



Considerations and strategies for cumulative industrial noise management using the NSW *Noise Policy for Industry* (NPfI)

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Abstract - The NSW Noise Policy for Industry (NPfI) sets out the NSW Environment Protection Authority's (EPA's) requirements for the assessment and management of noise from industry in NSW. It includes guidance on the management of cumulative industrial noise from multiple industrial developments, which can vary depending upon if there is a single controlling entity (eg. port area) or they operate independently (eg. employment lands). Recent experiences have identified several issues that arise with the implementation of this guidance when managing cumulative noise from multiple industrial facilities during the assessment process. Experience has also shown that there are additional considerations that should be included to determine a suitable approach to maximise the potential operations from all industrial lots and minimise noise allowances from being unnecessarily complicated or overly restrictive. This paper identifies several issues with the current way cumulative industrial noise management is being implemented across the planning, development, construction, and operational stages and provides additional strategies that can be considered to achieve the intended outcomes of the NSW NPfI.

1 INTRODUCTION

The NSW *Noise Policy for Industry* (NPfI) sets out the NSW Environment Protection Authority's (EPA's) requirements for the assessment and management of noise from industry in NSW. It "...aims to ensure that noise is kept to acceptable levels in balance with the social and economic value of industry in NSW" (NSW Environment Protection Authority, 2017). It includes guidance on the management of cumulative industrial noise from multiple industrial developments with the aim of addressing this issue that historically did not have clear guidance.

The NPfI has two components for controlling noise emissions from industry, where the "*intrusive*" level aims to control short-term emergence at residences (ie. background noise level + 5 dB(A)), while the "*amenity*" noise level aims to control the overall noise level to an appropriate amenity level at receivers based upon the type of receiver. It is through the amenity noise level that the NPfI aims to control the cumulative industrial noise level from multiple noise generating developments.

For a single development, the cumulative industrial noise from the proposed development combined with the surrounding existing industry need to be considered. For this situation, the NPfI provides a simplified approach for managing potential cumulative industrial noise, by setting the amenity goal for the individual development at 5 dB(A) below the recommended overall amenity level. This aims to allow for 3 or 4 other industrial operations to impact the nearby receiver and still achieve the recommended overall industrial noise goal.

However, where the proposed development involves a cluster of industrial operations such as an industrial estate or precinct, the NPfI provides two approaches to address the cumulative impacts from the multiple new industrial developments. The first approach for a greenfield site or redevelopment of major industrial clusters (NPfI Section 2.4.2) is through the division of the overall amenity level with allowances allocated to individual premises as part of the development. The second approach is through the establishment of a noise management precinct to manage individual premises cumulatively as a single noise generating site (NPfI Section 2.8).

These approaches are presented in the NPfl to deal with situations at the two extremes of major industrial clusters, where there is no overarching controlling entity and all development operate independently (eg. employment lands) or the industrial activities operate under a single controlling entity (noise management precinct) (eg. port area), as shown diagrammatically in Figure 1-1.

