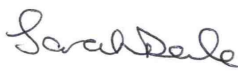


# Waterston/Blackbridge Study Area - Ecology Survey Report



Prepared by:  .....  
Lisbeth Nash  
Ecologist

Prepared by:  .....  
Sarah Dale  
Ecologist

Checked by:  .....  
Kevin Webb  
Associate Director

Approved by:  .....  
Kate Hockley  
Project Manager

Waterston/Blackbridge Study Area – Ecology Survey Report

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Churchill House, Churchill Way, Cardiff, CF10 2HH  
Telephone: 029 2035 3400 Website: <http://www.aecom.com>

Job No 60161755

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# 1 Introduction

## 1.1 Introduction

AECOM Limited is undertaking a programme of ecological survey work in the area of a proposed transport regeneration scheme near Waterston and Blackbridge in Pembrokeshire. The area being surveyed includes the proposed route corridor (study corridor) and the nearby Former RNAD Site (OS Grid reference SM916051). The study area is shown on Figure 1.1 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*). This report includes the results of these surveys to provide a baseline for ecological assessment, but does not undertake an assessment of impacts or provide recommendations for mitigation or compensation that may be required.

## 1.2 Background

On the instructions of Pembrokeshire County Council (PCC), AECOM Limited undertook the WelTAG Stage 1 Assessment of a proposed new road to bypass Waterston and to link to the Former RNAD Site, based on the methodology outlined within the Welsh Planning Transport and Appraisal Guidance (WelTAG). The ecology section of the WelTAG Stage1 Environment Report provided an overall ecological assessment of the study area, identifying potential ecological constraints and recommending a programme of further ecological survey work required to inform the Stage 2 WelTAG assessment.

On the instructions of PCC, AECOM Limited commenced with a programme of ecology surveys in May 2010 to satisfy WelTAG Stage 2 Assessment guidance for a proposed new road, to include the Former RNAD Site owned by PCC. Prior to commencing the further ecological surveys in May 2010, the scope of these surveys and survey methodology was agreed with Countryside Council for Wales (CCW).

On the 16<sup>th</sup> July 2010, PCC instructed AECOM to stop working on the ecological surveys. However, on the 9<sup>th</sup> August 2010 Milford Haven Port Authority (MHPA) instructed AECOM to continue the scheduled survey work in order that a full season of ecological surveys was completed in 2010.

AECOM and MHPA met with CCW on 15<sup>th</sup> September 2010 to discuss the findings of the ecology surveys to date and CCW requested that the Anabats continue to be used until May 2011, so that a full year of survey data could be gathered.

## 1.3 Limitations

The opinions expressed in this report and the comments and recommendations given, are based on the information obtained to date from the ecological surveys, desk studies, meetings and site observations only.

The information, views and conclusions drawn concerning the site are based, in part, on information supplied to AECOM by other parties. AECOM has proceeded in good faith on the assumption that this information is accurate. AECOM accepts no liability for any inaccurate conclusions, assumptions or actions taken resulting from any inaccurate information supplied to AECOM from others.

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## 1.4 Report Format

This report will summarise the findings of the WelTAG Stage 1 desk study, Phase1 Habitat Survey and protected species surveys. The report will then address each protected species group as a chapter outlining the survey methodology, results and recommendations for further action as appropriate. The report will then conclude by summarising the main ecological constraints associated with the Former RNAD Site and study corridor.

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The majority of the figures (survey maps) for this report have been published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011* otherwise they are included within the text of this report.

The appendices for this report have been published in a separate report: *Waterston / Blackbridge Study, Ecology Report Appendices, AECOM, October 2011*.

### **1.5 Legislation**

There are several different acts of legislation and regulations which refer to the protection of wildlife. These are summarised in Appendix 1 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Appendices, AECOM, October 2011*). In particular, the legislation relating to possible protected species on site is outlined. This is a brief summary of the legislation and is not to be regarded as a definitive legal opinion. When dealing with individual cases, the client is advised to consult the full texts of the relevant legislation and obtain further legal advice.

### **1.6 Quality Assurance**

This project has been undertaken in line with AECOM's Integrated Management System (IMS). Our IMS places great emphasis on professionalism, technical excellence, quality, environmental and Health and Safety management. All staff members are committed to establishing and maintaining our accreditation to the international standards BS EN ISO 9001:2008 and 14001:2004 and BS OHSAS 18001:2007. In addition our IMS requires careful selection and monitoring of the performance of all sub consultants and contractors.

All AECOM Ecologists are members of (at the appropriate level) the Institute of Ecology and Environmental Management (IEEM) and follow their code of professional conduct when undertaking ecological work.

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## 2 Desk Study and Phase 1 Habitat Survey

### 2.1 Desk Study Methodology

The objectives of the desk study were to review the existing available information to identify the following:

- Internationally, nationally and locally designated sites, up to 2km from the site.
- Special Areas of Conservation (SACs) designated for bats within a 5km radius of the site.
- Records of protected species within 2km of the site.
- Any other natural features of importance or concern to the consulted groups.

Information relating to protected habitats was collated using the MAGIC website ([www.magic.gov.uk](http://www.magic.gov.uk)). All internationally and nationally designated sites within a 2km radius were identified. In accordance with Bat Conservation Trust recommendations, Special Areas of Conservation (SACs) designated because of a known bat population, were included in a search of up to 5km radius.

The West Wales Biodiversity Information Centre (WWBIC) was consulted for notable, protected and priority species and designated habitats within 2km of the study area. The National Biodiversity Network ([www.searchnbn.net](http://www.searchnbn.net)) was reviewed for recent records of notable and protected species in the local area. The Countryside Council for Wales' ([www.ccw.gov.uk](http://www.ccw.gov.uk)) Interactive Maps was reviewed for information on designated sites.

The local Council Ecologist (Trevor Theobald) was contacted regarding local knowledge of protected species in the area.

### 2.2 Extended Phase I Habitat Survey Methodology

An Extended Phase I Habitat Survey (JNCC 1990, revised reprint 2007) of the site was undertaken by Nicola Lewis (MIEEM) and Chris Sutton (GIEEM Graduate member) as part of the WelTAG Stage 1 Assessment on 8<sup>th</sup> and 9<sup>th</sup> March 2010. This survey was updated throughout 2010 by surveyors undertaking protected species surveys within the study area. A detailed species list for the 4Gas Tunnels area was prepared and has been included at Appendix 2 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Appendices, AECOM, October 2011*). Access was made available in 2010 to the previously un-surveyed parcel of land in the vicinity of the artillery tunnel entrances and survey work has been undertaken in this area during 2010.

The surveys involved a site walkover and preliminary assessment of key habitats, land use and ecological features, particularly focusing on areas of natural habitat which will be affected by the proposals. The main habitats present were recorded using standard Phase I Habitat Survey methodology as described in the *Handbook for Phase I Habitat Survey: A technique for Environmental Audit* (JNCC, 2007). A list of plant species present on site was recorded. The site was inspected for signs of any invasive plant species subject to legal controls.

The site was assessed for its potential to support protected species in order to identify potential ecological constraints and to guide recommendations for further Phase II survey requirements for these species.

Figures 2.1A, 2.1B and 2.1C show the Phase 1 Habitat Maps that were created for the WelTAG Stage 1 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

Figure 2.2 shows areas of Japanese Knotweed growth across the study corridor (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).



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### 2.3 Limitations of Phase I Habitat Survey and Desk Study

Biological records can be received from a wide variety of sources and may or may not be comprehensive and accurate. However, if assessed in conjunction with an Extended Phase 1 Habitat Survey, they can contribute to a robust ecological assessment of a site. There are deemed to be no significant limitations to the desk study and Extended Phase 1 Habitat Survey described in this report. Access was not available for the entire survey area, although, aerial photographs were used to fill in information on broad habitat types. Overall, there are deemed to be no significant limitations to the desk study and Extended Phase 1 Habitat Survey described in this report in fulfilling the objectives of the report

### 2.4 Desk Study Results

#### 2.4.1 Designated Sites

There are no Biosphere Reserves, National Nature Reserves (NNRs) or Marine Nature Reserves (MNRs) within 5km of the centre of the study area.

There are two designated sites within or in the immediate vicinity of the site. The Milford Haven estuary is a Special Area of Conservation (SAC), 138,000ha in area. The SAC includes marine areas, sea inlets, tidal rivers, reefs, mud and sand flats, lagoons and salt marshes. Species listed on Annex II of the Habitats Directive which are a primary reason for selection are grey seal (*Halichoerus grypus*) and shore dock (*Rumex rupestris*). Other species listed on Annex II known to occur in the SAC include sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*), allis shad (*Alosa alosa*), twaite shad (*Alosa fallax*) and otter (*Lutra lutra*). The SAC does not include the Castle Pill inlet or the Milford Haven Marina. In addition, the intertidal habitat along the coastline is within Milford Haven Waterway Site of Special Scientific Interest (SSSI) up to mean high water. This SSSI is of special interest for its geology, ancient woodland, marine biology, saltmarsh, swamp, saline lagoons, rare and scarce plants and invertebrates, nationally important numbers of migratory waterfowl, greater and lesser horseshoe bats (*Rhinolophus ferrumequinum* and *Rhinolophus hipposideros*), and otter *Lutra lutra*.

Pembrokeshire does not have specific County Wildlife Sites but considers all designated sites, Wildlife Trust reserves and each area on a site by site basis under their biodiversity policies.

#### 2.4.2 Habitats

The study area is predominantly a rural area interspersed with small settlements adjacent to the eastern edge of Milford Haven. Approximately one quarter of the site comprises the Petroplus Oil Refinery. Other than the industrial developments along the coast, Waterston and residential edge of Milford Haven, much of the landscape comprises agricultural fields. In steep gullies, there are remnant patches of semi-natural ancient woodland as well as more recently planted woodlands, which may support diverse assemblages of associated species, including lichens and bryophytes. Many fields are relatively small in size surrounded by hedgerows. Dwellings in outside of Waterston and Milford Haven are traditional farmsteads or historic buildings.

The area is crossed by a series of potentially important corridors for protected wildlife, particularly Rhodal Bottom, Castle Pill and the railway corridor which links the Dragon LNG site to the main line at Harmeston.

Certain other habitat features e.g. intertidal habitat, saltmarshes, etc. also form natural flood defences which may be important at a local level.

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### 2.4.3 Species

There are recent records of badger (*Meles meles*), otter (*Lutra lutra*), four reptile species, and nine species of bat on the National Biodiversity Network. In addition, the area is likely to be a 'hotspot' for bats, with 12 species recorded at Scoveston Fort (Trevor Theobald, PCC, *pers.comm.*). Two Annex II species of bat, greater horseshoe (*Rhinolophus ferrumequinum*) and lesser horseshoe (*Rhinolophus hipposideros*) have been frequently recorded in the area. Otters are also known to regularly use Castle Pill up to Blackbridge. A number of bird species, some of which are sensitive to disturbance, are also known to use the estuary. There are a number of ponds within the study area, although no records of great crested newt were found during the desk study. The area also contains a number species listed on the National Biodiversity Action Plan and Pembrokeshire Biodiversity Action Plan.

## 2.5 Extended Phase I Habitat Survey Results

### 2.5.1 General Study Area Description

The site is situated in an area of pasture between Milford Haven and Dragon LNG Site at Waterston. With the exception of the urban and industrial areas, the main areas of study are dominated by improved pasture fields separated by species poor hedgerows, sometimes residing on banks or walls. Scattered trees line some of the hedgerows, and two lengths of semi-natural woodland follow watercourses through the study area. The coastal strip is lined with dense scrub. There are four important wildlife corridors in the study area, Castle Pill, the two watercourses through Rhodal Bottom Woods and the woods to the west of the oil refinery, and the railway line. Habitats present include, neutral semi-improved grassland, marshy grassland, improved grassland, amenity grassland, arable, swamp, scrub, hedgerows, running water, standing water, semi natural broadleaved woodland, and scattered trees.

### 2.5.2 Watercourses

There are two watercourses which could be affected by the various route options. The streams are shallow in places, slow flowing and range between 1m and 3m wide. Some sections of one of the streams flow through artificial concrete banks. The stream bed is largely made up from patches of mixed gravels and boulders. The banks are mostly covered by scrub and woodland. Rivers and streams are a Pembrokeshire local BAP Habitat.

### 2.5.3 Scrub

Areas of scrub are frequent on the embankment of the railway line and the coastal path. Scattered scrub is also present throughout the area, particularly close to the edge of the woodland blocks. Species include bramble (*Rubus fruticosus agg.*), gorse (*Ulex europaeus*), butterfly bush (*Buddleia davidii*), birch (*Betula sp.*), dogwood (*Cornus sanguinea*), dog rose (*Rosa canina*) and hawthorn (*Crataegus monogyna*).

Further areas of dense scrub are present within the Newton Noyes area in the vicinity of the artillery tunnel entrances. Scrub is dominated by butterfly bush but also with hawthorn, blackthorn (*Prunus spinosa*), dog rose and bramble.

### 2.5.4 Woodland and Mature Trees

The watercourses all support areas of woodland, mostly semi-natural broadleaved woodland, with Rhodal Bottom supporting semi-natural ancient woodland. Species predominantly include oak, beech (*Fagus sylvatica*) and sycamore (*Acer pseudoplatanus*), with further species including elm (*Ulmus procera*), ash (*Fraxinus excelsior*), yew (*Taxus baccata*) and cherry (*Prunus sp.*). Scrub woodland is identified as a Pembrokeshire BAP habitat.

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#### 2.5.5 Hedgerows

There are numerous hedgerows throughout the study area. All those noted during the walkover survey were species poor hedgerows. Some of these were growing on top of a bank or wall. Traditional field boundaries are identified as a Pembrokeshire BAP habitat.

#### 2.5.6 Grassland

The majority of grassland areas along the route are either improved agricultural pasture or amenity grassland, both of which have limited diversity in either structure or species. There are some patches of semi-improved grassland which have a higher diversity. Species include cocksfoot (*Dactylis glomerata*), red fescue (*Festuca rubra*), common nettle (*Urtica dioica*), curled dock (*Rumex crispus*), burdock (*Arectium sp*), hogweed (*Heracleum sphondylium*), creeping buttercup (*Ranunculus repens*) and red clover (*Trifolium pratense*). Small areas of marshy grassland are also present.

#### 2.5.7 Buildings

There are a number of commercial and residential properties throughout the study area. These include a number of new houses present close to the Option 5 works at Blackbridge, consisting of recently built houses, and several in the process of being built. The remaining residential properties consist of scattered farm buildings, with out-buildings and sheds at the rear of these properties, and houses within the town of Waterston. The properties tend to have slate roofs with wooden fascia and soffit boards. Many of the gardens in the new properties have yet to become established, and also incorporate areas for vehicle parking. Gardens and community spaces are identified as a Pembrokeshire BAP habitat.

The majority of the commercial buildings consist of the oil refinery and the industrial estate to the north of the oil refinery. Some of these commercial properties have corrugated iron roofs.

Within the Former RNAD Site are a number of disused industrial buildings of various types. Large warehouses predominate which are steel constructed with corrugated roofs and in a poor state of repair. Within these buildings are a number of sub rooms constructed of brick with false ceilings which provide roosting opportunities for bats. Further buildings (particularly at the western end of the site) include slate roofed office type buildings and sheds which, although in a poor state of repair, provide roosting opportunities for a range of bat species particularly those associated with the use of external features such as pipistrelle bats.

#### 2.5.8 Ponds

There are a number of potential ponds within the study area shown on the OS 1-25,000 map; although there are no ponds which lie directly in the path of the proposed route options.

#### 2.5.9 Invasive Species

Japanese Knotweed (*Fallopia japonica*) was noted to be present near to the Sewage Works at Waterston and in large patches within the artillery tunnels area at Newton Noyes. Further evidence of Japanese Knotweed was recorded within the Former RNAD Site (particularly at the eastern end) although this appeared to be dead at the time of the survey following regular spraying with Glyphosate herbicide during 2010. However, this area will require further survey prior to any development to determine the actual extent of active (live) Japanese Knotweed in case any has regrown. Figure 2.2 shows areas of Japanese Knotweed growth across the study corridor (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

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## 2.6 Protected or Notable Species

### 2.6.1 Native Flora

West Wales Biodiversity Information Centre returned no records of notable plant species. However, the fungi Olive Earthtongue (*Microglossum olivaceum*) and Bloxam's Entoloma (*Entoloma bloxamii*) have both been recorded within 2km of the study area at Honeyborough Cemetery and the Olive Earthtongue has also been recorded within 2km of the study area at Milford Haven Cemetery. Bryophytes Awl-leaved Ditrichum (*Ditrichum subulatum*) has been recorded within the study area at Blackbridge and Castle Pill and within 2km of the study area at Haven's Head. Bryophytes Wilson's Pottia (*Tortula wilsonii*) within the study area at Wear Point and the Prince-of-Wales Feathermoss (*Leptodon smithii*) has been recorded within 2km of the study area.

No notable plant species were recorded during the survey, although the survey was conducted at a sub optimal time of year and as such cannot be considered comprehensive. Although, based on the habitats present, the likelihood of rare or protected higher plants species being present within the study area is considered to be low, although bryophytes may be present within the wooded areas.

### 2.6.2 Invertebrates

West Wales Biodiversity Information Centre returned records of a number of species including dusky thorn (*Ennomos fuscantaria*), August thorn (*Ennomos quercinaria*), oblique carpet (*Orthonama vittata*), grayling (*Hipparchia semele*), white ermine (*Spilosoma lubricipeda*), buff ermine (*Spilosoma luteum*), small heath (*Coenonympha pamphilus*), dingy skipper (*Erynnis tages*), wall (*Lasiommata megera*), small pearl-bordered fritillary (*Boloria selene*), pearl-bordered fritillary, (*Boloria euphrosyne*), grizzled skipper (*Pyrgus malvae*) and white-letter hairstreak (*Satyrium w-album*) within 1km of the study area. The coastal habitat is also good for brown hairstreaks. Habitat suitable for these species was restricted within the survey area where the route options lie, to the hedgerows, woodland, watercourse and scrub. Dingy skipper has been noted to be present within the Former RNAD Site (Trevor Theobald PCC, Pers comm.); although this is considered to be a single record and not confirmation that this species regularly use this site.

### 2.6.3 Fish

West Wales Biodiversity Information Centre returned no records of protected or notable fish species within 1km of the study area. Species present within the nearby SAC include sea lamprey (*Petromyzon marinus*), river lamprey (*Lampetra fluviatilis*), allis shad (*Alosa alosa*), twaite shad (*Alosa fallax*). It is only considered a low potential that species of note would be present in the small streams throughout the study area.

### 2.6.4 Amphibians

There are a few ponds scattered throughout the study area. There are some features which would hinder movement of amphibians across the study area. These include dense residential and industrial development and the B4325. There are records of palmate newt (*Lissotriton helveticus*) returned by West Wales Biodiversity Information Centre just outside of 1km from the study area. No records of great crested newt (*Triturus cristatus*) were identified by West Wales Biodiversity Information Centre. National Biodiversity Network has no records of great crested newts within the 10km grid square SM90. Based on the lack of records and the barriers within the study area, the presence of great crested newts is considered to be unlikely. However, palmate newt may use streams and ditches in the area.

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#### 2.6.5 Reptiles

NBN has records of Adder (*Vipera berus*) common lizard (*Lacerta vivipara*), grass snake (*Natrix natrix*), and slow worm (*Anguis fragilis*) within the study area. West Wales Biodiversity Information Centre also returned records of these species within 1km of the study area, and the council suggest that slow worm and common lizards are common in this area. Anecdotal evidence from the land owner at Waterston indicates the presence of slow worm and adder on the route of option 1. There were some areas with moderate to high reptile potential within the coastal and residential areas of the study area and along the length of the old railway line, in particular in the areas where scrub is present. The land in the vicinity of the old artillery tunnels at Newton Noyes is particularly suitable, as are the more established areas of vegetation inland of the buildings at the Former RNAD Site. In addition, some of the hedgerows in the study area grow from a bank or wall. Crevices within these would provide ideal habitat for reptiles.

