

Port of Newcastle

Clean Energy Precinct Concept Plan

Preliminary Noise and Vibration Assessment

April 2023

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Clean Energy Precinct Concept Plan Preliminary Noise and Vibration Assessment

Port of Newcastle

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Glossary

Noise Terms

Ambient noise	The all-encompassing noise associated within a given environment at a given time, usually composed of sound from all sources near and far.																												
Assessment period	The period in a day over which assessments are made.																												
Background noise	Background noise is the term used to describe the underlying level of noise present in the ambient noise environment, measured in the absence of the noise under investigation, when extraneous noise is removed. It is described as the average of the minimum noise levels measured on a sound level meter and is measured statistically as the A-weighted noise level exceeded for ninety percent of a sample period. This is represented as the L_{90} noise level (see below).																												
Decibels (dB)	The human ear responds to minute pressure variations in the air. These pressure variations can be likened to the ripples on the surface of water but of course cannot be seen. The pressure variations in the air cause the eardrum to vibrate and this is heard as sound in the brain. The stronger the pressure variations, the louder the sound is heard. The range of pressure variations associated with everyday living may span over a range of a million to one. On the top range may be the sound of a jet engine and on the bottom of the range may be the sound of a pin dropping. Instead of expressing pressure in units ranging from a million to one, it is found convenient to condense this range to a scale 0 to 120 and give it the units of decibels. The following are examples of the decibel readings of every day steady or quasi-steady sounds. <table><tr><td><i>0db</i></td><td><i>the faintest sound we can hear under perfect conditions</i></td></tr><tr><td><i>20db</i></td><td><i>quiet bedroom at night or recording studio</i></td></tr><tr><td><i>30db</i></td><td><i>quiet library or quiet location in the country</i></td></tr><tr><td><i>40db</i></td><td><i>living room</i></td></tr><tr><td><i>50db</i></td><td><i>typical office space or ambience in the city at night</i></td></tr><tr><td><i>60db</i></td><td><i>normal conversational speech</i></td></tr><tr><td><i>70db</i></td><td><i>a car passing by</i></td></tr><tr><td><i>80db</i></td><td><i>kerbside of a busy road</i></td></tr><tr><td><i>90db</i></td><td><i>truck passing by</i></td></tr><tr><td><i>100db</i></td><td><i>nightclub</i></td></tr><tr><td><i>110db</i></td><td><i>rock band or 2m from a jackhammer</i></td></tr><tr><td><i>120db</i></td><td><i>70m from a jet aircraft</i></td></tr><tr><td><i>130db</i></td><td><i>threshold of pain</i></td></tr><tr><td><i>140db</i></td><td><i>25m from a jet aircraft</i></td></tr></table>	<i>0db</i>	<i>the faintest sound we can hear under perfect conditions</i>	<i>20db</i>	<i>quiet bedroom at night or recording studio</i>	<i>30db</i>	<i>quiet library or quiet location in the country</i>	<i>40db</i>	<i>living room</i>	<i>50db</i>	<i>typical office space or ambience in the city at night</i>	<i>60db</i>	<i>normal conversational speech</i>	<i>70db</i>	<i>a car passing by</i>	<i>80db</i>	<i>kerbside of a busy road</i>	<i>90db</i>	<i>truck passing by</i>	<i>100db</i>	<i>nightclub</i>	<i>110db</i>	<i>rock band or 2m from a jackhammer</i>	<i>120db</i>	<i>70m from a jet aircraft</i>	<i>130db</i>	<i>threshold of pain</i>	<i>140db</i>	<i>25m from a jet aircraft</i>
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dB(A); A-weighted decibels	The ear is not as effective in hearing low frequency sounds as it is hearing high frequency sounds. That is, low frequency sounds of the same sound pressure level are not heard as loud as high frequency sounds. The sound level meter attempts to replicate the human response of the ear by using an electronic filter which is called the “A” filter. A sound level measured with this filter switched in is denoted as dB(A). Most environmental noise is measured using the A filter.																												
Frequency	Of a periodic quantity: the time rate of repetition. The reciprocal of the period. Frequency is measured in hertz (Hz).																												

L ₉₀	The level of noise exceeded for 90% of the time. The bottom 10% of the sample is the L ₉₀ noise level expressed in units of dB(A).
L _{eq}	Equivalent sound pressure level – the steady sound level that, over a specified period of time, would produce the same energy equivalence as the fluctuating sound level actually occurring. The sound weighting of the noise measurement is commonly added, for example L _{Aeq} or L _{Ceq} .
Reflection	Sound wave changed in direction of propagation due to a solid object obscuring its path.
Sound level meter	An instrument consisting of a microphone, amplifier and indicating device, having a declared performance and designed to measure sound pressure levels.
Sound pressure level	The level of sound pressure, expressed in decibels, as measured by a standard sound level meter with a microphone.
Sound power level	Ten times the logarithm to the base 10 of the ratio of the sound power of the source to the reference sound power.
Structure-borne noise	Vibration propagating through solid structures in the form of compression or bending waves, heard as sound.

Vibration terms

Acceleration	Indicates the rates of change in speed of a vibrating particle
Accelerometer	A pickup that measures the level of vibration acceleration.
Ambient vibration	The all-encompassing vibration associated with a given environment, usually a composite of vibration from many sources, far and near.
Amplitude	The maximum value of a vibration waveform.
Displacement	A vector quantity that specifies the change of position of a body or particle.
Frequency	The time rate for each wave peak (of a vibration wave) to pass a given point. Frequency is measured in hertz (Hz).
Hertz (hz)	Units in which frequency is expressed. Synonymous with cycles per second.
Peak value	The maximum value of a quantity during a given interval.
Spectrum	A description of a quantity as a function of frequency or wavelength.
Transducer	A device that receives energy from one system and supplies energy of either the same or a different kind, to another system in such a manner that the desired characteristics of the input energy appear at the output.
Velocity	A vector quantity that specifies the time derivative of displacement.
Wavelength	Of a periodic wave. The distance, measured perpendicular to the wave front in the direction of propagation, between two successive points on the wave that are separated by one period.

1 Project background

1.1 Introduction

Port of Newcastle (the proponent) propose to construct and operate the new Clean Energy Precinct (the project), a facility for clean energy production in Newcastle, New South Wales (NSW) (refer Figure 1.1). Fully constructed, the project would facilitate clean energy production, storage, transmission, domestic distribution and international export using common user shared infrastructure. The first stage of the project would include establishment of lead-in infrastructure (e.g. utilities, storage and transmission facilities) to enable production, storage, distribution and export of clean energy types in future development stages (for example green hydrogen and green ammonia) as well as other potential future energy developments.

The proponent has engaged WSP Australia Pty Ltd (WSP) to undertake a preliminary assessment of potential noise and vibration impacts during construction and operations at the site at the scoping stage.

1.2 Project description

The project will enable production, storage, distribution and export of clean energy such as green hydrogen and green ammonia using common user shared infrastructure. Existing land uses of the project site and surrounds are predominately industrial, shipping and port operations with environmental conservation land to the north.

Fully constructed, the project would facilitate clean energy production, storage, transmission, domestic distribution and international export. The first stage of the project would comprise establishment of lead-in infrastructure including electrical infrastructure, water infrastructure and ancillary works, construction vehicle and workforce vehicle parking, construction laydown and stockpiles and construction of an ammonia storage facility (refer section 3 of the Scoping Report for more detail). The main components of the Concept Plan are outlined in the Scoping Report, and include the following:

- lead-in infrastructure precinct
- ammonia storage
- transmission easement
- roads and car park
- administration buildings.

An overview of Stage 1 of the Concept Plan for the project is summarised in Figure 1.1 and includes lead-in infrastructure such as the following:

- disturbance area, workforce, ancillary works, temporary facilities, access and dewatering (if required) during construction of Stage 1
- operational footprint, road crossings and ancillary features during operation of Stage 1
- electrical infrastructure, including grid connection, substation and switchyard
- water and wastewater infrastructure including network connection
- utilities and infrastructure corridors for utility connections.

Potential future development at the site is expected to be carried out in a staged approach. Potential future development at the site includes green hydrogen and ammonia production facilities, potential for an Innovation Hub, methanol storage facility, sustainable aviation fuel (SAF) storage facilities or other clean energy storage facilities. These potential developments would be part of separate development applications to be made in the future and would be generally consistent with the proposed Clean Energy Precinct Concept Plan.

It is expected that construction of the lead-in infrastructure (Stage 1 of the project) would commence in 2025 and take about two years to complete. It is anticipated that the project would be operational in late 2026 or early 2027.



Figure 1.1 Preliminary site layout

1.3 Purpose of this report

This report will identify:

- existing and future noise and vibration sensitive receivers and likely existing background noise levels
 - relevant legislation and indicative noise and vibration goals
 - likely noise and vibration sources affecting the identified receivers, including their impact, and potential cumulative impacts under the proposed scenario
 - possible requirements for noise control, in order to protect the future amenity of identified receivers.
-

1.4 Relevant legislation

A variety of noise and vibration legislation, standards and guidelines exist to ensure that noise is kept to acceptable levels, and in-balance with the social and economic value of industry to NSW. The following legislation, standards and guidelines are the primary documents applicable to this site to assess and manage noise and vibration in NSW:

Table 1.1 Relevant noise and vibration legislation

Document	Application
<i>Noise Policy for Industry</i> (NSW Environmental Protection Authority, 2017) (NPfI)	The NPfI is applicable to noise emissions from new or redeveloped industrial noise sources
<i>Road Noise Policy</i> (NSW Department of Climate Change and Water, 2011) (RNP)	The RNP is applicable to noise from new or upgraded roads
<i>Interim Construction Noise Guideline</i> (NSW Department of Environment and Climate Change, 2009) (ICNG)	The ICNG is applicable to noise from construction activities (it is noted that this document will soon be superseded by the Draft Construction Noise Guideline)
<i>Assessing Vibration: A Technical Guideline</i> (NSW Department of Environment and Conservation, 2006) (AVaTG)	AVaTG is applicable to (ground) vibration impacts affecting human comfort
<i>British Standard BS 7358-2: Evaluation and measurement for vibration in buildings. Part 2: Guide to damage levels from ground-borne vibration</i> (BS7358-2, 1993)	BS7358-2:1993 is applicable to (ground) vibration impacts affecting buildings and infrastructure

2 Existing noise environment

This section outlines the existing noise and vibration environment in the vicinity of the project. It also details noise and vibration sensitive receivers located outside the precinct.

2.1 Local noise sensitive receivers

The project site is adjoined by multiple heavy industrial land uses and large areas of unused land which acts as a buffer zone to any nearby noise sensitive receivers. The study area has been described through the definition of Noise Catchment Areas (NCA) which are used to classify areas that are likely to have a similar existing noise environment and experience similar noise impacts from the project.

Descriptions for each defined NCA are presented in Table 2.1 and shown graphically in Figure 2.1.

Table 2.1 Identified noise sensitive receivers and NCA

NCA	Location	Noise sensitive receivers	Existing noise sources	Distance from project boundary
1	Tomago	Isolated residential properties	Industrial noise from within Tomago and road traffic on Tomago Road.	3 kilometres (km) to the north
2	Fern Bay and Stockton	Suburban residential area including medium density retirement villages	Road noise from Nelson Bay Road, industrial noise from Kooragang Island and harbour activities.	4 km to the east
3	Mayfield	Suburban residential area	Heavy industrial noise from Mayfield north and within Mayfield West, road traffic on Industrial Drive and Tourle Street and harbour activities.	1 km to the south
4	Sandgate	Isolated suburban properties including a large cemetery and aged care facility	Heavy industrial noise from within Sandgate, road traffic on Maitland Road, train noise from the Coal Loader rail line.	600 metres (m) to the south west
5	Warabrook	Medium density suburban properties	Heavy industrial noise from within Sandgate, road traffic on Maitland Road, train noise from the Coal Loader rail line.	1 km to the south west
6	Kooragang Island	Industrial facilities	Heavy industrial noise within Kooragang Island, road traffic on Cormorant Road, train noise from Coal Loader rail line, and harbour activities.	Adjacent to the east
7	Kooragang Wetlands	Nil	Heavy industrial noise from within Kooragang Island and Tomago, and train noise from Coal Loader rail line.	Adjacent to the north

2.2 Existing noise environment

The project is generally surrounded by a highly urban and industrialised environment, influenced primarily by noise from road and rail traffic, and industrial sources, in addition to operations within the existing port and harbour areas.

Due to the preliminary nature of this assessment, noise monitoring to determine existing levels of background noise is not justified. Appendix A of *Australian Standard – Acoustics – Description and measurement of environmental noise, Part 3: Acquisition of data pertinent to land use* (AS 1055.3, 1997) outlines Estimated average background A-weighted sound pressure levels ($L_{A90(\text{period})}$) for different areas containing residences in Australia. Suitable levels have been selected in reference to the description of existing noise sources outlined in Table 2.1. A summary of these levels is provided in Table 2.2.

