# Analysis of 2017 Thames Basin Heaths SPA Parking Transects & Counter Data

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Footprint Contract Reference: 501
Date: 6th February 2019
Version: Final
Recommended Citation: Panter, C. 2019. Analysis of 2017 Thames Basin Heaths SPA Parking Transects & Counter Data. Unpublished report.

# Contents

## Acknowledgements

This work was commissioned by Natural England and we are grateful to Ann Conquest and Sarah Bunce for overseeing the work and for advice and comments.
We are grateful for the cooperation and assistance of the whole Thames Basin Heaths Partnership, and for the collation of all the counter and vehicle count data presented in this report.

# 1. Introduction

1.1 This report, commissioned by Natural England, details data collected as part of long-term monitoring of visitor pressure on the Thames Basin Heaths Special Protection Area (SPA). Data presented in this report are from two sources: automated people counters and coordinated counts of vehicles. All data were collected by the TBH Partnership staff in 2017.

## *The Thames Basin Heaths SPA*

1.2 The Thames Basin Heaths (TBH) Special Protection Area (SPA) - shown in Map 1 - covers an area of approximately 8,400ha and was classified under the Birds Directive in 2005. The SPA comprises 13 Sites of Special Scientific Interest (SSSI) distributed across three counties and 11 local authorities. The SPA includes areas of dry and wet heathland, mire, oak and birch woodland, gorse scrub and acid grassland, plus conifer plantation. Lowland heathland has a very limited global distribution and is among the most threatened habitat in Britain and Europe. The TBH SPA is classified for three species of birds, listed on Annex I of the Birds Directive: Nightjar *Caprimulgus europaeus*, Woodlark *Lullula arborea* and Dartford warbler *Sylvia undata*. All three species are ground nesting (or in the case of Dartford warbler, low nesting) species, and are particularly vulnerable to disturbance.

1.3 The proximity to London has led to high pressure for development, which has resulted in heathland loss and fragmentation. In the Thames Basin it has been estimated that the decline in heathland area was 53% between 1904 and 2003 with fragmentation of 52 main blocks to 192 smaller blocks during the same period (Land Use Consultants 2005).

1.4 A range of impacts to heathlands are particularly associated with the proximity to urban areas. These ‘urban effects’ (see Haskins, 2000; Underhill-Day, 2005 for review) include: increased fire incidence, trampling, pollution, and disturbance by humans and their dogs. Studies of the Annex I bird species show clear impacts of increased housing on both breeding success and numbers (Liley & Clarke, 2003; Liley, Clarke, Mallord, & Bullock, 2006; Mallord, Dolman, Brown, & Sutherland, 2007; Murison, 2002)

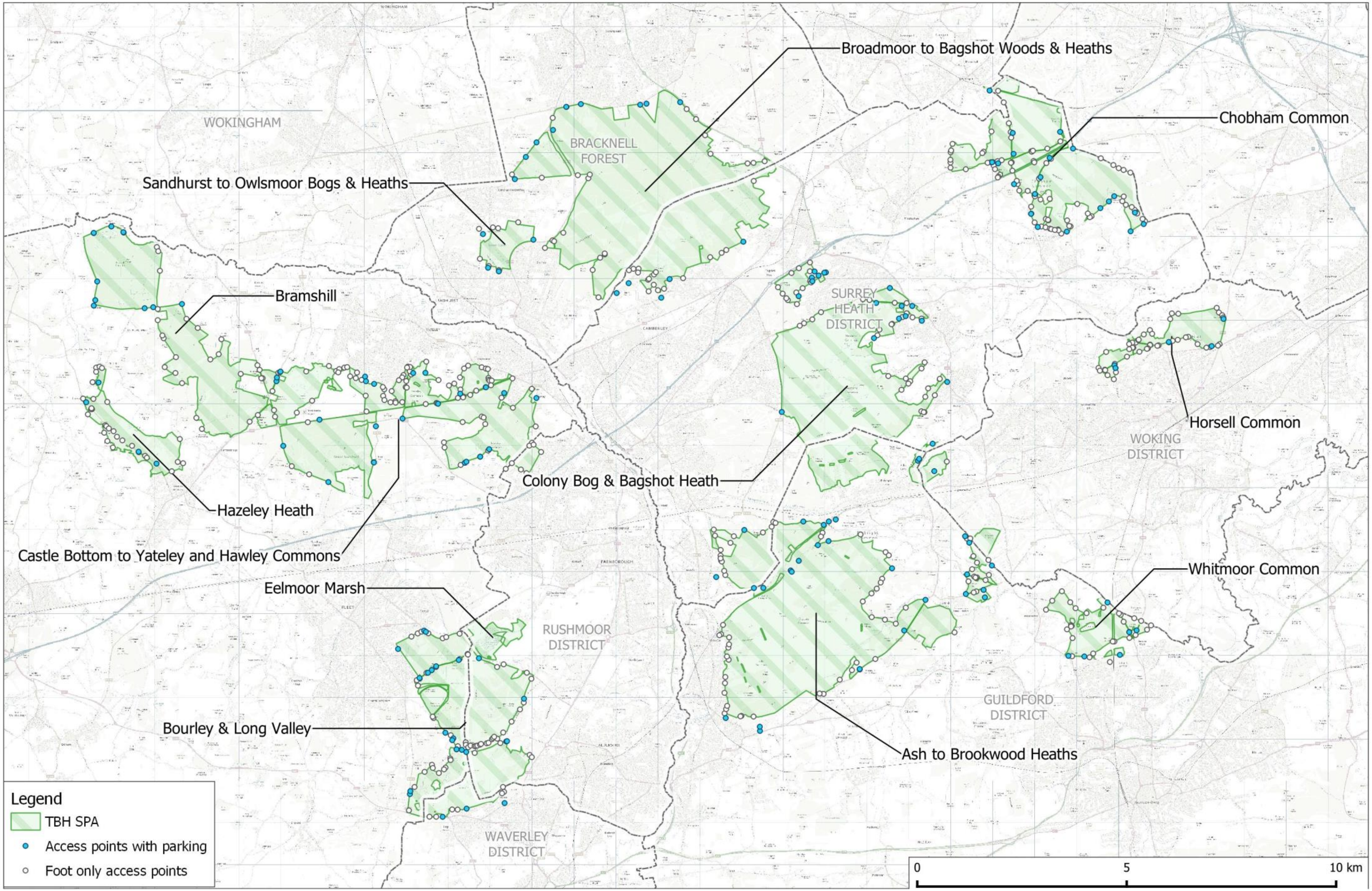
## *TBH SPA Area Delivery Framework and SAMM*

1.5 With the growing evidence of impacts of urban development, it was recognised that mitigation measures were necessary to ensure that continued residential development did not adversely impact the TBH SPA. The local authorities, with Natural England, worked to produce a series of mitigation and avoidance measures. The background to these is discussed in detail in Burley's report on the TBH SPA draft delivery plan (2007) and details of the agreed approach set out in the Thames Basin Heaths Special Protection Area Delivery Framework (Thames Basin Heaths Joint Strategic Partnership Board, 2009).

1.6 The delivery framework established a series of zones around the SPA that inform where and how residential development can be taken forward, and also establish mitigation measures including alternative natural greenspace sites (SANGs), on-site visitor access management and monitoring (the latter two coming under the umbrella heading of 'SAMM' –strategic access management and monitoring).

1.7 SAMM is coordinated strategically by Natural England working with the local authorities and partners, under the Thames Basin Heaths Partnership. The access management can include a variety of measures ranging from education and wardening, limiting car parking, managing path networks etc. The other part of SAMM is the monitoring of the mitigation measures. Regular monitoring is necessary to evaluate the levels of recreational use on heaths and on SANGs. Monitoring should allow a check on the effectiveness of measures, act as an early warning and allow mitigation measures to be adjusted as necessary to reflect changes in access patterns, and types of use on both heathland and SANG mitigation sites.

**Map 1: Thames Basin Heaths SPA, individual sites are labelled by SSSI names and access points shown.**



## Monitoring approaches

1.8 Access occurs widely across the SPA site and given the size and number of sites, is therefore hard to monitor. Data are collected in a range of ways, for example, through car park counts, or direct counts. The different counting methods have advantages and disadvantages, and the use of these, in combination, provides robust data to understand patterns.

### *Vehicle counts*

1.9 The provision of car parking spaces at, or adjacent to, the heaths is an important factor determining the number of visitors interacting with sites. In the Thames Basin Heaths, visitors arriving by car make up a considerable proportion of the total visitors.

1.10 Counts of the number of cars parked at heath access points can be conducted quickly to provide a good indication of the number of visitors at a site. Meaningful counts require a co-ordinated approach, using a set methodology and surveying period. The resulting data work to provide a good overview of the long-term access patterns on sites.

1.11 One minor disadvantage of the vehicle counts is that the data collection is time-consuming relative to the amount of data yielded. Counts are time consuming, require multiple members of staff simultaneously, can be hard to organise. However, the vehicle counts in tandem with automated counters work well.

### *Automated counters*

1.12 The use of automated counters placed on access points to record people provides a greater level of detail and does not involve lengthy fieldwork. These sensors require an effort to be maintained but provide an extremely large dataset across 24hrs a day. The staff time needed to otherwise produce this kind of data from on-site fieldwork would be unrealistic.

1.13 These sensors can be used to examine daily, weekly and monthly patterns at specific locations. These can be used as a baseline to examine the current access, and in the future to determine how these relate to SAMM actions, such as on-site management of the SPA and the provision of SANGs.

## Aims of this report

1.14 This report presents the car-park count data and automated count data collected during 2017. The report provides an overview of the data and results from the year and over time these results will fit with data from other years to provide a picture of visitor use and pick up any changes in access patterns.

# 2. Vehicle count methodology and analysis

## Methodology

2.1 Surveying methods for coordinated vehicle counts follow those from previous counts, first undertaken as a trial in 2012 (Fearnley & Gartshore, 2013), then in summer 2013 (Fearnley, 2013) and 2014 (Cruickshanks & Fearnley, 2014). In 2016 surveying was undertaken by the TBHP staff and allowed counts to be spread across the year (Liley, 2017). In 2017, counts were also spread across the year and undertaken by TBHP staff.

2.2 The main principle of the set methodology involves driving around the SPA and counting the number of vehicles in parking locations within a short window (e.g. around 2 hours). This gives a snapshot of visitor use at that moment in time. At locations as large as the TBH SPA, the approach requires the use of multiple surveyors to cover all parking locations in a sufficiently small time period, using a coordinated count approach. In the TBH, six surveyors cover six simultaneous areas, as shown in Map 2.

2.3 Surveyors drove the predefined route of their allocated section and recorded the total number of parked vehicles, categorised the types of vehicles and made any additional notes. The recording form allowed separate counts for different vehicle types (commercial vehicles, camper vans, MPVs and minibuses).

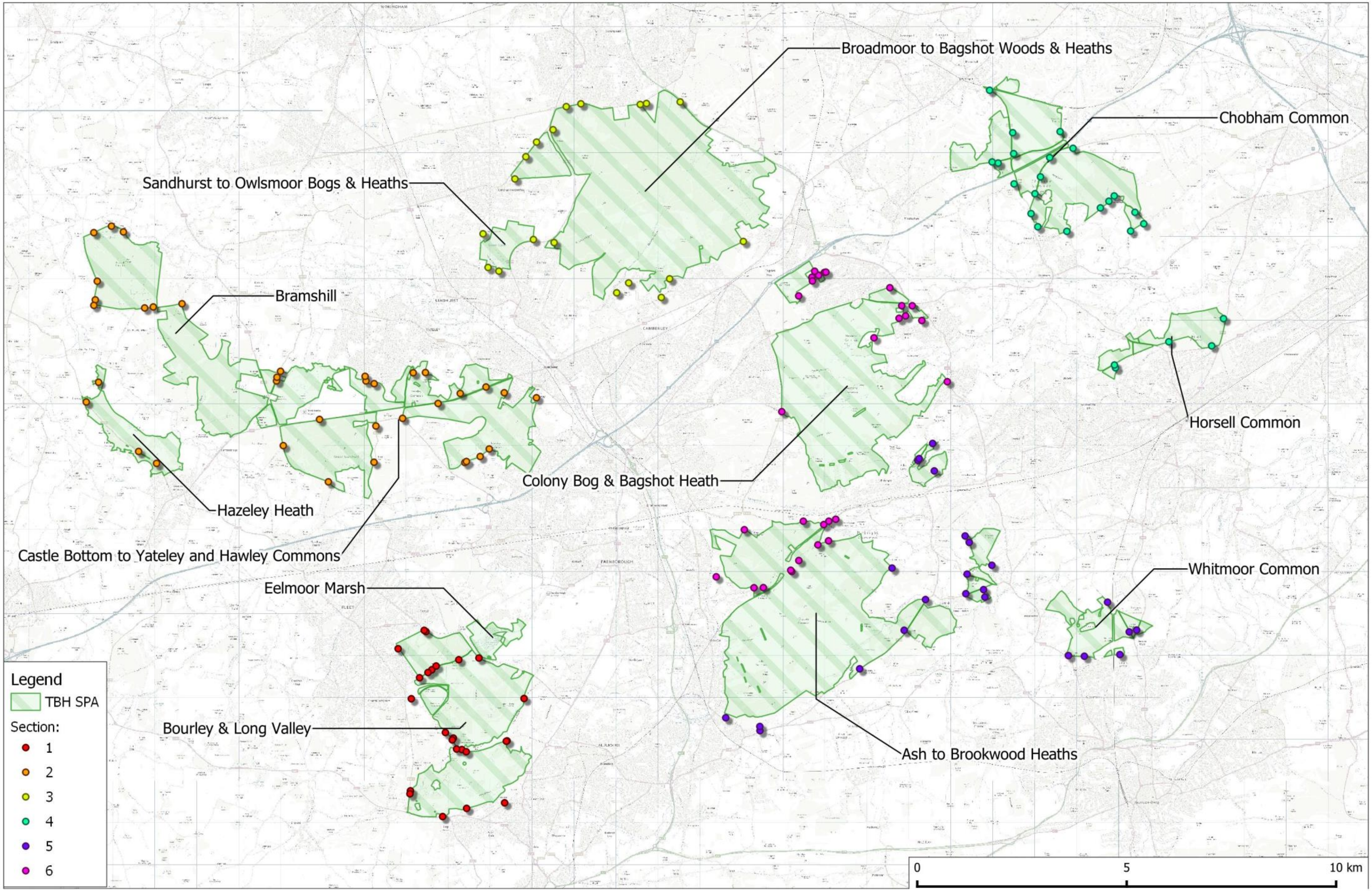
2.4 In 2017, fifteen transects (each transect covering the six sections in a single window) were completed. Counts covered a range of times and seasons (Table 1), and covered the whole year, ranging from January to December. Surveys were conducted around the end of every month, one per month, on a weekday, with double the effort in the summer months, which were conducted on a weekend day (Saturdays). Five transects started at 14:00, three at 10:00 and three at 16:00 and two at 07:00 and 18:00 – these earlier and later counts undertaken in the longer spring and summer days.

2.5 Due to updated methods from previous years direct comparison was not straightforward. Moving forward these will be conducted in a standardised manner – SEE XXXXX.

**Table 1: Summary of the fifteen surveying dates. Rows coloured by season; winter (blue), spring (yellow), summer (green), autumn (orange).**

| Transect number | Date | Day of week | Type of day | Start time |
|---|---|---|---|---|
| 1 | 25/01/2017 | Wednesday | term Weekday | 14:00 |
| 2 | 27/02/2017 | Monday | term Weekday | 16:00 |
| 3 | 24/03/2017 | Friday | term Weekday | 14:00 |
| 4 | 26/04/2017 | Wednesday | term Weekday | 18:00 |
| 5 | 22/05/2017 | Monday | term Weekday | 10:00 |
| 6 | 24/06/2017 | Saturday | term Weekend | 10:00 |
| 7 | 30/06/2017 | Friday | term Weekday | 18:00 |
| 8 | 26/07/2017 | Wednesday | school holidays Weekday | 07:00 |
| 9 | 29/07/2017 | Saturday | school holidays Weekend | 16:00 |
| 10 | 19/08/2017 | Saturday | school holidays Weekend | 14:00 |
| 11 | 21/08/2017 | Monday | school holidays Weekday | 14:00 |
| 12 | 29/09/2017 | Friday | term Weekday | 07:00 |
| 13 | 25/10/2017 | Wednesday | half-term Weekday | 16:00 |
| 14 | 27/11/2017 | Monday | term Weekday | 10:00 |
| 15 | 15/12/2017 | Friday | term Weekday | 14:00 |

**Map 2: Distribution of parking locations, categorised by the driving transect section they are covered by.**



## Analysis

2.7 The dataset included some omissions and other issues, which required clarification with TBHP staff prior to analysis. These included instances when:

- the ID number of the parking location was missing – *assumed that the parking location was missed or omitted and therefore no data [N=4].*
- the parking location ID was given, but no time was given and the number of vehicles was blank - *assumed location was missed or omitted and therefore no data [N=121].*
- the parking location ID and a time of surveying was given, but the number of vehicles was blank – *assumed location was surveyed, with 0 vehicles present in the parking location [N=32].*

# 3. Vehicle count results

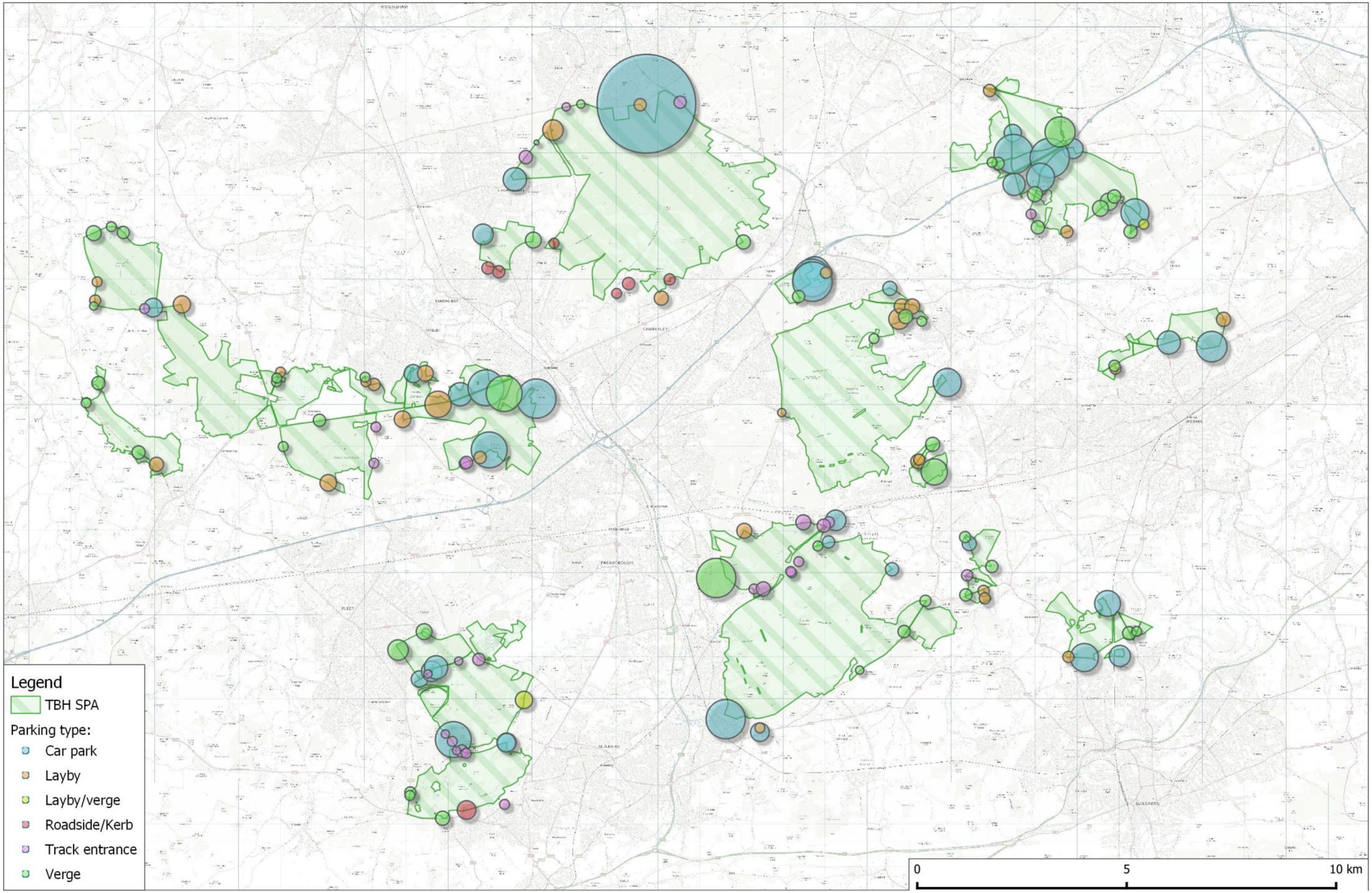
## Parking locations

3.1 In total, 160 discrete parking locations were mapped, with a total capacity of 2,116 spaces. Parking locations categorised by type are shown in Map 3 and totals given in Table 2. Approximately 27% of parking locations are formal car parks, however these locations account for 69% of the parking spaces compared to other informal parking locations.

