QUEEN'S DRIVE, EXMOUTH, DEVON

Survey of Badger Activity

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for

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by

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1.0 INTRODUCTION

1.1 Commissioning Brief

Julian Brown Consultancy Ltd (a specialist badger consultancy) have been contracted by East Devon District Council to carry out a badger *Meles meles* activity survey within Areas B, C, D and 4 at Queen's Drive, Exmouth, Devon. Hereafter Areas B, C, D and 4 are referred to as the 'site', with the centre of the site located at National Grid Reference SY 004 802.

1.2 Site Location and Description

The site is located at the southern edge of Exmouth, on the edge of the Exe Estuary. Areas B, C, D and 4 cover an area of approximately 1.9ha. The majority of the site comprises amenity grassland with scattered trees and hedgerows. The area is currently used as a tourist attraction and has a Pitch and Putt course, boating lake, miniature railway, adventure playground and trampolines. Buildings scattered throughout the site consist of kiosks, an amusement arcade, a soft play area for children ('Jungle Fun') and sheds.

The habitats surrounding the site are semi-urban. A sports pitch and residential area abut the northern site boundary, with a cricket pitch to the east and beach and seafront to the south-west of the site.

1.3 Development Proposal

Outline planning permission has been approved (granted by East Devon District Council on 10 December 2013) for a proposal to re-develop the existing leisure facilities at Queen's Drive to provide a new recreation and leisure zone on Exmouth's seafront. The development would include:

- indoor play and recreation area;
- a water sports hub;
- retail;
- public open space;
- a hotel or holiday accommodation;
- cafes and restaurants;

- car parking for 200+ spaces; and
- realignment of the existing road away from the seafront to improve access to the beach and the overall attractiveness of the area.

1.4 Details of Previous Badger Surveys

An Extended Phase 1 Habitat Survey was undertaken by Tamar Consulting in May 2012 (Tamar Consulting, 2012). This survey recorded no evidence of badger activity.

1.5 Purpose of this Report

This report presents the findings of a survey of badger activity within Areas B, C, D and 4 at Queen's Drive, Exmouth (see **Figure 1**). The survey was undertaken by Dr Julian Brown MCIEEM[1] on 5 June 2015 (Areas B, C and 4) and 16 June 2015 (Area D) (see **Appendix A** for experience and qualifications of the surveyor).

The objectives of the badger survey were to locate all badger setts and other signs of badger activity within the survey area. Using this information, this report provides an assessment of the implications of the development proposal on badgers, the Natural England licensing requirements, and provides mitigation recommendations as appropriate and recommendations for any additional surveys that may be required.

[1] Full member of the Chartered Institute of Ecology and Environmental Management.

2.0 BADGER ECOLOGY AND LEGISLATIVE BACKGROUND

2.1 Badger Ecology

Badgers in Britain usually live in groups of 3-10 individuals (Neal & Cheeseman, 1996), occupying a territory that is jointly defended against neighbouring badgers (Kruuk, 1978). Other badgers are more or less excluded from this land, which will encompass sufficient foraging areas to support the group throughout the year. Badger social groups are formed by individuals remaining within their natal group (Kruuk & Parish, 1982; Cheeseman *et al.*, 1987), with badger group size being determined by the amount of food available within the territory, while territory size is determined by the distribution of food patches (Kruuk & Parish, 1982).

Badgers defecate in pits termed dung pits and aggregations of these pits are called latrines. Other sources of badger scent such as urine and secretions from the anal, subcaudal and interdigital glands may also be deposited at latrines. Latrines are found throughout the social group territory, but in rural areas are concentrated on its periphery (Kruuk, 1978). These boundary latrines may be used by more than one social group and provide the opportunity for information exchange between neighbours. In urban areas latrines are generally concentrated around setts (Cresswell & Harris, 1988). Badgers tend routinely to use a network of well-worn paths to access different parts of their territory. The territory may include a number of setts of different sizes and functions (refer to **Appendix B** for a description of the different sett types).

