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Barn Owl Surveying Standards for National Road Projects

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BirdWatchIreland
protecting birds and biodiversity

Prepared by BirdWatch Ireland

RE Research

Technical

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Contact: Standards and Research Section, Transport Infrastructure Ireland
Postal Address: Parkgate Business Centre, Parkgate Street, Dublin 8, D08 DK10
Telephone: +353 1 646 3600
Email: infoPUBS@tii.ie

TII Publications

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1. Introduction

The Barn Owl (*Tyto alba*) is a Red-listed Bird of Conservation Concern in Ireland due to extensive population declines over recent decades. (1) The Bird Atlas (2007–2011) (2) highlighted a decline of 39% in the breeding range of Barn Owls in Ireland over the 40-year period since the original Atlas of Breeding Birds in Britain and Ireland (1968–1972). (3) The intensification of agriculture, in particular the reduction of prey rich foraging habitat, is likely to be the main driver of long-term Barn Owl population declines in Ireland. (4) (5) (6) The loss of nesting sites, increases in the use and exposure to rodenticides, (7) (4) and the expansion of the major road network (8) (9) (10) (11) have also been recognised as factors which may impact Barn Owl populations.

Barn Owls may be impacted by the development of national road schemes through the loss of nesting sites and displacement of nesting pairs, and through direct mortality due to vehicle collisions during the operational phase of road networks. (12) (13) (14) (15) During the planning of national road schemes, information on Barn Owl populations is therefore necessary to identify the scale of likely impacts and appropriate mitigation strategies. Due to their spatial distribution (refer to Figure 1), low population densities and nocturnal activity patterns, Barn Owls are a challenging species to survey. Nest sites are often difficult to access and detect and may not be recorded by standard bird survey techniques. (16) (4) The survey methods outlined in this standard are designed to locate all Barn Owl breeding sites within a defined 'zone of influence' to inform all phases of the planning, construction and operation of national road schemes in Ireland. The methods are informed by best practice survey methods and knowledge of Barn Owl ecological and nesting requirements, specific to the Irish context, based on research and monitoring of Barn Owls by BirdWatch Ireland.

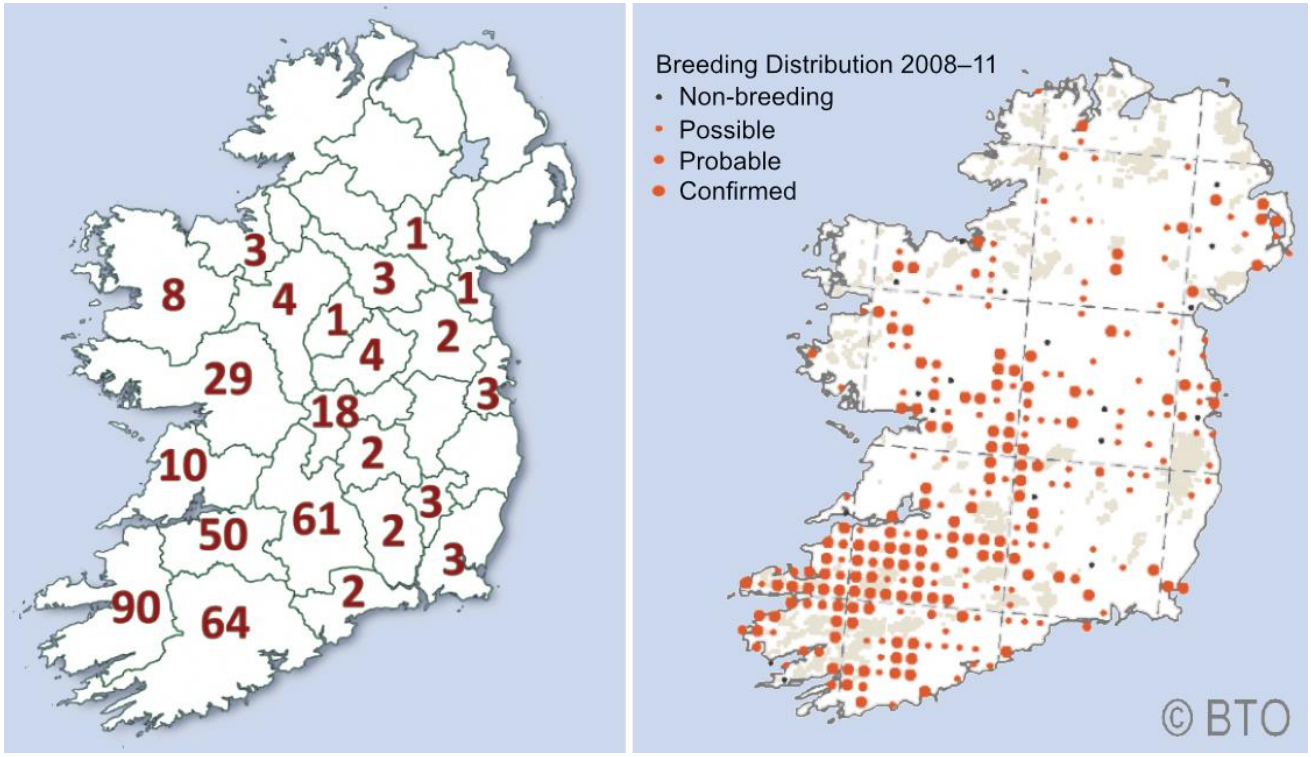

Figure 1: The number of Barn Owl sites per county in Ireland recorded by BirdWatch Ireland between 2006 and 2016 (left). The breeding range of Barn Owls in Ireland recorded by the Bird Atlas (2007–11) (right).

2. Legal and Disturbance Issues

The legislative framework under the Wildlife (Amendment) Act, 2000 provides for the protection of all wild birds and their nests, eggs and young (www.npws.ie/legislation). Barn Owls are a Schedule II species under the Wildlife (Amendment) Act, 2000. It is an offence to intentionally cause disturbance at a nest site or to breeding Barn Owls. All Barn Owl survey operations outlined in this standard require a licence (Section 22 9(d)) from the National Parks and Wildlife Service.

Survey operations should be carried out to minimise disturbance to breeding bird and bat species which may be encountered or present in sites investigated as part of Barn Owl survey work. Barn Owls are particularly sensitive to disturbance during the early stages of the breeding season, before laying and during incubation. Confirmed or suspected nest locations should not be approached or directly inspected and should be watched from a discrete distance to confirm occupancy. If a bird/s are flushed, or alarm call due to disturbance caused by survey operations, the site should be vacated immediately to allow the bird/s to return to the nest.

