trunks	Two tree climbing surveys to further assess features on the tree
A20	Scrub trackside with large ash trees on lower embankment	Negligible	No obvious features	No further survey required
B16	Woodland outside the SAC	Negligible	No obvious features	No further survey required
B17	Ash woodland with sparse understorey. Most trees have no bat roost potential. Two trees identified are listed separately below.	Negiligble	No obvious features	No further survey required

Ref*	Description	Assessment	PRF	Survey Recommendations Before Felling
T826	Ash	Moderate	2 holes from missing limbs 12m AGL	Two tree climbing surveys to further assess features on the tree
T827	Dead elm	Moderate	Vertical split on trunk with extensive decay	Two dusk/dawn emergence watch surveys to further assess features if tree is removed
T828	Dead elm	Negligible	No cavity features	No further survey required
T829	Large turkey oak with large canopy over track. Tree has signs of previous tree works with cut limbs	Unconfirmed	Cut limbs	One tree climbing survey for close inspection of cut limbs
B18	Woodland on rockface with large ash, cherry and lime trees. Tall coppice trees	Moderate to High	Large trees with rot holes from missing limbs	Further preliminary survey in winter needed if woodland removed. Specialist access equipment required for ground based assessment.
B19	Woodland with ash and birch. Trees have tall, straight growth	Low	Ivy cover	No further survey required

*T and NT denotes 'tree', A denotes 'linear area of woodland on Up side of track', B denotes 'linear area of woodland on Down side of track' and G denotes a 'group of trees'. Refs pre-faced with 'RS' indicate trees surveyed in 2020.

Abbreviation

PRF –Potential Roost Feature

N,E,S, W – compass bearings

Ref*	Description	Assessment	PRF	Survey Recommendations Before Felling
AGL – (height) Above Ground Level				

Appendix 10. Photographs

Photo 1. Disused Railway Line (Portbury Wharf)
Date: March 2015

Photo 2. Bridge 4 with bat roost
Date: August 2015

Photo 3. Poplar trees with bat roost potential on Disused Railway Line
Date: June 2015

Photo 4. Data logger on Disused Railway Line
Date: May 2016

	
Photo 5. Night roost in ivy covered shed on Disused Railway Line Date: April 2016	Photo 6. Disused Railway Line (Car impoundment) Date: January 2017

	
Photo 7. Portbury Fright Line Date: December 2015	Photo 8. Portbury Fright Line (Rock Fall Prevention Fence) Date: December 2015

	
Photo 9. Railway tunnel (Clifton 1) Date: August 2015	Photo 10. Bat roost at Clifton 1 (Natterer's bat) Date: January 2016

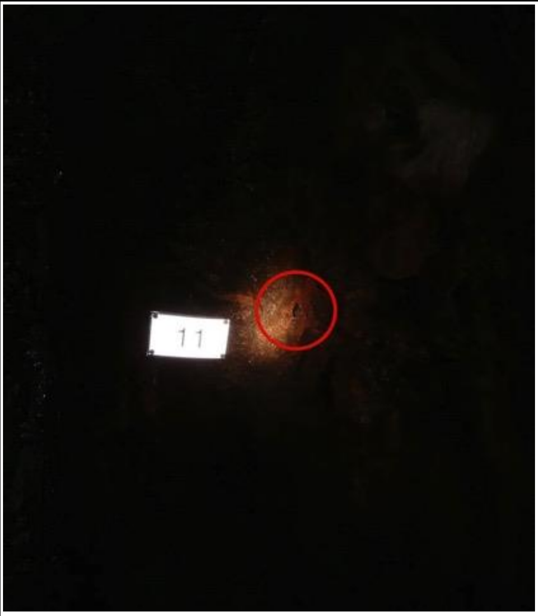
	
Photo 11. Railway tunnel (Clifton 2) Date: December 2015	Photo 12. Bat roost at Clifton 2 (Lesser horseshoe bat) Date: February 2016

	
Photo 13. Railway tunnel (Sandstone) Date: November 2016	Photo 14. Bat roost at Sandstone (Natterer's bat) shown by red arrow Date: January 2018

	
Photo 15. Railway tunnel (Pill) Date: November 2016	Photo 16. Station House Date: March 2018

	
Photo 17. Pill Station arch Date: September 2016	Photo 18. Bat roost at Pill Station Arch (Lesser horseshoe bat) Date: September 2016

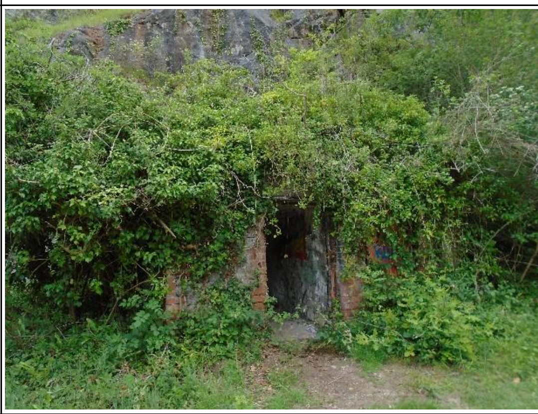
	
Photo 19. The Adit/ Cave Seven on Portbury Freight Line Date: March 2018	Photo 20. Hibernating bats at The Adit/ Cave Seven (Lesser horseshoe bats) Date: March 2018
	

Photo 21. S026 Nightingale Valley underpass is a typical example of the small, relatively well maintained brick arches for access under Portbury Freight Line Date: June 2018	Photo 22. Towpath Store at NGR ST 56219 73588 provides night roost opportunities, but there are no field signs of use by bats. Date: June 2018

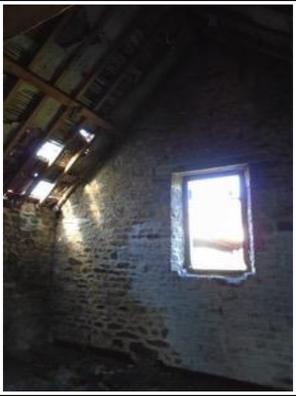
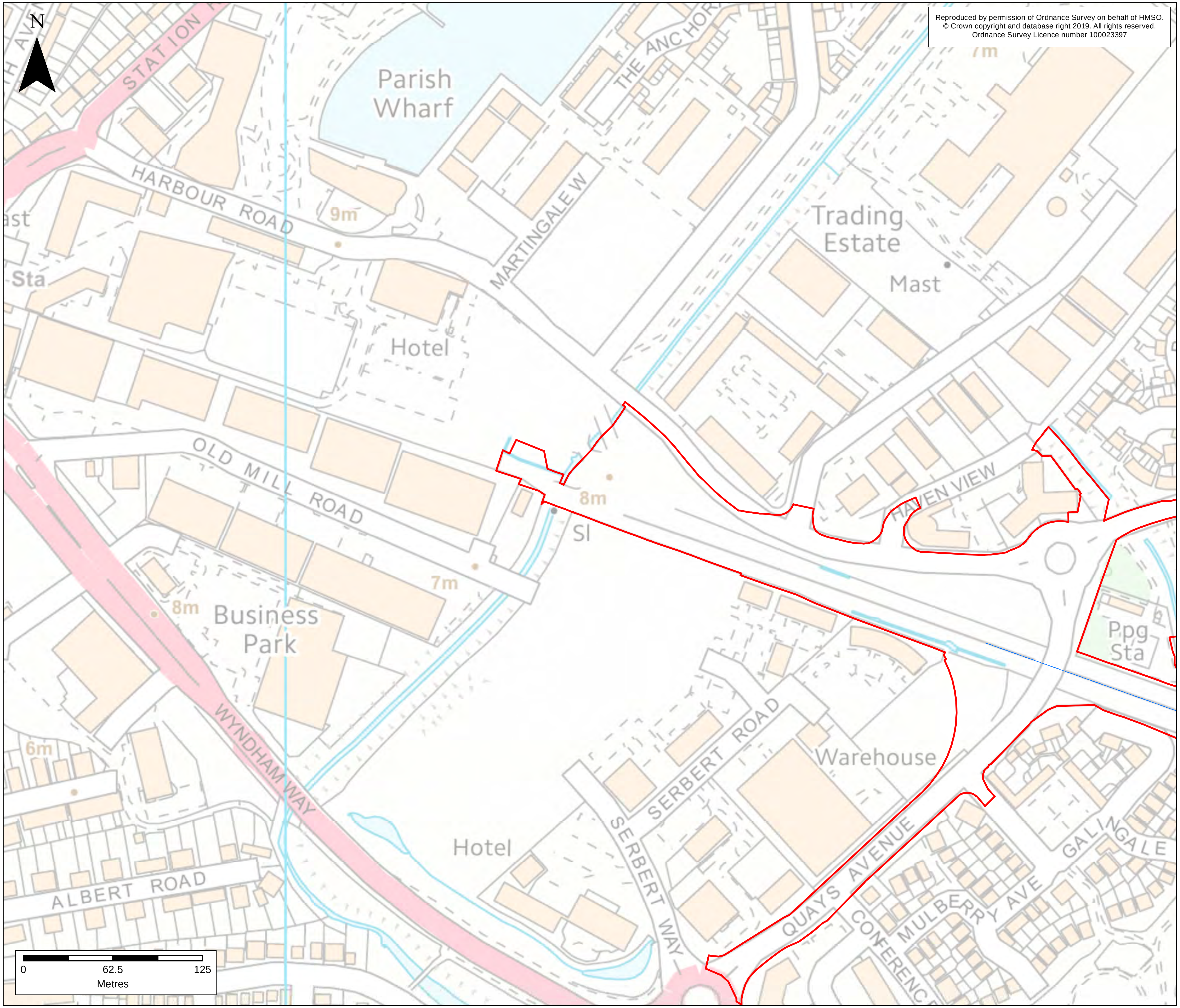
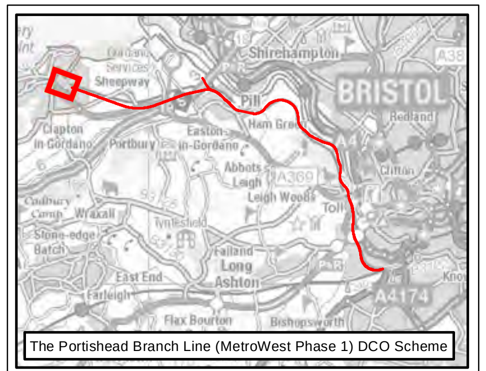
	
Photo 23. Lodway Farm Building LF1 – the exterior walls are solid and without crevices. Date: October 2018	Photo 24. Lodway Farm Building LF1 – the interior is exposed but internal walls are well pointed. Date: October 2018
	
Photo 25. Lodway Farm Building LF2 – the milking parlour has fallen into disrepair. Date: October 2018	Photo 26. Lodway Farm Building LF2 – the interior of the milking parlour is very exposed. Date: October 2018

	
Photo 27. Lodway Farm Building LF4 – derelict animal shelters to the rear of the milking parlour are in ruins and covered by vegetation. Date: October 2018	Photo 28. Lodway Farm Building LF6 – the wood store is a simple structure with no bat roost potential. Date: October 2018
	
Photo 29. Lodway Farm Building LF7 – traditional barn with a new roof. Date: October 2018	Photo 30. Lodway Farm Building LF7 – the interior of the barn shows the new roof structure. Date: October 2018

	
Photo 31. Lodway Farm Building LF8 – open fronted traditional barn with workshop at the gable end. Date: October 2018	Photo 32. Lodway Farm Building LF8 – exposed interior of the main barn area has bat roost potential on the underside of the roof. Date: October 2018





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Order Limits

Portishead Branch Line

The Nationally Significant Infrastructure Project (NSIP) Works

ES-A	MPC	AL	CF	14/11/2019	First draft
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Drawing : Location of Photographs
Bat Technical Appendix
(Sheet 1 of 24)
APFP Regulation 5(2)(a)

Drawn By : Martin Costello Date: 14/11/2019
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Approved By : Carolyn Francis Date: 14/11/2019

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Revision: ES-A

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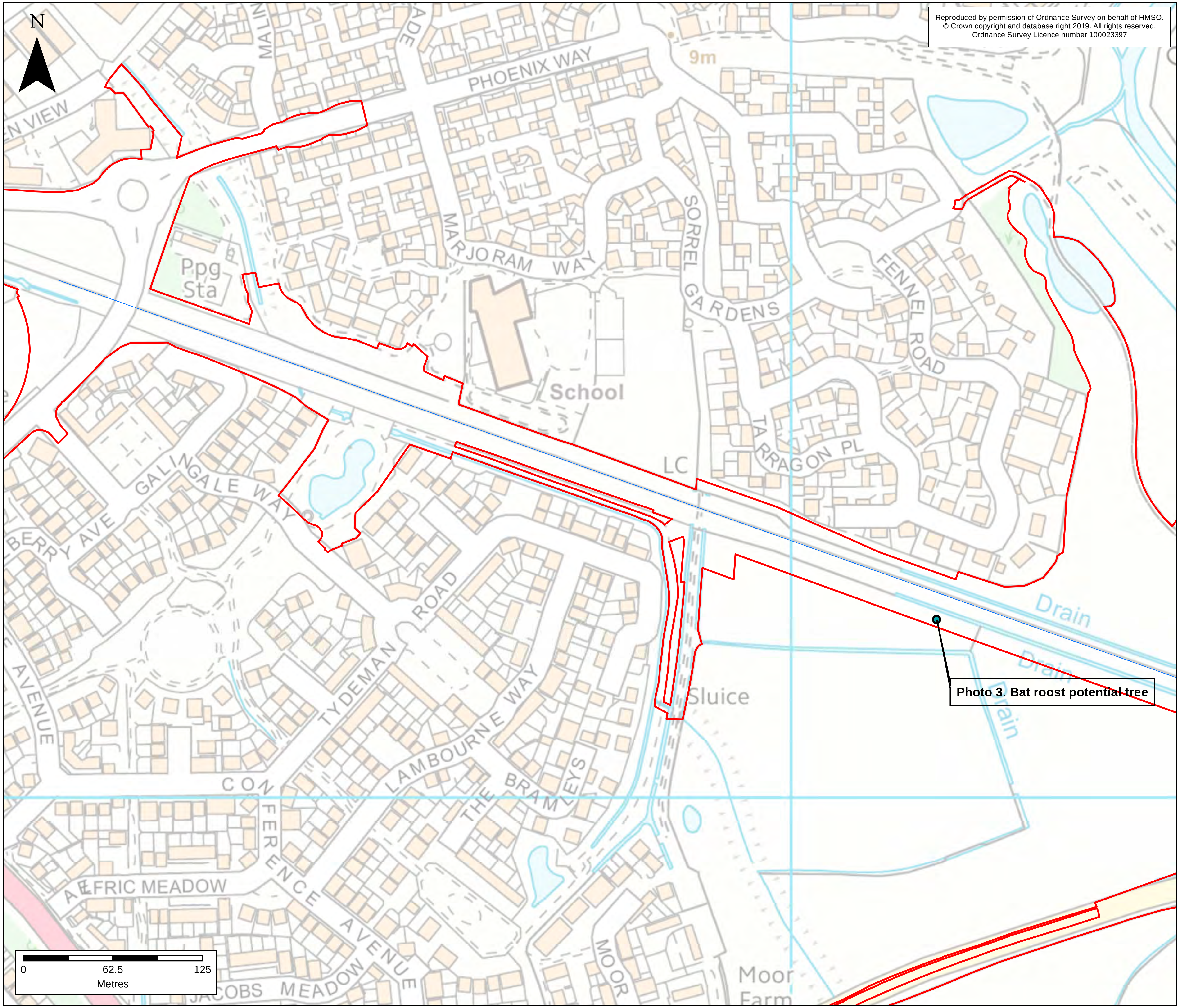

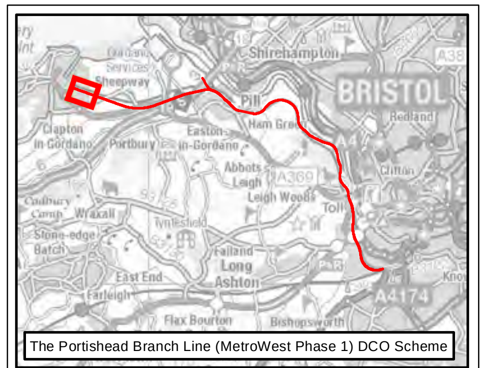

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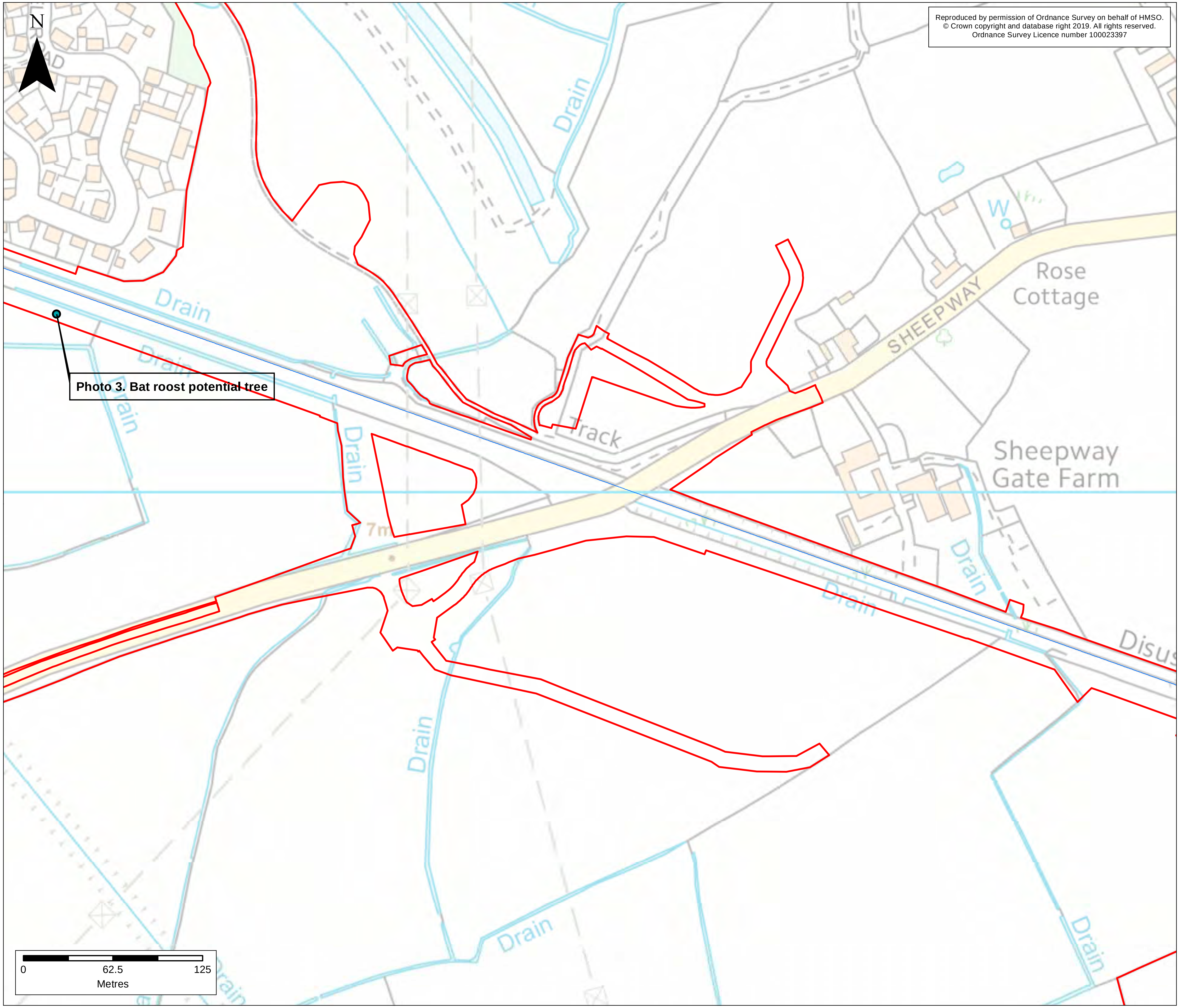

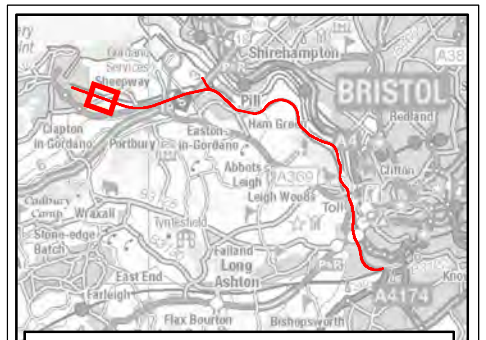

The Portishead Branch Line (MetroWest Phase 1) DCO Scheme

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Order Limits

Portishead Branch Line

The Nationally Significant Infrastructure Project (NSIP) Works

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(Sheet 3 of 24)
APFP Regulation 5(2)(a)

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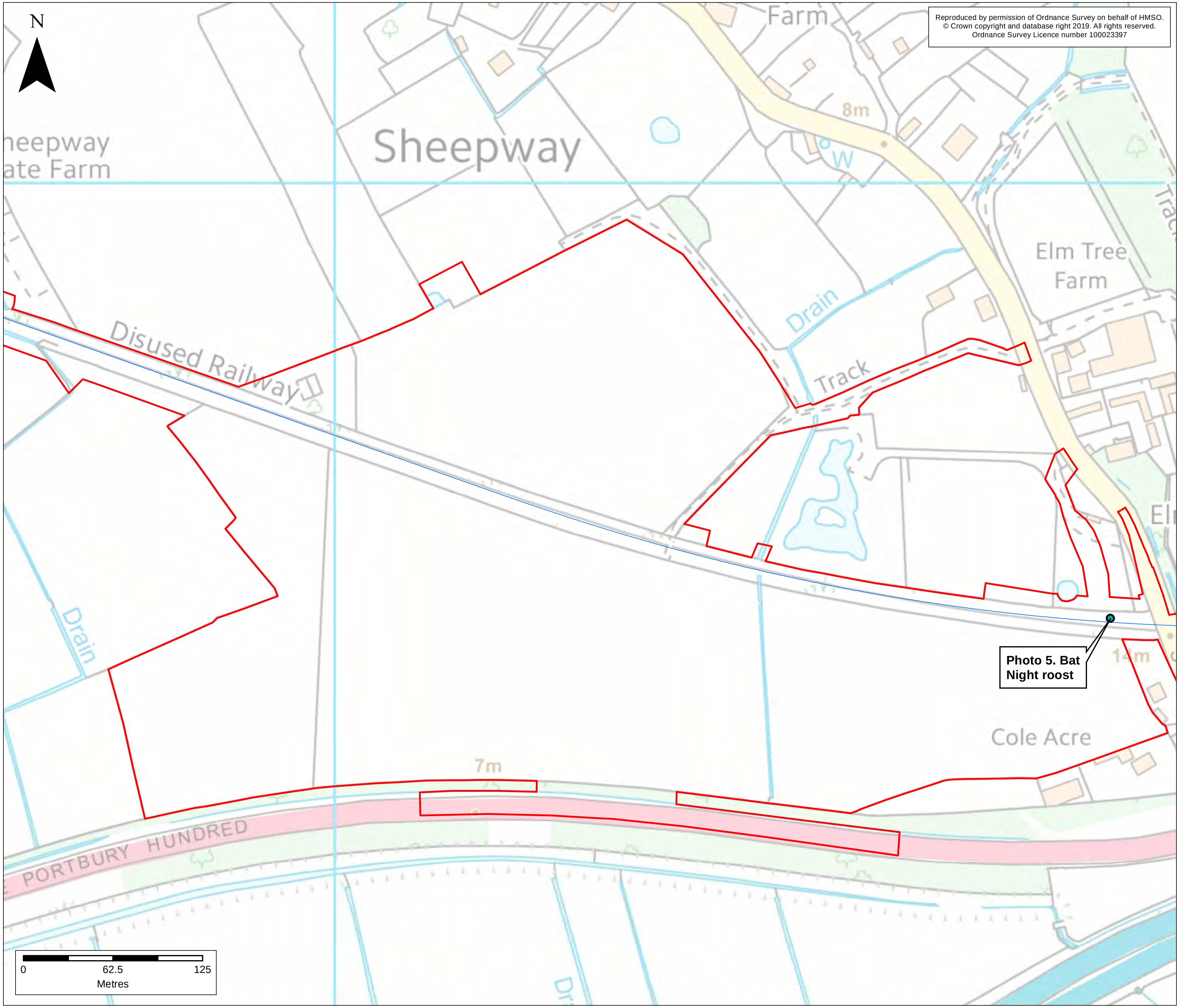

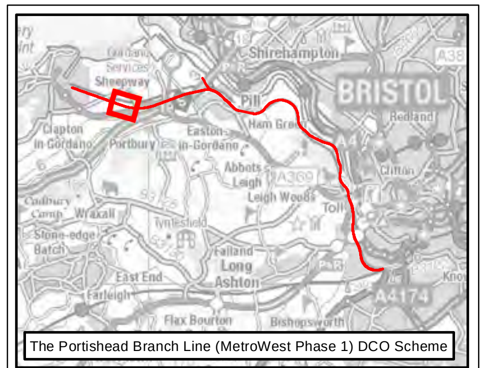

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APFP Regulation 5(2)(a)

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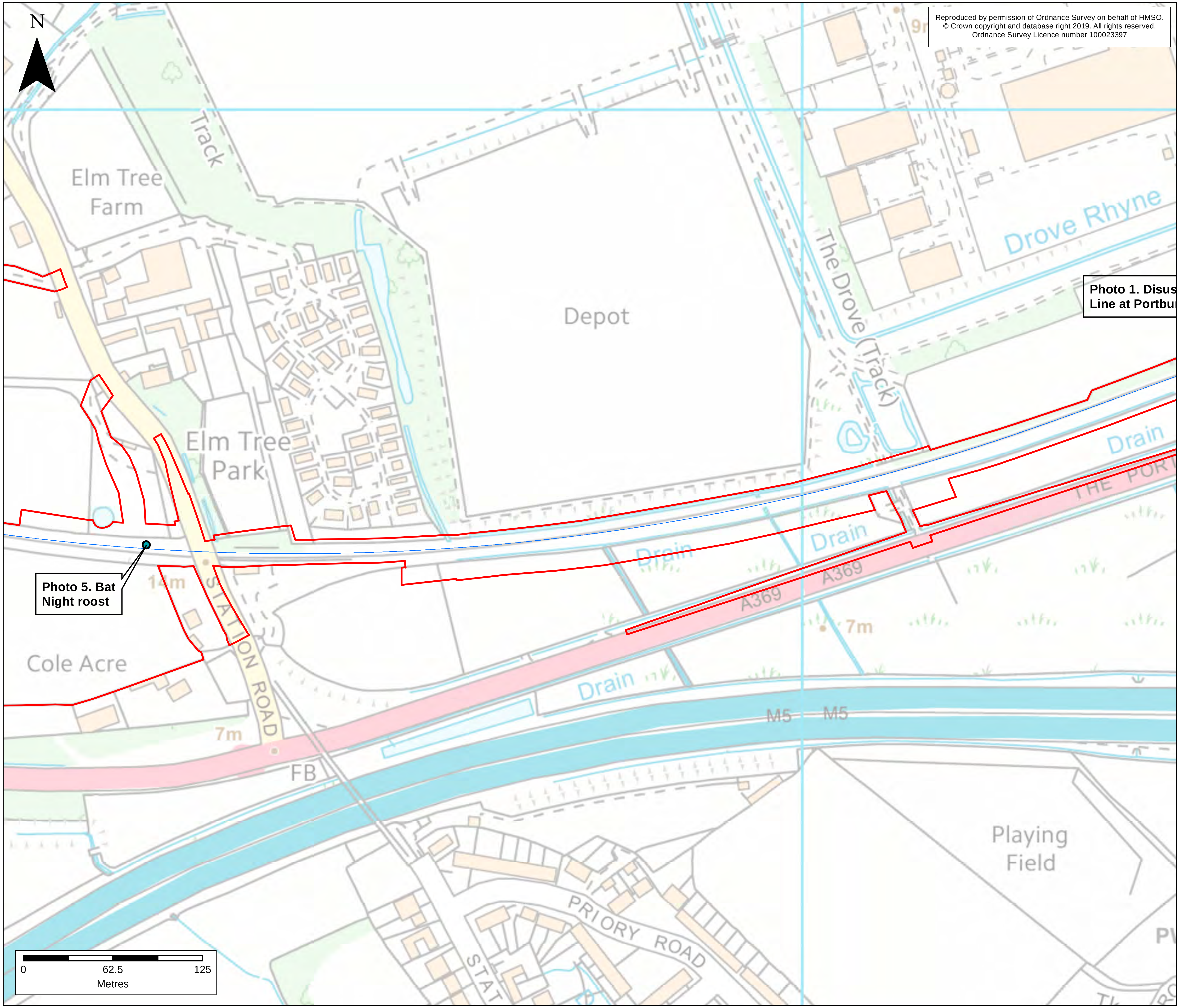

