FOOTPRINT ECOLOGY

Impacts of urban development at Burnham Beeches SAC and options for mitigation: update of evidence and potential housing growth, 2019.

Durwyn Liley

FOOTPRINT ECOLOGY, FOREST OFFICE, BERE ROAD,
WAREHAM, DORSET BH20 7PA
WWW.FOOTPRINT-ECOLOGY.CO.UK
01929 552444

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Summary

Chiltern District Council and South Bucks District Council are preparing a joint Local Plan to replace the existing Core Strategies and Local Plans for the two districts. This report has been commissioned to provide an update and 'refresh' relating to the impacts of housing growth in the two Districts on Burnham Beeches Special Area of Conservation (SAC), a site internationally important for nature conservation. Local Plans must be accompanied by a Habitat Regulations Assessment, and the screening part of the assessment work has identified recreation as an issue at Burnham Beeches SAC.

Burnham Beeches is (mostly) owned and managed by the City of London Corporation under an Act of Parliament as open access land for informal recreation. To date there has been a range of visitor studies and other work summarising the pressures from local housing. In addition, there has also been several recent changes relating to the management of recreation at Burnham Beeches. This report has been commissioned to bring the various threads together, and to consider the potential changes in recreation from housing growth in the relevant plans.

Impacts (to the SAC interest) from increasing levels of urban development are varied and have long been a concern. These impacts include:

- Contamination (e.g. dog fouling, litter, spread of plant pathogens);
- Increased fire risk;
- Trampling/wear (e.g. loss of vegetation, soil compaction, erosion, damage to trees from climbing);
- Harvesting (e.g. fungi, wood);
- Difficulties in managing the site (e.g. maintaining the grazing regime);
- Disturbance (e.g. affecting the distribution of livestock and deer);
- Fragmentation;
- Hydrological impacts (water availability and flow);
- Air quality.

Growing levels of urban development will increase these impacts and mean increasing challenges to maintain the conservation interest of what is a relatively small, isolated and vulnerable SAC.

Using housing data provided by Chiltern District Council and South Bucks District Council we estimate the potential change in housing as a result of the anticipated growth in the joint Local Plan. We also included estimates of the levels of growth in other surrounding Local Planning Authorities and their relevant plans, namely Slough Borough, Wycombe District Council and the Royal Borough of Windsor and Maidenhead. We combine the housing data with visitor survey data from Burnham Beeches (which included home postcodes of

interviewees) to estimate the potential change in recreation use as a result of new housing. Overall, we estimate an increase of 11% in visitor numbers. This 11% is broken down as follows:

- 2% Development in Chiltern and South Bucks already with planning permission (including those under construction);
- 2% Emerging Chiltern and South Bucks Plan, of which:
  - 1% Local Plan site allocations (greenbelt sites), excluding any development with planning permission;
  - 1% HELAA sites, excluding any development with planning permission;
- 5% Slough Borough;
- 1% Royal Borough of Windsor and Maidenhead.
- 1% Wycombe District.

These estimates are indicative and approximate, providing a guide to the scale of change. They suggest, solely as a result of the development that has yet to be granted planning permission and in the emerging Chiltern and South Bucks Plan, an increase of at least 2% in the numbers of visitors to Burnham Beeches.

We use the postcode data (over 900 visitor postcodes from visitor interviews) to derive a zone of influence within which future increases in housing would be expected to result in increased recreation pressure to Burnham Beeches SAC. Based on the 75th percentile (i.e. the distance within which 75% of visitors originated), we recommend a 5.6km zone around the SAC boundary. This zone represents the core area around the SAC where increases in the number of residential properties will require Habitats Regulations Assessment and mitigation measures will be necessary to rule out adverse effects on the integrity of the SAC from the cumulative impacts of development.

New housing that is directly adjacent to the SAC will pose particular risks and recreational use of Burnham Beeches is particularly high from those who live in close proximity to the SAC. In order to reduce the risks and prevent further urbanisation around the periphery of the SAC we recommend that there should also be a presumption against development around the SAC boundary, within 500m.

We identify a range of measures which will resolve the impacts from the combined growth within the 500m – 5.6km zone and these measures will inform the development of a management and mitigation strategy. The work presented here will also underpin the relevant appropriate assessment work, providing the joint local authorities with the evidence they need to inform policies in the joint Local Plan and ensure legal compliance with the relevant nature conservation legislation.

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1. Introduction

Overview

1.1 Chiltern District Council and South Bucks District Council are preparing a joint Local Plan to replace the existing Core Strategies and Local Plans for the two districts. This report has been commissioned to provide an update and 'refresh' relating to the impacts of housing growth in the two Districts on Burnham Beeches, a site internationally important for nature conservation. The report focusses on the impacts from increased recreation pressure on the site.

1.2 The two local authorities have been working with Natural England and the City of London (who own and manage the majority of the SAC) on a management and mitigation strategy to enable growth without an adverse effect on the integrity on the site. This report is necessary to provide a clearer understanding of the scale of likely change in housing and implications for Burnham Beeches, including options for mitigation and avoidance. This will inform the development of the management and mitigation strategy and also underpin the relevant assessment work, providing the joint local authorities with the evidence they need to inform policies in the joint Local Plan and ensure legal compliance with the relevant nature conservation legislation.

Legislative Context

1.3 European sites have the benefit of the highest level of legislative protection for biodiversity, stemming from European Directives. Public bodies, including local planning authorities, have specific duties in terms of avoiding deterioration of habitats and species for which sites are designated or classified, and stringent tests have to be met before plans and projects can be permitted. Importantly, the combined effects of individual plans or projects must be taken into account. For local planning authorities, this means that the combined effect of individual development proposals needs to be assessed collectively for their cumulative impact.

1.4 The designation, protection and restoration of European wildlife sites is embedded in the Conservation of Habitats and Species Regulations 2017, which are commonly referred to as the 'Habitats Regulations.' These Regulations are in place to transpose European legislation set out within the

Habitats Directive (Council Directive 92/43/EEC), which affords protection to plants, animals and habitats that are rare or vulnerable in a European context, and the Birds Directive (Council Directive 2009/147/EC), which originally came into force in 1979, and which protects rare and vulnerable birds and their habitats. These key pieces of European legislation seek to protect, conserve and restore habitats and species that are of utmost conservation importance and concern across Europe. European sites include Special Areas of Conservation (SACs) designated under the Habitats Directive and Special Protection Areas (SPAs) classified under the Birds Directive. The suite of European sites includes those in the marine environment as well as terrestrial, freshwater and coastal sites.

1.5 The application of the European legislation needs to be made with regard for the way in which the protective requirements should be secured by public bodies. The legislation requires public bodies to be proactive, not reactive. The overarching objective is to maintain sites and their interest features in an ecologically robust and viable state, able to sustain and thrive into the long term, with adequate resilience against natural influences. This requires public bodies to put measures in place to prevent deterioration of European sites, not to wait until there is harm occurring that needs to be rectified. Where European sites are not achieving their potential, the focus of attention by public bodies should be on restoration.

1.6 Public bodies are referred to as 'competent authorities' within the legislation. The duties set out within the Habitats Regulations in relation to the consideration of plans and projects are applicable in situations where the competent authority is undertaking or implementing a plan or project, or authorising others to do so.

1.7 The assessment process for plans or projects is called a Habitats Regulations Assessment ('HRA') and it is the screening part of the HRA for the Chiltern District Council and South Bucks District Council joint Local Plan that has identified the issue of increased recreation pressure on Burnham Beeches. As a consequence, there is a need for avoidance and mitigation measures to be taken forward. The European legislation is founded on the 'precautionary principle', i.e. it is necessary to demonstrate that impacts will not occur, rather than have proof that they will.

Burnham Beeches SAC

1.8 Burnham Beeches SAC is designated for beech/holly woodland[1], the main importance of which is the ancient beech trees and their associated invertebrates and epiphytes. The ancient trees developed in wood pasture, the ground element of which was heathland with wet flushes on nutrient poor acid soils. The SAC covers 384ha in two main ownerships. The southern 220ha (where the ancient trees occur) is also a National Nature Reserve (NNR) and is owned and managed by the City of London Corporation under an Act of Parliament as open access land for informal recreation. The remaining 160ha is in private ownership with access limited to public and permissive paths. Much of this part is coniferous forestry under conversion to broadleaved woodland.

1.9 The location of the SAC in relation to surrounding local authorities is shown in Map 1.

Previous work

1.10 Concerns about the impacts from the levels of recreation growth and the impacts of urban growth have long been raised and there is a body of previous work on Burnham Beeches that has considered the issues. Relevant material, much of which has been commissioned or undertaken by the City of London includes:

- A series of visitor surveys providing counts of visitors and estimates of the annual number of visits and trends in visitor use (e.g. Wheater & Cook 2003, 2012, 2016);
- A hydrological study (Wallingford HydroSolutions Ltd. 2013);
- A visitor survey of Burnham Beeches SAC involving face-face interviews with visitors (Liley, Floyd & Fearnley 2014);
- Two reports considering impacts of urban development at Burnham Beeches (Liley *et al.* 2012; King & Liley 2014);
- A study comparing soil samples in different parts of Burnham Beeches SAC, comparing areas with heavy trampling to areas with less trampling pressure (Fay 2014).
- A further visitor survey involving face-face interviews and recording routes of visitors using GPS units (Panter & Liley 2016);

[1] For full details of the site interest see the citation and conservation objectives (including supplementary advice) on the Natural England website

- A visitor survey to inform the potential introduction of Public Space Protection Orders relating to dogs (Liley & Panter 2017);
- Tree health monitoring and other ecological data collected by Corporation of London.

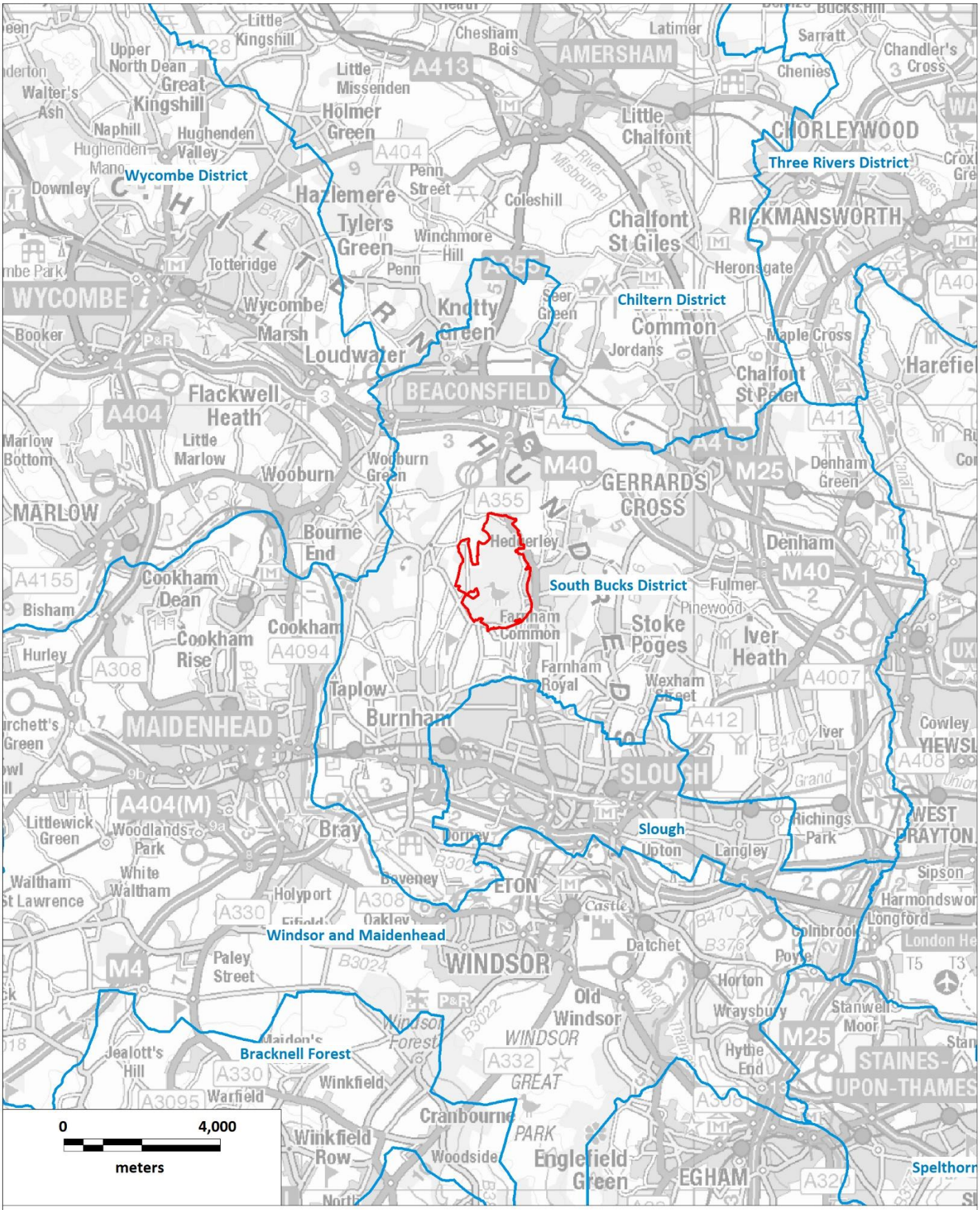
1.11 Some of these studies are now slightly dated, and while there are summaries of urban impacts (Liley *et al.* 2012; King & Liley 2014), these do not represent the current best available evidence. Changes in how access is managed at Burnham Beeches, with the introduction of Public Space Protection Orders (PSPOs) relating to dogs, has changed access patterns and visitor use since the summary of evidence produced in 2014.

Aim of this report

1.12 As such a 'refresh' of the evidence is required, bringing together information from existing studies and new data on visitor numbers and then placing this into context with housing completions and anticipated housing growth. The refresh will inform an emerging mitigation approach and provides information on:

- Plan growth around Burnham Beeches, based on the emerging spatial strategy;
- Consideration of the effects of other relevant Local Plans in combination with the Chiltern and South Bucks joint Local Plan;
- The relative success of management measures already in place, including the introduction of Public Space Protection Orders (PSPOs);
- Identification of, and justification for, the zone of influence within which development is likely to have a negative impact on the SAC and would therefore require mitigation;
- Recommendations on the appropriateness of an exclusion zone, within which the impacts of development would be so significant that effective mitigation would be unlikely to be achievable, and justification for its extent;
- Recommendations for appropriate and defendable management and mitigation measures for the SAC.

Map 1: Overview and location of Burnham Beeches SAC



2. Impact of urban growth on Burnham Beeches SAC

2.1 Impacts of urban growth include issues associated with increased recreational use of Burnham Beeches from local residents, along with issues relating to the built environment around the site, such as loss of supporting habitats, contamination, changes in water availability etc.

