Mains of Kinblethmont Solar Park: Ecological Appraisal

Does Not Include Confidential Annex

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Contents

Non-Technical Summary

Caledonian Conservation Ltd was commissioned by BWE Partnership to carry out baseline field surveys and an appraisal of the potential effects of the proposed Mains of Kinblethmont Solar Park. The site is approximately 6km north of Arbroath, Angus.

An Extended Phase 1 Habitat Survey was completed. As well as mapping habitats, the survey included searches for signs of protected mammals and completing a great crested newt Habitat Suitability Index. In addition, a desk-study was also completed, which involved formal data searches with organisations which hold biodiversity data.

The site is an arable field bounded by stone walls, which will be retained throughout the project. No habitats of conservation concern were found. After construction, the site will be used for grazing, which will benefit a number of species. Therefore no significant negative effects are predicted for habitats.

No observations or signs of otters, water voles or red squirrels were recorded during the survey onsite or within 250m. The habitat onsite and within 250m offers poor foraging habitat for otters and is totally unsuitable for water voles. There is potentially suitable habitat for red squirrels within 250m of the site amongst mixed plantation, but the site offers no suitable habitat. No observations or signs of badger were recorded onsite, however two outlier setts were found within 500m. Both are disused by badgers and presently have rabbits in residence. Arable land-use offers poor quality foraging for badgers. However, it is possible that both otters and badgers move through the area on occasion while foraging and both species are known from the wider area. It is possible that both species may travel through the site with a risk of increased mortality during construction. Therefore preconstruction surveys will be undertaken and management plans implemented if necessary. With this mitigation in place no significant impact is predicted. Construction activities will be confined to relatively small areas and will avoid suitable habitat, which was found unoccupied, therefore no direct effect on habitat is predicted. During the operational phase access to the site will be prevented by stock-proof fencing. However, the habitat will remain poor for foraging and places of shelter, with ample habitat of higher quality in the surrounding area. Therefore no significant negative effects are predicted for otter, water vole, red squirrels or badger.

All bat species are listed under Annex IV of the Habitats Directive and Schedule 5 of the Wildlife and Countryside Act. However, the site was not found to offer suitable roost habitats. The field is bounded on the south side by a treeline that may act as a transit route for bats between foraging zones and roosts, however this will be retained throughout the development. Bats may also confuse smooth surfaces such as solar PV panels for water, using echolocation. However, only limited drinking attempts are made before leaving in search of another water source. On rare occasions collisions have been recorded between bats and vertical reflective surfaces mistaken for water. However, the solar panels at this site will be horizontal. Therefore any risk of collision will be very low. Therefore no significant negative effects are predicted for bats.

Pink-footed geese and whooper swan have been recorded in the wider area during winter months. Pink-footed geese and whooper swan may be associated with Montrose Basin SPA and Firth of Tay and Eden Estuary SPA. Wildfowl may use the site for foraging in winter, depending on the suitability of the crops present. These species will also use grazing fields for foraging. Therefore, no effect is predicted on wildfowl, and the creation of foraging habitat that will be present consistently may benefit these birds.

Peregrine, kestrel and barn owl have been recorded in the wider area. Peregrine and barn owl are listed under Schedule 1 of the Wildlife and Countryside Act, while

kestrel is included on the Amber List of Birds of Conservation Concern. The site does not offer suitable breeding habitat for peregrine, barn owl or kestrel. The site offers only poor foraging habitat. Any field margins will be retained and the change of land-use to grazing will improve foraging opportunities. Therefore no significant negative effects are predicted, and the development may benefit raptors and owls.

Grey partridge and common quail have been recorded in the wider area. Common quail is listed under Schedule 1 of the Wildlife and Countryside Act, while grey partridge is included on the Red List of Birds of Conservation Concern. Both species may breed in grass, field margins or dense vegetation such as arable crops. Therefore the site does offer suitable habitat for these birds. However, the surrounding area offers ample alternative suitable habitat. Preconstruction surveys will be undertaken to determine whether any nesting birds are present within the construction footprint if works are scheduled during the breeding season. If grey partridge or common quail are found to breed, they will be monitored and appropriate buffers will be applied to limit disturbance until breeding is shown to have ended. A watching brief will be maintained by the Ecological Clerk of Works. Field margins will be retained. In addition, the stock-proof security fence will reduce medium-sized predators, which will benefit ground nesting birds. Therefore no significant negative effects are predicted.

Lapwing, woodcock and oystercatcher have all been recorded in the wider area. Lapwing is included on the Red List of Birds of Conservation Concern, while woodcock and oystercatcher are both Amber Listed. All three species are included on the Scottish Biodiversity List. The site does not offer suitable breeding habitat for woodcock. With the exception of field margins, the site does not offer suitable breeding habitat for other wader species. Preconstruction surveys will be undertaken to determine whether any nesting birds are present within the construction footprint if works are scheduled during the breeding season. If waders are found to breed, they will be monitored and appropriate buffers will be applied to limit disturbance until breeding is shown to have ended. A watching brief will be maintained by the Ecological Clerk of Works. Field margins will be retained, and the change of land-use to grazing will improve breeding opportunities onsite. In addition, the stock-proof security fence will reduce medium-sized predators, which will benefit ground nesting birds. Therefore no significant negative effects are predicted, and the development may benefit waders.

Crossbill, linnet, yellowhammer, skylark and meadow pipit have all been recorded in the wider area. Crossbill is listed under Schedule 1 of the Wildlife and Countryside Act. Linnet, yellowhammer and skylark are on the Red List of Birds of Conservation Concern, while meadow pipits are on the Amber List. Crossbill, linnet, yellowhammer and skylark are also on the Scottish Biodiversity List. There is no breeding or foraging habitat for crossbills onsite. Preconstruction surveys will be undertaken to determine whether any nesting birds are present within the construction footprint if works are scheduled during the breeding season. Furthermore, appropriate buffers will be applied to limit disturbance until breeding is shown to have ended. A watching brief will be maintained by the Ecological Clerk of Works. With the exception of the trees and field margins, the site offers only poor breeding or foraging habitat for other passerines. The field margins will be retained and the change of land-use to grazing will improve foraging and breeding opportunities for meadow pipit and skylark. Furthermore, the stock-proof security fence will reduce medium-sized predators, which will benefit ground nesting birds. Therefore, no significant negative effects are predicted and the development will have positive effects for passerines.

The site offers limited suitable habitat for reptiles. However, stone walls may offer potential hibernacula sites, and field margins offer potential foraging habitat. These features will be retained and so no effect is predicted. Increased vehicle traffic during

construction may present an increased risk of mortality. Reckless or intentional harm or killing to all reptiles is prohibited under Schedule 5 of the Wildlife and Countryside Act. Therefore preconstruction surveys will be undertaken of suitable habitat within the development footprint, if affected by activities. Where populations of reptiles are found, specific mitigation measures will be considered to avoid injury or mortality, including reptile exclusion fencing. Should any hibernacula be found these will be marked and development microsited to avoid destruction of these features and injury to the occupying reptiles. It is also recommended that excavations are covered up overnight and/or ramps provided in trenches to avoid reptiles becoming trapped. A suitably experienced and qualified Ecological Clerk of Works will be appointed to oversee construction activities. The land-use will change from arable to grazing resulting in an improvement in reptile and amphibian habitat, although the site will remain largely sub-optimal. It should also be noted that despite the short-term negative impacts, the works will create a mosaic of vegetation structure and heights that is essential for reptile populations to thrive. Vegetation structure is of utmost importance for reptiles, especially the availability of basking places, and ecotones where vegetation height changes. Therefore, it can be reported that the construction works will ultimately have significant positive benefits for reptiles if present in the area, and no significant negative effects are predicted.

The site does not offer high quality habitats known to support important communities of invertebrates of conservation concern. In addition, there are no important aquatic habitats onsite. However, insects which lay their eggs in water have also been found to confuse certain surfaces with similar polarized light reflective properties with water. Insects do confuse solar PV with water, as well as other artificial materials such as glass buildings, asphalt, car paint etc. There is therefore a risk that invertebrates may attempt to lay eggs on the dry solar PV panels, particularly where there are high quality aquatic habitats nearby. Studies have shown that the use of non-polarizing borders on solar PV panels reduces the risk of invertebrates with an aquatic phase attempting to lay eggs on these unsuitable surfaces. Non-polarizing borders will be used at this site in order to reduce this risk. Therefore no significant negative effects are predicted for invertebrates.

No significant negative effects are predicted on habitats or species as a result of the proposed development. The change of land-use from arable to grazing will have some positive effects on local biodiversity.

1 Introduction

Caledonian Conservation Ltd was commissioned by BWE Partnership to carry out baseline field surveys and an appraisal of the potential effects of the proposed Mains of Kinblethmont Solar Park. This document describes the baseline conditions and an appraisal of potential ecological effects which may be associated with this development.

Field surveys and this appraisal were undertaken by Chris Cathrine (Director) and Glenn Norris (Ecologist). Mapping was undertaken using ArcGIS 10, and was completed by Glenn Norris.

This document includes the following sections:

- The Development;
- Policy and Guidance;
- Methodology;
- Baseline Results;
- Data Limitations;
- Ecological Appraisal;
- Summary and Conclusions; and
- References.

This Ecological Appraisal should be read alongside the following additional documents:

- Planning Application; and
- Ramsay & Chalmers drawings, which accompany the Planning Application.

2 The Development

The development involves the installation of solar PV arrays in a field within the Mains of Kinblethmont, located approximately 6km north of Arbroath, Angus. The proposed site boundary is shown in Figure 1. This field is currently used for arable agriculture with small unmanaged margins.

The field is south-facing at varying degrees and the solar arrays will be angled to compensate (0º, 1.5º, 2º, and 3º) and spaced by a minimum of 6.6m, allowing continued access to the field by wildlife. A stock-proof security fence will also be installed.

Details of the development, including components, are shown in the following figures which accompany the planning application:

- Ramsay & Chalmers Drawing No. 006: Typical Site Details
- Ramsay & Chalmers Drawing No. 010: Site Layout Plan
- Ramsay & Chalmers Drawing No. 015: Alternative Layout – Average Gradients

3 Policy and Guidance

The appraisal approach was designed with reference to various relevant legislation, policy and guidance, and involved a number of stages. Following best practice, a preliminary ecological appraisal was completed to scope in the main issues, and scope out issues which did not require further consideration (Benatt 2013). Targeted novel baseline surveys were then undertaken where necessary to provide a baseline to inform this appraisal. Finally an ecological appraisal was completed.

Note that although in this case a full Ecological Impact Assessment (EcIA) has not been deemed necessary, due to the low sensitivity of the site and low impact of the development, EcIA guidance has been referred to, ensuring a rigorous approach to this appraisal.

The following legislation, policy and guidance documents have been considered in undertaking this ecological appraisal:

- Council Directive 92/43/EEC on the Conservation of Natural Habitats and Wild Flora and Fauna (*Habitats Directive*);
- Directive 2009/147/EC on the Conservation of Wild Birds (the codified version of Council Directive 79/409/EEC as amended) (*Birds Directive*);
- The Conservation (Natural Habitats, &c.) Regulations 1994;
- Wildlife and Countryside Act 1981 (as amended);
- Nature conservation (Scotland) Act 2004;
- The Conservation (Natural Habitats, &c.) Amendment (Scotland) Regulations 2007;
- Wildlife and Natural Environment (Scotland) Act 2011;
- The Protection of Badgers Act 1992;
- Angus Local Plan;
- Tayside Biodiversity Action Plan;
- Scottish Government Large Photovoltaic Arrays Guidance 2011;
- Cornwall Council Renewable Energy Planning Guidance Note 2: The Development of Large Scale (>50kW) Solar PV Arrays 2012[1];
- Scottish Government Planning Advice Note 1/2013: Environmental Impact Assessment;
- Scottish Planning Policy 2010;
- Scottish Executive National Planning Policy Guideline 6 (revised 2000): Renewable Energy Development;
- Scottish Planning Policy 6: Renewable Energy;
- Guidelines for Ecological Impact Assessment in the United Kingdom (Institute of Ecology and Environmental Management [IEEM] 2006);
- Guidelines for Preliminary Ecological Appraisal (Benatt 2013);
- Bat Conservation Trust Bat Surveys Good Practice Guidelines 2nd Edition (Hundt 2012);

[1] Referenced in Scottish Government guidance.

- Birds of Conservation Concern 2009 (Eaton *et al.* 2009); and
- Handbook of Biodiversity Methods (Hill *et al.* 2005).

4 Methodology

An Extended Phase 1 Habitat Survey was conducted within the initial site boundary and initial 250m buffer (Figure 2). The most recent proposed site boundary (Figure 1) does not extend beyond the initial site boundary, therefore data collected during this survey is still relevant and applicable to this appraisal and indeed covers a wider area providing context. This survey involved searching for signs of protected species (particularly mammals) and mapping the habitats in this area to a Phase 1 level. Any other ecological receptors that would warrant additional surveys were also to be noted.

In addition, a desk-based study was also completed to identify potential sensitivities and to provide a wider context.

4.1 Desk-based Study

Data requests for information were made with Leisure and Culture Dundee (LCD) (local records centre), Royal Society for the Protection of Birds (RSPB), Tayside Raptor Study Group (TRSG), British Trust for Ornithology (BTO), Tayside Bat Group (TBG), Scottish Badgers (SB), Saving Scotland's Red Squirrels (SSRS) and Amphibian and Reptile Conservation Trust (ARC).

4.2 Extended Phase 1 Survey

An Extended Phase 1 Habitat Survey was conducted within the initial site boundary and 250m buffer on 13th May 2014. This survey involved searching for signs of protected species (particularly mammals) and mapping the habitats in this area to a Phase 1 level.

The protected species survey targeted badger, otter, water vole and bats. All signs and sightings were recorded on large scale maps, and locations marked using hand held GPS devices.

A secondary visit was made on 7th April 2015 to ensure the land-use of the proposed site had not changed from the initial survey, and that the results remain valid.

4.2.1 Phase 1 Habitat Survey

Standard Phase 1 Habitat Survey methodology was used to identify habitat areas of ecological importance, as outlined in the Handbook for Phase 1 habitat survey published by the Joint Nature Conservancy Council (JNCC) (2007). The survey included the initial site boundary and an initial 250m buffer to provide context (Figure 2).

4.2.2 Protected species survey

A protected species survey was undertaken within the initial 250m buffer area (Figure 2). This survey targeted badger (*Meles meles*), otter (*Lutra lutra*) and water vole (*Arvicola amphibius*). Signs of other protected species such as red squirrel (*Sciurus vulgaris*), polecat (*Mustela putorius*) and pine marten (*Martes martes*) were also to be noted. All signs and sightings were recorded on large scale maps, and locations marked using hand held GPS devices.

Suitable habitat was also noted for birds, bats, amphibians, reptiles and invertebrates so as to identify the need for further targeted survey work before to inform an ecological appraisal.

