



12th September 2019

Submission to Heathrow Airport Expansion Consultation from the Friends of Richmond Park

1. The Importance of Richmond Park

Richmond Park is one of the most important parks in the UK. It is London's largest Royal Park and the largest enclosed urban park in Europe, covering 2,500 acres. It is a European Special Area of Conservation, a Site of Special Scientific Interest, and a National Nature Reserve - and is probably the most heavily protected park in the country. It is one of only two areas in the Heathrow wider area with this triple designation (the other being the much smaller Burnham Beeches). It is of both national and international importance for wildlife conservation – especially veteran trees, invertebrates, acid grasslands, bats, and birds.

Richmond Park is also the quietest place (with background noise of less than 30dB(A), equivalent to a rural area), and at night the darkest place, in London. People come to Richmond Park from all over London to enjoy its peace and tranquillity, as a respite from the bustle and noise of the city.

It is also a Grade 1 Registered Historic Park and Garden of '*high historical significance*': established in its present form by King Charles I in 1637 and preserved carefully ever since.

Richmond Park is world famous. It is visited by over 5.5 million people per year (similar in popularity to the British Museum at 5.8 million), with a rapidly increasing number of overseas visitors, drawn by social media.

It is also a haven for wildlife, a home to thousands of species of birds, bats, butterflies, beetles, bees and wasps, other invertebrates and fungi (many of them rare and protected) and 600 red and fallow deer. It has over 1200 veteran trees, up to 750 years old, and is the largest area of lowland acid grassland in London, with its accompanying grasses and wildflowers.

It's a magical space, loved by hundreds of thousands of Londoners.

2. Heathrow's expansion proposals

At present relatively few aircraft fly over Richmond Park. There are no flight arrivals (the main flight path for the southern runway is a mile north of the Park boundary) and only some departures, on easterly operations and at the southern extremity of the Park. Heathrow's proposals are for frequent, loud and low arriving flights directly over the north and centre of Richmond Park and a big increase in numbers and spread of departing aircraft over the south and centre of the Park. Specifically:

- a) Envelope A4 for arrivals on the southern runway is expected to contain multiple flight paths, with up to 47 flights/hour. When these flights paths are passing over Richmond Park, they will be as low as 1,500ft above the ground. Heathrow predict noise intensity at 68-76dB(A) for these flights over Richmond Park – **over ten times the current background noise;**
- b) Envelopes D2 and D3 for departures are each expected to contain up to three flight paths, with up to 50 flights/hour in each envelope. When these flights paths are passing over Richmond Park, they will be as low as 1,500ft above the ground. Heathrow predict noise intensity at 76-86dB(A) for these flights over Richmond Park; and
- c) Envelope IPA A2 under Heathrow's "early expansion" scheme for arrivals on the southern runway is expected to contain multiple flight paths, with up to 25 flights/hour between 6:00-7:00am and then up to another 40 flights/day. When these flights paths are passing over Richmond Park, they will be as low as 1,500ft above the ground. Heathrow predict noise intensity at 69-77dB(A) or more for these flights over Richmond Park.

3. Impact of Heathrow's expansion proposals

Heathrow's proposals will have a disastrous impact on Richmond Park and the tranquil haven it provides for both people and wildlife.

For people it will destroy the peace and tranquillity which is most frequently cited in visitor surveys as the reason people come to Richmond Park. Many surveys around the world have shown the benefits for mental health and wellbeing of being in nature and its peace and quiet.

That tranquillity is especially valuable for people who have mental health issues and the Park is used by psychiatrists as part of their treatment¹.

Routinely low & loud aircraft would also severely affect the natural environment of Richmond Park. Many Park species rely on the quiet, for example bats and owls for hearing prey and echolocation and songbirds such as skylarks for communicating and breeding.

¹ Guardian 28-Feb-19: "Heathrow expansion plan involves planes over Richmond Park"
https://www.theguardian.com/environment/2019/feb/28/heathrow-expansion-plan-involves-planes-over-richmond-park?CMP=share_btn_tw

Noise from overflying aircraft will have a particular damaging effect on Richmond Park for four reasons, none of which are taken into account in these or any previous Heathrow consultation documents:

- Loud noise such as from aircraft is perceived as worse when the ambient noise levels are low, such as the 30dB(A) level in Richmond Park;
- Noise travels further in open spaces because there are no structures to absorb or provide a barrier against it;
- Noise is perceived as more intrusive in places such as green spaces where people have come to find peace and quiet and escape the noise of urban life; the consultation documents describe visitors to green spaces as '*transitory*' and not therefore not likely to suffer noise effects as badly as people would in residential areas; it ignores why people are in Richmond Park in the first place;
- Prolonged or repetitive noise will be perceived as worse in open spaces because people have no escape, such as they have with shops in urban streets or their houses in residential areas.