In rural areas of Britain, earthworms (*Lumbricus terrestris*) have been identified as the single most important component of the badgers' diet (Bradbury, 1974; Kruuk & Parish, 1982; Hofer, 1986; Shepherdson *et al.*, 1990). Earthworms are largely obtained from grassland areas, particularly areas of short turf (Kruuk *et al.*, 1979) and to a lesser extent from deciduous woodland (Hofer, 1988). Suburban badgers are less dependent on earthworms with a significant proportion of their diet being anthropogenic in nature (e.g. food specifically put out for nocturnal mammals by local residents; food put out for wild birds and household pets; and gleanings from dustbins and compost heaps) (Harris, 1984). This human-derived food is largely obtained from residential gardens, which is the preferred foraging habitat for suburban badgers (Cresswell & Harris, 1988; Davison *et al.*, 2009).

2.2 Badgers and the Law

Badgers were initially partially protected by inclusion on Schedule 6 of the Wildlife and Countryside Act 1981. This protection has subsequently been strengthened by the Protection of Badgers Act 1992. The purpose of the Protection of Badgers Act 1992 is to protect badgers from incidental effects of lawful activities and deliberate attempts to inflict injury or kill badgers. Under the Act it is illegal to:

- wilfully kill, injure, take, possess or cruelly ill-treat a badger or attempt to do so;
- interfere with a badger sett by damaging or destroying it;
- obstruct access to, or any entrance of, a badger sett; and
- disturb a badger when it is occupying a sett.

A badger sett is defined as '*any structure or place which displays signs indicating current use by a badger*'. This can include culverts, pipes and holes under sheds, piles of boulders, old mines and quarries etc. Natural England have not set a time period for current use as the rate of decay of badger signs around a sett varies depending on soil type, topography, etc. Natural England recommends that in addition to currently occupied setts, plans also consider the effect of development on seasonally-used setts as these may be in use by badgers when development starts (Natural England, 2007).

2.3 Badgers and Development and Licence Requirements

2.3.1 Badger Disturbance

Under the Protection of Badgers Act 1992, any activity causing disturbance of badgers when they are occupying a sett is an offence unless it is undertaken in accordance with the terms of a disturbance licence from Natural England. As the Act does not highlight what constitutes disturbance, English Nature (the predecessor of Natural England) provided advice on the types of development activities, and their proximity to setts, that would warrant a badger disturbance licence (English Nature, 1995, 2002). English Nature (1995) state "*Up to 30 metres from any sett entrance is considered by English Nature to be a reasonable distance for work to be considered as licensable. Badgers are likely to show observable changes in their behaviour when some types of work are carried out within this distance*". English Nature's disturbance licensing guidelines can be summarised as follows:

- all work within 10m of the nearest sett entrance should be licensed;
- between 10 and 20m use of machinery is licensable, but hand digging is not unless tunnels are accidentally breached;
- between 20 and 30m only the largest machinery requires a licence; and
- over 30m the use of explosives and pile-driving may need to be licensed.

Natural England's interim badger licensing guidelines (Natural England, 2007) do not refer to disturbance zones around setts for different types of development activities. This is largely due to uncertainty over what activities will disturb badgers and a lack of clarity over the legal interpretation of the word 'disturbance'. The 2007 guidelines recommend the following in relation to badger disturbance:

- badger tunnels can extend to 20m from the entrance holes and are located between 0.2 and several metres deep (depending on soil and topography), therefore excavation work and heavy machinery should be kept well away from where it could result in damage to the sett or disturbance to any badger occupying the sett; and
- disturbances, such as loud noise or vibrations, that might agitate badgers occupying a sett should be avoided or limited to areas well away from the sett.

In June 2009, Natural England published further guidance on badger disturbance licensing following a legal review (Natural England, 2009). This guidance suggests that badgers are relatively tolerant of moderate levels of noise and activity around their setts (e.g. badgers will create setts under roads and railways and within urban gardens that are well-used by children and pets) and that low or moderate levels of apparent disturbance at or near to badger setts would not necessarily disturb badgers and would therefore not require a licence under the Act. Examples of activities at or near badger setts that Natural England do not consider likely to cause disturbance to badgers, and therefore would not normally be expected to require a disturbance licence, include the following:

- development, or other activities occurring close to badger setts (use of hand tools and/or machinery), where there is no reason to believe that the 'disturbance' will be greater than that which badgers commonly tolerate, and therefore any badger(s) occupying the sett are unlikely to be disturbed;

- vegetation removal (including felling small trees or shrubs) over or adjacent to setts (using hand tools and/or machinery); and
- clearing out of ditches/watercourses using machinery and/or hand tools where badger setts are present.