#### 2.6.6 Breeding Birds

West Wales Biodiversity Information Centre returned records of kingfisher (*Alcedo atthis*), common linnet (*Carduelis cannabina*), starling (*Sturnus vulgaris*), redwing (*Turdus iliacus*), song thrush (*Turdus philomelos*), reed bunting (*Emberiza schoeniclus*), hedge accentor (*Prunella modularis*), fieldfare (*Turdus pilaris*), herring gull (*Larus argentatus*), black headed gull (*Chroicocephalus ridibundus*), Mediterranean gull (*Larus melanocephalus*), common greenshank (*Tringa nebularia*), and green sandpiper (*Tringa ochropus*), curlew (*Numenius arquata*), yellowhammer (*Emberiza citrinella*) and skylark (*Alauda arvensis*) in the 10km square SM90. There is a large amount of scrub and woodland at the study area which has a high potential to support breeding birds. All of the hedgerows have potential to support breeding birds. With possible exception of skylark, the potential for ground nesting birds is low.

#### 2.6.7 Badger

West Wales Biodiversity Information Centre returned records of badger (*Meles meles*) with the study area, and badger were found dead at the side of the B4325 in the centre of the study area. Although no badger setts were identified during the survey, the majority of the route options could not be walked for their entirety due to a lack of access. However, there are a number of embankment areas which have the potential to support badger throughout the site, in particular, along the railway where a dead badger was found by the roadside. There is also reportedly a sett within the area of the PCC Depot at Waterston, and within Castle Pill.

#### 2.6.8 Bats

The council ecologist (Trevor Theobald) reported that the area is a hotspot for greater and lesser horseshoe bats (GHS and LHS), in particular Scoveston Fort and the magazine tunnels at Newton Noyes. Scoveston Fort has double figures of bat species present including GSH, LSH, brown long eared (BLE) (*Plecotus auritus*), Natterer's (*Myotis nattereri*), barbastelle (*Barbastella barbastellus*) and whiskered bat (*Myotis mystacinus*) (West Wales Biodiversity Information Centre). NBN records for the study area include BLE, Daubenton's (*Myotis daubentonii*), GHS, LHS, Natterer's, noctule (*Nyctalus noctula*), common pipistrelle (*Pipistrellus pipistrellus*), whiskered/Brandt's (*Myotis mystacinus /brandtii*) in the area.

A number of the commercial and residential properties within the study area have the potential to be used by roosting bats. Features include gaps between the wall and soffit and fascia boards, gaps in brick work, pitched roofs and hanging tiles. These features are suitable for a number of bat species. There are a number of mature trees within the study area which have features which may be suitable to support roosting bats. These features include broken limbs, peeling bark and dense ivy covered trunks and branches. In addition there are a number of tunnels near to Newton Noyes which lead into the rock face. These would provide ideal roost for a number of species of bats.

Capabilities on project:  
Ecology

The linear nature of the watercourses and the associated woodland, as well as the railway corridor, which links the Petroplus LNG site to the main line at Harmeston, means that the area has potential as an important bat commuter habitat. The same may apply to the hedgerows. Much of the lengths of these features are currently unlit. It must be noted that although bats do tend to commute along linear features, they can also cover open ground. It has been noted that GHS have crossed the Haven in this area. There are numerous important bat foraging habitats throughout the study area, including the water features, woodland edges, tidal area and agricultural land.

#### 2.6.9 Dormice

National Biodiversity Network has records of dormice (*Muscardinus avellanarius*) within the 10km grid square SM90, although West Wales Biodiversity Information Centre returned no records of dormice within 2km of the study area. The woodlands along the watercourses were assessed as having moderate potential for dormice; although the majority of field boundaries in the study area are narrow species poor hedgerows. However, due to the naturally low densities that dormice occur at, the population present within the study area is unlikely to be high. Dormouse is identified as a Pembrokeshire BAP species.

#### 2.6.10 Polecat

Polecats (*Mustela putorius*) have been noted to be in the wider area around the study site, but no records exist within the study area. Some aspects of the habitat, including woodland, riverbank, coastal and farmland are ideally suited to polecats.

#### 2.6.11 Otter

Otters (*Lutra lutra*) are reported (Trevor Theobald, *pers comm.*) to use The Pill (Castle) up to Blackbridge (spraints found in this area) although this is considered likely to be less activity recently due to horizontal drilling from LNG for a pipeline. Sections of the watercourses within and adjacent to the study area are potentially suitable for otter, including at the reservoir at Newton Noyes where otter spraints have been found. There are also reportedly 4 spraint sites along the coast between Newton Noyes Jetty and Castle Pill. West Wales Biodiversity Information Centre returned records of otter within 1km of the study area on Westfield Pill Nature Reserve. The area is likely to provide suitable foraging grounds for otter. There is the potential for holts to be situated along some stretches of the watercourses within the study area. Otter is identified as a Pembrokeshire BAP species.

Capabilities on project:  
Ecology

## 3 Bryophytes

### 3.1 Introduction

The extended Phase 1 Habitat Survey identified a range of bryophytes within the survey area. PCC stated that mosses and lichens of ecological value have not been recorded along the WeITAG route, although the ancient woodland between the LNG site and the Former RNAD Site may have potential and should be surveyed.

A bryophyte survey of these identified areas at Newton Noyes, Milford Haven Pembrokeshire was carried out on 11<sup>th</sup> and 12<sup>th</sup> October, 2010 by Dr Des Callaghan MIEEM in order to establish the current baseline.

The objectives of the survey were to:

- Undertake a survey of the sites according to the identified survey area plan and identify all species of bryophyte present; and
- Species of note (*threatened* or any with rarity status) to be recorded, GIS mapped and photographed.

The full details of the survey are outline in *EcoStudy (November 2010) Bryophyte survey of land at Newton Noyes, Pembrokeshire*. This report is included in full at Appendix 3 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Appendices, AECOM, October 2011*). The study area is shown in Figure 3.1 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

The survey encompassed all land covered by the industrial buildings within the Former RNAD Site, through the scrub and brownfield land associated with the old artillery tunnels and continued up the wooded valley and included the two reservoirs. The survey involved sampling all habitats based upon a visual assessment of those considered by the surveyor to be most likely to support assemblages of bryophytes.

### 3.2 Bryophyte Survey Methodology

#### 3.2.1 Desk-top Review

A desk-top survey of available information on bryophytes within the survey area was undertaken, including a review of records held by the West Wales Biodiversity Information Centre and NBN Gateway. Consultation with the vice-county bryophyte recorder for Pembrokeshire, Sam Bosanquet (CCW), was undertaken with regard to the locations of any species of conservation concern.

#### 3.2.2 Field Survey

The survey area was systematically searched for bryophytes, recording the species found and concentrating effort in patches of promising habitat. All species will be identified in the field as far as possible. Small samples of species that could not be identified in the field were collected for microscopic examination. A species inventory was compiled for the area and an estimate of the abundance of each species will be made based upon the DAFOR (dominant, abundant, frequent, occasional, rare) scale.

The distribution of species of special interest will be plotted within a GIS system based upon a base-map of appropriate scale, which will then be used to produce distribution maps for the reports. If a species of special interest proves to be frequent within a site, a sub-set of colonies will be chosen for the above detailed data collection. This approach is featured in the Common Standards Monitoring guidance for bryophytes (JNCC. 2005. Common standards monitoring guidance for bryophytes and lichens. Joint Nature Conservation Committee, Peterborough).

### 3.3 Bryophyte Survey Results

Seven species of bryophyte of conservation concern were identified as being present within 10km of the site by the desktop survey. Of those seven species only four (*Amblystegium radical*, *Cephaloziella turneri*, *Ditrichum subulatum* and *Tortula wilsonii*) had been recently recorded within 2km of the site.

Capabilities on project:  
Ecology

A total of 104 different species of bryophytes were recorded during the field survey. This is thought to represent an accurate assessment of those species present as there were no significant constraints associated with the field surveys.

The wooded valley and reservoirs area supports a species-poor, acidic bryophyte flora. The stream is largely lined with concrete and supports little bryophyte diversity. The middle and upper portions of the woodland are oak-dominated with a coarse grassy field layer and no rocky ground and supports few bryophytes. The lowest portion of woodland comprises mainly sycamore and beech and has a more open field layer with some rocky outcrops on the slopes. Here, common bryophytes on the ground include *Atrichum undulatum*, *Dicranella heteromalla*, *Dicranum scoparium*, *Fissidens dubius*, *Fissidens taxifolius* var. *taxifolius*, *Kindbergia praelonga*, *Mnium hornum*, *Plagiomnium undulatum* and *Plagiothecium nemorale*. The trees in this area are generally poor in epiphytes, with typical species including *Frullania dilatata*, *Hypnum andoi*, *Hypnum cupressiforme* var. *resupinatum*, *Isothecium myosuroides* var. *myosuroides*, *Metzgeria furcata*, *Microlejeunea ulicina* and *Ulota crispa*. Deadwood on the woodland floor supported a limited number of bryophytes.

The rock-faces within the site are largely overgrown with gorse and ivy. Those that remain exposed provide mildly acidic and dry surfaces and crevices which support an impoverished bryophyte flora. Damp, exposed soil along tracks through the rough grassland and scrub on the valley slopes provide habitat for a community of small, ephemeral bryophytes typical of circum-neutral to acidic conditions. In the lower part of the site, thin soil over concrete support an ephemeral community that is more calcicole in nature. Disused concrete pads, which are extensive over much of the ground within the site, provide suitable substrate for a typical pioneer community.

### 3.4 Conclusions

None of the bryophytes recorded from the site are legally protected, are of national conservation concern or are locally rare. Assessment of the bryophyte flora against the lower plant guidelines for the selection of biological SSSIs (Hodgetts 1992) shows that the assemblage is not of special interest in a national context. Indeed, all of the species are common or frequent within the British Isles. Therefore, the study corridor is not of particular conservation interest for bryophytes.



Capabilities on project:  
Ecology

## 4 Lichens

### 4.1 Introduction

The Phase 1 Habitat Survey identified a high density of lichens within the woodland and disused development areas at the southern end of the study corridor.

A baseline lichen survey of two sites at Newton Noyes, Milford Haven Pembrokeshire was carried out on 7 October, 2010 by Vince Giavarini.

The objectives of this lichen survey were to:

- Undertake a lichen survey of the two sites according to the survey area plan and identify all conspicuous species present.
- Species of note (*threatened* or any with rarity status) to be mapped in more detail.

The full details of the survey are outline in *Giavarini, Vince (October 2010) Lichen survey of the Newton Noyes woodlands and derelict buildings complex, Milford Haven, Pembrokeshire*. This report is included in Appendix 4 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Appendices, AECOM, October 2011*). The study area is shown in Figure 3.1 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

The lower and middle part of the wooded valley, the boundary trees, outcrops, scrub trees and derelict features (concrete buildings, ruins, collapsed walls, stony turf) and the north east section of woodland were surveyed for lichens. The survey also includes all other non-lichenised species traditionally treated as lichens.

### 4.2 Lichen Survey Methodology

The survey involved sampling the wide range of woodland habitats. Samples of critical taxa were collected for later determination under the microscope.

Epiphytic lichens were site assessed and evaluated using the Revised Index of Ecological Continuity (RIEC), a baseline lichen index. The scale can be applied universally to woodland sites across the whole of the UK. Epiphytic lichens were also assessed using more regionally accurate indices. Most appropriate for the Pembrokeshire area is the New Index of Ecological Continuity (NIEC). Lichens listed on these indices require long periods of continuous woodland canopy to establish and are therefore considered indicator species of ecological connectivity and woodland age.

This survey has made only a provisional subjective measure of abundance using the DAFOR scale (Dominant, Abundant, Frequent, Occasional, Rare). Quadrat data was not collected as part of this survey.

### 4.3 Lichen Survey Results

A total of 109 lichens were recorded across the two sites of which 64 are epiphytes, four are wood-inhabiting or lignicolous, and three are turf-dwelling, while the remaining 38 taxa occur on rock or stone of various kinds. Trees within the woodland area yielded 48 lichens. From the boundary, scrub and stand-alone trees 47 lichens were recorded.

Woodland lichen communities include the crustose associations of smooth-barked trees such as beech and sycamore (*Graphidion* and *Lecanorion*), the well-lit bark and branches of mature trees such as oak, featuring associations of leafy lichens (*Parmelion*), dry-bark communities at the foot of some of the larger valley trees (*Calicion*) and the brightly illuminated canopy communities on sallow and alder with a healthy cover of 'beard lichens' (*Usneion*). Nutrient-enriched lichen communities of the *Xanthorion* occurred only on trees along the exposed edges of the woodland valley (mainly sycamore and ash) where dust and airborne material was most readily intercepted or deposited.

None of the lichens recorded is *threatened*. However, four of the lichens recorded across the two sites have *Nationally Scarce* rarity status *Japewiella tavaresiana*, *Lecania hutchinsiae*, *Lecania rabenhorstii* and *Phaeographis inusta*. Two are also species for which Britain has International Responsibility (IR) namely *Lecanactis subabietina* and *Phaeographis inusta*.

Capabilities on project:  
Ecology

#### 4.4 Lichen Survey Results – Tunnel Area (4Gas Site)

##### 4.4.1 Woodland Lichens and Ecological Continuity

Epiphytic (bark-inhabiting) lichens recorded from the areas of woodland under investigation were evaluated against tables of lichen indices (lists of lichens considered to represent a “relict flora” otherwise called “Indicator species”). This method is used by lichenologists for assessing woodland age (i.e. Do these woodlands demonstrate long-term ecological continuity with the ‘wildwood’ or “old-growth forests” ancient woodland environments).

The data set was tested against the RIEC (Revised Index of Ecological Continuity), a list of 30 species. The tunnel area site yielded just four. However, two of these count only as one, as they often occur together in exactly the same microhabitat on shaded bark. Therefore, it scored 3/30 giving an **RIEC score of 15** (5 per species). This is well below the threshold for even the weakest suggestion of continuity. Any score of 25 or less equals no indication of ecological continuity.

The data set was tested against the NIEC (New Index of Ecological Continuity) which is a more sophisticated list of 70 species incorporating most of the RIEC lichens. It scored equally poorly if not worse, with a total again of four. Two of which, as with the RIEC, may only be counted as one. This gave an **NIEC score of 3/70**. According to NIEC scale all woodlands scoring less than 20/70 are likely to be of no or limited conservation importance.

Those species present at Newton Noyes scoring on each index are given in Table 4.1 together with the first host tree at the site they were recorded from.

**Table 4.1: Lichen Species Present at Newton Noyes Scoring on the RIEC and NIEC Indices**

RIEC Index	NIEC Index
<i>Enterographa crassa</i> (Fs)	<i>Lecanactis subabietina</i> (Q)
<i>Porina leptalea</i> (Fs)	<i>Lecanora jamesii</i> (S)
<i>Pyrenula chlorospila</i> (Fs)	<i>Phaeographis dendritica</i> (Fs)
<i>Pyrenula macrospora</i> (Fs)	<i>Phaeographis inusta</i> (S)

##### 4.4.2 Interpretation of Indices

The woodland site has a relatively high biomass of lichen, although biomass should never be used as an indicator of age; it is more an indication of site conditions which range from moist and sheltered to exposed. The lichen flora here benefits most from the humidity provided by poorly drained soils especially in the woodland opposite Venn Farm and in the deepest section of the woodland behind the reservoir. This provides generally good growing conditions for lichens. However, here at the woodland near the Tunnels an RIEC score of 15 and an NIEC of 3/70 suggest categorically no indication of ancientness.

The woodland lichens at this site with *Nationally Scarce* rarity status are *Japewiella tavaresiana* and *Phaeographis inusta*. *Lecanactis subabietina* has IR status. However, none of these are *threatened*. All are of *Least Concern* for conservation.

- *Japewiella tavaresiana*: crustose lichen of sallow branches with small brown, shiny discs (seen once).
- *Phaeographis inusta*: crustose scripture lichen with black elongated discs forming a tight mosaic on smooth bark of sallow (seen once on same tree as the above).
- *Lecanactis subabietina*: grey crustose lichen of sheltered acid oak bark with chalky-white pycnidia (seen twice on two oaks near railings leading to bottom of valley).

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Ecology

#### 4.4.3 Non-woodland Habitats

These include a range of abandoned stone structures: water tanks, concrete buildings and old mortared walls. Predictably on sites where there is a high level of disturbance much of the stonework is colonised by a range of pioneer lichens of acid or basic rock.

One dilapidated wall produced two similar species in close proximity namely, *Lecania hutchinsiae* and *Lecania rabenhorstii* that have Nationally Scarce status. Both are rather under-recorded in Britain but were not unexpected.

Exposed acid brickwork has a good cover of common mosaic-forming species such as *Buellia aethelea*, *Candelariella vitellina*, *Catillaria chalybeia* and *Rhizocarpon reductum*. The seams of mortar between have a lichen flora rich in calcicole lichens which included *Agonimia tristicula*, *Aspicilia calcarea*, *Caloplaca flavescens*, *Lecanora albescens*, *Lecanora campestris* and *Verrucaria nigrescens*.

Exposed soil was often poor for lichens as these areas were rapidly turned into moss carpets or invaded by a scrub of bramble and small trees. Only rarely was the cup-lichen *Cladonia humilis* or the mat-forming *Cladonia rangiformis* seen. Small pockets of short turf with siliceous stones, pebbles or tiny rock fragments were colonised by *Acarospora smaragdula*, *Porpidia crustulata* and *Scoliciosporum umbrinum*.

Outcrops of Old Red Sandstone are well vegetated and there is little space for lichens. The only area of bare rock seen was a north-facing section and this is colonised by the mild acidophiles *Opegrapha gyrocarpa*, *Lecidella scabra* and *Porpidia macrocarpa*. Dog lichen *Peltigera hymenina* was also recorded in this area.

#### 4.5 Lichen Survey Results – Former RNAD Site

The lichen interest is restricted to the edges of the site due to the influence of the industrial premises still standing. Habitats are few in number but mainly comprise broken concrete, wood, rubbish, spreads of acid rubble, and shallow soils over concrete floors (the cliffs at the rear of the site will be discussed later). The principal species of these habitats are often tiny, stress-tolerant ruderals, pioneer species with a rapid growth rate and short life cycle.

The western end of the Former RNAD site includes a sizable area invaded by Buddleja. Several years of dormant exposure has allowed only pioneer lichens to colonise the fist-sized lumps of siliceous rock. Nowadays this habitat is somewhat rare, a once major feature of many inner cities and run-down docklands between 1970 and 1985. Most wasteland sites have now often lain dormant for many years having been asset stripped and graded out before slowly greening over with invasive vegetation. Tiny lichen mosaics are common everywhere in this area but always dominated by two species *Buellia aethelea* and *Buellia ocellata* along with companion species *Acarospora smaragdula*, *Catillaria chalybeia*, *Lecidella scabra*, *Micarea erratica*, *Porpidia crustulata*, *Protoblastenia rupestris*, *Rhizocarpon reductum*, *Scoliciosporum umbrinum*, *Trapelia coarctata* and occasionally *Trapelia obtogens*.

Where the edge of the site overlooks the estuary, concrete paths are colonised by a mix of typical maritime lichens such as *Caloplaca marina* and *Xanthoria parietina*, opportunist taxa *Aspicilia contorta* ssp. *contorta*, *Caloplaca teicholyta* and *Verrucaria muralis*, species of the *Caloplaca holocarpa* complex, and the soily path specialist *Collema tenax* var. *ceranoides*.

Soily areas tended to carry bloated colonies of Nostoc (the algal component of several of the 'jelly lichens') yet few Nostoc-containing lichen species were encountered. A brief examination of metal objects failed to find any lichens tolerant of toxicity such as *Veizdaea* spp. Broken concrete often had *Sarcogyne regularis* establishing along freshly weathered surfaces. A few scattered weathered wooden items yielded additional lichens such as *Cladonia coniocraea*, *Micarea denigrata*, *Placyinthiella icmalea* and *Trapeliopsis flexuosa*.

Capabilities on project:  
Ecology

Throughout its length the wall of cliffs at the rear of the site is heavily overgrown with ivy and other climbing plants. Only occasionally is the pattern broken when the sandstone becomes suitable for colonisation by lichens or mosses. One particular lichen species forming pale blue-green tufts on grassy ledges mimics *Cladonia* colonies. This was confirmed as *Leprocaulon microscopicum*. Also identified was *Buellia ocellata*, *Lepraria incana* and *Verrucaria muralis*.

All the lichens encountered at the Former RNAD Site are of *Least Concern* and consequently not threatened.