There is also potential damage from nitrogen oxides (NOx) from aircraft emissions to the acid grassland and veteran trees, which are very sensitive 'receptors' and which along with beetles are the reason for Richmond Park's protection as a SSSI and NNR. The ecology of Richmond Park has developed over decades and centuries (some acid grassland and veteran trees date back to the enclosure in 1637) and with little scientific evidence of the cumulative impact of NOx, any action should be subject to the precautionary principle.

4. Treatment of Richmond Park in the PEIR

In spite of the importance of Richmond Park and the impact of the expansion on it, the Park is almost completely absent from the Preliminary Environmental Information Report (PEIR) in the Expansion Consultation documents.

As Table 1 shows, the Park is only partially covered. In some chapters Richmond Park is included, in others it gets passing reference, in others it is not mentioned at all.

Table 1: Treatment of Richmond Park in PEIR scoping and PEIR report

| | Treatment in PEIR Scoping & PEIR |
|----------------------------|---|
| Air quality | Excluded |
| Biodiversity | Excluded - except for beetles |
| Community | Excluded |
| Historic Environment | Included: Significant* |
| Health | Excluded |
| Landscape & Visual Amenity | Excluded |
| Noise & Vibration | Included: not considered significant** |

* Preliminary conclusion of PEIR – refer Appendix section 11.

** Richmond Park included in noise area, but noise effect not considered significant – refer Appendix section 16

Where Richmond Park is covered some of results are just not credible. The noise increase from 47 arriving aircraft/hour and a big increase in departing aircraft is estimated to be only 1-3dB. For tranquillity, the Park is mentioned specifically as having '*relative tranquillity*' but the impact of the proposals is expected to be negligible/slight – a strange conclusion when the proposals are for noisy flights over the quietest place in London.

Thirdly, the approach and methodology are biased against the Park and other large open spaces, as we show in the next section.

5. Why has this happened?

How can the major environmental effects of the Heathrow project on the most heavily protected urban park in the UK, of international fame and of enormous environmental significance, be virtually ignored by the PEIR?

There seem to be four reasons:

1. PEIR scoping, notably areal extents, metrics, and significance tests, clearly fails to work for the combination of major indirect project effects (flight path changes) and non-adjacent natural environments of great importance (Richmond Park). These flaws were in Heathrow's PEIR scoping proposal² (refer Appendix), and not subsequently picked up by Natural England³ in their response to the PINS consultation, and not noted by the Planning Inspectorate in their scoping opinion⁴. Therefore, the PEIR missed the whole picture;
2. The objective function of residents affected doesn't work with large open spaces: the relative merits or harm of different options are quantified in terms of the numbers of human residents affected. This measure clearly discriminates against large open spaces regardless of their environmental value and the 5.5m people who visit Richmond Park every year;
3. The noise measure is inappropriate: the PEIR generally uses L_{Aeq16} which is justified on the basis of average perceived effect on resident humans. There is no evidence that it is the correct measure for the impact of aircraft on the natural environment;
4. The process used by Heathrow in their airspace principles consultation in 2018³ and subsequently endorsed by the CAA was fundamentally flawed. It endorsed principle 6h (i.e. prioritising routing flight paths over parks & open spaces) despite the 1,000 consultees not including a single body responsible for managing or protecting large open spaces like Richmond Park⁵. In a similar vein, the analysis uses an Airports National Policy Statement that flights should avoid National Parks and AONBs. That

2 Heathrow EIA Scoping Report, May 2018

3 Natural England ref. 249432 of 19-Jun-18

4 Planning Inspectorate Scoping Opinion, ref. TR020003

5 Heathrow's Airspace Design Principles Submission – 31-Aug-2018 v1.0, Appendix 1

does not include European SACs, SSSIs or NNRs, although they would seem to as much if not more important.

6. What should be done?

The onus is on Heathrow to include in the full EIA/ES for the Enquiry a proper assessment of Richmond Park. Without that, the Inspector will not have all the relevant material available to make a fully informed decision.

Case law⁶ and guidance⁷ has stressed the need for a full set of environmental information to be available for consideration prior to a decision being taken on whether or not to grant planning permission.