Table 2.2 Residential receiver noise categories (EPA, 2017)

NCA	Receiver category	Estimated background noise levels $L_{A90(\text{period})}$			Description
		Day	Evening	Night	
1	R4	55	50	45	Areas with dense transportation or some industry or commerce
2	R3	50	45	40	Areas with medium density transportation or some industry or commerce
3	R5	60	55	50	Areas with very dense transportation or in commercial districts or bordering on industrial districts
4	R6	65	60	55	Areas with very extremely dense transportation or within predominately industrial districts
5	R3	50	45	40	Areas with medium density transportation or some industry or commerce
6	R6	65	60	55	Areas with very extremely dense transportation or within predominately industrial districts
7	R5	60	55	50	Areas with very dense transportation or in commercial districts or bordering on industrial districts

2.3 Existing vibration environment

Ground vibration impacts are generally limited to a small area surrounding the vibration source and rarely extend beyond approximately 100 m. Existing ground vibration sources within the study area would include industrial activities and heavy vehicle movements on local roads, in addition to construction activities at development sites.

Ground vibration associated with road traffic is generally low, and large separation distances between the project site and residential receivers mean that the risk of existing vibration impacts at sensitive receivers is considered extremely low. The primary routes for heavy vehicles to access the site are existing designated heavy vehicle routes and as such project traffic is not expected to impact the existing vibration environment.

Vibration sensitive developments, such as micro-electronics, medical and imaging laboratories have not been identified within the project area. Major, critical infrastructure exists within, and adjacent to the site, such as coal loading facilities, and gas pipelines. These items are not considered to be highly vibration sensitive. Given the large separation distances to any vibration sensitive receivers, no vibration impacts are considered likely to be associated with the project and ground vibration has not been discussed further in this document.

2.4 Meteorological influences

Meteorological conditions can influence or reduce the transmission of noise. In particular, weather conditions, including atmospheric temperature inversions and wind conditions can have a substantial impact on noise levels. These impacts are most noticeable at distances of more than 500 m.

Typical meteorological conditions in the area have been discussed in detail in the Air Quality and Odour Baseline Study for this project and are summarised below.

2.4.1 *Local meteorological conditions*

Local wind patterns have been obtained from the Bureau of Meteorology weather station at Williamstown (station number 061078), which is considered indicative of weather conditions at the site.

Inversion conditions are unlikely to form a part of the meteorological environment at this site. Wind directions are predominately from the west and north west throughout much of the year. Seasonal wind patterns are described in Table 2.3.

Table 2.3 Local wind patterns

Time period	Description of wind conditions
Summer	Morning: Moderate wind from the west and northwest Afternoon: Strong wind from the east and southeast
Autumn	Morning: Strong wind from the west and northwest Afternoon: Strong wind from the southeast
Winter	Morning: Strong wind from the west and northwest Afternoon: Strong wind from the west and northwest
Spring	Morning: Moderate wind from the west and northwest Afternoon: Strong wind from the southeast
Annual	Morning: Moderate wind from the west and northwest Afternoon: Moderate wind from the southeast

2.4.2 *Meteorological noise impacts*

Given the typical strength and varying direction of wind at the site, and the absence of temperature inversions, weather conditions are not considered to generally impact the transmission of noise from this site.

3 Noise legislation

3.1 Interim construction noise guideline

The Interim Construction Noise Guideline (ICNG) is used to assess and manage potential impacts from construction noise in NSW. The ICNG uses Noise Management Levels (NMLs) to determine the noise level at which the project is expected to impact noise sensitive receivers and require the implementation of reasonable and feasible noise management and mitigation to minimise these impacts. These management levels are presented in Table 3.2 and Table 3.3.

Table 3.1 defines how the NMLs are applied for residential receivers, based on existing Rating Background Levels (RBL) of noise in the study area. Residential receivers are deemed likely to be affected by noise where predicted construction noise levels exceed the NML. If the predicted noise levels exceed 75 dBA at a residential receiver, the receiver is deemed to be 'highly noise affected' and require additional targeted mitigation measures to minimise potential noise impacts during construction.

Table 3.1 Construction noise management levels for residential receivers and working hours

Working Hours	NML dBA $L_{eq}(15 \text{ min})$ ^{1,2}	How NML are applied
Recommended standard hours (SH) ³ : — Monday – Friday: 7 am – 6 pm — Saturday: 8 am – 1 pm — No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. Where the predicted or measured dBA $L_{eq}(15 \text{ min})$ is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dBA	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: — times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) — if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.
Periods outside recommended standard hours of work (OOHW)	Noise affected RBL + 5 dB	A strong justification would typically be required for works outside the recommended standard hours. The proponent should apply all feasible and reasonable work practices to meet the noise affected level. Where all feasible and reasonable practices have been applied and noise is more than 5 dB above the noise affected level, the proponent of any development works project should negotiate with the community.

- (1) Noise levels apply at the property boundary that is most exposed to construction noise, and at a height of 1.5 metres above ground level. If the property boundary is more than 30 metres from the residence, the location for measuring or predicting noise levels is at the most noise-affected point within 30 metres of the residence.
- (2) The RBL is the overall background noise level representing each assessment period (day/evening/night) over the whole monitoring period. The term RBL is described in detail in the NSW NPfI.
- (3) Recommended standard hours for normal construction work, excluding blasting, as per ICNG Table 1.

Construction NMLs are derived using RBLs in accordance with the ICNG, with further guidance provided by the CNVG. Table 3.2 provides a summary of the applicable NMLs based on the estimated background noise levels detailed in Section 2.2).

Table 3.2 Construction NMLs for residential receivers

NCA	Description	LA90(period) dBA			NML, Leq(15 minute) dBA ¹			
		Day	Evening	Night	Day (SH)	Day (OOH)	Evening (OOH)	Night (OOH)
1	Tomago	55	50	45	65	60	55	50
2	Fern Bay and Stockton	50	45	40	60	55	50	45
3	Mayfield	60	55	50	70	65	60	55
4	Sandgate	65	60	55	75	70	65	60
5	Warabrook	50	45	40	60	55	50	45
6	Kooragang Island	65	60	55	75	70	65	60
7	Kooragang Wetlands	60	55	50	70	65	60	55

(1) SH = recommended standard working hours, OOH = outside of recommended standard hours work as defined in Table 3.1.

Table 3.3 lists the NMLs that have been adopted for non-residential sensitive receivers, such as commercial, industrial or education land uses. The NMLs apply when the premises are in use during any assessment period. One non-residential sensitive receiver, a school, was identified within the study area.

Table 3.3 Construction NML for non-residential receivers

Land use	NMLs (Leq(15 min) dBA)
Classrooms at schools and other educational institutions	Internal noise level – 45 (external – 55) ¹
Active recreational areas	65
Passive recreational areas	60
Places of worship	Internal noise level – 45 (external – 55) ¹
Office, retail premises	70
Industrial premises	75

(1) As the acoustic performance of the building envelopes of these receivers is not known accurately, an external to internal correction of 10 dB has been applied. This is generally accepted as the minimum noise reduction that is typically provided by standard building facades, allowing for windows being open for ventilation.

3.2 Operational noise

The *NSW Noise Policy for Industry* (NPfI) provides the framework and process for deriving the noise limits for industrial developments under the *Protection of the Environment Operations Act, 1997*.

This section outlines potential, indicative noise trigger levels. These do not form any type of project criteria and are only included to identify the likely acceptability of predicted noise levels.

3.2.1 Overview

The NPfI outlines a procedure to assess industrial noise impacts utilising two assessment criteria for environmental noise. The first relates to the intrusiveness of a noise source, allowing for the noise under assessment to marginally above the background, whilst the other procedure relates to the acceptability of the resulting noise, in relation to the use of the surrounding landscape. Generally, the more stringent of the intrusive or amenity criteria is adopted as the project-specific noise criterion.

In assessing the noise impact of industrial sources, both components must be considered for residential receivers. In most cases, only one would become the limiting criterion and thereby determine the project-specific noise levels applied to noise from the Project's industrial sources. As the project would include a redesign of the area, existing background noise levels at the site are not considered to be representative of the project area.

Therefore, for the purposes of this assessment, only the amenity criteria have been used to provide a general indication of the acceptability of predicted noise. Potential impacts of specific projects would be assessed during the planning process, in accordance with the NPfI.

3.2.2 Assessment periods

The assessment time periods defined by the NPfI are presented in Table 3.4.

Table 3.4 NPfI Time Periods

Assessment period	Time
Day	7:00 am to 6:00 pm Monday to Saturday 8:00 am to 6:00 pm Sundays and public holidays
Evening	6:00 pm to 10:00 pm all days
Night	10:00 pm – 7:00 am

3.2.3 Intrusiveness criteria

The project intrusiveness noise level for residential receivers prescribed in the NSW NPfI is summarised as:

$$L_{eq}(15 \text{ minute}) \leq \text{Rating Background Level } (L_{90}) + 5 \text{ dBA}$$

The project intrusiveness noise levels have been established based on the typical noise levels described in Section 2.2 and are presented in Table 3.5.

Table 3.5 Established project intrusiveness noise level (dB L_{Aeq} 15 min)

NCA	Description	LA90(period) dBA			Intrusiveness noise levels, Leq(15 minute) dBA ¹		
		Day	Day	Evening	Day	Evening	Night
1	Tomago	55	50	45	60	55	50
2	Fern Bay and Stockton	50	45	40	55	50	45
3	Mayfield	60	55	50	65	60	55
4	Sandgate	65	60	55	70	65	60
5	Warabrook	50	45	40	55	50	45
6	Kooragang Island	65	60	55	70	65	60
7	Kooragang Wetlands	60	55	50	65	60	55

3.2.4 Amenity criteria

Existing residential receivers are generally categorised as “urban” residential as defined in the NPfI. A variety of non-residential receivers are located throughout the study area. The relevant NPfI amenity criteria for these land uses are presented in Table 3.6. It is noted that the Amenity Noise Levels relate to the total maximum permissible noise levels from all industrial development, not the maximum permissible noise emissions *from* the project alone.

The recommended Amenity Noise Levels (ANLs) represent the objective for total industrial noise at a receiver location. The amenity noise level emissions for any individual proposed development would be 5 dBA below these levels.

Table 3.6 Amenity criteria

Type of receiver	Indicative noise amenity area	Assessment period	Recommended ANL, dBA Leq(period)
Residential	Urban	Day	60
		Evening	50
		Night	45
Industrial interface	Residential properties at Sandgate	Day	65
		Evening	55
		Night	50
Commercial premises	All	When in use	65
Industrial premises	All	When in use	70
School classroom	All	Noisiest 1-hr period when in use	35 (internal) / 45 (external)
Places of worship	All	Noisiest 1-hr period when in use	40 (internal) / 50 (external)
Active recreation	All	When in use	55
Passive recreation	All	When in use	50

3.2.5 Maximum noise level assessment and sleep disturbance

The potential for operational noise impacts resulting from transient maximum noise level events and sleep disturbance during the night-time period is detailed in the NPfI. The maximum noise level event criteria for operational noise within the project at the nearest residential locations are the following:

- $L_{eq(15min)}$ 40 dBA or the rating background level plus 5 dB, whichever is the greater, and/or
- L_{Fmax} 52 dBA or the rating background level plus 15 dB, whichever is the greater.

Where maximum noise levels at a residential location exceed the criteria, a detailed maximum noise level event assessment should be undertaken.

Based on the estimated background noise levels detailed in Section 2.2, external maximum noise level event criteria are presented for NCAs containing noise sensitive receivers in Table 3.7.

Table 3.7 Sleep disturbance criteria

Location	Night-time RBL dBA	$L_{Aeq(15min)}$ criteria dB	L_{AFmax} criteria dB
NCA 1	45	60	65
NCA 2	40	55	65
NCA 3	50	65	65
NCA 4	55	70	65
NCA 5	40	55	65

3.2.6 Project noise trigger levels

In assessing the operational noise impact of the project on surrounding residential receivers, both the intrusiveness and amenity criterion must be considered. In most cases, only one criterion would become the limiting criterion and form the project noise trigger levels (PNTL) for the industrial source under assessment.

To standardise the time periods for the intrusiveness and amenity noise levels, the following conversion between L_{eq} period and $L_{Aeq 15 min}$ have been applied (as per Section 2.2 of the NSW NPfI):

$$L_{Aeq(15 min)} = L_{Aeq(period)} + 3 \text{ dB}$$

In accordance with Section 2.2 of the NSW NPfI, all project noise trigger levels and limits are expressed as $L_{eq(15min)}$, unless otherwise expressed. A summary of all relevant criteria is presented in Table 3.8. As there are no noise sensitive receivers in NCAs 6 and 7, they are not presented below.

Table 3.8 Summary of project noise trigger levels (PNTL)

NCA	Assessment/ receiver type	Project noise trigger levels dBA $L_{eq}(15 \text{ min})^{2,3}$		
		Day ¹	Evening ¹	Night ¹
1	Intrusiveness	60	55	50
	Amenity	63	53	48
	PNTL – Residential	60	53	48
2	Intrusiveness	55	50	45
	Amenity	63	53	48
	PNTL – Residential	55	50	45
3	Intrusiveness	65	60	55
	Amenity	63	53	48
	PNTL – Residential	63	53	48
4	Intrusiveness	70	65	60
	Amenity	68	58	53
	PNTL – Residential	68	58	53
5	Intrusiveness	55	50	45
	Amenity	63	53	48
	PNTL – Residential	55	50	45

(1) Day: the period from 7:00 am to 6.00 pm Monday to Saturday; or 8.00 am to 6.00 pm on Sundays and public holidays; evening: the period from 6.00 pm to 10.00 pm; night: the remaining periods.