#### 4.6 Conclusions

Two woodland lichens at the wooded area of the tunnels site were identified as having *Nationally Scarce* rarity status and one has IR status. However, none of these are *threatened*. All are of *Least Concern* for conservation. Both the RIC and NIEC scores demonstrated that the wooded area had no or limited conservation importance for lichens and that the woodland showed no ecological continuity or 'ancientness'.

The non wooded areas of the tunnels area identified two species which have *Nationally Scarce* status. However, both are rather under-recorded in Britain and were not unexpected.

All the lichens encountered at the Former RNAD Site are of *Least Concern* and consequently not threatened.

Capabilities on project:  
Ecology

## 5 Invertebrates

### 5.1 Introduction

The desk study and Phase 1 Habitat Survey identified that the mosaics of habitats at the southern end of the study corridor near the disused artillery tunnels and the Former RNAD Site had potential to support a diverse assemblage of invertebrates. The county ecologist also reported a sighting of dingy skipper (*Erynnis tages*) at the Former RNAD Site on 21/05/10. An invertebrate survey was undertaken at the southern end of the study corridor near the tunnels and the Former RNAD Site on 7<sup>th</sup> and 8<sup>th</sup> October 2010 by Colin Plant Associates (UK).

The survey methodology and results are summarised below. The full details of the report are given in *Colin Plant Associates (UK) (October 2010) Waterston site, Milford Haven, Invertebrate Appraisal, Report number BS/2575/10*. This report is included in Appendix 5 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Appendices, AECOM, October 2011*). The study area is shown in Figure 3.1 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

The objectives of the invertebrate survey were to:

- Appraise the sites overall potential to support a diverse or important assemblage of invertebrates; and
- Scope any species specific survey work deemed to be necessary.

The surveyed site is a classic, neglected post-industrial site. Areas of hard-standing either with derelict or demolished buildings have become invaded by ruderal herbage which ultimately gives way to scrub, here mostly Buddleia. Adjacent semi-natural areas that were modified in the industrial phase of the land-use have regenerated to some degree but are essentially, now, of a secondary character.

The overall habitat of the two areas, a rather complicated mosaic of woodland, scrub and grassland, with cliffs, steep slopes and level areas and some standing water, a small area of tall ruderal herbs and an under-cliff area – all working as a single habitat mosaic. Therefore the survey results have been presented as one habitat.

### 5.2 Survey Methodology

A single site visit was undertaken on 7<sup>th</sup> and 8<sup>th</sup> October 2010, including the intervening overnight period. During the daytime, the entire site was walked and terrestrial invertebrate habitats were examined.

An inventory of invertebrate species was not undertaken and during October would not be practical. However, light trapping was undertaken overnight and a list of moths and some other nocturnal insects arising from light trapping was collected. Some ground beetles were also encountered by turning over stones and other debris and some micro-moths were recorded from their larval leaf-mines.

### 5.3 Survey Results for Southern Study Corridor and the Former RNAD Site

A short list of species was recorded at the site although no species of particular conservation interest are present, although this is not a significant result given the minimal recording effort. However, it is necessary to mention some of the moths observed here.

The list of UK Biodiversity Action Plan species of moths is divided into two sections. In the first, a total of 81 species are afforded the status of UK BAP Priority Species; none of these is recorded in the surveyed although absence during this survey should not be interpreted as confirmation of absence. The second section is a list of 69 species that have declined in population by a significant amount in the past 25 years. These are not yet rare and are flagged as UK BAP species “for research only”. They were inadvertently included in the overall BAP list by non-specialists. These species were not intended to be affected by the requirements of *Planning Policy Statement 9: Biodiversity and Geological Conservation*, published by the Office of the Deputy Prime Minister during 2005, which requires Local Authorities to take measures to protect the habitats of UK BAP species from further decline through policies in local development documents. They were merely flagged for special attention.

Capabilities on project:  
Ecology

The survey recorded five Invertebrate Species which are not yet rare and are flagged as UK BAP Species “for Research Only” and are shown in Table 5.1. It is expected that other such species be present at the site if the survey were undertaken at a different time of year or over a longer period.

**Table 5.1: UK BAP Species “for Research Only” Invertebrate Species Recorded by the Survey**

Species	English Name	Caterpillar Food Plants
<i>Agrochola helvola</i>	Flounced Chestnut	Grasses - feeding on the roots and stem bases
<i>Agrochola lychnidis</i>	Beaded Chestnut	Deciduous trees and shrubs and herbaceous plants (requires both)
<i>Allophyes oxyacanthae</i>	Green Brindled Crescent	Rosaceous trees and shrubs
<i>Eugnorisma glareosa</i>	Autumnal Rustic	Polyphagous on herbaceous plants and grasses
<i>Hydraecia micacea</i>	Rosy Rustic	Herbaceous plants, especially docks, feeding in the rootstock

Whilst at the national level all of these have declined, numerically, in the past 25 years, amongst these five the decline of the flounced chestnut is most significant. This moth has perhaps become extinct in many inland areas of lowland Britain.

Casual enquiries of the Pembrokeshire County Moth Recorder indicate only a handful of recent reports for the county and never more than two individuals counted on any occasion. The presence of 15 examples at the lights (more or less equally divided between the three traps), is therefore of some significance.

An examination of the ecological associations of the moth species recorded on site suggests that most recorded species will be associated with the semi-natural/secondary habitats on the slopes and cliffs above the level area of the valley floor.

#### **5.4 Invertebrate Survey Conclusions Southern Study Corridor Area and the Former RNAD Site**

At present, the post industrial areas of the site are in the later dense scrub phase of succession. In general, invertebrate diversity is at its most diverse in the earlier phases of the succession.

Given the restricted nature of the flora and the geographical situation of the Former RNAD Site and Tunnels Site, it is not likely that either area will generate a species inventory that is especially rich in species of conservation significance.

Across the entire surveyed area, including both the Former RNAD Site, Tunnels Site and land north of the Tunnels Site, the level areas are of low invertebrate interest whilst the associated slopes, cliffs, under-cliffs and other associated secondary habitat areas may have a greater value. The invertebrate fauna in these areas might be of raised significance and would warrant closer examination. In particular, large numbers of the flounced chestnut moth were encountered.

Capabilities on project:  
Ecology

## 6 Reptiles

### 6.1 Introduction

The Extended Phase 1 Habitat Survey identified areas of habitat as being suitable to support reptiles. The Former RNAD Site and land close to the disused artillery tunnels at the southern end of the road route were identified as having the most potential to support significant populations of reptiles. During consultation PCC stated that common lizards (*Zootoca vivipara*), adders (*Vipera berus*), grass snakes (*Natrix natrix*) and slow worms (*Anguis fragilis*) have been found in the surrounding area, so reptile surveys should be undertaken for the study corridor. The desk study also returned records of all four common reptile species from the vicinity of the study corridor and Former RNAD Site.

### 6.2 Methodology

The reptile survey methodology was based on the guidelines for undertaking reptile survey provided by Froglife (Froglife 1999. Advice Sheet 10 – Reptile Survey). An Introduction to planning, conducting and interpreting surveys for snake and lizard conservation) and also the Herpetofauna Workers' Manual (Gent, T and Gibson, S 1998. Herpetofauna Workers' Manual. JNCC, Peterborough).

Artificial refugia (approximately 0.5m x 0.5m square sheets of heavy-duty mineral roofing felt or similar size corrugated metal sheets) were placed in suitable locations within the survey areas at a minimum density of 10 per hectare and then remained undisturbed for a period of at least seven days. During each survey all refugia and surrounding habitat and naturally occurring habitat features likely to be used by reptiles were checked for the presence of reptiles.

### 6.3 Evaluation

In order to assess the value of any given reptile population two assessment methodologies may be applied. Nationally, guidelines for the selection of SSSIs (JNCC 1989). Guidelines for selection of biological SSSI's. Peterborough) provide criteria for identifying nationally important populations of reptiles. The methodology developed by Froglife (1999) used in the identification of Key Reptile Sites can be used to evaluate reptile populations at a local or regional level. To qualify as a Key Reptile Site a site must meet at least one of the following criteria:

- Supports three or more reptile species;
- Supports two snake species;
- Supports an exceptional population (see Table 6.1 below) of one species;
- Supports an assemblage of species scoring at least 4 (see Table 6.1 below); or
- Does not meet any of the previous criteria, but is of particular regional importance due to local rarity.

**Table 6.1: Key Reptile Site Criteria (Froglife Advice Sheet 10)**

Species	Low Population (Score 1)	Good Population (Score 2)	Exceptional Population (Score 3)
Adder	<5	5 – 10	>10
Grass Snake	<5	5 - 10	>10
Common Lizard	<5	5- 20	>20
Slow Worm	<5	5 - 20	>20

Capabilities on project:  
Ecology

#### 6.4 Constraints

The survey was started later in the survey season than is considered optimal. Ideally a minimum of two weeks should be left between the placement of the refugia and the first survey visit to allow time for reptiles to find and start using the refugia. Survey work should also be completed before the end of September in any year before reptiles start to hibernate and so the final three survey visits to the study corridor would be considered sub-optimal. However, weather conditions were suitable during the survey period and a warm autumn generally mean that reptiles are likely to have remained active later than usual. Despite these constraints and although results cannot be used to estimate population size classes accurately the results are invaluable in establishing the presence of reptiles in areas of good habitat within the Former RNAD Site and the study corridor.

#### 6.5 Survey Results for the Study Corridor

Ninety three artificial refugia were placed in areas of suitable habitat within the southern end of the study corridor on the 16<sup>th</sup> September 2010. Refugia were checked on seven subsequent occasions and the results summarised in Table 6.1 below. Figure 6.1A shows the location of survey areas and total numbers of refugia within the site (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*). Table 6.3 summarises the weather conditions during each survey.

**Table 6.2: Summary of Reptile Survey Results from the Study Corridor Area**

Section	A	B	C	D	E	F	G	H	I	J
Date										
28 <sup>th</sup> September	3 SW, 1T	1SW				1SW		11T	1SW, 3T	5T
29 <sup>th</sup> September	1T		3T	1SW, 2T	1T		1SW, 1CL	20T	7T	3T
29 <sup>th</sup> September				1SW, 2T	1SW, 1T		1SW	18T	2T	
30 <sup>th</sup> September	7T		1T	1SW	1SW, 1CL,1T	2CL	2SW, 1CL	18T	2SW, 8T	8T
12 <sup>th</sup> October	4T	2T			3SW			1T		
13 <sup>th</sup> October	1SW, 5T				1SW	1GS	2SW	3T	1SW, 3T	1SW, 2T
14 <sup>th</sup> October	9T						1SW	13T	2T	1T

Definitions: SW = slow worm; CL = common lizard; GS = grass snake; T = common toad; N = smooth/palmate newt juvenile



Capabilities on project:  
Ecology

**Table 6.3: Summary of Weather Conditions during the Reptile Surveys in the Study Corridor**

Date	Time	Cloud Cover (Octars)	Temperature (°C)	Humidity (%)	Summary	Average Wind Beaufort
28 <sup>th</sup> September	14.30	8/8	16.0	91.9	Light showers	1
29 <sup>th</sup> September	11.30	2/8	15.3	76.9	Sunny	1
29 <sup>th</sup> September	15.15	3/8	16.4	80.7	Sunny with some cloud	1
30 <sup>th</sup> September	13.50	7/8	16.6	75.5	Cloudy, rain earlier	1
12 <sup>th</sup> October	12.00	0/8	14.4	63.2	Sunny	0
13 <sup>th</sup> October	14.00	3/8	18.2	63.3	Cloudy spells	0
14 <sup>th</sup> October	11.54	8/8	11	87.1	Cloudy	1

Survey results revealed that slow worm, common lizard and grass snake were all present within the site meaning that the site qualifies as a Key Reptile Site under Froglife guidelines. A peak count of six slow worms was recorded on three dates (28<sup>th</sup> and 30<sup>th</sup> September and 13<sup>th</sup> October 2010). The majority of records were of juveniles probably indicating that the adults may have started hibernating for the winter. A peak count of four common lizards was recorded on the 30<sup>th</sup> September 2010, although this species is also known to start hibernation in September so the count of four is likely to be an underestimate of the total population. One sub-adult grass snake was recorded on the 13<sup>th</sup> October 2010 indicating the presence of this species. Grass snakes often move larger distances than the other reptiles to find suitable breeding and hibernation sites and it is likely that this species has been under-recorded. No adders were recorded during the survey, although considering the seasonal constraints and short survey period the presence of adders cannot be ruled out.

A large number of primarily juvenile common toads (*Bufo bufo*) were recorded throughout the site indicating a large breeding population nearby (probably in either or both small reservoirs to the north of the site). One unidentified juvenile newt (either smooth or palmate) was recorded suggesting that small numbers of either species is breeding close to the site.

## 6.6 Survey Results for the Former RNAD Site

Seventy nine reptile survey refugia were laid out in areas of suitable habitat within the Former RNAD Site on the 26<sup>th</sup> August 2010. Refugia were checked on seven subsequent occasions and the results summarised in Table 6.4 below. Figure 6.1B shows the location of survey areas and total numbers of refugia within the site (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*). Table 6.5 summarises the weather conditions during each survey.

Capabilities on project:  
Ecology

**Table 6.4: Summary of Reptile Survey Results from the Former RNAD Site**

Section	A	B	C	D	E	F	G	H
Date								
15 <sup>th</sup> September	3SW	1T					2T	1T
16 <sup>th</sup> September	2SW, 4T	2SW, 1CL, 4T	1CL	4T	1T			
17 <sup>th</sup> September	2SW, 11T	1CL, 3T		1CL, 1T			2T	1T
28 <sup>th</sup> September	3T, 1N	5T		2T				2T
28 <sup>th</sup> September	3T	2T	1T				5T	
29 <sup>th</sup> September	7T		4T	1CL			2T	
13 <sup>th</sup> October	2SW, 6T			2T			1T	

Definitions: SW = slow worm; CL = common lizard; T = common toad; N = Smooth/palmate newt juvenile

**Table 6.5: Summary of Weather Conditions during the Reptile Surveys at the Former RNAD Site**

Date	Time	Cloud Cover (Octars)	Temperature (°C)	Humidity (%)	Summary	Average Wind Beaufort
15 <sup>th</sup> September	11.00	2/8	15.0		Sunshine and cloud	2
16 <sup>th</sup> September	12.00	6/8	16.7	67.0	Cloudy	0
17 <sup>th</sup> September	11.00	3/8	16.1	67.0	Sunshine and cloud	2
28 <sup>th</sup> September	12.30	8/8	15.0	96.1	Light rain	1
28 <sup>th</sup> September	16.00	8/8	16.5	90.5	Cloudy	0
29 <sup>th</sup> September	10.40	3/8	14.9	78.9	Sunny spells	1
13 <sup>th</sup> October	11.00	0/8	15.4	67.6	Sunny	0

Survey results revealed that slow worm and common lizard were present within the site. A peak count of four slow worms was recorded on the 16<sup>th</sup> September 2010 with smaller numbers recorded on four of the seven survey visits. The majority of records were of juveniles probably indicating that the majority of adults had started hibernating for the winter. A peak count of two common lizards was recorded on the 16<sup>th</sup> and 17<sup>th</sup> September 2010 although this species is also known to start hibernation in September so the small count is likely to be an underestimate of the total population. No grass snakes or adders were recorded during the survey, although considering the seasonal constraints and short survey period the presence of adders particularly cannot be ruled out. Habitat within the site is ideal for adders although slightly sub optimal for grass snakes considering the lack of fresh water close to the site boundary. Therefore, the site does not qualify as a Key Reptile Site under Froglife guidance, although the results may be influenced by survey constraints.

Capabilities on project:  
Ecology

A peak count of 18 juvenile common toads was recorded on one visit distributed throughout the site indicating a large breeding population nearby (probably in either or both small reservoirs to the north of the site).

## **6.7 Conclusions**

Survey work undertaken in 2010 has established the presence of small reptile populations within both the Former RNAD Site and habitat within the southern end of the study corridor. Grass snake, slow worm and common lizard are present in small numbers scattered across suitable habitat. Data collected during the survey does classify the 4Gas Site as a Key Reptile Site following Froglife Advice Sheet 10 (1999). The Former RNAD Site is not classified as a Key Reptile Site.

Capabilities on project:  
Ecology

## 7 Birds

### 7.1 Introduction

Habitats within the study corridor and the Former RNAD Site are suitable to support a range of breeding and wintering birds.

### 7.2 Methodology

No specific bird survey work was undertaken although bird records were collected throughout the survey period in 2010 by survey staff undertaking other survey work. Bird species recorded were assigned to the red, amber or green list of conservation concern as published by the RPSB/JNCC/BTO and updated in 2010 to give an indication of the current status of the species in the UK.

#### 7.2.1 *Birds of Conservation Concern Criteria*

The criteria used in assessments are intended to ensure that Birds of Conservation Concern (BoCC) listings reflect each species' global and European status as well as that within the UK, and additionally measure the importance of the UK population in international terms.

#### 7.2.2 *Red List Criteria*

Species that meet any of the following criteria are red listed: **IUCN** Global Conservation Status. Species listed by BirdLife International as being Globally Threatened using IUCN criteria.

- **HD** Historical Decline. A severe decline in the UK between 1800 and 1995, without substantial recent recovery.
- **BDp** Breeding Population Decline. Severe decline in the UK breeding population size, of more than 50%, over 25 years (BDp1) or the entire period used for assessments since the first BoCC review, starting in 1969 ("longer-term") (BDp2).
- **WDp** Non-breeding Population Decline. Severe decline in the UK non-breeding population size, of more than 50%, over 25 years (WDp1) or the longer-term (WDp2).
- **BDr** Breeding Range Decline. Severe decline in the UK range, of more than 50%, as measured by number of 10 km squares occupied by breeding birds, over 25 years (BDr1) or the longer-term (BDr2).

#### 7.2.3 *Amber List Criteria*

Species that meet any of the following criteria, but none of the red list criteria, are amber listed:

- **SPEC** European Conservation status. Categorized as a Species of European Conservation Concern (SPEC 1, 2 or 3).
- **HDrec** Historical Decline – Recovery. Red listed for Historical Decline in a previous review but with substantial recent recovery (more than doubled in the last 25 years).
- **BDMp** Breeding Population Decline. As for red list criteria BDp1 and BDp2, but with moderate decline (by more than 25% but less than 50%).
- **WDMp** Non-breeding Population Decline. As for red list criteria WDp1 and WDp2, but with moderate decline (by more than 25% but less than 50%).
- **BDMr** Breeding Range Decline. As for red list criteria BDr1 and BDr2, but with moderate decline (by more than 25% but less than 50%).
- **BR and WR Rarity**. UK breeding population of less than 300 pairs (BR) or non-breeding population of less than 900 individuals (WR).
- **BL and WL Localisation**. At least 50% of the UK breeding (BL) or non-breeding (WL) population found in 10 or fewer sites.
- **BI and WI International Importance**. At least 20% of the European breeding (BI) or non-breeding (WI) population found in the UK.

Capabilities on project:  
Ecology

#### 7.2.4 Green List Criteria

All regularly occurring species that do not qualify under any of the red or amber criteria are green listed. The green list also includes those species listed as recovering from Historical Decline in the last review that have continued to recover and do not qualify under any of the other criteria.

### 7.3 Survey Results for the Study Corridor

Records were collected of fifty-one bird species using the study corridor throughout 2010. Table 7.1 below shows the bird species recorded and their level of legal protection and conservation status. Further interpretation of these records is provided in the paragraphs below.