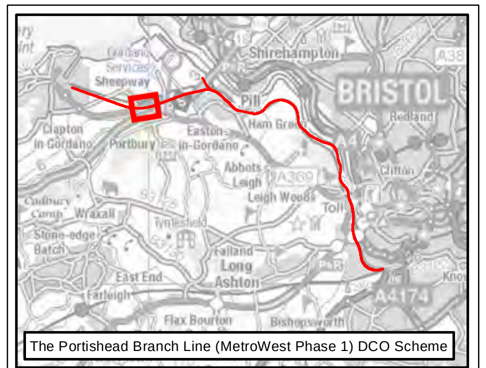

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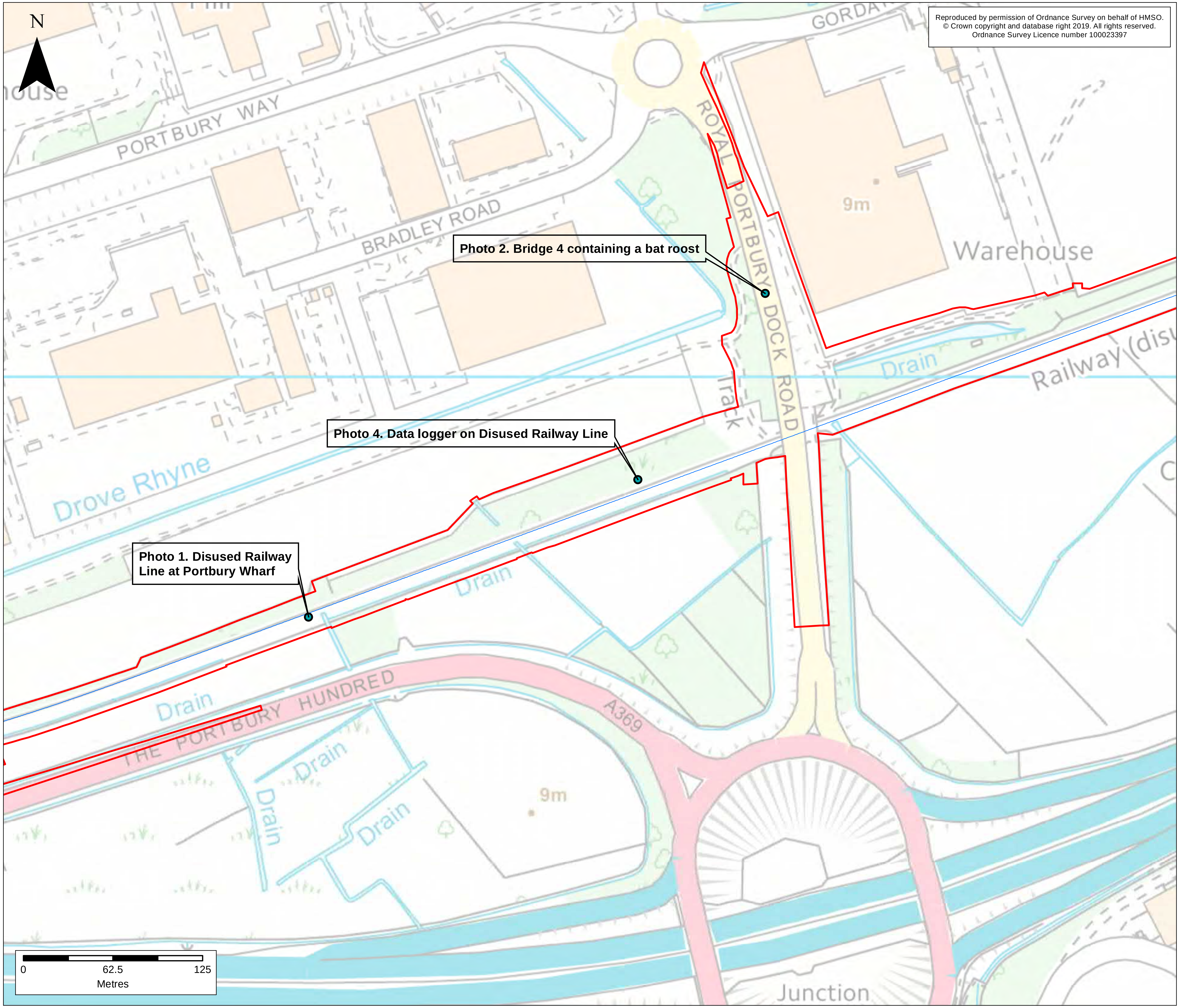

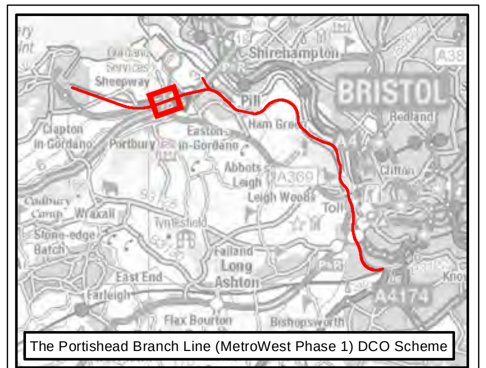

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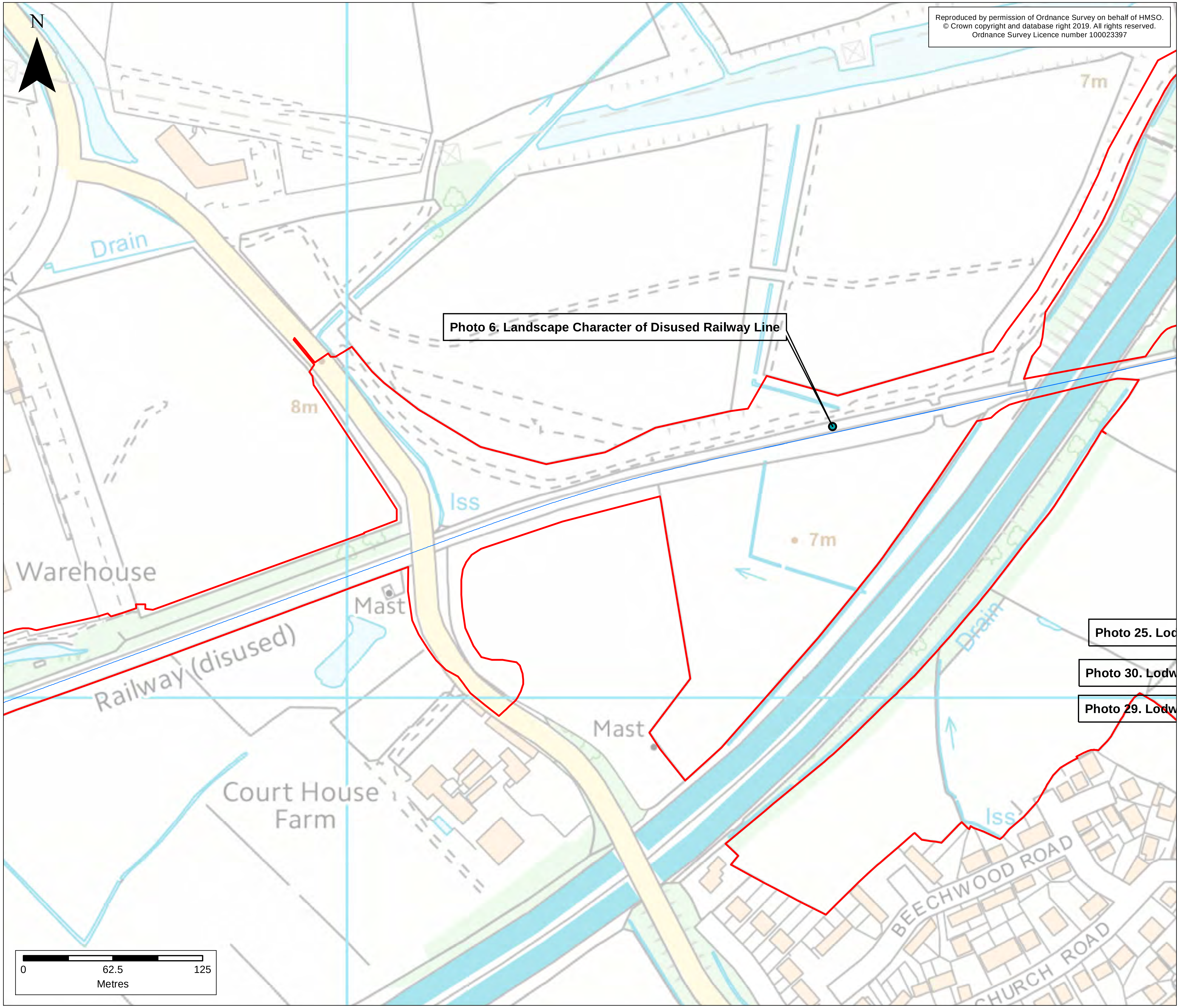

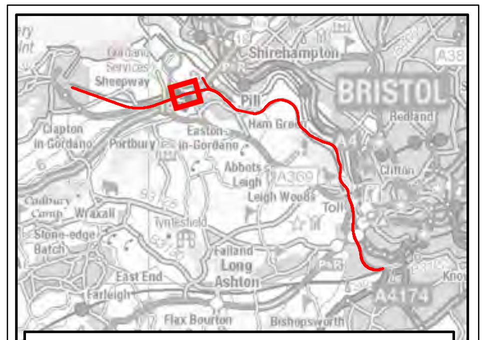

The Portishead Branch Line (MetroWest Phase 1) DCO Scheme

KEY

Order Limits

Portishead Branch Line

The Nationally Significant Infrastructure Project (NSIP) Works

Bat Photograph Locations

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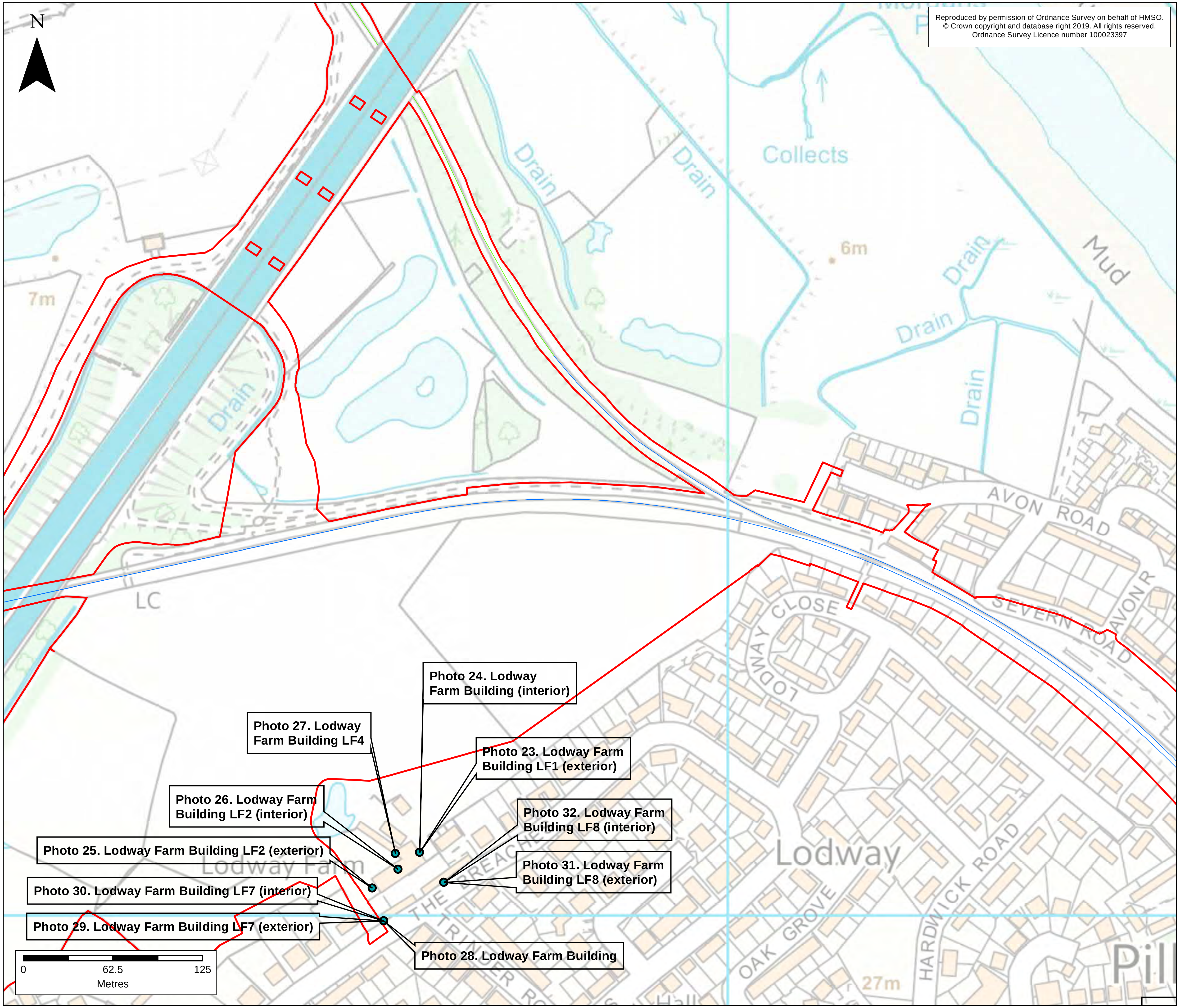

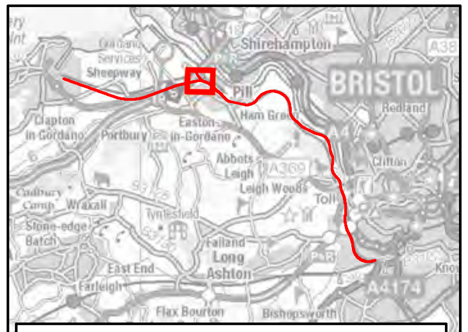

The Portishead Branch Line (MetroWest Phase 1) DCO Scheme

KEY

Order Limits

Portishead Branch Line

The Nationally Significant Infrastructure Project (NSIP) Works

The Associated Development

Bat Photograph Locations

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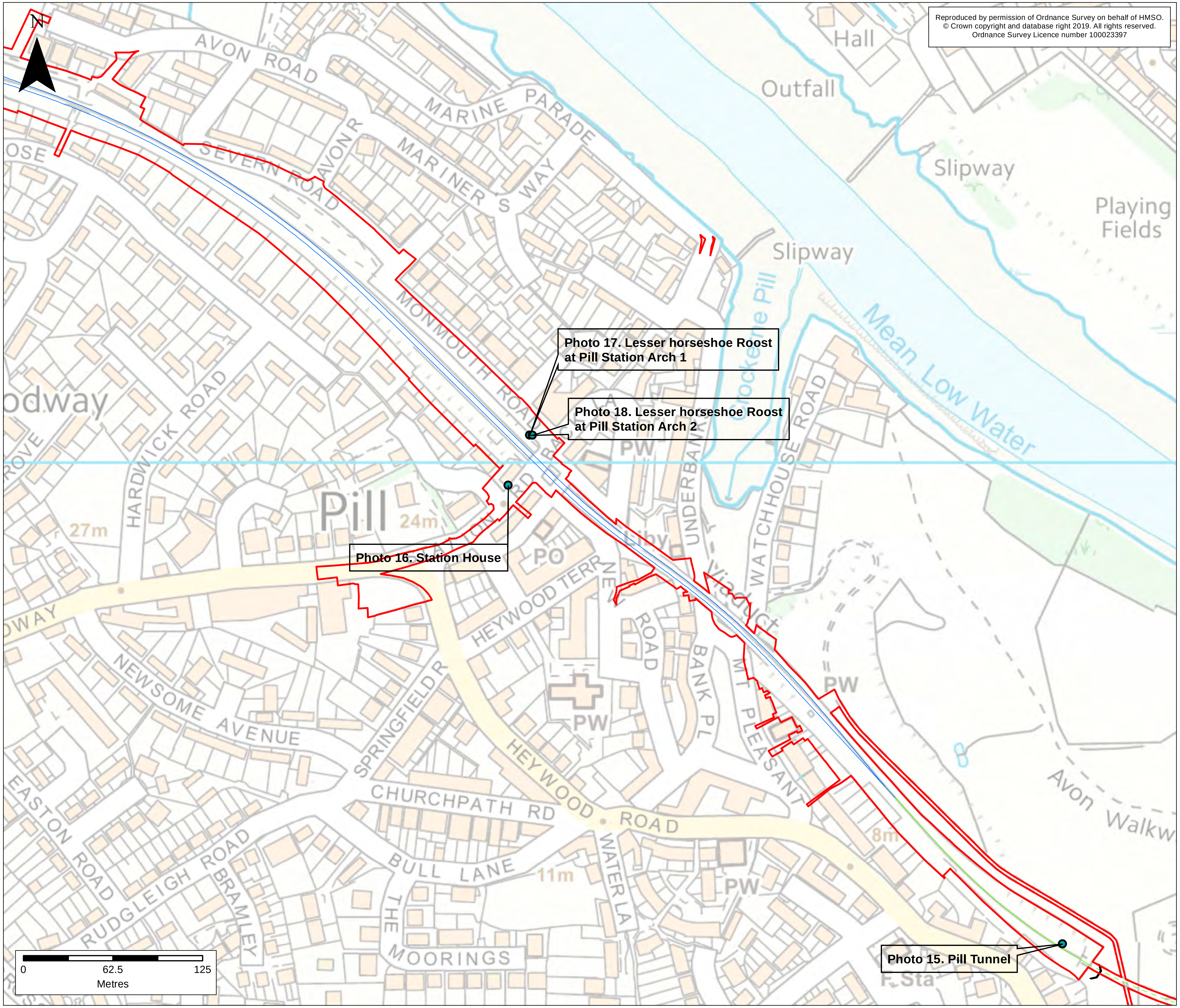

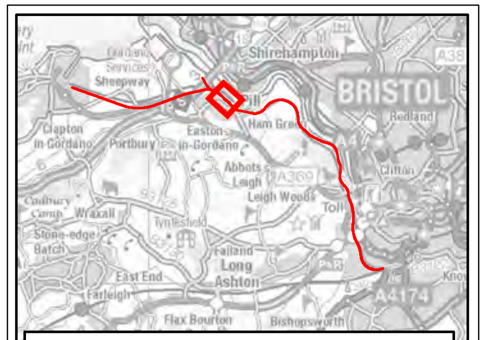

The Portishead Branch Line (MetroWest Phase 1) DCO Scheme

KEY

- Order Limits
- Railway Tunnel

Portishead Branch Line

- The Nationally Significant Infrastructure Project (NSIP) Works
- The Associated Development
- Section in Tunnel
- Bat Photograph Locations

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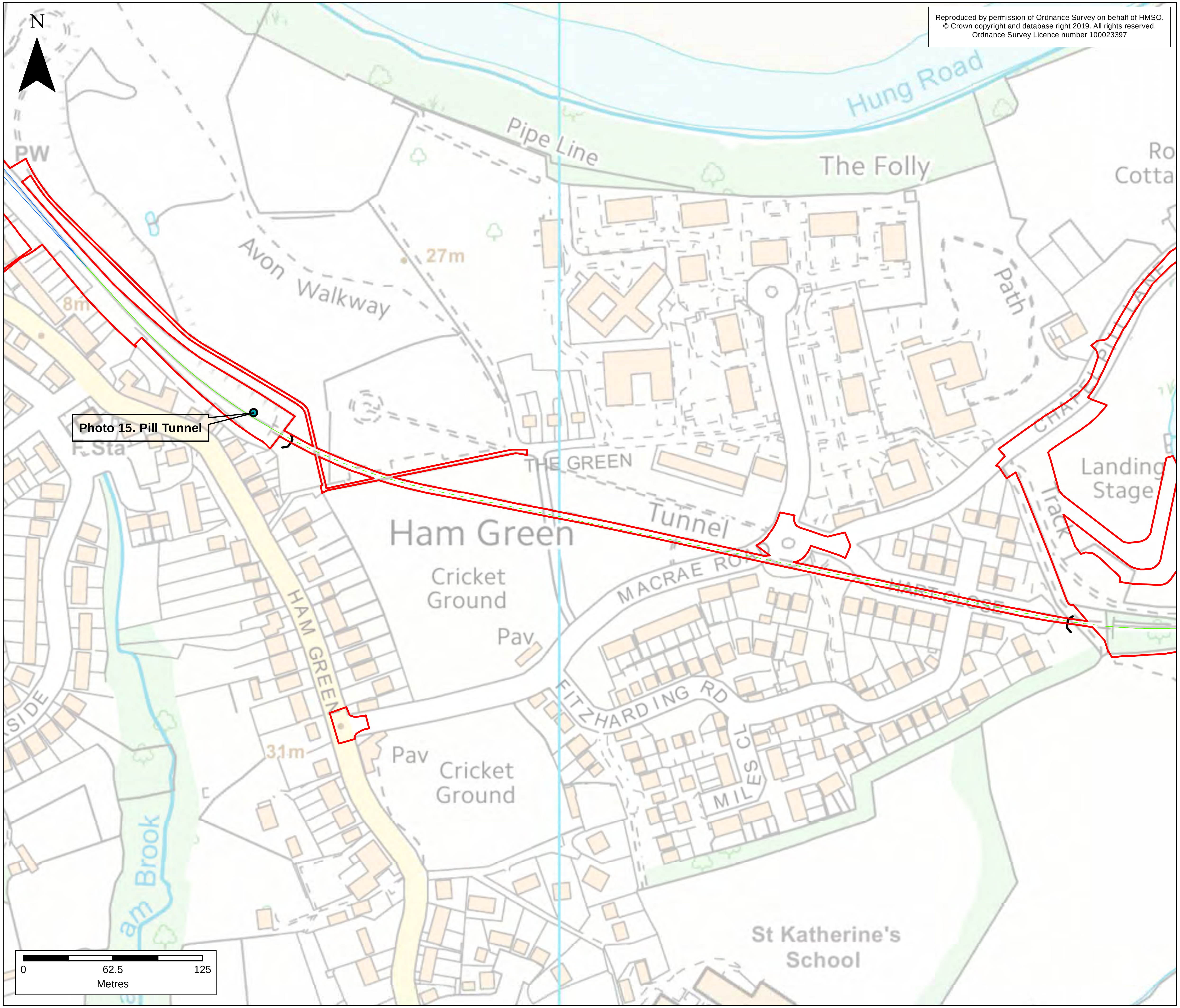

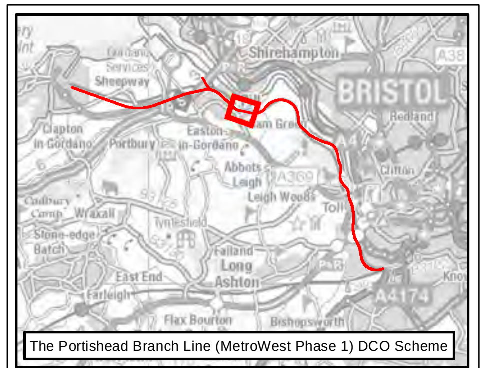

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- Order Limits
- Railway Tunnel

Portishead Branch Line

- The Nationally Significant Infrastructure Project (NSIP) Works
- The Associated Development
- Section in Tunnel
- Bat Photograph Locations

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APFP Regulation 5(2)(a)

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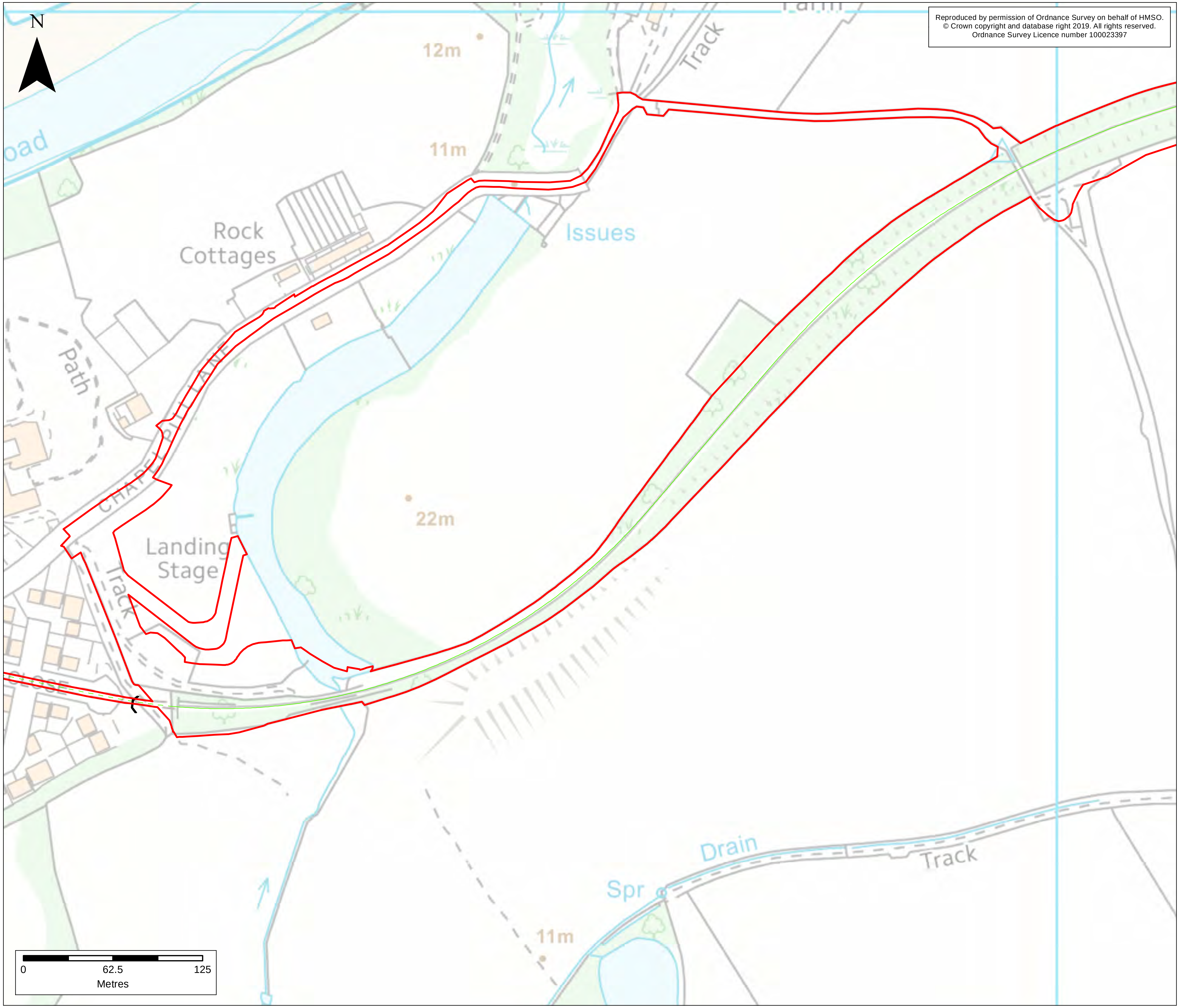

The Portishead Branch Line (MetroWest Phase 1) DCO Scheme

KEY

Order Limits

Railway Tunnel

Portishead Branch Line

The Associated Development

Section in Tunnel

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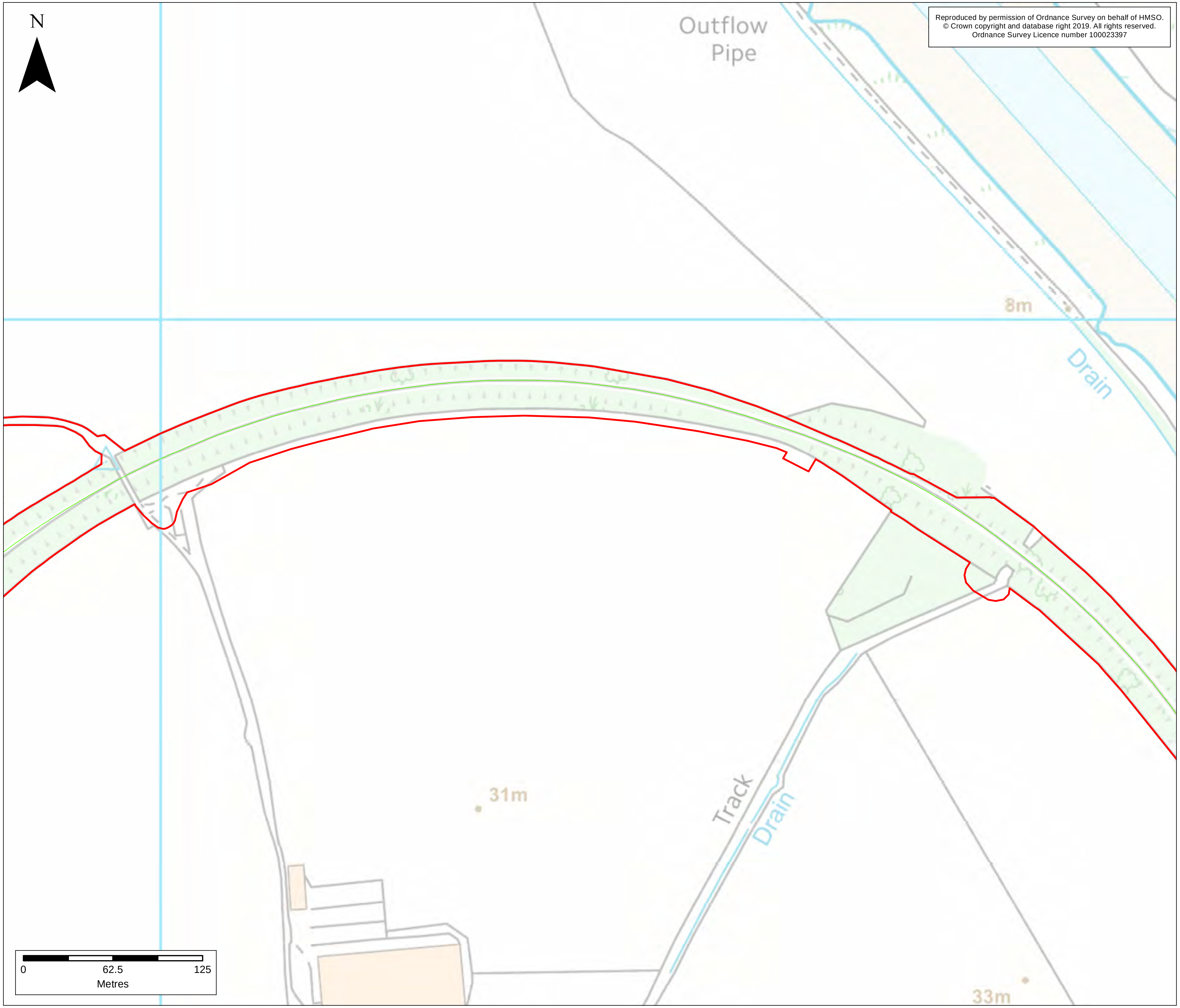