2.2 A summary of potential impacts is provided in Table 1. This provides context for the later parts of this report. A detailed review of impacts is beyond the scope of this report; series of general reviews provide much more detailed information and further context (see Underhill-Day 2005; Corney *et al.* 2008; Ryan 2012; Liley, Read & Barnard 2016; Saunders *et al.* 2019) and there are also a range of studies specific to Burnham Beeches (Barnard 2003; Read 2011; Liley *et al.* 2012; Wallingford HydroSolutions Ltd. 2013; King & Liley 2014; Moffat 2019).

Table 1: Summary of potential nature conservation impacts (to the SAC interest) linked to increased levels of surrounding development at Burnham Beeches. Impacts drawn from a range of studies and work at Burnham Beeches (see accompanying text for references).

Type of impact	Examples
Contamination	Dog fouling (nutrient enrichment from faeces and urine)
	Litter
	Fly-tipping
	Spread of disease (e.g. plant pathogens)
	Spread of non-native species (can be both unintentional and deliberate)
	Pollution from run-off (surrounding roads and hard surfaces)
Fire	Increased fire incidence linked to increased recreation use (BBQs, camp fires etc.)
Trampling/wear	Soil compaction from high levels of footfall
	Loss of vegetation cover
	Erosion
	Direct damage to veteran trees from climbing
Harvesting	Collection of wood for firewood
	Collection of fungi
Difficulties in management	Challenges in maintaining grazing regime with high levels of access and dogs
	Public pressure for more facilities, path surfacing, cafes, events, different management etc.
	Management of veteran trees potentially made more challenging due to need for more regular checks and need to ensure public safety
Disturbance	Distribution of deer and grazing livestock within site affected
Fragmentation	Loss of supporting habitats
	Isolation (lack of connectivity with other woodland or semi-natural habitat)
Hydrology	Changes in water availability and flow linked to increased hard surfacing in surroundings
Air quality	Changes in air quality (e.g. from local traffic increases)

2.3 Some examples of these impacts are illustrated in Figure 3, which includes a selection of images from Burnham Beeches and some other sites.

2.4 It is important to note that the above impacts can potentially interact and may also work in synergy. While individually some of the impacts may potentially be minor, or relatively rare (e.g. damage from fires), taken together the impacts are substantial and a wide range of studies clearly show that the conservation importance of woodlands in urban compared to more rural settings is compromised (e.g. Sadler *et al.* 2006; Vergnes *et al.* 2014; Lintott *et al.* 2014; Rayner *et al.* 2015; Sanz & Caula 2015; Fornal-Pieniak, Ollik & Schwerk 2019). For Burnham Beeches specifically, the site improvement plan produced by Natural England for the SAC[2] lists air quality, public access/disturbance, habitat fragmentation, deer species decline and invasive species as the prioritised issues for the site: all factors potentially linked to urban growth. Furthermore, dog fouling and trampling pressure from footfall are both cited as issues in the detailed supplementary conservation advice[3] produced by Natural England.

2.5 These various impacts are more complex when considered in the wider context of the issues facing Burnham Beeches. For example, climate change will result in more stormy weather, increased risk of droughts and greater risk/incidence of wildfires. These will all add to the issues facing the trees, increasing stress and potentially interacting with recreation and urban pressure to exacerbate the problems.

2.6 Many of the impacts set out above are linked to recreation use. Recreation use is therefore important to consider in depth and is a focus of subsequent sections of the report. It is however important to note that some of the urban impacts are not related to recreation, and management of recreation pressure/visitor numbers will not necessarily address all the issues identified. We have also included air quality in the list above, however it should be noted that air quality issues are likely to be linked to a range of factors, not least traffic use on the motorways and nearby Heathrow airport. This is a critical issue for Burnham Beeches and is being considered by the Chiltern and South Bucks Councils through other studies/modelling work. As such air quality is outside the scope of this report.

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[2] See the relevant page on the Natural England website

[3] Which can be downloaded from the Natural England website

Figure 1: Illustrations of impact. a) Veteran trees at Burnham Beeches draw adults and children alike; b) veteran at Burnham Beeches where bark mulch has been used to protect the roots and minimise soil compaction; c) an earlier picture of the same tree as in b: note the loss of bark and damage around base of tree; d) example from Dorset of tree in area with high dog walking use, note the loss of lichens around base from urine spray; e) example of heavy trampling exposing roots and resulting in vegetation loss, from Epping Forest SAC; f) vandalism to beech trunk at Burnham Beeches.

Updates on current condition and recent monitoring

SSSI condition

2.7 There are four units within Burnham Beeches SSSI and the condition monitoring information for these varies from 2006-2010[4]. Three units were recorded as favourable and one as favourable recovering. The commentary notes the good quality management in place and measures in place to manage public access and control potential damaging impacts due to trampling and dog walking.

Number of tree pollards

2.8 Old pollards are logged on a database and these trees are checked at regular intervals[5]. These trees are part of the key interest at Burnham Beeches. In 1990 there were 540 trees that were tagged and counted and in subsequent years and a further 37 old pollards have been found on the site. In 2018 the total number of these 577 trees still alive was 377, indicating a decline in old trees over time. Estimates from before the formal monitoring began suggest there were around 1300 old pollards in 1956 and over 2000 in the late 1800s. Targeted very careful management for each tree has resulted in a reduced mortality rate in recent years, however the figures still suggest a mortality level of around 0.13% of trees per annum (2007-2018).

2.9 A report by Moffat (2019) is a significant piece of additional evidence since the previous reviews of urban effects at Burnham Beeches. Moffat's review, commissioned by the City of London Corporation considered the possible influence of climate change, atmospheric pollution, visitor pressure and existing management on the future condition of the Beech *Fagus sylvatica* trees at Burnham Beeches. Moffat acknowledges the possibility of localised soil compaction where woody vegetation has been cleared and where footfall was high. Climate change projections indicate that the climate will be less suitable for Beech, adding to the stresses on the site and its trees.

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[4] SSSI condition from Natural England website, SSSI site detail page. Viewed April 2019.
[5] Monitoring data presented in this paragraph has been provided by Helen Reid for the City of London Corporation.

3. Housing change around the SAC

Change in recent years

3.1 In 2018 there were around:

- 1317 dwellings within 500m of the SAC;
- 13,760 within 2500m:
- 59,148 within 5km; and
- and 184,893 dwellings within 10km.

3.2 These data are extracted from postcode data held by Footprint Ecology giving the number of residential properties per postcode.

3.3 Housing change data for the period 2003-2018 are shown in Figure 2, with each graph showing a different extent out from the SAC (i.e. 0-500m, 0-2500m, 0-5000m and 0-10,000m). These distance bands (buffers) are shown in Map 2. It should be noted that the data from 2003 (the earliest year of data held by Footprint Ecology) are of a lower resolution (postcode centres mapped to the nearest 100m), whereas that from 2013 onwards are directly comparable.

3.4 The plots are at different scales and on none of them does the y axis go to zero, allowing the difference between years to be seen. It is clear from the plots that there has been a marked increase in housing in the area surrounding Burnham Beeches over the past 15 years or so. It can be seen that it is within 500m of the SAC that the scale of change (2013-2018) has been most marked, with an overall change of 6% (76 additional properties) over a five-year period. Housing directly adjacent to the European site boundary is likely to have a greater effect on the SAC due to the close proximity.

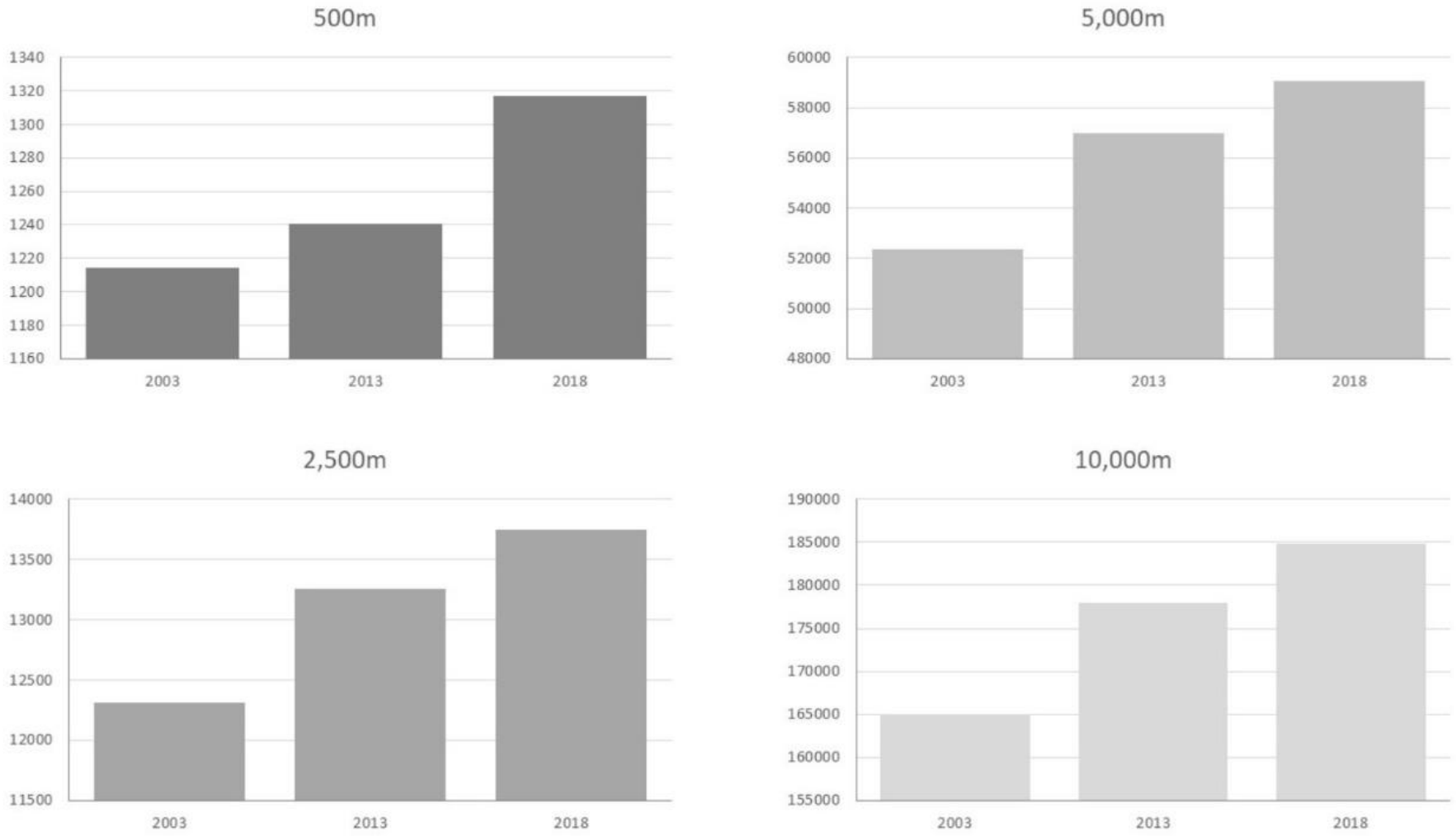
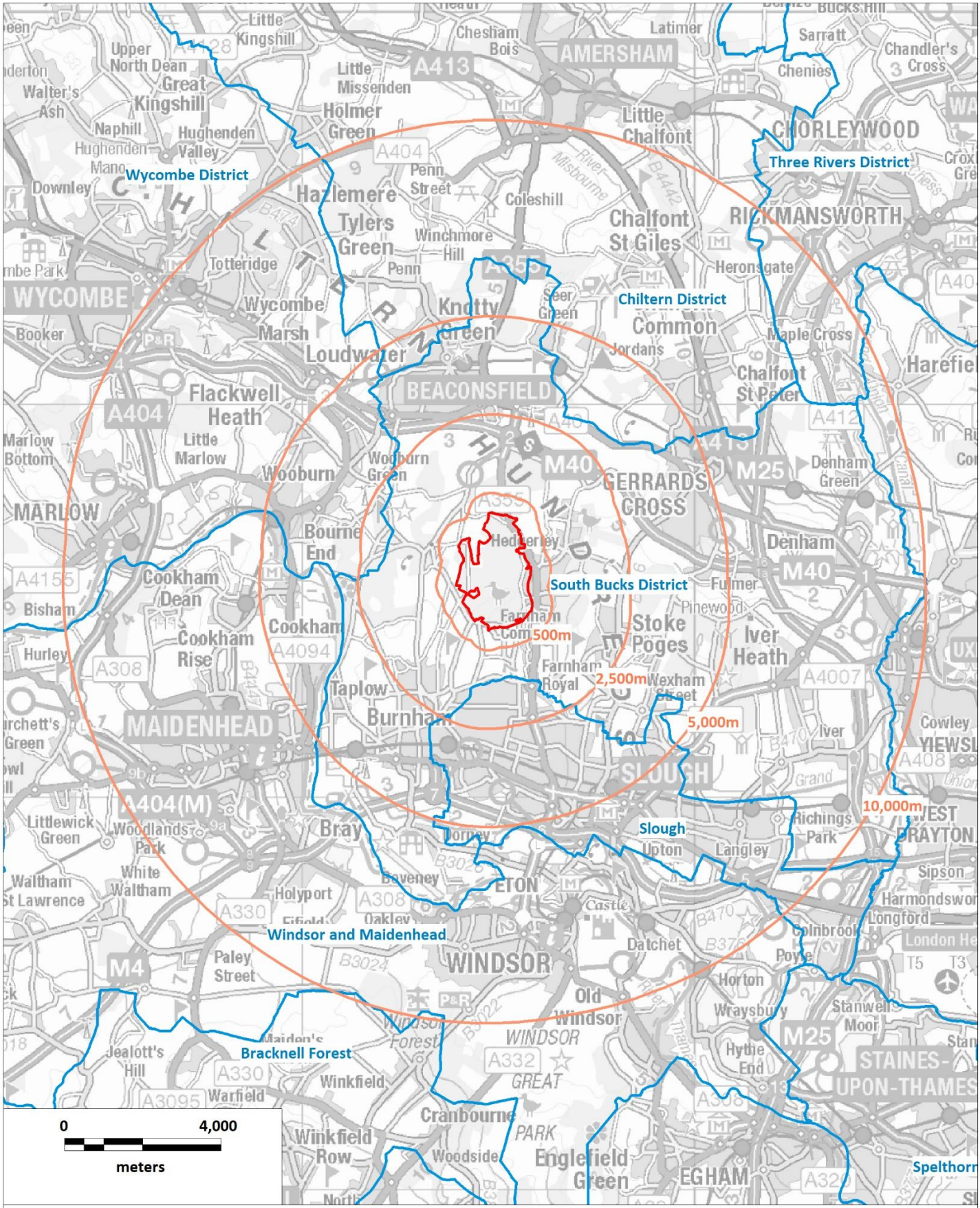
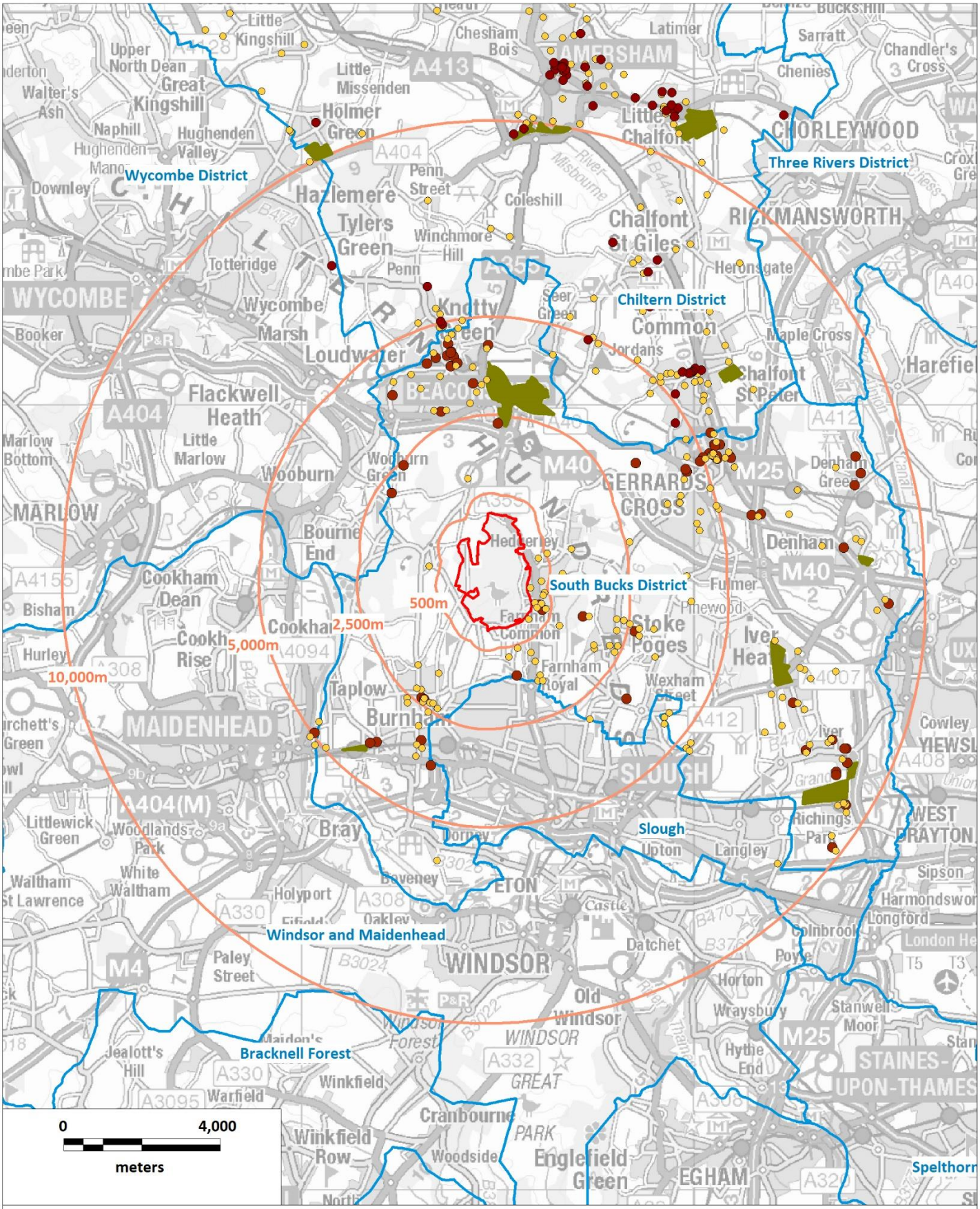