**Table 7.1: Bird Species Recorded within the Study Corridor**

Species	Schedule 1	Conservation Concern List	Summer/winter visitor	Potentially Breeding?
Grey Heron			All year round.	Yes
Sparrowhawk			All year round.	Yes
Kestrel		Amber	All year round.	Yes
Peregrine	Yes		All year round.	No
Pheasant			All year round.	Yes
Lapwing		Red	All year round, but increase in winter.	Yes
Snipe		Amber	Based on habitat winter visitor only.	No
Black-headed Gull		Amber	All year round, but large increase in winter.	No
Common Gull		Amber	All year round, but increase in winter.	No
Lesser Black-backed Gull		Amber	All year round, but increase on passage.	No
Herring Gull		Red	All year round, but large increase in winter.	No
Woodpigeon			All year round.	Yes
Collared Dove			All year round.	Yes
Barn Owl	Yes	Amber	All year round.	Yes
Kingfisher	Yes	Amber	All year round.	Yes
Green Woodpecker		Amber	All year round.	Yes
Great Spotted Woodpecker			All year round.	Yes
Skylark		Red	All year round.	Yes
Meadow Pipit		Amber	All year round.	Yes
Rock Pipit			All year round, but increase in winter.	No

Capabilities on project:  
Ecology

Species	Schedule 1	Conservation Concern List	Summer/winter visitor	Potentially Breeding?
Pied Wagtail			All year round.	Yes
Wren			All year round.	Yes
Duncock		Amber	All year round.	Yes
Robin			All year round.	Yes
Stonechat			All year round.	Yes
Fieldfare	Yes		Winter visitor.	No
Song Thrush		Red	All year round, but winter increase.	Yes
Redwing	Yes		Winter visitor.	
Mistle Thrush		Amber	All year round.	
Blackbird			All year round but winter increase.	
Blackcap			Summer visitor.	Yes
Whitethroat		Amber	Summer visitor.	Yes
Sedge Warbler			Summer visitor.	Yes
Chiffchaff			Summer visitor.	Yes
Goldcrest			All year round but increase during migration.	Yes
Long-tailed Tit			All year round.	Yes
Coal Tit			All year round.	Yes
Blue Tit			All year round.	Yes
Great Tit			All year round.	Yes
Jay			All year round.	Yes
Magpie			All year round.	Yes
Jackdaw			All year round.	Yes
Carrion Crow			All year round.	Yes
Rook			All year round.	Yes
Starling		Red	All year round, but large increase during winter.	Yes
House Sparrow		Red	All year round.	Yes
Chaffinch			All year round, but increase on passage.	Yes
Greenfinch			All year round, but increase on passage.	Yes
Goldfinch			All year round, but increase on passage.	Yes

Capabilities on project:  
Ecology

Species	Schedule 1	Conservation Concern List	Summer/winter visitor	Potentially Breeding?
Linnet		Red	All year round.	Yes
Reed Bunting		Amber	All year round.	Yes

Of those species recorded a number are winter visitors and suitable breeding habitat for others does not occur but despite this the study corridor is likely to support a reasonable assemblage of breeding birds typical of the habitat types present and the region. A full breeding bird survey may find additional species or prove that some recorded species are not breeding.

Five Schedule 1 species were recorded within the study corridor although fieldfare and redwing are winter visitors and will not be breeding within the study corridor. Peregrine was only recorded hunting above the site but suitable breeding habitat is not present. Kingfisher and barn owl were both recorded and both may be breeding within the wider study corridor although further survey work would be required to determine the status of each species. Seven red listed birds were recorded of which only herring gull will not be breeding within the study corridor. Suitable habitat exists for the remainder of red listed species but none is likely to breed in exceptional numbers based upon the habitats present.

#### 7.4 Survey Results for the Former RNAD Site

Records were collected of twenty-six bird species using the Former RNAD Site throughout 2010. Table 7.2 below shows the bird species recorded and their level of legal protection and conservation status. Further interpretation of these records is provided in the paragraphs below.

**Table 7.2: Bird Species Recorded within the Former RNAD Site**

Species	Schedule 1	Conservation Concern List	Summer/winter visitor	Potentially Breeding?
Kestrel		Amber	All year round.	Yes
Black-headed Gull		Amber	All year round but large increase in winter.	No
Herring Gull		Red	All year round but large increase in winter.	Yes (on buildings)
Woodpigeon			All year round.	Yes
Barn Owl	Yes	Amber	All year round.	Yes
Rock Pipit			All year round.	Yes
Pied Wagtail			All year round.	Yes
Wren			All year round.	Yes
Dunnock		Amber	All year round.	Yes
Robin			All year round.	Yes
Stonechat			All year round.	Yes
Song Thrush		Red	All year round, but increase in winter.	Yes

Capabilities on project:  
Ecology

Species	Schedule 1	Conservation Concern List	Summer/winter visitor	Potentially Breeding?
Blackbird			All year round, but increase in winter.	Yes
Blackcap			Summer visitor.	Unlikely
Whitethroat		Amber	Summer visitor.	Yes
Goldcrest			All year round, but increase on passage.	Unlikely
Long-tailed Tit			All year round.	Yes
Blue Tit			All year round.	Yes
Great Tit			All year round.	Yes
Magpie			All year round.	Yes
Jackdaw			All year round.	Yes
Carrion Crow			All year round.	Yes
Starling		Red	All year round.	Yes
Chaffinch			All year round.	Yes
Goldfinch			All year round.	Yes
Linnet		Red	All year round.	Yes

The Former RNAD Site is dominated by disused buildings with associated ruderal habitat and a patch of dense scrub along the site boundary. The habitat supports a typical assemblage of breeding birds based upon the habitat type and location in proximity to the estuary.

Barn owl was the only Schedule 1 breeding bird recorded within the Former RNAD Site and it is possible that the species may be nesting within one of the disused buildings. It is equally likely that the site is being used by transient or juvenile birds as temporary shelter as no evidence of breeding was recorded. Four red listed birds were recorded of which herring gull and starling may be using the buildings for breeding with song thrush and linnet using the dense scrub along the site boundary. The remainder of species recorded are likely to be breeding in small numbers only based upon the small size and lack of diverse habitats within the site.

## 7.5 Conclusions

Five bird species listed under Schedule 1 of the Wildlife & Countryside Act have been recorded using the Former RNAD Site and study corridor although only barn owl and kingfisher are likely to breed locally. Otherwise the assemblage of birds recorded represents one that is typical of the habitat and region.



Capabilities on project:  
Ecology

## 8 Bats

### 8.1 Introduction

During the Ecological desk study and Phase I Habitat Survey undertaken for the WelTAG Stage 1 Assessment, the area within the study corridor was identified as being a potential key area for bats in the region. Scoveston Fort is one of the most important greater horseshoe bat hibernacula in Pembrokeshire and lies less than 500m from the eastern end of the study corridor for the Link Road. Scoveston Fort is likely to play an integral role in maintaining the favourable conservation status of the Pembrokeshire Bat Sites and Bosherton Lakes Special Area of Conservation (SAC). Greater horseshoe bat roosts have also been identified at the Former Royal Naval Armaments Depot (RNAD) and the Former Artillery Tunnels within the study corridor. Bats from these roosts will be using the surrounding landscape as foraging habitat. Most bat species, including greater horseshoe bats use regular commuting routes to fly between roosts and foraging habitat. Landscape features such as hedgerows and woodland edges are usually used as commuting routes. Greater horseshoe bats tend to travel at 1m height above ground, close to the vegetation edge. Open fields are rarely crossed (Ransome 1996).

Due to the likely presence of greater horseshoe, other bat species listed under Annex II of the Habitat Regulations and a known high diversity of bats in the locality, a survey methodology was agreed with the Countryside Council for Wales (CCW). The data from 2010 will be used to form a baseline for the site and to inform WelTAG Stage 2 and EPS licences, and Environmental Impact Assessment or Appropriate Assessment should they be required.

The aim of the surveys was to gather data to assess the potential impact of the road scheme and associated proposals for the Former RNAD Site. Potential impacts include:

- Disturbance or permanent removal of key flight lines linking roosts to foraging areas;
- Removal or direct disturbance to bat roosts in buildings, tunnels or trees; and
- Permanent or temporary disturbance to roosts or flight lines from lighting associated with the proposals.

The objectives of the surveys were as follows:

- To identify the range and abundance of bat species using the area affected by the proposals;
- To identify key flight paths for bats, particularly greater horseshoe, within the study corridor;
- To identify key foraging areas within the study corridor; and
- To identify the location and status of bat roosts within the study corridor and the Former RNAD Site.

### 8.2 Bat Survey Methodology

To meet the objectives outlined in Section 8.1, a survey methodology was agreed with CCW. The methodology is four-part, to provide a comprehensive assessment of all potential impacts of the scheme throughout the seasons. The methodology is outlined in detail in the Technical Note *Port Blackbridge WelTAG: Bat Survey Methodology* (AECOM, May 2010), but is summarised below with any changes to the agreed methodology highlighted. The survey methodology is based on the standard protocol for greater horseshoes as outlined in the *Bat Mitigation Guidelines* (Mitchell-Jones, 2004) adapted for the site. Bat surveys were also undertaken in accordance with *Bat Surveys – Good Practice Guidelines* (Bat Conservation Trust, 2007).

Eight experienced bat surveyors were present during each emergence/activity survey. Every surveyor had at least two years experience of bat surveyors including experience with horseshoe bats, with at least four licensed bat ecologists present during each survey. A variety of detectors were used including Batbox Duet, Peterson and Anabat with recorders. Ambiguous bat passes were recorded and analysed following the surveys to aid identification where required.

Survey dates and weather conditions for each manual survey are shown in Table 8.2.

Figures 8.1A and 8.1B show the hedgerow survey locations, Figures 8.2A and 8.2B show the tunnels area survey positions, transects and results and Figure 8.3 shows the survey positions at the Former RNAD Site together with buildings and transects (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures*, AECOM, October 2011).

Capabilities on project:  
Ecology

Due to large areas of ancient semi-natural woodland within the study corridor, it was decided that surveys to identify roost trees would not be undertaken in 2010. These will be undertaken, if required, once a definitive route corridor has been decided to reduce survey effort.

#### 8.2.1 Study Corridor – Hedgerows 2010

In total, 21 hedgerows throughout the study corridor were identified as being subject to a potential impact from the proposed road scheme. Figures 8.1A and 8.1B show the hedgerow survey locations (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*). For one evening per month, from May 2010 to October 2010 inclusive, each surveyor stood at three locations adjacent to these hedgerows for one hour at a time recording bat passes. Each survey started at sunset and continued for three hours. The order in which the hedgerows were surveyed was rotated to provide a representative assessment of bat passes. At least one survey point on each hedgerow was undertaken every evening with the following exceptions:

- May – Hedgerows 12 and 13
- June – Hedgerows 1, 3 and 4
- August – Hedgerow 6
- September – Hedgerow 7
- October – Hedgerow 7

This was due to either issues with landowner consent or health and safety issues related to the presence of livestock.

In addition to the manual bat survey, Anabats (remote bat detectors and recorders) were positioned within hedgerows assessed during the Phase I survey as having higher potential as important flight paths. These include boundaries with direct links to known roosts, woodland edges, landscape scale features (e.g. vegetated lanes and railway corridor) and/or hedgerows over 3m in height.

The first night of recording was 26<sup>th</sup> May 2010, with the Anabats collected from the hedgerows on 5<sup>th</sup> November 2010. Four Anabats were used on a rotation basis for eight hedgerows. Anabats were allocated at random to each hedgerow to avoid detector bias.

An amendment to the original agreed methodology was that Hedgerow 5a was not surveyed by Anabat due to problems with access. Hedgerow 20, which meets the criteria for a 'higher potential' hedgerow was surveyed in addition to the agreed methodology. The time periods each hedgerow was surveyed for are outlined in Table 8.1. Due to access and equipment procurement, the Anabats underwent their first rotation on 30<sup>th</sup> June 2010. Therefore, there is little data for the southern end of the study corridor from the automated survey during May and June 2010. Other gaps in data collection due to equipment malfunction and one Anabat being stolen are outlined in Table 8.1.

All records were downloaded, labelled and counted using AnalookW Version 3.8. Summary tables of the number of bat passes per evening were then made and analysed in MS Excel.

#### 8.2.2 Study Corridor – Hedgerows 2011

As agreed with CCW no manual surveys of the hedgerows were undertaken in 2011. However, with the aim of having a complete 12 months of survey effort at the site Anabats were placed in the hedgerow during spring 2011. Between three and four Anabats were used on a rotation basis for eight hedgerows. Anabats were allocated at random to each hedgerow to avoid detector bias. The Anabats were placed initially on the 21<sup>st</sup> March 2011 and Anabats were finally collected from the hedgerows on the 17<sup>th</sup> July 2011. The time periods each hedgerow was surveyed are outlined in Table 8.1. Data gaps in collection due to equipment malfunction are also outlined in Table 8.1.

Capabilities on project:  
Ecology

All records were downloaded, labelled and counted using AnlookW Version 3.8 Summary tables of the number of bat passes per evening were then made and analysed in MS Excel.

#### 8.2.3 4Gas Tunnels 2010

Due to difficulties in gaining access, the tunnels manual emergence surveyed were only undertaken during August, September and October 2010 (Table 8.2) rather than from May to October 2010 inclusive as originally intended. Eight surveyors were present at each survey. Tunnel and survey locations are outlined in Figure 8.2A (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

There are nine tunnel entrances as well as a concrete archway leading into a void below the embankment wall close to Tunnel C. As I and J are close in proximity, these were surveyed by one ecologist. To more accurately determine the number and location of roosting horseshoe bats, in September and October, tunnels D and E were also surveyed by one ecologist, with an extra surveyor located on the wall above the archway/Tunnel C. Each emergence survey lasted one and a half hours after sunset. Following completion of the emergence surveys, pairs of surveyors then walked transects of the woodland, access track, cliff edge, Former RNAD Site boundary and sea wall until at least three hours after sunset. Access to the reservoir edge could not be obtained.

#### 8.2.4 Former RNAD Site

Six surveys of the Former RNAD Site were undertaken, four dusk only emergence surveys and two dusk and dawn surveys. Eight surveyors were present at each survey. Dusk surveys started 15 minutes before sunset and lasted for at least two hours. Two dawn re-entry surveys were completed one in August and one in October, each starting two hours before sunrise. Surveyors were located across the site to provide a thorough assessment of the bat roost potential of all buildings. The survey locations for the Former RNAD Site are shown on Figure 8.3 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

#### 8.2.5 Winter Surveys

As the study area is within 0.5km of an important hibernacula for greater horseshoe bats, several survey methods were employed to monitor bat activity throughout the winter. Two Anabats were positioned in the habitat surrounding Scoveston Fort in November 2010, with an additional Anabat used on a rotational basis to monitor tunnels at the 4Gas Site. The aim of the surveys was to determine whether the habitat surrounding known and potential hibernacula is used by greater horseshoe bat at all times of year. The deployment of the Anabats is shown in Table 8.1. Gaps in data collection due to equipment malfunction and one Anabat being stolen are also outlined in Table 8.1.

In addition, a comprehensive hibernation survey of the armaments tunnels at the 4Gas site was undertaken on 14th and 15th February 2011. Many of the tunnels have not been entered since decommissioning 10 years ago and had restricted access due to large piles of rubble outside the entrances. The rubble was carefully cleared away from the entrances under supervision by an ecologist. No scrub or surrounding vegetation was cleared to gain access through the doorways and the stone and brickwork of the tunnels was not affected. The tunnels were searched for hibernating bats as well as evidence of use such as corpses, insect prey remains and droppings. Rebecca Collins, a licensed bat ecologist experienced in surveying for horseshoe bats, undertook the survey in each tunnel accompanied by a safety expert familiar with the site and an ecologist with at least four years of bat survey experience. The condition of the tunnels was recorded including temperature and humidity at the entrances, mid-way into the tunnel and at the end inside the large rooms as well as any evidence of bats.

Capabilities on project:  
Ecology

Tunnel C was not accessed as this would have required removal of dense scrub potentially altering the suitability of the roost. The alcove beside Tunnel C was surveyed as far as possible using mirrors and torches but a significant area was left unsurveyed as access past the entrance blocks could not be made. Within the accessible tunnels large areas of cavities between internal walls of 'double-skinned' tunnels could not be fully surveyed and therefore results should be viewed as indicative only.





Capabilities on project:  
Ecology

Winter 2010/2011

Area	November 2010																													
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
CA																														
TFE																														
SFE	Not Surveyed – As Planned																													
SFS																														

Area	December 2010																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
CA																															
TFE																															
SFE																															
SFS	Not Surveyed – As Planned																														

Area	January 2011																														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31
CA																															
TFE																															
SFE	Not Surveyed – Due to Malfunction Anabat																														
SFS																															

Area	February 2011																												
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	
CA																													
TFE	Not Surveyed – Due to Malfunction Anabat																												
SFE	Not Surveyed – Due to Theft in Area																												
SFS	Not Surveyed – Due to Theft in Area																												

Capabilities on project:  
Ecology

*Spring 2011*

Hedgerow	March 2011																																						
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31								
5																																							
11																																							
12																																							
13																																							
14																																							
15																																							
19																																							
20																																							

Hedgerow	April 2011																																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30										
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11																																								
12																																								
13																																								
14																																								
15																																								
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20																																								

Hedgerow	May 2011																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31										
5																																									
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14																																									
15																																									
19																																									
20																																									

Hedgerow	June 2011																																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30											
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15																																									
19																																									
20																																									

Hedgerow 15 was not surveyed due to previous theft from this position.



Capabilities on project:  
Ecology

**Table 8.2: Survey Dates and Weather Conditions for Manual Surveys 2010**

Date	Location	Survey Times	Weather Conditions – Start	Weather Conditions - End
24/05/10	Hedges	Start: 21:40 End: 23:40 Sunset: 21:10	Wind Speed: Max. 2B Ave. 1B Cloud Cover: 0/8 Humidity: 78.3% Air Temp: 11.6°C Rain: None before or during.	Wind Speed: Max. 0B Ave. 0B Cloud Cover: 0/8 Humidity: 82.3% Air Temp: 9.9°C Rain: None before or during.
25/05/10	Former RNAD Site	Start: 21:00 End: 23:30 Sunset: 20:20	Wind Speed: Max. 3B Ave. 2B Cloud Cover: 1/8 Humidity: 78.8% Air Temp: 12.7°C Rain: None.	Wind Speed: Max. 1B Ave. 0B Cloud Cover: 3/8 Humidity: 81.6% Air Temp: 12.6°C Rain: None.
28/06/10	Former RNAD Site	Start: 21:15 End: 23:35 Sunset: 21:45	Wind Speed: Max. 3B Ave. 2B Cloud Cover: 8/8 Humidity: 85% Air Temp: 16.7°C Rain: Yes, before and during.	Wind Speed: Max. 1B Ave. 0B Cloud Cover: 8/8 Humidity: 95.3% Air Temp: 17.5°C Rain: Yes, before and during.
30/06/10	Hedges	Start: 21:30 End: 00:45 Sunset: 21:45	Wind Speed: Max. 2B Ave. 1B Cloud Cover: 8/8 Humidity: 85% Air Temp: 18.0°C Rain: None.	Wind Speed: Max. 1B Ave. 1B Cloud Cover: 4/8 Humidity: 88.3% Air Temp: 17.0°C Rain: None.
12/07/10	Hedges	Start: 21:25 End: 00:40 Sunset: 21:35	Wind Speed: Max. 0B Ave. 0B Cloud Cover: 7/8 Humidity: 79.2% Air Temp: 17.8°C Rain: Showers during the day.	Wind Speed: Max. 3B Ave. 1B Cloud Cover: 7/8 Humidity: 79.8% Air Temp: 16.1°C Rain: Showers during the day.

Capabilities on project:  
Ecology

Date	Location	Survey Times	Weather Conditions – Start	Weather Conditions - End
14/07/10	Former RNAD Site	Start: 21:20 End: 23:30 Sunset: 21:34	Wind Speed: Max. 2B Ave. 0B Cloud Cover: 7/8 Humidity: 89% Air Temp: 17.5°C Rain: Before and during. Heavy rain storms at 22:00 & 22:40.	Wind Speed: Max. 3B Ave. 2B Cloud Cover: 7/8 Humidity: 91% Air Temp: 16.1°C Rain: Before and during. Heavy rain storms at 22:00 & 22:40.
23/08/10	Former RNAD Site	Start: 20:00 End: 22:30 Sunset: 20:26	Wind Speed: Max. 2B Ave. 1B Cloud Cover: 0/8 Humidity: 68% Air Temp: 15.8°C Rain: Heavy rain previous morning.	Wind Speed: Max. 3B Ave 2B. Cloud Cover: 1/8 Humidity: 69.8% Air Temp: 15.2°C Rain: Heavy rain previous morning.
24/08/10	Former RNAD Site	Start: 04:15 End: 06:18 Sunrise: 06:17	Wind Speed: Max. 2B Ave. 1B Cloud Cover: 4/8 Humidity: 77.1% Air Temp: 15.6°C Rain: None.	Wind Speed: Max. 2B Ave. 2B Cloud Cover: 2/8 Humidity: 80.4% Air Temp: 14.9°C Rain: None.
24/08/10	Tunnels	Start: 20:15 End: 23:20 Sunset: 20:23	Wind Speed: Max. 1B Ave. 1B Cloud Cover: 6/8 Humidity: 84.6% Air Temp: 15.6°C Rain: None during day.	Wind Speed: Max. 0B Ave. 1B Cloud Cover: 7/8 Humidity: 85.5% Air Temp: 16.1°C Rain: None during day.
25/08/10	Hedges	Start: 20:15 End: 23:22 Sunset: 20:23	Wind Speed: Max. 2B Ave. 1B Cloud Cover: 8/8 Humidity: 90% Air Temp: 12.9°C Rain: Heavy rain during day; showers during survey.	Rain: Heavy rain during day; showers during survey.