**Table 2: The number of parking locations (and total number of parking spaces) in each section of the driving transect, categorised by the type of parking location.**

| Type | 1 | 2 | 3 | 4 | 5 | 6 | Total |
|---|---|---|---|---|---|---|---|
| Car park | 6 (118) | 6 (203) | 3 (385) | 12 (408) | 7 (154) | 9 (224) | 43 (1492) |
| Layby | | 12 (85) | 3 (25) | 5 (19) | 6 (20) | 6 (40) | 32 (189) |
| Layby/verge | 1 (10) | | | | | | 2 (12) |
| Roadside/Kerb | 1 (12) | | 6 (19) | | | | 7 (31) |
| Track entrance | 9 (18) | 5 (13) | 3 (10) | 1 (2) | 1 (3) | 8 (29) | 27 (75) |
| Verge | 6 (35) | 13 (88) | 4 (15) | 10 (84) | 10 (58) | 6 (76) | 49 (356) |
| **Total** | **23 (193)** | **36 (389)** | **19 (454)** | **29 (515)** | **24 (235)** | **29 (369)** | **160 (2155)** |

**Map 3: Distribution of parking locations, categorised parking type and points sized by the parking spaces.**



## 2017 Surveys

### *Duration*

3.2 The longest recorded duration for an individual count section was 3 hrs 34 mins (Section 5, 21/08/2017). However typically sections took much less time to complete. The average time taken across all dates was 1 hr 55 mins.

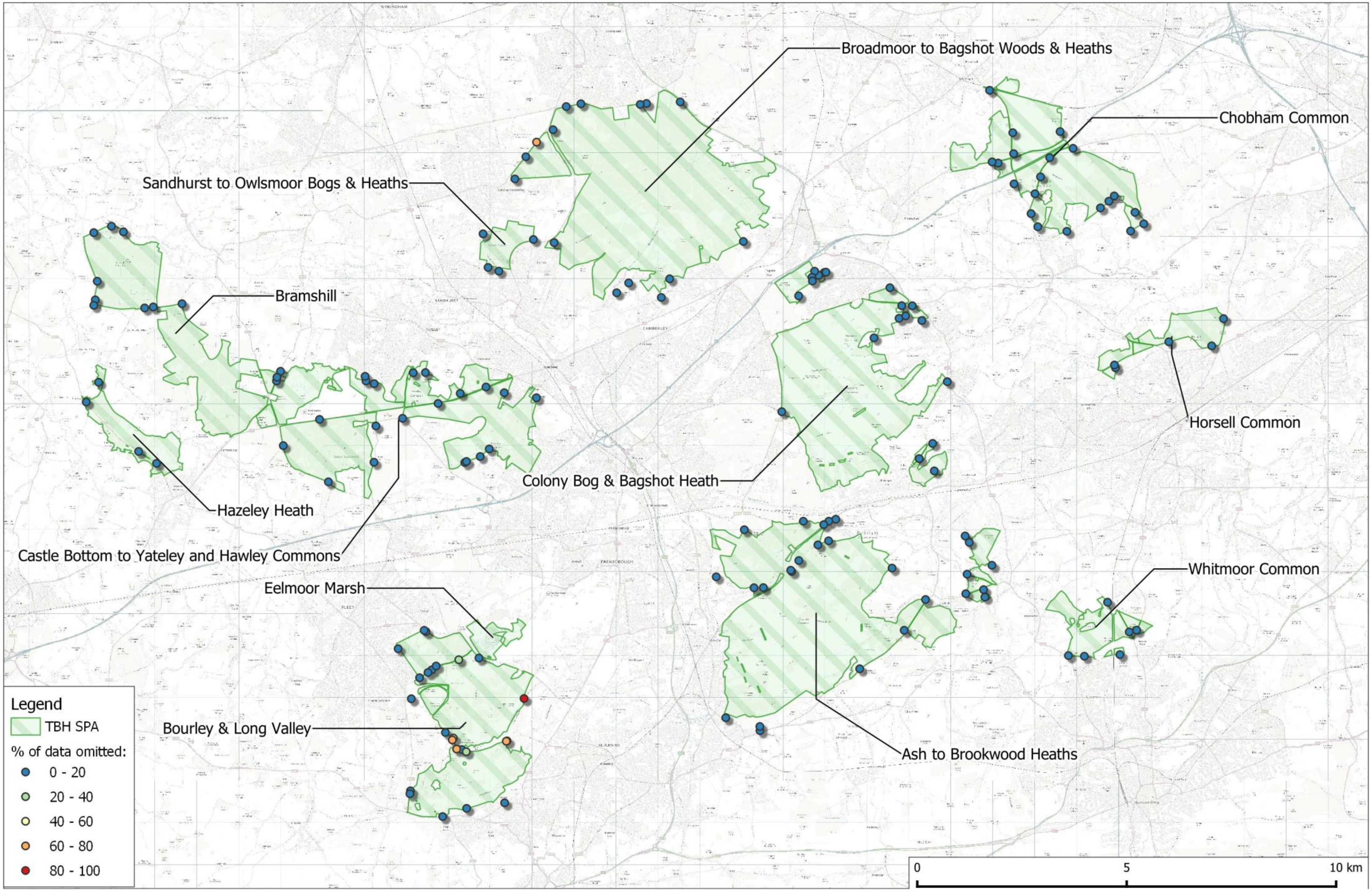
### *Car-park coverage*

3.3 Driving transect counts can miss some individual car parks as in some circumstances it is not possible to capture all data. These omissions can occur when individual car parks are closed, missed or inaccessible (e.g. road closures, traffic accidents, snow).

3.4 Of the 160 parking locations included in the counts, 137 locations (86%) were counted on all 15 transect dates. Remaining locations ranged from two to 14 counts completed, with the lowest count for a single location, (Section 1, ID 6) around Bourley & Long Valley (described as access to MoD military compounds only). Just 11 locations had less than 14 counts, and therefore 93% of locations had values for at least 14 of the 15 counts.

3.5 Overall completeness was 96%, with 2,305 individual counts recorded in total (out of a possible 2,400). The completeness at each parking location is shown in Map 4 and is summarised by sites later in Table 4.

**Map 4: Distribution of parking locations, categorised percentage of transect counts omitted.**



## Weather

3.6 Weather conditions during surveys were variable, with just over half of the transect dates in completely dry conditions (53%). Across all 2,305 individual parking location counts only 15% of locations were surveyed in the rain. There was only one transect date during which it was raining at 100% of parking locations – 29/07/2017, see Table 3.

**Table 3: Summary of transect durations and weather conditions.**

| Transect number | Date | Day of week | Start time | Longest duration of an area in a transect | Rain present (as % of parking locations) |
|---|---|---|---|---|---|
| 1 | 25/01/2017 | Wednesday | 14:00 | 01:44 | 0 |
| 2 | 27/02/2017 | Monday | 16:00 | 01:39 | 21 |
| 3 | 24/03/2017 | Friday | 14:00 | 02:06 | 0 |
| 4 | 26/04/2017 | Wednesday | 18:00 | 01:34 | 0 |
| 5 | 22/05/2017 | Monday | 10:00 | 01:41 | 1 |
| 6 | 24/06/2017 | Saturday | 10:00 | 01:26 | 1 |
| 7 | 30/06/2017 | Friday | 18:00 | 01:48 | 0 |
| 8 | 26/07/2017 | Wednesday | 07:00 | 01:52 | 7 |
| 9 | 29/07/2017 | Saturday | 16:00 | 01:55 | 100 |
| 10 | 19/08/2017 | Saturday | 14:00 | 01:29 | 0 |
| 11 | 21/08/2017 | Monday | 14:00 | 03:34 | 44 |
| 12 | 29/09/2017 | Friday | 07:00 | 02:20 | 57 |
| 13 | 25/10/2017 | Wednesday | 16:00 | 02:13 | 0 |
| 14 | 27/11/2017 | Monday | 10:00 | 01:46 | 0 |
| 15 | 15/12/2017 | Friday | 14:00 | 01:45 | 0 |

## 2017 Vehicle totals

3.7 In total, 6,995 vehicles were recorded from the 15 counts. This included 338 commercial vehicles, 192 vehicles with bike racks, 100 MPVs/minibuses, 47 commercial dog walker vehicles, and 22 campervans. In total, this equates to roughly 466 vehicles recorded across all locations on a typical single transect. These are the raw totals recorded, and have not accounted for variability in the number of parking locations counted due to (e.g. car parks closed, inaccessible or not counted).

3.8 Figure 1 shows these vehicle totals by date, and shows the variability within the data collected. The highest single count was on the August weekend (19/18/2017), in which 840 vehicles were recorded. The second highest count was 728 vehicles, on a June weekend (24/06/2017). The lowest count was 227 vehicles, counted on an October weekday (29/09/2017), during which it was raining on roughly half of the counts. This was followed by 232 vehicles on a July weekday (26/07/2017).

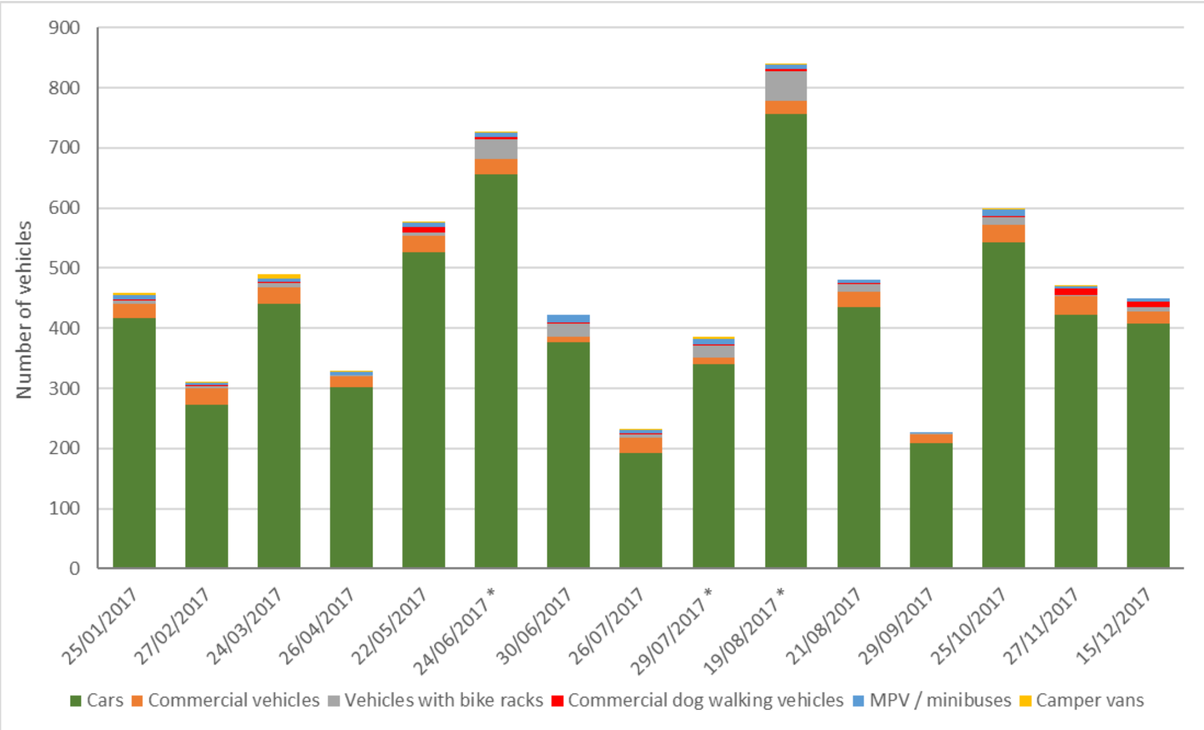



**Figure 1: Total numbers of parked vehicles by date. Style is repeated from the 2016 report. Dates with an asterisk indicate weekend dates.**

3.9 Totals recorded for all vehicles and different types of vehicles are provided for each named SSSI in Table 4. Raw counts in Table 4 highlight the highest numbers of total vehicles and of most vehicle types were around Broadmoor to Bagshot Woods & Heaths and lowest around Hazeley Heath.

**Table 4: Summary by sites of the completeness of surveys and raw total number of vehicles for each SSSI site. First two columns give the number of parking locations and average % of location surveyed. All other columns give the number of vehicles with a % for each based on the column total. Total vehicles column is the total for all vehicle types and columns to the right are a subset. Top two sites highlighted in red and bottom two in blue.**

| SSSI | Number of parking locations at site | Average of % completed | Total parked vehicles | Commercial vehicles | Vehicles with bike racks | Vehicles branded with dog walking | Camper vans | MPV / minibus vehicles |
|---|---|---|---|---|---|---|---|---|
| Ash to Brookwood Heaths | 27 | 99.0 | 722 (10) | 49 (14) | 13 (7) | **11 (23)** | **0 (0)** | 4 (4) |
| Bourley & Long Valley | 24 | 80.6 | 539 (8) | 21 (6) | 5 (3) | 3 (6) | 3 (14) | **0 (0)** |
| Bramshill | 9 | 100.0 | 132 (2) | **2 (1)** | 2 (1) | 2 (4) | **0 (0)** | **0 (0)** |
| Broadmoor to Bagshot Woods & Heaths | 15 | 94.7 | **1834 (26)** | **63 (19)** | **138 (72)** | 5 (11) | 4 (18) | **43 (43)** |
| Castle Bottom to Yateley & Hawley Common | 23 | 99.1 | 580 (8) | 14 (4) | 8 (4) | 4 (9) | **1 (5)** | **31 (31)** |
| Chobham Common | 20 | 99.7 | 480 (7) | 30 (9) | 2 (1) | **6 (13)** | **0 (0)** | 3 (3) |
| Colony Bog & Bagshot Heath | 19 | 99.3 | **1109 (16)** | 45 (13) | 2 (1) | 8 (17) | **1 (5)** | 4 (4) |
| Hazeley Heath | 4 | 98.3 | **24 (0)** | **2 (1)** | **0 (0)** | **1 (2)** | **0 (0)** | **0 (0)** |
| Horsell Common | 5 | 97.3 | 421 (6) | **7 (2)** | **1 (1)** | 4 (9) | **1 (5)** | **1 (1)** |
| Ockham & Wisley Commons | 4 | 100.0 | 491 (7) | **66 (20)** | 2 (1) | **1 (2)** | **6 (27)** | 4 (4) |
| Sandhurst to Owlsmoor Bogs & Heaths | 4 | 100.0 | **119 (2)** | 14 (4) | **0 (0)** | **0 (0)** | **6 (27)** | 4 (4) |
| Whitmoor Common | 6 | 100.0 | 544 (8) | 25 (7) | **19 (10)** | 2 (4) | **0 (0)** | 6 (6) |
| **Total** | **160** | **96.0** | **6995 (100)** | **338 (100)** | **192 (100)** | **47 (100)** | **22 (100)** | **100 (100)** |

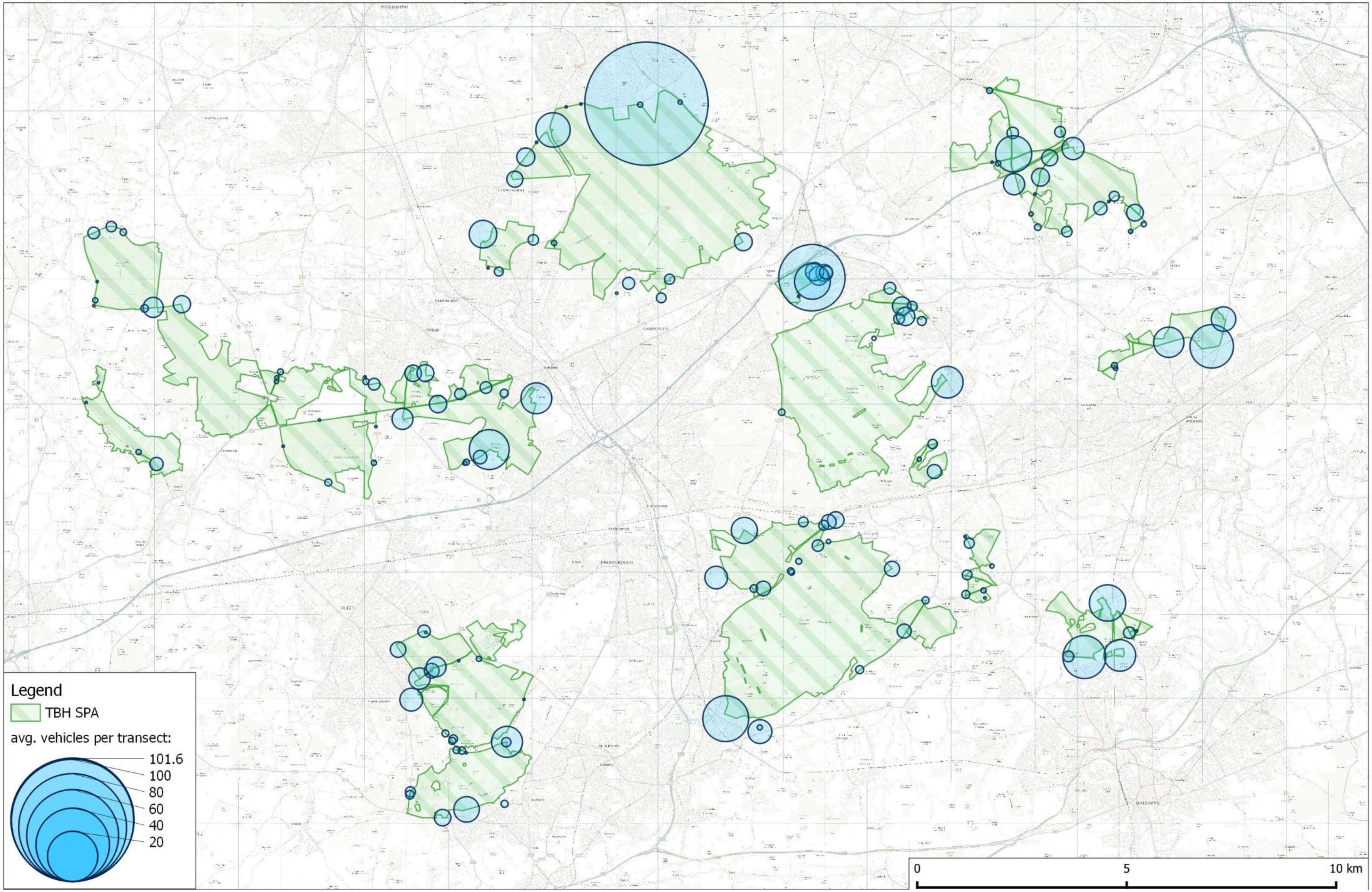
3.10 Total numbers of vehicles for each parking location are also presented as adjusted values accounting for surveying effort (by dividing by the number of counts), to produce average numbers of vehicles per transects. These data values are shown for each SSSI in Table 5. The overall pattern is very similar to that shown from raw values in Table 4.

**Table 5: Average numbers of vehicles per transect for each SSSI site. Total vehicles column is for all vehicle types and columns to the right are a subset. Cells are coloured based on values within the column, high values in red to low values in blue.**

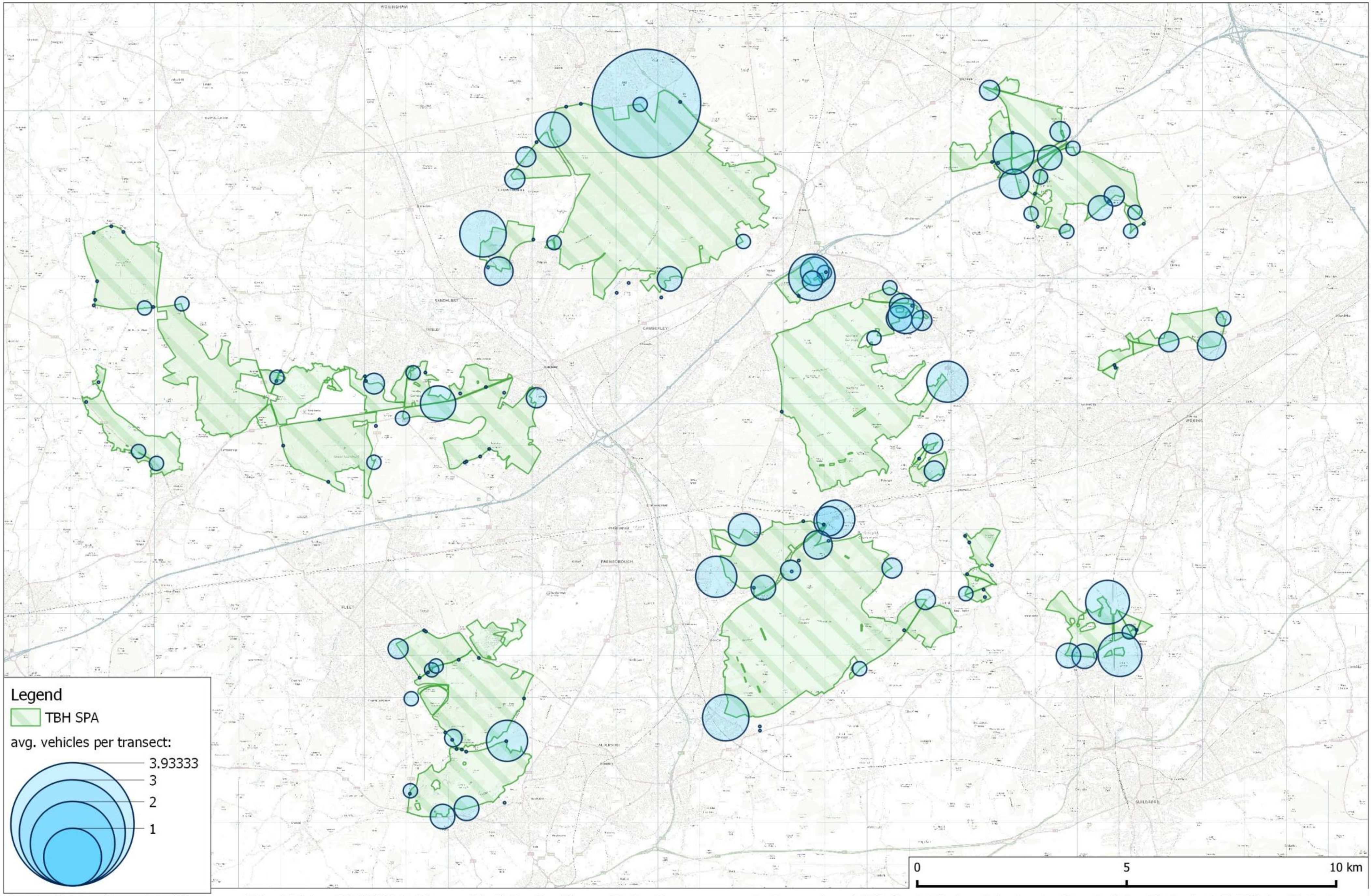
| SSSI | Total parked vehicles | Commercial vehicles | Vehicles with bike racks | Vehicles branded with dog walking | Camper vans | MPV / minibus vehicles |
|---|---|---|---|---|---|---|
| Ash to Brookwood Heaths | 48.4 | 3.3 | 0.9 | 0.7 | 0.3 | 0.0 |
| Bourley & Long Valley | 37.2 | 1.4 | 0.3 | 0.2 | 0.0 | 0.2 |
| Bramshill | 8.8 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 |
| Broadmoor to Bagshot Woods & Heaths | 122.3 | 4.2 | 9.2 | 0.3 | 2.9 | 0.3 |
| Castle Bottom to Yateley & Hawley Common | 38.8 | 0.9 | 0.5 | 0.3 | 2.1 | 0.1 |
| Chobham Common | 32.3 | 2.0 | 0.1 | 0.4 | 0.2 | 0.0 |
| Colony Bog & Bagshot Heath | 74.0 | 3.0 | 0.1 | 0.5 | 0.3 | 0.1 |
| Hazeley Heath | 1.6 | 0.1 | 0.0 | 0.1 | 0.0 | 0.0 |
| Horsell Common | 28.4 | 0.5 | 0.1 | 0.3 | 0.1 | 0.1 |
| Ockham & Wisley Commons | 32.7 | 4.4 | 0.1 | 0.1 | 0.3 | 0.4 |
| Sandhurst to Owlsmoor Bogs & Heaths | 7.9 | 0.9 | 0.0 | 0.0 | 0.3 | 0.4 |
| Whitmoor Common | 36.3 | 1.7 | 1.3 | 0.1 | 0.4 | 0.0 |
| **Total** | **468.6** | **22.6** | **12.8** | **3.1** | **6.7** | **1.5** |

3.11 Values of average number of vehicles per transect for each vehicle type are shown for each individual parking location in Maps 5 to 10. The maps use consistent graduated method of point sizing to indicate the relative number of vehicles recorded at each site. However, it should be noted that the exact values used in scaling points changes between different maps.

