Comhairle Cathrach & Contae Luimnigh
Limerick City & County Council

Limerick City and County Council
Public Art Commission

Artist Brief

Deadline date for receipt of submissions: Wednesday 25th June 12noon
E-mail address for return of quotations: artsofficesubmissions@limerick.ie

Introduction
Environmental noise, such as from traffic, can strongly reduce the user experience of parks. A possible method of amelioration is incorporating positively perceived sounds. Assessments have been carried out at the People's Park with respect to its identification as a Candidate Quiet Area in the Noise Action Plan 2024-2028. Participants of soundwalks in the park rated the existing sound environment as annoying for a section of the park near the R858 and Upper Mallow Street roads. A report from the Environment and Climate Action Team (Appendix 1) recommends to improve the perceived acoustic environment in this area by providing seating to encourage relaxation and social interaction with acoustic installations that mask environmental noise and provide natural sounds. Limerick City and County Council would like to commission an artist to create two audio islands for the public to sit, rest, and enjoy commissioned sounds in noise polluted areas of People's Park.

Budget:
The budget for this commission is **€20,000**
The successful artist will be responsible for the design and creation of the artwork including final installation within the budget. The budget is to include all costs, artist fees, expenses, materials, insurance, fabrication, engineer's reports, any relevant consultations and installation fees.

The budget for this commission is **inclusive of VAT**.

Concept and Materials

The concept is to create two audio islands to improve the perceived acoustic environment in this area by providing seating to encourage relaxation and social interaction with acoustic installations that mask environmental noise and provide natural sounds influenced by the River Shannon. The artwork is intended to be permanent and of high quality. The brief does not specify the materials to be used however due consideration must be given to selecting materials that will be durable and easily maintained over time. Aesthetically the design and

materials should complement the surrounding park, elements of the architecture in the area, landscape design, and being in an open public spaces.

The materials used should take into consideration the environmental demands of the site and occasional extreme weather conditions, including high winds.
Any proposals incorporating electronic or digital elements should consider the long term maintenance and durability of such materials on site.

Art Work Location

People's Park, proposed locations below:

Application Process

Applications should include:

Outline of Project Plan to include

- Summary of your proposal for the commission
- Visualisations or technical drawings
- Project Plan: outline your concept and how you will approach the commission (max 700 words)
- Details of the technical specifications (including any power requirements, if necessary), location, construction, structural and installation process for the artwork
- Outline how you feel this proposal will enhance the public space (max 150 words)
- Budget breakdown (material / fabrication quotes where necessary)

- Proposed Timeline
- Essential Supporting Material

••

Examples of up to five previous projects or works. Include images, dates and locations

••

Artist CV

Selection Criteria

AWARD CRITERIA, RULES AND WEIGHTINGS				
	CRITERION	%	MAX SCORE ACHIEVABLE	MIN SCORE REQUIRED
A	Quality of the proposed Proposal, Methodology, and demonstrated understanding of requirements	50 %	50	N/A
B	Price	20 %	20	10
C	Relevant experience of similar projects	30 %	30	15

Service providers should note that they must achieve a minimum rating of 'acceptable,'
or
60% of the total marks available in order to avoid elimination from the competition

Selection Panel

Representative from LCCC Environment and Climate Team
Representative from LCCC Arts Office
Representative from LCCC Parks
Independent Professional Artist and/or Independent Curator

Information Session

Information sessions will outline the background and context of the project and allow interested parties ask any questions about submitting a proposal.

Tuesday 20th May 1pm – Online
Email artsofficesubmissions@limerick.ie for link

Timeline

Information Session Tuesday 20th May 1pm - Online
Application Deadline – Wednesday 25th June 12noon

Queries

If any additional information is required in relation to the commission, development or technical specifications of the site, please contact artsofficesubmissions@limerick.ie

Ts &Cs

Insurance
The artist will be responsible for insurance of the artwork until it is installed on site. The Commissioner shall be responsible for insurance of the artwork after installation is complete. The artist will require Public liability Insurance and Employers Liability Insurance for any sub-contractors engaged by the artist and assisting with the installation of the work on site.

Tax Clearance:
All applicants MUST be tax compliant. Limerick City & County Council can verify your tax clearance status through Revenue's online facility at http://www.revenue.ie/en/online/tax-clearance.html.

Copyright
All applications must contain a statement that the proposed design is of the sole creation of the artist and that no other person has or will have any legal call on the work. Copyright for the work proposed will remain at all times with the artist.

Health & Safety
All work shall be carried out in line with the requirements of the Safety, Health and Welfare at Work Act (Nr.10 of 2005), supporting regulations, codes of practice and any industry best practice associated with the works being undertaken.

Contract

Comhairle Cathrach & Contae Luimnigh
Limerick City & County Council

Prior to the commencement of work or payments, a contract must be agreed and signed by the artist and the commissioner. A contract will be drafted to include all timeline, payment schedule, copyright and insurance details.

Deadline date for receipt of Quotations:
Wednesday 25th June 12noon

E-mail address for return of quotations: artsofficesubmissions@limerick.ie

Please note we cannot receive emails containing files that exceed 18MB in total or individual files in excess of 3MB

Comhairle Cathrach & Contae Luimnigh
Limerick City & County Council

Appendix 1

Insert: Re: Recommendation for Installation of Audio Island Seating in Noise Polluted Areas of the People's Park

Environment and Climate Action **11th March 2024**

Aidan Finn
Senior Engineer
Environment and Climate Action

Re: Recommendation for Installation of Audio Island Seating in Noise Polluted Areas of the People's Park

---

Abstract
Environmental noise, such as from traffic, can strongly reduce the user experience of parks. A possible method of ameleoration is incorporating positively perceived sounds. Assessments have been carried out at the People's Park with respect to its identification as a Candidate Quiet Area in the Noise Action Plan 2024-2028. Participants of soundwalks in the park rated the existing sound environment as annoying for a section of the park near the R858 and Upper Mallow Street roads. This report recommends to improve the perceived acoustic environment in this area by providing seating to encourage relaxation and social interaction with acoustic installations that mask environmental noise and provide natural sounds.

Introduction
Urban parks are of major importance for people living in cities for the social and health related benefits (Braubach *et al.* 2017). However, excessive environmental noise can threaten the benefits and have an adverse effect on citizens health and well-being (Fritischi *et al.* 2011). Sound levels inside parks can be mitigated in various ways, such as treating the source (e.g. traffic management) and boundary treatment (e.g. acoustic barriers). However, these methods generally have a limited impact. Traffic volumes have to be significantly reduced to have only a small percieved reduction in noise (a 40% reduction in traffic flow will provide a 2 dB reduction in noise – just perceptible to the average listener). Acoustic barriers have to be high and have sufficient length even if they are natural (natural barriers also requiring sufficient density and width). Additionally, barriers provide a visual obstruction between the inside and outside of a park which can be percieived as being unsafe. An alternative means to improve the acoustic environment is using a soundscape approach (Kang et al. 2016) by adding human preferred sounds instead of mitigating unwanted sounds. Examples include the: "West Side Story: Come Together" pilot project in Brighton (Lavia *et al.* 2012) which played recorded and live sounds at night along streets in the city centre in an otherwise problematic night-time economy district; "Sonic Garden" in the remodeled Nauener Platz Park in Berlin (Schulte-Fortkamp 2010) where the need for more pleasant sounds was recognized resulting in the installation of "audio islands" - benches with integrated speakers playing continuously pre-set sounds (e.g. birdsong, shingle beach sounds) to improve the acoustic experience of visitors to the park.

People's Park and the Noise Action Plan 2024-2028

The People's Park is the principal park in Limerick City located at the centre of the Georgian Quarter[1] (**Figure 1**). The park is approximately 3.5 hectares in size and contains a large number of trees that provide both greenery and shade. The park includes a memorial to Thomas Spring Rice (MP for the city of Limerick from 1820–1832), a 19th century bandstand, an ornate drinking fountain and two gazebos. In 2019 the park was awarded a Green Flag, an award that acknowledges good quality public parks and green spaces that are managed in environmentally sustainable ways and that achieve high environmental performance. It is bounded to the east, north and west by the R858, Upper Mallow Street and Pery Square roads, respectively, and to the south by buildings, mainly residential properties with an apartment block to the east (along Lord Edward Street) and St. Michael's National School and St. Michael's Church to the west. The park is home to the Limerick City Gallery of Art along Pery Square and a children's playground adjacent to Upper Mallow Street. The park is used for social activities, relaxation, walking, children playing and contains a number of benches

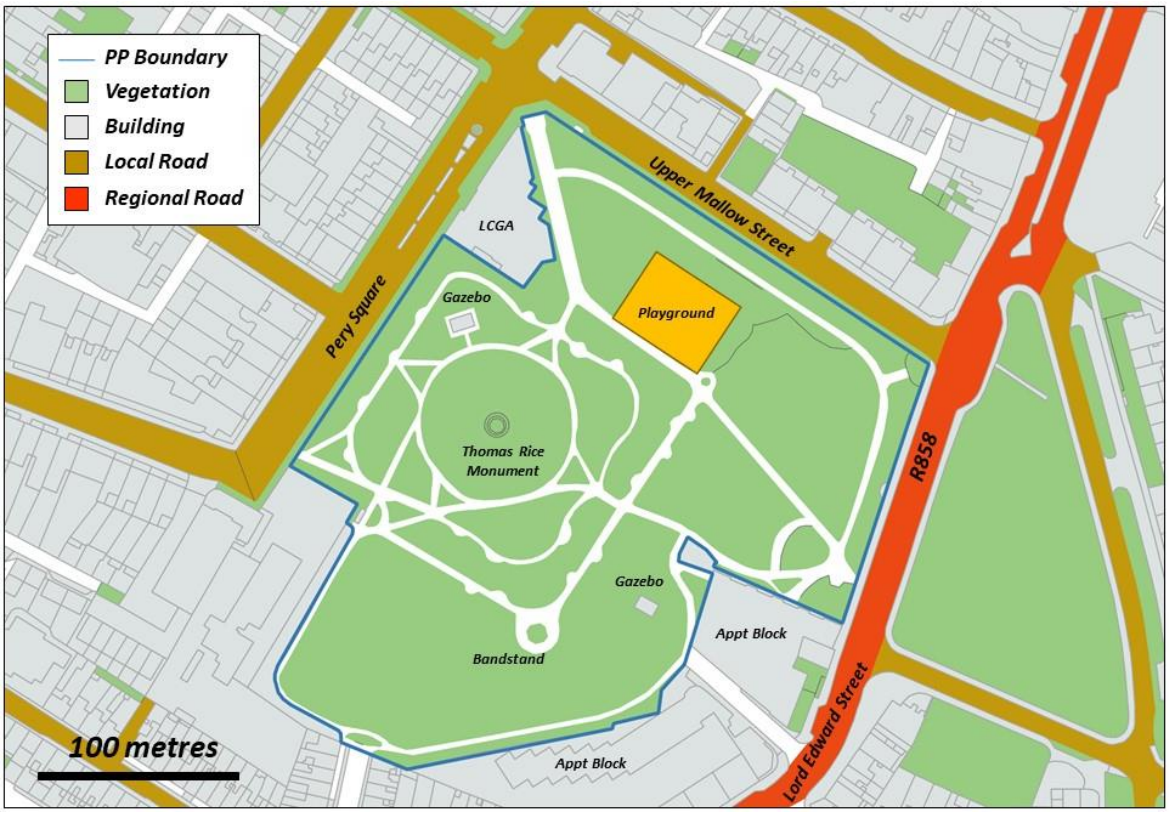


Figure 1. Site layout of the People's Park, Limerick City.

Noise action planing and sound level monitoring

The People's Park is identified as a Candidate Quiet Area in the Limerick Agglomeration Noise Action Plan 2024-2028. Based on strategic noise mapping it was identified as having environmental noise levels that are relatively low in comparison to community noise exposure (at least 25% of population within 1 km of the park is expected to be exposed to noise 10 dB above the median noise level in the park over day and evening time – times when it will be in use). An overview of noise calculations for the park are presented in **Table 1**, with the strategic noise mapping presented in **Figure 2**.

[1] The Georgian Quarter is an area which the Council is leading a number of innovative projects such as the refurbishment/rennovation of Georgian buildings, Decarbonisation Zone etc..

Table 1. A summary of the People's Park meeting the criteria for a Candidate Quiet Area.