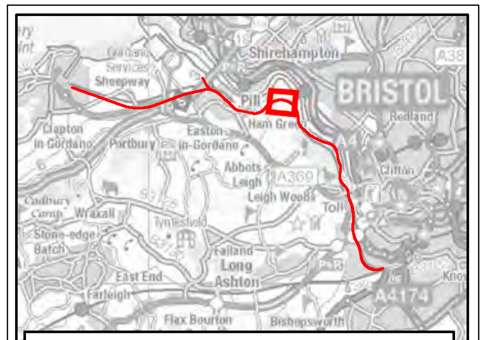

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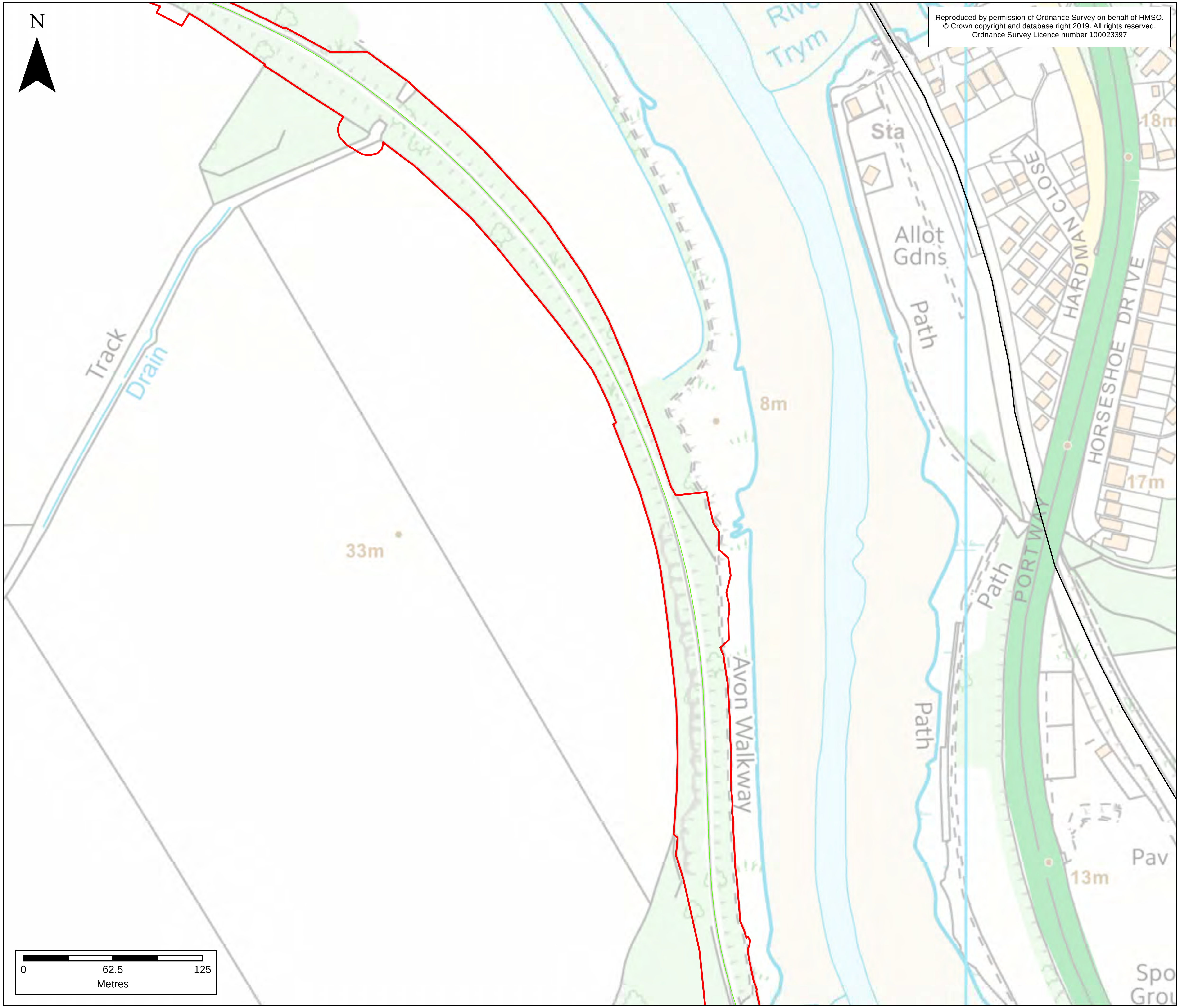

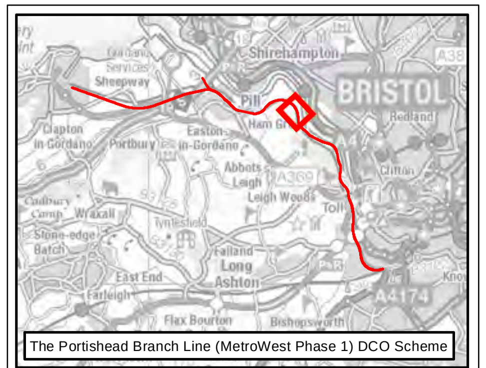

KEY

Order Limits

Existing Railway

Existing Railway Line

Portishead Branch Line

The Associated Development

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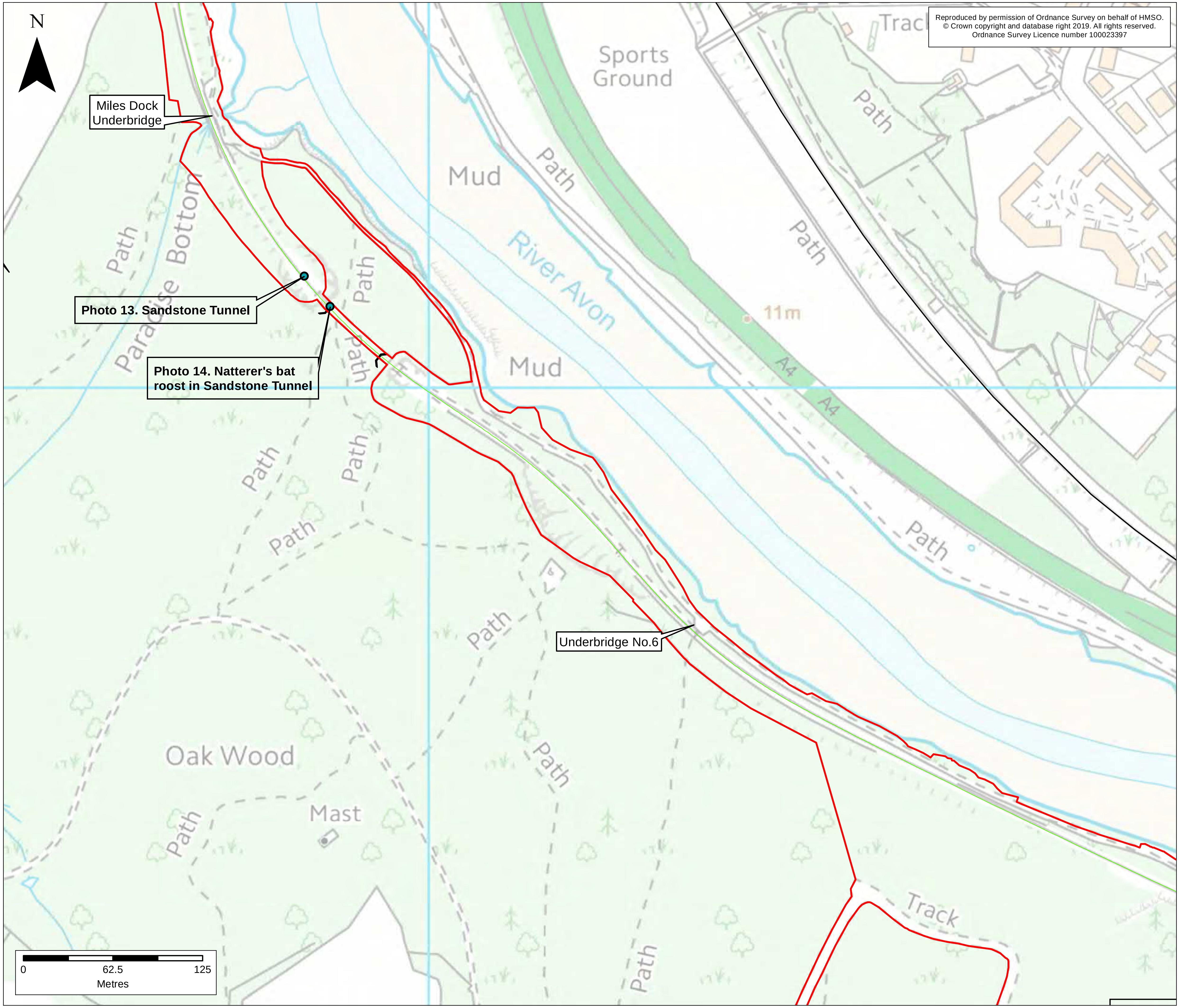

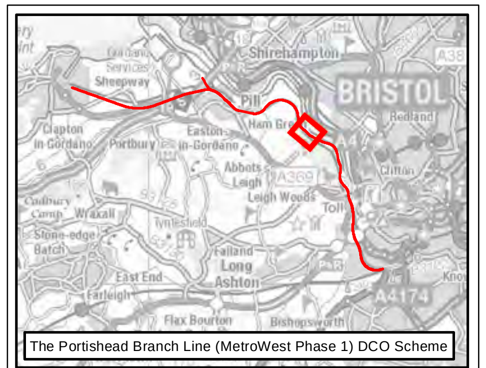

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Order Limits

Existing Railway

Existing Railway Line

Railway Tunnel

Portishead Branch Line

The Associated Development

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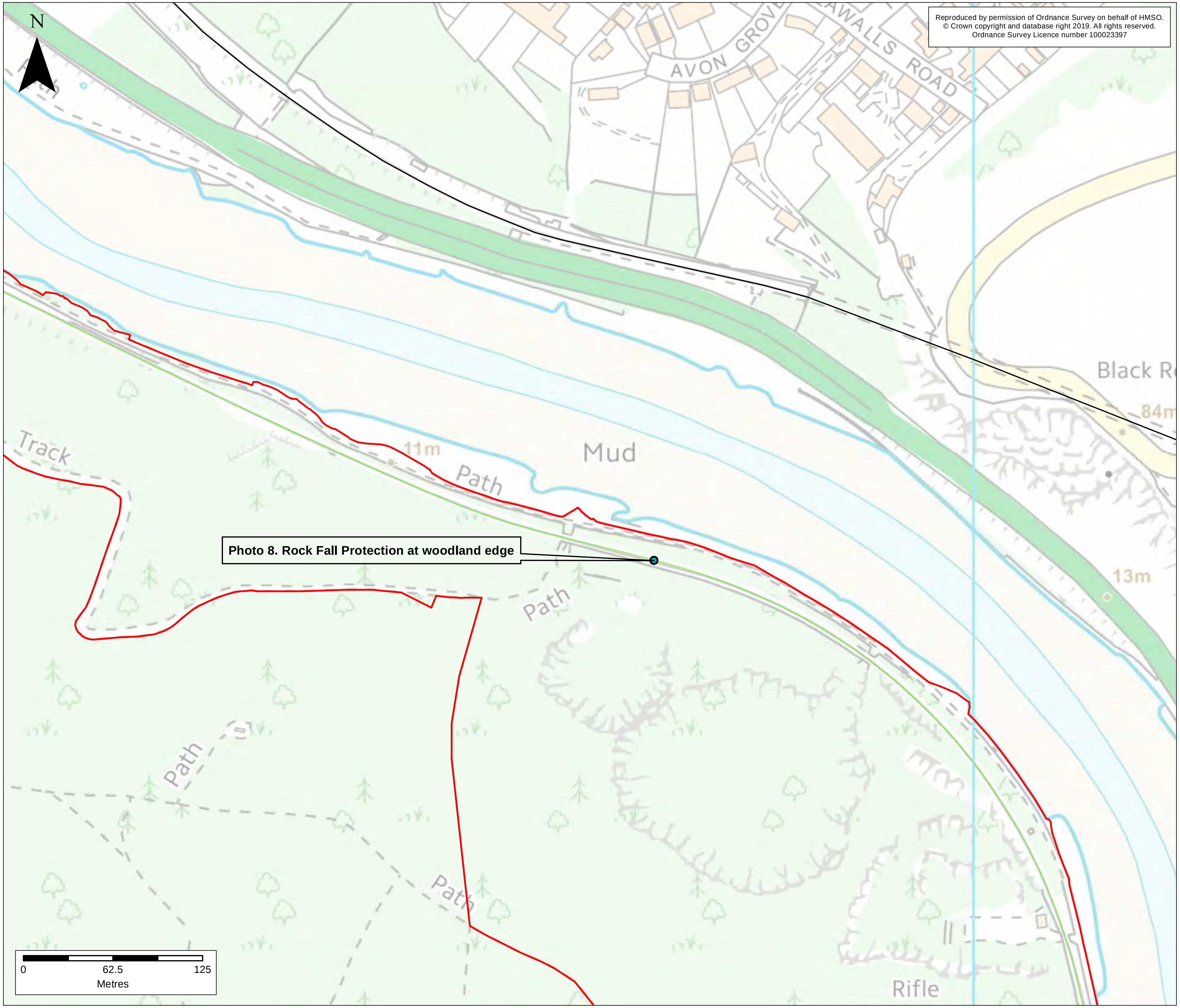

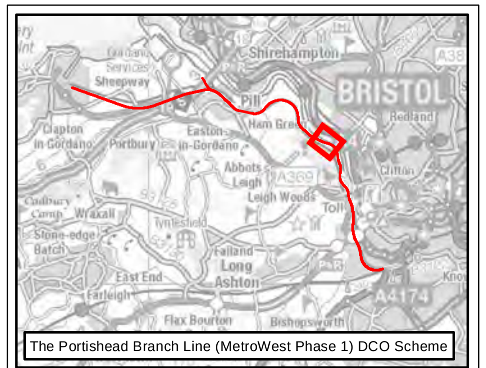

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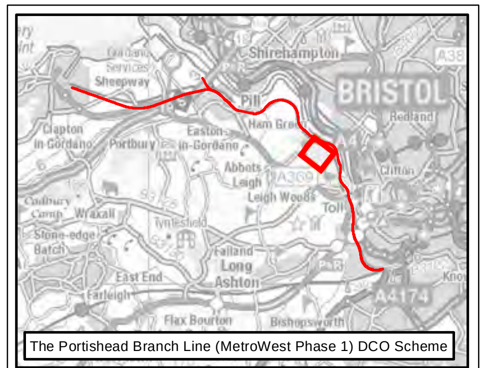

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Revision ES-A

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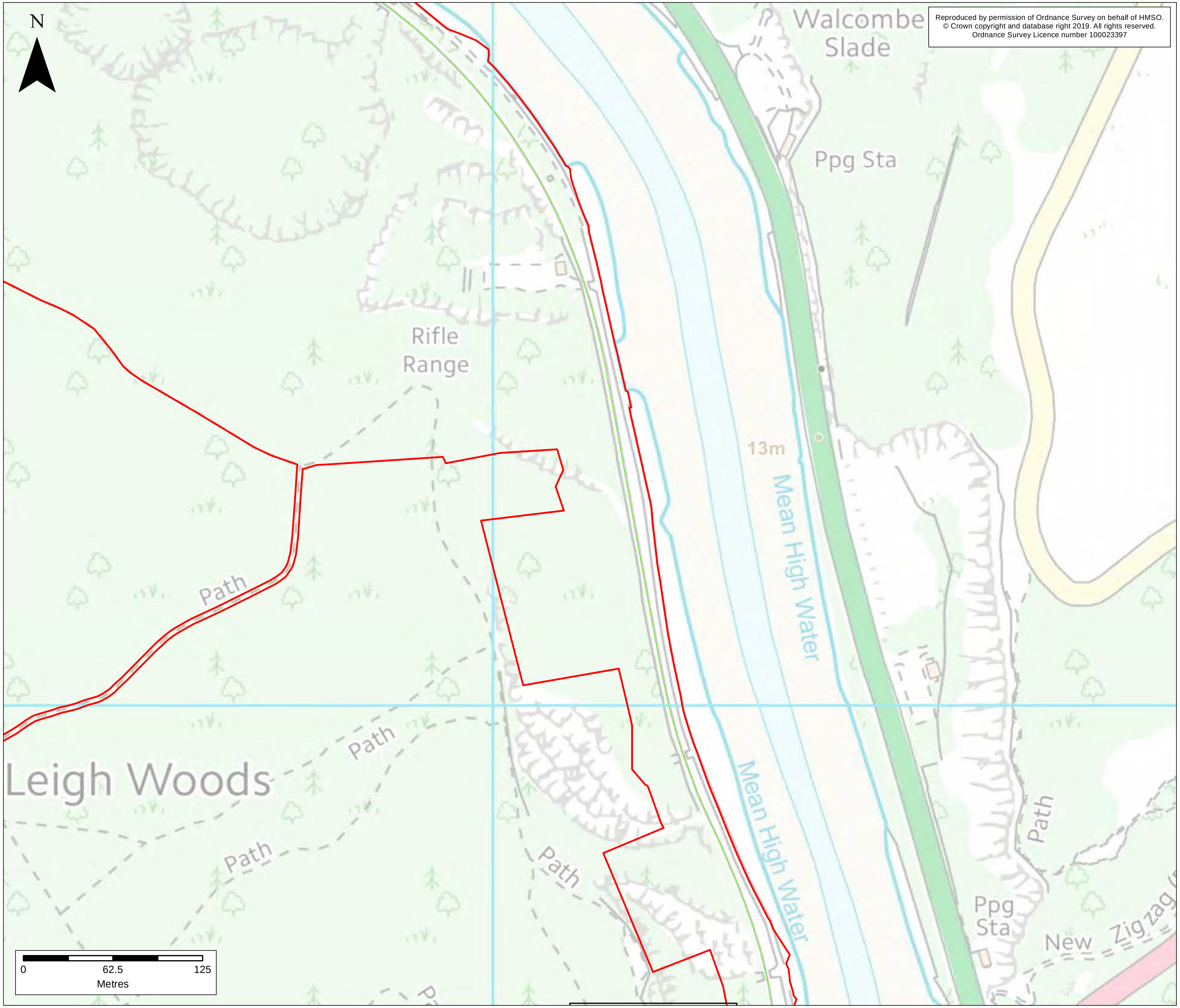

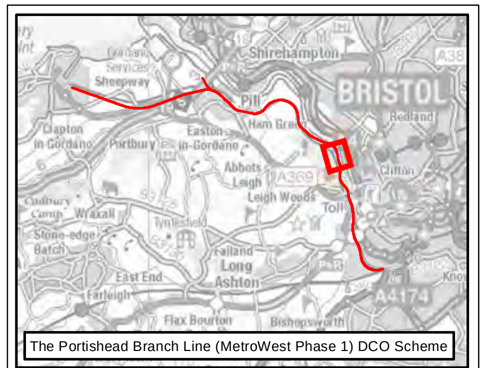

KEY

Order Limits

Portishead Branch Line

The Associated Development

ES-A	MPC	AL	CF	14/11/2019	First draft
Rev	By	Chkd	Apprvd	Date	Description

Client

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Project : Portishead Branch Line (MetroWest Phase 1)

Drawing : Location of Photographs
Bat Technical Appendix
(Sheet 17 of 24)
APFP Regulation 5(2)(a)

Drawn By :	Martin Costello	Date: 14/11/2019
Checked By :	Clare Williams	Date: 14/11/2019
Approved By :	Carolyn Francis	Date: 14/11/2019

Drawing No. : 674946-500-001 - A

Revision ES-A

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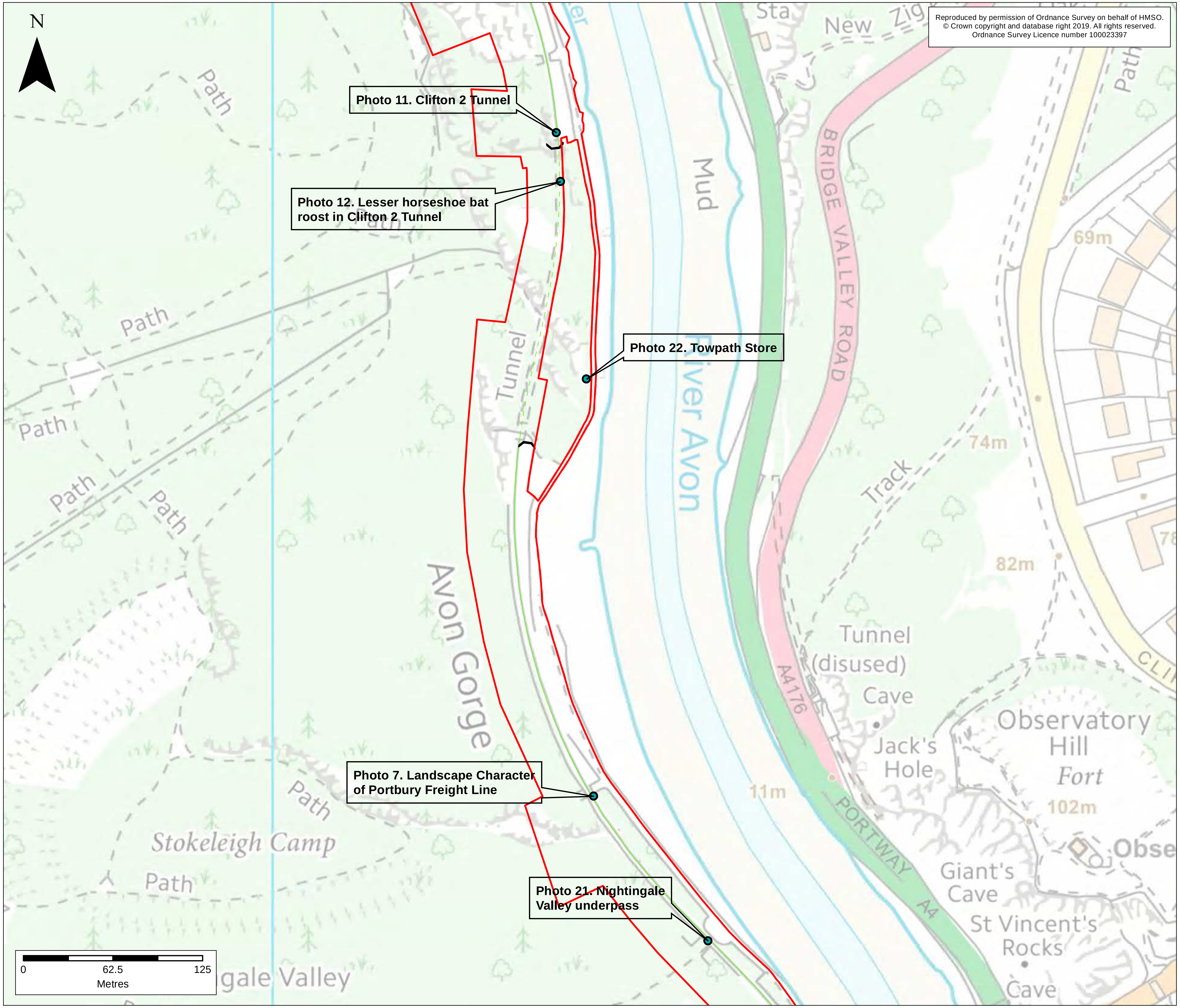

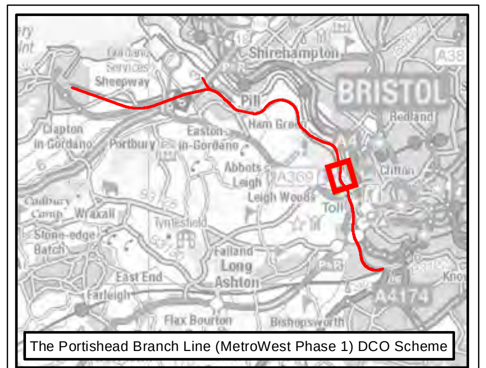

KEY

- Order Limits
- Railway Tunnel

Portishead Branch Line

- The Associated Development
- Section in Tunnel
- Bat Photograph Locations

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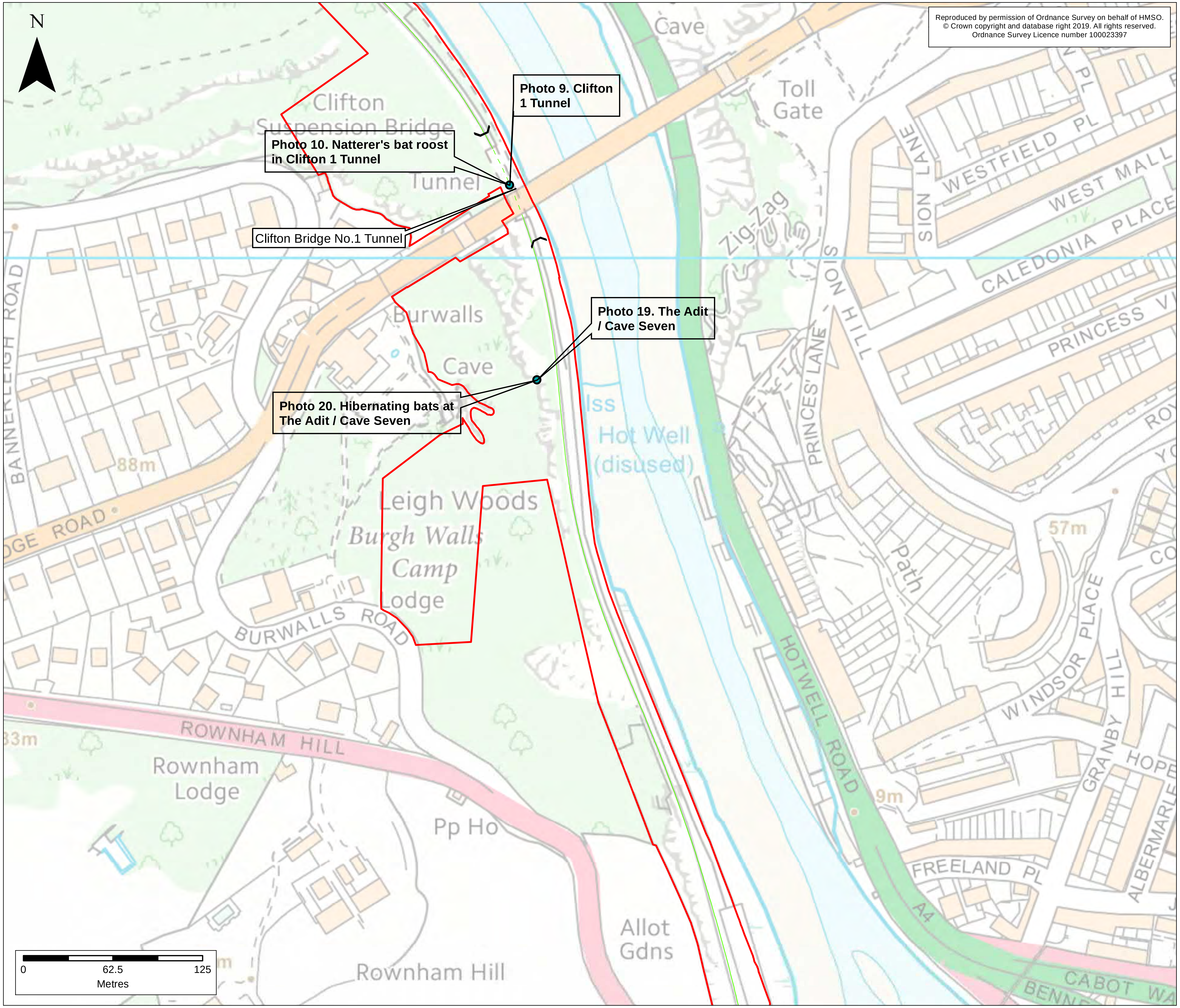

The Portishead Branch Line (MetroWest Phase 1) DCO Scheme

KEY

- Order Limits
- Railway Tunnel

Portishead Branch Line

- The Associated Development
- Section in Tunnel
- Bat Photograph Locations

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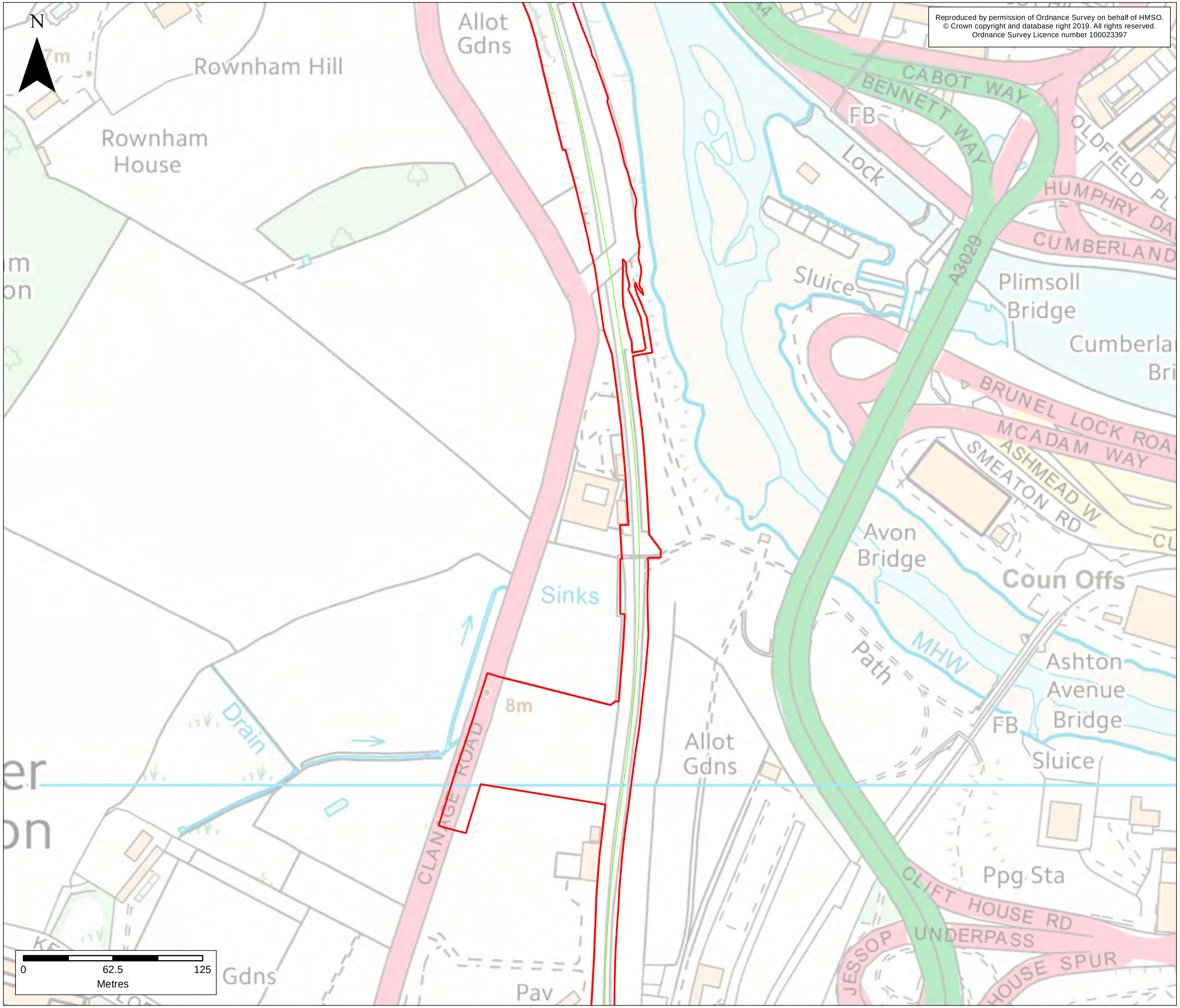