Target notes were made during the Phase 1 survey regarding field signs and habitat features of note.

Further information regarding specific protected mammal survey methods are provided below.

4.2.2.1 Badger

A full badger survey was conducted, following standard methodology and using appropriate field reference guides and SNH guidance (Roper 2010; Bang and Dahlstrøm 2006; SNH 2001). Badger field signs include:

- Setts – burrows indicating badger setts (level of activity and other signs may allow determination of sett type, *i.e.* main sett, annexe sett, subsidiary sett or outlying sett);
- Prints;
- Latrines (and dung pits used as territorial markers);
- Hairs – highly distinctive, and often become snagged on fences;
- Feeding signs – snuffle holes (small scrapes where badgers have searched for earthworms, insects or tubers); and
- Paths.

4.2.2.2 Otter

A full otter survey was conducted following standard methodology and using an appropriate field guide (Bang and Dahlstrøm 2006; Chanin 2003a; Chanin 2003b). Field signs included:

- Holts – below ground resting places;
- Couches – above ground resting places;
- Prints; and
- Spraints – faeces used as territorial markers, with a characteristic sweet odour.

4.2.2.3 Water Vole

Areas of potentially suitable habitat were surveyed following standard methodology and using an appropriate field guide (Bang and Dahlstrøm 2006; Harris *et al.* 2009; Strachan *et al.* 2011). This involved recording the following field signs:

- Faeces – recognisable by their size, shape, and content, and also distinguishable from rat droppings by their smell, if not desiccated;
- Latrines – faeces are often deposited at discrete locations known as latrines;
- Feeding stations – food items are often brought to feeding stations along pathways and haul out platforms, indicated by neat piles of chewed vegetation up to 10cm long;
- Burrows – appear as a series of holes along the water's edge distinguishable from rat burrows by size and position;
- Lawns – may appear as grazed areas around burrows;
- Nests – where the water table is high, above ground woven nests may be found;

- Footprints – tracks may occur at the water's edge leading into vegetation cover, and may be distinguishable from rat footprints by size; and
- Runways – low tunnels pushed through vegetation near the water's edge, which are less obvious than rat runs.

4.3 Great Crested Newt Survey

The following sections outline the methods used to survey for great crested newts, and are compliant with relevant guidance (Natural England and Defra 2015 as adopted by SNH).

4.3.1 Overview of Great Crested Newt Surveys

Great crested newt surveys are designed so as to meet Natural England guidance (as adopted by SNH). These guidelines recommend that surveys are undertaken within 500m of the initial site boundary.

The great crested newt survey methods involve three stages:

- Great Crested Newt Habitat Suitability Index (HSI);
- Great Crested Newt Presence Survey; and
- Great Crested Newt Population Assessment.

While the HSI is always required for any pond, the requirement of the following stages depends upon the results of the preceding stage.

4.3.2 Great Crested Newt Habitat Suitability Index

Two ponds were identified from OS maps and aerial photos and assessed on 8th May 2014. Locations are provided in Table 1 and displayed in Figure 3. Photos 1 and 2 show the West Mains Pond and Home Farm Pond.

Table 1. Pond locations.

Pond number	Pond name	Grid reference	Distance from development (m)
1	West Mains Pond	NO6328046981	6
2	Home Farm Pond	NO6412547169	555

Home Farm Pond lies beyond 500m from the proposed site boundary, however, at the time of survey Home Farm Pond lay within 500m of the initial site boundary. The pond was surveyed for great crested newts and has been included in this report to provide context for the wider area.

The ponds were assessed using the great crested newt Habitat Suitability Index (HSI) following the standard methods described in Oldham *et al.* (2000), as amended by ARG UK (2010). HSI scores are then categorised as detailed in Table 2 below (ARG UK 2010).

Table 2. Great crested newt HSI score categories (ARG UK 2010).

HIS Score	Category
<0.5	Poor
0.5 – 0.59	Below average
0.6 – 0.69	Average
0.7 – 0.79	Good
>0.8	Excellent

4.3.3 Great Crested Newt Presence Survey

A great crested newt presence survey should be undertaken for any ponds scoring an HSI score of 'average' or above (see Table 2). A presence survey requires four visits between mid-March and mid-June (two of which must be between mid-April and mid-May), in accordance with current guidance (Natural England and Defra 2015). Survey visits must be undertaken under licence, and survey methods include bottle trapping, netting, visual searches (including for eggs) and torching (English Nature 2001; Natural England and Defra 2015).

Only Home Farm Pond achieved an HSI score of 'average', therefore this pond was surveyed for the presence of great crested newts.

Home Farm Pond was surveyed on 12th/13th May, 13th/14th May, 10th/11th June and 11th/12th June 2014. Full details of survey times and weather conditions are provided in Tables 9 and 10 in Sections 5.5.2 and 5.5.3.

On each survey visit the pond was first visited in the evening. Torching was undertaken first, when suitably dark, using a Clulite Clubman Deluxe CB2 1 million candlepower spotlight.

After torching the pond, bottle traps were set around the pond perimeter, at 2m intervals for all accessible areas of shoreline.

Bottle traps were collected the following morning ensuring they were never left unattended for longer than 10 hours in May and 8 hours in June in accordance with guidance (English Nature 2001; Natural England and Defra 2015).

After collecting bottle traps, netting was undertaken as were egg searches (visual searches).

The number of bottle traps used per visit for the pond is indicated in Table 3 below.

Table 3. Number of bottle traps used for Home Farm Pond.

Pond	Number of bottle traps used
Home Farm Pond	30

4.3.4 Great Crested Newt Population Assessment

It is recommended that if great crested newts are confirmed as present at any pond, a great crested newt population assessment survey would be required, in accordance with guidance (English Nature 2001; Natural England and Defra 2015). A population assessment would require six visits between mid-March and mid-June (with at least three between mid-April and mid-May) – i.e. two additional visits. Surveys would be undertaken under licence, and methods would include bottle trapping, netting, visual searches and torching.

This level of survey would then allow the size class of the population would then be assessed in accordance with guidance.

However, in this case a population size assessment was not undertaken as no evidence of great crested newts was found at any of the ponds during the presence survey (first four visits).

5 Results

The baseline results are discussed in detail below. Each potential Valued Ecological Receptor (VER) is discussed in turn to allow these results to more easily inform a full Ecological Appraisal (EA) or Ecological Impact Assessment (EcIA) to accompany a planning application. A structured and robust assessment of potential effects has not been undertaken as part of this report.

5.1 Desk-based Study

5.1.1 Designated sites

A search of digital datasets indicates that there are no statutory designations of European importance, national importance or local importance within the site boundary. Table 4 provides information on Special Protection Areas (SPA) and Special Areas of Conservation (SAC) within a 20km buffer and Sites of Special Scientific Interest (SSSIs) within a 5km buffer.

Table 4. Designated sites.

Designation	Site name	Distance (km)	Comments
Special Area of Conservation (SAC)	River South Esk	7.3km N	Supports internationally important populations of species listed under Annex II of the Habitats Directive including: - Atlantic salmon (*Salmo salar*). - Freshwater pearl mussel (*Margeritifera margeritifera*). The development will have no direct or indirect impact on the site or adjacent habitat. Therefore, no pathway for effect has been identified in this appraisal.
Special Protection Area (SPA)	Montrose Basin	10.3km NNE	Supports internationally important wintering waterfowl assemblage, and internationally important wintering populations of the following bird species: - Dunlin (*Calidris alpina*). - Eider (*Somateria mollissima*). - Knot (*Calidris canuta*). - Shelduck (*Tadorna tadorna*).

Designation	Site name	Distance (km)	Comments
			- Wigeon (*Anas penelope*). - Pink-footed goose (*Anser brachyrhynchus*). - Greylag goose (*Anser anser*). - Redshank (*Tringa totanus*). - Oystercatcher (*Haematopus ostralegus*) (non-breeding). The development site offers potentially suitable foraging habitat for wintering waders and wildfowl. The site does not offer suitable or important habitat for any of the other species.
SAC	Firth of Tay and Eden Estuary	14.9km SSW	Supports internationally important habitats listed under Annex I of the Habitats Directive including: - Sub-tidal sandbanks. - Estuaries. - Intertidal mudflats and sandflats. In addition, the site supports internationally important populations of harbour seal (*Phoca vitulina*) (listed under Annex II of the Habitats Directive). The development will have no direct or indirect impact on the site or adjacent habitat. Furthermore, the site does not offer suitable habitat for harbour seal. Therefore there is no pathway for effect as identified in this appraisal.
SPA	Firth of Tay and Eden Estuary	15.4km SW	Supports internationally important breeding populations of breeding birds including: - Marsh harrier (*Circus*

Designation	Site name	Distance (km)	Comments
			aeruginosus). - Little tern (*Sternula albifrons*). Also supports internationally important wintering waterfowl assemblage, and internationally important wintering populations of the following bird species: - Common scoter (*Melanitta nigra*). - Cormorant (*Phalacrocorax carbo*). - Eider (*Somateria mollissima*). - Goosander (*Mergus merganser*). - Grey plover (*Pluvialis squatarola*). - Long-tailed duck (*Clangula hyemalis*). - Red-breasted merganser (*Mergus serrator*). - Sanderling (*Calidris alba*). - Velvet scoter (*Melanitta fusca*). - Dunlin (*Caladris alpina alpina*). - Greylag goose (*Anser anser*). - Redshank (*Tringa tetanus*). - Oystercatcher (*Haematopus ostralegus*). - Bar-tailed godwit (*Limosa lapponica*). - Goldeneye (*Bucephala clangula*). - Icelandic black-tailed godwit (*Limosa limosa islandica*). - Pink-footed goose (*Anser*

Designation	Site name	Distance (km)	Comments
			brachyrhynchus). - Shelduck (*Tadorna tadorna*). The development site offers potentially suitable foraging habitat for wintering waders and wildfowl. The site does not offer suitable or important habitat for any of the other species.
SAC	Barry Links	15.5km SW	Supports internationally important habitats listed under Annex I of the Habitats Directive including: - Shifting dunes. - Humid dune slacks. - Shifting dunes with marram. - Coastal dune heathland. - Dune grassland. As the development will have no direct or indirect impact on the site or adjacent habitat, there is no pathway for effect as identified in this appraisal.
SAC	River Tay	17.7km N	Supports internationally important habitats listed under Annex I of the Habitats Directive including: - Clear-water lakes or lochs with aquatic vegetation and poor to moderate nutrient levels. In addition, the site supports internationally important populations of species listed under Annex II of the Habitats Directive including: - Brook lamprey (*Lampetra planeri*). - Sea lamprey (*Petromyzon marinus*). - River lamprey

Designation	Site name	Distance (km)	Comments
			(*Lampetra fluviatilis*). - Atlantic salmon (*Salmo salar*). - Otter (*Lutra lutra*). The development will have no direct or indirect impact on the site or adjacent habitat. Therefore, no pathway for effect has been identified for the habitat and fish features of this SAC. However, although the site offers poor habitat, otter associated with this SAC may occasionally forage or travel through.

5.1.2 Data search results

To date, data has been supplied by:

- LCD;
- BTO;
- SB; and
- TBG.

ARC did not hold any data for the area.

Data has not yet been provided by SSRS, TRSG or RSPB.

BTO provided data from the 2007-11 Bird Atlas for the 2km squares within NO64. The methods employed for this survey mean that the distribution data is only representative at a 2km resolution, but this provides useful context when considered alongside the habitats identified during the Extended Phase 1 survey.

A search of the National Biodiversity Network Gateway (NBN Gateway) was also completed. There were no records of protected species on the site although records for otter, badger, red squirrel, bats (Chiroptera) and reptiles were found in the same 10km square. While this information has limited value compared with records provided by formal data searches with detailed metadata, it does provide general context.

Results of data searches are considered alongside novel survey results in the baseline descriptions below.

5.2 Weather

Timings and weather conditions during the Extended Phase 1 habitat survey are provided in Table 5 below. The site had been dry the day before the survey, therefore, the survey was completed under optimal conditions.

Table 5. Extended Phase 1 Habitat Survey Weather Conditions

Date	Surveyor	Start Time	Hour	Visibility	Wind speed	Wind direction	Rain	Cloud cover	Cloud height	Frost	Snow
13/05/15	GN/ CC	07:50	1	2	0	-	0	0	-	0	0
			2	2	0	-	0	1	2	0	0
			3	2	1	SW	0	1	2	0	0
			4	2	1	SW	0	2	2	0	0
07/04/15	CC	12:45	1	2	0	-	0	0	-	0	0

Visibility; 0 = <1km; 1 = 1-2km; 2 = ≥2km

Wind direction: according to 16-point compass

Wind strength: according to the Beaufort scale

Cloud cover: in eighths of sky

Cloud height: 0 = <150m; 1 = 150-500m; 2 = >500m

Rain: 0 = None; 1 = Drizzle/Mist; 2 = Light showers; 3 = Light rain; 4 = Heavy showers; 5 = Heavy rain

Frost: 0 = None; 1 = Ground; 2 = All day

Snow: 0 = None; 1 = Onsite; 2 = On high ground only

Surveyor: CC = Chris Cathrine; GN = Glenn Norris

5.3 Phase 1 Habitats

Overall, 16 habitats were identified and mapped during the Phase 1 Habitat Survey (J2.4 Fence and J5 Other are not considered habitats in this report). A summary of habitats is found in Table 6 and shown in Figure 4. Target notes are listed in Table 7 and their locations shown in Figure 4.

Table 6. Phase 1 habitat survey summary (see Figure 4 for map)

Phase 1 Code	Description
A1.1.2	Broad-leaved plantation
A1.2.2	Coniferous plantation
A1.3.2	Mixed plantation
A2.2	Scattered scrub
A3.1	Scattered broad-leaved trees
B4	Improved grassland
C3.1	Tall ruderals
G1	Standing water
I2.1	Quarry
J1.1	Arable fields
J2.1.1	Intact species-rich hedge
J2.2.2	Defunct species-poor hedge
J2.4	Fence
J2.5	Wall
J3.6	Building
J4	Bare ground
J5	Other (track)

Table 7. Phase 1 habitat survey target notes (shown in Figure 4)

TN	Grid Reference	Details
1	NO6425447279	Large patch of *Fallopia japonica* (Japanese Knotweed). This is a highly invasive plant that must be avoided or removed during construction activities.
2	NO6403947199	A recently planted (2-7 years old) broad-leaved plantation with a variety of species such as *Creteagus monogyna* (hawthorn), *Betula* sp. (birch) and *Sorbus aucuparia* (rowan) (Photo 3). The ground flora is heavily dominated by *Rumex obtusifolius* (broad-leaved dock) due to the recently disturbed nature of the plantation.
3	NO6321646980	South-facing rubble piles and tracks left by heavy plant with vegetation of varied sward height leave excellent basking sites and hibernacula for reptiles.
4	NO6372547508	A rookery of approximately 15 nests is situated in broad-leaved trees, to the north of the mast woodland.