Area (m^2)	Population within 1 km	Median $L_{Aeq,16hr}$	Area (m^2) below 45 dB $L_{Aeq,16hr}$	Population exposed to 10 dB above median $L_{Aeq,16hr}$
34,040	14,931	53 dB	4,021	3,885 *(26% of the population within 1 km)*

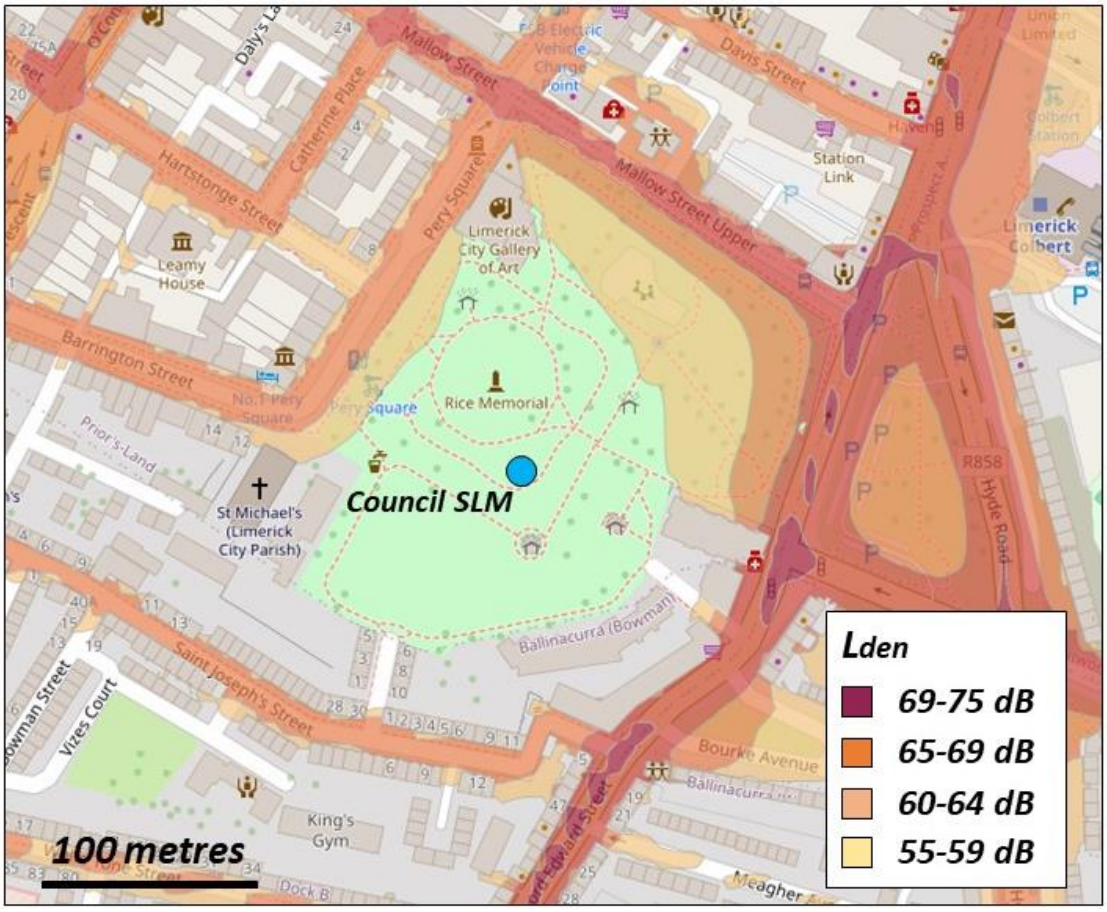


Figure 2. Strategic noise mapping for the People's Park[2] and the location of the sound level monitor (SLM).

The Council has been monitoring sound levels in the People's Park, at the core of the park, since 2019 (Figure 3, results are summarised in **Table 2**).

[2] Maps of $L_{Aeq,\ 16hr}$ for the Limerick Agglomeration were not produced as part of the strategic noise mapping contract, only L_{den}, as required under the Environment Noise Regulations

Figure 3. Fixed sound level monitor in the People's Park.

Table 2. Results of sound level monitoring at the core of the People's Park.

Year	Monitoring Results				
	LAeq,16hr, dB	*Lden*, dB	*Lday*, dB	*Levening*, dB	*Lnight*, dB
2019	57	58	59	52	48
2020	57	58	57	53	49
2021	57	59	57	52	52
2022	56	57	57	52	48
2023	56	58	57	52	50
2024	56	58	57	52	50

At the monitoring location the levels in **Table 2** for each year are relatively consistent, but the *Lden* results are higher than the predicted sound levels based on the strategic noise mapping (see **Figure 2** i.e. less than 55 dB *Lden*). However, these sound levels do not give the full picture of sound measured at the monitoring location. Not all sounds present in the park are noise (or unwanted sounds). An assessment of the sound levels at the monitoring station (**Appendix 1**) indicate that natural sounds from birdsong are dominant particularly in spring in autumn. This is succinctly presented in **Figure 4** which it is demonstrated that the proportion of low frequency sound (identified by the C-weighted average sound levels, *LCeq*) from environmental noise at the monitor decreases, and conversely the high frequency content increases, particularly in the morning- and evening-times during the spring (i.e. the dawn chorus is clearly audible) and evening-times during the summer but also during the year throughout the day-time (to a lesser extent in autumn and winter). The assessment of sound levels for 2024 at the monitoring location is described in more detail in **Appendix 1**.

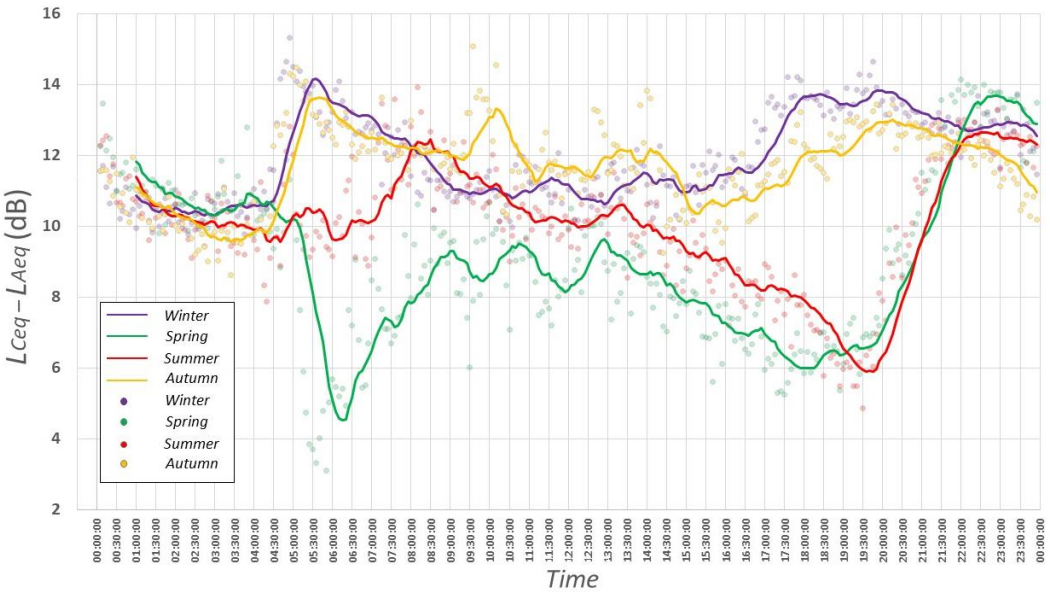


Figure 4. Average 5-minutes *LCeq* - *LAeq* levels (points) and rolling 1-hr average levels (lines) for each season[3] For 2024 for calm and dry days.

Soundscape Approach

Given that natural sounds effect the measurement sound levels in the park then an alternative approach is needed to characterise the sounds in the park and how they are perceived, a soundscape approach. The soundscape approach considers the acoustic environment as a resource for society, focusing on sounds people want or prefer. The conceptual framework is described in ISO 12913-1:2014 Acoustics - Soundscapes - Part 1. Low sound levels in the outside environment are not a primary requirement for acoustic preference. Core requirements include congruent soundscape and landscape, and dominant wanted sounds in a place over, and not masked by, unwanted sounds (Brown 2012).

Soundscape investigations intend to assess all sounds perceived in an environment in all their complexity and use a variety of data collection methods related to human perception, the acoustic environment and their context. One of those methods is by means of soundwalks (Schafer 1974), moderator-led walks with a focus on listening to the environment. It uses an empirical method for collecting data and data analysis for various locations which is described in ISO 12913-2:2018 Acoustics - Soundscapes - Part 2 and ISO 12913-3:2019 Acoustics - Soundscapes - Part 3.

The Council undertook moderator-led soundwalks under similar meteorological conditions in the spring and summer of 2023 for people that live, study and work in Limerick City (starting at 13:30 hrs Monday 27th March 2023 for citizens and 12:30 hrs Friday 30th May 2023 for Transition Year students from a Limerick City college) and for the National Public Participation Network (PPN) Conference in autumn 2024 (starting at 14:30 hrs Thursday 17th October 2024). Data for the soundwalks in 2023 was collected using the Hush City Framework (a methodology well described in Radicchi 2017, Jennings et al. 2023). Data for the soundwalk in 2024 was collected using a questionnaire format specified in ISO 12913-2 combined with the collection of binaural acoustic data. The analysis of the binaural data enables the characterisation of the acoustic environment and identification of auditory sensations.

[3] Dates for seasons for 2024 - Winter: 1st January – 19th March and 21st December – 31st December; Spring: 20th March – 20th June; Summer: 21st June – 22nd September; Autumn: 23rd September – 20th December.

The intended purpose of measurements is that they can be helpful to correlate with and support the perceived affective responses.

Four listening stops for each of the soundwalks (**Figures 5** and **6**) were selected based on a presumption they represent different acoustic environments in the park. Stop 1 was at one of the gazebos in the park, approximately 35 metres from a road (Pery Square) and the same distance to the Thomas Spring Rice Memorial, a focal point in the park. Tree cover was in close proximity to the location. Stop 2 was at the bandstand, approximately 40 metres from residential houses and an apartment block, and further from roads than Stop 1 (over 100 metres from roads bounding the park to the east and west). Stop 2 is in close proximity to trees, near the Council's sound monitor, and along a path that is slightly elevated above the surrounding open space. Stop 3 at an ornate fountain was adjacent to a childrens playground, with the nearest road being approximately 50 metres distance (Upper Mallow Street) and trees in close proximity. Stop 4 was beside the walled boundary of the site, adjacent to housing and facing open green space with few trees in close proximity. The nearest road to Stop 4 is Pery Square, approximately 110 metres away. Stop 4 is in a topographic depression approximately 1 to 2 metres below the path that led to Stop 2. The head and shoulder unit for the collection of binaural data (seen in **Figure 6**) was pointed face front towards the memorial for each of the measurement stops.

Binaural mapping was also undertaken in the summer of 2024 (starting at 14:30 hrs Friday 7th July 2024) that can be used to correlate results from the soundwalks and binaural analysis.

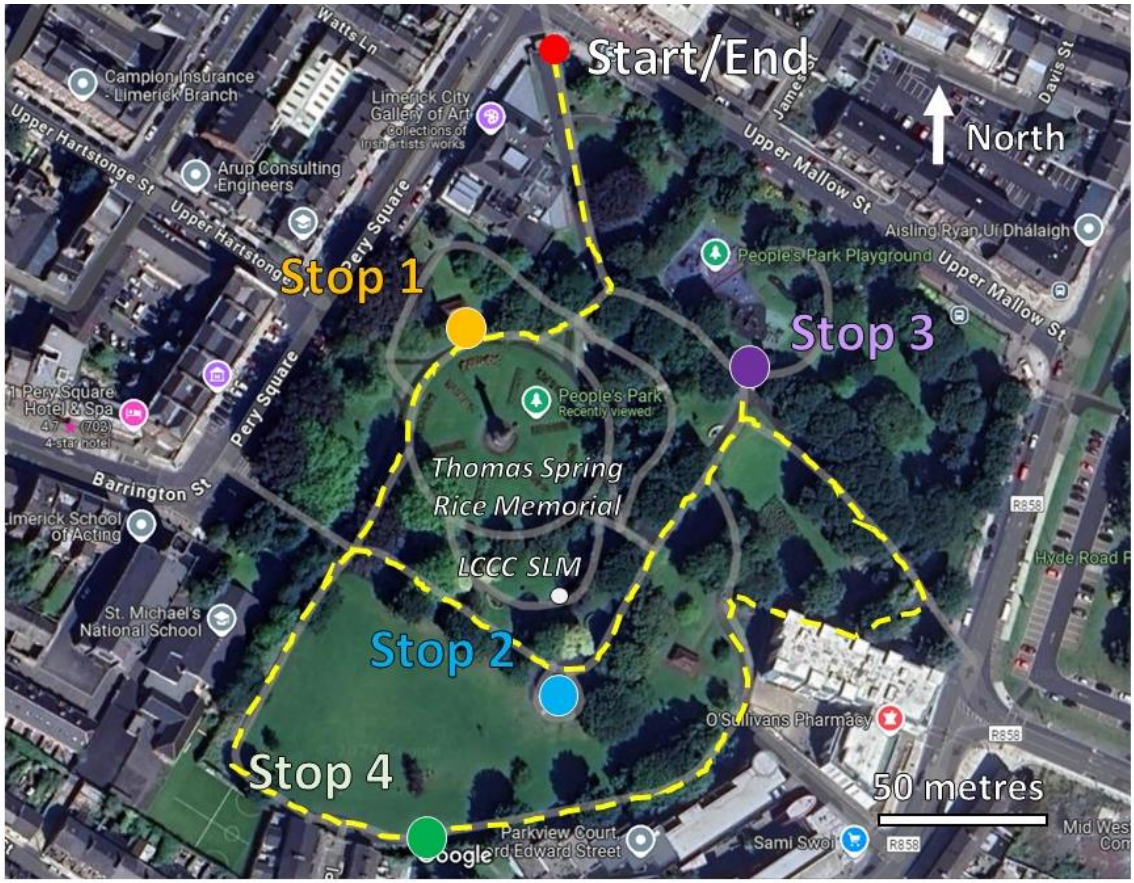


Figure 5. Path of the soundwalks undertaken by the Council in 2023 and 2024 including locations of the four listening stops.