Notwithstanding the above, the persons involved with activities near badger setts will need to exercise judgement as to whether their action may or may not cause disturbance to badgers. Where badger disturbance is unavoidable, works would need to be carried out under a Natural England badger disturbance licence. It is important to note that these licences are only issued by Natural England between July and November inclusive (see below).

2.3.2 Sett Interference

If necessary, it is possible to move badgers from a sett, but the difficulty/success of such actions depends upon the importance of the sett to that group of badgers and whether a suitable alternative sett exists within their territory. For setts in 'current use' by badgers, a licence must be issued (by Natural England) before the badgers can be moved and/or the sett destroyed. In general, the smaller the sett, the less important it is likely to be to the continued survival of a group of badgers, and the more successfully the badgers can be excluded from it. For example, the closure of a small number of outlying setts within a territory, which mainly function as nocturnal refuges when badgers are disturbed (Butler & Roper, 1994) and as temporary resting sites for badgers during the night (Brown, 1993), would be expected to have little or no impact on the badger group involved.

Any attempt to move badgers by direct means (using exclusion fencing, for example) must be done responsibly, and with suitable expertise. The licensing procedure should ensure that the implications of such an action have been fully investigated, any mitigating measures have been undertaken, and that a person with suitable expertise carries out the operation.

Badger development licences are generally only issued at sites with full planning permission (to avoid any possible conflict with the planning process) and are not generally issued during the period 1 December to 30 June inclusive (the badger 'breeding season') and therefore development works need to be carefully timed to avoid the 'close season' on licence applications. The 'close season' on licensing is due to the following:

- badgers are markedly less active during the winter months and actions such as exclusion are unlikely to be effective; and
- pregnant and lactating females, and dependant cubs, are likely to be found underground between mid January and the end of June.

For badger setts that require closure due to development, Natural England are only able to issue a sett interference licence to enable badgers to be relocated to another sett(s) within that group's territory. There is no provision under the Protection of Badgers Act 1992 to kill badgers for development of land and it is also not permitted to 'take' them for this purpose, thereby ruling out translocation as an option.

3.0 SURVEY METHODOLOGY

3.1 Introduction

This section outlines the methodology used during the badger activity survey within Areas B, C, D and 4 at Queen's Drive, Exmouth, carried out on 5 and 16 June 2015 by Dr Julian Brown MCIEEM.

3.2 Survey Area

The area surveyed included the site and, where possible, land up to at least 30m outside the site (the survey was extended outside the site in order to locate setts that may be situated adjacent to the working area and that may therefore be affected by the proposed works).

3.3 Badger Survey Methodology

The survey area was systematically searched for setts and other characteristic signs of badger activity such as latrines, paths (only confirmed badger paths were recorded, i.e. there was a clear link to a sett or additional evidence of badger activity nearby), footprints, hairs (caught on fences and in sett entrances) and feeding signs. For each badger sett identified, the number of entrances and level of use was recorded, and the sett was then classified according to the criteria used in the National Badger Surveys (Cresswell *et al.*, 1990; Wilson *et al.*, 1997) (see **Appendix B**). Sett grid references were established using a hand-held GPS unit (Garmin eTrex 10).

3.4 Limitations

No limitations to the survey were encountered.

4.0 SURVEY RESULTS

4.1 Introduction

This section reports the findings of the survey of badger activity within Areas B, C, D and 4 at Queen's Drive, Exmouth, carried out on 5 and 16 June 2015.

4.2 Sett Status and Activity

Two badger setts were identified within the survey area. These comprised a small main sett (Sett A) and nearby annexe sett (Sett B). The location of these setts is illustrated on **Figure 1**. Full details of the size and level of activity recorded at Setts A and B are provided in **Appendix C**.

4.3 Other Badger Activity within the Survey Area

Limited signs of badger foraging activity were recorded within Area C, occurring largely in the vicinity of Sett B. This activity comprised several small clusters of shallow foraging pits (also referred to as 'snuffle holes') that were characteristic of badgers digging for insect larvae, plant tubers and earthworms. A number of well-used mammal paths were found within Area C (see **Figure 1**). Whilst these paths were in use by badger, all of the mammal paths illustrated on **Figure 1** were also being used by fox (see below).

