KIER LIVING

CAERLEON ROAD, DINAS POWYS

ECOLOGICAL MANAGEMENT PLAN

03 August 2017

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ECOLOGICAL MANAGEMENT PLAN

DOCUMENT REF: E1774901 – Doc 01 – 03 August 2017

Issue	Revision	Stage	Date	Prepared by	Approved by	Signed
1	-	Draft	17 February 2017	Chrispian Lee Snell	Dr Matthew Watts (Director)	
2	Updated layout (Appx III) & text updates following LPA ecologist comments	Final Draft	13 July 2017		Dr Matthew Watts (Director)	
3	Appx. IV plan updated	For Submission	03 August 2017		Dr Matthew Watts (Director)	

CONTENTS

1.0 INTRODUCTION

1.1 Soltys Brewster Ecology were commissioned by Kier Living to devise an Ecological Management Plan for the Land North of Caerleon Road, Dinas Powys. The management plan is to consider the habitats which are to be created or retained as part of the reserved matters application, as recommended within the Soltys Brewster 2014 Ecological Appraisal Report (SBE, 2014) and subsequent advice issued by The Vale of Glamorgan Council as part of the Outline submission (March 2014, Ref: 2014/00282/OUT). The site is centred at grid reference ST 16457 71777 (see location plan in Appendix I). The site consists of a single field bounded by hedgerows. The general area surrounding the site is of a sub-urban nature, surrounded by residential properties and amenity grassland to the south and agricultural land to the east of the site. A railway track runs along the western boundary of the site with Eastbrook Station and Dinas Powys on the western side of the railway corridor (see location plan in Appendix I).

1.2 The baseline ecological conditions on site and in the adjoining habitats were established in June 2013 and updated in January 2017 by a combination of desk-based consultation and an Extended Phase I Habitat Survey. The ecological appraisals identified constraints regarding areas of semi-improved neutral grassland, foraging/commuting/roosting bats, nesting birds and the potential presence of a population of reptiles at the current development site. In consideration of all of the above, the mitigation and management measures described in the current report have therefore focussed on the protection of marginal trees and hedgerows, enhancement of hedgerows and maximising the biodiversity value of new planting/open space, with provision of specific on-site mitigation measures for existing species/ features of value.

1.3 Although a planning decision is yet to be issued, the site was recommended for approval at planning committee with draft condition 8 stating:

> *'The reserved matters applications shall pay full regard to the findings of the Extended Phase 1 Habitat Survey, prepared by Soltys Brewster Ecology, and shall follow the recommendations in Section 5 of the report. Prior to commencement of development, full details shall be provided of a scheme, including timescale's for implementation, for the enhancement of biodiversity on the site, for approval in writing of the Local Planning Authority and the approved scheme shall be fully implemented at the time of the development.'*

1.4 The purpose of the current document is to set out a strategy to meet the requirements of the Council for the management of habitats retained and created as part of the consented development. Responsibility for implementing the management of the ecological features across the site is to be the responsibility of Kier Living (as the site owners/developers).

2.0 SUMMARY OF SITE ECOLOGICAL APPRAISAL & ECOLOGICAL MITIGATION STRATEGY

2.1. This section provides an overview of the January 2017 site appraisal and the mitigation measures which will be implemented within the development. Information relating to the creation of habitats and features associated with the ecological mitigation are provided in the subsequent sections.

Desk Study

2.2. The data provided by SEWBReC confirmed that the site did not contain any statutory or non-statutory conservation designations and was not located in close proximity to any such site so as to be of ecological relevance. The records show there are Ancient Woodland sites approximately 700 metres North East and 500 meters North West of the site. As the Ancient Woodland sites are of considerable distance from the site and there are barriers including roads, fields and residential properties; the proposed development poses no threat to these woodlands.

2.3. The SEWBReC and NBN species data confirmed that there are no records of protected or otherwise notable flora and fauna specifically identified within the site. However, other records within a1km radius of site included Great Crested Newt *Triturus cristatus*, Common Pipistrelle *Pipistrellus pipistrellus* and unspecified Bat Chiroptera. These records were associated with habitats in areas other than the proposed development site and were not considered of particular relevance to it based on the known habitat preference of such species, the site conditions (for example no ponds on-site or in close proximity that could be used by amphibians) and the physical separation from the site. Records of mobile species such as birds and foraging/commuting bats were considered of some relevance to the site, and particularly the scrub and hedgerows forming the eastern and western boundaries.

Ecological Survey

2.4. The site principally comprised of semi-improved neutral grassland (see Phase 1 Habitat Map), with amenity grassland to the south and a combination of scrub and native hedgerows forming the eastern, western and southern boundaries. Eastbrook train station and railway corridor was adjacent to the western side of the site with agricultural land (horse-grazed paddock) to the east and existing residential development to the south. The distribution and extent of habitat features are described in the following sections and in the Target Notes in Appendix II, with habitat extent/distribution illustrated on the Phase 1 Map. The most notable change in the site conditions since the 2013 survey is the cessation of grassland management(via grazing) across the majority of the site, which has resulted in natural vegetative succession to a rank, tall

grassland sward, with scattered scrub and tall ruderal vegetation more prevalent. Distribution and extent of habitat features was otherwise unchanged from the 2013 survey (See Plates 2 & 10, Appendix II).

2.5. Incidental records of birds seen/heard on or flying over the site were also recorded over the course of the survey along with any evidence of invasive non-native plant species such as Japanese Knotweed *Fallopia japonica* or Montbretia *Crocosmia x crocosmiiflora* (no such species were identified during the 2013 or 2017 surveys). During the survey, larger hedgerow trees were assessed for their potential to support roosting bats, with trees assigned to one of the following categories describe by the Bat Conservation Trust (BCT 2016):

- Known or confirmed roost
- High – Trees with one or more potential roost sites that are obviously suitable for use by larger numbers of bats on a regular basis;
- Medium – Trees with one or more potential roost sites that could be used by bats but are unlikely to support a roost of high conservation status;
- Low – Trees of sufficient size and age to support potential roost features but with none seen the ground or features seen with only very limited roosting potential; no with Trees with no obvious potential, although the tree is of a size and age that elevated surveys may result in cracks or crevices being found; or the tree supports some features which may have limited potential to support bats.
- Negligible – Trees with negligible habitat features, unlikely to be used by roosting bats.

2.6. Trees with bat potential were identified on the southern and eastern boundary hedgerows. Two Hawthorn *Crataegus monogyna* trees on the southern boundary had dense Ivy *Hedera helix* covered trunks and were identified as having low bat potential (TN 2). Numerous trees including a Hawthorn and Ash *Fraxinus excelsior* tree with dense Ivy covered trunks (low bat potential), 1 Ash tree with a potential crevice (further tree climbing survey required), 2 Oak *Quercus robur* trees with holes and crevices (high bat pot) and a Field Maple *Acer campestre* with several Woodpecker holes (high bat potential) were identified on the eastern boundary hedgerow (TN3). These trees will require further surveys if felling or pruning works are required, although the layout (see Appendix III) indicates that this boundary would not be directly impacted, with rear gardens backing onto the hedgerow all along this part of the site.

2.7. The grassland and marginal scrub habitats within the site were identified as having reptile potential. The railways track and associated embankment running adjacent to the western site boundary could also be utilised by reptiles for foraging, basking and/or dispersal. The suitability of grassland habitats at the site for reptiles is likely to have increased in comparison to the 2013 condition as a consequence of lack of grazing and vegetative succession (i.e. to a rank, tussocky sward with scrub/ruderal vegetation).

2.8. During the site walkover a number of bird species were identified onsite including Jackdaw *Corvus monedula*, House Sparrow *Passer domesticus,* Blue Tit *Cyanistes caeruleus*, Dunnock *Prunella modularis*, Woodpigeon *Columba palumbus*, Great Tit *Parus major*, Long Tailed Tit *Aegithalos caudatus* and Magpie *Pica pica*. House Sparrow are included on the RSPB Red List and Dunnock are included on the RSPB Amber List due to species population declines.