3. Annual Cycle

Barn Owls have one of the longest breeding seasons of any terrestrial bird in Ireland (refer to Figure 2). Courtship begins as early as January, when the male and female roost together at the chosen nest site. The male is typically vocal at this time of year, emitting loud drawn out screeches after sunset. As the season progresses, the pair will regularly engage in courtship flights, soaring, or high speed vocal pursuits around the nest site at dusk. (5)

In the days prior to egg-laying, the female will become less active and cease to hunt. She will remain in the nest for the next two months, leaving only for brief periods and the male will deliver prey to the nest throughout the night. Laying usually occurs in late April or early May, but the timing can vary depending on several factors including weather conditions and local prey availability.

During the pre-laying and incubation phase, the female will regularly 'snore' from the nest at night, which is a call similar to that made by the young later in the season. Only the female incubates, and once laying begins, the male will typically leave the nest and roost elsewhere during the day. Usually four to six eggs are laid, two or three days apart. The eggs hatch after 30 to 31 days (5) and the female will stay in the nest and brood the young until they are two to three weeks old.

At approximately three weeks old, once the young can maintain their own body temperature and swallow whole prey, the adults roost away from the nest during the day and return at night to feed the young, with up to 25 prey deliveries per night. The owlets will 'snore' from the nest throughout the night. Once they reach between 55 and 60 days old, the feathers are nearly fully grown, and they will make their first flight.

In the late summer and autumn, the young start to disperse from the nesting area. Some birds may leave the nesting area soon after fledging, while others can remain into November or December. Average dispersal distance in Ireland is between 40 and 50km, with some birds recorded as adults breeding as little as 11km from their natal site, while others disperse further, with a movement of over 350km recorded. (17) The young will establish in their own home range and will breed in the following nesting season, which is their second calendar year.

The adults may occupy the nest throughout the winter, or may use alternative roost sites within the home range, typically returning to the nest site early in the following year. Individual nest sites may be occupied over consecutive years by successive generations of Barn Owls, with records of traditional nest sites in Ireland remaining active on a regular basis over more than 40 years. However, pairs can use an alternative nest within the same site or relocate to another site within their home range, particularly if the nest previously used becomes unsuitable.

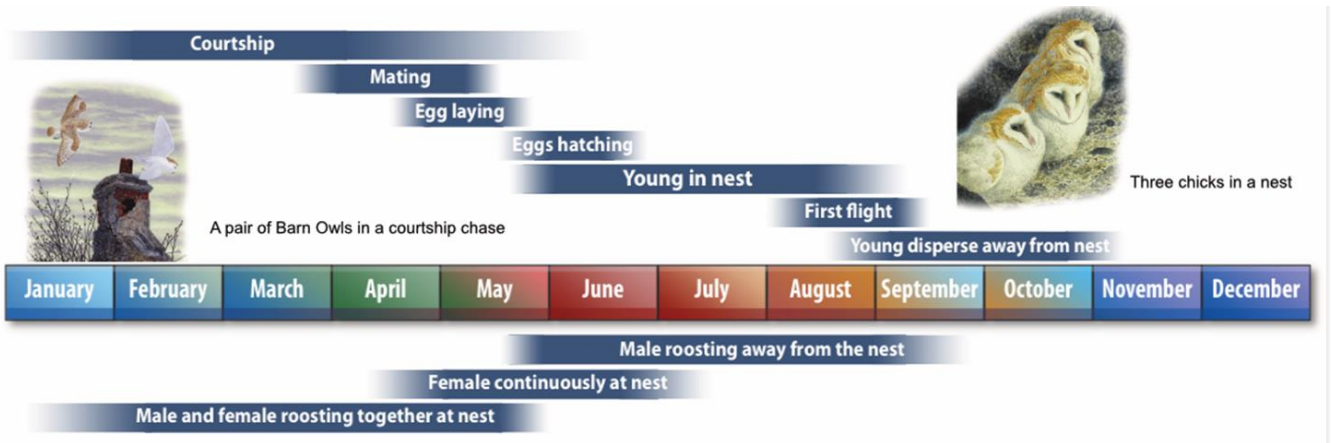

Figure 2: The Barn Owls annual cycle in Ireland

4. Habitat Use and Home Range

Barn Owls are primarily associated with open countryside, and occupy a range of landscapes, provided there are suitable nesting sites and sufficient prey-rich, open foraging habitat. The majority of recorded breeding pairs in Ireland are located below 150m asl (above sea level); however, successful nesting has been confirmed above 300m asl, and areas of suitable habitat up to 350m asl should therefore be considered potentially suitable.

Optimal foraging habitat for Barn Owls includes rough, species rich and low-intensity or unmanaged grassland habitats suitable for small mammals, which include grass margins and edge habitats along field boundaries, hedgerows, ditches, road-side verges, and woodland edge, as well as open areas of rank vegetation, wetlands and arable areas (refer to Figures 3 and 4). Barn Owls can occupy intensively managed landscapes, provided there are suitable foraging habitats in the form of rough grassland and field margins. Although they do not typically breed within extensively built up areas, Barn Owls can occur in urban and suburban areas, provided their nesting and foraging requirements are met, breeding pairs have been confirmed in urban parks in towns and cities and in occupied dwellings and abandoned buildings in villages.

The home range size of breeding Barn Owls in Ireland varies according to habitat quality and prey availability, ranging from 950 to over 9,000 hectares, with the majority of foraging concentrated within 4 to 5km of the nest site. Birds can occasionally travel greater distances with movements up to 9km recorded during the nesting season (refer to Figure 3). They are not a strongly territorial species and only actively defend the immediate area of the nest site; (5) therefore, home ranges can overlap, with nesting pairs recorded less than 350m apart in Ireland.

