

acoustic studio

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20 October 2017

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Dear Paul,

**TARONGA ZOO CONSERVATION SOCIETY - AFRICAN SAVANNAH AND CONGO
EXHIBIT
RESPONSE TO SSDA SUBMISSIONS RELATING TO ACOUSTICS**

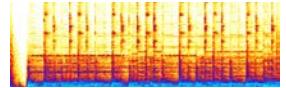
This letter presents Acoustic Studio's response to submissions relating to the acoustic SSDA report to support the proposed African Savannah and Congo Exhibit (the "Exhibit"), at Taronga Zoo in Mosman NSW. This acoustic advice is provided in the context of the revised proposal for the Exhibit, which has a reduced area, re-oriented lion enclosure, and modified grouping of lions. The updated proposal was presented by Taronga Zoo Conservation Society staff to Acoustic Studio at a meeting held on 12 October 2017.

Overview of changes and clarifications which affect acoustics:

1. The overnight lion enclosure has been re-oriented so that all doors open southwards, away from any residential receivers. This reduces noise emissions through doorways, if lions were to roar inside the enclosures (an unlikely event, but assessed for completeness). Significant shielding from local topography and existing buildings to the north and north-east results in attenuation of noise from the lion exhibit to residential receivers.
2. The number of dens has been reduced from eight to six, with family groups and potentially one male. The smaller family groups tend to communicate through quieter vocalisations and are less likely to roar at night. The reduced number of males also reduces the likelihood of roaring behaviour.
3. There is now one exhibit rather than two. There is therefore no distance between lion exhibits across which lions may communicate via roaring behaviour. Family groups are located in one exhibit area.
4. Lions are kept in their dens at night (from sunset to 7-7:30am), rather than in outdoor areas. For the well-being of animals, access to outdoor areas is provided but Taronga Zoo staff advise that the lions in captivity are not likely to venture outside at night, unlike lions in the wild. If they exit the den it is may be because they are unwell, or

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escaping a position of conflict. If the lions roar when outside or inside the den at night (10pm to 7am), it is likely to be a sign of an atypical situation requiring Zoo staff intervention, such as a disturbance among the animals.

5. The lions are kept in the dens around 6:30am to approximately 7:30am, as this is when staff are conducting cleaning, maintenance and food preparation in the outdoor areas, and separation of lions and staff is necessary for safety reasons.
6. The lions typically roar twice in a 24-hour period around feeding time at 10am and 5pm. They do not tend to roar at night (10pm to 7am). The acoustic assessment still needs to consider the possibility that they may occasionally roar at night. However the clarifications from Taronga Zoo staff indicate that such events would be unusual.
7. Construction works are contractually written to avoid weekend works, but the Taronga Zoo Conservation Society allows for contractors to seek approval for Saturday works on a case-by-case basis if required to expedite works or where there are constraints on deliveries during the week. Therefore the Zoo does not require any out of hours works, ie 7am to 8am, which was originally allowed for in the construction noise assessment. Only Standard 8am - 1pm Saturday works would be considered, and only then if required on a case-by-case basis.

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Responses to specific queries

1. The NSW Department of Planning and Environment requests confirmation that the proposed development incorporated the methods outlined within the Acoustic Report section 6.3.4, to mitigate animal noise in outdoor areas during defined night time hours.

Response:

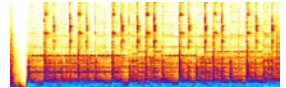
As noted above, at night lions are kept in their dens, rather than in outdoor areas, but they do have access to outdoor areas in case they are unwell, or escaping a position of conflict. If the lions roar when outside at night, it is likely to be a sign of an atypical situation requiring Zoo staff intervention, such as a disturbance among the animals.

The enclosure is to be constructed of blockwork with no doors or openings facing the north or west (in the direction of residential receivers). Upper level wall grilles will provide natural ventilation on the south-facing walls. Significant noise shielding between the openings in the dens and the nearest residential receivers is provided by the building itself, natural topography, and existing buildings on the Zoo premises.

Acoustic Studio has assessed the distance and shielding attenuation, and the likely attenuation through open mesh grilles from south-facing openings as well as from the

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proposed Bondek type roof (with internal insulation). Predicted roaring noise levels from inside the den are approximately 56-61dB(A) at the nearest residential receiver, assuming the maximum noise level roar. This complies with the Sleep Awakening Level. This analysis assumes the maximum noise level roar, which is unusual for lions in captivity, and that they would roar at night inside the dens, which would be highly atypical behaviour. The more typical roaring noise level would be 46-51dB(A) at the nearest residence, which is below the Sleep Disturbance Screening Level.

Outdoor areas just outside the dens, which the lions may access at night, are well shielded from residential receivers by buildings such as the lion dens as well as other zoo buildings, and topography. Therefore solid fences would not provide any noise benefit. Where they are provided as part of the proposal, they do not perform an acoustic function. With the clarification that lions do have access to some outdoor areas at night, Acoustic Studio has predicted roaring noise levels from just outside the den. If the lions do venture outside and roar at maximum volume, the predicted noise level at the nearest residential receiver would be approximately 61-66dB(A). This generally complies with the Sleep Awakening Level (at worst, it would exceed the Sleep Awakening Level by 1dB). The level would be approximately 51-56dB(A) assuming the more typical roar noise level which was measured by Acoustic Studio at Perth Zoo. This is below the Sleep Awakening Level assuming residential windows facing the Zoo are open sufficiently to provide natural ventilation.