Mitigation & Management Strategy

2.9. In identifying the type and extent of mitigation through the site clearance, construction and operation stages, mitigation has focussed on the protection, enhancement and planting of boundary hedgerows, scrub, trees and maximising the biodiversity value of new planting/open space, with provision of specific on-site mitigation measures for existing species/ features of value.

2.10. The mitigation measures associated with development incorporates the following key features:

- Retain marginal hedgerow and scrub habitats adjacent to the construction footprint with appropriate management implemented;
- Clear demarcation, by means of high visibility fencing (or similar) of the edge of the construction zone alongside retained hedgerows. No storage of materials or construction work to be undertaken within this fenced area;
- New planting used to supplement and strengthen the existing (retained) hedgerows and scrub through the use of native species. Replacement of hedgerow loss will be provided on a 1:1 basis using native species;
- New tree and shrub planting within the development footprint to use native species or those with a known wildlife benefit whenever possible;
- Hedgerow & scrub management work and/or tree felling to be undertaken outside the bird nesting season (i.e. between September and February inclusive) or else preceded by a thorough visual inspection to confirm no active nests are present;
- If trees identified with Low Bat Potential on southern boundary and or eastern boundary are to be felled, they will require section felling during the autumn or early spring (Sept/Oct or March/April), with limbs gently lowered to ground and left it situ for at least 48 hrs;
- Any works likely to impact on trees with medium and high potential for roosting on the eastern boundary hedgerow would be preceded by further survey work to identify the likely presence/absence of roosting bats. The findings of any survey would inform appropriate mitigation measures;

- Adoption of phased, directional cutting of grassland and scrub margins within the development footprint to limit any impacts on reptiles or amphibians. Grassland would be cut in the active season (April – September) using strimmers or brush cutters working directionally towards the western boundary so as to encourage animals to disperse towards the retained grassland and scrub at the western and northern areas of the site;
- Design of street lighting so as to minimise illumination of retained hedgerow & scrub corridors at the eastern and western boundary of the site and to maintain these as 'dark corridors for use by bats and other species. A map showing dark corridors and an advice note relating to bats and street lighting is provided in Appendix IV.
- Incorporation of bird boxes (25no.) suitable for use by a range of species such as Swift[1], Starling, House Sparrow and House Martin on new buildings – particularly those in close proximity to retained boundary vegetation.
- The adoption of SuDS will be incorporated into the design where possible, with design measures including kerb insets and off-set gully pots incorporated for amphibians. Example of inset kerb and gully pot design for amphibians shown in Appendix V;
- All boundary and internal fences will have a 100mm gap at the bottom of fence, to allow passage by small mammals including hedgehogs.

3.0 MANAGEMENT OF ECOLOGICAL FEATURES

3.1 The habitat mitigation and creation associated with development is described below. The sub-headings and measures described are based on the draft condition identified within the Planning Committee report and the recommendations in the 2014 survey report (SBE, 2014).

3.2 Monitoring of the ecological features, will be undertaken by a suitably qualified ecologist in years 2, 5, 10 following completion of the development phase. Following the monitoring visits it is recommended that the management regime is reviewed and amended as appropriate. More information on the monitoring scheme is provided in Section 4.0. A habitat management timetable summarising the required management actions across the site is provided in Table 1.

Retained reptile grassland/scrub area

3.3 As illustrated on the layout in Appendix III, the existing grassland in the north of the site and long the entire western boundary is to be retained and managed so as to provide benefits for biodiversity in general and to

[1] Where building height allows – Swift boxes require positioning at 5-7m above ground

serve as terrestrial habitat for reptiles as part of the development. A drainage attenuation area (basin) is proposed in the south west of the site with areas of informal public open space provided in the north west and to the west of the site entrance (see plan in Appendix III). These areas of informal open space will incorporate an element of retention of existing grassland and sowing/oversowing with a wildflower and amenity grass seed mix. The area of the attenuation basin will be sown with a combination of wetland meadow and wildflower meadow mix once constructed. Other areas of grassland created within the construction zone/development footprint – such a the central areas of public open space - are to be managed for amenity purposes and have not been considered in this document.

3.4 Grassland management for biodiversity can be complex and the management regime may need to be amended following monitoring visits (as described in Section 4.0) which will be used to assess the effectiveness of the current management regime. Given the existing condition of the grassland within the retained areas in the north and long the western boundary, an initial cut to a height of 100 – 200mm with all arisings removed will be undertaken in Spring or autumn via a tractor mounted mower (or similar) capable of cutting at a specified height. This operation is intended to return the grassland to a condition more comparable to the 2013 baseline. All ruderal vegetation (including Bramble) would be incorporated in this cutting operation although woody shrubs such as Hawthorn present within retained areas would be retained and subject to pruning as required.

3.5 Following the initial cut described above, subsequent management of retained grassland will be biannually via cutting with hand tools (strimmers) or a tractor-mounted mower/flail capable of delivering a cut at a specified height (100 – 200mm). Cutting will be undertaken in spring and autumn, to enable the wildflower and grass species to flower and set seed over the summer. Following each cut all cuttings/ arising will be removed and disposed of (composted) off-site as appropriate. Cuttings will not be allowed to remain on the grass for longer than 48h as they can smother establishing plants as well as causing nutrient enrichment, both of which can decrease floral diversity. Cutting of grassland will be undertaken directionally, working towards retained hedgerow corridors so as to allow animals to disperse or move away from disturbance as required. Existing Hawthorn shrub and proposed trees (see plan in Appendix III) will be retained and pruned as required (e.g. extension growth cut back) every two years as part of the grassland management in autumn. Scrub management will be undertaken using hand-held tools and will not be undertaken in spring to avoid any conflict with nesting birds.

3.6 Alongside the areas of retained grassland, informal open space (2no. areas) and the attenuation basin will be sown with appropriate meadow mixtures and amenity grass seed as illustrated on the soft landscape plan (Quattro Design & ACD Consulting, 2017). Sowing of grass seed to these areas will be undertaken in spring or autumn and, once established the grassland will be managed as described in Section 3.5.

Measures to protect hedgerows during the construction phase

3.7 The eastern boundary hedgerow will be protected from construction works by Heras fencing installed along the hedgerows entirety, creating a barrier between development and the hedgerows. Fencing will be set no less than 0.5 metres from the Root Protection Area (RPA) which is typically equivalent to the extent of the tree canopy. The plan in Appendix III illustrates the RPA's for selected trees in the south eastern part of the site and the arrangement of fencing adopted for these trees would be continued along the eastern boundary. Fencing will be checked daily before construction works commence and fixed or replaced before works start.

3.8 To avoid the risk of Badgers or other wildlife (e.g. hedgehogs, amphibians) becoming trapped in any deep excavations (e.g. for foundations), these will either be covered at night or a means of escape provided. The means of escape could comprise a rough-sawn timber board of 300mm width placed at an angle of less than 45 degrees extending from the bottom of the excavation to the top edge.

3.9 Once heras fencing is installed and the grassland vegetation within the development footprint has been strimmed/cut as described in Section 3.4, it will be maintained as short mown grassland or bare ground to ensure the development area remains unsuitable for reptiles.

Work required to restore existing hedgerows

Hedgerow Planting

3.10 The filling of gaps in the eastern and western boundary hedgerows will comprise native plants of locally common species to include Hazel, Field maple, Hawthorn, Oak Willow, Elm.

3.11 When planting within an existing hedge (filling gaps), to give the new plant a good start, the gap of vegetation will be thoroughly cleared and the hedge plants cut on either side back to healthy growth. This will be undertaken in winter when the ground is not frozen between November and March. The new plants will be kept free of competitive weeds and replaced if they fail. Monitoring visits (as described in Section 4.0) will be used to assess the effectiveness of the new planting and proposed management regime.