Capabilities on project:  
Ecology

Date	Location	Survey Times	Weather Conditions – Start	Weather Conditions - End
13/09/10	Former RNAD Site	Start: 19:30 End: 21:45 Sunset: 19:41	Wind Speed: Max. 2B Ave. 4B Cloud Cover: 7/8 Humidity: 88.3% Air Temp: 16.7°C Rain: Rain showers during the day.	Wind Speed: Max. 2B Ave. 3B Cloud Cover: 8/8 Humidity: 89.2% Air Temp: 16.6°C Rain: Rain showers during the day.
14/09/10	Tunnels	Start: 19:30 End: 22:30 Sunset: 19:37	Wind Speed: Max. 1B Ave. 2B Cloud Cover: 5/8 Humidity: 78% Air Temp: 15.1°C Rain: During the day.	Wind Speed: Max. Ave. Cloud Cover: 0/8 Humidity: % Air Temp: 14.6°C @ 21:07 Rain: During the day.
15/09/10	Hedges	Start: 19:25 End: 22:30 Sunset: 19:30	Wind Speed: Max. 2B Ave. 1B Cloud Cover: 2/8 Humidity: 88.5% Air Temp: 14.1°C Rain: None during day.	Wind Speed: Max. 1B Ave 1B. Cloud Cover: 2/8 Humidity: 81% Air Temp: 15°C Rain: None during day.
11/10/10	Former RNAD Site	Start: 18:30 End: 20:40 Sunset: 18:38	Wind Speed: Max. 0B Ave. 1B Cloud Cover: 0/8 Humidity: 58% Air Temp: 14.4°C Rain: None.	Wind Speed: Max. 3B Ave 2B. Cloud Cover: 0/8 Humidity: 59.4% Air Temp: 13°C Rain: None.
12/10/10	Tunnels	Start: 05:30 End: 07:40 Sunrise: 07:40	Wind Speed: Max. 0B Ave. 0B Cloud Cover: 0/8 Humidity: 75.2% Air Temp: 9.5°C Rain: None.	Wind Speed: Max. 0B Ave. 0B Cloud Cover: 0/8 Humidity: 85% Air Temp: 5.4°C Rain: None.
12/10/10	Tunnels	Start: 18:30 End: 21:30 Sunset: 19:38	Wind Speed: Max. 0B Ave. 1B Cloud Cover: 0/8 Humidity: 69.4% Air Temp: 11.0°C Rain: None.	Wind Speed: Max. 1B Ave. 1B Cloud Cover: 0/8 Humidity: 83.5% Air Temp: 9.1°C Rain: None.

Capabilities on project:  
Ecology

Date	Location	Survey Times	Weather Conditions – Start	Weather Conditions - End
13/10/10	Hedges	Start: 18:30 End: 21:30 Sunset: 18:37	Wind Speed: Max. 1B Ave. 1B Cloud Cover: 0/8 Humidity: 82% Air Temp: 11.2°C Rain: None.	Wind Speed: Max. 0B Ave 0B Cloud Cover: 0/8 Humidity: 90% Air Temp: 7.5°C Rain: None.
24/05/10	Hedges	Start: 21:40 End: 23:40 Sunset: 21:10	Wind Speed: Max. 2B Ave. 1B Cloud Cover: 0/8 Humidity: 78.3% Air Temp: 11.6°C Rain: None.	Wind Speed: Max. 0B Ave. 0B Cloud Cover: 0/8 Humidity: 82.3% Air Temp: 9.9°C Rain: None.
25/05/10	Former RNAD Site	Start: 21:00 End: 23:30 Sunset: 20:20	Wind Speed: Max. 3B Ave. 2B Cloud Cover: 1/8 Humidity: 78.8% Air Temp: 12.7°C Rain: None.	Wind Speed: Max. 1B Ave. 0B Cloud Cover: 3/8 Humidity: 81.6% Air Temp: 12.6°C Rain: None.
28/06/10	Former RNAD Site	Start: 21:15 End: 23:35 Sunset: 21:45	Wind Speed: Max. 3B Ave. 2B Cloud Cover: 8/8 Humidity: 85% Air Temp: 16.7°C Rain: Yes, before and during the survey.	Wind Speed: Max. 1B Ave. 0B Cloud Cover: 8/8 Humidity: 95.3% Air Temp: 17.5°C Rain: Yes, before and during the survey.

Capabilities on project:  
Ecology

**8.3 Bat Survey Results Spring/Summer/Autumn 2010: Study Corridor Hedgerows**

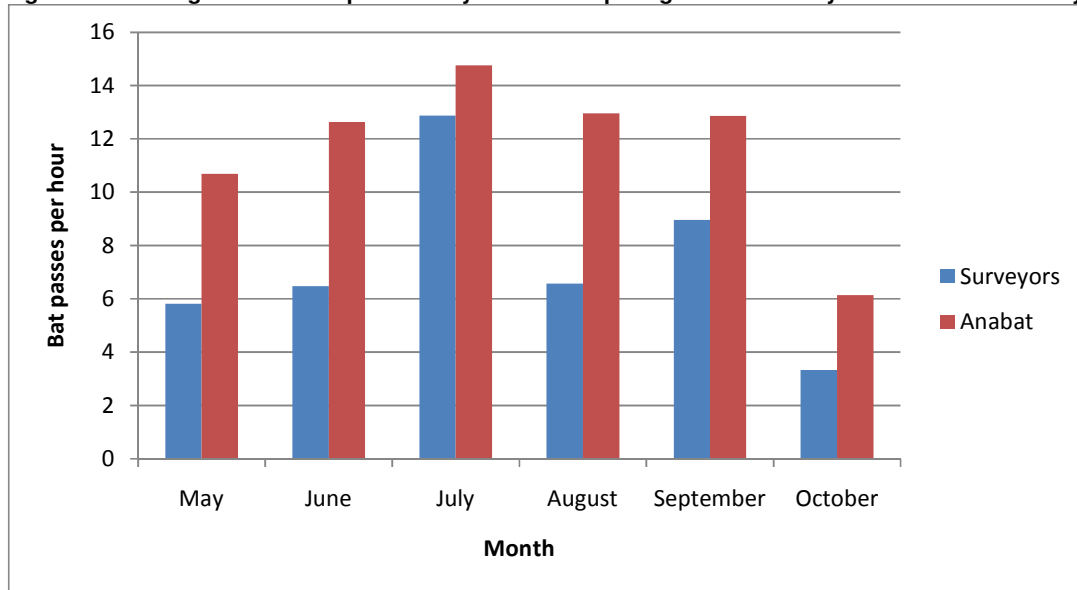
*8.3.1 Manual Detector Surveys*

**8.3.1.1 All Bat Species:**

During the monthly hedgerow surveys using 8 surveyors, a total of 986 bat passes were recorded over 136 hours of static surveys. The average number of bat passes per hour for all hedgerows was 7.25. In total, at least nine bat species were recorded including: greater horseshoe, lesser horseshoe, *Myotis* sp. (Natterer’s and whiskered/Brandt’s), noctule, serotine, long-eared, soprano and common pipistrelle bats. Of these recorded passes 802 were pipistrelle, with almost equal numbers of common and soprano pipistrelle bats. Records of noctule bats reached 44, with 46 records of *Myotis* species.

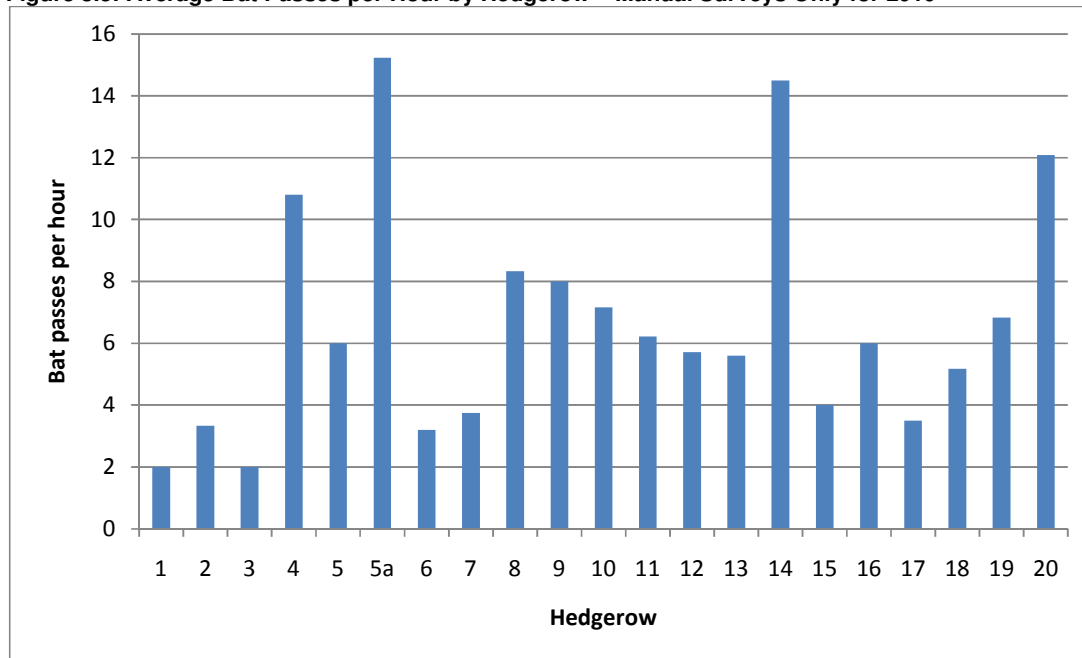
The greatest number of bat passes per hour was in mid-summer during July 2010, with fewer bat passes per hour at the start and end of the season (Figure 8.4). Hedgerows 4, 5a, 14 and 20 all had above an average of 10 bat passes per hour across all months, with Hedgerows 1, 2, 3, 6, 7, 15 and 17 all with an average of less than 5 bat passes an hour (Figure 8.5).

**Figure 8.4: Average Bat Passes per Hour by Month Comparing Manual Surveys to Automated Surveys for 2010**



Capabilities on project:  
Ecology

**Figure 8.5: Average Bat Passes per Hour by Hedgerow – Manual Surveys Only for 2010**



Mean number of bat passes per hour = 6.64

Figures 8.13A and 8.13B show the hedgerows used by all bats as identified via the manual static hedgerows surveys (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*)

- Green hedgerows had a high number of bat passes (upper 80<sup>th</sup> Percentile).
- Yellow hedgerows had a lower number of bat passes (lower 20<sup>th</sup> Percentile).
- Orange hedgerows had a moderate number of bat passes.
- Uncoloured hedgerows were not surveyed.

#### 8.3.1.2 Greater Horseshoe Bats 2010

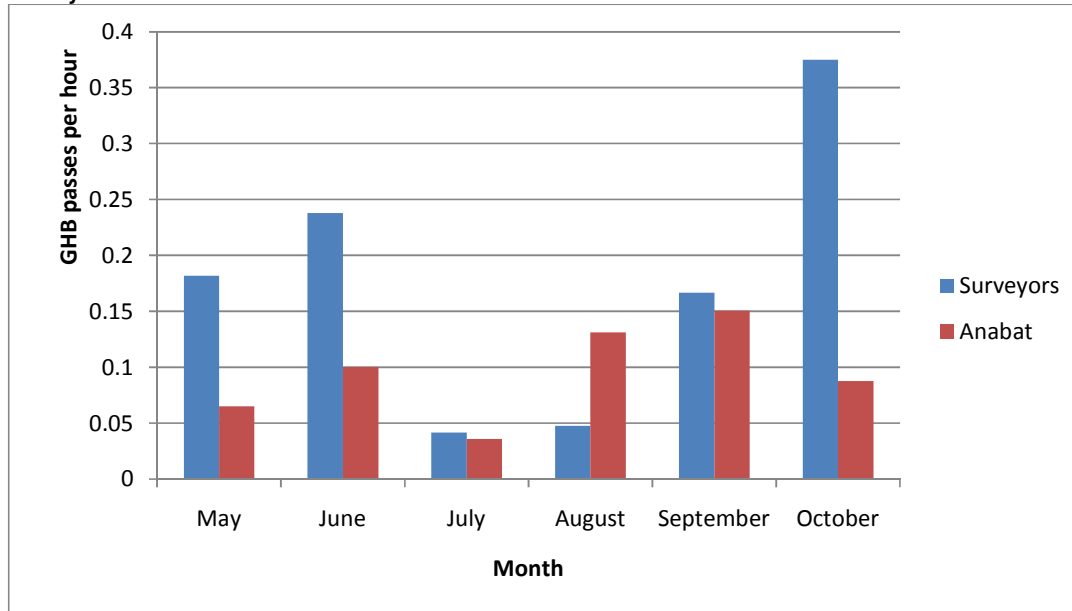
A full list of greater horseshoe bat passes recorded during the static observation surveys is included in Appendix 8.1 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Appendices, AECOM, October 2011*).

Twenty four greater horseshoe passes were recorded, as well as 9 lesser horseshoe passes and 3 horseshoe passes (unspecified species). There were a substantial number of horseshoe passes in October with 19 of the total of 36 horseshoe passes recorded in this month. 23.8% of all bat passes recorded during the static surveys on 13<sup>th</sup> October 2010 were horseshoe bats, and 6.1% of all bat passes in October were confirmed as greater horseshoe. In mid-summer, there were fewer horseshoe passes recorded and greater horseshoes comprises less than 1% of bat passes recorded. Figure 8.6 indicates the average number of greater horseshoe passes per month.

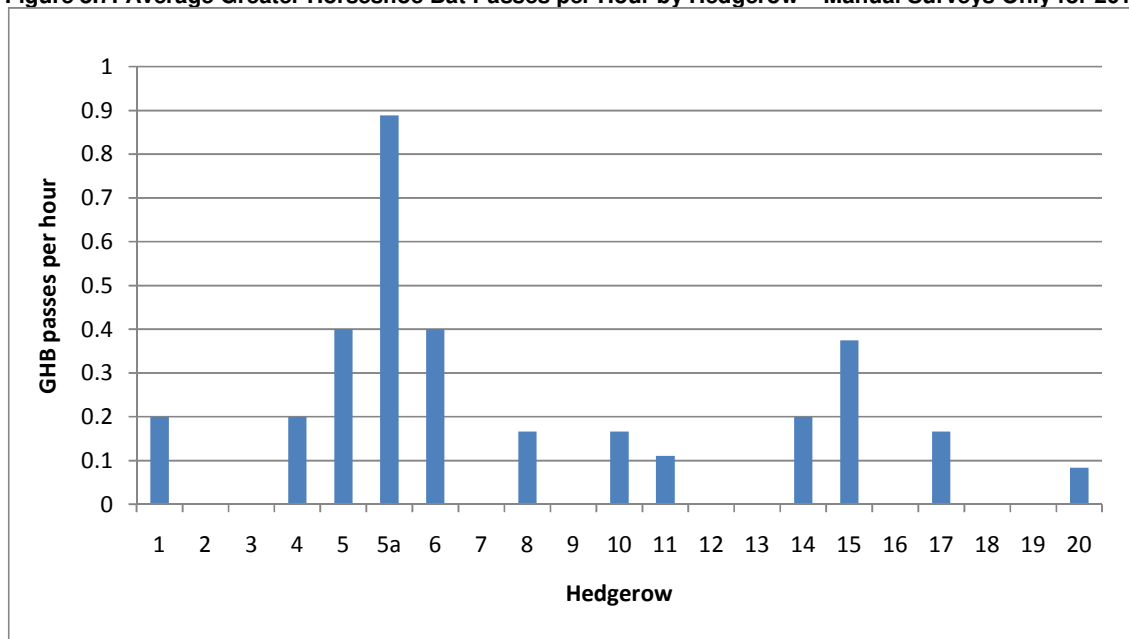
The average number of greater horseshoe bat passes per hour across all hedgerows for the static surveys was 0.26. The number of horseshoe bat passes recorded varied between hedgerows (Figure 8.7). Hedgerow 5a was found to have the greatest number of bat passes per hour (0.89), with Hedgerows 5, 6 and 15, all with greater than 0.3 bat passes per hour. No greater horseshoe bats were recorded using Hedgerows 2, 3, 7, 9, 16 or 18.

Capabilities on project:  
Ecology

**Figure 8.6: Average Greater Horseshoe Bat Passes per Hour by Month Comparing Manual Surveys to Automated Surveys for 2010**



**Figure 8.7: Average Greater Horseshoe Bat Passes per Hour by Hedgerow – Manual Surveys Only for 2010**



Mean number of GHB passes per hour = 0.16

Capabilities on project:  
Ecology

Figures 8.15A and 8.15B show the hedgerows used by greater horseshoe bats as identified via the manual static surveys (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

- Green hedgerows had a high number of bat passes (upper 80<sup>th</sup> Percentile).
- Yellow hedgerows had a lower number of bat passes (lower 20<sup>th</sup> Percentile).
- Orange hedgerows had a moderate number of bat passes.
- Uncoloured hedgerows were not surveyed.

### 8.3.2 Automated Surveys - May to October 2010

#### 8.3.2.1 All Bat Species

In total, the Anabats recorded for 409 survey or partial survey nights for a total of 3785.3 hours. A total of 43,304 bat passes were recorded and identified with an additional 179 recordings thought likely to be bat passes but which were unable to be identified. The average number of bat passes per hedgerow per hour was 11.44. In total, at least nine species were identified: greater horseshoe, lesser horseshoe, barbastelle, *Myotis* sp. (likely to be a number of species but unable to identify with certainty on the Anabat recordings), long-eared, noctule, serotine, common pipistrelle and soprano pipistrelle.

Bat passes per hour by month are shown in Figure 8.4. As expected, bat activity was greatest in mid-summer with 14.75 bat passes on average per hour during July 2010. In contrast, bat activity declined in October 2010 to an average of 6.14 bat passes per hour.

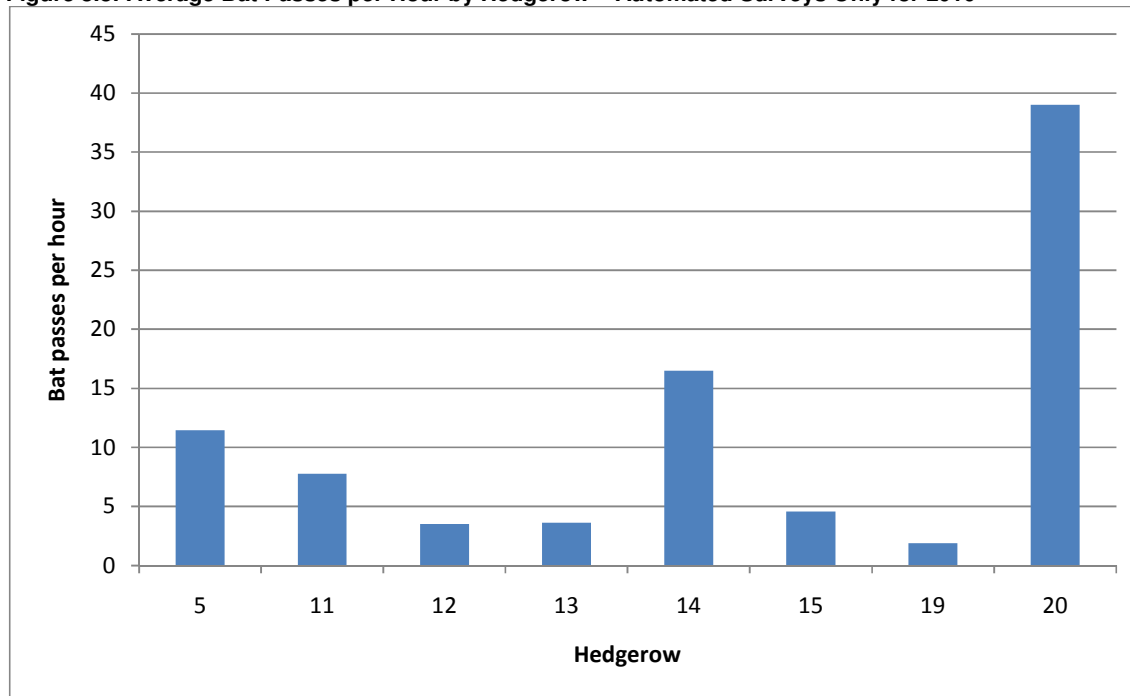
Bat activity per hour by hedgerow is shown on Figure 8.8. The survey at Hedgerow 20 recorded substantially more bat passes per hour than any other hedgerow; an average of 39.01 bat passes per hour. This is due to a large number of pipistrelle passes with a high level of foraging activity throughout most evenings. 89.0% of all passes on Hedgerow 20 were by pipistrelle bats with more soprano pipistrelle passes than common pipistrelle. A high proportion of bats recorded along this hedgerow were *Myotis* sp. (10.2%). The owner of the adjacent property Venn Farm has reported that he regularly sees large numbers of bats around the farmhouse at dusk, and occasionally finds bats inside the rooms (*Pers. Comm. Mr Johnson, Venn Farm*). Therefore, this property is likely to be a roost for a number of pipistrelle and/or *Myotis* bats, and given the numbers recorded, may support a maternity colony.