2. The NSW Department of Planning and Environment requests notes that the Acoustic Report does not consider potential noise impacts from any changes to the "Roar and Snore" activities, and any other activities undertaken within the proposed exhibits outside general zoo opening hours.

Response:

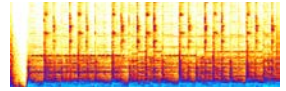
Taronga Zoo Conservation Society staff have confirmed that there is no proposal to change existing "Roar and Snore" operations, or any other zoo activities which may take outside general zoo opening hours (examples given are Vivid and concerts; these activities are independent of the African Savannah and Congo Exhibit proposal and will not change in any way due to the proposed Exhibit).

Current operations for Roar and Snore are commencing the sessions at 7:30pm. Visitors may visit lions during the tour before 10pm but lions are unlikely to roar at this time as it is after feeding time. Furthermore, the lions go into their dens after sunset and there would be no night time impacts due to Roar and Snore patrons visiting the lion enclosure in the evening hours between 7:30pm and 10pm.

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3. The NSW Environmental Protection Authority requires justification to the proposed construction hours extending beyond standard construction hours. An additional statement is required outlining movements of construction-related traffic prior to 7am weekdays and 8am Saturdays.

Response:

The only time considered for “out of hours” works in the construction noise assessment was Saturday 7am to 8am. Taronga Zoo Conservation Society staff have since advised that this will no longer be required, and that any Saturday works would fall within the standard hours of 8am to 1pm.

Furthermore, Taronga Zoo staff advise that Saturday works are not permitted under their general contracts and that Saturday work is only permitted by the Zoo on a case-by-base basis, if circumstances require Saturday works.

Particular consideration of construction-related road traffic noise impacts is required, as they travel along Bradley’s Head Road which is primarily a residential street. An assessment of construction vehicle noise impacts is based on information provided in the Transport Impact Assessment (Taronga Zoo Proposed African Savannah and Congo Exhibits – Transport Impact Assessment Issue C, GTA Consultants 17/05/2017).

Construction vehicles are to use the Whiting Beach Road access gate, near residential receivers, during zoo opening hours. They are restricted to Bradleys Head Road (south) access gates outside zoo opening hours. Zoo traffic management policy restricts heavy vehicles moving spoil or waste to between 7:30am to 4:30pm Mondays to Fridays, and 7:30am to 1pm on Saturdays.

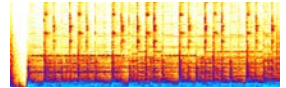
The Transport Impact Assessment report states that approximately 2 construction vehicles per hour are expected, and that adverse impacts from these arrivals is expected to be unlikely. On a weekday, this constitutes a very small proportion of peak hour traffic, and therefore does not create a noise impact. The construction vehicles would be travelling in the opposite direction of morning peak hour traffic and would not lead to traffic impacts that increase engine or idling noise.

On Saturdays, if construction is necessary on Saturdays, it would be due to one of two scenarios. The first would be a delivery of materials which might not be available during the Monday to Friday period. This would most likely generate one or two construction vehicles on a Saturday morning, and would not noticeably increase the existing traffic noise level. The second scenario is if weather or other circumstances have caused project delays and Saturday work is required to meet the construction program. In this case the number of construction vehicles would be similar to the weekday vehicles. If Saturday works are required, Taronga Zoo will ensure minimal construction-related vehicular traffic.

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If an extension of approved construction hours is required during the project, then approval will be sought and impacts of any out of hours construction-related activity would be identified and mitigated as required.

4. The NSW Environmental Protection Authority requires a quantitative assessment of predicted operational noise on surrounding sensitive receivers from mechanical plant and equipment, "Roar and Snore" or patron activities undertaken after general zoo opening hours.

Response:

"Roar and snore" and other patron activities will not change as a result of the proposed African Savannah and Congo Exhibit. Roar and Snore begins at 7:30pm and lions are put in their dens at sunset, which means that Roar and Snore patrons would only have the opportunity to visit the lions during a limited evening period.

Therefore the operational noise impact predictions for out of zoo opening hours relates only to mechanical plant and equipment.

At this stage of the design, plant has not been selected. However Taronga Zoo Conservation Society advises that the mechanical plant to be used in the proposed Exhibit is a split system cooling unit located at the rear (northern side) of the lions' dens. This cooling unit is to serve a secondary office and secondary food storage area (the main offices and food storage areas are located in existing buildings to the south of the Zoo premises).

The night-time NSW INP Intrusiveness criterion at the nearest residential receiver is 42dBL_{Aeq}(15min,Night) and the Amenity criterion is 40dBL_{Aeq}(Night). With distance attenuation and assuming a minimal 5dB shielding from topography and buildings (although 10-15dB is more likely in this location), this equates to an allowable plant noise level of 74 dB(A) at 3m. This level would be easily met by a single standard outdoor cooling unit which in our experience is typically less than 65 dB(A) at 3m. The selection of the outdoor unit would consider the environmental noise requirements and ensure that this limiting noise level is met at 3m from the unit.

I trust this provides the information you require at this time.

Sincerely yours,

Sav Shimada

Acoustic Engineer, Director, Acoustic Studio Pty Ltd

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