Maintenance of hedgerows

3.12 Left alone, a hedgerow will continue to grow upwards and outwards and will eventually become a line of trees. Hedges flower more profusely when they are cut less often because most of the trees and shrubs in hedgerows cannot flower on stems that have grown for less than one year. Therefore, cutting hedges every year means that wildlife is deprived of flowers, nuts and berries. Accordingly, the eastern and western boundary hedgerows at the site would be cut every three years. This will allow hedgerow shrubs to flower and to produce maximum fruit and seeds, and will also enable the hedge shape and density to be maintained.

Time of year

3.13 Hedges must not be cut during the bird-nesting season March-August. Outside this season, cutting should also take account of the autumn berry crop which in practice would equate to cutting operations being programmed over winter between December and February in any given year.

Hedgerow height & width

3.14 Due to consideration of protected species and the function of the hedgerows from a biodiversity and landscape/screening perspective a minimum hedgerow height of 3 metres and a minimum width of 3 - 4 metres for existing hedgerows will be maintained.

Management Company & Hedgerow Access

3.15 The appointment of a private management company to implement the measures described for retained hedgerows will be required. Information relating to rights of access and restrictive covenants to prevent residents undertaking their own hedgerow management is also required.

3.16 At the time of preparing this report the management company are yet to be decided, although the applicant (Kier Living) will be responsible for implementing the management operations described in the current document. Access to the western and northern hedgerows would be possible via proposed POS (see Appendix III), although implementation of management along the eastern boundary would be subject to further detailed discussions between Kier Living and the local authority.

3.17 To illustrate how management of the eastern boundary could be delivered, the following text has been reproduced from an unrelated management plan produced by Soltys Brewster for a site in Wiltshire. '*The curtilage of all residential properties adjacent to the eastern hedgerow will be defined by a 1.2m post & rail fence, which is intended to provide a clear definition of the garden boundary and discourage tipping of garden waste adjacent to retained hedgerow. Access to the hedgerows (by the management company) would be arranged by (the applicant) Operatives of the management company would be required to access the area between the hedgerow and the post/rail garden fence for the eastern hedgerow.*'

3.18 The appointment of a management company specific to the Caerleon Road site has yet to be confirmed although would be put in place by Kier Living. Similarly, details of restrictive covenants preventing residents' management of hedgerows outside their property boundary are yet to be decided; although would be put in place in discussion with the local planning authority prior to sale/occupation of units.

Bird Boxes

3.19 A total of twenty five bird boxes, representing a provision of approximately 35% (for the 70 Unit scheme) will be provided on new buildings – particularly those in close proximity to retained boundary vegetation. The number and type of boxes for use by particular species will be provided as follows;

- The 4 Swift boxes[2] will be positioned in groups of 2, out of direct sunlight (i.e. not oriented due south), at least 5 metres high under the eave and/or gable ends, away from disturbance, with no obstructions to flight path to the box. The boxes will be positioned where dropping will not be a nuisance i.e. side of house away from doors and windows;
- The 7 Starling boxes will be positioned out of direct sunlight at least 3 metres high under the eaves and/or gable ends on buildings on the eastern or western boundary. To avoid territorial disputes, the nests will be placed at least 3 metres apart and not over the main living area as Starling can be noisy;
- The 7 House Sparrow boxes will be positioned out of direct sunlight, at least 2 metres high under the eaves and/or gable ends on buildings on the eastern or western boundary. To avoid territorial disputes the nests will be placed at least 1 metre apart;
- The 7 House martin boxes will be positioned in groups of at least 2, out of direct sunlight, at least 3 metres high under the eave and/or gable ends on buildings, with no obstructions to flight path to the box. The boxes will be positioned where dropping will not be a nuisance i.e. side of house away from doors and windows;

Dark corridors for bats

3.20 Appropriate design and specification of street lighting will be adopted to minimise increased illumination of retained hedgerow & scrub corridors at the eastern and western boundary of the site and to maintain these as 'dark corridors' for use by bats and other species. The retained boundary vegetation will be maintained to a minimum height and width of 3- 4 metres. An indicative plan showing the dark corridors and an advice note relating to bats and street lighting is provided in Appendix IV. Where security lighting is provided for properties along the eastern boundary hedgerow, this will be motion sensitive – i.e. only activated by people or domestic pets – so as to maintain the dark corridor illustrated in Appendix IV.

[2] Where building height does not permit use of Swift boxes, these would be replaced with the equivalent number of Sparrow, House Martin or Starling boxes.

SuDS and design measures for amphibians

3.21 The adoption of SuDS will be incorporated into the design where possible, with an attenuation basin created at the south west of site (See Plan in Appendix III). Design measures including kerb insets and off-set gully pots will also be incorporated across the site in accordance with consultation comments received from the local authority ecologist. An illustration of inset kerb and gully pot design for amphibians are shown in Appendix V.

Fencing design for Hedgehogs and small mammals

3.22 All boundary and internal fences will have a 100mm gap at the bottom of fence, to allow passage by small mammals including hedgehogs.

Table 1. Habitat Management Summary

FEATURE/ LOCATION	YEAR 1	FROM YEAR 2 (In Perpetuity)	NOTES
Retained grassland – western & northern boundaries	**Biannually:** Cut grass to a height of c.100 - 200mmmm in late March/April Cut grassland a height of c.100-200mm in September/October All arisings to be removed.	**Biannually:** Cut grass to a height of c.100-200mmmm in late March/April Cut grassland a height of c.100-200mm in September/October All arisings to be removed.	An initial cut to a height of 100 – 200mm will be undertaken in Spring or autumn via a tractor mounted mower (or similar) capable of cutting at a specified height All arisings to be removed and disposed of/ composted off-site as appropriate.
Informal POS & New Wildflower/Wetland Planting	During construction, grass in these areas maintained as described for retained grassland.	Following establishment, management as described for retained grassland. Amenity grass at fringes of Informal Open Space managed as described for other amenity grass areas (ACD, 2017) – i.e. at 10-14 day intervals between April & October.	Machinery can be used although mower must be capable of delivering cut to specified height.
Existing hedgerows (Eastern & Western)	Hedgerows cut in January or February - Minimum hedgerow height of 3 metres and a minimum width of 2.5 metres.	Hedgerows cut every 3 years in January or February - Minimum hedgerow height of 3 metres and a minimum width of 2.5 metres.	All arisings to be removed. Hand tools to be used (including chainsaws).

FEATURE/ LOCATION	YEAR 1	FROM YEAR 2 (In Perpetuity)	NOTES
Planting/infilling of hedgerows (Eastern & Western)	To be undertaken in winter when the ground is not frozen between November and March - Infilling of gaps in hedgerows on the eastern and western boundaries. Planting will comprise native plants of locally common species - Hazel, Field maple, Hawthorn, Oak, Willow, Elm.	Management as described above	As described above

4.0 MONITORING OF ECOLOGICAL FEATURES

4.1 Monitoring of the ecological features created or retained as part of the development will be undertaken quarterly for the first year and then annually in in years 2, 5 and 10 following completion of development. All monitoring will be undertaken by a suitably qualified ecologist. Following the monitoring visits a brief report including a review of the current management regime is to be prepared and submitted to the local planning authority.

REFERENCES

ACD Consulting 2017. Caerleon Road, Dinas Powys. Soft Landscape Management and Maintenance Plan. Document Ref: PRI21273man, Dated June 2017

Bat Conservation Trust. (2016). *Bat Surveys – Good Practice Guidelines*. Bat Conservation Trust, London. Third Edition.