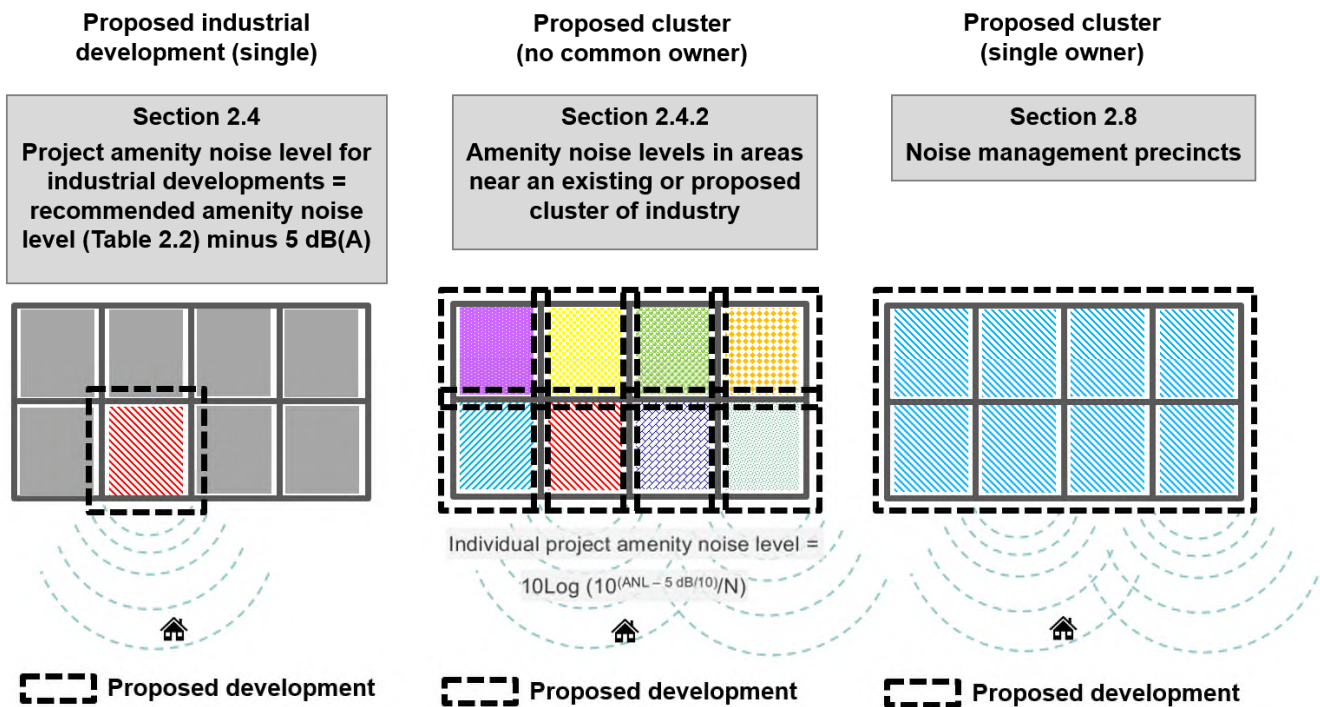


Figure 1-1 – NPfl industrial cluster approaches

In practice, when assessing the cumulative impacts of multiple industrial developments, there are several additional considerations when assigning the final allocation of individual noise quotas, including the proponent’s desire to maximise the potential operations from all industrial lots. Noise quotas also need to be balanced with the practicalities of implementing the assessment approach, while dealing with the realities and dynamic nature of actual industrial operations.

2 IDENTIFIED IMPLEMENTATION ISSUES

Large, rezoned areas for employment zoned land or proposed industrial estates are made up of multiple separate noise generating developments, such as various tenancies in a warehouse industrial estate or multiple operators across a port (land based) area.

During the environmental assessment stage, the industrial estate (or similar) is assessed as a whole proposal. This is to determine if and how the cumulative noise emissions from all operations across the proposed overall industrial development can achieve the derived noise emission limits cumulatively with the implementation of feasible and reasonable mitigation measures where required. The environmental assessments will often include traffic movements based upon generation rates from similar facilities or accepted generation rates for the overall land area. Potential plant and equipment (both fixed and moving) that could operate on the site would also be assessed. Indicative assumptions are often all that is available at that early project stage. It is common to conclude in these assessments that they are subject to further assessment during later design development stages when more information about the design is known, the tenants are confirmed, operations are better understood, and a building contractor has been engaged.

However, where the environmental assessment or Operational Noise Management Plan (or similar) prepared for the development does not assign noise allowances, such as noise quotas, to individual lots, there is no clear

guidance for these future assessments. As a result, there is no pathway in these future assessments to achieve compliance with the overall cumulative noise goals established for all developments. This is because typically, individual lots within these large developments are developed as separate projects, each with different developers and different contractors designing and building to separate defined scopes. Problems can then arise when a contractor is engaged to design and construct an individual lot.

The contractor is likely only responsible for the noise emissions from the base building component (ie. mechanical plant) and not tenant generated operational noise. At the environmental assessment stage, most of the focus is on external tenant operational noise, while the base building component is often considered a minor and manageable component. As a result, the base building noise is either excluded from the assessment or postponed to detailed design at a later project stage. However, in this situation, there is no clear acoustic design goal for the contractor to adopt during design of the base building other than the overall cumulative goal for the industrial cluster.