4.4 Fox Activity

An active fox earth was recorded underneath decking at the rear of the amusement arcade (Target Note 2 on **Figure 1**), with signs of fox also recorded underneath a shed within Area C (Target Note 3). A short length of tunnel, that had been excavated by fox, was recorded within a soil mound on the eastern edge of Area C (Target Note 1). All of the mammal paths recorded within Area C showed signs of fox use and significant fox activity was recorded at Sett B.

5.0 ASSESSMENT AND RECOMMENDATIONS

5.1 Introduction

This section provides an assessment of the survey results, advises on the Natural England licensing requirements and provides recommendations on the badger mitigation strategy.

5.2 Conclusions of Survey

A small main sett (Sett A) and annexe sett (Sett B) were identified within the survey area. It is possible that the status of Setts A and B periodically interchanges. Both setts are used by the same social group of badgers and both setts displayed signs of current use by badgers and are therefore afforded legal protection under the Protection of Badgers Act 1992. Due to the relatively low level of badger activity recorded within the survey area it is expected that the resident badger group comprises a relatively small number of individuals.

It is expected that the development proposal would necessitate the closure of Setts A and B. This would require a sett interference licence from Natural England. The closure of both setts would require the provision of an artificial sett (see below).

It is expected that badgers inhabiting Setts A and B undertake much of their foraging within the residential gardens to the north of the site as these have been shown to be the preferred foraging areas for suburban badgers (Cresswell & Harris, 1988). Residential gardens provide a source of human-derived food (e.g. food specifically put out for badgers, food put out for wild birds and household pets and gleanings from dustbins and compost heaps), which formed a significant proportion of the diet of a population of badgers studied in suburban Bristol.

5.3 Impact Assessment

Development can affect badgers directly through damage to setts or indirectly through disturbance, loss of foraging, interruption of access or increased risk of injury. Using the above criteria, the following sub-sections provide an assessment of the possible impact on badgers of development of land at Queen's Drive, Exmouth.

Badgers use several different setts within their territory, for a number of different purposes (see **Appendix B**); so damage or disturbance to just one or two setts from their territory would not necessarily have a negative impact on the badgers (this rule does not generally apply to main setts). Thus, it is the use and availability of alternative setts that largely determines the severity of the impact that sett damage or disturbance would have.

It is generally accepted that the loss of around 25%[2] or more of a social group's territory could have a significant effect on the viability of the group by reducing the foraging resource to a level unable to sustain the number of badgers present within the territory. Notwithstanding this, the effect of habitat loss on a badger group is likely to vary in relation to the type and amount of habitat lost and retained within a territory.

5.3.1 Sett Closures

The proposed development at Queen's Drive would require the permanent closure of Setts A and B, under licence from Natural England. The closure of one of these setts would have little or no impact on the resident badgers. The closure of both setts would be expected to have a significant temporary impact on this social group (e.g. days/weeks rather than months/years); however, the provision of an artificial sett (see Section 5.4.1) would minimise any long term impacts.

5.3.2 Sett Disturbance

The buffer zone recommended between the artificial sett and the working area (see Section 5.4.1) and around Setts A and B (required if works commence on site prior to the closure of these setts, see Section 5.4.3), would ensure no disturbance to badgers inhabiting these setts (see Section 2.3.1).

5.3.3 Loss of Foraging Resource

Badgers occupying Setts A and B are likely to range over an area of at least 30ha and possibly up to 50ha, which represents the spring range size of suburban badgers in Bristol (Cresswell & Harris, 1988). The resident social group of badgers would not experience a significant loss of territory and therefore no measures are required to enhance badger foraging habitat.

[2] This figure has not been published but has been accepted in numerous Public Inquiries (e.g. The Ruffets, Meadow Walk, Chepstow, Monmouthshire – Planning Inspectorate Reference APPE6940\A\00\1052150).

5.3.4 Territory Fragmentation

Relocating badgers from Setts A and B to an artificial sett constructed on the perimeter of the site would ensure that badgers had easy access to all of their off-site foraging areas, thereby avoiding territory severance which is believed to contribute to the fragmentation and dispersal of badger social groups. It is also important that badgers have continued access to adjoining social groups as inter-group mating is the main means by which genetic variation is maintained within badger populations.