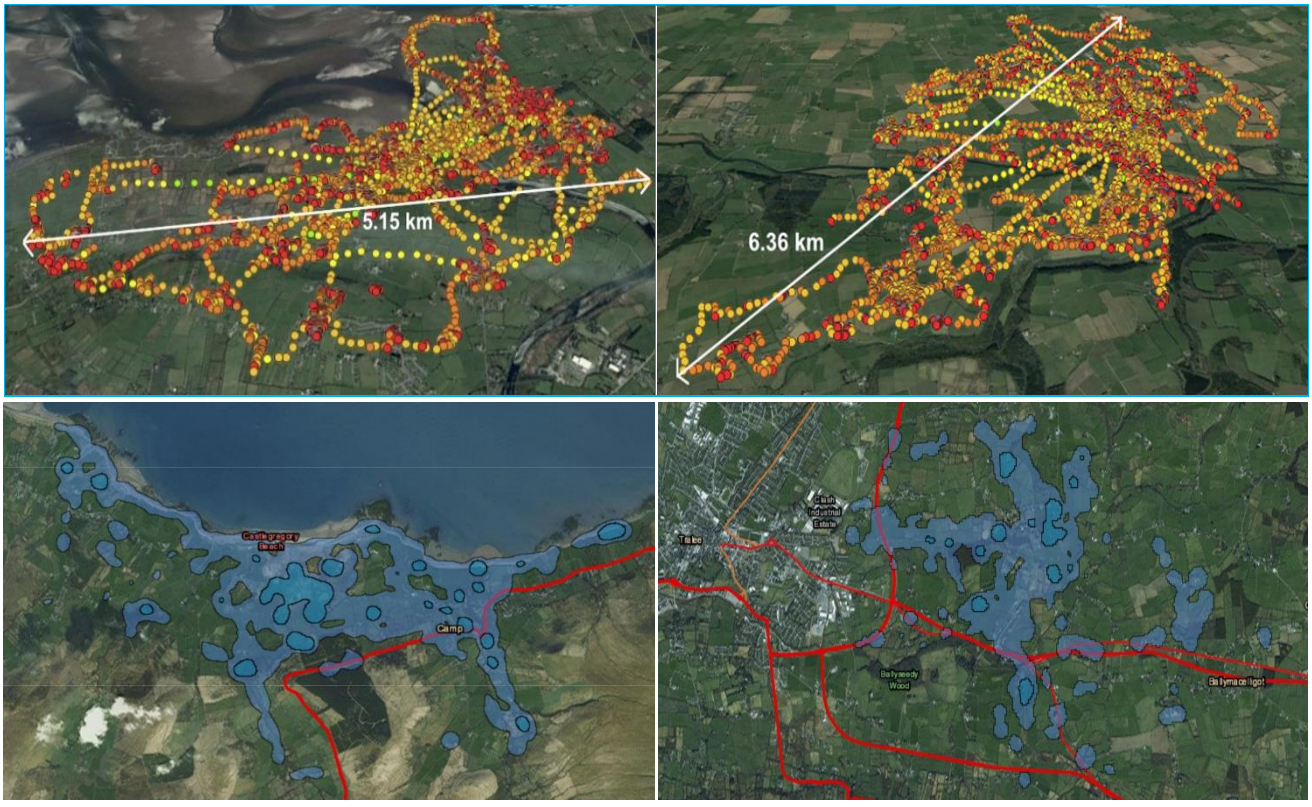

Figure 3: Barn Owl movements (top) and areas of activity (bottom) within the home ranges of breeding birds fitted with Global Positioning System (GPS) dataloggers in County Kerry

Figure 4: Foraging habitats and typical landscapes used by Barn Owls in Ireland, including rough grassland (top left), field margins of cereal fields and hedgerows (bottom left), mixed lowland agricultural landscapes with hedgerows and young forest plantation (top right and centre) and farmed land with woodland, wetland margins and low-intensity grassland (bottom right).

5. Nest Sites

Barn Owls are a cavity nesting species, and require a dry, dark and secluded space with a flat surface greater than 30cm x 30cm for nesting. (4) They will use a range of sites which provide suitable cavities including buildings, trees, bale stacks, fissures in rocks and artificial nest boxes. The nest entrance or access to the nest site can vary in size from large openings to as small as approximately 7cm x 7cm in diameter. (18) They do not construct a nest as such or bring nesting material into a nest, but will make a shallow scrape where the eggs are laid. (4)

Of 338 Barn Owl sites assessed over a 10-year period between 2006 and 2016 (refer to Figure 5), the majority were in man-made stone structures (n = 303), with trees (n = 32) and quarries (n = 3) also used by Barn Owls. The most common site types were farm houses (n = 92), ruined mansions (n = 73) and castles (n = 69).

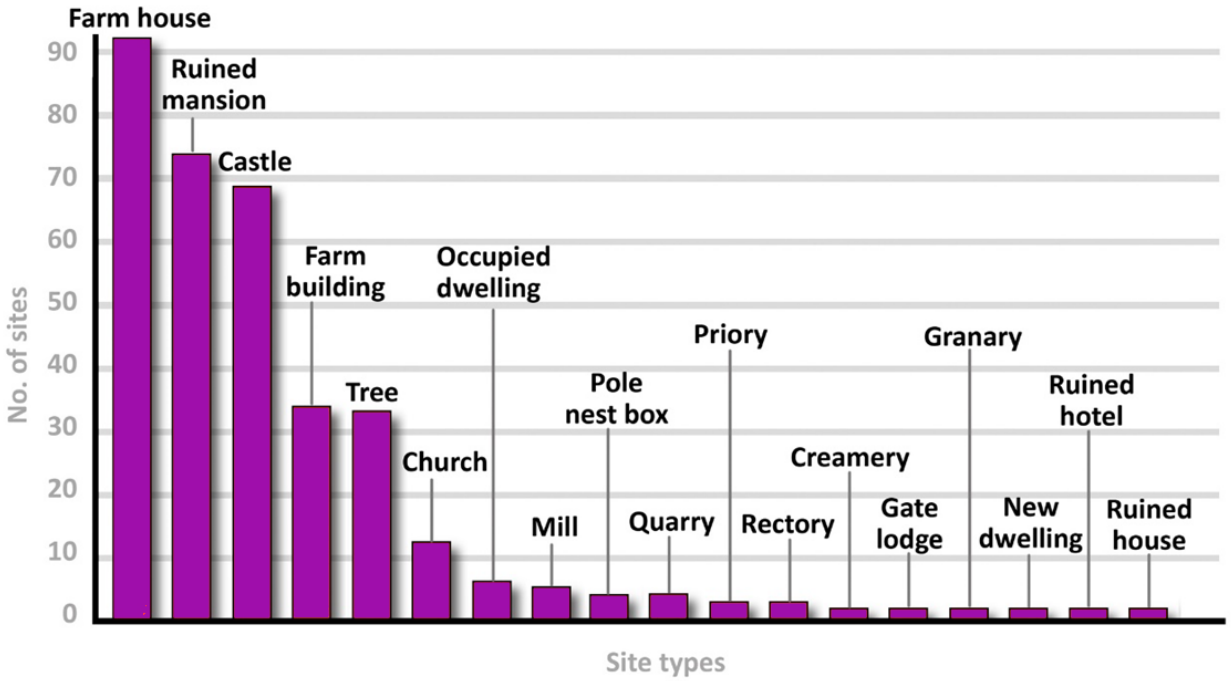

Figure 5: The variation in Barn Owl sites types recorded in Ireland between 2006 and 2016 (n = 338)

5.1 Buildings

Barn Owls use a range of building types for nesting (refer to Figure 6). Within buildings, nest sites are most frequently located within chimney structures, roof spaces, wall cavities and chutes. The gaps between stacked bales of hay or straw stored in farm buildings can also provide a suitable nesting site.