(2) $L_{eq, 15\text{min}} = L_{eq, \text{period}} + 3 \text{ dB}$

3.3 Road noise policy

Both operation and construction of the site would generate additional traffic on the local road network. Typical routes to the project site are likely to be along Maitland Road, Industrial Drive and Tourle Street. In NSW, any changes to road traffic noise are assessed in accordance with the *NSW Road Noise Policy* (RNP), (DECC, 2011).

The RNP can be used by individuals and agencies to assess and mitigate the impacts of traffic noise from new and redeveloped road projects, and traffic-generating developments on residential and other sensitive lands.

The policy links with other NSW Government policies and plans to ensure that where road traffic exists, its noise impacts are appropriately identified and addressed. As relevant to the potential road changes associated with this project, the following noise criteria would be considered at residential properties.

Table 3.9 Road traffic noise criteria

Road category	Type of project	Assessment criteria dBA (external)	
		Day (7am to 10pm)	Night (10pm to 7am)
Arterial roads	Existing residences affected by additional traffic on existing roads generated by land use developments	$L_{Aeq} (15 \text{ hour})$ 60	$L_{Aeq} (9 \text{ hour})$ 55

The RNP application notes state that *‘for existing residences and other sensitive land uses affected by additional traffic on existing roads generated by land use developments, any increase in the total traffic noise level as a result of the development should be limited to 2 dBA above that of the noise level without the development. This limit applies wherever the noise level without the development is within 2 dBA of, or exceeds, the relevant day or night noise assessment criterion.’*

Therefore, if the road traffic noise levels increase by more than 2 dBA as a result of the proposed construction traffic and the criteria in Table 3.9 are exceeded, investigation of mitigation options would be required.

During the construction phase of the project, heavy vehicles would be required for the delivery of materials and equipment and light vehicles would transport workers to and from the site. This additional road traffic may increase existing levels of road traffic noise along Maitland Road, Industrial Drive and Tourle Street. These roads are all major arterial roads and classified as designated heavy vehicle routes by Transport for NSW.

Mathematically, a doubling of road traffic numbers would result in a 3 dB increase in road noise and a 60 per cent increase in traffic is required to increase traffic noise levels by 2 dB.

Given the preliminary nature of this assessment, precise traffic numbers during construction are unknown. However in consideration of existing road traffic on these routes, it is considered highly unlikely that the project would generate increases in road traffic numbers of more than 60 per cent and as such would comply with the RNP guidelines. Road traffic would not be considered further in this assessment.

4 Construction noise and vibration assessment

4.1 General noise modelling assumptions

A detailed 3-dimensional noise model has been prepared for the project to assess potential noise impacts during construction and operation of the project. Impacts were modelled for typical activities under neutral meteorological conditions to estimate noise impacts at the nearest receivers.

A noise model was created with SoundPLAN 8.2 modelling software and the CONCAWE algorithm was adopted to assess the noise impacts from key noise sources.

Key modelling parameters and assumptions are shown in Table 4.1.

Table 4.1 Operational noise modelling inputs and assumptions

Parameter	Modelling input
Ground absorption	Ground absorption factors are set to: — 0.75 for mixed grass/open vegetation — 0.5 for urban areas — 0.0 for water
Terrain data	Terrain data has been provided by NSW Spatial Services
Meteorological conditions	Standard conditions: Stability category D, 0 m/s wind from source to receiver
Buildings	Footprints and heights sourced from LiDAR Geoscape data
Prediction resolution	Results are presented as noise contours, based on a 20 metre noise prediction grid spacing
Receiver height	The noise predictions are modelled for 1.5 metres above ground level
Location of noise sources	Due to the preliminary nature of detailed site layouts, noise sources have been placed around the boundary for each source, and as such represent a conservative analysis.
Modelled sound power levels	As described in Table 4.2 Noise sources were typically modelled at 2.5 metre height above ground level.
Assessment parameter/duration	L_{Aeq} (15 minutes)
Assumed hours	Construction noise has been assessed for Standard hours only (refer Section 3.1) Operational noise may occur at any time of day (day, evening, night)
Penalties for annoying characteristics	In accordance with the ICNG, +5 dB penalty has been applied for activities that generate particularly annoying noise sources. These are presented in Table 4.2. In consideration of proposed operational equipment lists outlined in Table 5.2, it is assumed that no penalty is required for operational noise sources.

4.2 Proposed construction methodology

Indicative construction equipment and staging has been developed in consideration to the preliminary site description and layout (refer Figure 1.1). Sound power level profiles associated with the construction fleet were developed outlining the equipment used at each construction stage, utilisation and number of plant. Sound power levels (SWLs) for individual plant items were generally sourced from the (former) Roads and Maritime Services' Construction Noise Estimator (part of the CNVG), which provides regulator-accepted sound power information for construction equipment. Where additional SWLs were required, these were sourced from similar industry standard databases.

4.2.1 Construction hours

Prediction of construction noise impacts from the construction activities has been conservatively calculated in accordance with the general modelling assumptions in Section 4.1, taking into account likely reductions in noise due to air absorption, topographical screening and ground absorption. A maximum potential impact has been predicted, based on the nearest extents of the construction area to noise sensitive receivers.

Table 4.2 summarises the main construction activities, plant and equipment for each stage of work at the construction site.

Table 4.2 Construction methodology

Stage	Activity
Stage 1: Site establishment	Implement temporary erosion, sediment, and pollution prevention controls Install temporary fencing
Stage 2: Vegetation removal	Remove existing vegetation and mulching
Stage 3: Earth works	Terrain shaping and compaction to prepare ground for construction
Stage 4: Paving activities	Laying of asphaltic pavement for roads and car parks
Stage 5: Concrete works	Pouring of concrete slabs and pads for development
Stage 6: Construction works	Construction of buildings and infrastructure
Stage 7: Site compound	Site offices, laydown and car parks and amenities

4.3 Noise source levels

The nominated equipment for the construction work scenarios and the SWL of each item are detailed in Table 4.3. SWLs have been sourced from the CNVS, *AS 2436:2010 - Guide to noise and vibration control on construction, demolition and maintenance sites*, and the *Department for Environment Food and Rural Affairs (United Kingdom), Update of noise database for prediction of noise on construction and open sites – Phase 3: Noise measurement data for construction plant used on quarries* (DEFRA noise database).

Table 4.3 Construction equipment Sound power levels

Construction stage	Plant and equipment	Estimated quantity	Plant sound power level L _{Aeq} (15 minute) dB
Site establishment	Franna Crane 20T	2	98
	Truck (medium rigid) ¹	4	103
	Road Truck ¹	4	108
	TOTAL ²	–	115

Construction stage	Plant and equipment	Estimated quantity	Plant sound power level L _{Aeq} (15 minute) dB
Vegetation removal	Bulldozer ¹	3	116
	Excavator (tracked) 35T ¹	4	107
	Chainsaw ¹	3	114
	Tub grinder/mulcher	2	116
	Dump truck	4	108
	Surface water pump	4	99
	Water pump generator	4	90
	TOTAL²	–	126
Earth works	Excavator (tracked) 35T	3	107
	Grader	3	113
	Vibratory Compactor ¹	6	113
	Scraper	3	110
	Water cart	2	107
	Surface water pump	4	99
	Water pump generator	4	90
	Roller	2	109
	Dump truck	4	110
	Bulldozer ¹	2	116
	Bobcat	2	110
	Backhoe	2	110
	Trenching excavator	1	98
	TOTAL ²	–	126
Paving activities	Pavement laying machine	1	114
	Asphalt truck & sprayer	1	110
	Concrete truck	1	103
	Dump truck	4	109
	Smooth drum roller	1	107
	Concrete saw ¹	1	118
	Surface water pump	4	99
	Water pump generator	4	90
	TOTAL ²	–	126

Construction stage	Plant and equipment	Estimated quantity	Plant sound power level L _{Aeq} (15 minute) dB
Concrete works	Concrete Truck & Pump ¹	8	112
	Concrete Vibrator	4	105
	Surface water pump	4	99
	Water pump generator	4	90
	Handheld jackhammer	1	119
	TOTAL ²	–	125
Construction works	Mobile crane	4	104
	Hand tools	12	102
	Angle grinder ¹	2	108
	Hammer drills, impact drivers etc.	4	116
	Concrete saw ¹	1	118
	Franna crane 20T	2	98
	Welding equipment	2	105
	Surface water pump	4	99
	Water pump generator	4	90
	Piling rig ¹	1	116
	Flat bed HIAB	2	95
	TOTAL ²	–	127
Site compound	Light vehicles	12	103
	Road Truck	2	108
	Site office diesel generator	4	87
	Surface water pump	4	99
	Water pump generator	4	90
	Rigid road truck	2	110
	Elevated work platform	2	98
	Air compressors	4	109
	TOTAL ²	–	114

(1) +5 dB penalty added to total for annoying characteristics in accordance with ICNG section 4.5

(2) Assessing one of each plant operating simultaneously at the nearest point to the receiver

4.4 Potential construction noise impacts

The following discussion of the predicted noise levels is based on the predicted noise contours contained in Appendix A have been assessed against the estimated construction NML presented in Section 3.1.

4.4.1 Construction Stage 1 – Site establishment

Noise during the site establishment stage of the construction works is predicted to comply with NMLs at all noise sensitive locations. Noise impacts of at least 45 dBA are predicted to be reached as far as Maitland Road, and industrial buildings along the Southern bank of the South Channel Hunter River are predicted to receive noise levels of up to 55 to 60 dBA, which does not exceed amenity criteria for Industrial premises.

4.4.2 Construction Stage 2 – Vegetation removal

Noise during the vegetation removal stage of the construction works is predicted to comply with NMLs at all noise sensitive locations. Residential properties in Sandgate (NCA 4), Warabrook (NCA 5) and Mayfield West (NCA 3) are predicted to experience noise impacts from vegetation removal works of up to 50 to 55 dBA. Noise levels are predicted to be highest around Mayfield West Industrial estate, where noise levels may reach 55 to 60 dBA.

4.4.3 Construction Stage 3 – Earthworks

Noise during the earthworks stage of the construction works is predicted to comply with NMLs at all noise sensitive locations. Residential properties in Sandgate (NCA 4), Warabrook (NCA 5) and Mayfield West (NCA 3) are predicted to experience noise impacts from vegetation removal works of up to 50 to 55 dBA. Noise levels are predicted to be highest around Mayfield West Industrial estate, where noise levels may reach 55 to 60 dBA.

4.4.4 Construction Stage 4 – Paving activities

Construction noise during paving activities may approach NMLs at the eastern most properties within Warabrook, however in consideration of existing road traffic noise levels at these sites, NMLs are unlikely to be exceeded. Noise during this construction phase is predicted to comply with NMLs at all other locations.

4.4.5 Construction Stage 5 – Concrete works

Construction noise during concreting works activities may approach NMLs at the eastern most properties within Warabrook, however in consideration of existing road traffic noise levels at these sites, NMLs are unlikely to be exceeded. Noise during this construction phase is predicted to comply with NMLs at all other locations.

4.4.6 Construction Stage 6 – Construction works

Noise during the construction stage of the works is predicted to comply with NMLs at all noise sensitive locations.

4.4.7 Construction Stage 7 – Site compound

Noise from the operation of the site compound is predicted to comply with NMLs at all noise sensitive locations.

4.5 Construction noise and vibration recommendations

4.5.1 Management controls

Although noise impacts are predicted to be unlikely, the mitigation management measures outlined in Table 4.4 should be implemented as standard measures where reasonable and feasible.

Table 4.4 Management controls

Action	Details
Working hours	Construction activities should be undertaken during recommended standard hours unless otherwise approved. Noise management measures should be included in Project Induction and Pre-start Briefings, Toolbox Talks etc. Work generating high noise levels should be scheduled during less sensitive time periods.
Implementation of any project specific mitigation measures required	In addition to the measures set out in this table, any project specific mitigation measures identified during subsequent assessment phases should be implemented.
Implement community consultation measures	Periodic notification (monthly letterbox drop or equivalent), website, Project Infoline, Construction Response Line, email distribution list.
Site inductions	All employees, contractors and subcontractors are to receive an environmental induction. The induction must at least include: — all relevant project specific and standard noise and vibration mitigation measures — relevant licence and approval conditions — permissible hours of work — any limitations on high noise generating activities — location of nearest sensitive receivers — construction employee parking areas — designated loading/unloading areas and procedures — site opening/closing times (including deliveries) — environmental incident procedures.
Behavioural practices	No swearing or unnecessary shouting or loud stereos/radios on site No dropping of materials from height or throwing of metal items.
Noise monitoring	A noise monitoring program should be carried out for the duration of works in accordance with the Construction Noise and Vibration Management Plan.
Respite periods	Restricting time when noisy work is carried out. High noise and vibration generating activities may only be carried out in continuous blocks, not exceeding 3 hours each, with a minimum respite period of 1 hour between each block. No more than 4 consecutive nights of high noise generating work may be undertaken over any 7 day period, unless otherwise approved by the relevant authority.
Complaint management procedure	Community complaints will be allocated to a responsible contractor representative immediately to facilitate the implementation of corrective actions. The details of the complaint will also be circulated to the applicable construction personnel for action, where required.