Figure 6. Listening stops 1 to 4 in the People's Park (17th October 2024).

The detailed results of the soundwalks and the binaural analysis are presented in detail in **Appendices 2** and **3**. In summary, natural sounds were dominant at Stops 2 and 4, towards the rear of the park while transportation noise and social signals (conversation, laughter, footsteps) were dominant at Stops 1 and 3 (stops nearer to the heavily trafficked roads) with pleasantness decreasing and annoyance increasing particularly at Stop 3 (summarised in **Figure 7**).

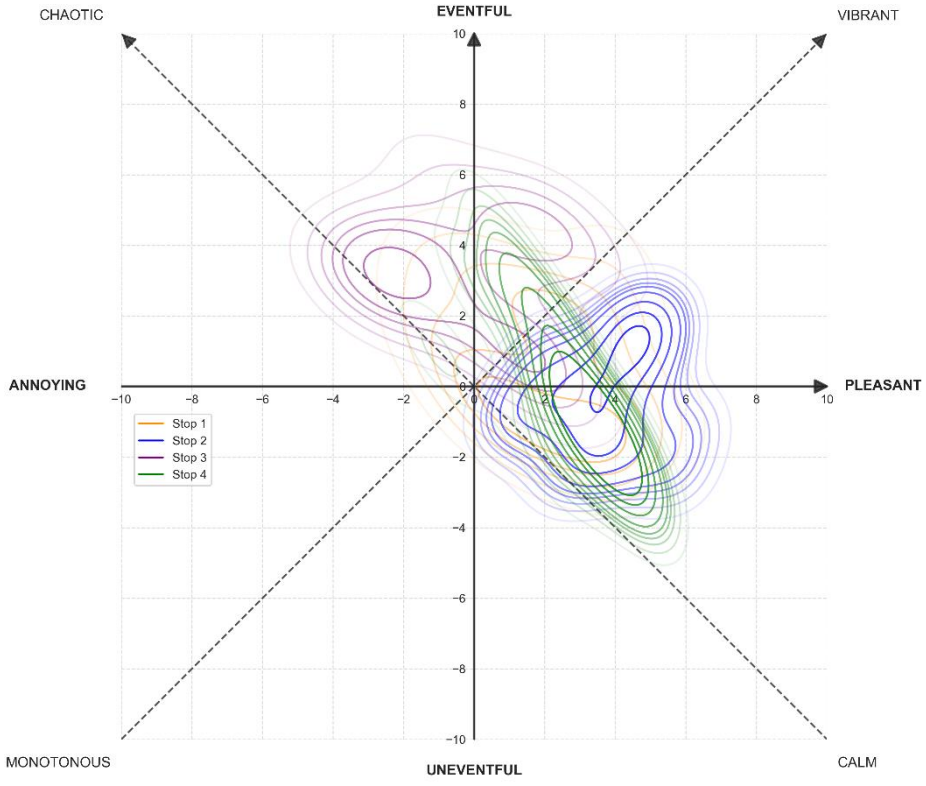


Figure 7. Scatter and density plots of the participants results to Question 2 (Table A3.1, Appendix 3) as per the equations in ISO 12913-3 for Stops 1 to 4 (*n= 14 at each of the stops - to note: some of the points plot over each other*), 17th October 2024.

The results of the binaural analysis from the soundwalk on 17th October 2024 at Stop 3 correlates to an area of relatively high roughness[4] (**Figure 8**), high tonality and low sharpness values (see Appendices 3 and 4), associated with traffic noise.

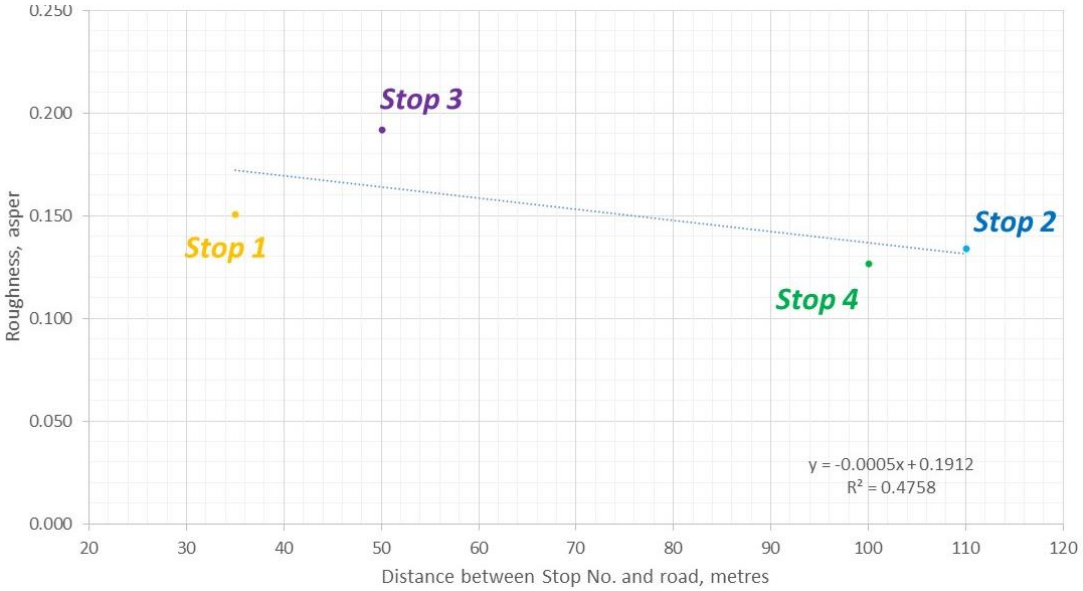


Figure 8. Measured roughness (asper) vs. distance from roads at the listening stops in the People's Park, 17th October 2024. *To note: this is a trend observed at other green spaces in Limerick as well.*

Binaural mapping from 5th July 2024 (described in detail in **Appendix 4**) has been used to undertake a GIS assessment to correlate/map where the acoustic characteristics identified at Stop 3 (of dominant transportation noise) are present across the park (**Figure 9**). These areas are adjacent to the R858 and adjacent to Upper Mallow Street, at junctions with the R858 and Pery Square. Improving the acoustic environment in these areas of the People's Park will likely improve the pleasantness of the soundscape and encourage social interaction.

[4] Roughness is a measure of the modulation of low frequency sound and is particularly associated with the acceleration and deceleration of traffic.

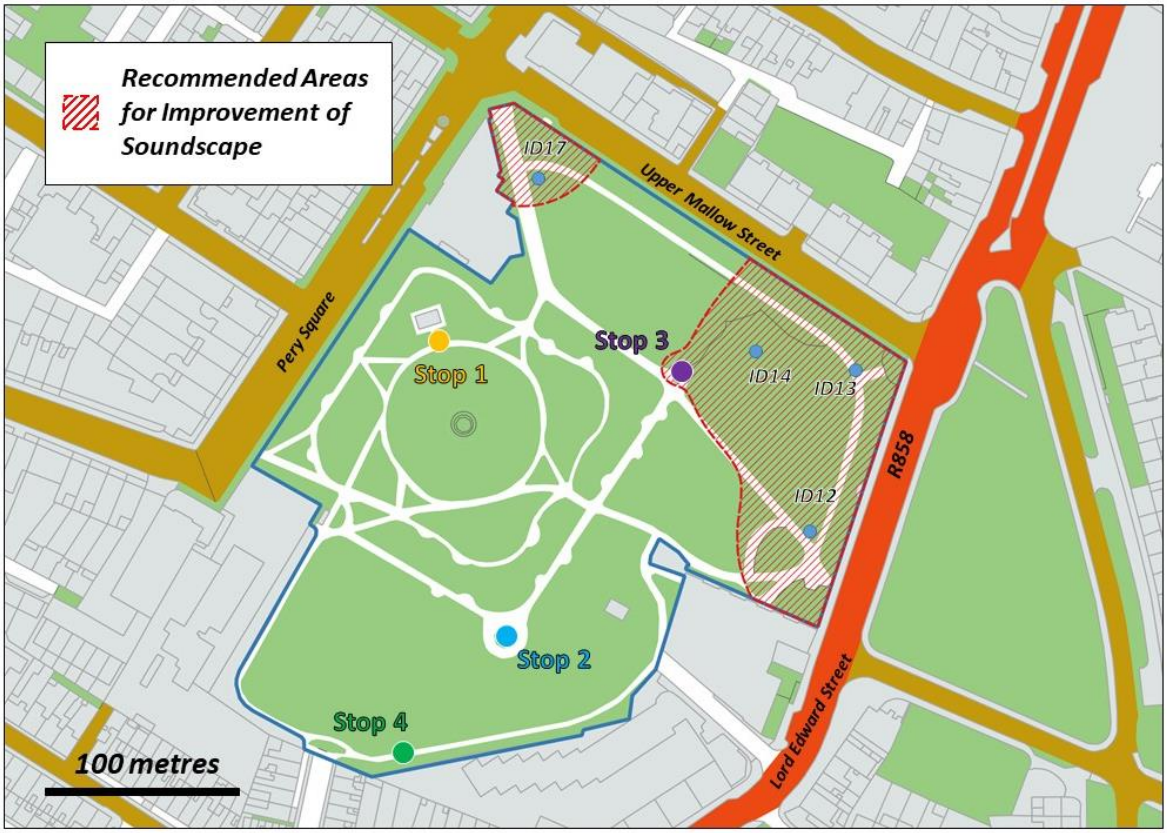


Figure 9. Area in the People's Park dominated by environmental noise based on soundwalks and binaural analysis (includes locations of binaural analysis for the example FFT-analysis in Figure 18, Appendix 4).

Recommendation

While the acoustic environment is considered to be pleasant across the majority of the People's Park it is recommended to improve the acoustic environment in the areas impacted by transportation noise, in the hatched areas of Figure 9, by using natural sounds to mask the sound of traffic. It is recommended to install audio islands - benches with integrated speakers playing continuously pre-set sounds directed towards the seating - similar to a measure used in Nauener Platz park, Berlin (e.g. **Figures 10**).

Figure 10. Example design of audio island seating with loudspeakers installed used at Nauener Platz park, Berlin (designed by Barbara Willecke).

Birdsong is already present in the park and so other natural sound such as flowing water might be introduced (e.g. sound or sounds of the River Shannon, a prominent feature in the landscape of Limerick City). Two locations are proposed to install audio islands - areas A and B in **Figure 11**.

It is recommended that a tender brief is prepared, in partnership with the Arts Office, for a sound artist to design and install bespoke audio islands (e.g. **Appendix 5**) to mask the sound of traffic and alter the soundscape with pleasant sounds.

Comhairle Cathrach & Contae **Luimnigh**

Limerick City & County Council

Figure 11. Locations for proposed audio islands in the People's Park to provide additional seating for augmentation of traffic noise with natural sounds.

References

Braubach, M., Egorov, A., Mudu, P., Wolf, T., Ward Thompson, C., Martuzzi, M. 2017. Effects of Urban Green Space on Environmental Health, Equity and Resilience. In book: Nature-Based Solutions to Climate Change Adaptation in Urban Areas. (Editors N. Kabisch et al.).

Brown, L., 2012. A Review of Progress in Soundscapes and an Approach to Soundscape Planning. The International Journal of Acoustics and Vibration. Vol. 17, No. 2, p. 73-81.

Fritschi, L., Brown, A., Kim, R., Schwela, D., Kephalopoulos, S. 2011. Burden of disease from environmental noise: Quantification of healthy life years lost in Europe. World Health Organisation.

International Organization for Standardization, 2014. Acoustics – Soundscape – Part 1: Definition and conceptual framework.

International Organization for Standardization, 2018. Acoustics – Soundscape – Part 2: Data collection and reporting requirements.

International Organization for Standardization, 2019. Acoustics – Soundscape – Part 3: Data analysis.

Jennings, J. S., Radicchi, A., O'Connell, N., Finn, A., Brodie, C., Lynch, C. 2023. A citizen science and soundscape approach to the investigation of quiet areas. Paper: Forum Acusticum 2023.

Kang, J., Aletta, F., Gjestland, T., Brown, L. A., Botteldooren, D., Schulte-Fortkamp, B., Lavia, L. 2016. Ten questions on the soundscapes of the built environment. Building and Environment, 108, p. 284-294.

Lavia, L., Easteal, M., Close, D., Witchel, H., Axelsson, Ö., Ware, M., Dixon, M. 2012. Sounding Brighton: Practical approaches towards better soundscapes. Inter Noise 2012.

A. Radicchi, A. 2017. 2017. A pocket guide to soundwalking: Some introductory notes on its origin, established methods and four experimental variations, *Perspectives on urban economics*, (Editors Besecke et al.), Universitätsverlag der TU Berlin, p. 70-73.