Although Barn Owls tend not to use buildings that are frequently used by people, provided the nest site is free from disturbance, Barn Owls can tolerate activity close to the nest. Nest sites have been recorded within the roof spaces and blocked chimneys of occupied dwellings, and houses which are being constructed. Breeding pairs have been recorded in active farm yards, nesting in between stacked bales or in nest boxes in modern farm buildings. Artificial nest boxes are now the most common recorded nesting site in Ireland and have been provided in a diverse range of built sites.

Several other species may occupy the same buildings as breeding Barn Owls. Jackdaws (*Corvus monedula*) nest within the majority of ruined buildings used by Barn Owls, and can nest in close

proximity, with both species recorded nesting within the same chimney spaces and nest box. Over half of the known Barn Owl sites are also used by Kestrels (*Falco tinnunculus*) for nesting or roosting. Breeding Peregrine Falcon (*Falco peregrinus*) and Raven (*Corvus corax*) have also been recorded within the same buildings used by Barn Owls.

Figure 6: Buildings used by breeding Barn Owls in Ireland, including a nest within the roof space of an unfinished modern house (top left), a derelict two-storey farmhouse (top centre), chimney system of a ruined mansion (top right), ruined mansion (centre left), ruined priory (centre), castle (centre right), barn in an active farmyard where the birds nested between bales (bottom left), and derelict cottage (bottom right).

5.2 Trees

Barn Owls select trees with a cavity of sufficient size for nesting, which are usually mature trees with a trunk diameter greater than 50cm (refer to Figure 7). Barn Owl nesting sites have been confirmed in Beech (*Fagus sylvatica*), Oak (*Quercus* species), Ash (*Fraxinus excelsior*), Sycamore (*Acer pseudoplatanus*), Horse Chestnut (*Aesculus hippocastanum*), Lime (*Tilia cordata*), and Monterey Pine (*Pinus radiata*) in Ireland. Typically, isolated trees or large trees within a tree line, hedgerow or at the edge of woodland facing out onto open habitat are selected, with trees in the interior of woodland generally avoided. Other species, particularly Jackdaw, may be found nesting within the same tree as Barn Owls.

Figure 7: Trees used by breeding Barn Owls, including a Beech showing the nest entrance (top left), Ash with several nest entrances (top centre), Beech which was completely hollow after being struck by lightning (top right), Lime trees which were both used for nesting and roosting (bottom left) and a Monterey Pine at the edge of a forest track (bottom right).

5.3 Quarries and rock faces

Quarries and rock faces with suitable cavities can be used by breeding Barn Owls (refer to Figure 8). A range of other species including Peregrine, Kestrel, Raven and Jackdaw can also occupy quarries and rock faces which may be used by Barn Owls.

Figure 8: Barn Owl nests in quarries, showing entrances to nest cavities and white-wash (top and bottom left) and a nest entrance showing pellets and moulted feathers (bottom right).

5.4 Nest boxes

Artificial nest boxes, designed specifically for Barn Owls, have been installed in ruined buildings, farm buildings and fitted to occupied dwellings, on trees and also mounted on poles (refer to Figure 9). In recent years, nest boxes have become the most common nest site type used by Barn Owls, with over 40 nesting pairs in nest boxes and likely to be more which are unrecorded.

Figure 9: Barn Owl nest boxes, including an outdoor A-frame nest box on a tree (top left), nest box installed in the roof space of a ruined farmhouse (top centre), pole mounted nest box (top right), nest box situated on a chimney of a derelict cottage (bottom left) and nest box placed in the interior of a derelict two-storey farmhouse (bottom right).

6. Survey Techniques

6.1 Sign searching

Sign searching is an effective method for establishing presence of Barn Owls. (18) At many sites, the presence or absence of Barn Owls can be determined by a visual inspection during the day to search for signs of occupancy which include pellets, white-wash and moulted feathers. Confirmation of signs indicates that a site has been used by Barn Owls; however, it is necessary to conduct a nocturnal watch to establish current occupancy and breeding status to inform road planning. Signs should be collected in a sealable bag and labelled with the site location and date, so that species identification can be validated if required, and this will also serve to ascertain recent activity at the site based on presence or absence of fresh signs on future visits. At certain sites, sign searching may not be an effective means of determining occupancy, as signs may not be obvious or accessible, e.g. sites which are inaccessible (a building which is unsafe or not possible to enter) or where the nest site is concealed (within a blocked chimney, roof space, or tree cavity which is not possible to access and where signs remain in the nest space). At sites where sign searching is deemed to be ineffective in determining Barn Owl presence, a nocturnal watch (refer to Section 6.2) should be carried out to confirm occupancy.

6.1.1 Pellets

Barn Owls usually swallow their prey whole and regurgitate the undigested remains in the form of a pellet. Barn Owl pellets are large (approximately 4cm x 2.5cm), dark in colour and contain large bones and skulls of small mammals and other prey items. Two pellets are generally cast over a 24-hour period. (5) At sites which have been in use for some time, a large build-up of pellets may be obvious. However, depending on the characteristics of the site, pellets may not be evident, such as in active sites where pellets do not fall from the nest to the ground (e.g. if birds use a chimney which is blocked, a tree cavity or a roof space to which there is no access, etc.).

Barn Owl pellets are similar to those of Long-eared Owl (*Asio otus*). However, the two can generally be differentiated on the location where they are found. Long-eared Owls typically nest in old corvid nests in trees and rarely use buildings. Barn Owls typically only nest in trees which have hollow cavities of sufficient size and depth, and therefore close investigation of the tree itself will usually provide a reliable indication of the species present. Kestrels routinely use buildings for nesting and roosting, and it is common to find both Kestrel and Barn Owl pellets (refer to Figure 10) in the same building.

Figure 10: Barn Owl pellets (left) and Kestrel pellets (right). With practice, Kestrel pellets are easily distinguished from those of Barn Owl by their smaller size (2.5cm x 1.5cm), colouration and contents, as Kestrel pellets regularly contain invertebrate remains which are unusual in Barn Owl pellets.