5.3.1 A1.1.2 Broad-leaved plantation

As with much of the surrounding area, the predominant land-use of Mains of Kinblethmont is arable farming, with large fields covering the majority of the site and buffer area. This leaves only small patches and strips of broad-leaved plantation throughout the initial 250m buffer (although no such habitat is present within the proposed site boundary), restricted to field margins and patches of land inaccessible to farm machinery. These woods comprise of *Acer pseudoplatanus* (sycamore), *Ulmus glabra* (wych elm), *Quercus* sp. (oak) and *Fagus sylvatica* (beech) with an understorey of *Cretaegus monogyna* (hawthorn). The composition of the ground flora suggests that these woodlands have been long-term components of the landscape due to the presence of ancient woodland indicator *Hyacinthoides non-scripta* (bluebell) (Averis 2013). Other woodland species include *Digitalis purpurea* (foxglove), *Myosotis sylvatica* (wood forget-me-not) and the woodland margin species *Anthriscus sylvestris* (cow parsley). Due to the woods situation within extensive arable land, soil enrichment caused by fertiliser run-off has resulted in the abundance of *Urtica dioica* (nettle), *Symphytum tuberosum* (tuberous comfrey) and *Galium aparine* (cleavers).

In addition to the well-established woodland present within the survey buffer, a small area has been set aside for planting, with young *C. monogyna*, *Quercus* sp., *Fraxinus excelsior* (ash) and *Prunus spinosa* (blackthorn) in tree guards (Photo 3).

5.3.2 A1.2.2 Coniferous plantation

There is a small plantation to the very south of the initial 250m survey buffer, composed entirely of *Picea stichensis* (Sitka spruce). This non-native tree provides minimal ecological value to the area.

5.3.3 A1.3.2 Mixed plantation

Mixed plantation is the most abundant woodland habitat present within the survey buffer, although it is not present within the proposed site boundary. The largest expanse of this habitat surrounds the old house of Kinblethmont and nearby holiday cottages to the south of the initial survey buffer. The tree composition includes *A. pseudoplatanus*, *Aesculus hippocastanum* (horse chestnut), *Sambucus nigra* (elder), *Pinus sylvestris* (Scots pine) and the exotic *Araucaria araucana* (monkey puzzle tree). The ground flora is very similar to the established broad-leaved plantations with woodland species such as *D. purpurea* and *M. sylvatica* and the nutrient-loving species *U. dioica* and *S. tuberosum*.

Of these well-established trees, several have the potential for crevices created by dead and rotten branches that can be used by bats for roosts.

Towards the highest point of the initial 250m buffer is a mobile phone mast within a compartment of mixed plantation. The woodland is a mix of *P. stichensis*, *A. pseudoplatanus*, *P. sylvestris*, and *Sorbus aria* (whitebeam). The ground flora solely exhibits species of enriched soils including *U. dioica* and *G. aparine*.

5.3.4 A2.2 Scattered Scrub

Individual *C. monogyna* are present along the roadside to the mobile phone mast. Their isolated and exposed location means they provide little ecological value.

5.3.5 A3.1 Scattered broad-leaved trees

Broad-leaved trees such as *Ulmus glabra* and *Tilia x europaea* (common lime) are used to line the roadways and tracks throughout the Mains of Kinblethmont. Beneath is intensively mown lawn. These lines may provide transit routes for bats between routes and foraging areas.

5.3.6 B4 Improved grassland

Grasslands adjacent to arable fields are at risk of agricultural enrichment and this is the case on Mains of Kinblethmont. Photo 4 shows a small patch of grassland previously used to dump hard-core located to the west of the site surrounded by arable fields and the vegetation present represents the high nutrient content and disturbance of the soils. The dominant species within the grassland was Yorkshire fog, a species known to thrive in nutrient-rich soils (Averis 2013). Additionally there was *Arrhenatherum eliatus* (false oat-grass), *Rumex obtusifolius* (broad-leaved dock), *U. dioica*, *Heracleum sphondylium* (hogweed) and *Brassica napus* (oil-seed rape), all of which are regularly found on enriched, disturbed soils.

5.3.7 C3.1 Tall ruderals

Just south of the mobile phone mast, a small section of a field has been left fallow. Due to the high disturbance and nutrient enrichment from the past it has been colonised by tall growing tall ruderal herbs such as *U. dioica*, *G. aparine*, *R. obtusifolius* and *Cirsium arvense* (creeping thistle).

5.3.8 G1 Standing water

There are two ponds within the initial 250m survey buffer of varying quality. West Mains Pond (Photo 1) to the south of the site that consists entirely of the run-off of rainwater from the adjacent arable field thereby becoming heavily enriched by nutrients. The discolouration of the water is so great that the bed is invisible in a

depth of 10cm. The poor water quality and regular use by deer have severely reduced species diversity along its banks. The Home Farm Pond (Photo 2) is larger and also eutrophicated as *Phragmites australis* (common reed) is becoming dominant. Other species include *Myosotis scorpioides* (water forget-me-not) and *Potamogeton* spp. (pond weed species). It is half surrounded by mixed plantation that shades the pond for the majority of the day.

5.3.9 I2.1 Quarry

In the surrounding area there are several small quarry pits, however, only one is within the initial 250m buffer. The quarry is bare rock with some patches of *Ulex europaeus* (gorse).

5.3.10 J1.1 Arable

Arable farming is the primary use of land on site (Photo 5) and in the surrounding area leaving only strands of woodland and grassland. Arable land covers the entirety of the updated site boundary. In some areas a field margin of three metres is kept unsown where rank grasses such as false oat-grass and cocksfoot can grow unchecked, although the majority of sowing occurs immediately adjacent to the field boundary.

5.3.11 J2.1.1 Intact species-rich hedge

There is one intact hedgerow bordering the track to the Home Farm buildings shown in Photo 6. The hedge structure is provided by *C. monogyna* and *P. spinosa*. Climbing amongst the thick foliage of the scrub is *Rosa canina* (common dog-rose) and *Rubus fruticosa* (bramble) with a ground flora of *Aegopodium podagraria* (ground elder), *A. sylvestris*, *Vicia sepium* (bush vetch), *S. tuberosum* and *M. sylvatica*.

5.3.12 J2.2.2 Defunct species-poor hedge

Although currently defunct, this recently planted hedge of *C. monogyna* and *P. spinosa* is yet to fill out or be properly laid. It is currently protected by a fence-line and will eventually be colonised by the hedge species present along the intact hedge opposite.

5.3.13 J2.4 Fence

Fences are found throughout the site and are marked on the map for completeness rather than their contribution to habitats.

5.3.14 J2.5 Wall

Un-mortared stone walls provide the boundaries to the majority of the fields and woodland compartments. One of which is currently across the site layout. This habitat may offer suitable habitat to reptiles for hibernacula or basking.

5.3.15 J3.6 Building

There are no buildings onsite, however there are several within the initial 250m buffer. The majority of the buildings at Home Farm are disused and in a state of disrepair. The houses near Kinblethmont are let out to holiday makers, and the buildings near Mains of Kinblethmont are active agricultural buildings. The disused buildings around Home Farm may offer roost potential for bats and nesting habitat for

barn owls (Photo 7). However, the buildings were found to have large numbers of pigeons, therefore it is unlikely that barn owls will roost here.

5.3.16 J4 Bare ground

In the very south west corner of the site is a patch of bare ground where heavy plant machinery has removed any vegetation leaving hard, sun-baked mud (Photo 8). This may provide suitable habitat for important pollinating invertebrates such as solitary bees.

5.3.17 J5 Other (track)

A concrete road continues to the fork before turning in to gravel tracks.

5.4 Protected Mammals

The following sections describe the findings of the protected species survey.

*5.4.1 Badger (***Meles meles***)*

Due to the sensitivity of the information, full details of badger survey results are provided in the Confidential Annex.

Two setts were found but only one was within 500m of the site and neither were in current use. Both of these were beyond the 30m buffer distance to avoid disturbance for most activities recommended in guidance (SNH 2001).

*5.4.2 Otter (***Lutra lutra***)*

No evidence of otter was found during the survey. There are no watercourses on site or in the surrounding area (the closest is the Lunan Water over a 1.5km away from which otters have been recorded historically) and only two ponds, neither of which stock fish nor contain large populations of amphibians.

The combination of the lack of suitable habitat for foraging and holt construction implies that it is highly unlikely to near impossible that otter will use the site.

*5.4.3 Water Vole (***Arvicola amphibius***)*

No evidence of water vole was found during the survey. There are no watercourses on site or in the surrounding area (the closest is a small stream over a kilometre away) and the only two ponds present lack the large swaths of bankside vegetation necessary for the sustenance of a water vole population (Harris *et al.* 2009; Strachan *et al.* 2011).

It is therefore extremely unlikely that water vole exist on site or in the wider area.

*5.4.4 Red Squirrel (***Sciurus vulgaris***)*

No red squirrels were seen during the protected mammals survey. LCD data holds records for red squirrels on Mains of Kinblethmont south of the initial 250m buffer within the mixed plantation. The site offers no suitable habitat for foraging or drey construction.

5.4.5 Bats (Chiroptera)

Bats are present within the wider area, having been recorded during great crested newt surveys in May and June (pipistrelles [*Pipistrellus* sp.] and brown long-eared bats [*Plecotus auritus*]). Tayside Bat Group holds no records for bats on the site however there is suitable habitat within the initial 250m buffer area. There is no suitable foraging or roosting habitat onsite. There are well-established compartments of woodland with several large old trees that may offer potential for roosting bats, as well as old derelict buildings near Home Farm (Photo 7). The field margins are lined with trees and could act as bat transit routes between roosts and foraging areas (Photo 9).

5.5 Great Crested Newts

No evidence of great crested newts was found during the survey. The following sections provide the full results of the survey, including other amphibian species recorded.

5.5.1 Habitat Suitability Index

Table 8 provides HSI results for each pond.

Table 8. Great crested newt Habitat Suitability Index (HSI) results

	Pond			
	Home Farm Pond		West Mains Pond	
Factor	**Score**	**SI Value**	**Score**	**SI Value**
1. Map location	B	0.50	B	0.50
2. Pond area	800m²	0.90	25m²	0.05
3. Number of years in ten pond dries up	0	0.90	5	0.50
4. Water quality	3	0.67	2	0.33
5. Percentage perimeter shaded	90	0.40	40	1.00
6. Water fowl impact	2	0.67	3	1.00
7. Fish presence	3	0.67	4	1.00
8. Number of ponds within 1km not separated by barriers to dispersal	3	0.67	1	0.45
9. Terrestrial habitat*	4	1.00	3	0.67
10. Percentage pond surface occupied by aquatic vegetation (March – May)	40	0.70	1	0.3
HSI Value	**0.69**		**0.45**	
HSI Category	**Average**		**Poor**	

* Uses Lee Brady's four point scoring system (ARG UK 2010).

5.5.2 Weather Conditions and Other Constraints

The weather conditions and times for each survey visit at each pond are provided in Table 9 below.

Table 9. Home Farm Pond: Great crested newt presence survey visit time and weather conditions

Visit			Start Time	Finish Time	Temp.	Rain	Wind Disturbing Water	Bright Moonlight	% Shore Searched
No.	Date	Survey							
1	12-13/05/14	Night	22:15	23:30	6 ºC	2	No	Yes	90%
		Day	20:00/ 06:30	21:00/ 07:15	13 ºC	2	No	No	90%
2	13-14/05/14	Night	22:00	23:25	7 ºC	2	No	Yes	90%
		Day	06:20	07:10	9ºC	2	No	No	90%
3	10-11/06/14	Night	22:45	00:45	12 ºC	2	No	Yes	90%
		Day	06:10	07:00	16 ºC	2	No	No	90%
4	11-12/06/14	Night	22:45	00:30	13 ºC	1	No	Yes	90%
		Day	06:20	07:30	16 ºC	1	No	No	90%

Rain: 0 = none; 1 = day before survey; 2 = immediately prior to survey; 3 = during survey

Weather conditions were within the ranges specified by guidance (English Nature 2001; Natural England 2015). New guidance recommends three visits be completed during peak survey season (mid-April to mid-May) (Natural England 2015), however at the time of survey published guidance required only two visits during peak season (English Nature 2001). Additionally, anecdotal evidence suggests that peak survey season for great crested newts in Scotland is later than in England (for which the guidance is produced). Therefore great crested newts are likely to still be active within ponds during mid- to late-June in Scotland (still within the recommended survey season).

As no evidence of great crested newts was found (see below), the additional two visits required for a population assessment were unnecessary and so not completed.

5.5.3 Amphibian Survey Results

No evidence of great crested newts was found at Home Farm Pond during the four presence survey visits in 2014.

The pond was found to support palmate newts (*Lissotron helveticus*), common frogs (*Rana temporaria*) and common toads (*Bufo bufo*). Several unidentified small newts were observed during torching, as eggs, and as immature and larval life stages. These may either be palmate or smooth newts (*Lissotron vulgaris*), although given only palmate newts were found they are likely to belong to this species.

Table 10 provides full amphibian survey results for each pond.

Table 10. Pond 1 amphibian survey results.

Visit	Method	Species															
		Lh				Lv/h				Rt				Bb			
		A	I	L	E	A	I	L	E	A	I	L	E	A	I	L	E
1	Visual search								X					X			
	Netting											X					
	Torching	8♂ 2♀				2♂ 10♀											
	Bottle traps	20♂ 3♀										X				X	
2	Visual search									X				X		X	
	Netting											X					
	Torching	10♂ 1♀				5♂ 1♀			X			X					
	Bottle traps	5♂ 1♀															
3	Visual search													1♂			
	Netting							X				X					
	Torching	56♂ 14♀										X					
	Bottle traps	5♂ 1♀										X					
4	Visual search								X								
	Netting							X									
	Torching	39♂ 13♀										X		1♀			
	Bottle traps	2♂		X								X					

Lh = palmate newt; Lv/h = unidentified small newt; Rt = common frog; Bb = common toad

A = adult; I = immature; L = larva; E = egg

♂ = male; ♀ = female

5.6 Ornithology

The following sections describe the potential ornithological sensitivities based on habitats and desk-study results.

5.6.1 Wildfowl

Small numbers of pink-footed goose (*Anser brachyrhynchus*) and whooper swan (*Cygnus cygnus*) have been recorded within 3km of the site according to LCD and BTO data. Tufted duck (*Aythya fuligula*) have also been recorded within 3km but the lack of suitable habitat on site means it is highly unlikely tufted duck use the site.