Schafer, R. M. 1974. Our sonic environment and the soundscape: The tuning of the world. Destiny Books (Publishers).

Schulte-Fortkamp, B. 2010. The daily rhythm of the soundscape "Nauener Platz" in Berlin. The Journal of the Acoustical Society of America, Vol. 127, No. 3, p. 1774.

Appendix 1 – Identification of natural sounds (birdsong) from sound level monitoring

Not all sounds in the People's Park are noise (or unwanted sounds). To demonstrate this, an investigation of sound pressure levels for 2024 is presented below on a seasonal basis (separated into winter, spring, summer and autumn). The results of sound level monitoring have been filtered for days expected to have been dry and calm to aid isolating high frequency natural sounds (e.g. birdsong) and low frequency sounds (primarily environmental noise from transportation). The monitoring data has been filtered for days which wind speeds were less than 5 m/s and no rain was recorded at Met Eireann's Shannon Airport meteorological station. Forty-five days over a twelve months period were identified meeting this criteria. The *Lden* and and *LAeq,16hr* over these days are both 55dB.

The *LAeq* results for each of the seasons (**Figure A1.1**) indicate that sound levels in general increase from approximately 04:00hrs, rising most steeply and to a higher level early in the morning (05:30 to 06:30hrs) in spring. There is a more gradual rise of *LAeq* levels in the winter, summer and autumn in the morning time. *LAeq* levels also rise to a high level in the evening times in spring and summer. There are also periods of the day with high *LAeq* levels.

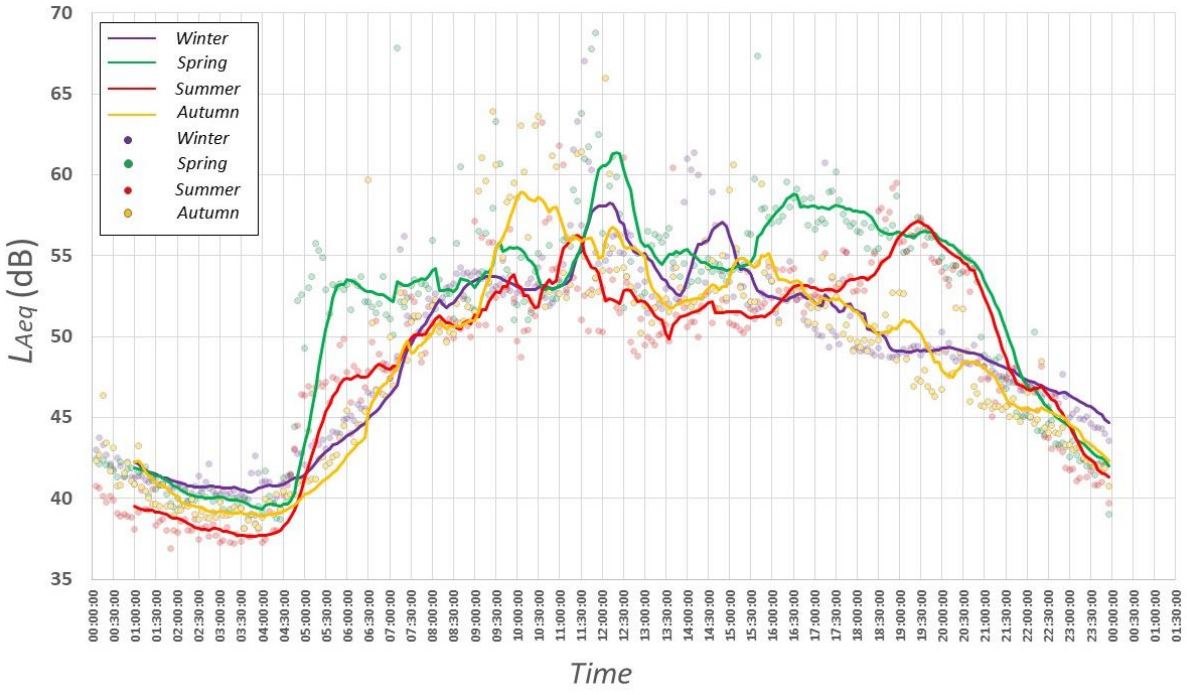


Figure A1.1. Average 5-minutes *LAeq* levels (points) and rolling 1-hr average levels (lines) for each season[5].

The *LCeq* levels[6] (**Figure A1.2**) indicates that low frequency sound levels, assumed to be from environmental noise (mainly road noise), do not rise as steeply early in the morning (from 04:00hrs) in spring as the *LAeq* and also do not elevate to the same extent in the afternoon and evening-time for spring and summer. The elevated levels between late morning and afternoon (10:00hrs and 15:00hrs) for all seasons are mirrored to some extent by the *LAeq* and *LCeq* levels, suggesting those day-time sounds contain some low frequency content.

[5] Dates for seasons for 2024 - Winter: 1st January – 19th March and 21st December – 31st December; Spring: 20th March – 20th June; Summer: 21st June – 22nd September; Autumn: 23rd September – 20th December.

[6] The C-weighting of sound is useful to identify low frequency sound, assumed in this case to be dominantly from environmental noise: transportation.

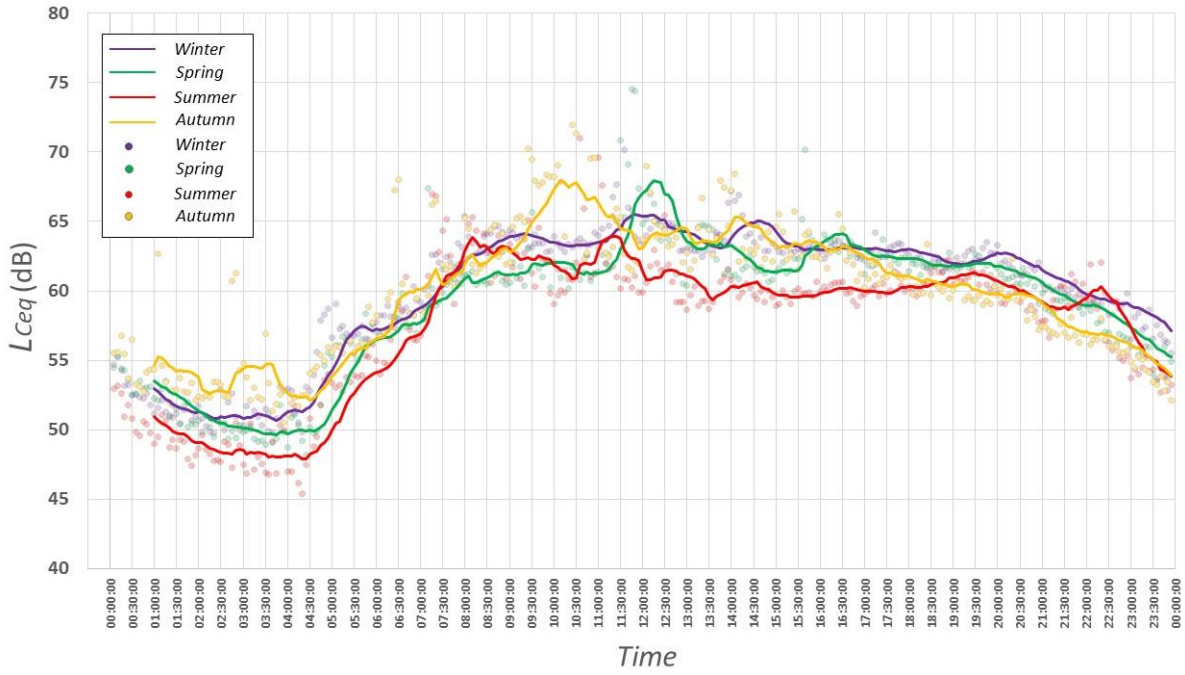


Figure A1.2. Average 5-minutes *LA10* levels (points) and rolling 1-hr average levels (lines) for each season.

The difference between the *LCeq* and *LAeq* levels (**Figure A1.3**) allows us to identify times when low frequency sounds (environmental noise) or high frequency sounds (birdsong) became more or less noticeable i.e. where there are falls in the profile then the proportion of low frequency sound in the overall sound decreased and conversely the higher frequency content increased. Throughout the year at night-time, low frequency sound levels *LCeq* levels were 10 to 14 dB above *LAeq* levels which is a noticeable difference, that is environmental noise was clearly audible and probably dominant in the park at night-time. During spring, higher frequency sound content increased in the early morning (05:00 to 09:00hrs), expected to be due to the sound of the dawn chorus. The high frequency sound content also increased in the afternoon and evening (peaking at approximately 18:00hrs). During the summer, the low frequency sound content (environmental noise) increased in the early morning until approximately 08:00hrs and then high frequency sound (birdsong) became more dominant steadily through the day peaking at 19:30hrs, slightly later than spring. During autumn and winter, environmental noise rose early in the morning and in the evening but during the day there was a relatively high proportion of high frequency sounds (birdsong) between approximately 06:00 and 18:00hrs.

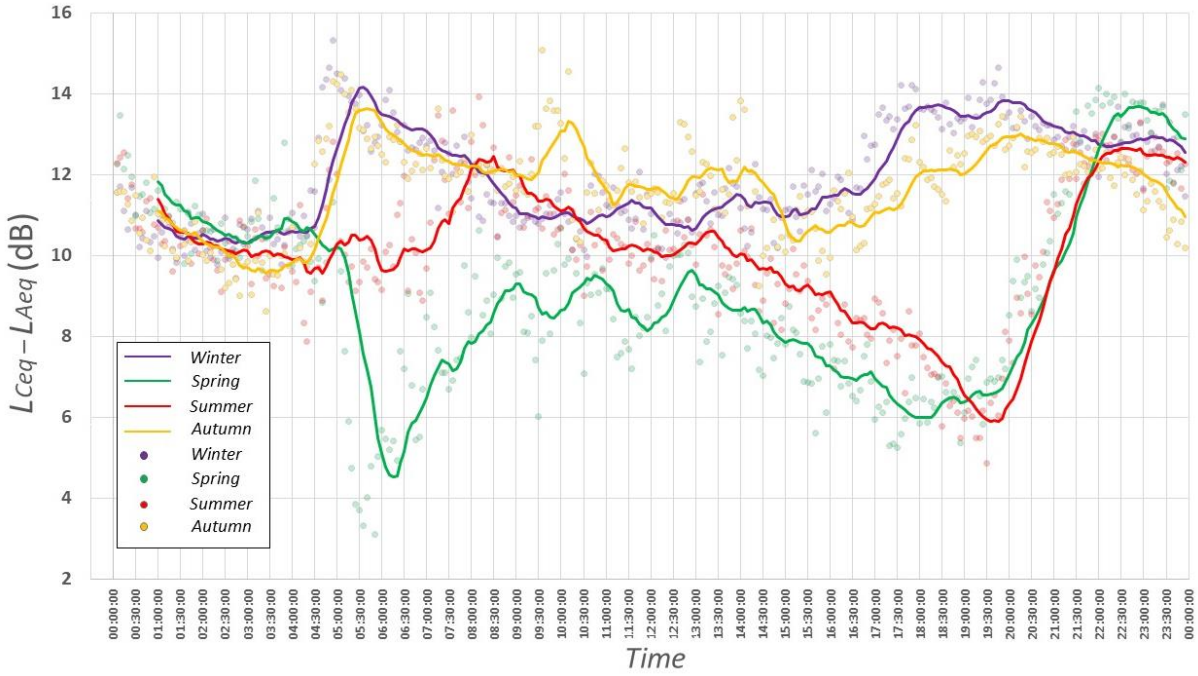


Figure A1.3. Average 5-minutes *LCeq* - *LAeq* levels (points) and rolling 1-hr average levels (lines) for each season.

To summarise, birdsong in the park was audible throughout the year, in all seasons. It was most prevalent during the spring (at morning and evening) and summer (in the evening), but with decreased high frequency content during the autumn and winter (birdcall is not as intense).

With that in mind, it can be concluded that natural sounds contribute significantly to sounds in the People's Park (i.e. sound levels measured are effected by natural sounds), particularly in the area of sound level monitoring (location presented in **Figure 2** of the main document).

Appendix 2 - Hush City Soundwalks

The salient results from the soundwalks using the Hush City Framework are presented in **Figures A2.1** and **A2.2** and are discussed below.

The number of participants datasets collected at the four predefined stops for each soundwalk was:

- sixty datasets in total from fifteen participants on 27th March 2023;
- forty-eight datasets in total on from twelve participants 30th May 2023; and,

The routes were dominated by people passing through (reported by 69% of participants on 27th March and by 70% of participants on 30th May), followed by people relaxing (reported by 47% of participants on 27th March and by 27% of participants on 30th May). There was an indication of favourable conditions for communication on 27th March (average score of 3.5 out of 5 on the *likert scale*) while participants were more neutral on that aspect on 30th May (average 2.9 out of 5).