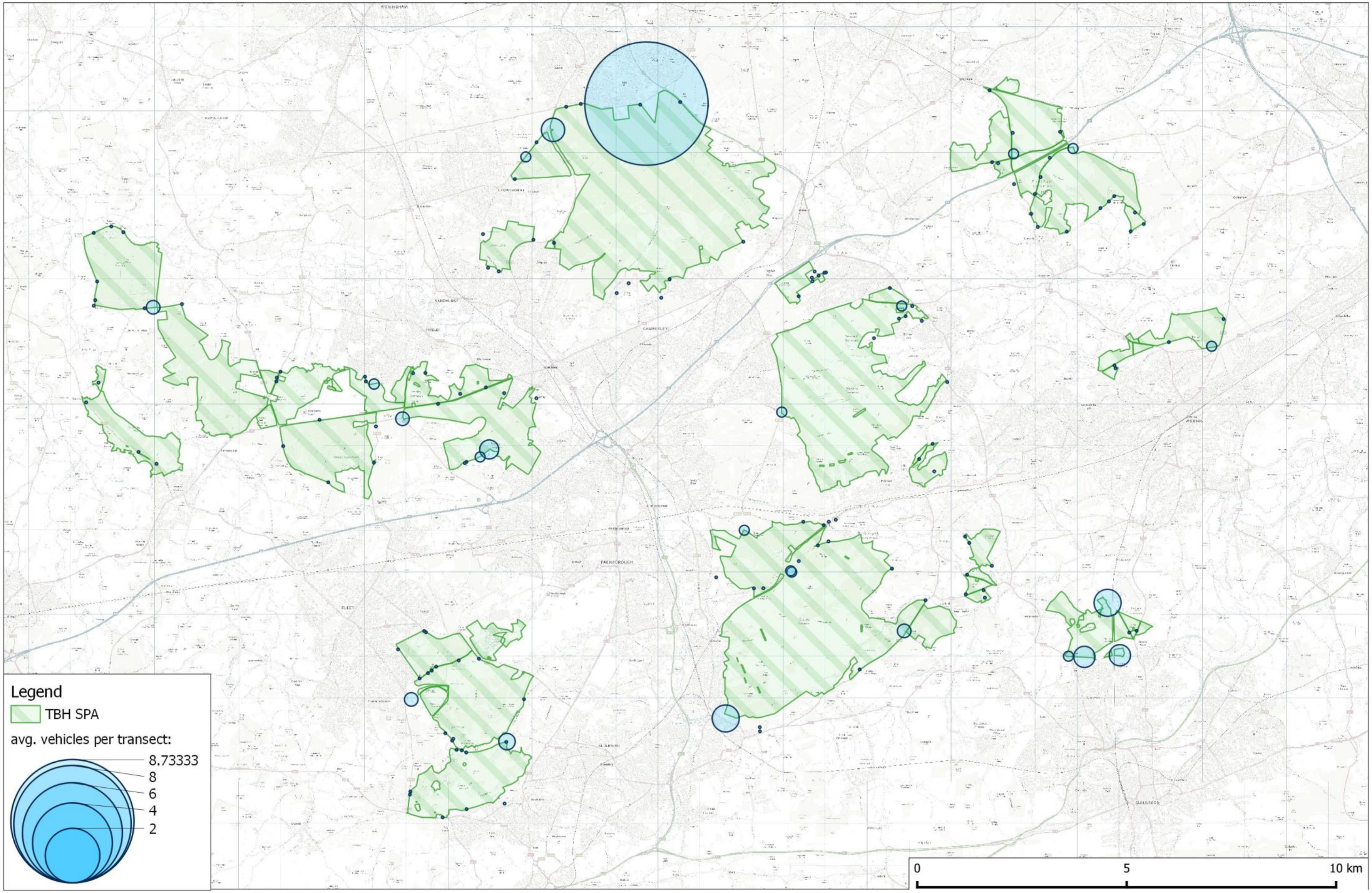
**Map 5: Distribution of parking locations, categorised by average number of vehicles per transect.**



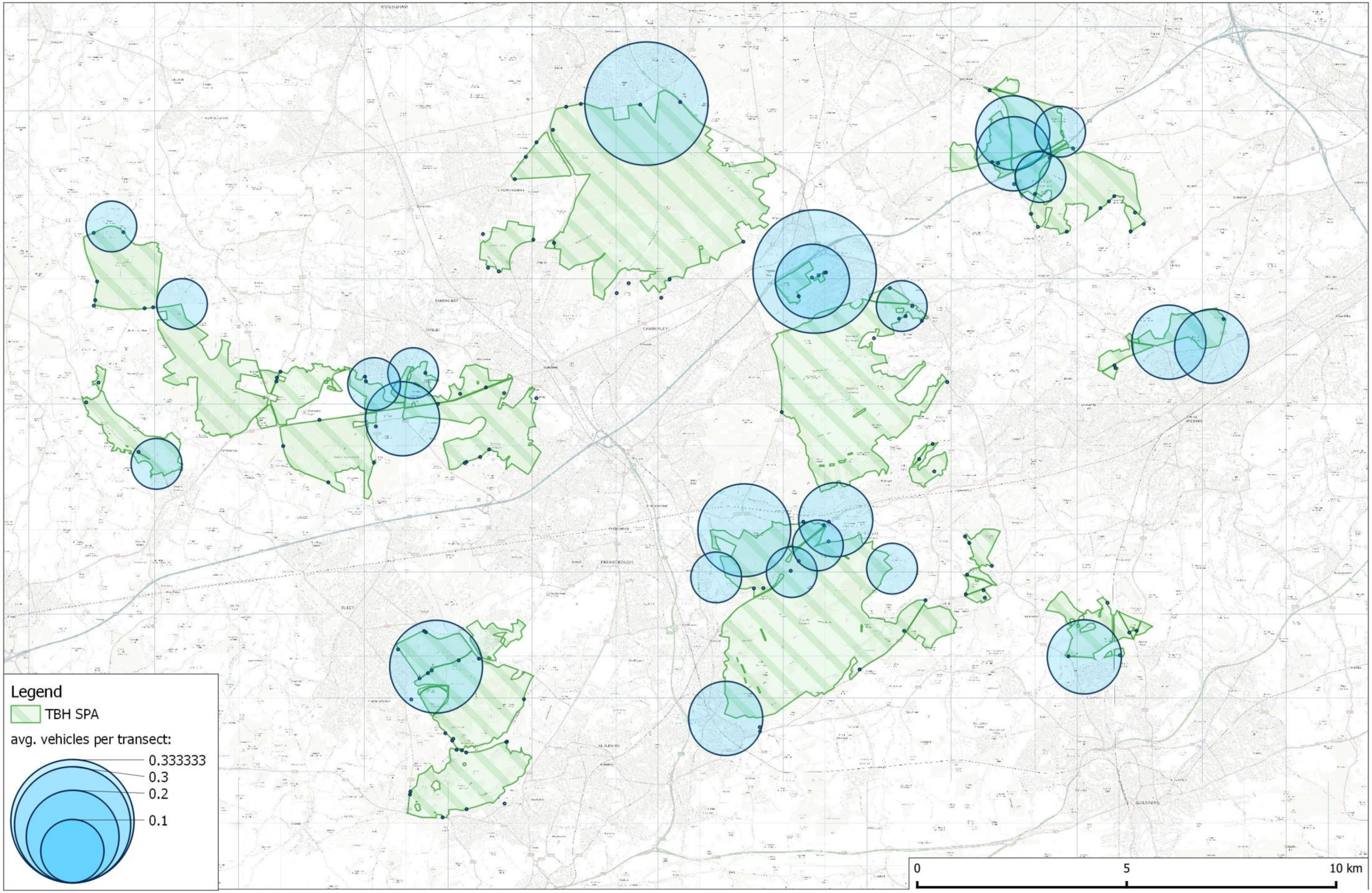
**Map 6: Distribution of parking locations, categorised by average number of commerical vehicles per transect.**



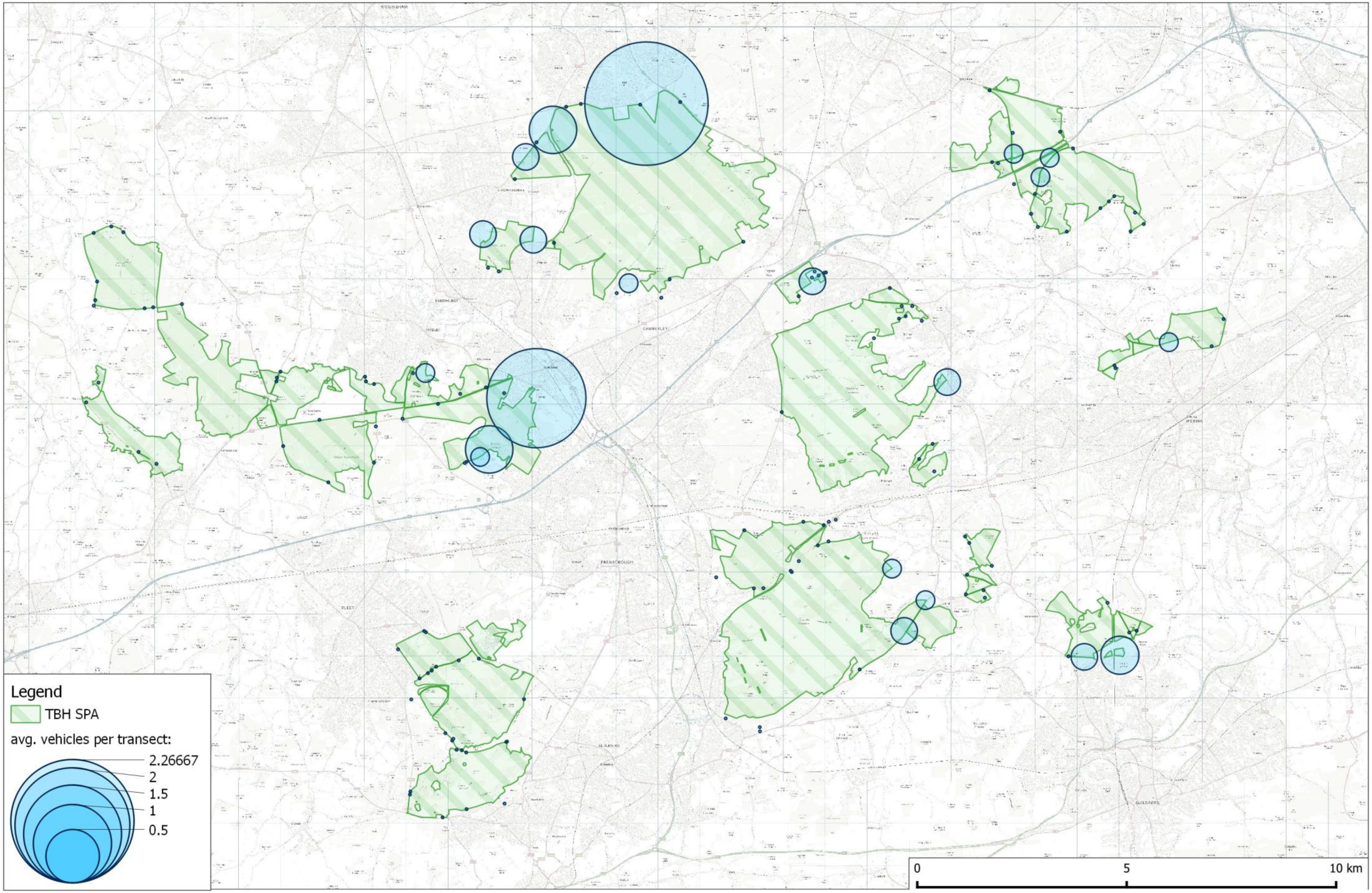
**Map 7: Distribution of parking locations, categorised by average number of vehicles with bike racks per transect.**



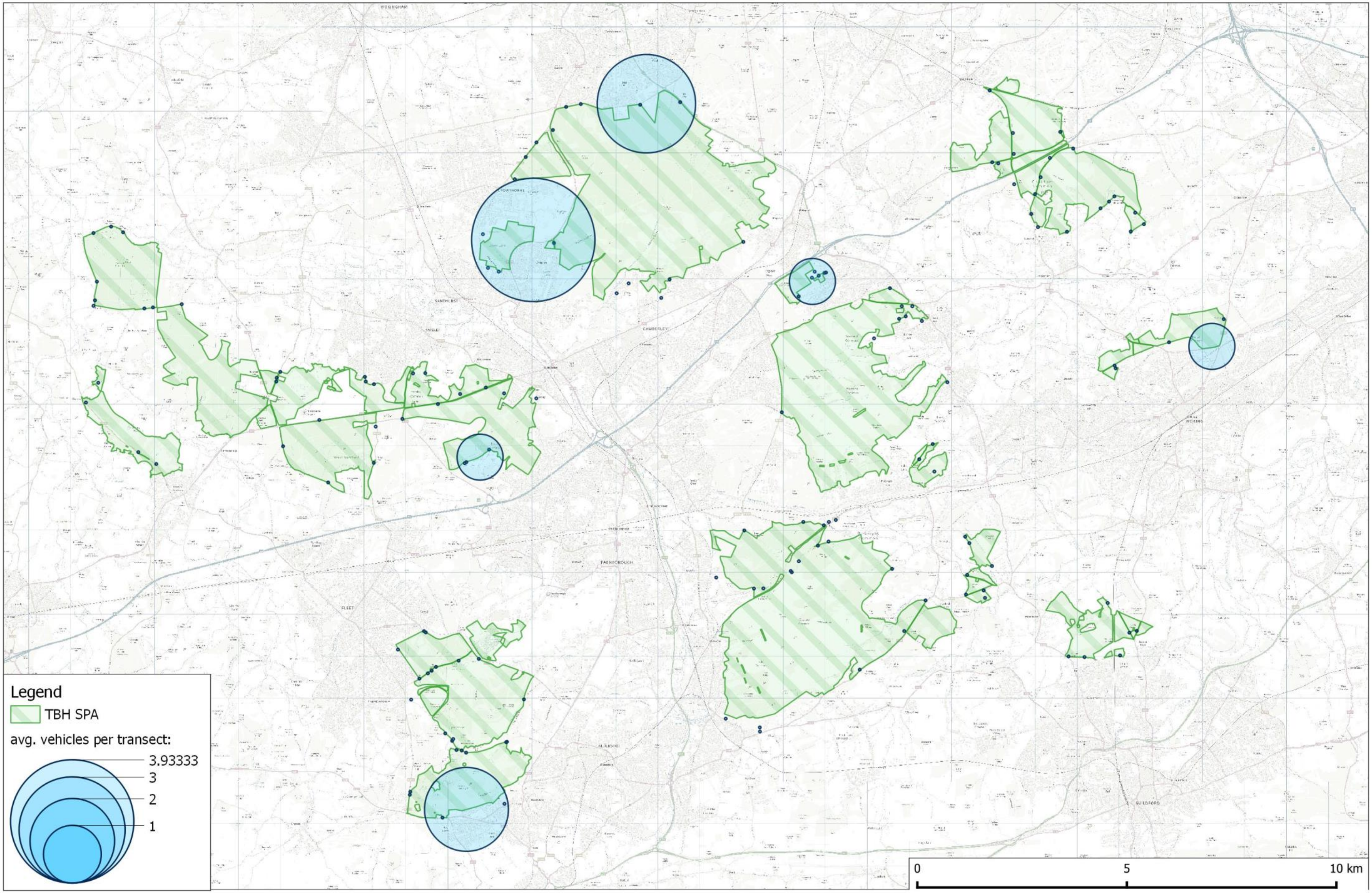
## Map 8: Distribution of parking locations, categorised by average number of branded commerical dog walker vehicles per transect.



**Map 9: Distribution of parking locations, categorised by average number of MPV/minivans per transect.**



**Map 10: Distribution of parking locations, categorised by average number of campervans per transect.**

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## *Temporal variation*

3.12 Counts were dispersed equally across the year, with one weekday count per month – with additional weekend day counts only in the summer months. Considering only these weekday counts of the total number of vehicles, adjusted for surveying effort (by dividing by the number of counts), the average vehicles per parking location was calculated.

3.13 The overall average across all weekday counts for the year was 2.72 vehicles per location – shown as a reference line on Figure 2. Comparison between seasons is shown in Figure 2, and suggests overall that summer was the lowest season for use on weekdays across the year – roughly 10% lower than the average across the whole year's data. Highest use was in spring with 2.97 vehicles per location on average.

3.14 However, as shown in

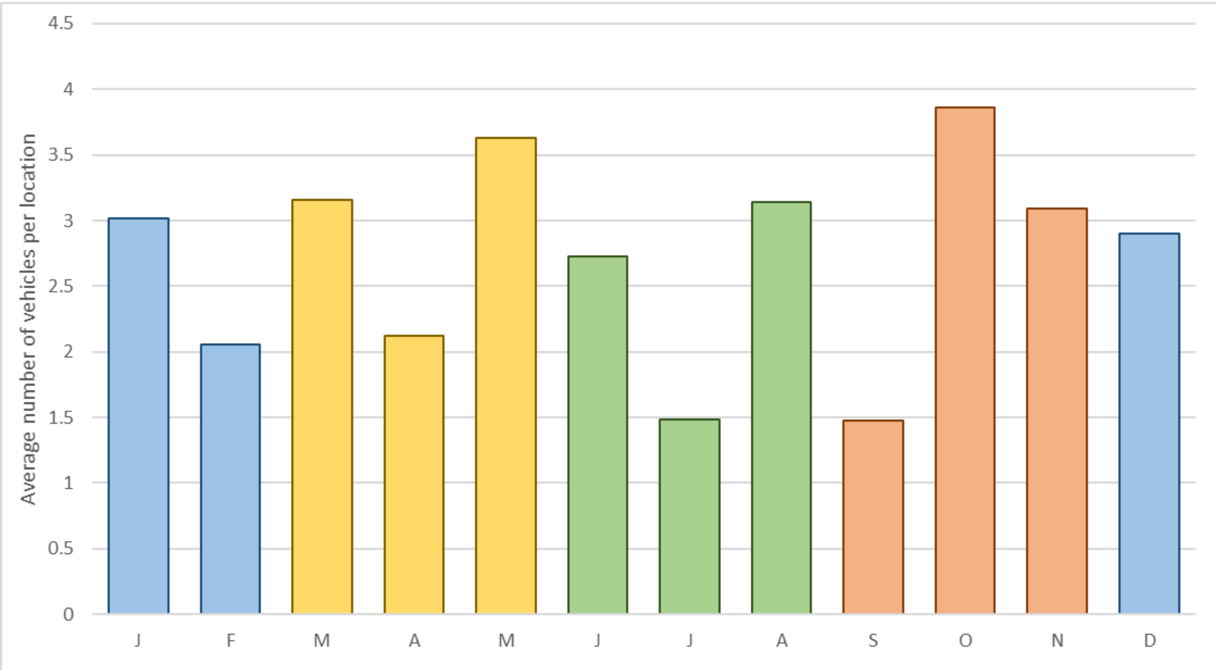



Figure 3, summer was one of the most variable months of data, and included one of the very lowest counts, while winter appeared to be the most consistent season of data.