4.5.2 Source controls

The source noise mitigation measures outlined in Table 4.5 should be implemented where reasonable and feasible to reduce the disturbance to the nearby receivers during the Project.

Table 4.5 Source controls

Action	Details
Equipment selection	All fixed plant at the work sites should be selected to be as quiet as practicable and where required, fitted with silencers, acoustical enclosures and other noise attenuation measures. Use mobile noise curtains to shield from sensitive receivers.
Equipment selection	Use quieter and less vibration emitting construction methods where feasible and reasonable.
Maximum noise levels	The noise levels of plant and equipment must have operating sound power or sound pressure levels that would meet the predicted noise levels.
Rental plant and equipment	Noise emissions should be considered as part of the selection process.
Use and siting of plant	Place as much distance as possible between the plant or equipment and residences and other sensitive land uses. Avoid simultaneous operation of noisy plant within discernible range of a sensitive receiver. Direct noise-emitting plant away from sensitive receivers. The offset distance between noisy plant and adjacent sensitive receivers is to be maximised. Plant used intermittently to be throttled down or shut down. Plant and vehicles to be turned off when not in use.
Plan worksites and activities to minimise noise	Plan traffic flow, parking and loading/unloading areas to minimise reversing movements within the site.
Non-tonal reversing alarms	Non-tonal reversing beepers (or an equivalent mechanism) would be fitted and used on all construction vehicles and mobile plant used on site.
Minimise disturbance arising from delivery of goods to construction sites	Loading and unloading of materials/deliveries is to occur as far as possible from sensitive receivers. Delivery vehicles to be fitted with straps rather than chains for unloading, wherever possible. Delivery to occur during standard hours where possible.
Construction related traffic	Schedule and route vehicle movements away from sensitive receivers and during less sensitive times. Limit the speed of vehicles and avoid the use of engine compression brakes. Maximise on-site storage capacity to reduce the need for truck movements during sensitive times.

4.5.3 Path controls

Table 4.6 outlines noise mitigation path controls to reduce the disturbance to affected receivers during the Project. Although it is considered unlikely to be required, they are provided here in case of future changes to the assessed preliminary construction methodology.

Table 4.6 Path controls

Action	Details
Shield stationary noise sources	Stationary noise sources should be enclosed or shielded whilst ensuring that the occupational health and safety of workers is maintained.
Shield sensitive receivers from noisy activities	Use structures to shield residential receivers from noise such as site shed placement; earth bunds; fencing; erection of operational stage noise barriers (where practicable) and consideration of site topography when situating plant.
Acoustic barriers	Erect temporary barriers on site at source where practical to reduce the impact of noise at receivers. AS2436 identifies the options for barriers to reduce noise emissions from construction sites.

5 Operational noise assessment

5.1 General noise modelling assumptions

A detailed 3-dimensional noise model has been prepared for the project to assess potential noise impacts during construction and operation of the project. Impacts were modelled for typical activities under neutral meteorological conditions to estimate noise impacts at the nearest receivers.

A noise model was created with SoundPLAN 8.2 modelling software and the CONCAWE algorithm was adopted to assess the noise impacts from key noise sources.

Key modelling parameters and assumptions are shown in Table 4.1.

5.2 Proposed operations

Indicative operational equipment has been developed in consideration to the preliminary site description and layout (refer Figure 1.1).

Prediction of operational noise impacts has been conservatively calculated in accordance with the general modelling assumptions in Section 5.1, and includes likely reductions in noise due to air absorption, topographical screening and ground absorption. A maximum potential impact has been predicted, based on the nearest extents of the project site to noise sensitive receivers.

Table 5.1 summarises the main operational noise sources for each project area.

Table 5.1 Operational noise sources and activities

Project area	Activity
Ammonia storage	Ammonia storage tank (approximately 30,000 tonnes) utilising centrifugal pumps
Hardstand area	Utilised by road trucks for laying down of construction materials
Electrical infrastructure	Infrastructure including substation, switchyard, and transmission infrastructure
Site facilities	Administration building and control room, primarily for staff operations

5.3 Noise source levels

The nominated equipment for each project area and the SWL of each item are detailed in Table 5.2. SWL likely to be associated with operations at the project site have been sourced from monitoring undertaken at similar sites and industry standard databases.

Table 5.2 Operational equipment - Sound power levels

Project area	Operational equipment	Estimated quantity	Plant sound power level $L_{Aeq}(15 \text{ minute})$ dB
Ammonia storage	Centrifugal gas pump	2	80
	TOTAL	–	83
Hardstand area	Road trucks	6	108
	TOTAL	–	116
Electrical infrastructure	Transformer	2	89
	Reactor	3	78
	TOTAL	–	92
	Circuit Breaker ¹	1	113 L_{Amax}
Site Facilities	Air conditioning	4	103
	Road trucks	2	108
	TOTAL	–	113

(1) Short term maximum event assessment only

5.4 Potential operational noise impacts

The following discussion of the predicted noise levels is based on the predicted noise contours contained in Appendix B have been assessed against the estimated operational PNTL presented in Section 3.2.

In consideration of these results, no operational noise impacts have been predicted during day or night-time operation of any project stage.

Operation of the circuit breaker is not anticipated to result in any sleep disturbance impacts.

5.5 Operational noise and vibration recommendations

Where operations proceed in accordance with the assumptions outlined in this section, noise mitigation and management measures are not considered necessary for these work stages.

It is recommended to establish a way for the community to submit noise complaints through either an online platform or over the phone. A register of the complaints should be maintained, and each complaint should be investigated and actioned where appropriate.

Likely noise emissions associated with future stages would be assessed, during the planning stages in accordance with the NPfI or other relevant policies or guidelines. Suitable noise management measures would be implemented to control any predicted noise impacts.

6 Conclusion

This report has provided a high-level assessment of potential noise and vibration impacts associated with the construction and operation of the proposed Stage 1 development scenario for the project.

The assessment has considered indicative background noise levels and noise criteria for the region surrounding the project.

Due to the large separation distances between the site and the nearest vibration sensitive receivers, vibration impacts during construction and operation of the project are considered highly unlikely.

Due to existing high traffic volumes, including heavy vehicles on the surrounding road network, road traffic noise impacts during construction and operation of the project are considered highly unlikely.

The modelling and assessment of potential construction noise impacts found that noise levels are likely to comply with NMLs during all work stages at all surrounding noise sensitive receivers.

The modelling and assessment of potential operational noise impacts found that noise levels are likely to comply with PNTLs during all project operations at all surrounding noise sensitive receivers. This includes potential cumulative and sleep disturbance impacts.

7 References

Government publications

- *Approved methods for the measurement and analysis of environmental noise in NSW* (Environmental Protection Authority, 2022).
- *Assessing Vibration: A Technical Guideline* (Department of Environment and Conservation, 2006) (AVaTG).
- *Interim Construction Noise Guideline* (Department of Environment and Climate Change, 2009) (ICNG).
- *Noise Policy for Industry* (NSW Environmental Protection Authority, 2017) (NPfI).
- *Road Noise Policy* (Department of Climate Change and Water, 2011) (RNP).
- *State Environment Planning Policy (Infrastructure)* (NSW Government, 2007).

Australian and international standards

- *Australian Standard – Electroacoustics – Sound Level Meters, Part 1: Specifications* (AS IEC 61672.1, 2019).
- *Australian Standard – Guide to noise and vibration control on construction, demolition and maintenance sites* (AS 2436, 2010).
- *Australian Standard – Acoustics – Description and measurement of environmental noise, Part 1: General Procedures* (AS 1055.1, 2018).
- *Australian Standard – Acoustics – Description and measurement of environmental noise, Part 3: Acquisition of data pertinent to land use* (AS 1055.3, 1997).
- *German Standard DIN 4150-3 Structural Vibration – Part 3: Effects of vibration on structures* (DIN4150-3, 1999).
- *British Standard BS 5228-1: Code of practice for noise and vibration control on construction and open sites. Part 1: Noise* (BS 5228-1, 2014).
- *British Standard BS 5228-2: Code of practice for noise and vibration control on construction and open sites. Part 2: Vibration* (BS 5228-2, 2014).
- *British Standard BS 7358-2: Evaluation and measurement for vibration in buildings. Part 2: Guide to damage levels from ground-borne vibration* (BS7358-2, 1993).

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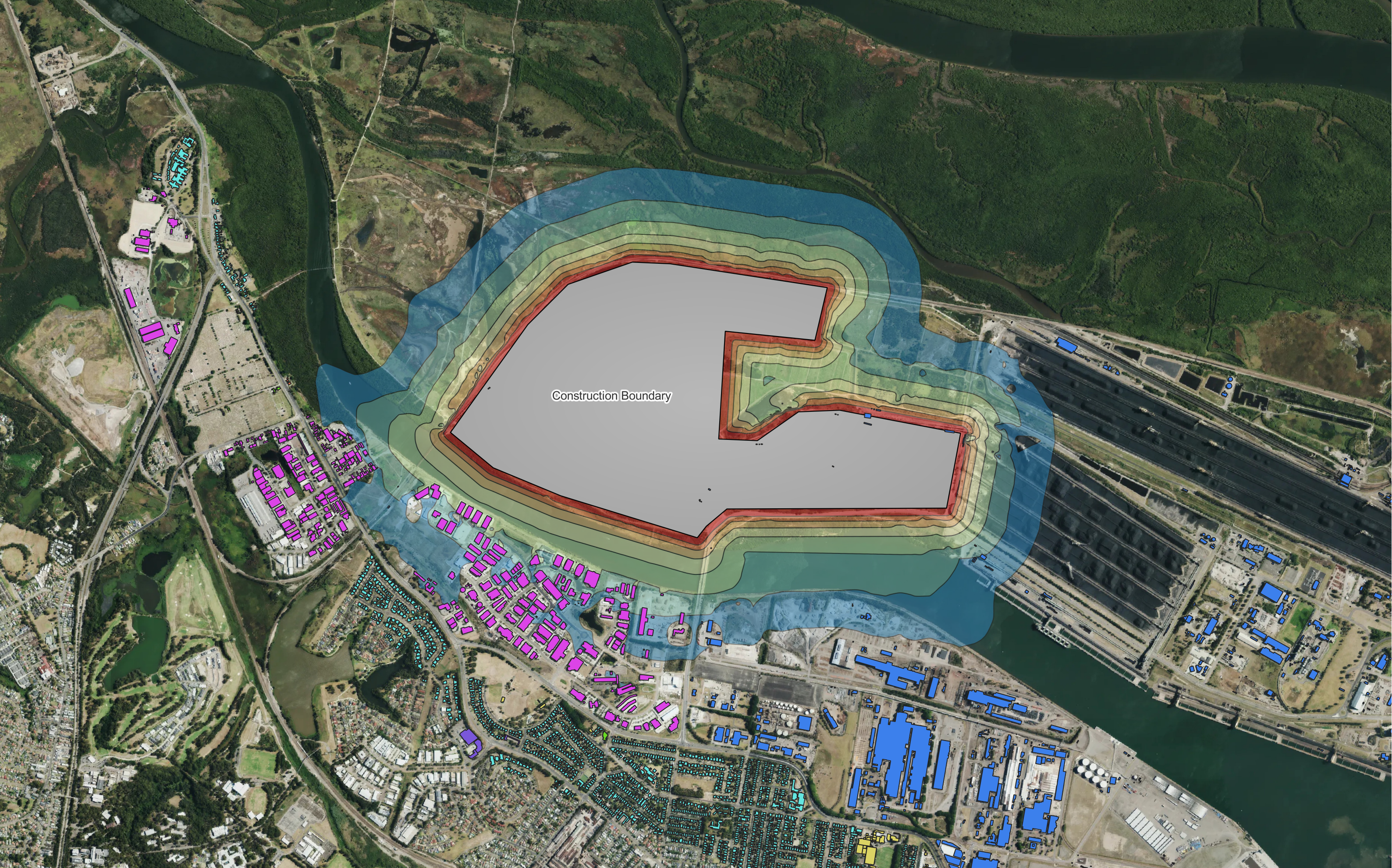
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Appendix A