Sound levels were lowest at Stops 2 and 4 for both soundwalks (measured between: 52.9 dB and 56.9 dB at Stop2; 51.4 dB to 54.2 dB at Stop 4) which correlates relatively well with the perceived quietness at those stops (Figures 4 and 5). Sound levels at Stops 1 and 3 were higher (measured between: 57.4 dB to 60.3 dB at Stop 1; 58.8 dB to 62.5 dB at Stop 3) although Stop 1 was perceived to be as quiet at Stop 4 by the students.

The sound of humans (movement, voices and social signals) was dominant at all the stops (up to 52% of the responses) followed by natural elements (up to 22% of the responses), animals (specifically birds – up to 28% of the responses) and motorised sounds (up to 18% of the responses). Motorised sounds were recorded by participants most at Stops 1 and 3 with construction also recorded at Stop 3. The higher sound levels and least perceived areas of quietness correlated with motorised sounds being more prevalent.

The main description of the sounds in the park was that they were pleasant, relaxing and familiar (up to 49% of responses at Stop 2, the bandstand). Citizens generally found the acoustic environment friendly (up to 18% at Stop 2) whereas this was less so for the students (only up to 6% of responses). The students perceived the sounds to be most lively at Stop 2 compared to the citizens finding the sounds most lively at Stop 3. Another notable positive description included the sound being beautiful (primarily for Stops 1, 2 and 4). Sounds in general were least natural, pleasant, relaxing and not preferred at Stop 3 - that stop being nearer to heavily trafficked roads bounding the park.

Comhairle Cathrach & Contae Luimnigh

Limerick City & County Council

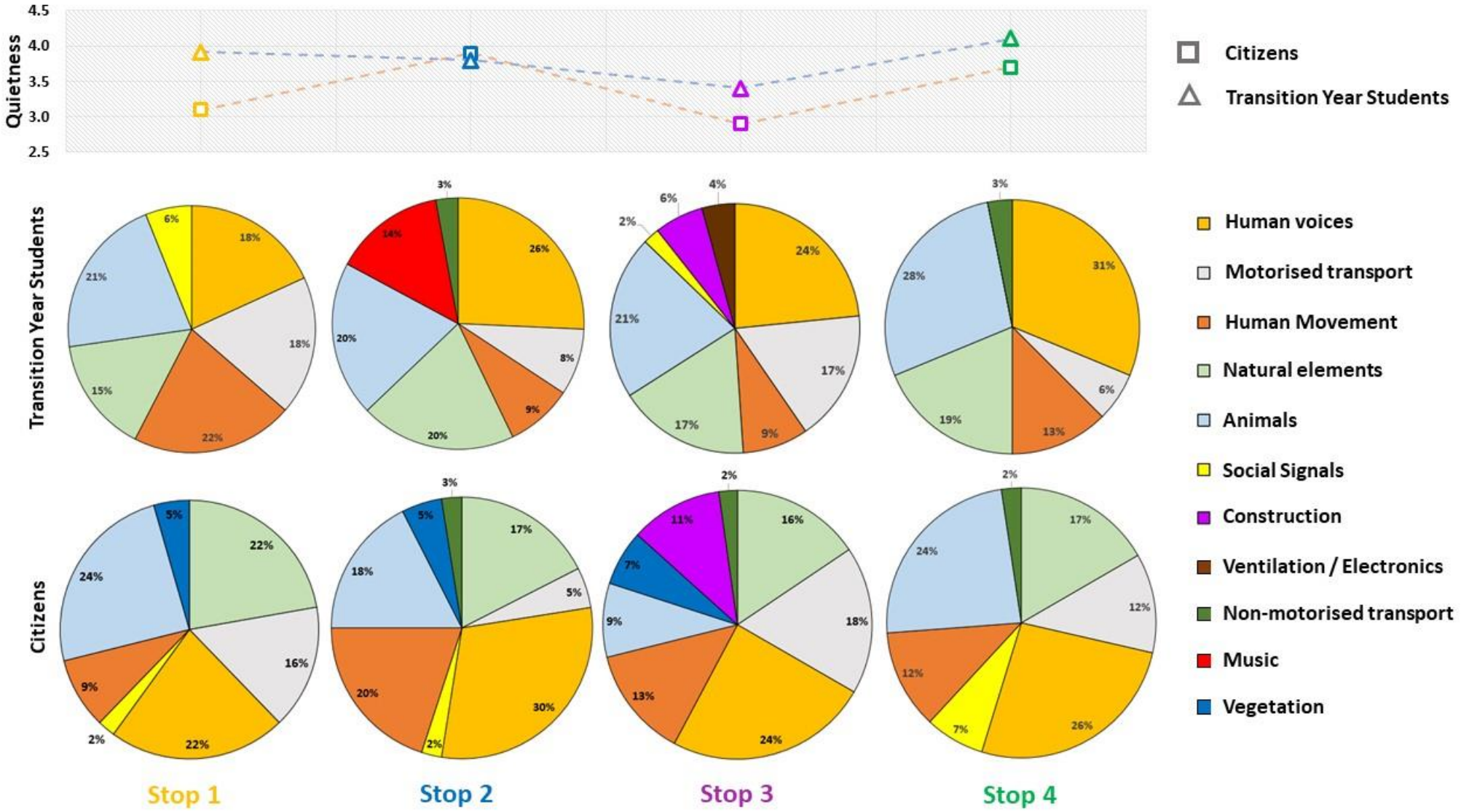


Figure A2.1. Summary of Hush City results for the perceived quietness and categorisation of sounds at Stops 1 to 4 in the People's Park (27th March and 30th May 2023).

Comhairle Cathrach
& Contae **Luimnigh**

Limerick City
& County Council

Comhairle Cathrach & Contae Luimnigh

Limerick City & County Council

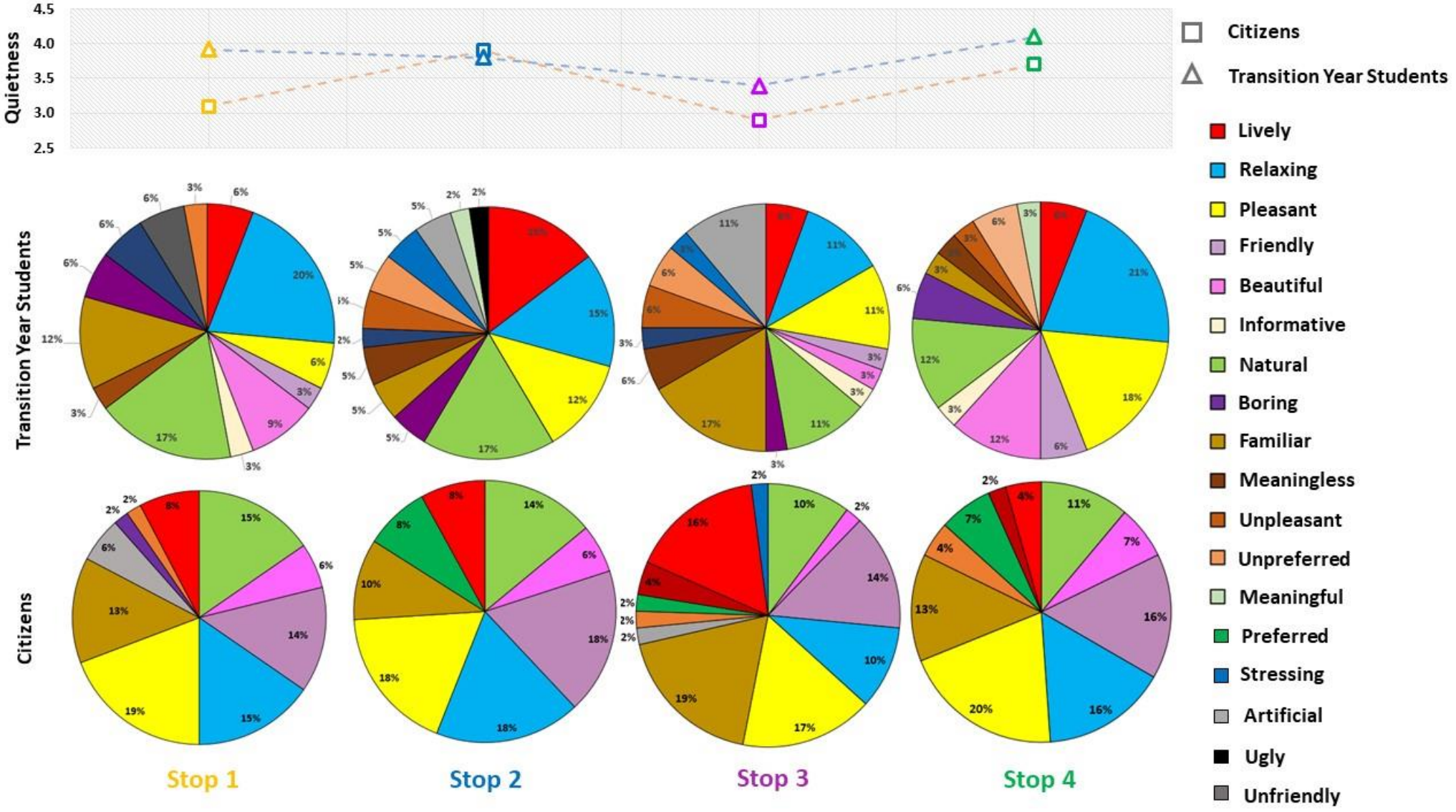


Figure A2.2. Summary of Hush City results for the perceived quietness and perceived affective response to sounds at Stops 1 to 4 in the People's Park (27th March and 30th May 2023).

Appendix 3 - ISO 12913 Soundwalk

The soundwalk on 17th October collected two types of data – participants responses to their acoustic environment and binaural data collected from a head and torso unit (shown in **Figure 6** of the main document). There were fifty-six datasets in total collected from fourteen participants at the four predefined stops for the soundwalk.

Qualitative Assessment - Questionnaires

The collected responses via the questionnaire were assigned scale values from 1 to 5 (using the *likert scale*) to four questions:

- the identification of the sound source for noise (e.g. traffic, industry), human activity (e.g. conversation, walking) and nature (e.g. birdsong, wind blowing vegetation);
- the perceived response to a variety of emotional indicators (e.g. pleasant, chaotic, vibrant etc.);
- an assessment of the surrounding sound environment;
- and an assessment of the appropriateness of the surrounding sound to the place.

The results in Table 3 present the median values from all participants as the measure of central tendency at each of the four stops. The results for Questions 1 and 2 in **Table A3.1** are more easily visualised in graph form (**Figures A3.1** and **A3.2**).

Table A3.1. Results of the questionnaires.

Location	***Stop 1***	***Stop 2***	***Stop 3***	***Stop 4***
Question 1 - Sound Source Identification?				
Type	***Median Value***	***Median Value***	***Median Value***	***Median Value***
Noise	*Moderately [3]*	*A little [2]*	*Moderately [3]*	*A little [2]*
Humans	*A lot [4]*	*A little [2]*	*A lot [4]*	*Moderately [3]*
Natural	*A little [2]*	*A lot [4]*	*A little [2]*	*Moderately [3]*
Question 2 - Perceived Affective Quality?				
Pleasant	*Agree [4]*	*Agree [4]*	*Neutral [3]*	*Agree [4]*
Chaotic	*Disagree [2]*	*Disagree [2]*	*Agree [4]*	*Disagree [2]*
Vibrant	*Neutral [3]*	*Neutral [3]*	*Neutral [3]*	*Neutral [3]*
Uneventful	*Disagree - Neutral [2.5]*	*Disagree - Neutral [2.5]*	*Disagree [2]*	*Disagree - Neutral [2.5]*
Calm	*Neutral [3]*	*Agree [4]*	*Disagree [2]*	*Agree [4]*
Annoying	*Neutral [3]*	*Disagree [2]*	*Disagree - Neutral [2.5]*	*Disagree [2]*

Eventful	*Neutral [3]*	*Neutral [3]*	*Agree [4]*	*Neutral [3]*
Monotonous	*Disagree [2]*	*Disagree [2]*	*Disagree [2]*	*Disagree [2]*
Question 3 - Assessment of surrounding sound environment?	*Neither good or bad [3]*	*Good [4]*	*Neither good or bad [3]*	*Good [4]*
Question 4 - Assessment of appropriateness of sound environment?	*Moderately - Very appropriate [3.5]*	*Very appropriate [4]*	*Moderately - Very appropriate [3.5]*	*Very appropriate [4]*

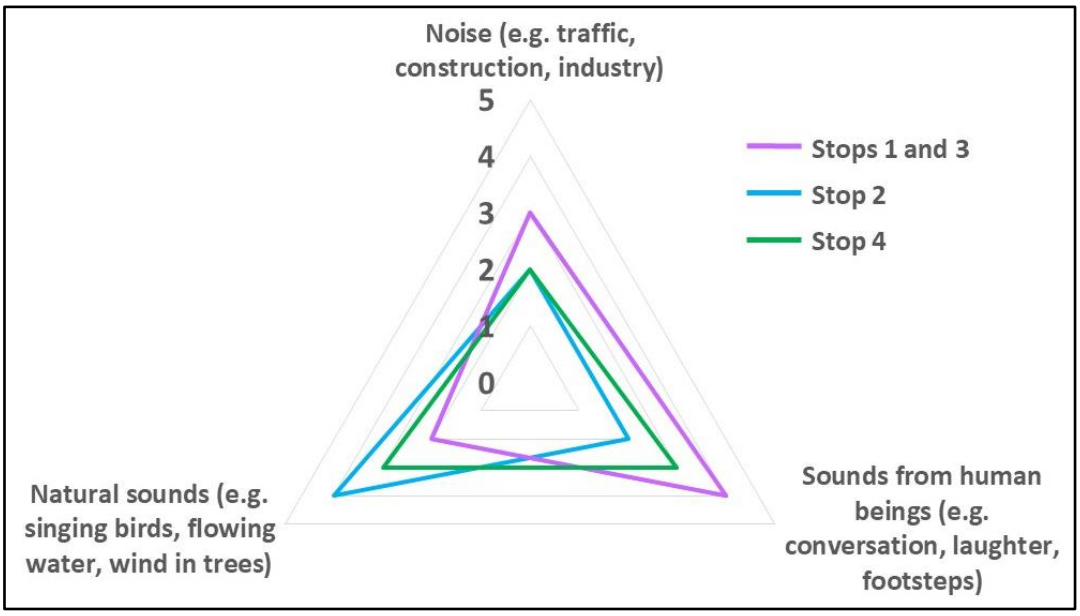


Figure A3.1. Median responses at the four stops in the People's Park to Question 1 – Sound Source Identification?