3.15 Figure 2 and

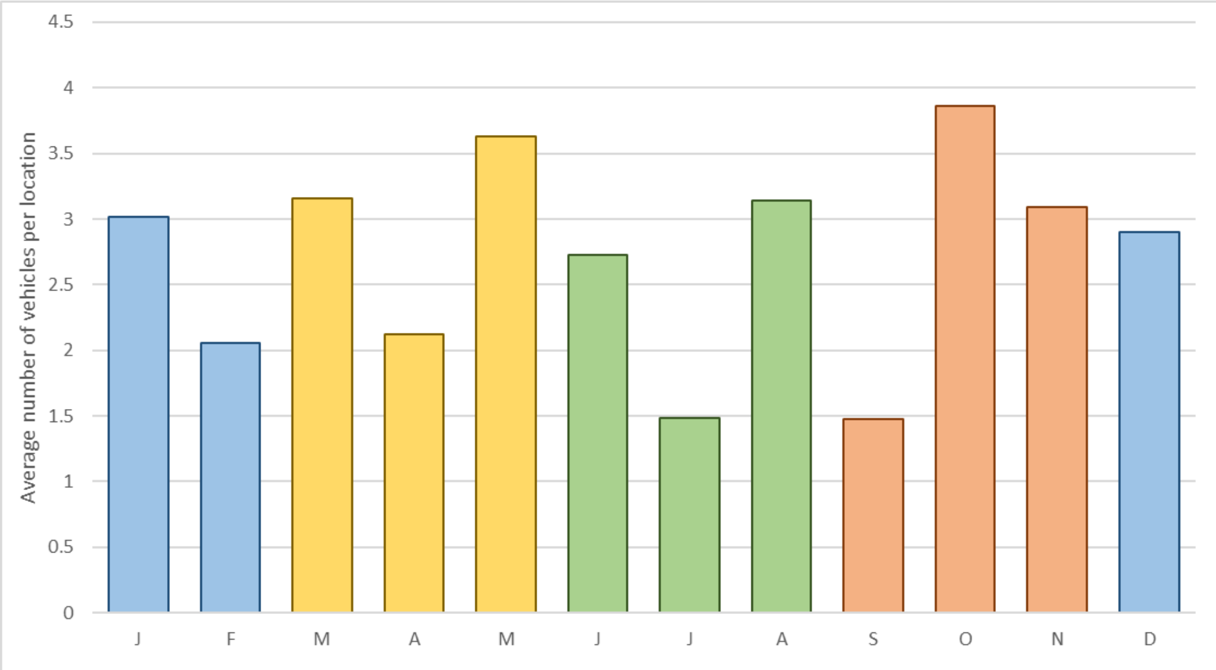



Figure 3 present only weekday values, and it is important to note that summer weekends were very busy and are not included. Weekend surveys in the summer had an average of 4.3 vehicles per parking space – higher than any other weekday count and overall 58% greater than the average weekday value for the whole year.

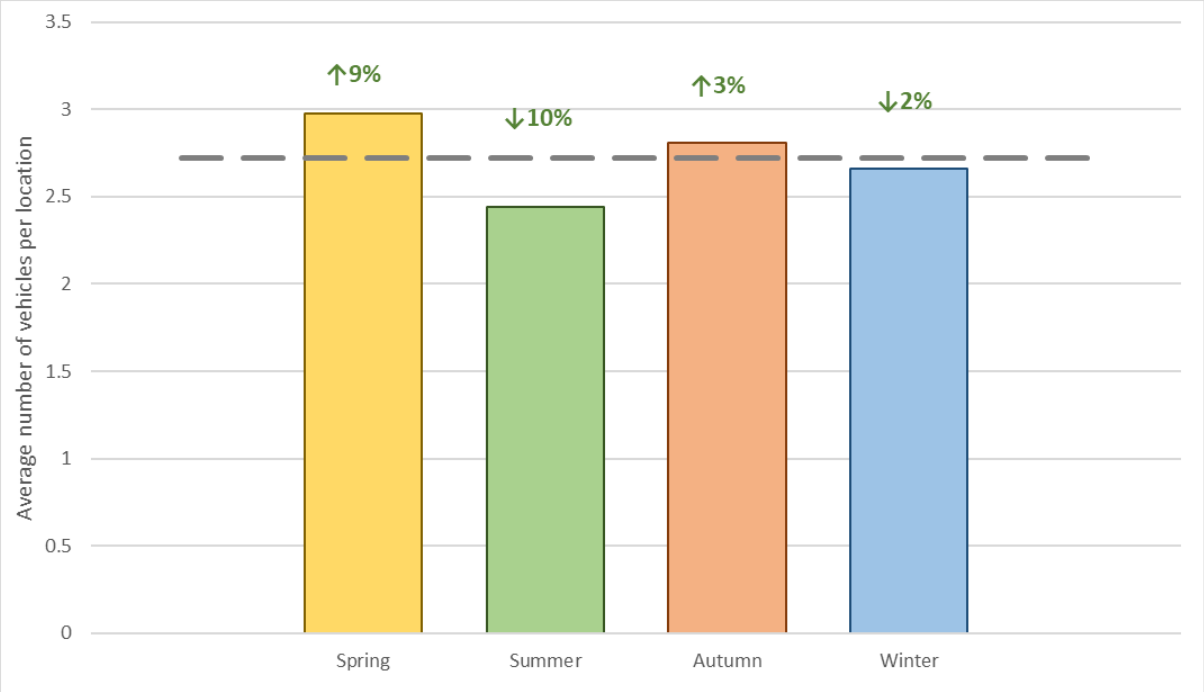



**Figure 2: Average number of vehicles per location recorded in each season. Dashed line indicates average across all seasons. Data considered weekday counts only, with 3 separate transect counts per month.**

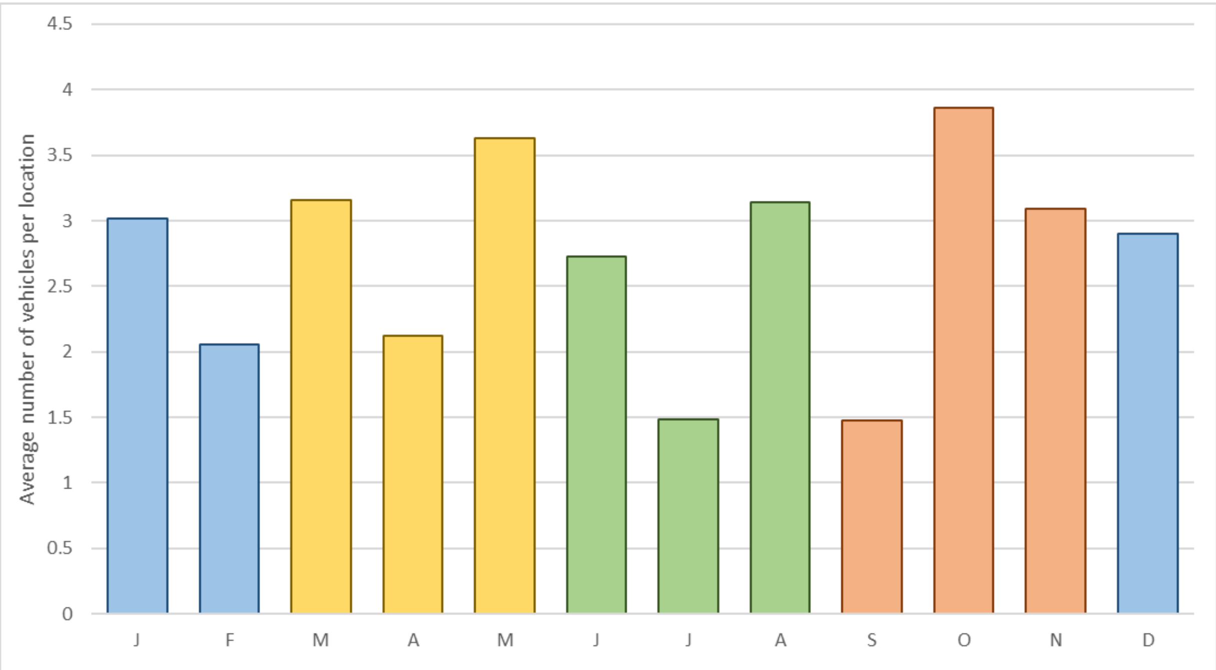



**Figure 3: Average number of vehicles per location recorded in each month. Data considered weekday counts only.**

3.16 One factor which may be influencing this pattern, is the different survey times, which differed in each season – as shown in Table 6.

**Table 6: Summary of number of transects with different start times in the different seasons. Only weekdays included.**

| Season | 07:00 | 10:00 | 14:00 | 16:00 | 18:00 |
|---|---|---|---|---|---|
| Spring | | 1 | 1 | | 1 |
| Summer | 1 | | 1 | | 1 |
| Autumn | 1 | 1 | | 1 | |
| Winter | | | 2 | 1 | |
| **Overall** | **2** | **2** | **4** | **2** | **2** |

3.17 The average number of vehicles at each location could vary considerably based on the different survey times. The two lowest counts shown in

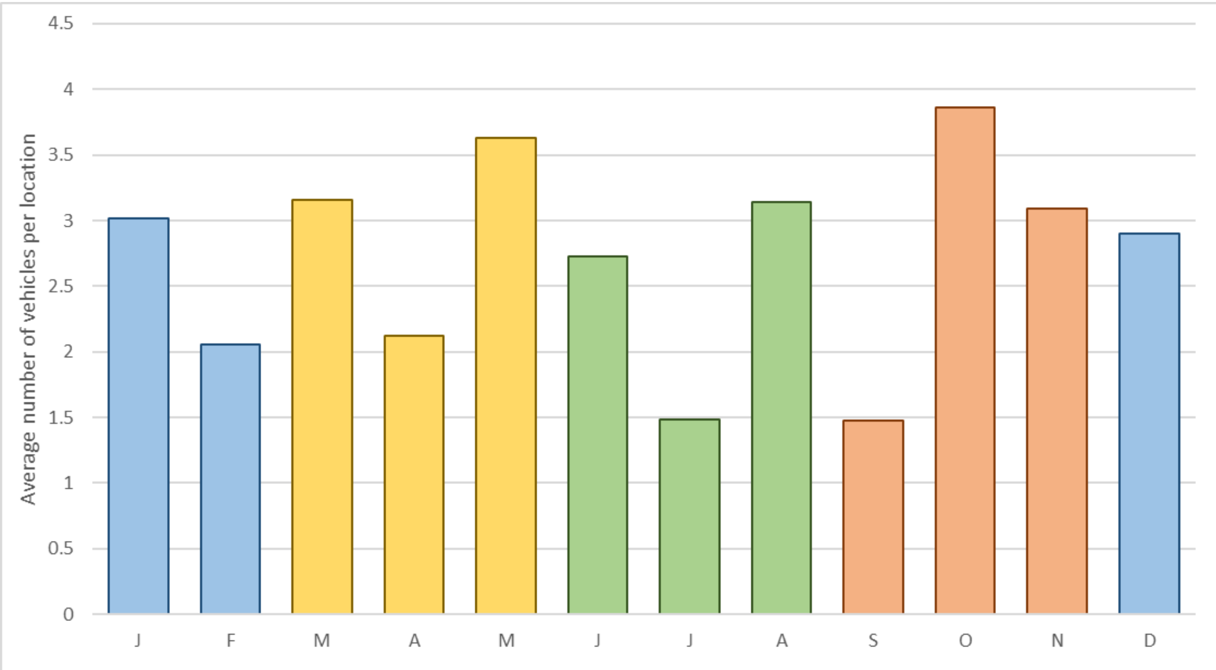



Figure 3 (in July and September) were those which were started at 07:00. Note that while count is low this is considered worthy of undertaking. Counts will be representative of use between 7:00 until around 9:00 (assuming 2 hours to complete), capture early morning dog walkers and may show different patterns of access.

3.18 Compared to the average across all times of day and seasons on weekdays only (2.72 vehicles per count), surveys starting at 07:00 were 46% lower than this average. Figure 4 shows there is something of an expected bell shape curve in the survey times, such that counts during the middle part of the day were higher. Overall, surveys at 10:00 were 24% higher than the average, at 14:00 12% higher, at 16:00 9% higher and at 18:00 11% lower.

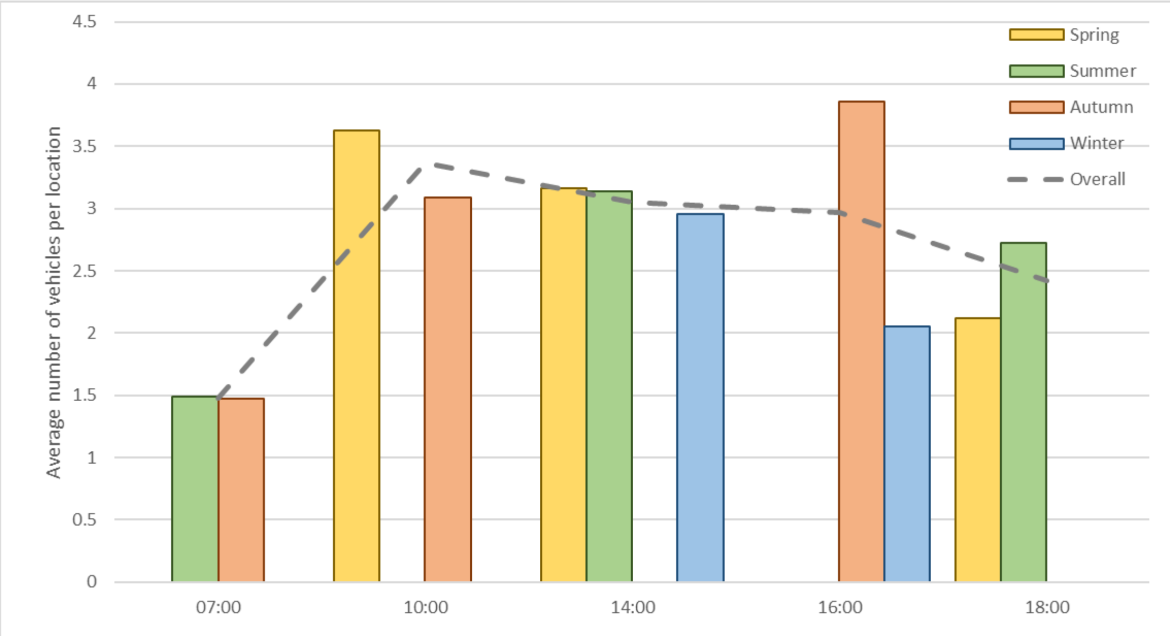



**Figure 4: Average numbers of vehicles per parking location at different times of day (using survey start times) and season. Data considered weekday counts only.**

## *Weekday-weekend variation*

3.19 Surveys were conducted on weekdays, except for during the three summer months, when two surveys per month were conducted; one on a weekday and one on a weekend day. A comparison with monthly weekday-weekend pairs could not be examined as times of day differed greatly – for example July surveys started at 10:00 on a weekend and 18:00 on a weekday. It is suggested that these could be better compared by using the automated counter data which can be paired easily.

3.20 The total number of vehicles for each site, was divided by the number of counts, to produce average numbers of vehicles per transects for each site separately for weekday and weekend day, as shown in Figure 5. Figure 5 is also annotated with the percentage change from weekday to weekend at each site.

3.21 Overall, the percentage change was a 76% increase in the number of vehicles across the whole transect from a weekday to a weekend day in the summer. At individual sites, only Hazeley Heath recorded a reduction in numbers of vehicles at weekends, but this was the site with the lowest numbers overall.

All other sites showed an increase at weekend days, most notably Broadmoor to Bagshot Woods & Heaths.

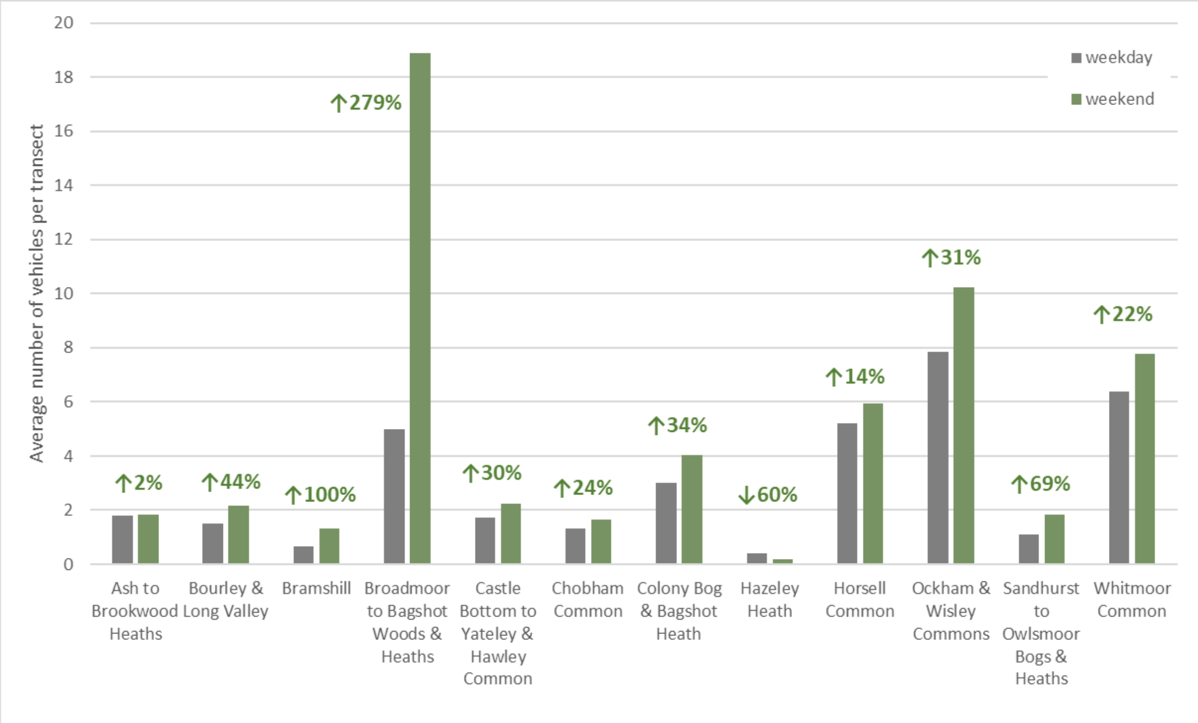



**Figure 5: Comparison of average number of vehicles per transect as a total for each site on weekdays and weekend days. Percentage values indicate the percentage change from weekday numbers to weekend day numbers. It is important to note this is only based on summer data.**

3.22 Overall, most vehicle types also showed an increase. Only the number of commercial vehicles remained consistent, showing just a 1% decrease (total number across both weekday and weekend of 118). Vehicles with bike racks increased by 173% (total seen 143), branded commercial dog walkers by 19% (13), MPV / minibus by 16% (49), and campervans by 411% (6) – however the overall small numbers observed for certain groups should be considered in relation to these percentages.

## Comparison to previous years

3.23 A full summary of totals recorded in each of the previous count years is given in Table 7. However, due to the different timings and different surveying effort, comparison between 2017 and previous years is difficult. Methods used were very similar in 2013 and 2014 (there was a single trial in 2012), but since then methods have been revised.

3.24 Raw count totals are provided for each vehicle type, along with a percentage composition calculation. This shows the proportion of uncategorised vehicles and remains fairly consistent at around 90% of all vehicles. There is the hint of an increase in the proportion of commercial vehicles in counts, rising from 2% in the first year, to 5% in 2017. Similarly, for commercial dog walkers, from a negligible 0% in 2013 and 2014 to always registering at 1% in the last two counts.

3.25 To account for varying survey effort, the number of vehicles per transect was calculated (see italics row in Table 7). This suggests a decrease in the number of vehicles recorded, down from around 528 vehicles per transect in 2013/2014 to 470 and 420 in 2016 and 2017 respectively. Other notable trends include a possible decrease in the number of vehicles with bike racks but increase in the number of commercial dog walker vehicles.

3.26 However, these trends are still only indicative and there has been no accounting for the very different methods (see notes column in Table 7). Transects in 2013 and 2014 were limited to the summer only, compared to year-round surveys in 2016 and 2017. Furthermore 2017 has now included some more weekends, but also a wide range of surveying times, including some notably quieter times of day. This approach will now be the standard moving forward.

**Table 7: Summary of the last four driving transect surveys. Raw total vehicles, including for the different types of vehicles, is shown. Values in brackets indicate the percentage composition of vehicles for each row. The surveying effort was consistent for 2013 and 2014, but otherwise has varied between years. As such the number of transects are given and an additional row of values in italics indicate the average number on a single transect.**

| Year | Number of transects | Number of location counted | Total parked vehicles | Total commerical vehicles | Total vehicles with bike racks | Total commerical dog walker vehicles | Total MPV/minibus | Total Campervans | Notes |
|---|---|---|---|---|---|---|---|---|---|
| 2013 | 6 | 960 | 3164 (93) | 84 (2) | 98 (3) | 8 (0) | 49 (1) | 4 (0) | Summer only |
| | | | *527.3* | *14.0* | *16.3* | *1.3* | *8.2* | *0.7* | |
| 2014 | 6 | 960 | 3178 (89) | 129 (4) | 112 (3) | 10 (0) | 146 (4) | 13 (0) | Summer only |
| | | | *529.7* | *21.5* | *18.7* | *1.7* | *24.3* | *2.2* | |
| 2016 | 11 | 1688* | 5211 (92) | 209 (4) | 108 (2) | 36 (1) | 58 (1) | 17 (0) | All year |
| | | | *473.7* | *19.0* | *9.8* | *3.3* | *5.3* | *1.5* | |
| 2017 | 15 | 2306* | 6296 (90) | 338 (5) | 192 (3) | 47 (1) | 100 (1) | 22 (0) | All year, but more effort in |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | *419.7* | *22.5* | *12.8* | *3.1* | *6.7* | *1.5* | summer & greater range of times |

* some car parks missed/omitted

## *Paired 2016 and 2017 counts*

3.27 To account for some of the variation in surveying effort and allow more detailed comparison we selected comparable pairs of data in 2016 and 2017. Comparable pairs were transects conducted in the same month (almost always at the end of the month), and on the same type of day (weekend or weekday). While these exact dates and in particular times varied this was considered the best approach to allow some comparison.