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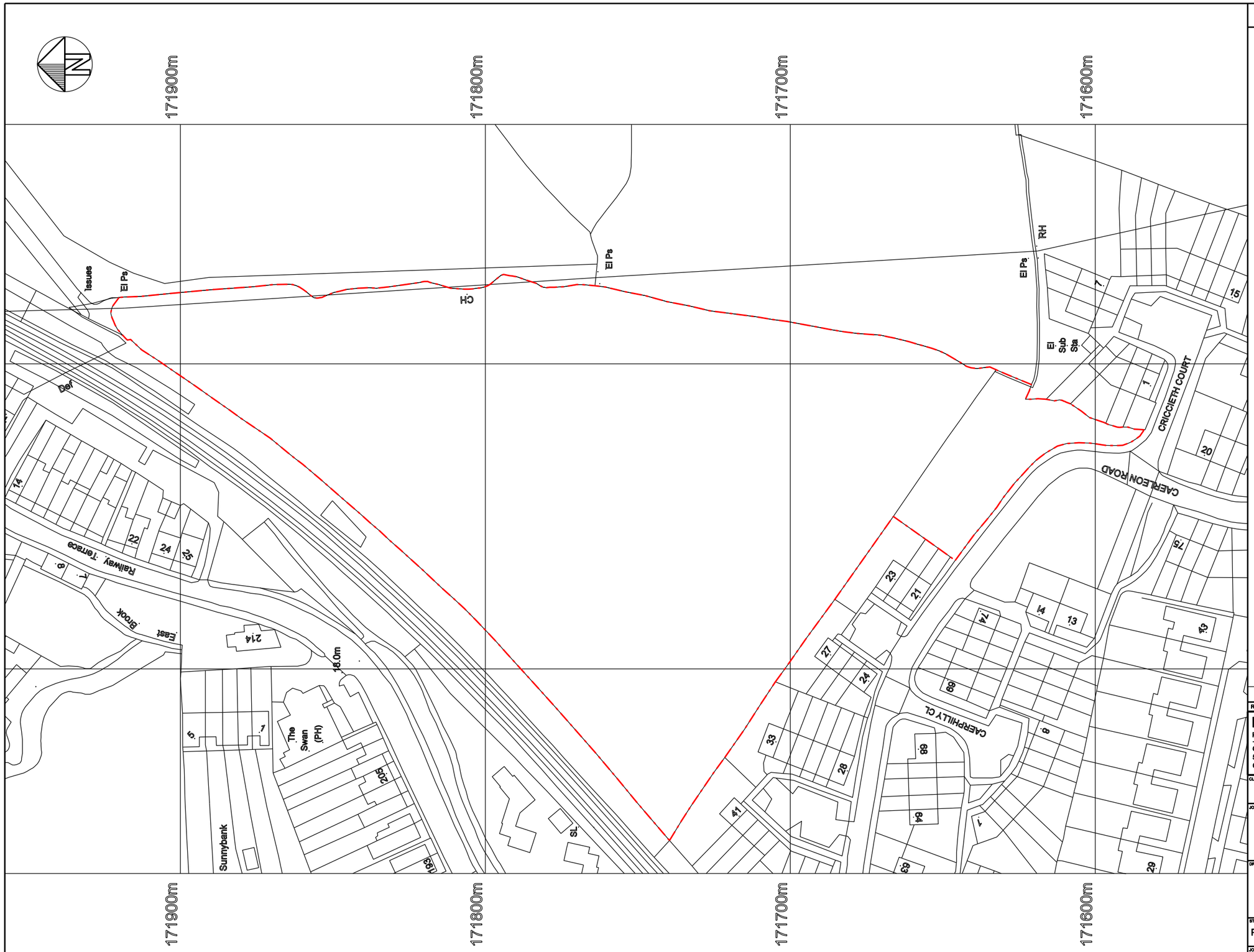
APPENDIX I SITE LOCATION PLAN



N O T E S

REVISION	DESCRIPTION	BY	DATE
A	Boundary line amended	RDP	22.03.13

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CLIENT
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JOB TITLE
LAND OFF CARLEON ROAD,
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DRAWING TITLE
SITE LOCATION PLAN

STATUS	DATE	DRAWN	CHECKED	SCALE @ A3
PRELIMINARY	20.03.13	RDP	JNW	1:1250

JOB NO.	DRAWING NO.	REV.
S9330	PR 100	A

APPENDIX II 2017 PHASE I HABITAT PLAN, SITE PHOTOS AND TARGET NOTES

Caerleon Road Site Photos 2017

Plate 1 – Southern hedgerow with Hawthorn with Ivy covering (low bat pot) (TN2)

Plate 2 – Semi-improved grassland

Plate 3 – Hedgerow with trees on eastern boundary

Plate 4 – Oak tree with bat roost potential on eastern hedgerow (TN3)

Plate 5 – Ash tree with bat roost potential on eastern hedgerow (TN3)

Plate 6 – Hedgerow on western boundary

Plate 7 – Ash tree with low bat roost potential on eastern hedgerow (TN3)

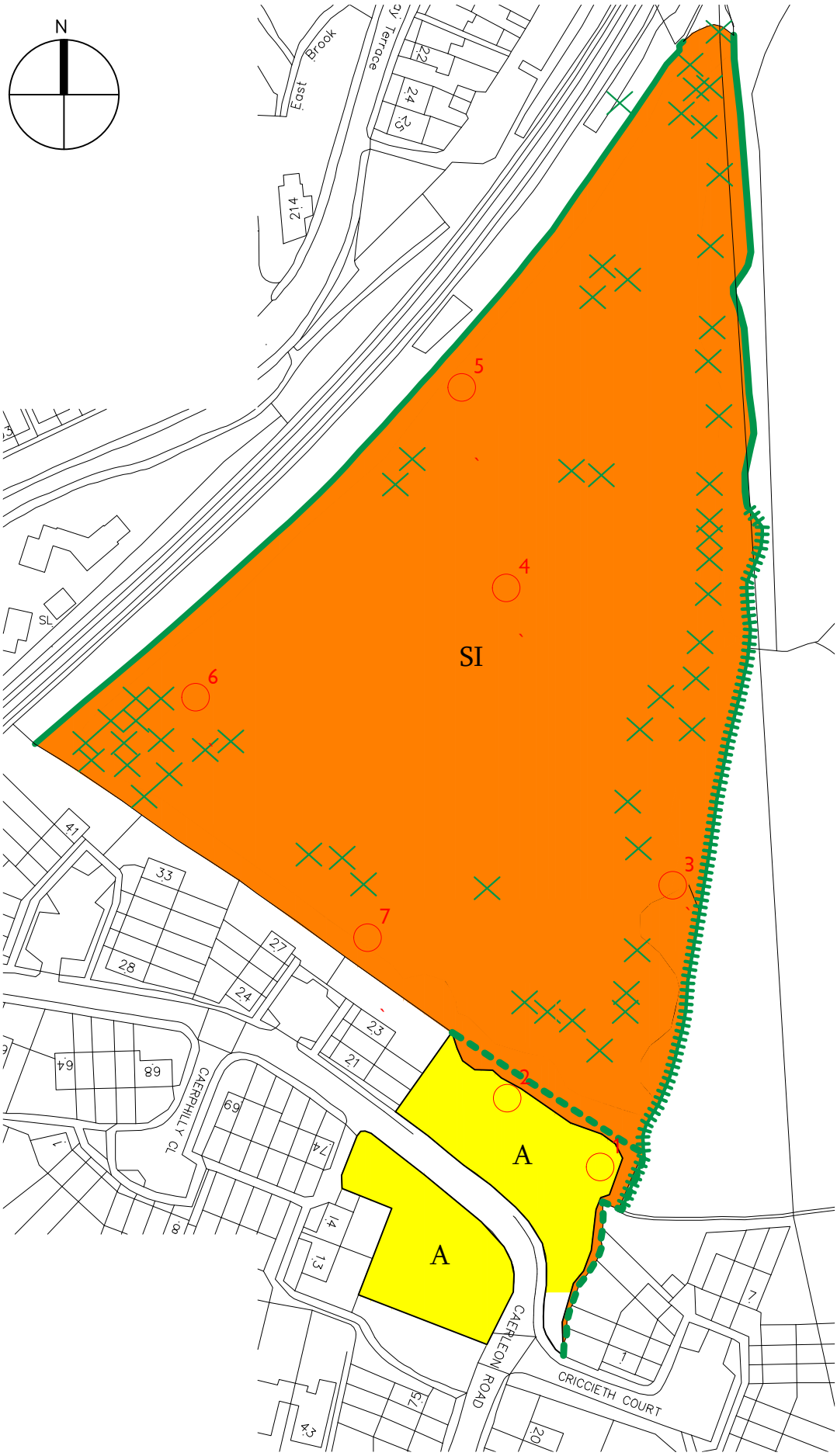
Plate 8 – Offsite trees overhanging site on southern boundary (TN 7)