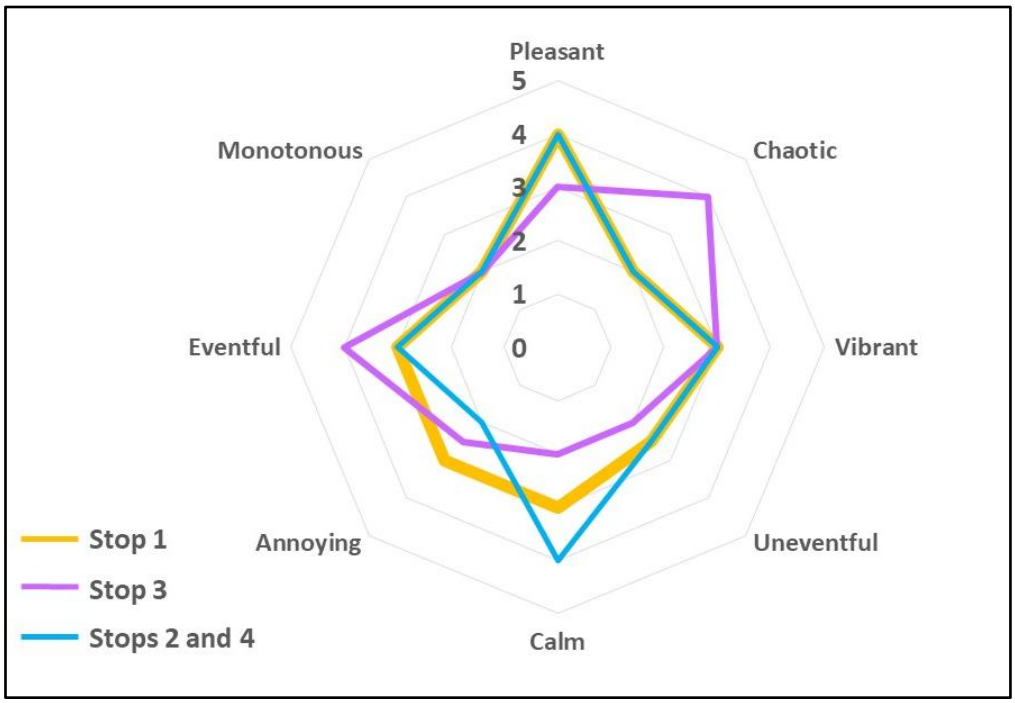


Figure A3.2. Median responses at the four stops in the People's Park to Question 1 – Perceived Affective Quality?

Traffic noise was clearly audible at Stops 1 and 3, those stops being nearer to the roads at the park boundary. Natural sounds became more noticeable further from the roads, but most noticeable at the band stand. Social signals were more noticeable at Stops 1 and 3 (people talking, footsteps), also with the sound of children playing at the playground at Stop 3.

Stops 1, 2 and 4 were generally considered most pleasant, being furthest from the more heavily trafficked roads and away from the playground. Stop 3 had an acoustic environment that was considered most chaotic and also eventful, probably due to the proximity of the playground. Natural sounds (rustling vegetation, birdcall) were more dominant to the rear of the park, away from roads. Stops 2 and 4 were considered most calm while Stops 1 and 3 were more annoying. The responses overall were neutral as to whether the sounds were uneventful or vibrant. However, in general at all the stops they were considered more pleasant and eventful than annoying, monotonous and uneventful.

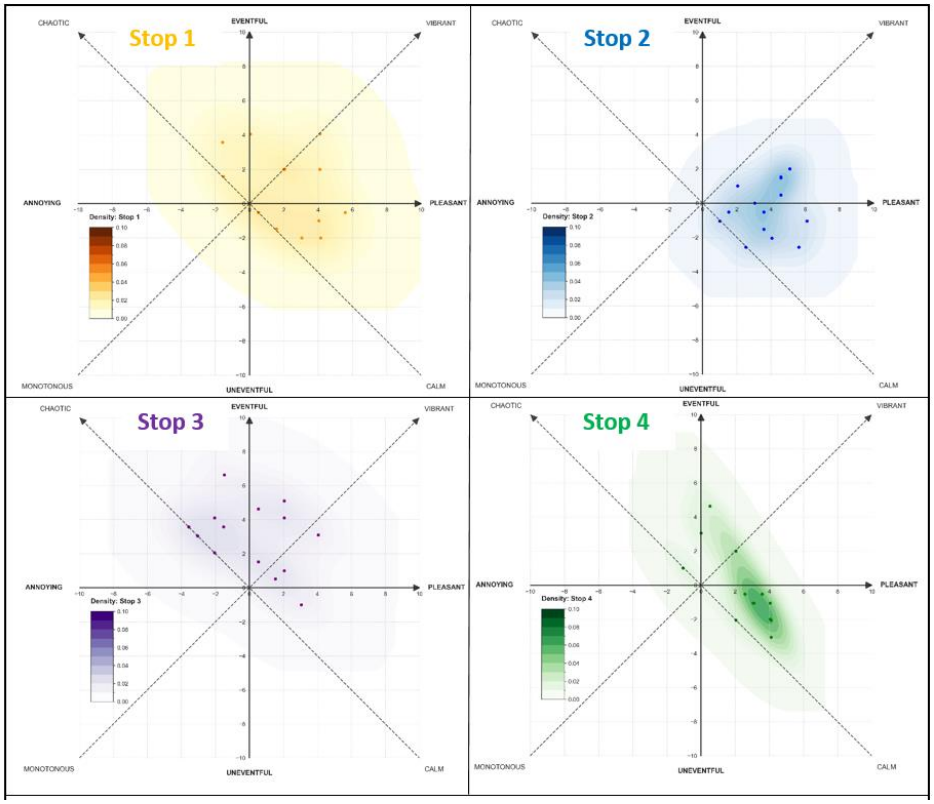
The responses to Question 2 (Table 3 and Figure 8) can be represented in a 2D-model where the main dimension is related to how pleasant or unpleasant the environment was judged, and therefore noted as pleasantness (ISO 12913-3). The second dimension is related to the amount of human and other activity. This is represented by how eventful or uneventful the acoustic environment is perceived to be, and therefore noted as eventfulness. If pleasantness and eventfulness axes are taken as perpendicular further labelling corresponds to two axes rotated at 45° representing environments that are chaotic and stressful versus calm and those that are monotonous (boring) versus vibrant (loud and resonant).

The coordinates for pleasantness and eventfulness based on the responses to Question 2 in Table 1 are calculated based on equations in ISO 12913-3. Scatter and density plots for each stop are presented in **Figure A3.3** with overall results plotted in **Figure A3.4**.

The results indicate that the perceived acoustic environment was pleasant at Stops 1, 2 and 4. There was slightly more annoyance associated with Stop 1 and there was a tendency towards it being considered vibrant. The perceived acoustic environment at Stop 2 was perceived to be calm and vibrant (as well as being pleasant) and Stop 4 was considered most calm. Of those three stops, Stop 1 had most traffic noise associated with the acoustic environment, correlating with some participants considering it to be annoying. Stops 2 and 4 were perceived to have more sound relating to nature and social signals and were considered most pleasant.

There was a mixed reaction whether the acoustic environment at Stop 3 was perceived to be pleasant. Stop 3 was considered chaotic with some participants considering it annoying, although there was a tendency towards the sound being considered vibrant by some participants. Sounds from the playground and traffic accounts for the more chaotic and annoying association with the acoustic environment. However, it is noted that through discussion with the group after the soundwalk there was an indication of the sound from the playground being perceived by some participants as being vibrant which may account for the mixed reactions observed for Stop 3 in Figure 8.

The combined scatter and density plot for all of the stops indicates that overall the acoustic environment was generally perceived by the participants to be pleasant, calm and vibrant (**Figure A3.4**). However, there can be an improvement of the soundscape particularly at Stop 3 for it to be more pleasant.



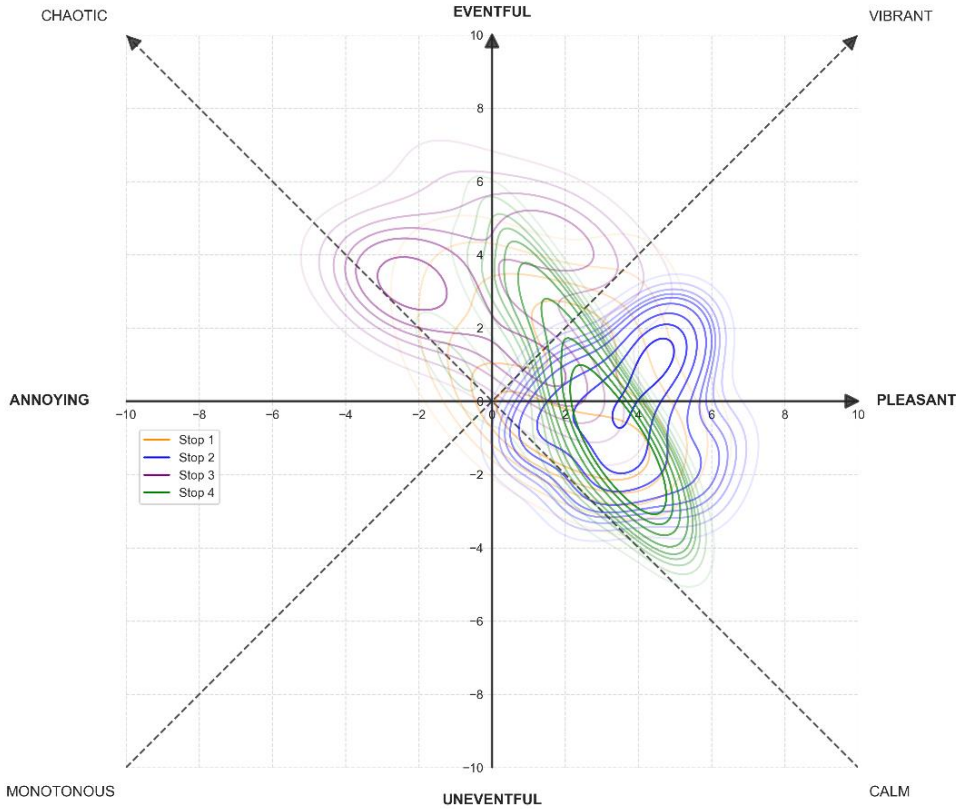


Figure A3.3. Scatter and density plots of the participants results to Question 2 (Table A3.1) as per the equations in ISO 12913-3 for Stops 1 to 4 (*n= 14 at each of the stops - to note: some of the points plot over each other*).