3.28 We selected 11 pairs, one weekday pair per month, excluding February and September (not surveyed in 2016), and just one weekend pair comparable in July. These pairs are shown in Figure 6.

3.29 Figure 6 shows the variability between these pairs and the overall limited seasonal patterns. It would appear pairs are often similar in the autumn and winter months, and use appears to be more variable within and between years in the warmer months. The dotted lines indicate the mean across all the data values presented in the figure. These mean values were an overall 3.10 vehicles per location in 2016 compared to 2.88 in 2017. However, it is unlikely there is a significant different, as median values show the opposite, with a greater average in 2017 than 2016 (3.02 compared to 2.92).

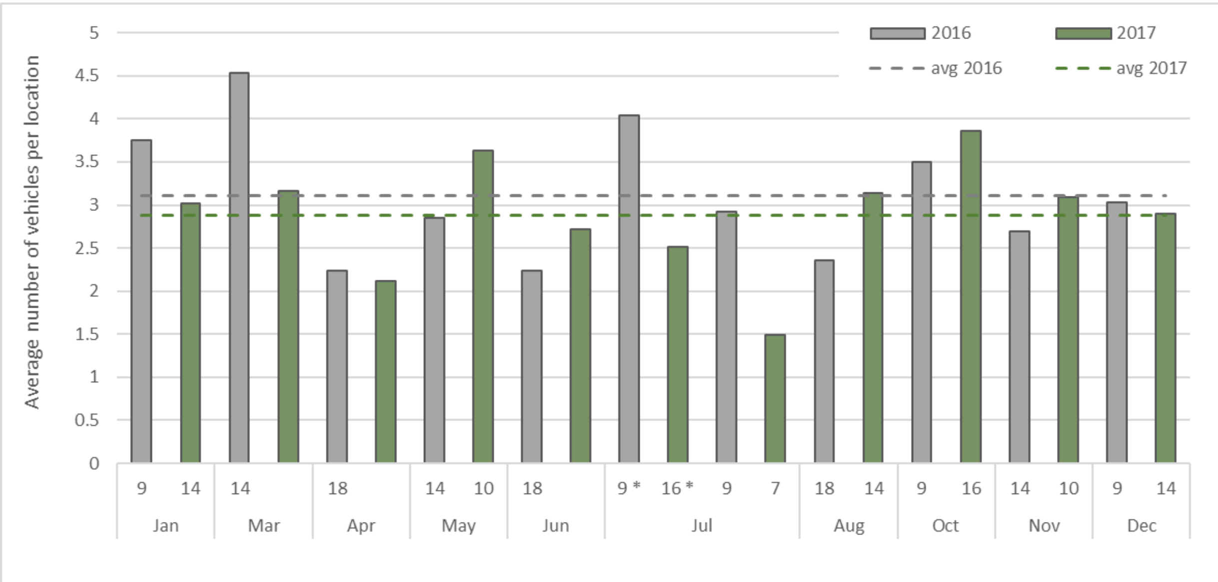



**Figure 6: Monthly pairs of 2016 and 2017 data. Data pairs which were in the same month and same type of day were used. Start times differed for most pairs, but start times are indicated. All pairs were on a weekday, except for one pair in Jul (marked with an *). Dotted lines show the average (mean) based on each pair value presented.**

## *Individual parking locations*

3.30 Individual parking locations were then examined between 2016 and 2017. There was a highly significant correlation between the overall totals at each parking location recorded in 2016 and 2017 (Pearson correlation coefficient=0.964, $p<0.001$), with a very strong fit ($r^2$ = 92%) indicating that relative values are similar (i.e. car parks that were busy in the previous year were busy this year).

3.31 Count data for 2016 and 2017 are shown in Figure 7, where we have fitted a linear trendline through the data points. This fitted line identifies individual parking locations that have a particularly high or low count in 2017 when compared with the 2016 data. The residual value – the extent to which the points are above or below the line – provides a means of highlighting locations where there appears to be a marked change.

3.32 The largest negative residual visible in Figure 7 and therefore largest degree of change was recorded at Section 6, ID 29, Colony Bog & Bagshot Heath, one of the Lightwater Country Park car parks. In 2016 the average count was 26.9 compared to 10.6 in 2017. The largest positive residual at Section 1, ID 7, The Lookout/Bracknell Go Ape on Broadmoor to Bagshot Woods & Heaths, showing an increase from 77.2 in 2016 to 101.6 in 2017.

3.33 Residual values for each parking location are represented in Map 11. Parking locations shown in red, are those with a negative residual value (i.e. point below in the trend line in Figure 7) and therefore where the count in 2017 was lower than would be expected. Points in blue are those locations where the number of vehicles was higher than expected.

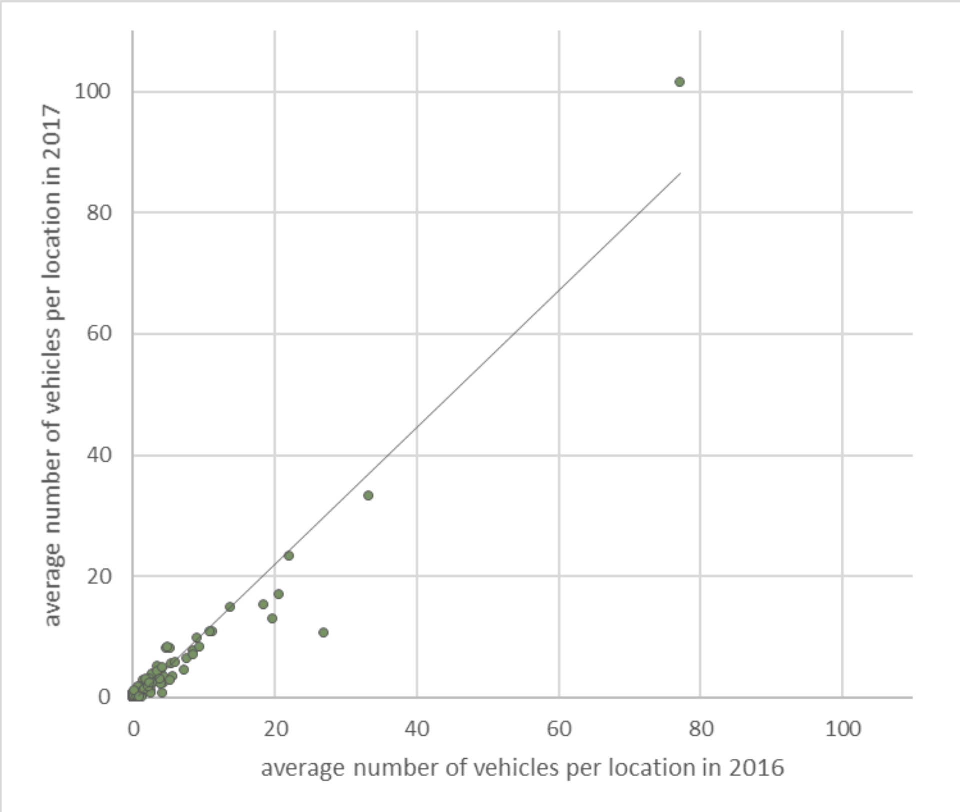
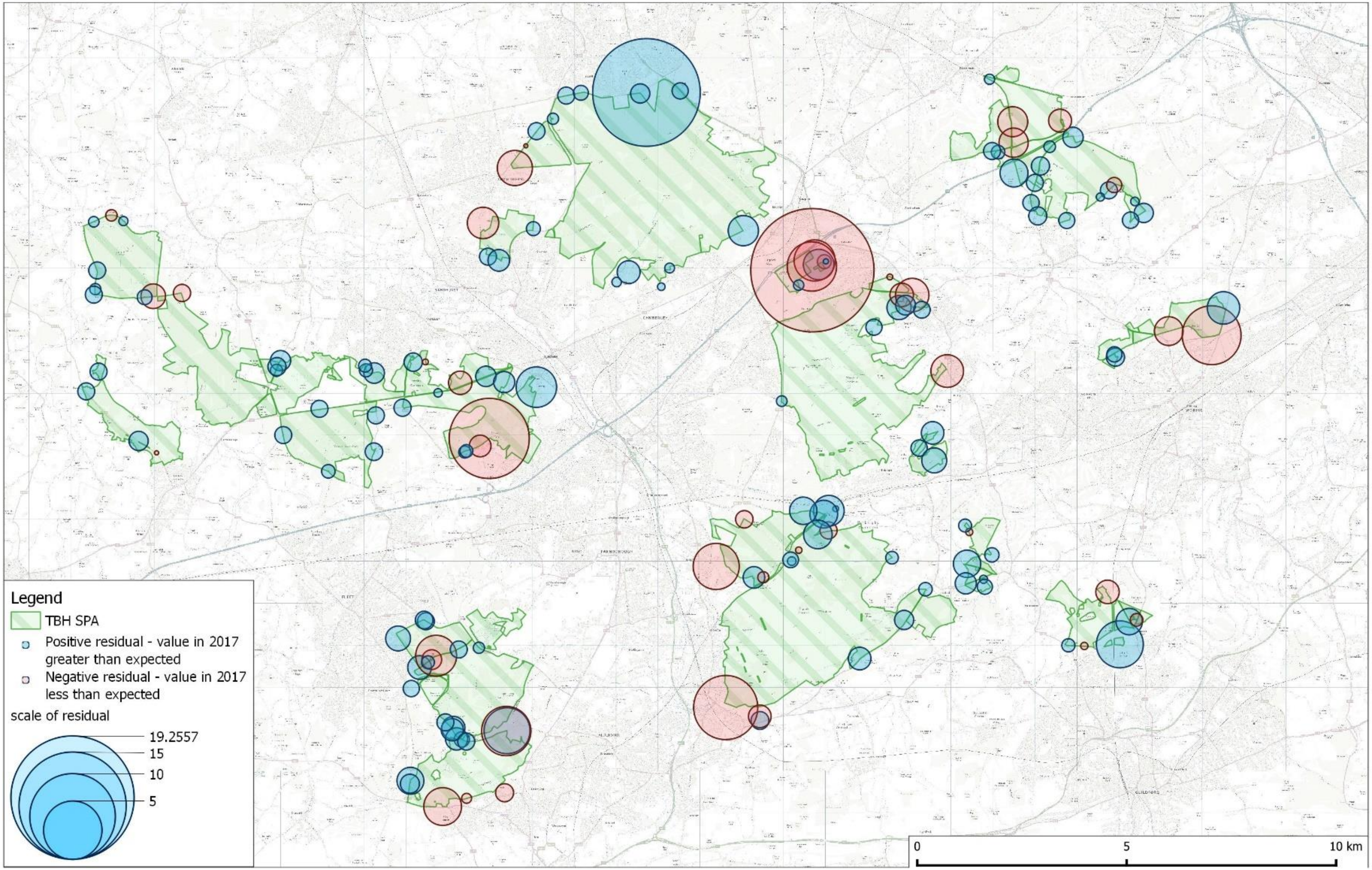



**Figure 7: Scatterplot of data (average vehicles per location) in 2016 and 2017. Diagonal line fitted from point**

3.34 Overall averages for sites suggest that in 2017 the largest reduction from predicted was at Colony Bog & Bagshot Heath, followed by Horsell Common and Ockham & Wisley Commons, while the largest increase was at Broadmoor to Bagshot Woods & Heaths, followed by Whitmoor Common.

**Map 11: Distribution of parking locations, categorised by the relationship with predicated data values from 2016. Red points are those which decreased compared to prediced and blue increased. Size of point shows the scale of change.**



## Discussion and Conclusions

3.36 Overall, the data suggest a slight reduction in the total number of vehicles recorded at parking locations around the SPA in 2016 compared to 2017. However firm conclusions are difficult due to the different approaches taken.

3.37 The results suggest, at least on weekdays, that use in summer is lowest, especially compared to in spring and autumn. Weekend use, however, can be much greater. Comparing 2016 and 2017 data based on comparable dates, we found very slightly lower numbers in 2017, but this was unlikely to be significant. The examination of individual parking locations between 2016 and 2017 showed many parking locations with reduced numbers on average. Many of these reductions were at medium sized parking locations, compared to the single largest increase which was at the largest parking location on the SPA, The Lookout.

3.38 These results therefore suggest: 1) an overall reduction in use; and 2) a move away from many smaller parking locations to single large locations. This results in a change in the distribution of visitor pressure, with higher, concentrated densities in a few locations, compared to a more even spread across the whole area. Additional data are required from further years to determine whether this pattern is real and future counts need to be conducted in line with the previous counts to give confidence in the findings. Comparisons of data across multiple years will reduce variability in counts from weather patterns and overall seasonal variability to show clearer long-term trends.

## Recommendations

3.39 Previous years used variable surveying approaches. Moving forward the methodology used in 2017 appears a robust one and is important this is now taken as the standard.

3.40 There is also a need to audit the parking locations. The types of parking locations (e.g. formal car park, verge, layby), are currently mixed, with some similar categories. These could be categorised in a more rigorous manner to better understand types and the changes in these. There could also be categorisation of the types of access, for example; but also; heath, heath and visitor facilities (e.g. leisure facilities), heath and other greenspaces (e.g. amenity areas), heath and residential (or permit holder) etc. This would allow clearer understanding of whether the level of change is a concern. In addition, the last audit of parking spaces at each location was in 2012 and a check is overdue.

3.41 Auditing would ideally involve a rolling 3 to 5-year check (any more than this would seem a very long period of change) and this could be done on quiet transect dates or over several transect dates. The audit would record changes such as the disappearance of old parking locations or appearance of new parking locations, along with a number of details for each parking location, such as parking capacity, type, substrate type, signage or interpretation, parking charges etc.

3.42 Furthermore, parking locations will also disappear, and new locations appear over time and these changes need to be considered. It is also suggested on a similar time scale (e.g. every 3 years) that a review of the locations counted is undertaken, with any new locations added or closed locations removed. This still needs to be a rational subset as it will be impossible to count all locations.

3.43 With regards to data collection, it is suggested that there should be some changes to the forms used. One recommendation would be to have a column which states which locations are surveyed (e.g. y/n) to make this explicit. In addition, a column to state when a car park is closed should be added, so that it is clear if the car-park has been visited and not currently accessible.

3.44 It could also be useful to have an option to record specific notes to each car park in the full dataset. There are some occasions when the accompanying notes state vehicles being parked in “layby opposite” where it is then unclear if these were included in the final count value and if these are counted every time. This also appears to occur when a car park is closed and cars are parked on the verge outside the parking location instead. Different surveyors may have different views on how this should be categorised and therefore standard guidelines would be useful. A note column for each parking location on recording sheets could make clear if these are included or not and the number of vehicles parked outside. It is suggested that in such examples, where a distinct new area is consistently being used, that a new numbered parking location should be set up to record it.

3.45 Finally, it would appear some parking locations were missed by surveyors, although this was very infrequent. In the longer term this may continue to happen infrequently, particularly if new staff are doing the surveys. It is suggested that some changes to methods could be made to ensure this does not happen, such as a clearer checklist of car parks or using route programmed GPS or phone apps to facilitate surveyors finding locations.

# 4. Automated counter methodology and analysis

## Counter dataset

4.1 The full set of counters for the whole TBH is 36 counters – as shown in Map 11. During 2017, all but one sensor was collecting data. The single sensor with no data was SAMM027, which was vandalised back in 2016 and never reinstated. The full list of counters is provided in Table 8.

4.2 Map 11 shows the distribution of all 36 counters, categorised by the type of access they reflect. The distribution, ownership and types of counter were discussed in detail in the 2016 analysis (see Panter, 2017). As no new sensors are included and the distribution has not changed this is not repeated in this report.

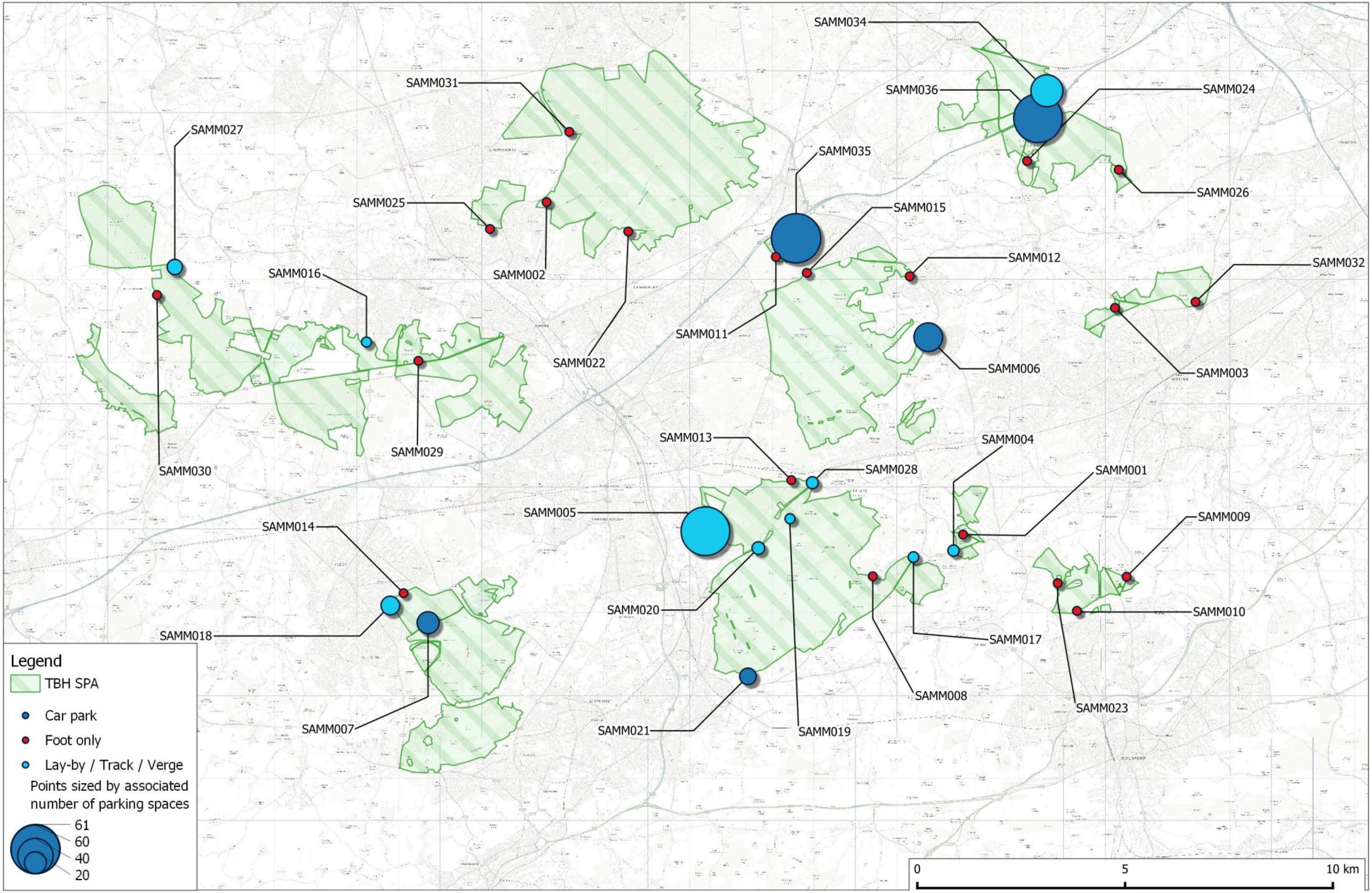
4.3 The raw sensor data were provided directly by the TBHP staff, and these were then reformatted and cleaned (to remove errors) prior to any analysis.