Plate 9 – Maple tree with woodpecker holes on eastern boundary (High bat pot) (TN3)

Plate 10 – Semi-improved grassland (2013)

Caerleon Road Target Notes January 2017

Target Note	Description/ Comment
	Birds identified on site – Jackdaw, Sparrow, Blue Tit, Dunnock, Woodpigeon, Great Tit, Long Tailed Tit, Magpie.
1	Unmanaged hedgerow with trees including Lime, Oak. (No bat pot)
2	Unmanaged hedgerow with trees including Nettle, Bramble, Ash, Dogwood, Hawthorn (x 2 low bat pot with Ivy covering), Elder,
3	Unmanaged hedgerow with trees including Hawthorn and Ash (Ivy covered Low bat Pot), Oak with many potential bat roost holes and cavities (High bat pot), Field Maple, Oak tree with bat roost potential feature in branch (Further ladder survey required), Ash tree with crevice in knobble branch (Further ladder survey required), Maple tree with many woodpecker holes (High bat pot), Willow, Rose & Elm.
4	Semi Improved grassland with Blackthorn, Bramble, Butterfly Bush (*Buddleja davidii)* encroachment, Compact Rush, Timothy, Cocksfoot, Willowherb.
5	Unmanaged scrubby hedgerow with Ash, Hawthorn, Blackthorn, Hazel, Bramble, Rose, Willow, Maple scrub.
6	Bramble scrub
7	Mature Chestnut & Oak trees in garden with no bat pot. Branches overhanging site.



Key

- Target note
- Scattered scrub
- SI — Semi-improved neutral grassland
- A — Amenity grassland
- Native species-poor hedgerow (defunct)
- Native species-poor hedgerow (intact)
- Native species-poor hedgerow and trees (intact)

client/project	drawing			
Kier Living **Caerleon Road, Dinas Powys**	Phase 1 Habitat Survey			
drawing no.	**revision**	**scale**	**drawn**	**date**
E1774901/001	*	NTS @ A4	CLS	Feb 2017

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APPENDIX III PROPOSED DEVELOPMENT PLAN (REV M)

Schedule of accommodation

Market Sale

	4no	Hatton	@692sqf
	6no	Pemberton	@727sqf
	6no	Holmewood	@906sqf
	4no	Kirkwood	@930sqf
	8no	Chelmsford	@1241sqf
	8no	Hareford	@1268sqf
	6no	Lindford	@1370sqf

Affordable

	5no	2B4P LCHO	@800sqf
	6no	1B2P Aff Rent	@540sqf
	13no	2B4P Aff Rent	@800sqf
	3no	3B5P Aff Rent	@945sqf
	1no	4B6P Aff Rent	@1140sqf

Key

- Site boundary
- Road
- Footpath
- Paving
- Shared surface
- Rumble Strip
- Parking spaces
- Public open space Approx: 1350sqm
- LAP Approx: 1100sqm
- Bin collection area (plots 8 - 15)
- Existing tree RPA
- Junction - Visibility splay (distance on drawing)
- Forward visibility

Sewer Easement

Approx Sewer Position

Sewer Easement

Pumping Station

Basin

25m x 2.4m

43m x 3m

Existing footpath

Existing driveway

0 5 20 2 10 50m

www.quattrodesign.co.uk

NOTES

REVISIONS

REV: DATE - DRAWN - CHECKED: NOTES

-: 09.01.17 - DC - RJF:
Drawing created.
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Site plan updated following clients comments.
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Attenuation tank removed

DRAWING TITLE

Proposed Site Plan

PROJECT

Caerleon Road, Dinas Powys

CLIENT

Kier Living

SCALE 1:500@A1 1:1000@A3

DATE Jan 2017

Quattro designarchitects

DRAWING NO. **5567/P/10**

REV **L**

Matthews Warehouse, High Orchard Street
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APPENDIX IV ADVICE NOTE ON BATS & LIGHTING AND INDICATIVE DARK CORRIDORS PLAN

ADVICE NOTE ON BATS & LIGHTING (2014)

The following advice in relation to Bats and lighting provides a summary of the review of available evidence compiled by the Bats and Lighting Research Project at the University of Bristol. The full report should be reviewed for further information on any of the summary points identified below. The citation for the full report is:

> ***Stone, E.L. (2013) Bats and lighting: Overview of current evidence and mitigation guidance. Lighting Research Project, University of Bristol.***

Introduction

Urbanisation and development affect bat habitats, either through direct loss or disturbance from light and noise pollution or human activities. Changes in habitat affect the quantity, quality and connectivity of foraging, drinking and roosting resources available to bats. Linear landscape features such as hedgerows, river banks and canals are important for bats, often being used for foraging and commuting (Limpens & Kapteyn 1991; Verboom *et al.* 1999).

Bat habitats and roosts are under increasing pressure and disturbance from suburban development and its associated artificial lighting. Connectivity of habitat and foraging areas to roosts is fundamental to the survival of many bat populations (Verboom & Huitema 1997). Lighting schemes can damage bat foraging habitat directly through loss of land and spatial exclusion of bats due to high illuminance, or indirectly by severing commuting routes from roosts, through light spillage polluting hedgerows, tree lines and watercourses (Racey 2006). Lighting around roosts has also been shown to delay emergence, causing bats to miss the peak in insect prey abundance (Downs *et al.* 2003).

Legislation pertaining to lighting in Britain

There is no legal duty for a lighting authority to illuminate roads in Britain and lighting is installed because the perceived benefits outweigh the negatives. Recent research by The Highways Agency (in England) found that the safety benefits of motorway lighting were 1/3 lower than previously thought. Additional field trials to switch-off lights on motorways have found lower numbers of accidents when lights were off than when illuminated (http://www.highways.gov.uk/knowledge/30236.aspx). A number of authorities have been trialling part night lighting solutions and even complete removal. The results have been mixed but a significantly large number of projects have shown no detriment from implementation of these changes.

Street lighting (A roads, B roads, pedestrian lighting)

There are over 7.5million street lights in the UK (Anon. 2009). Common light types used for external applications in the UK.

Common types of street light used in the Britain.

	Colour	% UV	Correlated colour temperature (k)[1]	Approx % of UK Lighting stock
Low pressure sodium (LPS / SOX)	Yellow/orange	0.0	1807	44%
High pressure sodium (HPS / SON)	Pinkish / off white	0.3	2005-2108	41%
Compact fluorescent	Warm white	0.5-1.0	2766-5193	15%
Metal Halide (e.g. Philips CosmoPolis)	Blue-white	2.0-7.0	2720-4160 CosmoPolis 2720	N/A
Light emitting diode (LED)	White/warm - white	0.0	2800-7000	N/A

Predicting the impacts of lighting on bats

There are many aspects of ecological light pollution which are yet to be investigated, and so a precautionary approach is important. It is important to consider the following when predicting the impacts of lighting on bats:

i. Impacts may be cumulative
Lighting is one of many anthropogenic impacts on bats and so it is important to consider impacts of lighting in the context of the site and other conditions affecting the species or colony. For example even a small amount of lighting may have a disproportionate impact on bats at sites where there are already high levels of disturbance, therefore impacts must be assessed in the context of other disturbances on the colony/roost in question.

ii. Impacts will vary according to site, species and behaviour
The impacts of lighting on bats is species specific and varies according to the specific behaviour being affected. Impacts on a site by site basis can be based on knowledge of the species involved and the type of behaviour affected.

iii. Impacts may occur over different temporal scales
Some impacts may occur over very short time frames making them more obvious (e.g. spatial avoidance) and therefore more likely to be recorded. However, lighting may impact behaviours over longer time scales (e.g. reduced breeding success) and may be harder to record and therefore underestimated.

iv. Impacts may occur at both the individual or population level
Lighting may impact on a few individuals in a colony or population, i.e. causing temporary avoidance of a commuting route used by a small percentage of bats occupying a roost. However, there may be effects at the population level, e.g. reduced juvenile growth rates due to reduced foraging or delayed emergence caused by lighting (e.g. see Boldogh *et al.* 2007).