Hedgerow 14 also has a high number of bat passes per hour with an average of 16.49. At this hedgerow, 85.5% of passes were pipistrelle bats with the highest proportion of *Myotis* sp. passes of all hedgerows at 12.3%. Hedgerow 5 also had greater than 10 bat passes (11.45) per hour. Two passes by barbastelle bats were recorded at both Hedgerow 5 and Hedgerow 14.



Capabilities on project:  
Ecology

**Figure 8.8: Average Bat Passes per Hour by Hedgerow – Automated Surveys Only for 2010**



Mean number of bat passes per hour = 11.04

Figures 8.14A and 8.14B show the hedgerows used by all bats as identified via the automated (Anabat) surveys (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*). Note that not all hedgerows were surveyed using Anabats.

- Green hedgerows had a high number of bat passes (upper 80<sup>th</sup> Percentile).
- Yellow hedgerows had a lower number of bat passes (lower 20<sup>th</sup> Percentile).
- Orange hedgerows had a moderate number of bat passes.
- Uncoloured hedgerows were not surveyed.

#### 8.3.2.2 Greater Horseshoe Bats

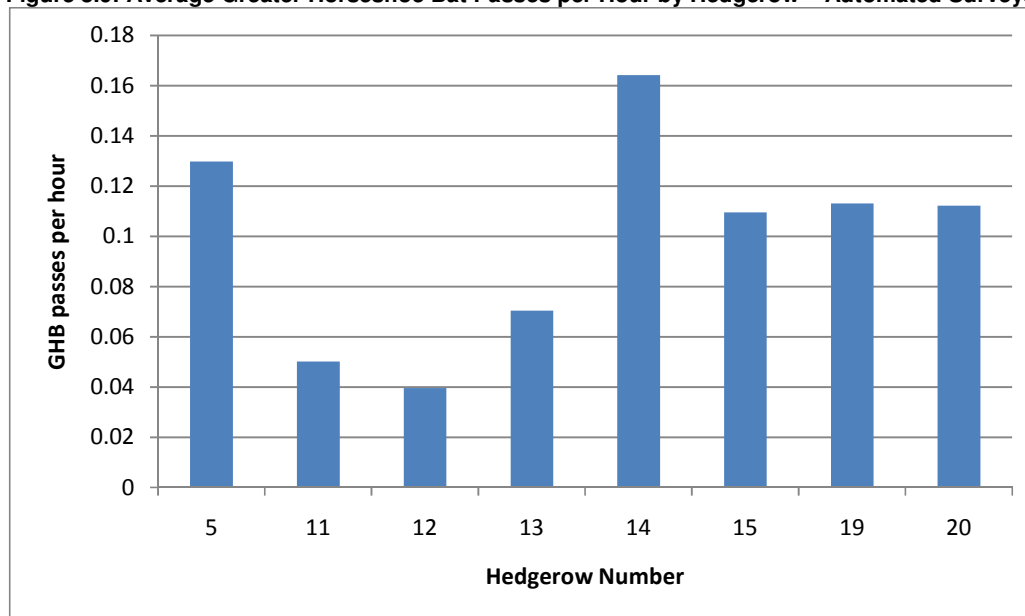
A total of 377 greater horseshoe bat passes and 33 lesser horseshoe bat passes were recorded during the automated surveys.

Conversely to the results for all species, the number of greater horseshoe bat passes per hour recorded by the Anabats was highest in August and September and lowest in July (Figure 8.5). This supports the assertion that the area is important for greater horseshoe bats in the autumn (mating season) and winter (hibernation season) with greater horseshoe bats gathering in numbers towards the end of the summer. However, it is important to note that even in mid-summer, horseshoe bats are still recorded regularly around the site.

Capabilities on project:  
Ecology

Again in contrast to the results for all species, the greatest number of horseshoe bat passes was on Hedgerow 14 with an average of 0.16 passes per hour (Figure 8.9). 24.1% of all greater horseshoe bats were recorded using this hedgerow. Hedgerow 5 was the next most frequently used with 18.3% of all greater horseshoe records and an average pass rate of 0.13 passes per hour. The least used hedgerow was number 12 (woodland edge) where 18 passes were recorded in total. Hedgerows 20 and 15 were the most frequently used by lesser horseshoe bats.

**Figure 8.9: Average Greater Horseshoe Bat Passes per Hour by Hedgerow – Automated Surveys Only for 2010**



Mean number of GHB passes per hour = 0.10

Figures 8.16A and 8.16B show the hedgerows used by greater horseshoe bats as identified via the automated (Anabat) surveys (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*). Note that not all hedgerows were surveyed with Anabats, although the hedgerows surveyed with Anabats were all found to be used by greater horseshoe bats and lesser horseshoe bats, so these hedgerows are considered to be important corridors for bats within the study area.

- Green hedgerows had a high number of bat passes (upper 80<sup>th</sup> Percentile).
- Yellow hedgerows had a lower number of bat passes (lower 20<sup>th</sup> Percentile.)
- Orange hedgerows had a moderate number of bat passes.
- Uncoloured hedgerows were not surveyed.

Capabilities on project:  
Ecology

### 8.3.3 Comparison of Automated and Manual Hedgerow Surveys

Overall, the results from both surveys convey similar results. In summary:

- There is high bat activity across the study area with a wide variety of species recorded.
- Common and soprano pipistrelles are the most common species, in approximately equal numbers.
- Bat activity was highest in mid-summer, but greater horseshoe activity was higher towards the end of the survey period with a dip in activity in July.
- Hedgerow 20 is an important area for foraging bats and is likely to be an important link to a large roost in the vicinity, as well as to the Former RNAD Site/4Gas Land.
- Hedgerows 15 and 20 are of importance for *Myotis* bats.
- Barbastelle bats are present in low numbers within the study area.
- Hedgerows 5/5a and 14 are particularly important corridors for greater horseshoe bats, with hedgerows 6, 15, 19 and 20 also having a notable number of passes for horseshoe bats.
- Greater horseshoe activity was recorded on hedgerows not originally identified with high potential as a significant corridor. This highlights that the majority of hedgerows in the area are likely to be used, at least occasionally, by greater horseshoes, with high potential areas in general recording the most number of bats.
- The average number of bat passes per hour was greater for the Anabat than the manual surveys. This could be because a surveyor will record one foraging bat as one pass whereas the Anabat may record it as several different recordings.
- The average number of greater horseshoe bat passes per hour was greater in the manual surveys than for the Anabat surveys. This is likely to be because the echolocation calls of horseshoe bats are highly directional and may be more easily missed due to the static placement of the Anabat microphone.

Figures 8.13A and 8.13B show the hedgerows with high use by bats (all species) using the 2010 and 2011 data collection (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*). Figures 8.14A and 8.14B show the hedgerows with high use by greater horseshoe bats using the 2010 and 2011 data collection (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

## 8.4 Bat Survey Results – 4Gas Tunnels

At least eight species were recorded during the surveys at the 4Gas tunnels: greater horseshoe, lesser horseshoe, barbastelle, *Myotis* sp., soprano pipistrelle, common pipistrelle, noctule and long-eared bats. At least eight greater horseshoe bats were recorded roosting within the tunnels in October 2010.

Tunnel C (Figure 8.2A - published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*) and the adjacent concrete archway appear to be the most commonly used roosting location for greater and lesser horseshoes with at least one individual present in each survey. Numbers were particularly high in October with 2-3 greater horseshoes and at least 9 lesser horseshoes present. It is thought that the greater horseshoes are roosting within Tunnel C, with the lesser horseshoes roosting in voids underneath the archway. Three common pipistrelle bats have been recorded emerging from Tunnel C.

In October, at least three greater horseshoe bats were recorded roosting in both Tunnels F and G along the seafront. Soprano pipistrelle bats have been recorded emerging from Tunnel J in both September and August. One brown long eared bat was recorded emerging from Tunnel A in August. Many of the tunnels are suitable for roosting bats and the bat population may use different tunnels at different types of year depending on humidity and microclimate.

The species and number of bats likely to be roosting at the site are outlined in Table 8.3.

Transects around the site recorded many passes by foraging long-eared and pipistrelle bats. In addition, three barbastelle passes were recorded: one close to Tunnel C and two close to the sea wall.

Capabilities on project:  
Ecology

Use of the area is likely to be highly seasonal, as indicated by changes in the number of roosting bats and variability of survey results. For example, only a few pipistrelle bats were recorded near to Tunnels F and G and during the sea wall transect in August and September, despite favourable weather conditions. However, in October, at least six greater horseshoes were recorded emerging from Tunnels F and G with seven species recorded foraging in the area. This indicates that the site may be of particular importance in the autumn and winter, but this is difficult to confirm given the lack of surveys in mid-summer.

Figures 8.2A and 8.2B show the tunnel survey positions, transects and results (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

**Table 8.3: Tunnel Entrance Conditions and Survey Results 2010**

Tunnel	Characteristics	Evidence of Roosting Bats
A	Doors closed and blocked by rubble. Both louvers intact. Dense ivy. No obvious entrances	Common and soprano pipistrelle recorded near tunnels shortly after sunset but no firm visual evidence of them leaving the tunnel.  August – Brown long eared bat emerged.
B	Doors closed and blocked by rubble. 1 louver panel missing providing potential entry point.	Common and soprano pipistrelle recorded near tunnels shortly after sunset but no firm visual evidence of them leaving the tunnel.
C (including archway)	One door open by 20cm but otherwise blocked by rubble. Hole at the top of left door. Dense vegetation coverage. Nearby an exterior breeze block wall has been demolished to leave an arched entrance 3m wide and 4m high. 5m inside is a wall of very large blocks of concrete or stone. Many potential access points for bats and voids appear to go back a considerable way.	August – 2+ greater horseshoe & 34 lesser horseshoe passes but not confirmed roost.  September – 1 lesser horseshoe confirmed roosting.  October – 2-3 greater horseshoes & 9+ lesser horseshoe bats roosting.
D	Doors closed and blocked by rubble. Potential access through missing panel/gaps in door. Potential access through gap in buckled stonework.	None
E	Doors closed and blocked by rubble. Potential access through missing panel/gaps in door.	None
F	Doors open 60cm and intact. Dense ivy above top of entrance.	October – 3 greater horseshoe bats and one soprano pipistrelle emerged.
G	Doors closed and blocked by rubble. One louver panel missing.	October – 3 greater horseshoe bats emerged.
I	Doors closed and blocked by rubble, One louver missing.	None

Capabilities on project:  
Ecology

Tunnel	Characteristics	Evidence of Roosting Bats
J	Doors bent with possible bat access at top. 1 louver missing.	September – Two soprano pipistrelles emerged from stonework to upper left of door.  October– Two soprano pipistrelle emerged from stonework to upper left of door.

### 8.5 Bat Survey Results – Former RNAD Site 2010

Buildings are numbered as based on Figure 8.3 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*). Photographs of the buildings are included in Appendix 8.2 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Appendices, AECOM, October 2011*).

Ten bat species were recorded during the surveys at the Former RNAD Site: greater horseshoe, lesser horseshoe, long-eared, Natterer's, Whiskered/Brandt's, barbastelle, noctule, serotine, common pipistrelle and soprano pipistrelle bat. At least six of these species were thought to roost within the building complex (Table 8.4 below).

Building C supports greater horseshoe with evidence of roosting during September and October 2010. There are a large number of droppings within a Former changing room block within Building C and a greater horseshoe bat was seen inside the structure during the October survey. A similar structure within Building B is also likely to be used by horseshoe bats.

There is evidence that lesser horseshoe roosts in Building D with a frequently used night-roost in the shed adjacent to Building A.

The site also supports a number of roosting pipistrelle and long-eared bats.

During the surveys, it was noted that a large number of bats fly in the direction of the Former RNAD Site. Surveys along the boundary fence between the Former RNAD Site and the 4Gas Site indicated a large number of bats including horseshoe, *Myotis* and long-eared bats travelling in both directions. Many of the buildings were used by foraging bats of varying species. This was usually bats foraging within the buildings just after emergence taking advantage of any immediate prey. On cold or windy nights this foraging within the buildings often lasted longer as the buildings are likely to provide shelter from the elements. Given the dynamic nature of the population at the site, it may be important for social behaviours, including mating in the autumn.

The rock face along the northern boundary appears to be particularly important to bats, with large numbers of bats using this corridor and pipistrelles feeding above the cliff on still evenings.

The buildings at the Former RNAD Site are large and provide a complex with innumerable potential roosting opportunities for bats at the site. Individual bats roosting at the site are likely to roost in a variety of locations within the buildings, changing at various times of year depending on microclimate and disturbance. Therefore, roosting locations provided below are indicative only and further surveys are likely to be required before demolition.

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**Table 8.4: Bat Roost Descriptions at the Former RNAD Site 2010**

Bat Species	Scientific Name	Likely Roost Locations	Likely Summer Bat Population
Greater Horseshoe	<i>Rhinolophus ferrumequinum</i>	Greater horseshoe seen hanging from wooden fixture inside shed of C in October. Large number of scattered GHB droppings amongst debris on floor.  Greater horseshoe records inside C during September and October including one record of emergence from the building.	1-2
Lesser Horseshoe	<i>Rhinolophus hipposideros</i>	Lesser horseshoe night roost in shed (outbuilding with red door) adjacent to A.  Lesser horseshoe recorded emerging from building D and foraging inside building C in October.	2-3
Long-eared Species	<i>Plecotus</i> sp.	July – Long-eared entered building C (likely night roost).  August – 1 long-eared bat emerged from building C; 1 individual re-entered C. individual emerged from building B.  September – 1 long-eared roost in C.  October – 1 long-eared emerging from C; 1 long-eared emerging from D.	1-5
Noctule	<i>Nyctalus noctula</i>	Likely noctule in building C. May have been foraging rather than roosting.	0-1
Soprano Pipistrelle	<i>Pipistrellus pipistrellus</i>	May – 2 soprano pipistrelles emerge from C.  June – 1 individual emerges from C.  August – 7 soprano pipistrelles emerge from C.  October – 1 emerging from building B.	Up to 10
Common Pipistrelle	<i>Pipistrellus pipistrellus</i>	May – 11+ individuals emerge from C; 1 from D; 1 from A.  June – 4+ individuals emerge from C.  July – 7 individuals likely emerged from C; 1 from building B.  August – 2 individuals from C2 from building A with 1 re-entering at dawn.  October – 1 individual seen emerging from B; 4 from building A.	Up to 20

Several *Myotis* records were also noted soon after sunset during the October survey. There is potential that these bats (likely Natterer's or Whiskered/Brandt's) are roosting within the building complex.

Figure 8.3 shows the Former RNAD Site survey locations and results (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

Capabilities on project:  
Ecology

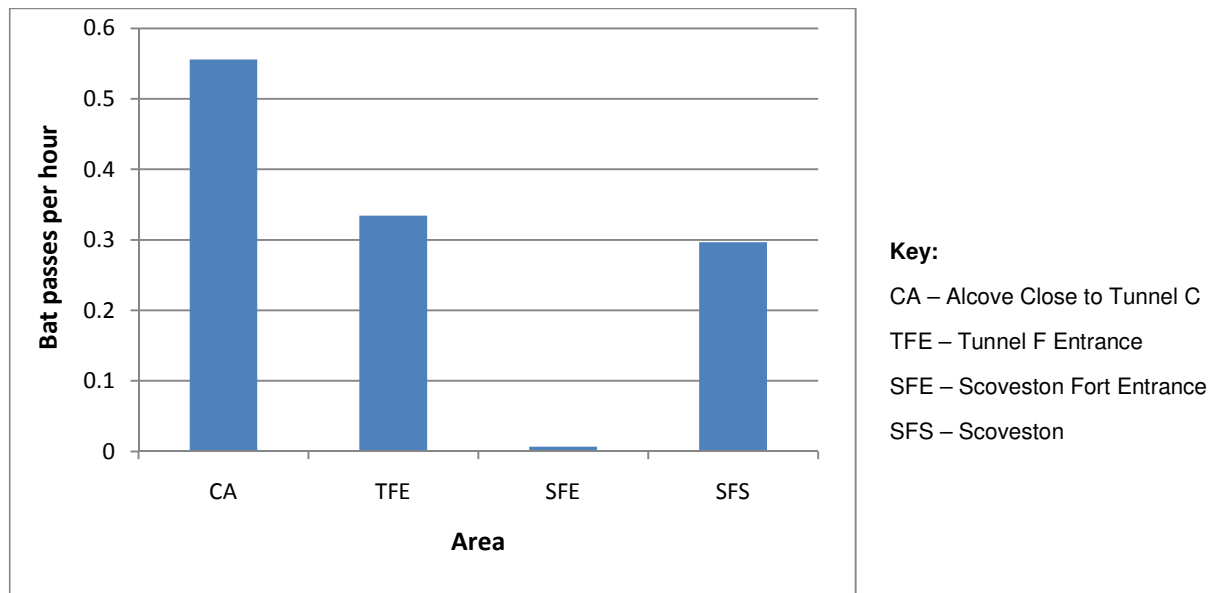
**8.6 Bat Survey Results – Winter 2010-2011 Surveys**

*8.6.1 Automated Monitoring*

Data records from Anabat recorders during the winter months were sporadic due to equipment failure (likely due to cold weather conditions) and theft of two Anabats (one in November 2010 and one in February 2011). In total, 312 bat passes were recorded from 55 survey nights. Average bat passes per hour for each remotely monitored area can be seen in Figure 8.10.

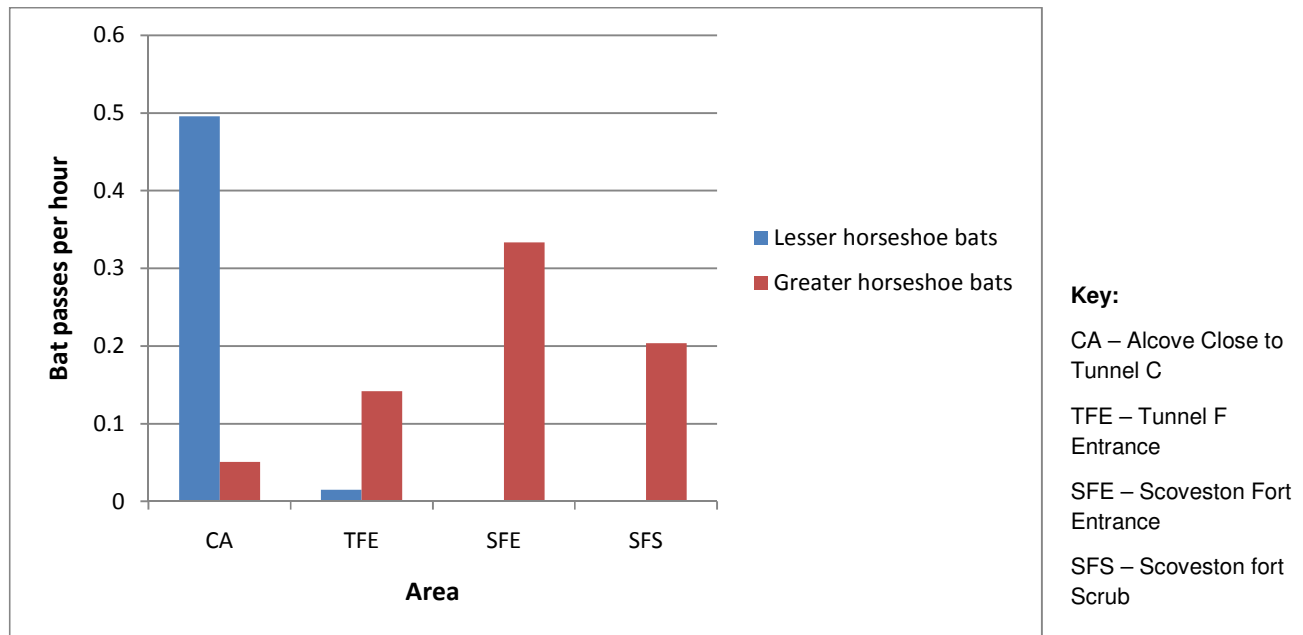
156 of these passes (50%) were by greater horseshoe bat, with 107 passes (35%) by lesser horseshoe bat. The percentage breakdown of horseshoe bat passes in each area can be seen in Figure 8.11. Other passes were by common pipistrelle, soprano pipistrelle and unidentified Myotis sp. Greater horseshoe bats were recorded in November and December 2010 at the moat around Scoveston Fort (SFS), at the alcove close to Tunnel C (CA) and outside Tunnel F (TFE) in the 4Gas Tunnel area. Lesser horseshoe bats were recorded mainly at the alcove close to Tunnel C (CA), with 3 passes outside Tunnel F in early December 2010. On the 12<sup>th</sup> November 2010, 67 passes by greater horseshoe were recorded in the scrub surrounding Scoveston Fort (SFS). The latest date of reliable recordings was 12<sup>th</sup> December 2010 with 10 greater horseshoe bat passes at Tunnel F (TFE) that evening.