Figure 2: Housing change 2003-2018 for different distances away from the SAC (0-500m, 0-2500m, 0-5000m and 0-10,000m). Data from postcode data held by Footprint Ecology giving the number of residential properties per postcode.

Map 2: Selected distance bands around Burnham Beeches SAC



Map 3: Potential future development (Chiltern & South Bucks)



Anticipated growth

Chiltern and South Bucks

3.5 Housing data for 2018 are summarised above. Future growth will add new housing and it is important to understand where this might come forward in relation to the SAC. Chiltern and South Bucks Council provided GIS data relating to potential future housing: separate GIS files were provided to indicate:

- Dwellings with planning permission (not yet started/under construction);
- Local Plan site allocations (green belt sites); and
- HELAA sites (i.e. sites from the Housing and Land Availability Assessment).

3.6 We checked for any overlap between the different layers and removed any sites from the HELAA layer or Local Plan site allocations (green belt) layer that were also in the planning application layer[6]. Map 3 shows the various GIS layers and therefore summarises future development (including that with planning permission) within Chiltern and South Bucks. The same data are also shown in Figure 3, which shows potential new development levels around the Burnham Beeches SAC, based on 500m distance bands.

3.7 Some of the HELAA and Local Plan site allocations (green belt sites) were large polygons and would potentially deliver relatively large numbers of houses. Where these were spread over multiple bands, we simply assumed an even distribution of housing across the whole area.

3.8 The dark green bars and the orange bars indicate the scale of change relating to the emerging Chiltern and South Bucks Plan and relate to sites that have not yet been granted planning permission.

[6] Note that this means, for example, that there were sites in the HELAA layer and that already had planning permission that were therefore excluded from the HELAA totals and appear on Map 3 as yellow dots rather than red ones.

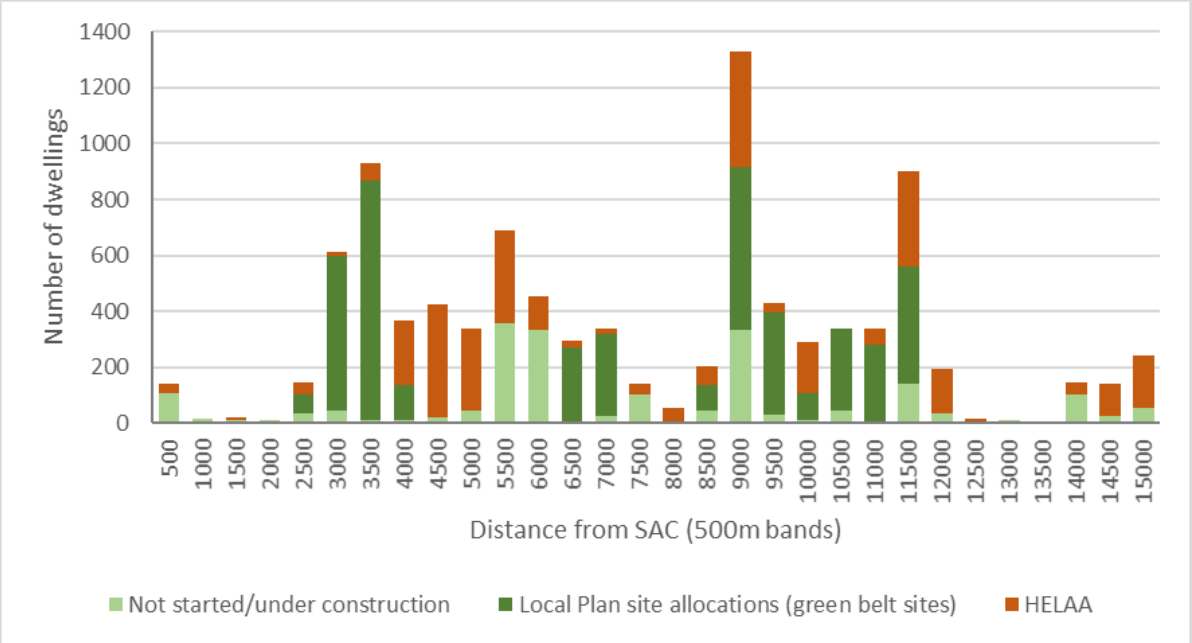


Figure 3: Summary of total numbers of dwellings that may come forward in the future, based on site allocations (green belt sites) and HELAA provided by Chiltern District and South Bucks District Councils and also showing housing currently with planning permission but not yet started or currently under construction.

3.9 It is important to recognise that the sites in Map 3 reflect sites in the emerging plan and are not finalised. As such the locations and totals may change, however their use allows us to estimate an approximate likely level of change in housing levels associated with the new plan. These totals are summarised in Table 2. It is notable that within 500m of the SAC, although there are no site allocations (green belt sites), there is a relatively high proportion of dwellings that have been granted planning permission but have not yet been started or are currently under construction, indicating (with the HELAA sites) an in-combination increase in housing of 11% within 500m.

Table 2: Summary of numbers (%) of current housing (2018) and additional housing from recent planning applications (approved and either not started or under construction) and potential future housing on site allocations (green belt sites). Percentages reflect the change from 2018.

Distance	2018	Not started/under construction	Greenbelt sites	HELAA sites	Total growth
0-500m	1317	108 (8)	0 (0)	32 (2)	**140 (11)**
0-2500m	13,760	184 (1)	70 (1)	84 (1)	**338 (2)**
0-5000m	59,148	321 (1)	1600 (3)	1087 (2)	**3008 (5)**
0-10,000m	184,893	1574 (1)	3697 (2)	2362 (1)	**7233 (4)**

Other local authorities

3.10 Burnham Beeches SAC is in close proximity to a range of other local authorities, besides South Bucks District and Chiltern District. It is therefore important to consider the in-combination effects of development in these other authorities. Of particular relevance are Slough, Windsor and Maidenhead and Wycombe. These authorities are at different stages in their local plans, and potential levels of growth are summarised in Table 3.

Table 3: Summary of plans and possible levels of growth for other local authorities in proximity to Burnham Beeches SAC.

LPA	Status	Plan timing	Annual growth	Total dwellings over plan period	Total dwellings post 2018	Source
Slough	Emerging	2013-2036	912-927[1]	20,000	15,652[2]	Report to planning committee, 1/11/2017;
Windsor & Maidenhead	Submitted 2018	2013-2033	420-850	14,240	11,420[3]	Submission version
Wycombe	Submitted 2018	2013-2033	550	10,925	9,900[4]	Publication version

[1] See para 5.36 in linked report to planning committee
[2] Calculated as (20,000/23)*18; i.e. 20,000 dwellings over 23 years with 18 years of plan remaining
[3] from table 4 in submission version of plan
[4] Annual growth of 550 multiplied by 18, the remaining years

3.11 In order to make very broad predictions of in-combination change around Burnham Beeches SAC, we drew on the figures in Table 3 for Slough, Windsor & Maidenhead and Wycombe. No attempt was made to accurately map all allocations or key sites. Instead we spread the levels of development across the relevant 500m distance bands around the SAC.

3.12 Given the emerging status of Slough's plan, it is difficult to anticipate growth scenarios. We therefore simply spread the 15,652 dwellings evenly across the local authority area. For Windsor and Maidenhead, the submission version of the plan sets out allocations totalling around 8,286 dwellings, mostly focussed on Maidenhead[7]. These allocations include 5125 dwellings in or around Maidenhead (i.e. around 6-9km from Burnham Beeches SAC) and around a further 1000 dwellings in the vicinity of Windsor (including west of Windsor and Datchet). These would fall around 7-8km from

[7] See Policy HO1.

Burnham Beeches SAC. For Wycombe, we drew on Figure 6 (housing distribution) of the Wycombe submitted local plan which sets out around 800 dwellings at Bourne End and Wooburn (i.e. 3-4500m from the SAC); 6350 dwellings in the Wycombe area (7-11km from the SAC) and 350 dwellings around Marlow (8.5-9km from the SAC).

3.13 The resulting potential housing growth around Burnham Beeches is shown in Figure 4.

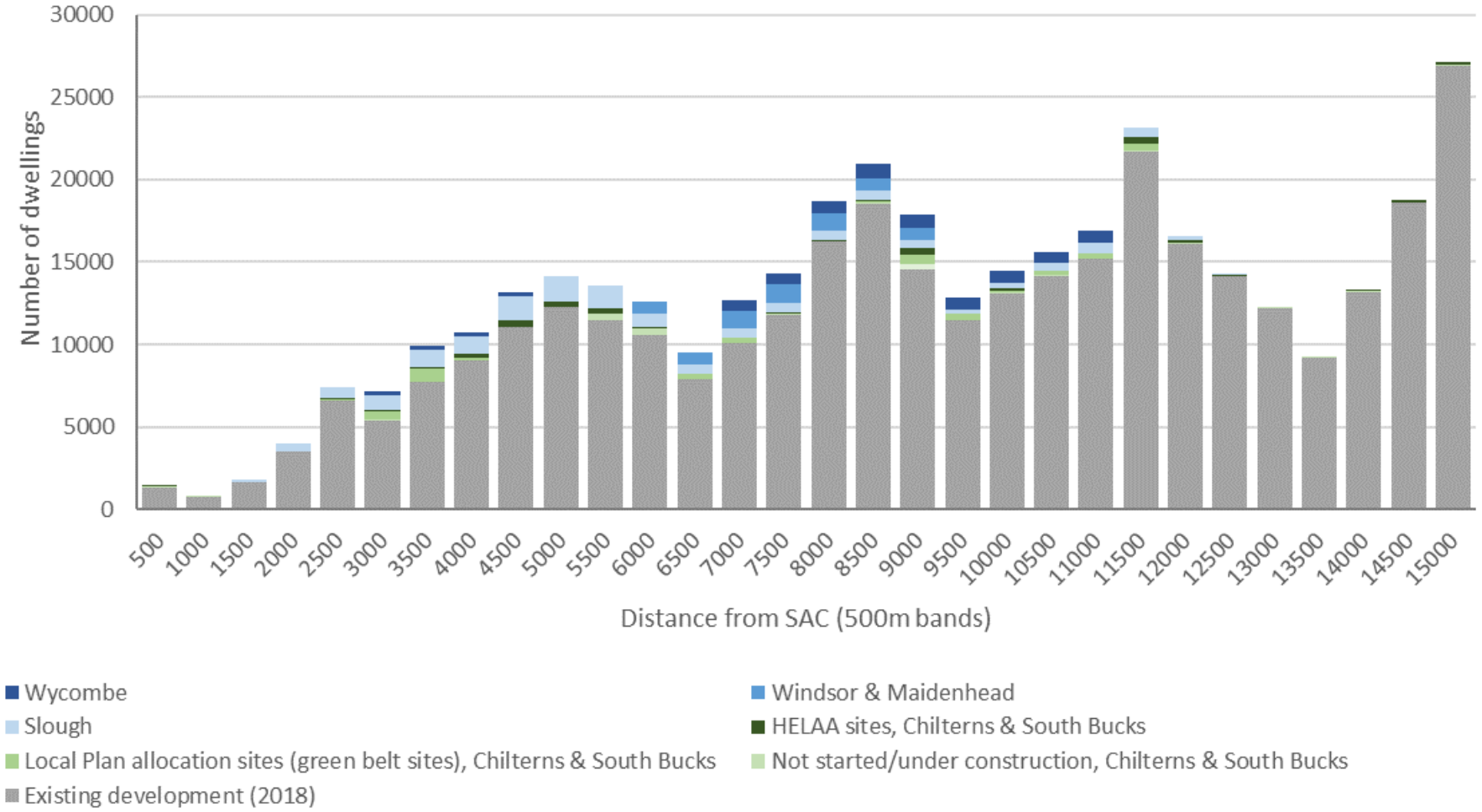


Figure 4: Approximate levels of future growth around Burnham Beeches SAC. Grey shading represents current levels of development with the bright colours reflecting anticipated growth in relevant local authorities (see accompanying text for details as to how estimated). The dark green and pale green data from Chiltern and South Bucks is the same as shown in Figure 3.