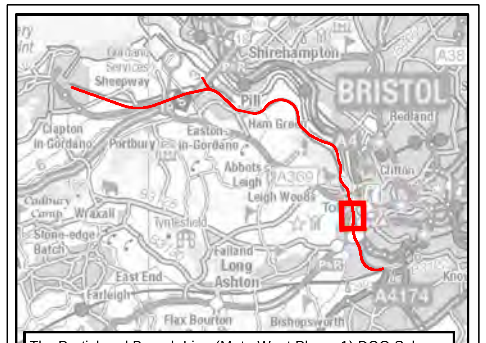

The Portishead Branch Line (MetroWest Phase 1) DCO Scheme

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Order Limits

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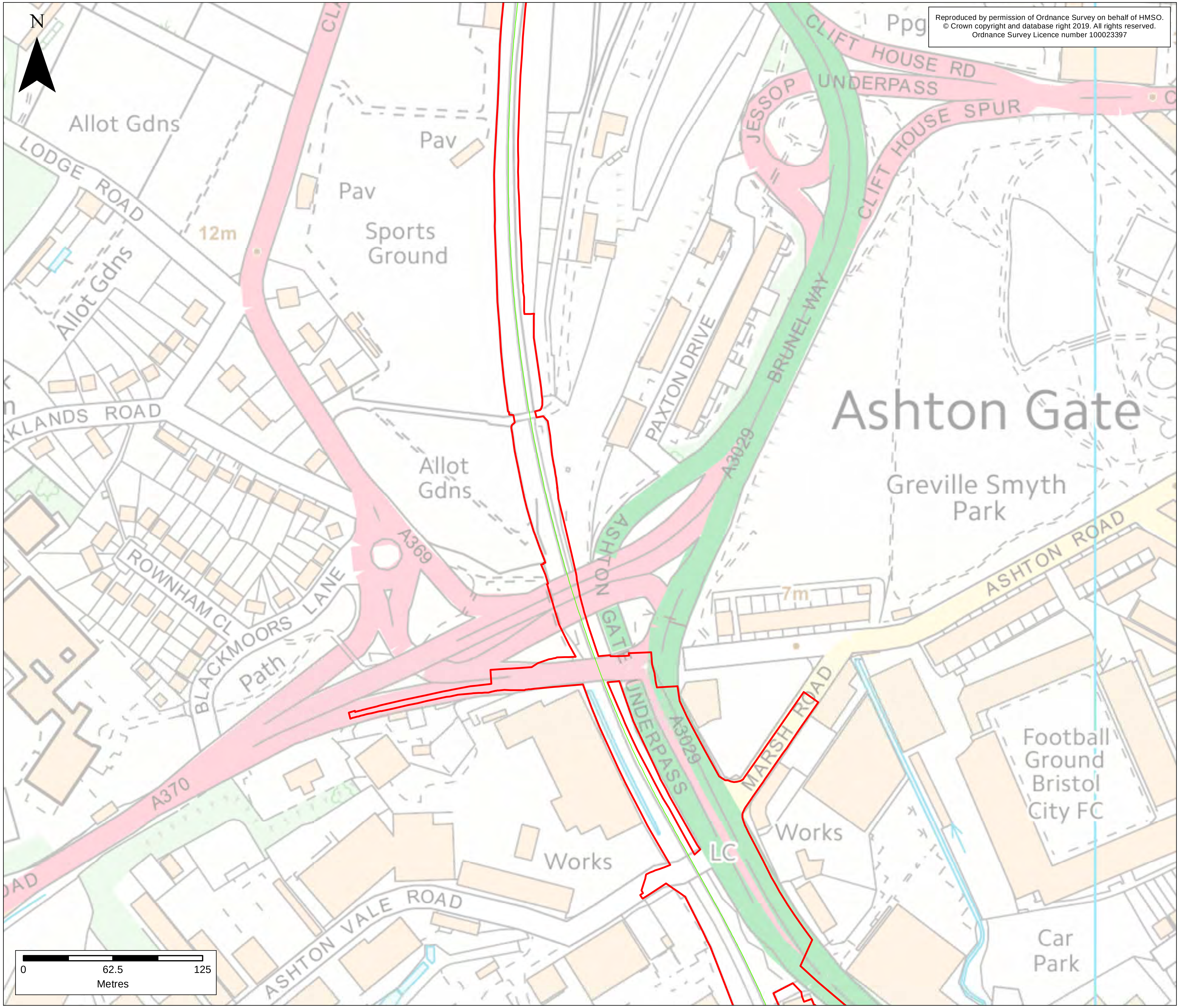

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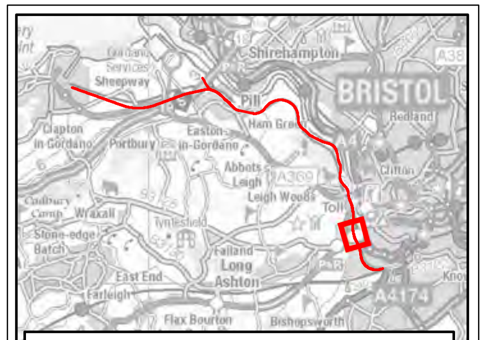

The Portishead Branch Line (MetroWest Phase 1) DCO Scheme

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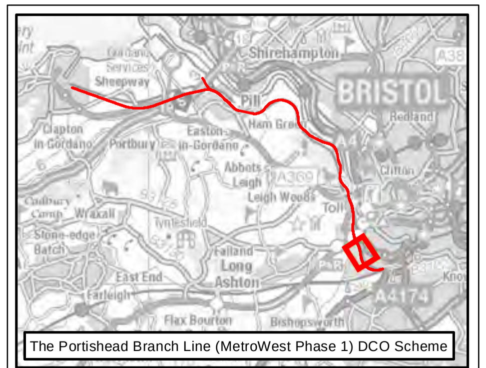

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Order Limits

Portishead Branch Line

The Associated Development

Other Works

Network Rail Permitted Development

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Revision: ES-A

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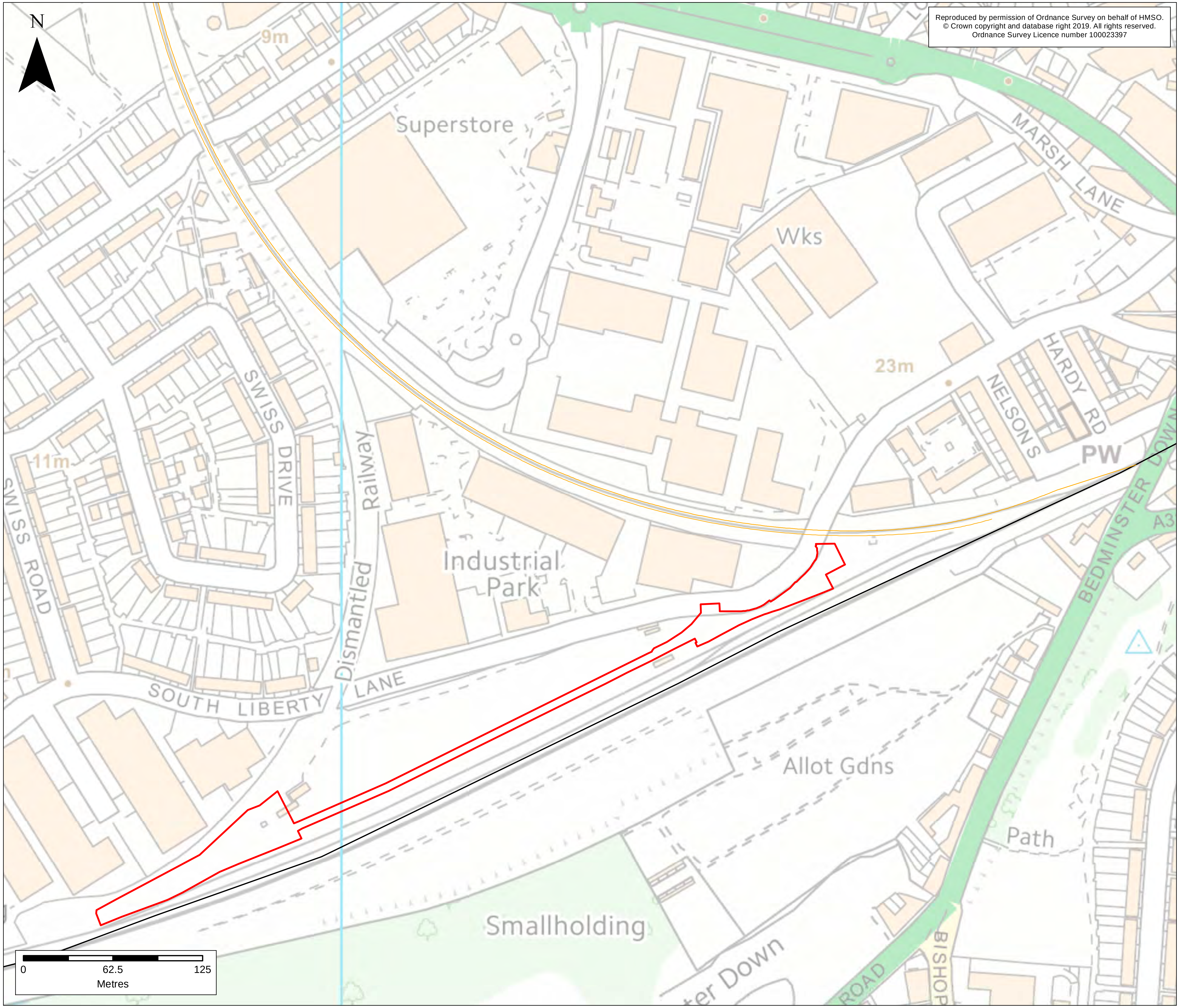

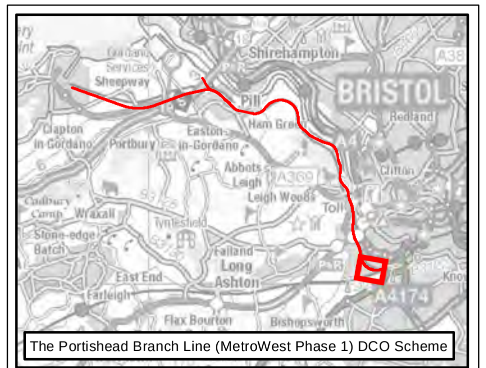

KEY

Order Limits

Existing Railway

Existing Railway Line

Other Works

Network Rail Permitted Development Rights

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(Sheet 23 of 24)
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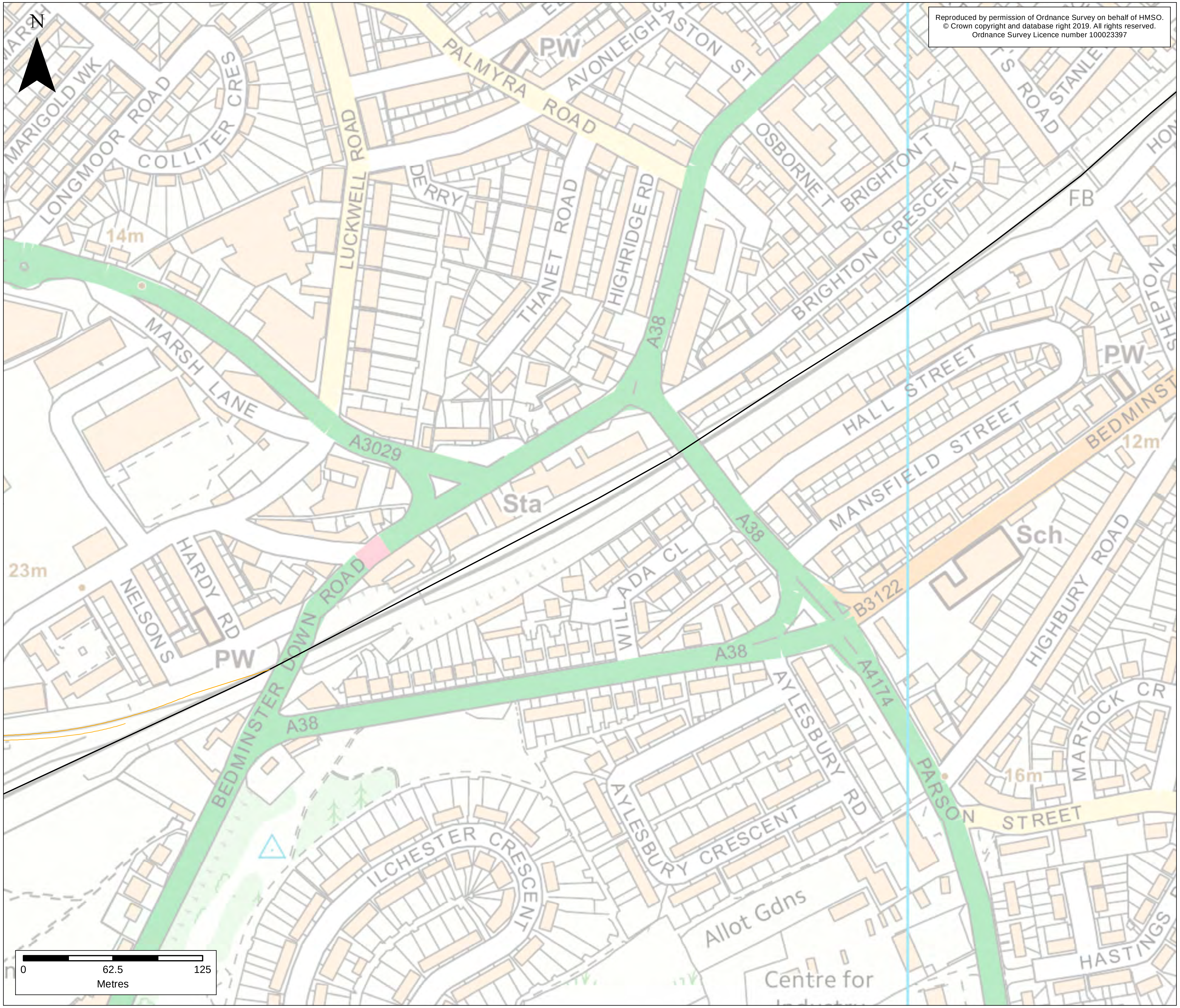

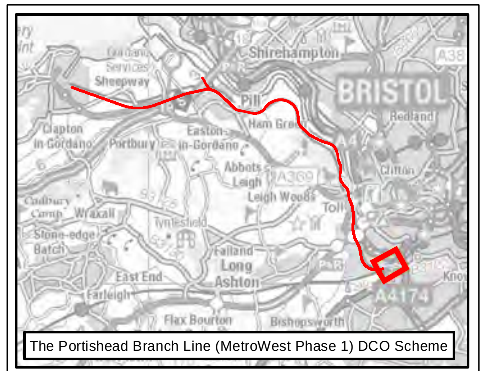

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Existing Railway

Existing Railway Line

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Appendix 11. 2020 Addendum Bat Report for Pill Station

PURE ECOLOGY

Portishead Branch Line

Addendum Bat Report for Pill Station

July 2020

Client	Jacobs
Job name	Portishead Branch Line
Report title	Addendum Bat Report for Pill Station
Reference	230-7MetroWest_PillStation_BatReport240120.

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Summary

The Planning Inspectorate (on behalf of the Secretary of State for Transport) accepted the DCO Application for Portishead Branch Line (MetroWest Phase 1) made by North Somerset District Council for examination on 12th December 2019. An environmental impact assessment (EIA) is being undertaken of the DCO Scheme in accordance with The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations). The Applicant has provided the information required to inform the EIA process in the Environmental Statement (ES), but some detailed aspects of the DCO Scheme design were unknown at the time of submission. This addendum to the Bat Technical Appendix provides further evaluation for the assessment of impacts on a lesser and greater horseshoe bat roost (*Rhinolophus hipposideros* and *R. ferrumequinnum)* on the northern platform and commuting route flight lines through Pill station.

This study has established baseline information on lesser and greater bat horseshoe bat activity at Pill Station. Roost occupancy on the northern platform and bat activity at five fixed locations on the railway line recorded the movement of lesser and greater horseshoe bats through Pill Station. A key aim of the study is to gain an understanding the movement of horseshoe bats through Pill station and importance of the railway line as a 'green corridor' through urban areas of Pill village.

Remote, unattended bat detector recording units (termed 'data loggers') were deployed at five locations along the freight line between NGR ST 52012 76279 and ST 52756 75675 to monitor the rail corridor for lesser and greater horseshoe bats between May and October 2019. Monthly inspections of the bat roost on the northern platform at Pill station were undertaken during the data logger deployments in 2019 and during a site visit in March 2020.

Lesser horseshoe activity across the whole study site was fairly consistent each month and the data show the highest levels of activity were at the Platform and to the east of Pill station. Nightly patterns of activity occurred at the beginning or end of the night, when bats are likely to be in close proximity to their roost. Monitoring locations to the west of Pill Station recorded much lower levels than the patterns of lesser horseshoe activity at the Platform. Greater horseshoe bat activity in the study area is intrinsically low and activity is predominantly at the eastern periphery of the study area.

In conclusion, maintaining connectivity between the Pill Station and land to the east is the most important consideration when designing mitigation. This is integral for retaining roost flight lines for lesser and greater horseshoe bats. Mitigation should

focus on maintaining the viability of the roost on the northern platform. These data indicate that activity at, or close to Pill Station, is not strongly associated with the disused railway line, which is an important corridor for bats with movement between the line and Brockley Hall Stables SSSI, a link with the North Somerset and Mendip Bats SAC. Whilst there is likely to be some movement from the wider area, much of the lesser horseshoe bat activity appears to be localised and greater horseshoe bat activity through the station is too low to be considered significant commuting behaviour. The overall importance as a roost habitat and linear landscape feature for bats is of value at a **local level.**

1 Introduction

1.1 Development Consent Order Scheme

1.1.1 The Portishead Branch Line (MetroWest Phase 1) Development Consent Order Scheme ("the DCO Scheme") is a nationally significant infrastructure project (NSIP) and a priority of the West of England's local authorities to improve passenger rail services.

1.1.2 The Planning Inspectorate (on behalf of the Secretary of State for Transport) has accepted the DCO Application made by North Somerset District Council. The Application was made on 15th November 2019 and accepted for examination on 12th December 2019. The DCO application seeks powers to build and operate the disused section of railway from Portishead to Pill, gain environmental consent to undertake works to the existing freight railway through the Avon Gorge and obtain powers for the compulsory acquisition of land.

1.1.3 An environmental impact assessment (EIA) is being undertaken of the DCO Scheme in accordance with The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the EIA Regulations). The Applicant has provided the information required to inform the EIA process in the Environmental Statement (ES), but some detailed aspects of the DCO Scheme design were unknown at the time of submission. This addendum to the Bat Technical Appendix provides further assessment of impacts on bats from platform lighting at Pill Station. The DCO Scheme includes re-opening Pill station with a single platform on the southern side of the railway.

1.2 Background Information from the ES

1.2.1 Pill station is a disused station in Pill village and is located off Station Road and Monmouth Road at National Grid Reference (NGR) ST 523 760. The station has fallen into disrepair since its closure in 1964, but the platforms along the southern and northern side of the railway line are still visible. The site of Pill station is in a deep cutting and there are two arches in the retaining wall on the northern platform, one of which appears to be a former store. These arches at Pill station are used by low numbers of roosting lesser and greater horseshoe bats (*Rhinolophus hipposideros* and *R. ferrumequinum*). A day roost for lesser horseshoe bats and a night roost for lesser and greater horseshoe bats were recorded in summer and autumn 2016.

1.2.2 The DCO Scheme includes re-opening Pill station with a single platform on the southern side of the railway. The two arches that are used by lesser and greater horseshoe bats will be retained, but renovation and improvements for the new platform is predicted to deter bats from day roosting because of significant disturbance from construction activities to remove the existing southern side (Down direction) platform and build a new replacement platform.

1.2.3 It is predicted that lesser and greater horseshoe bats will abandon roosts within the arches on the northern platform of Pill Station because of the lighting proposals. New lighting columns and luminaries will illuminate the platform, steps and ramp at the station. Without control measures and a suitable lighting plan to retain dark, unlit bat flight lines to the archways on the platform, lesser and greater horseshoe bats will not use the roost sites at Pill Station. There will also be increased disturbance from passengers on the southern platform. The archways are open fronted and their proximity passenger areas on the platform exposes the roost environment to human disturbance.

2 Study Area

2.1.1 The study area for the DCO Scheme focuses on the Order limits as shown on the General Arrangement Plans (DCO Document Reference 2.4) defined by the Order limits around the DCO Scheme from the proposed new station in Portishead to Ashton Junction. The study area has been divided into Portishead to Pill (disused line) and Portbury Freight Line due to the differences in the DCO Scheme for each section and differences in baseline ecology.

2.1.2 The extent of study area for assessment of impacts on bats from platform lighting at Pill Station is shown on **Figure 1** and is defined as the section of track up line and down line of the station platform between NGR ST 52012 76279 and ST 52756 75675.

2.1.3 Bat roosts in Pill station arches are located on the northern platform, as shown on **Figure 2**. A larger arch (named Arch 1) at the eastern end of the platform is a former store. The arch is bricked and has a doorway opening. A smaller arch (named Arch 2) is approximately 3m from Arch 1 and has an uncovered half-arc shape opening (approximately 1m floor to apex of arch at its highest point). Both arches are approximately 2.5m deep, extending beyond the breadth of the retaining wall structure into the earth bank of the cutting.

2.1.4 Five 'monitoring sites' were selected along the freight line to monitor bat activity and movement along the railway corridor using static-automated bat detectors, referred to as "data loggers" from fixed positions east, west and within Pill station. The data loggers were deployed within commuting, foraging and roosting habitats as shown on **Figure 1** and have been named according to their physical location. Location details of the data loggers are given in **Table 1.**

Table 1. Data logger Locations

Location Name (Fig. 1)	NGR	Habitat Description
Platform	ST 52414 76017	Roost location – data logger positioned on the platform outside Arch 1 and Arch 2.
East-1	ST 52425 75989	Commuting route – positioned at Pill Station overbridge on a section or railway without any foraging opportunities for bats.
East-2	ST 52593 75860	Foraging habitat – vegetated areas with woodland/ scrub habitats that provide feeding opportunities for horseshoe bats.
West-2	ST 52230 76175	
West-1	ST 52051 76265	

3 Study Scope

3.1.1 This study has established baseline information on lesser and greater bat horseshoe bat activity at Pill Station. Roost occupancy on the northern platform and bat activity at five fix locations on the railway line recorded the movement of lesser and greater horseshoe bats through Pill Station.

3.1.2 The 2019 survey data provides a baseline for assessment of impacts of platform lighting on lesser and greater horseshoe bat flight lines. The study evaluates the significance of the railway line as a green corridor through Pill and will inform roost mitigation designs. A key aim of the study is to gain an understanding the movement of lesser horseshoe and greater horseshoe bats through Pill station and importance of the railway line as a link through urban areas in Pill.

3.1.3 This report intends to answer the following key questions:

- Is there a peak in activity at the roost on the northern platform of Pill station?
- Do temporal patterns in bat activity give us an understanding of when the bats are day or night roosting at Pill station?
- Are there any patterns of nightly activity that would suggest bats are using the railway line as a commuting route through Pill Station?

3.1.4 The analysis of results also considered the following questions:

- How does bat activity at East-1 compare to East-2 and West-1 that are within wooded areas with foraging opportunities?
- Are there any similarities in patterns of nightly activity between monitoring sites Platform, East-1 and West-1 close to known roosts that may be indicative roost behaviour?
- Is there a distinction between activity to the east and west of Pill Station that may suggest the two areas are used in different ways, and may therefore be used by bats from different roosts/ localities? For example, bat activity to the east associated with bats from the Avon Gorge, and bat activity from the west associated with the disused railway line (towards the Portishead area).

4 Methodology

4.1 Desk Study

4.1.1 Survey data on bat roosts at Pill Station has been taken from review of DCO application document *6.12, Environmental Statement, Volume 2, Chapter 9 Ecology and Biodiversity.*

4.2 Field Surveys

Bat Activity Surveys

4.2.1 Remote, unattended bat detector recording units (termed 'data loggers') were deployed at five locations along the freight line between NGR ST 52012 76279 and ST 52756 75675 to monitor the rail corridor through Pill Station for lesser and greater horseshoe bats. The five data loggers were set up at monitoring sites shown on **Figure 1** and are named according to their their physical location in relation to Pill Station for reference when reading the results. The data logger monitoring locations are named as follows:

- West 1 – monitoring site at the western extent of the study area, furthest west of Pill Station
- West 2 – monitoring site west of Pill Station

- Platform – monitoring site at Pill Station
- East 1 – monitoring site east of Pill Station
- East 2 - monitoring site at the eastern extent of the study area, furthest east of Pill Station

4.2.2 Standardised acoustic monitoring was undertaken using Wildlife Acoustic's latest generation of full spectrum, realtime dataloggers, the SM4BAT-FS. The SM4BAT-FS captures 16-bit full spectrum recordings, recording data on an SDHC card.

4.2.3 Each datalogger unit was programmed to be active each night between dusk and dawn and recorded over the periods shown in **Table 2**.

4.2.4 The dataloggers are triggered by the bat's (ultrasonic) echolocation call and record continuously over the duration of bat activity. The recordings captured by the SM4BAT-FS were analysed using Kaleidoscope Pro software, by Wildlife Acoustic. This information was used to produce a database of bat activity along the disused railway line throughout the May – October study period. Using this high-resolution database, it is then possible to calculate a bat activity index (BAI) for a range of spatial and temporal bandwidths for lesser and greater horseshoe bats.

Table 1. Datalogger Monitoring Programme

Location	Deployment Month	Start Date	End Date	No. of Monitoring Nights
Platform	May	14/05/19	10/06/19	27
East-1			10/06/19	27
East-2			11/06/19	28
West-2			09/06/19	26
West-1			11/06/19	28
Platform	June	11/06/19	05/07/19	24
East-1			17/06/19	7
East-2			05/07/19	24
West-2			05/07/19	24
West-1			05/07/19	24
Platform	July	05/07/19	09/08/19	35
East-1			05/07/19	0 (microphone failure)
East-2			09/08/19	35
West-2			09/08/19	35
West-1			09/08/19	35
Platform	August	09/08/19	18/09/19	40
East-1			19/09/19	41
East-2			19/09/19	41
West-2			19/09/19	41
West-1			16/09/19	38

Location	Deployment Month	Start Date	End Date	No. of Monitoring Nights
Platform	September	19/09/19	07/10/19	18
East-1			22/09/19	3 (battery failure)
East-2			07/10/19	18
West-2			07/10/19	18
West-1			07/10/19	18
Platform	October	07/10/19	24/10/19	17
East-1			25/10/19	18
East-2			25/10/19	18
West-2			25/10/19	18
West-1			25/10/19	18

Roost Inspections

4.2.5 Monthly inspections of Arch 1 and Arch 2 on the northern platform at Pill station were undertaken during the data logger deployments in 2019 and during a site visit in March 2020. An internal inspection of the arches to search for free-hanging horseshoe bats using a Clulite torch were undertaken on the following dates:

- 14th May 2019
- 11th June 2019
- 5th July 2019
- 9th August 2019
- 19th September 2019

- 7th October 2019
- 23rd March 2020

4.3 Data Analysis

Data Processing

4.3.1 The data loggers provided raw data in the form of individual lesser horseshoe or greater horseshoe echolocation calls recorded on sound files with a maximum duration of 15 seconds each. Sound files were analysed using the *Kaleidoscope Pro* software (version 5.1.9) to produce data giving the date, time, location and species of each bat echolocation call detected.

Bat activity index – "BAI"

4.3.2 Data logger data was used to produce a database of bat activity across the study site throughout the May - October 2019 study period, using the "acoustic activity index" method presented by Miller (2001). This method reduces the statistical 'noise' associated with the repeat recordings of bats that can occur when one or several bats remain in an area within range of a data logger and are subsequently recorded multiple times. Repeat recordings of the same individual can result in the incorrect interpretation that a greater number of bats are using a given area.

4.3.3 Statistical noise associated with repeat recordings was reduced by recording the presence or absence of bat activity using one-minute time intervals, as per Miller (2001). If one or more lesser or greater horseshoe bat echolocation calls was recorded within a one-minute interval, bat activity per minute for that species was set to "1". If no activity was recorded within a one-minute time interval, bat activity per minute for that species was set to "0".

4.3.4 A bat activity index (BAI) was calculated by summing the per-minute bat presence/absence of bat activity for each hour between sunset and sunrise of each night during the study period. Essentially, the BAI is the number of minutes within each hour that bat activity was recorded.

Statistical Testing

4.3.5 BAI was summed to assess visually the general characteristics of bat activity in lesser horseshoe or greater horseshoe bats between monitoring sites (S1 to S5) and between months. BAI was summed for each day to establish trends in bat activity across the study period for both species.

4.3.6 Statistical analysis was performed using the software *R* (v.3.4.3, R Core Development Team 2017). Due to low counts of greater horseshoe activity activity, statistical analysis was only performed for lesser horseshoe bats.

4.3.7 To establish if lesser horseshoe bat activity was significantly different between monitoring sites and between calendar months during the study period, a generalised linear model (GLM) was constructed using summed daily BAI as the response variable[8]. Explanatory variables included monitoring site and study month as independent categorical variables and the sampling period of each study day in hours as an independent continuous variable. Sampling period was not a variable of interest but was included to account for variation in the duration of the sampling period each night due to days become longer and shorter during the study period.

4.3.8 Not all data loggers functioned correctly for the entire study duration. Faulty data loggers were excluded from statistical analyses on days in which the faults occurred. Two faults occurred during the study, one as a result of battery power failure and the second a microphone fault due to damage caused by birds during the deployment.

4.3.9 Tukey's multiple comparisons tests were performed on the "month" and "monitoring site" using the "glht" package in R to determine significant differences between the factor levels of these categorical variables. P-values were adjusted using multiple testing procedures under free combinations (simply known as "free" adjustment) as proposed by Westfall *et al.* (1999).

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[8] BAI is count data and was found to be overdispersed, therefore a Quasipoisson error structure was specified in the model; this is a statistical correction when modelling data that has greater variability than assumed under assumed distribution.

4.3.10 To identify activity patterns at the daily and hourly timescales, BAI was summed and plotted for the appropriate timescale. Plots were examined and compared to determine if activity levels were consistent over time and if peaks in activity commonly occurred at the same time of night within each monitoring site, were continuous between monitoring sites and to identify day and night roosting behaviour.

4.4 Evaluation

4.4.1 In order to evaluate the importance of ecological features identified in the desk study and field surveys, a set of standard measures are outlined in CIEEM Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater and Coastal (CIEEM, 2016). For each site, habitat and species/assemblages, a summary grade is determined based on the levels of value recommended in the guidance. This places the importance of each feature in a geographical context, using the following hierarchy:

- International
- National (i.e. England)
- Regional
- County
- District (or Unitary Authority, City or Borough)
- Local (or Parish)
- Site – within the immediate zone of influence only (the development site and surroundings)

4.4.2 Where possible, formal criteria are used to set features of conservation importance within this geographical context. For example, the Guidelines for the Selection of Biological SSSIs (Nature Conservancy Council, 1989) can be used as a basis for the assessment of features at a National level. Similarly, published guidelines for the selection of SINCs (Sites of Importance for Nature Conservation) can be used as the basis for assessing features of county level importance.

4.4.3 The significance of bat populations has been determined using published data on their distribution and rarity at different geographical levels (CIEEM, 2016). For this assessment, reference has been made to:

- The UK Post 2010 Biodiversity Framework (published 2012);
- UK Biodiversity Action Plan[9];
- North Somerset Local Biodiversity Action Plan;
- Distribution Atlas of Bats in Britain and Ireland 1980-1999 (Richardson, 2000);
- Mammals of the British Isles Handbook (Harris and Yalden, 2008);
- The State of the UK's Bats: National Bat Monitoring Programme Populations Trends 2011 (www.bats.org.uk)

4.5 Deviations, Constraints and Limitations

4.5.1 The standardised data logger survey used fix point locations for monthly monitoring. The exact location for the dataloggers was determined by the availability of trees and structures on which to attach the units. The railway was monitored from a single vantage point and positioned to detect bats using the centre of the track and inner edge of vegetation within the rail corridor. The data logger units have omnidirectional microphones, but where bats may deviate from the railway track the units may not detect their echolocation calls.