5.4 Recommendations

5.4.1 Artificial Sett

It is recommended that an artificial sett is constructed to accommodate badgers that would be excluded from Setts A and B. The artificial sett should be constructed at a secure location, ideally within an area of existing badger activity (within the same social group), but sufficiently removed from the proposed working area to avoid disturbance (it is recommended that the artificial sett is sited a minimum of 20m from the working area).

It is recommended that the artificial sett is constructed at the earliest opportunity to provide sufficient time for badgers to take up residence prior to the licensable badger works described below and for vegetation to establish across the sett, which would provide cover and protection for badgers. A lead in period of six months is generally recommended by Natural England (English Nature, 2002). It is recommended that the artificial sett comprises 12-15 chambers, constructed to provide two separate series of tunnels and chambers. Natural setts are often found to contain several more or less separate tunnel and chamber systems, connected to the remainder of the sett by only one or two linking tunnels. This may be particularly important when there are young cubs within the sett.

It is recommended that the artificial sett is constructed using prefabricated wooden chambers, with tunnels created using unperforated high-density polyethylene drainage pipe (300mm internal diameter). The artificial sett should be built on a 500mm high soil platform (this would ensure suitable drainage), with additional soil used to cover the chambers and tunnels. The depth of compacted soil above chambers and internal tunnels should be at least 1000mm to minimise temperature fluctuations within the sett.

It is recommended that the artificial sett is fed on a regular basis, to encourage badgers to enter the new structure and straw or hay left near the entrances to encourage badgers to drag this material into the sett for use as bedding. Some of this bedding material should include discarded bedding collected from Setts A and B (if present), as the badger scent within this bedding would provide a familiar olfactory cue at the artificial sett. During the feeding process, it is also recommended that soil from the spoil heaps of Setts A and B be deposited on the artificial sett spoil heaps as this would again provide a familiar scent at the artificial sett. At each feeding visit it is recommended that levels of badger activity are recorded at the artificial sett, as it may be necessary to demonstrate to Natural England that a suitable level of badger activity had been attained at the artificial sett.

Post development, it is recommended that public access to the artificial sett is restricted, possibly by the use of fencing and shrub planting (any fencing used should be permeable to badgers). Excluding members of the public from the artificial sett area is important as a number of studies have shown that public access to setts can be highly detrimental to local badger populations (e.g. Aaris-Sørensen, 1987; Jenkinson, 1991).

5.4.2 Closure of Setts A and B

The sett closures detailed in Section 5.3.1 would involve applying to Natural England for a sett interference licence. As described in Section 2.3.2, licences are only issued by Natural England between July and November inclusive. Natural England require up to 30 working days to process licence applications, once all necessary information is provided.

The exclusion of badgers from these setts would be undertaken in accordance with any Natural England licence conditions. Exclusion typically involves installing a one-way badger gate within each sett entrance, plus appropriate badger proofing (e.g. chain link netting) around the sides of the gates. The exclusion of badgers from Sett A would involve installing one-way badger gates and badger proof netting around the perimeter of the 'Jungle Fun' (it should be noted that while Sett A remains active, the removal of the 'Jungle Fun' is likely to require a sett interference licence from Natural England). Badgers would be excluded over a minimum period of 21 days (a condition of any Natural England licence) and following this period, provided the setts were no longer occupied by badgers (confirmed through monitoring at least every three days, a licence condition) the setts would be destroyed using a mechanical digger. Sett destruction would be carried out under the supervision of the licensee, again, a condition of any Natural England licence.

5.4.3 Protection of Setts A and B During Construction

Should development commence prior to the closure of Setts A and B, it is recommended that temporary fencing (e.g. Heras fencing would be appropriate) is erected to create a 20m buffer zone around Setts A and B, thereby preventing any possible sett damage resulting from accidental encroachment by machinery.

5.4.4 Minimising the Risk of Secondary Impacts to Badgers

It is expected that members of the resident badger group will continue to travel through the site during construction and therefore the following measures should be implemented to reduce the risk of secondary impacts to badgers:

- trenches in excess of one metre in depth should be covered or secured and a means of escape provided for any animal that does fall in (a suitable escape can be provided by wooden planks placed at a 45 degree angle);
- any temporarily exposed open pipe system should be capped in such a way as to prevent badgers gaining access;
- chemicals and fuels should be stored carefully and as far away from badger setts and paths as possible and in accordance with the Code of Construction Practice and the Environment Agency's Pollution Prevention Guidelines; and
- security lighting (if required) should be directed away from setts.