6.1.2 White-wash

At most active Barn Owl sites, white-wash will be evident, either directly associated with the nest or roost site, or under regular perches within or close to the site. Barn Owls are habitual in their behaviour and regularly use the same perches, under which there is often a build-up of white-wash.

Barn Owl white-wash can be distinguished from most other species as it is large, often almost pure white and regularly occurs in long vertical streaks (similar to lines of "white paint") (refer to Figure 11). The white-wash of Kestrel, Peregrine and Raven which can frequently use the same sites, can be confused with Barn Owl, and further searching for additional signs (pellets or moulted feathers) and/or a nocturnal watch should be carried out to confirm the species present as appropriate.

In situations where Barn Owls nest within chimneys, build-up of white-wash can often be observed in the fireplace or at the top of the chimney. Evidence of white-wash can be particularly useful at sites where pellets or moulted feathers are not obvious, such as derelict cottages where birds nest in the chimney but do not access the interior of the building. In such situations, birds will typically use perches close to the building, often inside adjacent open buildings. In these circumstances, white-wash may be the only obvious signs to indicate Barn Owl occupancy.

Figure 11: Examples of Barn Owl 'white-wash' on a fireplace used to access a chimney nest (top left), on vegetation under a nest entrance (top centre), at the entrance to a cavity nest in a quarry (top right), and under regular perches in buildings (bottom).

6.1.3 Moulted feathers

Moulted feathers can provide a reliable indication of Barn Owl presence (refer to Figure 12). White 'fluffy down' can gather around the nest entrance, and the presence of flies around the nest entrance may also provide a useful indication of nest location, as can prey remains or dropped prey items.

Figure 12: Barn Owl moulted feathers, including flight feathers (top left and bottom right), and a body feather (bottom left) which are distinctive, and fluffy down at the entrance to a chimney nest (top right), also the remains of a prey item dropped directly beneath the nest within a building (bottom centre).

6.2 Nocturnal watches

Nocturnal watches involve observing a potentially suitable or active Barn Owl site from a selected vantage point during the period when the birds are active in order to establish occupancy and breeding status based on observations, vocalisations and/or behaviour of birds associated with the site. Nocturnal watches should be conducted during the breeding period April to July and should be carried out from a discrete vantage point to avoid disturbance to breeding birds. The position of the vantage point should be informed by the specific characteristics of the site to ensure a good view of the site, and/or area of suspected activity, including flight paths to and from the site, and preferably so that the site/area of interest is against a light background or clear sky to aid observations. Typically, 20–50m from the site is an appropriate distance to conduct a nocturnal watch; however, this may vary, depending on site specific conditions including the scale of the site and access (refer to Figure 13). If the nest site location is known or suspected, based on existing evidence (presence of signs,

information from previous nocturnal watches, etc.), the watch may focus specifically on this area. It may be necessary to conduct the watch from inside buildings in certain situations. Regardless of the position, the surveyor should remain discrete at all times, including when accessing and departing the vantage point, and position themselves against a dark background or cover where possible, wearing dark or camouflage clothing. If one or both adults alarm call due to the presence of a surveyor then they should finish the watch and make an obvious departure from the site, as alarm calling can be taken as evidence of breeding. For large sites or those with many potential nesting areas, two or more surveyors or repeated visits may be required to effectively establish occupancy and breeding status.

Nocturnal watches should be conducted in calm and dry conditions for a minimum of two hours, commencing 30 minutes prior to sunset. In good conditions, where visibility is adequate to detect Barn Owls entering or exiting a site, it is possible to conduct watches throughout the night, until sunrise.

When conducting a nocturnal watch, it is important to listen for and note all vocalisations which often can be the best means of establishing occupancy and information on breeding status. If it is not possible to hear vocalisations from the vantage point, then the site should be quietly approached on completion of the nocturnal watch to listen for calls which may indicate occupancy and breeding. The surveyor should remain stationary for a minimum of 15 minutes or until calls are confirmed.

Watches should be undertaken until the status of the specific site is effectively determined. Multiple watches may be necessary to effectively establish occupancy and breeding status. The vantage point position may be adjusted on subsequent watches based on information gathered and areas of activity identified for the site. If evidence of breeding is confirmed, the site should be recorded as a ‘breeding site’ and there is no requirement for further visits unless necessary to obtain information on breeding success. If nocturnal watches during the breeding season produce no evidence of Barn Owls then the site can be considered as ‘unoccupied’.

Figure 13: Images of sites which are the focus of nocturnal watches taken from the vantage point. For the stone shed (left), the watch is focusing on birds approaching and entering or exiting via the roof space. In the case of the derelict farm house (right), the watch is focusing on the chimney. The vantage points are positioned to afford good views of the potential area of activity, against a clear sky and at sufficient distance to not cause disturbance.

7. Survey Methods

To accurately determine the distribution and abundance of Barn Owls in an area, it is necessary to attempt to locate all breeding sites. Barn Owl surveys to determine occupancy and breeding status should be carried out during the main nesting period (April to July) when the population is sedentary and when it is possible to detect and confirm nesting sites. Additional visits (July to August and later) may be carried out to determine breeding success. Best practice survey methods for determining Barn Owl distribution, abundance and nest site locations to inform the planning of national road schemes are outlined in the following sections. Appropriate Personal Protective Equipment (PPE) should be used when conducting fieldwork, which should include a hard hat, high-visibility clothing, boots, torch and mobile phone or two-way radio as required. A device for recording location (hand-held GPS unit or phone), sample bags with labels for collecting signs, and binoculars and dark or camouflage clothing for conducting nocturnal watches are also necessary.

7.1 Define the zone of influence

For national road schemes, the zone of influence for a Barn Owl survey should be defined by drawing a buffer of 5km around the proposed route alignment. The zone of influence will therefore extend for 5km either side of the route alignment, creating a survey area of 10km in width with the proposed route at the centre and extend for 5km from the start and end points of the route (refer to Figure 14). The extent of the zone of influence for Barn Owl surveys is based on the home range ecology of the species to incorporate all nest sites which may be potentially impacted by the road scheme (within 5km from the route).