Predictions of future changes in visitor numbers

3.14 Using the data on housing numbers summarised in the previous sections it is possible to use visitor survey data to make predictions about future changes in visitor use.

3.15 Visitor postcode data are shown in Maps 4 and 5. These data are drawn from three separate surveys undertaken by Footprint Ecology:

- The 2013 visitor survey of Burnham Beeches SAC involving face-face interviews with visitors (Liley, Floyd & Fearnley 2014);
- A further visitor survey involving face-face interviews and recording routes of visitors using GPS units (Panter & Liley 2016);
- A visitor survey to inform the potential introduction of Public Space Protection Orders relating to dogs (Liley & Panter 2017).

3.16 Each of these three surveys involved slightly different survey points, times of year and involved different questions, however they all generated postcodes from a sample of visitors using the site. Together these three surveys provide a total of 906 visitor postcodes. In Map 4, the majority of interviewee postcodes are shown (10 visitor postcodes lie outside the area shown). Map 5 shows the same data, however zoomed into the area around Burnham Beeches SAC (the outer orange line showing 10km radius around the SAC). There is a concentration of visitor postcodes directly around the SAC and in the closer distance bands.

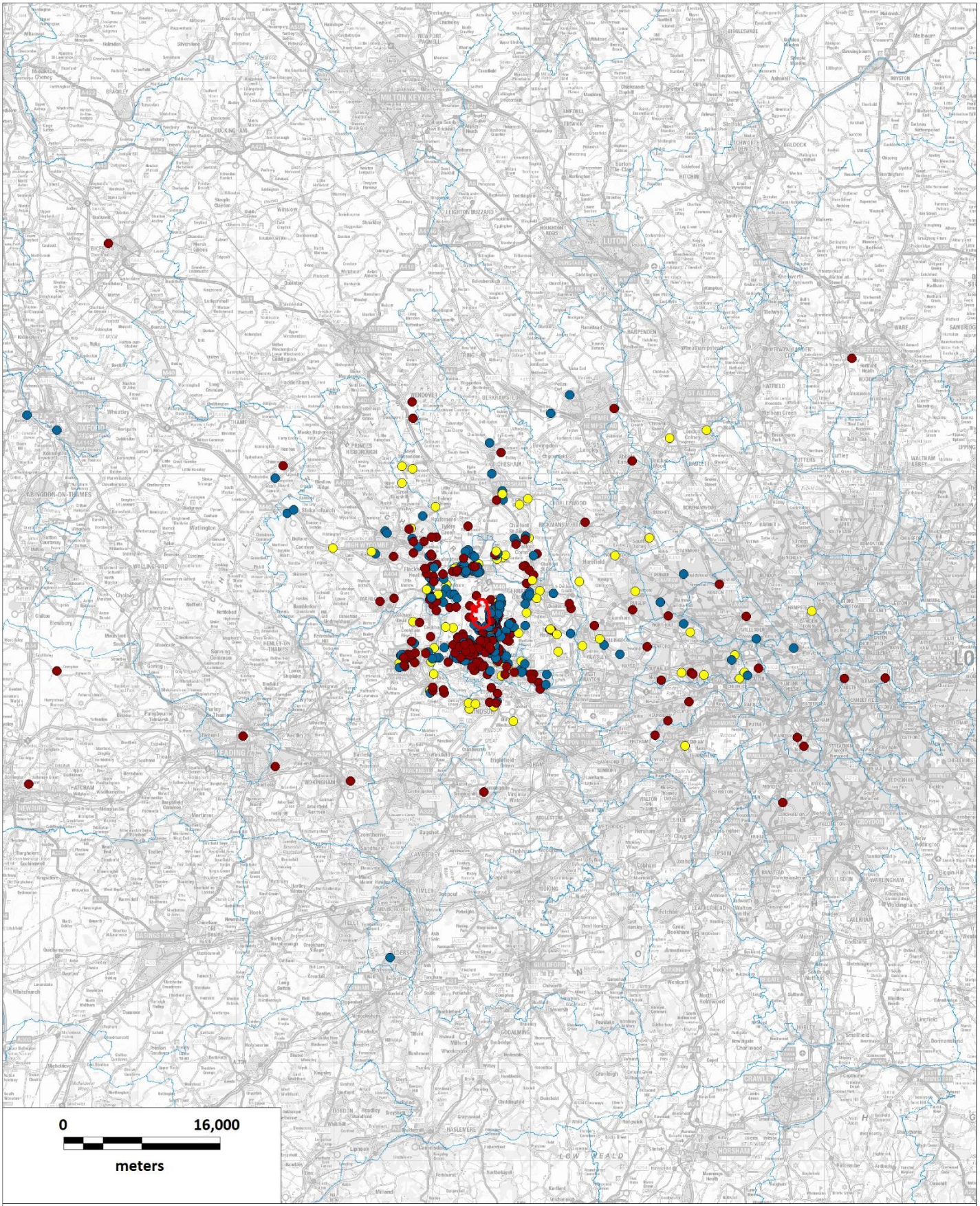
3.17 Pooled, these data show interviewees lived between 50m and 377km of the SAC (distances measures as the distance to the nearest main access car-park[8]). The median distance was 2293m. The medians did differ significantly between the three surveys (2013 survey median = 2546, 2016 survey=2397 and 2017 survey= 2045, Kruskal-Wallis $H=14.20$, $p<0.001$), indicating that people interviewed in the 2013 had travelled significantly further and those from 2017 significantly less. These differences may relate to changes in housing, changes in the patterns of use or different interview locations, times of year or other methodological differences.

3.18 The data are plotted in Figure 5 (frequency distribution) and Figure 6 (cumulative frequency). Figure 5 shows the percentage of interviewees that originated from each distance band and demonstrates the high proportion

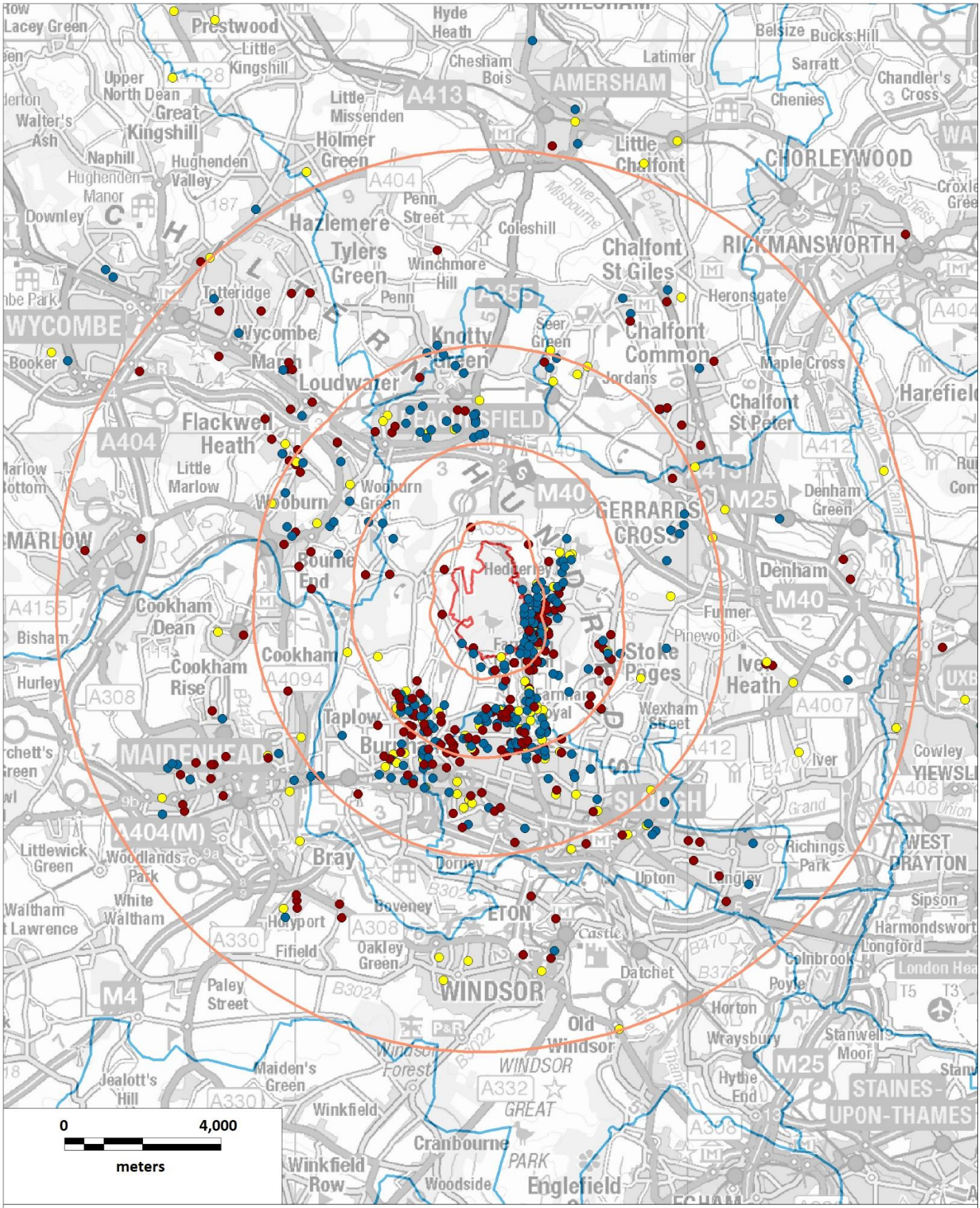
[8] For simplicity we used the Moat, the Stag, the Dell and the main car-park and took the distance from the home postcode to the nearest of these car-parks.

of local visitors – 26% living within 1km of the SAC. Figure 6 shows the same data, but cumulatively, enabling a check of the percentage of visitors that originate from within a certain radius.

Map 4: Visitor postcodes from different visitor surveys (all Footprint Ecology)



Map 5: Visitor postcodes from different visitor surveys (all Footprint Ecology)



Burnham Beeches SAC

Local authority boundaries

SAC buffers (500m, 2.5km, 5km and 10km)

Visitor postcodes

- 2013 visitor survey (327)
- 2016 GPS routes survey (223)
- 2017 PSPO survey (356)

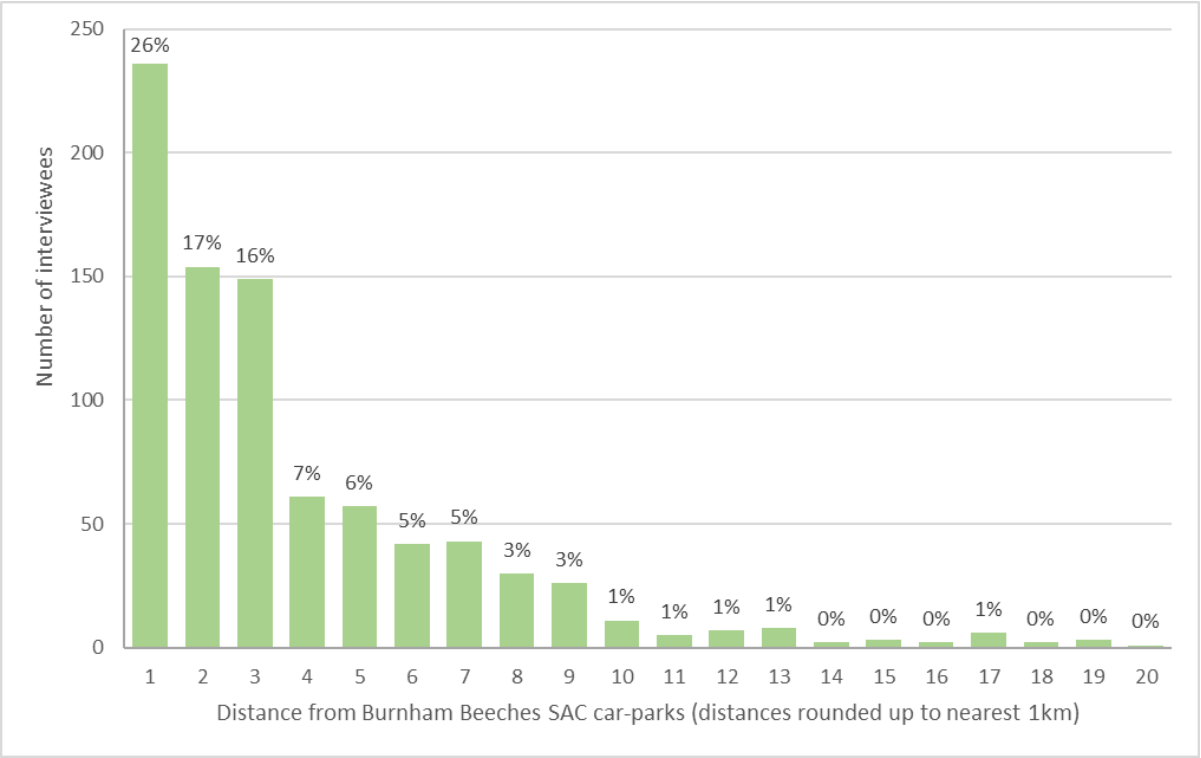


Figure 5: Frequency distribution showing number of interviewees and distance to nearest car-park. Data in 1km bands. Data for all 906 interviewee postcodes.