Furthermore, industrial clusters are often built and designed progressively, which means that each individual lot will often need to be considered in isolation, during both the design and compliance stages. This means that during compliance, it is often not possible to measure once all operations in the cluster are running to check the final cumulative noise levels as there may be a substantial period between the commencement of operations at the first and the last warehouse.

Without guidance on the breakdown of individual noise quotas, there is no clear way to prevent one component (eg. mechanical plant) of one individual lot from taking up the entire noise limit and can create a problem for all stakeholders involved. During the detailed design phase, an acoustic consultant would consider what is reasonable and best for their client. However, where their client is not the controlling entity of the overall industrial estate (eg. building contractor), and when the pathway for proportioning the overall noise responsibilities is unclear, a design which considers the wider implications on the estate could be detrimental to the consultant's client. In the best-case scenario for the estate, the acoustic consultant would aim to determine a suitable level of noise contribution to allow for the individual tenant/operation to be consistent with the noise contribution envisaged in the planning study or environmental assessment. In the worst case scenario, the acoustic consultant assesses the component for the individual lot development against the overall cumulative noise limits and will allow this small component (eg. single individual lot mechanical plant) to take up the total allowance meant for the entire industrial estate. This could lead to major noise design and compliance problems.

The following sections clarify the NPfI's standard approaches for addressing industrial cluster cumulative noise. Additional items when developing the noise management approaches throughout the industrial estate's project life cycle are proposed which aim to minimise some of the identified issues.

3 NPFI STANDARD SOLUTIONS

3.1 Noise management precinct

The noise management precinct approach as detailed in Section 2.8 of the NPfI is a complex approach that allows noise from multiple sites to be managed as a single site. The benefit of the noise management precinct approach is that rather than allocating a specific fixed noise quota to each individual lot within the precinct, the operational noise goals consider only the cumulative noise level at the receiver. This allows flexibility of management and enables changes to individual lot noise emissions within the overall cumulative goals. The individual allowance for noise, or "noise quota", from each lot/activity/development within the precinct is at the discretion of the operator of the precinct. This allows for the overall precinct to be flexibly utilised by the operator in a manner that can be more cost-effective and efficient. However, this approach does require careful setup, ongoing management, and for noise quotas to be included in commercial agreements, otherwise there are no restrictions preventing a single operator to generate noise that reaches the cumulative limit.

The noise management precinct is at one end of the spectrum for industrial cluster noise management, where the operator is responsible for achieving the cumulative noise goal from all noise generating operations. This can allow for an operator to adopt a risk-based approach, informed by their detailed knowledge of the site's operations, when considering elements such as the number of lots that may operate concurrently. Although ongoing management is required, this approach can help to minimise noise restrictions on tenants and can be adjusted over time as the on-going noise performance at receivers becomes known.

3.2 Cluster of new industry

At the other end of the spectrum, the flexible and wholistic approach of a noise management precinct cannot be applied without an overarching controlling entity, such as precincts where individual lots within the development are being sold off or there is an industrial/employment land release or rezoning. In these cases, the NPfI Section 2.4.2 provides guidance on how to consider noise quota allocation to individual lots within a proposed cluster of industry. The allocation for individual premises can be derived from the simplified approach presented in Equation 1 of Section 2.4.2 of the NPfI, which is reproduced below in Figure 3-1:

Equation 1: New multiple premises or redevelopment of existing clusters of industry

$$\text{Individual project amenity noise level} = 10\text{Log} (10^{(\text{ANL} - 5 \text{ dB}/10)}/N)$$

where:

ANL = relevant recommended amenity noise level from Table 2.2

N = number of proposed additional premises.