[1] refers to the colour appearance of the light emitted by a light source and is measured in degrees Kelvin (K). The CCT of a light source is calculated by relating the colour of the lamp to the light colour of a reference source when heated to a particular temperature. CCT gives a general measure of the "coolness" or "warmth" of the light source: CCT ratings below 3200K are considered warm whereas ratings above 4000K are considered cool. CCT gives an indication of the general appearance of the light, but not its spectral power distribution, and so two lamps that appear the same may have different colour rendering properties.

v. Impacts may be indirect occurring at the ecosystem or community level
Lighting can impact bats via changes at the ecosystem level. Lighting may lead to a competitive advantage for some species which benefit from the increased foraging opportunities provided by moths attracted to lights with high UV content. This may lead to competitive exclusion of those species unable to take advantage of new artificially illuminated areas (Arlettaz *et al.* 2000). Indirect effects include effects on bats' insect prey. Bats have a competitive advantage over moths at street lights (Svensson & Rydell 1998), which interferes with the relationship between predator and prey.

A summary of the key impacts per species according to behaviour types is provided in Table 5.1. These are based on current knowledge and may change as more evidence emerges, so are given as guidance only and specific levels of impact will vary on a site by site basis. Low impact does not mean there is no impact, but suggests that impact is likely to have a negligible impact on the population. Further research is required to have high confidence in many of these predictions and therefore they should be used as guidance only.

Table 5.1 Summary of predicted impacts of lighting according to bat behaviour.

Impact / Behaviour	High	Medium	Low
Maternity roost	All species	-	-
Night roost	*Rhinolophus hipposideros* *Rhinolophus ferrumequinum* *Myotis* spp. *Plecotus* spp.	*Pipistrellus* spp. *Nyctalus* spp. *Eptesicus serotinus* *Barbastella barbastellus*	-
Emergence	All species	-	-
Foraging	*Rhinolophus hipposideros* *Rhinolophus ferrumequinum* *Myotis* spp. *Plecotus* spp.	-	*Pipistrellus* spp. *Nyctalus* spp. *Eptesicus serotinus* *Barbastella barbastellus*
Commuting	*Rhinolophus hipposideros* *Rhinolophus ferrumequinum* *Myotis* spp. *Plecotus* spp.	-	*Pipistrellus* spp. *Nyctalus* spp. *Eptesicus serotinus* *Barbastella barbastellus*
Swarming	All species	-	-
Hibernation	All species	-	-

Key messages and recommendations:

Emergence and roosting

- Current evidence demonstrates that external light disturbance at emergence and return will have negative impacts for bats (especially *Rhinolophus*, *Myotis*, and *Plecotus* spp.) and should be avoided.
- Internal illumination of roosts is likely to impact negatively on long-term population growth and survival and should be avoided for all species.
- Direct illumination of a roost exit/entrance may cause roost abandonment for all species (particularly for *Rhinolophus* and *Myotis* spp.) and should be avoided.

Commuting

- Light disturbance along commuting routes will cause avoidance behaviour for *R. hipposideros* and *Myotis* spp. and should be avoided.

Foraging

- Light disturbance can reduce the availability of foraging areas for some species.
- A precautionary approach must be taken and illumination of foraging areas avoided, particularly for light sensitive species.

Hibernation

- There is limited evidence of the impact of lighting on hibernating bats. However illumination of hibernation sites should be avoided during the hibernation period.

Swarming

- There is a lack of evidence regarding the impact of lighting on bat swarming behaviour and so illumination of known or potential swarming sites should be avoided under the precautionary principle.

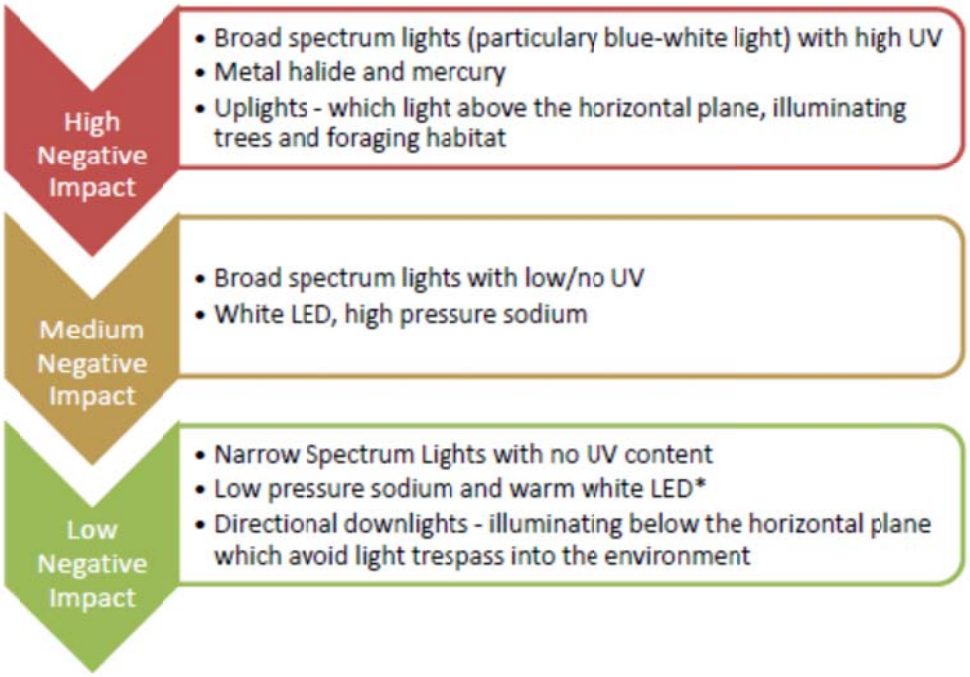
Summary of impacts of light types on bats

Light technology is rapidly developing and new light types are being installed and trialled across the UK. There is a general trend towards white light due to the increased colour rendering and increased perceived brightness for the human eye. Humans perceive white light as brighter than yellow light and so lower light intensities can be used to achieve the same perceived brightness. Commonly used emerging lamps include white LED (Philips Stela and DW Windsor Monaro), warm-white LED, and ceramic metal halide (e.g. Philips 5. CosmoPolis). Some companies are testing new light types to find a wildlife friendly lamp which has little or no impact on wildlife e.g. QL Philips Clearsky lamps which are said to prevent migrating birds from colliding with offshore platforms. To date no such product has been rigorously tested on bats. However, there is little evidence of the comparative impacts of different light types on different bat species and behaviours.

The figures overleaf provides a general summary of the **relative** impacts of light types on bats. However, there is a lack of evidence regarding the comparative impacts of different light types on bats and these summaries should be considered general rules of thumb until more detailed information is available.

Summary of the current evidence of the relative impacts of different light types on bats

Light type	Species	Impact	Evidence
White LED	*Rhinolophus hipposideros* and *Myotis* spp.	Reduced activity and spatial avoidance of commuting routes	Stone *et al.*, 2012
Warm white LED	Unknown at present	Unknown - though likely to have less impact on light sensitive species than white light types	
Low pressure sodium	*Nyctalus noctula*	Increased activity and foraging	Rydell & Baagoe 1996
	Pipistrellus spp.	No significant increase in activity compared to dark areas	Blake *et al.*, 1994
High pressure sodium	*Rhinolophus hipposideros and Myotis* spp.	Reduced activity and spatial avoidance of commuting routes; delayed commuting time	Stone *et al.*, 2009; 2011
	Pipistrellus spp., *Nyctalus noctula, Eptesicus serotinus*	Increased activity and foraging	Rydell & Baagoe 1996
Compact fluorescent	Unknown at present	Unknown - though likely to have a similar impact on light sensitive species as other white light types	
Mercury vapor lamps	*P. pipistrellus and Pipistrellus* spp. *Eptesicus* spp.	Increased activity (Rydell (1991) recorded increased activity of *Eptescius nilssoni* (a species not present in the UK) at mercury vapor lamps in Sweden in spring April – May)	Haffner & Stutz 1985; Blake *et al.* 1994, Rydell & Racey 1995.