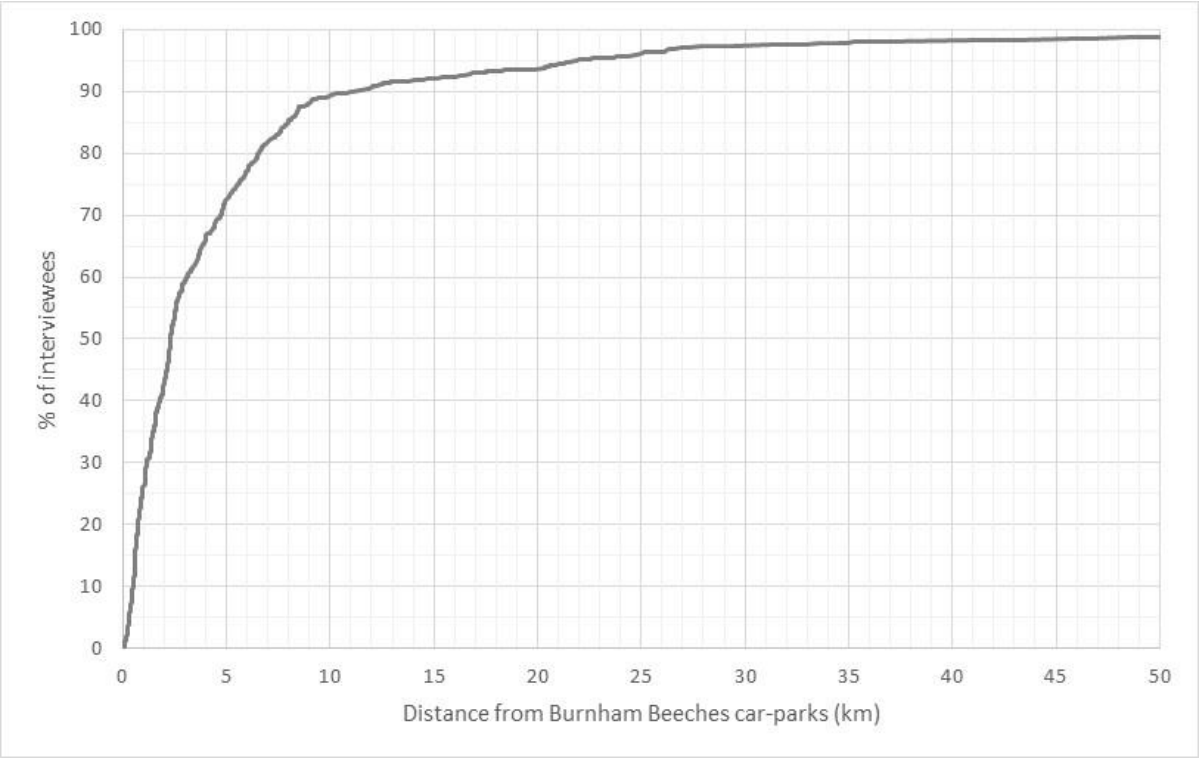


Figure 6: Cumulative percentage plot showing percentage of interviewees from different distances from the main Burnham Beeches car-park. Data for all 906 interviewee postcodes.

3.19 These data show that a high percentage of visitors originate from the closer distance bands, and as the housing data show (e.g. Figure 4), there is relatively little housing at the nearer distance bands (e.g. within 2km) as these bands are smaller in area and do not encompass any of the larger settlements.

3.20 The closer people live to Burnham Beeches, the more likely they are to visit, and this relationship is summarised in Figure 7. As distance increases away from the SAC, in successive distance bands, the proportion of residents visiting will be less and less. The plot in Figure 7 shows the number of interviewees per residential property, which is high close to the SAC and tails off with distance. The data for the 2013, 2016 and 2017 surveys are shown as separate points and the line has been fitted by eye to and shows the shape of the decay curve.

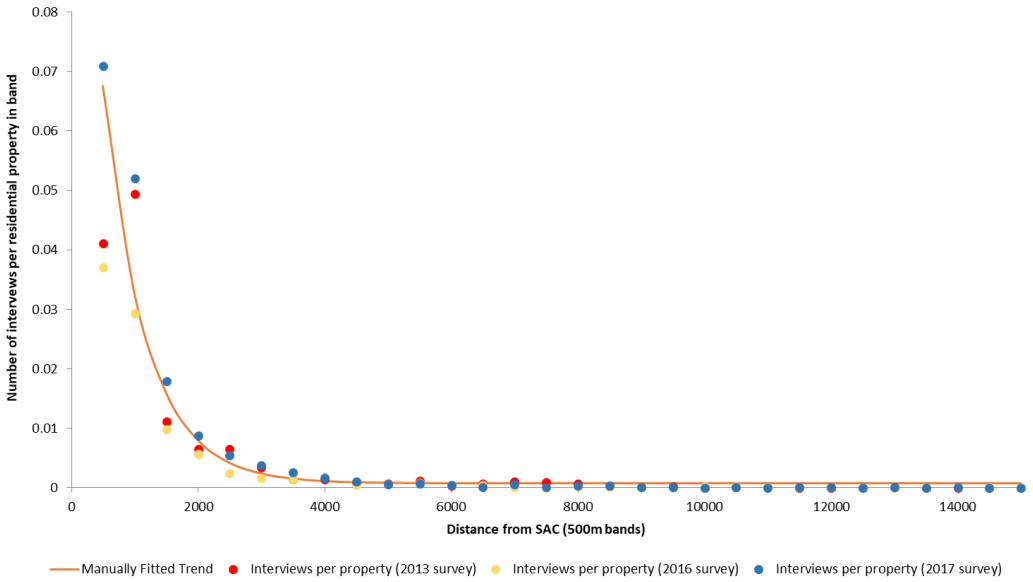


Figure 7: Number of interviewees per residential property. Data shown for the three surveys separately and the line fitted by eye based on the r^2 value (i.e. how well the line fits the data). Y=0.14-1.48x +0.008. r2=0.80

3.21 Using the fitted line in Figure 7 it is possible to predict the effect of different housing scenarios. The estimate of the number of annual visits to Burnham Beeches in 2015/16 was 551,400 (Wheater & Cook 2016). We estimate the uplift in visits that would be expected (using the fitted line equation in Figure 7) under different scenarios as follows:

1. Current (we assume 551,400 visitors and use the 2018 housing figures)

2. Current plus additional housing with permission but not started/under construction (Chiltern and South Bucks)
3. As 2) but also with the addition of Local Plan allocation sites (green belt) and HELAA sites in Chiltern and South Bucks
4. As 3), but with the addition of other local authorities (Slough, Windsor and Wycombe).

3.22 The predictions are summarised in Table 4. It can be seen that development in Chiltern and South Bucks is predicted to result in an increase in visitors of 4% compared to current, with 2% of the increase attributed to HELAA sites and Local Plan allocation sites (green belt sites), i.e. the emerging Local Plan. If we assume 551,400 visitors as the current level, then a 4% change is potentially a further 23,315 visits per annum.

3.23 Looking wider to gain an in-combination perspective of the growth in Chiltern and South Bucks alongside Slough, Windsor & Maidenhead and Wycombe then the overall increase in annual visits is predicted to be 11%. This 11% increase is in the absence of any mitigation, and assumes that new development at a given distance will generate a set number of visits, i.e. not taking into account any site specific variation (such as on-site greenspace).

Table 4: Summary of predicted increases in visit rate as a result of additional growth around Burnham Beeches.

	Annual visitors	Increase in visits compared to current	% change compared to current
1) Current	551,400		
2) Current plus additional housing with permission but not started or under construction (Chiltern and South Bucks)	562,612	11,212	2
3) As 1) but also with the addition of greenbelt and HELAA sites in Chiltern and South Bucks	574,715	23,315	4
4) As 3), but with the addition of other local authorities (Slough, Windsor & Maidenhead and Wycombe).	614,311	62,911	11

3.24 This predicted in-combination level of increase of 11% is summarised in Figure 8, which shows the relative contribution from each authority. It can be seen that around half the overall increase in visits predicted is linked to development in Slough. Development in the emerging Chiltern and South

Bucks Local Plan (i.e. HELAA and Greenbelt sites, not including any development apparently with existing permission or being built) is predicated to result in a change of 2%.

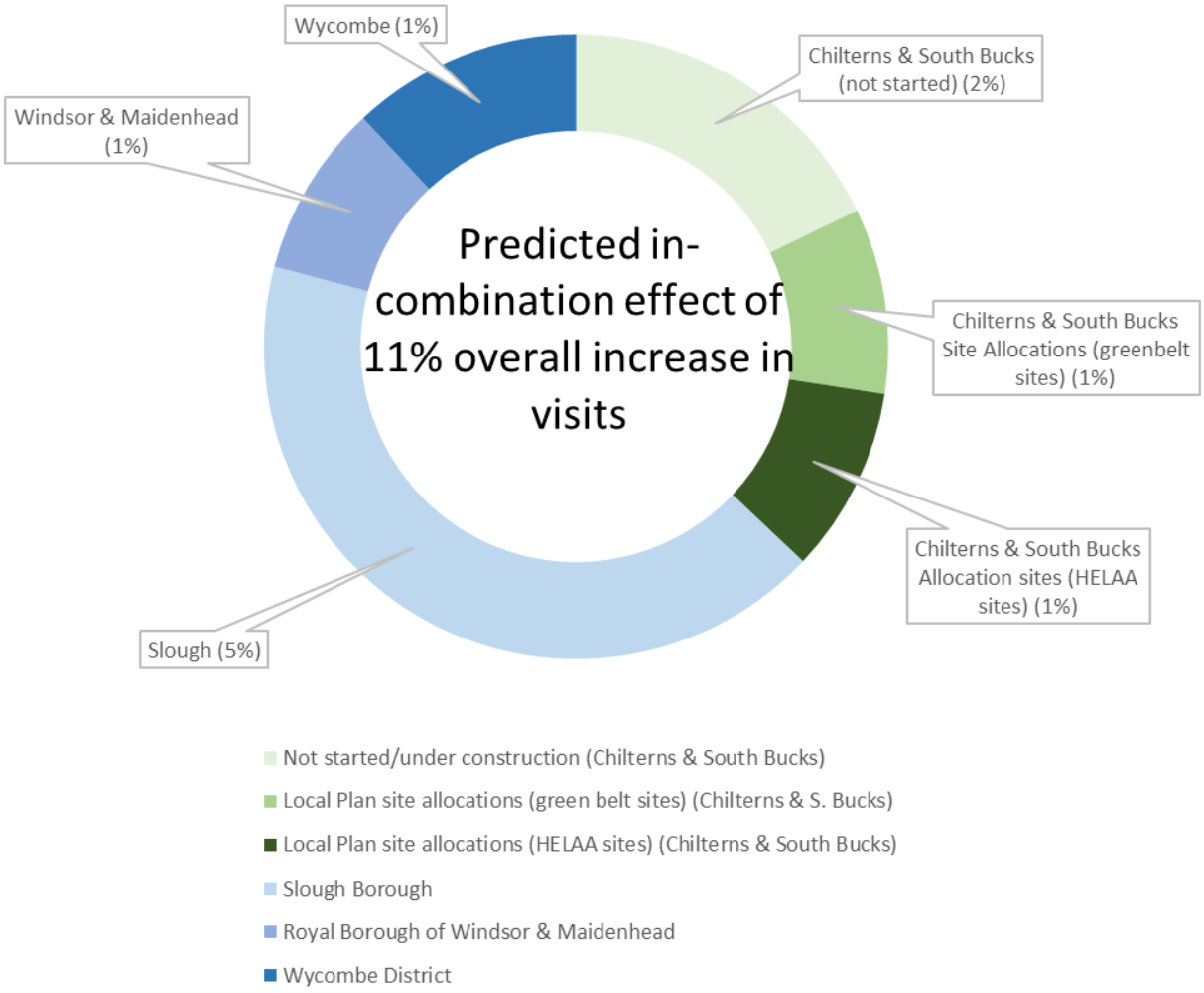


Figure 8: Breakdown of the predicted 11% increase in annual visits, by local authority. The percentages in boxes around the outside of the graphic together give an 11% increase..

Limitations with the predictions

3.25 We have predicted the in-combination effects of development across a number of different local authorities and estimate a 11% increase in annual visits. This figure is a guide, an approximate estimate only and intended to inform the necessary mitigation and avoidance required. We have apportioned additional growth to different distance bands around the SAC and used GIS data provided by Chiltern and South Bucks District Councils. We have drawn on a number of different GIS data files for the Chiltern and

South Bucks Districts and tried to capture a coherent snapshot of how future housing might change. We have not made any assumptions of growth outside the greenbelt/HELAA sites, i.e. any housing that comes forward away from these sites is not factored into our predictions. For the other local authorities, we have been more approximate, simply taking figures from the relevant local plans and estimating how this growth relates to our distance bands around Burnham Beeches.

3.26 It should also be noted (as described above) that our predictions do not take into account any mitigation measures, such as additional greenspace that might accompany specific developments.

4. Visitor origins and a potential zone of influence

4.1 Visitor data from three different visitor surveys (undertaken by Footprint Ecology in 2013, 2016 and 2017) are shown in Maps 4 and 5. In total these surveys generated 906 interviewee postcodes. In this section of the report we consider what geographic area would comprise a zone of influence for Burnham Beeches SAC, i.e. where future development will have an impact on visitor use of Burnham Beeches.

Outer zone boundary

4.2 As previous analyses show, much of the visits originate from the area relatively close to Burnham Beeches and with increasing distance away from the SAC visit rates decrease. Such a pattern is typical and to be expected. People who live nearby will visit more than those further away. The challenge with such data is that there is no single cut-off point beyond which no-one visits. The pooled postcode data includes visitors who lived in Devon and one from Northumberland, indicating that a small proportion will have travelled some distance. In order to identify the outer boundary of any zone of influence it is necessary to be able to identify spatially the area within which visitors originate and where further housing will generate additional recreation. Any zone of influence clearly needs to exclude outlying postcodes, such as the one from Northumberland.

4.3 The 75th percentile (i.e. the distance within which 75% of interviewees lived) from the interview data provides a good measure of a potential overall zone of influence and this has been used widely at other sites to define a zone of influence within which additional development will be likely result in increased levels of access. The 75th percentile has been used at heathland sites (such as Cannock Chase SAC, the Dorset Heaths and the Thames Basin Heaths SPA), coastal sites (such as the Solent) and at woodland SAC sites such as Epping Forest SAC. While these sites differ in recreation use and habitat, the overall principle is sound - the use of the 75th percentile means the area within which the majority of visitors live can be identified.

4.4 It can be seen from Figure 5 and Figure 6 that the 75th percentile falls between 5 and 6km; the actual value is 5.6km. In Map 6 we show this as a single band around the SAC, using a uniform buffer of 5.6km.

4.5 In Map 6 we also show a convex hull enclosing the 75% of postcodes that are closest to the SAC car-parks. A convex hull is not necessarily an even buffer; it is created by the GIS as a polygon that encloses all the selected points and can be envisaged as equivalent to a rubber band stretched around the points. As such, the convex hull consists of a minimal set of nodes with all the relevant postcodes on or inside the polygon. The convex hull is shown as a dark red line on Map 6. The convex hull is a broadly similar shape to the even buffer and lies inside the 5.6km buffer as the latter is drawn around the SAC boundary. Both approaches broadly enclose an area from Beaconsfield in the north to the M4 in the south and from the M25 in the east to the edge of Maidenhead in the west.