Figure 3-1 – Extract from NPfI Section 2.4.2

NPfI Section 2.4.2 Equation 1 is a basic formula designed to divide the overall noise goal equally among each industrial lot. For example, if there were two industrial lots within the cluster, a 3 dB reduction from the cumulative noise goal would be assigned to each lot; for four lots, there would be a 6 dB reduction. The -5 dB component of NPfI Section 2.4.2 Equation 1 is to account for the contribution of other industrial noise outside of the cluster which may contribute to the cumulative industrial noise level at a receiver. If no other industrial sources are present, this -5 dB correction can be removed from the equation. Although this basic approach allows for an easy derivation of individual noise quotas for all lots within the development, it does not aim to do this fairly, efficiently, or in a manner to maximise the use of the industrial land. For example, a large noise intensive development and small quiet development would be allocated the same noise allowance.

4 IMPLEMENTING THE NPFI - SITE SPECIFIC CONSIDERATIONS TO DETERMINE THE BEST-FOR-PROJECT APPROACH

Although the NPfI provides some guidance on how to address noise from an industrial cluster, its direct application has its limitations. There are a range of further site specific issues that should be considered to determine the best-for-project approach. Preferably at the environmental assessment stage, a framework for considering these potential issues should be set up for the approval stage and future assessments. Site specific factors should be incorporated into the establishment of the noise requirements for an industrial cluster, not only to set the overall goals for the industrial cluster in accordance with the NPfI, but to establish noise levels that maximise the use of the industrial land in an efficient manner from a noise compliance perspective.

The site specific guidance should establish a pathway or framework so that the expected noise emission outcomes can be achieved through the various project stages, including planning, development, construction, and operational stages. It is understood that site specific approaches for cumulative noise should be based upon the strategic planning documents for the area (such as a Development Control Plan). However, as these documents tend to lack clear guidance, reliance on the current state guidelines or individual proponents' acoustic consultants may result in inconsistent approaches across a new or existing industrial precinct.

This paper does not aim to provide clear guidance on how to set industrial cluster noise quotas or how they are to be applied and managed. Instead, it aims to highlight a range of issues that have been identified with the current cumulative noise approaches and suggests some further ideas that should be considered by various involved stakeholders to better handle cumulative industrial noise and achieve the intended outcomes of the NSW NPfl. These include:

- Different proportioning methods (prediction informed allocation, area based, equal acoustic burden, etc.)
- Breakdown of allowances for development components (ie. warehouse base building services and the tenant operational noise)
- Concurrency of noise generating operations
- Accounting for different key receiver locations that are exposed to the subject noise source
- Considerations during various project stages.

The method for setting and implementing industrial cluster noise quotas should be developed specifically for each industrial cluster under investigation. An industrial cluster will have its own range of cumulative noise considerations that need to be identified and appropriately addressed in a consistent manner.

These issues need to be considered by the various involved stakeholders involved in a project as the responsibility may differ between different industrial clusters. In some circumstances, cumulative noise management issues will not be of concern to the regulators (ie. Council, EPA or Department of Planning, Housing and Infrastructure (DPHI)) in situations where there is a single entity managing noise in accordance with a single approval. However, where responsibility is to be shared (which is typical for industrial subdivisions), then it is important that the regulator or similar entity is involved in a more active or detailed manner.

Where site specific guidance was insufficient, cumulative noise has been addressed inconsistently. Therefore, it is recommended that regulators provide clearer guidance of the assessment methods and approaches to adopt, preferably as part of site specific planning documents.

4.1 Different proportioning methods

4.1.1 Accounting for development size

Equality of allocation is often a consideration where the future tenants are unknown, but they are likely to involve similar types of operations (such as warehouse estate). NPfl Section 2.4.2 Equation 1 does not account for the size of each premise within the cluster. This can result in smaller lots being provided with the same noise quota as larger lots, thereby leading to an unequal allocation of quotas if individual noise sources across all sites were similar. However, lot size does not always correlate to potential for noise generation. An individual lot could have more noise intensive activities, which could present difficulties in allocating noise quotas based on lot size alone. However, if operations across all lots are similar, this can often be a reasonable starting point. A simple and more equitable solution for this is to divide the quota based on the size of each lot when compared to the total area of all lots within the cluster. This is detailed below in the following modified equation (Equation 1):

$$\text{Individual project amenity noise level} = ANL - 10 \log \left(\frac{TLA}{ILA} \right) - 5 \quad (1)$$