To facilitate these measures, contractors and subcontractors should be made aware of the location of badger setts and badger routes as part of environmental site induction courses. They should also be informed of the protection afforded to badgers under the Protection of Badgers Act 1992 and the need for confidentiality of the sett locations.

5.4.5 Update Badger Surveys

It is important to note that badgers are able to establish a new sett over the course of a few nights. It will therefore be necessary to carry out an update badger survey immediately prior to site clearance/construction and immediately prior to any licence application to Natural England (Natural England require badger survey information to have been collected within two months of the licence start date).

6.0 CONCLUSIONS

Land at Queen's Drive, Exmouth, is proposed for re-development to provide a new recreation and leisure zone. A survey of badger activity within Areas B, C, D and 4 on **Figure 1**, identified a small main sett (Sett A) and annexe sett (Sett B) within Area C (survey undertaken by Dr Julian Brown MCIEEM on 5 and 16 June 2015).

Setts A and B, which are occupied by the same social group of badgers, both displayed signs of current use by badgers and are therefore afforded legal protection under the Protection of Badgers Act 1992. It is possible that the status of Setts A and B periodically interchanges. Due to the relatively low level of badger activity recorded within the survey area it is expected that the resident badger group comprises a relatively small number of individuals.

The development proposal at Queen's Drive would necessitate the closure of Setts A and B. This would require the provision of an artificial sett, which would minimise any long term impacts on the resident badgers. The resident badgers would not experience a significant loss of territory and therefore no measures are required to enhance badger foraging habitat.

The artificial sett should be constructed at least six months in advance of closing Setts A and B to provide sufficient time for badgers to take up residence within the artificial sett and vegetation cover to establish across the artificial sett. The artificial sett should be constructed at a secure location on the perimeter of the site (to provide badgers with easy access to off-site foraging within their territory), but sufficiently removed from the working area (at least 20m) to avoid disturbance.

The required sett closures would need to be carried out under a sett interference licence from Natural England. Badger licences are generally only issued by Natural England between July and November inclusive (to avoid the badger 'breeding season'), with badger development licences only issued at sites with full planning permission (to avoid possible conflict with the planning process).

The closure of Setts A and B would involve excluding badgers using one-way gates and badger proof netting around the sides of the gates. Badgers would be excluded over a minimum period of 21 days (a Natural England licence condition). Following this period, provided the setts were no longer occupied (confirmed through regular monitoring, a licence condition), they would be destroyed using a mechanical digger, under the supervision of the licensee (a licence condition).

Should development commence on site prior to the closure of Setts A and B, it is recommended that temporary fencing (e.g. Heras fencing would be suitable) is erected to create a 20m buffer zone around Setts A and B, thereby preventing any possible damage resulting from accidental encroachment by machinery. Other measures to minimise the risk of secondary impacts to badgers are provided in Section 5.4.4.

It is recommended that an update badger survey is undertaken immediately prior to site clearance/construction to ensure that no new setts had been established within the site. It would also be necessary to carry out an update survey immediately prior to any licence application to Natural England.

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Appendices

Appendix A.

Qualifications and Experience of Dr Julian Brown

Dr Julian Brown attained an Honours Bachelor of Science Degree in Zoology (1989) from the University of Bristol and a Doctor of Philosophy from the University of Bristol (1993) for his research on the transmission of bovine tuberculosis from badgers to cattle. This research developed a novel tracking technique which enabled the behaviour of badgers to be studied in more detail than has previously been possible and in particular provided detailed information on patterns of badger movement, foraging and scent marking behaviour.

Dr Brown has been a freelance badger consultant since 1996 and is largely contracted to undertake badger surveys for the planning, construction and development industries. This has included providing advice and recommendation on badger mitigation, bait marking studies to assess the proportion of territory to be lost to development, artificial sett construction, sett closures and attending public inquiries as an expert witness. In 1997, a high-profile contract from South Somerset District Council involved translocating (under a MAFF damage licence) a social group of badgers undermining residential gardens in St Andrew's Road, Yeovil, to a site on Exmoor.