4.6 In order to define the outer zone of any zone of influence, the even buffer is the best approach. The convex hull is a useful check, but the shape of the convex hull is defined very much by the individual postcodes and as such is more likely to fluctuate slightly over time depending on the postcode data collected. The 5.6km buffer around the SAC provides a more robust, simpler and easier to define approach. It is the approach used at other European sites, subject to detailed scrutiny and has been adopted in a wide range of plans and mitigation strategies (see Burley 2007 for background).

4.7 The 5.6km distance also fits well with other sites where a zone of influence has been established, for example 5km is used for the Dorset Heaths and the Thames Basin Heaths, 5.6km is used on the Solent and 6.2km for Epping Forest.

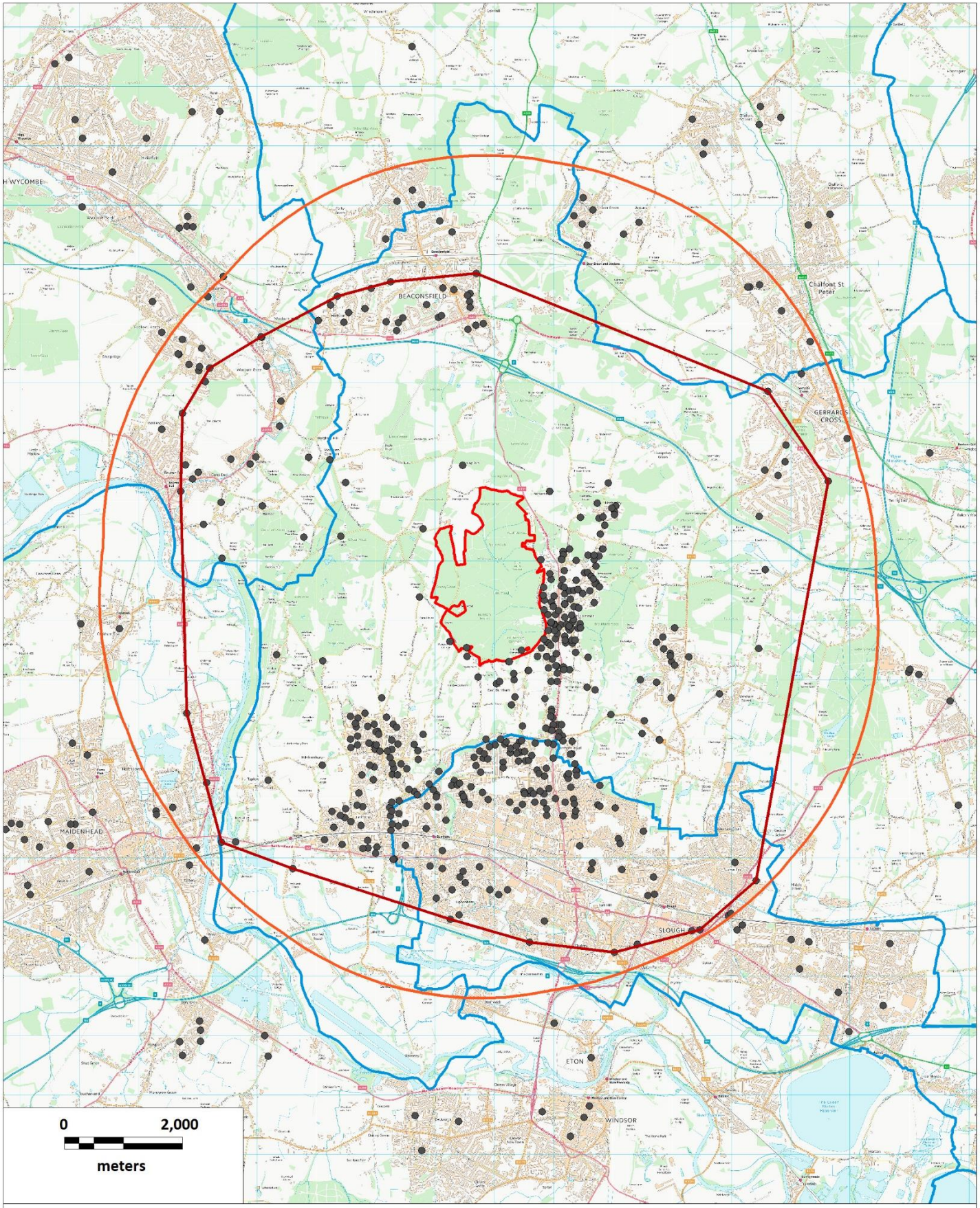
4.8 In paragraph 3.22 we predicted that development in Chiltern and South Bucks would result in an increase in visitors of 4% compared to current. Looking solely within the 5.6km zone, the increase is around 3.3%, i.e. the majority of access. Given development outside the zone will still generate some additional recreation pressure, large developments beyond the zone of influence may still require mitigation.

4.9 The overall effect of development (in terms of recreational use) at different distances from the SAC (drawing on the curve shown in Figure 7) are summarised in Table 5. This highlights that at 0.5km a single dwelling would generate a similar number of visits to 8 dwellings at 2km from the SAC and that by 5.6km the equivalent value is 81 dwellings. At a distance of 6km from the SAC a development of 82 dwellings would be expected to generate a similar level of access as a single dwelling at 0.5km.

Table 5: Equivalent numbers of dwellings that would generate similar levels of access to the SAC

Distance from SAC boundary	0.5km	2km	4km	5.6km	6km	10km
Equivalent numbers of dwellings	1	8	57	81	82	84

Map 6: 5.6km buffer around SAC and convex hull



Burnham Beeches SAC

5.6km buffer around SAC boundary

Local authority boundaries

Convex hull enclosing the closest 75Region of the postcodes

Pooled visitor postcode data

Development close to the SAC boundary

4.11 A development exclusion zone has been established around many other European sites to reflect the particular risks with development directly adjacent to the boundary. Local plans and strategic mitigation schemes include a presumption against development within these areas and such zones have become an established policy approach.

4.12 Examples of areas where a zone is in place include:

- Across the Thames Basin Heaths (11 local planning authorities)
- Around the Dorset Heaths (five local planning authorities)
- In the Brecks (e.g. Breckland District)
- Around the East Devon Pebblebed Heaths (East Devon District Council)
- Around Cannock Chase SAC (e.g. Cannock Chase Council Local Plan)
- At Ashdown Forest SPA/SAC (e.g. Wealden District's Core Strategy Local Plan)

4.13 All the above examples are heathland sites and a 400m zone is used. For heathland sites the issues relate to recreation, increased cat predation, fire risk and other urban effects. The approach is widely accepted and reduces the risks from increasing urbanisation. It provides greater certainty that mitigation measures (such as access management) for the cumulative levels of urban growth will be successful as such measures can be targeted to those travelling some distance.

4.14 The appropriateness of such a zone was considered in detail at the Thames Basin Heaths Technical Sessions, carried out to assist the examination of the South-East Plan (see Burley 2007 for detail and discussion), and found to be a robust approach. In Dorset, a critical review of the 400m zone (Riley et al. 2016), found no substantive argument to fundamentally depart from its use.

4.15 The general principle is that development in the areas directly adjacent to the European site boundary pose a higher risk due to the proximity. Recreation use is much higher and local residents are able to walk from their house directly onto the European site. People accessing on foot from nearby housing can do so through numerous small paths and as such can by-pass the main entry points. As such they are not likely to pass rangers, interpretation, dog bins etc; instead they can simply use the easiest route available. Desire lines and informal routes can form, away from the main paths. Opportunities to intercept/engage with very local visitors or deflect them to other locations are much reduced compared to those travelling by

car to main car-parks. People living very close to the site will use the space as their de facto greenspace and are likely to use it in a very different way to those who make a choice to visit and travel some distance.

4.16 Urban impacts such as dumping of garden waste and increased fire incidence (e.g. Kirby & Tantram 1999) are likely to relate to housing in close proximity and are harder to address because the impacts can occur spread over a wide front, rather than around main car-parks (which is where those travelling to the site by car are most likely to have barbeques etc.).

Table 6: Potential nature conservation impacts from nearby development (see Table 1) and discussion of how development close to SAC boundary will exacerbate risks to the SAC. Grey shaded rows highlight impacts where there is uncertainty that development close to the SAC boundary might have a disproportionate impact.

Type of impact	Examples	Issues related to development close to SAC boundary
Contamination	Dog fouling	Dogs accessing site from multiple access points instead of car-park. Fouling therefore along range of different paths. Harder to ensure dog bins etc in correct locations.
	Litter	Risk of littering as an issue more widely on site, due to local users using multiple access points and small paths and not passing bins.
	Fly-tipping	Garden rubbish etc potentially likely to be dumped within short radius of where people live.
	Spread of disease	Visitor flow more spread around site and through multiple access points, possibly increasing risk.
	Spread of non-native species	Greater risk of garden escapes, deliberate planting etc. from people living nearby.
	Pollution from run-off	Only relates to roads directly around and through site – clearly linked to local housing.
Fire	Increased fire incidence linked to increased recreation use (BBQs, camp fires etc.)	Evidence shows greater fire incidence where more housing nearby. Greater likelihood of informal barbeques, kids playing etc. directly close to housing.
Trampling/ wear	Soil compaction from high levels of footfall	Housing close to SAC will generate more recreational use than housing further away and therefore more footfall.
	Loss of vegetation cover	Housing close to SAC will generate more recreational use than housing further away and therefore more footfall.
	Erosion	Housing close to SAC will generate more recreational use than housing further away and therefore more footfall.
	Direct damage to veteran trees from climbing	Local children more likely to play on-site and visit without parents; access levels higher and more dispersed – with more trees at risk.
Harvesting	Collection of wood for firewood	Greater risk from very local housing as ability to carry wood more easily (e.g. by wheel barrow) and avoid rangers.
	Collection of fungi	Uncertain whether greater risk from local housing, risk may relate to levels of access?

Type of impact	Examples	Issues related to development close to SAC boundary
Difficulties in management	Challenges in maintaining grazing regime with high levels of access and dogs	Visitors from local housing more likely to treat site as nearest greenspace and therefore different types of access. Access more spread and potentially wider range of times of day.
	Public pressure for more facilities, path surfacing, cafes, events, different management etc.	Uncertain whether greater risk from local housing, risk may relate to levels of access? Pressure for better path surfacing etc. perhaps more likely to be linked to local regular users?
	Management of veteran trees potentially made more challenging due to need for more regular checks and need to ensure public safety	Visitor flow more spread around site and through multiple access points, increasing risk/issues.
Disturbance	Distribution of deer and grazing livestock within site affected	Visitor flow more spread around site and through multiple access points, increasing risk/issues.
Fragmentation	Loss of supporting habitats	Development adjacent to the SAC much more likely to result in loss of land with links to SAC.
	Isolation (lack of connectivity with other woodland or semi-natural habitat)	Development adjacent to the SAC much more likely to result in loss of land with links to SAC.
Hydrology	Changes in water availability and flow linked to increased hard surfacing in surroundings	Only applies to nearby development.
Air quality	Changes in air quality (e.g. from local traffic increases)	Will relate to roads around periphery and through SAC, use of which will be linked to local housing.

4.17 The visitor survey data shows that residents living very close to Burnham Beeches SAC are very much more likely to visit. From Figure 7, it is clear that visitors living within 500m are much more likely to visit the SAC and (based on Figure 7): one house within 500m of the SAC would be expected to generate a similar number of visits to 57 dwellings at 4km (see Table 5). Development directly adjacent to Burnham Beeches SAC therefore poses a very particular risk.

4.18 In Figure 9 below, we show the visitor survey data and show how visitor rates decline with distance. This is a similar plot to Figure 7, however this time we have used 100m bands around the SAC out to 1000m and only used the postcode data from those people who walked or cycled to reach the SAC. At this spatial resolution it is important to recognise that there are some challenges with the data, as postcodes are treated as point data from a specific location, yet can cover multiple dwellings, for example along a street.

Using bands of 100m is approaching too fine a scale to be confident that a visitor originated in a particular band, but the pattern is useful to see. The plot suggests a decline in visitor rates out to 300m, beyond which the pattern is less clear. There is clearly a much higher visit rate (visitors on foot and bicycle) from the first 200m around the SAC.

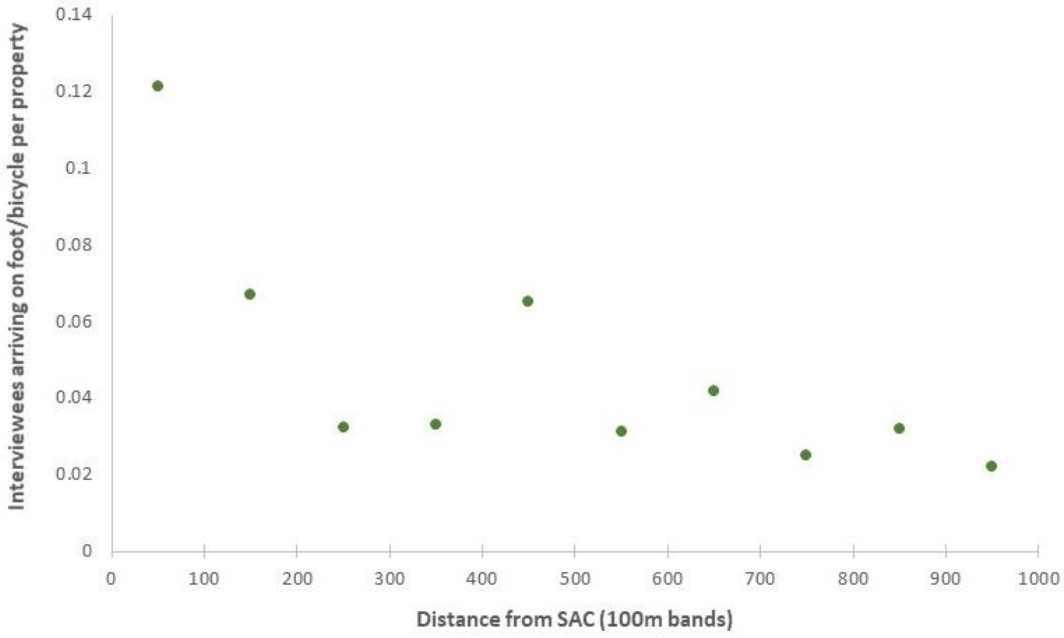


Figure 9: Number of interviewees per residential property, visitor postcodes from pooled Footprint Ecology data, where mode of transport was recorded.

4.19 The area in close proximity to Burnham Beeches SAC is shown in Map 7, which illustrates the first 500m around the SAC boundary, with the orange shading representing 100m bands out to 500m. It can be seen that it is Farnham Common, Farnham Park and East Burnham that are of particular concern and relevance, as nearby urban areas. Visitor postcodes are also shown, with the shading reflecting the mode of transport of interviewees (i.e. the data used to generate Figure 9). The GPS routes survey from 2016 did not ask about mode of transport so that information is not available for all postcodes shown. It can be seen that the shaded orange bands do reflect the area from which people walk from their homes. It can also be seen that yellow dots (i.e. car-born visitors) are starting to predominate around the 400-500m band.