Schedule 4 of the Town & Country Planning (Environmental Impact Assessment) Regulations 2011, sets out the necessary information to assess impacts on the natural environment to be included in an ES. In particular:

- A description of the aspects of the environment likely to be significantly affected by the development, including, in particular, population, fauna, flora, soil, water, air, climatic factors, material assets, including the architectural and archaeological heritage, landscape and the interrelationship between the above factors; and
- A description of the likely significant effects of the development on the environment – this should cover direct effects but also any indirect, secondary, cumulative, short, medium and long term, permanent and temporary, positive and negative effects.

Clearly the proposals by Heathrow to route aircraft over Richmond Park (the darkest, quietest, cleanest, and most biodiverse area in London), via new flight paths within envelopes A4, D2, D3 (and IPA A2) at low level with sound levels around 80dB(A), landing lights on and inevitable engine emissions, will have significant permanent impact on the Richmond Park environment.

The current process may already be exposed to legal challenge inasmuch as the Applicant's Scoping Report and the PEIR (both required by law), both substantively failed to identify these material likely significant effects of the development on the environment.

As noted earlier, these gaps in the scoping report prepared by Heathrow and submitted to PINS were not subsequently picked up by Natural England in their response to the PINS consultation, and generally not noted by the Planning Inspectorate in their scoping opinion.

These flaws need to be remedied.

⁶ Harrison, J in R. v. Cornwall County Council ex parte Hardy (2001)

⁷ Note on Environmental Impact Assessment Directive for Local Planning Authorities Office of the Deputy Prime Minister (April 2004) available from <http://webarchive.nationalarchives.gov.uk/+http://www.communities.gov>.

If these flaws are remedied, we would expect the treatment of Richmond Park in the EIA/ES to be as shown in Table 2 below.

Table 2: Proper treatment of Richmond Park in EIA/ES

| | <u>In PEIR Scoping & PEIR</u> | <u>Correct treatment</u> |
|----------------------------|--|---|
| Air quality | Excluded | High significance |
| Biodiversity | Excluded - except for beetles | Major significance, multiple species & habitats |
| Community | Excluded | High Adverse Significance |
| Historic Environment | Included | Likely Significant |
| Health | Excluded | Likely Adverse Significance |
| Landscape & Visual Amenity | Excluded | High Adverse Significance |
| Noise & Vibration | Included, "not significant" | Unacceptable Adverse Effect Level (UAEI) |

The Appendix gives our detailed analysis for our conclusions in this table. It also has more detail on the characteristics of Richmond Park that need to be taken into account in the EIA/ES.

12-Sep-19

Analysis of Heathrow Expansion EIA Scoping Report and PEIR

5. Air Quality

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| Treatment | Excluded |
| Reason for treatment | The air quality core assessment area is a 12km x 11km area centred on Heathrow. The PEIR asserts that aircraft on approach and departure from Heathrow have a limited impact on ground-level pollutant concentrations beyond the airport boundary as aircraft are high enough that emissions are diluted by atmospheric diffusion before reaching the ground. Therefore, the illustrative core assessment area includes all locations closest to the airport where there may be potential for air quality effects from aircraft emissions on the ground and in the air. |
| Correct treatment | Certain Richmond Park receptors, e.g. protected acid grasslands, are highly sensitive to NOx. The current NOx level in Richmond Park is 20µgm ⁻³ . A consequence of the project is numerous aircraft passing over the Park at less than 2,000ft. The effects of diffusion of NOx from aircraft on such sensitive receptors, the effects of diffusion across the Park, and the cumulative effects over years and decades, are unproven. Because of the lack of scientific knowledge of the cumulative effects on such sensitive receptors, the EIA/ES should adopt the precautionary principle. |
| Correct rating | High sensitivity, Medium magnitude of change Significance: High Significance |

6. Biodiversity

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| Treatment | Excluded - except for beetles |
| Reason for treatment | The PEIR study area for biodiversity is confined to the area in the vicinity of the DCO Project, plus a SSSIs search area (extended after Scoping), plus any European sites (SACs) designated for nature conservation within 20km of the boundary. Thus, Richmond Park is only included in the PEIR Biodiversity assessment due to (a) importance for its diverse deadwood beetle fauna (over 200 species) associated with ancient trees and for the presence of the most extensive area of dry acid grassland in Greater London; and (b) its SAC designation of stag beetle <i>Lucanus cervus</i> . |
| Correct treatment | The near-Heathrow site areal exclusion limit is inappropriate. Indirect effects beyond this area does not take account of DCO Project operations notably flight paths over Richmond Park. Also there is no evident legal or precedent basis for this arbitrary in/out scope decision. The ES should thoroughly assess the potential for the DCO Project to affect the Biodiversity of Richmond Park, including compliance with Regulation 63 of the Conservation of Habitats and Species Regulations 2017, an Appropriate |