4.5.2 It is acknowledged that using an activity index (BAI) as described in this appendix, Section 4.3 manipulates the raw data. Grouping data in this way to eliminate repetition of bat calls from the same bat, which causes 'noise', has the potential to reduce the resolution of the data. Finding the optimum balance in the trade-off between reducing noise and maintaining reasonable data resolution is difficult in the absence of a measure of "true" bat activity. Miller (2001) uses a grouping interval of one minute, and this is used for this report. Based on bat observation experience of the author of this report, one minute is a suitable interval to reduce the effect of repeat recordings whilst minimising the data loss of real bat activity.

4.5.3 A second issue with the use of an activity index is that, using these data alone, it is not possible to determine the different behaviours being used by bats and therefore determine the relevance of a given location (e.g. for feeding versus

[9] The UK BAP has been superseded by the UK Post-2010 Biodiversity Framework, but many of the tools developed under UK BAP remain of use, including background information about the lists of priority species.

commuting). This study distinguished areas with potential foraging opportunities based on habitat appraisal for lesser and greater horseshoe bats to help interpret the likely behaviour of bats.

4.5.4 The data loggers were deployed all season. They were left out on site for the duration of the study period (May to October) with monthly checks to change the batteries and microphone calibration, and replace faulty microphones as required. Sampling effort varied between data logger monitoring locations because of differences in battery life, and the occasional loss of data collection due to a microphone fault (see **Table 2**). This variation in sampling effort has been taken into account when analysing the results. The BAI has been standardised by the sampling effort (summed BAI divided by total sampling effort in hours at each location) in order to show bat activity patterns. This is discussed in the results **Section 5.2** of this appendix.

4.6 Personnel

4.6.1 The study was conducted by Anton Kattan MCIEEM a consultant ecologist registered with Natural England to use Class 2 survey licences. Anton Kattan has 20 years of professional experience and has specialist knowledge and training in bat ecology and survey. Data analysis was undertaken by Dr. Benedict Godsall, a consultant ecologist with a research background in small mammal populations.

5 Results

5.1 Pill Station Bat Roost Monitoring

5.1.1 The two stone arches on the northern platform at Pill station are used by a low number of lesser horseshoe bats as a day roost and by both lesser and greater horseshoe bats for night roosting.

5.1.2 The presence of a lesser horseshoe bat day roost and greater horseshoe night roost in the arches on the northern platform of Pill station was identified by surveys in 2016. Lesser horseshoe and greater horseshoe night roost activity was recorded in July 2016. A data logger deployed inside the arches confirmed there was regular bat activity within Arch 1 and Arch 2 by both species. The results of the night roost monitoring are summarized in **Table 3** and results of the day roost counts are in **Table 4**.

Table 3. Records of Lesser and Greater Horseshoe Bat Activity in the Arches at Pill Station in 2016

Species	Location	Dates Species Recorded (2016)	No. of Days with Diurnal Activity	No. of Nights with Nocturnal Activity
Lesser horseshoe	Arch 1	18 - 22 July	5	4
	Arch 2	19 - 21 July	3	1
Greater horseshoe	Arch 1	20 July	0	1
	Arch 2	20, 22, 23 July	0	3

5.1.3 The lesser horseshoe bat day roost was monitored in 2019 with monthly daytime roost inspections (May – October) and in early 2020. Records of lesser horseshoe bats day roosting in the arches are given in **Table 4**. The data confirms both arches are utilised, but the larger Arch 1 appears to be the favoured day roost location.

Table 4. Roost Counts of the Number of Lesser Horseshoe Bats Present in Arches 1 and 2 on the Northern Platform at Pill Stations

Date	Arch 1	Arch 2
18 July 2016	1	0
28 September 2016	0	1
14 May 2019	0	0
11 June 2019		0
5 July 2019	1	1
9 August 2019	2	0
19 September 2019	1	0
7 October 2019	1 (torpid)	0
23 March 2020	0	0

5.2 Lesser Horseshoe Bat Activity Surveys 2019

5.2.1 The following analysis of results can be read with reference to the graphs provided in **Appendix A**.

General Characterisation of Spatial-temporal Patterns of Lesser Horseshoe Bat Activity

5.2.2 Lesser horseshoe bat activity, when summed across the total study period, was found to be greatest at the East-1 location, in spite of over 600 hours less recording time than all other data logger locations. The location with the second highest level of lesser horseshoe bat activity was the Platform. West-1 and West-2 had the lowest levels of lesser horseshoe bat activity. The results are shown on **Graph 1**.

5.2.3 **Graph 2** shows the same data, but in this case BAI has been standardised by the sampling effort (summed BAI divided by total sampling effort in hours at each location) in order to show the spatial activity patterns when the variation in sampling effort is taken into account. The ranking of sampling locations remains the same when BAI is standardised as it is when BAI is summed across the study period, but there is a relative increase in lesser horseshoe bat activity at the East-1 location.

Comparison of Relative Levels of Bat Activity between Datalogger Monitoring Locations

Most activity East-1→Platform →East-2 →West-2 → West-1 Least Activity

5.2.4 The results of the statistical analysis for variation in lesser horseshoe bat activity between monitoring sites are given in **Appendix B**. Significant differences in lesser horseshoe bat activity were found between all five monitoring locations. The monitoring locations can therefore be ranked in terms of lesser horseshoe bat activity (when considering the study period as a whole) in the same order as shown on **Graphs 1 and 2**.

5.2.5 **Graph 3** shows the standardised BAI for each month. When sampling effort variation was taken into account, June was shown to have the highest level of lesser horseshoe bat activity relative to other months, followed by May. July to September all had comparable levels of lesser horseshoe bat activity.

5.2.6 The results of the statistical analysis for variation in lesser horseshoe bat activity between months are given in **Appendix B**. No statistical significant differences in lesser horseshoe bat activity were found between any study months when the study area was considered as a whole.

Temporal Variation in Lesser Horseshoe Bat Activity at each Monitoring Location

Monthly timescale

5.2.7 Graphs **4 and 5** show lesser horseshoe bat activity at the month timescale at each sampling location separately. **Graph 4** shows the summed BAI, and **Graph 5** the standardised BAI. Standardising BAI by sampling effort did not lead to significant changes in the relative lesser horseshoe bat activity between months, except for the East-2 location, discussed below.

5.2.8 The greatest lesser horseshoe bat activity was recorded at the Platform location in June. Similar to this was lesser horseshoe bat activity at the East-1 location in August and September. At the Platform location, May and July had moderate levels of lesser horseshoe bat activity, while August-October were low. At East-1, October also showed relatively high levels of activity, with low levels in May and June (and no recorded data in July due to a technical fault).

5.2.9 East-2 had reasonable consistent low-moderate levels of lesser horseshoe bat activity across the study period with a notable drop in activity in August. September had the highest number of lesser horseshoe bat recordings, but when sample size was accounted for, May was shown to have the highest relative activity. West-2 had low levels of activity throughout the study period, with peaks in July and October, and lowest activity in May and September. West-1 had very low activity in each month.

Daily timescale

5.2.10 Plotting BAI at the daily time scale shows the consistency of use by lesser horseshoe bats at each of the monitoring locations.

5.2.11 Across the study site as a whole (**Graph 6**) lesser horseshoe bat activity was recorded on all but three days throughout the entire study period.

5.2.12 The Platform location (**Graph 7**) had the second highest recorded bat activity of the five monitoring locations. Daily lesser horseshoe bat activity was consistent but at low or very low levels throughout the study period. Typically, lesser horseshoe bat activity was recorded for fewer than 10 one-minute intervals during a night, with activity increasing above this level during several nights in May and June.

5.2.13 The highest recorded lesser horseshoe bat activity occurred at East 1 (**Graph 8**). In this location there was a logger fault throughout the latter half of June, July and early August. In May, lesser horseshoe bat activity was low and varied. In August, September and October, activity was more consistent and often over 10 one-minute intervals per night.

5.2.14 At the East-2 location (**Graph 9**), daily activity was frequent but very low during May, June and July. During August and September daily activity was sparse, until the end of September when daily activity became more frequent and at higher levels. October had consistent low levels of lesser horseshoe bat activity on a daily basis.

5.2.15 West-1 (**Graph 10**) had sporadic, very low levels of lesser horseshoe bat activity across the study period, with little evidence of sustained use by lesser horseshoe bats. At West-2 (**Graph 11**), lesser horseshoe bat activity occurred in distinct bouts numbering from 3 – 30 days with gaps of several days or weeks in between, possibly suggesting temporary roosting by a low number of lesser horseshoe bat during extended foraging bouts.

<u>Hourly timescale</u>

5.2.16 The results presented in **Table 5** provide a description of generalised patterns of nightly lesser horseshoe bat activity in each month at each monitoring location shown on **Graphs 12-16** To produce these, the BAI of each hour was summed across study nights in each calendar month for each monitoring location[10].

[10] The graphs of nightly lesser horseshoe bat activity have not been included in this report, but can be made available on request.

Table 2: Summary of Generalised Nightly Lesser Horseshoe Bat Activity Patterns.

Location	Month	Activity summary
Platform *(Graph 12)*	May	Peaks in activity during the hour after sunset, between midnight and 1am, and an hour before sunrise. Drop-off in activity between these times.
	June	Moderate and consistent levels of activity in the first 3 hours after sunset, increasing to peak activity levels between 1am – 4am, dropping off an hour before sunrise.
	July	Low activity with small peaks approximately 2 hours after sunset and 2-3 hours before sunrise.
	August	Low activity, slightly higher between 1am-4am, or 2-4 hours before sunrise
	September	Low activity with small peaks 2 hours after sunset and 1 hour before sunrise.
	October	Low activity, mostly occurring in the first two hours after sunset.
East-1 *(Graph 13)*	May June July August September	Fairly consistent pattern of peak activity occurring around sunset or within the first 2 hours after sunset, then activity declines before another peak 1-2 hours before sunrise.
	October	Peak activity within an hour of sunset, after which activity declines.
East-2 *(Graph 14)*	May June July August September October	Typical pattern of peak activity in the first 1-2 hours after sunset, followed by a decline to low levels. August had very little and sporadic activity.
West-1 *(Graph 15)*	May	No or very little activity in the first 6 hours after sunset. Activity increases to low level in the 2 hours before sunrise.
	June	No or very little activity in the first 5 hours after sunset. Activity increases to low level in the 2 hours before sunrise.

Location	Month	Activity summary
	July	Very low activity with very small, almost negligible peak between 1am – 3am.
	August	Small peaks in low activity in the hour after sunset and hour before sunrise.
	September	Low and sporadic activity, no pattern.
	October	
West-2 *(Graph 16)*	May	Low and sporadic activity, no pattern.
	June	Negligible activity until a peak 1-2 hours before sunrise.
	July	Reasonably consistent low-moderate activity from 1 hour after sunset to 1 hour before sunrise.
	August	Low and sporadic activity, no pattern.
	September	
	October	Low activity with small peaks 1 hour after sunset and 3 hours before sunrise.

5.3 Greater Horseshoe Bat Activity Surveys 2019

General Characterisation of Spatial-temporal Patterns of Greater Horseshoe Bat Activity

5.3.1 Greater horseshoe bat activity, when summed across the total study period, was found to be greatest at the East-2 location by a large difference (**Graph 17**). The location with the second highest level of greater horseshoe bat activity was West-1, which was comparable with Platform. East-1 had the lowest level of greater horseshoe bat activity. **Graph 18** shows the standardised BAI - when the variation in sampling effort was taken into account. The ranking of sampling locations remains the same when BAI is standardised as it is when BAI is summed across the study period.

5.3.2 Due to low greater horseshoe bat activity and the clear difference in greater horseshoe bat activity between East-2 and all other monitoring locations, statistical analysis was not performed on this data set.

5.3.3 **Graph 19** shows the standardised BAI for each month. When sampling effort variation was taken into account, May was shown to have the highest level of greater horseshoe bat activity relative to other months, followed by June and

July. August and September had comparably low levels of greater horseshoe bat activity, with October still having the lowest level.

5.3.4 No statistical analysis was performed on the greater horseshoe data set.

Temporal Variation in Greater Horseshoe Bat Activity at each Monitoring Location

Monthly timescale

Graph 20 shows the standardised BAI. The greatest greater horseshoe bat activity was recorded at the East-2 location in June, followed by May and July at the same location. Activity levels at East-2 were very low in August and October, with higher (but still low) greater horseshoe bat activity in September.

5.3.5 East-1 had very low levels and a datalogger fault in the latter half of June, all of July and early August, therefore no data was recorded in July.

Daily timescale

5.3.6 Plotting BAI at the daily time scale shows the consistency of use by greater horseshoe bats of each of the monitoring locations.

5.3.7 Across the study site as a whole (**Graph 21 and 22**) greater horseshoe bat activity was most consistent in May, the second half of June and mid-late July. August and September had many days in which no greater horseshoe bat activity was recorded at any monitoring site, and October only had a single day of greater horseshoe bat recording.

5.3.8 The Platform location (**Graph 23**) was barely used by greater horseshoe bat at all during the study period.

5.3.9 East-2 (**Graph 24**) had the highest recorded greater horseshoe bat activity of all five monitoring sites. This activity occurred in May, June and July, with the greatest concentration of activity occurring in late May/early June. With the exception of a few days of very low activity in late September, the East-2 location was hardly used at all by greater horseshoe bat during August-October.

5.3.10 East-1 (**Graph 25**), West-1 (**Graph 26**) and West-2 (**Graph 27**) were hardly used by greater horseshoe bat throughout the study period, with any recorded activity at these locations being sporadic and very low intensity.

Hourly timescale

5.3.11 The greater horseshoe nightly activity had a clearer pattern, which was also similar between monitoring locations. Greater horseshoe bat activity was typically greatest in the middle of the study nights between midnight and 3am, with little or no activity outside of these times.

5.3.12 **Graphs 28 -32** show the generalised patterns of nightly activity in each month at each monitoring location. To produce these, the BAI of each hour was summed across study nights in each calendar month for each monitoring location.

6 Discussion

6.1.1 Lesser horseshoe bat activity at Pill station appears to predominantly be associated with roost behaviour. The roost is occupied throughout the year by low numbers of bats. The activity data shows a clear peak in activity at the Platform in June, with moderate levels in May and July suggesting summer roosting. The East-1 location has the highest levels of recorded lesser horseshoe activity within the study area and this may be from bats flying around the roost, possibly using the shelter of Pill Station overbridge as a flight area. Most months showed some peak in activity occurring at the beginning or end of the night, when bats are likely to be in close proximity to their roost. In June, peaks of lesser horseshoe activity during the night (1am-4am) may be associated with night roosting.

6.1.2 Lesser horseshoe bat activity is significantly and consistently greater to the east of Pill Station compared to the west. This indicates there is greater habitat availability and quality to the east of Pill station. As discussed in this appendix Section 6.1.1, there is some evidence to suggest that some of the lesser horseshoe bat activity at East-1 and East-2 may be associated with the roost at Pill station. It is also possible that there is connectivity with population areas to the east, such as the Avon Gorge. However, lesser horseshoe activity across the whole study site was fairly consistent each month, and there were no seasonal peaks in activity to suggest a wider landscape function (such as movement between hibernation sites and breeding areas (in spring/ autumn), or foraging activity associated with 'Core Sustenance Zones'.

6.1.3 The BAI does not distinguish between different types of behaviour, but by looking at trends and patterns in the spatial and temporal differences between data logger monitoring locations these data indicate that activity at, or close to Pill Station, is not strongly associated with the disused railway line, which is an important corridor for bats with movement between the line and Brockley Hall Stables SSSI, a link with the North Somerset and Mendip Bats SAC. Whilst there is likely to be some movement from the wider area, much of the lesser horseshoe bat activity appears to be localised around the station. Monitoring locations to the west recorded much lower levels than the patterns of lesser horseshoe activity at the Platform. West-1, which is closest to the disused railway line, had the lowest amount of lesser horseshoe bat activity of any of the monitoring locations (with the very low lesser horseshoe bat activity being consistently low across the months). Furthermore, there are no obvious similarities in patterns of nightly lesser horseshoe activity between the Platform, East-1 and West-1 to indicate bats are moving past these points in a way that would suggest it was a significant commuting route.

6.1.4 Greater horseshoe bat activity in the study area is intrinsically low, indicating there is limited habitat functionality for this species. Pill Station platform is scarcely used and activity is predominantly at the eastern periphery of the study area. There is a seasonal peak in activity between May and July, with nightly activity being between midnight and 3am (which is outside roost emergence times). Night roosting at Pill Station appears to be infrequent. There is very little evidence of movement along the railway line, and Pill Station does not appear to be on an important commuting route. The study area may be at the periphery of more significant greater horseshoe habitats to the east.

6.1.5 In conclusion, maintaining connectivity between the Pill Station and land to the east is the most important consideration when designing mitigation. This is integral for retaining roost flight lines for lesser and greater horseshoe bats. Whilst maintaining connectivity along the railway line for commuting bats should not be entirely discounted, this study concludes mitigation should focus on maintaining the viability of the roost on the northern platform. The overall importance as a roost habitat and linear landscape feature for bats is of value at a **local level.**

References

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Wray S., Wells D., Long E., Mitchell-Jones T. (2010). *Valuing Bats in Ecological Impact Assessment.* In Practice (70). p23-25. IEEM.

Figure 1. Survey Area

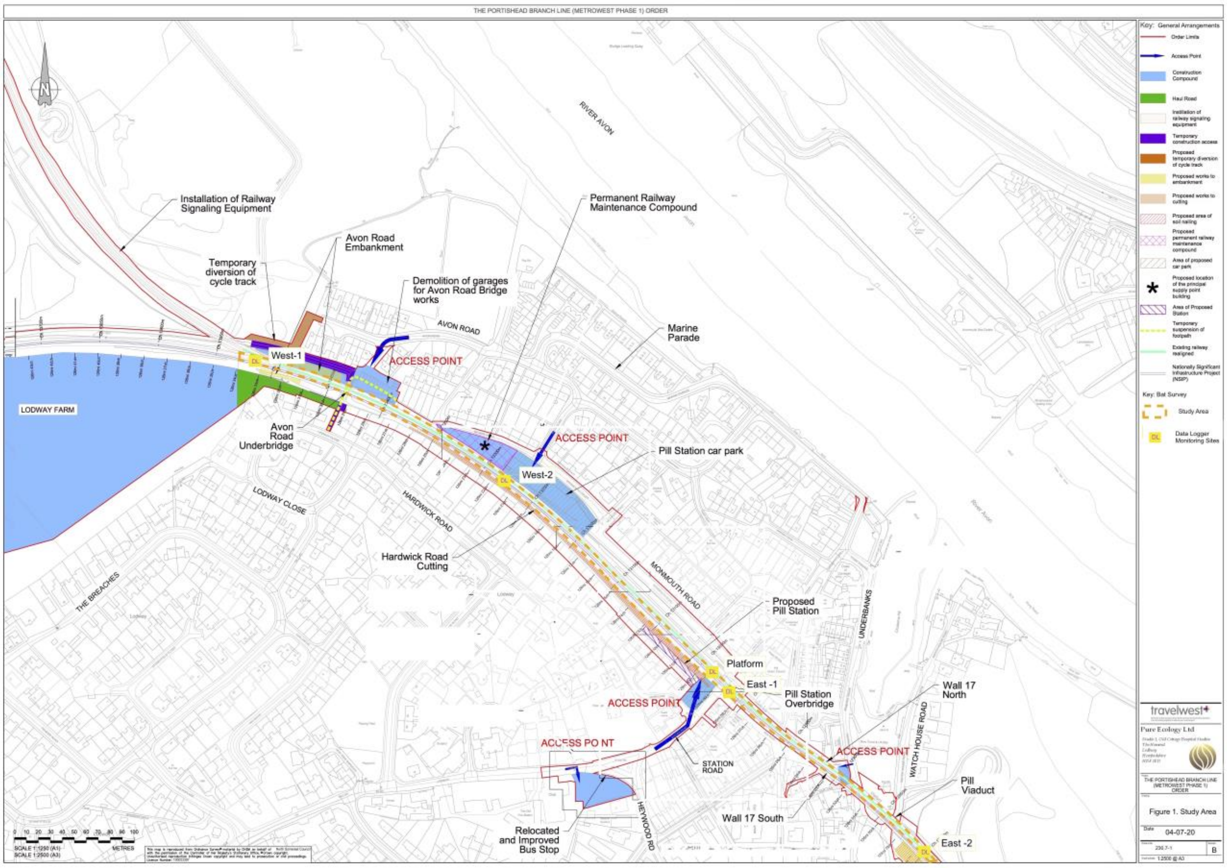
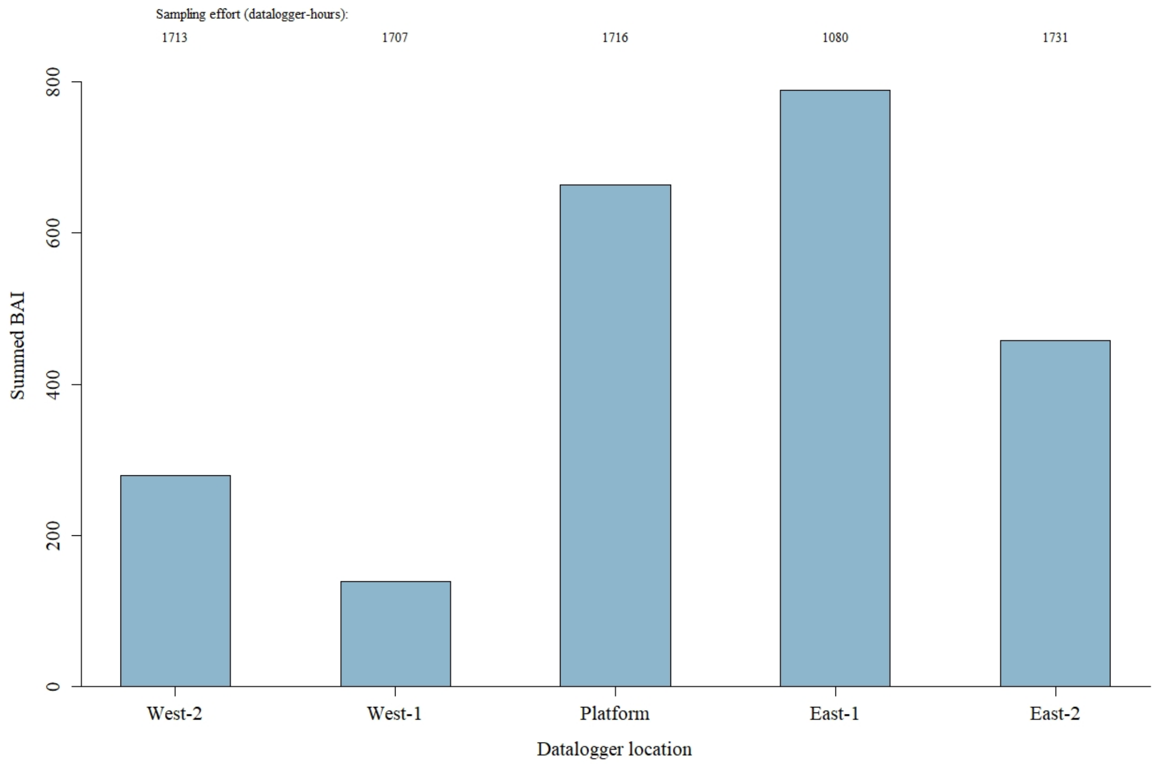


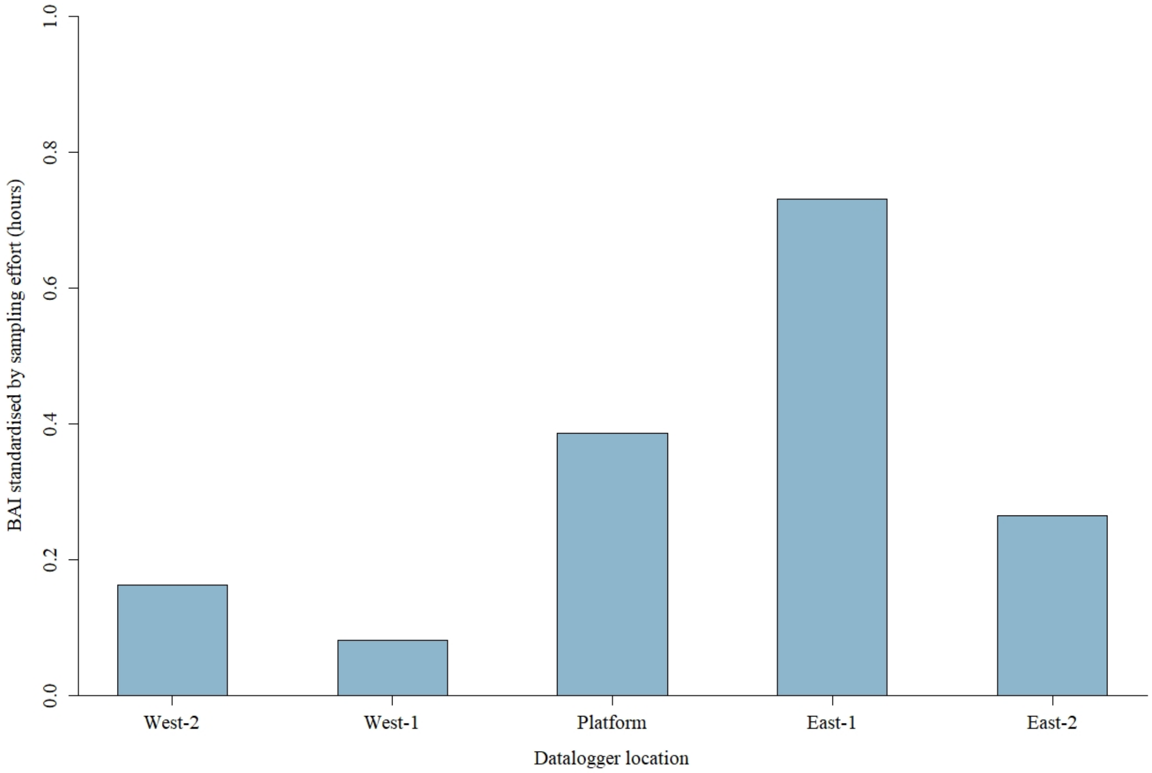
Figure 2. Pill Station Arches

Appendix A. BAI Analysis of 2019 Lesser and Greater Horseshoe Bat Surveys

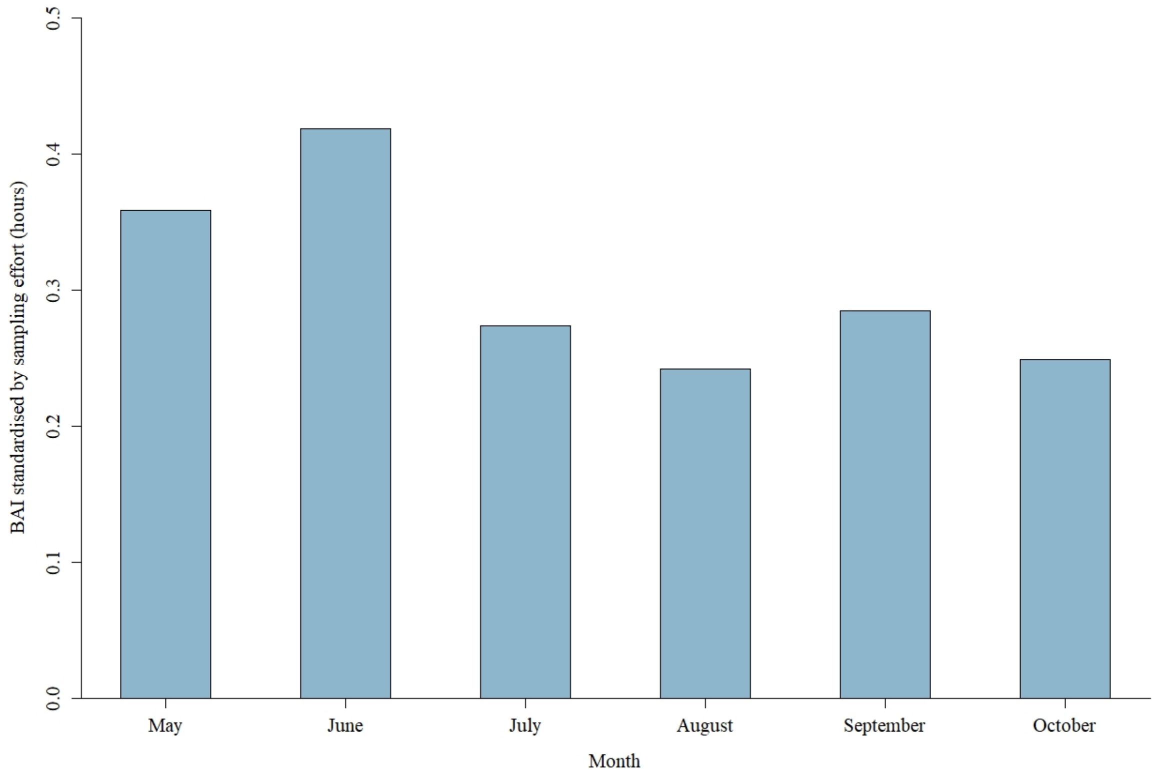
Lesser Horseshoe Bat



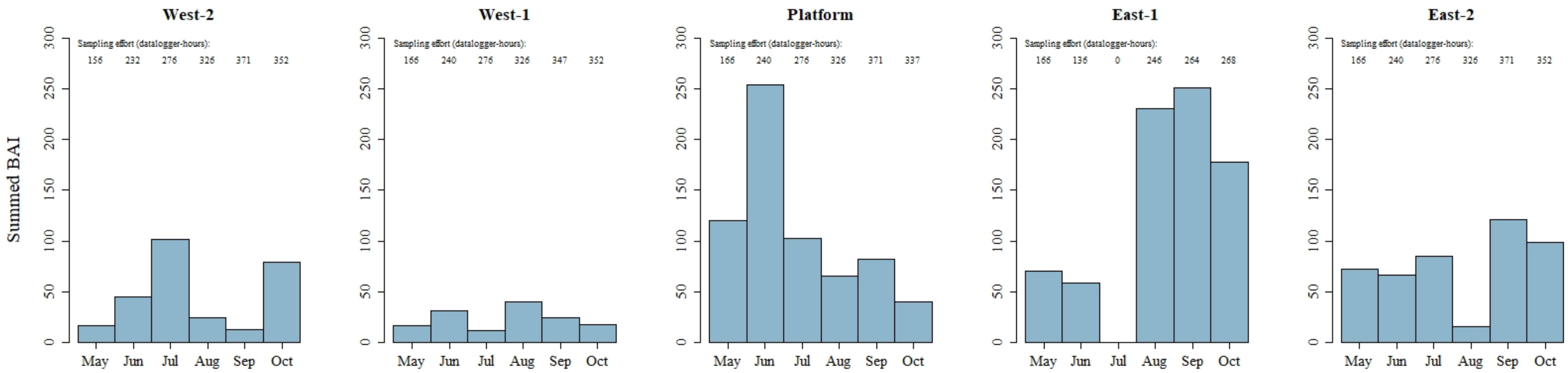
Graph 1: Lesser Horseshoe BAI summed across the whole study period for each datalogger location.