5.6.2 Raptors

Peregrine (*Falco peregrinus*), buzzard (*Buteo buteo*), kestrel (*Falco tinnunculus*), sparrowhawk (*Accipiter nisus*) and tawny owl (*Strix aluco*) have all been recorded within 10km of the site according to BTO and LCD data. Peregrine were recorded overwinter according to BTO data and there is no suitable breeding habitat onsite or in the wider area. During the survey on the 13th May 2014, a buzzard was seen alarming near woodland on the Mains of Kinblethmont suggesting the presence of a territory (over 400m from the proposed site). A sparrowhawk was seen within the woodland near the remains of Kinblethmont, and according to LCD data, have bred within 3km of the site in 1991. The woods to the south of the site near the Mains of Kinblethmont provide nesting habitat for all of the above species. However, the foraging habitat onsite is restricted to narrow field margins due to the arable land-use. Therefore the loss of available foraging habitat in the surrounding area will be negligible.

5.6.3 Barn Owl

BTO data includes records of possible breeding of barn owl (*Tyto alba*) in the same 10km square as the site. The disturbance distance for barn owls is considered to be 100m (Ruddock and Whitfield 2007; Whitfield *et al.* 2008). There are no buildings within this distance suitable to support nesting barn owls. The site itself offers only limited foraging habitat for barn owl.

5.6.4 Gamebirds

Records provided by the BTO and LCD show that grey partridge (*Perdix perdix*) has been observed within 3km of the site during breeding season. The site offers potentially suitable breeding and foraging habitat for this species. Grey partridge has suffered declines of 39% between 1994 and 2007 in the UK (Riseley *et al*. 2008).

Common quail (*Coturnix coturnix*) has been recorded to breed within 2km of the proposed development site, based on BTO data. Quail is a migratory game bird whose number fluctuates each summer depending on weather conditions. The site does offer potentially suitable breeding and foraging habitat for this species.

Corncrake (*Crex crex*) has been recorded during breeding season within 3km of the site in 1996, according to BTO and LCD data. However, corncrake breed largely in the Inner and Outer Hebrides, Caithness, Sutherland and Orkney (Forrester *et al.* 2007) where breeding habitat is still favourable due to farming practices remain less intensive than in eastern Scotland. Singing males have only been confirmed along the west coast since 2003 (Forrester *et al.* 2007). It is therefore unlikely that corncrake is present as a breeding bird in the surrounding area.

5.6.5 Waders

Waders including lapwing (*Vanellus vanellus*) and woodcock (*Scolopax rusticola*) have recorded within 5km over winter according to LCD and BTO data. LCD data also indicates probable breeding of oystercatcher (*Haematopus ostralegus*) within 3km of the site.

5.6.6 Passerines

LCD and BTO data also indicates that a number of species of passerines are known to occur within 10km of the site, including skylark (*Alauda arvensis*), meadow pipit (*Anthus pratensis*), linnet (*Carduelis cannabina*) and yellowhammer (*Emberiza cintronella*) which may be affected by this development. However, the arable field which comprises the majority of the site is of limited value for these birds.

Crossbill have also been recorded in the area based on LCD and BTO data. However the site does not offer any suitable habitat for these birds, which rely upon availability of conifer seeds for breeding (Forrester *et al.* 2007).

In addition, there is a rookery adjacent to the site in the woodland immediately north of the mast. The rookery consists of approximately 15 nests. Rooks (*Corvus frugilegus*) feed on a mix of invertebrates and seeds (cereal grains) (Forrester *et al.* 2007) in a habitat with a mixture of arable land and pasture. The current surrounding area is predominantly arable, including the site.

5.7 Amphibians and Reptiles

Breeding habitat is restricted to the two ponds as the only waterbodies within the initial 250m buffer. The poor water quality of the West Mains Pond and its considerable distance from other freshwater habitats make it highly unlikely that amphibians are present. Presence of larvae of both common frogs (*Rana temporaria*) and common toads (*Bufo bufo*) confirm that the Home Farm Pond is used for breeding however, this pond is separated from the site by some distance and several barriers of unsuitable habitat. Therefore it is highly unlikely that amphibians will exist on site.

To the west of the site layout is an area of disturbed ground separated from the site by an un-mortared stone wall, which offers potentially suitable habitat for reptiles. Vegetation structure is of utmost importance for reptiles, especially the availability of basking places, and ecotones where vegetation height changes (Edgar *et al.* 2010). These conditions are caused by movement of heavy plant creating a mosaic of different sward heights, often leaving bare ground which provide excellent basking locations. In addition, the large piles of partially vegetated rubble and the un-mortared stone wall provide excellent potential hibernacula and refugia. It is possible that reptiles are present in this habitat, however, they are unlikely to venture on to site due to the severe drop in habitat quality, structure and cover.

5.8 Invertebrates

There is an area of bare land with partially vegetated rubble piles adjacent to the west boundary of the site. Open Mosaic Habitats on Previously Developed Land (OMH) (also known as 'brownfield' habitat) is a UK BAP and SBL priority habitat known to support important populations of invertebrates of conservation concern (Gibson 1998; Bodsworth *et al.* 2005; Buglife 2009; Buglife 2012; Macadam *et al.*

2013). It has been recognised that brownfields may have as many associated Red Data Book (RDB) and Nationally Scarce invertebrate species as ancient woodlands. At least 194 invertebrate species of conservation importance, including 50 Red Data book and 131 Nationally Scarce species, have been recorded from brownfield sites in the UK. This includes 50% of rare solitary bees and wasps and 35% of rare ground beetles (Bodsworth *et al.* 2005). The area of habitat adjacent to the site does not qualify as OMH based on the Buglife assessment criteria (Buglife 2012; Macadam *et al.* 2013). However, this area may still support invertebrate communities of local importance. The design of the development has therefore avoided any impact on this habitat. The majority of the habitat included within the site is used for arable farmland and is therefore unable to support important invertebrate communities. Therefore, it is considered unlikely that the development site supports important invertebrate populations or communities of conservation concern.

6 Data Limitations

The Extended Phase 1 Habitat Survey was completed in low winds and bright sunshine, with light showers occurring two days previously. Therefore the survey was completed under optimal conditions.

Newt surveys were carried out in fair weather and warm conditions. Each visit was accompanied by a full moon, which is known to have a minor negative effect on the number of newts caught (Deeming 2008). Despite this, large numbers of newts were observed during each visit.

Novel ornithology surveys were not completed, as the development area is of poor value to birds. The site offers only very limited nesting habitat for Schedule 1 birds or other species of conservation concern. Data search results provide a good indication of rare species which are likely to be present in this area, and pre-construction surveys and Ecological Clerk of Works presence will prevent contravention of the Wildlife and Countryside Act 1981 (as amended). Therefore, more detailed ornithology surveys are not considered necessary.

Therefore, there are no significant data limitations as identified in this appraisal.

7 Ecological Appraisal

The following section considers the potential effects of the development on ecology.

7.1 Ecological Appraisal Methodology

The approach taken to the appraisal of ecological impacts follows the Ecological Impact Assessment guidance produced by the Institute of Ecology and Environmental Management (IEEM 2006). These guidelines set out the process for assessment through the following stages:

- Identification of Valued Ecological Receptors (VERs) (the ecological components of highest value present at a site);
- Determining the nature conservation value (sensitivity) of the VERs present within the zone of influence that may be affected by the development;
- Identifying the potential effects based on the nature of the construction, operation and decommissioning of the proposed development;
- Determining the magnitude of the impacts including consideration of the sensitivity of the receptor and the duration and reversibility of the effect;
- Determining the significance of the impacts based on the interaction between the effect magnitude/duration, and the nature conservation value and the likelihood of the effect occurring;
- Identifying mitigation measures required to address significant adverse effects;
- Determining the residual impact significance after the effects of mitigation have been considered, including a description of any legal and policy consequences; and
- Identification of any monitoring requirements.

7.1.1 Identification of Valued Ecological Receptors

The assessment process involves identifying VERs. These ecological receptors and their conservation concern, or 'Sensitivity', are determined by the criteria defined in Table 11. It should be noted that these criteria are intended as a guide and are not definitive. Attributing a value to a receptor is generally straightforward in the case of designated sites, as the designations themselves are normally indicative of a value level. For example a site designated as a Special Area of Conservation under the Habitats Directive is implicitly of European (i.e. international) importance – and so classified as of 'Very high' sensitivity. Professional judgement is important when attributing a value level to a particular species or individual habitat. In these cases, reference has also been made to national guidelines for the selection of Sites of Special Scientific Interest (SSSI) in order to determine which level of significance should be applied (Nature Conservancy Council, 1989). Social and economic factors are also considered when valuing receptors, if appropriate.

Table 11. Approach to Identifying Sensitivity for Ecological Receptors.

Sensitivity Level	Examples
Very high	An internationally designated site, candidate site, or an area meeting the criteria for an international designation (e.g. Special Area of Conservation [SAC]). Large areas of priority habitat listed under Annex I of the Habitats Directive, and smaller areas of such a habitat that are essential to maintain the viability of that ecological resource. A regularly occurring, nationally significant population of any internationally important species, listed under Annex II or Annex IV of the Habitats Directive or Annex I of the Birds Directive. A regularly occurring migratory species listed under Annex II/2 of the Birds Directive connected to an SPA designated for this species.
High	A nationally designated site, or area meeting criteria for national level designations (e.g. Site of Special Scientific Interest [SSSI]). Significant extents of a priority habitat identified in the Scottish Biodiversity List, or smaller areas which are essential to maintain the viability of that ecological resource. A regularly occurring, regionally significant population of any nationally important species listed as a Scottish Biodiversity List priority species and Species listed under Schedule 1 or Schedule 5 of the Wildlife and Countryside Act, Annex II or Annex IV of the Habitats Directive or Annex I of the Birds Directive.
Medium	Viable areas of key semi-natural habitat identified in the Scottish Biodiversity List. A regularly occurring, locally significant population of any nationally important species listed as a Scottish Biodiversity List priority species and Species listed under Schedule 1 or Schedule 5 of the Wildlife and Countryside Act, Annex II or Annex IV of the Habitats Directive or Annex I of the Birds Directive. Sites which exceed the local authority-level designations but fall short of SSSI selection guidelines, including areas of semi-natural woodland exceeding 0.25ha.
Low	Areas of semi-natural ancient woodland smaller than 0.25ha. Sites of Importance for Nature Conservation or equivalent sites selected on local authority criteria. Local Nature Reserves. Other species of conservation concern, including species included under the Birds of Conservation Concern Red List (Eaton *et al.* 2009) or Local BAP (LBAP). Areas of habitat or species considered to appreciably enrich the ecological resource within the local context e.g. species-rich flushes or hedgerows.

Sensitivity Level	Examples
Negligible	All other species and habitats that are widespread and common and which are not present in locally, regionally or nationally important numbers or habitats which are considered to be of poor ecological value (e.g. commercial forestry).

7.1.2 Assessment of Effects

Effects on VERs are judged in terms of magnitude and duration, or 'reversibility' (Regini 2000).

Magnitude is determined on a quantitative basis where possible. This may relate to the area of habitat lost to the development footprint in the case of a habitat receptor, or predicted loss of individuals in the case of a population of a particular species of animal. Magnitude is assessed using the five categories detailed in Table 12.

Table 12. Criteria for Describing Magnitude (adapted from Percival 2007)

Magnitude	Description
Severe	Total loss or very major alteration to key elements/features of the baseline (pre-development) conditions such that the post development character / composition / attributes would be fundamentally changed and may be lost from the site altogether. Guide: <20% of population/habitat remains
Major	Major loss or major alteration to key elements / features of the baseline conditions such that the post development character / composition/attributes would be fundamentally changed. Guide: 20-80% of population/habitat lost
Moderate	Loss or alteration to one or more key elements / features of the baseline conditions such that post development character / composition / attributes would be partially changed. Guide: 5-20% of population/habitat lost
Minor	Minor shift away from baseline conditions. Change arising from the loss / alteration would be discernible but the underlying character/composition/attributes would be similar to pre-development circumstances/patterns. Guide: 1-5% of population/habitat lost
Negligible	Very slight change from baseline condition. Change barely distinguishable, approximating to the "no change" situation. Guide: < 1% population/habitat lost

In the case of designated sites, spatial magnitude is assessed in respect of the area within the designated site boundary. For non-designated sites, spatial magnitude is assessed in respect of an appropriate scale depending on the value of the receptor.

Reversibility is defined by considering the duration of the impact. This is the time for which the impact is expected to last before recovery – i.e. return to pre-construction baseline conditions (see Table 13).

Table 13. Criteria for Describing Reversibility of Effects

Reversibility	Definition
Irreversible	Effects continuing indefinitely beyond the span of one human generation (taken as approximately 25 years), except where there is likely to be substantial improvement after this period (e.g. the replacement of mature trees by young trees which need >25 years to reach maturity, or restoration of ground after removal of a development. Such exceptions can be termed very long-term effects).
Reversible	Effects that recover over the lifetime of the development, either naturally or as a result of mitigation or compensation. Duration of reversible effects can be categorised as below: Long-term (15 - 25 years) Medium-term (5 – 15 years) Short-term (up to 5 years)

Knowledge of how rapidly the population or performance of a species is likely to recover following loss or disturbance (e.g. by individuals being recruited from other populations elsewhere) is used to assess reversibility, where such information is available.

Magnitude, reversibility and sensitivity are then considered alongside proposed mitigation, and the consequence of the effect determined. The nature of any effect on a VER is assessed as negative or positive based upon IEEM guidelines. While a negative change is one that is likely to cause an adverse effect on the integrity of a VER, a positive will result in a beneficial change. The concept of 'integrity' in this context refers to sustained coherence of ecological structure and function of a VER, and includes consideration of both temporal and spatial factors.

Magnitude, reversibility and sensitivity are then considered alongside proposed mitigation, and the consequence of the effect determined. The nature of any effect on a VER is assessed as being either negative or positive, which is based upon IEEM guidelines. The concept of 'integrity' in this context refers to sustained coherence of ecological structure and function of a VER, and includes consideration of both temporal and spatial factors.

The combined assessment of the magnitude of the effect and the sensitivity of ecological receptors has been used to determine whether or not an effect is significant with respect of the EIA Regulations. Table 14 shows how these criteria are considered to determine the overall level of significance of an effect. Effects with significance levels of moderate, high and very high are considered to be significant in terms of EIA Regulations.

Table 14. Significance Level of Ecological Effects

	Sensitivity of VER				
Magnitude of effect	**Very High**	**High**	**Medium**	**Low**	**Negligible**
Severe	**Very High**	**Very High**	**High**	**Medium**	**Low**
High	**Very High**	**Very High**	**Medium**	**Low**	**Very Low**
Moderate	**Very High**	**High**	**Low**	**Very Low**	**Very Low**
Minor	**Medium**	**Low**	**Low**	**Very Low**	**Very Low**
Negligible	**Low**	**Very Low**	**Very Low**	**Very Low**	**Very Low**

Red = SIGNIFICANT in terms of EIA Regulations
Green = NOT SIGNIFICANT in terms of EIA Regulations

7.1.3 Potential Effects on Ecological Receptors

Overall, solar PV parks are relatively benign, with low or no negative ecological impacts (Tsoutsos *et al.* 2005; RSPB 2011). This is particularly the case when installed in agricultural environments with poor biodiversity value. When installed in areas of intensive agriculture there may even be positive effects that benefit local wildlife through land-use change (RSPB 2011).