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| | <p>Assessment for a European/Internationally designated site, and any Annex 1 bird species. Also, as Natural England advises, a habitat survey (equivalent to Phase 2) should be carried out in order to identify any important habitats present. In addition, ornithological, botanical and invertebrate surveys should be carried out at appropriate times in the year;</p> <p>The EIA/ES should assess the cumulative impact of the DCO Project on all protected and notable species and habitats, and the full range of all other species and habitats, present in Richmond Park;</p> <p>In particular the EIA/ES should include an assessment of the extensive and diverse bat population of Richmond Park including the vital part the Park plays in their nocturnal ranging in the SW London context;</p> <p>The EIA/ES should clearly identify the veteran/aged trees, and all water bodies, in Richmond Park that could be affected by the DCO Project's operations and ensure they are valued and assessed in the ES.</p> <p>Falling from these assessments numerous Likely Significant Effects are expected on Richmond Park's enormous biodiversity due to: nitrogen from take-off and landing aircraft and aural and visual stimuli and noise produced by departing/arriving aircraft on habitats, flora, wildlife, and breeding/wintering birds, invertebrates, and other protected and notable species.</p> |
| Correct rating | <p>Direct impact on habitats:</p> <p>Woodland: Medium impact – High sensitivity</p> <p>Grassland: Medium impact – High sensitivity</p> <p>Open water: Medium impact – High sensitivity</p> <p>Indirect impact on species:</p> <p>Plant species⁸; Deer; Bats⁹; Badgers; Birds – breeding^{10,11,12}; Birds – wintering¹³; Invertebrates; other protected & notable species¹⁴</p> |

9. Community

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| Treatment | Excluded |
| Reason for treatment | <p>The "Inner study area" is close to Heathrow for those near the DCO project, and a "Wider study area" for knock-on direct effects. Neither includes Richmond Park.</p> <p>There is no rationale for excluding the effect of the operations on the public open space of Richmond Park.</p> |

8 Acid grasslands

9 Brown Long-eared, Noctule, Leisler's, Serotine, Daubenton's, Common Pipistrelle, Nathusius' Pipistrelle, Soprano Pipistrelle, Natterer's

10 RSPB Red-listed (of serious concern): Starling, House Sparrow, Mistle Thrush, Song Thrush, Grey Wagtail, Skylark, Starling and House Sparrow

11 RSPB amber-listed: Reed Bunting, Greenfinch, Dunnock, Meadow Pippit, Kingfisher, Stock Dove, Tawny Owl, Mute Swan and Kestrel

12 Resident owl species: Tawny (yellow listed) and Little Owl

13 Average 119 species of birds per year includes numerous red and amber listed, some of which over-winter. <https://www.frp.org.uk/wp-content/uploads/2019/01/The-Birds-of-Richmond-Park-2009-2018-Final.pdf>

14 Incl. Great Crested Newt

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| Correct treatment | <p>The ANPS requires that “<i>final impacts on affected groups should be the subject of a detailed review, carefully designed through engagement with the local community</i>”.</p> <p>The National Planning Policy Framework (NPPF) includes sustainable development incl. local services that reflect the community’s needs and support its health, social and cultural well-being.</p> <p>Therefore the PEIR should “<i>...identify effects on people, ... and community facilities/public services, public open space ...including recreation as a result of the ... operation of the DCO Project</i>”</p> <p>Richmond Park has High sensitivity to change as: (a) users of this NNR (essentially regional) Park have no alternative comparable resource available; and (b) environmental receptors have no ability to respond to the proposed changes. And a clear indirect effect of the DCO Project proposals would be a High magnitude of change in patterns and levels of recreational use of the NNR resource.</p> |
| Correct rating | <p>High sensitivity, High magnitude of change Significance: High Adverse Significance</p> |