Predicted construction noise contours

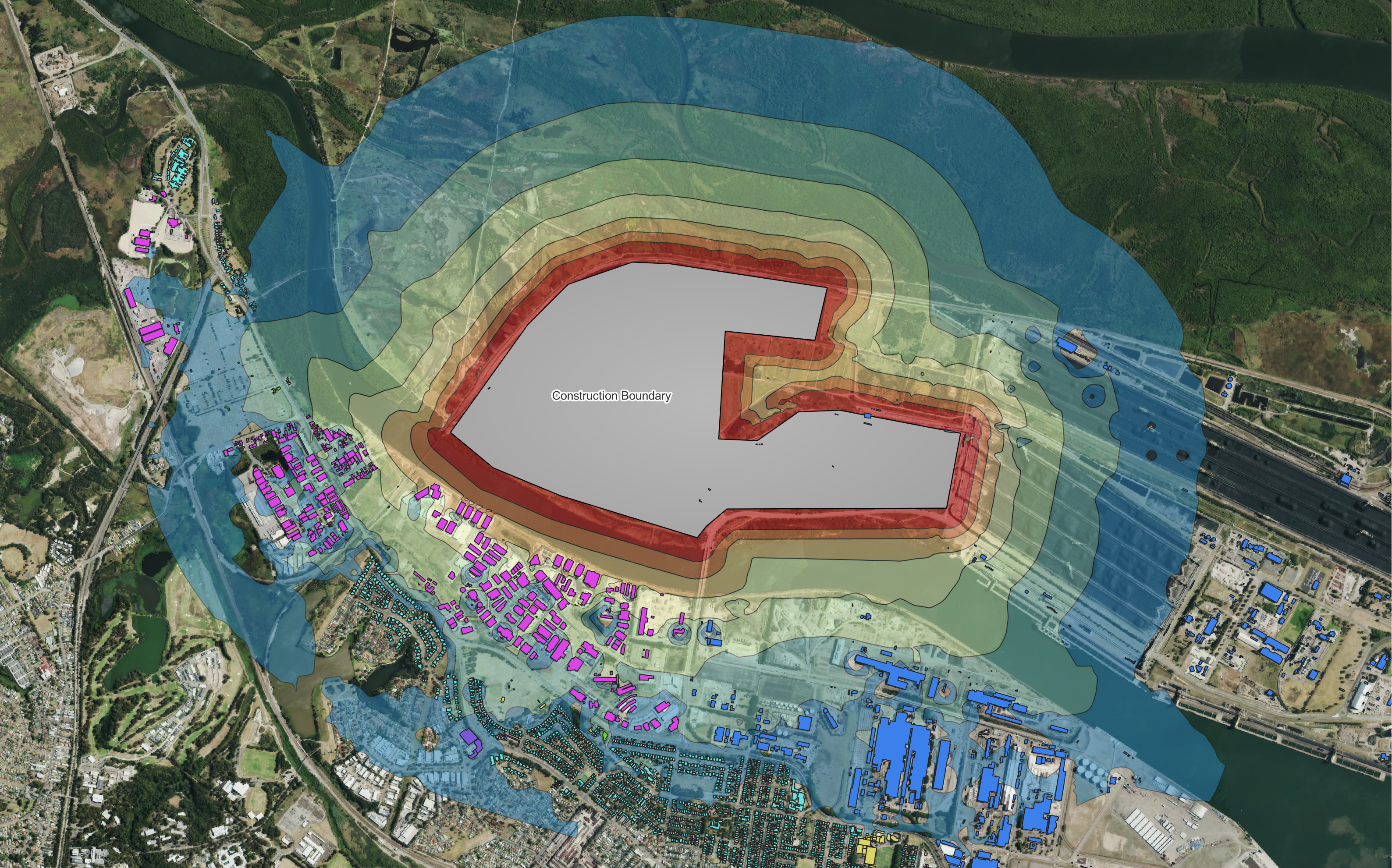


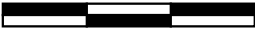


Map: Construction Stage 1 - Site Establishment		Author: NR				1:18,000 at A4	Legend Building Classification - Industrial/Utilities - Community Use - Commercial/Business - Conservation/National Park - Recreational/Open Space - Residential - Special Use	Noise Contours (dB) 45 50 55	60 65 70 75	Port of Newcastle Clean Energy Precinct Construction Stage 1 - Site Establishment
Date: 03/03/2023		Approved by: BI								

To be read in conjunction with WSP document: PS134739-BI-NSW-NC-ACO-REP-1
Map Source: NSW Spatial Services

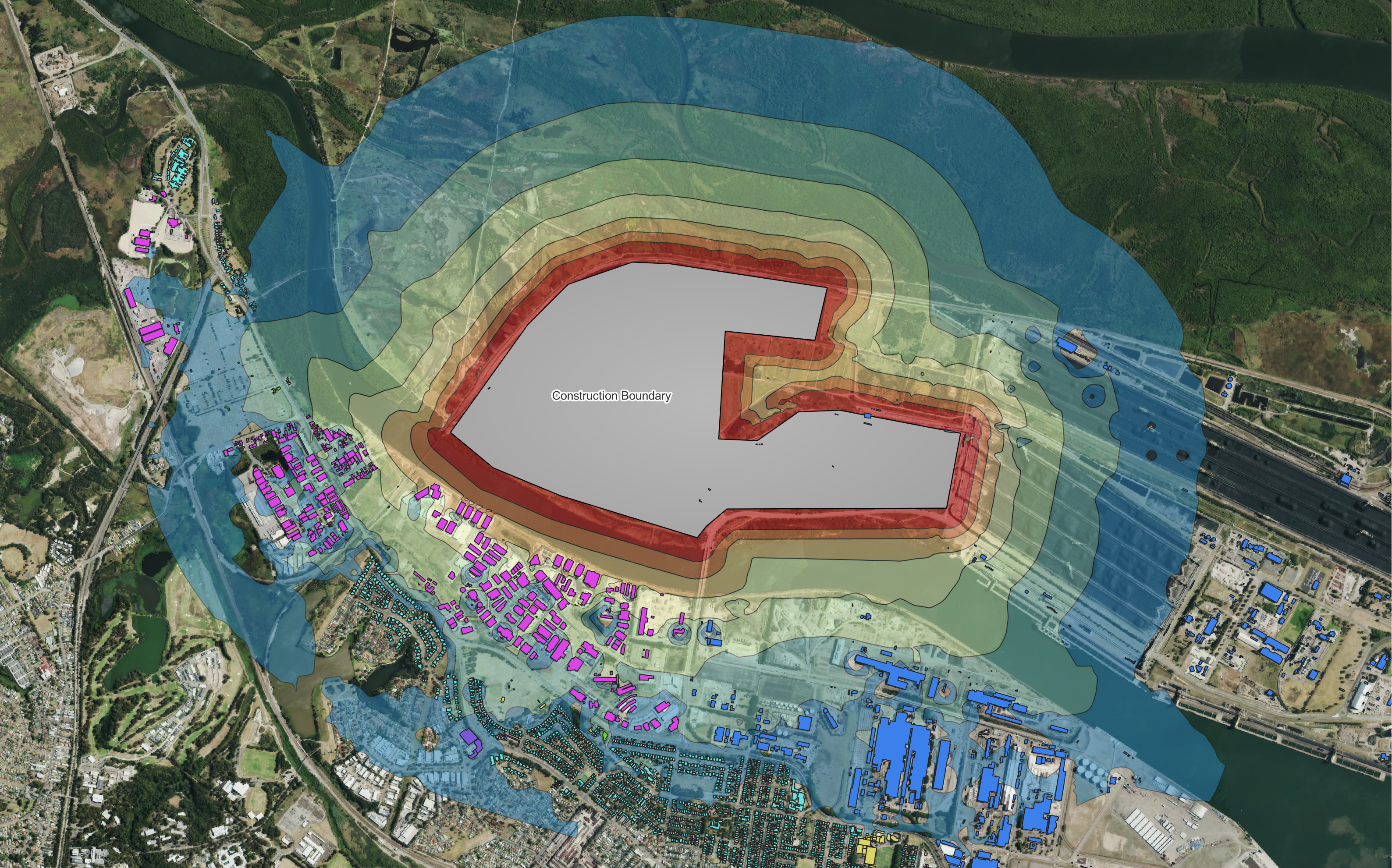
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Map: Construction Stage 2 - Vegetation Removal		Author: NR			1:18,000 at A4	Legend Building Classification  Community Use  Commercial/Business  Conservation/National Park  Industrial/Utilities  Recreational/Open Space  Residential  Special Use	Noise Contours (dB)  45  50  55	 60  65  70  75	Port of Newcastle Clean Energy Precinct Construction Stage 2 - Vegetation Removal 
Date: 03/03/2023		Approved by: BI							

To be read in conjunction with WSP document: PS134739-BI-NSW-NC-ACO-REP-1
Map Source: NSW Spatial Services

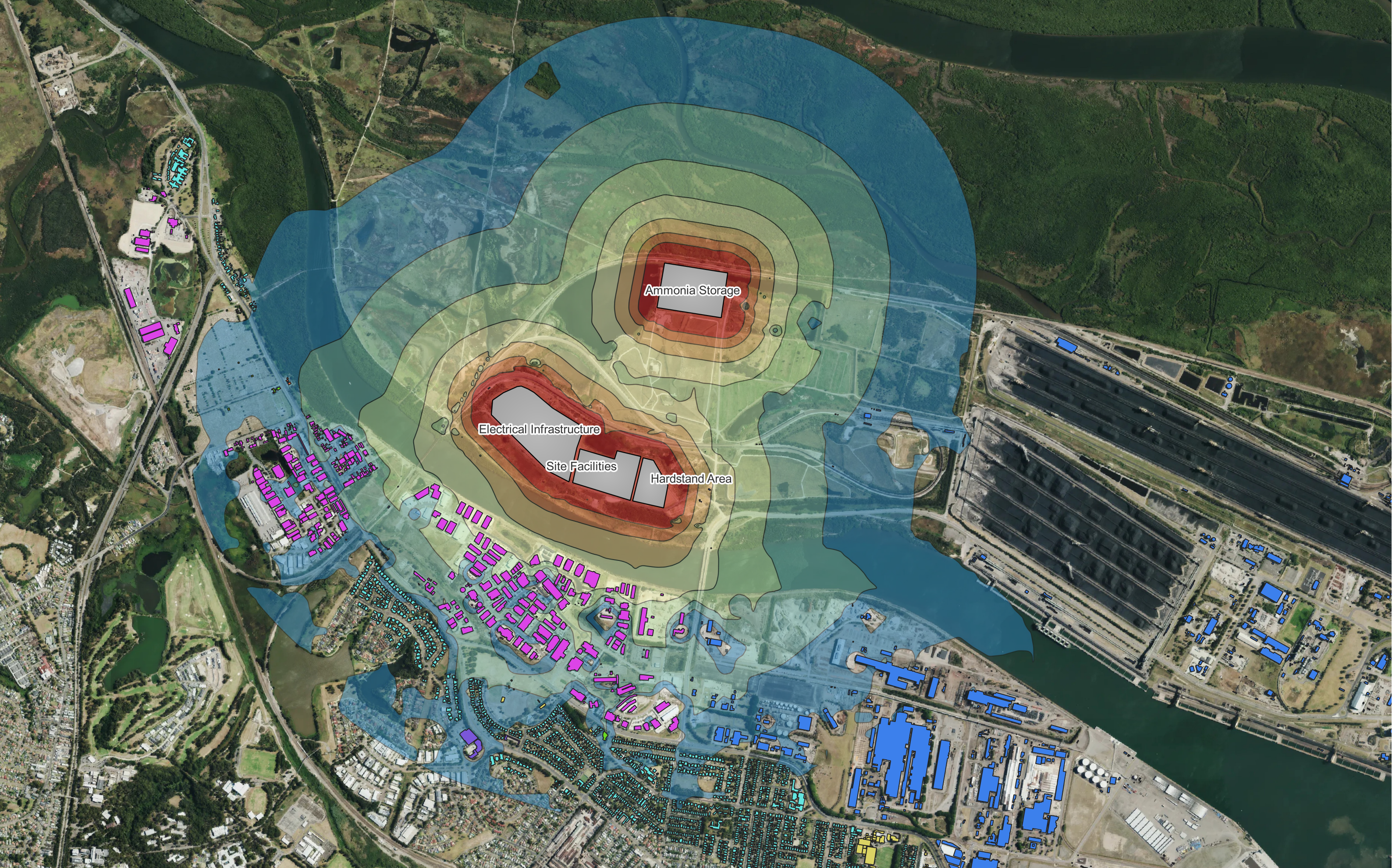
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Map: Construction Stage 3 - Earth Works		Author: NR			1:18,000 at A4	Legend Building Classification - Industrial/Utilities - Community Use - Commercial/Business - Conservation/National Park - Recreational/Open Space - Residential - Special Use	Noise Contours (dB) 45 50 55	60 65 70 75	Port of Newcastle Clean Energy Precinct Construction Stage 3 - Earth Works
Date: 03/03/2023		Approved by: BI							

To be read in conjunction with WSP document: PS134739-BI-NSW-NC-ACO-REP-1
Map Source: NSW Spatial Services