4.20 In line with a wide range of other European sites, which provide context and case examples, we recommend a zone should be established around the SAC within which there would be a presumption against development. It is

difficult to identify a definitive cut-off point, however taking a precautionary approach and based on Map 7, 500m would seem an appropriate choice. This reflects the zone within which many residents clearly walk to the site. As a further check, in Map 8 we show the same visitor data (as in Map 7), this time just those people who had travelled to the site on foot and with the shading of the dots reflecting the frequency of visit. The darker red shading reflects those visitors who are visiting most frequently on foot. In order to capture these frequent foot visitors, 500m would seem appropriate.

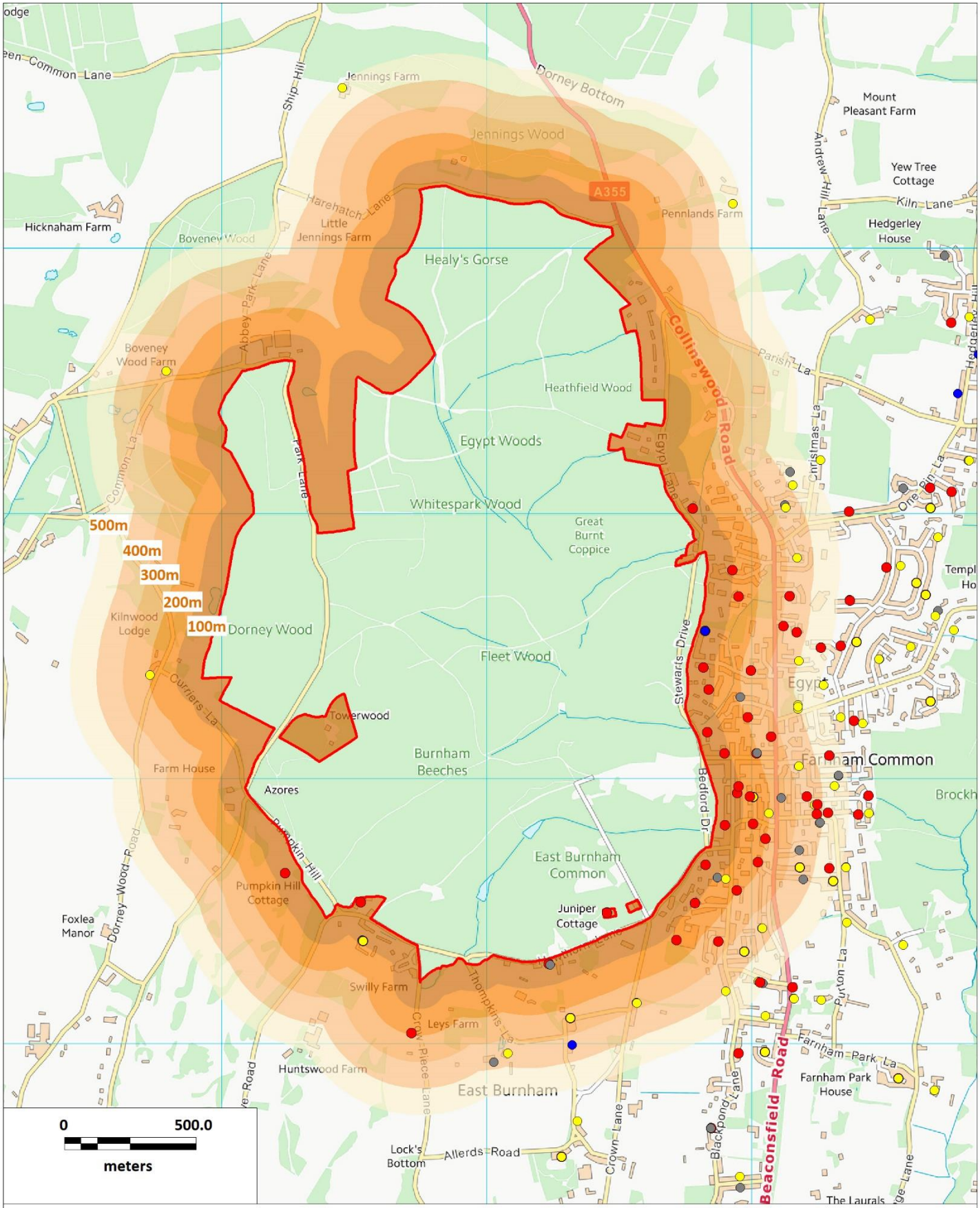
4.21 Establishing such a zone would provide much more certainty that cumulative impacts from recreation and urban pressures can be mitigated successfully and would result in a marked reduction in the risk to the SAC. Development just beyond 500m, particularly any large developments from which there there is direct and easy access to the SAC may also warrant particular scrutiny and will need to demonstrate no adverse effects on integrity to the SAC.

4.22 Our suggestion for 500m is based on the analysis above and the parallels with other European sites where there are risks from urban effects. While other European sites have used a 400m zone, the visitor data presented here appear to justify a slightly wider zone which we recommend based on the specific circumstances.

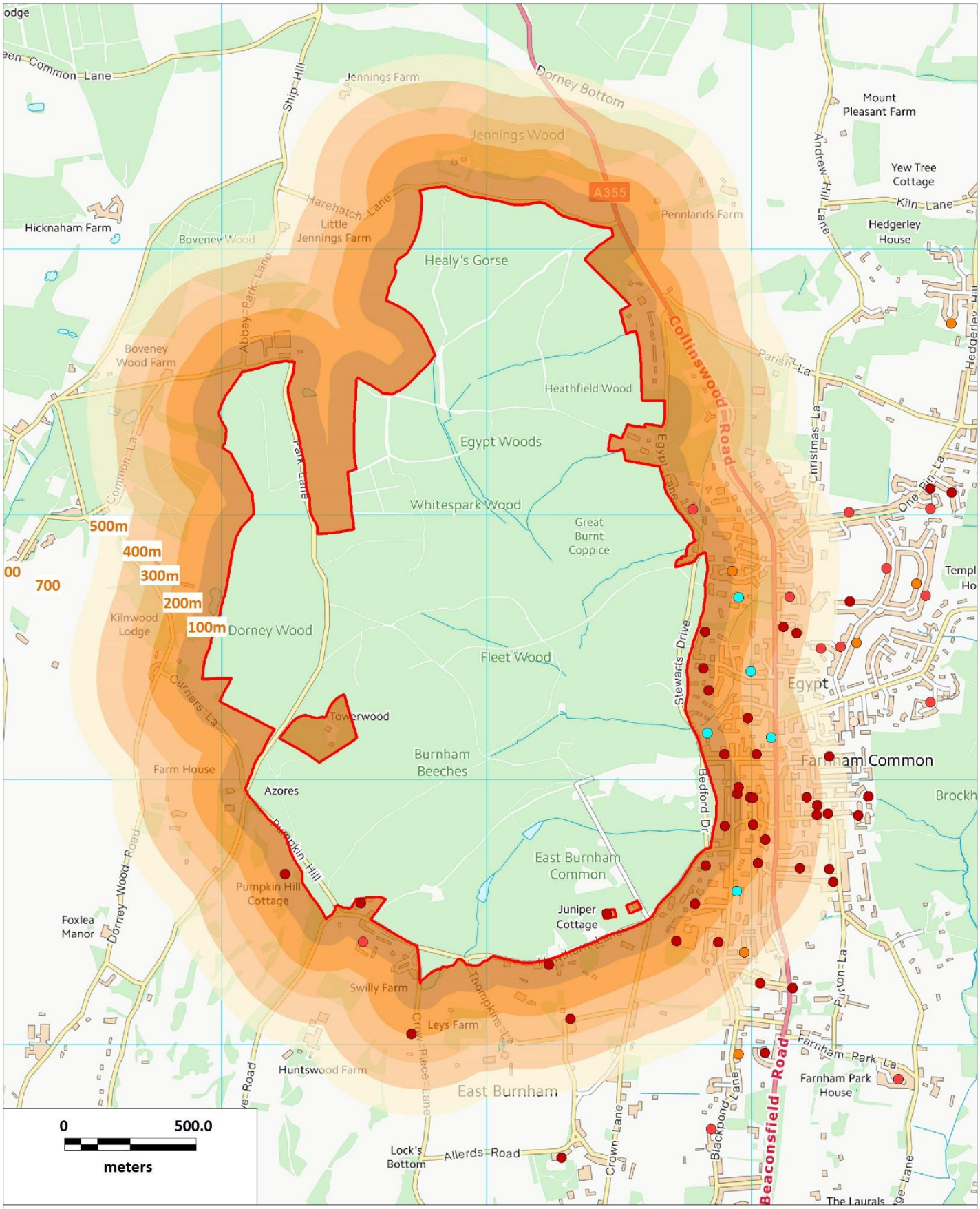
4.23 There are no site allocations (green belt sites) that are relevant to the 500m but there are a small number of HELAA qualifying sites that fall within 500m, some of these already have planning permission. The HELAA qualifying sites are:

- SB0198, residential, 0 net dwellings, completed.
- SB0183, residential, 8 remaining dwellings net, status: completed
- SB0184, residential, 6 remaining dwellings net, status: completed
- SB0285, 8 net dwellings, status: accepted at Stage 2
- SB0419, 7 net dwellings, status: accepted at Stage 2
- SB0389, 18 net dwellings, status: accepted at Stage 2

Map 7: 100m bands around the SAC, to 500m



Map 8: 100m bands around the SAC, to 500m and frequency of visit by foot visitors



Burnham Beeches SAC

Foot visitors and frequency of visit

- Three or more times per week (86)
- About twice a week (21)
- About once a week (13)
- About once per month (6)
- Less than once per month (9)
- Other, please detail (8)
- Don't know / First visit (3)

- 100m
- 200m
- 300m
- 400m
- 500m

5. Management of recreation at Burnham Beeches

5.1 The City of London Corporation carefully manages access and carefully balances the need to provide for recreation with the management of the site for nature conservation. There are three car-parks (including the main parking area at Lord Mayor's Drive), a café, information hut and toilets and a range of trails through the site. Other infrastructure includes signage, interpretation, dog bins and litter bins. Rangers patrol the site and directly engage with visitors and there is also detailed visitor information available on the internet. A programme of events includes guided walks, 'meet the ranger' events etc. There is a volunteer group and a consultation group which involves the local community.

5.2 Over the years, key measures to manage and enhance access at Burnham Beeches have included the closure of the private roads that run through the site to control traffic, the introduction of conservation grazing to enhance biodiversity, control of mountain biking and the introduction of a 'honey pot' access policy (that focusses visitor activity on those parts of the site most able to accommodate the pressures).

5.3 The vision for the site, background to current management and management targets are set out in the Burnham Beeches Management Plan (Read 2010).

5.4 In this section of the report we summarise visitor data and consider recent management interventions in more detail. In particular we consider:

- The effect of car-parking charges;
- The effect of the introduction of Dog Control Orders and Public Space Protection Orders ('PSPOs') primarily relating to dog fouling, dogs on leads and the number of dogs per person;
- Other management.

Visitor numbers and types of access

5.5 There were an estimated 551,400 visits to Burnham Beeches in 2015/16 (Wheater & Cook 2016). These visits were made by an estimated 32,764 individuals (23,138 adults and 9,626 children) accompanied by 8,482 dogs. Around half (52%) of visitors arrive by car (Wheater, *pers comm.*).

5.6 Visit numbers have fluctuated over recent years and shown some changes in relation to management interventions. The numbers of dogs entering the site has shown a decline since 2010 (when the car-parking charges were first introduced).

5.7 The main activities taking place on the site (taken from Liley, Floyd & Fearnley 2014) are:

- Dog walking (56% of groups interviewed);
- Walking without a dog (28% of groups interviewed;
- Family outing (9% of groups interviewed);
- Running (3% of groups interviewed); and
- Cycling (1% of groups interviewed).

5.8 The relative proportions of different activities does vary slightly between different surveys, reflecting differences in survey locations, time of year, weighting of survey effort to different times of day etc.

Public Space Protection Orders ('PSPOs')

5.9 Dog control orders ('DCOs') were introduced at Burnham Beeches in December 2014, in line with a Dog Management Strategy produced for the site in that year. The DCOs were introduced to:

- Ensure a fair and proportionate balance between the needs of visitors so that all can enjoy the NNR;
- Reduce the number of dog related incidents and complaints recorded each year;
- Reduce the impact of dog control management on the resources available to manage the NNR;
- Improve the welfare of wildlife and habitats, meeting the City of London's obligations under various legislations.

5.10 The national legislation relating to DCOs was repealed and replaced with Public Space Protection Orders ('PSPOs') and in line with the legislation, the DCOs at Burnham Beeches were converted to PSPOs in 2017. The PSPOs are as follows:

1. The Fouling of Land by Dogs (Burnham Beeches) Order 2017. This requires visitors to Burnham Beeches to remove dog faeces deposited by a dog for which they are responsible.
2. The Dogs on Leads (Burnham Beeches) Order 2017. This requires visitors to keep a dog for which they are responsible on a lead of not

more than five metres in length. The order applies to specified parts of Burnham Beeches

3. The Dogs on Leads by Direction (Burnham Beeches) Order 2017. This requires visitors to put and keep a dog for which they are responsible on a lead of not more than five metres in length when directed to do so by an authorised officer. The order applies to a specified part of Burnham Beeches.
4. The Dogs Exclusion (Burnham Beeches) Order 2017. This excludes dogs from the café enclosure at Burnham Beeches.
5. The Dogs (Specified Maximum) (Burnham Beeches) Order 2017. This limits visitors to Burnham Beeches to four dogs per person.

5.11 Order 1 (fouling) and order 5 (four dogs per person) apply across the whole site. Order 2 (all dogs on leads) applies across the south-western half of the site, south of Haise Drive and Sir Henry Peeks Drive, while order 3 relates to the remaining (north-eastern) part of the site. The main car-park and café fall within the area covered by order 3. There is however a small fenced area around the café where dogs are excluded at all times (order 4).

5.12 The introduction of the orders has apparently resulted in a decrease in the numbers of dogs being brought to the site and a shift in the distribution of access within the site. The distribution of visitor footfall within the site are shown in Panter & Liley (2016) including presentation of route data collected using GPS units handed out to visitors. These data show a shift in access towards the north-east of the site, including Egypt, Fleet Wood and also around the Moat. There has been a reduction in footfall in areas such as the Dell, Lord Mayors, New Coppice Ponds and Stag, reflecting a focus in use away from the area where dogs are required to be on leads. The route data show a wide dispersal of visitors and a wide range of routes used.