Where:

ANL = relevant recommended amenity noise level,

TLA = Total Lot Area (summation of the area in m² of all lots within the cluster)

ILA = Individual Lot Area (the area in m² of the individual lot within the cluster)

This modified equation provides an equal proportion of the noise quota based upon the area of each lot within the cluster. However, this approach means that the requirements are more onerous for lots on the edge of the industrial cluster nearest to the receivers. Conversely, similar sized lots located further away from receivers within the industrial cluster are offered more leniency, as those lots would benefit from additional distance to the receiver along with shielding from neighbouring structures. This approach makes it significantly easier for industrial lots further within the industrial cluster and away from the receivers to achieve the individual noise quotas compared to the lots at the front. Consistent with the guidance for NPfI Section 2.4.2 Equation 1, the -5 dB component can be removed from the equation if there is no other industrial noise other than the proposal present in the surrounding area.

However, inequality of noise mitigation requirements is not necessarily a negative outcome. If this is identified during the planning stages, then noisy operations could be incentivised to select lots within the cluster that are more suitable from a noise perspective (ie. setback and shielded) to maximise the use of the industrial land in an efficient manner. However, in the case that all operations are similar (such as multiple 24 hour warehouse facilities), this can severely restrict the operations of some lots within the cluster, or they may need to implement substantial on-site noise mitigation measures (ie. extensive noise walls and enclosures) to achieve their individual noise quotas. This approach has recently been considered by NSW regulators for some large rezoning projects.

4.1.2 Providing equity at receiver

Neither NPfI Section 2.4.2 Equation 1 or the modified area based equation above, consider how easy or difficult it is to achieve the assigned noise quotas at the receiver. Attempting to provide equity at the receiver is a difficult proposition, especially during the early stages of a development when detailed information is limited. Furthermore, the lot layout can play a significant role in determining how easy or difficult it is for any particular lot to achieve the assigned noise quota. One option is to apply an “equal acoustic burden” at the receiver. With this option, a predetermined scenario (eg. sound power per area or simplified modelling) is established for all lots within the development and noise levels are predicted at the receiver. The predicted noise levels from each lot are used to determine the allowed noise levels at all receivers. This would result in lots closer to receivers (and with less shielding to the receiver) being assigned higher noise quotas than lots that are further away and/or better shielded. This would result in a more equitable acoustic burden across the industrial cluster. Similar approaches that have been considered in the past and can be reviewed and modified for NSW assessment context include DIN-45691 *Noise allotment (Geräuschkontingentierung)* or those implemented at the Port of Rotterdam, or methods such as those considered in “A risk-based approach to precinct planning” (Jenkin & Scully, 2023).

However, there are issues with the above process as this can result in perverse outcomes, as it may require operations that are substantially offset and/or shielded from nearby receivers, to implement noise mitigations that achieve insignificant noise levels when compared to the overall noise goals. This approach may only be suitable where noise generating activities are relatively uniform across all developments.

4.1.3 Alternative proportioning approaches

Alternative approaches, such as allocating the environmental assessment predicted noise levels as the noise quotas to each lot, or prediction informed allocation methods, can also be a very beneficial way to maximise the use of the industrial land. This way the allocation to individual developments is directly related to the expected noise levels at the environmental assessment stage for individual lots. This method considers setback and shielding from the receivers for the various industrial developments and thereby provides a more equitable and efficient outcome for the individual lots, in the case that a development concept masterplan is known.

However, where this is based upon a speculative set of operations, especially when the final tenant or operator is not known, then this can result in perverse or unreasonable outcomes. If the noise quotas are set very low because of assumed operations, mitigation measures are then required to achieve these very low goals. Expected noise emissions predicted at the environmental assessment stage should always be used to both inform or review the derivation of any cumulative noise quotas and confirm their feasibility. Care should be taken to minimise perverse outcomes where the predicted noise levels are adopted as individual lot noise quotas to address

cumulative noise issues so that they are not set unnecessarily low, considering that there can be many changes through the development process.