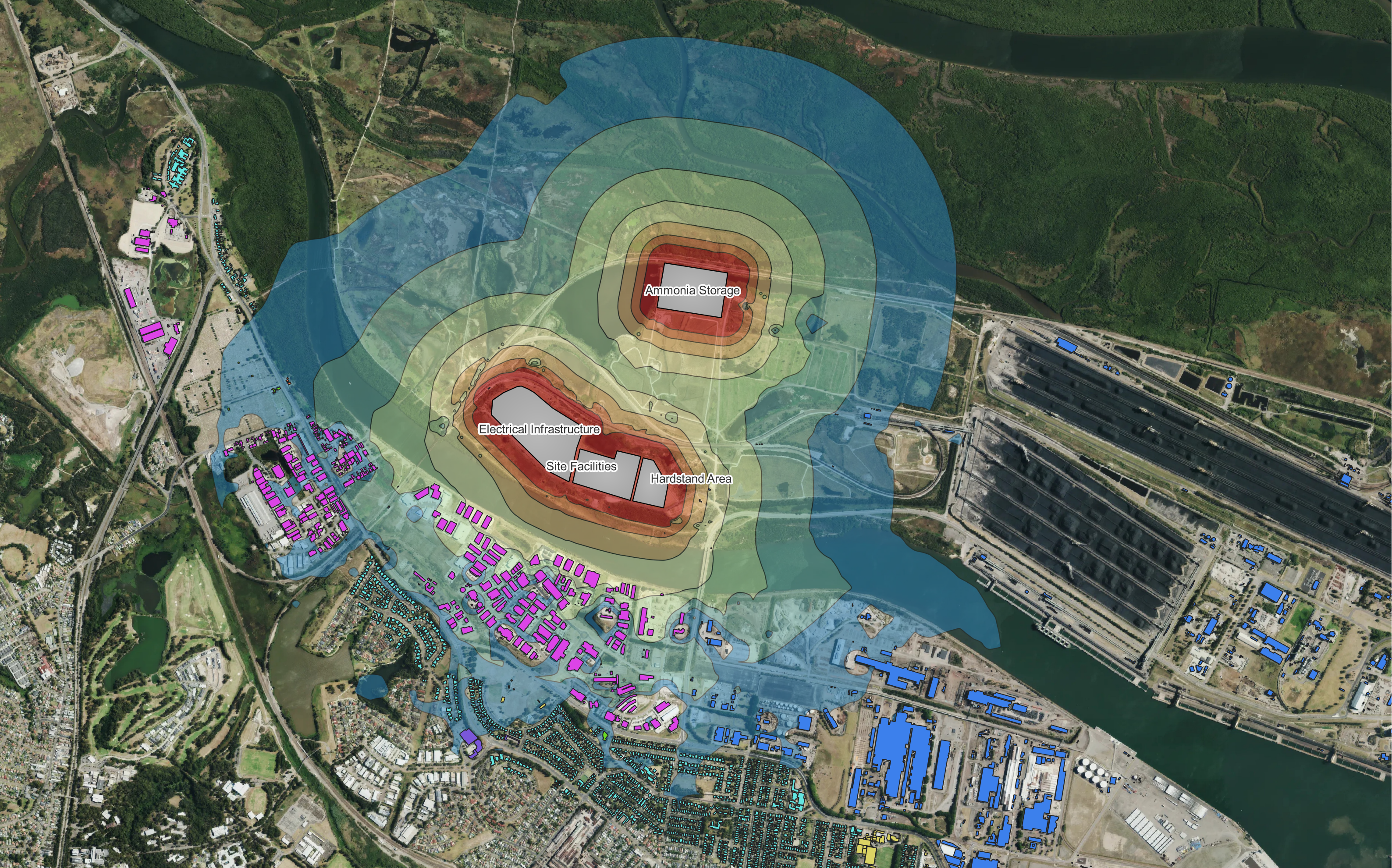
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Map: Construction Stage 4 - Paving Activities		Author: NR				1:18,000 at A4	Legend Building Classification Industrial/Utilities Recreational/Open Space Commercial/Business Conservation/National Park Electrical Infrastructure Site Facilities Hardstand Area	Noise Contours (dB) 45 50 55	60 65 70 75	Port of Newcastle Clean Energy Precinct Construction Stage 4 - Paving Activities
Date: 03/03/2023		Approved by: BI								

To be read in conjunction with WSP document: PS134739-BI-NSW-NC-ACO-REP-1
Map Source: NSW Spatial Services

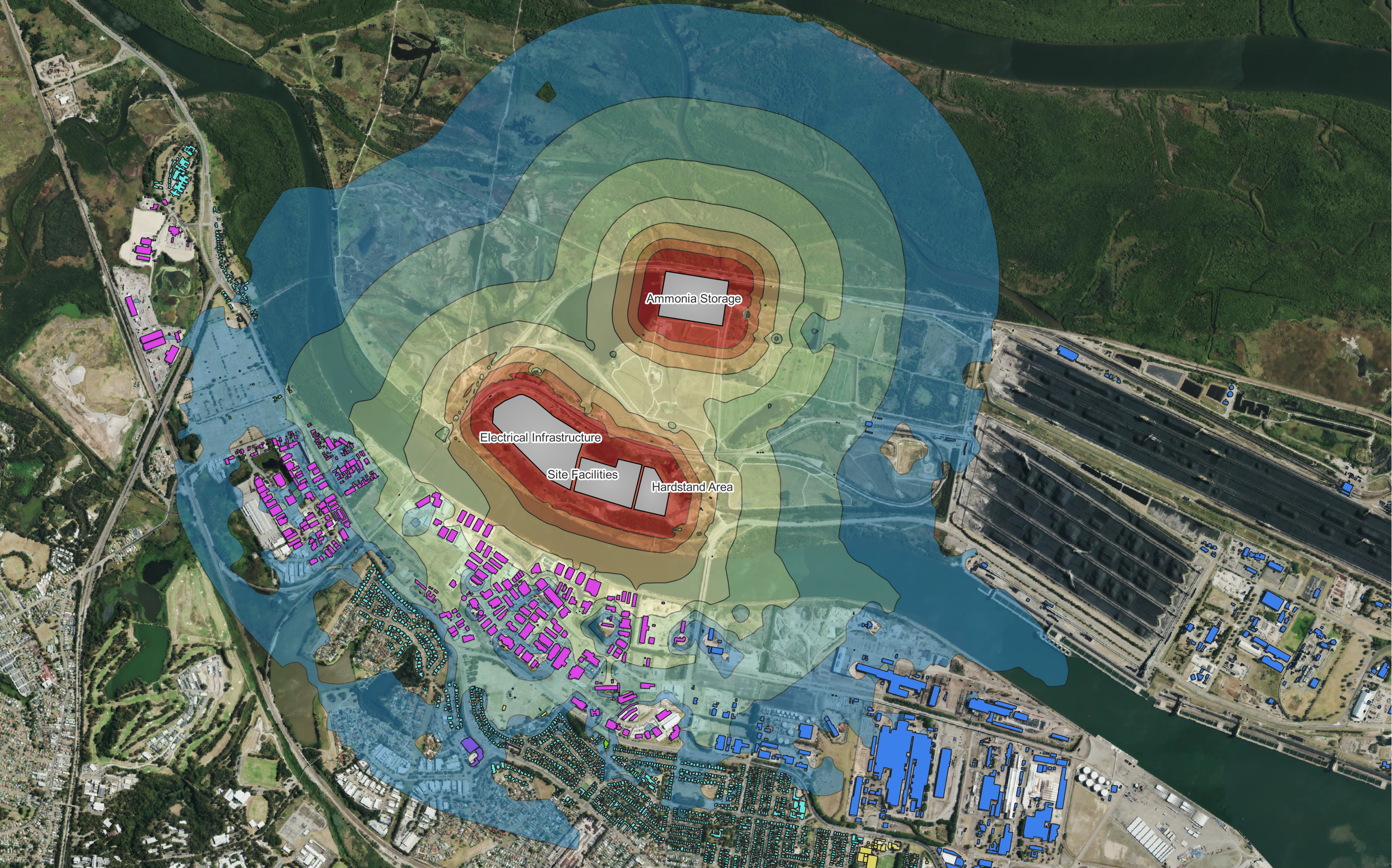
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Map: Construction Stage 5 - Concrete Works		Author: NR			1:18,000 at A4	Legend Building Classification - Industrial/Utilities - Community Use - Commercial/Business - Conservation/National Park - Recreational/Open Space - Residential - Special Use	Noise Contours (dB) 45 50 55	60 65 70 75	Port of Newcastle Clean Energy Precinct Construction Stage 5 - Concrete Works
Date: 03/03/2023		Approved by: BI							

To be read in conjunction with WSP document: PS134739-BI-NSW-NC-ACO-REP-1
Map Source: NSW Spatial Services

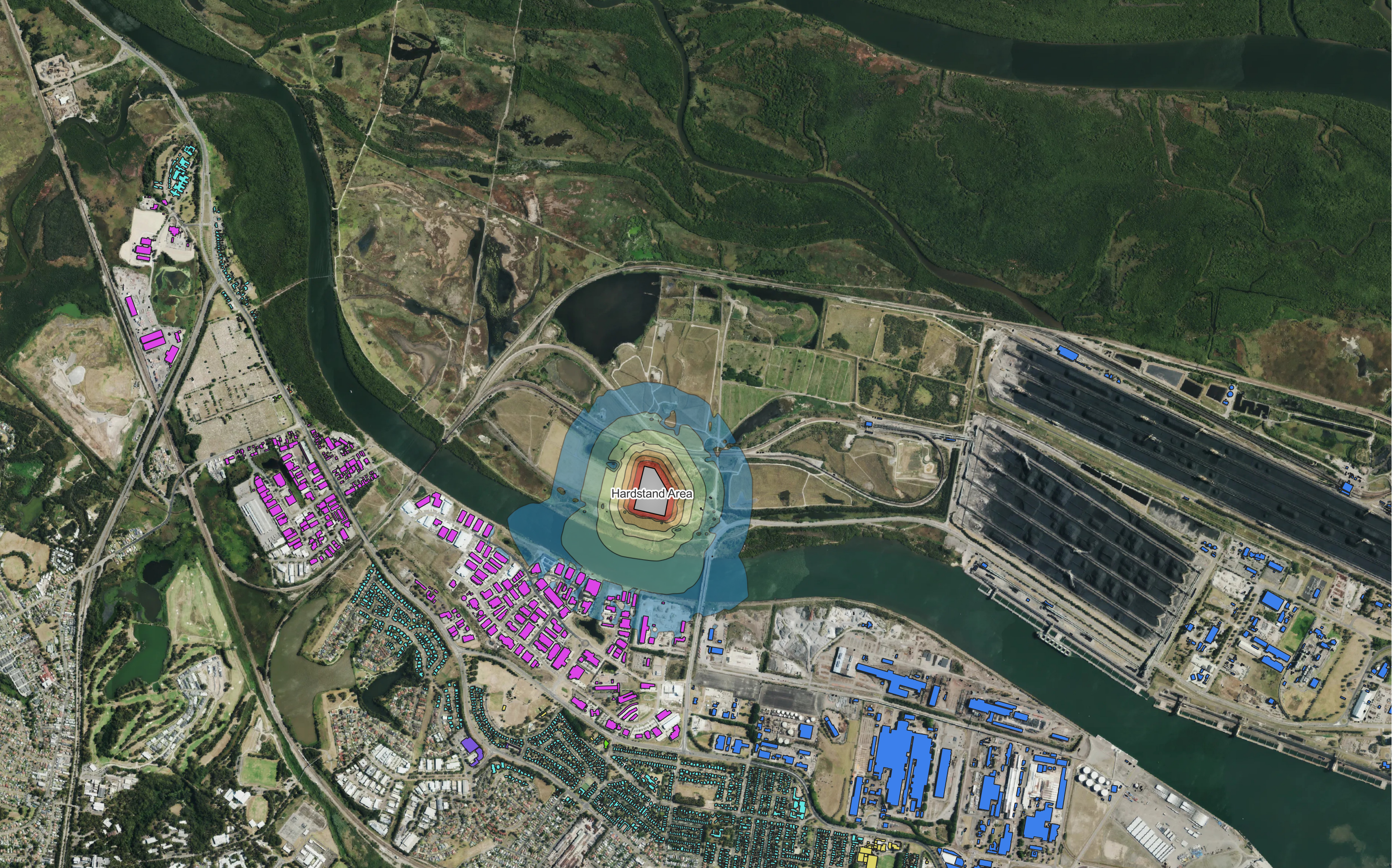
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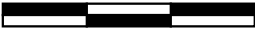
Map: Construction Stage 6 - Construction Works		Author: NR			1:18,000 at A4	Legend Building Classification - Industrial/Utilities - Community Use - Commercial/Business - Conservation/National Park - Recreational/Open Space - Residential - Special Use	Noise Contours (dB) 45 50 55	60 65 70 75	Port of Newcastle Clean Energy Precinct Construction Stage 6 - Construction Works
Date: 03/03/2023		Approved by: BI							

To be read in conjunction with WSP document: PS134739-BI-NSW-NC-ACO-REP-1
Map Source: NSW Spatial Services

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Map: Construction Stage 7 - Site Compound		Author: NR	
Date: 03/03/2023		Approved by: BI	
To be read in conjunction with WSP document:		PS134739-BI-NSW-NC-ACO-REP-1	
Map Source: NSW Spatial Services			



1:18,000
at A4

Legend

Building Classification	Industrial/Utilities	Noise Contours (dB)	60
Community Use	Recreational/Open Space	45	65
Commercial/Business	Residential	50	70
Conservation/National Park	Special Use	55	75