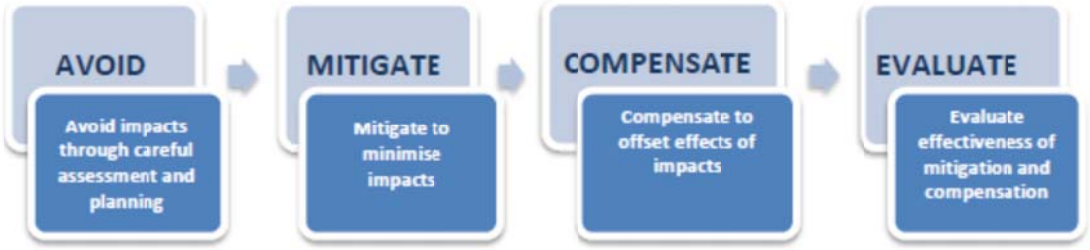


Approach to mitigation of artificial lighting

When mitigating the impacts of artificial lighting on bats it is important to ask the following key questions:

1. Do we need to light?
2. Where does the light need to be?
3. What is the light required for?
4. How much light is actually needed to perform the tasks required ?
5. When is the light required?

The following approach should be taken when developing a mitigation strategy:



Mitigation Strategies
Mitigation strategies will vary on a site by site basis according to the required level of lighting, use of the area, the surrounding habitat, the species of bat and specific behaviour affected.

No light
Where possible the ideal scenario would be to have no light at all at locations used by bats. This may be possible with good planning and involvement of lighting engineers at the survey and pre-planning stage. This may involve switching off existing units on site and ensuring areas used by bats have no new light units installed and will have no light trespass from nearby lights. If possible sites should contain light exclusion zones (dark areas) which are interconnected to allow bats to move freely from their roosts along commuting routes to their foraging grounds without being subject to artificial illumination.

Variable lighting regimes (VLR)
In many cases it is not feasible to have light exclusion zones in all in the areas occupied by bats at a site. In such cases new generation lighting controlled by CMS systems may be preferable to enable variable lighting regimes (VLR) to suit both human and wildlife use of the site. VLR involve switching off or dimming lights for periods of the night. Many county councils are adopting VLR using CMS controlled units, switching off/dimming lights when human activity is low (e.g. 12.30 – 5.30am). This technology could also be used to create a lighting regime that switches off lights during periods of high bat activity, such as commuting or emergence. Lights can also be dimmed (e.g. to 30% power) for periods of the night to reduce illumination and spill. The exact regime of lighting at a site will depend on the nature of public use and type and amount of bat activity, and will therefore vary between sites.

Habitat creation

- **Light barriers**: vegetation can be planted (e.g. hedgerows or trees) to reduce light spill so acts as a light barrier. Careful consideration should be given to the minimum size of the habitat required to restrict any light trespass when used as a light barrier. The size and depth of the corridor will vary according to the distance from the light source, light intensity, light spread and light type.
- **Dark corridors**: dark corridors can be created to encourage/guide bats away from lit areas or around lit obstacles (such as roads). Corridors should be placed with consideration for the use of the landscape as a whole in relation to key commuting routes, linking foraging sites and roosts. Corridors can be composed of man-made or natural materials (e.g. fences, brick walls, tree lines or hedges). Corridors with outgrown vegetation are preferable as they create dark fly ways sheltered from predators and the elements. Heavily clipped low hedges or tree-lines are less suitable. To increase their effectiveness dark corridors should be:

i. Well-connected within the bat landscape – linking to existing flight paths, roosts or foraging areas;
ii. Outgrown with mature vegetation providing shelter for bats from the weather and predators as they fly;
iii. Planted with native species to encourage insect populations, thereby allowing bats to forage along the corridors;
iv. Located away from roads to avoid traffic noise which will reduce the foraging efficiency of passive listening bats (Schaub 2008); and
v. Monitored/maintained long-term to ensure they remain functional, e.g. have not been removed or altered in a way that will reduce effectiveness.

Spacing and height of units

Increasing the spacing between light units can reduce the intensity and spread of the light to minimise the area illuminated and give bats an opportunity to fly in relatively dark areas between lights. Reducing the height of light units will keep the light as close to the ground as possible, reducing the volume of illuminated space. This will also give bats a chance to fly over the light units in the dark area above the light (as long as the light does not spill above the vertical plane). There are many low level lighting options for pedestrian and cycle path lighting which minimise spill and reduce overall illumination including: low level illuminated bollards, down-lights, handrail lighting or footpath lighting.

Reducing intensity

Reducing light intensity will reduce the overall amount and spread of illumination. For some bat and insect species this may be sufficient to minimise disturbance or the magnitude of any negative impacts. However, some species may require very low light levels to have little/no impact on bat behaviour. Stone *et al*., (2012) found that levels as low as 3.6lux caused spatial avoidance of a preferred commuting route by *Rhinolophus hipposideros.* Average light levels recorded along preferred commuting routes of *Rhinolophus hipposideros* under natural unlit conditions were 0.04 lux across eight sites (Stone 2011). When mitigating the impacts of lighting for such species very low lux levels may not be suitable for human needs. In such cases reducing intensity may not be an option and alternative strategies may be preferable (e.g. dark corridors or light barriers). A "light threshold" below which there is little impact on bats may not exist for some species which may be light averse regardless of intensity (e.g. possibly *Rhinolophus hipposideros*). Light intensity can be reduced by:

- *Dimming*: CMS technology can be used to reduce the power of lights on request (e.g. by 80%) and can be used as part of a VLR for periods of high bat activity;
- *Changing the light source:* new technologies such as ceramic metal halide (e.g. Philips CosmoPolis, 45 watts) often have a lower wattage compared to old lamp types (e.g. HPS, 75 watts), and can be used to reduce light intensity. However, there is a trade-off between reduced intensity and the pattern of light distribution. Some older light types such as HPS, produce a heterogeneous light environment whereby light intensity declines steeply away from the light source. However some new technologies such as LEDs produce a uniform light distribution resulting in a loss of dark refuges between the lamps (Gaston *et al.* 2012). In such cases it may be preferable to increase the spacing between the units to create dark refuges. In addition when changing the light source it is important to consider the effects of the spectral content of the light; or
- *Creating light barriers:* light intensity can be reduced at a particular site by creating a light barrier which restricts the amount of light reaching the sensitive area. Barriers can be in the form of newly planted vegetation walls, fences or buildings.

Changing the light type

When selecting a light type it is important to consider the colour appearance and rendering of the lamps in relation to human and bat vision. Different light types are likely to have different effects on bats, and these effects will be species and behaviour specific. Choosing the light type (colour/spectral distribution) will inevitably be a compromise between the environmental and public requirements. Currently there is a lack of evidence of the comparative impacts of light types on bats. However, the following key principles can reduce potential negative impacts on bats and wildlife in general:

- *Avoid blue-white short wavelength lights*: these have a significant negative impact on the insect prey of bats. Use alternatives such as warm-white (long wavelength) lights as this will reduce the impact on insects and therefore bats
- *Avoid lights with high UV content:* (e.g. metal halide or mercury light sources), or reduce/completely remove the UV content of the light. UV has a high attractiveness to insects leading to direct insect mortality at street lights thereby reducing the availability of insect prey (Bruce-White & Shardlow 2011). Use UV filters or glass housings on lamps which filter out a lot of the UV content.