4.2 Additional site specific factors

Further to the different proportioning methods outlined in Section 4.1, there are a range of other factors that have not historically been addressed. In order to more efficiently and effectively use the industrial land under investigation, consideration should be given to the following factors.

4.2.1 Accounting for concurrency of other industrial operations

The noise intensity of an industrial operation can vary significantly over a 24 hour period (such as a warehouse or distribution facility), where there can be times when there is very little noise being emitted compared to peak activity periods. When conducting an NPfl assessment, it is a standard approach to consider a realistic worst case 15-minute assessment. If this is done for each individual development within an industrial cluster, this can potentially lead to an overly conservative assessment, especially if cumulative impacts from all developments are assumed to operate concurrently under worst case scenarios. A range of these issues could be addressed through utilising an amenity period assessment; however, this would be challenging as it would not align with the 15-minute assessment period currently used for consent noise limits, and compliance monitoring would likely be difficult for direct comparison against noise limits.

A noise proportioning approach that allocates a share to all developments so that they add back up to the overall noise limit, tends to assume that worst case 15-minute noise is being generated by each industrial lot concurrently across all industrial lots. This is especially the case where the situation is not a noise management precinct, and each development is applying individually to a regulatory authority for approval. Typically, it is not possible to understand in detail whether some industrial lots are operational or not during the assessment periods. However, considering the variable nature of industrial operations, it is very unlikely that all sites within an industrial cluster would be operating with their worst case 15-minute activities occurring in the same 15-minute period. As such, when determining the cumulative noise quota during the environmental assessment stage, it would be appropriate to consider if there should be a correction to any noise allowances to account for the likely number of other nearby industrial operations that would be operating concurrently, whether with this is with the worst case 15-minute activities or at a different operating state. This concept is diagrammatically shown in Figure 4-1.

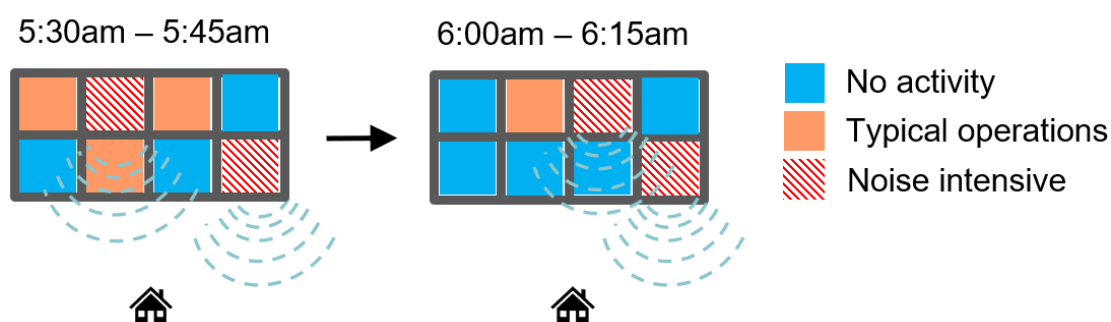


Figure 4-1 – Example diagram of concurrent operations considerations

Noise sources such as base building services are more likely to be operating continuously, and so there is a higher potential for these to be operating concurrently across many sites. However, the external transient industrial activities (eg. trucks and loading docks) are unlikely to be operating concurrently across all sites. As such, if the base building services are sufficiently mitigated so they are not the dominant source of noise, it would be appropriate to consider an adjustment to any cumulative allowance for the number of concurrent operations that may impact a receiver.

4.2.2 Noise component allocation

Even if there is a noise allocation made to an individual lot within an industrial cluster, when a contractor is engaged for the detailed design and construction stages of the industrial base building, they are likely only to be responsible for the noise emissions from the base building component (ie. mechanical plant, building envelope noise breakout). However, where the noise emissions from an industrial lot is dominated by external activities, or the tenant operations are speculative, it is likely that the base building's noise emissions are expected to be minor, with the majority of noise emissions assumed to come from the tenant activities. As such, there can be a problem if the contractor then designs to the overall industrial lot noise allocation, and not to a lower design noise quota for the base building component only. There should also be a noise assessment once the tenant becomes known to confirm consistency with the environmental assessment stage assumptions to ensure that any industrial lot noise allocations are suitable, and the tenant operations can work within the noise allocation (potentially with mitigation and management). Where applicable, the noise assessment for any future tenant use, would need to take into account the final noise emissions from base building services (which might require additional mitigation treatments and/or replacement) subject to the proposed tenant operations and fitout, to ensure that combined they can achieve the overall lot noise quota. An example of this division, with a larger proportion allocated to the external tenant activities, is presented in Figure 4-2.