There are four ways in which a solar park may affect ecological receptors:

- Habitat loss;
- Disturbance;
- Confusion with water; and
- Collision.

Each of these forms of potential effects are discussed in turn below, and are considered in greater detail when relevant to individual receptor assessments.

7.1.3.1 Habitat Loss

During the construction phase the potential effects of associated noise and visual disturbance could lead to the temporary displacement of animals. Potential effects are likely to be greatest during the bird breeding season (mainly between March and August, depending on species) and behavioural sensitivity to the effects will vary between species. Disturbance to birds is becoming increasingly well understood, although it depends heavily on the individuals involved. However, larger bird species, those higher up the food chain or those that feed in flocks in the open tend to be more vulnerable to disturbance than small birds living in structurally complex or closed habitats such as woodland (Hill *et al*. 1997). The potential effects associated with construction activities are only likely to occur for as long as the construction phase continues. The exception to this would be if an adverse effect on a receptor were such that the local population becomes extinct and replacement through recruitment or recolonisation does not occur.

7.1.3.2 Disturbance

The operation of solar parks and associated human activities for maintenance purposes also has the potential to cause disturbance and displace species from the development site. Disturbance effects during the operational phase will be less than during the construction phase, as there will be a much lower level of human activity of a less intrusive nature. In this case, the level of human disturbance during operation will be equivalent to current disturbance levels under the current agricultural land-use. During the operational life of the solar park animals are unlikely to be disturbed by the infrastructure itself, and birds have been observed to nest on solar PV structures (Hernandez *et al.* 2014).

7.1.3.3 Confusion with water

Bats possess an innate ability to detect water through echolocation, and can confuse smooth surfaces, such as solar PV, with water (Greif and Siemers 2010; Russo *et al.* 2012). Bats have been found to approach smooth surfaces and attempt to drink from these (Russo *et al.* 2012). On rare occasions, collisions have been recorded between bats and vertical reflective surfaces when mistaken for water, which is discussed in more detail in the section below (Natural England 2011). No feeding buzzes have been recorded associated with approaches to reflective surfaces (Russo *et al.* 2012). However, bats soon learn that the smooth surfaces are not water, and leave.

Insects which lay their eggs in water have also been found to confuse certain surfaces with similar polarized light reflective properties with water. Insects do confuse solar PV with water, as well as other artificial materials such as glass buildings, asphalt, car paint etc. (Kriska *et al.* 1998; Kriska *et al.* 2006; Kriska *et al.* 2008; Horváth and Kriska 2008; Horváth *et al.* 2010). There is therefore a risk that invertebrates may attempt to lay eggs on the dry solar PV panels, particularly where there are high quality aquatic habitats nearby (Horváth *et al.* 2010; RSPB 2011).

7.1.3.4 Collision

Unlike wind turbines, there is not a high risk of collision with birds or bats associated with solar PV developments. Although there is an inherent possibility with any structure in the landscape, there is no increased risk with solar PV (RSPB 2011). There have been suggestions that bats (particularly juveniles) may be at a small increased risk of collision, when confusing vertical solar PV panels with water (Natural England 2011).

There have also been high profile reports of birds and other animals being burned or colliding with heliostat solar plants in America (McCrary *et al.* 1986; Pimentel *et al.* 1994). Heliostat solar is highly reflective and concentrates light towards central receivers, whereas solar PV absorbs light and is not reflective nor uses central receivers (RSPB 2011). Therefore, the higher risk of collision and heat related injury or mortality associated with heliostat technology does not apply to solar PV (Pimentel *et al.* 1994; RSPB 2011).

7.2 Receptor Assessments

A summary of identified Valued Ecological Receptors (VERS) is provided in Table 15 below.

Table 15. Summary of identified Valued Ecological Receptors

Sensitivity	VER
VERY HIGH	Otter Pink-footed goose Whooper swan
HIGH	Peregrine Barn Owl Common Quail Crossbill
MEDIUM	Bats Red Squirrel Grey partridge Linnet Yellowhammer Skylark Reptiles
LOW	Badger Kestrel Lapwing Oystercatcher Meadow pipit Invertebrates

Receptors of negligible conservation importance are not considered further in this assessment as they were not recorded in important numbers or areas. These receptors are generally common and widespread species or habitats.

Other VERs are discussed as groups or individual receptor accounts as appropriate. Potential construction and operational effects are also considered for each receptor.

Mitigation is then discussed where appropriate. However, it should be considered that the principle mitigation measure adopted to minimise the ecological impact of the development has been the use of an iterative design process. Use has been made of ecological constraints plans and ecological issues have been taken into account throughout the design process. This means that most mitigation measures are embedded within the overall design, allowing the opportunity to microsite infrastructure away from the most sensitive habitats or species. This section presents specific measures adopted through the different phases of the

development. An Ecological Clerk of Works (ECoW) will be appointed to oversee mitigation measures, and ensure best practise during the construction and decommissioning phases.

Potential decommissioning effects are considered to be of the same nature as construction effects, with the exception that habitat is likely to be restored and displaced species able to return to abandoned areas.

7.2.1 Badger

Badgers are protected under the Protection of Badgers Act 1992, however they are now a common and widespread species in Scotland and the UK as a whole. Badgers are therefore considered to be of **low sensitivity**.

7.2.1.1 Potential Construction Effects

No badger setts or evidence of badgers were recorded within 250m of the updated development site. Furthermore, the habitat onsite does not provide cover and slopes for the establishment of setts which are required by badgers (Roper 2010).

Two outlier setts were found beyond 250m from the buffer during the protected mammal survey for the initial site boundary. No evidence of recent use by badgers was found, however, both were in current use by rabbits. One entrance was partially blocked by a large stone. No main setts were found within the survey area suggesting that the site lies near the boundaries of territories where outlier setts are more common (Roper 2010).

Badgers are known from the wider area and may, on occasion, forage onsite. However, this is likely to be infrequent as the site does not offer good foraging habitat for this species.

Increased noise, increased ground vibrations and vehicle traffic may result in disturbance to badgers, if they forage in this area during construction activities.

Increased vehicle traffic during the construction phase may also present an increased risk of mortality to badgers.

There is also a risk that badgers may become trapped in trenches required during construction activities which may result in mortality.

Therefore, there is a small possibility of disturbance and increased mortality risk during construction. It is highly unlikely that there would be any noticeable impact on the local population. Furthermore, the population would certainly be able to recover in the unlikely event of any mortality through natural recruitment.

Although any impact on badgers is considered highly unlikely, mitigation is recommended as a precaution. Preconstruction surveys should be undertaken to ascertain current local status and use of the development footprint. Should any setts be identified, and disturbance considered likely, an application will be made to SNH for a licence. If a license is required, implementation of a badger management plan may be necessary. Where there is a potential risk of fatality through collision with construction traffic, specific mitigation measures will be considered including badger fencing and wildlife reflectors. It is also recommended that excavations are either covered up overnight and/or ramps provided in trenches to avoid badgers, or other mammals, becoming trapped during the construction phase. A suitably experienced and qualified Ecological Clerk of Works will be appointed to oversee construction activities.

Following implementation of mitigation measures outlined above, any potential impact would be of **negligible magnitude**, **reversible in the short- to medium-**

term, and of a **very low significance** level. Therefore **no significant negative effect is predicted.**

7.2.1.2 Potential Operation Effects

There will be no increase in human disturbance after installation. However, stock-proof security fencing will prevent access to fields by badgers. The existing arable land-use does not offer suitable foraging habitat for badgers. The sheep grazing habitat that will replace the arable habitat after construction will also be of poor value to foraging badgers. Therefore there will be no loss of important habitat. Fencing off of the field will not limit badger distribution, as many alternative dispersal routes of greater value (e.g. areas of dense scrub and vegetation) exist in the area. Therefore, **no significant effect is predicted.**

7.2.1.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, with the exception that fences are likely to be removed and so badgers could pass through the fields again. The habitat will remain unsuitable for badgers regardless of whether the land-use returns to arable or remains sheep grazing. Relevant mitigation described under Construction Effects will also be applied during Decommissioning.

7.2.2 Otter

The otter population in Tayside is thought to be at or near carrying capacity, and has demonstrated a sustained improvement (Strachan 2007; Chanin 2013). Otters are a qualifying feature of the River Tay SAC, for which the otter population is considered to be in favourable condition, and at or near carrying capacity (Strachan 2007). In addition otters are listed under Annex IV and of the Habitats Directive and Schedule 5 of the Wildlife and Countryside Act. They are therefore considered to be of **very high sensitivity.**

7.2.2.1 Potential Construction Effects

No evidence of otters or holts (for which the habitat is sub-optimal) was found within the initial 250m buffer. There are no watercourses on site, nor within 1km of the site, and the area 250m does not have the necessary habitats to support large numbers of amphibians (sometimes used as a food source) to attract otters to the site.

Although not impossible, it is highly unlikely that otters will either forage or commute through the site due to the lack of watercourses and poor to non-existent foraging habitat.

Increased noise, increased ground vibrations and vehicle traffic may result in disturbance to otters, if they forage in this area during construction activities.

Increased vehicle traffic during the construction phase may also present an increased risk of mortality to otters.

There is also a risk that otters may become trapped in trenches required during construction activities which may result in mortality.

Therefore, there is a very small possibility of disturbance and increased mortality risk during construction. It is highly unlikely that there would be any noticeable impact on the local population. Furthermore, the population would certainly be able to recover in the unlikely event of any mortality through natural recruitment.

As there is a risk of an impact on the local otter population through mortality, mitigation is required to reduce this to an acceptable level. Preconstruction surveys

should be undertaken to ascertain current local status and use of the development footprint. Should any holts or couches be identified, and disturbance considered likely, an application for a European Protected Species licence will be made. If a license is required, implementation of an otter management plan may be necessary. Where there is a potential risk of fatality through collision with construction traffic, specific mitigation measures will be considered including otter fencing and wildlife reflectors. It is also recommended that excavations are either covered up overnight and/or ramps provided in trenches to avoid otter, or other mammals, becoming trapped during the construction phase. A suitably experienced and qualified Ecological Clerk of Works will be appointed to oversee construction activities.

Following implementation of mitigation measures outlined above, any potential impact would be of **negligible magnitude**, **reversible in the short- to medium-term**, and of a **low significance** level. Therefore **no significant negative effect is predicted.**

7.2.2.2 Potential Operation Effects

There will be no increase in human disturbance after installation. However, stock-proof security fencing will prevent access to the field by otters. The existing arable land-use does not offer suitable foraging habitat for otters. The sheep grazing habitat that will replace the arable habitat after construction will also be of poor value to foraging otters. Therefore there will be no loss of important habitat. Fencing off of the field will not limit otter distribution, as many alternative dispersal routes of greater value (e.g. water courses) exist in the area. Water courses that may be used by otters in transit are some distance from the site (the Lunan Water is over 1.5km from the site). Therefore, **no significant negative effect is predicted.**

7.2.2.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, with the exception that fences are likely to be removed and so otters could pass through the field again. The habitat will remain unsuitable for otters regardless of whether the land-use returns to arable or remains sheep grazing. Relevant mitigation described under Construction Effects will also be applied during Decommissioning.

7.2.3 Red squirrel

Red Squirrel are listed under Schedule 5 of the Wildlife and Countryside Act and included on the Scottish Biodiversity List. They are therefore considered to be of **medium sensitivity**.

7.2.3.1 Potential Construction Effects

Red squirrels are arboreal living and eating amongst trees, rarely venturing to ground-level, or leaving woodland. There is no suitable foraging or drey constructing habitat present onsite, therefore **no effects are predicted** on this species as a result of construction.

7.2.3.2 Potential Operation Effects

The grazing land-use onsite during operation will remain as unfavourable habitat to red squirrel therefore **no effects are predicted** on this species during operation.

7.2.3.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects. The habitat will remain unsuitable for red squirrels regardless of whether the land-use returns to arable or remains sheep grazing.

7.2.4 Bats

All bat species are listed under Annex IV of the Habitats Directive and Schedule 5 of the Wildlife and Countryside Act. As such, bats are considered to be of **medium sensitivity.**

7.2.4.1 Potential Construction Effects

The site consists of an arable field, which cannot support bat roosts. The field margins and treelines that border the field may offer commuting routes or foraging habitat, however, these will be retained.

Should any linear feature be disrupted (e.g. for access to a field by machinery), high fencing should be placed in the gap to maintain the continuity of the feature in the short-term (Parson 2005). Once the gap is no longer in use, the wall should be rebuilt or hedges and trees replanted to maintain the linear feature for the long-term. Following implementation of mitigation measures outlined above, any potential impact would be of **negligible magnitude**, **reversible in the short-term**, and of a **very low significance** level. Therefore **no significant negative effect is predicted.**

7.2.4.2 Potential Operation Effects

Bats possess an innate ability to detect water through echolocation (Greif and Siemers 2010). Bats can confuse smooth reflective surfaces, such as solar PV panels, for water, using echolocation (Greif and Siemers 2010; Russo *et al.* 2012). However, only drinking attempts have been found to be made when bats approach smooth surfaces which appear to be analogous to water when identified through echolocation (Russo *et al.* 2012). Furthermore, these attempts are limited, and the bat soon leaves in search of another water source. On rare occasions, collisions have been recorded between bats and vertical reflective surfaces when mistaken for water (Natural England 2011). Such collisions are thought to be more likely to occur with juvenile bats (Natural England 2011). However, the solar arrays that will be installed at this site will be laid at an angle of at most 3° above horizontal. In addition, no feeding buzzes have been recorded associated with approaches to reflective surfaces (Russo *et al.* 2012). Therefore, the risk of collision at this site is extremely low, as would be any associated mortality. It is highly unlikely that there would be any noticeable impact on the local population. Furthermore, the population would certainly be able to recover in the unlikely event of any mortality through natural recruitment.

Therefore, any potential impact would be of **negligible magnitude**, **reversible in the short-term**, and of a **very low significance** level. Therefore **no significant negative effect is predicted.**

7.2.4.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, with the exception that solar arrays are likely to be removed.

7.2.5 Wildfowl

Pink-footed geese may be associated with Firth of Tay and Eden Estuary SPA and Montrose Basin SPA. There are no SPAs designated for whooper swans within the maximum 20km connectivity distance (Pendlebury *et al.* 2011; SNH 2012). However, as the majority of all migratory wildfowl will at some point visit an SPA in the UK, pink-footed geese and whooper swans are considered to be of **high sensitivity** for the purposes of this assessment.

7.2.5.1 Potential Construction Effects

Pink-footed geese and whooper swan are known to occur within the same 10km square as the site during winter months. Although the site is a considerable distance from SPA roost locations, it is within the connectivity distance for both Firth of Tay and Eden Estuary SPA and Montrose Basin SPA. These species do use some arable agricultural fields for foraging, and this site may offer suitable crops in some years. Therefore, it is possible that geese and swans may use the site for foraging on occasion. Although the land-use will change from arable to grazing, these birds also use improved grassland as foraging habitat. Therefore, **no effect is predicted**.