**Figure 8.10: Average Bat Passes per Hour by Area – Winter Automated Surveys for 2010-2011**



Capabilities on project:  
Ecology

**Figure 8.11: Average Lesser Horseshoe Bat and Greater Horseshoe Bat Passes per Hour by Area - Winter Automated Surveys for 2010-2011**



#### 8.6.2 Hibernacula Surveys Winter 2010-2011

The condition of the tunnels and evidence of use by bats is recorded in Table 8.5. In total, one lesser horseshoe was found in Tunnel E and three greater horseshoes were found in two different locations within Tunnel F. All were in torpor. Tunnel locations are shown on Figure 8.2A and the survey results are shown on Figure 8.2B (these figures are published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*). Horseshoe bat droppings were found in all of the tunnels, with fresh droppings from winter 2011, as well as droppings appearing to be from summer 2010. Some of the collections of droppings were indicative of day roosts rather than night feeding roosts.

It can be concluded that greater horseshoe and lesser horseshoe bats use the tunnels and the surrounding habitat regularly throughout the year. The varying conditions provided by the tunnels mean that a small number of individual bats could be roosting in the tunnel system but regularly moving between different tunnels as weather conditions change. Additionally or alternatively, the tunnel system could support larger numbers of bats at certain times of year. The lack of surveys of the tunnels in early spring and mid-summer means that the latter possibility cannot be discounted.

It should also be noted that there were limitations to the hibernation survey given that the longest tunnel (Tunnel C) and nearby alcove could not be accessed. These are the areas where the most activity was recorded in the autumn during emergence surveys. In addition, numerous areas of the tunnel including cavity walls, large areas of the 'double-skins', areas high up in the main rooms of tunnels e.g. ledges, behind girders or under unstable cranes could not be surveyed. The areas could also support other species of roosting bat including *Myotis sp.* Droppings should also be considered as indicative only as the large amount of debris on the tunnel floors and damp conditions within tunnels mean that many droppings could have been overlooked.

Horseshoe bats are known to move between hibernation sites throughout the year in response to changes in weather conditions and one survey is not indicative of the potential for use throughout the hibernation period.



Capabilities on project:  
Ecology

**Table 8.5: Results of 4Gas Tunnels Hibernation Surveys 2011**

Tunnel	Date of Survey & Weather Conditions	Description of Condition and Structure	Temperature/ Humidity	Evidence of Bats
A	15/2/11 at 15:00  10.1°C, 82% humidity	5m wide, 3.5m high, 50-60m long. Double-skinned (cavity approx 70cm wide), brickwork largely intact. Entrance tunnel opening into large room (no side rooms). In large room, plaster work coming away creating crevices between exposed brickwork. Damp, drains contained water. Boreholes through to double skin. Entrance is ivy-covered with gap in one louver and open grills. Calcite straws and cave spiders.	Mid Tunnel: 11.3°C, 98% humidity  End of tunnel (in double skin): 12.8°C, 98% humidity	Droppings only.  Greater Horseshoe Bats – droppings along entrance tunnel (winter 2011). 5-6 droppings at entrance to room and also at entrance into double skin (winter 2010-2011). 1 scattered dropping in large room.  Lesser Horseshoe Bats – old droppings (summer 2010) along entrance tunnel. Small number at entrance into main room (winter 2010-2011).  Other – several unidentifiable droppings by entrance and in main room (degraded due to damp conditions).
B	15/2/11 at 14:00  8.8°C, 80% humidity	4m wide, 3.5m high, 50-60m long, Single-skinned. Brickwork largely intact. Entrance tunnel opening into large room (no side rooms). Intact flagstones and minimal vegetation around entrance door. One louver partially open. Grills open to inside. Calcite straws.	Mid-Tunnel: 11.7°C, 92% humidity  End of tunnel (main room): 12.2°C, 92% humidity	Droppings only.  Greater Horseshoe Bats – scattered along entrance tunnel (some from winter 2010-2011). Scattered round edge of main room with 40+ droppings in one corner of the room (winter 2010-2011).  Lesser Horseshoe Bats – Scattered along entrance tunnel with a collection of 10 droppings approximately 25m into tunnel.  Other - Several unidentifiable droppings along tunnel.
C	Not Surveyed	Surrounded by dense scrub. Small (50cm) gap by entrance door but lack of access/egress classifies tunnel as a confined space. No safe entry.	N/A	N/A
Alcove (by C)	14/2/11 at 16:30  8.4°C, 69% humidity	Could only view from start of infill with concrete blocks. Alcove 3m high at entrance but appears to open into large void at both ends. Cracks and crevices by entrance inspected where possible.	N/A	No droppings or bats observed but could not be accessed for the most part.
D	14/2/11 at 11:50  8.1°C, 79% humidity	Tunnel 5m wide, 3m high, 50-60m long. Tunnel is dry. Brickwork intact. Vent inside door (opens to exterior). Double-skinned with hatch door into lining. Crevices where concrete is palling off the wall. Entrance tunnel with side room opening into larger room. One louver missing in doorway and broken concrete flagstones above.	Mid-Tunnel: 10.2°C, 82.1% humidity  End of tunnel (main room): 11.2°C, 85% humidity	Droppings only.  Greater Horseshoe Bats - 2 large collections of droppings at two separate locations in side room (summer 2010).

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Tunnel	Date of Survey & Weather Conditions	Description of Condition and Structure	Temperature/ Humidity	Evidence of Bats
E	14/2/11 at 12:45 7.3°C, 84% humidity	Tunnel 5m wide, 3.5m high, 50-60m long. Double-skinned. Brickwork largely intact. Hibernating herald moths. Entrance tunnel opening into large room with adjoining side room. Gap of 60cm above one door and gap of approximately 50cm at bottom where doors meet. Louvers intact but grills open on one. Possible access from above where flagstones are loose.	Mid-Tunnel: 8.9°C, 88% humidity End of tunnel (main room): 10.4°C, 85% humidity	1 Lesser Horseshoe Bat in torpor by entrance to large room (temperature at location 10.5°C, 81% humidity). Large collection of droppings underneath. Droppings throughout tunnel. Greater Horseshoe Bats – 30+ droppings in side room. Several in large room (some probably winter 2010-2011). Lesser Horseshoe Bats – 20+ droppings in side room. A number of piles and scattered droppings around large room. 200+ lesser droppings (and other species) inside wall cavity. Other – 25 unidentified droppings in one pile along entrance tunnel. Unidentified droppings in main room among lesser droppings.
F	14/2/11 at 10:20 10.1°C, 68% humidity	5m wide, 3.5m high, 52m long. Loose flagstones above entrance. No missing louvers. Ivy covered in part. Door open approx 1m. Brickwork largely intact. Double-skinned. Louvers intact. Entrance tunnel leading into large room (no side room) with several panels open into double skin.	Mid-Tunnel: 12.1°C, 73% humidity End of tunnel (main room): 12.4°C, 75% humidity	2 Greater Horseshoe Bats in torpor 30m into tunnel on western wall. Hanging on mortar/brickwork 2.5m above ground level (conditions 12.1°C, 73% humidity). 1 further Greater Horseshoe Bat in torpor inside double skin, 6m high hanging from brickwork (conditions 12.6°C, 87% humidity). Droppings in alcove to east immediately inside entrance door. Too much debris on tunnel floor to see droppings.
G	14/2/11 at 11:05 9.6°C, 74% humidity	5m wide, 3.5m high, 52m long. Doors closed. One louver missing and grill open inside on other. Brickwork largely intact except row of boreholes into wall cavity. Entrance tunnel leading into large room (no side room). Damp. Calcite straws on ceiling. Chamber is single-skinned (blast wall removed).	Mid-tunnel: 9.9°C, 88% humidity End of tunnel (main room): 12.5°C, 87% humidity	Droppings only. Greater Horseshoe Bats – 1 fresh (winter 2010-2011) dropping along drain at edge of large room. Horseshoe species – large number of droppings under light fitting in main room. Likely from last season.
I	14/2/11 at 14:50 8.4°C, 69% humidity	5m wide, 3.5m high, 50-60m long. Single-skinned. Brickwork largely intact. Cave spiders, herald moths and calcite straws. One louver has slight gap and the other louver is open. Entrance tunnel leading into main room with side room.	End of tunnel (main room): 12.0°C, 95% humidity	Droppings only. Greater Horseshoe Bats – scattered in first 40cm of tunnel. 8 droppings at 5m into tunnel (summer 2010). 50+ droppings in centre of side room (summer 2010). 15-20 droppings entrance of side room (summer 2010). 16 fresh droppings by entrance to large room (winter 2010-2011). Lesser Horseshoe Bats – scattered throughout first 40cm of tunnel. 8 droppings 20m into tunnel. Scattered droppings at 35m into tunnel. 4 droppings under pillar in large room. 40+ droppings in corner of large room.

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Ecology

Tunnel	Date of Survey & Weather Conditions	Description of Condition and Structure	Temperature/ Humidity	Evidence of Bats
J	14/2/11 at 15:30 8.4 °C, 69% humidity	4m wide, 3.5m high, 52m long. Dense ivy, loose flagstones and crumbling brickwork around entrance. One louver missing. Single-skinned (blast wall removed). Entrance tunnel with side room and large main room.	Mid-tunnel: 12.2 °C, 87% humidity End of tunnel (main room): 11.6 °C, 80% humidity	Droppings only. GHB – Scattered droppings along entrance tunnel. 30+ under archway into side room. 10+ at entrance into main room (under brick rim). 10+ in drain along main room. LHB – 10+ droppings 12m into tunnel.

Capabilities on project:  
Ecology

## 8.7 Bat Survey Results Spring 2011: Study Corridor Hedgerows

### 8.7.1 Automated Surveys

#### 8.7.1.1 All Bat Species

In total, the Anabats recorded for 62 survey or partial survey nights. A total of 800 bat passes were recorded and identified with an additional 13 recordings thought likely to be bat passes but which were unable to be identified. In total, at least seven species were identified: greater horseshoe, lesser horseshoe, *Myotis* sp. (likely to be a number of species but unable to identify with certainty on the Anabat recordings), noctule, serotine, common pipistrelle and soprano pipistrelle. Bat activity was evenly spaced across the spring months with the majority of activity from *Pipistrelle* sp. (89.76%), with 18.44% identified as common pipistrelle, 32.65% soprano pipistrelle and the remainder unidentified. A substantial number of noctules were also found (6.91%) while horseshoe bats only contributed 2.69% of the overall total species recordings.

Bat activity per hour by hedgerow is shown on Figure 8.12. The survey at Hedgerow 14 recorded substantially more bat passes per hour than any other hedgerow; an average of 4.98 bat passes per hour. This was due to a large number of pipistrelle passes with a high level of activity detected during April 2011.

Similarly to the Anabat surveys in 2010, hedgerow 5, 11, 13, 14 and 20 have been identified as important hedgerows for horseshoe bats.

#### 8.7.1.2 Horseshoe Bats

A total of 19 greater horseshoe bat passes and 2 lesser horseshoe bat passes were recorded during the automated surveys. The greatest number of horseshoe bat passes were recorded on Hedgerow 5 and Hedgerow 11.

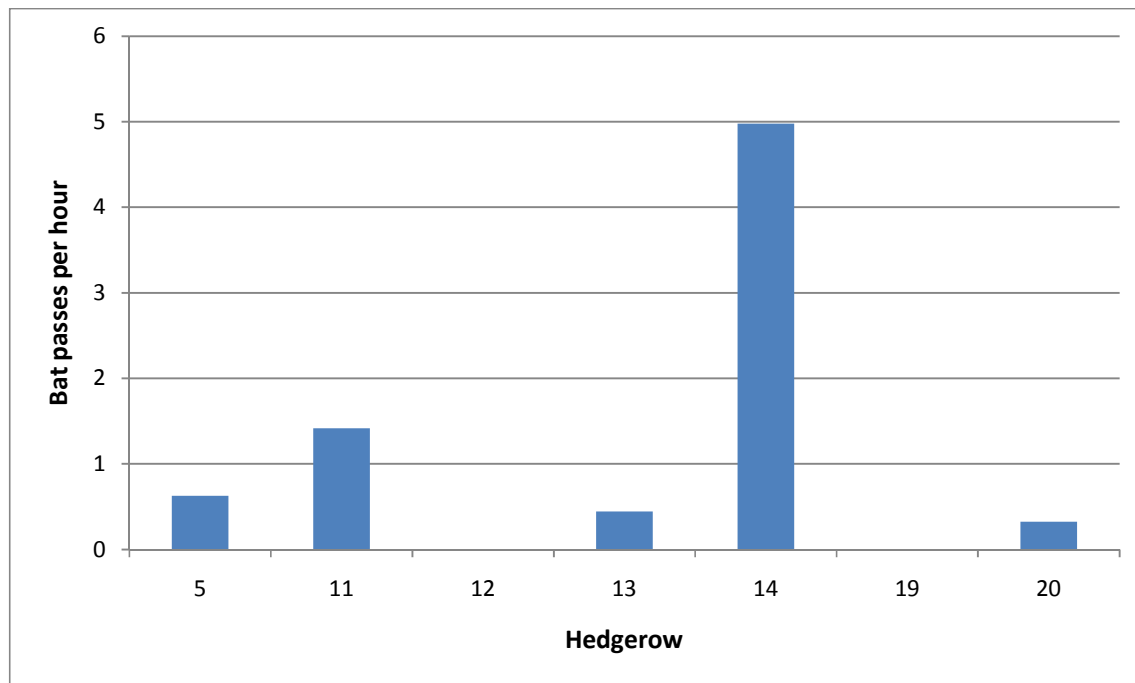
Similarly to the Anabat surveys in 2010, hedgerow 5 has been identified as an important hedgerow for horseshoe bats.

#### *Limitations*

Unfortunately the Anabats suffered a greater failure rate following the winter remote surveying period, probably linked to adverse weather conditions causing damage to the Anabat units. The deployment of the Anabats over Spring 2011 period is shown in Table 8.1. Due to the sporadic data collection no maps of hedgerow use in 2011 have been produced.

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Ecology

Figure 8.12: Average Bat Passes per Hour by Hedgerow – Spring 2011 Automated Surveys



## 8.8 Conclusions

The study area is important for a number of bat species including greater and lesser horseshoe bats. Barbastelle, an Annex II species, also use the area.

The Former RNAD Site and the tunnels within the 4Gas compound provide a variety of roosting opportunities during the summer and winter for at least five bat species. There are also likely to be nearby roosts for pipistrelle, *Myotis* and horseshoe bats including Venn Farm and barns at Castle Hall Farm.

Many hedgerows provide a key link between roosts and foraging areas. In particular, Hedgerows 5/5a, 14, 15 and 20 are likely to be important corridors for greater horseshoe bats and other species, but other hedgerows may also be important.

Key foraging areas include areas of the 4Gas compound, inside the buildings of the Former RNAD Site, the scrub adjacent to Hedgerow 20 and edges of the woodland in the northern section of the study corridor.

The 4Gas tunnels are used by greater and lesser horseshoe bats throughout the year. Individual bats are likely to move between tunnels depending on exterior weather conditions and internal micro-climate. Therefore, the whole compound including surrounding vegetation and flight corridors should be considered as an important greater and lesser horseshoe bat roost. These tunnels and the adjacent Former RNAD Site are also likely to be used by the same bat population as Scoveston Fort.

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## 9 Otter

### 9.1 Introduction

The WelTAG stage 1 desk study and consultation with the county ecologist identified that Otter were known to regularly use Castle Pill up to Blackbridge. The county ecologist also reported frequent signs of otter along the seawall at the Former RNAD Site. As otter presence had already been established in the area, an otter breeding and resting site survey was undertaken.

An otter survey was undertaken on 13<sup>th</sup> October 2010 by Dr Paul Chanin Mammal Ecologist and Lisbeth Nash (AECOM) (AIEMA, glEEM). The observations and conclusions of the survey are detailed in *Chanin, Paul (15 October 2010). Notes on Otters, Waterston, Milford Haven*. This is included in Appendix 9 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Appendices, AECOM, October 2011*). The study area is shown in Figure 9.1 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

Three sources of existing information were consulted prior to the survey. The findings of these are summarised below:

- 4th Otter survey of Wales 2002
  - 97% of 66 sites surveyed in Cleddau hydrometric area were positive.
  - Fourteen sites were surveyed on the estuary or small streams feeding directly into it. Two were negative.
- National Biodiversity Network NBN
  - National otter survey sites are not recorded and there are no records later than 1993.
  - Nearest records: Two from Pwllcrochan and Pwllcrochan Marsh, directly opposite on south side of Milford Haven Estuary (1988 and 1993) and one from nearby Wallaston in 1992. Note that Pwllcrochan Marsh is considered a potential breeding area in Geoff Liles report.
- Report by Geoff Liles (Liles G. 2003. Otter activity and habitat availability on the Pembrokeshire coast and Milford Haven Waterway within the Pembrokeshire marine candidate Special Area of Conservation. Unpublished report to Pembrokeshire Marine SAC Relevant Authorities Group.)
  - Found spraint at all but one of 24 sites around the Milford Haven estuary.
  - 16 of these sites had potential resting sites and seven had potential as breeding sites (breeding recorded from two of these, at Slebech, some 20km upstream of the Former RNAD Site).
  - At Castle Pill, 18 spraints were found at four spraint sites (7 fresh; 2 recent; 9 old). It appears that only the seaward end may have been surveyed.
  - Liles (2003) concluded that the estuarine section of Castle Pill had potential for resting sites but not for breeding.

### 9.2 Otter Survey Methodology

The study area is shown in Figure 9.1 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*). The Castle Pill inlet, the Reservoir and stream on the four gas land and the pond at Green Farm were all surveyed. The areas were surveyed for signs of otter and assessed for their potential as a breeding or resting site.

Spraints were assessed under the categories 'Not yet dry' (Nyd), 'Dry-intact' (Di) and 'Dry-fragmented' (Df). This avoids having to estimate the age of the spraint, which can often be misleading, as the condition of a spraint can be changed significantly by local environment and recent weather as well as by time.

In addition the site was visited in February 2011 to undertake a hibernacula survey for bats in the 4Gas site tunnels. Evidence of otters was found in one of these tunnels as described in the results section.

The reservoir area was visited informally in April 2011 by Kevin Webb (AECOM, MIEEM).