In 1994, Dr Brown was employed as a badger consultant with Bristol Ecological Consultants (BEC), where his main responsibilities were to conduct badger surveys in areas of potential development and to assess the impact of proposed developments on the long-term survival of local badger populations. While working with BEC, Dr Brown was involved with a badger radio-tracking study to assess the outcome of a badger relocation exercise.

In 1993, he was employed as a Scientific Officer to carry out an individual project to provide recommendations for the successful translocation of badgers. A social group of six badgers was monitored, following its translocation from an urban area of East Sussex to an artificial sett in a wooded location in Suffolk. Badgers were radio-tracked to determine their initial movements from the release site and their subsequent home ranges. Behavioural observations recorded information such as contact between individual badgers and use of feeding areas. Latrines were located and faeces removed for diet analysis and cage-trapping was used to monitor the condition of animals, including changes in weight and the breeding status of females.

Dr Brown is regularly invited to present papers and talks on badger ecology, which has included presentations at the Mammal Society Conference, National Federation of Badger Groups Annual Conference and the University of Oxford. He has published several scientific papers on different aspects of badger ecology, the latest of which uses the quantification of latrine use as a means of estimating badger social group size and population density (Journal of Applied Ecology, Vol. 38, pp 1114-1121). Dr Brown is a full member of the Chartered Institute of Ecology and Environmental Management.

Appendix B.

Types of Badger Setts and Levels of Use

The territory of a social group of badgers may include a number of setts of different sizes and functions:

Types of Setts

Main setts
These are in continuous use, they are large, well-established, often extensive and may have large spoil heaps outside the entrances. There are likely to be well-worn paths leading to the sett. It is where the cubs are most likely to be born. There is generally only one main sett per social group of badgers. Main setts are usually built in very specific positions, where there is the right combination of soil (to facilitate drainage and ease of digging), aspect, slope and cover. Since suitable sett sites are at a premium, main setts are usually long-established, and may have been in use for decades or even centuries. The average number of holes is 15.

Annexe setts
These occur in close association with the main sett (usually within 150m), and are linked to the main sett by clear well-used paths. Annexe setts consist of six holes on average, but they are not necessarily in use all the time, even if the main sett is very active. If a second litter of cubs are born, this may be where they are reared.

Subsidiary setts
These comprise five holes on average, but are not in continuous use and are usually some distance from the main sett (50m or more). There is no obvious path connecting them to the main sett and their 'ownership' can often only be determined by bait marking.

Outlying setts
These consist of only one or two holes. They can be found anywhere within the territory and usually have small spoil heaps, indicating that they are not very extensive underground. There are no obvious paths connecting them to other setts, they are only used sporadically and often used by foxes or rabbits when not occupied by badgers.

Sett Use and Levels of Activity

The size, status and level of activity of each sett can be assessed by counting the number of entrance holes. The degree of use of each entrance hole can be classified as follows:

Well-used holes
These are clear of any debris or vegetation, are obviously in regular use, and may or may not have been excavated recently.

Partially-used holes
These are not in regular use and have debris such as leaves and twigs in the entrance, or have moss and/or other plants growing in or around the entrance. They could be in regular use after a minimal amount of clearance.

Disused holes
These have not been in use for some time, are partially or completely blocked, and could not be used without a considerable amount of clearance. If the hole has been disused for some time, all that may be visible is a depression in the ground where the hole used to be, and the remains of the spoil heap, which may be covered in moss or plants.

In addition to their setts, badgers occasionally lie-up above ground in small depressions lined with dry grass and leaves, usually under a fallen log or dense patch of bramble. These are termed 'day nests', although it is uncommon for badgers to occupy them during the day; the animals more often use them as shelter for short periods during the night. These structures are not usually given the legal protection afforded to setts.

Appendix C.

Classification of Setts Recorded

Sett A — Main sett that comprised at least 1 well-used hole and 2 partially-used holes situated near the western boundary of Area C, underneath a soft play area ('Jungle Fun') (National Grid Reference (NGR) SY 00449 80189 for well-used entrance). Although a torch-light search for sett entrances was undertaken, it was not possible to carry out an exhaustive search for entrances underneath the 'Jungle Fun' and therefore an additional entrance(s) may exist.

Sett B — Annexe sett that comprised 8 partially-used holes and 2 collapsed tunnels situated near the western boundary of Area C, adjacent to two sheds (NGR SY 00461 80217 for approximate centre of sett). The sett also displayed signs of use by fox.

Figures