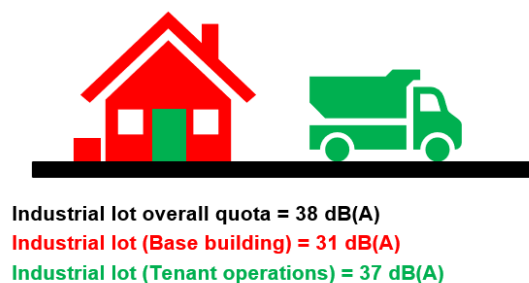


Figure 4-2 – Example diagram of noise component allocation (base building and tenant operations)

However, it should be noted that noise emissions from external activities may not dominate at all receivers in all directions. As such, it may not be appropriate to apply the same noise component breakdown for all receivers, because the individual noise components may vary for different receivers or for different directions. For example, warehouse hardstand could be the dominant noise source at receivers to the west of a development while the mechanical plant might dominate at receivers to the east. These site specific considerations are required so that mitigation measures are not overly stringent or unnecessary, but also ensure cumulative noise requirements are clear and appropriate. The assumed division between the base building component and the external tenant activities can also influence the cost and difficulty of implementing noise mitigation measures to address external tenant activities at later project stages. External tenant activities are typically more difficult to mitigate than the base building component, which can be controlled by appropriate mechanical system design and implementation of common engineering methods.

When taking into account the concurrency of other industrial operations as per Section 4.2.1, it should be noted that if the base building component is minimised, which would typically be steady state noise, this can also assist with justifying that it is unlikely that a large number of industrial lots may impact the same receiver with substantial noise levels concurrently.

4.2.3 Accounting for critical receiver separation

Noise catchment areas (NCA) are typically used to group assessment receivers and aid with assessment and reporting. However, if an NCA is substantially large compared to the distance between the industrial cluster, then this can result in each lot being controlled by very different receivers within the one NCA, and the potential cumulative noise levels at any one receiver could be substantially lower than the sum of the worst predicted noise levels for an NCA. It is important to consider that the “potentially most impacted receiver” will not be the same for each industrial development within the cluster. However, all of the noise allowance methods detailed in the above

sections all divide up NCAs in a manner where it is assumed that a single critical receiver will be impacted by the allocation to each industrial lot, so that the cumulative noise level remains below the overall noise goal when combined. The problem with this is shown in Figure 4-3. To an extent, this could be addressed through determining individual receiver specific noise level quotas breakdowns, however doing this for all surrounding receivers individually or a representative subset, could be very difficult to manage subject to the site.

This means that as part of the allocation of noise allowances, it may be possible to apply a correction to account for the separation between the industrial cluster and the critical receivers (ie. the example in Figure 4-3 could allow a correction of 2 dB) to account for relative separation distances from the lots of the industrial cluster to each nearby receiver.