11. Historic Environment

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| Treatment | Included |
| Reason for treatment | <p>The PEIR notes that Richmond Park is a grade I, Registered Historic Park and Garden, and is of high significance. It goes on to list designated heritage assets of high significance occurring within the boundary of Richmond Park, including White Lodge (Grade 1) currently home of the Royal Ballet Junior School.</p> <p>The PEIR accepts that Designed Landscapes and Associated Buildings and Structures ... are assumed to be particularly sensitive to further changes in noise environment and consequently more likely to experience significant effects due to changes resulting from the DCO Project.</p> <p>Also “<i>Site analysis has yet to be undertaken to establish these factors for the wider study designated heritage assets [i.e. including Richmond Park]</i>”</p> <p>The PEIR gives a preliminary conclusion for Richmond Park: “<i>ATM increases will result in additional noise effects that introduce <u>medium</u> [our emphasis] magnitude of change to the setting that contributes to the significance of the Registered Historic Park and Garden and most associated designated heritage assets. This is a significant effect.”.</i></p> <p>Heritage value: High Magnitude of change: Medium to High Significance: Significant</p> |
| Correct treatment | <p>The current lack of noise is a major contributor to the significance of the Richmond Park historic environment (acknowledged in the PEIR); Richmond Park is particularly sensitive to changes in the noise environment, since the current ambient level of <30dB(A) is so low and the proposed flight envelopes would result in peak noise levels of around 80dB(A) [Heathrow data]; It is difficult to think of a historic environment in the UK which would suffer more from the increase in operational noise proposed by the DCO Project;</p> |

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| | Hence the EIA/ES should give a final (not preliminary) assessment that the magnitude of change should be high , not medium; The PEIR notes that Heathrow do not yet have the baseline noise metrics for many wider areas. Also, the three Heathrow noise monitors in Richmond Park are inadequate to represent the areal variations over this 2,500-acre park. Therefore, Heathrow must undertake a baseline noise survey of Richmond Park. This must occur before the DCO application and be included in the EIA/ES. |
| Correct rating | Heritage value: High Magnitude of change: High Significance: Significant |

12. Health

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| Treatment | Excluded |
| Reason for treatment | <p>On the face of it, health effects due to changes to sound exposure as a result of additional ATMs etc. are ruled in on the basis of noise (unwanted sound) being a pathway for health effects. And <i>"Noise emissions from aircraft are expected to cover an area that extends several kilometres around the land being considered for the DCO Project"</i></p> <p>However:</p> <p>(a) The areal extent of health impacts from arriving and departing aircraft is restricted to the airport area e.g. <i>"The proposed study area for health is... (5) Changes in sound and air quality exposure from aircraft and <u>other</u> on-airport sources"</i> [our emphasis];</p> <p>(b) Mental health and wellbeing, while being a requirement of the regulations, are not in fact included in the PEIR (e.g. <i>"... health effects relating to annoyance; sleep disturbance; cardiovascular impacts and cognitive development of children."</i>);</p> <p>(c) Effects on people in parkland are not included in the PEIR (e.g. <i>"Residents; Users of schools and medical and social facilities; Operators of schools and medical and social."</i>);</p> <p>(e) Impacts of noise on health are passed across to 16. Noise and Vibration but not in fact dealt with properly in that chapter;</p> <p>(f) The PEIR does not assess the impact on the Holly Lodge Centre for people with special educational needs and disabilities despite these groups being ruled-in.</p> |
| Correct treatment | <p>(a) There must be a compliant assessment of the effects on the mental health and wellbeing^{15,16} of Park visitors of proposed aircraft movements over Richmond Park; and</p> <p>(b) There must be a compliant assessment of the impact on the Holly Lodge Centre for people with special educational needs and disabilities;</p> |

¹⁵ Spending at least 2 hours a week in nature is associated with good health and wellbeing: Mathew P. White, Ian Alcock, et al. <https://www.nature.com/articles/s41598-019-44097-3>

¹⁶ Preserving our natural soundscapes is crucial for our mental health and wellbeing: 2019, psychologist Dr Alison Greenwood writes about the potential impact of low flying aircraft over Richmond Park. <https://www.frp.org.uk/heathrows-proposed-expansion-and-richmond-park/>

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| | (c) There must be a compliant assessment of the impact on the Royal Ballet Junior School – White Lodge. |
| Correct rating | High impact, Medium sensitivity Significance: Likely Adverse Significance |