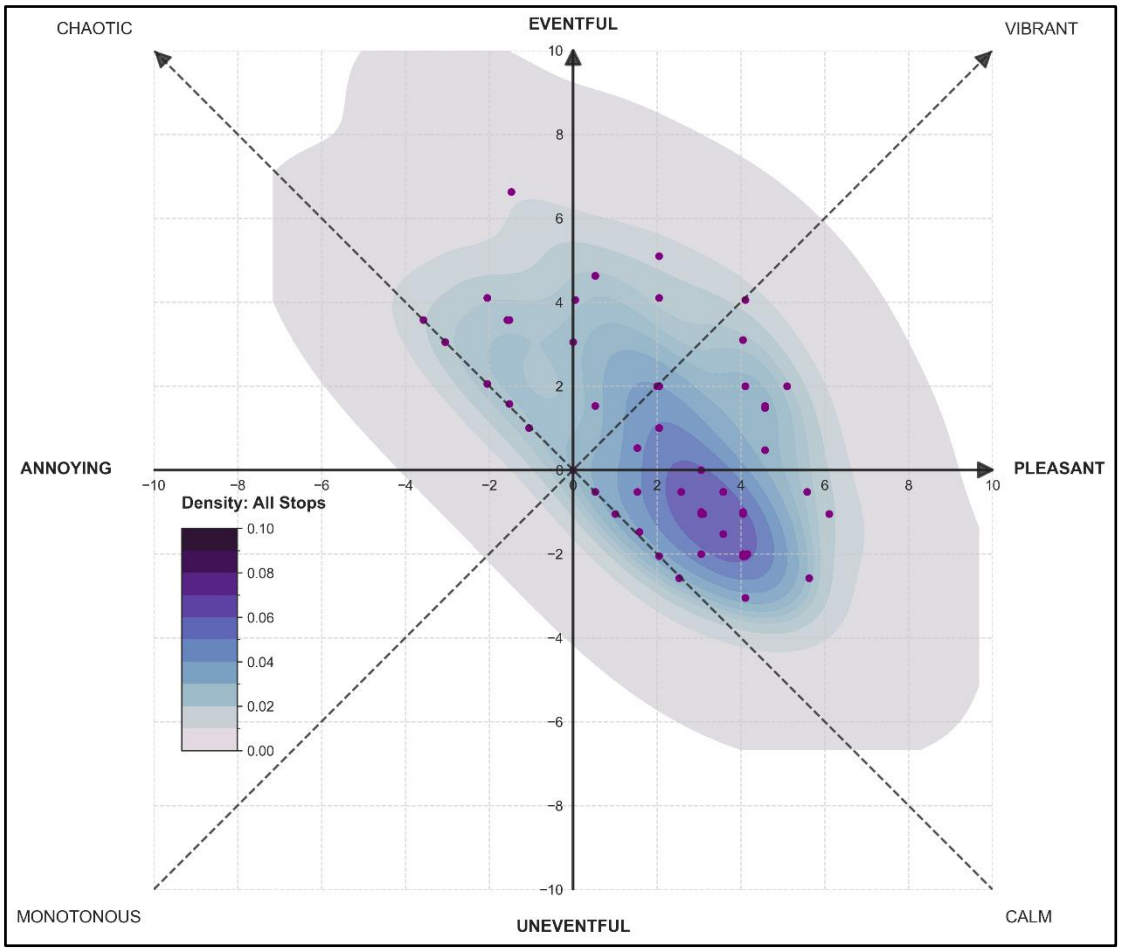


Figure A3.4. Combined scatter and density plot of the participants results to Question 2 (Table 3) as per the equations in ISO 12913-3 for all stops (*n= 56 - to note: some of the points plot over each other*).

Quantitative Analysis - Binaural analysis

Binaural measurements provide two signals representing the left and right ear of a human listener, so acoustic parameters are calculated for both ears separately. The maximum measurements for either the left or right ear recorded by the artificial head are provided in Table 4 for selected parameters.

Table 4. Binaural measurements for each of the listening periods (2 minutes logging), 17th October 2024.

Location	***Stop 1***	***Stop 2***	***Stop 3***	***Stop 4***
Sound Pressure Level (LAeq,2min), dB	*53*	*56*	*61*	*54*
Sound Pressure Level, (LCeq,2min), dB	*64*	*63*	*66*	*59*
Tonality, tuHMS	*0.211*	*0.091*	*0.283*	*0.167*
Loudness, sone	*8.62*	*9.18*	*12.80*	*8.61*
Loudness, N5 (5th Percentile), sone	*10.40*	*10.40*	*15.20*	*9.73*

Roughness, asper	*0.151*	*0.127*	*0.192*	*0.134*
Sharpness, acum	*1.20*	*1.48*	*1.19*	*1.38*

Natural sounds and social signals can have high sound levels (discussed above). In Table 4 the *LAeq* at Stops 1, 2 and 4 are very similar, ranging between 53 dB and 56 dB (a 3 dB difference in levels is just noticeable by a person and 5 dB is expected to be noticeable) and so A-weighted sound pressure levels alone are not necessarily useful to correlate between the listening stops and the participants perceived affective responses.

As discussed above, average C-weighted sound pressure levels[7] (*LCeq* over a period of time, T) are a better representation of how humans perceive low frequency sounds. Higher C-weighted sound pressure levels indicate a higher low frequency sound content. The *LCeq* levels were similar at Stops 1, 2 and 3, most likely due to traffic noise. The relatively low *LCeq* level at Stop 4 may have been partly a result of that area being located in a topographic depression in the park, the surrounding high ground may mitigate some traffic noise (as well as attenuation due to the greater distance of the listening stop from the roads).

The roughness of sound (asper) is a complex effect which quantifies the subjective perception of rapid amplitude modulation (or fluctuation) of a sound within low to medium frequencies (15-300 Hz). It has been identified from studies in Limerick that sound measured near traffic has a higher roughness than sound measured further away and this is also identified at the People's Park (**Figure A3.5**). Stops 1 and 3, close to roads have higher roughness values than Stops 2 and 4, further from roads. The roughness at Stop 3 is most likely to be highest because it is adjacent to the more heavily trafficked roads (R858 and Upper Mallow Street).

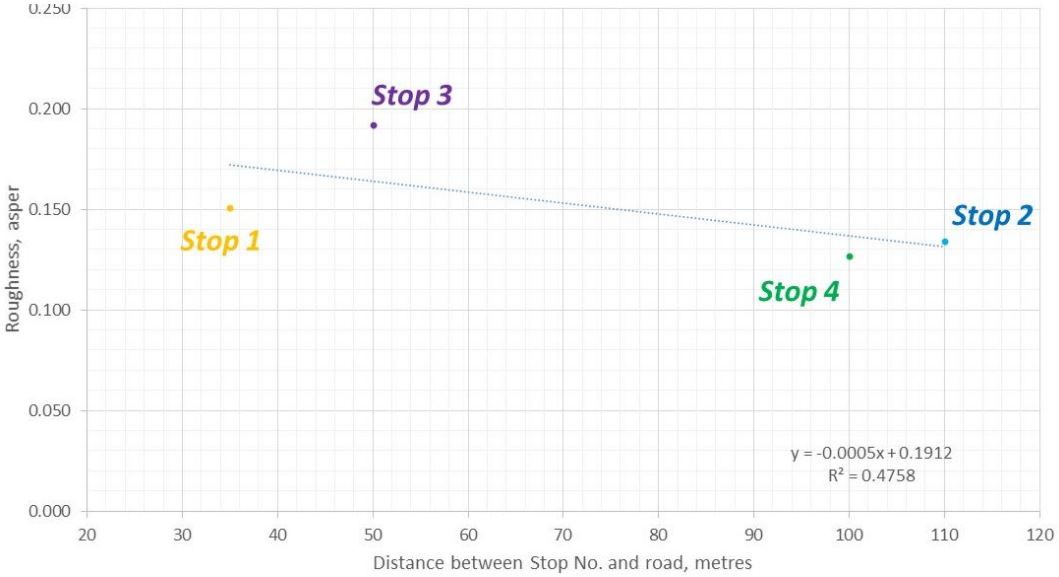


Figure A3.5. Measured roughness (asper) vs. distance from roads at the listening stops in the People's Park. ***To note: this is a trend observed at other green spaces in Limerick as well.***

[7] *C-weighting* is an adjustment applied to sound measurements that provides more emphasis to low frequency sound.

The measurement of loudness (sone) has an advantage over sound pressure levels because it is measured on a linear scale, rather than sound pressure which is measured on a logarithmic scale. It is easier to compare the perceived increase in loudness between one stop and another. The 5th percentile loudness (N5, the loudness exceeded for 5 % of the time) is considered to be a good indication of annoyance[13]. The loudness results at Stops 1, 2 and 4 were similar. The loudness at Stop 3 would have been perceived as being approximately 30 % higher than the other listening stops which correlates with the sound environment being perceived as more annoying.

Tonality (a measure of the strength of tones – the sound of a single frequency, tuHMS) is also considered to be a good indicator for annoyance where it is related to environmental noise[13]. Tonality was lowest at Stops 2 and 4 which correlates well with those stops being considered the most calm and pleasant (**Figure A3.3**).

Sharpness (acum) is a measure of the high frequency content of sound. For example, the rustling of leaves would be expected to have relatively high sharpness levels. Stops 2 and 4 had the highest sharpness levels, relating to the sound of moving vegetation (branches and leaves) which was more audible than at Stops 1 and 3, correlating well with the perceived responses in **Figure A3.1**.

Appendix 4 - Binaural mapping

The parameters that are required under ISO 12913 – Part 2 to be collected for binaural analysis were mapped on a grid basis in the People's Park on 5th July 2024 (separate from the soundwalks) based on 2 minutes measurements taken at each of the locations in Figure 11.

Figure A4.1. Measurement locations for binaural analysis mapping across the People's Park on 5th July 2024 (red points). For comparative purposes the four listening stops for the soundwalks are included.

The results are presented in **Figures A4.1** to **A4.6**. Features of note are that sound levels and loudness are highest towards Upper Mallow Street and the R858. The roughness values indicate that roughness values increase towards the R858 and towards the junction of Upper Mallow Street and Pery Square (besides the Limerick City Gallery of Art. Roughness values can be related to the acceleration and deceleration of traffic and these areas of high roughness may be close to such zones along those roads. The sharpness decreases in the areas of high roughness adjacent to the roads where traffic noise masks natural sounds (vegetation and birdsong). The sharpness decreases towards the centre of the park, potentially where the rustling of leaves is sheltered by surrounding trees. The tonality is also highest towards Upper Mallow Street and the R858 elated to the sound from vehicles.

Figure A4.2. Measured average sound pressure levels (*LAeq* dB) across the People's Park on 5th July 2024.

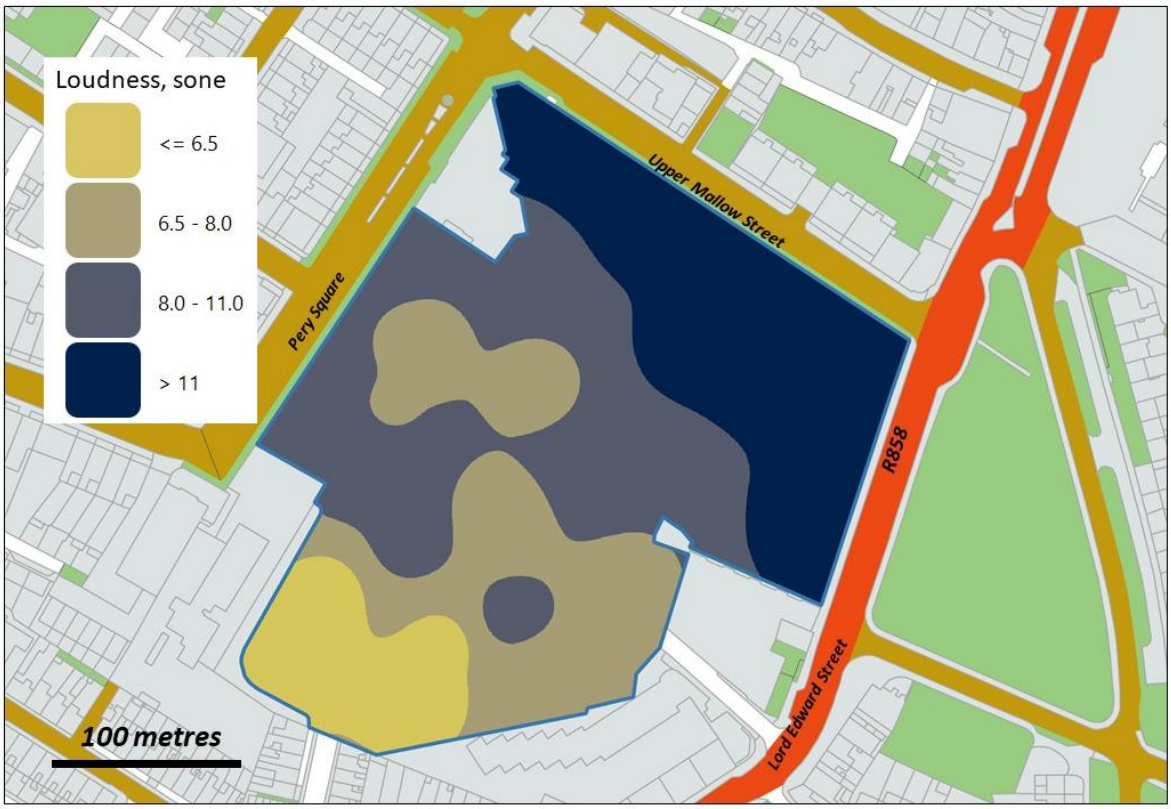


Figure A4.3. Loudness (sone) across the People's Park on 5th July 2024.