7.2.5.2 Potential Operation Effects

The site will still be available for foraging geese during operation. Furthermore, the change to grazing will provide consistently suitable habitat, whereas the current arable land-use provides variable suitable habitat for foraging geese depending upon crop rotation. Therefore, **no effect is predicted**.

7.2.5.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects. The habitat will remain suitable for foraging geese whether it remains as grazing or is returned to arable (depending on crop type). Therefore, **no effect is predicted**.

7.2.6 Raptors

There are records of peregrine and kestrel in the wider area. As are listed under Schedule 1 of the Wildlife and Countryside Act, they are considered to be of **high sensitivity**. Kestrel is included on the Amber List due to a population decline of 44% since 1970 (Balmer *et al.* 2013), as well as being included on the Scottish Biodiversity List, and so is considered to be of **low sensitivity**.

7.2.6.1 Potential Construction Effects

As there is no potential breeding habitat for peregrine or kestrel **no effects are predicted** on this species as a result of construction.

Furthermore, with the exception of the field margins, the site offers only poor foraging habitat for raptors. The field margins will be retained, and the change of land-use to grazing will improve foraging opportunities onsite. As such, a **long-term positive effect** of **negligible magnitude** and so **very low level of significance** is predicted.

7.2.6.2 Potential Operation Effects

The change of land-use to grazing will improve foraging habitat and be of benefit to raptors throughout operation.

No negative effects are predicted.

7.2.6.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, although the habitat may return to its current less-suitable condition if arable farming is resumed.

7.2.7 Barn owl

As barn owls are listed under Schedule 1 of the Wildlife and Countryside Act, they are considered to be of **high sensitivity.**

7.2.7.1 Potential Construction Effects

There are no potential barn owl nest sites within the recommended 100m buffer distance to avoid disturbance to this species (Ruddock and Whitfield 2007; Whitfield *et al.* 2008). Therefore **no effects are predicted** on breeding barn owl as a result of disturbance during construction.

Furthermore, with the exception of the field margins, the site offers only poor foraging habitat for barn owl. The field margins will be retained, and the change of land-use to grazing will improve foraging opportunities onsite. As such, a **long-term positive effect** of **negligible magnitude** and so **very low level of significance** is predicted.

7.2.7.2 Potential Operation Effects

The change of land-use to grazing will improve foraging habitat and be of benefit to barn owls throughout operation.

Therefore, **no negative effects are predicted**.

7.2.7.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, although the habitat may return to its current less-suitable condition if arable farming is resumed.

7.2.8 Gamebirds

There are records of common quail and grey partridge breeding in the wider area, and the site does offer suitable habitat for these species. As common quail is listed under Schedule 1 of the Wildlife and Countryside Act, they are considered to be of **high sensitivity**. Grey partridge is included on the Red List and Scottish Biodiversity List, and so is considered to be of **medium sensitivity**.

7.2.8.1 Potential Construction Effects

The site offers potentially suitable breeding habitat for both common quail and grey partridge, which may both breed in grass such as at field margins or in dense vegetation such as arable crops (Forrester *et al.* 2007; Balmer *et al.* 2013). Angus and the farmland of the north-east is a stronghold for both species. Common quail is a migratory bird, and populations vary between years, with occasional influxes such as in 2011 when over 100 calling males were recorded in Angus and Dundee (Balmer *et al.* 2013). Grey partridge, conversely, are resident. Both species are present in the highest densities in areas of arable farming (Forrester *et al.* 2007).

There will be disturbance and a temporary loss of potential breeding and foraging habitat during construction. However, the wider area offers ample alternative breeding and foraging habitat. A preconstruction survey will be undertaken to determine whether any nesting birds are present within the construction footprint, if works are scheduled during the breeding season. If quail or partridge are found to

breed, appropriate buffers will be applied in accordance with best practice and available literature. Construction activities will be restricted or prohibited within buffer areas as appropriate until breeding is shown to have ended. A watching brief will be maintained by the Ecological Clerk of Works. Any effect on either common quail or grey partridge is considered highly unlikely with mitigation in place. Any effect would be of **negligible magnitude, reversible in the short-term,** and of a **very low level of significance.** Therefore **no significant effect is predicted.**

The field margins will be retained, and the change of land-use to grazing will continue to offer potential foraging opportunities onsite. Considering this mitigation, a **long-term negative effect** of **negligible magnitude** and so **very low level of significance** is predicted. Therefore **no significant effect is predicted.**

7.2.8.2 Potential Operation Effects

The level of disturbance to gamebirds will remain the same after construction as it is under the current arable land use.

In addition, stock-proof security fencing will limit access to the site by medium-sized predators. It has been shown that removing predators from an area can have beneficial effects on ground nesting birds (Smith *et al.* 2010). Therefore, a **long-term positive effect** of **negligible magnitude** and so **very low level of significance** is predicted.

Therefore **no significant negative effects are predicted.**

7.2.8.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, although the habitat may return to its current more-suitable condition if arable farming is resumed. Relevant mitigation described under Construction Effects will also be applied during Decommissioning.

7.2.9 Waders

Lapwing, woodcock and oystercatcher have all been recorded in the wider area. Lapwing and woodcock are Red Listed, while oystercatcher is Amber Listed. Lapwing are included on the Scottish Biodiversity List. Although populations of wintering waders are included on SPA citations within 20km, the distances (10.3km to Montrose Basin SPA and 15.4km to Firth of Tay and Eden Estuary SPA) mean that it is extremely unlikely that birds associated with these sites will regularly forage at Mains of Kinblethmont. In addition, BTO and LCD records only show lapwing, woodcock and oystercatcher being present in the area during the breeding season, when they are not associated with the SPAs.

As such they are considered to be of **low sensitivity.**

7.2.9.1 Potential Construction Effects

With the exception of the field margins, the site does not offer suitable breeding habitat for other wader species. The field margins will be retained, and the change of land-use to grazing will improve breeding opportunities onsite. As such, a **long-term positive effect** of **negligible magnitude** and so **very low level of significance** is predicted.

A preconstruction survey will be undertaken to determine whether any nesting birds are present within the construction footprint if works are scheduled during the breeding season. If waders are found to breed, appropriate buffers will be applied in accordance with best practice and available literature. Construction activities will be restricted or prohibited within buffer areas as appropriate until breeding is shown to

have ended. A watching brief will be maintained by the Ecological Clerk of Works. Any effect on waders is considered highly unlikely with mitigation in place. Any effect would be of **negligible magnitude, reversible in the short-term,** and of a **very low level of significance.** Therefore **no significant effect is predicted.**

7.2.9.2 Potential Operation Effects

The level of disturbance to waders will remain the same after construction as it is under the current arable land-use.

In addition, stock-proof security fencing will limit access to the site by medium-sized predators. It has been shown that removing predators from an area can have beneficial effects on ground nesting birds (Smith *et al.* 2010). Therefore, a **long-term positive effect** of **negligible magnitude** and so **very low level of significance** is predicted.

Therefore **no significant negative effects are predicted.**

7.2.9.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, although the habitat may return to its current less-suitable condition if arable farming is resumed. Relevant mitigation described under Construction Effects will also be applied during Decommissioning.

7.2.10 Passerines

Crossbills are listed under Schedule 1 of the Wildlife and Countryside Act and included on the Scottish Biodiversity List, and are therefore considered to be of **high sensitivity**.

Skylark, linnet and yellowhammer are included on the Red List and Scottish Biodiversity List. Therefore, these species are considered to be of **medium sensitivity**.

Meadow pipit are Amber Listed, therefore are considered to be of **low sensitivity**.

7.2.10.1 Potential Construction Effects

As there is no potential breeding habitat for crossbill or yellowhammer **no effects are predicted** on these species as a result of construction.

Nesting bird checks will be undertaken for all other species if works are scheduled for the breeding season. If nests are found, appropriate buffers will be applied in accordance with best practice and available literature. Construction activities will be restricted or prohibited in buffer areas as appropriate until breeding is shown to have ended. A watching brief will be maintained by the ecological clerk of works. Any effect would be of **negligible magnitude, reversible in the short-term**, and of a **very low level of significance**. Therefore **no significant effect is predicted**.

Linnet and yellowhammer rely on seeds throughout most of the year and with wild plant becoming less common due to herbicides arable crops such as oilseed rape is becoming important to these birds as a food source for the majority of the year (Forrester *et al.* 2007). The change in land-use from arable to grazing will reduce the available seed stock to foraging birds, although, due to the vast amount of arable crops present in the immediate surrounding area the loss is likely to be minimal. As such, any effect would be of **negligible magnitude, reversible in the long-term**, and of a **very low level of significance**. Therefore **no significant effect is predicted**.

With the exception of the field margins, the site offers only poor breeding or foraging habitat for other passerines. The field margins will be retained, and the change of land-use to grazing will improve breeding and foraging opportunities onsite for skylark and meadow pipit. As such, a **long-term positive effect** of **negligible magnitude** and so **very low level of significance** is predicted.

7.2.10.2 Potential Operation Effects

The level of disturbance to passerines will remain the same after construction as it is under the current arable land-use.

In addition, stock-proof security fencing will limit access to the site by medium-sized predators. It has been shown that removing predators from an area can have beneficial effects on ground nesting birds (Smith *et al.* 2010). Therefore, a **long-term positive effect** of **negligible magnitude** and so **very low level of significance** is predicted.

Therefore **no significant negative effects are predicted.**

7.2.10.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, although the habitat may return to its current less-suitable condition if arable farming is resumed. Relevant mitigation described under Construction Effects will also be applied during Decommissioning.

7.2.11 Reptiles

The site offers limited suitable habitat for reptiles. However, stone walls may offer potential hibernacula sites, and the field margins offer potential foraging habitat.

Adders, common lizards and slow-worms are all protected from intentional or reckless killing or injury under the Wildlife and Countryside Act, and are also Scottish Biodiversity List species. They are therefore considered to be of **medium sensitivity.**

7.2.11.1 Potential Construction Effects

There is potentially suitable reptile habitat adjacent to the site boundary. It is unlikely that reptiles will move across the site under its current land-use. The development has been designed so as to retain field margins and the stone wall that separates the site from the potentially suitable reptile habitat. Therefore, there will be no loss of potential reptile habitat.

Increased noise, increased ground vibrations and vehicle traffic may result in disturbance to reptiles if they are present within the site boundary during construction activities.

Increased vehicle traffic during the construction phase may also present an increased risk of mortality to reptiles. It is also possible that reptiles may be directly killed or injured by construction activities and there is a risk that reptiles may become trapped in trenches which may result in mortality.

Preconstruction surveys should be undertaken of suitable habitat within the development footprint to identify presence of reptiles, if likely to be affected by activities. Where populations of reptiles are found to be present specific mitigation measures will be considered to avoid injury or mortality, including reptile exclusion fencing. Should any hibernacula be identified, these will be marked and development should be microsited to avoid destruction of these features and injury to the occupying reptiles. It is also recommended that excavations are either covered

up overnight and/or ramps provided in trenches to avoid reptiles becoming trapped during the construction phase. A suitably experienced and qualified Ecological Clerk of Works will be appointed to oversee construction activities.

Therefore, there is a possibility of disturbance and increased mortality risk to reptiles during construction. It is highly unlikely that there would be any noticeable impact on the local population. Furthermore, the population would certainly be able to recover in the unlikely event of any mortality through natural recruitment. The proposed mitigation also minimises any risk of injury or mortality to individual reptiles. Therefore, any predicted negative impact would be of **negligible magnitude** and **reversible in the short-term**, and so of a **very low significance level.** Therefore **no significant negative effect is predicted.**

The land-use will change from arable to grazing. This represents an improvement in reptile habitat, although the site will remain largely sub-optimal. It should also be noted that despite the short-term negative impacts, the works will create a mosaic of vegetation structure and heights that is essential for reptile populations to thrive. Vegetation structure is of utmost importance for reptiles, especially the availability of basking places, and ecotones where vegetation height changes (Edgar *et al.* 2010). Therefore, it can be reported that the construction works will ultimately have significant positive benefits for reptiles if present in the area.

The development will therefore have a **positive effect** of **negligible magnitude** over the **long-term** on reptiles.

7.2.11.2 Potential Operation Effects

The level of disturbance to reptiles will remain the same after construction as it is under the current arable land-use. However, the site will be marginally more suitable for these species during operation.

Stock-proof security fencing will have a gap at the bottom and wide enough spacing to allow reptiles to access the site without presenting a barrier.

Therefore **no negative effects are predicted**.

7.2.11.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, although the habitat may return to its current less-suitable condition if arable farming is resumed. Relevant mitigation described under Construction Effects will also be applied during Decommissioning.

7.2.12 Invertebrates

The site does not offer high quality habitats known to support invertebrates of conservation concern, and there are no aquatic habitats present.

However, solar PV can have particular effects on invertebrates that lay eggs in aquatic habitats through reflection of polarized light and it is possible that some of these species may overfly the site. Therefore these effects are considered here.

The site is bounded by stone walls, which provide good invertebrate habitat for shelter, sun basking and foraging. However, these walls are to be retained throughout the operation of the solar park.

Invertebrates are considered to be of **low sensitivity** for the purposes of this appraisal.

7.2.12.1 Potential Construction Effects

The best areas of invertebrate habitat present are the stone walls and field margins. The field margins vary in length however, and are often less than 1m wide. As the development has been designed so as to retain field margins and the stone walls, **no effect is predicted**.

Therefore, **no significant negative effects are predicted**.

7.2.12.2 Potential Operation Effects

Insects which lay their eggs in water (e.g. mayflies, caddisflies, various true-flies, water beetles etc.) have been found to confuse certain surfaces with similar polarized light reflective properties with water. Insects do confuse solar PV with water, as well as other artificial materials such as glass buildings, asphalt, car paint etc. (Kriska *et al.* 1998; Kriska *et al.* 2006; Kriska *et al.* 2008; Horváth and Kriska 2008; Horváth *et al.* 2010). There is therefore a risk that invertebrates may attempt to lay eggs on the dry solar PV panels (Horváth *et al.* 2010; RSPB 2011). However, research has shown that the use of white borders dramatically reduces the risk of invertebrates confusing solar PV panels for water (Horváth *et al.* 2010). Unfortunately, it has been found that white bordered solar PV panels are not commercially available, and so this is not an option.