13. Landscape and Visual Amenity

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| Treatment | Excluded Note: in the PEIR, Richmond Park is excluded from both Landscape, and Visual Amenity parts - but at times mistakenly conflated with Richmond Hill TCA. |
| Reason for treatment | Richmond Park is excluded because the PEIR fails to include indirect operational effects of the DCO Project on Landscape and Visual Amenity. The PEIR study area extends only 5km from the DCO Project area, and beyond the study area the PEIR concludes there are not expected to be significant landscape and visual effects due to intervening distance and landcover limiting the influence of the DCO Project in respect of landscape character and visual amenity. |
| Correct treatment | a) There must be an assessment of Richmond Park in terms of Landscape as defined in the European Landscape Convention, Council of Europe (2000), as: <i>"...an area, as perceived by people, whose character is the result of the action and interaction of natural and/or human factors"</i> . Heathrow agree, saying <i>"Landscape character arises from the pattern of these factors, or elements, that make one landscape different from another and includes perceptual aspects such as tranquillity."</i> b) Given that Richmond Park is the quietest (<30dB(A)) and most tranquil place in the London area, there must be an assessment of the impact of the project operations on tranquility in Richmond Park. Tranquility should be quantified as per Temple Group report for English Heritage 8-Jul-14 c) There should be a landscape character assessment for Richmond Park as required by the NN NPS. This should include <i>"...significant effects of the ... operation on landscape components and landscape character (including historic landscape characterisation)"</i> d) The Project operations must <i>"... contribute to and enhance the natural and local environment by protecting and enhancing [the Richmond Park] valued landscapes"</i> as per NPPF |
| Correct rating | Sensitivity: High , magnitude of change: High adverse Significance: High Adverse Significance |

16. Noise and Vibration

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| Treatment | Included: not considered significant |
| Reason for treatment | Richmond Park is inside the Aircraft Noise Study Area, and the PEIR notes that increases in noise due to operation of the DCO Project may adversely affect the acoustic character of such areas. However, the PEIR concludes that receptors |

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| | <p>are unlikely to experience significant effects. The PEIR then reaches a conclusion based on the “users” receptor (despite “receptors” being defined as people <i>and</i> environment): users will not be exposed to any increased noise for long periods, and hence use of the open spaces and facilities would not be disrupted, therefore the adverse noise effects on users are not considered significant. This conclusion is supported by a calculation that the increase in noise in Richmond Park is 1-3dB on an LOAEL $L_{Aeq,16h}$ basis.</p> |
| Correct treatment | <p>a) The measures L_{Aeq} with 16hr average, and resident population exposed, are totally inappropriate for human impact in parkland with relatively few residents but 5.5m visitors (refer (f) below for correct treatment);</p> <p>b) The treatment of human health effects of noise (passed into this section from 12. Health) is inadequate in that it excludes mental health and wellbeing despite this being a requirement in the regulations;</p> <p>c) Significance in this NNR should be determined by the effect of noise on wildlife as well as on humans^{17,18,19,20,21};</p> <p>d) the effects of noise, including the peaks and intervals effects of noise intrusion having disproportionate effects, on the 5.5m annual visitors must be properly assessed;</p> <p>e) There is no evidence cited that L_{Aeq} with 16hr average is an appropriate measure for the impact on wildlife;</p> <p>f) Richmond Park should be classified based on maximum noise level (outdoors, free-field) using peak noise (not L_{Amax}) and number of events and an assessment of tranquility and wildlife disturbance adjusted for Additional Factors (a) change in overall ambient noise, and (b) unusual character in the existing receiving environment; and</p> <p>g) The PPG(N) definition of UAEL is inappropriate and needs to be adjusted for noise impact on wildlife.</p> |
| Correct rating | Unacceptable Adverse Effect Level (UAEL) |

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17 Traffic noise reduces foraging efficiency in wild owls: <https://www.nature.com/articles/srep30602>

18 Impact of anthropogenic noise on songbirds: American Naturalist, 2010: Behavioural Plasticity Allows Short-Term Adjustment to a Novel Environment by Karin Gross,1,2 Gilberto Pasinelli,1,3 and Hansjoerg P. Kunc. <https://www.journals.uchicago.edu/doi/abs/10.1086/655428?mobileUi=0&journalCode=an>

19 Bats hunting methods effected by noise: (Article by Andrea Schaub, Joachim Ostwald, Björn M. Siemers, Journal of Experimental Biology 2008) <https://jeb.biologists.org/content/211/19/3174>

20 Anthropogenic noise threatens animals in Richmond Park: Research scientists Dr Hansjoerg Kunc & Dr Rouven Schmidt, 2019 <https://www.frp.org.uk/songbirds-owls-and-bats-under-threat-from-proposed-new-flight-paths-over-richmond-park/>

21 Aircraft noise leading to aggression and hearing loss in birds. Andrew D. Wolfenden Hans Slabbekoorn Karolina Kluk Selvino R. de Kort. 21-Aug-19 <https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/1365-2656.13059>