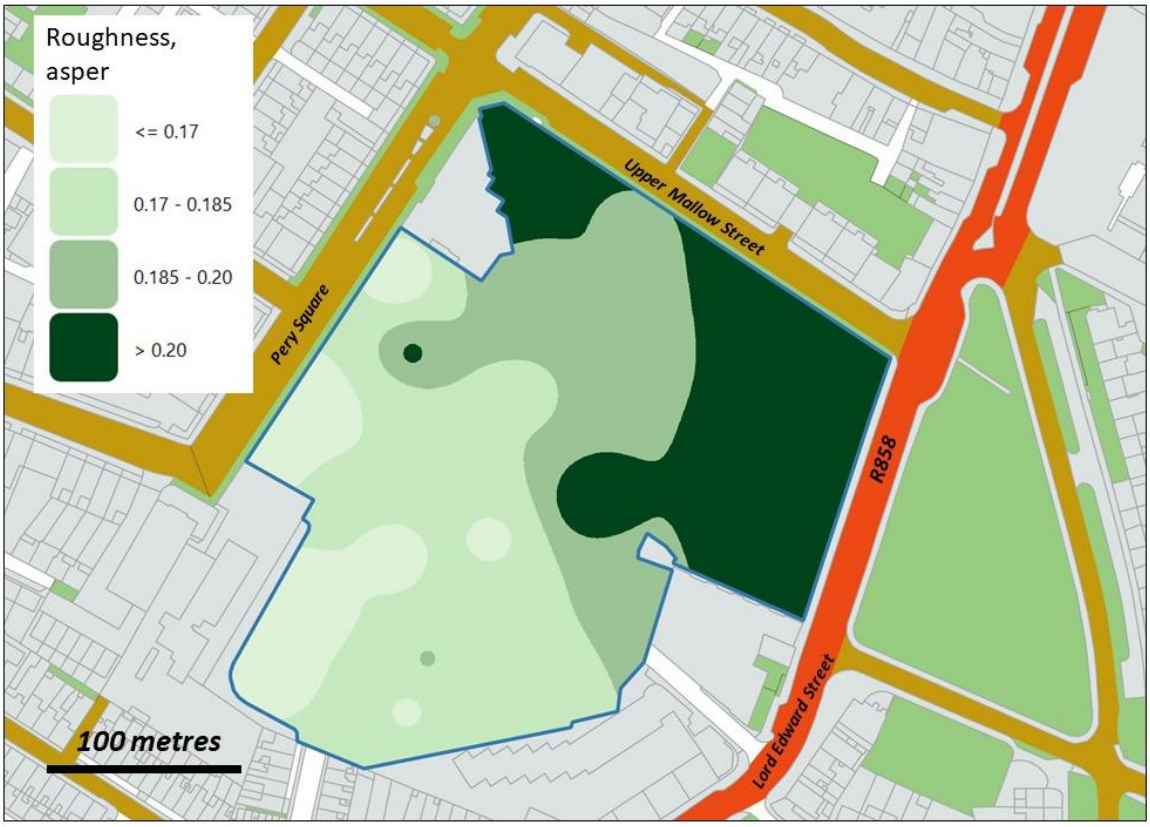


Figure A4.4. Roughness (asper) across the People's Park on 5th July 2024.

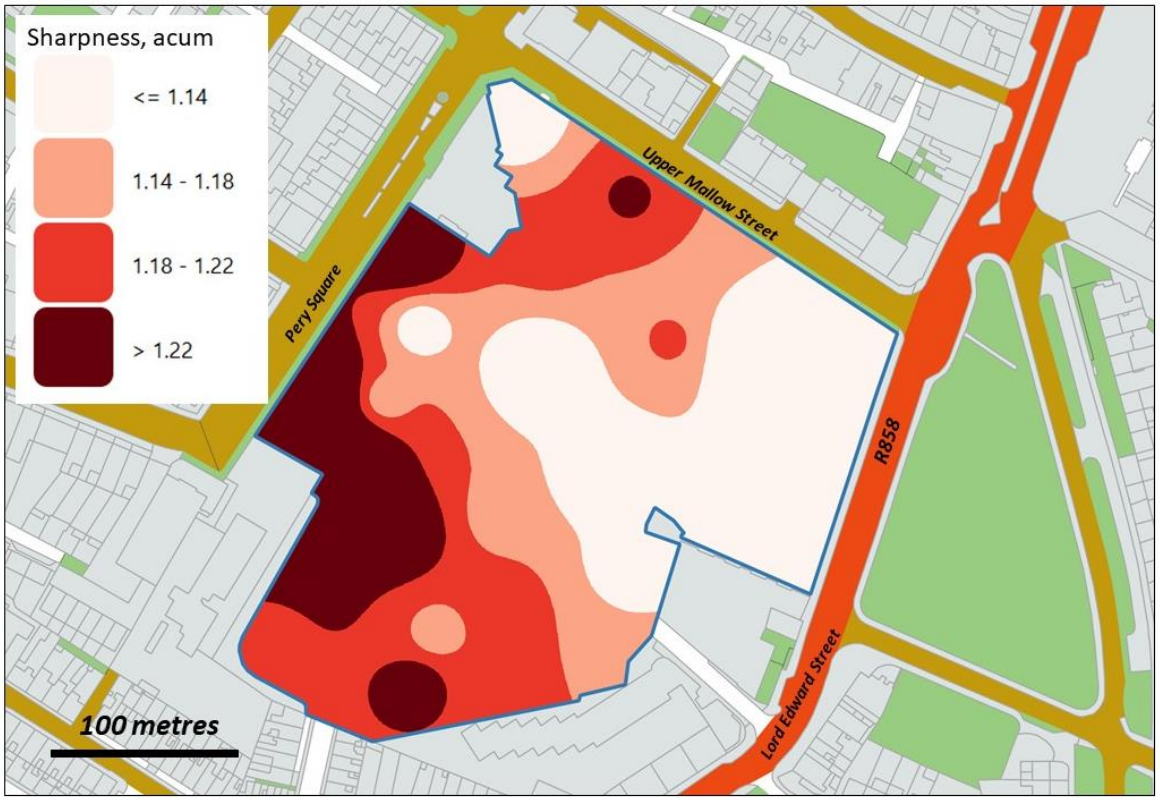


Figure A4.5. Sharpness (acum) across the People's Park on 5th July 2024.

Figure A4.6. Tonality (tuHMS) across the People's Park on 5th July 2024.

Based on the soundwalks, sounds at Stop 3 in the park were as perceived by the participants were least preferred which correlates with an area of relatively high loudness, high roughness, high tonality and low sharpness. GIS analysis has been used to establish areas of the park that correspond to those matching characteristics of the acoustic environment. The hatched areas in **Figure A4.7** highlights the areas where the soundscape in the park was least preferred, based on the binaural mapping. In these areas the dominant frequency of sound is in the 1,000 Hz and low frequency (below 200 Hz) ranges (**Figure A4.8** – yellow/orange regions in the graphs). These are frequencies associated with traffic.

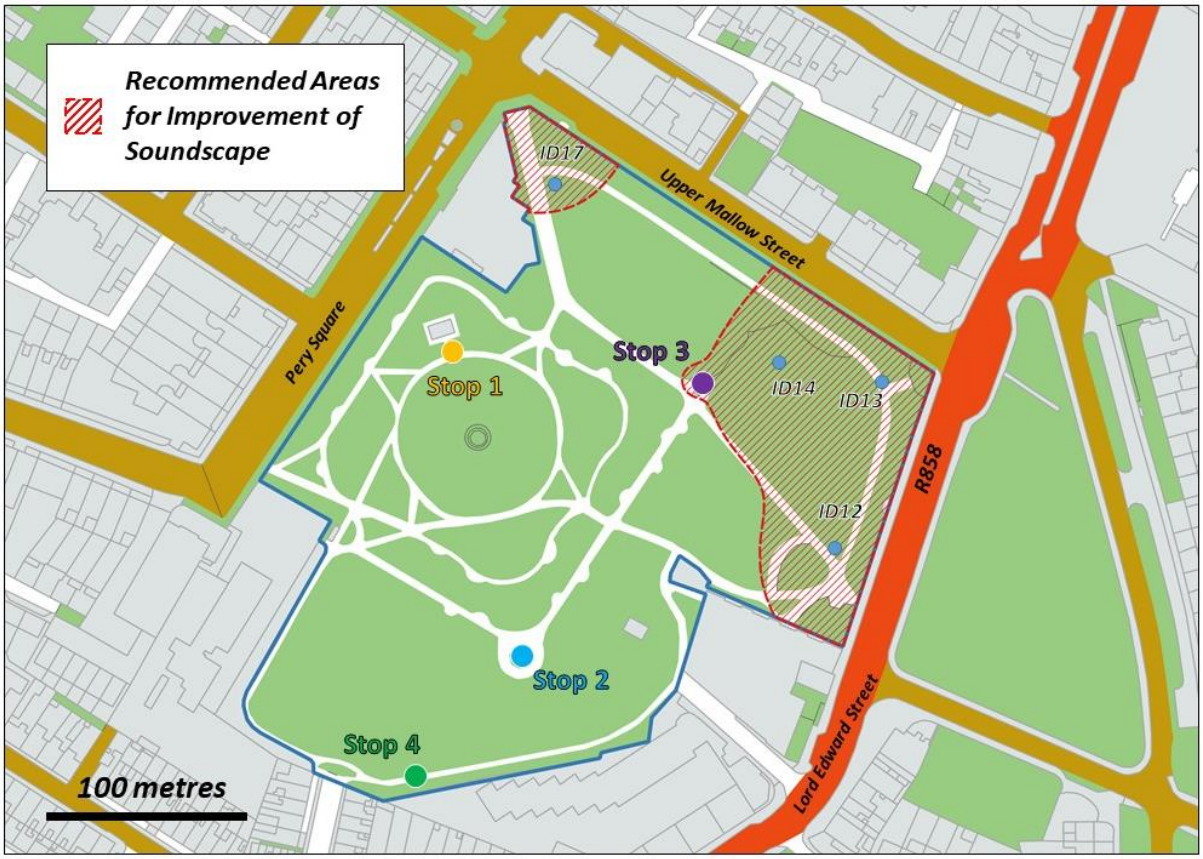


Figure A4.7. Area in the People's Park that the soundscape is interpreted to be least preferred (hatched area) based on soundwalks and binaural analysis (includes locations of binaural analysis for the example FFT-analysis in Figure 18).

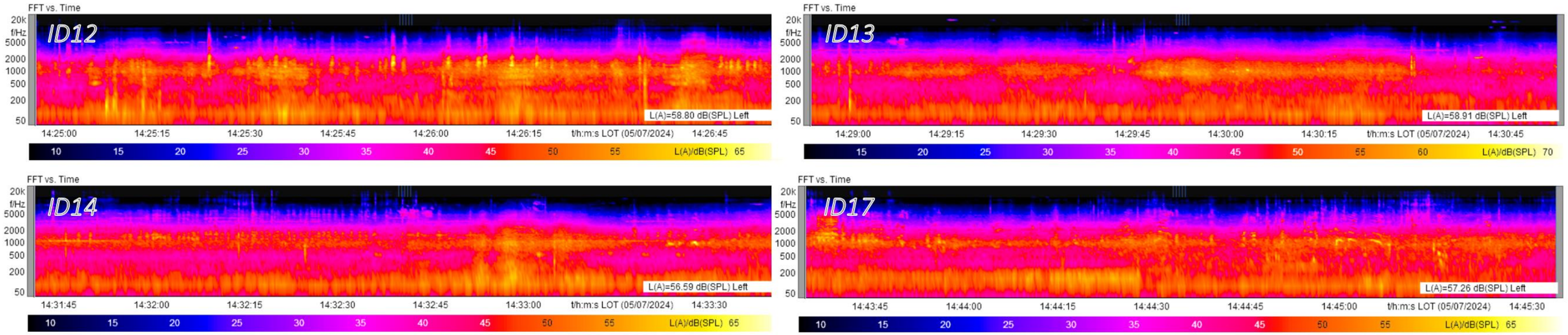


Figure A4.8. Example of spectra of binaural data from monitoring locations ID12, ID13, ID14 and ID17 (see Figure A4.7).

Appendix 5 - Example outline of a brief for sound art in the People's Park - to be discussed and developed with the Arts Office

The People's Park is the principal park in Limerick City located at the centre of the Georgian Quarter. The assessment of sound in the park taking a soundscape approach (reviewing the acoustic environment as perceived by people) indicates that there are areas, near the R858 and Upper Mallow Street, which transportation noise dominates and is least preferred. In these areas the soundscape can be improved to encourage visitors in the park to relax and socially interact (hatched area in **Figure A5.1**). The dominant frequency of transportation noise in these areas is at low frequencies (below 200 Hz) and around 1,000Hz. These are frequencies associated with traffic.

The tender request is to provide two fixed seated sound installations (audio islands) in two designated locations of the People's Park (locations A, B in **Figure A5.1**), which will require a connection to mains electricity. The sound installations (e.g. benches, ring seats) will provide an immersive listening experience, masking traffic noise, using the sound or sounds providing a connection to the River Shannon in Limerick City.

The sound or sounds shall provide looped continuous playback with a smooth transition of samples between the end and start. It will be required to set a default amplification of the playback equipment at the location of the seating (to be agreed with the Council).

The budget for the installations is €20,000. The budget shall be inclusive of all costs: artist fees, any necessary research, sound collection/production/realisation, installations, groundworks, insurance, documentation, warranty and VAT.

Figure A5.1 - Area in the People's Park that the soundscape is interpreted to be least preferred (hatched area) based on soundwalks and binaural analysis and locations for proposed audio islands.