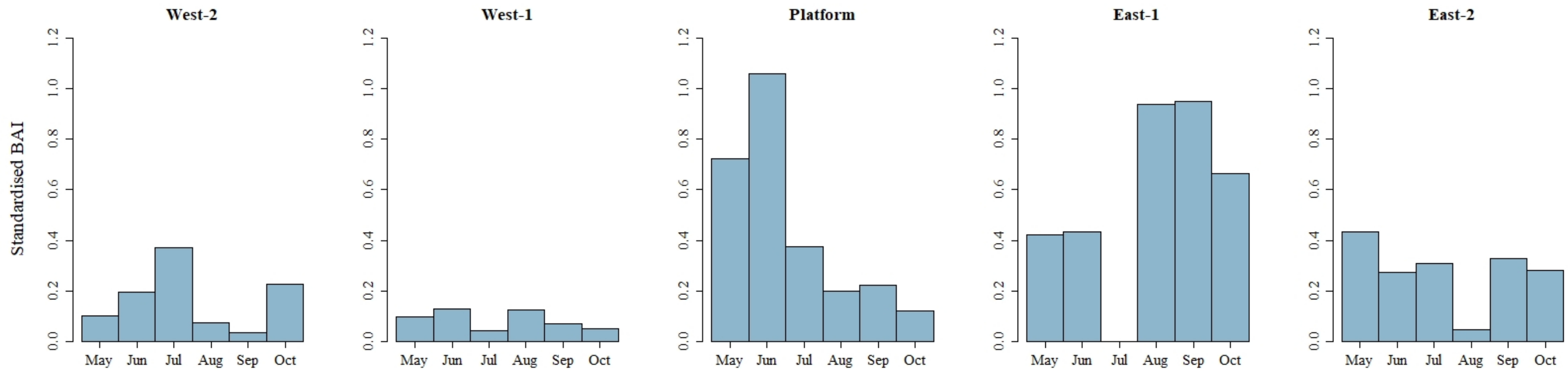
Graph 2: Standardised BAI (summed BAI/sampling effort) for Lesser Horseshoe bats over the total study period at each data logger location.



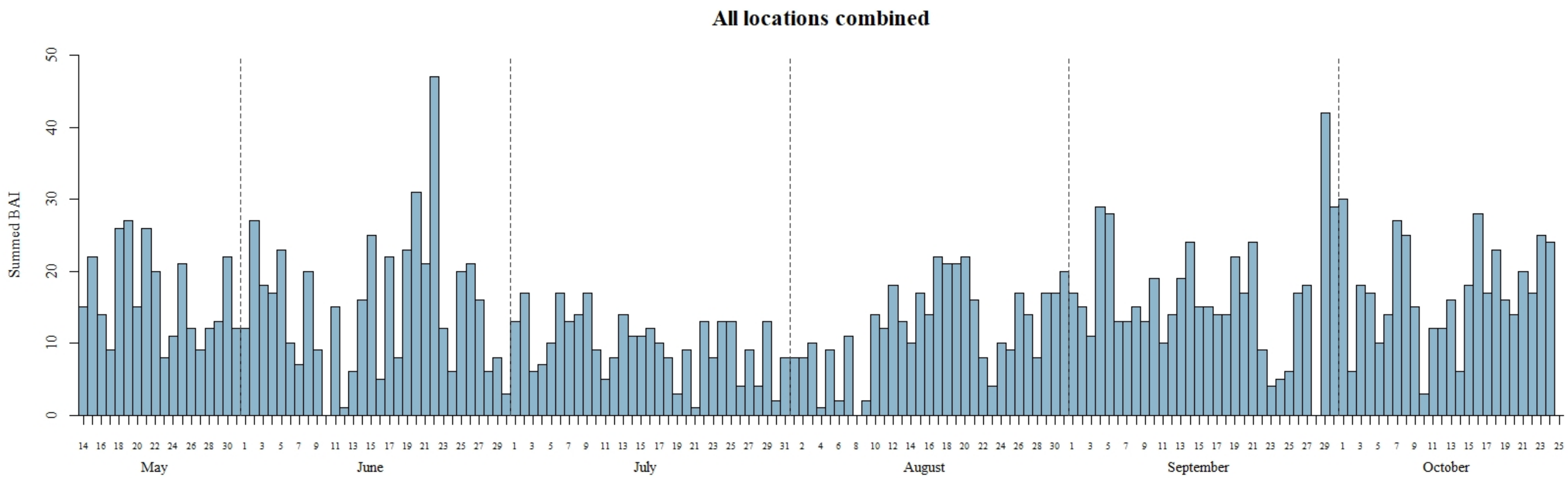
Graph 3: Standardised Lesser Horseshoe BAI (summed BAI/sampling effort) across all sampling locations for each month



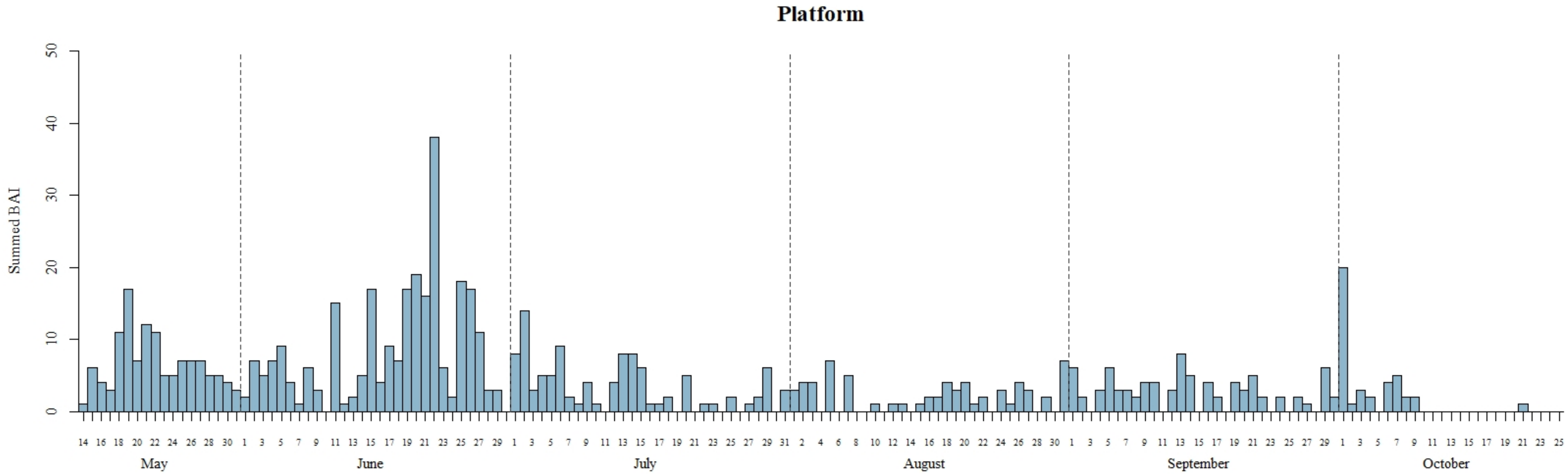
Graph 4: Lesser Horseshoe BAI summed for each month at each sampling location.



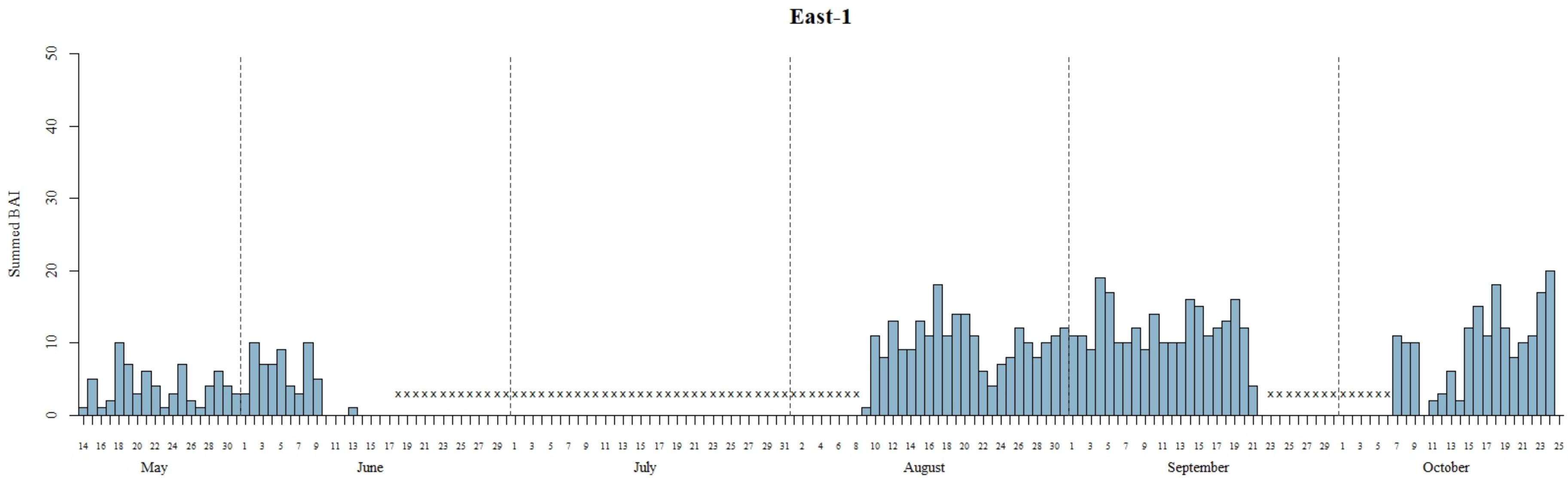
Graph 5: Lesser Horseshoe BAI standardised by sampling effort for each month at each sampling location.



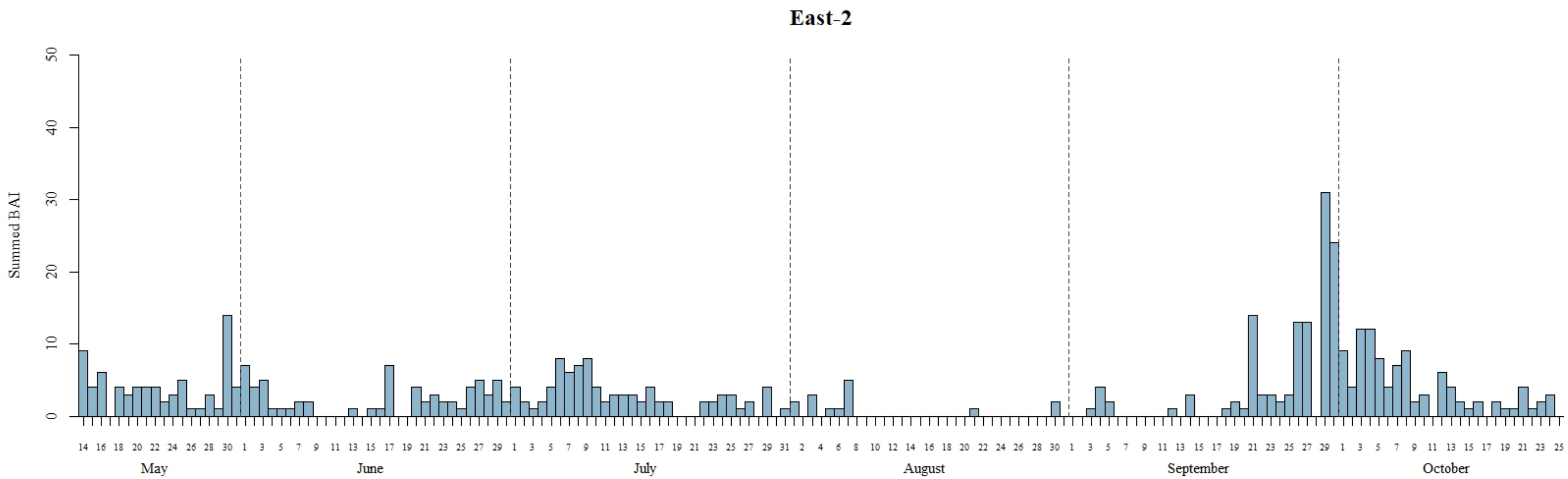
Graph 6: Summed daily Lesser Horseshoe BAI for all monitoring locations combined



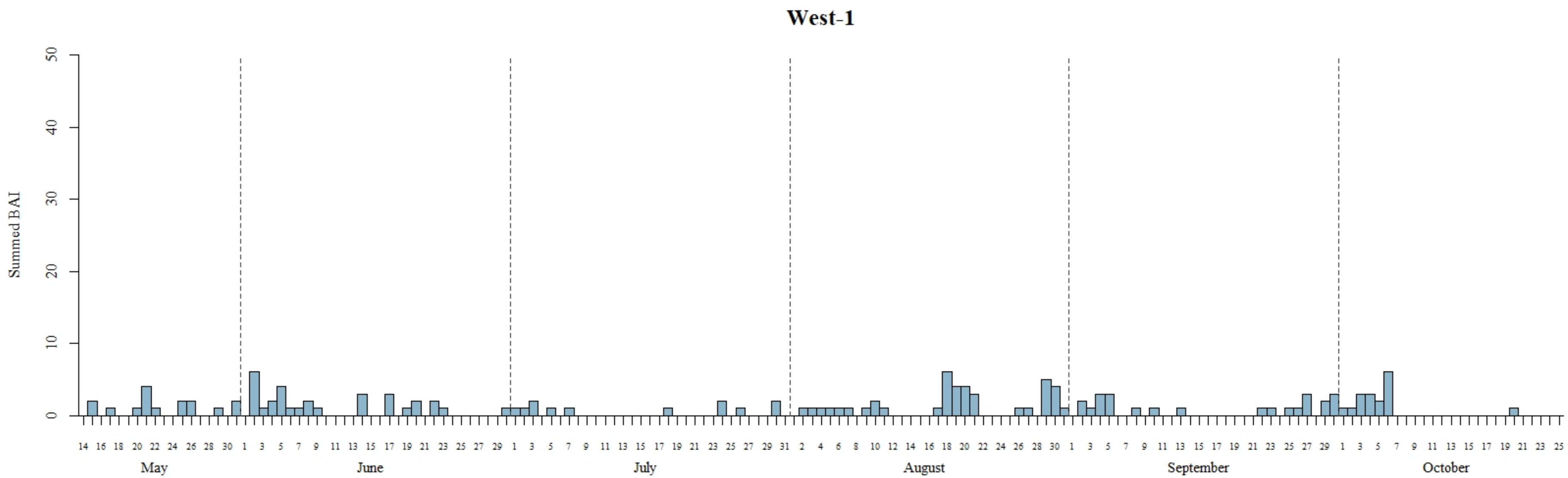
Graph 7: Summed daily Lesser Horseshoe BAI for the Platform location



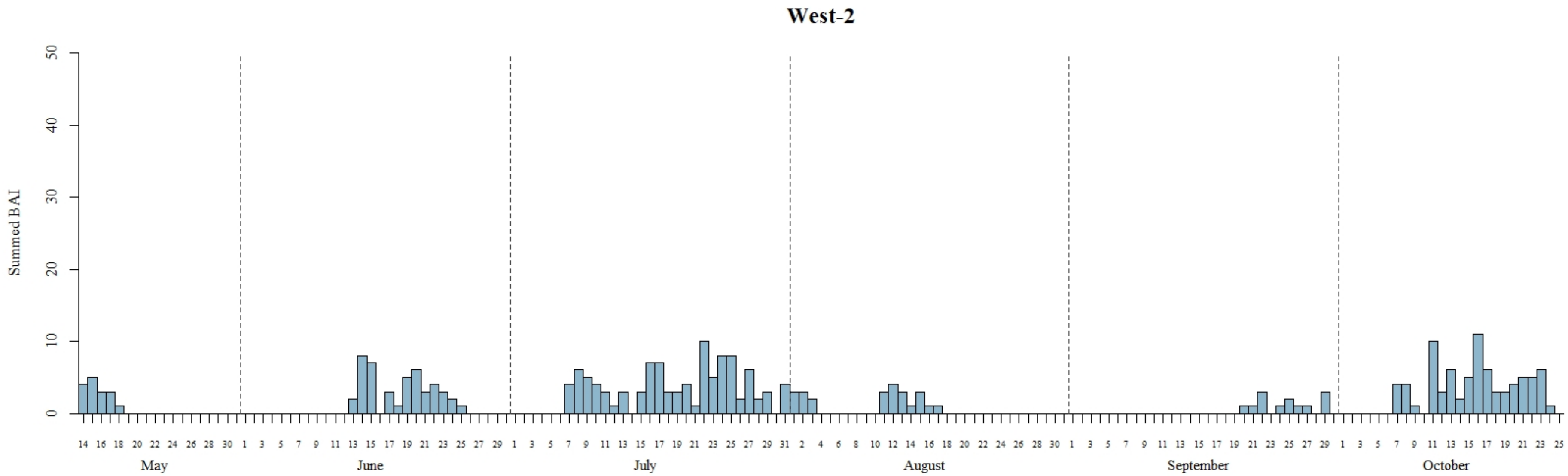
Graph 8: Summed daily Lesser Horseshoe BAI at the East-1 location. Days marked with an 'X' indicate a fault with the datalogger as a result of which no data was recorded.



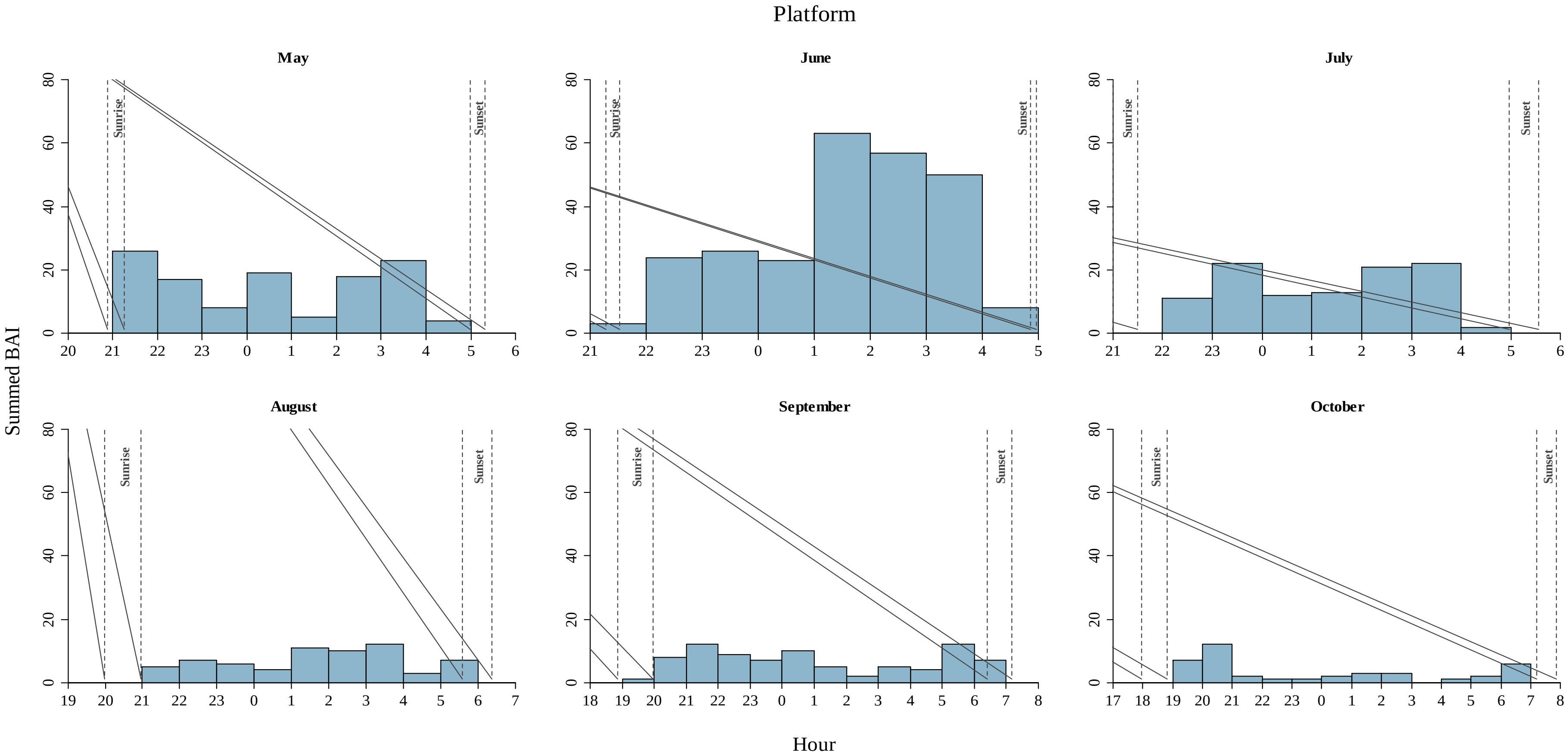
Graph 9: Summed daily Lesser Horseshoe BAI at the East-2 location.



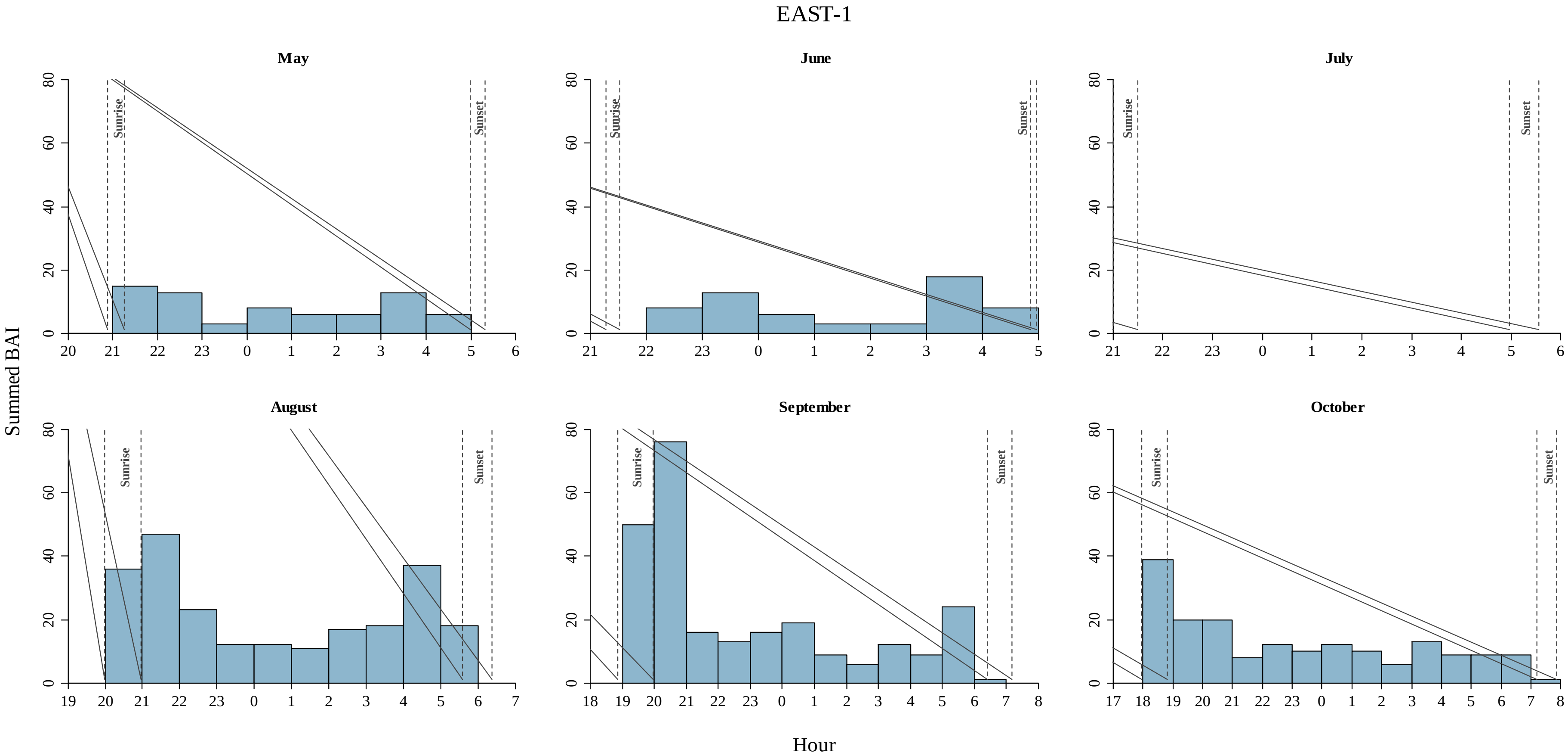
Graph 10: Summed daily Lesser Horseshoe BAI at the West-1 location.



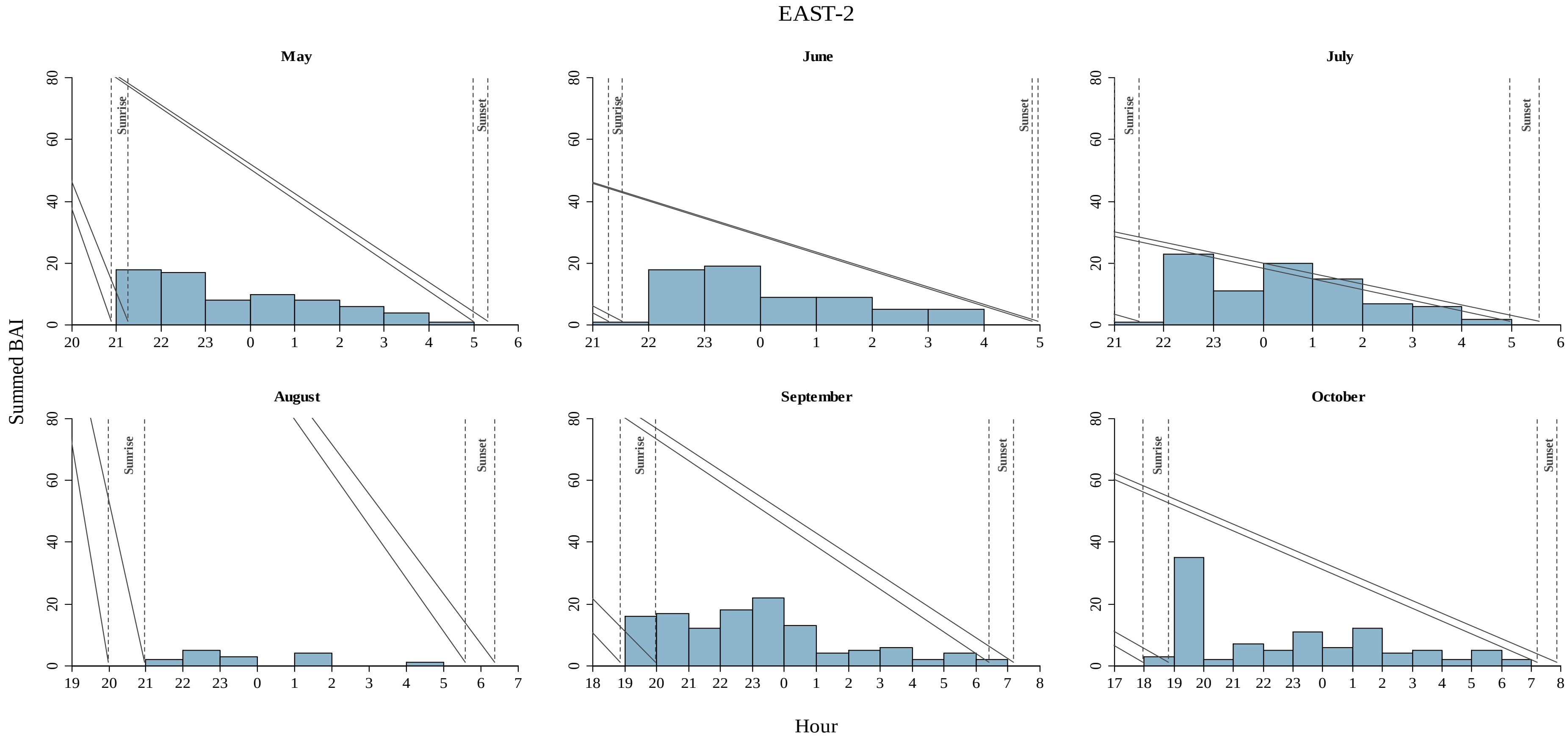
Graph 11: Summed daily Lesser Horseshoe BAI at the West-2 location.



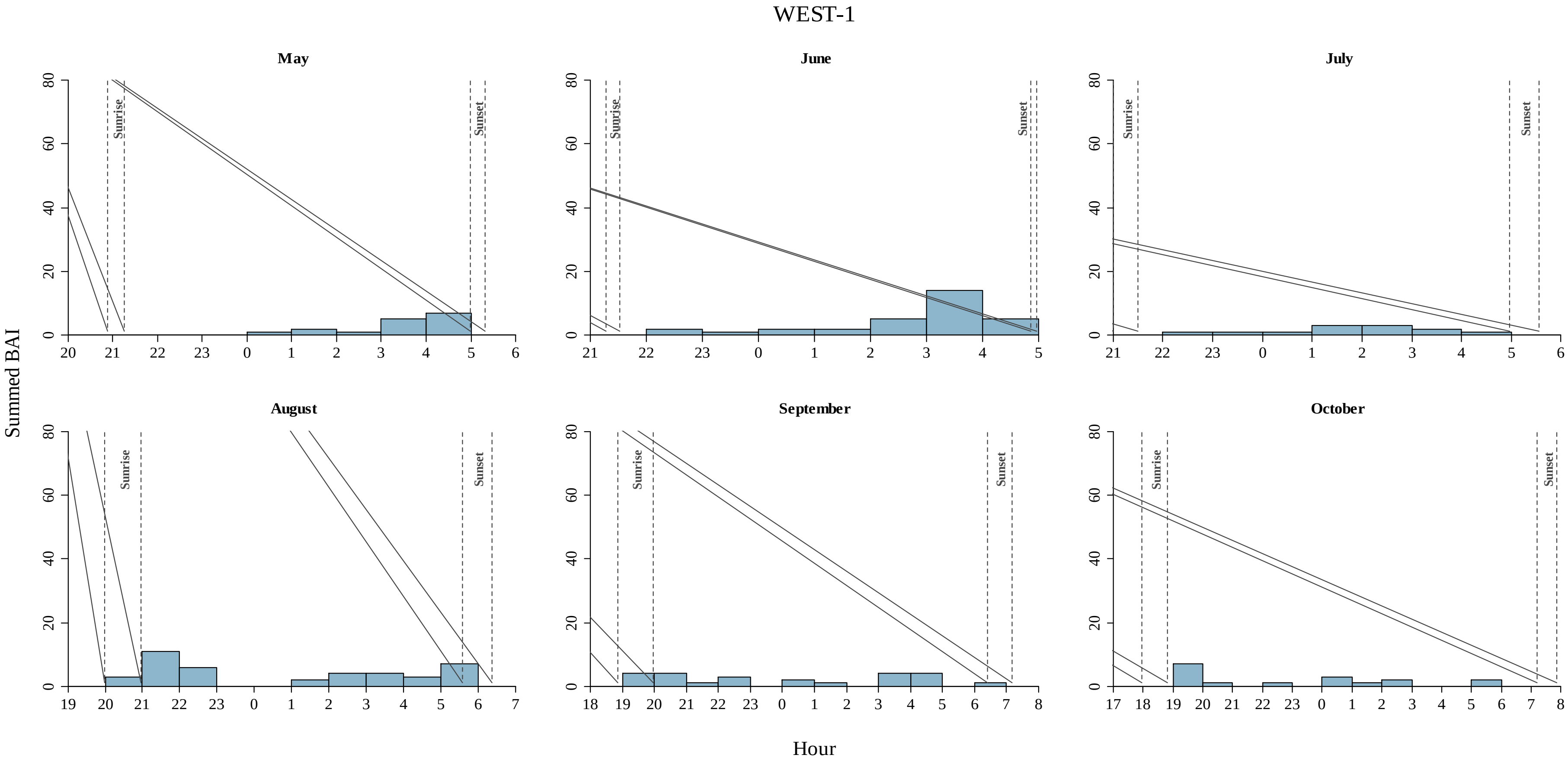
Graph 12: Lesser Horseshoe BAI for each hour summed across all the study nights in each month for the Platform location. Dashed vertical lines show the range of sunset and sunrise times within each calendar month.