**Table 8: Summary table of the locations of the 36 sensors. Sorted by SSSI then by ID. Final columns indicate sensors which had data in 2016 (21 sensors) and 2017 (35 sensors).**

| SSSI Name | Sensor ID | Name | 2016 | 2017 |
|---|---|---|---|---|
| **Ash to Brookwood Heaths** | SAMM001 | Bullswater Common - North Corral | ✓ | ✓ |
| | SAMM004 | Bullswater Common - South Corral | ✓ | ✓ |
| | SAMM005 | Ash Ranges - Opposite Potters | | ✓ |
| | SAMM008 | Ash Ranges - Henley Park | | ✓ |
| | SAMM013 | Ash Ranges - Gapemouth Road north | | ✓ |
| | SAMM017 | Ash Ranges - Opposite Royal Oak pub | | ✓ |
| | SAMM019 | Ash Ranges - Mychett Place Road middle layby | | ✓ |
| | SAMM020 | Ash Ranges - Mychett Place Road south inside flags | | ✓ |
| | SAMM021 | Ash Ranges - Nightingale Road | | ✓ |
| | SAMM028 | Ash Ranges - Gapemouth Road railway bridge | | ✓ |
| **Bourley & Long Valley** | SAMM007 | Forest of Eversley - Aldershot Road car park | | ✓ |
| | SAMM014 | Forest of Eversley - Pedestrian entrance | | ✓ |
| | SAMM018 | Forest of Eversley - Florence Road | | ✓ |
| **Bramshill to Heath Warren Wood** | SAMM027 | Heath Warren Wood - St. Neots Road | ✓ | |
| | SAMM030 | Heath Warren Wood - Bramshill Depot | ✓ | ✓ |
| **Broadmoor to Bagshot Woods & Heaths** | SAMM002 | Broadmoor Bottom - Owlsmoor | ✓ | ✓ |
| | SAMM031 | Crowthorne - Devils Hwy | ✓ | ✓ |
| **Castle Bottom to Yateley and Hawley Commons** | SAMM016 | Yateley Common - Vigo Lane | ✓ | ✓ |
| | SAMM029 | Yateley Common - A30 | | ✓ |
| **Chobham Common** | SAMM024 | Chobham Common - Clearmount | ✓ | ✓ |
| | SAMM026 | Chobham Common - Fishpool | ✓ | ✓ |
| | SAMM034 | Chobham Common - Burma Rd | ✓ | ✓ |

| SSSI Name | Sensor ID | Name | 2016 | 2017 |
|---|---|---|---|---|
| | SAMM036 | Chobham Common - Staple Hill | ✓ | ✓ |
| **Colony Bog & Bagshot Heath** | SAMM006 | Bisley | | ✓ |
| | SAMM011 | Lightwater Country Park - Viewpoint | ✓ | ✓ |
| | SAMM012 | Brentmoor Heath | ✓ | ✓ |
| | SAMM015 | Brentmoor - Red Road | | ✓ |
| | SAMM022 | Barossa - Kings Ride | | ✓ |
| | SAMM035 | Lightwater Country Park - Leisure Centre | ✓ | ✓ |
| **Horsell Common** | SAMM003 | Horsell Common - Horsell Common Rd | ✓ | ✓ |
| | SAMM032 | Horsell Common - Near 6-ways car park | ✓ | ✓ |
| **Ockham & Wisley Commons** | SAMM033 | Ockham Common | ✓ | ✓ |
| **Sandhurst to Owlsmoor Bogs & Heaths** | SAMM025 | Wildmoor Heath - Thibet Rd | ✓ | ✓ |
| **Whitmoor Common** | SAMM009 | Whitmoor - A320 Guildford Rd | ✓ | ✓ |
| | SAMM010 | Whitmoor Common - Salt Box Rd side | ✓ | ✓ |
| | SAMM023 | Whitmoor Common - Path to St. Mary's Church | ✓ | ✓ |

**Map 11: Distribution of sensors, categorised by the type of access and number of spaces at parking locations.**



## *Data reformatting*

4.4 The raw dataset for 2017 provided by the TBHP staff consisted of 262,230 data rows from the 35 sensors (as listed in Table 8). This single dataset contained collated individual data files which were downloaded from each sensor on a regular basis (every two to three months). The combined data set from all 35 sensors detailed:

- The sensor unit name;
- Data point id (id column which consecutively counts the number of data rows from each 'file' – each file being a separate data download);
- A date-time column;
- The number of events per hour (or single event for some units); and
- Any data handling notes.

4.5 Into these raw data were inserted a series of columns used for the data analysis: date, day of month, month-year, and hour. The normal format for the sensors was for each data row to detail the total number of events (an 'event' being a recorded pass) for the given hour. Issues in last year's dataset resulted from sensors recording individual passes as separate rows, rather than hourly totals, however no instances were recorded in these data. Two duplicate hour data rows were recorded (i.e. two values for a single sensor on a single date and hour), and values summed in these instances.

4.6 Table 9 shows a summary of the completeness of raw data recorded, following the initial data reformatting but not data cleaning.

**Table 9: Monthly summary of raw data recording each sensor, values indicate the estimated number of days the sensor was collecting data for. Values in brackets indicate the percentage of hours for which the sensor was recording data out of the total hours in the month. When percentages are rounded to 100% the percentage is not stated, but values highlighted in bold.**

| Sensor ID | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMM001 | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 16.4 (55) | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM002 | **31** | 28 (97) | **31** | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM003 | **31** | 28 (96) | **31** | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM004 | 0 (0) | 19.3 (67) | **31** | **30** | **31** | **30** | **31** | 21.5 (69) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| SAMM005 | 0 (0) | 0 (0) | 17.5 (56) | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM006 | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 17.5 (58) | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM007 | 0 (0) | 0 (0) | 15.3 (49) | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM008 | 0 (0) | 0 (0) | 11.5 (37) | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM009 | **31** | 28 (97) | **31** | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM010 | **31** | 28 (97) | **31** | **30** | 3.4 (11) | 16.6 (55) | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM011 | **31** | 28 (96) | **31** | **30** | **31** | **30** | **31** | 22.6 (73) | 0 (0) | 0 (0) | 0 (0) | 0 (0) |
| SAMM012 | **31** | 28 (97) | **31** | **30** | **30.9** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM013 | 0 (0) | 0 (0) | 16.5 (53) | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM014 | 0 (0) | 0 (0) | 15.4 (50) | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM015 | 0 (0) | 0 (0) | 11.3 (37) | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM016 | **31** | 28 (97) | **31** | **30** | **31** | **30** | **31** | 30.5 (98) | **30** | **31** | **30** | **31** |
| SAMM017 | 0 (0) | 0 (0) | 14.4 (47) | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM018 | 0 (0) | 0 (0) | 15.5 (50) | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM019 | 0 (0) | 0 (0) | 17.4 (56) | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM020 | 0 (0) | 0 (0) | 11.5 (37) | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM021 | 0 (0) | 0 (0) | 17.5 (57) | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM022 | 0 (0) | 0 (0) | 18.3 (59) | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM023 | **31** | 28 (96) | **31** | **30** | 3.5 (11) | 16.5 (55) | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM024 | **31** | 28 (96) | **31** | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM025 | **31** | 28 (97) | **31** | **30** | **30.9** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM026 | **31** | 28 (97) | **31** | **30** | **30.9** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM028 | 0 (0) | 0 (0) | 16.5 (53) | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM029 | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 0 (0) | 17.5 (58) | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM030 | **31** | 28 (96) | **31** | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM031 | **31** | 28 (96) | **31** | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM032 | **31** | 28 (97) | **31** | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM033 | **31** | 28 (96) | **31** | **30** | **30.9** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM034 | **31** | 28 (96) | **31** | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM035 | **31** | 28 (97) | **31** | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |
| SAMM036 | **31** | 28 (96) | **31** | **30** | **31** | **30** | **31** | **31** | **30** | **31** | **30** | **31** |

## *Data cleaning*

4.7 Manual cleaning of the data was required to remove data recorded which appeared spurious or was completely lacking (e.g. false zeros).

4.8 There were notably fewer errors within the data compared to 2016. Furthermore, only one continuous section of data with zero values was noted from sensors. This was for the sensor SAMM010 between 21/02/2017 and 14/06/17 and this data was simply filtered out.

4.9 However, the 2017 data held more sections with clearly inflated values, e.g. hourly values in the order of 1,000s. Such values often occur because of damage to the sensors and can be identified by very high values outside of the usual hours (e.g. for SAMM016 between 01/01/17 and 07/05/17 32% of passes were between 23:00 and 07:00). These issues were present in the data for the following sensors:

- SAMM011 (28/03/17- end)
- SAMM016 (start- 7/05/17);
- SAMM016 (30/09/17- end);

4.10 The final cleaning step was to eliminate data values which were the first and last data rows for each sensor's individual download files. These data relate to the time when the sensor was set up/downloaded, and the sensor will have recorded multiple passes during the setting-up/ re-testing process. As such the recorded data values for at least one hour would be incorrect.

4.11 Use of the multiple exclusion principles described above resulted in the removal of 10,801 data rows (therefore hours). However, to fully remove any further possible errors in the data and allow an easier and more accurate analysis of the data, we eliminated all data for the whole day from the sensor where any hourly values had been eliminated, leaving data relating to whole days only. This step resulted in a total of 12,608 rows excluded (inclusive of the above 10,801 rows), accounting for approximately 4% of data rows, and therefore hours, from total 262,228 (this compares to 9% of data in 2016).

4.12 The amount of data removed for each sensor and by month is expressed as a percentage of the total month in Table 9. February 2017 was the month with the highest percentage of data across all sensors removed.

## *Data analysis*

4.13 Analyses were based on the raw pass values. These values are approximate to, but not directly equivalent to, the number of people.

4.14 In all data analysis, the raw number of passes are presented as averages based on hours or days of data recorded to account for data coverage. Data in this report are often presented as graphs or tables. Tables are used to provide actual values, with all table cells coloured to graphically show patterns at a glance. In these tables, row represents a counter, and cells within each row are coloured red to green, reflecting low to high values. It should be noted that the red to green cell colouring in tables shows the ranking of cells, rather than the actual scale of difference between cells.

4.15 Detailed calibration of individual sensors would be required before the values presented could be converted into the number of people, rather than simply passes. Calibration is necessary as sensors may record people and groups in different ways or pick up on other passes (e.g. dogs), such that an approximation between passes and people is not consistent between sensors. This will also differ between the different types of locations, and types of sensor. Furthermore, the relative number of people entering and leaving will differ with the different visitor flow on sites. It cannot be assumed that the number of passes is double the amount of access (i.e. equal numbers of people passing in both directions, both entering and leaving) as in some locations the flow may be much more unidirectional.

4.16 For this reason, the relative differences between individual sensors may not always be true, and this could not be investigated in detail. However, within an individual sensor the changes over time are considered more reliable and are likely to be directly comparable.

# 5. Automated counter results

5.1 After data cleaning, the 2017 dataset consisted of 35 sensors which had collected 249,620 data rows, i.e. hours of data. The number of data rows for individual sensors in this cleaned data set ranged from 2,039 (SAMM011, equivalent to c. 85 days) to 8,616 for 12 sensors (equivalent to c. 359 days); most sensors collected a reasonable amount of data, with a mean value of 7,132 hours per sensor (equivalent to c. 297 days).

5.2 The average number of passes recorded per hour is shown per month for individual sensors in Table 10. The cell values in Table 10 have been coloured to easily show the peaks and lows across individual sensors over time, and also data gaps. SAMM011 had the largest data gap across the year, with nine months of missing data. It should also be noted that many sensors had a data gap during January and February, and this must be considered when examining other data patterns.

5.3 The typical values (mean with standard error) across each of the months of data are shown for each sensor in the final column of Table 10. These averages ranged from 0.1 people per hour (SAMM022) to 17.6 (SAMM032).

5.4 The maximum recorded average for a sensor in a single month was 20.4 for SAMM016 in September, followed by 20.1 for SAMM032 in April. Overall, 15 sensors (43%) recorded a maximum value in April, considerably more than any other month; next highest was June by just 4 sensors, and July, August and March, all 3 sensors. Monthly variation is also expressed for each location in Map 12.

**Table 10: Average number of passes per hour in each month for individual sensors, with cells coloured red to green for low to high values for each sensor. The final column shows the overall mean and standard error of monthly values, with top five values in red bold and lowest five in blue bold.**

| | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec | Mean ± SE |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMM001 | | | | | | 0.7 | 0.5 | 0.5 | 0.5 | 0.5 | 0.6 | 0.4 | 0.5 ± 0.04 |
| SAMM002 | 1.8 | 1.9 | 2.4 | 2.5 | 2.1 | 1.9 | 2 | 2.3 | 2.1 | 2 | 2 | 1.8 | 2.1 ± 0.07 |
| SAMM003 | 1.1 | 1 | 1 | 1.8 | 1.8 | 0.9 | 1 | 1.3 | 1.5 | 1.6 | 1.5 | 1.4 | 1.4 ± 0.09 |
| SAMM004 | | 0.4 | 0.4 | 0.6 | 0.4 | 0.6 | 0.3 | 0.4 | | | | | 0.4 ± 0.05 |
| **SAMM005** | | | 13.4 | 14.7 | 13.7 | 13 | 13.5 | 13.2 | 12.8 | 12.7 | 11.2 | 9.9 | **12.8 ± 0.43** |
| SAMM006 | | | | | | 0.7 | 0.7 | 0.9 | 0.6 | 0.6 | 0.5 | 0.6 | 0.7 ± 0.04 |
| SAMM007 | | | 10.9 | 10.1 | 9.9 | 9.2 | 10 | 9.7 | 7.9 | 10.6 | 10.1 | 9 | 9.8 ± 0.27 |
| SAMM008 | | | 0.8 | 1.3 | 0.9 | 1 | 1.1 | 0.9 | 1 | 0.9 | 0.6 | 0.5 | 0.9 ± 0.07 |
| SAMM009 | 0.3 | 0.2 | 0.3 | 0.7 | 0.3 | 0.4 | 0.4 | 0.3 | 0.4 | 0.4 | 0.4 | 0.2 | 0.4 ± 0.03 |
| SAMM010 | 0.6 | 0.6 | 0 | 0 | 0 | 2.6 | 2.4 | 2.7 | 2.4 | 2.5 | 2.1 | 1.8 | 1.5 ± 0.33 |
| SAMM011 | 4.5 | 4.6 | 6.3 | | | | | | | | | | 5.1 ± 0.6 |
| SAMM012 | 2.4 | 1.4 | 1.5 | 2.6 | 2.2 | 2.1 | 1.8 | 1.8 | 1.9 | 2 | 0.2 | 0.2 | 1.7 ± 0.22 |
| SAMM013 | | | 2.5 | 2.6 | 2.8 | 3.4 | 2.4 | 2.4 | 2.7 | 2.5 | 1.2 | 0.7 | 2.3 ± 0.25 |
| SAMM014 | | | 2.1 | 1.4 | 1.4 | 1.1 | 0.9 | 1 | 0.9 | 1 | 1 | 0.8 | 1.2 ± 0.12 |
| **SAMM015** | | | 0.4 | 0.6 | 0.4 | 0.3 | 0.4 | 0.3 | 0.3 | 0.3 | 0.2 | 0.3 | **0.3 ± 0.04** |
| **SAMM016** | | | | | 6.5 | 13.2 | 9.1 | 10.3 | 20.4 | - | - | - | **11.9 ± 2.38** |
| SAMM017 | | | | | 1.7 | 1.4 | 1.7 | 1.5 | 1.5 | 1.4 | 1.3 | 1.3 | 1.5 ± 0.04 |
| **SAMM018** | | | 10.9 | 13.6 | 11.7 | 10.8 | 12.2 | 12.1 | 12.5 | 13.2 | 12.2 | 11.1 | **12.0 ± 0.29** |
| SAMM019 | | | 0.7 | 0.7 | 0.7 | 0.5 | 0.6 | 0.7 | 0.5 | 0.5 | 0.4 | 0.4 | 0.6 ± 0.04 |
| SAMM020 | | | 2.7 | 2.7 | 2.5 | 1.7 | 2.3 | 2.5 | 1.9 | 2 | 2 | 1.4 | 2.2 ± 0.14 |
| SAMM021 | | | 1 | 1.1 | 1 | 1 | 0.8 | 1 | 1 | 1.1 | 0.9 | 1.1 | 1 ± 0.03 |
| **SAMM022** | | | 13 | 15.1 | 13.8 | 12 | 13 | 12.9 | 12.5 | 13.4 | 12.5 | 13.6 | **13.2 ± 0.28** |
| SAMM023 | 1.9 | 1.2 | 1.5 | 3.8 | 3 | 2.8 | 2.8 | 2.9 | 2.7 | 2.7 | 2.3 | 2.2 | 2.5 ± 0.2 |
| **SAMM024** | 0 | 0 | 0.1 | 0.1 | 0.3 | 0.2 | 0.4 | 0.2 | 0.2 | 0.1 | 0.1 | 0 | **0.2 ± 0.03** |
| **SAMM025** | 0 | 0 | 0.1 | 0.2 | 0.3 | 0.4 | 0.4 | 0.3 | 0.1 | 0.1 | 0 | 0 | **0.2 ± 0.04** |
| **SAMM026** | 0.1 | 0.2 | 0.3 | 0.3 | 0.4 | 0.4 | 0.3 | 0.2 | 0.1 | 0.1 | 0 | 0.1 | **0.2 ± 0.04** |
| SAMM028 | | | 5.6 | 3.4 | 4.4 | 3.9 | 3.6 | 3.7 | 3.3 | 5.6 | 7.3 | 4.7 | 4.6 ± 0.41 |
| SAMM029 | | | | | | 1.5 | 1.6 | 1.6 | 1.2 | 1.1 | 0.8 | 0.8 | 1.2 ± 0.13 |
| SAMM030 | 1.4 | 2.2 | 1.5 | 2 | 1.8 | 1.7 | 1.8 | 1.8 | 1.8 | 1.9 | 1.6 | 1.2 | 1.7 ± 0.08 |
| SAMM031 | 1 | 1.4 | 1.4 | 1.8 | 1.2 | 1.4 | 1.3 | 1.3 | 1.2 | 1.5 | 1.1 | 1 | 1.3 ± 0.07 |
| **SAMM032** | 15 | 16.6 | 18 | 20.1 | 17.8 | 19.4 | 16.9 | 19.3 | 18.5 | 18.4 | 14.9 | 16.9 | **17.6 ± 0.47** |
| **SAMM033** | 0.2 | 0.1 | 0 | 0.2 | 0 | 0.1 | 0.1 | 0.1 | 0.1 | 0 | 0 | 0 | **0.1 ± 0.01** |
| SAMM034 | 0.7 | 0.5 | 0.5 | 1.5 | 1.5 | 1.5 | 1.4 | 1.7 | 1.4 | 1.5 | 1 | 0.7 | 1.1 ± 0.13 |
| SAMM035 | 6.5 | 6.9 | 5.6 | 5.9 | 5 | 6.2 | 4.7 | 5 | 5.3 | 4.7 | 7.3 | 6.1 | 5.8 ± 0.25 |
| SAMM036 | 2 | 1.6 | 2 | 2.7 | 1.8 | 1.6 | 1.6 | 1.7 | 1.5 | 1.9 | 1.6 | 1.6 | 1.8 ± 0.09 |
| **Mean** | **2.3** | **2.3** | **3.5** | **3.9** | **3.6** | **3.5** | **3.3** | **3.5** | **3.7** | **3.4** | **3.1** | **2.9** | **3.2 ± 0.15** |

5.6 The temporal variation in data across all sensors is displayed in the graph in Figure 8. This shows the highest peak in April, followed by a slightly lower peak in September. Months with the lowest number of passes were January and February, but many sensors lacked data during these months (see Table 10).

5.7 Interestingly, this monthly pattern is contrary to the 2016 data which showed a peak in July, followed by August and lowest values in February and March, but these were also influenced by incomplete data.

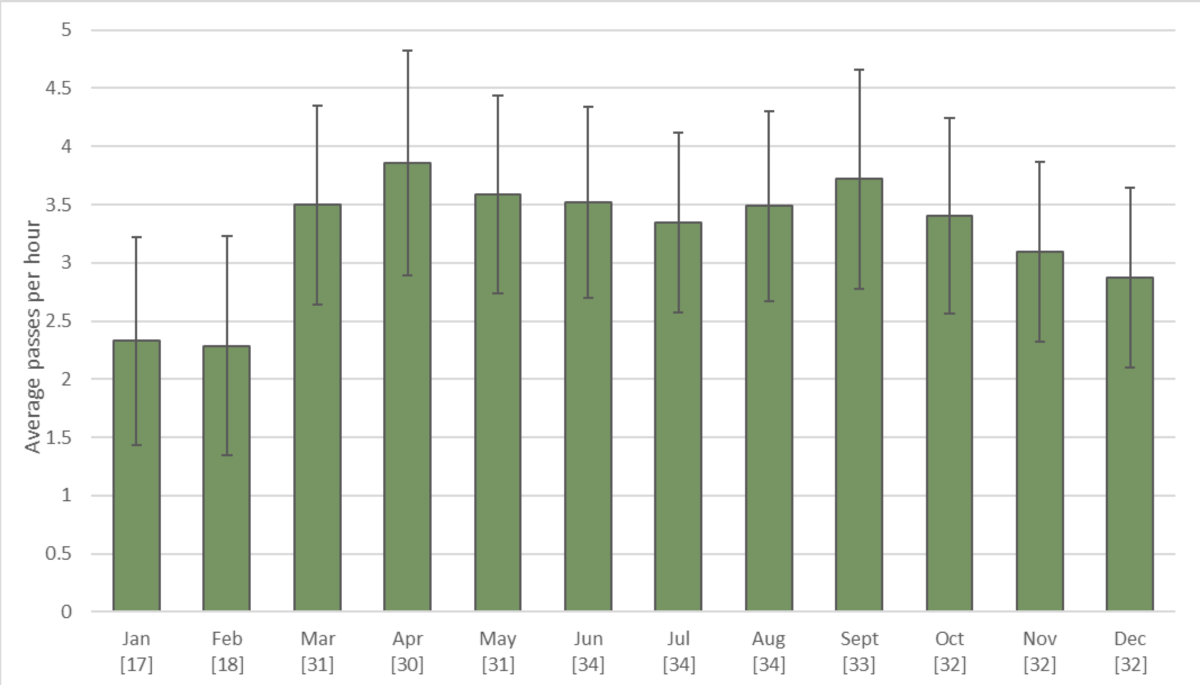
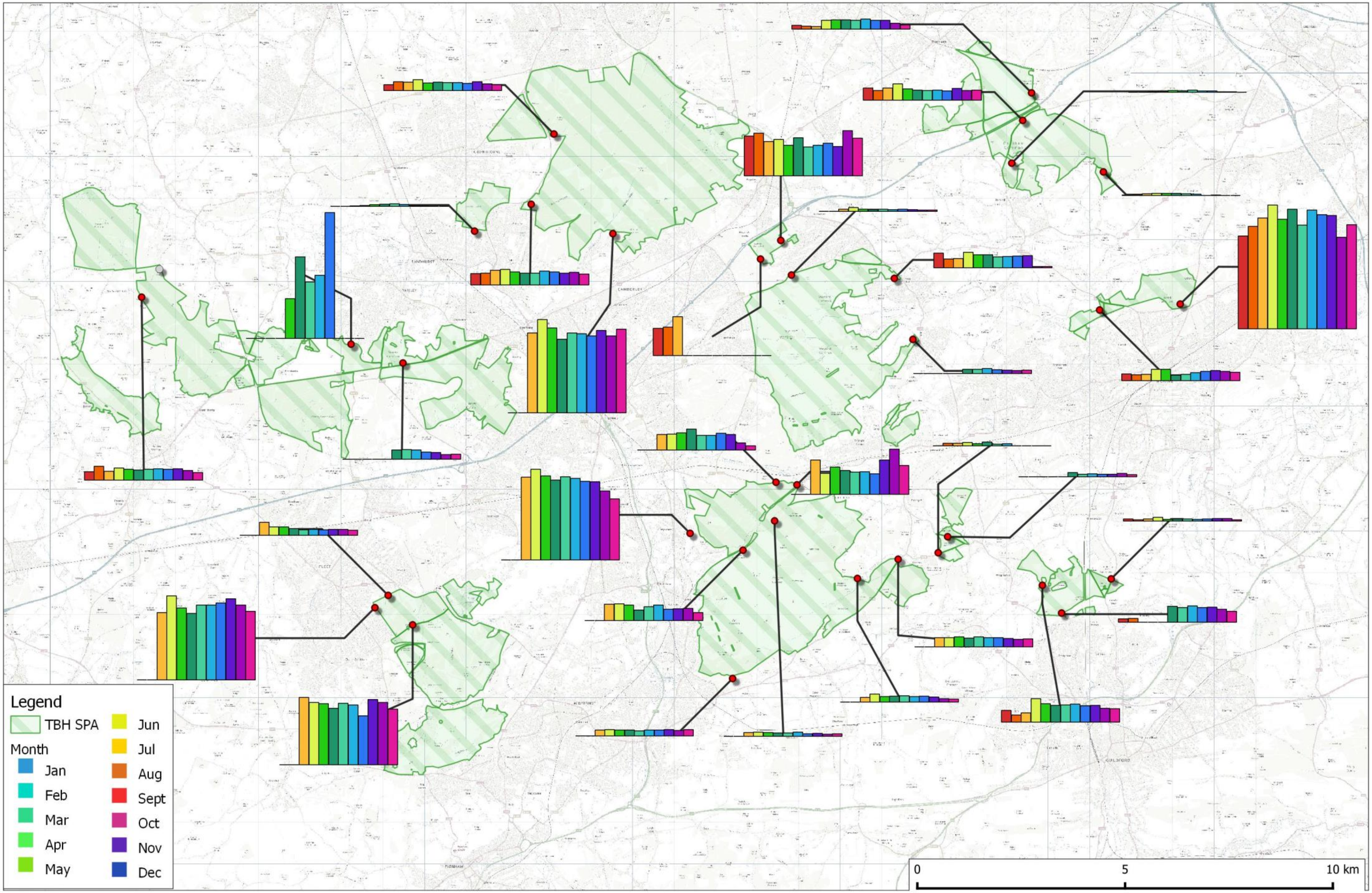