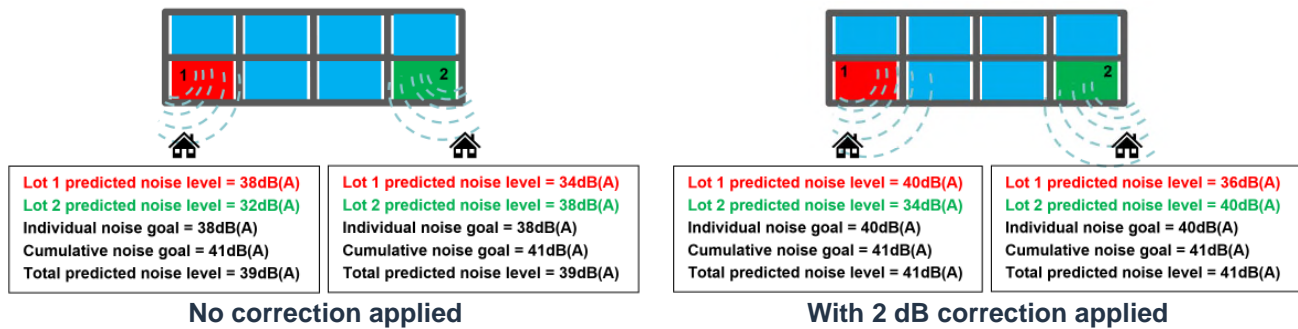


Figure 4-3 – Example diagram of differences in cumulative impacts with and without receiver separation correction

4.3 Using the factors for design development

The noise limits that are included in any development consent are likely to be cumulative total noise limits that apply to the whole development, and not the noise contributions of each component (such as separate industrial operations and/or the separation between base building and tenant noise) that make up the total noise. That is, unless a breakdown of noise quotas is included by the acoustic consultant in their approval stage noise assessment (noting there is no current NSW policy requiring them to do so) and the consent references the noise quotas stipulated in the acoustic report, then there is no specific requirement to apportion the cumulative noise limit into noise quotas.

For noise management precincts with a single controlling entity, a noise component breakdown is unlikely to be included in a development consent condition. This should remain the case as the breakdowns (when specified as statutory limits) could be unnecessarily restrictive and may remove opportunities for improvements during detailed design. However, any noise component breakdowns should be included in commercial agreements and internal planning documentation, or guidance included in an approved operational noise management plan (or similar). This allows for noise quotas to be updated without modifying the development consent condition while responding appropriately to the project’s evolving needs. It is important that the noise quotas remain relatively flexible where required or allocations form part of the commercial negotiations, to allow for efficient use of the industrial land.

In the case of no overarching controlling entity, careful consideration should be given to the allocation of noise quotas during the concept approval assessment stage with the intended usage of the land in mind. Specific guidance on how to derive noise quotas for future individual lot assessments should be included. It would be recommended that noise component breakdowns are included either in the development consent condition or reference document. However, a pathway to allow for the allocations to be modified should be readily available, where this is demonstrated as appropriate and required to the approval authority. Best-for-project approaches may differ between developments for dividing up these components to benefit the overall development due to site specific factors (ie. costs, tenant type flexibility, etc.).

Similarly, noise allocations should be considered by developers as part of leasing strategies or as part of marketing campaigns through approaches to incentivise louder operations to take up lots where allowances can

be more easily achieved (likely further away and shielded) or similar. This way, substantial mitigation measures and restrictions can be minimised or replaced with less costly or restrictive ones, through early planning and tenant allocation, to assist with maximising the use of the industrial land (a finite resource).

5 CONCLUSION

The NPfl noise requirements from industrial clusters aim to control the overall industrial noise to an appropriate level at nearby sensitive receivers. However, due to the nature of the development process, generally insufficient information is provided to be able to fully inform the next project stage in a way that allows the development to be built and operated in a manner that meets cumulative noise limit requirements set during environment approval stages. Conversely, where generalised cumulative noise management approaches are implemented, if they remain simplistic without taking into consideration additional site specific factors relating to cumulative noise, they may be overly stringent and not maximise the use of the industrial land.

To manage cumulative noise from an industrial cluster, an appropriate method to determine noise allowances should be implemented, whether that is through a noise management precinct with a single overall controlling entity, or through a noise allocation because there is no overall controlling entity. Furthermore, site specific factors should be considered when determining individual industrial lot noise quotas. An appropriate proportioning method should be used, along with the inclusion of factors where appropriate such as likely concurrency of noise from other operations, the relative distance from receivers to the industrial cluster, and any additional division required to provide further allocations to individual noise components (ie. base building, mechanical plant etc). The allocated cumulative noise quotas to each lot should be determined so that they provide a pathway that maximises the use of the industrial land efficiently from an acoustic perspective, and can be implemented through the various project stages, including planning, development, construction, and operational stages.

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