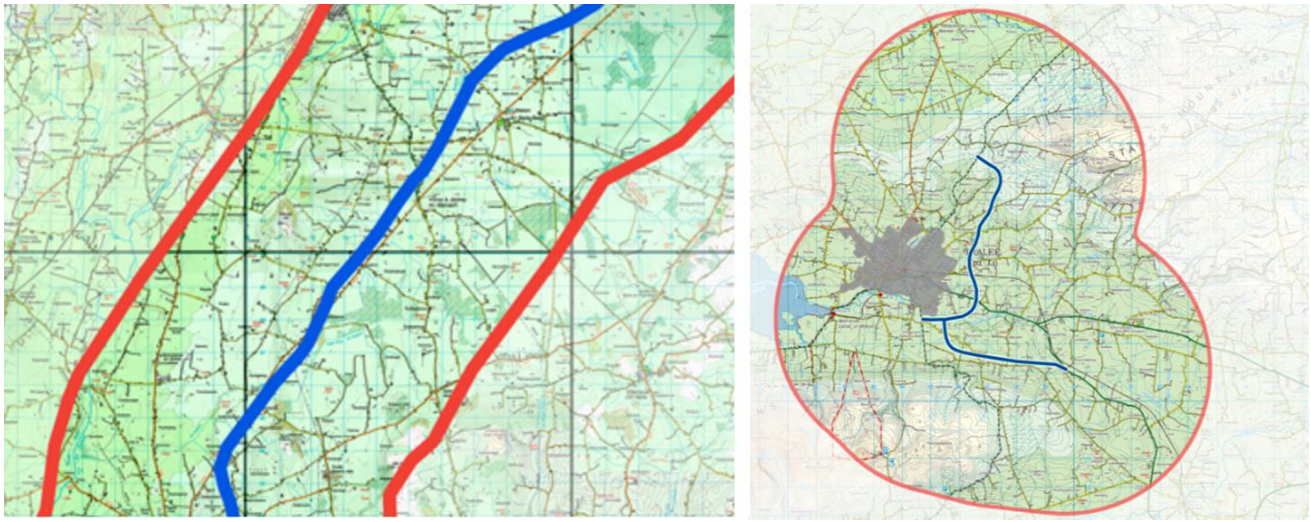

Figure 14: The zone of influence showing a buffer of 5km around the route.

7.2 Collate existing information on Barn Owl occupancy

All existing information on Barn Owl occupancy, distribution and abundance within the defined zone of influence should be collated from relevant sources. Information can be requested from BirdWatch Ireland (John Lusby at jlusby@birdwatchireland.ie) that maintains a database of known active and historic Barn Owl nest sites in Ireland. Detail on previously occupied sites and locations provides a useful starting point for the survey but cannot be taken to represent a complete or current overview of Barn Owl occupancy in an area, which requires a systematic survey to locate all breeding pairs.

7.3 Define the search area

Survey maps of the zone of influence of appropriate scale should be prepared for use in the field. Maps should feature all roads and buildings within the zone of influence. Ordnance Survey and aerial imagery (Bing Maps or Google Earth) should be reviewed to identify potentially suitable buildings and quarries within the zone of influence which should be marked on the survey maps, alongside all known active and historic Barn Owl sites.

Areas which are unsuitable for breeding Barn Owls should be highlighted on the survey maps and excluded from further survey effort (refer to Figure 15). Unsuitable areas are defined as all lands over 350m asl, densely populated and built up areas, open bodies of water, and the interior of forests. The search area should therefore include all other areas within the zone of influence which are below 350m asl and which may contain suitable breeding sites for Barn Owls, including buildings, mature trees, quarries and rock faces and artificial nest boxes.

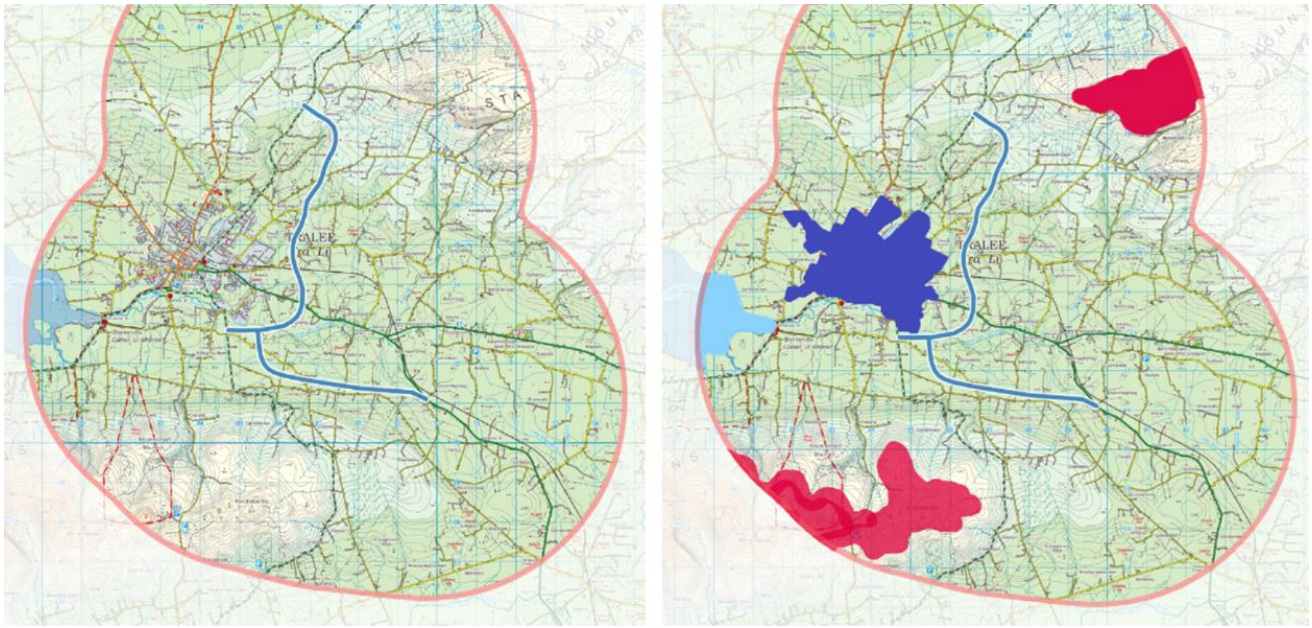

Figure 15: A defined zone of influence for a Barn Owl survey (left), and the defined search area (right) showing upland areas above 350asl (in red) and a built-up area (blue) which are excluded from the search area.

7.4 Determine site suitability and occupancy of Barn Owls

All buildings, mature trees, quarries and rock faces and artificial nest boxes within the defined search area should be assessed during the day time to determine their suitability for breeding Barn Owls.

Assessment of site suitability can be undertaken prior to the breeding season during January to March, or alternatively during April to July, when Barn Owl occupancy of potentially suitable sites can also be assessed on the same visit.