### 9.3 Otter Survey Results

The otter survey results are included in Table 9.1 and discussed in section 9.4 and 9.5. The survey results are mapped on Figure 9.1 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

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**Table 9.1: Otter Survey Results 2010**

Area of Survey	Otter Signs Recorded
Seaward end of Castle Pill - swing bridge	Mass of dried spraints found on west side of bridge (SM 913 054).
Western shore of Castle Pill from Black Bridge upstream, following shore round past ruined castle and back along eastern shore.	1 Df spraint found on western shore (SM 916 061). 1 Nyd spraint at ford, head of estuarine water (SM 919 063).
4Gas Tunnel Site. Walked upstream to reservoir and pond.	1Nyd and 1 Df - in stream at 4Gas site where there is a small concrete footbridge and the culvert goes underground (SM 918 050). 1 Nyd; 1 Di; 1Df - on boulder in steam at edge of woodland (SM 921 050). 1 Df - on boulder in steam in woodland. Very large fish bones bleached possibly large Carp. (SM 921 050).
Pond at Green Farm	No evidence of otters. Cattle activity more or less all round edge. Not suitable for resting or breeding.

Spraints were assessed under the categories 'Not yet dry' (Nyd), 'Dry-intact' (Di) and 'Dry-fragmented' (Df).

During the hibernacula bat survey of the 4Gas Tunnels an area just inside the entrance of Tunnel E which is situated on the 4Gas stream, had evidence of use as a resting holt by otters. There was a large amount of fish scales and bones in debris from old, degraded (non-intact) spraints on the floor of the tunnel, an area of about 300mm by 300mm of debris. There was also several more recent dry, intact spraints on rubble just inside the tunnel entrance.

During an informal visit to the site in April 2011 three holt sites with potential for breeding were identified around the edge of the reservoir. Not yet dry, intact spraints were identified along with feeding remains and anal jelly. This is all evidence of active otter use at the reservoir

#### 9.4 Otter Survey Conclusions – Study Corridor and 4Gas Tunnels

Our surveys agree with Liles (2003) that breeding is not very likely on the estuarine part of Castle Pill. There is moderate potential beside the stream in Rhodal Bottom coming in from Waterston east towards Castle Pill. There is potential for some disturbance from footpath along the whole length but the footpath is not at waterside. This area was not surveyed due to limited access at the waterside.

It is suspected that otters would not go up to the pond at Green Farm due to the disturbance from cattle and comments from the farmer that the pond has not been stocked with fish. There are other largish ponds in the catchment along the same stream, about half way from the estuary and near Steynton. There are also smaller ponds at Upper and Middle Scoveston. These additional ponds were not surveyed.

The reservoir and pond at the 4Gas tunnels site have high potential for breeding. They are fairly close to the shore and there is a lot of dense vegetation around the edges which could provide good cover. If the large fish remains found in a scat ca 100m downstream were from carp in October 2010, and the carp were from the pond and reservoir, then there must also be a very good food supply there. Based on the findings during the informal visit to the reservoir in April 2011, the reservoir is considered to be a breeding site for otter. Development within 250m of the reservoir should be avoided, or will require a European Protected Species Licence and mitigation.

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Ecology

Spraints found at the entrance to a culvert on the 4Gas tunnels site suggest that otters seem to be coming through a culvert from sea - a distance of > 100m. The culvert entrance is within the sea wall near the boundary between the Former RNAD Site and the 4Gas Site.

An area just inside the entrance of Tunnel E which is sited above the stream, had evidence of long term use as a resting holt by otters.

#### **9.5 Otter Survey Conclusions – Former RNAD Site**

Otters are known to commute along the sea wall around the Former RNAD Site. There is no potential for breeding on the Former RNAD Site but otters may be crossing it using the sea wall from the swing bridge to gain access to the reservoir. They may also be using the culvert in the sea wall at the Former RNAD Site boundary to commute through to the reservoir.



Capabilities on project:  
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## 10 Dormouse

### 10.1 Introduction

The Phase 1 Habitat Survey identified that there was habitat in the area with a high potential for supporting dormouse.

A dormouse survey was undertaken by Sarah Dale (IEEM) licensed dormouse handler and Lisbeth Nash (gIEEM). Three survey visits were undertaken across the season in 2010 one in August, one at the end of September and one in November.

There was no habitat on the Former RNAD Site suitable for dormice. The Former RNAD Site was not surveyed for dormice.

The survey data is shown in Appendix 10.1 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Appendices, AECOM, October 2011*). The study area and hedgerow numbers are shown in Figures 10.1A and 10.1B (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

### 10.2 Dormouse Survey Methodology

#### 10.2.1 Habitat Assessment

The habitat within the study corridor was assessed both during the Phase 1 Habitat Survey in May 2010 and on 21<sup>st</sup> June 2010 and any hedgerows, scrub and woodland with the potential to support dormouse was recorded.

Habitats typically suitable for dormouse include:

- - Deciduous woodland, with a dense understory, species-rich shrub layer and thick ground cover;
- - Continuous, thick, wide hedgerows over 4m high with connections to nearby suitable woodland;
- - Hazel or sweet chestnut coppice;
- - Thick continuous areas of scrub, particularly bramble, close to hedgerows or woodlands.

Though these habitats are typical for dormice there is potential for them in any vegetated habitat which is well connected to potential food sources and other wider habitat areas. Only areas considered to be of high or moderate risk of supporting dormouse were surveyed.

#### 10.2.2 Dormouse Nest Tube Survey

Dormouse surveys were undertaken in line with the protocol outlined in the *Dormouse Conservation Handbook* (Bright, *et al.*, 2006). 292 tubes were installed on 21<sup>st</sup> - 25<sup>th</sup> June 2010. These were placed at 10m intervals in suitable hedgerows H2, H5S, H6A, H6, H8, H9, H10, H11N, H11s, H12, H13, H14A, H14, H16A, H16, H18, H19s, H19N, H20, HA1, HA2, HA3, HB1, HB2, HI, HH, Venn Farm Lane and the 4Gas Tunnels area. The study area and hedgerows are shown in Figures 10.1A and 10.1B (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

Chanin and Woods (2003) provide guidance on survey effort requirements. Using an index based on number of tubes and length of survey period, Chanin and Woods recommend that a score of 20 should be obtained to make a comprehensive assessment of presence/ absence of dormouse in an area. Ideally, dormouse tubes are installed just before dormice emerge from hibernation in April and monitoring for at least one season of activity until November.

For this survey, the score is 116.8. As this score is well over the recommended minimum score of 20 this survey should make a comprehensive assessment of presence/ absence of dormouse in the area

Tubes were inspected monthly in August, September and November for any presence of dormouse and any signs, particularly for recently constructed nests. One licensed dormouse surveyor was present during all visits. Tube inspection was undertaken noninvasively using an angled mirror. If evidence of a nest was found, the tube was removed and inspected by a licensed surveyor. Evidence of use by other small mammals was also recorded.

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### 10.2.3 Survey Limitations

It would usually be recommended that a search of fallen hazel nuts should be undertaken in September/October to assess whether any bear the tooth marks of dormice. However, as hazel was rare within the vicinity, this could not be undertaken.

## 10.3 Dormouse Survey Results

### 10.3.1 Habitat Assessment for Dormouse

#### 10.3.1.1 Study Corridor

The study corridor consists mostly of grazing pasture crossed by hedgerows and woodland. There is good connectivity across the study area between these habitats and to other suitable areas of suitable habitat outside the study area.

The condition and composition of the 27 suitable hedgerows that were surveyed are described in Appendix 10.2 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Appendices, AECOM, October 2011*).

#### 10.3.1.2 The Tunnels

The southern end of the study area at the 4Gas Tunnels consists of brown field land, semi improved grassland and woodland. The brown field land is dominated by buddleia scrub. The cliff which borders the brown field area is dominated by blackthorn and gorse scrub.

Suitable habitat areas include:

Area A – Edge of woodland along track. Area dominated by hawthorn and sycamore.

Area C – Brown field land at base of cliff. Area dominated by buddleia scrub.

Area E – In hedgerows along access track to 4Gas tunnels. Area dominated by blackthorn.

Area F – On woodland edge and in hedgerows along access track to 4Gas tunnels. Area dominated by blackthorn and bramble.

#### 10.3.1.3 Former RNAD Site

The Former RNAD Site as a whole contained little habitat that was suitable to support dormice. The vegetated cliff on the northern boundary has potential to support dormice and it is well connected to areas of woodland and hedgerows. However, this area was not surveyed for dormouse as the cliff is too steep and unsafe to access.

### 10.3.2 Dormouse Nest Tube Survey Results 2010

The dormouse nest tube survey results are shown in Appendix 10.1 (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Appendices, AECOM, October 2011*). No dormice or evidence of dormouse was identified during the three surveys within any of the hedgerows or survey areas. There was repeated evidence of wood mouse/yellow necked mouse in several of the hedgerows across the season.

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#### **10.4 Conclusions**

Whilst the tube survey did not detect the presence of dormice, there is suitable habitat for dormice on the site and the site is well connected to the wider landscape. No dormouse records exist within 2km and the local county ecologist is not aware of any dormouse populations near the study area. Bright *et al.* (2006) suggests that 20 hectares of habitat is required to support a viable population of dormice. The same publication suggests that dormouse densities tend to be low, even in optimal habitat: typically <10 per hectare. The study corridor comprises approximately 122 hectares. Therefore, the site has the capacity to support a viable population. However, the dormouse survey, despite being of valid survey effort, failed to identify the presence of dormice in the study area. The desk study evidence and the results of the nest tube survey indicate that the study area is unlikely to support a large population; although, the extent of potential habitat suggests that there is still a low risk that a low density of individuals may be present.

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## 11 Badger

### 11.1 Introduction

WWBIC returned records of badger (*Meles meles*) with the study area. The woodland which runs along the access track to the Former RNAD Site is reported by the county ecologist to support several large active badger setts. The Phase 1 Habitat Survey identified suitable habitat for badgers. The area is dominated by pastoral land use with a number of wooded stream valleys, a railway line, woodlands, scrub and hedgerows. However, limited by access constraints, the initial site walkover did not identify any badger setts. A badger was found dead at the side of the B4325 near where the railway crosses the road during the Phase 1 Walkover Survey.

It was recommended that further surveys for badger be undertaken and between May and October 2010 sightings of live badger, latrines and setts were recorded. Evidence of badger activity across the study area has been mapped in Figures 11.1A and 11.1B (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

### 11.2 Methodology

No specific survey for badger has been undertaken during 2010. A preferred route has not been defined as yet and a detailed survey of all areas of dense scrub and woodland within the study corridor would have required extensive survey effort. However, during the six months of bat, dormouse and reptile surveys at the study area between May and October 2010 sightings of live badger, latrines and setts were recorded.

### 11.3 Survey Results Study Corridor

There is a large amount of badger activity across the study corridor. Evidence of badger activity across the study area has been mapped in Figures 11.1A and 11.1B (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

The woodland which runs along the access track to the Former RNAD Site is reported by the county ecologist to support several large active badger setts. Numerous badger tracks were seen crossing the access track. Live adult and juvenile badgers were seen on the eastern woodland edge on a number of occasions during the bat surveys. Badgers were also seen on the Former RNAD Site access track.

During the dormouse and reptile surveys at 4Gas site at the southern end of the study corridor a number of badger latrine and badger scat was identified. This includes a large boundary latrine with 20 plus pits located within the woodland near the reservoir. Boundary latrines are used to mark the edge of a territory and are an indication that at least two populations of badger are active within the area. A live sighting of a juvenile badger was recorded on hedgerow 19 south.

Live badger sightings including one juvenile were recorded on three occasions during bats surveys at the northern end of the study corridor near Rhodal Bottom. A two holed outlier sett was also identified in hedgerow 8 and an old 2 to 3 holed sett was identified in hedgerow 14.

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**Table 11.1: Live Records of Badgers within the Study Corridor**

Date	Evidence	Location	OS Grid Reference
06/ 2010	Live juvenile badger	Woodland edge.	191647/205741
07/2010	Live juvenile badger	Woodland edge.	191647/205741
13/07/2010	Live badger	Hedgerow 21.	191791/250366
13/07/2010	Three live juvenile badgers	Hedgerow 21 (one ran through gate from field to the south).	191791/250366
12/07/2010	Live badger	Hedgerow 13.	193150/206250
08/2010	Live badger – unknown age	Scaling cliff at the site entrance to the Former RNAD Site.	191488/205316
08/2010	Two live badgers	On access track to the Former RNAD Site.	191540/205610
25/08/2010	Live badger	Hedgerow 12 travelling south into woodland.	193230/206300
25/08/2010	Live juvenile badger	Hedgerow 13.	193150/206250
14/09/2010	Live badger	4Gas land near stream.	191924/205056
15/09/2010	Live juvenile badger	Hedgerow 19 south.	199444/205192

Evidence of badger activity across the study area has been mapped in Figures 11.1A and 11.1B (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

#### 11.4 Survey Results – Former RNAD Site

A live badger was seen scaling the cliff near the entrance gate to the Former RNAD Site during one of the bat surveys in August 2010. No latrines were identified within the boundary of the Former RNAD Site. However, badger activity has been identified within the woodland which runs along the access track to the Former RNAD Site and along the access track itself. There is not considered to be any potential for badger setts within the site boundary.

Evidence of badger activity across the study area has been mapped in Figures 11.1A and 11.1B (published in a separate report: *Waterston / Blackbridge Study, Ecology Report Figures, AECOM, October 2011*).

#### 11.5 Conclusions

There is a large amount of badger activity in the area. At least two populations ('clans') of badger appear to be active within the study corridor. There may be an active sett within 30m of the study corridor depending on the final alignment of the road and area of associated works. There is unlikely to be any badger setts within 30m of the Former RNAD Site.

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## 12 Summary of Results

### 12.1 Study Corridor and Tunnels

#### 12.1.1 Bryophytes

None of the bryophytes recorded from the site are legally protected, are of national conservation concern or are locally rare. Assessment of the bryophyte flora against the lower plant guidelines for the selection of biological SSSIs (Hodgetts 1992) shows that the assemblage is not of special interest in a national context. Indeed, all of the species are common or frequent within the British Isles. Therefore, the study corridor is not of particular conservation interest for bryophytes.

#### 12.1.2 Lichen

Two woodland lichens at the wooded area of the tunnels site were identified as having *Nationally Scarce* rarity status and one has IR status. However, none of these are *threatened*. All are of *Least Concern* for conservation. Both the RIC and NIEC scores demonstrated that the wooded area had no or limited conservation importance for lichens and that the woodland showed no ecological continuity or 'ancientness'.

The non-wooded areas of the tunnels area identified two species which have *Nationally Scarce* status. However, both are rather under-recorded in Britain and were not unexpected.

#### 12.1.3 Invertebrates

Given the restricted nature of the flora and the geographical situation of the southern study corridor and Tunnels site, it is not likely that these areas will generate a species inventory that is especially rich in species of conservation significance. The level areas are of low invertebrate interest whilst the associated slopes, cliffs, under-cliffs and other associated secondary habitat areas may have a greater value. The invertebrate fauna in these areas might be of raised significance and would warrant closer examination.

#### 12.1.4 Reptiles

Survey work undertaken in 2010 has established the presence of small reptile populations within habitat within the southern end of the study corridor. Grass snake, slow worm and common lizard are present in small numbers scattered across suitable habitat. Data collected during the survey does classify the 4Gas site as a Key Reptile Site following FrogLife Advice Sheet 10 (1999).

#### 12.1.5 Birds

Five bird species listed under Schedule 1 of the Wildlife & Countryside Act have been recorded using the study corridor, although only barn owl and kingfisher are likely to breed locally. Otherwise, the assemblage of birds recorded represents one that is typical of the habitat and region.

#### 12.1.6 Bats

The study area is important for a number of bat species including greater and lesser horseshoe bats. Barbastelle, an Annex II species, also use the area.

The tunnels within the 4Gas compound provide a variety of roosting opportunities during the summer and winter for at least four bat species. There are also likely to be nearby roosts for pipistrelle, *Myotis* and horseshoe bats including Venn Farm and barns at Castle Hall Farm.

Many hedgerows provide a key link between roosts and foraging areas. In particular, Hedgerows 5/5a, 14, 15 and 20 are likely to be important corridors for greater horseshoe bats and other species, but other hedgerows may also be important.

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Key foraging areas include areas of the 4Gas compound, the scrub adjacent to Hedgerow 20 and edges of the woodland in the northern section of the study corridor.

The 4Gas tunnels are used by greater and lesser horseshoe bats throughout the year. Individual bats are likely to move between tunnels depending on exterior weather conditions and internal micro-climate. Therefore, the whole compound including surrounding vegetation and flight corridors should be considered as an important greater and lesser horseshoe bat roost. These tunnels and the adjacent Former RNAD Site are also likely to be used by the same bat population as Scoveston Fort.

#### 12.1.7 Otter

There is moderate potential for breeding otters beside the stream in Rhodal Bottom coming in from Waterston east towards Castle Pill. It is suspected that otters would not go up to the pond at Green Farm. Otters may use additional ponds with the catchment (outside of the study corridor). The reservoir and pond at the 4Gas tunnels site have high potential for breeding. Spraints found at the entrance to a culvert on the 4Gas tunnels site suggest that otters seem to be coming through a culvert from the sea. In addition, an area just inside the entrance of Tunnel E which is situated above the stream, had evidence of use as a resting (non-breeding) holt by otters.

#### 12.1.8 Dormouse

The desk study evidence and the results of the nest tube survey indicate that the study area is unlikely to support a large population; although the extent of potential habitat suggests that there is still a low risk that a low density of individuals may be present.

#### 12.1.9 Badger

There is a large amount of badger activity in the area. At least two populations ('clans') of badger appear to be active within the study corridor. There may be an active sett within 30m of the study corridor depending on the final alignment of the road and area of associated works.

## 12.2 Former RNAD Site

### 12.2.1 Bryophytes

None of the bryophytes recorded from the site are legally protected, are of national conservation concern or are locally rare. Assessment of the bryophyte flora against the lower plant guidelines for the selection of biological SSSIs (Hodgetts 1992) shows that the assemblage is not of special interest in a national context. Indeed, all of the species are common or frequent within the British Isles. Therefore, the study corridor is not of particular conservation interest for bryophytes.

### 12.2.2 Lichen

All the lichens encountered at the Former RNAD Site are of *Least Concern* and consequently not threatened.

### 12.2.3 Invertebrates

Given the restricted nature of the flora and the geographical situation of the Former RNAD Site, it is not likely that the site will generate a species inventory that is especially rich in species of conservation significance. The level areas are of low invertebrate interest whilst the associated slopes, cliffs, under-cliffs and other associated secondary habitat areas may have a greater value. The invertebrate fauna in these areas might be of raised significance and would warrant closer examination.

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#### 12.2.4 Reptiles

Survey work undertaken in 2010 has established the presence of small reptile populations within both the Former RNAD Site and the 4Gas tunnels site. Slow worm and common lizard are present in small numbers scattered across suitable habitat. The 4Gas tunnels site is classified as a 'Key Reptile Site' under Froglife Guidance but the former RNAD site does not classify based upon the survey work undertaken to date.

#### 12.2.5 Birds

Five bird species listed under Schedule 1 of the Wildlife & Countryside Act have been recorded using the Former RNAD Site, although only barn owl and kingfisher are likely to breed locally. Otherwise the assemblage of birds recorded represents one that is typical of the habitat and region.

#### 12.2.6 Bats

The study area is important for a number of bat species including greater and lesser horseshoe bats. Barbastelle, an Annex II species, also use the area. The Former RNAD Site provides a variety of roosting opportunities during the summer and winter for at least five bat species. There are also likely to be nearby roosts for pipistrelle, *Myotis* and horseshoe bats including Venn Farm and barns at Castle Hall Farm.

The inside of the large buildings of the Former RNAD Site and the cliff edge are key foraging areas for a number of species. The buildings at the Former RNAD Site are likely to provide sheltered foraging conditions in conditions of high winds or rain, and as such, may be a key habitat for the local bat population. The Former RNAD Site is likely to be used by the same bat population as Scoveston Fort.

#### 12.2.7 Otter

Otters are known to commute along the sea wall of the Former RNAD Site. There is no potential for breeding on the Former RNAD Site but otters may be crossing it along the sea wall from the Swing Bridge to get to the Reservoir. They may also be using the culvert in the sea wall at the boundary of the Former RNAD Site to commute through to the reservoir.

#### 12.2.8 Dormouse

There is negligible potential for dormouse on the Former RNAD Site, although the habitat on the adjacent cliff and associated scrub is potentially suitable habitat.

#### 12.2.9 Badger

There is unlikely to be any badger setts within 30m of the Former RNAD Site.



Capabilities on project:  
Ecology

## 13 References

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