**Figure 8: Monthly mean number of passes per hour, calculated from mean values for each sensor; bars show mean values with error lines as standard error. Values in square brackets for each month indicate the number of counters for which there was data.**

## Map 12: Histograms to shown comparitive monthly number of passes per hour recorded at each sensor location.



5.8 The hourly patterns across the day were also investigated, as shown in Table 11. Table 11 presents the average hourly number of passes for each sensor between the hours of 7am and 10pm expressed as a percentage of all passes recorded across the 24hr day, thus allowing comparison between sensors. As in all tables, red to green colouring shows the low to high values across the day. The final column shows the percentage of passes which were recorded outside these hours (i.e. between 22:00 and 06:59). The percentages are also shown graphically in Map 13.

5.9 The individual sensors show variable patterns in access. The average hourly percentage from all sensors showed a peak value of 9.3% for the hour 12:00, followed by 9.1% for 13:00 and 15:00, 8.6% for 11:00 and 8.4% for 14:00. However, most illustrate either a single peak or twin peak distributions of busyness across the day for different locations. Sensors such as SAMM006 and SAMM007 show some of the clearest twin peaks, but other sensors also show this pattern to varying degrees. A clear single peak appears most evident at SAMM034, which also shows the largest percentage for any hour, with 31% of passes recorded between 15:00-15:59 – this was considered likely a genuine pattern, as the same pattern was observed in last year's data (although only 24%).

5.10 SAMM016 shows a concerning pattern with 32% of passes outside of the 07:00 -22:00 window. The extent to which this is consistent error or actual night-time use of the site is unclear as the sensor did appear to be working in other aspects.

5.11 Hourly data shown in Table 11 and Map 13 are across the entire year of data. Hourly patterns are likely to vary across different types of day (e.g. weekday and weekend) and more clearly across seasons (due to daylight hours). However, different sensors were working at different times of year and therefore the above influences will vary for each sensor.

5.12 Table 12 is therefore used to simplify patterns and show the differences in hourly values in just the Sensitive Period (between 1st March and 15th September). With increased day length in the Spring and Summer most sensors show a wider range of hours of visiting during the Sensitive Period. This is often more noticeable in the evenings for example at sensors; SAMM019 and SAMM020, where 10% of passes were between 21:00 and 22:00.

**Table 11: Hourly percentage of passes recorded for the different sensors, with cells coloured red to green for low to high values. Percentage calculation based on all recorded passes during the 24 hrs, but only values between 07:00 and 21:00 shown. The final "N/A" column provides the total percentage of values outside the 07:00-22:00 window. Based on all data across the year, which may be variable for the different sensors.**

| Counter | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | N/A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMM001 | 0 | 1 | 7 | 8 | 8 | 9 | 12 | 7 | 8 | 8 | 10 | 9 | 6 | 5 | 2 | 0 |
| SAMM002 | 2 | 5 | 7 | 8 | 8 | 8 | 8 | 9 | 9 | 8 | 9 | 7 | 5 | 3 | 2 | 2 |
| SAMM003 | 1 | 1 | 3 | 7 | 14 | 15 | 12 | 11 | 8 | 9 | 7 | 5 | 3 | 2 | 1 | 1 |
| SAMM004 | 1 | 6 | 8 | 6 | 8 | 7 | 7 | 11 | 7 | 8 | 7 | 5 | 5 | 2 | 1 | 11 |
| SAMM005 | 2 | 4 | 7 | 8 | 9 | 8 | 7 | 7 | 7 | 7 | 7 | 8 | 7 | 5 | 3 | 4 |
| SAMM006 | 1 | 3 | 8 | 9 | 9 | 7 | 7 | 7 | 8 | 8 | 9 | 8 | 7 | 5 | 2 | 2 |
| SAMM007 | 0 | 1 | 4 | 6 | 10 | 10 | 9 | 8 | 8 | 9 | 10 | 9 | 7 | 5 | 2 | 2 |
| SAMM008 | 0 | 1 | 2 | 5 | 10 | 13 | 13 | 10 | 9 | 9 | 8 | 6 | 5 | 5 | 3 | 1 |
| SAMM009 | 1 | 1 | 2 | 4 | 7 | 5 | 6 | 11 | 20 | 15 | 12 | 6 | 4 | 2 | 1 | 3 |
| SAMM010 | 1 | 4 | 7 | 7 | 7 | 7 | 8 | 8 | 8 | 8 | 9 | 9 | 8 | 5 | 3 | 1 |
| SAMM011 | 1 | 2 | 9 | 10 | 12 | 11 | 8 | 8 | 13 | 11 | 7 | 4 | 1 | 1 | 0 | 2 |
| SAMM012 | 2 | 3 | 6 | 8 | 10 | 9 | 10 | 6 | 6 | 7 | 9 | 7 | 5 | 4 | 2 | 6 |
| SAMM013 | 0 | 1 | 2 | 6 | 8 | 15 | 13 | 9 | 9 | 9 | 6 | 6 | 4 | 3 | 4 | 5 |
| SAMM014 | 0 | 2 | 9 | 8 | 10 | 6 | 5 | 5 | 5 | 6 | 9 | 14 | 10 | 4 | 3 | 4 |
| SAMM015 | 1 | 4 | 6 | 8 | 9 | 9 | 7 | 10 | 10 | 6 | 7 | 5 | 7 | 5 | 6 | 0 |
| SAMM016 | 4 | 4 | 4 | 3 | 4 | 7 | 8 | 6 | 5 | 6 | 4 | 3 | 4 | 3 | 3 | 32 |
| SAMM017 | 2 | 5 | 7 | 6 | 5 | 5 | 8 | 7 | 9 | 9 | 8 | 9 | 9 | 5 | 3 | 3 |
| SAMM018 | 1 | 2 | 4 | 8 | 11 | 9 | 8 | 8 | 8 | 7 | 8 | 9 | 7 | 4 | 3 | 3 |
| SAMM019 | 1 | 2 | 2 | 4 | 7 | 8 | 7 | 7 | 6 | 6 | 8 | 8 | 11 | 11 | 7 | 5 |
| SAMM020 | 1 | 10 | 6 | 4 | 5 | 5 | 5 | 5 | 4 | 4 | 5 | 8 | 11 | 11 | 8 | 8 |
| SAMM021 | 3 | 3 | 5 | 7 | 9 | 10 | 8 | 7 | 5 | 6 | 7 | 10 | 10 | 6 | 2 | 2 |
| SAMM022 | 0 | 3 | 5 | 8 | 9 | 10 | 9 | 8 | 7 | 7 | 8 | 9 | 7 | 4 | 3 | 3 |
| SAMM023 | 0 | 1 | 2 | 6 | 9 | 11 | 12 | 9 | 9 | 10 | 9 | 7 | 8 | 3 | 2 | 2 |
| SAMM024 | 0 | 2 | 4 | 5 | 10 | 9 | 9 | 7 | 9 | 10 | 11 | 6 | 5 | 6 | 4 | 3 |
| SAMM025 | 1 | 3 | 4 | 7 | 8 | 7 | 5 | 3 | 4 | 5 | 6 | 9 | 10 | 12 | 8 | 8 |
| SAMM026 | 0 | 1 | 2 | 5 | 7 | 8 | 10 | 7 | 11 | 12 | 11 | 11 | 6 | 5 | 2 | 2 |
| SAMM028 | 0 | 3 | 6 | 9 | 12 | 10 | 10 | 8 | 6 | 7 | 7 | 6 | 3 | 4 | 4 | 5 |
| SAMM029 | 1 | 1 | 3 | 6 | 9 | 12 | 8 | 7 | 8 | 7 | 11 | 10 | 8 | 5 | 3 | 1 |
| SAMM030 | 1 | 3 | 4 | 7 | 11 | 13 | 13 | 10 | 7 | 7 | 8 | 6 | 3 | 2 | 1 | 4 |
| SAMM031 | 0 | 1 | 3 | 5 | 10 | 13 | 11 | 10 | 7 | 7 | 7 | 7 | 6 | 5 | 4 | 4 |
| SAMM032 | 1 | 2 | 4 | 6 | 9 | 10 | 10 | 10 | 10 | 10 | 10 | 8 | 5 | 3 | 2 | 0 |
| SAMM033 | 0 | 1 | 3 | 5 | 8 | 11 | 15 | 14 | 12 | 8 | 3 | 0 | 2 | 0 | 0 | 18 |
| SAMM034 | 0 | 1 | 3 | 1 | 3 | 6 | 6 | 12 | 35 | 11 | 6 | 4 | 3 | 4 | 2 | 3 |
| SAMM035 | 0 | 1 | 5 | 8 | 11 | 11 | 12 | 10 | 8 | 8 | 8 | 7 | 4 | 3 | 2 | 2 |
| SAMM036 | 0 | 0 | 1 | 2 | 6 | 11 | 14 | 12 | 12 | 12 | 11 | 7 | 4 | 3 | 2 | 3 |

## Map 13: Histograms to show comparitive hourly percentage of passes per hour recorded at each sensor location.

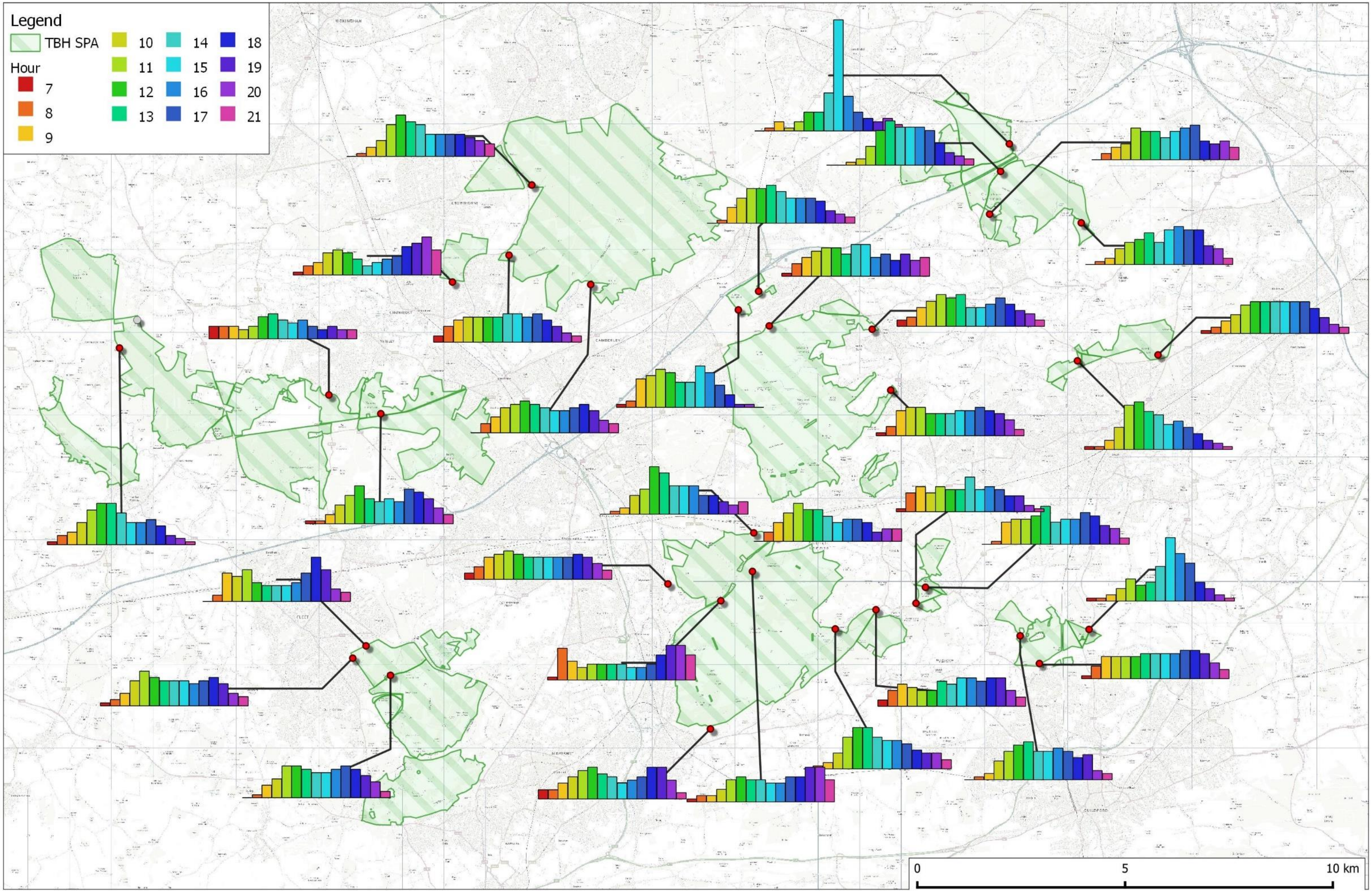


**Table 12: Hourly percentage of passes recorded for the different sensors during the Sensitive Period (1st Mar to 15th Sept), with cells coloured red to green for low to high values. Each row has a final column for the percentage completeness of the data, which has to be considered when examining the patterns shown.**

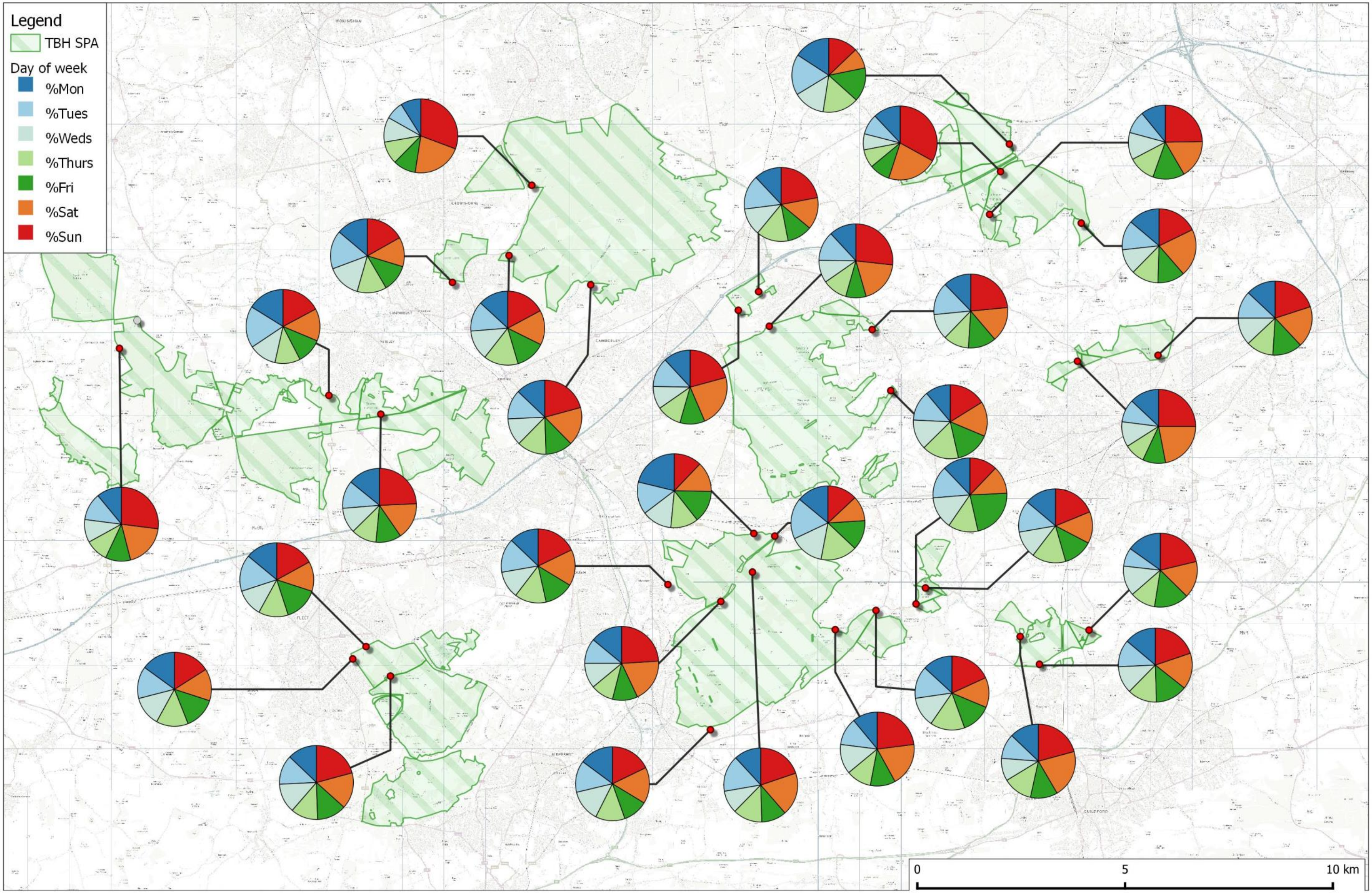
| Counter | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 | 19 | 20 | 21 | N/A |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| SAMM001 | 0 | 3 | 11 | 9 | 8 | 6 | 11 | 5 | 7 | 8 | 9 | 5 | 5 | 8 | 3 | 2 |
| SAMM002 | 3 | 6 | 7 | 8 | 7 | 7 | 7 | 7 | 8 | 7 | 8 | 8 | 6 | 4 | 3 | 4 |
| SAMM003 | 1 | 3 | 4 | 8 | 14 | 12 | 11 | 9 | 7 | 8 | 7 | 6 | 5 | 3 | 2 | 0 |
| SAMM004 | 1 | 6 | 8 | 6 | 7 | 7 | 6 | 11 | 7 | 7 | 6 | 5 | 5 | 2 | 2 | 14 |
| SAMM005 | 2 | 5 | 8 | 9 | 9 | 7 | 5 | 6 | 6 | 6 | 6 | 8 | 9 | 7 | 4 | 3 |
| SAMM006 | 1 | 5 | 11 | 10 | 7 | 5 | 7 | 8 | 6 | 8 | 9 | 6 | 7 | 7 | 3 | 0 |
| SAMM007 | 0 | 2 | 4 | 6 | 10 | 10 | 8 | 7 | 7 | 8 | 9 | 9 | 8 | 6 | 3 | 3 |
| SAMM008 | 0 | 1 | 3 | 6 | 9 | 13 | 13 | 9 | 8 | 8 | 7 | 7 | 5 | 6 | 3 | 2 |
| SAMM009 | 1 | 1 | 2 | 4 | 7 | 4 | 7 | 11 | 15 | 16 | 14 | 7 | 5 | 3 | 1 | 2 |
| SAMM010 | 2 | 6 | 8 | 7 | 7 | 6 | 7 | 6 | 6 | 7 | 8 | 7 | 9 | 8 | 4 | 2 |
| SAMM011 | 1 | 3 | 9 | 10 | 11 | 9 | 7 | 8 | 11 | 10 | 8 | 6 | 3 | 1 | 0 | 3 |
| SAMM012 | 3 | 4 | 7 | 9 | 11 | 9 | 6 | 6 | 6 | 7 | 9 | 7 | 6 | 4 | 3 | 3 |
| SAMM013 | 0 | 1 | 2 | 6 | 8 | 16 | 13 | 8 | 8 | 8 | 6 | 5 | 5 | 4 | 4 | 6 |
| SAMM014 | 1 | 3 | 11 | 8 | 10 | 6 | 5 | 4 | 4 | 6 | 9 | 12 | 9 | 6 | 5 | 1 |
| SAMM015 | 1 | 5 | 7 | 7 | 8 | 9 | 6 | 8 | 10 | 5 | 6 | 4 | 9 | 6 | 9 | 0 |
| SAMM016 | 4 | 4 | 4 | 3 | 3 | 7 | 3 | 4 | 3 | 3 | 2 | 2 | 3 | 3 | 3 | 49 |
| SAMM017 | 3 | 7 | 7 | 6 | 4 | 5 | 8 | 7 | 9 | 8 | 7 | 8 | 9 | 5 | 3 | 4 |
| SAMM018 | 1 | 3 | 4 | 9 | 10 | 8 | 7 | 7 | 8 | 6 | 7 | 8 | 7 | 5 | 4 | 6 |
| SAMM019 | 1 | 2 | 2 | 4 | 7 | 8 | 5 | 6 | 5 | 5 | 8 | 8 | 11 | 14 | 10 | 4 |
| SAMM020 | 1 | 11 | 5 | 4 | 4 | 5 | 5 | 4 | 3 | 3 | 4 | 7 | 12 | 13 | 10 | 9 |
| SAMM021 | 3 | 3 | 6 | 7 | 9 | 11 | 7 | 5 | 4 | 6 | 7 | 10 | 9 | 7 | 3 | 3 |
| SAMM022 | 1 | 4 | 6 | 8 | 9 | 9 | 8 | 6 | 6 | 7 | 7 | 8 | 7 | 6 | 4 | 4 |
| SAMM023 | 1 | 1 | 3 | 6 | 9 | 10 | 10 | 7 | 8 | 9 | 7 | 7 | 11 | 5 | 3 | 3 |
| SAMM024 | 0 | 2 | 5 | 4 | 10 | 8 | 8 | 8 | 9 | 10 | 10 | 5 | 5 | 7 | 4 | 5 |
| SAMM025 | 1 | 3 | 4 | 7 | 7 | 6 | 5 | 3 | 4 | 5 | 6 | 8 | 11 | 13 | 9 | 8 |
| SAMM026 | 0 | 1 | 2 | 5 | 7 | 8 | 10 | 7 | 10 | 12 | 10 | 11 | 7 | 6 | 2 | 2 |
| SAMM028 | 0 | 1 | 5 | 9 | 13 | 11 | 9 | 7 | 6 | 5 | 5 | 5 | 5 | 5 | 6 | 8 |
| SAMM029 | 2 | 2 | 3 | 5 | 10 | 10 | 8 | 5 | 6 | 5 | 11 | 9 | 9 | 7 | 4 | 4 |
| SAMM030 | 2 | 4 | 5 | 9 | 12 | 13 | 10 | 6 | 6 | 8 | 8 | 6 | 4 | 3 | 1 | 3 |
| SAMM031 | 1 | 2 | 4 | 5 | 11 | 11 | 10 | 7 | 7 | 7 | 6 | 6 | 7 | 7 | 6 | 3 |
| SAMM032 | 1 | 2 | 4 | 7 | 9 | 10 | 9 | 9 | 9 | 9 | 9 | 7 | 6 | 4 | 3 | 2 |
| SAMM033 | 0 | 2 | 4 | 4 | 8 | 11 | 14 | 12 | 10 | 7 | 3 | 0 | 2 | 0 | 0 | 23 |
| SAMM034 | 0 | 1 | 4 | 1 | 3 | 6 | 5 | 13 | 36 | 5 | 6 | 4 | 4 | 5 | 3 | 4 |
| SAMM035 | 1 | 2 | 6 | 10 | 11 | 10 | 10 | 7 | 6 | 7 | 8 | 7 | 6 | 5 | 3 | 1 |
| SAMM036 | 0 | 0 | 2 | 3 | 8 | 12 | 13 | 10 | 10 | 11 | 10 | 7 | 5 | 4 | 3 | 2 |