Sites confirmed to be 'unsuitable', which do not provide nesting opportunities for Barn Owls, should be recorded as such and can be excluded from further survey effort. All sites which are classed as 'potentially suitable' for Barn Owls should be recorded, including an accurate location (using the Irish Transverse Mercator (ITM) coordinate system) and marked on the survey map. A thorough inspection should be conducted during the day to assess occupancy, based on the presence of signs, and to inform the requirement for follow up visits and nocturnal watches. The methods for determining suitability and occupancy for each site type are outlined in the following sections.

7.4.1 Buildings

All buildings within the defined search area should be assessed to determine suitability for breeding Barn Owls. The exterior of modern and occupied buildings and the interior and exterior of ruined, derelict, farm buildings, and any other built site considered to be potentially suitable should be inspected thoroughly, checking for potential nesting opportunities.

Buildings should be classed as 'unsuitable' if there are no nesting opportunities for Barn Owls. Most modern and occupied dwellings will be unsuitable for Barn Owls and can be quickly ruled out on inspection to ensure that there are no artificial nesting sites associated with the building, blocked chimneys or access to the roof space or other suitable cavities.

Buildings should be considered 'potentially suitable' if they provide nesting opportunities for Barn Owls. This includes any cavities or other dry, dark and secluded spaces with a floor space greater than 30cm x 30cm (4) and an access point of approximately 7cm x 7cm or greater (Barn Owl Trust 2012) (18) including blocked chimneys, roof spaces, wall cavities, chutes and any other cavities which meet these specifications. Where the suitability of a site is not possible to accurately determine but where it is suspected there may be nesting opportunities available, the site should be recorded as 'potentially suitable'. The location of all potentially suitable sites should be recorded and mapped.

For all buildings considered to be 'potentially suitable' for breeding Barn Owls, a thorough day time inspection should be carried out during April to July (on the same day as assessing the suitability of the site, if possible) to record the presence of signs indicating Barn Owl occupancy, including pellets, white-wash and moulted feathers. All areas of the interior and exterior of the building which are safe to access should be checked, with particular attention to the ground under suitable cavities, chimneys and perches, both inside and outside the building, and the entrance to potential nesting or roosting sites. Areas where there is a build-up of white-wash should be inspected for additional signs to confirm the relevant species.

If it is possible to access all areas of the site and a thorough inspection yields no signs to indicate the presence of Barn Owls, then the site can be classed as 'unoccupied' and can be excluded from further survey effort, and no further action is required.

Other species using the site should be recorded. The species name, signs observed and breeding status should be noted where possible.

At sites where sign searching may not be effective as a stand-alone method for determining Barn Owl occupancy (e.g. where part or all of the building is inaccessible, unsafe to search, or where the nest site may be concealed), a nocturnal watch is necessary to confirm activity.

All signs which may be attributed to Barn Owl should be collected in a sealable bag and labelled with the site location and date. Collection of signs will facilitate assessment of future use by conducting a follow up visit to record the presence or otherwise of fresh signs. Collecting signs will also allow confirmation of the species identification, should this be necessary.

A nocturnal watch should be conducted at all sites where Barn Owl activity is confirmed, suspected or possible by a day time inspection. Nocturnal watches should be carried out according to best practice methods as defined (refer to Section 6.2).

7.4.2 Trees

All mature trees with a trunk diameter greater than 50cm which are isolated, or within tree lines, hedgerows or at the woodland edge within the defined search area should be inspected to determine suitability for breeding Barn Owls. All trees which do not meet these criteria can be considered ‘unsuitable’ and excluded from further survey effort. Trees which provide large and deep cavities should be considered ‘potentially suitable’. It should be noted that some tree cavities may have small entrances which open into large cavities or cavities which are hidden from view. If it is suspected that a tree may have concealed cavities (e.g. ivy covered mature trees) then this site should be considered ‘potentially suitable’ and the location recorded and mapped accordingly.

A thorough inspection of all trees classed as potentially suitable should be conducted in the day time during April to July. The perimeter around the base of the tree extending out to the furthest branches should be scanned for signs of Barn Owl occupancy including pellets, white-wash and moulted feathers. All parts of the tree should be scanned to check for white-wash and the presence of down, particularly around cavity entrances.

If signs of Barn Owl are recorded, they should be collected and placed in a sealable bag and labelled with the site location and date.

Nocturnal watches should be conducted according to best practice methods (refer to Section 6.2) at all sites where Barn Owl activity is confirmed, suspected or possible by the day time inspection.

7.4.3 Quarries and rock faces

The entire quarry or rock face should be scanned with binoculars from a suitable vantage point/s and assessed from beneath and above to determine the availability of suitable cavities for Barn Owls. If there are no suitable cavities then the site can be classed as ‘unsuitable’ and excluded from further survey effort. If suitable cavities are confirmed, suspected or possible then the site should be classed as ‘potentially suitable’ and the location recorded and mapped accordingly.

For all potentially suitable quarries, all areas of the base of the quarry or rock face should be inspected to within 5m for the presence of signs indicating use by Barn Owls, with particular attention to the ground under suitable cavities, or perches where there is a build-up of white-wash.

If a complete search can be effectively carried out which yields no signs to indicate the presence of Barn Owls then this site can be classed as ‘unoccupied’ and can be excluded from further survey effort. If it is not possible to conduct a complete search of the site, or if there are potentially suitable cavities which may not yield signs then a nocturnal watch should be conducted to determine occupancy.

Nocturnal watches should be conducted according to best practice methods (refer to Section 6.2) at all sites where Barn Owl activity is confirmed, suspected or possible, based on the day time inspection.

7.4.4 Nest boxes

Nest boxes which are installed within buildings or on mature trees should be recorded when assessing the suitability of these sites. Although rare in Ireland, nest boxes can also be mounted on poles and therefore placed in open areas away from buildings and mature trees. All open areas within the defined search area should be scanned with binoculars to detect pole mounted nest boxes.

The majority of nest boxes should be considered suitable for Barn Owls unless their specifications do not meet the requirements for breeding Barn Owls or their placement is deemed to be inappropriate. The location of all suitable nest boxes should be recorded and mapped.

The area under the nest box and all suitable perches in proximity to the nest box (approximately 20m) should be inspected for signs to indicate the presence of Barn Owls. The area immediately around the nest box, including the top of the box, landing ledge and entrance should be scanned with binoculars to check for the presence of white-wash, pellets and down.

Nocturnal watches should be conducted, according to best practice methods (refer to Section 6.2), at all nest box sites where Barn Owl activity is confirmed, suspected or possible, based on the day time inspection.

7.5 Confirm occupancy and breeding status

Sites should be recorded as **'unsuitable'** for breeding Barn Owls if the day time inspection confirms that there are no nesting opportunities available.