Aquatic invertebrates detect water for egg laying through perception of polarized light (Schwind 1991; Schwind 1995; Horváth and Kriska 2008; Lerner *et al.* 2008; Bruce-White and Shardlow 2011; Lancaster and Downes 2013). Solar cells polarize light and so are attractive to aquatic invertebrates, which mistake the cells for water. White non-polarizing borders have been shown to make solar panels unattractive to aquatic insects (Horváth *et al.* 2010). This is likely to be because the cells themselves, which remain polarizing, are of a small area, and the insects therefore perceive these are small puddles and not larger water bodies suitable for egg laying. It should be noted that research has only been conducted comparing white non-polarizing borders and polarizing borders – there are no published studies comparing the effect of other colours of non-polarizing borders (Horváth *et al.* 2010). Therefore, as aquatic invertebrates detect water for egg laying using polarized light, and not visible wavelengths, it is reasonable to expect that the critical property for a border is that it is non-polarizing, and that the colour itself is unimportant. Water polarizes ≥30% light, and aquatic beetles and bugs have been shown to select breeding sights with polarization of ≥35% (Schwind 1995). However studies have found that invertebrate taxa such as mayflies and tabanid flies that breed in habitat for which the solar PV panels may be confused (e.g. ponds) will select waterbodies for egg laying that polarize ≥20.7% of light (Kriska *et al.* 2009). Therefore the borders must polarize less than 20.7% light in order to break perception of the panels so that aquatic invertebrates do not view them as suitable egg laying habitats (Horváth *et al.* 2010).

Furthermore, there are no aquatic habitats onsite. However, in order to limit any potential risk to invertebrates with an aquatic phase, non-polarizing borders will be used at this site. Therefore, a **long-term negative effect** of **negligible magnitude** and so **very low level of significance** is predicted.

Therefore **no significant negative effects are predicted.**

7.2.12.3 Decommissioning Effects

Potential decommissioning effects are considered to be of the same nature as construction effects, although the habitat may return to arable farming if this is resumed.

8 Summary and Conclusions

No significant negative effects are predicted on any ecological receptors as a result of this development. The change of land-use from arable to grazing will have some positive effects on local biodiversity.

Table 16 details the predicted effects after mitigation has been considered. As decommissioning activities are of a similar type and intensity as construction activities, the assessment considers that likely significant effects of decommissioning will be of a similar nature to the likely significant effects of construction. In the case of this development, mitigation measures during construction would also apply to the decommissioning phase and so are not repeated. This is likely to be precautionary as in practice many of the decommissioning effects are likely to be of a smaller scale than the construction effects.

Table 16. Summary of residual effects.

VER	Sensitivity	Potential Effect	Mitigation	Magnitude (after mitigation)	Reversibility (after mitigation)	Nature (after mitigation)	Significance level (after mitigation)	Level of Certainty/ Comments and Significance (in terms of EIA regulations)
CONSTRUCTION (AND DECOMMISSIONING) EFFECTS								
Badger	Low	Disturbance, increased mortality through construction/traffic. Entrapment in trenches	Preconstruction surveys, Management Plan if badger present involving ECoW presence during construction, covering of trenches/providing escapes	Negligible	Reversible in Short to Medium-term	Negative	Very Low	Not significant. High certainty. No evidence of badgers within 250m of site. Management plan required if pre construction surveys prove badger presence.
Otter	Very High	Disturbance, increased mortality through construction/traffic. Entrapment in trenches	Preconstruction surveys, Otter Management Plan if otters present involving ECoW presence during construction, covering of trenches/providing escapes,	Negligible	Reversible in Short– to Medium-term	Negative	Very low	Not significant. High certainty. No evidence of otters within 250m of site area. Management plan required if preconstruction surveys prove otter presence
Red Squirrel	Medium	Loss of habitat, disturbance.		No effects predicted.				Not significant. High certainty. No suitable

VER	Sensitivity	Potential Effect	Mitigation	Magnitude (after mitigation)	Reversibility (after mitigation)	Nature (after mitigation)	Significance level (after mitigation)	Level of Certainty/ Comments and Significance (in terms of EIA regulations)
								breeding or foraging habitat onsite.
Bats	Medium	Potential loss of linear features used as commuting routes.	Erection of high fencing to maintain continuous linear feature. Replanting hedge or trees for long-term maintenance of linear feature.	No effects predicted				Not significant. High certainty. No suitable roost habitat present. Although field boundaries which may be used as a commuting route may potentially be damaged.
Wildfowl (pink-footed geese and whooper swan)	Very High	Loss of foraging habitat, disturbance		No effects predicted				Not significant. High certainty. Site will remain suitable for foraging.
Peregrine	High	Loss of foraging habitat	Retention of field margins. Change of land-use to grazing.	Negligible	Long-term	Positive	Very low	Not significant. High certainty. Foraging habitat will be improved after construction. No suitable nesting habitat present.
Kestrel	Low	Loss of foraging habitat, disturbance	Retention of field margins. Change of land-use to grazing.	Negligible	Reversible in the short-term	Positive	Very low	Not significant. High certainty. Site will offer improved foraging habitat after land-use change.
Barn owl	High	Loss of foraging	Retention of field margins. Change	Negligible	Long-term	Positive	Very low	Not significant. High certainty. Foraging habitat

VER	Sensitivity	Potential Effect	Mitigation	Magnitude (after mitigation)	Reversibility (after mitigation)	Nature (after mitigation)	Significance level (after mitigation)	Level of Certainty/ Comments and Significance (in terms of EIA regulations)
		habitat	of land-use to grazing.					will be improved after construction. No suitable nesting habitat present.
Common quail	High	Loss of breeding and foraging habitat, disturbance	Preconstruction surveys will identify nesting birds. If present appropriate buffers will be implemented. Construction works will be restricted as appropriate within buffers until nesting is shown to have ended. Retention of field margins.	Negligible	Reversible in the short-term	Negative	Very low	Not significant. High certainty.
Grey partridge	Low	Loss of breeding and foraging habitat, disturbance	Preconstruction surveys will identify nesting birds. If present appropriate buffers will be implemented. Construction works	Negligible	Reversible in the short-term	Negative	Very low	Not significant. High certainty.

VER	Sensitivity	Potential Effect	Mitigation	Magnitude (after mitigation)	Reversibility (after mitigation)	Nature (after mitigation)	Significance level (after mitigation)	Level of Certainty/ Comments and Significance (in terms of EIA regulations)
			will be restricted as appropriate within buffers until nesting is shown to have ended. Retention of field margins.					
Waders (lapwing, woodcock and oystercatcher)	Low	Loss of habitat, disturbance	Preconstruction surveys will identify nesting birds. If present appropriate buffers will be implemented. Construction works will be restricted as appropriate within buffers until nesting is shown to have ended. Retention of field margins. Change of land-use to grazing	Negligible	Reversible in the short-term	Negative	Very low	Not significant. High certainty. Improved breeding and foraging habitat after construction for most wader species.
Crossbill	High	No effects are						Not significant. High certainty. No breeding

VER	Sensitivity	Potential Effect	Mitigation	Magnitude (after mitigation)	Reversibility (after mitigation)	Nature (after mitigation)	Significance level (after mitigation)	Level of Certainty/ Comments and Significance (in terms of EIA regulations)
		predicted						habitat present onsite.
Linnet	Medium	Loss of foraging and nesting habitat	Preconstruction surveys will identify nesting birds. If present appropriate buffers will be implemented. Construction works will be restricted as appropriate within buffers until nesting is shown to have ended. Retention of field margins. Change of land-use to grazing	Negligible	Long-term	Negative	Very low	Not significant. High certainty. Loss of foraging habitat is minimal due to surrounding habitat providing food source.
Yellowhammer	Medium	Loss of foraging and nesting habitat	Preconstruction surveys will identify nesting birds. If present appropriate buffers will be implemented. Construction works	Negligible	Long-term	Negative	Very low	Not significant. High certainty. Loss of foraging habitat is minimal due to surrounding habitat providing food source.

VER	Sensitivity	Potential Effect	Mitigation	Magnitude (after mitigation)	Reversibility (after mitigation)	Nature (after mitigation)	Significance level (after mitigation)	Level of Certainty/ Comments and Significance (in terms of EIA regulations)
			will be restricted as appropriate within buffers until nesting is shown to have ended. Retention of field margins. Change of land-use to grazing					
Other passerines	Low	Loss of habitat, disturbance	Preconstruction surveys will identify nesting birds. If present appropriate buffers will be implemented. Construction works will be restricted as appropriate within buffers until nesting is shown to have ended. Retention of field margins. Change of land-use to grazing	Negligible	Long-term	Positive	Very low	Not significant. High certainty. Change in land-use will benefit skylark and meadow pipit.

VER	Sensitivity	Potential Effect	Mitigation	Magnitude (after mitigation)	Reversibility (after mitigation)	Nature (after mitigation)	Significance level (after mitigation)	Level of Certainty/ Comments and Significance (in terms of EIA regulations)
Reptiles	Medium	Loss of habitat, disturbance, increased mortality through construction	Preconstruction surveys, Management Plan if reptiles present involving ECoW presence during construction, covering of trenches/providing escapes. Retention of field margins and potential hibernacula sites. Change of land-use to grazing and effects on habitat after heavy plant use will benefit these species.	Negligible	Long-term	Positive	Very low	Not significant. High certainty. Only poor habitat onsite. Habitat will be improved by development but remain sub-optimal.
Invertebrates	Low	Loss of habitat, disturbance	Retention of field margins.	Negligible	Long-term	Positive	Very low	Not significant. High certainty. Only poor invertebrate habitat onsite. Development will improve habitat.

OPERATIONAL EFFECTS								
Badger	Low	Exclusion from foraging habitat due to stock-proof fencing	None	Negligible	Long-term	Negative	Very low	Not significant. High certainty. Site currently offers poor foraging habitat for badger, and habitat after construction will remain sub-optimal. Ample alternative higher quality habitat available in surrounding area.
Otter	Very high	Exclusion from foraging habitat due to stock-proof fencing	None	Negligible	Long-term	Negative	Very low	Not significant. High certainty. Site currently offers poor foraging habitat for otter, and habitat after construction will remain sub-optimal. Ample alternative higher quality habitat available in surrounding area.
Red squirrel	Medium	No effect is predicted.	None					Not significant. High certainty. Habitat will remain unusable to red squirrel.
Bats	Medium	Collision	None	Negligible	Reversible in short-term	Negative	Very Low	Not significant. High certainty.
Barn owl	High	Collision	Habitat improvement through the Habitat Management Plan	Negligible	Medium-term	Negative	Very Low	Not significant. High certainty. No good habitat on site, behaviour of birds mitigates against collision.

Common quail	High	Reduced access to medium-sized predators	Stock-proof security fencing will reduce access to medium-sized predators, benefiting ground nesting birds.	Negligible	Long-term	Positive	Very low	Not significant. High certainty.
Grey partridge	Low	Reduced access to medium-sized predators	Stock-proof security fencing will reduce access to medium-sized predators, benefiting ground nesting birds.	Negligible	Long-term	Positive	Very low	Not significant. High certainty.
Waders	Low	Reduced access to medium-sized predators	Stock-proof security fencing will reduce access to medium-sized predators, benefiting ground nesting birds.	Negligible	Long-term	Positive	Very low	Not significant. High certainty.
Passerines	Low	Reduced access to medium-sized predators	Stock-proof security fencing will reduce access to medium-sized predators, benefiting ground nesting birds.	Negligible	Long-term	Positive	Very low	Not significant. High certainty.
Reptiles	Medium	Reduced access to medium-sized predators	Stock-proof security fencing will reduce access to medium-sized predators, benefiting reptiles and amphibians.	Negligible	Long-term	Positive	Very low	Not significant. High certainty.

Invertebrates	Low	Egg laying on unsuitable habitat due to confusion with water	Non-polarizing borders on solar PV panels	Negligible	Long-term	Negative	Very low	Not significant. High certainty.
DECOMMISSIONING EFFECTS								
Potential decommissioning effects are considered to be of the same nature as construction effects, with the exception that habitat is likely to be restored and displaced species able to return to abandoned areas. Relevant mitigation described under Construction Effects will also be applied during Decommissioning.								

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APPENDIX 1: Photographs

Photo 1: West Mains Pond (NO6328046981). © Glenn Norris.

Photo 2: Home Farm Pond (NO6412547169). © Glenn Norris.

Photo 3: Recently planted broad-leaved woodland with high abundance of *Rumex obtusifolius* (broad-leaved dock) (NO6403947199). © Glenn Norris.

Photo 4: Disturbed ground and rubble piles combined with high nutrient loading results in improved grassland (NO6320947122). © Glenn Norris.

Photo 5: The proposed site is currently in use as an arable field, as is the majority of the surrounding habitat (NO6320947122). © Chris Cathrine.

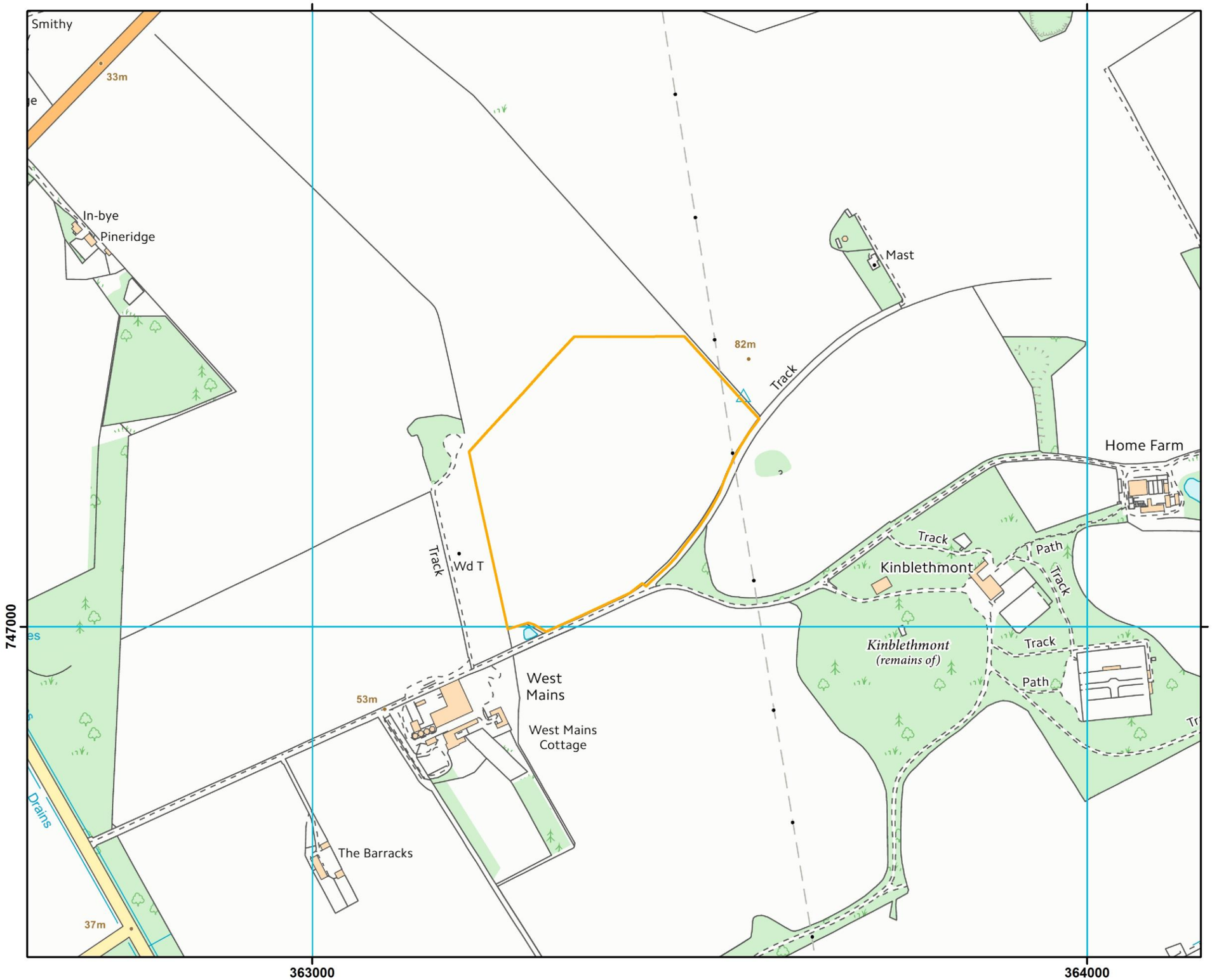
Photo 6: An example of an intact species-rich hedge (NO6401647206). © Glenn Norris.