5.13 Variation across the days of the week was examined and shows the number of passes is strongly biased towards weekends, particularly Sundays, across most sensors. This is illustrated in Table 13 which shows the average number of daily passes recorded on each day of the week for individual sensors. These data show that on average the number of passes recorded was 37% higher at weekends compared to the average across all days, and 21% higher on Sundays (in 2016 this was slightly higher - 38% at weekends and 23% on Sundays). Use in 2017 could be as high as 55% on weekends and 33% on Sundays – as recorded at SAMM036. Although, at just five sensor locations (14% of sensors) the peak values were recorded on a weekday (SAMM004, 013, 016, 028, 034, but not SAMM023, which was in this list in 2016). SAMM031 and SAMM036 were notable in that double the expected proportion of passes in a day (i.e. one seventh) were recorded on the Sunday. This daily information is shown graphically as proportions for each day in Map 14.

**Table 13: The average number of passes for each day of the week. The percentage of all passes which occur at weekends and Sundays is also shown.**

| | Mon | Tues | Weds | Thurs | Fri | Sat | Sun | % of passes on weekends | % passes on Sundays |
|---|---|---|---|---|---|---|---|---|---|
| SAMM001 | 48.5 | 48.6 | 41.1 | 53.7 | 44.4 | 49.6 | 67.4 | 33 | 19 |
| SAMM002 | 195.9 | 191.8 | 184.5 | 212.6 | 194.5 | 224.6 | 252.5 | 33 | 17 |
| SAMM003 | 119.7 | 96.5 | 99.6 | 87.7 | 98.9 | 208.7 | 235.5 | 47 | 25 |
| SAMM004 | 37.6 | 44.9 | 45.5 | 42.3 | 70.1 | 38.5 | 37.6 | 24 | 12 |
| SAMM005 | 1156.5 | 1306.4 | 1113.7 | 1237.5 | 1123.4 | 1436.9 | 1584.9 | 34 | 18 |
| SAMM006 | 50.6 | 61.2 | 59.1 | 74.1 | 68.6 | 68.5 | 74.4 | 31 | 16 |
| SAMM007 | 862.3 | 848.5 | 862.5 | 831 | 852.4 | 1090.2 | 1429 | 37 | 21 |
| SAMM008 | 68.3 | 77.1 | 80.9 | 71.8 | 66.4 | 121.2 | 144 | 42 | 23 |
| SAMM009 | 39.1 | 22.2 | 33.7 | 29.8 | 40.5 | 41.3 | 55.6 | 37 | 21 |
| SAMM010 | 151.4 | 128.2 | 130.1 | 136.8 | 149.9 | 168.8 | 222.3 | 36 | 20 |
| SAMM011 | 426.9 | 449 | 359 | 379.1 | 394.1 | 824.7 | 753.8 | 44 | 21 |
| SAMM012 | 143.8 | 167.5 | 135.9 | 134.2 | 147.8 | 183.2 | 272.1 | 38 | 23 |
| SAMM013 | 348 | 226.2 | 210.6 | 202.5 | 236.7 | 212 | 197.7 | 25 | 12 |
| SAMM014 | 111.7 | 122 | 92.4 | 104.8 | 116.9 | 104.7 | 133.5 | 30 | 17 |
| SAMM015 | 29 | 30.2 | 24 | 26 | 21.1 | 44.8 | 65.7 | 46 | 27 |
| SAMM016 | 1361.5 | 1561.9 | 980.3 | 960.2 | 898 | 1220.6 | 1464.2 | 32 | 17 |
| SAMM017 | 136.1 | 146.7 | 136.9 | 151.7 | 138.6 | 138.3 | 186.4 | 31 | 18 |
| SAMM018 | 1255.2 | 1224.5 | 1103.4 | 1150.9 | 1204.5 | 1168.8 | 1361.3 | 30 | 16 |
| SAMM019 | 47.8 | 61 | 40.3 | 49.5 | 41.3 | 74.1 | 78.6 | 39 | 20 |
| SAMM020 | 204.2 | 158.9 | 159.5 | 155.8 | 164.8 | 290.3 | 355.6 | 43 | 24 |
| SAMM021 | 101.9 | 95.1 | 93.1 | 86.5 | 78 | 108.3 | 126.5 | 34 | 18 |
| SAMM022 | 1186.8 | 1175.6 | 1139.7 | 1164 | 1118.1 | 1525.7 | 1912.1 | 37 | 21 |
| SAMM023 | 218.2 | 186.9 | 174.1 | 219.9 | 200.4 | 355.4 | 357.8 | 42 | 21 |
| SAMM024 | 11.6 | 10.4 | 12.4 | 12.7 | 15.2 | 18.2 | 26.5 | 42 | 25 |
| SAMM025 | 15 | 18.6 | 16.2 | 13.9 | 13.6 | 13.9 | 19.1 | 30 | 17 |
| SAMM026 | 19.2 | 18.8 | 15 | 16.7 | 17.4 | 29.7 | 25.2 | 39 | 18 |
| SAMM028 | 444 | 567 | 486.4 | 509.6 | 396.9 | 350.4 | 405.9 | 24 | 13 |
| SAMM029 | 118.8 | 105.6 | 89.9 | 94 | 95.4 | 136.6 | 205.8 | 40 | 24 |
| SAMM030 | 134.5 | 145 | 123.9 | 115.4 | 134.1 | 225.4 | 329.4 | 46 | 27 |
| SAMM031 | 82.6 | 77.1 | 99 | 88.5 | 87.1 | 199.6 | 279.4 | 52 | 31 |
| SAMM032 | 1618.3 | 1516.7 | 1427 | 1511.6 | 1591.5 | 2182.1 | 2505.2 | 38 | 20 |
| SAMM033 | 6.4 | 5.2 | 7.1 | 5.1 | 4.4 | 11.8 | 14 | 48 | 26 |
| SAMM034 | 126.8 | 146.2 | 110.7 | 126.3 | 117.2 | 72.4 | 108.3 | 22 | 13 |
| SAMM035 | 476.7 | 602.2 | 478.3 | 566.8 | 440.7 | 568.9 | 894.4 | 36 | 22 |
| SAMM036 | 149.8 | 118.8 | 85 | 104.6 | 109.5 | 278.4 | 414.7 | 55 | 33 |

**Map 14: Pie charts to show proportion of passes recorded on different days of the week at each sensor location.**



5.14 Variation across the year was most interesting for the Sensitive Period, from 1st March to 15th September, during which SPA bird species are nesting. Data were therefore split into the Sensitive and Non-Sensitive Periods.

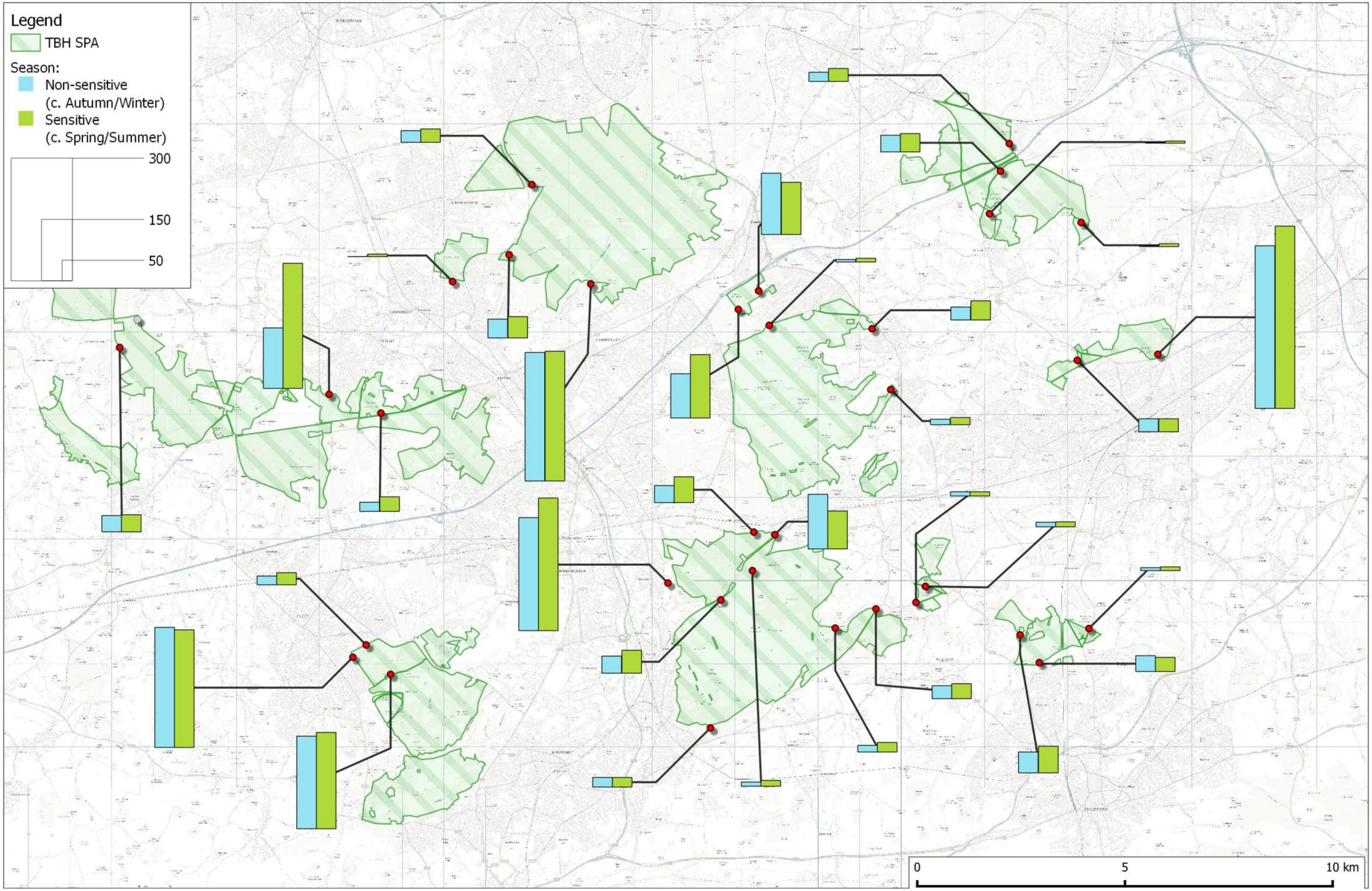
5.15 Overall, the typical passes per day was roughly equal outside-Sensitive Period (c. autumn/ winter) compared to the Sensitive Period (c. spring/ summer). Across all sensors, 55% of recorded passes were in the Sensitive Period compared to 45% in the Non-Sensitive Period (in the 2016 data this was 50:50). However, it has to be noted that these periods have different day ranges: the Sensitive Period covers 260 days compared to 166 days for the Non-Sensitive Period.

5.16 The differences between the Sensitive and Non-Sensitive Periods were examined for each sensor and are presented in Table 14 and Map 8 (showing average passes per day). Table 14 shows typically the average daily number of passes was greater in the Sensitive Period than the Non-Sensitive Period. This is generally visible from the monthly data (see Table 10), which shows peaks in many individual months in spring and summer. At four locations, highlighted in Table 14, the mean number of passes per day in the Sensitive Period was greater than in the Non-Sensitive Period, these were; SAMM010, 018, 028 and 034.

**Table 14: The average number of passes per day recorded for each sensor across the whole year and during the Sensitive Period (1st Mar to 15th Sept) and Non-Sensitive Periods. The final columns give the proportion of Non-Sensitive to Sensitive (col c/ sum (col c + col d) : col d/ sum(col c + col d) ) and the ratio of Non-Sensitive passes to Sensitive (col b/d) . Values in bold indicate greater use on a day in the non-sensitive (winter/autumn) period.**

| Sensor | Mean number passes per days | | | Proportion of Non-Sensitive to Sensitive Period | Ratio of Non-Sensitive |
|---|---|---|---|---|---|
| | Non-Sensitive Period (c. autumn/ winter) [166] | Sensitive Period (c. spring/ summer) [260] | Whole Year [365] | | |
| SAMM001 | 11.7 | 12.6 | 12.1 | 48:52 | 1.0 |
| SAMM002 | 46.4 | 52.9 | 49.9 | 47:53 | 0.9 |
| SAMM003 | 32.5 | 32.4 | 32.5 | 50:50 | 1.0 |
| SAMM004 | 10.4 | 10.9 | 10.9 | 49:51 | 1.0 |
| SAMM005 | 276.7 | 324.7 | 307.1 | 46:54 | 0.9 |
| SAMM006 | 13.6 | 18 | 15.7 | 43:57 | 0.9 |
| SAMM007 | 226.5 | 236.2 | 232.6 | 49:51 | 1.0 |
| SAMM008 | 17.2 | 24.2 | 21.6 | 42:58 | 0.8 |
| SAMM009 | 7.9 | 9.8 | 9 | 45:55 | 0.9 |
| SAMM010 | 38.9 | 35.4 | 37.2 | **52:48** | 1.0 |
| SAMM011 | 108.4 | 155 | 122.7 | 41:59 | 0.9 |
| SAMM012 | 32.2 | 47.7 | 40.6 | 40:60 | 0.8 |
| SAMM013 | 42.7 | 63.6 | 55.9 | 40:60 | 0.8 |
| SAMM014 | 22.2 | 29.7 | 26.9 | 43:57 | 0.8 |
| SAMM015 | 6.3 | 9.5 | 8.3 | 40:60 | 0.8 |
| SAMM016 | 148.3 | 305.9 | 289.5 | 33:67 | 0.5 |
| SAMM017 | 32.6 | 37.2 | 35.5 | 47:53 | 0.9 |
| SAMM018 | 294.3 | 288 | 290.3 | **51:49** | 1.0 |
| SAMM019 | 10.7 | 15 | 13.4 | 42:58 | 0.8 |
| SAMM020 | 42.3 | 56.3 | 51 | 43:57 | 0.8 |
| SAMM021 | 23.8 | 23.5 | 23.6 | 50:50 | 1.0 |
| SAMM022 | 314.5 | 317.2 | 316.2 | 50:50 | 1.0 |
| SAMM023 | 51.5 | 66.1 | 58.6 | 44:56 | 0.9 |
| SAMM024 | 1.8 | 5.3 | 3.7 | 25:75 | 0.5 |
| SAMM025 | 0.9 | 6.2 | 3.8 | 13:87 | 0.2 |
| SAMM026 | 2.1 | 7.2 | 4.9 | 23:77 | 0.4 |
| SAMM028 | 133.9 | 93 | 108.1 | **59:41** | **1.2** |
| SAMM029 | 23 | 35.8 | 29 | 39:61 | 0.8 |
| SAMM030 | 39.8 | 42.5 | 41.3 | 48:52 | 1.0 |
| SAMM031 | 28.7 | 33.3 | 31.2 | 46:54 | 0.9 |
| SAMM032 | 398.1 | 445.4 | 423.8 | 47:53 | 0.9 |
| SAMM033 | 1.4 | 2.2 | 1.8 | 39:61 | 0.8 |
| SAMM034 | 22.5 | 32.1 | 27.7 | 41:59 | 0.8 |
| SAMM035 | 149.9 | 128 | 138 | **54:46** | **1.1** |
| SAMM036 | 41.4 | 44.9 | 43.3 | 48:52 | 1.0 |
| Total | 71.1 | 86.2 | 79.8 | 45:55 | 0.9 |

## Map 15: Average passes per day recorded during the Sensitive Period (c. Spring/Summer) compared to Non-Sensitive Period (c. Autumn/Winter).



## Discussion and Conclusions

5.17 The results from sensor data show an overall total of 829,661 passes recorded (after the removal of errors). This is based on the 35 sensors, but included a notable number of data gaps. Clearly sensors are working to capture a considerable amount of access onto the SPA. Sensors cover a wide range of levels of access ranging from an average of 7.7 passes per day (SAMM033) to 1,766 passes per day (SAMM032). Understanding these patterns over time is important for long-term monitoring.

5.18 Overall the reliability of data presented appears good, and a clear improvement on the 2016 dataset. The formatting of data suggest sensors are working uniformly, and with fewer errors than 2016. The higher proportion of sensors working and the consistent pool of these should lead to robust long-term data.

5.19 However, a concern would be understanding the degree of error in the data and how these passes relate to numbers of people. As stated, 829,661 passes have been recorded, but we are unable to say how this relates to the number of people. Clearly, this value would be similar, but there is a degree of uncertainty. Some sensors have recorded some possible errors e.g. night time passes at SAMM016, which may or may not be genuine. In addition, sensors may record people, dogs, cyclist, children etc. in different ways such that sensor values are inflated or reduced in comparison to the actual number of people. On site, visual calibration of sensors would be needed to show how these are recording access.

## Recommendations

5.20 Recommendations for counters were discussed in the 2016 data report (Panter, 2017). Overall, as 2017 data appears much better than 2016 – with many fewer errors – there appears little need to consider any further recommendations.

5.21 However, some key points from these recommendations, would be to:

- Conduct detailed calibration of sensors to check how people are recorded as passes, and the entering/leaving ratio.
- Record information about these access points using a set recording form which can be used to see factors which may be affecting the long-term patterns.
- Record in greater detail the types of access and types of locations (e.g. type of access point, number of parking spaces in associated

access point) to allow us to categorise locations and consider changes in access in response to long term changes to access management (e.g. introduction of car parking charges)

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