Sites should be classed as **'potentially suitable'** if the day time inspection records confirmed, suspected or possible nesting opportunities for breeding Barn Owls.

Potentially suitable sites should be confirmed as **'unoccupied'** if best practice survey methods can effectively record no evidence of Barn Owl activity at the site. The site should be recorded as **'previously occupied'** if signs to indicate the presence of Barn Owls are confirmed; however, no indication of recent use is established via follow up day time inspections and nocturnal watches. The site may have been used as a seasonal or temporary roost, or may have been previously used as a nest site which has since been abandoned.

The site should be recorded as **'active'** if Barn Owl activity is confirmed via evidence of fresh signs or confirmation of one or both adults via observation or vocalisation, but there is no indication of breeding, this could be a non-breeding site, used for roosting, or a 'breeding site' which may have failed prior to the survey visits.

Sites should be confirmed as a **'breeding site'** based on confirmation of the following:

- A pair present at the site by observation or vocalisation;
- A female attending a nest, or confirmation of pre-laying, incubation or brooding behaviour;
- Defensive behaviour by one or both adults; and
- Confirmation of a prey delivery or if young are observed or heard.

A step by step outline of all stages of the Barn Owl survey are presented in Figure 16.

If it is required to determine breeding success, nocturnal watches focused on the nest site should be conducted as necessary during July to August and later as appropriate, based on the timing of breeding and according to best practice methods (refer to Section 6.2) to confirm fledging and to determine the number of fledged young.

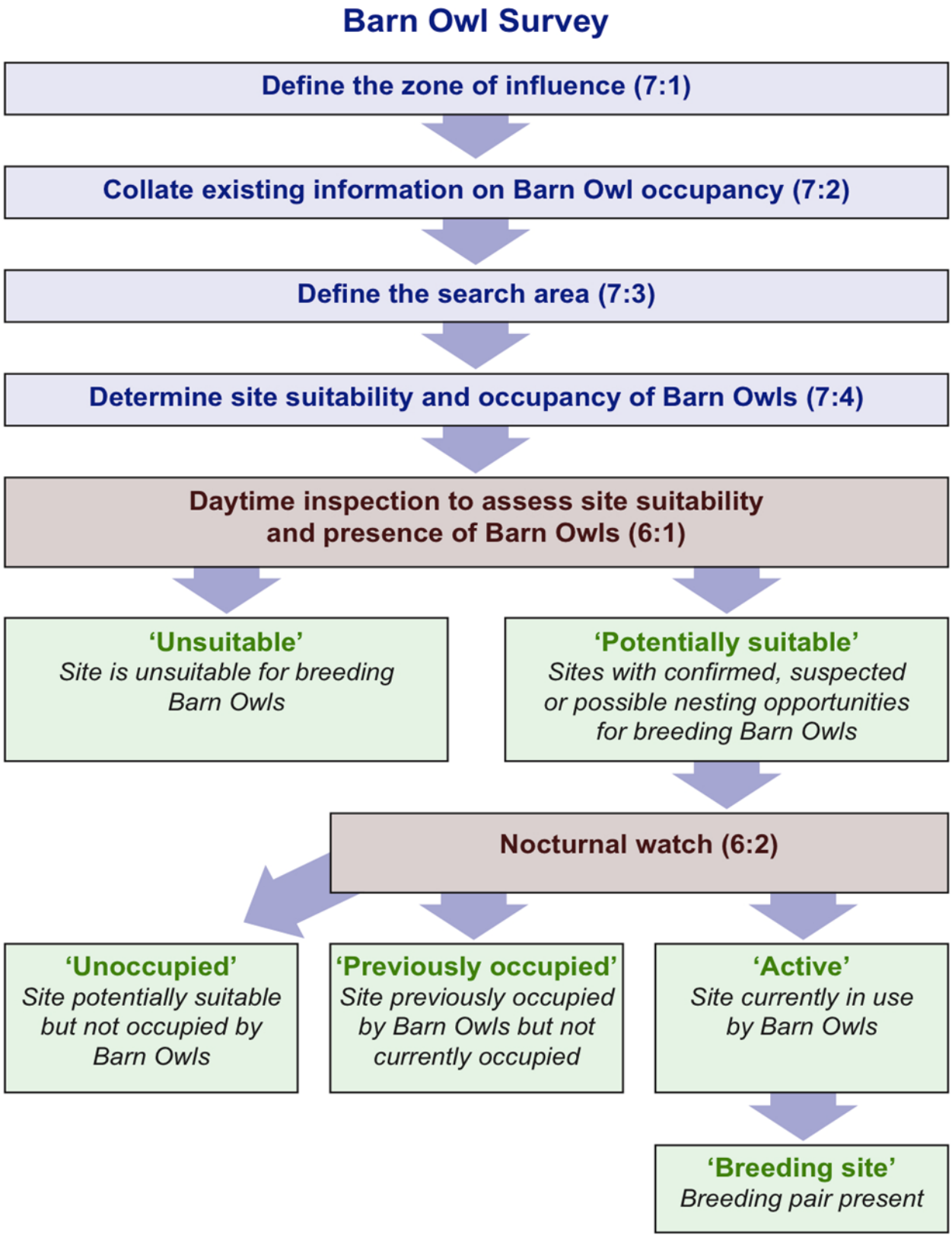

Figure 16: An overview of all the steps and outcomes of a Barn Owl survey

8. Survey Schedule

The survey schedule presented in Table 1 provides a recommended schedule for survey visits. A minimum of two survey visits to potentially suitable sites are required, with the first visit to determine suitability and to undertake a day time inspection for the presence of Barn Owls and a second visit to conduct a nocturnal watch to determine occupancy and breeding status. Further visits should be carried out as necessary to determine occupancy and breeding status of a site. To determine breeding success and performance, one or more additional visits are required.

Table 1: Barn Owl survey schedule

Survey Visit	Period	Purpose
Visit 1	January to March	To identify suitable sites and nesting opportunities
Visit 2	April to July	To identify suitable sites, occupancy and breeding status
Visit 3	June to July	To confirm breeding status and success
Visit 4	July to August (September)	To determine breeding success and late nests/second broods

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Bonneagar Iompair Éireann
Transport Infrastructure Ireland

Ionad Ghnó Gheata na Páirce,
Stráid Gheata na Páirce,
Baile Átha Cliath 8, D08 DK10, Éire

Parkgate Business Centre,
Parkgate Street,
Dublin 8, D08 DK10, Ireland

www.tii.ie

info@tii.ie

+353 (01) 646 3600

+353 (01) 646 3601