Port of Newcastle Clean Energy Precinct
Construction Stage 7 - Site Compound

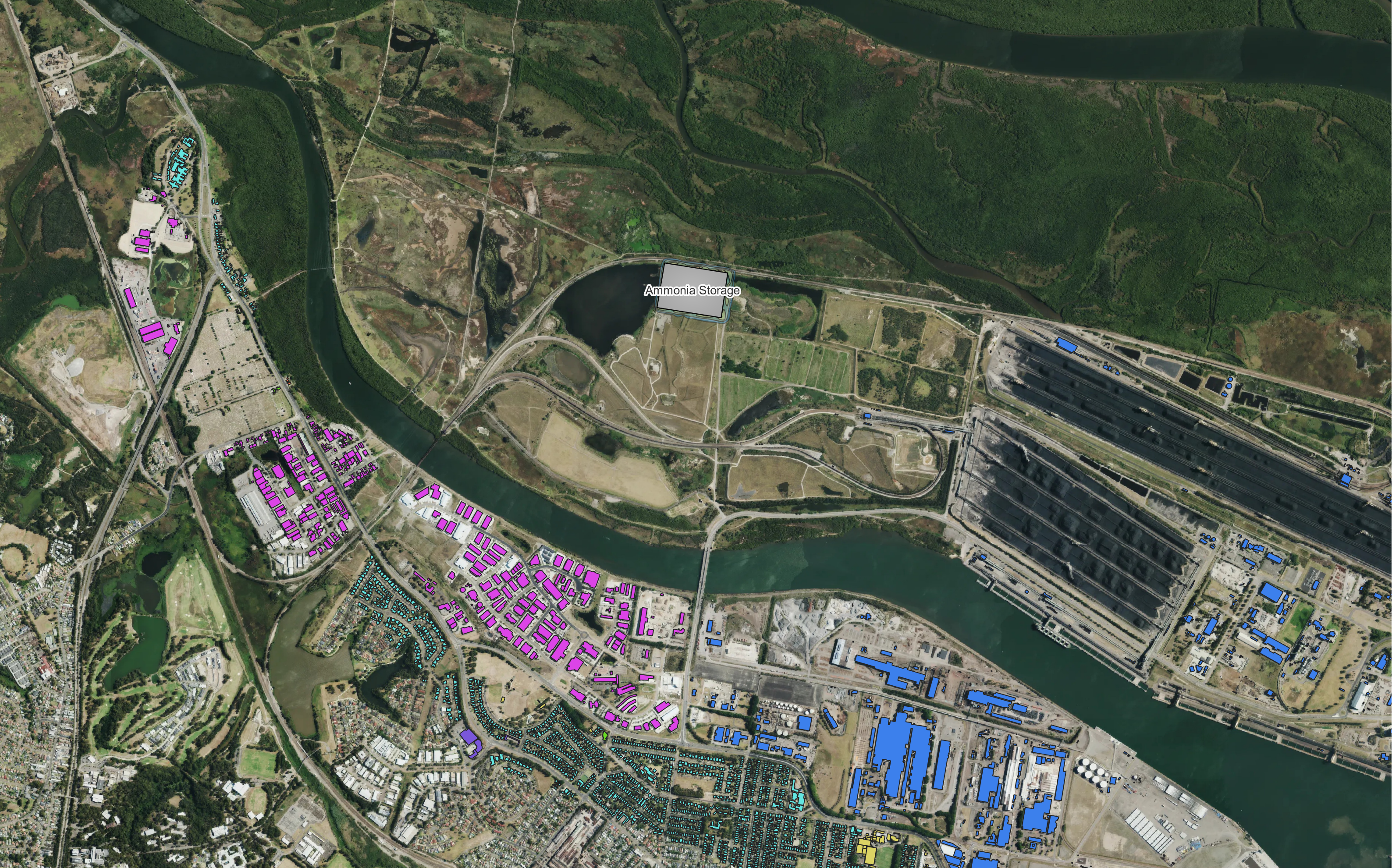


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Appendix B

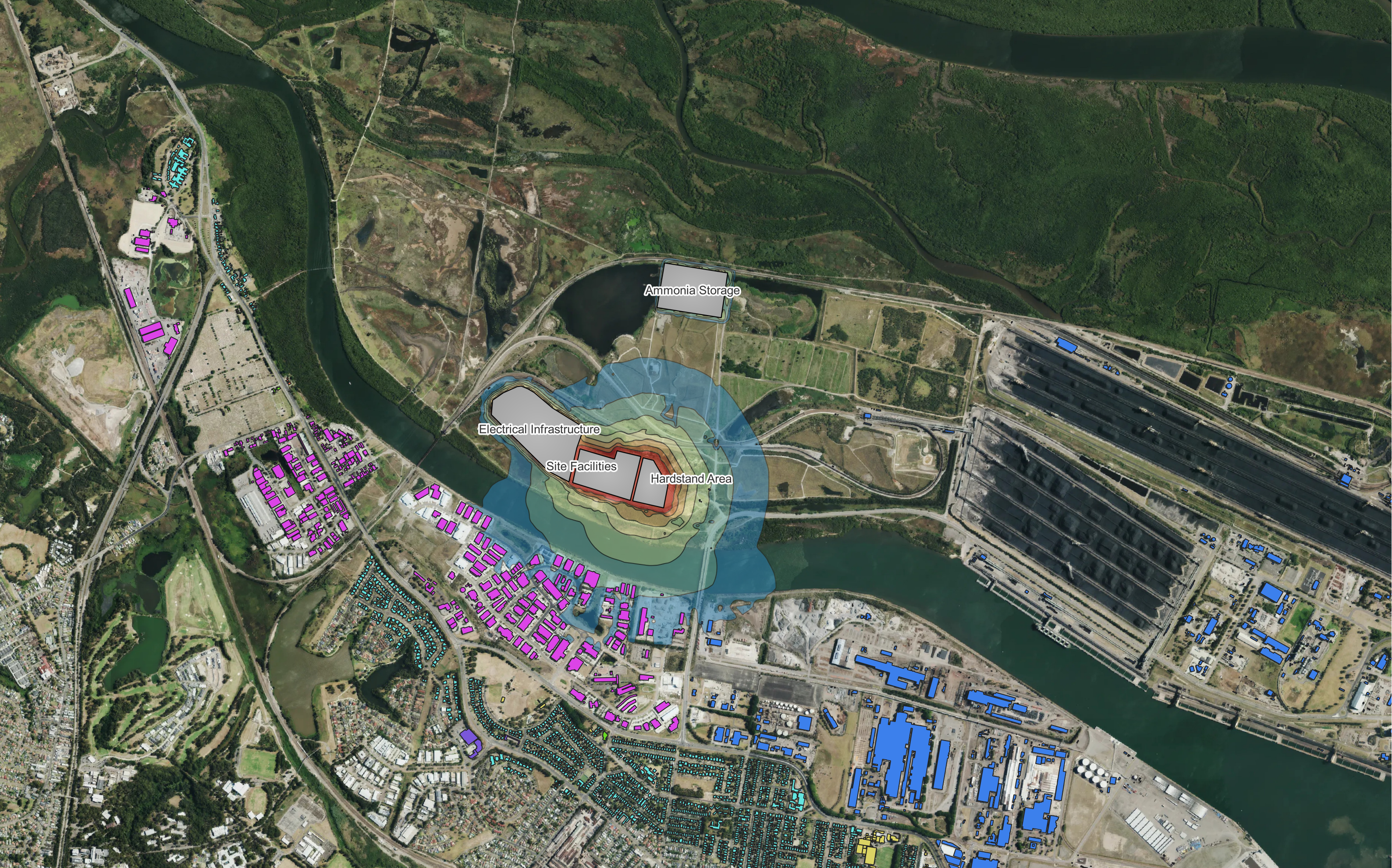
Predicted operational noise contours





Map: Operation Stage 1 - Ammonia Storage		Author: NR			1:18,000 at A4	Legend Building Classification Industrial/Utilities Community Use Commercial/Business Conservation/National Park Recreational/Open Space Residential Special Use	Noise Contours (dB) 45 50 55	60 65 70 75	Port of Newcastle Clean Energy Precinct Operation Stage 1 - Ammonia Storage
Date: 03/03/2023	Approved by: BI	To be read in conjunction with WSP document: Map Source: NSW Spatial Services							

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Map: Operation Stage 1 - All Sites	Author: NR	
Date: 03/03/2023	Approved by: BI	
To be read in conjunction with WSP document: PS134739-BI-NSW-NC-ACO-REP-1		
Map Source: NSW Spatial Services		

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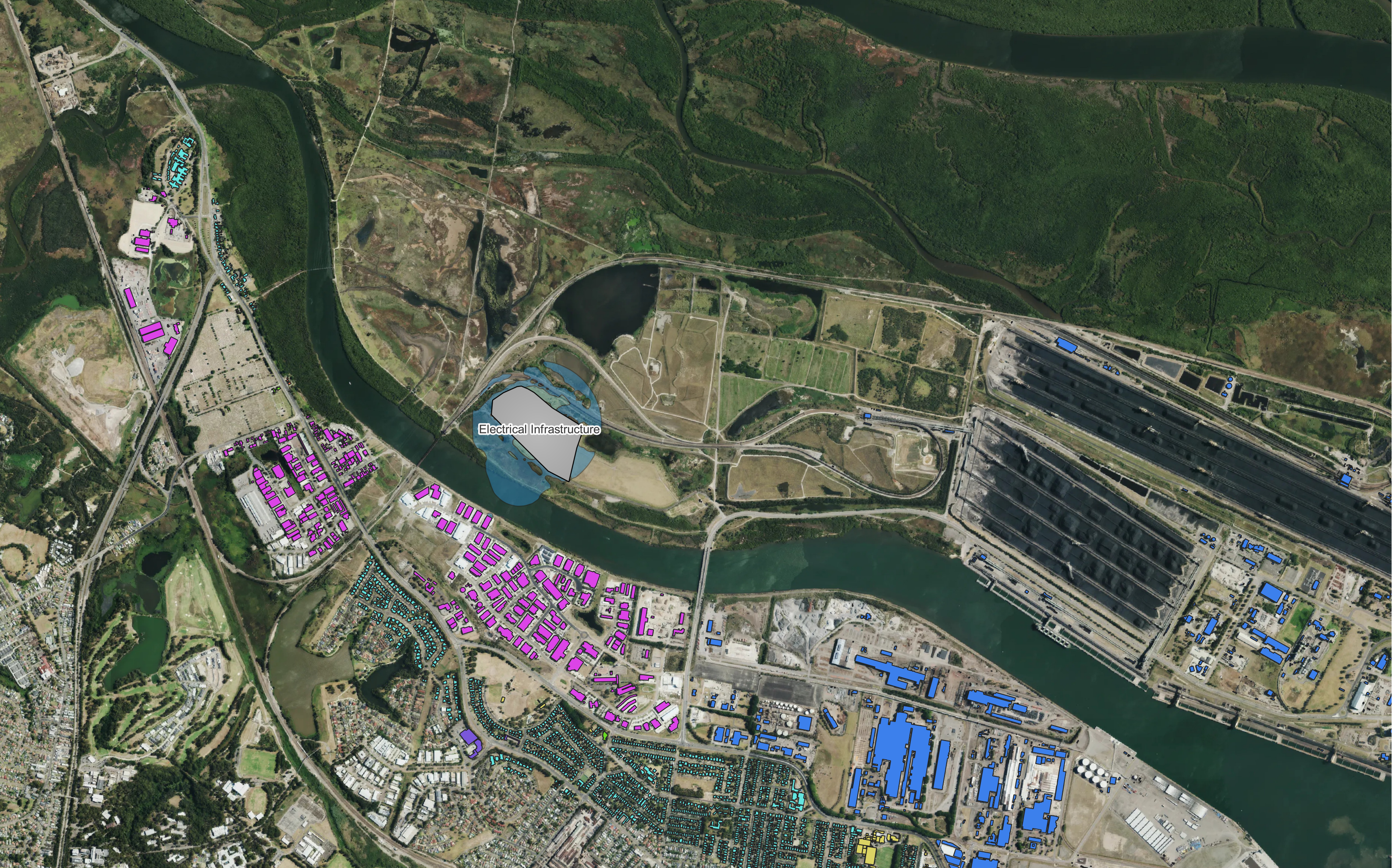
0 200 400 600 m

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at A4

Legend	
Building Classification	
Community Use	Industrial/Utilities
Commercial/Business	Recreational/Open Space
Conservation/National Park	Residential
	Special Use
Noise Contours (dB)	
45	60
50	65
55	75