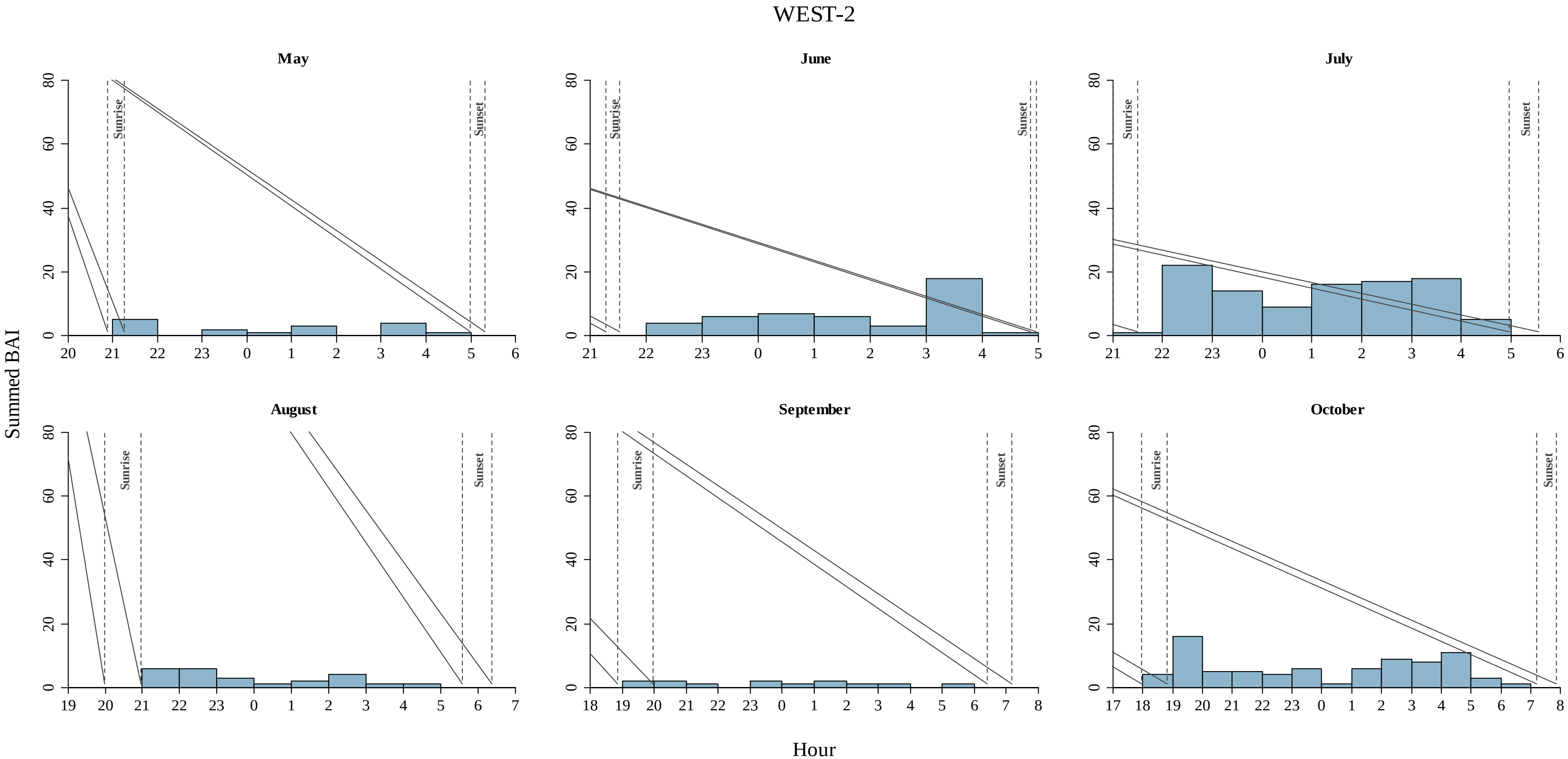
Graph 13: Lesser Horseshoe BAI for each hour summed across all the study nights in each month for the EAST-1 location. Dashed vertical lines show the range of sunset and sunrise times within each calendar month



Graph 14: Lesser Horseshoe BAI for each hour summed across all the study nights in each month for the EAST-2 location. Dashed vertical lines show the range of sunset and sunrise times within each calendar month

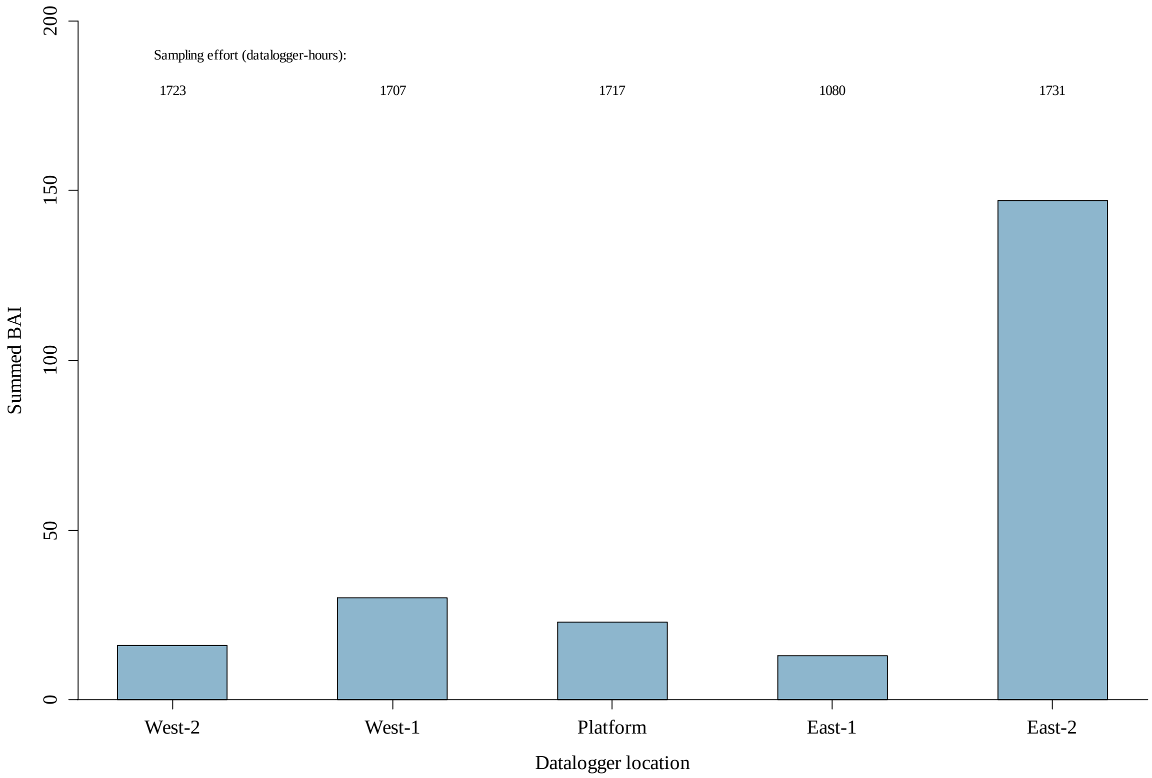


Graph 15: Lesser Horseshoe BAI for each hour summed across all the study nights in each month for the West-1 location. Dashed vertical lines show the range of sunset and sunrise times within each calendar month.

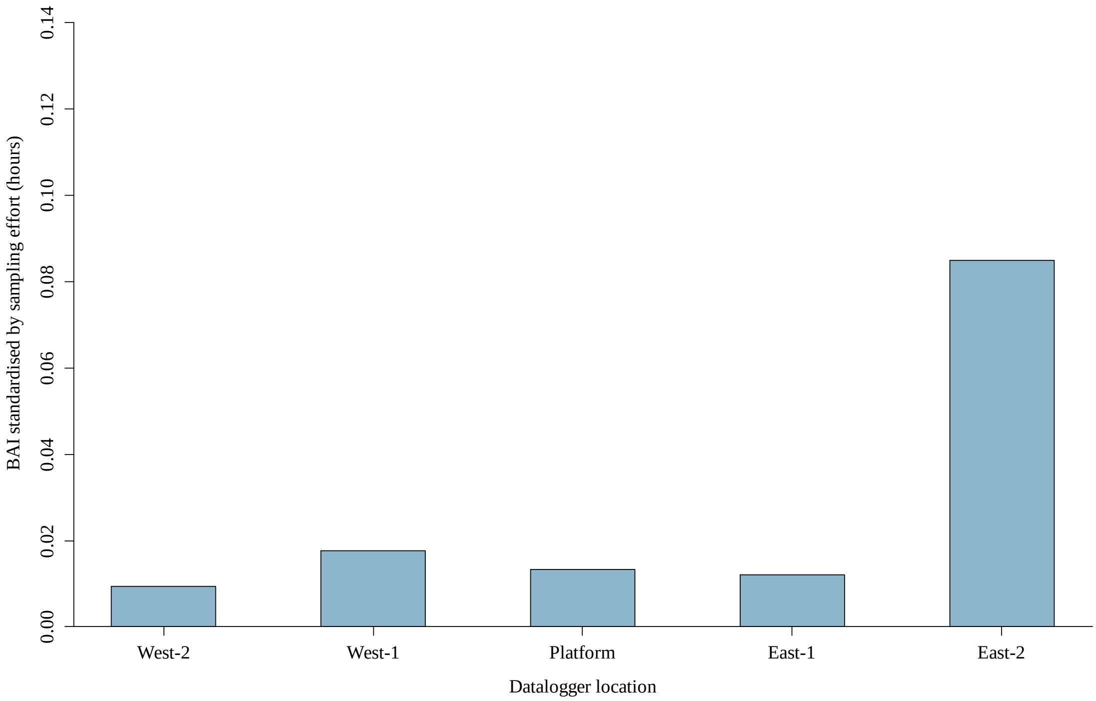


Graph 16: Lesser Horseshoe BAI for each hour summed across all the study nights in each month for the West-2 location. Dashed vertical lines show the range of sunset and sunrise times within each calendar month.

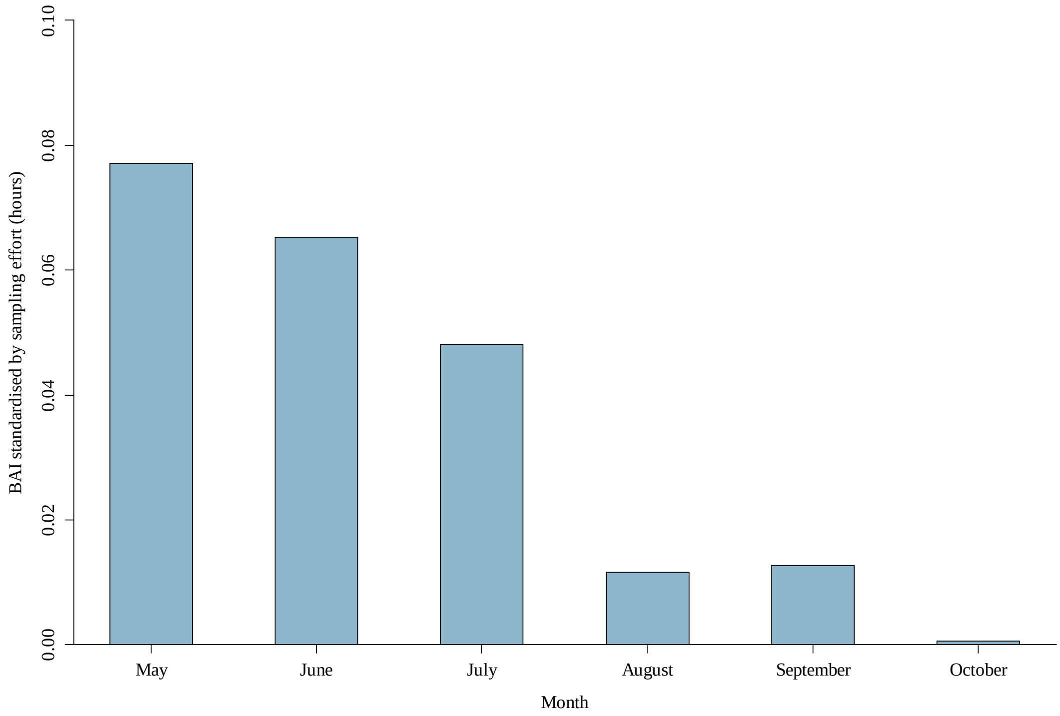
Greater Horseshoe Bat



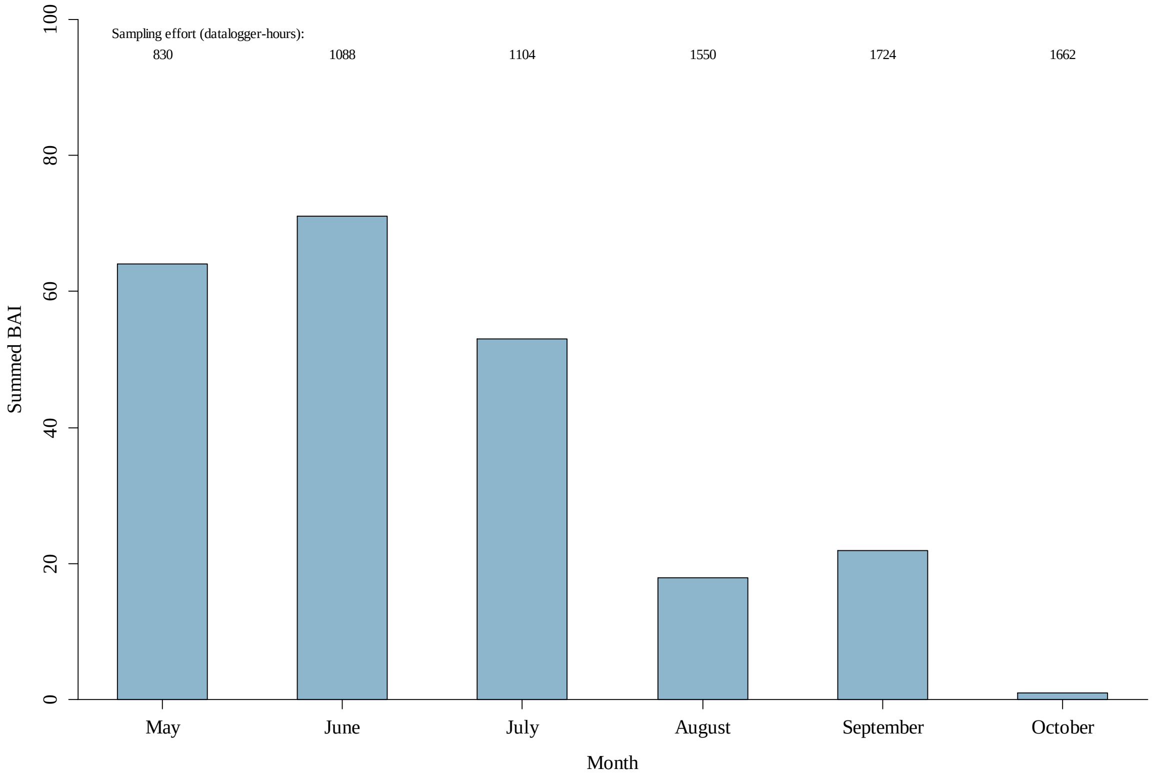
Graph 17: Greater Horseshoe Bat Activity Index summed across the whole study period for each datalogger location. Note: the sampling effort was >600 hours less for the East-1 location than other data logger locations



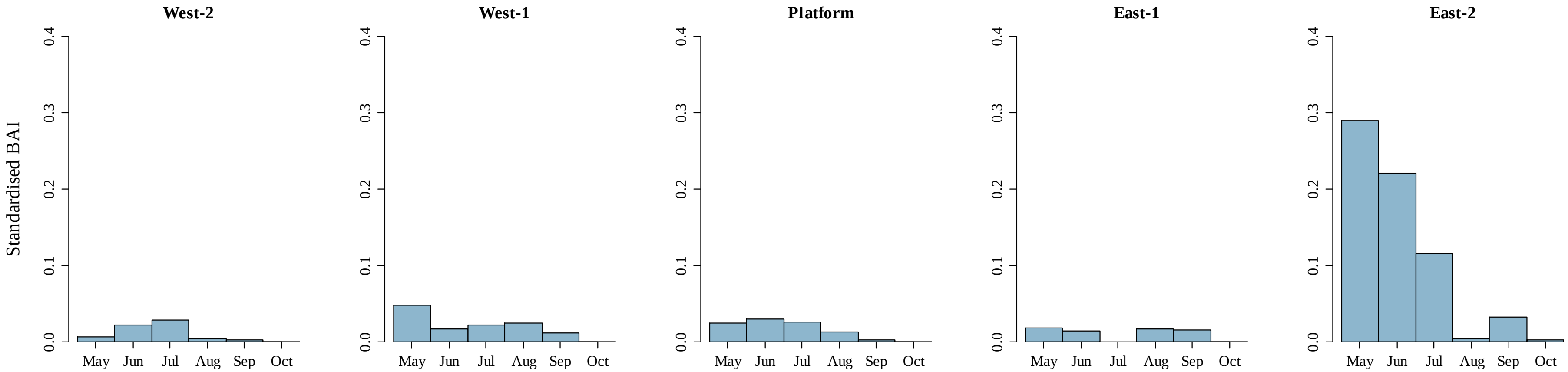
Graph 18: Standardised Greater Horseshoe BAI (summed BAI/sampling effort) for the total study period at each data logger location.



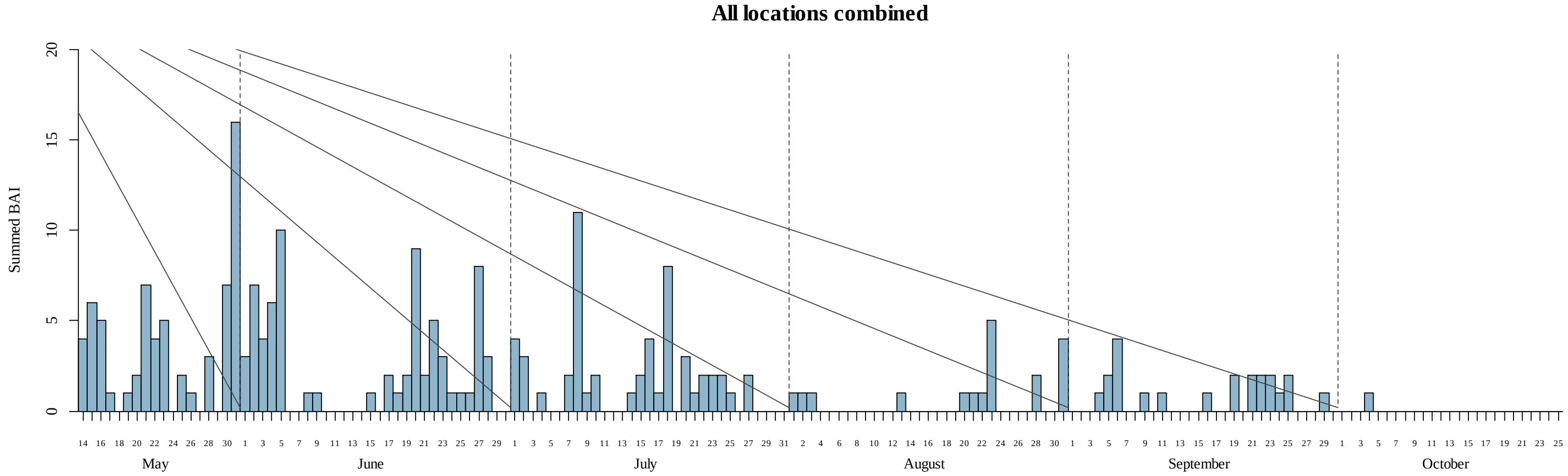
Graph 19: Standardised Greater Horseshoe BAI (summed BAI/sampling effort) across all sampling locations for each month



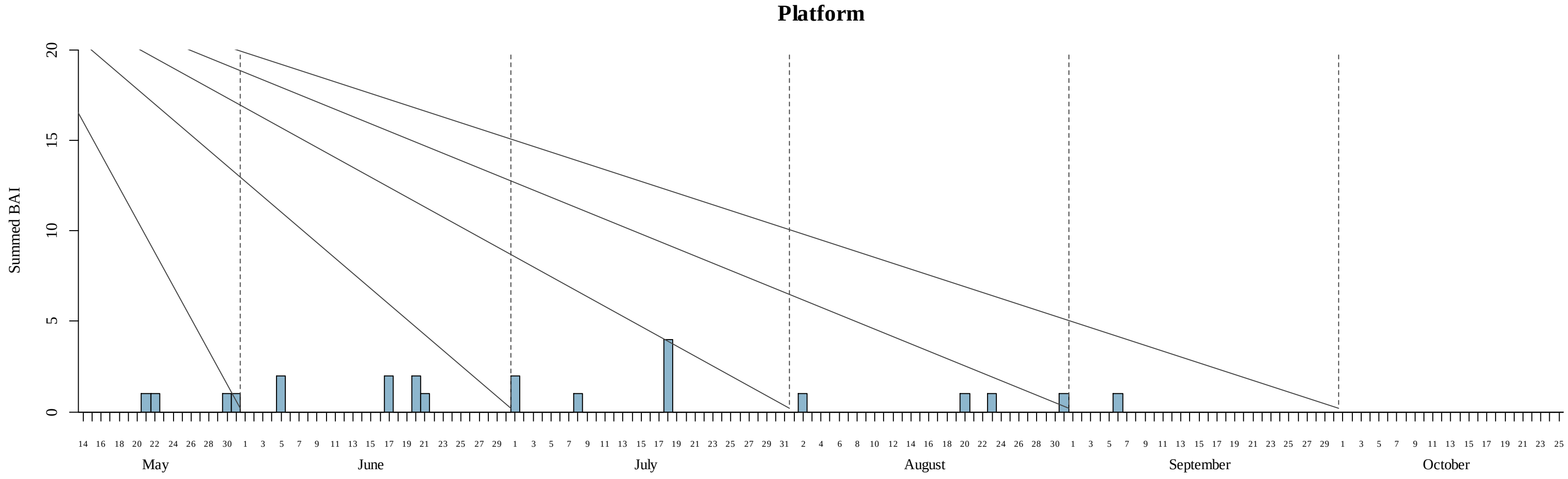
Graph 20: Greater Horseshoe BAI summed across all sampling locations for each month.



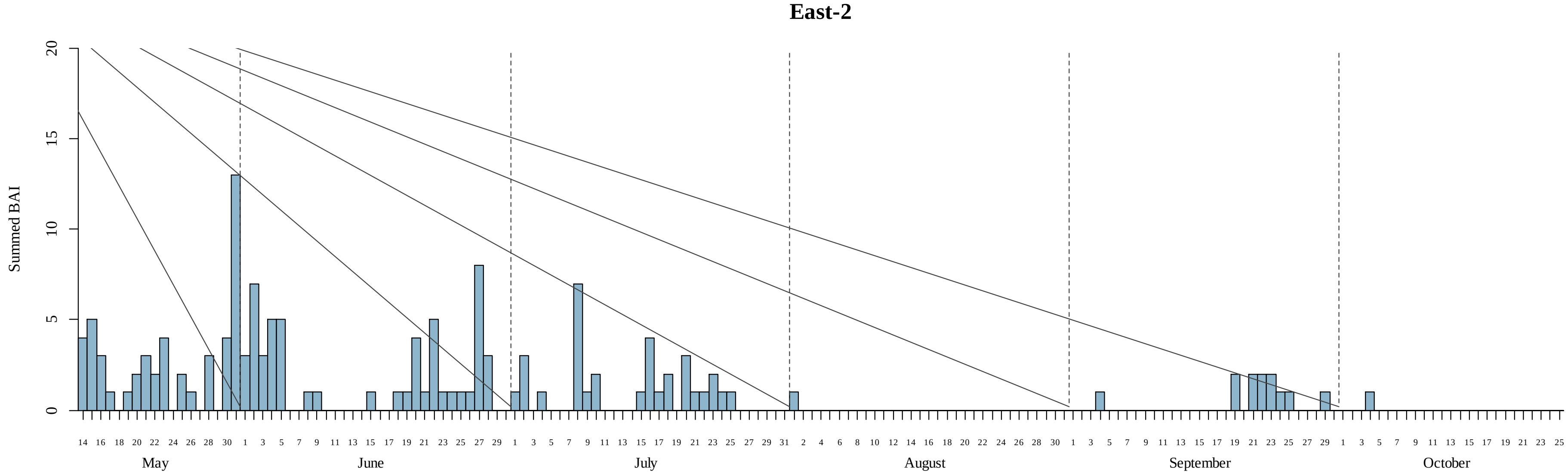
Graph 21: Greater Horseshoe BAI standardised by sampling effort for each month at each sampling location



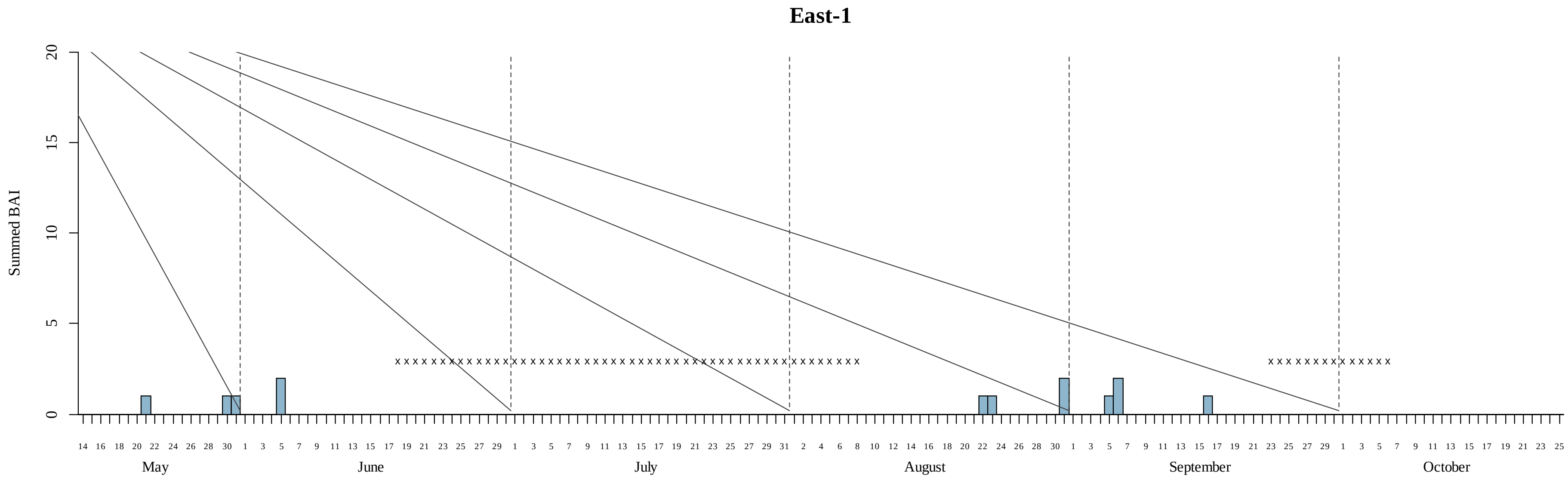
Graph 22: Summed daily Greater Horseshoe BAI for all monitoring locations combined



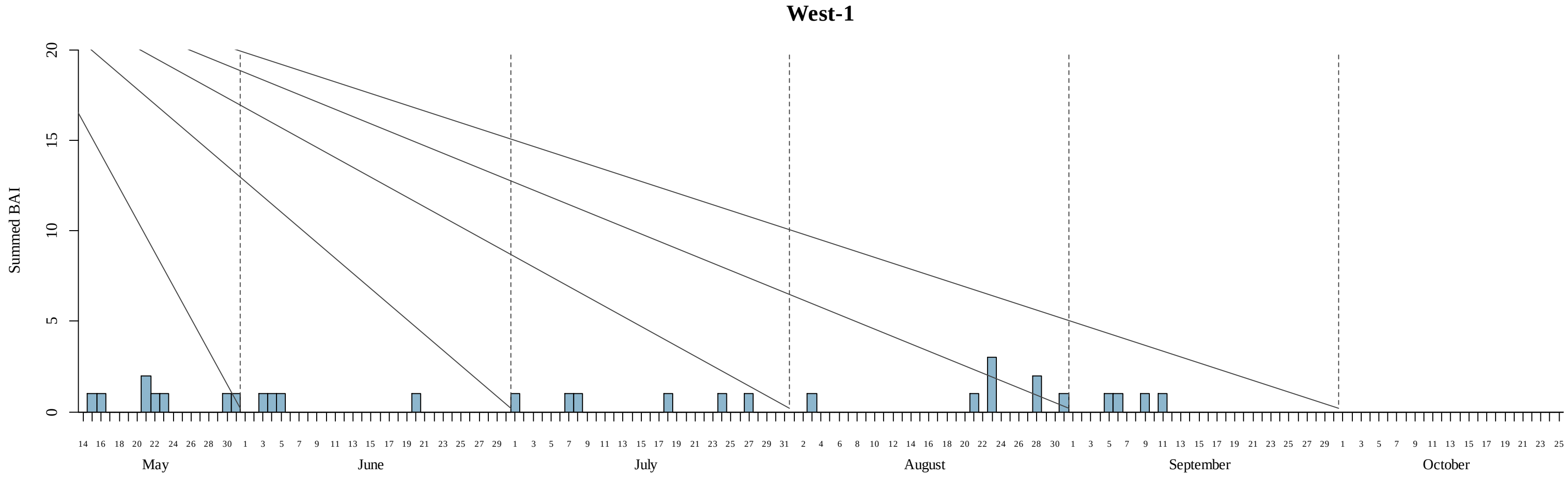
Graph 23: Summed daily Greater Horseshoe BAI for the Platform location