Photo 7: An example of disused farm buildings near Home Farm Pond with potential for barn owls (NO6411947166). © Glenn Norris.

Photo 8: The bare ground provides good habitat for reptiles and invertebrates (NO6321146953). © Glenn Norris.

Photo 9: Treelines line the roads adjacent to the site. These may provide transit routes for bats between roosts and foraging sites (NO6336247005). © Glenn Norris.

APPENDIX 2: Figures



KEY

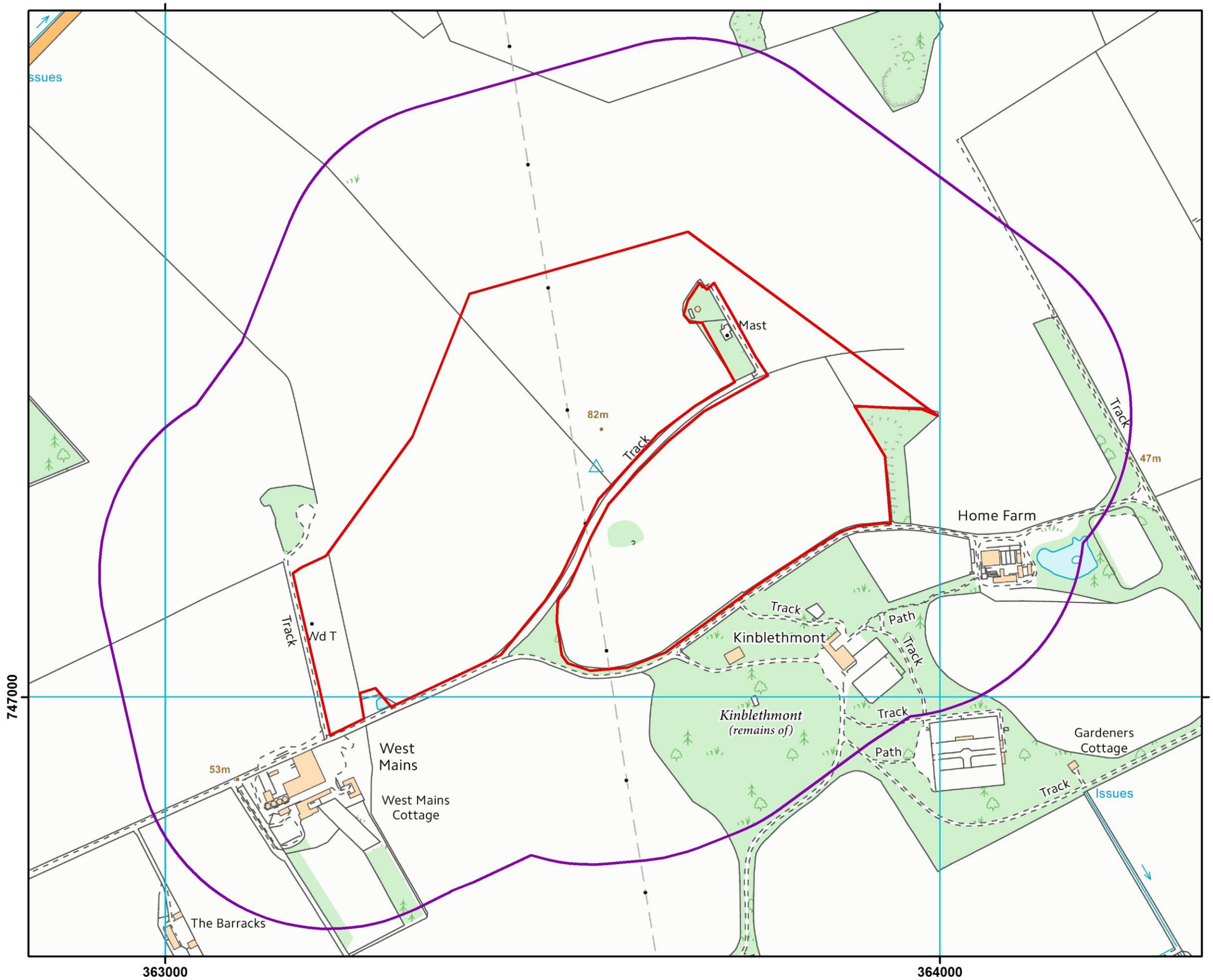
Site boundary

BWE PARTNERSHIP

PROFESSIONAL ENERGY DEVELOPMENTS

1	**FIGURE**
Site Boundary	**TITLE**
1:5,000 @ A3	**SCALE**
CC0233-1	**DWG. NO.**

N



KEY

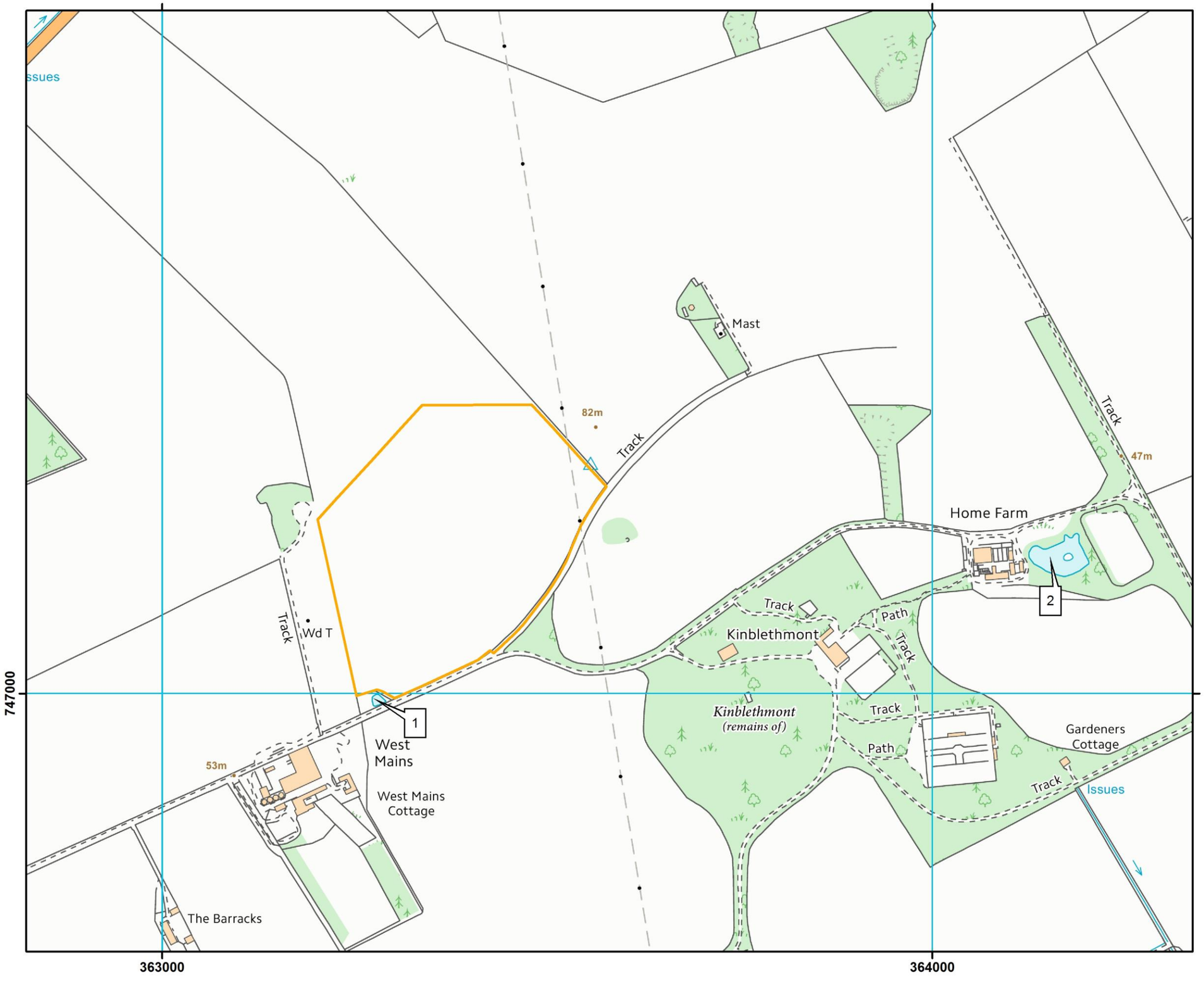
- 250m buffer
- Initial site boundary

N

BWE PARTNERSHIP

PROFESSIONAL ENERGY DEVELOPMENTS

2	**FIGURE**
Initial Site Boundary	**TITLE**
1:5,000 @ A3	**SCALE**
CC0233-2	**DWG. NO.**



KEY

Site boundary

Labels refer to Pond Number in Table 1

BWE PARTNERSHIP

PROFESSIONAL ENERGY DEVELOPMENTS

3	**FIGURE**
Ponds Selected for HSI	**TITLE**
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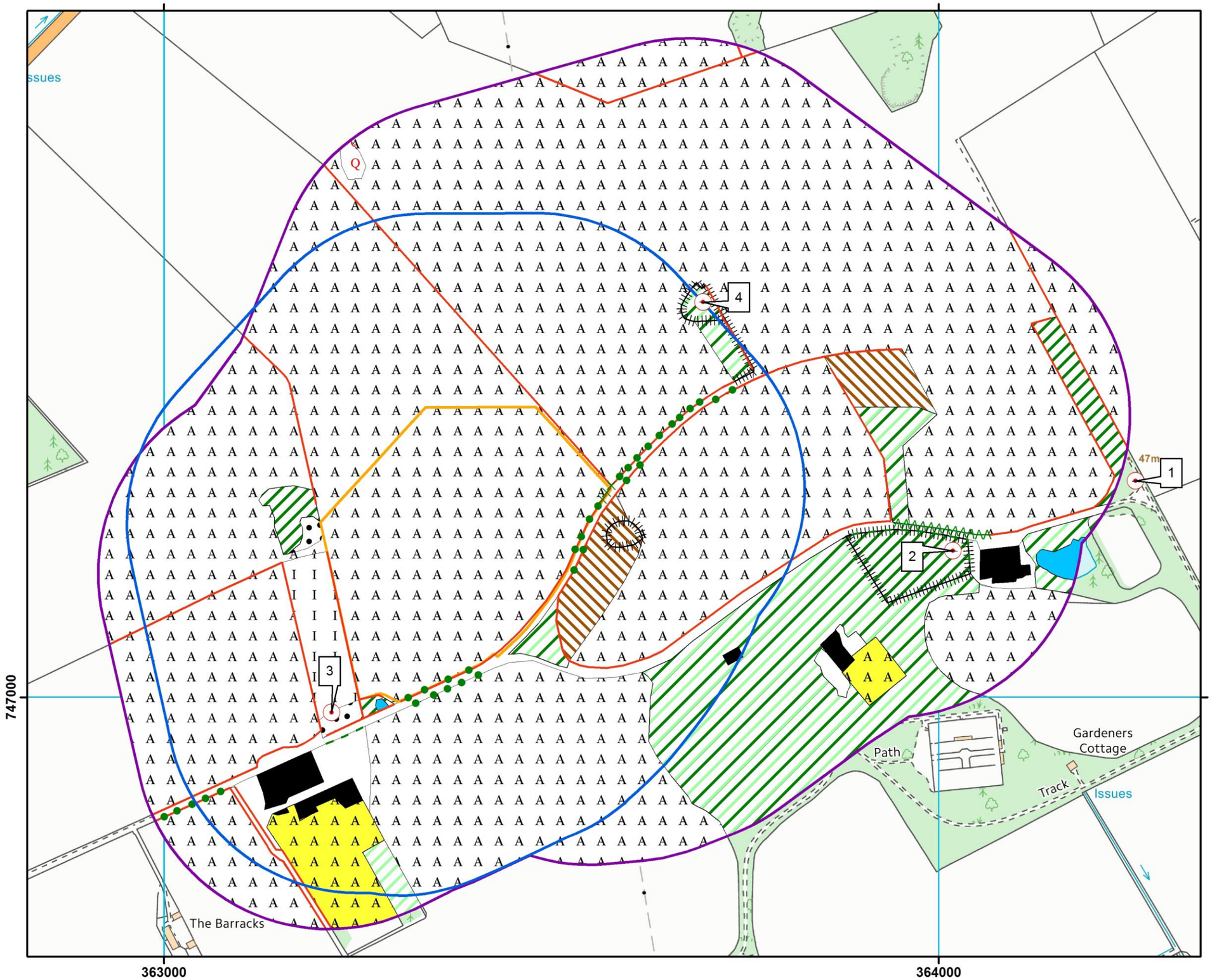

KEY

- Target note
- A2.2 Scattered scrub
- A3.1 Scattered broad-leaved trees
- J2.1.1 Intact species-rich hedge
- J2.2.2 Defunct species-poor hedge
- J2.4 Fence
- J2.5 Wall
- A1.1.2 Broad-leaved plantation
- A1.2.2 Coniferous plantation
- A1.3.2 Mixed plantation
- B4 Improved grassland
- C3.1 Tall ruderals
- G1 Standing water
- I2.1 Quarry
- J1.1 Arable
- J1.2 Amenity grassland
- J3.6 Building
- J4 Bare ground
- J5 Other
- Initial site boundary 250m buffer
- Site boundary 250m buffer
- Site boundary

BWE PARTNERSHIP
PROFESSIONAL ENERGY DEVELOPMENTS

4	FIGURE
Phase 1 Habitat Map	TITLE
1:5,000 @ A3	SCALE
CC0233-4	DWG. NO.