Port of Newcastle Clean Energy Precinct
Operation Stage 1 - All Sites

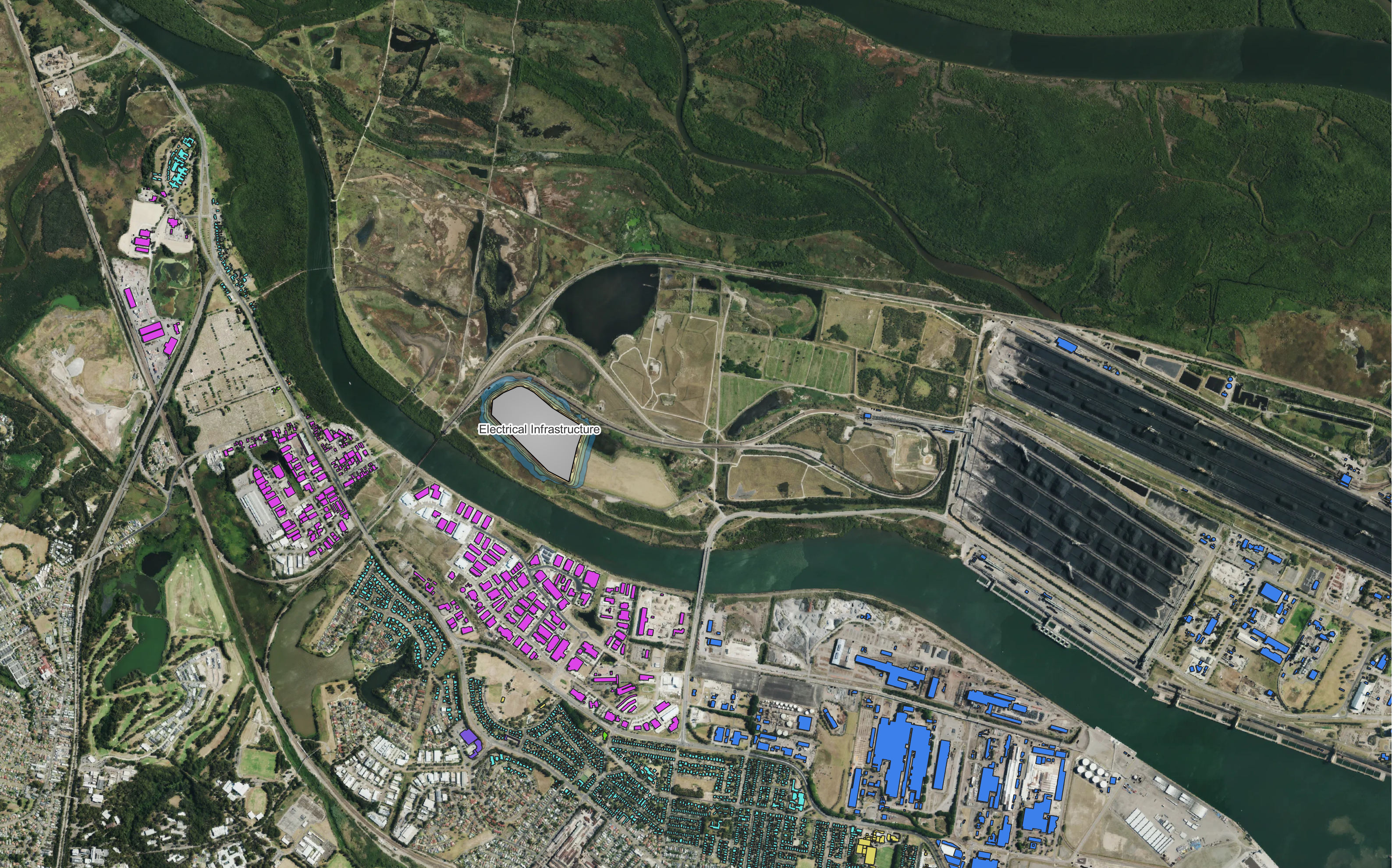
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Map: Operation Stage 1 - Electrical Infrastructure CB		Author: NR				1:18,000 at A4	Legend Building Classification Community Use Commercial/Business Conservation/National Park Industrial/Utilities Recreational/Open Space Residential Special Use	Noise Contours (dB) 45 50 55	60 65 70 75	Port of Newcastle Clean Energy Precinct Operation Stage 1 - Electrical Infrastructure Circuit Breaker
Date: 03/03/2023		Approved by: BI								

To be read in conjunction with WSP document: PS134739-BI-NSW-NC-ACO-REP-1
Map Source: NSW Spatial Services

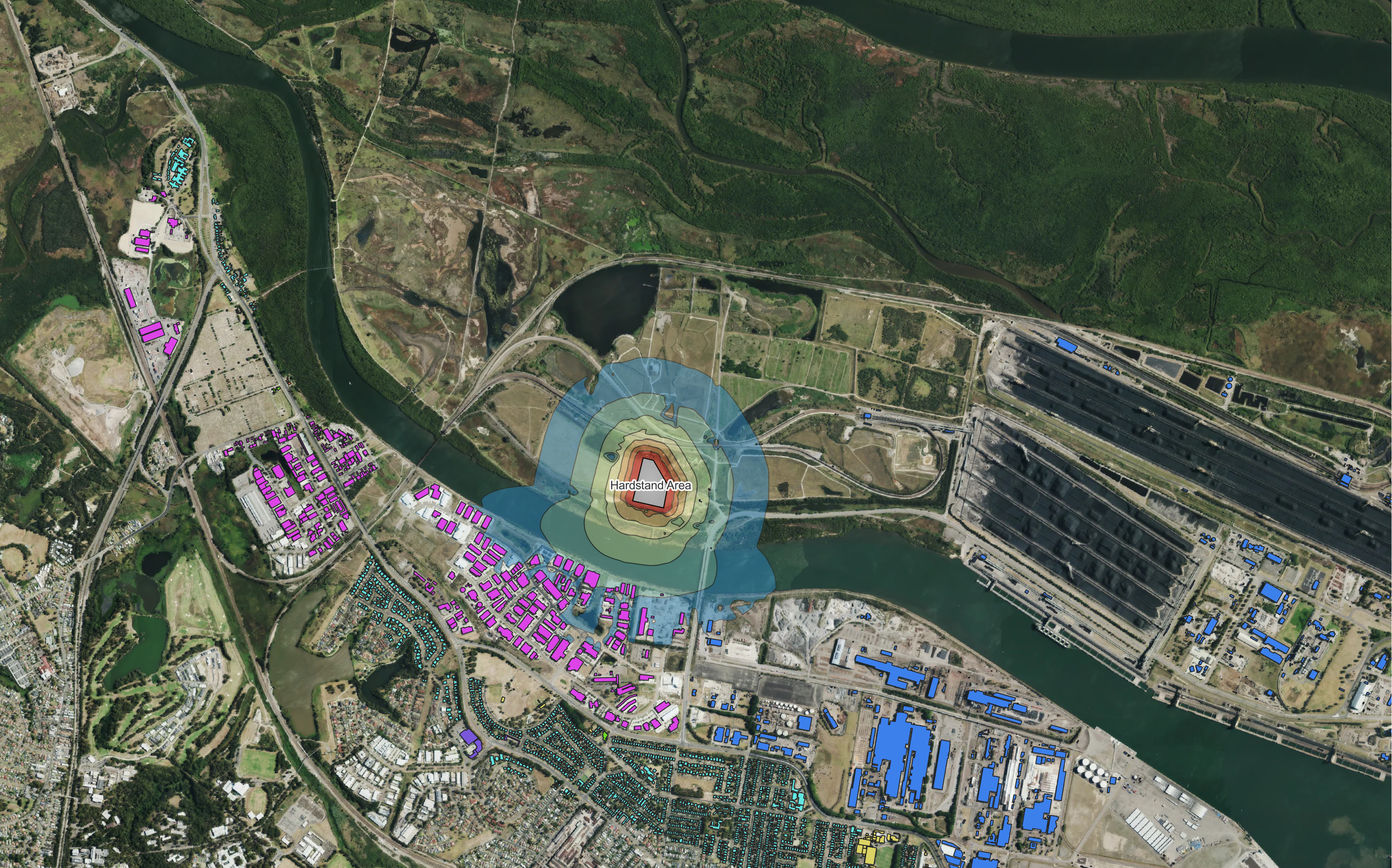
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Map: Operation Stage 1 - Electrical Infrastructure		Author: NR				1:18,000 at A4	Legend Building Classification - Industrial/Utilities - Community Use - Commercial/Business - Conservation/National Park - Recreational/Open Space - Residential - Special Use	Noise Contours (dB) 45 50 55	60 65 70 75	Port of Newcastle Clean Energy Precinct Operation Stage 1 - Electrical Infrastructure
Date: 03/03/2023		Approved by: BI								

To be read in conjunction with WSP document: PS134739-BI-NSW-NC-ACO-REP-1
Map Source: NSW Spatial Services

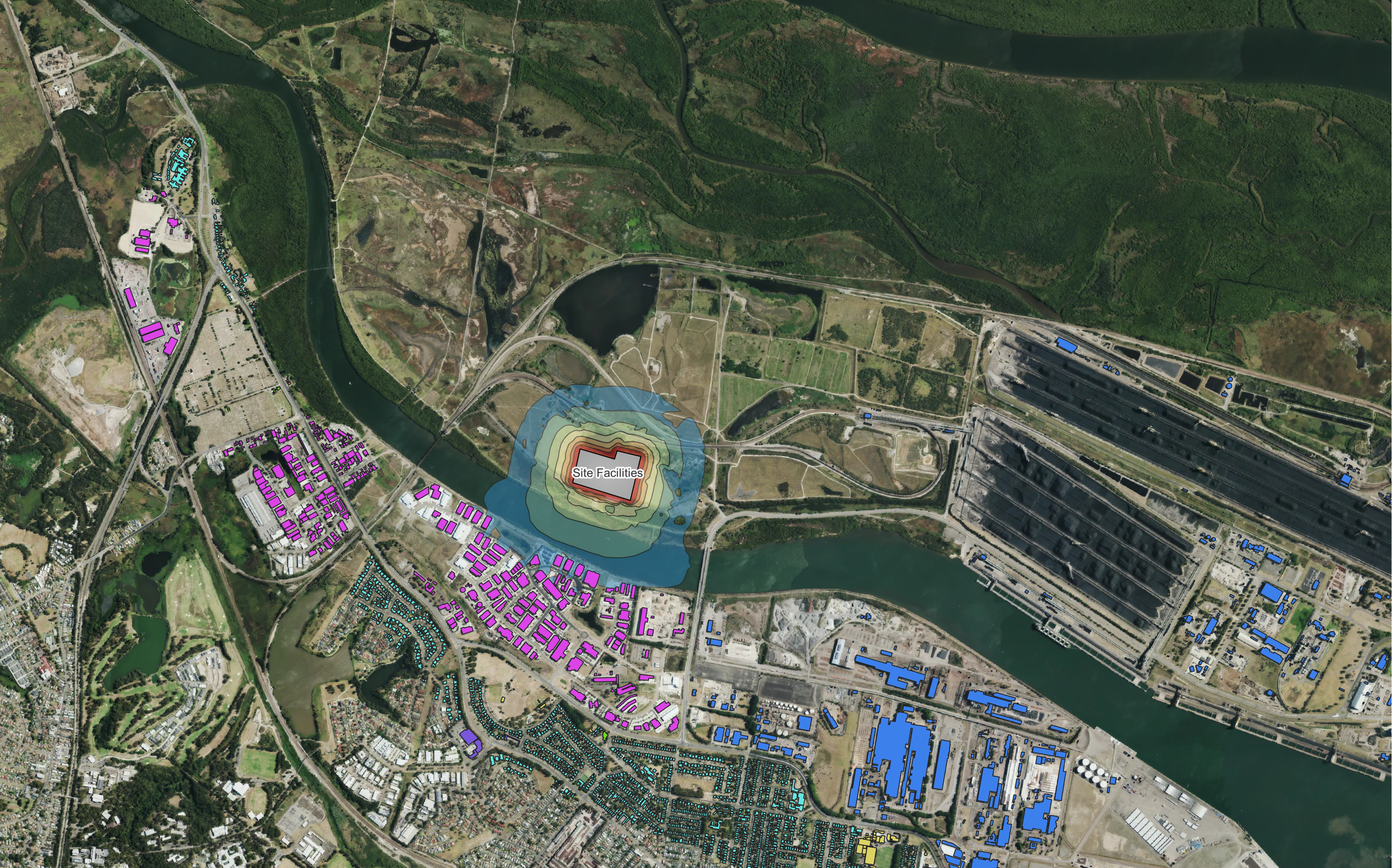
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Map: Operation Stage 1 - Hardstand Area				Legend	Building Classification Community Use Commercial/Business Conservation/National Park	Industrial/Utilities Recreational/Open Space Residential Special Use	Noise Contours (dB) 45 50 55	60 65 70 75	Port of Newcastle Clean Energy Precinct Operation Stage 1 - Hardstand Area
Date: 03/03/2023	Author: NR Approved by: BI								

To be read in conjunction with WSP document: PS134739-BI-NSW-NC-ACO-REP-1
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Map: Operation Stage 1 - Site Facilities		Author: NR				1:18,000 at A4	Legend Building Classification Industrial/Utilities Recreational/Open Space Commercial/Business Conservation/National Park Residential Special Use	Noise Contours (dB) 45 50 55	60 65 70 75	Port of Newcastle Clean Energy Precinct Operation Stage 1 - Site Facilities
Date: 03/03/2023		Approved by: BI								
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