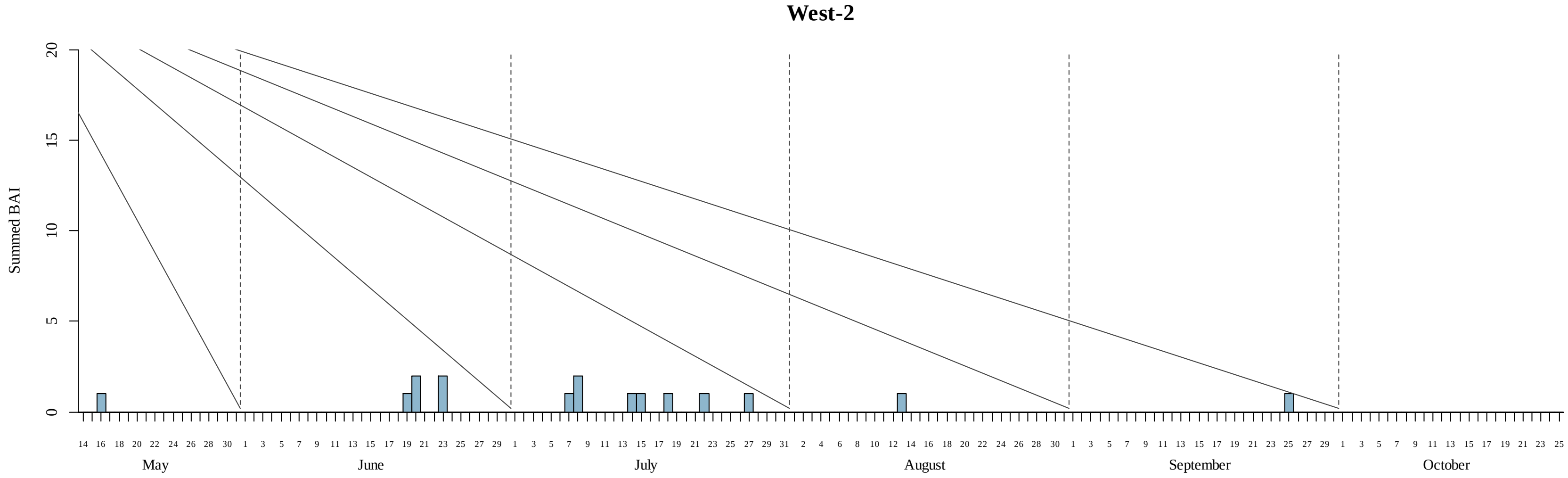
Graph 24: Summed daily Greater Horseshoe BAI at the East-2 location



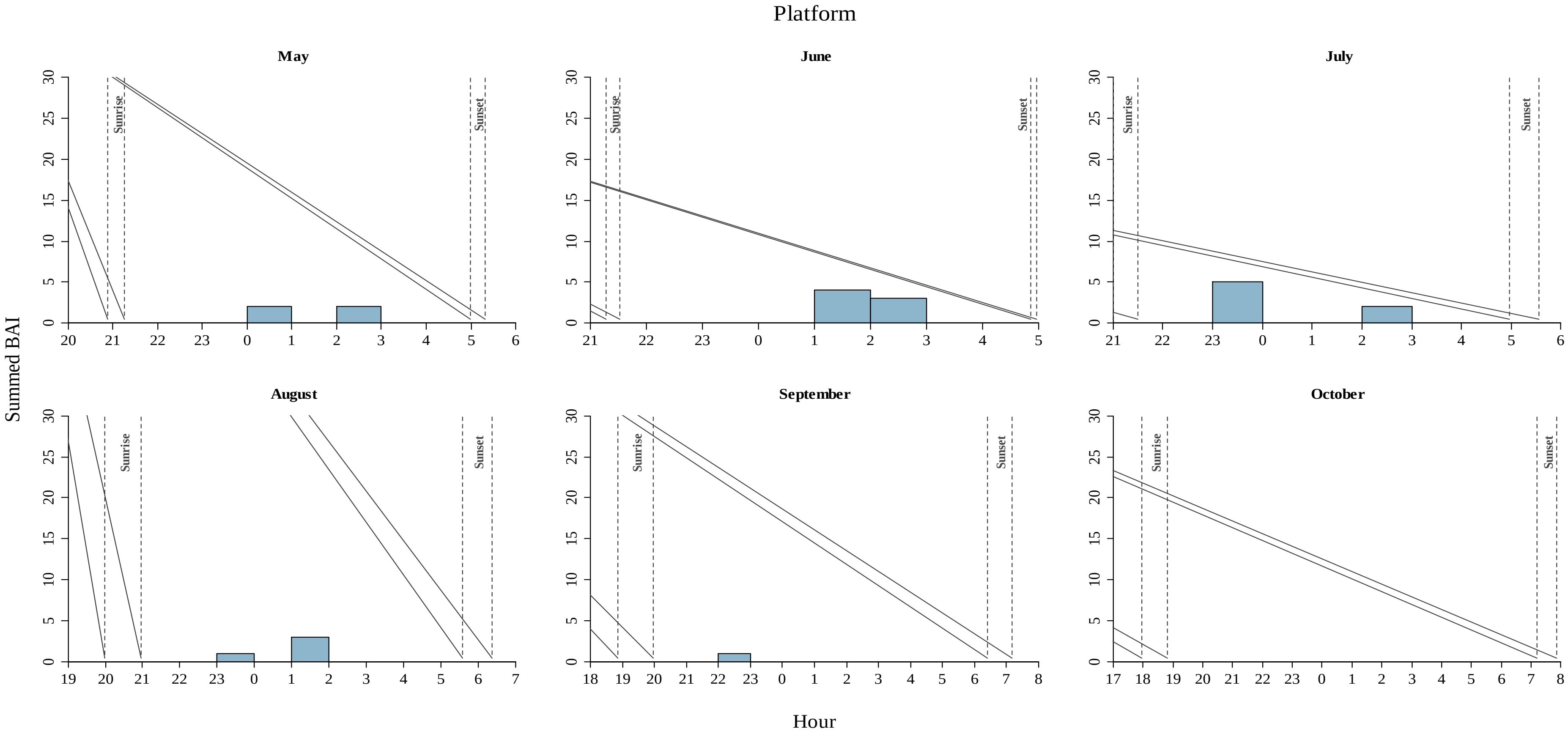
Graph 25: Summed daily Greater Horseshoe BAI at the East-1 location. Days marked with an 'X' indicate a fault with the datalogger as a result of which no data was recorded



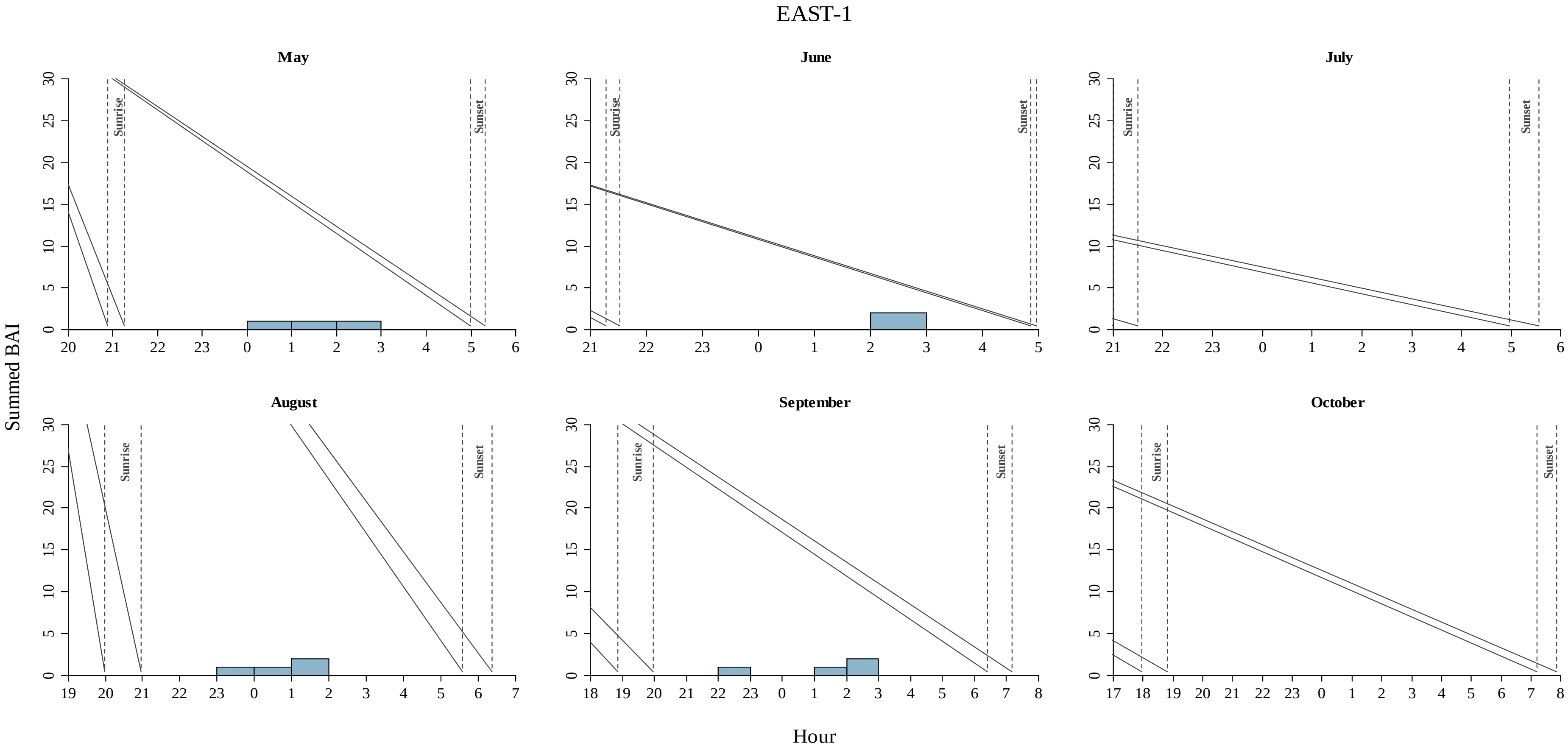
Graph 26: Summed daily Greater Horseshoe BAI at the West-1 location.



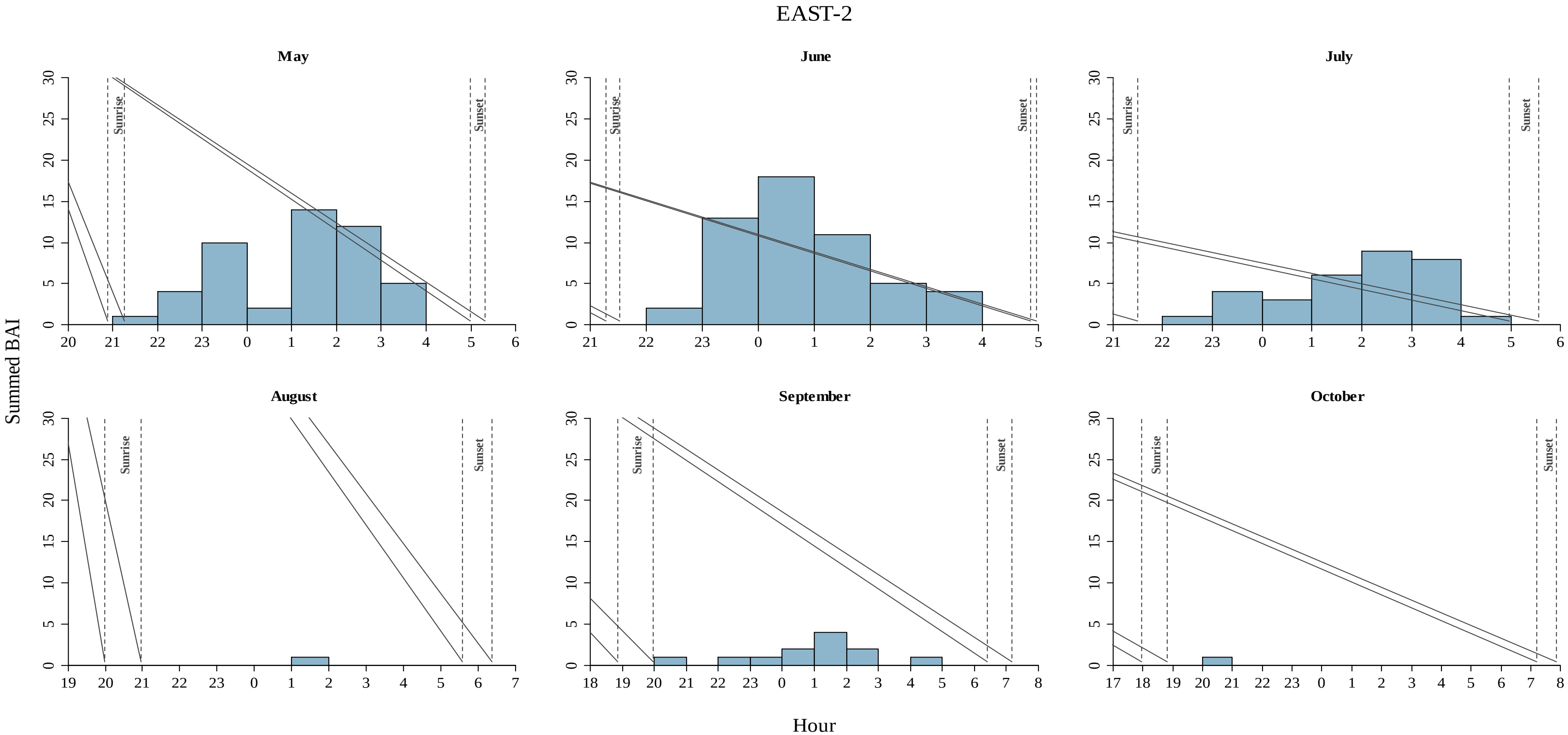
Graph 27: Summed daily Greater Horseshoe BAI at the West-2 location.



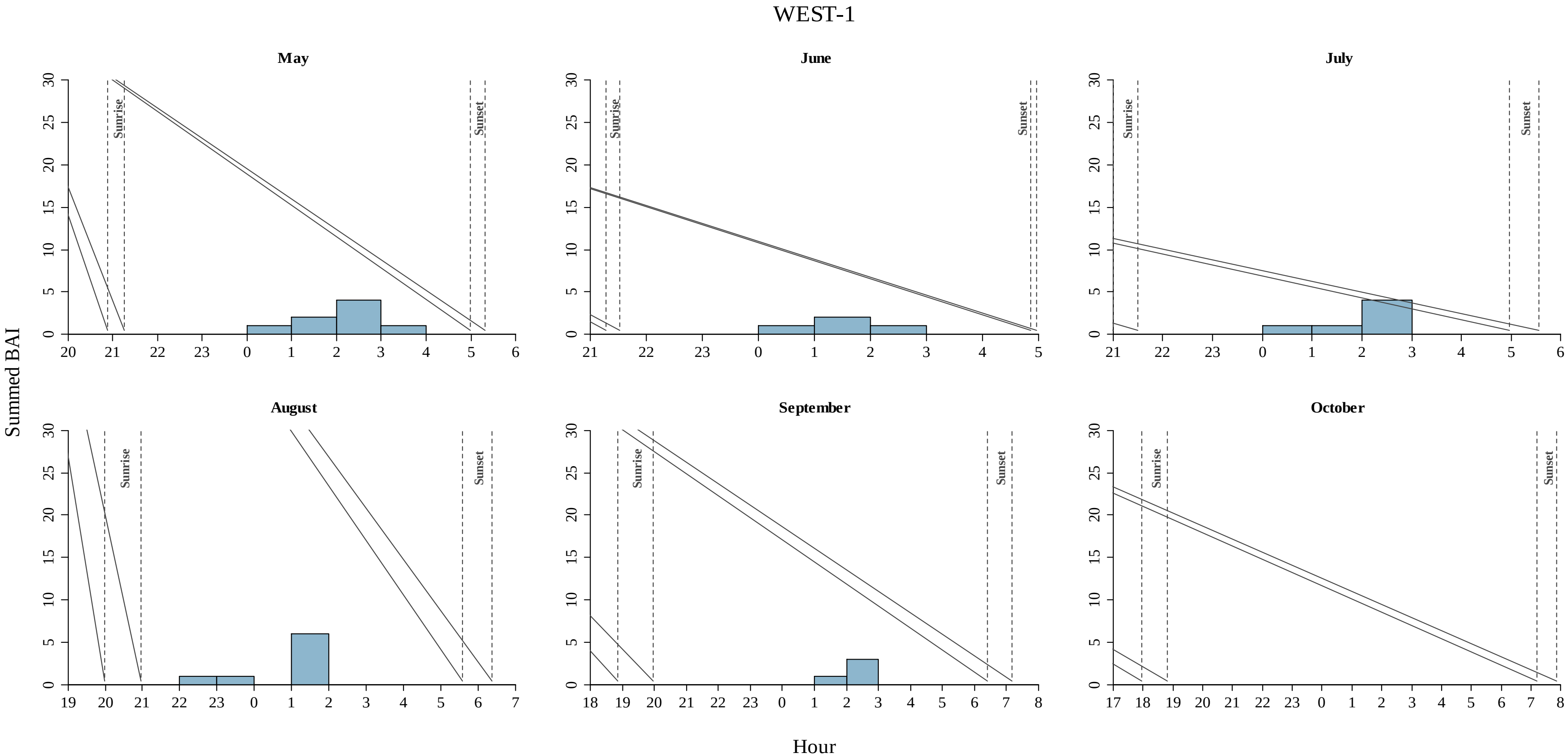
Graph 28: Greater Horseshoe BAI for each hour summed across all the study nights in each month for the Platform location. Dashed vertical lines show the range of sunset and sunrise times within each calendar month.



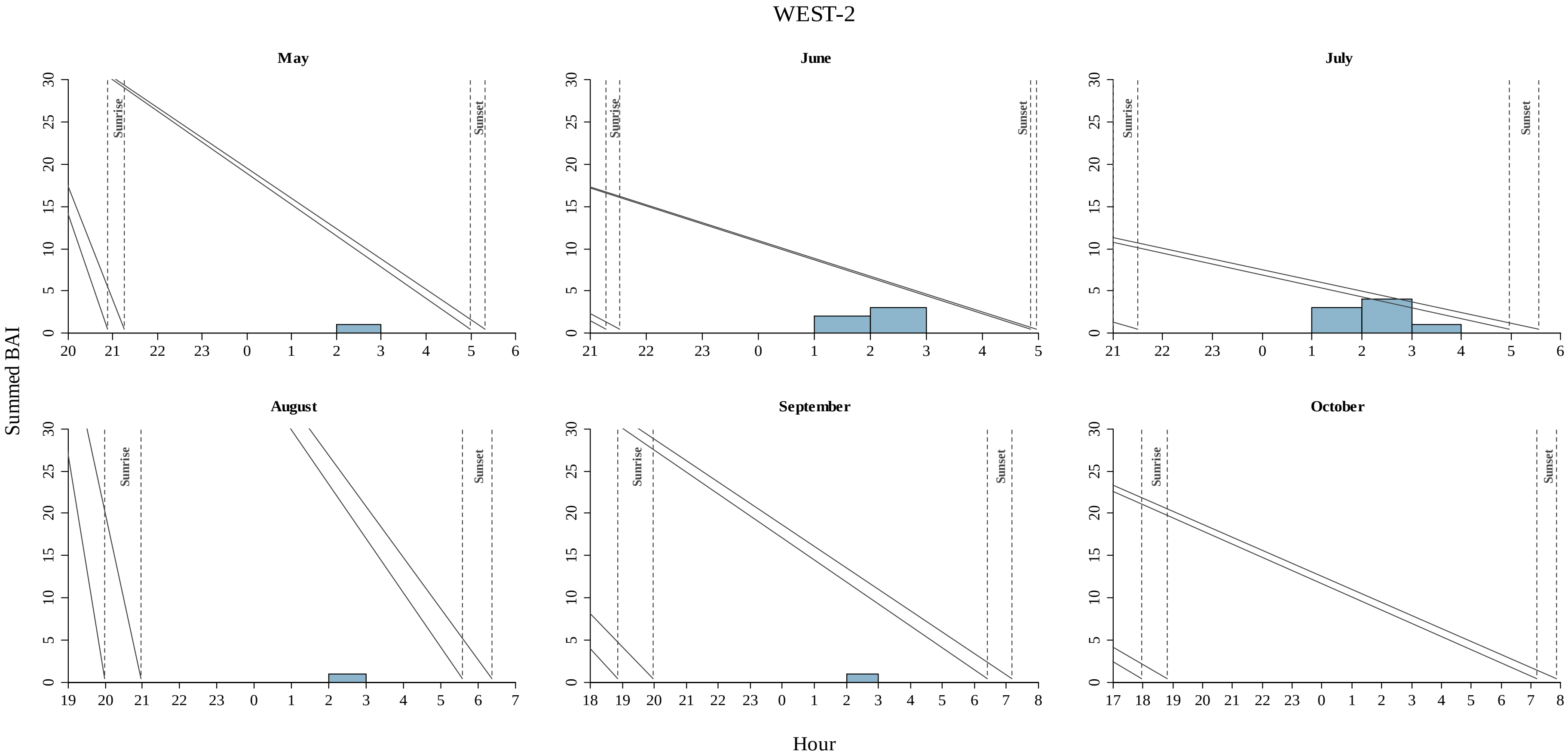
Graph 29: Greater Horseshoe BAI for each hour summed across all the study nights in each month for the East-1 location. Dashed vertical lines show the range of sunset and sunrise times within each calendar month.



Graph 30: Greater Horseshoe BAI for each hour summed across all the study nights in each month for the East-2 location. Dashed vertical lines show the range of sunset and sunrise times within each calendar month.



Graph 31: Greater Horseshoe BAI for each hour summed across all the study nights in each month for the West-1 location. Dashed vertical lines show the range of sunset and sunrise times within each calendar month.



Graph 32: BAI for each hour summed across all the study nights in each month for the West-2 location. Dashed vertical lines show the range of sunset and sunrise times within each calendar month.

Appendix B. Results of Tukey's Multiple Comparisons Test

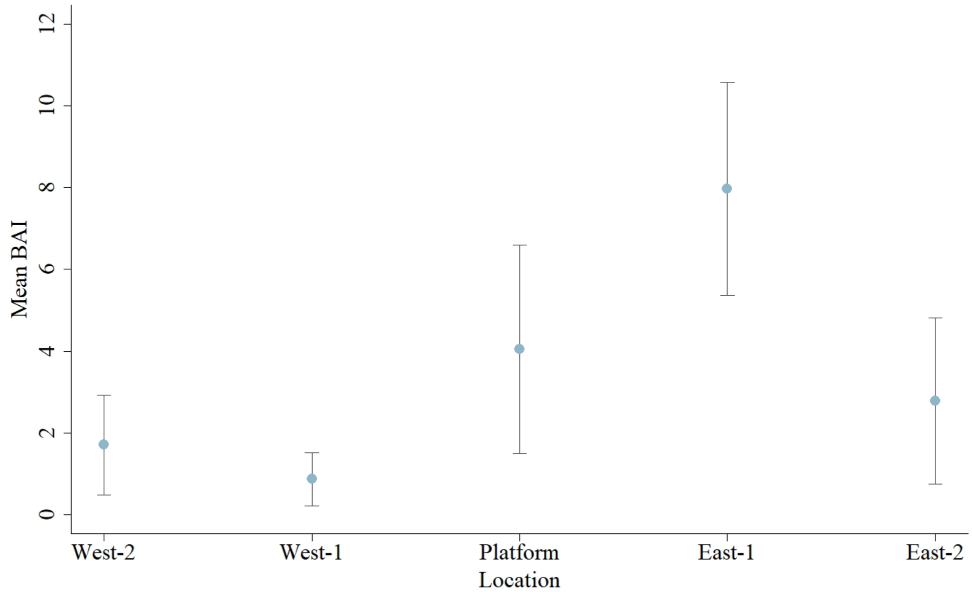


Figure A 1: Means +/- 1 standard deviation of the summed daily BAI data used as the response variable in a GLM to determine significant differences in LHS activity between monitoring locations.

Table A 1: Results of Tukey's multiple comparison test performed to determine significant pairwise differences in LHS activity between monitoring locations

Comparison	Estimate	Standard Error	z value	*p* value
East-2 - East-1	-1.070	0.123	-8.673	< 0.0001
Platform - East-1	-0.692	0.111	-6.217	< 0.0001
West-1 - East-1	-2.242	0.190	-11.804	< 0.0001
West-2 - East-1	-1.559	0.145	-10.731	< 0.0001
Platform - East-2	0.378	0.124	3.037	0.00406
West-1 - East-2	-1.172	0.198	-5.921	< 0.0001
West-2 - East-2	-0.489	0.156	-3.141	0.00406

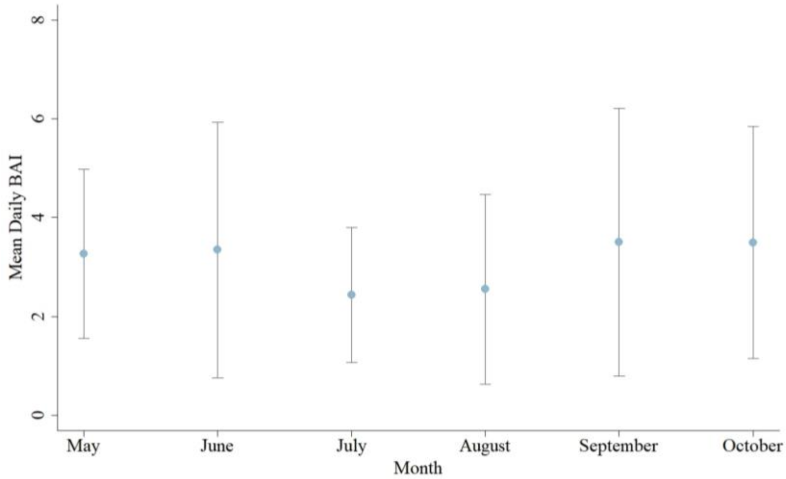


Figure A 2: Means +/- 1 standard deviation of the summed daily BAI data used as the response variable in a GLM to determine significant differences in LHS activity between calendar months during the study period.

Table A 2: Results of Tukey's multiple comparison test performed to determine significant pairwise differences in LHS activity between calendar months during the study period.

Comparison	Estimate	Standard Error	z value	*P* value
Jun - May	0.175	0.166	1.051	0.799
Jul - May	0.109	0.174	0.629	0.940
Aug - May	-0.227	0.230	-0.988	0.799
Sep - May	0.022	0.383	0.058	0.988
Oct - May	-0.045	0.585	-0.078	0.988
Jul - Jun	-0.065	0.163	-0.399	0.974
Aug - Jun	-0.402	0.269	-1.493	0.535
Sep - Jun	-0.152	0.436	-0.350	0.974
Oct - Jun	-0.220	0.642	-0.343	0.974
Aug - Jul	-0.336	0.240	-1.400	0.593
Sep - Jul	-0.087	0.395	-0.221	0.974
Oct - Jul	-0.155	0.598	-0.259	0.974
Sep - Aug	0.249	0.234	1.064	0.799
Oct - Aug	0.182	0.425	0.427	0.973
Oct - Sep	-0.067	0.252	-0.268	0.974

Appendix 12. Personnel

The bat surveys were undertaken by a team of experienced professional ecologists, all of whom are members of the Chartered Institute for Ecology and Environmental Management (CIEEM) and hold relevant licences for the bat surveys undertaken.

The walked transects were undertaken by Anton Kattan MCIEEM and Robert Pelc gradCIEEM, both of whom are experience bat ecologist registered with Natural England to use Class 2 survey licences. Anton Kattan is a consultant ecologist with 14 years of experience and has specialist knowledge and training in bat ecology and survey. Robert Pelc is a consultant ecologist with over 3 years of experience.

The tree climbing survey was carried out by Anton Kattan MCIEEM and Edward Bodsworth MCIEEM, both of whom are experienced and licensed bat ecologists. They are also Lantra qualified in tree-climbing and aerial rescue (NPTC level 2 certification).

The trapping surveys in 2015 were undertaken by a team of four surveyors. Dr. Ian Davidson-Watts of Davidson-Watts Ecology Ltd. was the principal ecologist for the trapping survey and was licensed by Natural England under project licence 2015-9664-SCI-SCI-1. Dr. Davidson-Watts has been researching bats since 1995 and mist netting bats and training bat-workers for licensed activities since 1996. Dr. Davidson-Watts MCIEEM led a team of three surveyors. Anton Kattan, a consultant ecologist with 14 years of experience, with 3 years of experience and training for capturing bats using mist netting and harp traps was lead ecologist and Robert Pelc and Christopher Greenland were assistant ecologists. Dr. Davidson-Watts and Mr. Kattan were responsible for the removal and welfare of bats trapped for the 2015 study.

Trapping surveys at Portbury Freight Line tunnels in 2016 were undertaken by a team of five surveyors led by Dr. Ian Davidson Watts. The survey team comprised Dr. Davidson-Watts, Mr. Kattan, Mr. Pelc and Dr. Matt Zeale, with assistance from Mr. Owen Crawshaw. Dr. Zeale is an employee of Davidson-Watts Ecology Ltd and Research Collaborator in bat ecology and behaviour at Bristol University. Owen Crawshaw was a field assistant for trapping at Pill tunnel. The radio tracking was undertaken by a team of four surveyors. The study was coordinated by Dr. Ian Davidson-Watts with the assistance of surveyors Anton Kattan, Robert Pelc and Christopher Greenland.

Trapping surveys at Portbury Freight Line tunnels in 2018 coordinated by Dr. Ian Davidson Watts was licensed by Natural England under project licence 2018-34304-SCI-SCI. The survey team comprised Dr. David Hill, Mr. Kattan, Mr. Pelc and Mr. Thomas Foxley. Dr Hill has been researching bats since 1997 and has been an independent consultant ecologist specialising in advanced bat survey for development projects since 2015. He developed the Sussex Autobat lure and has published research papers on bat research, including the use of acoustic lures for the capture of bats. Mr. Foxley is a professional ecologist with six years experience and holds a Class 2 survey licence. Dr. Hill was lead trapper and Mr. Kattan was lead tracker for the study.

Clare Williams is a senior ecologist with Jacobs (formerly CH2M) and project coordinator for the Scheme. Clare has a Natural England Class 2 bat survey licence.

Sophie Mairesse and Katrina Rimington of Bridgeway Consulting Ltd were commissioned by Jacobs (formerly CH2MHILL) to undertake preliminary bat roost assessments of structures on Portbury Freight Line. Sophie Mairesse is an accredited agent under Natural England licence number CLS02882.