5.13 City of London Corporation staff log all incidents, fines and prosecutions (see Table 1). The approach taken by the City of London is not a zero tolerance one, such that the majority of incidents simply result in a dialogue where the person involved is asked to put the matter right and provided with information or guidance from the ranger team. Formal investigation and further action are only taken where the person involved repeatedly breaks the rules or refuses to comply.

Table 7: Summary of annualised figures relating to PSPO/Dog Control Orders, adapted from report to Epping Forest & Commons Committee, 14th May 2018.

Incidents detail	2015/16	2016/17	2017/18
Total DCO/PSPO incidents	517	386	334
Order 1 - Fouling	11	11	7
Order 2 - Dogs off lead in the on-lead area	453	329	285
Order 3 - Dogs not under effective control in the off-lead area	46	30	27
Order 4 - Dogs taken into the dog free area	4	16	15
Order 5 - More than 4 dogs/person	3	0	0
Number of incidents resulting in a formal report/investigation	8	15	15
Number of formal action /letters written warnings issued	2	8	9
Number of Fixed Penalty Notices ('FPN's) issued	0	0	0
Number of FPN prosecutions	0	0*	1*

* Incident occurred in 16/17 - prosecution through magistrate court 2017/18

5.14 From the figures in Table 7 there is a general indication of a year-on-year reduction in the number of incidents - but this is not consistently the case. The data do show that despite the legislation in place there is a need for a strong ranger presence to further reduce non-compliance. The number of formal actions and fixed penalty notices is perhaps likely to increase with time as repeat offenders are increasingly identified over time.

Car-park charging

5.15 Car-parking is allowed at three car-parks only: the main car-park on Lord Mayor's Drive, and other car-parks at the Dell and the Stag. Gates to the car-parks are opened at 8am and they remain open until dusk. Car-park charges were introduced in August 2011 and increased in 2016 to the current level which is a daily charge of £3 per motor vehicle and £18 per coach, which applies on weekends and bank holidays with donations at all other times. Disabled visitors correctly displaying a valid blue badge are exempt. All revenue raised is used by the City of London Corporation for the management of Burnham Beeches.

5.16 Following the initial introduction of the charges there was a dip in the level of access, with numbers then appearing to stabilise before rising again. Numbers dropped again a little after the increase in parking charges. There has been a marked decrease in the number of dogs brought to the site following the introduction of parking charges.

Other management

5.17 The management of Burnham Beeches is in many ways exemplary, with carefully planned interventions set out in a detailed management plan and backed up by long-term monitoring data.

5.18 Other relevant management measures and interventions that relate to resolving issues from recreation and urban development to the SAC include:

- Mulching around the base of veteran pollards to protect the roots and minimise erosion;
- 'Dead hedging' around sensitive trees, using brash to create obstacles to deter visitors from trampling too much in particular areas;
- Fencing around certain very sensitive trees, such as the Druid's Oak;
- Active management of pollards to prolong their life;
- Encouraging the use of tarmac roads for cycling and walking;
- Surfacing of paths (to encourage their use and reduce pressure on adjacent land);
- Increased patrolling from Rangers (to assist and inform visitors);
- Careful selection of grazing livestock (to minimise issues with visitors); and
- Temporary and permanent signage to inform visitors about work being carried out and the impact of their activities.

5.19 Measures such as the mulching, dead headging and fencing provide some additional protection to vulnerable trees but are limited in scope. Mulching does not limit people accessing the trees, simply provides some protection to the roots. Dead hedging may deter some people, but is dependent on dead wood and brash being available and a lot of material is necessary to provide a ring around a tree. The old, gnarled trees do have a particular draw and visitors will always want to go right up to them.

6. Recommendations avoidance and mitigation measures for the SAC.

Introduction

6.1 Burnham Beeches is vulnerable to pressures from recreation and urban development, these will be exacerbated by other issues facing the site, including climate change. The previous sections highlight the range of impacts and show that, as a result of planned housing growth, recreation levels could increase by around 11%, in the absence of any mitigation. A relatively small proportion of this (a 2% overall change) relates to development in the emerging Chiltern and South Bucks Plan and overall around 4% of the increase is linked to development within Chiltern and South Bucks. Visitor management at Burnham Beeches over recent years has involved a number of interventions which help reduce the impacts, however these are not sufficient to absorb the impacts identified.

6.2 A strategic and plan led approach to protecting European sites from the impact of recreation is now widely recognised as being more effective than dealing with these impacts on a development by development basis. For example, educating visitors, reinforcing messages with site-based staff, and providing the right infrastructure to meet visitor needs and influence visitor behaviour cannot all be funded through an individual development. Mitigation for recreation pressure needs to be a multi measure approach, with measures working together in an integrated way (i.e. as a package of different measures) to give confidence that adverse effects can be ruled out.

Other sites and approaches

6.3 Burnham Beeches is not unique in facing these challenges; however, the small size of the site and its isolation mean it is particularly vulnerable. Many other European sites, including a range of SAC sites, have strategic mitigation approaches in place to ensure adverse effects on integrity from the cumulative in-combination effects of urban growth can be resolved. Notable and relevant examples include the Dorset Heaths, the Thames Basin Heaths, South Devon (including Dawlish Warren SAC), Cannock Chase and Ashdown Forest.

6.4 Perhaps of particular relevance to Burnham Beeches, given their nature conservation interest, are the New Forest, Epping Forest and Hatfield Forest.

Planning authorities around the New Forest have received funding from central government to undertake a major study (currently on-going) to identify how to resolve the issues of recreation from urban growth around the New Forest SPA/SAC. At Epping Forest SAC, adjacent planning authorities have signed a Memorandum of Understanding to progress a mitigation approach that will deliver a range of on-site management measures and potentially also new green space around the SAC. Hatfield Forest is not an SAC, but is a relatively small site with many ancient pollard trees. The National Trust (who manage the site) have been facing growing issues from recreation linked to urban development around the site and approaches to resolving these issues in the long-term are being explored with the relevant local authorities and Natural England (see Saunders *et al.* 2019 for background). These examples provide a range of useful background and potential approaches to resolving the issues identified at Burnham Beeches.

6.5 Examples of approaches used in other sites are summarised in Table 8 and some are also illustrated in Figure 10. In Table 8 we have listed the approaches under four headings: Infrastructure/SANG, Access Management, Education and Monitoring. SANGs are Suitable Alternative Natural Greenspace, a positive approach, providing an alternative destination and drawing visitors away from the European sites. Most strategic mitigation schemes simply split measures into Infrastructure/SANG and 'SAMM' (Strategic Access Management and Monitoring), with SAMM essentially covering all the non-infrastructure elements. The land and costs of maintenance of SANGs and new green infrastructure need to be secured in-perpetuity and this can be delivered by developers (e.g. as part of a single large development), through a local authority (potentially managing a site strategically and collecting revenue from different developments) or by a third party.

Table 8: Overview of some of the mitigation approaches at other sites

Infrastructure/SANGs	Access Management	Education	Monitoring
Improvements to other greenspaces to deflect access	Rangers/wardens/volunteer ambassadors on the European site	Community events	Visitor counts on greenspace sites and European sites
Provision of new semi-natural greenspaces to deflect access	New signage and interpretation	Guided walks	Interviews with visitors to greenspace and European site
Other infrastructure (e.g. BMX parks)	Path management/maintenance	School visits and education material	Path monitoring
	Changes to parking on European site (limiting verge parking, changes to car-parks etc.)	Dog project to work directly with dog walkers	Ecological monitoring
	Leaflets and orientation/way finding maps		
	Provision of marked routes		
	Codes of conduct		
	Vegetation management (e.g. to close desire lines or enhance routes)		
	Creation of refuge areas where no recreation use		
	Erosion control on paths etc.		

a) Ranger employed by the Solent Bird Aware Project;
b) Upton Country Park SANG;
c) Dog bins on the Pebblebed Heaths;
d) Dorset Dogs awareness raising event;
e) Interpretation and viewing area on the Exe Estuary SPA;
f) Dog training area at Upton Heath Country Park;
g) Ranger employed by the Thames Basin Heaths Partnership.

Figure 10: Examples of mitigation and avoidance measures at other locations

Recommended mitigation and avoidance measures at Burnham Beeches

6.6 Drawing on measures implemented at other sites and discussion with both the City of London Corporation staff and South Bucks Council staff, we suggest the following as potential measures for a strategy. These measures would relate to any development coming forward within 5.6km, and may be necessary for large developments beyond 5.6km:

Presumption against development close to the SAC

6.7 Limiting new development adjacent to the SAC is a key measure and zone of 500 is recommended (see previous section).

Measures relating to increased footfall, erosion, general 'wear and tear'

6.8 With a potential 11% increase in access (4% from housing growth in Chiltern and South Bucks), impacts from footfall, erosion etc. will increase. This will mean additional management to simply maintain the existing infrastructure, let alone providing additional infrastructure. The following are mostly undertaken routinely/already by Burnham Beeches staff, but there will be additional work necessary as a result of further visitors:

- Path repairs and maintenance, including both easy access paths/surfaced routes and the rest of the path network within the site;
- Repairs to car-parking areas and internal tarmac road, with works including resurfacing and maintenance of edges etc;
- Management of entrances, with the multiple foot access points requiring checks and maintenance including path surfacing, kerbing, formalising/removing desire lines.

Dealing with litter and waste

6.9 Increased visitor use will mean a potential for greater levels of waste, for example with bins filling up more frequently. Litter collection draws staff time away from other work and has a nature conservation impact through contamination. These issues could be resolved through:

- Provision of dog waste bags, additional dog waste bins and additional dog waste collection, as required;
- Provision of funding to pay for some additional staff time for litter collection and dealing with fly tipping.

Interpretation and events

6.10 Raising awareness about the site and the issues relating to recreation is important and should involve influencing behaviour. Dog focussed events such as dog training, guided walks for dog walkers, creating dedicated dog projects have been successful at other sites. Potential measures at Burnham Beeches could include:

- Provision and maintenance of interpretation boards, potentially including regularly updated panels and messages about positive steps visitors can take to minimise their impact;
- Literature for visitors, including leaflets and orientation maps;
- Update/refresh of information point at the café – this is likely to be more effective if regularly updated, changed and up-to-date;
- Events, including those targeted at 'new' residents and groups such as dog walkers where particular concerns regarding impacts. Events can include dog training, guided dog walks, open days etc.
- SAC Engagement Ranger, an additional part-time post with a focus on visitor engagement, running events, talking to visitors and helping with the promotion of sustainable transport, enforcement of PSPOs etc.

Other aspects of increased visitor numbers

6.11 Specialist veteran tree management is undertaken to prolong the life of trees and regular checks are made for health and safety issues, where there may be risk to the public. Increased recreation may mean an increased need for interventions relating to particular trees, for example bark mulching around the base. Livestock are an important component of the management of the site and increased access can cause issues with grazing animals, for example through dogs off-leads or people approaching animals, feeding them etc. Potential mitigation work could include

- Targeted tree safety work and specialist veteran management where risks/issues from increased recreation;
- Livestock management, including more regular checks; replacement of individual livestock and liasion with visitors.

Monitoring

6.12 Monitoring is an important component of the mitigation and avoidance as it ensures any particular issues can be picked up quickly and resolved. Access patterns are not static and will change over time, for example different activities can become popular or types of visitor change. Changes can be

triggered by a range of factors, such as publicity, media promotion, social media, changes at other sites (e.g. car-park charges changed) etc. Monitoring results can inform and update future mitigation interventions and allow a shift of resources to different elements. Key monitoring components are:

- Visitor numbers;
- Visitor feedback and interviews (including postcode data from interviewees);
- Route data within the site (i.e. where people go);
- Visitor behaviour (e.g. dogs on leads);
- Ecological impacts (potentially covering tree health and condition, soil sampling and condition, vegetation cover/wear and possibly some selected species, such as epiphitic lichens);
- Log of incidents, collected in a standardised way to allow comparison over time, covering fly-tipping, fires, illegal activity, fixed penalty notices relating to the PSPOs, cycling off-tracks, vandalism etc.

SANGs (Suitable Alternative Natural Greenspace)

6.13 SANGs work to create additional space for recreation, providing green infrastructure that can absorb increased recreation use without adding pressure to the European sites. SANGs provide recreation space for local residents and can be designed to draw recreation use that would otherwise occur on the European sites. SANGs work as part of a mitigation package, dovetailing with measures (such as access management on the European sites), which can help deflect damaging activities to the alternative destinations. As such SANGs cannot be relied on in isolation but can play an important role.

6.14 The ideal SANG-type approach could well be provision of land near the periphery of Burnham Beeches, providing a dedicated area for dog walking and further visitor facilities, essentially buffering the core part of the SAC. If managed by the City of London Corporation there could even be the scope for some redistribution of visitor facilities and infrastructure away from the SAC.

6.15 Such an approach would depend on suitable land becoming available. Recent evidence from the Thames Basin Heaths has suggested that SANGs are most effective with new residents, potentially indicating that once visitor patterns become established it is hard to deflect them (Allinson 2018). This places greater emphasis on the need for SANGs to be 'up-front' and this

creates a particular challenge. Any suitable land should be secured in advance and established as SANG prior to occupation of the development being mitigated for. A challenge for reliance on SANGs as strategic mitigation for multiple small developments is therefore confidence that suitable land in the right location would be available, could be acquired and it would need to be available for recreation use prior to occupation. As such, it may be necessary for an advance purchase as opportunities allow.

6.16 For large developments[9], SANGs can be delivered by the developer at the development location, providing dedicated recreation space of suitable quality on the new residents' doorstep. In such cases the challenge is ensuring sites are of suitable quality (given the proximity to urban development) and size. There also has to be confidence that the sites can be secured and appropriately managed in perpetuity. Large greenbelt sites are likely to be best able to provide substantial areas of greenspace as part of a development.

6.17 Small sites and brownfield sites are unlikely to be able to accommodate the scale of space required for a SANG and would therefore have to make a contribution towards some strategic SANG provision. This would clearly depend on the opportunities available, and one option could be the enhancement of existing sites.

6.18 In the Thames Basin Heaths and other areas, new sites are provided at a rate of 8ha per 1000 new residents, equivalent to 0.0192ha per dwelling (assuming 2.4 occupancy). There is no reason to suggest any alternative rate of delivery would be more appropriate for Burnham Beeches. A key component of new greenspace will be the overall size, as interview data from Burnham Beeches suggests an average walk of 3.6km (Panter & Liley 2016); 30-40ha are likely to be the minimum overall size necessary to provide enough space for such a route.

[9] Around the Dorset Heaths, developers of sites of around 50 or more dwellings are expected to deliver their own SANGs (see South-east Dorset LPAs 2016)

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Glossary

HELAA	Housing and Economic Land Availability Assessment
GIS	Geographic Information System (mapping software)
HRA	Habitats Regulations Assessment
SAC	Special Area of Conservation
SAMM	Strategic Access Management and Monitoring
SANG	Suitable Alternative Natural Greenspace
SSSI	Site of Special Scientific Interest