Reducing spill

Lighting should be directed only where it is needed to avoid trespass (spilling of light beyond the boundary of area being lit). Attention should be paid to avoid the upward spread of light near to and above the horizontal plane to minimise trespass and sky glow. Trespass can be minimised either prior to installation with careful lighting design and selection of appropriate lamp units, or post installation using a range of lamp modifications to restrict and direct light.

Prior to installation:

- Ensure a low beam angle of the lights (ideally less than 70° above the horizontal) (ILP, 2011)
- Install full horizontal cut off units (with no light more than 90° above the horizontal)
- Avoid the use of upward light (e.g. ground recessed luminaires or ground mounted floodlights up-lighting trees, buildings and vegetation)
- For security lighting use 'variable aim' luminaries which allow you to change the beam angle by moving the lamp
- LED lamps allow for directional lighting as individual/groups of LED bulbs can be switched off to direct light to specific angles and most luminaires are full cut off

Post installation:

- Install directional accessories on existing light units to direct light away from sensitive areas and minimise spill (e.g. baffles, hoods and louvres)
- Where possible change the angle of the lamp housing to reduce the angle of the beam below 70°

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Schedule of accommodation

Market Sale

	4no	Hatton	@692sqf
	6no	Pemberton	@727sqf
	6no	Holmewood	@906sqf
	4no	Kirkwood	@930sqf
	8no	Chelmsford	@1241sqf
	8no	Hareford	@1268sqf
	6no	Lindford	@1370sqf

Affordable

	5no	2B4P LCHO	@800sqf
	6no	1B2P Aff Rent	@540sqf
	13no	2B4P Aff Rent	@800sqf
	3no	3B5P Aff Rent	@945sqf
	1no	4B6P Aff Rent	@1140sqf

Key

- Site boundary
- Road
- Footpath
- Paving
- Shared surface
- Rumble Strip
- Parking spaces
- Public open space Approx: 1350sqm
- LAP Approx: 1100sqm
- Bin collection area (plots 8 - 15)
- Existing tree RPA
- Junction - Visibility splay (distance on drawing)
- Forward visibility

Indicative dark corridor (bats) - retained vegn. 3-4m width

Indicative dark corridor (bats) - retained vegn. 3-4m width

Pumping Station

Basin

Sewer Easement

Approx Sewer Position

Sewer Easement

25m x 2.4m

43m x 3m

Existing footpath

Existing driveway

0 5 20
2 10 50m

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NOTES

REVISIONS

REV: DATE - DRAWN - CHECKED: NOTES

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DRAWING TITLE

Proposed Site Plan

PROJECT

Caerleon Road, Dinas Powys

CLIENT

Kier Living

SCALE	1:500@A1 1:1000@A3
DATE	Jan 2017

Quattro designarchitects

DRAWING NO.	**REV**
5567/P/10	**L**

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APPENDIX V EXAMPLE OF INSET KERB AND GULLY POT DESIGN FOR AMPHIBIANS

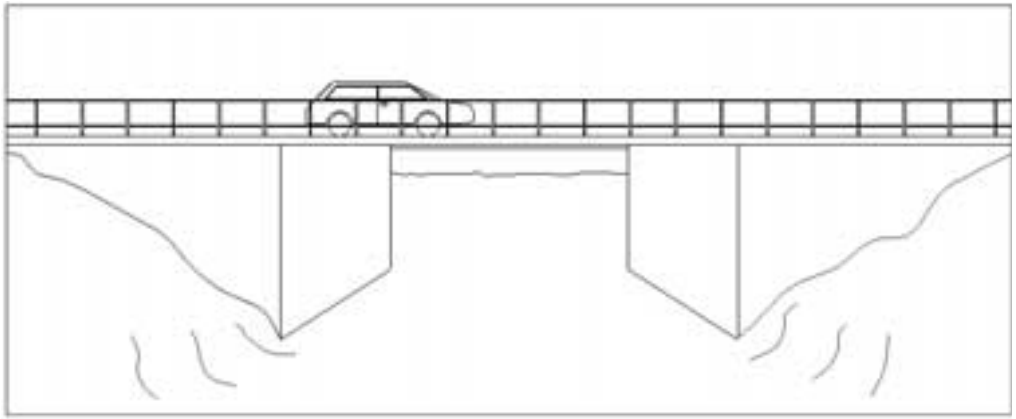

Figure 5 *Underpasses can provide effective links for wildlife*

9.5 KERBS, DRAINS AND GULLY-POTS

Kerbs and road drains, gully pots and buried or sheer sided chambers and pipework, that are designed for fuel, oil or surface liquid interception and storage, may act as a fence and as a trap to amphibians. These features can cause amphibian mortality by trapping them in polluted places where they can suffer from toxic effects, exposure, starvation and drowning. Their use should be avoided in areas where amphibians are present. There are a range of alternative designs available to minimise the impact of kerbs and road drains on amphibians (eg Figure 6). Designs for amphibian tunnels, fences, permeable surfaces and gully pots are continually being developed, and those with appropriate ecological expertise will be able to supply further information.

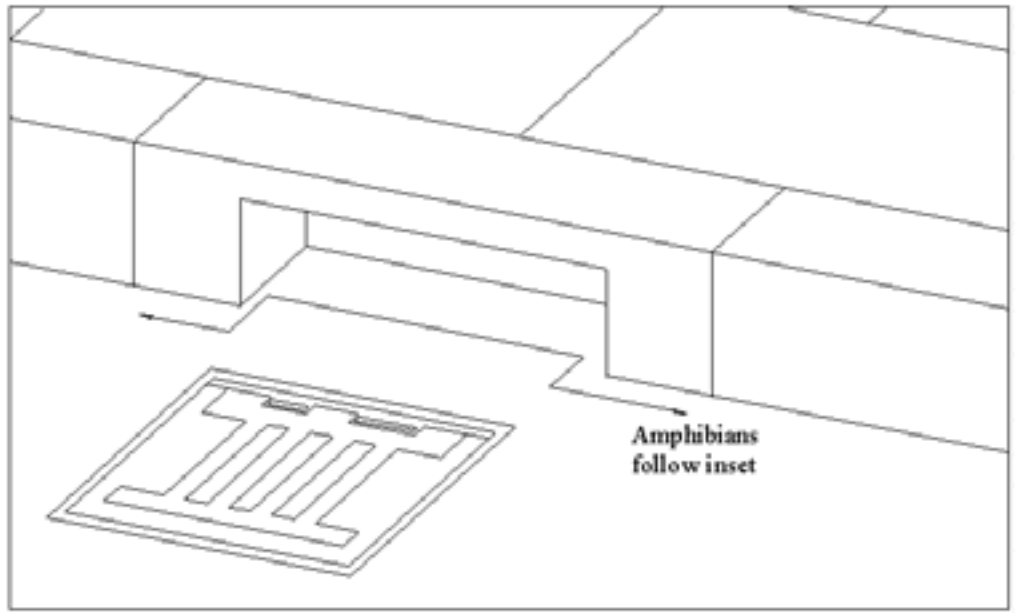

Figure 6 *Inset kerb stones greatly reduce gully pot trapping of amphibians*

9.6 AMPHIBIAN TRANSLOCATION

Where it is not possible to keep amphibians at their original location, or safeguard them by short distance '*in situ*' transfers, it may (as a last resort) be necessary to trap and translocate the entire population to a new site. This is likely to be the case where entire breeding sites or land areas are to be lost and cannot practicably be replaced for technical reasons. Where possible, the receptor site should be within 1km of the original, or at least as close as is practicable. It is vitally important that both receptor and donor site share the same hydrological and ecological conditions as far as possible.

'*In situ*' amphibian transfer and translocation is a time-consuming process, normally requiring a trapping period of several months. Trapping should be carried out both on land (pit-fall trapping) and in water (netting and by draining/hand), and should ideally cover a period of at least one year, or one season as a minimum (March to September). Where great crested newt or natterjack toad are being translocated, the appropriate government licensing authority will be required to license the operation.